The Invention of Nature: Human and Environmental Futures In A Biotechnological Age

by

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Table of Contents

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Declaration

This thesis is all my own work and has not been submitted for a degree at any other university.

Abstract

This thesis considers the potential consequences for social and biological diversity, arising from the introduction of genetically modified crops in developing countries. It argues that the production of agricultural biodiversity is an ongoing social process, involving countless temporally and spatially located works in progress. These localised applications of knowledge about diversity, find their expression in performances which do not simply unfold in time and space but construct them, (re)producing and structuring, territorialising and stratifying.

The thesis argues that the social, is a heterogeneous amalgam of unknowably complex relationships; suggesting also that the introduction of GM technologies involves simultaneous processes of de-territorialisation and re-territorialisation, substituting a heterotopian reality for the premise of a utopian fantasy - a singular, genetically deterministic world, which denies its own partiality.

The thesis examines how, the Convention on Biological Diversity, the Biosafety Protocol, the TRIPs agreement and other WTO agreements, extend particular ordering stories through time and space, arguing that the deployment of biotechnologies can only succeed through the enrolment of humans and non-humans into these polymorphic networks. It argues that the mechanisms and ordering narratives of the CBD and TRIPs conflict with the socio-cultural practices that produce biodiversity; suggesting, that IPRs provide a means for disciplining farmers, while maintaining the materiality of GM seeds through time-space. These technologies cannot be deployed without corresponding bodies of knowledge; they are, assemblages, *active presences*, permitting the exercise of power through the embodiment of particular "modes of ordering."

Finally, the thesis argues that the development of community intellectual rights, and traditional resource rights offer little hope for either maintaining the social practices necessary for the maintenance of agricultural biodiversity, or for increasing the substantial freedoms of communities in the two thirds world, without the recognition of the heterogeneous nature of social existence and the regeneration of people's spaces.

Glossary of Abbreviations

AIA	Advanced Informed Agreement
AoA	Agreement on Agriculture
BSWG	Open Ended *ad hoc* Working Group on Biosafety
CBD	Convention on Biological Diversity
CGIAR	Consultative Group on International Agricultural Research
CIR	Community Intellectual Right(s)
CITES	Convention on International Trade in Endangered Species
COP	Conference of The Parties
CSIR	Indian Council of Scientific and Industrial Research
CTE	World Trade Organisation Committee on Trade and Environment
DNA	Deoxyribonucleic Acid
DSB	Dispute Settlement Body of the WTO
EC	European Community
ESCR	International Covenant on Economic, Social and Cultural Rights
EU	European Union
FAO	United Nations Food and Agriculture Organisation
G77	Group of 77 developing countries at the United Nations
GATT	General Agreement on Tariffs and Trade
GM	Genetically Modified
GMO	Genetically Modified Organism
GRAIN	Genetic Resources Action International
GURT	Genetic Use Restriction Technology
ICBG	International Collaborative Biodiversity Group
IDRC	The International Development Research Centre
INBio	Instituto Nacional de Biodiversidad (Costa Rica)
IPGR	International Plant Genetic Resources Institute
IPRs	Intellectual Property Rights
IRRI	International Rice Research Institute
ISE	International Society of Ethnobiologists
IUCN	The World Conservation Union
IUPGR	International Undertaking on Plant Genetic Resources
LMO	Living Modified Organism
MASIPAG	Magsasaka at Siyentipiko Para sa Ikauunlad ng Agham Pang-agrikultura
MEA	Multilateral Environmental Agreement
NGO	Non Governmental Organisation

PGRFA	Plant Genetic Resources for Food and Agriculture
RAFI	Rural Advancement Foundation International
rDNA	Recombinant Deoxyribonucleic Acid
SBSTTA	Subsidiary Body on Scientific Technical and Technological Advice
SPS	Agreement on Sanitary and Phyto Sanitary Measures
TBGRI	Tropical Botanic Garden and Research Institute (Kerala, India)
tGURTs	(trait) Genetic Use Restriction Technologies
TPS	Technology Protection System
TRIPS	Agreement on Trade Related Aspects of Intellectual Property
UPOV	Union for the Protection of New Varieties of Plants
TRRs	Traditional Resource Rights
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Conference on the Law of The Sea
UNCTAD	United Nation Conference on Trade and Development
UNDP	United Nation Development Program
UNEP	United Nations Environment Program
USDA	United States Department of Agriculture
USFDA	United States Food and Drug Administration
USPTO	United States Patent Office
USTR	United States Trade Representative
vGURTs	(varietal) Genetic Use Restriction Technologies
WCMC	World Conservation Monitoring Centre
WIPO	World Intellectual Property Organisation
WTO	World Trade Organisation

Chapter 1

The Invention of Nature

Choosing a title for this thesis was not easy given the scope of the subject matter. However, in settling on *The Invention of Nature: Human and Environmental Futures in a Biotechnological Age* I wanted, even if somewhat opaquely, to provide a sense of the multiple issues that are examined throughout this work. Thus, the invention of nature is firstly meant to refer to the biological inventiveness that has resulted in the diversity of life that exists on this planet. Secondly, there is the suggestion that nature itself can only ever be experienced by humans within social networks more or less extended in time-space and, as such, that it is a human invention regardless of its physical existence outside of human practices. Thirdly, the invention of nature refers to the practices and knowledges of farmers, particularly in the two thirds world,[1] that have resulted in the agricultural biodiversity that exists today. While finally, the invention of nature relates to the inventive step established

[1] Descriptions of countries as developing or less developed, southern or third world, present various well documented problems. While still a collective term for an extremely diverse collection of countries and thus by no means perfect, Pereira and Seabrook's use of the phrase 'the two thirds world' (see Pereira, W. & Seabrook, J. (1992) *Asking the Earth: The Spread of Unsustainable Development* (Mapusa, Goa: The Other India Press), which I adopt throughout this work, has the advantage of containing less hierarchical nuances while at the same time re – articulating some of the common problems faced by these countries, as the concerns of the majority of the peoples of this earth.

by courts and patent offices in granting intellectual property rights on DNA sequences found in nature.

For, this thesis is concerned with the potential detrimental impacts that the introduction of transgenic crops pose for diversity, both biological and cultural; it is concerned with the manner in which both biodiversity and biotechnology are mobilised and deployed within social networks more or less extended in time and space; it is concerned with how we understand and construct the spaces and environments which we inhabit; and, it is concerned with the manner in which control is exercised between diverse points in time and space. In all of these areas law plays a part, whether it is as a means through which particular conceptions of biodiversity are problematised and extended; a means through which farmers' practices are controlled; or, as a means through which many contend that farmers and communities 'right's' can be protected from the consequences of globalisation.

While the title refers to a biotechnological age, I do not want to suggest that a homogenous and therefore artificial 'we', has reached a point of disjuncture from a previously shared historical era, only that biotechnologies now exist contemporaneously with our lives. Indeed, that these technologies are not only understood differently by diverse people, but that the effects of their mobilisation within multiple spatio-temporal networks results in their being experienced asymmetrically, is one reason why I refer to human and environmental futures in the plural.

As will become apparent, I am not primarily concerned with either, assessing the risks of, for example, horizontal gene transfer from GM crops into the wider environment, or, of finding a means to regulate and manage those risks.[2] Rather, I am concerned with the impacts on diversity, both environmental and social, that arise from the manner in which biotechnologies are being deployed; the social and environmental consequences that emerge from the strategies and techniques adopted by those introducing transgenic crops; and the potential consequences of these strategies for both farmers in the two thirds world and agricultural diversity generally.

Drawing on the work of Foucault, Callon, Law, Latour and Deleuze, amongst others, I examine how the work of geneticists are made possible through the deployment of a range of social practices and their associated mythologies; their validity dependent upon their ability, or, rather, the ability of their constituents to mobilise the pre-existing practices and myths which inform our social worlds. As Paul Billings observes, "DNA has associated 'genetic Mythologies': of limitless biological relevance, of being the most basic of biological information, of genetic determinism, and of "high tech" scientific truth. These myths influence the perceptions and acceptance of genetic

[2] For those whishing to examine these issues in more detail see Rissler, J & Mellon, M. (1996) *The Ecological Risks of Engineered Crops* (London: The MIT Press), Rifkin, J. (1998) *The Biotech Century* (New York: Jeremy P. Tarcher/Putnam); Ho, M (1998) *Genetic Engineering Dream or Nightmare? The Brave New World of Bad Science and Big Business* (Bath: Gateway Books); Lappe, M & Bailey, B. (1999) *Against The Grain: The Genetic Transformation of Global Agriculture* (London: Earthscan).

information and methods by our society"[3]. Thus while our reception of the practices and mythologies of genetics and biotechnology is dependent upon our location within a complex web of social practices, the mythologies themselves, the myriad stories and narratives which order our lives, are at the same time the products, or perhaps it is better to say they are *the generational effects*, of the interrelationships between numerous socio-temporal networks.

David Harvey suggests that, "if space is always a container of social power, then the reorganisation of space is always a reorganisation of the framework through which social power is expressed."[4] In *Chapter 2*, I examine more closely what I believe are some of the important interrelationships between space and biodiversity. In order to do so, and also to lay the ground-work for an examination later in this thesis of how social power is expressed through the reorganisation of space, I draw a distinction between three dimensions of space, between geophysical, topographical and topological spaces. I not only argue that biodiversity can only be understood and maintained within social relationships located in space-time, but also, that different conceptions and understandings of biodiversity co-exist; that these different knowledges about biological diversity find their expression in social practices extended in time and space, and it is within these practices that biodiversity and, in particular agricultural biodiversity has been produced.

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[3] Billings, P.R. (Ed.) (1992) *DNA on Trial: Genetic Identification and Criminal Justice* (Plainview, NY: Cold Spring Harbour Laboratory Press) p.2

In *Chapter 3,* I consider the 1992 Convention on Biological Diversity together with the history and content of the Cartegena Protocol to the Convention on Biological Diversity signed in January 2000. I argue that both the CBD and the Biosafety Protocol, develop strategic visions that are inimical to the diverse social practices which, in *Chapter 2*, I argue are a fundamental component of not only the manner in which agricultural biodiversity is understood, but also, of its physical (re)production. As such, the manner in which biodiversity is problematised and ordered within these legal instruments, is itself problematic, for both the CBD and Biosafety Protocol provide a means of extending and performing a particular vision of biodiversity; a vision of its worth and of the means through which biodiversity can be managed, through time and space. Thus, the CBD and the Biosafety Protocol, can be seen as mechanisms which function to reorganise spatial relationships and are therefore a means, as well as the products, of an expression of power.

In Anthony Giddens' more recent works, he argues that, "the advent of modernity increasingly tears space away from place by fostering relations between "absent" others, locationally distant from any given situation of face to face interaction."[5] Through placing too much emphasis on absence in his characterisation of globalisation, I believe that Giddens leads us all too easily to neglect the *active presences* through which power is exercised and around

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[4] Harvey, D. (1990) *The Condition of Postmodernity* (London Blackwell Publishers) p.255

[5] Giddens, A. (1990) *The Consequences of Modernity* (London: Polity Press) p.18

which space is reorganised. Therefore, in *Chapter 4*, I turn my attention to the means by which the presence of those who appear locationally distant, at least in a geophysical sense, can be achieved. In particular for the purposes of this thesis, I focus on intellectual property rights (IPRs), as a means of exercising power through time-space. I examine the negotiation and implementation of the Agreement on Trade Related Aspects of Intellectual Property (TRIPs agreement), in order to further explore the linkages between IPRs, Biotechnology, and biodiversity.

Through IPRs, GM seeds are endowed with the characteristics of being novel and advanced, thus providing a legitimation for the supplanting of other non GM seeds, at the same time furnishing a reason why GM seeds should be treated differently by farmers within a novel legal regime. TRIPs facilitates the extension of this meaning through time and space while providing the apparatus for deployment of texts, devices and disciplinary practices necessary to maintain and stabilise this socio-technical network and control the production of space. Importantly, the TRIPs mechanism itself is also a part of this network extending a particular mode of ordering through time and space, re-configuring the end users' (farmers') conceptions of their spatial and temporal relationships

IPRs also provide the means for the consolidation and deepening of life science companies' interests. While at one level the TRIPs agreement is often said to undermine the Convention on Biodiversity, I suggest that they

are both predicated on many of the same notions sharing a similar outlook on biotechnology and biodiversity. I argue that the TRIPs agreement provides a mechanism for the control of genetic technologies, stabilising their meanings through time-space while in addition, enabling the re-organisation of socio-spatial practices. Thus while IPRs can be considered as a threat to diversity, this is because of their underlying rationale, not because they conflict with the biodiversity convention.

I argue that despite their current importance, IPRs are an imperfect means of enrolling others, of drilling farmers and adapting their practices. It is therefore unsurprising that genetic use restriction technologies (GURTs) have emerged, one form of which have euphemistically been dubbed "Terminator Seeds." These seeds better translate the interests of their makers, while at the same time raising further the problems which arise through placing too much confidence in law as a means of redemption, be it within a strengthened Biodiversity Convention, a modified TRIPs agreement, or, other strategies such as farmers or community intellectual rights. In the end, these solutions share a common thread; they are a part of the same credo, problematising the environment from similar perspectives.

Finally, *Chapter 5*, places the issues and arguments that have been dealt with in the main body of this work, in the context of wider debates surrounding globalisation and food security. As the concluding episode of this particular story, *Chapter 5* looks forwards, drawing on the lessons learned by the

foregoing analysis in order to ask how, given the journey upon which we have engaged, we are to ensure our human and environmental futures. I argue that in contrast to actions focused at an abstract global level, such as those approaches that form the main focus of criticism within this work, diversity can only be maintained through localised strategies. I look at two farmers' organisations, one in Bangladesh, the NayaKrishi Andolon, and one in the Philippines, The Magsasaka at Siyentipko Para sa Ikauunlad ng Agham Pang-agricultura (MASIPAG), that have adopted their own strategies for maintaining both their biological and cultural diversity and their social and economic security.

Both these organisations have arisen in response to the perceived failures of previously adopted models of development. In stark contrast to the 'global' vision peddled by those concerned to promote the inevitability of mono-cultural transgenic crops in feeding the world, they provide inspiration for human and environmental futures which recognise their own plurality and heterogeneity, not, as models to be aped, but as striking examples of the regeneration of peoples' spaces attuned to their own developmental needs, the success of which is measured by their own values. These farmers' organisations, I suggest, provide examples of the only means of ensuring human dignity, food security and the continuation of social practices necessary for maintaining biodiversity. I do not propose that their particular solutions can or should be adopted globally, as that would run counter to much that I have argued throughout both this introduction and the rest of this

thesis, however our challenge is one of developing a language and understanding of diversity and law which does not deny the validity of their voice.

1.1 A Biotechnological Age

Biotechnology[6] or, at least, *some* of the issues associated with the products and processes of the many different technologies that encompass

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[6] There is no easy answer to the question "what is biotechnology"? As, the World Intellectual Property Organisation's (WIPO) 1992 *Guide On The Licensing Of Biotechnology* states, "The simple term 'biotechnology' covers a diverse range of technical activities and various definitions of its scope have been proposed. Biotechnology has been described as including any technique that uses living organisms (or parts of organisms) to make or modify products, to improve plants or animals, or to develop, micro organisms for specific uses. In perhaps the most succinct definition of the subject, biotechnology is said to be the industrial exploitation of biological systems." (p.11) Similarly Article 2 of the CBD defines biotechnology as "any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use," it has the potential to include a range of processes which we might not automatically associate with GM crops. As Daryl Macer comments "the word "biotechnology" simply means using living organisms, or parts of them to provide goods or services. The word can apply to agriculture in the past thousands of years ...we should not forget that all civilisations were formed needing food, clothes and medicines and in that sense biotechnology is not new." (*Report on Food, Plant Biotechnology and Ethics* for UNESCO *Proceedings of the Fourth Session of The International Bioethics Committee* (Paris: UNESCO) para 1.2)

Defining biotechnology in these terms however, would also include the use of yeast in the manufacture of bread, wine or beer. Indeed, such a wide definition is often helpful to the biotech industry as a means of generating the impression, that there is nothing new in the practices in which they are engaged. For example, in one of Monsanto's explanatory leaflets for Roundup Ready® soybeans, they claim that "in reality, biotechnology is not much different from the plant breeding that growers and plant breeders have been doing for generations; it is just more efficient and accurate ...Our early ancestors discovered that wine beer and bread could be produced using the fermentation process, in which micro-organisms rearrange chemical elements to form alcohol and carbon dioxide. Fermentation is a form of biotechnology, so bread and beer are some of the original products of the biotechnology process." (Monsanto (1997) *Roundup Ready soybeans: Technology Overview*) This position is in stark contrast to that taken by life science companies when seeking intellectual property rights for their 'inventions.'

While, there may be nothing technically at fault with definitions of biotechnology which include these essentially biological processes, they do little to describe that which is fundamentally different about the practices used by the new biotech industry, of the differences between what could and often is described as the new and the old bio-technologies. However a little later in its guide on the licensing of biotechnology, the WIPO manages to rectify this, when in saying that, "the distinctive feature of modern biotechnology is the act of technical intervention within the cells of the organism to act directly on cellular

biotechnology, are, today, of far wider public concern, than when I first began the research for this thesis. If the name of the giant agrochemical company Monsanto was then known to anyone outside of the farming, or, industrial chemical communities, it was, in all likelihood, due to them keeping a canister of the company's glyphosate based herbicide Roundup® in their garden shed.

At that time few people knew, or, for that matter cared, that Monsanto, together with a number of other large life science companies, were about to market genetically modified seeds to farmers, nor, did they realise that each time they added a squeeze of tomato puree to their spaghetti Bolognese sauce, they were potentially already using a genetically modified (GM) food product.[7] Many of the current life science giants, such as Novartis,[8] Aventis,[9]

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components often at the molecular level." (WIPO (1992) *Guide on the Licensing of Biotechnology* pp.14) Throughout this work, when I use the term biotechnology it is this notion to which I am referring, the ability to directly manipulate the genetic material of an organism at a cellular level.

[7] On Wednesday the 18th of May 1994, after five years voluntarily working with the U.S. Food and Drug Administration, the biotech company Calgene, (now Monsanto) were finally given approval to market their *Flavr Savr*® tomato (*The Washington Post*, Thursday May 19th 1994, pp.A.01). The *Flavr Savr*, ® originally launched by Clagene in 1992, was the first genetically engineered crop to be marketed in the U.S. The tomato contained two changes to its genetic structure, the first of these was aimed at reducing the levels of the enzyme polygalacturonase, which attacks the pectin in the cell walls of the fruit so that the rotting process would be slowed down, allowing the tomato to be ripened on the vine, rather than picked green and then reddened during storage using ethylene gas. The second change to the tomato's genetic structure, was the addition of a marker gene resistant to the antibiotic Kanamycin, added in order to allow scientists to identify those cells with the new transgene.

Calgene believed that the flavour of the vine ripened *Flavr Savr*® would command a premium price of around three times that of normal tomatoes, something that was necessary to recoup the resources they had spent during the USFDA approval process. However, they were wrong on both counts, not only was the *Flavr Savr*® regarded as not particularly tasty, but unfortunately for Calgene the *Flavr Savr*® turned out to be a commercial flop, in part due to difficulties with transporting the tomatoes intact (see Martha Groves in the *Los Angeles Times* 18th August 1997 pp.D1). By June 30th 1996, Calgene's reported net losses for the previous four financial years amounted to US $196 million, with Calgene reporting an additional loss alone of US $63.9 million in the six months ending December 31st 1996. *(Wall St Journal* Wednesday April 2 1997 pp.B.5). The, *Flavr Savr*® made its way into the UK via a tomato puree produced under licence by Zeneca and sold in Safeway stores.

and Pharmicia[10] had yet to come into existence and Dolly the sheep was just a twinkle in Ian Willmut's and Keith Campbell's eyes.[11]

Today the most prosaic aspects of genetic engineering receive an airing in the press all be it, that the stories are often poorly researched, seemingly reliant on PR handouts from either anti-GM, Non-Governmental Organisations (NGOs) or, the pro-GM biotech industry. In the United Kingdom,

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[8] Novartis, was formed by the merger of two Basel based companies, Sandoz and Ciba in 1996. In the first year of trading, their total sales amounted to CHF 31.2 billion ($21.53 billion) Focusing on life sciences, Novartis sold their chemical business at the same time as the merger and organised the company into three divisions, healthcare, agribusiness and nutrition of which healthcare amounted to 60% of Novartis's overall sales bringing in CHF 18,742 million (US $12,931 million), the agribusiness division accounted for 27% of the business or CHF 8,327 million (US $5,745 million) and Nutrition totalled CHF 4,111 million (US $2,836) or 13% of their world-wide sales. The agribusiness division was split again into 3 sections, crop protection which accounted for 73% of the division and sales in 1997 of CHF 6,088 million (US $4200 million); seeds which brought in CHF 1,346 (US $928 million) and represented 16% of the division; and animal health accounting for the remaining CHF 893 million (US $616 million) or 11% of sales. Overall the R & D investment in 1997 for the agribusiness division amounted to CHF 735 million (US $507 million).

With Novartis's acquisition of Merck's crop protection business for CHF 1.3 billion ($897 million) on 1st July 1997, Novartis became the largest crop protection company in the world. On December 2nd 1999 Novartis and AstraZenneca announced their intention to spin off and merge their agriculture divisions into a seperate listed company called Syngenta. The company would have combined sales of US $7.9 billion with the crop protection business accounting for US $ 6.9 billion and the Seeds US $1 billion making them the third largest seed company in the world after DuPont (who acquired Pioneer Hi Bred in 1999) and Monsanto.

[9] On the 1st of December 1998, Hoechst (which included AgrEvo) and Rhone Poulenc announced their intention to merge in order to create a new company, Aventis. Aventis was finally formed on 15 December 1999, it employs 90,000 people in 120 countries and had consolidated world-wide sales in 1999 of €20.5 billion (US $21.1 billion). The Crop Science division accounted for €4,055 million (US $4,174 million) of the overall sales with herbicides alone making up €1,529 million (US $1574). Seeds account for just €270 million (US $278 million) however this was an increased of 36.4 % on 1998, partly due to the success of LibertyLink® a genetically modified glufosinate tolerant seed package which Aventis regards as an important future product.

[10] Created by the merger of Monsanto and Pharmicia & Upjohn on April 3rd 2000.

[11] Dolly the sheep was the first successfully cloned mammal announced by Wilmutt *et al* in Vol.385 *Nature* pp.811-813 for an insight into the story of her emergence see, Wilmutt, I. Campbell, K. & Tudge, C. (2000) *The Second Creation* (London: Headline Book Publishing)

supermarkets such as Iceland[12] and Sainsburys[13] try hard to assure consumers that there are no genetically modified food products on their shelves, while at Monsanto's UK headquarters in High Wycombe, Genetically Modified Organisms (GMOs) were somewhat ironically banned from their canteen following 'customer concern'.[14] A far cry indeed from when the first GM food products almost imperceptibly found their way onto the supermarket shelves.

Whether reading a newspaper, watching the TV or listening to the radio, not a day goes by without encountering, or so it would seem, yet another story involving the 'new' biology and its potential impact on one, or other, aspect of our lives.

Popular books on genetics become best sellers, filling the shelves of bookshops everywhere; biotechnological 'breakthroughs' emerge almost weekly, as a new gene function or possible genetic 'cause' of disease is discovered; potential new medicines are found amidst the DNA of trees in

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[12] In the UK, Iceland has 770 Stores, a turnover of £1.4 billion, employs 22,000 people, produces over 2.000 own brand products and possesses a 16% share of the market. On Wednesday March 19th 1998 Malcolm Walker) founder Chairman and Chief executive of Iceland announced that from the 1st of May 1998 all Iceland's products would be GM free. (*The Guardian* Thursday March 19th) In an interview with John Vidal (*The Guardian* April 1st 1998 pp.T4) Walker described how relatively easy this task had been even though it had taken 18 months for the Technical director to trace back all the ingredients to source.

[13] On the same day that Iceland took out full page advertisements in UK national newspapers stating that they were GM free, Sainsbury claimed to have eliminated GM products from all but 20-25 of its own brands.(*Financial Times* Saturday May 2nd 1998).

[14] *The Guardian*, Thursday December 23 1999. An incident that Iceland turned into a PR stunt by delivering non GMO party snacks to their door.

tropical rain forests; seemingly wondrous claims are made regarding the potential benefits of genetically modified 'super' plants, or, animals, engineered in order to feed more people, provide better yields, or more nutrition, than those plants or animals that are bred "traditionally"; at the same time, we are told, geneticists are now able to "map" the genetic structure of human beings, or at least the 5% -10% they have decided is not "junk." Geneticists are, it would seem, a new breed of prophet, who with an almost religious fervour, bring us ever closer to a truer understanding of nature, and humanity.

Subsumed by the hyperbole, however, are a host of novel social, ethical and legal issues that appear to be given less consideration in the pages of the press, when compared to the column inches given over to each new genetic 'discovery.' In addition, the speed with which these developments occur leaves the wider consideration of these complex issues continuously lagging behind existing technological possibilities, with reports by governmental or inter governmental committees and bodies, fated to be out of date almost as soon as they are published, the destiny or, so it would seem, that is similarly prescribed for countless academic articles, books and thesis.

Attempting to keep track of what the giant multinational life science companies are doing on a day-to-day basis is a near impossible task. The consolidation of the life science industry in the areas of healthcare, agribusiness and nutrition continues apace at a dramatic rate. Despite the occasional hiccup,

shares in biotech companies continue to be considered a relatively good long-term investment. For, although political controversy now surrounds the introduction of GM food and crops, public confidence in the medical use of transgenic technologies remains high, providing at least one reason why when Monsanto and Pharmicia & Upjohn merged to create Pharmicia on April 3rd 2000, a company with combined pharmaceutical and agricultural sales of around US $16.5 billion, they partially span off the agribusiness side of the company to form a separate legal entity which retained the name Monsanto. This Multi billion dollar industry has come a long way from when the geneticist Herbert Boyer teamed up with the businessman Robert Swanson to start the company Genentech with $1,000 of their own money in April 1976.

Towards the end of the 1960's as genetic engineering began to make the move from the realms of science fiction, into the arena of scientific possibility, a number of those involved, called for a wider public debate on the potential risks of this new science. As one of the founding fathers of genetics James Watson, wrote at the time, "this is a matter far too important to be left solely in the hands of the scientific and medical communities."[15] Not all scientists were as quick to accept the prudence of encouraging such a debate, indeed James Watson himself was not keen to see limits placed on genetic experiments by those outside of the scientific community, while Philip Abelson, editor of *Science,* summed up a perhaps still widely held fear when he wrote that "talk

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[15] Watson, J.D. (1971) "Moving Towards The Clonal Man," *Atlantic* pp.53, quoted in Wright, S. (1994) *Molecular politics: Developing American and British Regulatory Policy for Genetic Engineering, 1972-1982* (Chicago: Chicago University Press) p.124.

of the dire social implications of laboratory related genetic engineering is premature and unrealistic. It disturbs the public unnecessarily and could lead to harmful restrictions on all scientific research."[16]

In 1972 the same Herbert Boyer who would start the first biotech company Genentech, four years later, together with Stanley Cohen, Robert Helling and Annie Chang, finally succeeded in transferring genetic material from the toad *xenopus laevis* into *Escheri Coli* (*E.Coli*). Some of the implications of Boyer and the others' successful experiment were soon at the forefront of the minds of those scientists involved in these early forays into cellular level genetic manipulation, leading 150 of them to meet in February 1975 at the Asilomar Conference Centre, Pacific Grove, California.

One outcome of the 1975 Asilomar conference was the lifting of a partial moratorium on experimentation, which had been in place since July the previous year, replacing them with a series of strict, self-imposed regulations. However, in many ways the effective result of the conference was to produce a climate whereby not only were the potential benefits of biotechnology stressed over the potential risks, but scientists were considered as those most capable of undertaking this risk analysis. As Susan Wright observes

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[16] Abelson, P. (1971) "Editorial: Anxiety About Genetic Engineering" 23rd July 1971 Vol.173 *Science* No.3994 at Editorial

"In general terms the legacy of Asilomar was a sense that the burden of proof rested with scientists to show that the new biogenetic technology they wanted to develop was safe, and until they could do so they should proceed with caution. ... The obvious differences between the British and Amercian institutions responsible for forming an initial policy assessment – the one public and the other semi private – should not obscure their functional similarities: both were oriented to promote biomedical research, and their primary constituencies were the communities of British and American biomedical researchers. Members of the committees and groups appointed by these institutions ... were drawn almost exclusively from their constituencies. ... It was in the interest of nearly all admitted to policy making arenas that they not jeopardize control of policy by dissension, apparent inaction, or acknowledging as central dimensions of the issue that obviously transcended the expertise of scientists. ... the overwhelming tendency of the process ... was to reduce the scope (and thereby the daunting complexity) of hazard evaluation by seeing broader social problems as falling outside the field of concern. Thus the genetic engineering problem was re-projected almost exclusively in terms of producing suitable safety precautions to contain hazards. In other words, it was reduced and redefined in terms that made it susceptible to a technical "solution". ... The proceedings of the Asilomar conference show that a reductionist discourse bearing within it the seeds of a technical solution expressed personal and economic interests in developing the field without external intervention and at the same time contributed powerfully to

defining and reinforcing the central role of biomedical research community in policymaking."[17]

Thus, while regulations were indeed later placed upon the research practices of the bio-genetic communities, not only was the extent of those regulations determined predominately by the community themselves, but as the economic possibilities of a biotech industry became apparent, what regulatory structures that were in place were oriented so as not to hamper possible lucrative research or, at a later date, internationally competitive business.

Arguably the single issue that has led to a recent renewed public interest in biotechnology is that of creating genetically modified crops and animals for food, so finally bringing about a public, although not always informed, and certainly limited, debate on biotechnology that Jim Watson and others called for at the end of the 1960s.

In both the UK and Europe, public scepticism of the life science industry's claims, as well as the ability, more generally, of scientists to definitively quantify risk, has increased over the past few years, perhaps in part, due to previous disquiet relating to food safety in respect of "Mad Cow Disease" (BSE) in beef, and, salmonella in chickens and chickens eggs.

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[17] Wright, S. (1994)) *Molecular politics: Developing American and British Regulatory Policy for Genetic Engineering, I1972-1982* (Chicago: Chicago University Press) pp.157 – 159.

In the United Kingdom there has been widespread direct action by grassroots organisations 'decontaminating' fields where GM crops are being tested.[18] Organisations as diverse as the Women's Institute, Greenpeace, Oxfam, the Consumers Association and The National Trust have all stated their anxieties amidst calls for a moratorium on further deliberate releases of GMOs. The British royal family, or, at least one of its members, Prince Charles, has also felt it a matter of such concern that he became involved in the debate.[19] As John Vidal wrote in the Guardian "the coming together of peace and environmental activists is just the tip of the opposition against companies promoting GM food technologies. A stunning array of middle England is now roughly united in disapproval or fear of the implications and is not impressed by corporate claims that GM is totally safe, healthy and will benefit the developing World."[20]

1.1.1 The Expansion of Transgenic crops

The first field trials for GM crops were conducted in France and the USA in 1986. Over the next ten years 3,647 trial permits for GM crops were issued in 34 countries, however, as each permit covers a number of sites and locations[21] the amount of individual field trials conducted during this ten year period stands at around 15,000. By far the greatest number of trial permits

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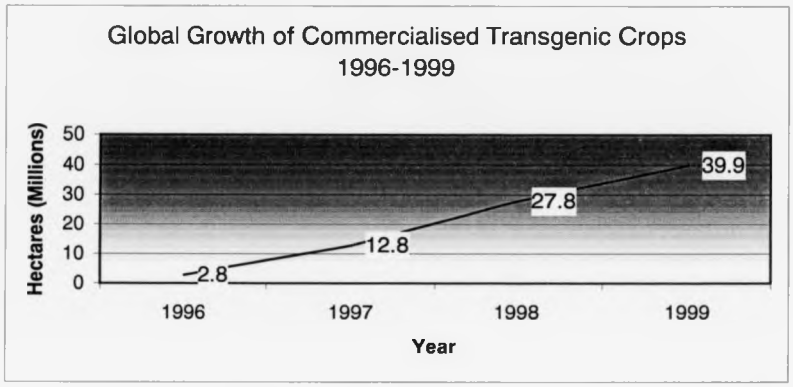
[18] See for example *The Guardian, June 13th 1998 Saturday pp.*1-2.

[19] Prince Charles wrote a number of articles and speeches on GM crops see for example his piece in *The Daily Telegraph*, Monday 8th June 1998, pp.16.

[20] *The Guardian* Friday, July 31st 1998 Home Page.

[21] For example in the US in 1995 although 707 permits were granted for trials the total number of field trials for that year was 3,728.

(1,952) were issued in the USA, representing 7,098 individual field trials and accounting for 54% of the global total of transgenic crop tests.[22]



Source - ISAAA[23]

In 1992 the first commercial planting of a transgenic crop, a variety of genetically modified tobacco resistant to Cucumber Mosaic Virus (CMV), took place in China. Since that time, while the total acreage of transgenic crops in China has not substantially increased,[24] it is the United States that has seen the most dramatic increase in the adoption of GM varieties with, in 1999, 28.7

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[22] James, C. & Krattiger, A.F. (1996) *Global Review of the Field Testing and Commercialization of Transgenic Plants: 1986 to 1995 The First Decade of Crop Biotechnology, ISAAA Briefs No. 1* (Ithaca, NY: ISAAA).

[23] Figures compiled from - James, C. (1999) *Global Status of Commercialized Transgenic Crops: 1999. ISAAA Briefs No.12: Preview* (Ithaca, NY: ISAAA); James, C. (1998) *Global Review of Commercialized Transgenic Crops: 1998. ISAAA Briefs No. 8* (Ithaca, NY: ISAAA); James, C. (1997) *Global Status of Transgenic Crops in 1997. ISAAA Briefs No. 5* (Ithaca, NY ISAAA).

[24] For an outline of China's use of transgenic crops and the introduction of Monsato's Transgenic cotton, see Song, Y. (1999), "Introduction of Transgenic Cotton in China." *Biotechnology and Development Monitor*, No.37, pp.14-17.

million hectares given over to transgenic crops out of a total 39.9 Million hectares globally.[25]

Country by Country Breakdown of Commercialised GM Crops 1999		
Country	Hectares (millions)	% of World Planting
USA	28.7	72%
Argentina	6.7	17%
Canada	4	10%
China	0.3	<1%
Australia	0.1	
South Africa	0.1	
Mexico*	< 0.1	
Spain	0.03	
Rumania	0.002	
France	0.001	
Portugal	0.001	
Ukraine	0.001	

Source - ISAAA[26]

*No exact figure available

The first crop to be commercially grown in the US was the FlavrSavr® tomato in 1994, however it has been soybean and corn that have led to the large increase in global planting, with soybean accounting for 54% of total transgenic crop plantings. Fifty percent of soybean now grown in the USA[27]

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[25] James (1999) *op.cit. n.*23.

[26] James (1999) *op.cit. n.*23.

[27] In 1999 15 million hectares of transgenic soybean were planted in the US out of a total of 30 million hectares, James (1999) *op.cit. n.*23.

and 90% of the soybean grown in Argentina[28] is now transgenic. Similar trends can also be observed in relation to other crops in so far as 33% of the corn grown in the US in 1999 was transgenic[29] as was 55% of the cotton crop,[30] while in Canada 62% of the 1999 canola crop was genetically modified.[31] To some extent therefore, the market has potentially levelled out in relation to some crops in some countries. Argentina, for example, can only attain further increases in the amount of transgenic soybean she grows, if more agricultural land is actually given over to growing soybean.

Crop by Crop Breakdown of Commercialised Transgenic Food Crops 1999

Crop	Hectares (Millions)	% of Global Planting
Soybean	21.5	54%
Corn	11.2	28%
Cotton	3.7	9%
Canola	3.4	9%
Potato		<1%
Squash		<1%
Papaya		<1%

Source - ISAAA[32]

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[28] In 1999 6.4 million hectares of transgenic soybean were planted in Argentina out of a total of 7 million hectares, James (1999) *op.cit. n.*23.

[29] Out of the total 31.4 million hectares of corn grown in the US in 1999, 10.3 million was transgenic, James (1999) *op.cit. n.*23.

[30] 3.2 million hectares of transgenic cotton was planted in the US in 1999, out of a total of 5.9 million hectares, James (1999) *op.cit. n.*23.

[31] 5.5 million hectares of Canola was planted in Canada in 199 out of which 3.4 million hectares was transgenic, James (1999) *op.cit. n.*23.

[32] James (1999) *op.cit. n.*23.

Through takeovers, mergers and intellectual property rights (IPRs), the advent of transgenic technologies and genetically modified crops are helping to create a setting within which the control of food production is passing into the hands of a small number of multinational agrochemical, or, as they would prefer to be known, life science companies. What is more, not only are both the production of food and the issue of maintaining biodiversity widely problematised as subjects requiring biotechnological solutions, but in addition, many governments and International Governmental organisations consider it in their interest to promote biotechnology.

What follows in this thesis, is a modest attempt to examine these sites of struggle, the spaces where diverse notions of knowledge collide; where medicine, science and commerce compete, not only, with environmental and developmental discourses, but also, with the knowledge systems and social practices of many diverse cultures. It is an attempt to understand how issues in relation to the maintenance of biodiversity and the production of food become problematised, first as scientific and then as biotechnological questions.

Each new biotechnological development brings with it changes in the way that nature and humanity are constructed within particular social networks extended in time-space. This thesis examines some of the ways in which the construction of knowledge occurs, and importantly considers some of the potential consequences of this process for biodiversity and our environments.

This thesis therefore is as much about the multiplicity of ways that the inhabitants of this planet experience the world, as it is about biotechnology, law or development.

In order successfully to achieve any meaningful discussion on the potential effects of GM crops for our lived environments, it is, I believe, necessary to move beyond both a limited concern with the manner in which the deliberate release of GMOs can be regulated and a narrow focus on the possible direct causal effects of GMOs on the environment.

A central tenet of my argument lies in the belief that we cannot understand nature other than through our multiple engagements with the social. That, the manner in which we perceive nature can only ever be through our location within a complex web of cultural practices, practices which hold no 'objective' meaning outside of themselves.[33] At the centre of this thesis therefore is the notion that there is, and never can be a singular thing such as *'nature'*, or, *'the environment'* that can be conceived of and managed on a global scale. What I consider to be problematic therefore, are not only the solutions that are generally posited to the 'conservation' of biodiversity, but also the manner in which environmental issues are problematised, the form in which questions are constructed, and, more generally, the theoretical and sociological tools we use to construct the world, nature and our environments.

Knowledge about biological diversity is produced by social and therefore spatial and temporal practices. Changes to spatial and temporal practices, the manner in which space and time are constructed, result in changes in the way that biological diversity is problematised, therefore, involving changes in the way that biodiversity is understood. As a consequence we need to consider not only how we come to know the world, the manner in which the meanings of things are maintained over distance through space and time, but also, how we understand nature, the nature of things and the nature of our lived environments, how space and time are themselves constructed. Space in this sense should be considered as a social phenomenon and not a geometric construction or vacuous void, for, "in reality social space incorporates social actions, the actions of subjects both individual and collective who are born and who die, who suffer and who act."[34]

Bio-diversity can therefore, only be understood and maintained, within myriad sets of recursive cultural practices, defined by relationships that are grounded within specific spatial and temporal locations. The environments and spaces of which I write, are socially constituted; they are multiple, diverse and contested. Nature should not be considered as separate from culture but rather as a miscellaneous collection of territorialised spaces. As with the physical location of most of this planet's plant genetic diversity, the myriad

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[33] This is discussed further in Chapter 2 below.

[34] Lefebvre, H. (1991) *The Production of Space* Trans. Donald Nicholson – Smith (Oxford: Blackwells Publishers) p.32.

practices of local communities, farmers and indigenous peoples within the two-thirds world, hold the key to maintaining not only our knowledges about bio-diversity, but the production of biodiversity itself.

This thesis is not a journey to seek the authentic truth from an idealised peoples 'in touch' with 'mother nature.' There are no 'noble savages' here, nor, do I seek recourse in the concepts of de-traditionalisation, 'modernisation,' globalisation or (post)modernity, to explain the experiences which peoples are undergoing throughout the world. For, all of these notions are built upon reductionist myths, they lay claim to objective truths and singular notions of 'progress,' prioritising one particular set of social practices over others. For this reason I try not speak of the conservation of bio-diversity, or for that matter of *the environment*. For, conservation suggests stasis, it suggests the ability to objectively understand nature outside of specifically grounded social practices and *the environment* suggests a singular place that we all understand in the same way. In the end such reductionist accounts I shall argue, deny that which they seek to 'conserve' the social production of diversity.

One of the arguments that I shall develop throughout this thesis, is that seeds, as with all social objects, possess no meaning other than that which is provided by virtue of their existence within a web of social practices. We

should consider them 'assemblages'[35] a concrete physical form mingled with a body of knowledge and its associated cultural practices. Genetic technologies in this sense are social for, "there is always a human technology which exists before a material technology."[36] Seeds as assemblages both perform and embody particular ways of seeing the world, or rather, perform and embody a 'modes of ordering' the world. Seeds are both actors and agents, their meaning derived from social practices whose reach extends through time and space. However, their agency is fragile, without the extension of disciplinary practices to support them, seeds loose their meaning, and no longer act as agents for a specific social network. In Chapters 3 & 4 I examine how seed manufacturers attempt to maintain the meaning of their seeds, through time and space and the implications these attempts at ordering pose for biodiversity.

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[35] I have borrowed the term from Deleuze and Guattari and use it in much the same way. Although their use of the word is not easy to define in a limited space the following extracts form Deleuze, G. & Guattari, F. (1988) *A Thousand Plateaus: Capitalism and Schizophrenia* (London: The Athalone Press) provide some sense of the manner in which in which they deploy it. "On a first horizontal axis an assemblage comprises two segments, one of content, the other of expression. On the one hand it is a *machinic assemblage* of bodies, of actions and passions, an intermingling of bodies reacting to one another; on the other hand it is a collective *assemblage of enunciation*, of acts and statements, of incorporeal transformations attributed to bodies. Then on a vertical axis, the assemblage has both *territorial sides*, or reterritorialised sides, which stabilize it, and *cutting edges of deterritorialization*, which carry it away." (p.88) "We will call an *assemblage* every constellation of singularities and traits deducted from the flow – selected, organized, stratified – in such a way as to converge (consistency) artificially and naturally; an assemblage in this sense, is a veritable invention" (p.406).

[36] Deleuze, G. (1988) *Foucault* (London: The Athlone Press) p.48.

1.1.2 Beyond the Direct Causes of Environmental Harm

In order for us to fully comprehend some of the potential environmental consequences, and in particular the possible impending harm for agricultural biodiversity that the introduction of GMOs may bring about, it is necessary to consider the processes, practices and legitimating myths and ideologies which accompany, and indeed prefigure, the introduction of GMOs. These social processes are, as I shall argue later in this work, as important, if not a more, probable threat to our environments, than those causes of environmental harm that GMOs potentially pose from their direct biological interaction with other flora and fauna, and upon which most regulation of genetic engineering has focused.

The deliberate release of genetically modified organisms, into the 'natural' environment,[37] brings with it a number of potential detrimental consequences. For example, there are the potential pleiotropic[38] and epistatic[39] effects of transgenes in the original modified plants; the risks of cross pollination with

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[37] Below I shall argue that when we talk of a 'natural environment' it is always a mediated and therefore a multiple environment. Although occurrences may happen in the natural environment which are independent of human action, those occurrences will always be perceived from our embeddedness within multiple social networks, that is, that our environments can only ever be understood. Despite recognising this I adopt the phrase natural environment here precisely to draw the distinction between our mediated and social understanding of our environments and the biological interaction of elements within these environments.

[38] Pleiotropy is the effect of the trangsene on the functioning of other genes in the organism thus affecting more traits than the one targeted in the modified organism.

[39] Epistasis is the process through which one gene modifies the expression of another gene that is not an allele of the first.

wild relatives; the risks of horizontal gene transfer[40] and then recombination creating plants that contain the original transgene or transgenes; increases in antibiotic resistance resulting from horizontal gene transfer;[41] the possibility of 'super' pests developing increased immunity to the modified organism; the prospect that a crop engineered predominately to protect against attack from for example the Boll worm or European corn borer, will also kill other insects such as butterflies or bees;[42] the continued reliance on agrochemicals which pose potential detrimental effects for soil nutrition; and, the possibility of vector recombination creating new strains of viruses.

In this thesis, rather than concern myself with these potential causes of environmental harm, I examine the possible *structural* or *social* causalities of environmental change and degradation, which potentially arise with the deliberate release of GMOs into the environment. In particular I shall be examining the manner in which biodiversity is threatened by GMO's through the legal, economic and political practices, that have accompanied their development and introduction. These social practices, involve a myriad of non-linear sets of interactions between multiple social networks, a crucial

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[40] The transfer of genes from one organism to another by means other than reproduction (vertical gene transfer). A number of means of transferring and altering genetic material occur naturally through for example *viruses*, many of which cause diseases, and other pieces of parasitic genetic material, called *plasmids* and *transposons*.

[41] Antibiotic resistant genes have frequently been used as markers, enabling genetic engineers to tag those cells that have taken up the gene for the specific trait to be modified, Ciba-Geigy's (now Novartis') transgenic maize for example, contained a gene resistant to ampicillin, while Calgene's (now Monsanto's) modified Tomato mentioned above (n.7) contains a marker gene resistant to Kanamycin. The fear is that these genes will then transfer to humans through horizontal gene transfer bringing about increased resistance to antibiotics.

[42] Bt cotton for example developed to protect cotton from Boll worms.

element of this thesis is therefore concerned with the transformative power of biotechnology, or, more accurately, it is concerned with the power that arises as a function of the mobilisation of biotechnologies within polymorphic social networks. How these networks are maintained and extended through space and time, as well as their significance for our understanding of our lived environments, are the central concerns of this work.

1.2 Modest Sociologies of Multiple Social Worlds

In *The Sources of Social Power,* Michael Mann argues against the use of social theories whose abstract generalisations make possible the assertions that there are such things as a society, or societies, whose organisation, development and history can ultimately be understood. Instead of searching for a definitive form of social order or organisation therefore, we should recognise the social as 'messy', both acknowledging and accepting this 'messiness,' which results from a reality wherein "societies are constituted of multiple overlapping and intersecting social networks of power."[43]

We need perhaps, to think of the social as an ever-present murmur, the continual clamour, of the living and the dead; a landscape that resonates with the voices not only of its six billion living inhabitants but echoes also with the voices of our ancestors. It is a landscape in which silences are generated through the practices of social networks, through the determination of that

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[43] Mann, M. (1986) *The Sources of Social Power: Volume 1 A history of power from the beginning to AD 1760* (Cambridge: Cambridge University Press) p.1.

which can and cannot be spoken. Because, "the patterns in the networks of the social are unknowably complex"[44], one can never truly 'know' *the* social, at best all that one can ever hope to achieve is a captured glimpse, which even then, is only a somewhat peripheral and partial hint of *a* multitude of social worlds.

The view from here is always a subjective and prejudiced view, because we can only ever 'know' the form and content of the world, from our location within the recursive cultural practices that are concurrently both the creation and the creator of our social worlds. We live our lives therefore embedded within these manifold, diverse and mercurial social networks, simultaneously both their product and their constitutive force, creating, inhabiting, and travelling through spaces, where meaning, truth and understanding, exist in a continual state of flux. To hold, therefore, that there is something so simplistic as 'a society', be it global or otherwise, a bounded totality with a structure that can be described in relation to a system, or series of subsystems; to suggest that social relations are merely the product of economic structures, or, a shared historical path which ends with alternatively either late, or, post modernity, leads only to a reductionist and violent cul-de-sac, where, like the tuning dial of a radio, the countless voices of the ether are filtered out until just one narrative remains.

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[44] Law (1994) *Organising Modernity* (Oxford: Blackwell Publishers) p.108.

What holds true for attempts to describe the social holds true also for attempts to describe 'law.' There is no attempt here to answer the question what is law? I do not believe it possible that law has a universally observable character grounded in either rule observance, sub system reflexivity, legal principles or morals. Such a search and recourse to such descriptions, must always be doomed to failure. For, 'law's' nature can only ever be found embedded in partial social associations and alliances that are extended in time-space; their relevance, enforceability, power, standing and content, reliant on the enrolment of others into social networks.

These observations however raise methodological problems, for not only do we have to question what are to be the foci of our study, if society or societies are not, but in addition, there remains the problem of how we escape the grip of abstractionism and the lure of the meta-narrative. The partial answer lies in limiting the scope of the claims, which, as sociologists we make for our work. At he same time, adopting as a focus of study the means through which power evolves within the polymorphic[45] spatial and temporal nexus which are our social habitat. From an analytical perspective this means focusing our attention towards the central problems of power, problems that concern

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[45] As Mann also uses the term polymorphic I ought to point out the different contexts in which we use the term. Mann uses the word polymorphic to describe a 'crystallisation' of differentially centred power which he believes is to be found in modern states (Mann, M. (1993) *The Sources of Social Power: Volume 2 The rise of classes and nation-states, 1760-1914* (Cambridge: Cambridge University Press) p.75.) On the other hand, I want to convey the notions of flux and flows through and within social networks; if morphing is the change of one substance into another, then polymorphing is meant to imply a multiple and never ending process of continual instability and change.

"*organisation, control, logistics, communication* – the capacity to organise and control people, materials and territories."[46] For, it is with the ability to stabilise meanings at a distance within topological social networks that power arises, all be it as I shall argue below, that such meanings are always partial and fragile.

Mann's own methodology does not escape criticism, his writing remains in the grand sociological tradition of Weber and Marx, seeking to provide a history of power through the ages. Mann's answer to the problem of abstract generalisation is to resort to a methodology not dissimilar to Weber's, drawing on a typography that not only distinguishes between six types of power; *collective, distributive, extensive, intensive, authoritative and diffused,* but also, categorises four organisational means through which power is controlled; the *ideological, economic, military and political.*[47] By using this typology he can then analyse *A history of power from the beginning to AD 1760* or *The rise of classes and nation-states, 1760-1914* by checking off the particular forms and organisational means of power, which he detects at particular moments in 'the history' of society.

As sociologists we frequently fail to acknowledge our partiality. The tendency to portray ourselves as impartial observers, adopting methodologies and theories which allow us to extrapolate from the specific out to the general,

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[46] Mann (1986) *op.cit. n.*43, pp.2-3.

[47] See throughout Mann (1986) *op.cit. n.*43, and Mann (1993) *op.cit. n.*45.

from the particular to the universal, emerge all to often in our work. Mann's typology is a case in point, all be it that it is somewhat less problematic than others, for, despite his recognition of the futility of abstract generalisation, he continues to create his own meta historical narrative on power.

In arguing that this is problematic, and that "all methodologies even the most obvious ones have their limits,"[48] it is necessary to ameliorate the problem of reductionism through a continual process of reflexivity. If we are not to resort to grand meta-narratives, to universalisation through abstraction, by recourse to notions such as globalisation, we must be prepared to explore means of describing complexity. In order to avoid the violence of hierarchies, we must be prepared to situate ourselves, to develop theories which as Nigel Thrift has suggested, are based on a "contingent foundationalism,"[49] whose groundings are always recognised as in contestation, so that in the words of Donna Harraway we write of "politics and epistemologies of location, position and situating where partiality and not universality is the condition of being heard to make rational knowledge claims. These are claims on peoples lives; the view from a body, always a complex structuring and structured body, versus the view from above, from nowhere from simplicity."[50]

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[48] Feyerabend, P. (1993) *Against Method* 3rd ed. (London:Verso) p.23.

[49] Thrift, N. (1996) Spatial Formations (London: Sage Publications) p.xi.

[50] Harraway, D.J. (1991) Simians Cyborgs and Women: The Reinvention of Nature (London: Free Association Books) p. 195.

Within this thesis therefore, I have attempted to develop both a 'modest' theory and sociology.[51] The theory is modest in so far as it makes few claims to universality. It claims only to describe how people come to know the social, without claiming either to know how they know the social, or for that mater how they should know the social. In adopting a modest theory I wish to limit the violence of hierarchies so that one can "make a clearing for voices that speak from outside the authorised scholarly discourse whilst simultaneously recognising that this ambition is only necessary to an extent, since the scholarly discourse network is but one form of practice"[52]

It is a modest sociology, in so far as it attempts to be what John Law describes as a *sociology of ordering.* For, "sociologies of ordering do not buy into a reductionist commitment to some final version of order ... to a particular theory of class or gender exploitation."[53] This is because sociologies of ordering "whether legislative or interpretaive prefer to explore how hierarchies come to be told, embodied, performed and resisted ... to choose to look at hierarchy in this way is neither to ignore it nor to deny it. Rather it is to tell stories about its mechanics about its instances about how we all do it, day by day."[54] Sociologies of ordering are concerned with both the mechanisms of power and the constitution of knowledge, they are concerned with the tactics,

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[51] This notion derives in particular from the works of Nigel Thrift, Donna Haraway, Bruno Latour, John Law and Michel Callon.

[52] Thrift, N. (1996) *op.cit. n.*49, p.30.

[53] Law, J. (1994) *op.cit. n.*44, p.134.

[54] Law, J. (1994) *op.cit. n.*44, p.134.

strategies, functionings and techniques of power, examining the means through which power is exercised and knowledge is constituted. Finally, sociologies of ordering are perhaps primarily concerned with telling stories.

The philosopher, Walter Benjamin called for the necessity of story telling as a means of becoming, a means of establishing the speakers place and their relation to time.[55] This act of story telling, is one that I wish to engage in, however, I am well aware that story telling is not a neutral affair. Throughout this thesis you will find a collection of stories. There are stories about property and stories about law. There are environmental stories and scientific stories, spatial stories and temporal stories. There are stories of resistance and stories of struggle, but above all, the stories which are re-told here, are all stories about ordering. This is not, however, a fully accurate description of their nature, for these stories are not just *about* ordering, they do not simply *tell* of attempts at social ordering, *they are* themselves ordering stories, or perhaps it is rather that *they are both stories of ordering and stories which attempt social order*, however partial their success. This theme is one which returns constantly throughout this work, a theme from which I cannot myself escape, for, in my attempt to tell a story of ordering stories, I too am creating my own ordering tale.

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[55] Benjamin, W. (1999) *Illuminations*, Trans.Harry Zorn (London: Pimlico).

I argue that the 'social' is materially heterogeneous. That the dichotomy between human and non-human objects is an artificial one, in so far as the materiality of human and non human objects, the meanings with which they are endowed, are the relational effects of what can be described as polymorphic social networks. These social networks, fold time and space, while creating alliances and spaces of convergence. They continually struggle to maintain their stability while mapping the borders of their territory, demarcating domains of coherence and of power. As the individual paths of our lives continue on their nomadic trajectories, leaving their trace in space and time, our relative locations to other human and non-human objects in time-space, our proximity and sense of connectedness, are thus derived from our transient locations within these topographical social networks. Therefore, in so far as we cannot escape our embeddedness within the social, we can neither escape its multiplicity and the partiality of the particular within it.

Thus, all objects should be regarded as a function of the social, and therefore, all human and non-human bodies, need to be considered as continually located at the intersection of a multitude of networks. The exterior surface of these bodies becomes a site of encounter, capable of representing multiple meanings as if internal to themselves. Social bodies or objects, can be regarded as assemblages, while they may have a concrete form, the meaning of this form is contingent on the interplay of networks which come to bear on their surface. Social objects are always therefore contingent, an assemblage

of cultural practices. Thus when we speak, we have no option but to speak from within this contingency.

1.3 Strategic Visions: Stabilising Facts and Ordering Worlds

In June 1999 the Nuffield Council on Bioethics published the fifth of their major reports on the ethical implications of genetic technologies. The report entitled *Genetically Modified Crops: The Ethical and Social Issues,* considers many of the possible implications of GM crops for the health and environments of peoples within both the north and south, before recommending a series of strategies for successfully monitoring and regulating their introduction. From the opening pages of the introduction however, the report's own ordering tale becomes strikingly apparent. As the following extract indicates, the Nuffield Council's working party proceeds from an *a priori* assumption that while ethics is a product of the social, the essential character of science is defined by the rules of nature.

> "The development of GM plant technology raises two kinds of issues: the scientific and the ethical. Science is concerned with understanding the world in which we live and in particular the causal relationships that shape that world ... Ethics, by contrast is concerned with what we ought or ought not to do. Ethical principles provide standards for the evaluation of policies or practices, for example, indicating that it would be wrong to carry out a

certain genetic modification because to do so would threaten human health or the environment"[56]

This artificial positivist separation between science and ethics, between a supposedly neutral scientific world as it is, and a politically contentious social world, is one which we shall see drawn by numerous actors on a number of occasions throughout this thesis. This proposal is problematic however, in so far as it suggests that nature directs the construction of science, while at the same time denying the social construction of scientific knowledge: for, in the assertion that science is the discovery of unproblematic facts about the world as it is, we are presented with a false dichotomy between the multiple worlds of the social and the singular world of nature.

A model of science that denies its complexity and lack of consensus, denies also, the negotiations that must take place between the many social networks and different modes of ordering which go to make up the many parts of scientific enterprises. In addition the claim that science rationally uncovers objective and therefore universal truths of the natural world, has the effect of if not silencing, then certainly rendering to an extent unheard, claims or questions regarding the validity of scientific claims, most especially when the claims arise from those outside of the scientific disciplines. As the Physicist and environmental activist Vandana Shiva argues, "the conventional model of

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[56] Nuffield Council on Bioethics (1999) *Genetically Modified Crops: The Ethical and Social Issues* (London: Nuffield Council on Bioethics) p.6, para. 1.2.

science, technology and society locates sources of violence in politics and ethics, that is in the application of science and technology, not in scientific knowledge itself."[57]

While those involved within science know that "scientific work is heterogeneous"[58] this does not prevent science, as we shall see below,[59] frequently being mobilised, as a unified practice, which, through reason, discovers the objective, universal, truth, about nature. This modern day 'myth'[60], or, 'fairy tale' as Paul Feyerabend[61] has dubbed it, is a reductionist account, as all accounts undoubtedly are, that not only passes over the complexity of social practices and interactions contained within it, but also, proceeds from an *a priori* supposition that 'nature' can be understood as distinct from cultural practices. Moreover, the assertion that 'the secrets of nature', can be revealed once and for all within the scientific 'field', leads to

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[57] Shiva, V. (1990) "Reductionist Science as Epistemological Violence" in Ashis Nandy ed. *Science Hegemony and Violence: A requiem for Modernity* (New Delhi: Oxford Univeristy Press & The United Nations University) p.233.

[58] Star, S.L. & Greisemer, J.R. (1989) "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39" Vol.19 *Social Studies of Science* 387 at 387.

[59] Although this is a theme that surfaces throughout this thesis, it is particularly relevant in relation to the discussion in Chapter 3, concerning the Biosafety Protocol negotiations.

[60] In using the term myth, both here and throughout this thesis, I can do no better than quote Barthes in saying that "*myth is depoliticized speech* ... Myth does not deny things, on the contrary, its function is to talk about them; simply, it purifies them, it makes them innocent, it gives them a natural and eternal justification, it gives them a clarity which is not that of an explanation but that of a statement of fact ... In passing from history to nature, myth acts economically: it abolishes the complexity of human acts, it gives them the simplicity of essences, it does away with all dialectics, with any going back beyond what is immediately visible, it organises a world which is without contradictions because it is without depth, a world wide open and wallowing in the evident, it establishes a blissful clarity: things appear to mean something by themselves." Barthes, R. (1993) *Mythologies* (London: Vantage) p.143.

[61] Feyerabend, P. (1975) *Against Method: Outline Of An Anarchistic Theory of Knowledge* (London:NLB).

the privileging of one body of knowledge over others, with the assertion that the knowledge and the products of scientific 'progress' should supplant 'less' advanced knowledges and products. In our case in particular, that the crops and knowledges of many of those in the two thirds world should be replaced by advanced scientific farming techniques and improved modified crop varieties. As Feyerbend comments

> "I assert that there are no 'objective' reasons for preferring science and western rationalism to other traditions ... It is true that Western Science has now infected the whole world like a contagious disease and that many people take its (intellectual and material) products for granted - but the question is: was this a result of argument (in the sense of the defenders of Western Science), i.e. was every step of the advance covered by reasons that are in agreement with the principles of Western Rationalism? Did the infection improve the lives of those who were touched by it? The answer is no to both questions"[62]

Thus, although the myth of science maintains a strong hold on the consciousness, and is frequently resorted too by those seeking to assert the neutrality of an overtly political act, it has, at the same time, come under increasing scrutiny; a result of both its own self reflexivity, which renders unrecognisable the description of the way that 'science' is 'done' found within the myth, and the result of a wider more general scepticism of all attempts at

the making and privileging of universal truth claims whose professed legitimacy rests only in logocentric reasoning.

To say that scientific knowledge is socially constructed is not however, to say that the events which science describes do not occur. Nor, is it to say that the objects of scientific entrepreneurship do not exist other than as epistemic inventions. Rather, it is to recognise the hybrid character of that which we call nature, a simultaneously real and narrated nature, a nature which can never be understood other than through our multiple and diverse social existence. As Bruno Latour argues in relation to the ozone hole it is "too social and too narrated to be truly natural; the strategy of industrial firms and heads of state is too full of chemical reactions to be reduced to power and interest; the discourse of the ecosphere is too real and too social to boil down to meaning effects."[63] Similarly here, the subjects of biodiversity and the risks posed to it by transgenic crops, are too social and too narrated to be capable of description as if from a neutrally disinterested scientific gaze, which exists anyway, only in myth.

1.3.1 A Serendipitous Helix

The two elements of this 'fairy tale', which 'scientists' would perhaps most easily accept as unrepresentative of their work are found, in the assertion that 'science' is a unified practice, as well as in the claim that the results of

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[62] Feyerabend, P. (1987) *Farewell to Reason* (London: Verso) p.297.

scientific endeavour are always achieved through the application of reason. As the practising scientific researcher knows, and as we shall see below, most scientific discoveries include a degree of chance, or luck, which negates the claim to the process of 'discovery' as resting in pure reason. At the same time, the 'successful' co-existence of different methodologies, theories and scientific disciplines, renders the notion of a unified scientific project progressing step by step towards a universal theory of everything, as pure fantasy. An apposite example through which to explore these ideas a little closer, can be found Crick and Watson's story of the structure of DNA.

On April 25th, 1953 the British scientific journal *Nature*, published, 3 related papers. The first, written by James Watson and Francis Crick,[64] who were, at the time, two unknown biochemists at the Cavendish Laboratory, Cambridge, spanned barely more than a page, but was to have an impact out of all proportion to its size. For Crick and Watson personally, publication brought international fame and repute, while at the same time earning them, along with fellow biochemist Maurice Wilkins, a Nobel Prize in 1962.[65] Not only is Crick and Watson's original 1953 paper, when taken alongside the three

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[63] Latour, B. (1993) *We have Never Been Modern* Trans. By Catherine Porter (London: Harvester Wheatsheaf).

[64] Watson, J. and F.H.C. Crick (1953a) "Molecular Structure of Nucleic Acid; A Structure for Deoxyribose Nucleic Acid" Vol 171 *Nature* pp. 737-738.

[65] The citation for the 1962 Nobel Prize for Medicine or Physiology states that it was awarded to three "for their discoveries concerning the molecular structures of nucleic acid and its significance for information transfer in living material."

others that they wrote in that year,[66] considered with the work of Charles Darwin and Gregor Mendel as revealing one of 'the great secrets of life,' but also, arguably, provided the basis from which has grown a multi-billion dollar industry.

Crick and Watson proposed "a radically different structure for the salt Deoxyribose Nucleic Acid"[67] (DNA), claiming that it "has two helical chains each coiled round the same axis."[68] They were not the first to suggest a structure for DNA.[69] However, the two related papers in that April 25th edition of *Nature,*[70] carried the results of independent experiments by scientists at Kings College, London, which appeared to lend support to Crick and Watson's proposal that DNA molecules formed a double helix.

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[66] Five weeks later on the 30th May, *Nature* published a second article, Watson, J.D. and F.H.C. Crick (1953b) "Genetical Implications of the Structure of Deoxyribonucleic Acid Vol.172 *Nature* pp. 964 - 967. The other papers were J.D. Watson and F.H.C. Crick (1953c) "The Structure of DNA" *Cold Spring Harbour Symposia on Quantitive Biology*, XVIII pp. 123-131 and Crick, F.H.C. and J.D. Watson (1954) "The Complimentary Structure of Deoxyribonucleic Acid" *Proceedings of The Royal Society*, Vol .A. 223 pp. 80-96.

[67] Watson & Crick (1953a) *op.cit. n.*64, p. 737.

[68] *Ibid.*

[69] Linus Pauling and Robert Corey had published a paper proposing a structure for DNA earlier in 1953 Pauling, L. and R.B.C. Corey (1953) Vol. 171 *Nature* pp. 346, which Crick and Watson criticise in their original 1953 paper. Crick and Watson's paper also makes a passing reference to a structure proposed by Fraser "in the press". This was added following comments by Maurice Wilkins and Rosalind Franklin at Kings, where Fraser was a colleague, on the first drafts of the *Nature* paper. According to Jim Watson, Fraser's work was "until then unknown to us in detail" and "did not seem worthwhile resurrecting only to be quickly buried" however they kept the reference. See Watson, J. (1981) *The Double Helix; A Personal Account of the Discovery of the Structure of DNA, A new Critical edition ed Gunther S, Stent.* (London Wiedenfield and Nicholson) pp.128-129.

[70] Wilkins, M.H.F., A.R. Stokes and H.R. Wilson, (1953) " Molecular Structure of Deoxypentose Nucleic Acids" Vol. 171 *Nature* pp. 737-740 and Franklin, R.E. and R.G. Gosling "Molecular Configuration in Sodium Thymonucleate" Vol.171 *Nature* pp. 740-741.

As Francis Crick comments, their 'discovery' was driven in part, "not by logic but by serendipity."[71] Crick and Watson's approach to 'the problem of DNA', was "to ask which atoms like to sit next to each other. In place of pencil and paper, the main working tools were a set of molecular models superficially resembling the toys of pre-school children."[72] Their reasons for doing so were numerous, in part, it was because as Watson admits, when he came to Cambridge he "knew nothing of about the X-ray diffraction techniques which dominated structural analysis."[73] Perhaps the primary reason, for Crick and Watson's adoption of this model building technique, however, had been its successful use by Linaus Pauling in 1951, when he had described the á form of the protein Keratin (the protein involved in the production of hair and fingernails) as having a helical structure.

In adopting this technique, Crick and Watson were attempting to "imitate Linaus Pauling and beat him at his own game."[74] They considered that "Pauling's accomplishment was a product of common sense, not the result of complicated mathematical reasoning"[75] Of course 'common sense' is always grounded in a particular set of cultural practices, in this case those of a scientific 'field', but the point remains that the search for DNA's structure was

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[71] Crick, F. (1990) *What Mad Pursuit: A personal View of Scientific Discovery* (Harmondsworth: Penguin) p. 65.

[72] Watson, J. (1981) *The Double Helix; A Personal Account of the Discovery of the Structure of DNA, A new Critical edition ed Gunther S, Stent.* (London Wiedenfield and Nicholson) pp.32/34 (herinafter Watson *DH).*

[73] Watson *DH* p.22.

[74] Watson *DH* p.32.

[75] Watson *DH* pp.32/34.

not based solely in the application of reason, instead as Watson describes the process, "all we had to do was construct a set of molecular models and begin to play- with luck, the structure would be a helix."[76]

Watson's own admission of his inadequate knowledge of crystallography and X ray diffraction techniques also raises the matter of the multitude of methodologies employed by those seeking to define the structure of DNA. Those such as Rosalind Franklin whose work Watson somewhat uncharitably but characteristically recalls in the following terms.

> "The years of careful unemotional crystallographic training had left their mark. She [Franklin] had not had the advantage of a rigid Cambridge education only to be so foolish as to misuse it. It was downright obvious to her that the only way to establish the DNA structure was by pure cyrstallographic approaches. As model building did not appeal to her, at no time did she mention Pauling's triumph over the á-helix. The idea of using tinker toy like models to solve biological structures was clearly a last resort. Of course Rosy knew of Linus' success but saw no obvious reason to ape his mannerisms. The measure of his past triumphs was sufficient reason in itself to act differently; only a genius of his stature could play like a ten year old boy and still get the right answer."[77]

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[76] Watson *DH* p.34.

[77] Watson *DH* p.45.

In contrast to Rosalind Franklin's 'unemotional' methods, Watson describes his own more serendipitous and presumably more emotional approach for discovering the structure of DNA, unleashing his own inner child to play in the laboratory and discover the beauty of truth.

> "I spent the afternoon cutting accurate representations of the bases out of stiff cardboard. But by the time they were ready I realised that the answer must be put off till the next day ... when I got to our still empty office the following morning, I quickly cleared away the papers from my desk top so that I would have a large, flat surface on which to form pairs of bases held together by hydrogen bonds. Though I initially went back to my like with like prejudices, I saw all too well that they led nowhere. When Jerry came in I looked up, saw that it was not Francis, and began shifting the bases in and out of various other pairing possibilities. Suddenly I became aware that an adenine-thymine pair held together by two hydrogen bonds was identical in shape to a guanine-cytosine pair held together by at least two hydrogen bonds."[78]

Indeed, not only does Watson recall, that one day having built their model, "we had lunch, telling each other that a structure this pretty just had to exist,"[79] but Crick, tells of an occasion when Jim Watson, slightly the worse for drink, spoke to a Cambridge biophysics club at Peterhouse College. According to

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[78] Watson *DH* p.114.

[79] Watson *DH* p.120.

Crick, when Watson "came to sum up he was quite overcome and at a loss for words. He gazed at the model, slightly bleary eyed. All he could manage to say was "It's so beautiful, you see, so beautiful!" But then of course it was."[80]

Despite or perhaps because of this belief in the aesthetic quality of their discovery, Crick and Watson's original 1953 paper was "both brief and restrained."[81] While Watson claims to have rushed home one night to tell his sister Elizabeth and her companion Bertrand Fourcade that "I had probably beaten Pauling to the Gate and that the answer would revolutionise biology,"[82] when it came to including a discussion of the genetic implications of their discovery in that first article, Watson was not so confident. As Crick remarks "Watson was against it. He suffered from periodic fears that the structure might be wrong and that he had made an ass of himself."[83] Thus a compromise was reached whereby they included the sentence "It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material."[84] It was only after seeing the two papers from Kings published in the same issue of Nature, that Watson became more confident and wrote with Crick a second paper published on the 30th May 1953[85].

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[80] Watson *DH* p. 79.

[81] Crick, F. (1974) "The Double Helix: A Personal View" Vol. 248 *Nature* p.766.

[82] Watson *DH* p.116.

[83] Crick (1974) *op.cit. n.*81 p.766.

[84] Watson & Crick (1953a) *op.cit. n.*64, p.737.

Crick and Watson's playfulness, may have led to their ability to outline the structure of DNA but while dramatic, it is not quite the stuff of heroic scientific saga; of a valiant effort to uncover the truth about nature through the application of human reason. Nor, did Crick and Watson's endeavours occur in a vacuum, rather, they took place against a backdrop of many others work, each employing different methodologies, illustrating the collection of cultural practices, or modes of ordering,[86] which are contained within 'science' but which must at the same time be presented as forming a composite whole, if the aspirational objects of scientific desire are to be successfully standardised and mobilised. Indeed in many ways the stories contained within this thesis are a continuation of that process, a continuation of the means through which childlike cardboard models are successfully mobilised outside of the laboratory as the truth about nature and, of how genetic mythologies find their concrete form in social practices extended in time and space.

Foucault rightly observes that "order is at one and the same time, that which is given in things as their inner law, the hidden network that determines the way they confront one another, and also that which has no existence except in the grid created by a glance, an examination, a language; and it is only in the blank spaces of this grid that order manifests itself in depth as though already there, waiting in silence for the moment of its expression."[87] However his

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[85] Watson & Crick (1953b) *op.cit. n.*66, pp. 964 – 967.

[86] The phrase comes from Law (1994) *op.cit. n.*44.

[87] Foucault, M. (1974) *The Order of Things: An Archaeology of the Human Sciences* (London:Routledge) p.xx.

observation automatically raises the question as to how these ordering processes, which are only ever partial, take place. What is the manner in which facts are both created and stabilised, all be it temporarily, and objects acquire meanings as if intrinsic to themselves?

It is this central concern which forms the framework of this thesis, for, if order is not inherent in things themselves, then it must be created in the application of practices and knowledges to things, it must inhere in the successful mobilisation and deployment of things, and must derive from the strategies and techniques of concrete individuals, rather than within any artificial claims to abstract and universal truths about the nature of nature. In other words I am not concerned with heroic stories of enlightenment, modernity, science, progress, development, and globalisation, because these serve to move our focus away from material relations that are the result of social orderings, limiting our possibilities by reference to abstract self-referential truth claims. Instead I am concerned with understanding how practices of translation and purification take place, of how nature is hybridised and mobilised of how boundaries are created and traversed, of how our 'natural' worlds are given the illusion of permanence.

Permanences, or at least the illusion of permanences, are I would argue, achievable because while future possibilities may be limitless, our individual possibilities are limited by our location within a multitude of intersecting polymorphic social networks, that topologically create spatial and temporal

relationships between human and non human social objects acting also to create an artificial separation between the two. The multiplicity of social networks that come to bear upon us, provide us with choices while at the same time limiting the extent of those choices, so while conceiving of the social in this way implodes the separation between actor and agent, at the same time the limits of the possible must be perceived of as short stories rather than epic tales. As Latour comments

> "Seen as Networks, however, the modern world, like revolution, permits scarcely anything more than small extensions and practices, slight accelerations in the circulation of knowledge, a tiny extension of societies, miniscule increases in the number of actors, small modifications of old beliefs. When we see them as networks, Western innovations remain recognizable and important, but they no longer suffice as the stuff of saga, a vast saga of radical rupture, fatal destiny, irreversible good or bad fortune"[88]

1.3.2 Excluding the Children of Eve From the Garden of Science

At various time throughout this thesis, we shall see some of the actors in our tale, mobilise both science and modernity as heroic stories and noble quests, similar to the manner in which Gods take human form in much mythology. In these heroic sagas, humans such as Crick and Watson, become merely the

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[88] Latour (1993) *op.cit. n.*63, p.48.

embodiment of scientific and modern method, their bodies acting solely as conduits for the uncovering, through science, of nature, which, in its turn, can then be rationally managed. Of course, as we have seen, the mythology does not match the reality, but I think there is an important point here, for, science must be purified or perhaps it is better to say that its Godlike purity must be seen to be maintained, free from any infestation of human sociality, if it is to preserve its heroic and omnificent claims. When it becomes tainted by the presence of humans and can be seen to be nothing more than another social practice, its ability to maintain the positivist distinction between the worlds of politics and science becomes untenable and its authority is questioned.

One of the central paradoxes of the myth of modernity lies in the recognition that to be modern, is to acknowledge that modernity itself can never be realised; like science, modernity is narcissistic liking nothing better than to be its own subject, continually focused on itself, subject to continual processes of disintegration; for, "modernisation entails after all, the perpetual disruption of temporal and spatial rhythms, and modernism takes as one of its missions the production of new meanings for space and time in a world of ephemerality and fragmentation."[89] Thus the myth of modernity is one which states that to be modern, is to be always of the moment, to be endlessly reborn and yet at the same time, to be the most advanced that one can be, so that in the end

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[89] Harvey, D. (1989) *The Condition of Postmodernity* (London Blackwell Publishers) p.216.

modernity and science can be regarded simply as projects of penultimatism, as Habermas argues;

> "Because the new the modern world is distinguished from the old by the fact that it opens itself to the future, the epochal new beginning is rendered constant with each moment that gives birth to the new. Thus it is characteristic of the historical consciousness of modernity to set off the most recent [*neusten*] period from the modern [*neu*] age: within the horizon of the modern age, the present enjoys a prominent position as contemporary history... A present that understands itself from the horizon of the modern age as the actuality of the most recent period has to recapitulate the break brought about with the past as a *continuous renewal*."[90]

The myth of modernity is not just about continual processes of rupture and disruption however, it is also about the mobilisation of nature, the circulation of human and non human objects, of "immutable mobiles,"[91] by hybrid networks whose existence is in the same moment both recognised and denied, so that the proliferation of objects throughout 'the world as it is', is considered the uncovering of nature's order through human rationality. Thus for Alain Touraine, "it is impossible to describe as 'modern' a society which tries

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[90] Habermass, J. (1987) *The Philosophical Discourse of Modernity* (Cambridge: Polity Press) pp.6-7.

[91] Latour, B. (1987) *Science in Action: How to Follow Scientists and Engineers Through Society* (Milton Keynes: Open University Press).

primarily to organise and to act in accordance with a divine revelation or a national essence. But nor is modernity pure change or a mere sequence of events; it means the diffusion of the products of *rational* activity: scientific technological and administrative activity"[92]

It is this diffusion of the products of rational activity that is meant to mark the separation of a human journey from darkness into light, from a life governed by superstition about nature, to one where nature is conquered by humanity. Through enlightenment humanity is supposed to lead itself out of the shadows, so that, "the program of the enlightenment was the disenchantment of the world the dissolution of myths and the substitution of knowledge for fancy."[93] The shadows from which humanity emerged however, were, at one and the same time, a creation of enlightenment itself, for, the notion of the enlightenment merely substituted one set of myths for another; less the disenchantment of the world, more its re-enchantment and the substitution of one fancy for another. As Horkheimer and Adorno recognise "myth is already enlightenment and enlightenment reverts to mythology"[94] or perhaps more tellingly as Latour observes "how could we be capable of disenchanting the world when every day our laboratories and our factories populate the world with hundreds of hybrids stranger than those of the day before"[95]

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[92] Touraine, A. (1995) *Critique of Modernity* (Oxford: Blackwells) p.9.

[93] Adorno, T. and Horkhimer, M. (1979) *Dialectic of Enlightenment* Trans. By John Cumming (London: Verso) p.3.

[94] *Ibid* p.xvi.

[95] Latour (1993) *op.cit. n.*63, p.115.

It is within the myth of enlightenment, that modernity and science are given birth, for, in order to dissolve the myths and fancies that exist in the dark, humanity must come to control and dominate nature, it must free itself from superstition and the subjective fears of humans objectified onto nature. Thus, as Zygmunt Bauman argues

> "modern science was born out of the overwhelming ambition to conquer Nature and subordinate it to human needs. The lauded scientific curiosity that reputedly pushed the scientists 'to go where no humans yet dared to go' was never free from the exhilarating vision of control, management, making things better than they are (that is more pliable, obedient, willing to serve). Indeed Nature came to mean something to be subordinated to human will and reason – a passive object of purposeful action, an object itself devoid of purpose and hence waiting to absorb the purpose injected by its human masters. The concept of Nature in its modern rendition, opposes the concept of humanity by which it has been spawned."[96]

An example of this supposed mastery of nature by a scientific project elevated to a position beyond the realm of the social, can be seen in the prologue to *What Mad Pursuit* in which Frances Crick writes both of his discovery of the structure of DNA and of his 'early years', his loss of faith in the Christian religion and the reasons for his choosing to become a scientist. As Crick

relates his falling out with Christianity, he assigns religion to the realm of cultural practice, to superstition and non-reason, yet, despite his recognition of the serendipity involved in his research with Watson, denies science as a social practice, or I should rather say a collection of humans practices. When Crick writes of science he writes also of the triumph of modernity and rationality over superstition and fancy.

> "A belief, at the time it was formulated, may not only have appealed to the imagination but also fit well with all that was then known. It can nevertheless be made to appear ridiculous because of the facts later uncovered by science. What could be more foolish than to base one's entire view of life on ideas that, however plausible at the time, now appear to be quite erroneous? And what would be more important than to find our true place in the universe by removing one by one these unfortunate vestiges of earlier beliefs? Yet it is clear that some mysteries have still to be explained scientifically. While these remain unexplained, they can serve as an easy refuge for religious superstition."[97]

Crick has no doubt about the eventual triumph of science, even though his criticism of the foolishness of religion can equally be levelled at his own precious scientific model of science, after all how many scientists have led apparently foolish lives believing in one scientific truth, only to find out that

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[96] Bauman, Z. (1991) *Modernity and Ambivalence* (Cambridge: Polity Press) pp.39-40.
[97] Crick (1990) *op.cit. n.*71, p. 11.

they were worshiping at the altar of a false God. However, these beliefs in science, in modernity and progress, are important in the story to come because it is in the separation between traditional knowledge of biodiversity, and modern scientific knowledge of agricultural practices, that the battles around the problematisation of biodiversity and GMOs emerge. It is in the assertion that only new, modern and scientific agriculture, can solve the problems of food production and the maintenance of agricultural diversity that we find innovative practices of generations of farmers marginalized.

When Anthony Giddens observes that "modernity is essentially a post traditional order" so that "the transformation of time and space, coupled with the disembedding mechanisms, propel social life away from the hold of pre established precepts or practices"[98] he is, both right and wrong for while a belief in modernity leads one to accept the distinction between the traditional and the modern, between expert and lay knowledges, the fallacy of the observation lies in accepting modernity as real. To prefer 'science' in place of other social practices because of recourse to a universal and metaphysical conception of reason is in the end an untenable position, as "rationalism has no identifiable content and reason no recognisable agenda over and above the principles of the party that happens to have appropriated its name."[99]

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[98] Giddens, A. (1991) *Modernity and Self Identity: Self and Society in the Late Modern Age* (Cambridge: Polity Press) p.20.

[99] Feyerabend, P. (1987) *op.cit. n.*23 p.13.

1.4 Outline of a Thesis

To recap and summarise on what I have written so far. In this thesis I argue that biodiversity is threatened by biotechnology, *not*, because of the potential causes of environmental harm which GM crops may pose from, for example horizontal gene transfer or epistasis, although these are of themselves both significant and an important field of study in their own right, *but rather*, because of the means by which genetic technologies are deployed, the social practices and structures which facilitate and make possible not only the introduction of biotechnological products and process, but also, the existence of genetic technologies themselves.

This argument is simultaneously developed, within a theoretical framework that posits the social, as a heterogeneous amalgam of unknowably complex relationships; relationships derived from our continuous engagement in ordering processes whose success is only ever partial. Order in this sense, paradoxically resembles what we might more usually describe as chaos, it is a complex interaction of human and non-human objects that derive materiality from their location within polymorphic social networks extended in space-time. To this extent materiality needs to be considered as a social process, with the result that the material nature of any given human and non-human objects can be simultaneously conceived differently, within different social relationships. Importantly, given what I have to say about our relationship with nature and biodiversity, this is not a concern "with the simple unfolding of social structures

in space but with the means whereby networks of actors *construct* space by using certain forms of calculation and representation"[100]

Although I expand upon this theoretical framework at length over the chapters that follow, there are four aspects of this argument that perhaps need to be highlighted at this juncture.

Firstly, in developing this theoretical framework, the distinction between humans and non-humans is partially broken down in order that, the relationships between humans and non-humans, the material existence, if you will, of humans and non humans, should be considered as deriving from social practices embedded in time and space. A consequence of this is that, not only may humans be programmed to behave in a particular manner through their engagement with non-humans, but also, non-humans should be recognised as engaging with, and playing a role in, the formation of the social itself. Thus, non-humans should not be thought of as things whose meaning is derived solely from their form, but rather, like humans, they should be regarded as continuous processes, both engaging with and engaged upon by countless partially successful attempts at social ordering. To this extent human and non-human objects should be treated similarly, as John Law puts it, it is not "that there *are* no divisions. It is rather that such divisions or

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[100] Murdoch, J. (1995) "Actor-networks and the evolution of economic forms: combining description and explanation in theories of regulation flexible specialisation and networks" Vol. 27 *Environment and Planning A,* 731 at 750.

distinctions are understood as *effects or outcomes.* They are not given in the order of things."[101]

Secondly, and related to the first point, in developing this theory there is an attempt to collapse the traditional dichotomy between actors and agents; all humans, and importantly, given what I have said in the previous paragraph, all non-humans, are capable of behaving as both actors and agents simultaneously both the product and the creators of a social world which exists only as a conglomeration of multiple social performances.

Thirdly, power should be considered as a product, or, perhaps more accurately as a function, of this day to day engagement in ordering practices that are extended, to a lesser, or, greater extent, in space-time. To this extent, "power has no essence; it is simply operational. It is not an attribute but a relation: the power relation is the set of possible relations between forces, which passes through the dominated forces no less than through the dominating."[102] Thus rather than consider power as a thing to be possessed, it should instead be considered as the property of a chain,[103] or syntagm,[104] of

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[101] Law, J. (1999) "After ANT: Complexity, naming and topology" in John Law & John Hassard (eds.) *Actor Network Theory and after* (Oxford: Blackwell Publishers) p.3.

[102] Deleuze, G. (1988) *Foucault* (London: Athalone Press) p.27.

[103] Latour, B. (1991) "Technology is Society Made Durable" in, John Law (ed.) *A Sociology of Monsters: Essays on Power, Technology and Domination* (London: Routledge/ Sociological Review) p.110.

[104] The notion of a syntagm is that of a serial relationship, a chain built from smaller blocks. Thus a word is a syntagm produced from phonemes, while a clause is a syntagm formed from words. The syntagm is in contrast to the paradigm in so far as a syntagm is an *and* relationship with things, while a paradigm is an *or* relationship with things. Latour uses the term to describe chains of translation, although it was coined by de Saussure.

human and non human actors; power lies both within the chain, holding the network of social relations together and at the same time is a product of the chain, the function of the network of social relations. As Latour recognises, even the most strident of dictators derives their power only in its performance "when you simply *have* power – *in potentia* – nothing happens and you are powerless; when you *exert* power – *in actua* – *others* are performing the action and not you."[105]

Power resides within the ability to maintain social networks through time and space. Not only is it something which exists within the bonds of the network, but it lies within the ability to construct a body of knowledge about, in our case, seeds, for "there is no power relation without the correlative constitution of a field of knowledge, nor any knowledge that does not presuppose and constitute at the same time power relations."[106] One of the main concerns of this piece of research therefore is a consideration of the role which law plays in allowing the extension of particular social networks through time and space. It is an attempt to consider the techniques and strategies of power which "are deployed through implantations, distributions, demarcations control of territories and organisations of domains."[107]

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[105] Latour, B. (1986) "The Powers of Association" in, John Law, (ed.) *Power Action and Belief: A New Sociology of Knowledge* (London: Routledge & Keegan) p.264.

[106] Foucault, M. (1977) *Discipline and Punish, The Birth of the Prison* (Harmondsworth: Penguin) p.27.

[107] Foucault, M. (1980) "Questions on Geography" in *Power/Knowledge: Selected Interviews and other writings 1972-1977* Colin Gordon (Ed.) (Hemel Hempstead: Harvester) p.77.

Fourthly, and more by way of an observation on the other three points, a number of questions begin to emerge. In this complex, heterogeneous social world where, the meanings and order of things are fragile and multiple, how does social work get done? How do alliances emerge around boundary objects, and how are these extended through time and space? In essence, how are social worlds stabilised? The answer to these questions, form the basis of this thesis.

Biotechnology I shall argue, involves simultaneous processes of de-territorialisation and re-territorialisaton. For biotechnology to succeed, the multiple actors involved must continue to enrol others to their way of thinking, extending and stabilising multiple social networks in space-time. It is through these processes of enrolment, processes whose form is captured within Michel Callon's notion of "interessement,"[108] that the power of biotechnology emerges in its ability to define both the problems and the solutions to which end biotechnology is to be utilised. What is important to remember is that the deployment of genetic technologies can only be achieved through the social networks within which they gain their relational materiality. For genetic

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[108] Callon describes interessement as the "group of actions by which an entity ... attempts to impose and stabilize the identity of the other actors it defines through its problematisation ... To interest other actors is to build devices which can be placed between them and all other entities who want to define their identities otherwise. A interests B by cutting or weakening all the links between B and the invisible (or at times quite visible) group of other entities c, D, E, etc. who may want to link themselves to B. The properties and identity of B are consolidated and/or redefined during the process of interessement. B B is a result of the association which links it to A. This link disassociates B from all the C, D, and Es (if they exist) that attempt to give it another definition. We call this elementary relationship which begins to shape and consolidate the social link the triangle of interessement" (Callon, M. (1986) "Some Elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay" in Law (1996a) pp.207-208).

technologies to be regarded as the solution, the situation must be problematised as a biotechnological one.

In order to stabilise the materiality of genetic technologies through time and space, in order to maintain the fidelity, mobility and durability, of what are after all social objects, and to create the appearance of universality through the "circulation of particulars"[109], there must be in place combinations of, devices, texts and disciplinary practices.[110] Genetic technologies, need to be considered as assemblages[111] of these social forms, assemblages that permit the exercise of power through their existence as "active presences"[112] and *not* absent others, presences which both embody and perform "modes of ordering,"[113] presences which exist as actors and agents both. These assemblages accordingly cannot be deployed without a corresponding body of knowledge, which, both defines and generates boundary relations between different modes of ordering,[114] delineating between the inclusive and the excluded, while at the same time not escaping the fact that the inclusive and excluded remain "boundary objects,"[115] sites of contestation and agreement.

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[109] O'Connell, J. (1993) "Meterology: The creation of Universality by the Circulation of particulars" Vol.23 *Social Studies of Science* pp.129-173.

[110] See Law, J. (1986) "On the methods of long-distance control: vessels, navigation and the Portugese route to India" in Law (1996a) pp.234-263.

[111] See *n.*35 above

[112] Thrift (1996) *op.cit. n.*49, p.x.

[113] Law (1994) *op.cit. n.*44.

[114] Law (1994) *op.cit. n.*44, p.111.

[115] See Chapter 2 below and Leigh Star, S. & Griessemer (1989) "Institutional Ecology, 'translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39" Vol.19 *Social Studies of Science* pp.387-420 and Fujimura, J. (1992) Crafting Science: Standardised Packages, Boundary Objects and Translation" in

The deployment of genetic technologies involves the restructuring of space, the substitution of a heterotopian reality, "where a multiplicity of fragmentary possible worlds exist in the same impossible spaces,"[116] for, a utopian fantasy of a singular, genetically deterministic world, which denies its own partiality. Nature and thus biodiversity can only ever be understood within multiple social networks extended in topological space, these social networks construct both topographical/representational spaces, as well as lived geographical/physical spaces, the process of territorialisation, or, spatialisation, that are necessary for the deployment of genetic technologies therefore, inevitably result in changes to the way that spaces are perceived of and used, the way that diversity and nature are constructed and problematised.

Andrew Pickering (ed.) *Science as Practice and Culture* (Chicago: University of Chicago Press).

[116] Harvey, D. (1990) *op.cit. n.*89, p.48.

Chapter 2

Spaces of Diversity

The foci of this thesis, are the practices, processes and methods through which the introduction of the products of rDNA technologies are taking place at an international level; the international policies and legal instruments which regulate rDNA technologies and products; together with, an assessment of the how these may potentially impact on biodiversity in the two thirds world. Until this point, however, I have spent less time considering the character and attributes of biodiversity and more on examining the myths and realties of scientific work, the manner in which scientific work is understood and carried out, and the process by which biotechnology and its associated mythologies, moves from the laboratory to the field.

In this chapter, I examine a number of related issues. Firstly, I attempt to establish some common ground, examining what is generally understood when referring to biological diversity. I explore some of the shared characteristics of agricultural biodiversity, the common factors that bound its continual production and management while at the same time asking why we should concern ourselves with maintaining biodiversity in general, and agricultural biodiversity in particular.

Secondly, having established some common ground from which to work, I want to subvert this notion, proposing that we do not and for that matter cannot, hold a shared understanding of nature and biodiversity. Rather, I shall suggest that agricultural biodiversity is reliant upon social practices located in time-space. As Kothari and Das observe,

> "farmers have evolved sophisticated and complex agricultural systems and practices. These include the use of diversity over both time and space within the farm, with practices like multiple cropping and inter-cropping of a mix of species or intra-species variety, crop rotation, maintaining fallow periods, incorporating wild and weedy relatives of crops, experimental and deliberate selection for a variety of traits, and interspersing of trees and other non-crop species."[1]

The social practices of these farmers, I argue, are not only performed within geophysical and topographical spaces, but are themselves practices of spatialisation; farmers practices therefore *produce* spaces and do not simply take place within spaces, these spaces are negotiated, social and territorialised spaces, structured and structuring spaces, which both configure, and themselves are configured by farmers numerous different practices and

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[1] Kothari, A & Das, P. (1999) "Local community knowledge and practices in India" in Posey, D. (ed.) *Cultural and Spiritual Values of Biodiversity* (London: Intermediate Technology Publications & UNEP) p.190.

constructions of knowledge about nature, the environment, biodiversity and space itself.

In the next chapter I shall briefly examine the Convention on Biological Diversity (CBD) together with the Biosafety Protocol. I shall argue that in sharp contrast to the proposal that biodiversity can only be understood within specific spatially and temporally located knowledge and practices, the CBD proceeds from the proposition that biodiversity is objectively knowable, a resource which can be globally managed for utilitarian ends.

The CBD is more than just a legal text, but an organisation with global pretensions that attempts to monopolise and control the debate on biodiversity. As a social organisation the CBD contains divergent views, yet at the same time to be successful it must create sufficient shared agreement to produce relatively stable facts about biodiversity, so that the human and non-human objects that constitute both its make up and its focus can be understood. In order to function, the CBD, must bring to bear resources, skills, techniques, materials, practices and concepts, it must facilitate co-operative work across social worlds, which it does for the most part in a manner that is characterised by a reductionist concern with the conservation of genetic resources.

In this chapter I argue that the continual production and management of agricultural biodiversity relies on spatio-temporal relationships, which are by their very nature social, and therefore never capable of being objectively

understood. These social practices are not only performed in time and space but are themselves spatial and temporal performances. The fields in which farmers perform are sites of encounter, striated places, hierarchical and hierarchicalised spaces, where in the bringing to bare of diverse knowledge and the organisation of space exists the exercise of power.

2.1 What is Biodiversity?

Other than as a perceived threat, humans appear to have little or no role within the pages of many a report on the sate of global biodiversity. Rather, the approach is one that conceives of nature as something independent from humans, an objectively knowable thing, the existence of which is considered as driving both the results, the method, and the form, of scientific research into biodiversity. One influential report on the status of biodiversity maintains that, "it has become a widespread practice to define biodiversity in terms of gene, species and ecosystems, corresponding to three fundamental and hierarchically related levels of biological organisation."[2] This characteristically sweeping statement however, raises more questions than it provides answers. Where exactly do humans come in this hierarchical structure? What does this hierarchy mean for conservation, are genes at the bottom and ecosystems at the top, or is it the other way round? But perhaps most importantly, why should this hierarchical method of describing nature be considered fundamentally authoritative?

The notion of biodiversity I want to work with, is one that not only includes humans, but recognises a multitude of different relationships to, and within, nature that are dependant on cultural diversity; so that, if we were to think of these relationships in terms of a picture, they would more likely resemble the anarchic quality of a Jackson Pollock, than the ordered, minimalist straight black lines and primary colours of a Mondrian which, the notion of "hierarchically related levels" of biodiversity somehow conjures up.

If we are to glimpse a fraction of the complex relationships that produce biodiversity, we need to begin somewhere, so we may as well begin with the categories handed to us by biologists. We must, however, keep firmly in our mind that the "order of things" presented by these biological stories, has no validity beyond that which we ourselves provide it with, a categorisation that includes animals painted with a fine hair brush, or those that break the water pitcher, is equally as valid.[3] Indeed, an essential aspect of all that follows, lies in accepting that there is and never can be a categorical description of the complex negotiated concepts that make up biodiversity.

2.1.1 Genetic Diversity

When people refer to genetic diversity they are referring to distinct varietal differences between organisms, between say Royal Gala and Granny Smiths

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[2] WCMC/ IUCN/ UNEP/ WWF/ WRI (1992) *Global Biodiversity: Status of the earths living Resources* (London: Chapman Hall) p.xiii.

[3] This is, of course, a reference to the Chinese encyclopaedia found in *The Order of Things* Foucault (1974)

apples, or Maris Piper and Estema potatoes, differences whose source lies within the basic units of hereditary genetic information. The extent of this varietal difference can be impressive, in India for example there are said to exist over 50,000 indigenous varieties of rice developed from the one species *Oryza sativa*, not to mention the 5,160 indigenous varieties of sorghum, 1,607 indigenous varieties of tea, 701 Indigenous varieties of Cassava, and 1,975 indigenous varieties of cotton that are also found there. [4]

Genetic diversity therefore, refers to the range of disparity in the basic units of genetic variation in organisms, the cause of which ultimately lies within the four base pairs of DNA. With the exception of twins and cloned animals such as Dolly, each individual organism possesses their own genetic profile. At any given gene locus on a chromosome, there are two alleles, that is, two alternative forms of a gene inherited from a different parent. Individuals are described as homozygous when they have two copies of the same allele at a given locus and heterozygous when they have two different alleles at that locus.[5] The overall level of heterozygosity, or the proportion of gene loci that contain different alleles, could therefore be said to be a measure of an individual's genetic diversity. Thus, if we are considering genetic diversity

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[4] Figures collected for a draft report by The Indian Institute of Public Administration on the Conservation of Biological Diversity in India in Ashish Kothari, (1997) *Understanding Biodiversity Life Sustainability and Equity* (Hyderabad: Orient Longman) p.135.

[5] Recessive traits are expressed in people who are homozygous for a particular gene but not in those who are heterozygous. The effects of such a trait can be seen in sickle cell anaemia, where the substitution of just one base pair of DNA at a given location, leads to the abnormal production of haemoglobin, caused by the replacement of one amino acid, glutamic acid, by another, valine.

purely as individual variation, this would encompass all the living organisms on the planet.

In addition to individual genetic variation therefore, and a more important focus for conservationists, is the genetic variation that lies within-populations and among-populations. At the population level each gene locus may be either monomorphic, that is both alleles are always the same across the population at given location on a chromosome; and polymorphic, where there are multiple types of alleles at a locus. *Within-population variation* is a measure of the mean individual heterozygosity level across the potential available gene pool, that is, it is a quantification of the polymorphic variation found within a population, the types of alleles present and the frequency with which they are found across that population's member's. However, because species do not normally exist as randomly breeding individuals but in populations that may be separated geographically, *among-population variation* provides a measure of the mean genetic divergence that occurs among populations at different geographic locations, thus allowing the determination of the spatial distribution of genetic diversity.

2.1.2 Species Diversity

Species diversity is perhaps the most common form of biological diversity that people tend to think of. Conservation projects are often targeted at saving a particular species, indeed a red list system of threatened species has been developed by the IUCN and WCMC from data provided by national reporting; while, the maintenance of individual species remains at the core of much

national and international environmental legislation such as in for example the Convention on International Trade in Endangered Species (CITES).

The concept of a species however, is neither fixed nor unambiguous, as Meffe and Carroll make clear "species designations are testable hypothesis, ... designations are temporary and may change when better information becomes available; that is, the hypothesis may be rejected in the future. The main argument over the species question is how these hypotheses are tested, the type of information used, how it is used and the philosophical framework chosen."[6]

The two most commonly held concepts for defining species are, the biological species concept and the phylogenetic, or cladistic species concept. The more common of these hypotheses among non-biologists is the biological species concept, that is, that a species is defined by a groups reproductive isolation, its actual or potential, given geographic separation, ability to reproduce.

In contrast, the phylogenetic or cladistic species concept draws upon shared derived characteristics, reflecting genealogical relationships of ancestry or the branching of ancestral taxa. While in some cases species differentiation would stay the same under both concepts, wide scale adoption of a cladistic

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[6] Meffe, G.K. & Carrol C.R. (1994c) "The species in Conservation" in Gary K. Meffe, C Ronald Carrol and Contributors *Principles of Conservation Biology* (Sunderland, Massachusetts: Sinauer Associates, Inc.) p.53.

species concept would elevate many sub species described using the biological species concept, into species.

Other methods for defining and classifying species include the evolutionary, ecological, recognition and cohesion species concepts. This is complicated still further in so far as a nominalist biological perspective would question, as an arbitrary concept, the very notion of species, while pluralist conceptions suggest that concepts of species should change depending upon the taxa under consideration.

Although it is frequently claimed that to date we currently know of around 1.5 million species,[7] estimates in relation to the number of species which exist but are, as yet, still unknown usually vary somewhere between 5 and 30 million, although others place this figure as high as 100 million.

2.1.3 Ecosystem Diversity

There is no single definition of an ecosystem, nor, is there a quantitative measurement of ecosystem, habitat or community level diversity. At one level the entire planet can be considered as a complex ecological entity, as for example in James Lovelock's Gaia hypothesis where, "the earths biosphere, atmosphere, oceans and soil; the totality constituting a feedback or cybernetic system ... seeks an optimal physical and chemical environment for life on this

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[7] Raven, P & Wilson E.O. (1992) "A 50 Year Plan for Biodiversity Surveys" in 258 *Science* 1099 - 1110 at 1099.

planet."[8] However, what is commonly referred to by ecosystem diversity is the diversity of ecological complexes, or local habitats, within which species and genetic diversity occurs. Ecosystem diversity is the biological relationships between interrelated complexes of flora and fauna; communities comprised not only of biotic components, but also, of abiotic components such as climate and soil type, it is the relationships of communities in forests and wetlands, deserts and scrub.

2.1.4 Cultural Diversity

Lastly, and most contentiously for some, there is cultural diversity, the diversity of knowledge systems about plants and animals, their interrelationships and their uses. Cultural diversity not only exists between different peoples and local communities, but also, varies between villages, gender, religions and castes. An example of the extent of this diversity can be seen, once again, in India where according to the *Anthropological Survey of India*, there are 4635 distinct ethnic communities; 325 languages belonging to 12 language families together with six major religions and dozens of smaller independent faiths.

This diversity extends downwards into villages and 'local communities,' Mala Village, for example, in the Dakshina Kannada district of Karnataka, in Southern India, has a population of just 5,070 however, this consists of 24

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[8] Lovelock, J. (1979) *Gaia: A new Look at Life on Earth* (Oxford: OUP) p.10.

different ethnic communities.[9] Each community applies their own distinct knowledge of the local biodiversity, each playing a different role in its utilisation and maintenance, with this knowledge still further fragmented within these communities, by gender, age group and the roles and occupations of specific individuals.

When we think abut biodiversity therefore we should be thinking about the complex relationships between these essentially indescribable different aspects of diversity, we cannot separate out a species from its ecosystem or a gene from a species without losing sight of some aspects of the relationships which go to make up biodiversity. Perhaps most importantly of all, we must remember that our knowledge of species, varieties and ecosystems is derived from social relationships, it is, in one sense at least, a human nature with which we are dealing when we refer to biodiversity. So that, without people, without the inclusion of social and cultural diversity a picture of the planet's biological diversity is dramatically incomplete; for, nature is a negotiated and ever changing concept, as Mcnaghten & Urry observe "there is no singular 'nature' as such, only a diversity of contested natures; ... each such nature is constituted through a variety of socio cultural processes from which such natures cannot plausibly be separated."[10]

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[9] Achar, K.P. et al (1997) *Documentation of People's Knowledge and Perceptions about Biodiversity Conservation through Peoples Biodiversity Register at Mala Vilage Panchayat, Karkala Taluk, Karnataka State.* Biodiversity Conservation Prioritisation Project (BCPP) of the Karnataka State Council for Science and Technology, Bangalore, India.

[10] Macnaghten, P & Urry, J. (1998) *Contested Natures* (London: Sage Publications) p.1.

2.1.5 Measuring Diversity

At least one major reason why biodiversity has become such a politically contentious issue over the past two decades, lies in the fact that over 90% of the planet's biological diversity is situated in the tropical and subtropical sectors of Africa, Asia and South America.[11] Within these areas, the forests appear to be the most diverse, so that, according to one report, between "6-7% of the earths surface may contain 50% to 90% of all species of plants and animals."[12] The 13.7 Km^2 of La Selva Forest in Costa Rica for example harbours 1,500 species of plants, more than in the total 243,500Km^2 of Great Britain;[13] while in Borneo 700 species of trees have been identified in one 15 hectare area of Rain Forest, a number equivalent to the total number of tree species in North America.[14] Similarly in Panama, just 19 individual trees of the species *luhea seemannii*, were found to have more than 1200 species of beetles living on them.[15] As we shall see, while the boundaries of two thirds world may physically encompass much of the planet's biodiversity, the technology to convert that biodiversity into a utilised genetic resource exists, for the most part, in the remaining one third world. The peoples of the two thirds therefore world are simultaneously characterised as both the guardians

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[11] RAFI (1994) *Conserving Indigenous Knowledge Integrating Two Systems of Innovation* (New York: United Nations Development Program) p.12.

[12] Jermy, Long, Sands, Stork, Winser (Eds.) (1996) *Biodiversity Assessment: a guide to good practice.* (London: Department of the Environment/HMSO) p.22.

[13] Jermy et al (1996) *op.cit. n.*12, p.22.

[14] Tolba, M.K. (1992) *Saving Our Planet: Challenges and Hopes* (UNEP/ Chapman & Hall: London) p. 76.

[15] Jermy et al (1996) *op.cit. n.*12, p.22.

of biodiversity and as potentially its greatest threat, by those one third worlders wishing to utilise genetic resources, or, conserve particular species.

It is not hard to find statistics and country by country comparisons on biodiversity, however not only do these vary considerably from report to report, comparatively up to date worldwide information on the status of biological diversity is not always to hand, despite the continuing efforts of the Convention on Biological Diversity (CBD), The United Nations Environment Program (UNEP), The International Union for the Conservation of Nature (IUCN), International Plant Genetic Resources (IPGR), World Resources Institute (WRI), World Conservation and Monitoring Centre (WCMC), The Food and Agriculture Organisation of the United Nations (FAO), and others.

Data, compiled in order to develop strategies for the management of biological diversity, including some of those which I will recount myself in a moment, tend to focus on two aspects of biodiversity, the given amount of species in a country and the species richness of a given location or country. It is worth at the outset therefore, highlighting a number of problems that arise in relation to both, the manner in which these statistics are complied and the form in which they are presented.

Firstly, when comparing the concentration of biodiversity on a comparative country by country basis, figures relating to the species richness of a given location, are only estimates, based on sampling and extrapolation. Secondly, precisely how many species exist, in which specific geographic locations, is

something which of itself there is no certainty, so much so, that a report on biodiversity by the WCMC, suggests that "between 80% and 95% of all living species have not yet been described."[16] This of course also has implications for the ability of anyone to provide accurate data on the species richness of a given location. Furthermore, both of these methods of describing biodiversity are ecologically speaking, crude, hardly reflecting the true complexity of biological diversity, as Posey observes,

> "technical descriptions of biodiversity often give the impression that science and economics are adequate tools with which to characterize the qualities of the intricate web of life ... it is easy to forget that values of plants, animals, landscapes and ecosystems cannot be adequately measured in statistical or monetary terms – and certainly cannot be described using the languages of only a few academic disciplines and markets, no matter how politically favoured and powerful they might be."[17]

So, while we are often presented with a mass of technical data concerning biodiversity, this only goes to show how little we really know or understand it. In contrast, it is striking the extent to which when reading biodiversity data, facts and figures are delivered as if there is some certainty to them, estimates and rounded up figures are tabulated and then presented as a seemingly

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[16] World Conservation Monitoring Centre (1994) *Biodiversity Sourcebook* (Cambridge: WCMC & IUCN).

[17] Posey, D. (ed.) (1999) *Cultural and Spiritual Values of Biodiversity* (London: Intermediate Technology Publications & UNEP) p.xvii.

objective account of the biological diversity found within a country or region. These figures then act as the justification for targeting resources towards biodiversity conservation management strategies, in order that specific 'at risk' species can be protected. While, resources are frequently aimed at the preservation of threatened species be it dolphins, pandas, or whales, less are spent considering what we don't know, the uncertainty that surrounds the role played by so far unknown insects, fungi and micro organisms and similarly, the knowledge systems of farmers and local communities which have produced and maintained biodiversity.

One example of this unknown potential range of biological diversity comes form Norway where microbiologists discovered the presence of 4000-5000 bacterial species in a single gram of beech forest soil.[18] Micro organisms such as these, not only potentially possess unknown agricultural or pharmacological value[19] but also, play an important and frequently little understood role within the maintenance of ecosystems. As a UNEP report on agricultural biodiversity comments,

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[18] Raven & Wilson (1992) *op.cit. n.7*, p.1099.

[19] Take for example, a soil bacteria discovered in Thuringia Germany in 1911, endearingly called *Bacillus thuringiensis (Bt)*. Some strains of the *bacillus*, are deadly to particular insects; the *kurstaki* strain for example is lethal to lepidopteron larvae, since, when ingested the bacillus produces a crystallised toxin in the gut of the larvae, that eventually breaks down the insects stomach wall and leads to the its death. Since the 1930s *Bacillus thuringiensis* has been commercially available as a naturally occurring, non-chemical and therefore organic, alternative for insect control. However, with the onset of rDNA technology, a number of crops have been developed which use *Bt* genes, Monsanto's Bollgard Cotton® for example, uses genes from the *Kurstaki* strain to attack the larvae of Bollworms, other *Bt* crops are also being developed with strains such as *Bt tenebrionisis*, effective against the Colorado potato beetle.

> "The great natural diversity and abundance of soil organisms maintain soil productivity. Soil organisms and microorganisms maintain nutrient cycling, soil structure, moisture balance and fertility of soils. Mycorrhiaze, fungi that live in symbiosis with plants roots, are essential for nutrient and water uptake by plants. Yet, this rich resource is largely invisible and unrecognised by the public. Increasingly, agricultural systems are losing this diversity, undermining soil fertility and leading to productivity losses."[20]

There are at least two important aspects to these observations about soil and the diversity of organisms found within soil, which relate to a wider concern with our relationships with plant and animal diversity generally. Firstly, while these microorganisms may be unknown to scientists, this does not mean that local communities do not know either the role that their agricultural practices play in the maintenance of soil productivity, or, in some cases the attributes of a particular soil type. One example of this is provided by Brazilian farmers whose knowledge that something in the soil killed fire ants, led scientists from the University of Florida to a particular fungus in the soil which they duly took back to the US, isolated and described as *Beauveria Bassiana 447*, deposited in the American Type Culture Collection[21] and duly patented.[22] As a report published by the UNDP observes,

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[20] UNEP (1996a) *Consideration of Agricultural Biological Diversity Under the Convention on Biological Diversity* UNEP/CBD/COP/3/14 p.13 §42.

[21] Accession No. ACCT 20872.

[22] US 4925663 *Biological Control of Fire Ants With a Fungal Pathogen*, the 13 claims made within the patent essentially relate to means of producing *B Bassiana 447* and its utilisation as a pesticide for controlling Fire Ants. At a later the University of Florida were granted a further patent, US 563689, *Controlling Cockroaches, Carpenter Ants And Pharoah Ants using*

"to a degree that would be astonishing to many scientist, the particular properties of certain soils have long been recognised and valued by indigenous peoples. They may not be aware of the exact bacteria of fungi resident in the soils, but the anti tumour, antibiotic or steroid characteristics of certain soils are known and valued. Community healers customarily apply soil to wounds and diseases."[23]

Secondly, it is useful to note at this stage, given the nature of the deliberations that take place in later chapters, the major reasons identified by UNEP for the continuing loss of soil diversity. Essentially, these arise out of the perceived need to both, overcome localised geophysical differences in soil types as a necessary preparation for the deployment of 'modern' agricultural varieties; as well as the changing of farmers practices and methods of production as an integral requirement of growing those varieties.

In particular, UNEP identify the heavy use of agrochemicals (pesticides, chemical fertilizers, etc.); the uniformity of crops over time and space; intensive tillage practices; and the decline in use of animal manure, intercropping, crop rotation and other methods of increasing organic matter in soils, as responsible for the loss of diversity in soil organisms.[24] If we continue

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Beauveria Bassiana which extends the use of *B. Bassiana 447* as a pesticide for other insects.

[23] RAFI (1994) *Conserving Indigenous Knowledge Integrating Two Systems of Innovation* (New York: United Nations Development Program) p.23.

[24] UNEP (1996a) *op.cit. n.*20, p.13 §42.

to prioritise the conservation of individual species, rather than addressing some of the central issues that lie behind agricultural development policies, such diversity will continue to be lost indeed, even were to change our priorities tomorrow "a large fraction of the species likely to be exterminated during the next century will disappear before they have been named much less understood ecologically."[25]

If we are to maintain the planet's biological diversity we have to maintain all its constituents. We have not only to find means of sustaining, species, genetic, ecosystem and cultural diversity but we will have to change many of our current practices and ways of thinking. The lack of knowledge which we possess about the unknown insects, organisms and other unknown elements of biological diversity, not only reflects our lack of knowledge about how complex biotic communities work, but should also serve as a warning in relation to just how little, in reality, we currently and are probably ever likely, to understand of the manner in which complex biological systems function. As Meffe and Carrol observe;

> "Ecological systems are complex, often individualistic and currently unpredictable beyond limited generalities. The public and even other scientists, often do not appreciate this and cannot understand why ecologists are such uncertain folks who hedge their bets and will not

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[25] Orians, G, H. (1994) "Global Biodiversity; Patterns and Processes" in Gary K. Meffe, C Ronald Carrol and Contributors *Principles of Conservation Biology* (Sunderland, Massachusetts: Sinauer Associates, Inc.) p.82.

provide a simple answer to an environmental problem. The reason is of course that there usually is no simple answer. Ecological systems are complex, their dynamics are expressed in probabilities, stochastic influences may be strong, and many significant process are non linear. *Uncertainty is inherently part of ecology and conservation*."[26] [original emphasis].

2.1.6 "Threats to Biodiversity"

Threats to biodiversity arising from human intervention in the environment, are frequently described as deriving from five causes, the over utilisation of resources; pollution derived from industrial and agricultural activities; the introduction of non endemic species into local ecosystems; change of land use; and, global warming.

Although it is true that all of these causes of environmental harm, potentially affect the delicate balance of sustainable ecosystems, threatening the continued viability of local genetically diverse populations through reductions in their size and the levels of genetic variation within and among communities; our concern cannot begin and end with these direct threats to biodiversity. Indeed, the limited manner in which these 'threats' are problematised, and thus the context in which solutions for the managing of risks are put forward, is itself not only problematic but ultimately poses a threat to biodiversity.

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[26] Meffe, G. K. & Carroll, C.R. (1994b) "What is Conservation Biology?" in Meffe & Carrol *et al* (1994a) p.20.

As I commented in the first chapter, the direct causes of environmental harm cannot be considered separately from international agricultural, environmental and social and economic policies that deploy particular notions of progress in their problematisation of the issues of biodiversity and food security. It is therefore essential, that these social or structural processes be addressed, if we are to secure human and environmental futures that do not rely on the violent mobilisation of particular mythological constructions of science and modernity.

To this end, one of the arguments that runs through the current work, holds that, the approaches found towards conserving biodiversity within the CBD are themselves a threat to the continued maintenance of biological diversity, in so far as they assert the possibility of defining and understanding the risks that humanity poses for biodiversity, while, at the same time, attempting to implement global strategies to address those risks. This standpoint is flawed from the outset; given the complexity of social interactions in which we engage with our environments, it is impossible to generalise about the effects that changes to these relationships will have on these environments, even though it remains possible to say that changes to social relations with the environment will bring change. For the same reasons, strategies to maintain biodiversity must be truly based at a local level and not simply be the local expression of a global plan, if they are to maintain the relationships that have resulted especially in agricultural diversity.

It is for this reason that I argue throughout this work, that the introduction of transgenic crops and their associated practices and mythologies, not least the manner in which IPRs are now being mobilised and deployed in order to discipline and reconfigure farmers spatial and temporal practices, threaten the continued production of agricultural biodiversity. At the same time arguing that rather than maintaining diversity, the CBD is not only a mechanism through which the complexity of biodiversity is condensed to a reductionist concern with nature as a genetic resource, but that the CBD facilitates and extends the mobilisation of GM crops and their associated mythologies.

2.1.7 Why Conserve Biodiversity?

Why should we concern ourselves with maintaining diversity, especially as this would seem to mean curbing current patterns of consumption and production, and significantly modifying our conception of development?

Rather than start with the anthropocentric utilitarian reasons for realising the importance of diversity, let us first consider a more ecocentric reason. *Biospherical Egalitarianism*, is one of the seven principles of Deep Ecology first articulated by Arnie Naess in 1973,[27] it is qualified by an "in principle" clause, which, as Naess himself makes clear, is inserted "because any realistic praxis necessitates some killing, exploitation and suppression."[28] The

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[27] Naess, A (1973) "The Shallow and the Deep, Long-Range Ecology Movement: A summary" Vol.16 *Inquiry* pp.95-100 *repr*. George Sessions (ed) (1995) Deep Ecology for the 21st Century (Boston: Shambhala Publications Ltd) pp. 151-156 and Alan Drengson & Yuichi Inoue (eds.) (1995) The Deep Ecology Movement: An Introductory Anthology (Berkeley: North Atlantic Books) pp.3-12.

[28] *Ibid* p.95

qualification is made therefore on the basis that we cannot live without affecting the world in some way, and so by initially positing every plant and animal with an intrinsic worth, it would therefore be necessary for the person wishing to utilise that plant or animal, to justify their actions. The notion of an intrinsic value of anything however, is problematic when asserting that nature can only hold meaning for humans within social networks, likewise justifications for the current utilisation of nature and diversity abound. So, whether we move any further towards practices that maintain diversity through deploying the notion of biospherical egalitarianism is questionable.

Paradoxically, the more utilitarian reasons for maintaining diversity may seem to many, more convincing. At a basic level plants and animals sustain us they provide us with food and produce the oxygen we need to survive, thus when we threaten biodiversity we threaten our own existence. Beyond this, 80% of peoples in the two-thirds world rely on traditional medicines for their primary health care. [29] A total of 5,100 species have been identified in use in Chinese traditional medicine,[30] while in Mexico of the 3000 medicinal plants identified, only around 800 have been properly documented and less than 50 studied in the laboratory.[31] Importantly, it is not just those 80% in the two thirds world who are reliant on diversity for medicines, over 3000 antibiotics including

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[29] WCMC/ IUCN/ UNEP/ WWF/ WRI (1992) *op.cit. n.*2, p.xvii.

[30] WRI/ IUCN/ UNEP (1992) *Global Biodiversity Strategy: Guidelines for Action to Save, Study, and use Earth's Biotic Wealth Sustainably and Equitably* p.4.

[31] Querol, D. (1992) *Genetic Resources: Our Forgotten Treasure, Technical and Socio Economic Approaches* (Penang, Malaysia: Third World Network) p.51.

penicillin and tetracycline are developed from biodiversity[32] while active substances in the rosy periwinkle from Madagascar provide the best treatment for leukaemia. Indeed even in 1992 overall worldwide medicines from wild products were estimated to be worth approximately $40 billion.[33]

'Wild' plants and animals form the substantial part of diet for many people.[34] The plants Neolithic man began to cultivate 10,000 years ago still form the mainstay of our diets, so that of the approximately 30,000 edible plants about 7,000 have been utilised in food and agriculture at one time or another.[35] It is an oft reported figure that 90% of the worlds calories are supplied by just 30 species however, this understates the importance of many crops at a regional and sub regional level. As the Prescott Allens comment, "crops such as fonio, *Digitaria exilis* Stapf and Quino, Chenopodium quinoa Willd., are lost in global production data, but to conclude that they are unimportant is to conclude that the people of Guinea, Gambia and Bolivia who rely on them are unimportant."[36] While rice and wheat produce 26% & 23% respectively of calories on a global scale cassava accounts for only 1.6%, nevertheless for

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[32] WCMC/ IUCN/ UNEP/ WWF/ WRI (1992) *op.cit. n.*2, p.xvii

[33] Tolba (1992) *op.cit. n.*14, p.79.

[34] Generally see also Guijt, I., Hinchcliffe, F. & Melnyck, M. (1995) *The Hidden Harvest -- The Value of Wild Resources in Agricultural Systems -- A Summary* (London: International Institute for Environment and Development) and Bell, J (1995) "The hidden Harvest" *Seedling* October 1995 (Barcelona: Genetic Resource Action International).

[35] FAO (1997) *The State of the Worlds Plant Genetic Resources for Food and Agriculture* (Rome: Food and Agriculture Organisation of The United Nations) p.14

[36] Prescott-Allen, C. & Prescott Allen, R (1990) "How Many Plants Feed The World?" Vol4.(4) *Conservation Biology* pp.365-374 at 371.

those living in Central Africa, cassava produces over 50% of their calorific intake.

In contrast to the 30 species which provide the bulk of the worlds calorific intake, per capita food supply data collected from 142 countries shows that 103 species account for 90% of the worlds food supply, with 120 species considered by the FAO as important for food production at a national scale.[37] Even this however, does not give a sense of the overall picture, for as Daniel Querol observes, in Mexico while there are fewer than 30 non-conventional cultivated species, of which some such as Huauzontle Chayote, Chilacayote, and Zapotes have no translatable name, there are perhaps some 800 non cultivated species used for food.[38]

Non Cultivated foods are an important source of vitamins, minerals and other nutrients which complement staple crops and are relied upon by the poorest and most vulnerable peoples in rural areas, by children and the elderly. Research conducted by Calestous Juma showed that out of a survey of 12000 households from 43 villages in Kenya and despite the large scale displacement of local plants in agriculture, nearly 47% of households gathered fruit and vegetables which came from the wild, with 49% actively tending wild plants that grew in their farms.[39] The significance of this source of food for

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[37] FAO (1997) *op.cit. n.*35, p.15.

[38] Querol (1992) *op.cit. n.*31, pp.50-51.

[39] Juma, C. (1989) *Biological Diversity and Innovation: Conserving and Utilising Genetic Resources in Kenya* (Nairobi, Kenya: African Centre for Technology Studies) p.50.

those in rural areas is further enhanced when one considers the demographic makeup of countries in the two thirds world. India, for example, is a country with a population of 1 billion people equivalent to 1/6th of the Earth's human inhabitants, of which, 80% live in rural areas.

Even those with considerable personal experience of their own countries rural development are surprised at times by the reliance placed on non cultivated crops. Dr. Farhad Mazhar, managing director of the Bangladeshi organisation UBINIG,[40] recounted an example of this to me personally, in explaining his own surprise at research UBINIG had undertaken showing that up to 40% of food in rural regions in Bangladesh, was derived from non cultivated crops.[41]

Countless millions of people in the two thirds world therefore are reliant on bio diverse food systems to sustain them, a mixture of cultivated and non cultivated crops providing food and health to peoples within limited fiscal constraints. The maintenance of food security is reliant therefore on continuing to sustain biodiversity, but a particular form of biodiversity one that is cognisant of the importance of culture, of local knowledge and practices, of the day to day importance of the continued production of biodiversity as a strategy in peoples lives, in the continuation of the practices which are coexistent with peoples everyday lives.

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[40] UBINIG is an NGO that works with farmers in Bangladesh, one such group, the Nayakrishi Andolon, is discussed in Chapter 5 below.

[41] Personal conversation with Dr Fahad Mazahar in New Delhi, India, Oct 30th 1999.

Biodiversity is also important for maintaining local food security in other ways, cultivated agriculture has long been reliant on both the continual production of varieties by farmers in the field, and through breeding with 'wild' relatives, in generating new varieties which are resistant to drought or particular pests or diseases.[42]

The loss of biodiversity in agriculture has increased dramatically over the past four decades. The application of generations of farmers' knowledge that has gone into producing and maintaining *inter species* and *intra species* diversity in the field, has gradually and dramatically been eroded. While centuries have been responsible for producing the 50,000 Indian varieties of rice developed by farmers from *O.sativa* together with the localised knowledge that results in a mosaic of different cropping patterns utilised throughout the world, the last four decades has seen an increasing reliance in the two thirds world on a handful of crops and varieties, as endemic species have gradually been displaced by new HYVs.[43]

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[42] For examples of the introgression of valuable agronomic traits in landraces and wild relatives see FAO (1997) pp.28-29.

[43] The literature on the impact of HYVs is large, that which takes a critical stance on the affects of HYVs for biodiversity is somewhat smaller. For some recent examinations of the consequences of the spread of HYVs for biodiversity in India see Shiva, V. (1998) *Globalisation of Agriculture Food Security and Sustainability* (New Delhi: Research Foundation for Science Technology and Ecology); Shiva, V. (1991) *The Violence of The Green Revolution* (London: Zed Books); Batra, S.K. (1995) *Indian Agriculture and New Economic Policy: Impact of Agro Industry No 53/95* (New Delhi: Indian Social Institute); Dogra, B (1993) *Seeds Industry of India: Seeds of Plenty or Seeds of Discontent* (Dehradun, India: Navadanya) Nellithanam, R. & Nellithanam J. (1997) "Green Revolution and Subsistence Agriculture; You Reap as You Sow" *Economic and Political Weekly* 930, May 3rd 1997.

Detailed accounts of the loss of varietal diversity in the United States during the twentieth century, suggests that in comparison to the 100 years previous, approximately 86% of the 7,098 apple varieties that were grown in the US have been lost, 95% of the cabbage, 91% of the field maize, 94% of the pea and 81% of the tomato varieties.[44] These varieties are now gone for ever, existing in neither commercial agriculture or gene banks, so that, while it is possible that some of the genes from these cultivars may still exist in other varieties, there can be no denying that biodiversity has been irreplaceably lost. Twentieth century industrial agriculture has continued to be characterised by large-scale varietal uniformity so that in the US for example, 50 % of wheat is now produced from only 9 varieties.[45] This is not a story that is confined to the US and Europe however, for over the past four decades the rest of the world has been under pressure to adapt farming to "modern" needs.

A few examples should suffice, for the time being, according to the FAO, all modern rice varieties now share the same dwarfing gene, while UNEP estimates that half of all native varieties of seed in India had been replaced with HYV seed by 1968,[46] in Sri Lanka, rice varieties decreased from 2000 in 1959 to 5 in 1992.[47] In 1982 IR 36, an HYV variety, was planted on 11 million

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[44] FAO (1997) *op.cit. n.*31, p.35.

[45] UNEP (1996a) *op.cit. n.*20, p.10.

[46] UNEP (1996a) *op.cit. n.*20, p.11§30.

[47] UNEP (1996a) *op.cit. n.*20, p.10.

hectares in Asia[48] while in the Philippines in the mid 1980s just two rice varieties covered 90% of agricultural land.[49] Similarly in Bangladesh HYV varieties of wheat covered 96% of the total wheat growing area with a single cultivar, *Sonalika*, planted on 67% of that.[50] At about the same time the same cultivar also accounted for 30% of India's wheat production.

Through the increase in areas devoted to one variety and the increase in crop relatedness between varieties, not only is the availability of *in situ* germplasm reduced, but potential vulnerability to pests and diseases is increased threatening food and crop security. While potato blight, *phytopthora infestans*, which resulted in the Irish potato famine of 1845-48, is an obvious example of what can happen when genetic diversity is lost in the field, other less well known examples include events such as those in 1970 when southern corn leaf blight wiped out 15% of US corn at a cost of $1 billion.[51] Then, in Cuba, during 1979/80, a rust attack affected a sugar cane variety which covered 40% of the country, resulting in the loss of more than 1 million tones of sugar, worth approximately US $500 million,[52] while in 1984 citrus canker resulted in 18 million tress being destroyed in the US.[53]

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[48] FAO (1997) *op.cit. n.*31, p.31.

[49] RAFI (1997) *Human Nature: Agricultural Biodiversity and Farm Based Food Security* (Ottawa, Canada: RAFI) p.22.

[50] FAO (1997) *op.cit. n.*31, p.31.

[51] Lappé, M & Bailey, B. (1999) *Against the Grain: The Genetic Transformation of Global Agriculture* (London: Earthscan) p.100.

[52] FAO (1997) *op.cit. n.*31, p.32.

[53] Lappé & Bailey (1999) *op.cit. n.*51, p.100.

2.2 Diverse Spaces in Spaces of Diversity

So far in this chapter I have suggested that in order to fully comprehend biodiversity it is necessary that cultural diversity be included together with genetic diversity, ecosystem diversity and species diversity. In the rest of this chapter I will further develop the argument, that nature, our environment and therefore biodiversity are understood, in diverse ways, by different peoples; that this knowledge about nature, its value and its uses, are an integral part of biodiversity, even if not perceived as strictly "biological" within a normal understanding of the word. In order to do this however, we need first to turn our attention towards the concept of space, in an attempt to understand how social practices are not only performed in space, but are at the same time responsible for the production of space.

The use of the word space usually conjures up images of Star Wars,® and star ships; of Neil Armstrong and, Darth Vader, Buzz Aldrin and Jim Kirk, it is the black void against which those early NASA photographs, "Earth Rise" and the romantically titled "22727" have provided the image of spaceship earth, the lonely planet.[54] When we talk about space we tend to be either so unlucky that "there is not enough space to swing a cat " or in contrast that "there is enough space here to hide a tank; battleship; or, football stadium" completing the phrase with whichever epithet at the time seems the most humorous.

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[54] For an overview of the history of these images and their place in global ecological mythology, see Cosgrove, D. (1994) "Contested Global Visions: One World, Whole Earth and the Apollo Space Photographs" *Annals of The Association of American Geographers* 84(2) 1994 pp.270-294.

Synonymous with space, it would seem, is the notion of emptiness. Is this space taken, we ask, as we are about to sit down either at an already occupied table, or, an apparently vacant seat in the cinema? We visit the country for the wide-open spaces, only here another resonance is also at work, for country spaces, are thought of as natural spaces; spaces of wilderness, of which more later. Back in the urban sprawl, we need our space, sometimes a personal space and sometimes just a space to park the car. Of course, an occupied parking space is a space that has something in it, no longer empty, but now full.

We give little serious thought, for the most part, to the organisation of space and the spaces that surround us, to the relationships that we have with our physical surroundings or that our physical surroundings have with us. As Shields observes:

> "the realm of the spatial has often been assumed to be purely neutral and a-political, conferring neither disadvantage, nor benefit to any group. This 'empirical space' is complacently understood to be fully defined by dimensional measurements (height, width and breadth) and by trigonometric descriptions of the geometrical relationships between objects, which are thought to sit in a kind of vacuum. According to this empirico-

physics model 'space' exists (even though it is a 'nothingness';) as a given."[55]

In contrast to this notion of 'empirical space' however, we should consider space as something that is socially produced. Social space or rather social spaces are striated spaces, spaces that talk of and reproduce hierarchies, spaces which are inhabited by human and non human objects, organised and organising spaces which both produce and maintain power relationships. "Social space incorporates social actions, the actions of subjects both individual and collective who are born and who die who suffer and who act."[56]

This is not to say that these geophysical spaces do not have a presence that exists independently of social actions, but rather that we can only understand our physical surroundings, our lived environments, within social relationships. In other words, that our relationships with these, what we might describe as geo-cultural spaces, are negotiated by topographical and topological spaces, or perhaps it is better to say that geophysical spaces are coexistent with, topographical and topological spaces that these three elements, or dimensions, of space are both interwoven and inter-laden.

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[55] Shields, R. (1997) "Spatial Stress and Resistance: Social Meanings of Spatialization" in Georges Benko & Ulf Strohmayer eds. *Space & Social Theory: Interpreting Modernity and Postmodernity* (Oxford: Blackwell Publishers) p.187.

[56] Lefebvre, H. (1991) *The Production of Space*, Trans. Donald Nicholson Smith (Oxford: Blackwell) p.33.

In drawing a distinction between geophysical space, topographical space and topological space, I do not mean to suggest that these categories exist independently of one another, rather that these are different dimensions of the same socially produced spaces. By adopting this typography, I want merely to provide a tool for considering the processes of spatialisation, a means through which to move from one non hierarchical although hierarchicalised dimension of space to another. At the same time, by adopting a distinction between three different dimensions of space, I hope to deploy a form of language that will provide the means of explaining how human and non-human objects are brought together within spatio-temporal networks, of how power is expressed and articulated both through space and within the organisation of spaces.

As I make clear in Chapter 5, despite the increased importance that is allotted to space in theories of globalisation, the central focus for most writers remains on geophysical space, so that, for example David Harvey's fascination with speed and technology leads him in *The Condition of Postmodernity* to portray globalisation as the compression of time-space, the "annihilation of space through time."[57] So that, while Harvey acknowledges that the reorganisation of space and of time is an expression of power, he remains primarily focused on distanciation, on the separation between 'actors' in geophysical space; a concern which results in his spending less time concerned with the centrality of presence in the expression of power and the stabilisation of social worlds.

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[57] See Harvey, D. (1990) *The Condition of Postmodernity* (Oxford: Blackwells).

Similarly Giddens' focus on globalisation as a natural consequence of modernity that leads to a process of "fostering relations between "absent" others, others who are locationally distant from any given situation of face to face interaction,"[58] a concern with "the separation of space from place,"[59] necessarily leads the eye away from what should be the true focus of concern. For, the expression of power is achieved through its functioning, in the mobilisation and deployment of techniques and strategies, essentially dependant on a continual and continuing presence. At the end of the day, theories of globalisation are overly enamoured by the geophysical and topographical dimensions of space, which are closer, in many ways, to the empirical model of space that we have already refuted.

We need to consider that the appearance of universality of global actions at a distance, is achieved as O'Connell suggests, "through the circulation of particulars."[60] It is these particulars, the human and non-human objects that make up the social, with which we should be concerned, questioning their perceived durability, subjecting to interrogation the texts, devices and practices, through which long distance control is achieved.[61] For these particulars are ever present; these diverse social objects are brought together in relationships, topological relationships, that fold time and space,

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[58] Giddens, A. (1990) *The Consequences of Modernity* (London: Polity Press) p.18.

[59] Giddens (1990) *ibid* p.18.

[60] O'Connell, J. (1993) "Meterology: The Creation of Universality by the Circulation of Particulars" Vol.23 *Social Studies of Science* pp.129-173.

[61] see Law, J. (1986) "On the Methods of Long Distance Control: vessels, Navigation and the Portuguese Route to India" in John Law (ed.) *Power Action and Belief: A New Sociology of Knowledge* (London: Routledge & Keegan Paul) pp.234-263.

relationships achieved through polymorphic social networks continually in flux, bringing together heterogeneous social forms. To do so however, we perhaps need to better understand the distinctions that I draw between geophysical, topographical and topological spaces.

2.2.1 Geophysical Spaces

By, geophysical space I mean the spaces which we physically inhabit, urban spaces, farmed spaces, and 'natural spaces', yet whilst these geophysical spaces encompasses the physicality of space, the thing we can see and touch, the mountain and the stream, the tower block and the corn field, they are still territorialised spaces, or what we could perhaps call geo-cultural spaces. Geophysical space is a social space in so far it is produced and only made understandable, within social networks extended in space-time. Thus our environment as a collection of sometimes-coexistent geo-cultural spaces, is capable of maintaining multiple meanings constituted as the sacred, or as a resource for the geneticist. This is not to say that the physical world exists only in our imagination, for, it has a presence outside of any meaning that we grant to it, but at the same time the spaces and objects that compose the environment, can only be understood through the associations, which we place upon them.

In *The Production of Space*, Lefebvre draws a distinction between *absolute space* and *abstract space*.[62] Absolute space while recognised by Lefebvre as

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[62] Lefebvre (1991) *op.cit. n.*56 pp.48-49.

being both religious and political was "a product of the bonds of consanguinity, soil and language,"[63] a social space but still tied strongly to nature. History as he puts it "then smashed naturalness forever and upon its ruins established the space of accumulation."[64] Even Deleuze's and Guattari's more complex nomadic wanderings impose a distinction between the striated and the smooth, between a people in touch with nature and those somehow separated from it, between cultivators on the one hand; farmers and city dwellers on the other.

> "When the ancient Greeks speak of the open space of the *nomos* – non delineated, unpartitioned; the pre urban country side; mountainside, plateau, steppe - they oppose it not to cultivation, which may actually be a part of it, but to the *polis*, the city, the town. When Ibn Khaldūn speaks of *baiya*, bedouinism, the term covers cultivators as well as nomadic animal raisers: he contrasts it to *hadara*, or "city life." ... from the most ancient of times, from Neolithic and even Palaeolithic times *it is the town that invents agriculture*: it is through the actions of the town that the farmers and their striated space are superposed upon the cultivators operating in a still smooth space."[65]

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[63] Lefebvre (1991) *op.cit. n.*56, p.48.

[64] Lefebvre (1991) *op.cit. n.*62, p.49.

[65] Deleuze, G. & Guattari, F. (1988) *A Thousand Plateaus: Capitalism and Schizophrenia* (London: Athalone Press) p.481.

These distinctions between the striated and the smooth, absolute space and abstract space, continually revive the myth of rupture in our relations with geophysical space and nature, the movement from a human life subordinated to nature, to one where nature is subordinated by human life. However, space and our relationships with nature are, neither less abstract or more abstract at different points in space and time, but are always negotiated, always produced through spatialising practices. Although there are multiple different imaginings and representations of space and of spaces, the meanings that we attribute to geophysical spaces are never emptied out as Giddens or Beck would claim.

2.2.2 Topographical Spaces

By topographical spaces I mean to imply the means by which we represent geophysical spaces to ourselves through paintings, and maps, photographs and satellite imagery. These representations are themselves narratives, rich with myth and ordering tales, thus topographical spaces are not only constructed by social relationships with spaces, but act to arrange and order social relationships with space. Topographical spaces are therefore one of the means through which geophysical spaces can be said to be geocultural spaces. Importantly however topographical spaces continue to prioritise the physicality of space. While a map of the London Underground reorganises physical space, moving stations in order to produce a clearer scheme of things, the presented image is still one of a flat network the space between Victoria and South Kensington stations remains perceived as a distance to be overcome, a space to be travelled and overcome.

2.2.3 Topological Spaces

Topological spaces are striated both territorialized and a means of territorialisation of physical space, yet unlike topographical space it need not be concerned with measuring distance --- Topological space joins physical spaces and objects together creating relationships or is it rather that relationships draw together physical spaces and objects otherwise separated by linear time and geophysical distance. Within topological space objects are not localised by a given set of co-ordinates, rather they are brought together through polymorphic networks that flow through fluid topological regions. "In a network space, then, proximity isn't metric. And here and there are not objects or attributes that lie inside or outside a set of boundaries. Proximity has, instead, to do with the identity of the semiotic pattern. It is a question of the network elements and the way they hang together. Places with a similar set of elements and similar relations between them are close to one another and those with a different elements or relations are far apart."[66] Topological spaces, or regions, overlap: they incorporate time and should be considered as spaces of displacement drawing human and non human objects together, their relationships defined by borders through which we continually pass.

2.2.4 Farmers' Practices as Spatial Practices

I am not an anthropological romanticist and do not believe that indigenous peoples or rural communities in the two thirds world, are closer to 'mother

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[66] Mol, A. & Law, J. (1994) "Regions, Networks and Fluids: Anaemia and social Topology" Vol. 24. *Social Studies of Science* pp.641-671.

nature' than one third worlders, for, as I have tried to argue above, I do not consider that there is a singular 'nature,' whether mother like, or otherwise, with which we can commune. Similarly it should have become apparent that I do not hold there to be a monolithic body of scientific or expert knowledge against which traditional, local or indigenous knowledge is pitched in battle. What I intend describing below therefore, is something, which though often referred to as 'local knowledge,' is far more complex than such a reductionist abstraction suggests. As Cohen comments, "local knowledge masquerades as an orthodoxy, even as being so monolithic as to be contrastable to 'extraneous' or 'expert' knowledge, or theorised into a 'folk model.' But just as a multiplicity of meanings may lurk behind a common symbol, so a multiplicity of knowledges, which may not easily be reconcilable, informs common 'knowledge.'"[67]

What I am about to outline below, are numerous adaptive knowledges about plants and their environments, living knowledges rooted in experience and practice, knowledges and practices which inform the production of space, of ideas and conceptions about space, as much as they are themselves products of spatialisation. While these diverse knowledges and practices, that appear so interrelated with the continual production of agricultural biodiversity, take place within space, the spaces in which the performance of these practices and knowledges occur are localised spaces, simultaneously

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[67] Cohen, A.P. (1993) "Segmentary Knowledge: a Whalsay Sketch" in Hobart, M. (ed) *An Anthropological Critique of Development: The Growth of Ignorance* (London: Routledge) p.32.

geophysical, topographical and topological spaces, rather than an abstract and generalisable local space.

These localised practices and knowledges are at the same time temporally located, neither static, nor capable of abstraction, with no epistemic independence outside of their performance. As Bourdieu recognises, "practice unfolds in time ... its temporal structure, that is its rhythm, its tempo and above all its directionality is constitutive of its meaning ... because it is entirely immersed in the current of time, practice is inseparable from temporality, not only because it is played out in time, but also because it plays strategically with time."[68] However in Bourdieu's schema, practices "are always in the present" they "unfold in succession" and therefore do not develop into discourse or theoretical expression. This argument is developed, in order that Bourdieu can then assert a dichotomy between the time of the Kabyle, which for him is rooted in practice, and abstract time, the time of science, a monolith of his own making. As he argues, "science has a time which is not that of practice ... science is only possible in a relation to time which is the opposite of that of practice, it tends to ignore time and so to detemporalize practice."[69]

Bourdieu's own oppositional coupling between abstract detemporalized logic, and the rhythmic logic of practice is, I would argue, unfounded, for local

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[68] Bourdieu, P (1990) *The Logic of Practice*, Trans. Richard Nice (London: Polity Press) p.81.

[69] Bourdieu (1990) *Ibid* p.81.

knowledges *and* science unfold in practices, both are played out in space and time, and both are realised in localised performances, even though both may at times pronounce their global pretensions. Let us not forget, the refrain to which I continually return, the social is a heterogeneous mess of partially successful ordering stories that are more or less extended in time-space. All humans and non-humans are always a site of intersection for multiple social networks, whose ordering performances it is impossible to elude. To adopt Bourdieu's oppositional coupling between abstract science and the logic of practice not only leads us to lose sight of this complexity, but can also, even amongst the most sympathetic of observers, lead to the presentation of social practices as individual performances impossibly occurring outside of the social.

When van Beek describes the agricultural knowledge of the Dogon he writes that, "though some generalisation as to categories of fields, crops and other resources are made, the focus is on the individual and his or her knowledge of his or her personal environment. Local knowledge, at least in agriculture, is less dependent on 'tradition' (whatever that may be) than on personal experience; it is a process of information selection and evaluation, more than a body of ready made notions and values. Trial and error is much more important than fixed ideas, as the system of acquiring knowledge is definitely non-scholastic."[70] This comment however, perhaps tells us as much about

[70] van Beek, W. E. A (1993) "Processes and limitations of Dogon Agricultural Knowledge" in Hobart (1993) *op.cit. n.*67 p.56.

van Beek's prejudices towards scholastic knowledge, as it does about Dogon agricultural practices.

There is, it would seem, a three-fold process at work in van Beek's characterisation of the Dogon. Firstly, he considers Dogon knowledge to be practical. In common with Bourdieu therefore, these practices are individualised by van Beek, the acquisition of Dogon knowledge seemingly removed from the social worlds which inform these practices, so we are left with the impression of individuals standing in a field moving from one lucky coincidence to another. Secondly, although van Beek shows an earlier awareness of the detailed knowledge possessed by the Dogon, a detailed knowledge of manure types, of varietal differences and their suitability and adaptability to heterogeneous environmental habitats; he still insists on denying this local knowledge the same value as other scholastic and, presumably from his standpoint, modern scientific knowledge. Thirdly, by drawing the distinction between local knowledge based on trial and error and the scholastic acquisition of knowledge, he proceeds from the myth of science as abstract, rational, objective and universal, rather than the grounded practices of science as localised and located knowledge, also unfolding through experiential trial and error.

The manner in which farmers in the two thirds world utilise and produce agricultural biodiversity, is not admittedly derived from an abstract design of universal application, but it does involve the application of knowledges about biodiversity, knowledges which are performed through social practices more

or less extended in time-space. In the selection and exchange of seeds, the selection and adaptation of varieties, the naming of cultivars and soil types and other practices, there is the same deployment and mobilisation of bodies of knowledge as when scientific knowledge is mobilised and deployed. We need to keep firmly at the forefront of our thinking the realisation that no bodies of knowledge have a monopolisation on truth claims or, an epistemic existence outside of localised social practises.

Rural practices in much of the biodiverse two thirds world, are spatially and temporally located, with knowledge about the uses of biodiversity, plants and seeds derived from the community to which people belong, their gender, their personal experience and the experience of others. I briefly referred above to Mala Village in the Dakshina Kannada district of Karantaka State, India, it is a biodiversity rich village in the foothills of the Western Ghats and, as already mentioned, has a population of 5070 comprised of 24 different ethnic communities. The distribution of knowledge about biodiversity as with the distribution of agricultural labour, is spread across and within those communities.[71] While there are/were a small number of aged individuals within the village who were noted for their special knowledge of plants and herbal medicines for humans and animals, knowledge about biodiversity permeates the lives of many people, with the local environment providing the means from which they earn a living.

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[71] Achar *et al* (1997) *op.cit. n.*9,.

What is significant for our discussion is that different ethnic communities, hold different responsibilities in the life of the village. Some of the major users of biodiversity, the non-timber forest collectors, gather various fruit and seeds, gums and resins, stems, leaves, roots and barks, are drawn from three communities the Malekudiyas, Marati Naikas and Korages; the medicinal herb collectors, are also drawn from these communities together with some members of the Moolya community. Fishermen on the other hand, are mostly comprised of members of the Mera community, although for some months of each year a troupe of nomadic fisherman come to the village.

The bulk of the local people are small agriculturalists growing rice, oil seeds, black gram, green gram and horse gram, while the paddy cultivators are drawn from the Bunts, Billavas, Jains and Chitpavans, the last being considered expert horticulturalists growing arecanut and coconut as well as pepper, cocoa and cashew. Basket Weavers and mat weavers are drawn from the Malekudiyas and Korages, while, carpenters, blacksmiths and other artisans are drawn from different communities all using and possessing a diverse range of knowledge about the local biodiversity.

These webs of knowledge about biodiversity that weave throughout the different communities in Mala Villlage, are not of course generalisable throughout India, let alone throughout the rest of the two thirds world. Leaving aside the complexities of the caste system India, different peoples knowledge of their local biodiversity is dependant not only on the external geophysical and topographical landscape but also on the internal landscape of local

customary cultural practices. As is the case in Mala village, an important element of these practise are the divisions of labour and of responsibility that occur not only across age groups but importantly between genders.

While rural women within the two thirds world, often share some of the same problems and difficulties, for example gaining access to land, technology, seeds and agricultural inputs, they cannot be considered an homogenous group from which it is possible to generalise about 'women's' knowledge of biodiversity and agricultural biodiversity in particular.[72] The position of individuals in differing societies and communities, within different districts, of different countries, taken together with the division of labour in the agricultural process and the differing responsibilities of women within the communities and families to which they belong, bring with them differing degrees of contact about, and knowledge of, local biological diversity.

For example, according to one study conducted in the Zomba district of Malawi during the mid 1980's, while both sexes worked the maize fields, women were often solely responsible for harvesting storage and selection of seed, with 98% of those women preferring local varieties over those available

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[72] On the gendered separation of agricultural labour see further Agarwal, B. (1989) "Women Land and Ideology in India" in Haleh Afshar & Bina Agarwal *Women Poverty and Ideology in Asia* (London: McMillan) pp.70-98; Jetley, S (1984) "India Eternal Waiting" in UNESCO *Women in the villages, Men in the Town* (Paris: UNESCO) pp.75-147; Cecile Jackson (1995) "Environmental Reproduction and Gender in the Third World" in Stephen Morse & Michael Stocking (ed) *People and Environment* (London: UCL Press) pp.109-130; Agarwal, B. (1991) "Agricultural mechanisation and Labour Use: A Disaggregated Approach" in Haleh Afshar (ed.) Women development & Survival in the Third World (London: McmIllan) pp.172-187.

from the agricultural extension services.[73] On the other hand in Zimababwe cash crops such as maize together with cotton, or sunflowers, are considered as 'men's crops,' with women growing sorghum, millets, groundnuts and other legumes.[74] Any available economic resources tend to be expended on the cash crops meaning that the more traditional 'women's crops' are then grown only on poorer soil with little, if any, agricultural inputs whether organic or chemical.[75]

Throughout many rural populations of the two thirds world, in addition to agricultural labour for cash crops, women often bear the responsibility of producing crops for local consumption, according to the IUCN, for example, in Sub Saharan Africa up to 80% of women, bear the responsibility of providing food for the family. Whether this is in 'family gardens' or out in larger fields, it often means that women have more responsibility for the traditional locally grown crops and varieties.[76] In the Almora district of Uttar Pradesh, women are often provided with seeds from their home at marriage, and may exchange seeds with neighbouring villages where there are relatives. While

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[73] Akeroyd, A.V. (1991) Gender, Food Production and Property Rights: Constraints on Women Farmers in Southern Africa" in Afshar (1991) pp.139-171.

[74] See Oosterhout S, van (1996) "What does *in situ* conservation mean in the life of a small scale farmer? Examples from Zimbabwe's Communal Areas" in Louise Sperling & Michael Loevinsohn (eds.) *Using Diversity Enhancing and Maintaining Genetic Resources on Farm - Proceedings of a Workshop held on 19th –21st June 1995 New Delhi India* (New Delhi: IDRC).

[75] For a consideration of some of the issues faced by women in relation to the introduction of new crops in the two thirds world see Zweifel, H. (1995), "Modern Biotechnologies in Agriculture: Impact on women in the South." *Biotechnology and Development Monitor*, No.23, pp.10-13; Song, Y. (1999), "Feminization of Maize Agricultural Production in Southwest China." *Biotechnology and Development Monitor*, No.37, p.6-9.

[76] Traditional crops in this context are not necessarily endemic to the region, although they may well have been growing there for hundreds of years. An example would be Cassava in

seed exchange also occurs within the villages, this only appears to take place within the same caste.[77] As in other communities in Bangledesh, rural women have a significant role to play in the selection and storage of seed as Dr Farhad Mazhar of UBINING comments,

> "in the agrarian culture it is the woman who conserves preserves and germinates seeds. This involves highly intricate knowledge, which is transmitted from mothers to daughters, from sisters to sisters, from mothers in law to the daughters in law, or from one village sister to another. Unless one is familiar with the delicate wisdom of seed conservation and propagation, it is hard even to guess why some seeds should be dried under bright sun, and others under shade. Among the germination techniques, some seeds are left overnight in the atmospheric moisture."[78]

I have been trying to provide some notion, although it can only ever be a mere sketch, of the context within which the complex picture of knowledge about biodiversity and agricultural biodiversity in particular emerges; the complexity of social relationships that are involved in agriculture biodiversity and of the inseparability of this knowledge from the lives of people. That complexity

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Africa which though an important source of food with large degree of genetic diversity was introduced into Africa from Latin America.

[77] Tiwari, R. & Das, A. (1996) "Documentation of Local Crop Varieties Evolving A Participatory Methodology" in Sperling & Loevinsohn (1996) pp.66-78.

[78] Mazhar, F. (1996) "NayaKrishi Andolon: An initiative of the Bangladeshi Peasants For A Better Living" in Sperling & Loevinsohn (1996) pp.261-262 In the same vein see also Howard-Borjas, P. (1999), "Some Implications of Gender Relations for Plant Genetic Resources Management." *Biotechnology and Development Monitor*, No.37, p.2-5.

however does not stop with knowledge about diversity, but is interwoven with the production of agricultural diversity itself, interwoven with the social production of time and space, and interwoven in the fields of farmers. Many rural farmers combine species and genetic diversity in their fields, with both inter-species and intra-species cropping patterns, the result is a complex set of practices which not only change over time and space but maintain and produce biodiversity.

In India, the ecologist Claude Alvares has documented the cropping patterns of hundreds of individual farmers, who draw on traditional knowledge using inter-specific practices in order to minimise agricultural inputs. One of those farmers, Annand Mukund Subhedar, for example comes from Tiwasa village, in the Yavatamal District of Maharastra, he has a 104 hectare farm which is split into an intricate mosaic of 74 smaller plots, across which are carried out 18 different rotational cropping patterns. Within these plots there is a still further level of inter species cropping in so far as, for example, sorghum is regularly mixed in with the cotton in order to attract birds, which will in turn eat the pests feeding on the cotton. Other combinations planted on the farm include sorghum and green gram, pigeon pea and black gram or a three crop mix of green gram bajara and pigeon pea, as Alvares comments " the advantage of such combinations are the drawing of predators to the pests

which live on one or the other plant as well as the nitrogen provided by the leguminous part of the combination"[79]

Pat Roy Mooney of the Rural Advancement Foundation International (RAFI) tells of a single Bangladeshi family who over the course of 5 years undertook on their one hectare farm "61 different crop rotation patterns involving 13 different rice varieties and 10 different crops"[80] all of which took place over 17 different fields. Ashish Khotari, on the other hand explains a once common practice by farmers of the Tehri Garhwal region of the Uttar Pradesh Himalayan foothills, called *baranaja*, meaning literally 12 grains. "*Rajma* (kidney beans) *urad* (black gram) *mung* (green gram) *kulth* (horse gram) *marsha*, (amaranthus), *mandua* (finger millet) *jhangora* (barnyard millet) and other crops are grown in a jumbled profusion which to a modern agricultural scientist would appear a mess, but which is actually a carefully considered way of obtaining optimal sustained yields. Since the maturity periods of these crops vary, different crops are harvested at different times, helping to retain soil moisture and providing a constant supply of food. Fertility is continually recharged by the use of leguminous plants like pulses"[81]

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[79] Alvares, C. ed (1996) *The Organic Farming Sourcebook* (Goa: The Other India Press) p.259.

[80] Mooney, P. (1996) "The Parts of Life: Agricultural Biodiversity, Indigenous Knowledge, and the Role of the Third System" in *Development Dialogue* (Dag Hammarskjöld Foundation) pp.86.

[81] Khotari (1997) *op.cit. n.*4, p.52, and see also, Kothari, A & Das, P. (1999) "Local Community Knowledge and Practices in India" in Posey (1999) *op.cit. n.*1, p.190.

On-farm inter-specific diversity in the field leads to highly productive, sustainable systems, which limit risks and provide food, and economic security. However, unlike the monocultural landscape of intensive industrial agriculture the yield derived from the field is more complex and cannot simply be measured in terms of tonnage per acre achieved, it includes benefits in relation to labour and agrochemical costs, straw and food production, as well as the maintenance of biodiversity at soil and plant level.[82] As Daniel Querol observes, "new species appear in the fields and whether these are useful or not depends on the species and on the knowledge of the peasant. A Maize field in Oaxaca, Mexico had 214 "weeds" which were not eliminated by the producer as he had a specific use for each one ... the same field in the United States would be considered a disaster by the North American Farmer."[83] I am not arguing against the application of technologies, rDNA or otherwise, to breed new varieties, but the associated mythologies and methodologies which accompany the deployment of these varieties, the mythologies which all too often deny the validity of these farmers knowledge.

In addition to inter species diversity, farmers fields in the two thirds world are often also a place of intra species diversity. As Bellon, Pham and Jackson point out, in order to see the effects that farmers have had through intra-species development in the field, one needs only consider the number of

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[82] See Shiva, V (1995) *Biodiversity Based Productivity: A Framework for an Alternative Assessment for Sustainable Agriculture* (Dehra Dun, India: Research Foundation For Science Technology and Natural Resource Policy); Shiva, V. (1993) *Monocultures of The Mind: Perspectives on Biodiversity and Biotechnology* (London: Zed Books).

[83] Querol (1992) *op.cit. n.*31, p.37.

varieties of Asian rice, *Oryza sativa*, that have been produced through on farm innovation.[84] In India alone this totals 50,000 varieties with estimates ranging up to 100,000 varieties worldwide. Kshirsagar and Pandey in their study of rice diversity in Garah Madhupur village in the Jaipur district of Orissa, in India, suggest four reasons why a single rice farmer in that region may grow up to 12 different rice cultivars.[85]

Firstly, they suggest, that farmers try to match cultivars to specific environmental niches. Secondly, it serves as a method of reducing potential risk from pests, diseases and climate. Thirdly choosing to grow different varieties provides the ability to stagger labour demand in relation to harvesting planning and weeding while finally, different varieties may serve different demands, some may be more suitable for different types of cooking, while others produce more straw.[86]

The maintenance of intra specific varietal diversity in the field involves complex processes of interpretation and evaluation, that combine spatially

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[84] Bellon, M.R, Pham, J.L. and Jackson, MT (1997) "Genetic Conservation: A role for Rice Farmers" in N. Maxted, B.V. Ford-Lloyd and J.G. Hawkes (eds.) *Plant Genetic Conservation* (London: Chapman & Hall) pp.263-289.

[85] Kshirsagar, K.G. & Pandey, S. (1996) "Diversity of Rice Cultivars in a Rainfed Village in The Orissa State of India" in Sperling & Loevinsohn (1996) pp.54-65.

[86] Bellon, Pham & Jackson, after considering a number of studies on rice create a typography of three concerns - agro ecological – performance of a variety with respect to rainfall, temperature soil quality and topography – technological – which pertains to performance of a particular variety management and inputs response to fertilizers delays in weeding etc and –Use taste texture yield quality production for subsistence or market and straw for fodder. Similar consideration are also found in other studies for example see also Friis-Hansen (1999) *The socio-economic dynamics of farmers' management of local plant genetic resources - A framework for analysis with examples from a Tanzanian case study* CDR Working Paper 99.3, May 1999 (Copenhagen: Centre for Development Research).

and temporally located knowledges and practices in relation to the management of seed flows; the selection and adaptation of varieties; and, the selection and storage of seed, together with an understanding of the diverse social and spatial landscapes that farmers in the two thirds world inhabit. The resulting proliferation of varieties is impressive when considered in contrast to the recent trend of, for example just one village in the Indian sate of Nagaland was found to have 70 rice varieties, while in a single district of Orissa scientists identified over 1,500 varieties.[87]

While new varieties may be bought from seed dealers, the exchange and sale of existing germplasm between farmers has played an important role in producing and maintaining agricultural diversity. In one recent study, researchers watched the spread of a new rice variety, Kalinga III, over a period of years. From its initial introduction into just three villages in 1994, farmer to farmer diffusion resulted in the spread of Kalinga III, to 41 villages by 1996 and over 100 villages covering an area of several thousand square kilometres by 1997.[88] While the social relationships that lead to such diffusion are complex and diverse, what is clear, is that women often play a lead role in the diffusion of seeds, and knowledge about seeds.

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[87] Khotari (1997) *op.cit. n.*4, p.51.

[88] See Whitcombe, J.R., Pere, R. Jones, S. and Josh, A. (1999) "Farmer Participatory Crop Improvement. IV The spread and Impact of a Rice Variety Identified by Participatory Varietal Selection" Vol.35 *Experimental Agriculture* pp.471-487.

Out of the number of varieties that maybe available to farmers the criteria for choosing which ones to grow will vary, some of these decisions will be made on an agro ecological basis, (soil quality, rainfall, topography) some technological, (reliance on fertilizers, the need to spread labour, different times of harvest) and others in relation to the intended end use (texture, yield, taste).[89] Concerns within a particular village will vary from farmer to farmer therefore in stark contrast to the use of yield is a primary indicator of value we are not looking at a homogenous set of criteria which can be easily quantified.

With crops such as maize, intra species cropping provides the means for experimentation and the production of new varieties that are adapted to local environments, at the same time farmers want to maintain the purity of seed lines for planting in the next season. Thus land may be divided into plots, with different seeds grown in different plots, the seed at the centre of the plot breeding true and that at the edges providing the ability for crosses that may be chosen by the farmer for further experimentation in trial plots.[90] Farmers also use their knowledge of different varieties when making decisions regarding their selection and storage of seeds, practices which play an important role in the management of the varieties which the farmer chooses to maintain and plant from season to season. In other words, diversity is reliant on seed flows, variety selection, variety adaptation and seed selection and storage.

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[89] See Bellon *et al* (1997) *op.cit. n.*84.

At this stage it is perhaps appropriate to retell a tale told by the Dutch sociologist Jan Douwe van der Ploeg.[91] His narrative takes place within the Andean highlands of Peru, and tells of a highly complex reflexive process of potato farming. According to van der Ploeg each farmer may cultivate between 12-15 small plots of land, plots which are worked, according to practices derived from both the farmers experience of growing potatoes, a dynamic process changing over time, and from the nature of the land itself, the geophysical space which a plot encompasses.

The Andean potato farmers change their planting methods from plot to plot. In one, for example, they may cultivate a single variety of potato sown at random, whereas in another, the same farmer may choose to plant a number of varieties in well delineated rows. The reasoning which a framer adopts in choosing a particular method, incorporates a number of variables, it may arise from the nature of the soil on a particular plot, or the shade created by the topograpical landscape, it will depend on their previous experience of cultivating particular plots of land, as well as the farmers impression of the potato varieties grown.

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[90] Richards, P. (1996) "Culture and Community Values in the Selection and Maintenance of African Rice" in Stephen B. Brush and Doreen Stabinsky (eds.) *Valuing Local Knowledge* (Washington DC: Island Press) pp.209-229.

[91] van der Ploeg, J. D. (1993) Potatoes and Knowledge in Hobart (1993) *op.cit. n.*67, pp.209-227.

The Andean farmers knowledge is one based in labour, a process of continuous interpretation and evaluation where, "... the labour process does not lend itself easily to any standardisation or exact planning. Diversity both permeates and is created by the process itself. Thus, the decisions taken during the labour process indeed determine the results and, when evaluated in connection with the results, this decision also leads to the generation of new or more detailed knowledge."[92]

This Andean tale therefore is not only a tale of biological and genetic diversity, a tale of multiple varieties of potatoes grown within a specific geophysical space, but it is also, a tale of how that biological diversity is intertwined within the diversity of practices which the Andean potato farmers generate, it is enmeshed within their lives, it exists within space and time, merging experience with locality.

The Peruvian potato farmers are not searching for a reducible, or generalisable, method of growing potatoes, nor, are they searching for a genotypical plant that will produce an average yield across many plots of land. Rather, the methods of growing potatoes which the Andean farmers adopt leads to cross fertilisation and the increased production of varietal hybrids. This is a story then about the production of not only hybrid varieties of potato but of hybrid and diverse relationships of farmers, of space, of potatoes and of time.

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[92] van der Ploeg (1993) *op.cit. n.*91, pp. 209/210.

So, while this tale of Andean Potato farmers is for me about diversity and the production of hybrids, I also consider it to be a story about time and space, about the way that these farmers lives and the crops that they grow are intertwined with the spaces they inhabit; of how their experiences are intermeshed with the repetitive and recursive passing of time through which they travel. As Maurice Bellon from the International Rice Research Institute (IRRI), has remarked;

> "Diversity maintained by farmers is not just the set of varieties they keep, but also the management processes these varieties are subject to and the knowledge that guides these processes. In fact, the specific varieties in the set may change through time. Hence farmers' diversity is a process rather than a state."[93]

The purpose of this chapter has been in part to serve as prelude to the discussions in those Chapters yet to come, while at the same time providing a framework within which we can consider the implications for biodiversity posed by the strategies, legal and otherwise, to conserve it; the manner in which crops using rDNA technologies are being deployed; and the directions of current agricultural research.

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[93] Bellon, M. R. (1996) "On Farm Conservation as a Process: An Analysis of its Components" in Sperling & Loevinsohn (1996) *op.cit. n.*74, pp.261-262.

The deployment of the results of agricultural research can only be achieved through limiting the degree of heterogeneity ecologically and culturally that are encountered. The performers, in this case farmers in the two thirds and one third worlds, must be enrolled they must reconfigure themselves, in turn reconfiguring the topographical landscape. It is within this reconfiguration, within reterritorialisation of space, the reordering of spatial and temporal practices that we see power exercised, not as a process of globalisation, but in the localised performance of social practices. One of those strategies for achieving the reordering of space and the performance of power is through the mobilisation of law to which we shall begin to turn our attention in greater detail in the next chapter.

Chapter 3

Trading Biodiversity and Biosafety

In the last chapter I suggested that biodiversity can only ever be understood within temporally and spatially located bodies of knowledge. At the same time I argued that agricultural biodiversity is the product of natural and human selection, of countless innovative performances by farmers for over 10,000 years. Agricultural biodiversity therefore is neither static nor the consequences of fortunate accidents, but the result of social practices extended in time-space.

In this chapter I turn my attention to the international strategies that have emerged during the last decade for protecting biodiversity generally and from the risks of biotechnology in particular. In the first part of this chapter therefore I want to briefly examine the Convention on Biological Diversity (CBD).[1] In sharp contrast to the proposal that biodiversity can only be understood within specific spatially and temporally located knowledge and practices, the CBD proceeds from the proposition that biodiversity is objectively knowable, a resource which can be globally managed for utilitarian ends. As Kathleen McAffee comments, "this global environmental-economic paradigm reduces

[1] *Repr.* (1992) 31 *ILM* 818.

organisms and ecosystems to their allegedly fungible components and assigns monetary prices, calculated with reference to actual or hypothetical markets, to those components. The result is a panplanetary metric for valuing and prioritising natural resources and managing their international exchange"[2]

The CBD is more than just a legal text, but an organisation with global pretensions, that attempts to monopolise and control the debate on biodiversity. As a social organisation it contains divergent views, yet at the same time to be successful it must create sufficient shared agreement to produce relatively stable facts about biodiversity, so that the humans and non-humans which constitute both its make up and its focus can be understood. In order to function, the CBD, must bring to bear resources, skills, techniques, materials, practices and concepts, it must facilitate co-operative work across social worlds, which it does for the most part in a manner that is characterised by a reductionist concern with the conservation of genetic resources. While the commodification of nature is hardly a new practice, the CBD provides a new conduit for furthering the developmental goals of other organisations, while at the same time positing a symbiosis between "the Siamese twins of biodiversity and biotechnology."[3]

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[2] McAfee, K. (1999) "Selling Nature to Save It? Biodiversity and Green Developmentalism" Vol. 17 *Environment and Planning D: Society and Space* pp.133-154 at 134.

[3] Weiszacker, C. von (1996) "Biodiversity Newspeak" in Miges Baumann, Janet Bell, Florianne Koechlin and Michel Pimbert, (eds.) *The Life Industry; Biodiversity People and Profits* (London: Intermediate Technology Publications) p.65.

In the second and larger part of this chapter I turn my attention to the Biosafety Protocol negotiations, which concluded on Jan 29th 2000 in Montreal, Canada. Under Article 19(3) of the CBD, the parties to the Convention were required to consider the need for a Biosafety protocol. What resulted from the negotiations is an example of the further narrowing of the debate regarding Biodiversity within the CBD, with not only, the attempt to exclude social and economic considerations from a place in the assessment of risks relating to biodiversity but also, the further deepening of the links between biotechnologies, biodiversity and trade.

3.1 Biodiversity as A Genetic Resource

Peoples and states have recognised for millennia, the importance for their economic development of utilising and regulating access to biodiversity. The collection and utilisation of genetic resources extends back to Neolithic Man's first agricultural experiments 10,000 years ago, and we know that the Egyptians were listing medicinal plants around 1600 BC, just one extant example of the written representation of knowledge that had previously passed orally from generation to generation. Similarly, Mesopotamian inscriptions tell of expeditions in 2,500 BC conducted solely to bring back new species and varieties of plants and we know that botanical gardens have existed since at least 460 BC.[4] More recently, colonial rulers from the Portuguese to the British used their navies to expropriate genetic resources

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[4] See Juma, (1992) *The Gene Hunters: Biotechnology and The Scramble For Seeds* (London: Zed Books).

from around the world,[5] and now scientists from universities and life science companies carry out the same tasks.

The regulation of biodiversity too, has a long history. Richard Grove notes, that "as early as 450 B.C. Artaxexes had attempted to restrict the cutting of the Cedars of Lebanon,"[6] while the regulation of biological resources, and in particular forests, has been conducted throughout the ages, whether by the Romans, King Rudolph in 1289, the Venetians in the 15th Century, The English through various Acts of Parliament such as the 1668 Forest of Dean Act and 1696 New Forest Act, or by the Dutch and British East India Companies in the 16th, 17th, and 18th centuries. Just as significantly, if not more so, local ecological knowledge has found its expression in the traditions and rules of various religions, beliefs and community practices from time immemorial.[7]

While this long history of environmental regulation is frequently overlooked, the conclusion in 1992, of the United Nations Conference on Environment and Development (UNCED) in Rio De Janeiro, is often considered a watershed in the international recognition of the importance of the environment, from which, emerged the Convention on Biological Diversity, The Rio Declaration, Agenda

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[5] See Grove, R. (1998) *Ecology Climate and Empire The Indian Legacy in Global Environmental History 1400-1940* (Delhi: Oxford University Press) and Hobbhouse, H. (1992) *Seeds of Change Five Plants that transformed the World* (London: Papermac).

[6] Grove, R. (1995) *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860* (Cambridge: Cambridge University Press).

[7] See Gadgil, M. and Guha, R. (1992) *This Fissured Land: An Ecological History of India* (Delhi: Oxford University Press).

21, The forestry Principles, The Climate Convention, The Desertification Convention, The UN Commission on Sustainable Development, The Conference on Small Island Developing States, The Conference on Straddling and Highly Migratory Fish Stocks, The Inter Governmental Panel on Forests and hundreds of national strategies for implementing these various initiatives.

Despite the Earth Summit's success in generating a number of legal instruments and initiatives it is also perceived by many, as a missed opportunity, little more than a talking shop, which not only retread much of the same ground as the Stockholm Conference twenty years earlier in 1972, but to some extent gave up already won ground, subordinating environmental concerns to those of economic development, while recognising neither biocentric environmental rights, nor, anthropocentric human environmental rights, in the end, neither significantly addressing some of the fundamental concerns of environmentalists nor those of developing countries.[8]

3.1.1 Towards UNCED and the CBD

I do not want to revisit the CBD or UNCED negotiations in any significant detail as this has been covered in numerous places before.[9] However, as the

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[8] The literature is large but for indicative examples see Sachs, W. (ed.) (1993) *Global Ecology: A new Arena of Political Conflict* (London: Zed Books); Pallemaerts, M. (1992) "International Environmental Law From Stockholm to Rio; Back to the Future" Phillipe Sands (ed) *Greening International Law* (London: Earthscan); Shelton, D. (1992) "What Happened in Rio to human Rights" *3 Yb. Int'l Env.L* (1992) pp.75-93;

[9] See generally Redgwell, C and Bowman, M (1995) *International Law and The Conservation of Biological Diversity* (London: Kluwer Law International), McConnel, F. (1996) *The Biodiversity Convention: A negotiating History* (London: Kluwer Law International); Burhenne-Guilmin, F. & Casey-Lefkowitz, S. (1992) "The New Law Of Biodiversity" *3 Yb. Int'l Env.L* (1992) pp.43-59 and *ibid.*

primary international instrument concerned with biodiversity there are some important aspects of the CBD in particular its underlying approach and the manner in which it constructs the *in situ* conservation of biodiversity, which do need to be considered. Additionally, the CBD provides both the legal basis and the framework within which the Biosafety Protocol negotiations took place; we need therefore, to understand something of the CBD in order to fully appreciate the basis of the discussion covered in the rest of this chapter regarding the Biosafety Protocol.

Throughout the 1980's the maintenance of genetic diversity began to emerge as an important issue in a number of international forums. Thus the 1980 World Conservation Strategy had as one of its goals the "preservation of genetic diversity and sustainable utilisation of species and ecosystems, " while the text of the 1982 World Charter for Nature included the need to "maintain genetic viability." Perhaps most significantly the 1983 conference of The Food and Agriculture Organisation of the United Nations (FAO) not only adopted, by Resolution 8/83, an International Undertaking on Plant Genetic Resources[10]

[10] The FAO conference in 1993 unanimously adopted Resolution 7/93, calling for negotiations to revise The International Undertaking so that it was in harmony with the CBD; realised Farmers' rights; and dealt with issues of access to *ex situ* collections not covered by the CBD. This process is still ongoing as of September 2000, for an overview of the position at the times of writing see the report prepared by the FAO in April 2000 for COP 5 of the CBD - UNEP (2000) *Agricultural Biological Diversity: Review Of Phase I Of The Programme Of Work And Adoption Of A Multi-Year Programme Of Work Report on the negotiations for the revision of the International Undertaking on Plant Genetic Resources* UNEP/CBD/COP/5/INF/12

but also established a permanent intergovernmental forum to deal with issues arising from the undertaking.[11]

By decision 14/26 of the 17th June 1987, the United Nations Environment Programme (UNEP) convened the *Ad Hoc* Working Group of Experts on Biological Diversity to consider the need for an international biodiversity convention. Earlier, in 1984, the IUCN had prepared its Principles for the Conservation of Wild Genetic Resources, and, in a parallel process to UNEP had during 1988 been drafting its own Convention on Biological Diversity. As a part of the work of the *Ad Hoc* Working Group, the executive director of UNEP, asked it to consider the draft IUCN articles, and, realising that work still needed to be done in order to obtain a satisfactory Convention, by UNEP decision 15/12, the Ad Hoc Working Group of Technical and Legal Experts was established in May 1989, to prepare an international legal instrument for the conservation and sustainable use of biological diversity.

By February 1991, following UNEP decision 16/27, the ad hoc working group had become known as the Intergovernmental Negotiating Committee meeting seven times between 1991 and 1992, when the draft text was finalised, and, became open for signing at the Earth Summit in Rio. The CBD entered into

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[11] This was The Commission on Plant Genetic Resources although it is now called The Commission on Plant Genetic Resources for Food and Agriculture. The commission has developed a Global System for the Conservation and Utilisation of Plant Genetic Resources for Food and Agriculture which has 171 participating countries. In 1996 a Global Plan of Action on Plant Genetic Resources adopted at Leipzig in Germany, became part of the global system which includes codes of conduct for Plant Germplasm Collecting and Transfer and one for biotechnology. In addition the System has a network of *ex situ* and *in situ* collections and an early warning system on Plant Genetic Resources.

force on December 29th 1993, 90 days after its 30th ratification. Initially signed by 168 countries, it currently has 177 parties with, as of September 2000, only 8 parties who have not as yet ratified the agreement, the USA being the most significant.[12] Despite Article 37 preventing reservations to the agreement, the UK, France, Italy and the US all attached statements of interpretation when signing the convention.

Article 1 of the CBD describes its objectives as "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources." To this end, while Article 3 asserts the sovereign rights of states to exploit their own resources the provision of Articles 16, 17, 18 & 19, not only provide for access to genetic resources but also, for the distribution of benefits derived from them. The CBD is not solely a legal text but is importantly an organisation whose purpose is to coordinate and conduct research, training, public education and awareness of issues relating to biodiversity. The text

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[12] At the time of writing, out of the 177 countries who have signed the CBD, apart from the US the other countries still to ratify the agreement are, Afghanistan, Azerbaijan, Libya, Malta, Thailand, Tuvalu, and Yugoslavia. Under the Bush administration the US initially refused to sign the CBD when it became open for signature at Rio, their reasons for doing so are reprinted in (1992) 31 *ILM* 818. In 1993 however, with the incoming Clinton Administration, Secretary of State for foreign affairs Madeline Allbright, signed the CDB on its final day of opening, 4th June 1993. The treaty was transmitted to the senate by President Clinton on 19th November 1993 where notwithstanding the approval, on July 11th 1994, of the Committee on Foreign Relations by 16 votes to 3, attempts to ratify the treaty before the end of the session failed. Despite letters of support for ratification, all be it subject to qualifications, from amongst others, the US Biotechnology Industry Organisation (BIO), Merck & Co. inc and The US Council for International Business, ratification was resisted by a group of 35 Senators led by Jesse Helms and Bob Dole (See 103rd Congressional Record for September 30th & October 4th 1994 as well as the *New York Times* Sept 26th 1994). The primary concerns of the senate were the same as the US had declared when initially refusing to sign the CBD, namely that its terms were too vague in relation to Intellectual Property Rights (IPRs), funding, biotechnology and future protocols, the biosafety protocol among them.

provides a framework within which the Secretariat, The Conference of the Parties (COP) and the Subsidiary Body for Scientific Technical and Technological Advice (SBSTTA) conduct an ongoing process of research and education with Article 7 requiring parties to identify and monitor the necessary components of biological diversity and its sustainable use (Articles 6 & 10). Significantly, the convention requires parties to make provisions for *ex situ* (Article 9) and *in situ* (Article 8) conservation of biodiversity, while Article 14 necessitates that impact assessment studies be conducted on "proposed projects that are likely to have significant adverse effects on biological diversity" in order to minimise those effects.

3.1.2 Understanding the CBD

To truly understand the CBD it is necessary to think of it not simply as an environmental agreement, but as an international trade agreement. For, the CBD both facilitates trade in genetic resources and provides a framework within which the international export of rDNA technology is now regulated under The Biosafety Protocol. The value placed on Biodiversity within the CBD is ultimately an economic one, where the complex interactions of communities and ecosystems, which we observed in the last chapter, are reduced to a singular anthropocentric utilitarian vision, in which biodiversity's value can only be realised as a repository for genetic resources. In order to understand more fully why this is the case, we need to consider in more detail both the philosophical underpinnings of the Convention as well as the positions of some of the parties to the CBD negotiations.

Although the results of the work Nicolai Vavilov carried out during the 1920s and 1930s have come in for some revision, both his general philosophy and approach still influence current agricultural research and, it could be argued, form a central pillar on which the CBD is built. Vavilov was President of the Lenin Academy of Agricultural Sciences and Director of the Institute of Applied Botany until he was accused of agricultural sabotage and espionage, eventually dying in prison of malnutrition in 1943 another victim of Stalin's rule.

In order to improve crops in the USSR Vavilov, with 20,000 staff spread over more than four hundred research institutes and experimental stations, conducted expeditions to Afghanistan, Abyssinia, Chain, Central America and South America, in order to collect plants of economic interest including 26,000 different strains of wheat. If there is one important organising theme to Vavliov's work, it lies in the notion of the eight world centres of origin of cultivated plants which he developed, centres which for the most part were found mostly within the tropics.[13] His hope was that the genetic resources contained within the diversity of plants in the centres of origin would serve as a basis for breeding programs in the USSR. As he comments, "our exploratory work was pursued with a particular goal in mind: to utilize the plant resources

[13] These "World Centres of Origin of Cultivated Plants" were described by Vavilov as the Chinese, Indian, Central Asiatic, Near Eastern, Mediteranean, Abyssinian, South Mexican and Central American, and South American see Vavilov, N.I. (1951) "Origin, Variation, Immunity & Breeding of Cultivated Plants" in Vol. 13 *Chronica Brittanica* and Vavilov, N.I. (1992) *Origin and Geography of Cultivated Plants* (Cambridge: Cambridge University Press).

of the world maximally for the purpose of plant breeding based on a global gene bank."[14]

In his collected work, Vavilov asserted the economic importance for the USSR in utilising the worlds plant genetic resources through the application of scientific methodologies in crop breeding programs for food production. As he wrote in 1931

> "we have barely begun the systematic study of the World's plant resources and have discovered enormous untouched reserves, unknown to scientific breeders in the past. The tremendous potential source of species and varieties requires thorough investigation employing all the newest methods. ... The enormous plant potentials discovered in the centres of primary origin of forms and species of cultivated plants should be subjected to investigation not only by the taxonomist but also by the physiologist, the biochemist and pathologist. In the field of genetics, which aims at new creations through the most rational combinations of parents, an immense field of the most fascinating and urgent work is opened up."[15]

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[14] Vavilov, N.I. (1992) *Origin and Geography of Cultivated Plants* (Cambridge: Cambridge University Press) p.307.

[15] Vavilov (1951) "Phytogeographic Basis of Plant Breeding," Vol. 13 *Chronica Brittanica* p.53

Sixty years later, the Consultative Group on International Agricultural Research (CGIAR)[16] were also extolling the benefits of the scientific utilisation of Biodiversity in their submission to UNCED, expressing similar sentiments to those of Vavilov in justifying the need for a biodiversity convention.

> "Genetic Resources are an asset and a tool to boost local, regional and national economies in all nations of the World; but their conservation is more certain if they provide jobs and incomes ... Plant genetic resources have a key role in world trade. Increased agricultural production, not just in quantity but in diversity of crops, leads to improved standards of living, which in turn create increased demand for imports of both food and non food items. This boosts world trade. In addition, plant genetic resources have a demonstrated ability to pay for their conservation many times over. The scale of this economic benefit is large enough to finance the cost of conserving other materials with as yet undiscovered qualities"[17]

What links these two statements is the positing of biodiversity purely as a resource, a genetic resource, with a value only realisable in economic terms and comprehensible only from a scientific perspective. As with the CBD itself, it is not the recognition of complex interminglings of human knowledge with

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[16] CGIAR was created in 1971 under the co-sponsorship of the World Bank, the FAO and the UNDP. Despite its lack of status under international law it is highly influential in setting the agenda for developing countries agriculture research through overseeing the work of the sixteen International Agricultural Research Centres, which were central in the implementation of the "Green Revolution."

[17] CGIAR submission to UNCED quoted in Weizsacker, C. von (1993) "Competing Notions of Biodiversity" in Wolfgang Sachs (ed.) *Global Ecology: A new Arena of Political Conflict* (London: Zed Books) p.121.

biological ecosystems that is at the centre of concerns, but the utilisation of genetic resources. The utilisation of genetic resources would, according to CGIAR, lead to development, sustainably of course, while at the same time providing not only significant gains in food security but justifying the means through which biodiversity could earn its keep. While it may come as no surprise that a World Bank funded organisation might hold such a position, it was also one that for the most part was taken by the G77 countries themselves during the CBD negotiations.

From the perspective of the G77 countries, negotiations for UNCED and the CBD were part of a broader agenda of "restructuring global economic relations to obtain required resources, technology and access to markets."[18] To some extent therefore, the CBD negotiations and the final text itself, centre on issues already articulated within the UN during attempts to establish a New International Economic Order (NIEO)[19] and The Right To Development.[20]

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[18] Boyle, A. (1995) in Redgwell, C and Bowman, M (eds.) *International Law and The Conservation of Biological Diversity* (London: Kluwer Law International).

[19] The early 1970's saw the growing assertiveness of the two-thirds world within the UN one result of which was the attempt to establish a New International Economic Order (NIEO) as a challenge to the perceived neo-colonialism of the former colonial nations. In so far as the NIEO exists, its contents can be found in 3 resolutions adopted by consensus within the UN. The 1974 Declaration on the Establishment of a New International Economic Order (UNGA Res. 3201-S.VI), The Programme of Action on The Establishment of a New International Economic Order (UNGA Res. 3202-S.VI) & The Charter of Economic Rights and Duties of States (UNGA Res. 3281 XXIX).

[20] The Right to Development was first conceptualised in 1972 by the Senegalese jurist Keba M'baye (in "Le Droit au Development Comme un Droit de L'homme," Vol.5 *Revue de Droit de L'homme* 505). It was subsequently recognised in 1977 at the thirty third session of the UN Commission on Human Rights, by resolution 4(XXXIII) and then on the 4th December 1986, by the UN General Assembly, with 146 votes in favour, 6 abstentions and only the USA opposing (UNGA Resolution 41/128). The right to development is a collective right, which includes but is not limited to economic development, vested not only in individuals, but groups, peoples and states, while applicable at all levels, community, local, national, regional and global. Partly for this reason it has come under attack by some as a groundless concept (see Donnelly, J. (1984) "The 'Right to Development': How Not to Link Human Rights and

The essentially bio-rich G77 countries were, and ostensibly still are, concerned not only with asserting their sovereign rights over genetic resources, but significantly, ensuing that their value is realised. To this end, and to some extent implicitly echoing the common but differentiated responsibilities of states contained within Principle 7 of the Rio Declaration,[21] G77 countries were concerned that in return for providing access to biodiversity, there should be additional funding for implementation of the agreement, mechanisms for benefit sharing arising from the utilisation of biodiversity, and the obligation to transfer technologies, including biotechnologies, to the two thirds world.

3.1.3 From Common Heritage to Common Concern and Back?

There is a continually oscillating tension in both the text of the CBD and the ongoing arguments over bio piracy and the patenting of genetic resources, which I consider further in Chapters 4 and 5, between sovereign property rights and an open commons system; between the reworking of Lockean dogma that is found in Garret Hardin's *Tragedy of the Commons*[22] and the

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Development" in Welch, C.E. & Meltzer, R.I. (eds.) *Human Rights and Development in Africa* (Albany: State University of New York Press)), the concept has been much more favourable accepted however by those within the two thirds world, see Alston, P. (1988) "Making Space for New Human Rights: The Case of the Right to Development" Vol.1 *Human Rights Yearbook* 3; Mansell, W. & Scott, J. (1994) Why Bother About a Right to Development" Vol.21(2) *Journal of Law and Society* 171; and in a wider context Shivji, I.G. (1989) *The Concept of Human Rights in Africa* (London: Codesria).

[21] The Rio Declaration on Environment and Development A/CONF.151/5/Rev.1 *repr.* (1992) 31 *ILM* 876.

[22] Hardin, G. (1968) "The Tragedy of The Commons" Vol. 162 *Science* p.1243 – Hardin's Tragedy is similar to that found in Locke, in so far as he argues that private property serves to prevent the overuse of the commons from the 'inherent' selfishness of 'man'. As Hardin writes

recognition of biodiversity as the common heritage of mankind[23] (although for reasons we shall consider briefly below the text of the CBD actually uses the phrase "common concern of humankind") which finds itself played out in a number of ways throughout the CBD.

It is possible to argue that the convention as a whole is predicated on the notion of a common heritage, that the existence of articles requiring that access is given to genetic resources, together with the requirements for exchanging information, technology, and other non financial benefits is a recognition in itself of the common heritage that lies within biodiversity. This point of view comes particular to the fore when arguments are being made against the monopolisation of genetic resources by the life science industry, at which time the notion of a commons is invoked in order to classify the life science companies acts' and the IPRs that they mobilise, as an enclosure of the commons.[24]

In contrast to the notion of a commons, two articles in particular embed Hardin's tragic view into the CBD. Article 3 recognising states sovereign rights

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"ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all" (at 1244).

[23] The Notion of the Common Heritage of Mankind emerged towards the end of the 1960s primarily through its championing by the Maltese Ambassador Arvid Pardo, see further Cassese, A. (1986) *International Law in a Divided World* (London: Clarendon) pp.376-392. In addition to the IUPGR use of the concept has also been made in *UNCLOS III* and the 1979 *Agreement Governing Activities of States on the Moon and Other Celestial Bodies*.

[24] See for example RAFI (undated) *Enclosures of The Mind: Intellectual Monopolies* (Ottawa: RAFI/IDRC/CBDC) and Shiva V., Jari A., Bedi G., and Holla Bhar R. (1997) *The Enclosure and Recovery of The Commons* (New Delhi: RFSTE).

and Article 16 ensuring the CBD is supportive of IPRs,[25] both of which not only run counter to the notion of a common heritage but paradoxically undermine each other, as we see in the next chapter.

Article 3 declares that states have the "sovereign right to exploit their own resources pursuant to their own environmental policies." This central feature of the convention runs counter to previously held views on the freely available access to and movement of plant germplasm, and is the result not only of the assertion of the two third world's newly found political presence but also their experience of what free access and the common heritage of mankind had come to mean in particular in relation to the FAO's International Undertaking.

Many crops grown in countries today for food or otherwise are the direct result of the free transfer of genetic materials from region to region and country to country. Cassava for example has not only become an important a staple of

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[25] The tension between sovereign property rights and a common heritage can clearly be seen within the text of Article 16 itself. Article 16.2 relating to the access and transfer of technology relevant to the conservation of biodiversity states that "in the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognise and are consistent with the adequate and effective protection of intellectual property rights." The intention lying behind Article 16 is to enable benefit sharing with those countries granting access to genetic resources. However, in order for the contracting parties to maximise the value of those resources the CBD needs to respect IPRs hence Article 16.2 and ultimately Article 3. At the same time Article 16.5 recognises that IPRs have the ability to undermine benefit sharing and therefore states that "the Contracting Parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of this Convention, shall cooperate in this regard subject to national legislation and international law in order to ensure that such rights are supportive of and do not run counter to its objectives." Herein lies a paradox of the Biodiversity Convention for while strong IPRs in line with sovereign property rights on biotechnological products and processes maximises the value of genetic resources, they undermine benefit sharing. At the same time benefit sharing, which is implicitly based on the recognition of the common heritage of Biodiversity, can only be achieved with weaker IPR protection that does not maximise the value of genetic resources and therefore leaves little benefit to share.

the rural African diet, but Africa itself has become a secondary centre of genetic diversity for cassava, despite the fact that it is not endogenous to the continent and was introduced around 300 years ago from Latin America.[26] The cuisine and diets of many countries are heavily reflective of the movements of plants that accompanied the colonial passages of the 16th to nineteenth centuries.[27] The unrestricted movement and development of crop varieties within the two thirds world has until the recently occurred through co-operation, whether at a community or international level, even the Green Revolution varieties were developed on a free access basis.[28]

IR 8 for example is a rice variety developed by the IRRI resulting from a cross between an Indonesian variety called *Pea* and a variety from Taiwan called *Geo-Woo-Gen,*[29] containing a dwarfing gene now found in all HYV rice varieties. Or, there is Norin 10, originally taken to the US from Japan in 1946, by 1984 wheat developed from its genes accounted for 59% of total US production. Norin 10 was a dwarfing variety of wheat developed by the Japanese which, as well as including genes from a Japanese variety *Darauma*, also had genes from farmers' varieties taken to Japan in the 19th Century from the United States, one of which in turn had been brought to the

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[26] See FAO (1997) *The State of the Worlds Plant Genetic Resources for Food and Agriculture* (Rome: Food and Agriculture Organisation of The United Nations) p.22.

[27] See for some examples Juma (1989) *op. cit. n.*4 and Hobbhouse (1992) *op.cit. n.*5.

[28] For an early but prophetic article on the differences in this regard between the green revolution and the then yet to happen biorevolution see, Buttel, F., Kenney, M., Kloppenburg, Jr, J. (1985) "From Green Revolution to Biorevolution: Some Observations on the Changing Technological Bases of Economic Transformation in The Third" *World Economic Development and Cultural Change* p.31.

[29] See Shiva, V. (1993) *Monocultures of The Mind; Perspectives on Biodiversity and Biotechnology* (London: Zed Books).

US from the Ukraine. Similarly, in recounting his own experiences with IR 64, a rice variety in whose development he was involved and which had 70 parental genotypes, The former Director of the Indian Agricultural Research Institute, Prof S.K. Sinha, personally expressed his own incredulity to me, that any one individual or company can claim rights to plants whose history was a complex and multifaceted web of exchange, selection, experimentation and development involving farmers and scientists that is characteristic of all varieties not just IR 64.[30]

At the twenty second session of the FAO conference held in November 1983, the FAO, by resolution 8/83, adopted the International Undertaking on Plant Genetic Resources (IUPGR).[31] The original version of the IUPGR was, according to Article 1, "based on the universally accepted principle that plant genetic resources are a heritage of mankind and consequently should be available without restriction." Interestingly the undertaking covered all forms of germplasm, providing for access not only to landraces and wild varieties, but also to cultivated and elite breeders lines.[32] The objective of the IUPGR was, again according to Article1 "to ensure that plant genetic resources of economic and/or social interest, particularly for agriculture, will be explored,

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[30] Personal conversation with Prof. S.K.Sinha, at the USI Premises, New Delhi, 29th October 1999.

[31] For an overview see Cooper, D. (1993) "The International Undertaking on Plant Genetic Resources" Vol.2(2) *RECIEL* 158; Esquinas-Alcazar, J. (1993) The Global System on Plant Genetic Resources Vol.2(2) *RECIEL* 151; and see *n.*10 *supra*.

[32] IUPGR Article 2.1 "In this Undertaking: (a) "plant genetic resources" means the reproductive or vegetative propagating material of the following categories of plants: i. cultivated varieties (cultivars) in current use and newly developed varieties; ii. obsolete cultivars; iii. primitive cultivars (land races); iv. wild and weed species, near relatives of

preserved, evaluated and made available for plant breeding and scientific purposes."

The objectives of the IUPGR arose primarily out of two major concerns from countries in the two thirds world. The first of these was the manner in which multinational seed companies were monopolising germplasm, making profits from varieties that had ultimately derived from genes originating within the borders of the two thirds world through the use of plant breeders rights and patents. Secondly, countries were concerned that not only was germplasm being removed to seedbanks which were for the most part out of their control but that in addition any improvement or use of that germplasm was not finding its way back into the two thirds world.[33] Deploying the notion of the common heritage of mankind was an attempt to undermine the monopolisation of germplasm by providing open access to *all* germplasm. Unsurprisingly this move was opposed by a number of countries including the US and Canada who ultimately refused to sign the IUPGR.[34]

On 29th November 1989 although maintaining that plant genetic resources were the common heritage of mankind, the 25th session of the FAO conference by resolution 4/89, stated that "Plant Breeders' Rights, as provided

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cultivated varieties; v. special genetic stocks (including elite and current breeders' line and mutants;"

[33] For background to the political situation prior to and during the negotiations for the IUPGR see generally Mooney, P.R. (1979) *Seeds of The Earth: A Private or Public Resource?* (Ottawa: Inter Pares); Fowler, C. & Mooney, P. (1990) The Threatened Gene: Food Politics and The loss of Genetic Diversity (Cambridge: The Lutterworth Press).

[34] See Hamilton, N.D. (1993) "Who Owns Dinner: Evolving Legal Mechanisms For Ownership Of Plant Genetic Resources" *Tulsa Law Journal* p.587.

for under UPOV (International Union for the Protection of New Varieties of Plant) are not incompatible with the International Undertaking;"[35] Despite the recognition given to farmers' rights during the same session[36] the recognition of plant breeders' rights marked a change in the approach of the IUPGR; this was no longer an instrument with a uniform regime that encouraged the free exchange of germplasm as the common heritage of mankind, but one in which the common heritage of mankind was used to expropriate genetic resources in the two third world, while denying access to germplasm developed in the one thirds world. It is perhaps unsurprising that not only did countries in the two thirds world turn away from the notion of common heritage by asserting their sovereign rights over genetic resources in the IUPGR by resolution 3/91, but that they also followed the same course during the negotiations for the Biodiversity convention. As President Hassan Mwinyi of Tanzania said at the time,

> "Most of us in developing countries find it difficult to accept the notion that biodiversity should be considered the common heritage of mankind while the flow of biological products from the industrial countries is patented,

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[35] Resolution 4/89 of the 25th Session of the FAO Conference.

[36] Resolution 5/89 of the 25th Session of the FAO Conference – Farmers rights are defined in the resolution as "rights arising from the past, present and future contributions of farmers in conserving, improving, and making available plant genetic resources, particularly those in the centers of origin/diversity. These rights are vested in the International Community, as trustee for present and future generations of farmers, for the purpose of ensuring full benefits to farmers, and supporting the continuation of their contributions." For a discussion on the implementation of Farmers Rights through *in situ* conservation see Brush, S. (1994) *Providing Farmers Rights Through in Situ Conservation of Crop Genetic Resources Background Study Paper No.3 for The Commission on Plant Genetic Resources, First Extraordinary Session, November, 1994* (Rome: FAO).

expensive and considered the private property of the firms that produce them. This asymmetry reflects the inequality of opportunity and is unjust."[37]

This partly provides the reasoning not only behind the move from genetic resources as a common heritage of mankind in the 1983 version of the IUPGR to a common concern in the 1992 CBD, but also, for the strong assertion of the sovereign rights of states in the CBD.[38] While it would have been open for G77 countries to countries to have argued for the development of a multinational fund, along the lines of that found within UNCLOS and the IUPGR, to share not only the financial benefits arising from the utilisation of biodiversity but also for the dissemination of information and technologies; in firmly asserting their sovereign rights over genetic resources they opted for bilateral solutions with access provided on "mutually agreed terms."

Not only has a great opportunity been lost in the CBD, but it has served only to reinforce the legitimacy of germplasm as property, a moral argument to undermine the actions of life science companies in their use of IPRs has been lost, and more importantly, countries in the two thirds world now see it as in their interest to maximise the economic potentialities of "genetic resources" perhaps to the loss of the two thirds world as a whole. As Usha Menon of the

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[37] President Ali Hhassan Mwinyi of Tanzania during the UNCED process, quoted in Odek, J.O. (1994) Bio Piracy: Creating Proprietary Rights in Plant Genetic Resources Vol.2. *J.Intell.Prop.L* 141 at 169.

[38] For a discussion of the issues of common heritage, sovereignty and farmers rights which took place at the time by some of those involved see Khalil, M.H., Reid, W., Juma, C. (1992) *Property Rights and Genetic Resources* (Nairobi: African Centre For Technology Studies); Juma, C.& Ojwang, J.B, (1992) Technology Transfer and Sustainable Development International Policy Issues (Nairobi: African Centre for Technology Studies).

Indian National Institute of Science Technology and Development Studies argues,

> "Contrary to what many believe, the new position is not in the interests of the countries of the South. Restricting access to wild genetic material in fact makes it available to the multinational corporations which have the resources to gain access to these materials thereby excluding the other countries of the south. While the earlier regime of free access to both types of genetic materials ignored the private (including small community) contribution to genetic resources, the current regime ignores the common heritage component. Similar to the case of technology, in the case of genetic resources also, both types of contributions are important and need to be recognised. What is needed in fact is a new regime which will provide greater access to both types of materials, the breeders' material of the North and the wild germplasm and land races of the South."[39]

Maintaining genetic resources as the common heritage of mankind failed. In part, as we have seen, this was because, an open commons system which included a general fund such as that found within the UN Convention on the Law of The Sea, was perceived as allowing the expropriation of genetic resources by those with the technology to do so, but it was also a means to counter the calls for the protection of IPRs within the CBD. In contrast

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[39] Menon, U (1995) "Access to and Transfer of Genetic Resources" Vol.10 (2/3) *Int. J. Technology Management* pp.311-324 at 323; see similarly Kameri-Mbote, A.P. and Cullet, P. (1999) "Agro Biodiversity and International Law – A Conceptual Framework" Vol.11(2) *Journal of Environmental Law* 257-279.

however, the point was and is still frequently made by G77 countries, that the private property regime of IPRs when extended to agricultural products serves not only to undermine state sovereignty but also the common heritage of countless farmers whose ingenuity has resulted in the development of varieties upon whose germplasm those products are developed. The assertion of a common heritage should not however, mean the undermining of the obligations and differentiated responsibilities of states as Stephen Brush argues

> "Common heritage does not mean that a person who seeks to obtain genetic resources has no obligation to those who provide them. On the contrary, common heritage implies a reciprocity between the collector of genetic resources and the producer. The reciprocity is that collective knowledge flows in both directions. Genes may be gathered from peasant fields but improved crop varieties and other non proprietary technology return to peasants. Reciprocity may be direct, or balanced in the form of payment for seed; but it may also be indirect or generalised, in the understanding that the flow of knowledge and biological resources between collector and producer is not one way or confined to the specific transaction at hand. ... A contemporary reading of the common heritage principle suggests two additional reciprocal expectations. First, the Benefits derived from collecting genetic resources will be widely shared and come full circle

back to the donors. Second, collectors will share the responsibility of conserving the resources."[40]

In the next section I shall move on to consider the Cartegena Protocol on Biosafety and in so doing move on our examination of the relationships between rDNA technologies and biodiversity a little further. At the beginning of this chapter I suggested that to understand the CBD one needed to consider it not simply as a Multilateral Environmental Agreement (MEA) but as an agreement that facilitates both trade in genetic resources, and, with the adoption of the Biosafety Protocol, international trade in transgenic crops. The Protocol that emerged from the negotiations, has the appearance at least initially, of support from all quarters. However this consensus, I would argue is something of a chimera, for, not only is the Protocol ridden through with compromises, but it essentially subordinates the governing of trade in rDNA technologies to the rules of World Trade.

3.2 The Biosafety Protocol: A Chimera of Consensus

At 4.45 am, on the 29th January, 2000, at the headquarters of the International Civil Aviation Organization in Montreal, the resumed first session of the Extraordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity (Ex COP), adopted, the *Cartegena Protocol on Biosafety*

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[40] Brush, S.B. (1996) "Is Common Heritage Outmoded?" in Stephen B. Brush and Doreen Stabisnsky (eds.) *Valuing Local Knowledge: Indigenous People and Intellectual Property Rights* pp.143-164 at 148.

to the Convention on Biological Diversity[41] (The Biosafety Protocol). While this point marked the end of a long and somewhat intense series of negotiations, the central disagreements that characterised those lengthy discussions, disagreements regarding the scope and content of the protocol; the relationship of the protocol with, in particular, the World Trade Organisation (WTO) agreements; and, ultimately the social, economic and political disparities that existed between the negotiating parties, have, with the adoption of the protocol, neither ceased to exist, nor have they been fundamentally settled.

The Biosafety Protocol provides an international mechanism for harmonising minimum standards[42] of regulation as it relates to the transboundary movement of any "living modified organisms[43] resulting from modern

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[41] The name was agreed upon by delegates to the earlier session of the Ex Cop held in Cartegena des Indias, Colombia, from the 22-23 Feb 1999, hence the title. See UNEP (1999) *Decisions Adopted By The Conference Of The Parties To The Convention On Biological Diversity At The First Part Of Its First Extraordinary Meeting Cartagena, 22-24 February 1999*, UNEP/CBD/ExCOP/1/3 Annex1 - Decision 3

[42] They are minimum standards in so far as Article 2 (4) provides that "nothing in this Protocol shall be interpreted as restricting the right of a Party to take action that is more protective of the conservation and sustainable use of biological diversity than that called for in this Protocol, provided that such action is consistent with the objective and the provisions of this Protocol and is in accordance with that Party's other obligations under international law." However, as we shall see below, the last clause of this article, which obliquely refers to obligations under the multinational Trading System severely restricts the ability of parties to adopt provisions beyond the scope of the protocol. Indeed, even measures consistent with the protocol may well be capable of challenge within the DSB.

[43] The use of the term "living modified organism" dates back to disagreements during the negotiations of the CBD regarding the inclusion of the terms biotechnology and Genetically Modified Organism. LMOs are defined by Article 3(g) of the Protocol as "any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology." Given the continual assertion by biotech companies and some states that biotechnology is nothing new, having been carried out by humans for centuries, this requires further clarification, so that in Article 3(i) "Modern Biotechnology means the application of (a) In vitro nucleic acid techniques, including recombinant deoxyribonucleic acid (DNA) and direct injection of nucleic acid into cells or organelles, or (b) fusion of cells beyond the taxonomic

biotechnology, that may have an adverse effect on the conservation and sustainable use of biological diversity."[44] While this would appear to limit the Protocol only to those products of rDNA technologies that may directly harm biodiversity, the actual scope of the protocol includes LMOs intended for use as food, for feed or for processing, permitting parties to the protocol to take measures necessary for the protection of human health. In addition, Article 26 of the protocol, explicitly provides that parties may base their decisions regarding the importation of LMOs, on socio economic grounds.

The Final Text of the Biosafety Protocol draws a number of distinctions between, different categories of products derived from rDNA technologies. Central to the protocol, is an advanced informed agreement (AIA) procedure[45] which compels parties, to require that exporters of LMOs notify in writing, the competent national authority of the importing party, prior to the first intentional transboundary movement of an LMO intended for introduction into the environment.[46] The importing country, is then required to come to a decision as to whether or not the importation of a particular LMO will be approved,

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family, that overcome natural physiological reproductive or recombination barriers and that are not techniques used in traditional breeding and selections."

[44] One of the central issues of disagreement has been the scope of the Biosafety Protocol. Throughout the negotiations a number of countries have argued that as a Protocol to the CBD, parties should only be competent to consider in their decision making processes, measures which relate to biodiversity. However, the final text of the Protocol reflects the majority of countries views that the scope should include the ability to take into consideration effects of LMOs on human health as per article 19.3 of the CBD. (This can be seen in a number of articles throughout the Protocol - Preamble, 1, 2(2), 2(5), 4, 7(4), 10(6), 11(8), 12(1), 15(1), 16(2), 16(5), 17(1), 17(3)(c), 17(4), 18(1), 21(6)(c), 23(1)(a), Annex III 1 & 8(a).).

[45] Covered by Articles 7,8,9 & 10 of the Protocol.

[46] Article 7.

based on a risk assessment, within a given period, as provided for by the protocol.

The AIA procedure however, covers only those LMOs intended for introduction into the environment and does not cover organisms produced by rDNA technology intended for use as food, feed or for processing,[47] for which, a different decision and information procedure is provided for in Article 11. Finally, the transboundary movement of pharmaceuticals are, under Article 5, explicitly excluded from the scope of the Protocol.

The final text of the Protocol appears to be acceptable to many of the protagonists in this debate, to both the advocates of genetic technologies and its opponents, or at least it appears that way as far as their public pronouncements are concerned. So that, on the one hand Benedikt Haerlin of Greenpeace feels able to claim that "this is an historic step towards protecting the environment and consumers from the dangers of genetic engineering ... The protocol adopted in Montreal lays the foundation for a stronger future agreement that will eventually protect the environment from GMOs."[48] While, at the same time Joyce Groote, chair of the Global Industry Coalition, which represents more than 2,200 companies in the biotech sector can state that, "the Protocol represents significant progress for biotechnology while protecting biodiversity ...The Protocol provides an incentive for

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[47] Article 7.2.

[48] GreenPeace USA, Press Release, 31st January, 2000.

continued investment to develop innovative products. It is a very clear indicator that the biotechnology industry will continue to grow."[49]

This of itself ought to suggest that rather than successfully bringing to an end the concerns that separate the disparate parties to the negotiations, whether states or, observers; environmental NGOs, or industry lobby groups, the Biosafety Protocol, resembles something of the emperor's new clothes. The final text of the protocol, should not be considered as a marvellous example of international environmental law-making simultaneously allaying the differences between the parties; rather, disputes over the products of rDNA technologies will continue, for, it is not just that the Protocol must be ratified by 50 countries before it comes into effect;[50] or, that one of the major exporters of LMOs, the USA, has not yet ratified the Convention on Biological Diversity (CBD) itself; [51] or that issues relating to the labelling of commodities[52] or, of liabilities and redress[53] have yet to be decided upon, but, rather that the major differences that existed between the parties to the negotiations, are now firmly embedded within the protocol itself.

In addition, much has been lost in the attempt to produce a protocol acceptable to the major negotiating groups. For, not only have the negotiations resulted in a text which, while it may not be explicitly subordinate

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[49] Novartis, Press Release, 29th January, 2000.

[50] Article 37(1).

[51] See *supra n*.12.

[52] Article 18(2)(a).

to the multilateral trading system, has, at the very least, been made compatible with it, but in addition, the protocol represents the further capture of the debate on biodiversity within international law, framing and narrowing the range of voices considered legitimate to speak on risks to the environment posed by LMOs.

As I argue below, a proper appreciation of risk must comprehend its compound forms, the ways in which risk proliferates across social borders, for, there is never a singular definable risk, but rather there are multifaceted complexes of pluralized risks constructed within socio technical networks more or less extended in time-space. The BioSafety Protocol negotiations can, at one level, be seen as a debate regarding the definition and architecture of risk, where in place of a complex conception of risks is found a prescriptive model, a reductionist account of both risk, and the social, which denies their essential pluralism.

What we find in the final text of the Biosafety Protocol is an attempt at the monopolisation of risk assessment, a denial of the validity of knowledge claims by those outside the confines of a supposed "objective science." While non scientific voices may speak on both the relationship of rDNA technology on biodiversity and the risks associated with rDNA products, the Biosafety Protocol through its own procedures and its implicit recognition of the validity of the SPS agreement disavows their calls. The neutrality of science is taken

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[53] Article 27.

as a given, and not as a social function despite the fact that, as Brian Wynne observes "science is not meaning free or meaning neutral, but dripping with impoverished and expropriated meanings."[54]

3.2.1 A Short History

As we saw above the Convention on Biological Diversity (CBD) entered into force on the 29th December 1993, a little over eighteen months after it was first opened for signature, at UNCED in Rio de Janeiro. One of the requirements of the CBD was that under Article 19.3 parties to the convention were to,

> "consider the need for and modalities of a protocol setting out appropriate procedures, including, in particular, advance informed agreement, in the field of the safe transfer, handling and use of any living modified organism resulting from biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity."[55]

When the first Conference of the Parties to the Biodiversity Convention (COP 1) met in Nassau, between the 28th November and 9th December 1994, agreement was reached on establishing an Open Ended *Ad Hoc* Group of

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[54] Wynne, B. (1996) "May the sheep Safely Graze? A reflexive View of The expert lay knowledge Divide" in Scott Lash, Bronislaw Szerszynski & Brian Wynne (eds.) *Risk Environment & Modernity Towards a New Ecology* (London: Sage Publications) p.60

[55] Article 19.3 Convention on Biological Diversity *rep.* 31 *ILM* 818 (1992). Article 8(g) also requires parties to "Establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental impacts that could affect the conservation and sustainable use of biological diversity, taking also into account the risks to human health;"

Experts on Biosafety, working to the same terms of reference as laid out in article of 19.3 of the CBD.[56] The Open Ended Ad Hoc Group were required to meet for one week in 1995 in order to prepare a report for the 2nd COP. To help them in their task, it was also decided that a background document be prepared by a panel of 15 experts chosen by the CBD secretariat and aided by UNIDO, UNEP, FAO and WHO. The remit for the panel of experts, was a consideration of "existing knowledge and experience on risk assessment and management, and guidelines and/or legislation already prepared by the Parties"[57]

These early reports[58] are of interest for in many ways, not only did they lay the groundwork for what was to come, but they also highlight some of the tensions and differences of approach that remained throughout the Biosafety protocol negotiations.

The 15 government nominated experts met in Cairo in May 1995. Despite their remit, the Cairo Report did not produce a detailed analysis of guidelines; legislation; knowledge, or, experience of risk assessment and management. For, rather than assess the approach, adequacy, scope and implementation of existing rules, the background document provided little more than a brief description of some national and international provisions, the panel choosing

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[56] See Decision 1/9 of COP1 UNEP (1995a) *Report of the First Meeting of the Conference of the Parties to the Convention on Biological Diversity* UNEP/CBD/COP/1/17 p.33

[57] *Ibid* §. 7

[58] That is, the report of the panel of 15 experts (the Cairo report) and the Open-ended *Ad Hoc* Group of Experts on Biosafety (the Madrid Report).

instead, for the most part, to provide a summary of their views on biotechnology.

The approach of the Cairo Report is perhaps best summarised in paragraph 66 where a distinction is drawn between the potential *primary and secondary effects* of LMOs, and, what the report describes as the potential *indirect* effects of LMOs. Primary effects were described as those that "might result directly from the transfer of genetic material from the LMO to other organisms and from the LMO itself on other organisms,"[59] with potential secondary effects being "effects that might arise from primary effects."[60] The potential indirect effects of LMOs on the other hand, were the broader cultural, social and economic changes that the introduction of LMOs might bring with them.

The Cairo Report, while recognising the importance of these indirect effects, nevertheless, was of the opinion that socio economic considerations should not form a part of either the panel's work, or risk assessment generally, stating that "risk assessment should be restricted to the basis of objective parameters. Socio-economic aspects bring value judgements into the analysis which inevitably vary among countries and communities and from case to case depending on considerations other than the nature of the technologies themselves."[61] The distinction that the Cairo Report draws between objective, scientific parameters and subjective socio economic parameters, not only

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[59] UNEP (1995b) *Report of the Open-Ended Ad Hoc Group of Experts on Biosafety* UNEP/CBD/COP 2/7/Annex IV p.31.

[60] *Ibid*

depicts a model of consensual scientific work directed by nature which at the very least is dubious, but also, importantly fails to take into consideration the recognition given, in both the preamble and Article 8 of the CBD as regards the importance of social cultural and economic considerations for the *in situ* conservation and sustainable use of biodiversity.

One further aspect of the Cairo report that is worth considering at this juncture, is the panel's general attitude towards recombinant DNA (rDNA) technologies. On the whole the report takes a positive attitude to rDNA technologies citing Chapter 16 of Agenda 21 and the potential advantages that the sound management of biotechnology could bring to improvements in "food and feed supply, health care and environmental protection". At a number of points throughout the report the panel states that "biotechnology does not differ from other technologies,"[62] that, the distinction of modern from traditional biotechnologies "does not imply any greater risk attached to products from modern biotechnologies *vis a vis* those arising from traditional ones."[63]

Despite recognising that risk management measures need to be considered when an LMO "is to be transferred to a new environment,"[64] and that potential risks posed by LMOs "are often environment-dependent" so that, "an

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[61] UNEP (1995b) *op. cit. n.*59 Annex IV § 21.

[62] UNEP (1995b) *op. cit. n.*59 Annex IV p.31.

[63] UNEP (1995b) *op. cit. n.*59 Annex IV § 23 and see also § 31.

[64] UNEP (1995b) *op. cit. n.*59 Annex IV § 69

organism that is safe in one country is not necessarily safe in another country;"[65] the Cairo report also considers that since the advent of rDNA technologies in the 1970s "many of the initial concerns and fears have been allayed as experience and knowledge has accumulated."[66] Indeed the Cairo report goes further in suggesting, that "as a result of the progressive development of an LMO, there would in many cases be sufficient information at the time of commercialisation to allow the removal of any distinction between LMOs and organisms produced by traditional methods."[67]

There are those who criticise the regulation of the LMOs generally and the Biosafety Protocol in particular, as the display of an irrational and inordinate fear of technology, in so far as it discriminates between crops that may have a detrimental effect on the environment and are produced by 'traditional' means, and, those produced by rDNA technologies.[68] Indeed, the Cairo report itself in many ways, epitomizes this position, however, merely because there is an increased familiarity with the process of rDNA technologies does not mean that we should be less concerned with its products.

The testing of rDNA products in the laboratory and in field trials, together with the commercial planting in specific geographic contexts, does not mean, that

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[65] UNEP (1995b) *op. cit. n.*59 Annex IV § 82

[66] UNEP (1995b) *op. cit. n.*59 Annex IV § 26

[67] UNEP (1995b) *op. cit. n.*59 Annex IV § 69

[68] For recent examples see Adler, J.H. (2000) "More Sorry Than Safe: Assessing The Precautionary Principle And The Proposed International Biosafety Protocol" 35 *Tex. Int'l L.J.* 173 & McHughen, A. (2000) *A Consumer's Guide to GM Food From Green Genes to Red Herrings*, (Oxford: Oxford University Press)

we can extrapolate out from these the effect which a given LMO may have at some point in the future, on all eco systems in all geographic locations. For this reason alone a precautionary approach to the transboundary movement of the products of rDNA technologies is necessary. What is more, an issue which at times seems to be lost with the argument that products of rDNA technologies should be treated in the same manner as 'traditional' products, is that in order to conserve and sustainably utilise biodiversity, what also needs to be addressed are current attitudes towards agriculture and development, a point recognised within the CBD at Articles 6 & 8.[69] The Canaries, Mauritius and St Helena are examples from three centuries past, where the delicate ecological balance was forever upset by the introduction of alien species in order to serve the expansionist policies of the British and Dutch East India Companies,[70] yet we still do not seem to have learnt our lesson.

Following the meeting in Cairo of the panel of 15 experts, the Open Ended *Ad Hoc* Group of Experts on Biosafety, met at the Palacio de Congresos in

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[69] Parties to the CBD are by virtues of Article 8 committed to "f) Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies; ... (h) Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species; (i) Endeavour to provide the conditions needed for compatibility between present uses and the conservation of biological diversity and the sustainable use of its components;" While Article 6 states that "Each Contracting Party shall, in accordance with its particular conditions and capabilities: (a) Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, inter alia, the measures set out in this Convention relevant to the Contracting Party concerned; and (b) Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies." On agricultural biodiversity and its relationship to the CBD see, UNEP (1996a) *Agricultural Biodiversity under the Convention on Biodiversity a Note by the Executive Secretary* UNEP/CBD/COP/3/14

[70] Grove (1995) *op. cit. n.*5 and Grove, R. (1998) *op. cit.* n..6.

Madrid from the 24th to the 28th July 1995.[71] At the Madrid meeting consensus was reached by the delegates on a number of possible issues to be addressed within an international framework for biosafety. These included, all activities relating to LMOs that "may have an adverse effect on the conservation and sustainable use of biological diversity:"[72] the transboundary movement of LMOs;[73] the deliberate release of LMOs into the environment;[74] mechanisms for risk assessment and risk management;[75] a procedure for an advanced informed agreement;[76] exchange of information;[77] definition of terms;[78] implementation mechanisms[79] and capacity building.[80]

However, on socio economic considerations, liability and compensation and financial issues, no consensus was reached. In addition although a large majority of states at the meeting felt the need for a new legally binding protocol under the CBD, there was no consensus on this point, with both the enhanced co-ordination and strengthening of existing agreements, as well as the introduction of new voluntary guidelines also floated as possibilities. As with the Cairo report some of the problems that arose in Madrid were to

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[71] For details of the meeting see *Op cit n.*49

[72] UNEP (1995b) *op. cit. n.*59 Annex I § 18 (a)(i)

[73] UNEP (1995b) *op. cit. n.*59 Annex I § 18 (a)(ii)

[74] UNEP (1995b) *op. cit. n.*59 Annex I §18 (a)iii

[75] UNEP (1995b) *op. cit. n.*59 Annex I §18 (a)iv

[76] UNEP (1995b) *op. cit. n.*59 Annex I §18 (a)v.

[77] UNEP (1995b) *op. cit. n.*59 Annex I §18 (a)vi.

[78] UNEP (1995b) *op. cit. n.*59 Annex I §18 (a)ix.

[79] UNEP (1995b) *op. cit. n.*59 Annex I §18 (a)viii.

[80] UNEP (1995b) *op. cit. n.*59 Annex I §18 (a)vii.

remain live issues for the rest of the negotiations. The scope and status of any protocol, its relationship to other international agreements, whether a protocol should include socio economic considerations, and what to do in relation to liability and compensation for environmental harm caused by LMOs, remain, as I shall argue below, to a large extent unresolved, despite the eventual adoption and signing of the protocol by 68 parties.

In November 1995 at Jakarta, the second Conference of the Parties (COP 2) met and considered the Mardrid report.[81] Amidst debate over the intended scope of any new protocol, the COP adopted Decision II/5, in order to develop a "protocol on biosafety, specifically focusing on transboundary movement, of any living modified organism resulting from modern biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity."[82] The elements of a protocol were to be elaborated within a new body, the Open-ended *Ad Hoc* Working Group on Biosafety (BSWG), whose terms of reference included taking into account the precautionary approach contained within Principle 15 of the Rio Declaration.[83] In addition the BSWG was to elaborate key terms and concepts; consider AIA procedures; identify

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[81] UNEP (1995b) *op. cit. n.*59 Annex I.

[82] UNEP (1995c) *Report of the Second Meeting of the Conference of the Parties to the Convention on Biological Diversity* UNEP/CBD/COP 2/19 Decision II/5 p.49.

[83] UNEP (1995c) *op. cit. n.*82 - Annex to Decision II/5 p.50. Principle 15 of the Rio Declaration states that, "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." UNCED/A/Conf.151/5/Rev.1.

relevant categories of LMOs, in order to produce a draft protocol by the end of 1998.

The first BSWG meeting was held in Aarhus Denmark from 22-26th July 1996.[84] This first meeting was little more than a forum for agenda setting organising future work, most of the issues that we have already touched upon, raised once again. Another issue surfaced however, which in the later stages of the negotiations would take centre stage dividing countries as to whether any future Protocol should be subordinate to the WTO agreements. The items of future work decided on at this stage were limited to the compilation of recommendations from governments on the contents of a future protocol, a background document on existing agreements, and a document of existing terms.

At BSWG 2[85] the following year in Montreal a wide number of pre-negotiation issues were discussed on possible elements of a Protocol, the main business of the session was the convening of a contact group to consider and compile definitions of key terms for the BSWG 3 meeting in October 1997. Between October 1997 and August 1998 three BSWG meetings took place[86] slowly

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[84] For the report of the meeting see UNEP (1996b) *Report of The First Meeting of The Open Ended Ad Hoc Working Group on Bio Safety* UNEP/CBD/BSWG/1/4.

[85] UNEP (1997a) Report of the Second Meeting of the Open-Ended Working Group on Biosafety UNEP/CBD/BSWG/2/6.

[86] UNEP (1997b) Report of the Third Meeting of the Open-Ended Ad Hoc Working Group on Biosafety UNEP/CBD/BSWG/3/6; UNEP (1998a) Report of the Fourth Meeting of the Open-Ended Ad Hoc Working Group on Biosafety UNEP/CBD/BSWG/4/4; UNEP (1998b) Report of the Fifth Meeting of the Open-Ended Ad Hoc Working Group on Biosafety UNEP/CBD/BSWG/5/3.

reducing the number of options for each article of a consolidated daft text produced at BSWG 3.[87]

The COP 4 decision IV/3 extended the deadline for the negotiations and established an extra meeting to be followed by an Ex COP to adopt the protocol. However, at BSWG 5[88] in August 1998 positions continued to polarise, with thirteen of the 40 articles of revised consolidated draft text completely bracketed reflecting both the lack of consensus on even the key elements of a protocol, and the lack of time available for discussions. Perhaps no surprise then that by the time of the BSWG 6[89] in Cartegena des Indias, which was to be followed by the ExCOP,[90] 30 articles, out of 42, in the draft negotiating text remained unresolved.[91]

3.2.2 Precautionary Boundaries

As I suggested in Chapter 1, our understanding of science is one, which must, by necessity, regard all scientific work to be socially heterogeneous, located within sets of social practices that mobilise human and non-human objects. The results of scientific research are neither based on a singular methodology nor, rationally derived from a map of nature that is objectively knowable.

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[87] UNEP (1997c) Compilation of Draft Text Prepared by the Secretariat on Selected Items UNEP/CBD/BSWG/3/4.

[88] UNEP (1998b) Report of the Fifth Meeting of the Open-Ended Ad Hoc Working Group on Biosafety UNEP/CBD/BSWG/5/3.

[89] UNEP (1999b) Report of the Sixth Meeting of the Open-Ended Ad Hoc Working Group on Biosafety UNEP/CBD/EXCOP/1/2.

[90] UNEP (2000b) Report of the Extraordinary Meeting of the Conference of the Parties for the Adoption of the Protocol on Biosafety UNEP/CBD/EXCOP/1/3.

[91] UNEP (1998d) Draft Negotiating Text UNEP/CBD/BSWG/6/2.

For scientific work to succeed however, collective action must be mobilised across differing social worlds, with, social actors finding enough agreement on methodological and substantive issues to produce relatively stable facts, all be it that these facts, are both partial and relational. The model of science and scientific work that emerges therefore, is one that is inherently socially reflexive; it is self-confrontational, producing an inherent pluralisation of scientific validity and knowledge. As Ulrich Beck observes.

> "the sciences are now being confronted with their own objectivized past and present – with themselves as product and producer of reality and of problems which they are to analyze and overcome. In that way they are targeted not only as a source of solutions to problems but also as a *cause of problems*."[92]

For Beck the resulting "*risk society*" is the product of late modernity, a function of the society from which it is derived.[93] It should have become apparent by now, that with Latour, I hold that "we have never been modern." Therefore,

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[92] Beck, U. (1992) *Risk Society: Towards a New Modernity* (London: Sage Publications) p.156.

[93] Beck describes risk society as "a phase of development of modern society in which social, political and ecological and individual risks created by the momentum of innovation increasingly elude the control and protective institutions of industrial society." (Beck, U. (1996) "Risk Society and the Provident State" in Scott Lash, Bronislaw Szeszynski & Brain Wynne (eds.) *Risk Environment & Modernity: Toward a New Ecology*, (London Sage Publications) p.27) Beck's image therefore is one of modern society turned in on itself, both its product and its concern, as he states elsewhere, "In the risk society, the recognition of the unpredictability of the threats provoked by techno-industrial development necessitates self reflection on the foundations of social cohesion and the examination of prevailing conventions and foundations of 'rationality'. (Beck, U. (1994) "The Reinvention of Politics" in Ulrich Beck, Anthony Giddens

while Beck and Giddens contend that risk society and high modernity are characterised by the lack of trust in abstract institutions allied to the lifting out, disembedding, or detraditionalisation of social relations across time-space,[94] I would contend that what we are observing is the continuing territorialisation, rearticulation and embedding of meanings in space-time, neither delineated by sequential histories nor spacing geographies.

So while Beck's larger project is inherently problematic in simplifying both the heterogeneity of social interactions and spatial histories, his observations on the plurality, and hence demonopolised nature of knowledge claims in relation to risks, are useful for an understanding of the GM debate generally and some of the difficulties with the Biosafety Protocol negotiations in particular.

At the heart of the GM debate are questions regarding the legitimacy of those who are heard to make claims about risks; questions about what subject matter can and should form the basis of those claims; questions regarding the extent to which it is possible to define future potential risks in relation to genetic technologies; and questions relating to the use and validity of science and scientific advice.

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and Scott Lash (eds.), *Reflexive Modernisation: Politics Tradition and Aesthetics in the Modern Social Order* (Polity Press: Cambridge) p.8).

[94] Ideas that owe a lot to Habermas' notion of lifeworlds colonised by abstract systems. See Habermass, J. (1986) *The Theory of Communicative Action* Volumes 1 & 2 (London: Polity Press).

In 1997, at the same time as the US was negotiating over the contents of the Biosafety Protocol, Dan Glickman, the US Agricultural Secretary, while giving a speech to the International Grains Council, stated that in relation to biotechnology "as long as these products prove safe, we will not tolerate segregation. We will not be pushed into allowing political science to govern these decisions. The stakes for the world are simply too high."[95] It is not that there is no acceptance of risk in what Glickman says, it is the manner in which those risks are framed, Similarly in 1999 Glickman while addressing an FAO conference stated that,

> "it is morally incumbent upon all governments to ensure that the public safety and the environment are always protected by all emerging technologies. We've all seen what happens when the frenzied rush to embrace new technology blinds us to its potential risks as in the early days of nuclear energy when we did not fully understand the need for adequate safeguards and regulatory oversight. These are not arguments in favour of halting progress. Rather, they make the case for wise technological and science-based stewardship. In the long run, sound scientific progress cannot be stopped. The United States looks to FAO to take a leadership role in biotechnology and to be an objective and analytical clearinghouse in the current debate. Uniform and scientifically sound global standards under the Codex Alimentarius Commission and the International Plant Protection Convention must be developed. Only through a system rooted in

[95] Remarks of Secretary Dan Glickman to the International Grains Council, London,

science and untainted by ideology or profit-seeking can the best of biotechnology's potential be realized and its risks averted."[96]

I should perhaps make clear at this point, that I do not buy into the notion of globalisation as an imperialist, or neo colonialist, project and find generalist statements such as those of David Harvey that "globalisation is undoubtedly the outcome of a geopolitical crusade waged largely by the United States,"[97] to be overly simplistic. As I will argue in more detail later in this work, I am not denying, that there are not desires at work here, but these are not the desires of a hegemonic ideological monolith in the shape of the US.

The reach of companies, and individuals their desires and practices are extended through time and space, they are mediated by law, by states, and by the human and non-human objects that are both situated within and act upon the heterogenous social worlds that we inhabit.[98] This is not to say that power is not at work here, but if we focus on the myth of the imperialist state

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England -- June 19, 1997, USDA Press Release No. 0196.97.

[96] Remarks As Prepared for Delivery by Secretary of Agriculture Dan Glickman to the U.N. Food and Agriculture Organization 30th Conference, Rome, Italy November 13, 1999 USDA Press Release No. 0453.99.

[97] Harvey, D. (2000) *Spaces of Hope* (Edinburgh: Edinburgh University Press) p.68.

[98] For example the United States Council for International Business continually lobbied the US Trade Ambassador Charlene Barshefsky, in addition to working closely with the US negotiators during the actual negotiations, so that the stance of US represented the position of the Biotech industry, as acknowledged in a letter to the USTR dated 2nd December 1998 and signed by the American Farm Bureau Federation; American Seed Trade Association; Biotechnology Industry Organization; Corn Refiners Association, Inc.; Enzyme Technical Association; Grocery Manufacturers of America; National Food Processors Association; The Soap and Detergent Association; United States Council for International Business and the U.S. Grains Council which states that "The U.S. business community has worked closely with the U.S. negotiating team headed by the Department of State. U.S. negotiators have been responsive to our concerns and have sought appropriate changes in the Protocol to address these concerns."

extending its geopolitical reach globally, then we miss the essence of power, we provide power with an objective materiality, it becomes a thing outside of social relationships, rather than the bond that holds relationships together and a function of our acquiescence in the desires of others as our own.

All this is by ay of stating that I am not using Dan Glickman's comments in order to vilify the US, but, as an example of the way in which the debate on the associated risks of rDNA technologies is continuously narrowed through both the suggestion that we should not concern ourselves with the possible socio economic risks of rDNA technologies, and, the proposal that scientists are not only the sole people who should determine what constitutes a significant direct risk, but also that science is somehow a singular body with a singular voice.

A report prepared by the Global Environmental Change Programme in October 1999, observed that, "as advisors to ministers, scientists often come under great pressure to reach unambiguous judgements about the safety of new technologies such as GM foods. This means that they find it difficult to justify precautionary advice due to the lack of evidence to back it up."[99] Lack of current scientific evidence does not however, mean that there is not a risk, nor, that there are not divergent opinions, scientific and otherwise on the extent of potential risks. Indeed the processes of continual self reflexivity

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[99] ESRC Global Environmental Change Programme (1999) *The Politics of GM Food: Risk Science and Public Trust*, Special Briefing No.5 University of Sussex.

found within scientific work and within the social itself, suggest that there will always be ambiguity and divergence of opinion on technologies new and old.

What has remained central to the GM debate is the manner in which genetic technologies are problematised. The undemocratic manner in which arguments relating to the acceptability and assessment of risk have been framed as issues to be resolved by "sound science," when there is no singular scientific body or method, and where there are wider held concerns which extend beyond the realms of the broad social institutions of science. Indeed as the authors of the Report also recognise, the public debate or should we more correctly say, the public debates on rDNA technologies are neither irrational nor unsound, but paradoxically more cognisant of the complexity involved in scientific and social work, rightly sceptical of claims based on a monopolisation of knowledge relating to an assessment of the potential risks of GM technologies.

The precautionary principle[100] is intended to provide a legal means of dealing with risk; managing uncertainty and diverging scientific views on the potential

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[100] The precautionary principle developed from the notion of *Vorsorgeprinzip* found in German law. In essence, the precautionary principle reverses the burden of proof on individuals, companies and states so that they must show that their action will not be harmful to the environment. Thus, in contrast to individuals, companies and states being able to carry out actions freely unless there is scientific proof of the harmfulness of those actions to the environment, they must prove that their future actions will not be harmful to the environment before being permitted to carry them out. In its strongest form, this can mean that those actors wishing to carry out particular activities must show that *no harm* will be committed to the environment, as in the prior justification procedures of the *Oslo Convention For the Prevention of Marine Pollution by Dumping From Ships and Aircraft*, however in weaker forms the precautionary principle merely means that states can prevent actions taking place even though there may be a lack of "full scientific certainty" regarding their potential harmfulness.

future environmental consequences of particular courses of action; and thus, allowing the implementation of regulatory structures with broad based environmental policy objectives.

Despite the inclusion of the principle in numerous multilateral agreements, in the 1999 Southern Bluefin Tuna Case,[101] Judge Laing's opinion that the precautionary principle was not yet a part of customary international law,

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The precautionary principle therefore allows the implementation of regulatory structures with broad-based policy objectives.

In an international context, the precautionary principle first appears in attempts to prevent North Sea pollution. For example, the preamble to the 1984 Bremen Ministerial Declaration of the International Conference on the Protection of the North Sea, provides that states "must not wait for proof of harmful effects before taking action." By the time of the second North Sea conference in 1987, the declaration actually spoke of a precautionary approach. It is now to be found in many Multilateral Environmental agreements including Principle 15 of the *1992 Rio Declaration on Environment and Development (UNCED)* A/CONF.151/5/Rev.1 and Article 3 Principle 3 of the *Framework Convention on Climate Change*, New York, 9th May 1992. Similarly the precautionary principle has also become a part of EC law for, although prior to the coming into force of the Single European Act (SEA) in 1987 there had been little basis within EC law for introducing environmental legislation, the SEA changed this position through the introduction of a new Article 130 that provided a clear and unambiguous basis for environmental regulations and directives. The SEA version of 130r(2) stated that not only should community objectives be based on "preventative action" but that the polluter should also pay. However, with the coming into force of the Treaty on European Union, signed at Maastricht on February 7th 1992, the preventative principle contained in Article 130r was replaced with the use of the precautionary principle. (Following the coming into force of the Amsterdam Treaty Article 130r is now Article 174.)

The status of the precautionary principle as a general principle of International law outside these treaties remains however uncertain, so that, in the *Southern Bluefin Tuna Cases* (*New Zealand* v. *Japan*; *Australia* v. *Japan*) 27th August 1999, heard within the International Tribunal for the Law of The Sea (ITLOS) one of the judges, Laing, stated that "it is not possible, on the basis of the materials available and arguments presented on this application for provisional measures, to determine whether, as the Applicants contend, customary international law recognizes a precautionary principle." Separate Opinion by Judge Laing §16 The judgement can be found at http://www.un.org/Depts/los/ITLOS/Tuna_cases.htm

On the precautionary principle generally, see: McIntyre, O. & Mosedale, M. (1997) "The Precautionary Principle as A Norm of Customary International Law" Vol 9. *Journal of Environmental Law* pp.221-241; O'Riordan, T & Cameron J. (eds.) (1994) *Interpreting the Precautionary Principle* (London: Earthscan); Backes, C. & Verschuuren, J. (1998) "The Precuationary Principle in International European and Dutch Wildlife Law" *Colorado Journal of International Environmental Law and Policy* pp.43-70, Freestone, D. (1994) "The Road From Rio; International Environmental Law After the Earth Summit" Vol 6 *Journal of Environmental Law* pp.193- 218; Freestone, D & Hey, E. (eds.) (1996) *The Precautionary Principle and International Law* (The Hague: Kluwer).

[101] *Op. cit n.*100

derived from a concern that although states can be seen to have accepted a precautionary approach in relation to the environment, the lack of specificity and uniformity with which the principle is articulated rendered it indefinable. In particular Laing pointed to the "the wide potential ambit of its coverage; the clarity of operational criteria; the monetary costs of environmental regulation; possible public health risks associated with the very remedies improvised to avoid risk; diversity and vagueness of articulations of the notion; uncertainties about attendant obligations, and the imprecision and subjectivity of such a value-laden notion."[102]

It is for precisely these reasons, that one of the continual, and I would suggest still remaining, bones of contention within the Biosafety Protocol is the Precautionary Principle; its inclusion and its scope; and the extent to which measures can be taken by states to exclude rDNA technologies from their borders on scientific, or socio economic grounds.

While the preamble to the CBD notes that, "where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat;" the main body of the text contains no mention of a precautionary approach or principle. One of the early considerations in the Protocol's negotiations therefore was the extent to which the Protocol should

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[102] Separate Opinion by Judge Laing in *Southern Bluefin Tuna op. cit n.*100 §15.

incorporate the consideration of socio economic issues and the precautionary principle.

By the time of the Cartegena Draft Negotiating Text there were 18 references to socio economic considerations all be it that these were all bracketed. However, in the final text, what we see is a compromise the effects of which will no doubt find their way into the Dispute Settlement Mechanism of the WTO, which I examine in more detail below. While the heterogeneity of scientific work has been recognised in so far as a lack of scientific certainty will not prevent states being able to take action to prevent the import of the products of rDNA technologies which may have potential adverse effects for the "conservation and sustainable use of biological diversity,"[103] states must still base their decision on a process of scientific risk assessment which conforms to the Protocol's requirements. A new Article 26 in the Final Text, appears on the surface to hold out some hope that socio-economic considerations can be taken into account by states in their decision making processes, however, this is qualified by providing that any decisions made on socio economic grounds, are in conformity with states' international obligations, most significantly, these are WTO rules, to which we shall now turn our attention.

[103] Articles 10.6 and 11.8

3.2.3 The Protocol and the WTO

One of the central dividing issues between parties during the Biosafety Protocol negotiations, and a matter that still remains essentially unresolved, is the relationship between the Protocol and the World Trade Organisation (WTO). The linkages between trade and the environment ought at one level to be obvious to all; international trade relies on manufacturing and agriculture while, manufacturing and agriculture are reliant on natural resources derived from our planets' environment; at the same time, the detritus of manufacture, the by-products, waste and pollutants, themselves tradable commodities, are released back into our planet's environment to cause whatever harm they may.

At a more abstract level, even the notion of sustainable development, so central to the Rio process and upon which the environmental policies of most governments have since UNCED been based, places explicitly at its heart, the orientation and utilisation of the environment towards economic growth.[104] As Sachs observes "sustainable development calls for the conservation of development, not for the conservation of nature ... it is not the preservation of

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[104] The Brundtland report make his explicit when it states "Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainable development does imply limits – not absolute limits but limitations imposed by the present state of technology and social organisation on environmental resources and by the ability of the biosphere to absorb the effects of human activities. But technology and social organisation can be both managed and improved to make way for a new social era of economic growth. ... Meeting essential needs requires not only a new era of economic growth for nations in which the majority are poor, but an assurance that those poor get their fair share of the resources required to sustain that growth." (WCED (1989) *Our Common Future* (Oxford:OUP) p.8.)

nature's dignity which is on the international agenda, but to extend human centred utilitarianism to posterity."[105]

In spite of what some may consider as an obvious connection, the linkages between environment and trade were not overtly recognised within the 1947 General Agreement on Tariffs and Trade (GATT), indeed, it was not until 1971, following the suggestion of the then Director-General, Olivier Long, that The Group on Environmental Measures and International Trade (EMIT Group) was established with a mandate to "examine upon request any specific matters relevant to the trade policy aspects of measures to control pollution and protect the human environment especially with regard to the application of the provisions of the General Agreement taking into account the particular problems of developing countries."[106]

Despite the existence of a body mandated to examine trade and environment issues within the GATT, the EMIT Group remained inactive; no parties formally requesting it to consider anything for 20 years. However in the run up to the 1992 UNCED conference in Rio, countries from the European Free Trade Association (EFTA)[107] requested the Director-General, Arthur Dunkel, to convene the EMIT Group in order both to consider a number of general trade and environment issues, and to additionally provide a contribution to the UNCED process. After some debate, the EMIT group was convened from

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[105] Sachs, W. (1993) "Global Ecology and the Shadow of Development" in Wolfgang Sachs (ed.), *Global Ecology: A new Arena of Political Conflict* (London: Zed Books) p.10

[106] GATT Document C/M/74

November 1991 to January 1994 with a three fold mandate, to examine "trade provisions contained in existing multilateral environmental agreements; multilateral transparency of national environmental regulations likely to have trade effects; and trade effects of new packaging and labelling requirements aimed at protecting the environment."[108] Despite some general deliberation within the EMIT group of the implications of the Rio Declaration and Agenda 21, it was decided to leave further consideration of these issues until after the Ministerial meeting in Marakesh in April 1994.

Towards the end of the Uruguay round of GATT negotiations, it was agreed within the Trade Negotiations Committee that a future work programme on Trade and Environment, together with an institutional structure to facilitate that programme, should be put forward for consideration at the Marakesh Ministerial Meeting. This led to the adoption, of the Decision of the 14th April 1994 on Trade and Environment, (The Marakesh Decision), which, while recognising the commitment to sustainable development within the preamble to the WTO Agreement, and noting the previous work within GATT on the Rio Declaration and Agenda 21 by amongst others the EMIT group, directed the first meeting of the General Council of the WTO, to establish a Committee on Trade and Environment (CTE), whose tasks should be; "to identify the relationship between trade measures and environmental measures, in order to promote sustainable development; (b) to make appropriate recommendations

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[107] Austria, Finland, Iceland, Norway, Sweden, Switzerland

on whether any modifications of the provisions of the multilateral trading system are required, compatible with the open, equitable and non-discriminatory nature of the system."[109]

The terms of reference for the CTE are very broad, with the text of the Marakesh Decision referring to ten items covering many aspects of the trade and environment debate.[110] The CTE proceeds from the basis however, that "that there should not be, nor need be, any policy contradiction between upholding and safeguarding an open, non-discriminatory and equitable multilateral trading system on the one hand, and acting for the protection of the environment, and the promotion of sustainable development on the other"[111] and for some therefore, is grounded on an inherent and fundamental misconception that free trade and environmental protection are compatible goals. The CTE has also come under criticism from other quarters for its lack

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[108] The terms of reference of the EMIT group are reproduced in WTO (1999) *Background Document to the High Level Symposium on Trade and Environment Geneva 15th –16th March 1999* (Geneva: WTO) p.7 §22

[109] Decision of the 14th April 1994 on Trade and Environment.

[110] Those ten items are : "the relationship between the provisions of the multilateral trading system and trade measures for environmental purposes, including those pursuant to multilateral environmental agreements; the relationship between environmental policies relevant to trade and environmental measures with significant trade effects and the provisions of the multilateral trading system; the relationship between the provisions of the multilateral trading system and: (a) charges and taxes for environmental purposes (b) requirements for environmental purposes relating to products, including standards and technical regulations, packaging, labelling and recycling; the provisions of the multilateral trading system with respect to the transparency of trade measures used for environmental purposes and environmental measures and requirements which have significant trade effects; the relationship between the dispute settlement mechanisms in the multilateral trading system and those found in multilateral environmental agreements; the effect of environmental measures on market access, especially in relation to developing countries, in particular to the least developed among them, and environmental benefits of removing trade restrictions and distortions; the issue of exports of domestically prohibited goods; TRIPs; Services; appropriate arrangements for relations with non-governmental organizations referred to in Article V of the WTO and transparency of documentation".

[111] Decision of the 14th April 1994 on Trade and Environment

of progress towards resolving any of the substantive issues related to trade liberalisation and environmental protection,[112] assuming once again that these issues can be resolved.

One of the fundamental issues the CTE is mandated to consider is the relationship between Multilateral Environmental Agreements (MEAs) and the WTO.[113] The CTE's contribution to date in this endeavour has however been by no means authoritative. In a background document for a high level symposium on trade and environment held in March 1999, the secretariat of the CTE, states that "there is a widely held view in the CTE that trade measures agreed to amongst parties to an MEA, even if WTO-inconsistent, could be regarded as "lex specialis"[114] under public international law and ought not to give rise to legal problems in the WTO."[115] Of course this does not mean that an MEA such as the Biosafety protocol, will be considered as an instance of *lex specialis*, nor that problems will not arise in relation to the

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[112] see for example the comments of Halina Ward and Duncan Brack as well as the papers by Damien Geradin and Magdha Shahin in Ward, H. & Brack, D. (eds.) (2000) *Trade, Investment and the Environment* (The Royal Institute of International Affairs & Earthscan: London)

[113] Generally see Brack, D. (2000) "Multilateral Environmental Agreements: An Overview" in Halina Ward and Duncan Brack (eds). *Trade Investment and the Environment*, (Earthscan: London) pp.122-137; Schoenbaum, (1997) *International Trade And Protection Of The Environment: The Continuing Search For Reconciliation* 91 Am. J. Int'l L. 268, pp.268-313; UNEP/IISD (2000) *Environment and Trade – A Handbook* (Geneva: UNEP/IISD).

[114] Under the principle of "lex specialis" a later more specialised treaty signed by all the parties to an earlier treaty would prevail over the former.

[115] WTO (1999a) *Background Document to the High Level Symposium on Trade and Environment, Geneva 15th –16th March 1999, Outline* pp.11: in addition on the relationship between MEAs and trade Issues within the WTO see also WTO (1994) *Report by Ambasador H Ukawa, Chariman of the group on Environmental Measures and International Trade to the 49th Session of the Contracting Parties WTO/L/7402*; WTO (1996) *Report (1996) of the Committee on Trade and Environment* WT/CTE/1 see also the numerous CTE bulletins which can be accessessed via the WTO website http://www.wto.org

Dispute Settlement Body (DSB) of the WTO, merely, that some members of the CTE believe it will not.

To date the DSB has not ruled on the compatibility or conflict of measures within an MEA and WTO rules. However, in the 1996 report prepared by the CTE for submission to the Singapore Ministerial Conference, are to be found the following observations:

> The CTE notes that governments have endorsed in the results of the 1992 U.N. Conference on Environment and Development their commitment to Principle 12 of the *Rio Declaration* that "Unilateral actions to deal with environmental challenges outside the jurisdiction of the importing country should be avoided. Environmental measures addressing transboundary or global problems should, as far as possible, be based on an international consensus." There is a clear complementarity between this approach and the work of the WTO in seeking cooperative multilateral solutions to trade concerns. The CTE endorses and supports multilateral solutions based on international cooperation and consensus as the best and most effective way for governments to tackle environmental problems of a transboundary or global nature. WTO Agreements and multilateral environmental agreements (MEAs) are representative of efforts of the international community to pursue shared goals, and in the development of a mutually

supportive relationship between them due respect must be afforded to both.[116]

These 'conclusions,' appear in the report after more than forty pages explaining the different points of view within the CTE on all the items. What is perhaps most remarkable in this paragraph, a paragraph noted indeed by the appellate body of the DSB in the *Shrimp/Turtle* case, is the ambiguous nature of its content. The language adopted within the report, perhaps reflecting the disagreements within the CTE, is open to a variety of interpretations, providing no direct answer to the major question of whether an MEA should take precedence over the rules of the WTO. This is perhaps most observable in §178 of the report which states:

"The CTE recognizes that WTO Members have not resorted to WTO dispute settlement with a view to undermining the obligations they accepted by becoming Parties to an MEA, and the CTE considers that this will remain the case. While WTO Members have the right to bring disputes to the WTO dispute settlement mechanism, if a dispute arises between WTO Members, Parties to an MEA, over the use of trade measures they are applying between themselves pursuant to the MEA, they should consider trying to resolve it through the dispute settlement mechanisms available under the MEA. Improved compliance mechanisms and dispute settlement

[116] WTO (1996) *op. cit n.*115 at §171.

mechanisms available in MEAs would encourage resolution of any such disputes within the MEA."[117]

The recommendations of the 1996 CTE Report are not legally binding, even though they were noted by the DSB in the *Shrimp/Turtle* case, but even if they were, they amount to little, if anything, other than a statement that parties to the WTO can enter into MEAs and that the DSB can settle disputes relating to a conflict between an MEA and the WTO, all be it that parties should consider settling it within the dispute settlement procedures of the relevant MEA. Not quite a resounding vote from the CTE for the environment over free trade.

As early as the Cairo report it was recognised that a "lack of harmony among national regulatory systems may create non-tariff trade barriers in international trade."[118] While the position of the US was made clear during the early meetings its use of language in the document containing the views of governments on the contents of a Protocol for BSWG 2, was uncharacteristically opaque stating merely "the protocol should specify that nothing in it shall affect the rights and obligations of countries under agreements that have entered into force prior to the adoption of the protocol."[119] The primary concern of the US and Europe was however more stridently put forward by the Australian government who declared that "the

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[117] WTO (1996) *op. cit n.*115 at §178.

[118] UNEP (1995b) *Report of the Open-Ended Ad Hoc Group of Experts on Biosafety* UNEP/CBD/COP/2/7 p.34 §. 82(c).

[119] UNEP (1997d) *Compilation of the Views of Governments on the Contents of the Future Protocol* UNEP/CBD/BSWG/2/2 p.32.

outcome of negotiations on the protocol would need to ensure that the instrument does not derogate from the provisions of the Agreement Establishing the World Trade Organization (WTO) or affect the rights and obligations of members of WTO."[120]

The different stances taken by the parties to the Biosafety Protocol negotiations regarding the appropriate hierarchical relationship between the Protocol and WTO, became more fundamental as the process carried on. Importantly, despite different proposals on this issue, it remains unresolved in the final text adopted at the ExCop in Montreal. During BSWG 4, the 2nd Sub Working Group worked on a proposal for an Article requiring the Non Discriminatory application of the Advanced Informed Agreement (AIA) Procedure. One of the options suggested, for what was at the time Article 24, makes it an explicit requirement that the Biosafety Protocol be "consistent with the non-discriminatory provisions of the WTO Agreement."[121] In contrast, and also within the remit of Sub Working Group II, while working on the then Article 34, an article to govern the relationship of the protocol with other International Agreements, is in option 3 the suggestion that, "In the event of any inconsistency between this Protocol and the obligations set out in: (a) The Agreement on Technical Barriers to Trade; (b) The Agreement on the Application of Sanitary and Phytosanitary Measures, the Parties to this

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[120] UNEP (1997d) *op. cit. n.*119 p.33.

[121] This suggestion was contained in what was at the time an article dealing with Non Discrimination (Article 24) UNEP (1998a) Report of the Fourth Meeting of the Open-Ended Ad Hoc Working Group on Biosafety UNEP/CBD/BSWG/4/4 p.57 and was carried forward into the 1998 Revised Consolidated Text of Draft Articles UNEP (1998c) *Revised Consolidated Text of The Draft Articles* UNEP/CBD/BSWG/5/Inf.1.

Protocol agree that this Protocol shall prevail to the extent of the inconsistency and waive to this extent their right to bring a complaint against any other Party under these agreements."[122]

By the time of the draft negotiating text for BSWG 6, these contradictory positions had, to some extent, merged within the same bracketed draft article. The text of Article 34 read that "the provisions of this Protocol shall not affect the rights and obligations of any Party to this Protocol deriving from any existing international agreement to which it is also a Party [except where the exercise of those rights and obligations would cause serious damage or threat to biological diversity]."[123] By the end of BSWG 6 the Article had lost its brackets and become Article 31 of the Categena Draft Protocol on Biosafety. During the ExCOP the then Article 31 became one of the major sticking points, with the Miami Group insisting that everything that had previously been in brackets before the end of BSWG 2 now be deleted completely. It is important to note that what the Miami group were resisting was an explicit statement of intention that the Biosafety Protocol should be considered as *lex specialis* taking precedence over other more general agreements, such as those within the WTO, in those areas falling within the competence of the Protocol and the CBD. By deleting the contents of the text that had been in brackets the Protocol potentially became subordinate to the WTO rules, at the very least remaining within its competence, for without the qualifier, it would

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[122] At the time this was Article 34 see UNEP (1998a) p.57 and was carried forward into the 1998 Revised Consolidated Text of Draft Articles UNEP (1998c).

[123] Draft Negotiating Text, November 1998, UNEP (1998d).

be less easy to argue that the WTO's competence was explicitly excluded by the Protocol. The central significance of this being that the WTO rules which would likely govern a dispute involving LMOs, the SPS agreement and the *Hormones case*, as we shall see below, will not allow socio economic considerations but must be based on a scientific approach.

After the intransigence of the Miami Group brought the negotiations on the Biosafety Protocol to a halt at BSWG 6, Canada, Japan and the US suggested, during the preparations for the Seattle Ministerial Conference, that the WTO in the context of new Agricultural negotiations should develop its own working party on GMOs.[124] The suggestion made its way, all be it bracketed, into the revised Draft Ministerial Declaration of 19th October 1999, at § 71, and led to problems for the chief EU negotiator Commissioner Pascal Lamy who overstepped his authority and ignored the agreed EU position in relation to biotechnology, supporting the US call for a biotechnology working group.[125] The environment ministers of France, UK, Italy and Denmark

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[124] Canada proposed a "working party on biotechnology," (WTO (1999b) *Preparations for the 1999 Ministerial Conference, Proposal for Establishment of a Working Party on Biotechnology in WTO, Communication from Canada, 4 October 1999,* WT/GC/W/359WT/GC/W/359) whilst Japan wanted an "examination group for new issues including GMOs,"(WTO (1999c) *Preparations for the 1999 Ministerial Conference, Proposal of Japan on Genetically Modified Organisms (GMOs), Communication from Japan, 4th October 1999*, WT/GC/W/365). The US on the other hand suggested that "the objectives for the negotiations include addressing disciplines to ensure trade in agricultural biotechnology products is based on transparent, predictable and timely processes." (WTO (1999d) *Preparations for the 1999 Ministerial Conference, Negotiations on Agriculture, Measures Affecting Trade in Agricultural Biotechnology Products, Communication from the United States, 27 July 1999,* WT/GC/W/288).

[125] The test of an EU draft ministerial declaration prepared by Pascal Lamy expanded on that of the WTO draft of 19th October stating that "ministers would agree to establish a working party with a fact finding mandate on the relationship between trade, development, health, consumer and environmental issues in the area of modern biotechnology."

promptly issued a statement that the Biosafety Protocol negotiations were the proper forum for deciding a multilateral approach to biotechnology issues, suggesting that the negotiations would be undermined by a WTO group and might well lead to a precedent setting move subordinating MEAs to the WTO.

Between the two ExCops, three sets of informal discussions were held. At the first in Montreal during July 1999, spokespersons from the five negotiating groups met with the ExCop President Juan Mayr and stated their political will to finalise the negotiations. The next informal session was held in Vienna during September 1999. Following initial consultations with the negotiating groups, a round table discussion devoted to resolving differences between the groups on core issues, including the protocol's relationship with other international agreements, was conducted with two spokespersons from each group. Although the central differences remained, the Chairman as a result of the Vienna meeting presented a Non-Paper to both an additional round of informal talks in Montreal prior to the resumed EXCOP and for the ExCop itself. This Non-Paper proposed a number of changes to the existing Cartegena draft, including the deletion of articles 31 (relationship with other agreements) and 22 (non Discrimination) and instead reflecting their content in both the Preamble and a new paragraph in what was then Article 8 (The Decision Procedure).

The Miami group remained resistant on this point until the last day of negotiations, although in the end there was no non-discriminatory paragraph added to the decision procedure (which became Article 10 in the Final Text).

A compromise preambular text was adopted which recognised trade and environment agreements as mutually supportive for achieving sustainable development, while emphasising that the protocol "shall not be interpreted as implying a change in the rights and obligations of a Party under any existing international agreements." An explanatory statement followed this, stating that the above clause "is not intended to subordinate this Protocol to other international agreements." In the end, the Final text has not resolved the issue of the relationship between the WTO agreements and the Protocol. It contains no substantive Article that explicitly states the ascendancy of the CBD, unlike the previous Cartegena draft, instead we find a set of vague propositions in the preamble, which in a manner reminiscent of the language of the CTE's 1996 Report to the Singapore Ministerial Conference, leaves open the possibility that implementing measures taken by a party to an MEA, in this specific case the Biosafety Protocol, may potentially fall to be considered by the DSB of the WTO. Some might say that that is the price you have to pay in order to obtain the adoption of the Protocol, but in the end it is the Miami group rather than any of the other negotiating groups which gained the most on this issue in the changes between the earlier Cartegena text and the one eventually adopted in Montreal.

To understand more fully why the status of the relationship between the Biosafety Protocol's provisions and the rules of the WTO is so important an issue, one needs to know a little more about the WTO, its agreements, including the General Agreement on Tariffs and Trade (GATT Agreement) and the Dispute Settlement Body DSB.

3.2.4 The General Agreement on Tariffs and Trade

Following the conclusion of the Uruguay Round and the signing, in Marrakesh, of the Agreement Establishing the World Trade Organisation, (WTO Agreement), the GATT Agreement now forms a central part of the WTO regulatory framework. While there is no specific agreement that deals with environmental issues, the GATT; The Agreement on Technical Barriers to Trade (TBT agreement); The Agreement on Sanitary and PhytoSanitary Measures (SPS Agreement); The Trade Related Aspects of Intellectual Property Agreement (TRIPs Agreement); The Agriculture Agreement; and the preamble to the WTO Agreement, all contain provisions recognising the right of countries to take action in order to protect their environments. As described above, the relationship between trade and environment issues is also examined within the WTO in the Committee on Trade and Environment (CTE) that was brought into being through the adoption of a Ministerial decision adopted at the signing of the Final Act in Marrakesh.

The GATT agreement, and for that matter, the foundation of the World Trade Organisation, is, for the most part, premised upon two non-discriminatory principles. The first of these, "the most favoured nation (MFN) principle," provides that equal treatment is unconditionally extended to like products "originating in or destined for the territories of all other contracting parties."[126] Under Article I of GATT, states are required therefore, not to discriminate

[126] GATT 1994 Article I.

between the products of contracting parties through the levy of import duties or charges[127] or, under Article XI the application of quantitative restrictions.[128]

The second non-discriminatory measure within GATT is usually referred to as "the national treatment principle," wherein, products imported from contracting parties should not only be given "treatment no less favorable [*sic*] than that accorded to like products of national origin"[129] but such products should also not be subject to, import duties, regulations and taxes which function as disguised measures "to afford protection to domestic production,"[130] under Article III, and, under Article XI, quantitative restrictions and "other measures ... instituted or maintained on the importation ... or exportation ... of any product".

It does not take an in depth knowledge of the WTO agreements, or the jurisprudence of the Dispute Settlement Body (DSB) of the WTO, to recognise that decisions taken under national regulations implementing the Biosafety Protocol and which by their nature relate to restrictions on the importation of LMOs have the potential to fall foul of the GATT. The argument frequently put forward by those, such as the US, who are the primary exporters of LMOs, is that, genetically altered crops such as soya, are a "like product" to non genetically altered soya. Thus regulations on the import of LMOs would

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[127] GATT 1994 Article I.

[128] GATT 1994 Article XI.

[129] GATT 1994 Article III.

[130] *Ibid.*

discriminate between "like products" and therefore be potentially contrary to the GATT. While this may seem a specious argument to some, even putting it aside, the catch all "other measures" provision of Article XI would, it seems, automatically bring any regulations dealing with the import or export of LMOs necessary for the implementation of the Biosafety protocol within the ambit of the GATT and would require that such regulations are justified as a valid exception under Article XI examined below.

As outlined above, environmental exceptions appear in a number of WTO agreements. While the preamble to the WTO Agreement recognises that world trade should be carried out "in accordance with the objective of sustainable development," it is even in the best light, little more than a nod towards the Earth Summit, and has no substantive force. Article XX of GATT however, provides general exceptions to the preceding articles, where measures are "necessary to protect human, animal or plant life or health;"[131] or where such measures relate to "the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption."[132] Following the Appellate Body's reports in both the *US Gasoline*[133] and the *Shrimp/Turtle*[134] cases, any

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[131] GATT 1994 Article XX (b).

[132] GATT 1994 Article XX (g).

[133] In *United States – Standards for Reformulated and Conventional Gasoline* WT/DS2/9 (*US Gasoline*) the panel stated that "the chapeau by its express terms addresses, not so much the questioned measure or its specific contents as such, but rather the manner in which that measure is applied. It is, accordingly, important to underscore that the purpose and object of the introductory clauses of Article XX is generally the prevention of "abuse of the exceptions of [what was later to become] Article [XX]." This insight drawn from the drafting history of Article XX is a valuable one. The chapeau is animated by the principle that while the exceptions of Article XX may be invoked as a matter of legal right, they should not be so

exceptions made under XX (b) and (g) must be considered in light of the requirement that they are neither arbitrary, discriminatory or disguised restrictions on trade.[135]

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applied as to frustrate or defeat the legal obligations of the holder of the right under the substantive rules of the *General Agreement*. If those exceptions are not to be abused or misused, in other words, the measures falling within the particular exceptions must be applied reasonably, with due regard both to the legal duties of the party claiming the exception and the legal rights of the other parties concerned."

[134] *United States - Import Prohibition Of Certain Shrimp And Shrimp Products* - WT/DS58/AB/R. (The *Shrimp/Turtle* case) Since 1987 all US shrimp trawlers had been required to have turtle excluder devices (TEDs) fitted to them under regulations issued pursuant to The Endangered Species Act 1973. In 1991 the US introduced an import ban, on shrimp harvested with commercial fishing technology that might have an adverse affect on turtles. The import ban did not apply to countries certificated by the US as either being countries in whose waters endangered sea turtles do not occur or whose methods of fishing did not pose a threat to turtles; or countries who provided documentary evidence that their fishing methods complied with US standards. When these regulations were first introduced they applied specifically to a wider Caribbean/western Atlantic region (Mexico, Belize, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Trinidad and Tobago, Guyana, Suriname, French Guyana and Brazil.) with a three year phase in period. On 19th April 1996 however, the ban was extended to include all foreign countries effective from the 1st May. The appellate body found against the US finding not only that there was discrimination between countries arising from the different phase in periods and the certification procedures were of themselves arbitrary as they comment in the report "with respect to neither type of certification under Section 609(b)(2) is there a transparent, predictable certification process that is followed by the competent United States government officials (§ 180) ,,, The certification processes followed by the United States thus appear to be singularly informal and casual, and to be conducted in a manner such that these processes could result in the negation of rights of Members. (§ 181)" In relation to the chapeau of Article XX and environmental exceptions generally the Appelate body stated that;

"What we have decided in this appeal is simply this: although the measure of the United States in dispute in this appeal serves an environmental objective that is recognized as legitimate under paragraph (g) of Article XX of the GATT 1994, this measure has been applied by the United States in a manner which constitutes arbitrary and unjustifiable discrimination between Members of the WTO, contrary to the requirements of the chapeau of Article XX. For all of the specific reasons outlined in this Report, this measure does not qualify for the exemption that Article XX of the GATT 1994 affords to measures which serve certain recognized, legitimate environmental purposes but which, at the same time, are not applied in a manner that constitutes a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail or a disguised restriction on international trade. As we emphasized in United States – Gasoline, WTO Members are free to adopt their own policies aimed at protecting the environment as long as, in so doing, they fulfil their obligations and respect the rights of other Members under the WTO Agreement."

[135] The chapeau of Article XX reads "Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade."

The *Shrimp/Turtle* and earlier *Tuna Dolphin*[136] cases involved import restrictions on products due to their process and production methods (PPMs). In both these cases the PPMs were not an intrinsic element of the product, so called non product-related PPMs, in so far as different methods of catching Tuna and Shrimp are extrinsic to the character of Tuna and Shrimp themselves. Genetic technologies however involve product related PPMs that are intrinsic to the nature of LMOs, for this reason measures taken in relation to LMOs under the biosafety protocol in addition to falling within the compass of the GATT agreement, will also fall under the ambit of the SPS Agreement.

3.2.5 The Sanitary and Phyto-Sanitary Agreement

The SPS agreement allows countries to apply sanitary[137] and phytosanitary[138] measures, in order to ensure that plants and animals are protected from pests and diseases; and that food, is safe for consumers. These measures may take many forms, for example requiring that products come from disease free areas; that products are processed or produced in a particular manner; that foods contain only permitted additives; or, that foods have maximum levels of pesticide residues. By their very nature, sanitary and phystosanitary measures act to restrict trade; the purpose of the SPS agreement therefore, is not to impinge on the rights of countries to set their own levels of health

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[136] United States – Restrictions on Imports of Tuna BISD 39S/155 (Tuna/Dolphin I) *repr.* 30 ILM 1594 (1991) & United States – Restrictions on Imports of Tuna Ds 29R (Tuna/Dolphin II) *repr.* 33 ILM 839 (1994).

[137] Human and animal health measures.

[138] Plant health measures.

protection, while requiring transparent decision making that prevents sanitary and phytosanitary measures acting as disguised trade barriers.

The agreement, encourages the harmonisation of sanitary and phyto-sanitary measures through the adoption of International standards such as those provided by the joint FAO/WHO Codex Alimentarius Commission (the Codex)[139] while, at the same time, explicitly recognising the right of countries to adopt their own higher standards provided they are based on a risk assessment consistent with the requirements of the SPS agreement.[140] For a measure to be consistent with the SPS agreement it must be applied "only to the extent necessary to protect human, animal or plant life or health;"[141] be "based on scientific principles;"[142] and should not be maintained "without sufficient scientific evidence."[143] In addition a measure must not "arbitrarily or unjustifiably discriminate between Members"[144] or "constitute a disguised restriction on international trade."[145] Measures should be based on an appropriate risk assessment process[146] taking into account available scientific

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[139] SPS Agreement Article 3. Other organisations specifically mentioned in the agreement are the International Office of Epizootics and organisations operating within the International Plant Protection Convention.

[140] SPS Agreement Article 3.3.

[141] SPS Agreement Article 2.2.

[142] SPS Agreement Article 2.2.

[143] SPS Agreement Article 2.2. In cases where there is insufficient scientific evidence under Article 5.7 members can still take provisional measures "on the basis of available pertinent information" however there is then a requirement for those adopting the SPS measures to actively seek more information and objectively review the measures "within a reasonable period."

[144] SPS Agreement Article 2.2, Note the same language as used in Article XX of the GATT agreement.

[145] SPS Agreement Article 2.2 and note the comment *ibid.*

[146] SPS Agreement Article 5.

evidence,[147] relevant PPMs;[148] as well as relevant economic, ecological and environmental conditions.[149] Finally any measures which a party does impose should "not be more trade-restrictive than required to achieve their appropriate level of sanitary or phytosanitary protection."[150]

The Hormones Case[151]

It is, of course, by no means authoritative to draw conclusions from a case in the DSB involving the imposition of unilateral trade restrictions under the SPS agreement, with how the DSB may react to any restrictions on trade undertaken by a party in pursuance of their obligations under an MEA such as the Biosafety Protocol. The *Hormones Case* however, does provide an indication of the interpretive approach of the DSB towards the provisions of the SPS agreement, which it is possible to argue therefore, provides a persuasive account of the approach the DSB might take, toward a party placing restrictions on the importation of LMOs.

The *Hormones Case* involved a prohibition by the EC on the imports of meat, and meat products from cattle, to which certain natural and synthetic

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[147] SPS Agreement Article 5.2.

[148] SPS Agreement Article 5.2.

[149] SPS Agreement Article 5.2.

[150] SPS Agreement Article 5.6.

[151] *EC Measures Concerning Meat And Meat Products (Hormones)* WT/DS26/AB/R & WT/DS48/AB/R.

hormones had been administered for the purpose of growth promotion.[152] The Appellate body concerned itself with number of issues raised within the original Panel report, however, I only intend covering those issues which might be pertinent to any future deliberations by the DSB on import restrictions relating to LMOs. For our purposes, therefore, the appellate body's report in the *Hormones case*, held, firstly, that the precautionary principle did not override the provisions of Article 5.1 and 5.2 of the SPS agreement, in other words, in taking SPS measures, members must conduct an assessment of risk adopting the criteria laid down by the SPS agreement.[153]

Secondly, any SPS measures taken by WTO members need not conform to international standards but should be based on them.[154] Thirdly, where countries take SPS measures with a scientific justification, not withstanding the wording of Article 3.1, they must still make those measures in accordance with the requirements laid down in Article 5 for a risk assessment process.[155] This means that there must be not only a "rational relationship between the measure and the risk assessment"[156] but also that any measures must be

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[152] The hormones involved were: oestradiol-17β, progesterone, testosterone, trenbolone acetate, zeranol and melengestrol acetate ("MGA").

[153] *Hormones Case* §125 The risk assessment will have to be on a specific case by case basis (see below). However there is no requirement that the risk assessment be carried out by the nation implementing the SPS measure, rather it may be based on a risk assessment taken by another country or an international organization § 190.

[154] *Hormones Case* §168. At the moment there are no international standards in relation to LMOs.

[155] *Hormones Case* §176.

[156] *Hormones Case* §193.

taken "on a case-to-case basis."[157] Finally while the Appelate body acknowledged that measures may be taken on the basis of divergent, or minority scientific opinions "from qualified and respected sources" [158] the scientific evidence drawn upon, should not be of a general nature instead being "sufficiently specific to the case at hand."[159]

What does the interpretation of the SPS agreement by the Appellate body in the *Hormones Case* mean for any possible future dispute brought to the WTO regarding domestic measures implementing the Biosafety Protocol? Firstly, should a case ever be brought before the DSB, it would seem that measures taken pursuant to the precautionary principle contained in Articles 10.6 & 11.8 of the Protocol might potentially be considered incompatible with the provisions of Article 2.2 of the SPS agreement.[160] Secondly, and perhaps most importantly in the context of my overall argument, Article 26 of the Protocol, although providing the possibility for parties to make decisions regarding the importation of LMOs on socio economic grounds, must make sure that such provision are compatible with obligations under other international agreements. A defence of measures taken on the basis of Article 26 is most likely to be deemed inconsistent with Articles 2,3 and 5 of the SPS agreement. Thirdly, a moratorium aimed at products derived from rDNA technologies and thus not taken on a case by case basis, would probably be regarded as

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[157] *Hormones Case* §194.

[158] *Hormones Case* §194.

[159] *Hormones Case* §200.

[160] See the discussion *supra* on p.186.

inconsistent with the SPS agreement, although this would also be the case were such a measure challenged under the dispute resolution procedure of the Protocol itself. Finally, measures taken by a country could not be based on general scientific research or research relating to other products developed using rDNA technology, but must instead relate to the potential significance of a specific LMO and a specific environment.

In Chapter 2, I argued that agricultural biodiversity was a social creation; the product of a mosaic of unfolding social practices and knowledge that is temporally and spatially localised. At the beginning of this Chapter, I suggested that in order to understand the CBD, it needed to be considered as not only a multilateral environmental agreement but an international trade agreement. I then moved on to suggest that while the CBD is the most significant international agreement and organisation that deals with the conservation of Biodiversity its approach is one which, despite recognising the need for *in situ* conservation of traditional knowledge, attempts to globally manage genetic resources and in so doing acts counter intuitively to the heterogeneous nature of biodiversity and traditional knowledge seen in Chapter 3. In addition, I also considered the Biosafety Protocol and the manner in which, whether within its own rules, or, in those of the WTO to which the Protocol has been made consistent, the ability to consider the socio economic risks which rDNA technologies pose for biodiversity has been controlled and limited.

In the next Chapter I intend looking at another WTO agreement, the Trade Related Aspects of Intellectual Property Agreement. I will argue that the TRIPs agreement allows the reterritorialisation of farmers' fields and like the Biosafety Protocol extends the reach of those wishing to deploy rDNA technologies, through enrolling and reconfiguring the farmers themselves. Through controlling farmers' practices the TRIPs agreement thus poses a threat to the continued production of agricultural biodiversity, particularly in the two thirds world.

Chapter 4

TRIPs and the Territorialisation of Spaces

How does a man in an office in St Louis, influence a farmer in Kerala or Andrah Pradesh, so that he changes the manner in which the land in that area has been farmed for generations? What brings these two together across time and geophysical space? How is a micro organism found in Germany in 1911 mobilised today, by a scientist in a laboratory, and tomorrow, by a sales representative from a seed company? What brings together an ethnobotanist in Gabon, small children eating the sweet berries of a tree, the representative of a Mid Western university, a fizzy drink, a supermarket, and you or me? How are these heterogeneous mixes of human and non humans related in these forever unfinished social stories?

What we are concerned with here are the flows and circulation of materials, the passage of objects, entities, actors, processes and agents whose relations, whose materiality, are "interactively constituted."[1] What we are also concerned with is performance, or rather with what John Law calls performativity;[2] that is the manner in which these materials, these

[1] See Law, J. and Mol, A. (1995) "Notes on Materiality and Sociality" *The Sociological Review* pp.275-294.

[2] See Law J. (1999) After ANT: Complexity, Naming and Topology in John Law & John Hassard (eds.) *Actor Network Theory and after* (Oxford: Blackwell Publishers).

heterogeneous entities, not only achieve their form in the performative character of relational materiality, but of how the relations themselves achieve their relative stability, of how the boundary objects which are the products of these relations, what Bruno Latour refers to as "immutable mobiles,"[3] are made comparatively durable through time and space. What we are dealing with therefore is nothing so simple and reductionist as binary opposites, of actors and agents, the modern and the traditional, the natural and the social or the global and the local, but fluid relationships of flows, irreducible pluralist works in progress.

These heterogeneous performative actions take place within polymorphic social networks that are themselves the outcome of ongoing performances. But to talk of a network, in these days of the internet, of computer, telephone and railway networks, not to mention business networks, can lead to confusion, for the nodal points of these networks are rigid, fixed in both time and space, indeed, these technological networks are themselves practices of spatialisation reinforcing the concept of space as three dimensional and empirical. Sennet in the following extract for example, writes of stationary places lying within a global business network saying, "at present places – be they a factory in Mexico an office in Bombay or the multimedia centre in lower Manhattan – are nodes in a global network. Places exercise weak or no sovereignty over the network, fearing that, if the network is taxed or regulated

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[3] See Latour, B. (1993) *We Have Never Been Modern* Trans. Catherine Porter (London: Harvester Wheatsheaf).

locally, another node can as easily be found in Canada if not Mexico in Boston if not Manhattan"[4] The network here is formed by drawing lines between static points, linking locations which remain remote, although connected; these are networks of located places formed and reformed by the redrawing of branches, which, at the same time, reasserts the still locationally distant context of their constituents.

The networks of which I write however are mercurial and polymorphic, continually undergoing change, they are defined not by fixed points, but rather, they bend, or, fold space and time, bringing together social objects in the same topological spaces, these networks are transformative and productive, they are always local, never global or universal, although they are more or less extended in time and space.[5] Although Law and Latour have suggested that our over familiarity with technological networks, now carries with it too much metaphorical baggage,[6] I believe, that as long as we ally to the metaphor of a network the notions of the topological and the polymorphic, then we can maintain the fluid complexity necessary to partially glimpse the social, providing a means for describing the complex transformations and

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[4] Sennet, R. (1999) "Growth and Failure: The new Political Economy and Its Culture" in Mike Featherstone & Scott Lash eds. *Spaces of Culture, City, Nation, World* (London: Sage Publications) p.24.

[5] For an article attempting to examine the distinction between different types of networks forms see Murdoch, J. (1995) "Actor Networks and the Evolution of Economic Forms: Combining Description and Explanation in Theories of Regulation Flexible Specialization and Networks" Vol.27 *Environment and Planning A* pp.731-757.

[6] Law, J. (1999) "After ANT: Complexity, Naming and Topology" and Latour, B. (1999) "On recalling ANT" both in John Law & John Hassard (eds.) *Actor Network Theory and after* (Oxford: Blackwell Publishers).

performances of social ordering at least, if not more usefully than by writing of rhizomes or fractals.

In this Chapter, I examine how IPRs are not only mobilised within the social, but are themselves a means through which social networks find their expression. IPRs, it will be seen, are social stories, tales of order and of hierarchy, which both perform social orderings and are themselves the products of ordering tales. IPRs allow the bringing together of otherwise disparate objects, folding time and space, creating alliances and the perception of obligatory points of passage while at the same time, providing a means of extending relationships, and methods of control, through time and space.

I began this chapter by asking how a number of human and non-human objects were linked. In the rest of this chapter I intend moving on to examine how these hybrid objects, these machinic assemblages of concrete physical form mingled with bodies of knowledge and their associated cultural practices, are circulated and made durable. That is, I will examine how the links between these human and non human objects are created and maintained, how nature is mobilised and put to work, and how power is produced in these performances.

In order for GM crops to function as their makers intend, seeds must be made to overcome the diversity of farmers practices and spatial topographies, not through the *emptying out* of meaning and space or, the lifting out of social

relations, but through the reorganisation of space and the *importation* of meaning. The field and the seed become sites of contest around which the reordering of farmers' practices ultimately takes place. The seeds themselves are hybrid objects assemblages that attain a degree of agency, as they circulate they proselytise, both carrying their message and enrolling others, their success however depends upon their durability, upon the effectiveness of the performative social practices that generate their relational materiality. It is here that we shall also consider the role of IPRs as mechanisms of control, but first we need to fill in the details, by explaining the notion of IPRs, before moving on to explore how IPRs have been enrolled in the work of particular companies and states. In the latter parts of this chapter, I consider what an imperfect means of fact stabilisation IPRs offer and of how the introduction of genetic use restriction technologies (GURTs) provide other, potentially more 'successful,' means of achieving the same goals.

4.1 Inventing Incentives

In January 1996 the US Agriculture Secretary Dan Glickman told those assembled at the Indian Agriculture Research Institute that "there would be very few inventions of anything, particularly in agriculture, without patent protection because it is the fundamental fact of nature that people will not go through the expense of development of new ideas just for the altruistic benefit of the human race." Glickman's somewhat sad perspective on humanity not only exemplifies the justifications frequently given for Intellectual Property Rights (IPRs), but, at the same time, devalues the inventive genius of generations of farmers who, have continually applied their knowledge about

agriculture in everyday practices for the past 10,000 years. Indeed many countries have, until very recently, specifically exempted the granting of patents on food, agricultural and medicinal products.

As a proprietary legal form the patent, emerged in Europe in the twelfth century. *Litteraes patentes,* literally "open letters", were official documents conveying privileges of rank, title and freedom of movement, that were sealed by the grantor at the bottom of the page, thus rendering them open. These open letters enabled the transfer of technology between countries by allowing master craftsmen to travel and instruct apprentices in the 'mysteries' of their trade, while at the same time restricting the ability of those apprentices to set up in practice once their period of indenture was over.[7]

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[7] Edward II is, for example, known to have granted letters patent, to John Kemp, a Flemish Weaver in 1331, as well as to two Brabant Weavers so they could settle in York in 1336 and three clockmakers form Delft in 1368. (see David, P. A. (1993) "Intellectual Property Institutions and The Panda's Thumb: Patents, Copyrights, and Trade Secrets in Economic History" in Wallerstein, Mogee and Schoen (eds.) *Global Dimensions of IPRs in Science and Technology* (Washington: National research Council/National Academy Press) p.45.) Similarly, a licence for life was granted to John Utynam from Flanders, on April 3rd 1449, so that he could "come to make glass of all colours for the windows of Eton College and St Mary and St Nicholas Cambridge ... because the said art has never been used in England" the patent then continued with the prohibition that no liege of the King "learned in such arts shall use them for a term of twenty years." (Quoted in Parliamentary Office of Science and Technology (1996) *Patents Research and Technology – Compatibilities and Conflicts* (London:HMSO)) This royal prerogative continued in England through to the 17th century by which time its abuse in favour of both the Crown's fiscal needs, and the Court's favourites, was such that Parliament acted to curb it, passing the Statue of Monopolies in 1623, in order that a monopoly of 14 years or less could only be granted to "the first true inventor" of a new manufacture. The First patent Staute is however generally considered to have been passed in the Venetian State in 1471. The Venetian Statute provided inventors with a monopoly on the manufacture of the products of their intellect for a period of ten years so that "more men would apply their genius, would discover, and would build devices of great utility to our common wealth".

Phillips and Firth describe IPRs, as "the legal rights which may be asserted in respect of the products of human intellect."[8] While IPRs include rights which are not based on intellect such as trade marks,[9] not all products of the human intellect, as Philips and Firth description suggests, have the capability to subsist as IPRs. The right is one that exists, only in so far as the holder is given the limited protection of the court, it is law that defines which products of the human imagination should be considered as intellectual property and, therefore, which creative outpourings are capable of legal protection.

While the last point may at first appear obvious, IPRs are frequently justified on the basis that the rights derive from the intrinsic quality of human acts as accomplishments of individually creative authorship,[10] whether made manifest within works of literature, art and music, methods or products of manufacture, or more recently plant varieties. Justifications for IPRs tend, all to often, to focus on the legal grant as recognition of an individual's entitlement,[11] either through the mingling of a persons' labour with that of a newly created product,[12] or through the added value a person brings to a product.[13] As Cary Fowler observes;

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[8] Phillips, J. & Firth, A.(1995) *Introduction to Intellectual Property* 3rd Ed (London: Butterworths).

[9] Trade marks are a marketing device and serve only to protect a company's products from imitation.

[10] Some of the problems that arise from the deployment of the "romantic vision of authorship" are examined in Boyle, J. (1996) *Shamans Software & Spleens: Law and The Construction of the Information Society* (Cambridge, MA: Harvard University Press).

[11] Hettinger, E.C (1989) "Justifying Intellectual Property" Vol. 18 *Phillosophy & Public Affairs* 31-52.

[12] This is a justification for property rights similar to that of Locke's that "Though the Earth and all inferior creatures be common to all Men yet every man has *property* in his own *Person*. This no body has any right to but himself. The *Labour* of his body, and the *Work of*

"In modern Industrialised societies, the purposes and effects of patents are taken for granted. So uncritical has our thinking become, that indeed they are seen as a civil right, something above questioning and examination. In this atmosphere it is difficult to see patent systems as they really are – as human created institutions designed for human purposes, as the offspring not of religion or philosophy but of politics and economics."[14]

On even the most cursory examination of IPRs, it can be seen that not all acts of intellectual activity are recognised by law as being capable of protection. While copyright rules would perhaps be the closest of IPRs to this "authorship" model, they provide that not all manifestations of intellectual endeavour are protected. Similarly the rules that have developed in relation to patents make

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his hands we may say are properly his. Whatsoever then he removes out of the state that nature hath provided, and left it in, he hath mixed his *Labour* with and joyned [*sic*] to it something that is his own, and thereby makes it his *property*. It being by him removed form the common state Nature placed it in, it hath by his *labour* something annexed to it, that excludes the common right of other men. For this labour being the unquestionable property of the Labourer, no man but he can have a right to what that is once joyned [*sic*] to, at least where there is enough, and as good left in common for others." Locke, J. (1988) *Two Treatises of Government*, Peter Laslett (ed.), (Cambridge: Cambridge University Press), pp.287-288 (Second Treatise §27).

[13] Robert Nozick is critical of those who find justification for IPRs in Locke asking "Why does the mixing of one's labour with something make one the owner of it? Perhaps because one owns one's labour, and so one comes to a previously unowned thing that becomes permeated with what one owns. Ownership seeps into the rest. But why isn't mixing what I own with what I don't own a way of losing what I own rather than gaining what I don't? If I own a can of tomatoe juice and pour it in the sea so that its molecules ... mingle evenly throughout the sea do I thereby own the sea, or have I foolishly dissipated my tomatoe juice? *Perhaps the idea, instead, is that labouring on something improves it and makes it more valuable; and anyone is entitled to own a thing whose value he has created ... why should one's entitlement extend to the whole object rather than just to the added value one's labour has produced?*" [emphasis added] Nozick, R. (1974) *Anarchy State and Utopia* (Oxford: Basil Blackwell) p.175.

[14] Fowler, C. (1995) "Biotechnology Patents and The Third World" in Vandana Shiva and Ingunn Moser (eds.) "Biopolitics; A Feminist Ecological Reader on Biotechnology" (London: Zed Books) p.214.

it apparent that while some intellectual acts are recognised as being capable of protection, others are not. For, an intellectual act that creates an object with no, at the time, known use, or, which is obvious to someone trained in the art, cannot be patented, because it does not meet the requirements of novelty, inventive step and utility. Similarly Crick and Watson's description of the structure of DNA, while undoubtedly involving an intellectual act, is incapable of protection, falling as it does into the category of a discovery. In addition, IPR legislation invariably includes exceptions to its general rules, so that some acts which otherwise would have been legally protected, will not be capable of a grant because they are not in the public interest or are against public morality.[15]

It is important to keep firmly in mind that IPRs always seek to balance the interests of an abstract public with those of specific actual or legal individuals, indeed it is possible to go further and state, as Mann did in the 1920s, that "patent systems are not created in the interest of the inventor but in the interest of national economy. The rules and regulations of the patent system are not governed by civil or common law but by political economy."[16] IPRs are not therefore a right derived from an individual's intellectual invention but a means of furthering the public interest. IPRs are temporally and spatially located, the boundaries of what is and what is not recognised as worthy of

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[15] See for example TRIPs Article 27 - UK - EPA s53 and below Indian Patents Act of 1970 s.3 and s.5.

[16] Government of India (1959) *Report on the Revision of The Patents Law* by Shri Justice N. Rajagopala Ayyangar, September 1959 (New Delhi: Government of India) p.10 §21. (hereinafter *Ayyangar Report*)

protection, continually in flux, whether from new technological challenges or, from changes in the public, political and/or judicial acceptance of particular acts as coexistent or necessary for the public interest.

In 1946 the Swan Committee[17] identified four assumptions on which the granting of a limited monopoly privilege of the patent system are based.

> "The theory upon which the patent system is based is that the opportunity of acquiring exclusive rights in an invention stimulates technical progress in four ways; first, that it encourages research and invention; second that it induces an inventor to disclose his discoveries instead of keeping them as a trade secret; third, that it offers a reward for the expenses of developing inventions to the stage at which they are commercially practicable; and fourth, that is provides and inducement to invest capital in new lines of production which might not appear profitable if many competing producers embarked on them simultaneously. Manufacturers would not be prepared to develop and produce important machinery if others could get the results of their work with impunity."[18]

In justifying its position on strong IPRs for biotechnological products and processes, the life science industry frequently calls on a similar set of

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[17] The Swan Committee was set up by the UK Board of Trade to consider the reform of the Patents and Designs Act 1932. Recommendations made by the committee were implemented in the UK Patents Act of 1949.

[18] *2nd Interim Report of the Departmental Committee on Patents and Designs Acts, Chaired by Kenneth R.* Swan, April 1946 Cmd. 6789 § 9.

rationalizations that describe a "critical synergy between the biotechnology industry and intellectual property protection."[19] Without patents it is argued, there would be no life science industry, not least because of the R & D costs involved in bringing product to the market.[20] Otto A. Stam who at the time was head of the Patent Department at Ciba-Geigy,[21] opines the position of the life science industry perfectly when he writes that

> "without efficient patent protection in the most important trading areas, there can be no research and development of new pharmaceuticals ...Industry will not introduce important products onto the market if exclusivity, even if limited in time is unavailable in markets. Without adequate protection, no investments will be made in Pharmaceutical research and consequently there will be no corresponding transfer of technology to countries that de facto grant no patent protection for pharmaceuticals"[22]

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[19] BIO (1994) *Comments of the Biotech Industry, Critical Synergy: The Biotechnological Industry and Intellectual Property Protection, Presentations of the Intellectual Property Committee of Biotechnological Industry Organisation at The October 17th 1994, Hearing of the US Patent and Trademark Office Sand Diego California* p.1.

[20] Even in 1993 these were put at between $240-300 million dollars for one pharmaceutical product see Rathmann, G.B. (1993) "Biotechnology Case Study" in Wallerstein, Mogee and Schoen (eds.) *Global Dimensions of IPRs in Science and Technology* (Washington: National research Council/National Academy Press) p.325.

[21] Ciba-Geigy merged with Sandoz to form Novartis.

[22] Stamm. O.A. (1993) "Intellectual Property Rights and Competitive Strategy: A Multinational Pharmaceutical Firm in Wallerstein, Mogee and Schoen (eds.) *Global Dimensions of IPRs in Science and Technology* (Washington: National research Council/National Academy Press) p.227. Interestingly given the position Stam articulates, Switzerland only allowed product patents for drugs in 1978 yet Ciba-Geigy, a Swiss firm, had still managed to become a world leader.

Passing over the obvious point that there have been many instances of medical research, that have occurred without that person having uppermost in their minds the possible financial rewards which they could make from patenting an invention,[23] what should be noted is that the quotations from both the Swan Committee and Otto Stam inherently acknowledge the importance of the public interest in their justificatory rationale for IPRs. Stam is, of course, keen to defend patents on the basis of their importance for Ceiby, in particular, and the Biotech industry in general, his justification for strong patent protection rests implicitly however, on the argument that both the development of pharmaceuticals and the transfer of those technologies to other countries are in the public interest. The Swan committee's utilitarian justification for patents also has at its heart, the notion that the gains made to the public through "progress," outweigh the limited grant of monopoly rights to an individual.

Where the balance should be drawn between individual entitlement[24] and the public interest, forms the central issue around which a large part of this chapter is organised, as we examine the transnationalisation of IPRs within the framework of the Agreement on Trade Related Aspects of Intellectual Property (TRIPS) and its consequences for biodiversity. Once more the central questions are those of problematisation; questions of whose

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[23] For the changing nature of academic research and the role of patents see Eisenberg, R. (1987) "Proprietary Rights and the Norms of Science in Biotechnological Research" Vol.97 *Yale L.J.* 179.

[24] Given what I have already written, I use the term in the context of legal entitlement, not a moral justification.

knowledge is considered appropriate for defining problems and thus, whose knowledge should be put to use in overcoming them; questions regarding how the public interest is defined and of how best it can be served. For some, this balance has tilted too far the in favour of private interests over those of the public domain as the signatories of the Bellagio Declaration make clear:

> "In general systems built around the author paradigm tend to obscure the importance of "the public domain," the intellectual and cultural commons from which future works will be constructed. The assumption of these systems is that one must reward creators in order to ensue new production. Yet the "reward" has its costs. Each intellectual property right, in effect fences off some portion of the public domain making it unavailable to future creators. If one is concerned about promoting future production of books, ideas, inventions and works of art, then one must be just as careful in one's protection of a vigorous and diverse public domain, a "commons" of scientific literary and artistic raw material, as one is in one's protection of the authors' rights and incentives. Recently there has been a dangerous international tendency to suppress the former concern and to concentrate on the latter."[25]

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[25] The Bellagio Declaration in Boyle, J. (1996) *Shamans Software & Spleens: Law and The Construction of the Information Society* (Cambridge, MA: Harvard University Press) p.196.

4.1.1 India and Patents

The relative balance between the granting of IPRs to individuals and those of the public interest and domain, particularly in relation to patents, is bought sharply into focus if one considers the patent regime in India. At the time of its independence in 1947, the new republic inherited from their old colonial rulers the Indian Patents and Design Act of 1911.[26] The 1911 Act was considered to be both out of date, and, to run counter to the newly emerged Republic's interests. One of the earliest priorities of the Nerhu Government was therefore, the reform of the 1911 Act, to which end the Patents Inquiry Committee, which included among its members the former Controller of Patents Shri K. Rama Pai, was appointed in 1948 under the Chairmanship of a retired high court judge, Justice Bakshi Tek Chand. In 1949 the Committee produced an interim report, calling for the immediate amendment of the 1911 Act to counteract the abuse and misuse of patent monopolies in India, before finally submitting their completed report at the end of April 1950.

In 1953 The Patents Bill was introduced into the Lok Sabha, which although incorporating some of the amendments recommended by the Patents Inquiry Committee, was based largely on the UK's 1949 Patents Act. The bill however subsequently lapsed when the Lok Sabha was dissolved. In 1957, The Government of India appointed Shri Justice N. Rajagopala Ayyangar to look afresh at the whole issue of patents. The resulting report, which was

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[26] The British had first introduced an earlier Patent Act in India, in 1856.

published on 14th September 1959, is a highly detailed and comprehensive consideration of the purpose of patent systems at different times in different countries histories; as well as an in depth analysis of the social and economic ends which an Indian patent regime could achieve.

What is perhaps most surprising about justice Ayyangar's 1959 report, when reading it today, is the continued relevance of Justice Ayyangar's comments and observations; indeed, many of the arguments which are currently made by those campaigning against the WTO's intellectual property regime could have come straight from its pages. Ayyangar firmly believed in a patent system,[27] and was of the opinion that the limited monopoly rights granted by patents could help India's economic and social development.[28] However, what concerned him most, as with the Patents Inquiry Committee beforehand, was the manner in which foreign companies used the 1911 Act to ensure a protected market. In 1958 for example out of a total of 3,572 patents, Indian

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[27] For example at p.19 §43 he states "I consider that the patent system is the most desirable method of encouraging inventors and rewarding them."

[28] Under the title 'what changes are necessary in the Indian Law' Ayyangar makes the following comments " The precise provision of the patent law, however, have to be designed, with special reference to the economic conditions of the country, the state of scientific and technological advance, its future needs and other relevant factors and so as to minimise if not eliminate the abuses to which a system of patent monopoly is capable of being put. Bearing in view the matters I have set out above, I would recommend the retention of the patent system but that it should be improved – (1) by defining with precision inventions which should be patentable and by rendering unpatentable certain inventions, the grant of patents to which will retard research, or industrial progress or be detrimental to national health or well being; (2) by expanding the scope of anticipation so as to comprehend not merely what is known or published in this country, but also what is known or published outside India; (3) by providing remedies for the evils which India, in common with other countries, experiences from foreign owned patents which are not worked in the country, but which are held either to block the industries of the country or to secure a monopoly of importation; (4) by providing special provisions as regards the licensing of patents for inventions relating to food and medicine; (5) by providing remedies for other forms of abuse resorted to by patentees, to secure a more extended monopoly or a monopoly for a longer duration than what the statute grants" Ayyangar Report p.19 §44-45.

nationals took out only 529, while non-Indian nationals took out 3,043.[29] As Ayyangar writes in the report

> "Even with the attainment of independence and rapid growth of scientific education by opening of more institutions for postgraduate training and the establishment of several national laboratories, the proportion of Indian to foreign patents still remains substantially the same as during the earlier period [1930-37] and is roughly 1:9."[30] A little later on he continued, "these patents are therefore taken not in the interests of the economy of the country granting the patent or with a view to manufacture there but with the main object of protecting an export market from competition from rival manufacturers particularly those in other parts of the world"[31]

On the 21st of September 1965 a new Patents Bill was introduced into the Lok Sabha based mainly on the proposals of the Ayyangar report. The Bill was referred to a Joint Committee of Parliament which, after amending the Bill presented it again to the Lok Sabha, where the bill could not proceed for lack of time, lapsing with the dissolution of the Lok Sabha on 3rd March 1967. After over 20 years however, the current Indian Patents Act received the assent of the President on 19th September 1970 eventually coming into force in 1972.

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[29] *Ayyangar Report* Appendix A, Table 1, p.302, Similar ratios of foreign held patents to domestically held ones, appear to have also existed in other developing countries see, Vaitsos, C. (1972) "Patents Revisited: Their Function in Developing Countries" Vol. 9(1) *Journal of Development Studies* pp.71-98.

[30] *Ayyangar Report* p.12 § 26.

[31] *Ayyangar Report* p.13 § 29.

The 1970 Act represents a patent system that was intended to be more conducive to the Indian national interest than the colonial 1911 Act, a notion indicated by the objectives contained in s.83 of the Act itself:-

> "Without prejudice to the other provision contained in this Act, in exercising the powers conferred by this chapter, regard shall be had to the following general considerations, namely,
>
> (a) that patents are granted to encourage inventions and to secure that the inventions are worked in India on a commercial scale and the fullest extent that is reasonable practicable without undue delay; and
> (b) that they are not granted merely to enable patentees to enjoy a monopoly for the importation of the patented article"[32]

To this end, the 1970 Act ensures the introduction of a system of compulsory licensing[33] and licensing of right[34] in line with the recommendations of Justice Ayyangar. Significantly however, the Act also creates a distinction between products and processes, something that was again central to Justice Ayyangar's 1959 report, as he wrote,

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[32] S.83 *The Patents Act [India] 1970* (39 of 1970).
[33] S. 84 *The Patents Act [India] 1970*.
[34] S. 86 & s.87 *The Patents Act [India] 1970*.

"The denial of product claims is necessary in order that such important articles of daily use as medicine or food which are vital to the health of the community should be made available to every one at reasonable prices and that no monopoly should be granted in respect of such articles. It is considered that the refusal of product patents would enlarge the area of competition and thus result in the production of these articles in sufficient quantity and at the lowest possible cost to the public.

To render even the process unpatentable is I consider not in [the] public interest as the grant of exclusive rights to the process which an inventor has devised would accelerated [*sic*] research in developing other processes by offering an economic inducement to the discovery of alternative processes leading again to a larger volume of manufacture at competitive prices."[35]

Thus, while section 3 of the 1970 Act[36] precludes from protection methods of agriculture and horticulture as well as "any process for the medical surgical curative prophylactic or other treatment of human beings or any process for a similar treatment of animals or plants to render them free of disease or to increase their economic value or of their products," section 5 of the 1970 Act

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[35] *Ayyangar Report* pp. 42-43 §101.

[36] The Patents Act [India] 1970 s.3. "The following are not inventions within the meaning of this act [...](b) An invention the primary or intended use of which would be contrary to law morality or injurious to public health; [...](h) a method of agriculture or horticulture (g) any process for the medicinal, surgical, curative, prophylactic or other treatment of human beings or any process for a similar treatment of animals or plants to render them free of disease or to increase their economic value or that of their products."

does not permit the granting of patents on "substances intended for use, or capable of being used as food or as medicine or dug, or relating to substances prepared or produced by chemical processes." All be it that processes of manufacture for those substances are patentable for seven years.

The stipulation in the 1970 Act that patents shall not be available on food, agricultural or drug products, together with the provisions for compulsory licensing, licensing of right, and that patents must actually be worked in India, provides a different perspective on the relationship between IPRs and a country's economic and social development, than that found within Europe, Japan and the US. A position not too surprising given that what is in the public interest of one state, may well not be in the public interest of another. The recognition, or rather the lack of recognition, that states may posses diverse economic and social goals, which, may lead to their holding different views on what should remain in the public domain, has, as we shall now see, become one of the central sources of tension, during negotiations on international IPR regimes within WIPO, the Uruguay Round of GATT and today within the WTO.

4.1.2 Trouble in Paris

India was not the only country in the two thirds world to examine the role of patents in their economic and social development.[37] In 1969 the Treaty of Cartegena provided Chile, Bolivia, Colombia, Ecuador and Peru with a framework in which to adopt a common strategy for consolidating their markets and regulating foreign investment. One of the issues to which the Andean Pact turned was the provision of IPRs and, in 1974, they adopted Decision 85[38] providing member countries with a common law on patents, designs and trademarks.[39] Like India, the purpose of the Andean Pact's revised IPR regime was aimed at serving the economic and social

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[37] For an analysis which is critical of the suggestion that patents are in the interest of countries in the two thirds world, see Oddi, A.S. (1987) "The International Patent System and Third World Development: Reality or Myth?" *Duke L.J.* 831 *cf.* Rapp. R.T. & Rozek, R.P. (1990) "Benefits and Costs of Intellectual Property Protection in Developing Countries" Vol.24 (5) *Journal of World Trade* pp.750-102.

[38] *Repr.* (1974) Vol.13 *ILM* 1489.

[39] Decision 85 was later replaced by Decision 313, *repr* (1993) Vol.32 *ILM* 180, which in its turn was replaced by Decision 344, in 1993, and most recently by Decision 486 which came into force on December 1st 2000. Decision 486 is specifically intended to comply with the TRIPs agreement and was introduced following concerted pressure from the US to amend Decision 344, with member states of the Andean Community placed on both the Special 301 Watch List, and the Priority Watch List at different times. Decision 344 had already widened the scope of patentable inventions, although it specifically excluded from patentability, genetic material from humans, animals, pharmaceuticals on the WHO's essential drug list, and, the usual provisions relating to products which might be prejudicial to human, animal or plant life, the environment, or, which might be contrary to public morality (Article 7). In addition to Decision 344 the Andean Community also adopted in 1993 Decision 345, which introduced a Plant Variety regime in line with UPOV 1991. Decision 344, maintained provisions for the compulsory licensing of patents after 3 years (Articles 42-50), together with a requirement that patents should be manufactured and distributed in the Andean Community, however, imports could be substituted for manufacture "where this is done on a scale sufficient to satisfy the demands of the market" (Article 38). The new Decision 486 extends patents to micro-organisms while remaining quiet on the subject of the essential drugs list, however perhaps most interestingly, Decision 486 attempts to include in its provisions the recognition of the rights of local, indigenous and afro American peoples over their collective knowledge in addition to articulating in a number of articles the need to comply with the CBD, so that, for example Article 75 provides that patents will be revoked if a relevant contract or right of access to the *in situ* genetic material in the Andean Community is not presented. Rights of access to genetic resources are covered by Decision 391.

development of the countries involved; and, in a similar fashion to the Indian Patents Act 1970, included provisions for compulsory licences while, requiring that products should be manufactured "on the soil of the member nations which granted the patent."[40] In addition, although not drawing the same distinction between products and processes as the Indian Act, Article 5 provided that pharmaceutical products, food for human, animal or vegetable consumption, as well as vegetable varieties should be excluded from patentability; perhaps no surprise given that Constantine Vaitsos, one of the central architects of Decision 85 and head of the Andean Pact's Secretariat on foreign investment and technology policies, was well acquainted with Justice Ayangar's 1959 report.[41]

In order to help those from one country gain a patent in another, 14 countries signed the *Paris Convention for the Protection of Industrial Property,* on March 20th 1883,[42] with the result that members of the Paris Union, extended 'national treatment' to foreign property holders. In 1893, the national bureaux of both the Paris and Berne Conventions merged, forming the United International Bureaux for the Protection of Intellectual Property (BIRPI), which, from 1967 under the leadership of the US representative Arpad Bogsch, underwent a large scale program of reorganisation and restructuring that led

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[40] Decision 85, Article 31.

[41] Frequent references are made to the report in a 1972 article by Vaitsos, (Vaitsos, C. (1972) "Patents Revisited: Their Function in Developing Countries" Vol. 9(1) *Journal of Development Studies* pp.71-98) which in its turn was a shorter version of an earlier report presented to the Andean Pact as background for Resolution 85.

[42] Which was subsequently revised at Brussels on December 14, 1900, at Washington on June 2, 1911, at The Hague on November 6, 1925, at London on June 2, 1934, at Lisbon on October 31, 1958, and at Stockholm on, July 14, 1967. It was last amended in 1979.

to the eventual formation of the World Intellectual Property Organization (WIPO) in 1970, itself in turn, becoming a specialised agency of the United Nations in 1974.

At that time India was not a member of the Paris Union[43] although a number of other G77 countries were;[44] however, this did not prevent the Indian Government calling for a revision of the Paris Convention as a condition for signing. Support for revising the Paris Convention in line with India's and the Andean Pact's position, came via The United Nations Conference on Trade and Development (UNCTAD) who throughout the 70s produced a number of reports supporting the G77 countries arguments,[45] indeed even in 1991 during the Uruguay round negotiations, UNCTAD stated that "the exact relationship between a strong system of intellectual property protection and increased transfer of technology remains uncertain ... more legal protection will not automatically lead to an enhanced process of technology transfer"[46]

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[43] India Joined the Paris Convention in August 1998. Having signed the TRIPs agreement, whose contents are far more onerous, there seemed little point in not joining The Paris convention. See Kumar, N. (1998) "India, Paris Convention and TRIPs" *Economic and Political Weekly* September 5th -12th 1998, pp.2334-2335.

[44] Brazil had joined in 1884, the Dominican republic in 1890, Mexico in 1903 and Cuba in 1904, a further 62 G77 countries joined the Paris Union after 1962.

[45] See for example UNCTAD (1974) *The Role of The Patent System in the Transfer of Technology to Developing Countries* TD/B/AC.11/19; UNCTAD (1975) *The International Patent System as an Instrument for National Development* TD/B/C.6/AC.2/3; and see also Vol.2(9) *World Development* 1974.

[46] UNCTAD (1991) *Trade and Development Report* UNCTAD/TDR/11 p.91.

The diplomatic conference for the Revision of the Paris Convention met four times between 1980 and 1984.[47] Although WIPO held some preliminary consultations as to a fifth meeting, the negotiations had by then reached an impasse. While the G77 countries pursued a number of issues during the negotiations including preferential treatment, the central stumbling blocks were Article 5quater,[48] which provides that Union Members extend the same privileges to imported products from another member country that they would to domestic ones; and Article 5A,[49] dealing with compulsory licensing. Article 5quater ran counter to the demand, coming from G77 countries, that patents should be worked in the country that grants them, while Article 5A was from a G77 perspective, in need of clarification.

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[47] See generally Sell, S.K. (1998) *Power and Ideas: North South Politics of Intellectual Property and Antitrust* (New York: State University of New York Press) & Ryan, M. (1998) *Knowledge Diplomacy: Global Competition and the Politics of Intellectual Property* (Washington DC: Brookings Institution Press)

[48] *Paris Convention for the Protection of Industrial Property* Article 5quater "When a product is imported into a country of the Union where there exists a patent protecting a process of manufacture of the said product, the patentee shall have all the rights, with regard to the imported product, that are accorded to him by the legislation of the country of importation, on the basis of the process patent, with respect to products manufactured in that country."

[49] 5A (1) Importation by the patentee into the country where the patent has been granted of articles manufactured in any of the countries of the Union shall not entail forfeiture of the patent. (2) Each country of the Union shall have the right to take legislative measures providing for the grant of compulsory licenses to prevent the abuses which might result from the exercise of the exclusive rights conferred by the patent, for example, failure to work. (3) Forfeiture of the patent shall not be provided for except in cases where the grant of compulsory licenses would not have been sufficient to prevent the said abuses. No proceedings for the forfeiture or revocation of a patent may be instituted before the expiration of two years from the grant of the first compulsory license. (4) A compulsory license may not be applied for on the ground of failure to work or insufficient working before the expiration of a period of four years from the date of filing of the patent application or three years from the date of the grant of the patent, whichever period expires last; it shall be refused if the patentee justifies his inaction by legitimate reasons. Such a compulsory license shall be non-exclusive and shall not be transferable, even in the form of the grant of a sub-license, except with that part of the enterprise or goodwill which exploits such license. (5) The foregoing provisions shall be applicable, *mutatis mutandis*, to utility models.

At issue during the negotiations to revise the Paris Convention were not only different perspectives on the functioning and justifications for IPRs, but, differences of opinion concerning the necessary constituents of development. Broadly speaking while OECD countries held that development is, in part, facilitated by a strong IPR framework that will then bring about foreign direct investment and technology transfer, the past experiences of G77 countries bore out the argument, that economic and social development could only be achieved through the stimulation of domestic production and the reduction of imports. In addition G77 countries saw socially important sections of the economy, such as food, agriculture and drug production as deserving of different standards of IPR protection, emphasising their public interest in keeping these sectors in the public domain. This difference of opinion, between countries in the two thirds world and those within the OECD, is one that still continues in negotiations on the implementation and renegotiation of the TRIPs agreement to which we shall now turn our attention.

Before doing so however, it is worth noting that with the impasse of the Paris Convention negotiations, the US began its own bilateral attempts to change the IPR regimes of countries such as Korea, India and China. Amendments in 1984 and 1988, to section 301 of the US Trade Act 1974 made it possible for the United States Trade Representative (USTR) to initiate "appropriate actions" against foreign governments which conduct acts, practices or policies that deny the "fair and equitable provision of adequate and effective protection of intellectual property rights." The US Trade Act allows individual companies and trade associations to petition the USTR as to countries they believe are

breaching trade agreements or harming US commercial interests, a process regularly undertaken by organisations such as PhARMA, the IPC and InBio. These petitions provide industry organisations, such as those representing the biotech industry, to heavily influence US trade policy in so far as they are then frequently relied upon by the USTR when identifying countries that are to be placed annually on either the watch list, or the priority watch list which are established under the Act.[50]

4.1. 3 The Uruguay Round and TRIPs

The TRIPs agreement came into force on the 1st January 1995,[51] its stated aim being the reduction of "distortions and impediments to international trade"[52] through the creation of 'minimum standards'[53] of intellectual property protection. The TRIPs agreement is, in other words, an attempt to prevent national IPR rules acting as non-tariff barriers to trade. The agreement covers

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[50] In the 2000 special 301 report the USTR "identified 59 trading partners that deny adequate and effective protection of intellectual property or deny fair and equitable market access to United States artists and industries that rely upon intellectual property protection," 16 of these were placed on the priority watch list, (Argentina, the Dominican Republic, Egypt, the European Union, Greece, Guatemala, India, Israel, Italy, Korea, Malaysia, Peru, Poland, Russia, Turkey, and Ukraine) while 39 others were placed on the "Watch List." The DSB has considered section 301 of the 1974 Trade Act and found it to conform with WTO rules in *United States – Sections 301-310 Of The Trade Act Of 1974* WT/DS152/R.

[51] For a general overview see Correa, C. M. (2000) *Intellectual Property Rights, The WTO and Developing Countries* (London: Zed Books/Third World Network) Correa, C. M. (1994) " The GATT Agreement on Trade Related Aspects of Intellectual Property Rights: New Standards for Patent Protection" [1994] 8 *EIPR* 327; Verma, S.K. (1996) "TRIPs Development and Transfer of Technology" Vol 27 (3) *IIC* 331; UNCTAD (1994) "Agreement on Trade Related Aspects of Intellectual Property Rights" *Trade and Development Report 1994 (Supplement)* UNCTAD/TDR/14; The South Centre (1997) *The TRIPs Agreement: A Guide for the South. The Uruguay Round Agreement on Trade-Related Intellectual Property Rights* (Geneva, Switzerland: The South Centre).

[52] TRIPs Agreement – preamble.

[53] Despite being described as minimum standards they provide higher levels of IPR protection than most of the two thirds word at the time possessed.

patents,[54] copyrights,[55] trademarks,[56] integrated circuit designs,[57] industrial designs,[58] geographical indicators[59] and trade secrets.[60] For our purposes however, we shall be concerned primarily with patents. The agreement provides a differential set of implementation periods for "developed," "developing" and "least developed countries," with the latter having until the 1st January 2005 to implement these 'minimum standards in their national legislation.[61]

Although the TRIPs agreement emerged out of the Uruguay round of GATT negotiations, this merely signalled a change of forum, at least in relation to patents, for issues that had remained unresolved for a number of years within

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[54] Articles 27-34.

[55] Articles 9-14.

[56] Articles 15-21.

[57] Articles 35-38.

[58] Articles 25-26.

[59] Articles 22-24.

[60] Article 39.

[61] Article 66 – However, where countries do not provide patent protection for "pharmaceutical and agricultural chemical products commensurate with its obligations under Article 27" by the 1st Jan 1995, then, under Articles 70.8 & 70.9 they must provide both a mailbox facility for the filing of patents and Exclusive Marketing Rights (EMRs)" for a period of five years after obtaining market approval in that Member or until a product patent is granted or rejected in that Member, whichever period is shorter, provided that, subsequent to the entry into force of the Agreement Establishing the WTO, a patent application has been filed and a patent granted for that product in another Member and marketing approval obtained in such other Member." In the case of India, non compliance with these articles, resulted in cases being brought by Europe (*India - Patent Protection for Pharmaceutical and Agricultural Chemical Products* - WT/DS79/R) and the US (*India - Patent Protection for Pharmaceutical And Agricultural Chemical Products* WT/DS50/R & *India - Patent Protection for Pharmaceutical And Agricultural Chemical Products* - WT/DS50/AB/R) in the WTO. These in turn led to the subsequent amendment of section 24 of the Patents Act 1970 by the Patents Amendment Act 1999 in order to comply with both TRIPs and the Panel and Appellate body decisions. For an overview of the WTO decisions see Macdonald Brown, C & Ferera, L. (1998) "First WTO Decision on TRIPs" [1998] (2) *EIPR* 69-73; Reichman, J. H. (1999) "Securing Compliance With The TRIPs Agreement After US v India" Vol.1 (4) *Journal of International Economic Law* pp.585-601. And for a criticism of India's course of actions see

the World Intellectual Property Organisation (WIPO).[62] The inclusion of IPR issues in the Uruguay round of the GATT negotiations, signalled a strategic shift of forum, following the stalling of negotiations within WIPO which had, at least from the US perspective, aimed at bringing the Paris Convention in line with US standards of IP protection in the early eighties.[63] The central players in achieving this move were however not states, nor the office of the USTR, although the USTR was itself mobilised, they were multinational companies, initially just two companies, IBM and Pfizer.

Pfizer's central concern lay in gaining stronger patent protection for pharmaceuticals, which, as in India, many countries explicitly excluded from product patent protection, while IBM, were concerned with both stronger international patent protection for their computer hardware and explicit recognition of copyrights for software.[64] As Michael Ryan comments, "together Pfizer and IBM fostered a strategy of multilateral diplomacy using the forum provided by the GATT's Advisory Committee on Trade Policy and Negotiation

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Dhar, B. (1998) "Complying with TRIPs Commitment: EMR versus Product Patent Regime" *Economic and Political Weekly*, December 19th 1998, pp.3230-3231.

[62] One of the suggestions for the impetus by the US to move discussions on IPRs from WIPO to the Uruguay round negotiations was the ability to trade 'concessions' in other area such as agriculture and textiles see Subramanian, A. (1990) "TRIPs and the Paradigm of the GATT: A tropical Temperate View" Vol. 13(4) *World Economy* pp.509-521 and Ryan, M.P. (1998) *op cit. n.*48.

[63] Similar moves had been attempted to strengthen the Berne Convention in relation to copyright interestingly the 1971 revision had granted special treatment for developing countries.

[64] On IBMs vigorous protection of its IP and US policy generally during the eighties see See Mody, A. (1990) "New International Environment for Intellectual Property Rights" in Francis W. Rushing & Carole Ganz Brown (eds.) *Intellectual Property Rights in Science Technology and Economic Performance* (Boulder, Colorado: Westview Press).

(ACTPN) on which their chief executive officers were represented."[65] Indeed Edmund T. Pratt, Pfizer's CEO, was the ACTPN's chairman.

At the beginning of the Uruguay round Edmund Pratt and IBMs chairman John Opel, established the Intellectual Property Committee (IPC), to co-ordinate policy positions for the negotiations;[66] the IPC was then joined by similar manufacturing organisations from Europe[67] and Japan.[68] Here is how the then CEO of Monsanto, James Enyart, has described the ensuing process.

> "Since no existing trade group or association really filled the bill, we had to create one [...] once created the first task of the IPC was to repeat the missionary work we did in the US in the early days, this time with the industrial associations of Europe and Japan to convince them that a code was possible [...] we consulted many interest groups during the whole process. It was not an easy task but our Trilateral Group was able to distil from the laws of the more advanced countries the fundamental principles from protecting all forms of intellectual property [...] besides selling our concepts at home we went to Geneva where we presented our document to the staff of the GATT secretariat. [...]

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[65] Ryan, M. (1998) *op cit n.*48, p.68.

[66] The Committee remains in existence today, although with a slightly different membership, and lobbies on IP issues in Washington and Geneva. The original thirteen members of the IPC were - Bristol Myers, Du Pont, Pfizer, Johnson & Johnson, Merck, Monsanto, General Electric, General Motors, Hewlett Packard, IBM, Rockwell, Warner Brothers, FMC Corporation, interestingly enough, given the final content of the TRIPs agreement, six of these companies were at the time involved in developing biotechnological products.

[67] Union of Industrial and Employees Confederations (UNICE).

[68] The Keidanren.

> what I have described to you is absolutely unprecedented in GATT. Industry has identified a major problem for international trade. It crafted a solution, reduced it to a concrete proposal and sold it to our own and other governments [...] The Industries and traders of world commerce have played simultaneously the role of patients, the diagnosticians and the prescribing physicians."[69]

The TRIPS agreement has implications for many aspects of the two third world's economic and social policies,[70] particularly in relation to public health, pharmaceutical pricing and production,[71] however as our concern here is biodiversity and GM crops, I intend covering in detail only those aspects of the TRIPs agreement relevant to this. Of central importance in this respect is Article 27 dealing with patents.

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[69] Enyart, J. (1990) "A GATT Intellectual Property Code" *Les Nouvelles* XXV (2) pp.53-56.

[70] While we look at the impact of TRIPs for Biodiversity below, for some early assessments of the potential negative impact of TRIPs for India in particular, see Nair, K & Kumar (eds.) (1994) *Intellectual Property Rights* (New Delhi: Allied Publishers) Justice VR Krishna Iyer, Justice O Chinnappa Reddy, Justice DA Dessai and Justice Rajinder Sachar (1996) *Report of the Peoples Commission on GATT on The Constitutional Implications of the Final Act Embodying The Results of The Uruguay Round Of Multilateral Negotiations* (New Delhi: Centre For the Study of Global Trade System and Development); Dhavan, R, & Prabha, M. (1995) "Patent Monopolies and Free Trade; Basic Contradiction in Dunkel Draft" Vol. 37 (2) *Journal of The Indian Law Institute* 195; Menon, U. (1993) "TRIPs Negotiations and Indian Agriculture" Vol.52 *Journal of Scientific & Industrial Research* pp.296-303; Gana, R. L. (1996) "Prospects For Developing Countries Under The Trips Agreement" Vol. 29 *Vand. J. Transnat'l L.* 735; Gana, R. L. (1995) "Has Creativity Died In The Third World? Some Implications Of The Internationalization Of Intellectual Property Vol.24 *Denv. J. Int'l L. & Pol'y* 109.

[71] See Keyala, B.K. (1999) *TRIPs Agreement on Patent Laws: Impact on Pharmaceuticals and Health For All* (New Delhi: Centre For The Study of Global Trade Systems and Development), and for access to essential drugs see the Consumer Project on Technology at http://www.cptech.org/ip/health/ who have been working with Medicine Sans Frontier on IPRs and essential drug issues, see the MSF campaign website at http://www.accessmed-msf.org/

Article 27 provides that members must allow product and process patents for a period of 20 years "provided that they are new, involve an inventive step and are capable of industrial application"(27.1). Member countries must not discriminate against imports and therefore patents need not be worked domestically (27.1). Members may exclude patents where "necessary to protect *ordre public* or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment" (27.2) and although they may specifically exclude patents on plants and animals they must provide protection for "microorganisms, and essentially biological processes for the production of plants or animals." (27.3.b) In addition "Members shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof" (27.3.b).

Taken together the different elements of Article 27 require that countries provide patents on biotechnological products and process (which would include GM crops) for a period of twenty years. This obviously runs counter to sections 3 and 5 of the Indian Patents Act 1970, in so far as products capable of being a food or a medicine are not capable of protection under the 1970 Act. Similarly with the requirement for a 20 year period of protection for plant varieties either through patents or another "effective system."

One of the key aspects of this Article is the inclusion of the word "effective." Although farmers rights[72] Community Intellectual Rights (CIRs) and Traditional Resource Rights (TRRs), have been proposed as possible *sui generis* systems,[73] whether these would be regarded as "effective," in respect of any action bought for consideration in the DSB, is a moot point.[74] The African group, India and others have argued that as both Article 27.3(b) is open for review from 1999 and that the whole TRIPs agreement is up for review from

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[72] The notion of farmers rights has been developed in relation to the FAO's International Undertaking on Plant Genetic Resources (for discussion on the IUPGR see 3.1.3 above) and in the present context see Swaminathan, M.S. (1998), "Farmers' Rights and Plant Genetic Resources." *Biotechnology and Development Monitor*, No.36, p.6-9. Attempts to include Farmers Rights in legislation can be seen in the texts proposed by the Bangladesh National Committee on Plant Genetic Resources (NCPGR) for a Plant Varieties Act of Bangladesh and the related Biodiversity and Community Knowledge Protection Act of Bangladesh. The Gene Campaign in India have also proposed farmers rights as the basis for sui generis legislation in their *Convention of Farmers and Breeders* CoFab.

[73] See for example Grain (1999) *Beyond UPOV Examples of developing countries preparing non-UPOV sui generis plant variety protection schemes for compliance with TRIPS* (Barcelona: Grain); Seiler, A. (1998), "Sui Generis Systems: Obligations and options for developing countries." *Biotechnology and Development Monitor*, No.34, p.2-5; Louwaars, N. P. (1998), "Sui Generis Rights: From opposing to complementary approaches." *Biotechnology and Development Monitor*, No.36, p.13-16.

[74] There is no reason why countries should choose to adopt the UPOV 91 model, however as more countries do so, the greater is the likelihood that the DSB would look to UPOV 91 in assessing the effectiveness of any other *sui generis* national legislation. As part of a review procedure on the implementation of Article 27, the TRIPs council were notified that 17 out of 18 respondents had put in place *sui generis* systems using UPOV as their model, (see WTO (1999e) *The Relationship Between The Convention On Biological Diversity (CBD) And The Agreement On The Trade-Related Aspects Of Intellectual Property Rights (TRIPs); With A Focus On Article 27.3 (B)* WT/CTE/W/125). What is more in 1999 the Organisation Africaine de la Propriété Intellectuelle (OAPI) (which comprises Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Cote d'Ivoire, Djibouti, Gabon, Guinea, Mali, Mauritania, Niger, Senegal and Togo) indicated that they were going to accept UPOV 91. (GRAIN (1999). *Plant variety protection to feed Africa? Rhetoric versus reality* (Barcelona: GRAIN); RAFI (1999) "Francophone African OAPI States Are Out-of-Step with OAU and other African Countries", *Geno-Types*, 24 February 1999). This move runs contrary to the position of the OAU, however, which from March 1998, made a number of statements concerning not only the inappropriateness of TRIPs Article 27 as it currently stands, but also, the intention of the OAU to develop a Model Law defining breeders' rights; farmers' rights, benefit-sharing and access to genetic resources, the details of which were finalised in November 1999. The African group, in their submission to the WTO on 29th July 1999, signalled a similar position in their suggestions for revising Article 27 see, WTO (1999f) *Preparations For The 1999 Ministerial Conference - The TRIPS Agreement - Communication from Kenya on behalf of the African Group 29 July 1999* WT/GC/W/302.

2000[75] then there should be no implementation of the TRIPs agreement until such time as the review process is finished, this would also provide the possibility of defining what elements might comprise an effective *sui generis* system.[76] This position is however, strongly opposed by the US.

4.2 TRIPs, the CBD and Genetic Resources

By virtue of article 27, the TRIPs agreement requires that states not only provide IPR protection for plants, whether by patents or another *sui generis* system, but that they also, provide patent protection on the products and process of rDNA technology. While these requirements, in relation to biotechnology, extend internationally the position that has existed in the U.S. since 1980 and the landmark case of *Diamond* v. *Chakrabarty*,[77] as we have seen above, many countries, such as India, have until now, considered it in the public interest not to allow IPRs on products which can be used as a food or a drug. Thus the TRIPs agreement mounts a serious challenge to

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[75] Article 71.1.

[76] See WTO (1999f) *op.cit n.*75 and WTO (1999g) *Preparations For The 1999 Ministerial Conference Implementation Issues to be Addressed Before/At Seattle Communication from Cuba, Dominican Republic, Egypt, El Salvador, Honduras, India, Indonesia, Malaysia, Nigeria, Pakistan, Sri Lanka and Uganda, 1st October 1999* WT/GC/W/354.

[77] 447 US 303, 65 L.ed 2d 144, 100 S Ct. 2204, guidelines issued by the USPTO in January 2001, state that it will turn down patents on gene sequences unless applicants state at least one "specific, credible and substantial" use for the gene (Vol.66 (4) *Federal Register*, Friday January 5th 2001, pp.1092-1099). On the patenting of biotechnology generally see Walden, I (1993) "Intellectual Property in Genetic Sequences" Vol.2(2) *RECIEL* 126; Llewelyn, M. (1994) "Industrial Applicability/Utility and Genetic Engineering: Current Practices in Europe and the United States" Vol.16 (11) *EIPR* 437; Crespi, C. (1995) "Biotechnology Patenting: The Wicked Animal Must Defend Itself' Vol.17 (9) *EIPRI* 431; Llewelyn, M. (2000) "The Patentability Of Biological Material: Continuing Contradiction And Confusion" Vol. 22(5) *EIPR* 191; Hettinger, N. (1995) "Patenting Life: Biotechnology, Intellectual Property, And Environmental Ethics" *Boston College Environmental Affairs Law Review* 267; Doll, J. (1998) The Patenting of DNA Vol.280 *Science* 689; Heller, M.A. & Eisenberg, R.S. (1998) Can Patents Deter Innovation? The Anticommons in Biomedical Research Vol.280 *Science* 698;

countries wishing to pursue their own routes of socio economic development, limiting the ability of states to legislate in their public interest.

Although 27.2 of TRIPs refers specifically to the environment by providing states the ability to exclude from patentability inventions, "the prevention within their territory of the commercial exploitation of which is necessary to protect *ordre public* or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment," this exception is not dissimilar to those found within the Article XX GATT and the SPS Agreement, and therefore, in relation to any dispute bought to the DSB would likely be interpreted in similar fashion. In other words, evidence of environmental harm posed by the patenting of particular products would have to be based on a non-discriminatory, non-arbitrary, scientific case by case risk assessment of the specific risk posed for the environment by a specific product. The implications of the TRIPs agreement for biodiversity generally, and the CBD in particular, extend beyond merely the potential risk of one particular product for their environment.

The relationships and synergies between the CBD and TRIPs are multifaceted if not always fully recognised.[78] In the last chapter we saw that the CBD is

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Roberts. T (1994) "Broad Claims for Biotechnological Inventions" Vol.(9) *EIPR* 373; Crespi, T.S. (1995) "Biotechnology, Broad Claims and the EPC" Vol.(6) *EIPR* 267).

[78] For the relationship between TRIPs and the CBD see generally - Dutfield, G. (2000) *Intellectual Property Rights, Trade and Biodiversity* (London: Earthscan / IUCN); Yamin, F. (1995) *The Biodiversity Convention and Intellectual Property Rights* (Gland, Switzerland: WWF); Cameron, J. & Makuch, Z. (1995) *The UN Biodiversity Convention and the WTO TRIPs Agreement: Recommendations to Avoid Conflict and Promote Sustainable Development* (Gland, Switzerland: WWF); Purdue, D. (1995) "Hegemonic TRIPs: World

based less on the maintenance of the four interlinked elements of biodiversity described in Chapter 2, that is genetic diversity, species diversity, ecosystem diversity and cultural diversity; and more, on the conservation of plants animals and other organisms as valuable "genetically coded functions."[79] Although the CBD is often described as a deal in which "conservation of and access to southern biodiversity, including genetic diversity are given in exchange for access to Northern biotechnology and funding."[80] It is important to keep firmly to the forefront of our minds that access to and utilisation of a countries genetic resources are carried out on *a bilateral* basis, not, with a fictional north, but an individual company or university, while, the genetic resources of which the CBD speaks are posited as the property of sovereign states, not a common and fictionalised south, or, for that matter, the

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Trade, Intellectual Property and Biodiversity" Vol. 4.(1) *Environmental Politics* pp.88-107; Baer, K.W. (1995) "A Theory Of Intellectual Property And The Biodiversity Treaty" Vol.21 *Syracuse J. Int'l L. & Com.* 259; Swanson, T. (1995) (ed) *Intellectual Property Rights and Biodiversity Conservation: An Interdisciplinary Analysis of the Values of Medicinal Plants* (Cambridge; Cambridge University Press); UNEP (1996) *The Convention on Biological Diversity and the Agreement on Trade Related Intellectual Property Rights (TRIPs: Relationships and Synergies* UNEP/CBD/COP/3/23; UNEP (1996) *The Impact of Intellectual Property Rights Systems on The Conservation and Sustainable Use Of Biological Diversity And On the Equitable Sharing of Benefits From Its Use: A Preliminary Study* UNEP/CBD/COP/3/22; WTO (1995) *Environment and Trips* WT/CTE/W/8; Bosselmann, K. (1996) "Plants And Politics: The International Legal Regime Concerning Biotechnology And Biodiversity" *Colorado Journal of International Environmental Law and Policy* 111; Lesser, W. (1997) *The Role of Intellectual Property Rights in Biotechnology Transfer under the Convention on Biological Diversity ISAAA Briefs No. 3.* (ISAAA: Ithaca, NY.).

[79] Vogel, J. & Ingram, G. (1993) "Biodiversity or Genetically Coded Functions The importance of definitions" Vol.2 (2) *RECIEL* pp.121-125. In which Vogel and Ingram argue for the use of the term GCF (genetically coded functions) instead of biodiversity because "by thinking in terms of GCFs, the product of evolution, i.e. genetic information, becomes a commodity. By creating intellectual property rights over that commodity ... the market will bid up the value of habitats on the likelihood of GCFs" at 124. see also Vogel, J. (1994) *Genes for Sale: Privatization as a Conservation Policy* (Oxford: Oxford University Press).

[80] Roht-Arriazza, N. (1997) "Of Seeds and Shamans the Appropriation of the Scientific and Technical Knowledge of Indigenous and local Communities" in Bruce Ziff and Praima V. Rao, (eds.) Borrowed Power: Essays on Cultural Appropriation (New Brunswick, New Jersey: Rutgers University Press) p.259.

communities whose knowledges are drawn upon in commercialising genetic resources.

In many ways therefore the CBD not only legitimates but also encourages the private ownership of germplasm, together with strong and effective IPRs to maximise the economic value of biodiversity as Genetically Coded Functions. While article 16 of the CBD makes explicit some of the linkages between the CBD and IPRs many of the relationships between the two are implicit, not to mention that the extension of IPRs to plants and biotechnological products has the potential to undermine many of the CBD's aims, and certainly the misplaced hopes that many have in the CBD for the maintenance of biodiversity.

The CBD provides both a mechanism and a framework through which biodiversity is ordered; biodiversity is translated and transformed from the multiple and socially contextual heterogeneous meanings which are found in the practices of a myriad different communities throughout the world, into a still socially contextual and diverse set of meanings that are more manageable. In other words the CBD must become what Fujimura in another context calls a "standardised package,"[81] it must attain, a certain degree of agreement around its core concepts, in order that its work can be done. It is in the dong of this work, the unfolding of practices that not only take place within

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[81] Fujimura, J.H. (1992) "Crafting Science: Standardised Packages, Boundary Objects and 'Translation'" in Andrew Pickering (ed.) *Science as Practice and Culture* (London: University of Chicago Press).

time and space but which simultaneously construct time and space that biodiversity is reordered. Importantly this is not the impoverishment or emptying out of meaning and particularly not the substitution of the traditional for the modern, but the importation and translation of meaning, dense new meanings which are neither abstract nor abstracted from individuals day to day lives. Indeed it is only in the enrolment of other actor/agents into this topological network that the performative power of the CBD can be expressed. Thus as the CBD becomes an obligatory point of passage, through which actions in relation to biodiversity are co-ordinated, the further the CBDs mode of ordering is extended in time and space, bringing together, human and non human objects within its topological region.

One of the central objectives of the CBD as we have seen already seen, and as stated in Article 1, is the "fair and equitable sharing of the benefits arising out of the utilization of genetic resources." This objective is further elaborated in the CBD through provisions found in Articles 8(j), 15, 16 and 19. Article 19.2 explicitly provides that states "shall take all practicable measures to promote and advance priority access on a fair and equitable basis by Contracting Parties, especially developing countries, to the results and benefits arising from biotechnologies based upon genetic resources provided by those Contracting Parties;" however, through the separation of the tangible and intangible components of biodiversity the situation has arisen whereby the informational components of biodiversity, in particular the sequences of Gs,Ts,Cs, and As, which code for specific genetic characteristics, have been constructed by courts and patent offices, as being in the public domain or *res*

communis,[82] not as the property of sovereign states, or even individual human beings. Thus, when a previously unknown genetic sequence is isolated and then a novel use found for it, IPRs in the form of a patent are available for both the method of isolating the genetic sequence and the resulting genetic product.

The granting of patents on products and processes developed from biodiversity in the two thirds world, has been dubbed by many as "biopiracy."[83] While the term biopiracy is intentionally both provocative and emotive, alluding to the onset of a novel form of (genetically?) modified colonialism by MNCs, universities and research institutes, it also, to some degree, reinforces the commodification of biodiversity through the assertion that sovereign states, or peoples, have been robbed of their genetic property. While it would be possible to examine any number of examples of biopiracy,[84] the manner in

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[82] Correa,C. (1994) *Sovereign Rights over Plant Genetic Resources, Background Study Paper No.2 First Extraordinary Session of The Commission Plant Genetic Resources* (Rome: FAO).

[83] See Shiva, V. (1997) *Biopiracy: The Plunder of Nature and Knowledge* (Boston, MA: South End Press); Aoki, K. (1998) "Neocolonialism, Anticommons Property, And Biopiracy In The (Not-So- Brave) New World Order Of International Intellectual Property Protection" Vol.6 *Ind. J. Global Legal Stud.* 11; Roht-Arriaza, N. (1996) "Of Seeds And Shamans: The Appropriation Of The Scientific And Technical Knowledge Of Indigenous And Local Communities" Vol.17 *Mich. J. Int'l L.* 919; Odek, J.O. (1994) "Bio-Piracy: Creating Proprietary Rights In Plant Genetic Resources" Vol.2 *J.Intell.Prop.L* 141.

[84] For more details see the web sites of GRAIN http://www.grain.org & RAFI at http://www.rafi.org . It is not only the products of *in situ* diversity on which attempts have been made to attain IPRs. Materials held in *ex situ* collections held by one or other of the International Agricultural Research Centres have on occasion been the subject of claims. Plant breeders rights were claimed on two chickpea varieties from ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) in 1998 but were later abandoned following international condemnation. Under trust agreements drawn up in 1994 between each of CGIAR's institutions and the FAO, the accessions are meant to be held "on trust for the benefit of the international community, in particular the developing countries in accordance with the international Undertaking on Plant Genetic Resources" (Article 3a of the Trust Agreements). Similarly on 20th December 2000 the International Center for Tropical Agriculture, filed a formal request for the re-examination of US patent no. 5,894,079 on a

which patent offices and the courts separate the tangible and intangible elements of biodiversity can perhaps be seen to best affect by comparing two US patents, US 5,326,580[85] on *Brazzein Sweetener* and US 5,401,504 on *The Use of Turmeric in Wound Healing*.

4.2.1 US 5,401,504 - The Use of Turmeric in Wound Healing

On December 28th 1993 Suman K. Das and Hari Har P. Cohly, on behalf of the University of Mississippi Medical Centre filed a claim for "a method of promoting healing of a wound in a patient, which consists essentially of administering a wound healing agent consisting of an effective amount of turmeric powder to said patient."[86] The patent application quite openly stated that, "although it is primarily a dietary agent, turmeric has long been used in India as a traditional medicine for the treatment of various sprains and inflammatory conditions. ... The active ingredient in turmeric powder is curcumin, which is completely symmetrical molecule ... At present there is no evidence to indicate that habitual consumption of humans has any toxic effect in humans."

The Indian Council of Scientific and Industrial Research (CSIR) decided to challenge the patent on the grounds of obviousness. For, not only were medical journals cited in the patent application evidence of the non-

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variety of Mexican yellow, or "Enola," bean. Although the beans were not obtained from CIAT's accession, the challenge notes that CIAT maintains over 260 bean samples with yellow seeds, 6 of which are "substantially identical" to those claimed in the patent.

[85] Continued in US 5,741,537 US 5,527,555, and US 5,346,998 and

[86] US Patent No. 5,401,504

obviousness of the claims, but as far back as 1956 the CSIR had, in a glossary of Indian medicinal plants, referred to the wound healing properties of Turmeric. Like the so called 'patents' on Neem[87], and Basmati Rice[88] the 'patent' on turmeric, or *haldi*, was a symbolic and highly charged political issue in India, considered not only as the theft of "grandma's home grown remedy" but the taking of a part of India's history, culture and heritage.[89]

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[87] One 'act of bio piracy' most frequently referred to is the 'patenting' of the Neem tree, (see for example Shiva, V. & Holla-Bhar, R. (1993) "Intellectual Piracy and the Neem Tree" Vol.23 (6) *The Ecologist* pp.223-227). Beyond the rhetoric and political manoeuvring, it is important to note that the Neem tree has not been patented, and indeed cannot be patented, there were however, as of September 2000, 172 patents on products and processes derived from Neem. Some of these belong to Indian companies outside of India, indeed I personally know of two instances where a memorandum of understanding was entered into between a Canadian NGO (The International Development Research Centre IDRC) and the Vittal Mallya Scientific Research Foundation (VMSRF) whereby the IDRC would own the technologies developed from "Project Neem (India)" in all other countries but India. (In India the technologies were to be owned jointly by VMSRF and the Government of India with the IDRC holding a licence). The wonders of neem have been know by farmers and others in India for countless generations, however following a report by the US National research Council into Neem's many properties, interest outside of India increased with the general approach towards it being, as *Science* commented in 1992, that "squeezing bucks out of Neem ought to be relatively easy" (*Science* 17th January 1992 p.275). On May 10th 2000, the EPO, revoked European Patent No. 436,257 for "a method for controlling fungi on plants by the aid of hydrophobic- extracted neem oil" held jointly by W.R. Grace and the USDA. (see, The Hindu, Friday, May 12, 2000 "India wins patent war over neem;" *The Hindu*, Wednesday, May 17, 2000 "Winning the war against bio-colonisation;" *The Hindu*, Wednesday, May 17, 2000, "Patenting rationale and status of neem;" *The Hindu*, Saturday, May 20, 2000, "*The Hindu*-Editorial: Preventing patents;" *Indian Express*, Friday, May 19, 2000 "Pune entrepreneur won neem patent battle" ; Vol.9(2) *Down To Earth* News: "Back Where It Belongs" June 15th 2000 p.15) The revocation of this particular patent on the grounds of obviousness can hardly be seen as a victory against the patenting of genetic resources, nor, does it suggest either the recognition of sovereign rights over genetic resources, or, the recognition of community rights.

[88] On September 2nd 1997 The US patent office granted US 5,663,484, to a Texas based company Rice Tec on "Basmatti Rice Lines and Grains." Much has been made of the potential breadth of the patent in so far as immediately preceding the claims, the patent states that "variations which are functionally equivalent are within the scope of this invention." In addition the use of the term Basmati itself has led to criticism, with arguments that it should be considered a geographic indicator in the same manner as Champagne or Bordeaux. The Indian Government are preparing a challenge to the patent although Rice Tec stands by its claim that there is nothing challengeable within US 5663484. On a related note, on the 27th January, 2001, *The Guardian* (p.2) reported that scientists at Syngenta had unravelled the genome for rice, and were planning to exploit those elements for which they have a use, with Myriad Genetics. The report also commented that there are already 229 patents on rice traits.

[89] *The Week*, August 4th 1996 p.12.

In September 1997, the CSIR succeeded in their battle to get the US Patent and Trademark Office (USPTO) to revoke US 5,401,504, a decision regarded as a major victory by many of those who argue that biopiracy is undermining the implementation of the CBD. To consider the revocation of the patent on the Use of Turmeric in Wound Healing a victory over bio-pirates is to be persuaded by a mistaken belief that what was achieved in the revocation of the patent, was the recognition of India's sovereignty over both its traditional knowledge and genetic resources. It is important to remember firstly, that there was never a patent on Turmeric, but on "the use of turmeric in wound healing", the discovery of a tangible pre-existing product of nature, Turmeric, would never have been granted. The revocation of US 5,401,504 does little more than recognise that in this particular case, one of the criteria for granting a patent was not met due to the intangible element being obvious. Indeed that the patent on Turmeric has been revoked, rather than representing any form of change in policy at the USPTO, merely reinforces the claims of geneticists that patents on genetic sequences isolated from a product of nature and for which a novel utility has been found, are not only novel applications of knowledge but, non obvious applications of knowledge.

The revocation of the patent, leaves many problems unresolved not least that recognised by the Indian Government in a submission to the WTO, when it states that the "the time, effort, and money involved in getting individual patents examined and revoked in foreign patent offices is prohibitive. Hence,

an internationally accepted solution to such bio-piracy is necessary."[90] Most significantly however, despite the revocation of the patent on Turmeric, there is nothing to prevent a patent being granted for both a process that isolates the genetic sequence or sequences that make up the active elements of Turmeric together with any products developed containing those isolated sequences. To understand more fully why this is the case, it is worth considering briefly US 5,741,537.

4.2.2 US 5,741,537 – Brazzein Sweetener

In the West African State of Gabon there grows a climbing shrub referred to as the *l'arbe j'oublie* by locals and by its Latin name of *Pentadiplandra Brazzeana Baillon* by botanists. The shrub grows red berries of about five centimetres in diameter, which, because of their sweetness, are eaten by animals and humans alike. Following a trip to southern Gabon, by scientists from the University of Wisconsin, Madison, in 1993 the University sought and were granted a patent, US 5,326,580, claiming an invention which "involves the isolation of a new sweet protein from *Pentadiplandra brazzeana Baillon*, herein named 'Brazzein'."[91]

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[90] WTO (2000) *Protection Of Biodiversity And Traditional Knowledge – The Indian Experience, Submission by India* WT/CTE/W/156 & IP/C/W/198, 14 July 2000.

[91] US Patent No. 5326580

The University of Wisconsin claimed, or rather still claim,[92] not only to be able to isolate a new protein called *Brazzein*, but to be its inventors. This protein, they argue, can be isolated from the rest of the genetic structure of *Pentadiplandra Brazzeana Baillon* and, because it did not occur naturally in this isolated state was both novel, and involved an inventive step. As claim 1 of the patent states, "we claim a sweet protein containing an amino acid sequence according to SEQ ID NO:4 amino acid residues 2-54, wherein the protein has been produced recombinantly and is essentially free of Pentadiplandra brazzeana plant material other than Brazzein."[93] Similarly, claim 5 of the patent is for "an isolated and purified DNA sequence that encodes the protein of claim 1."[94]

US 5,236,580 includes a claim on a particular genetic sequence, a sequence found within the DNA of *Pentadiplandra Brazzeana Baillon,* that grows in Gabon, but, for which the University of Wisconsin are granted limited proprietary rights as inventors of a means of isolating Brazzein. This is not however simply a claim on a process of isolating Brazzein, but a claim for Brazzein as a product, indeed the breadth of the claim is expanded in US 5741537 to include "a method of increasing the sweetness of a composition selected from the group consisting of foods and beverages comprising the step of adding sufficient amount of Brazzein protein to the composition, so

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[92] There are currently at least nine patents on Brazzein filed world-wide by the University of Wisconsin US 5,741,537; US 5,527,555; US 5,346,998; US 5,326,580; ZA9503888; ZA9401061; WO9531547; WO9419467 and EP0684995.

[93] US Patent No. 5,326,580.

[94] US Patent No. 5,527,555

that the composition has an increased sweetness, wherein the Brazzein protein has been produced in a recombinant host cell and said protein has been isolated"[95]

The reason behind The University of Wisconsin's keenness to pursue this claim can be found in the patent application itself, for not only is Brazzein, "2,000 times sweeter in 2% solution than a 2% sucrose solution," but "thermostability tests indicate that this protein has greatly desired heat stability characteristics (thus making it much more suitable for use in connection with baking). In this regard, the protein still tasted very sweet after two hours of incubation at 98 DEG C."[96] Given that aspartame, one of the leading artificial sweeteners, loses its sweetness when exposed for long periods to high temperatures and, that there is a world-wide market for sweeteners in excess of $100 billion, one does not need to be of a rapacious nature to understand Wisconsin's motivations. When asked by a representative from RAFI whether the University of Wisconsin were going to share with Gabon, any of the benefits that may accrue to them by virtue of their patent, a spokesman for the University stated that Brazzein "is an invention of a UW-Madison researcher ... Wisconsin has no connection to Gabon."[97] In the meantime, not only have the University of Wisconsin licensed the technology to a number of companies, but they have sold the exclusive rights to NekTar, a company that

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[95] Claim 1, US 5741537.

[96] US Patent No. 5,527,555.

[97] RAFI *Communique* Sep/ Oct 1995.

have successfully modified maize to express Brazzein genes. Jim Eckles, the CEO of NeKtar Worldwide, is reported to have said that "we expect to extract one kilogram of Brazzein from a ton of corn processed. This doesn't sound like much until you realize that this equates in sweetness to at least 1,000 kilograms of sugar."[98]

The cases of Brazzein and of Turmeric may appear similar, but this is only because they both involve biological material and the use, to a greater or lesser extent, of pre-existing knowledge. The inherent logic of the patent system is one, which has always recognised that "inventors" build on a pool of common intangible knowledge; indeed, this premise is at the centre of the notion that full details of inventions should be published. Thus, the utilisation of pre-existing knowledge in order to develop novel process and products is fundamental to the patent system, limited only by the requirement that a new and further application of knowledge has occurred.

What marks the difference between these two patents is the process of translation found in the patent on Brazzein, but not in that on the use of Turmeric in wound healing. The Turmeric patent does not contain a process by which the active parts of Turmeric are translated into the Gs, Ts, Cs and As of genetic code, indeed it is in this intangible process of re-coding that the inventive step necessary to grant a patent on any other biological material is to be found, provided of course that there is some utility to which the code can

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[98] RAFI (2000) *Communique* May/June 2000.

be put. Vandana Shiva has written that "the argument that intellectual property is only recognisable when performed in laboratories with white lab coats is a fundamentally a racist view of scientific development."[99] Drawing a distinction in this way between, 'traditional' or 'local knowledge' and 'scientific knowledge' is however, while admittedly serving a political purpose, both crude and essentially untenable. More significantly however, it leaves open the mistaken belief that the CBD and IPRs can work to maintain biodiversity.

It is important to understand the logic of IPRs to know them for what they, and recognise the limits of the goals which they can achieve. In allowing the patenting of biotechnological products and procesess on food, medical and agricultural products, the means are provided by which the structure of nature can be rewritten and then extended through time-space. Indeed the power relations that are at work are captured in the very chains of translations through which power functions, as Donna Harraway observes, "sciences and modern biologies are constructed by a common move –*the translation of the world into a problem of coding,* a search for common language in which all resistance to instrumental control disappears and heterogeneity can be submitted to disassembly, reassembly, investment and exchange."[100] Harraway's insight illuminates one of the central problems of the CBD and it's recognition of IPRs, for, through this recognition, the CBD legitimates and

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[99] Shiva, V. (1991) "Dispossession of Knowledge: Theft of Third World Resources and Intellectual Property" in *Third World Resurgence* No.8 April 1991.

[100] Harrway, D. (1991) *Simians, Cyborgs and Women: The Reinvention of Nature* (London: Free Association Books) p.164 and in Harraway (1985) "A Cyborg Manifesto: Science, Technology and Socialist Feminism in the 1980's Late Twentieth Century" *Socialist Review 80* pp.65-108.

facilitates the reduction of diversity to a language of Gs, Ts, Cs, and As. In place of heterogeneous knowledges about biodiversity, nature becomes coded information to be utilised, privatised and exploited by those with the technologies to do so. In the very process of translating diversity into genetic code we see the exercise of power, an exercise that is then extended by IPR regimes through time and space.

4.2.1 A Share in the Benefits?

It would be wrong to suggest that all bioprospecting is undertaken with the same dismissive attitude, as that adopted by the University of Wisconsin, Madison, towards the positive assertions of peoples and states, in respect of the tangible and intangible rights claimed over biodiversity. There are many, including those within life science companies, who genuinely believe that in line with the Biodiversity Convention,[101] benefits arising from the utilisation of knowledges about biodiversity should be distributed with those peoples or states, from which that knowledge came.

From a practical perspective, prospective bioprospectors have had to come to terms with a changing ethical and legal landscape. As more countries implement the CBD in national legislation, permits to bioassay the flora and fauna of a country are only being granted in return for a share in any potential future benefits, including profits. It is thus becoming far less easy for

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[101] Article 19 requires contracting parties to take "all practicable measures" to ensure the distribution of the benefits of biotechnology to those parties who provided the original genetic resource.

companies and institutions to act in a similar manner to that of the University of Wisconsin over Brazzein. The issues of access to biodiversity, IPRs, and the equitable sharing of benefits arsing from the utilisation of genetic resources, remain however, both inextricably linked and not easily resolvable.[102]

Collaborative contracts are encouraged by the CBD through both its general underlying principles, and the text of specific articles, particularly 8(j), 15, 16, 17, 18 & 19. Indeed, article 18 specifically requires that parties promote technical and scientific cooperation and, in particular, "joint ventures for the development of technologies relevant to the objectives of this convention."[103] These collaborative programmes can be either bilateral, or multilateral,[104] with perhaps the most well known example of a bioprospecting agreement being

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[102] An example of the recognition of this link, together with a legal response to it, can be found in the Andean Pact's Decision 486. Article 26 sub sections (h)&(i) require proof of access and authorisation to use Indigenous, traditional or local community knowledge in relation to any patent application for which they may be applicable. Article 75 (g) & (h) also provide for the revocation of any patent on products and process developed from genetic resources if it is found that access and authorisation has not been given. Decision 486 is expected to work together with the Andean Pacts Decision 391 for a *Common Regime on Access to Genetic Resources* which governs access and benefit sharing. Similar attempts to integrate IPR and Biodiversity legislation can be found in the texts proposed by the Bangladesh National Committee on Plant Genetic Resources in September 1998, for a *Biodiversity and Community Knowledge Protection Act of Bangladesh* and a *Plant Varieties Act of Bangladesh*.

[103] CBD Article 18 (5). Similarly Article 18(4) states that parties "shall in accordance with national legislation and policies encourage and develop methods of cooperation for the development and use of technologies, including indigenous and traditional technologies."

[104] On bioprospecting contracts generally see Rubin, S. and Fish, S. (1994) "Biodiversity Prospecting: Using Innovative Contractual Provisions To Foster Ethnobotanical Knowledge, Technology, And Conservation" Vol. 5 *Colo. J. Int'l. Env'l. L &Pol'y* 23; Putterman, D.M. (1996) "Model Material Transfer Agreements For Equitable Biodiversity Prospecting" Vol 7. *Colo. J. Int'l. Env'l. L &Pol'y* 149; Asebey, E.J. and Kempenaar, J.D. (1995) Biodiversity Prospecting: Fulfilling The Mandate Of The Biodiversity Convention Vol. 28 *Vand. J. Transnat'l L.* 703; Coughlin, MD (1993) "Using the Merck – InBio Agreement to Clarify the Convention on Biological Diversity" 31 *Colum. J. Transnat'l L.* 337.

the bilateral contract between Merck and INBio[105] in 1991.[106] The contract provided INBio with $1 million up front, together with laboratory equipment worth $130,000. In return INBio provided Merck with exclusive rights to bioassay 10,000 samples. The precise amount of royalties INBio would receive has not been disclosed, however, whatever that percentage may be, INBio's bioprospecting agreements stipulate that 10% of research budgets and 50% of future royalties be shared with the Ministry of the Environment and Energy (MINAE) for reinvestment in conservation.

Two collaborative projects, one in the Chiapas region of Mexico and the other in Kerala India, provide examples of some of the pitfalls that can befall collaborative bioprospecting projects. The first of these is one of the current 6 multilateral projects undertaken by the International Collaborative Biodiversity Group,[107] the ICBG-Maya.[108] Dr. Brent Berlin the investigator of the ICBG-

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[105] The Costa Rican *Instituto Nacional de Biodiversidad* (INBio) was formed in 1989; although an autonomous institution it has a close relationship with the Costa Rican government and is funded by Ministry of Natural Resources, Energy and Mines (MIRENEM) now renamed the Ministry of Environment and Energy (MINAE). INBio's other partners include the Universidad de Costa Rica, Universidad Nacional, Escuela Agrícola de la Región del Trópico Húmedo (EARTH), Instituto Tecnológico de Costa Rica (ITCR), Strathclyde University, Düsseldorf University, Lausanne University, University of Massachusetts, Cornell University, Bristol Myers Squibb, Ecos-La Pacífica, Indena, Givaudan Roure and Diversa.

[106] On the Merck INBio agreement in particular see Coughlin, MD (1993) *op cit.n* 106.

[107] The ICBG program was initiated in 1992 by three US Government organisations the National Institutes of Health (NIH), the National Science Foundation (NSF) and the U.S. Agency for International Development (USAID). It is funded by six institutes of the National Institutes of Health (NIH), the Biological Sciences Directorate of the National Science Foundation (NSF) and the Foreign Agriculture Service of the United States Department of Agriculture (USDA). The NIH themselves state that the "program is based on the belief that the discovery and development of pharmaceutical and other useful agents from natural products can, under appropriate circumstances, promote sustained economic growth in developing countries while conserving the biological resources from which these products are derived" see http://www.nih.gov/fic/programs/icbg.html In 2000 there were 6 ICBG groups working in 10 countries, other collaborative partners include Novartis, American Home Products, Bristol Myers Squib, DowElanco Agrochemicals and Glaxo-Welcome together with numerous Universities and research centres.

Maya project, has been a past president of the International Society of Ethnobiologists (ISE),[109] and firmly believes that the project in the Chiapas region of Mexico conforms to the ISE's Code of Ethics.[110] The ICBG Maya formed a trust, PROMAYA,[111] to administer the distribution of any royalties derived from the commercialisation of its research to the Maya communities, royalties that would be shared equally between PROMAYA, the University of Georgia, EOSUR, and MNL. In addition the ICBG Maya Co-operated with the Mexican Governments National Institute of Ecology, obtained the necessary permits required by the *Ley General del Equilibrio Ecologico* and produced a series of plays, videos and documents in Tzetal, Tzotil and Tojlobal to explain the ICBG project.

Despite these efforts, the project has been severely criticised by the Council of Traditional Indigenous Doctors and Midwives from Chiapas (Consejo de

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[108] The ICBG Maya project "Drug Discovery And Biodiversity Among The Maya Of Mexico" is a collaborative project run by Dr. Brent O. Berlin of the University of Georgia, scientists at the El Colegio de la Frontera Sur (EOSUR) in Chiapas, Mexico, and the Welsh biotech company Molecular Nature Ltd.

[109] The ISE was founded in 1988 in Belem Brazil, at the time of its inception the ISE adopted the Declaration of Belem which declared both that "procedures be developed to compensate native peoples for the utilization of their knowledge and their biological resources;" and that "mechanisms be established by which indigenous specialists are recognized as proper authorities and are consulted in all programs affecting them, their resources, and their environments." In many ways the ISE's Code of Ethics builds on these and other elements contained in the Belem Declaration.

[110] In 1998 the ISE adopted a code of ethics which drew on the Declaration of Belem, the CBD, and the spirit of a number of Indigenous Peoples Declarations, through the inclusion and recognition of the principles of Prior Rights; Self-Determination; Inalienability; Traditional Guardianship; Active Participation; Full Disclosure; Prior Informed Consent and Veto; Confidentiality; Respect; Active Protection; Precaution; Compensation and Equitable Sharing; Supporting Indigenous Research; The Dynamic Interactive Cycle and Restitution. (The Code can be consulted at the ISE website) The Code of Ethics is, or at least was, to be supplemented by added Guidelines for Research Collections Databases and Publications (The third draft of which can be consulted at) however at the Seventh International Congress of Ethnobiology held in Athens, Georgia in October 2000, the Guidelines were not considered.

[111] Promotion of Intellectual Property Rights of the Highland Maya.

Medicos y Parteras Indigenas Tradicionales de Chiapas, COMPITCH).[112] Indeed such was the continued furore, that in September 2000 the Mexican Government denied the ICBG-Maya permission to conduct bio-assays on material collected from the Chiapas region. At the heart of this dispute are difficult questions concerning how a community is defined; who can speak for a community; who has rights over any tangible and intangible property; and how shares in any benefits should be distributed, as the comments reportedly made by Isidro Lopez Rodriguez of COMPITCH illustrate;

> "Traditionally, it is Community Assemblies, not individuals or families, which provide consent. In fact, in almost all the affected communities, a simple majority of the assembly is required to make decisions, whereas a 75% majority is required to make decisions that affect the common patrimony ... None of the 'prior informed consent' forms gathered by ICBG Maya indicate the required level of agreement. To the contrary, some of the forms include no more than 15 signatures, and these are from individuals, not representatives appointed by the Assembly ... Collective resources do not belong to one, two, or even fifty communities in the Highlands of Chiapas, but may belong to the entire area inhabited by the Maya, well beyond the Mexican borders. ICBG-Maya does not seem to realize the implications for

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[112] See RAFI (1999) *Biopiracy Project in Chiapas, Mexico Denounced by Mayan Indigenous Groups; University of Georgia Refuses to Halt Project*, RAFI News Release 1 December 1999; RAFI (1999) *Messages from the Chiapas Bioprospecting Dispute An analysis of recent issues raised in the Chiapas Bioprospecting controversy with reflections on the message for BioPiracy*, RAFI Geno-type December 22 1999; RAFI (2000) *"Stop Biopiracy in Mexico!" Indigenous Peoples' Organizations from Chiapas Demand Immediate Moratorium Mexican Government Says No to Bioprospecting Permits*, RAFI News Release 23 October

conflict among Mayan communities, when some of these have taken on the authority – and reaped the benefits – of patenting what is essentially a common historical and cultural heritage ... The actions of ICBG-Maya are all the more serious as the impacts affect the basic needs of the people, including health care. This privatization of knowledge, along with the threat of conflict among communities, leads to cultural erosion – and it is in direct contradiction to one of the declared goals of the ICBG-Maya: to preserve traditional knowledge. This knowledge does exist and could continue to flourish if communities are free to use and control their resources in keeping with the practices of their culture."[113]

In defence of the CBG Maya project, Dr. Berlin, replies that, not only do those working on the project respect the rights of indigenous peoples, to which extent they have done everything they can to assure their informed consent, but they have also taken measures to share the benefits that may arise from the project with the Maya communities of Highland Chiapas. In addition, Dr. Brent questions the rights of any one group or NGO, in particular COMPTICH to speak for the people of the Chiapas. However most significantly for our purposes Dr. Berlin, ultimately falls back to the position of the CBD in asserting that, "the natural resources of Mexico are the sole property of Mexico. This is recognised in Mexican Law and reinforced by the 1992

2000 and for statements by the ICBG-Maya see http://guallart.dac.uga.edu/ethi and http://guallart.dac.uga.edu/ICBGreply.html

[113] RAFI (2000) *"Stop Biopiracy in Mexico!" Indigenous Peoples' Organizations from Chiapas Demand Immediate Moratorium Mexican Government Says No to Bioprospecting Permits,* RAFI News Release 23 October 2000.

Convention on Biological Diversity."[114] In this one statement Dr. Berlin succeeds in undermining any claims that the communities of the Chiapas may make in respect of their tangible or intangible knowledges of biodiversity, not only denying the validity of their voices but, subordinating any rights that they claim to the sovereign rights of the state.

In India, another bioprospecting project, this time with the Kani of Kerala, has encountered a number of similar problems.[115] In 1982 the Indian Government's, Ministry of Environment and Forests, launched the All India Coordinated Research Project on Ethnobiology, as a result of which, a team of scientists from the Tropical Botanic Garden and Research Institute (TBGRI) undertook an ethnobotancial study in the Western Ghat region of Kerela. It was during this study that two members of the Kani tribe disclosed the properties of a wild plant known locally as Arogayapacha (*Trichophus zeylanicus*).

From the outset scientists from the TBGRI promised to share the benefits of any products with the Kani. Scientist at the TBGRI developed a herbal formulation called "jeevani" and in November 1995, sold the formula to Arya Vaidya Pharmacy Coimbatore Ltd (AVP) for Rs 1 Million (£16,000). This

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[114] Reply posted on the University of Georgia's Website at http://guallart.dac.uga.edu/ICBGreply.html

[115] See Anurada (1998) *Sharing with the Kanis A Case Study From Kerela, India.* (Unpublished Paper Submitted to CBD Secretariat); Martin, M. (1998) "How to Sell A Wonder Herb" Vol.7. (12) *Down To Earth* pp.29-35; Government of India (1998) *Benefit Sharing Model Experimented by Tropical Botanic Garden and Research Institute (TBGRI), A National Centre of Excellence on Tropical Plant Diversity* (Unpublished Paper Submitted To CBD Secretariat).

licence fee, together with 2% of the profits derived from Jeevani was to be split equally between the TBGRI and the Kani tribe. Although the representatives of 40 tribal settlements launched the Kani Community Welfare Trust in November 1997 the TBGRI were not given permission by the state government to transfer any funds into the bank account, in part this was because of political wranglings over both the size of the royalty payment and the private nature of the partner institution which dated back to 1995. In the mean time although in addition to the Licence fee, the first royalty payment of $21,000 has been paid to the TBGRI,[116] as of January 2001, still no monies have made their way back to the Kani.

The problems associated with the program do not end there however. Not only have objections to the project been raised by the Kerela Institute for Research, Training and Development of Scheduled Castes and Scheduled Tribes (KIRTADS), but while those Kanis from the Kuttichal Gram Panchayat area appear to have been supportive of the program; Kanis in the Vithura and Peringamal Panchayat areas, who have had little contact with the TBGRI, are not.[117] In addition, the Forest Department have refused to let any more *arogyapacha* leaves out of the area fearing the possible consequences that the collection and then smuggling of a rare plant might bring. As a

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[116] This took place in 1999, see Bagla, P. (1999) "Model Indian Deal Generates Payments" Vol.283 *Science* pp.1614-1615.

[117] Similarly on April 9th, 1997, the Pattuvam Panchayat of Kerela, India, published a People's Biodiversity Charter which contained in part the categorical statement that " ... life forms, their seeds, cells, genes or properties of life forms existing within the territory of this Registry regardless of whether all these life forms are known to us by their names or not, whether we are using them through our direct knowledge or not, shall under no circumstances be subjected to patents or other monopoly rights ..."

consequence, the implementation of a pilot program by a number of Kani families to cultivate *arogyapacha,* has been stopped, as has the production of Jeevani by AVP. As R.V. Anuradha comments, "the irony of the situation is that TBGRI, the Forest Department and KIRTADS are all part of the same state government among whom there is no coordination or even a mechanism for dialogue."[118]

Beyond, the political wranglings, these stories from Kerela and Chiapas, raise an important point for, as we have seen, indigenous, traditional or local communities are not homogenous. If these tales, and those other stories of diversity contained in Chapter 2, tell us anything, in particular perhaps the example of Mala Village, it is that communities are not defined by geophysical or topological boundaries. Rather, knowledges about nature and about diversity exist within topological spaces that can be encompassed by the same geophysical and topographical areas. This distinction therefore between complex networks of topological communities drawn together both inside and outside of geophysical space, and cruder conceptions of homogenous communities that are supposedly defined by regional geophysical localities, is one of the central issues that those wishing to implement the CBD have to face.

Ultimately the CBD is unsatisfactory in providing any guidance as to how these issues can be overcome. As we have already seen, the CBD is

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[118] Anurada (1998) *op cit. n.* 116, p.11.

predicated on the notion that States posses sovereign rights over their genetic resources, however, in fulfilling their obligations to conserve biodiversity *in situ* Article 8(j) requires that contracting parties

> "respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices"[119]

In the context of our discussion, the use of the terms local and traditional in Article 8(j) can be seen as problematic. In attempting to define the "traditional knowledge holder," WIPO suggests that it encompasses "all persons who create, originate, develop and practice traditional knowledge in a traditional setting and context."[120] However, the use of the word traditional in this context, not only maintains the artificial distinction between modern and non modern,

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[119] CBD Article 8(j) other references to indigenous and local communities are made in the CBD in Article 10(c) relating to the sustainable use of biodiversity; Article 17.2 regarding the exchange of information; and, Article 18.4 on technical co-operation. In order to implement Article 8(j) and the related provisions, COP 4 decided, in Decision IV/9, to establish an *ad hoc* open-ended inter-sessional working group, which held its first meeting in Seville, Spain, between the 27th – 31st March 2000 For an indication of the future work of this Group see UNEP (2000) *Indicative List Of Activities That Could Be Carried Out Under The Tasks Identified In The Programme Of Work On Article 8 (J) And Related Provisions Of The Convention On Biological Diversity* UNEP/CBD/WG8J/1/INF/1.

[120] WIPO (2000) *Intellectual Property Needs and the Expectations of Traditional Knowledge Holders: World Intellectual Property Organisation (WIPO) Draft Report on Fact Finding Missions on Intellectual Property and Traditional Knowledge (1998-1999) July 3rd, 2000.*

between scientific models of knowledge and practical ecological knowledge,[121] which I have criticised above in Chapters 1 and 2, but also, provides the setting in which the ability to deny traditional knowledge as *prior art* in the context of IPR applications can be made. Indeed it is within this very difference between a form of knowledge already recognised as capable of being granted IPRs and the apparent need to protect traditional knowledge that *sui generis* forms of IPRs such as Traditional Resources Rights (TRRs) and Community Intellectual Rights (CIRs) are proposed.[122]

As we have seen in both the Kani and ICBG-Maya examples, local knowledge can all to easily be subsumed within geophysical and topographical dimensions of space, even by those sensitive to the conditions in which they

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[121] See Gadgil, M. et al (1998) "New Meaning For Old Knowledge The Peoples Biodiversity Register Programme" (Unpublished Paper).

[122] On CIRs and TRRs generally see Tilahun, S. and Edwards, S. (eds.) (1996) *The Movement for Collective Intellectual Rights* (Addis Ababa: Institute for Sustainable Development); Cottier, T. (1998) "The Protection of Genetic Resources and Traditional Knowledge: Towards More Specific Rights and Obligations in World Trade Law" Vol.1(4) *Journal of International Economic Law* pp.555-584; Posey, D. and Dutfield, G. (1996) *Beyond Intellectual Property: Toward Traditional Resource Rights For Indigenous Peoples and Local Communities* (Ottawa: IDRC); The Crucible Group (1994) *People Plants and Patents The Impact of Intellectual Property on Trade Plant Biodiversity and Rural Society* (Ottawa: IDRC) Shiva, Jafri, Bedi & Holla-Bhar (1997) *The Enclosure and Recovery of the Commons* (New Delhi: RFSTE); GRAIN (1995) Towards A Biodiversity Community Rights Regime (Barcelona: GRAIN); GRAIN (1999) *Beyond UPOV Examples of developing countries preparing non-UPOV sui generis plant variety protection schemes for compliance with TRIPS* (Barcelona: GRAIN); Seiler, A. (1998), "Sui Generis Systems: Obligations and options for developing countries." *Biotechnology and Development Monitor*, No.34, p.2-5; WIPO (2000) *Intellectual Property Needs and Expectations of Traditional Knowledge Holders, Draft Report on Fact Finding Missions on Intellectual Property and Traditional Knowledge* (Geneva: WIPO); Singh Nijar, G. (1998), "Community Intellectual Rights Protect Indigenous Knowledge." *Biotechnology and Development Monitor*, No.36, p.11-12; Louwaars, N. P. (1998), "*Sui Generis* Rights: From opposing to complementary approaches." *Biotechnology and Development Monitor*, No.36, p.13-16, in addition see the web sites of RAFI and GRAIN *op cit n.*85; Dutfield, G. (1997) *Can The TRIPs Agreement Protect Biological and Cultural Divesity?* (Narobi, Kenya: African Centre for Technology Studies).

work.[123] Local Knowledge as Gertz points out is not confined to geophysical conceptions of space and place, knowledges are local "as to accent – vernacular characterizations of what happens connected to vernacular imaginings of what can."[124] It is these shared accents, inflections, dialects, intonations and nuances, that define the boundaries of topological communities, in these hazy Turneresque social landscapes, communities can be seen to be ill defined by anything as crude as geophysical or topographical boundaries. Reason enough perhaps why it would be wise for us to discontinue our use of term local knowledge in this context, indeed as I have already suggested I would prefer to do away with the notions of "the local" and its corollary "the global" generally and write instead of social relationships more or less extended in time and space.

In order to overcome some of the associated problems that arise from attempting to identify those individuals or communities who provide knowledge of biodiversity from which commercial products are then developed; while at the same time dealing with the difficulties of deciding who should, or should not, share in the benefits derived from any commercialisation of that knowledge, Madhav Gadgil[125] and others,[126] suggest

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[123] For example in the Text Proposed by The National Committee on Plant Genetic Resources for a Biodiversity and Community Knowledge Protection Act of Bangladesh, Article 4 provides a number of wide descriptions of different of individuals and peoples which can be considered as communities under the Act yet, still states, in Article 4(2)a, that for the purposes of the Act "the local community will imply a community where a definite locality and place can be associated with it."

[124] Gertz, C. (1993) *Local Knowledge* (London: Fontana) p.215.

[125] Gadgil, M. *et al* (1998) *op.cit n.*123; Gadgil, M. (1997) Biodiversity: Thinking Differently, *The Hindu* Sunday April 20th 1997.

the adoption of national biodiversity funds and bodies, to administer the sharing of benefits in relation to a whole range of issues, not solely those proportionally relational to an individuals or communities contribution. Such a strategy runs the risk of disenfranchising communities, merely substituting the State's appropriation of resources and knowledges in place of those of MNCs and other institutions. Indeed it is precisely this assertion of the state's sovereignty over resources within its borders, that proves problematic with Dr. Berlin's justification of the ICBG-Maya project. A point brought more sharply into focus in relation to indigenous knowledges, for, as most indigenous declarations make clear, the assertion of rights over their cultural and intellectual property is intrinsically linked to the assertion of their right to self determination.[127]

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[126] See for example Gene Campaign & Forum For Biotechnology and Food Security (1997) Draft Act Providing For the Establishment of Sovereign Rights Over Biological Resources (New Delhi: Gene Campaign); Swaminathan, M.S. (1998) Report of The Expert Committee on Biodiversity Constituted by The Ministry of Environment & Forests (New Delhi: Govt of India); National Committee on Plant Genetic Resources (1998) Biodiversity and Community Knowledge Protection Act of Bangaldesh (Draft) (Dhaka:NCPGR).

[127] See for example The Mataatua Declaration on Cultural and Intellectual Property Rights of Indigenous Peoples (Whakatane Aotearoa 1993) Bejing Declaration of Indigenous Women (1995), Kari Oca Declaration and Indigenous Peoples' Earth Charter (Kari Oca, Brazil, 1992) Declaration on a sustainable Future for the Environment and Traditional Peoples of the Okinsky Territory (Siberia 1994) , Indigenous Peoples Statement on Access and Intellectual Property Rights to COP II of the CBD (Jakarta 1995), Treaty for a Lifeforms Patent-Free Pacific and Related Protocols (Fiji 1995) Julayinbul Statement on Indigenous Intellectual Property Rights (Jingarrba 1993) UN Draft Declaration on the Rights of Indigenous Peoples E/CN.4/Sub.2/1993/29/Annex I The texts of many Indigenous Peoples declarations are reproduced on the Centre for World Indigenous Studies Web Site at http://www.cwis.org/ see also Darrell A. Posey (1996) *Traditional Resource Rights: International Instruments for Protection and Compensation for Indigenous and Local Communities* (Gland, Switzerland): IUCN).

While the CBD continues to examine the issue of Benefit Sharing[128] reconvening the Panel of Experts on Benefit Sharing[129] and urging parties "to ensure that national biodiversity strategies as well as legislative, administrative or policy measures on access and benefit-sharing contribute to conservation and sustainable-use objectives;[130] we run the risk of losing sight of some of the central issues, by focusing all our attention on issues of prior informed consent, local knowledge and the equitable sharing of benefits. As Richard Scroeder comments "an exclusive emphasis on distributive justice mechanisms overlooks and potentially undermines, a wide range of fundamental claims to resources, place based identities and livelihoods."[131]

IPRs on agricultural, medicinal and food products not only continue the economic concentration of the seed, agriculture, food and drugs markets, but they also threaten agricultural biodiversity and food security, a reason after all

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[128] For examples of the CBD's work on benefit sharing see UNEP (2000) *Report Of The Panel Of Experts On Access And Benefit-Sharing Contents* UNEP/CBD/COP/5/8/UNEP (1998) *Benefit Sharing Case Studies Aristocladus Korupensis and Prunus Africana Submission by the United Nations Environment Programme* UNEP/CBD/COP/4/Inf.25; UNEP (1998) *Synthesis of Case Studies on Benefit Sharing* UNEP/CBD/COP/4/Inf.7; UNEP (1996) *The Impact of Intellectual Property Rights Systems on The Conservation and Sustainable Use of Biological Diversity and on the Equitable Sharing of Benefits From Its Use* UNEP/CBD/COP/3/22; UNEP (1998) *Access to Genetic Resources and Means for Fair and Equitable Benefit Sharing Case Study Submitted By Switzerland* UNEP/CBD/COP/4/Inf.16; UNEP 1998 *Report of the International Workshop Best Practices For Access to Genetic Resources* UNEP/CBD/COP/4/Inf/10; *Addressing the Fair and Equitable Sharing of The Benefits Arising Out of Genetic Resources; Options For Assistance to Developing Country Parties to The Convention on Biological Diversity* UNEP/CBD/COP/4/22 *Measures to Promote and Advance The Distribution of Benefits From Biotechnology in Accordance with Article 19* UNEP/CBD/COP/4/21A other benefit sharing case studies can be accessed at http://www.biodiv.org/benefitsharing/gen-res.html#cases .

[129] The panel was originally convened by Decision IV/8 UNEP/CBD/COP/4/27/Annex1 and reconvened by Decision V/26 UNEP/CBD/COP/5/23 p.196.

[130] *Ibid*

[131] Schoreder, R. (2000) "Beyond Distributive Justice: Resource Extraction and Environmental Justice in the Tropics" in Charles Zerner (ed.) *People Plants and Justice: The Politics of Nature Conservation* (New York: Columbia University Press) p.64.

why the Ayangarr committee recommended that no Indian patents should be available on them. No matter how the equitable distribution of the benefits derived from the commercialisation of biodiversity is achieved, this still remains the case, with or, without TRRs and CIRs. Indeed, many of the essential underlying reasons why benefit sharing has become such an important issue for communities in the two thirds world, remain un-addressed. Issues such as the lack of access to basic needs and freedoms, the increasing sense of powerlessness felt by communities, the lack of opportunities for development, and the increasing loss of dignity and self-respect which communities' posses. It is the amelioration of these factors, as defined by communities themselves, which must be the criteria for assessing any benefit sharing projects.[132] Benefit sharing may help some communities, however as with many of the existing projects, the benefits arising from the commercialisation of biodiversity may be small or, non existent.[133] Of the thousands of plants and plant extracts collected by any one of these forays, companies may or may not find them useful, drug development might take ten years or more, with still further delays before any monies or other benefits, find their way back to either an individual, state, or community. The question that still remains, is whither those communities and states for which no 'utility' can be found for their biodiversity?

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[132] A similar point in a different context is made by Sen, A. (2000) *Development as Freedom* (Oxford: OUP).

[133] See Laird, S. Cunningham, A.B. and Estherine, L. (2000) One in Ten Thousand? The Cameroon Case of Ancistrocladus korupensis in Charles Zerner (ed.) *People Plants and Justice: The Politics of Nature Conservation* (New York: Columbia University Press) pp.345-373.

4.3 (re)Producing Space: TRIPs as a Disciplinary Practice

The text of the CBD as we have seen, contains a tension, between the sharing of the benefits derived from the utilisation of biodiversity and its recognition of IPRs. While the CBD is predicated on the ability of states to make the most out of biodiversity as genetically coded functions, IPRs draw a distinction between the tangible and the intangible, which, while reasserting a myth of authorship in relation to the isolation of DNA and its utilisation in rDNA products, can serve to undermine the basis on which the CBD exists.

IPRs, and here we must include Plant Breeders Rights (PBRs) as well as patents, have the ability to further affect bio diversity in a three fold manner, firstly they provide for the ability of companies thorough mergers and acquisitions to consolidate the market and thus limit the seeds on offer to farmers. Secondly they provide a means of legitimation to the claims that rDNA products are advanced and therefore ought to be utilised in favour of "primitive cultivars" and thirdly they provide a means of enrolling farmers and reordering their practices that is, that IPRs allow organisations to extend their reach in time and space.

4.3.1 IPRs and Plants

Although we have briefly seen that IPRs have been extended to genetically modified plants in the guise of biotechnological products and processes, in order to understand how IPRs allow the extension of power relationships in space-time we need to first fill in some further details regarding the

introduction of IPRs to plants. The USA was the first country to extend IPR protection to plants under the *Plant Patent Act 1930*. This act allows breeders to seek a patent, with limited description requirements, for any new and distinct varieties of asexually reproduced plant other than tuber propagated species.[134]. While other countries experimented with the granting of rights for plant breeders, with the exception of Cuba, Korea and South Africa, they did not follow the American model. In Holland for example the *Plant Breeders Decree of 1941* provided monopoly rights solely for horticultural seeds with agricultural growers given only the right to compensation from a breeder's

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[134] 35 USC § 161 "Whoever invents or discovers and asexually reproduces any distinct and new variety of plant, including cultivated sports, mutants, hybrids, and newly found seedlings, other than a tuber propagated plant or a plant found in an uncultivated state, may obtain a patent therefore." The restriction of the act to asexual methods (by grafting, budding, division or such like) was based on the belief that sexually reproduced varieties could not be bred true to type. Because of the difficulty with describing plants, descriptions need only be "as complete as reasonably possible" (35 USC §162). In 1970 the *Plant Variety Protection Act* (7 USC 2321 et seq) provided protection for sexually reproduced plants. Following the decision in *ex parte Hibberd et al* (227 USPQ (BNA) 443) industrial patents are also available for plants in the US. The decision in *Hibberd,* which is in relation to claims for maize seeds, plants and tissue cultures with increased Trytopan contnt, was made on the basis that the legislature did not specifically make provisions to prevent the patenting of plants under 35 USC 101 when enacting either the PPA or the PVPA. For an overview of IPRs for plants in the US see Kjedgaard, R.H. and Marsh, D.R. (1997) "Recent Development in the Patent Protection of Plant Based Technology in the United States" Vol.19 (1) *EIPR* pp.16-20. In contrast under Article 53(b) of the European Patent Convention (EPC), patents are not permitted on "plant and animal varieties or essentially biological processes for the production of plants and animals." Because microbiological products and processes are patentable there is a tension in article 53 where patents on microbiolgical products and processes have the potential to encompass plant varieties see for example Novartis II, Decision of the Enlarged Board of Appeal 20th December 1999, G 1/98, 3/2000 *Official Journal EPO* 111, on the earlier decision in this case see Llewelyn, M. (2000) "The Patentability Of Biological Material: Continuing Contradiction And Confusion" Vol. 22(5) *EIPR* pp.191-197 and for another example of the tension inherent in Article 53 see Schrell, A. (1996) "Are Plants (Still) Patentable?: Plant Genetic Systems (EPO Decision T356/93)" Vol.18 *EIPR* p.242-244. The decision of the enlarged board of appeal is in line with the wording of the EC Directive 98/44 *Directive on the Legal Protection of Biotechnological Inventions* Article 4 (2) which states that "Inventions which concern plants or animals shall be patentable if the technical feasibility is not confined to a particular plant or animal variety" it seems unlikely that this area will not be revisited once the directive comes into force however.

fund and the ability to market propagated material as *elite* or original.[135] While on the other hand regulation of the seed industry in the UK by the Seeds Act 1920, was intended to protect the buyers of seed not to protect breeders.

In 1956 the French government invited others to a Diplomatic Conference on the protection of New Plant varieties, resulting in the adoption of the *International Convention for The Protection of New Varieties of Plants* (UPOV).[136] Since 1961 the text of the UPOV agreement has subsequently been amended 3 times in 1972, 1978 and 1991.[137] The convention extends national treatment to the nationals of all members of the Union,[138] however, in order to be granted a right the variety must be new, distinct, uniform and stable.[139] The scope of the breeder's rights under each of the Acts is different, in particular the main concern for countries in the two thirds world is the extent to which breeders rights have been extended at the expense of what are referred to as the 'farmer's privilege' and the 'breeder's exemption' by the 1991 Act.[140]

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[135] See Menon, U. (1995) "Evolution of Intellectual Property in Plants" in B.Sharma et al. (eds.) *Genetic Research and Education: Current Trends and The Next Fifty Years* (New Delhi: Indian Society of Genetics & Plant Breeding) pp.2167-2184.

[136] See Byrne, N. (1993) "Plant Breeding and the UPOV" Vol.2 (2) *RECIEL* 136.

[137] The revision of the convention has led to three different Acts to which states may belong. The 1961 Act (which includes the 1972 amendment) entered into force in 1968; the 1978 Act entered into force 8th November 1981 and the 1991 Act which entered into force on April 24th 1998. As of 26th May 2000 45 states have ratified the convention, Belgium and Spain are the only countries to remain within the 1961/72 Act, while, by virtue of Article 37(3) of the 1991 Act countries had only until 21st December 1993 to acceed to the 1978 Act, unless the were categorised by the UN as a "developing country" in which case an instrument of accession could be deposited until December 31st 1995.

[138] Article 3 in the 1961 and 1978 Acts; Article 4 in the 1991 Act.

[139] Article 5 1991 Act and Article 6 1961 & 1978 Acts.

[140] On the implications of this aspect of UPOV for countries of the two thirds world see Dhar, B. & Rao, C.N. (1997) *Plant Breeders and Farmers In the New Intellectual Property*

The 1961 and 1978 acts provide, that the effect of the right granted to the breeder is such as to require their prior authorisation in relation to "the production for purposes of commercial marketing; the offering for sale; and the marketing of the reproductive or vegetative propagating material as such of the variety."[141] Two exemptions arise from the scope of this right. The first is the right of breeders to use varieties protected by a certificate in order to create other varieties the so called 'breeders exemption.'[142] The second is the right of farmers to save seed for their own use as it is not production for the purposes of commercial marketing, the 'farmers' exemption.' The extended rights of the breeder in the 1991 Act have limited both of these exemptions.[143]

Article 14 of the 1991 Act removes the qualification "for purposes of commercial marketing" that appeared in the 1961 and 1978 Acts, relating to

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Regime: Conflict of Interests? (New Delhi: Centre for Study of Global Trade System and Development); Verma, S.K. (1995) "TRIPs and Plant Variety Protection in Developing Countries" Vol.17 (6) *EIPR* pp.281-289; Menon, U. (1993) "TRIPs Negotiations and Indian Agriculture" Vol.52 *Journal of Scientific and Industrial Research* pp.296-303; Surenda, L. & Gopalakrishnan (1995) "Intellectual Property, Seeds, The Future of Farmers and Farming" (1995) 5 *Supreme Court Cases* (Jour) 10; Wijk, J. van (1995), "Plant Breeders' Rights Create Winners and Losers." *Biotechnology and Development Monitor*, No.23, p.15-19; Ghijsen, H. (1998), "Plant Variety Protection in a Developing and Demanding World." *Biotechnology and Development Monitor*, No.36, p.2-5.

[141] Article 5 (1) of the 1961 and 1978 Acts. The two earlier Acts provide that the length of duration of this right shall not be under 15 years (Article 8) while the 1991 Act extend this to a period of not less than 20 years for plants other than trees or vines, which have a minimum period of protection of 25 years (Article 19).

[142] This exemption is specifically recognised by Article 5(3) of the 1961 and 1978 Acts which states that "authrorization by the breeder shall not be required either for the utilisation of the variety as an initial source of variation for the purposes of creating other varieties or for the marketing of such varieties."

[143]Article 14 of the 1991 Act redefines the rights of the breeder so that their authorisation is necessary for "(i) production or reproduction (multiplication) (ii) conditioning for he purpose of propagation (iii) offering for sale (iv) selling or other marketing (v) exporting (vi) importing (vii) stocking for any of the purposes in (i) to (vi) above."

the production of the reproductive or vegetative material of the variety. Thus the breeder is initially put in the position that any reproduction of a variety can only be undertaken with their authorisation that can be made "subject to conditions and limitations."[144] This extended right is qualified however by Article 15, that allows exceptions to the breeders right where acts are done privately for non commercial purposes; for experimental purposes; and, acts done for the purpose of breeding other varieties. However, while this appears to reinstate the exemption in relation to experimentation and breeding, it is itself qualified by Article 14 where authorisation is still required when varieties are *essentially derived* from the protected variety, are not clearly distinguishable from the protected variety or, the production of which requires the repeated use of the protected variety. Essentially derived in this context means those varieties obtained "by the selection of a natural or induced mutant, or of a somoclonal variant, the selection of a variant individual from plants of the initial variety, backcrossing, or transformation by genetic engineering."[145]

Thus in extending breeders rights, the rights of breeders to experiment has been curtailed, a situation which, if moved into the context of agricultural biodiversity in the two thirds world, means that farmers ability to experiment can in some circumstances be controlled. The continual processes of on farm experimentation that have resulted in the production of agricultural biodiversity, have, at least within the framework of the 1991 Act, been

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[144] UPOV 1991 Act Article 14 (1)(b).

potentially and severely curtailed, in so far as distinct varieties developed by farmer/breeders and adapted to local conditions, would be considered as essentially derived from a protected variety and therefore an infringement of the certificate holders right, when the variety expressed or retained essentially the same characteristics as the initial variety, even when the new variety was clearly distinguishable from that initial variety.[146]

The restriction of the farmers exemption also begins with the reformulation of Article 14 of the 1991 Act. Article 15(2) appears to provide an exemption to farmers in so far as contracting parties to the convention can restrict the right of the breeder "in order to permit farmers to use for propagating purposes, on their own holdings, the product of the harvest which they have obtained by planting ... the protected variety." This, exception however is qualified in so far as it must not only be "within reasonable limits" but in addition must be "*subject to the safeguarding of the legitimate interests of the breeder*." In other words the farmer who keeps back seed must pay a licence fee to the breeder of the protected variety.

What needs to be remembered is that prior to the TRIPs agreement most countries in the two thirds world did not have any form of IPRs on plants, indeed In 1988 a WIPO study found that 44 countries explicitly excluded IPRs on plant varieties.[147] Therefore some of the above discussion regarding the

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[145] UPOV 1991 Act Article 14(5)(c).

[146] UPOV 1991 Act Article 14 (5)(b)(i)(ii)(iii).

[147] See Verma (1995) *op.cit n.*141.

relative differences between the earlier acts and the 1991 Act serves only to show how even within UPOV the restrictions on farmer/breeders have not been as onerous as the current provision which countries in the two thirds world may be forced to adopt. The practice of keeping back, cleaning and selling seed is not however, one that is limited to countries in the two thirds world, for at least until recently, this was a common practice in the rest of the World.

In 1995 The US Supreme Court heard a case bought by the seed company Asgrow, now owned by Monsanto, against two farmers Denny and Becky Winterboer.[148] The case involved the US *Plant Variety Protection Act* 7 USC 2321 section 2543[149] which purported to allow farmers not only to keep back harvested seed for their own use but to sell seed to other farmers, provided, this was not their primary occupation. Termed "brown bagging" farmers would not only keep back open pollinated seed such as Soybean but would sell them on to other farmers in brown bags, something which they thought they

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[148] *Asgrow Seed Co.* v. *Winterboer* 33 U.S.P.Q.2D (BNA) 1430.

[149] The United States Congress amended this section by the *Plant Variety Protection Act Amendments of 1994* (Pub. L. 103-349, 108 Stat. 3136, 3142) in order to remove the apparent right to sell harvested seed, however, when the case was bought the section read as follows. "Except to the extent that such action may constitute an infringement under subsections (3) and (4) of section 2541 of this title, it shall not infringe any right hereunder for a person to save seed produced by him from seed obtained, or descended from seed obtained, by authority of the owner of the variety for seeding purposes and use such saved seed in the production of a crop for use on his farm, or for sale as provided in this section: Provided, That without regard to the provisions of section 2541(3) of this title it shall not infringe any right hereunder for a person, whose primary farming occupation is the growing of crops for sale for other than reproductive purposes, to sell such saved seed to other persons so engaged, for reproductive purposes, provided such sale is in compliance with such State laws governing the sale of seed as may be applicable. A bona fide sale for other than reproductive purposes, made in channels usual for such other purposes, of seed produced on a farm either from seed obtained by authority of the owner for seeding purposes or from seed produced by descent on such farm from seed obtained by authority of the owner for seeding purposes shall not constitute an infringement."

remained entitled to do under the PVPA 1970, provided it formed less than 50% of their income.

Asgrow became concerned that the Winterboers were making a living from growing their seed and sent a local farmer, Robert Ness, to purchase soybean seed from the Winterboers. Denny Winterboer sold Ness some seed that he said was "just like" two Asgrow varieties, A1937 and A2234, but for about half the price that the protected varieties were on sale for.

In the supreme court Scalia, J delivering the opinion of the court (Stevens, J., dissenting), declared in true judicial style that "it may be well to acknowledge at the outset that it is quite impossible to make complete sense of the provision at issue here ... With this advance warning that not all mysteries will be solved, we enter the verbal maze of Section 2543."[150] Of course, despite the impossibility of the task, the court still managed to come to a decision as to the correct statutory interpretation, finding for Asgrow, and overturning the decision of the Appeal court.[151]

The Winterboer story, as with the PVPA itself, shows how until very recently, there was not only a tradition of farmers in the US keeping back and cleaning harvested seed, for both their own use and for sale, but, that seed companies are now attempting to change those farmers practices through law, in the

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[150] 33 USPQ 2d (BNA) 1430 at 1433.

[151] The Appeal Court had found for the Winterboers (25 USPQ 2d (BNA) 1202) having overturned the decision of District Court for the Northern District of Iowa (22 USPQ 2d 1937).

process asserting a monopoly over the production and replication of seed. At the time of the Winterboer case, around 65% of seed in the US was replaced annually, compared with just 6.6% in India.[152] Under the 1991 UPOV convention, farmers in countries which are part of the Union will neither be able to keep back harvested seed for their own use, or exchange it, whether for financial gain or not, without the permission of the breeder. This not only has financial implications for farmers in the two thirds world but in addition raises important concerns for the continued adoption and spread of varieties with characteristics which may be useful to farmers.[153] As we saw above although countries do not have to adopt plant patents under TRIPS they must adopt effective *sui generis* plant protection; as more countries adopt the UPOV 91 model, the greater is the likelihood that the DSB would look to its' provisions in assessing the effectiveness of any other *sui generis* national legislation. The increasing significance of UPOV therefore derives from the growing list of states that that have now ratified the convention[154] together with the union's existence as an organisation administered by WIPO, a specialist UN body.

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[152] The figures are comparative figures for 1988 in Dhogra, B. (1993) *Seeds Industry of India: Seeds of Plenty of Seeds of Discontent* (Dehradun, India: Navdanya) p.8. The high dependence on the annual replacement of seed in the US is also indicative of the high use by farmers of F1 hybrids.

[153] In one recent study, researchers watched the spread of a rice variety Kalinga III over a period of years. Farmer to farmer diffusion resulted in the spread of Kalinga III from its introduction in three initial villages in 1994, to 41 villages by 1996 and over 100 villages covering an area of several thousand square kilometres by 1997 see Whitcombe, J.R., Pere, R. Jones, S. and Josh, A. (1999) "Farmer Participatory Crop Improvement. IV The spread and Impact of a Rice Variety Identified by Participatory Varietal Selection" Vol.35 *Experimental Agriculture* pp.471-487.

[154] As of September 2000, 46 states had ratified the convention, although many of those are party to the 1978 Act. Under the terms of UPOV however, any new parties wishing to join the Union can only now sign up to the 1991 Act.

An example from the UK of what can happen to the price of seed with the introduction of Plant breeders rights is provided by Tracey Clunies-Ross in relation to potatoes.[155] Clunies-Ross tells how, after the introduction of the UK's *Plant Varieties Act* in 1964,[156] seed potato growers although they started to pay a royalty on protected varieties they could still buy or sell their stock "over the fence" in much the same way as unprotected varieties. In the early 1990s however things began to change as those with rights over potatoes began enforcing them, issuing special notices through the British Society of Plant Breeders informing growers that production of protected varieties could now only be undertaken with prior authority of the breeders agent. As Clunies-Ross continues:

> "As the buying and selling of reproductive material of protected varieties was tightened up, growers became unable to grow most of the popular protected varieties unless they agreed to grow them under contract. Many

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[155] See Clunies Ross, T. (1996a) *Farmers Plant Breeders & Seed Regulations An Issue of control: A Case study of the Scottish Seed Potato Industry* (Sturminster Newton: The Ecologist); Clunies-Ross, T. (1996b) "Creeping Enclosure: Seed Legislation and, Plant Breeders Rights and Scottish Potatoes" Vol. 26(3) *The Ecologist* pp.110-114.

[156] Linked to the Plant Varieties Act are two national lists an A list and B list. The A list contains new varieties that have been tested for conformity with the requirements of distinctness, uniformity and stability while the B list contains already known varieties. Fees must be paid to the Plant Variety Rights Office both for the tests, as well as for maintaining a variety on the A list. Under the Seeds (National Lists of Varieties) Regulations 1982 no seed can be sold in the UK unless the variety is on a national list or the EC common catalogue. When the Common catalogue was completed in 1980 a number of what were considered to be "duplications" were intentionally left out of the catalogue as they were thought to be synonymous with other varieties. The Henry Doubleday Research Association concluded however, that only 38% of the duplications were synonyms and that therefore around one thousand distinct varieties from 23 vegetable species, were bound to disappear as it would not be possible to trade in them. (On the compilation of the common catalogue see Clunies-Ross, T. (1995) *Seeds Crops and Vulnerabiltiy: A Re-examination of Diversity in British Agriculture, A Discussion Paper* (Sturminster Newton: The Ecologist) pp.32-33).

seed potato growers went down this route and took out contracts to grow protected varieties, which specified the price at which the contracting company would take back the crop, and bared growers from selling the crop to anyone else. The frustrations of the growers rose as the companies in control of the contracts began to cutback on the acreage allocated to seed potatoes; to tighten the specifications for the crop; and to reduce the prices being paid. Growers argued that a handful of companies "acting as a cartel" were fixing process and manipulating the market. They maintained that their own profitability was being threatened and that ... seed potatoes being bought under contract from the Scottish growers for £140 per tonne, were being sold for more than double that to English ware growers, whilst the two sets of farmers were prevented from dealing directly with each other."[157]

4.3.2 Mergers and Acquisitions

The past few years has seen a process of consolidation between the largest international seed companies and the largest agrochemical companies, a convergence that has occurred in tandem with the realignment of the companies involved towards the life sciences, facilitated in part through divesting themselves of some of their previous core business.[158] Indeed this

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[157] Clunies Ross, T. (1996a) *op.cit n.*156, p.25.

[158] For example when Sandoz and Ciba merged in 1996 to form Novartis they sold their chemical business and reorganised the new company into three divisions, healthcare, agribusiness and nutrition with combined sales in the first year of CHF 31.2 billion ($21.53 billion). Similarly Monsanto span off their chemical (although not their agrochemical) business in 1977 for $3 billion, The German company Hoechst, who have since merged with Rhone Poulenc to form Aventis, sold it's American chemical subsidiary Celanese in 1998. In the same year that DuPont sold its petroleum subsidiary, Conoco, for $4.4 billion providing as thir

restructuring of corporations as life science companies is central to understanding not only why this continuing process of consolidation is taking place, but also, where it is likely to lead in the years ahead. It is important to understand that IPRs are an essential driving force in this process of consolidation, the intellectual property base of particular companies often provides the incentive for mergers or take-overs; they provide a means of controlling markets; a means for tying in other products in the technology portfolio of a company and ultimately an incentive for further financial investment. In the foreseeable future the realignment of this sector appears set to continue as the links between food, the next generation of crops and pharmaceuticals, develops. The acquisition of Protein Technologies International by DuPont for 1.5 billion in 1998 would appear to mark the beginning of this next stage.[159]

The actions of Monsanto, though not the largest of these companies, as we shall see, have since 1977 been perhaps one of the most bullish in relation to their acquisition of seed operations. As part of their overall corporate strategy however, Monsanto were also looking for another major biotech company with which to merge and on 19th December 1999, they announced their intention to do so with Pharmicia Upjohn.

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reason for doing so as "The Conoco split off marked the final chapter in our historic relationship with Conoco. We freed up $21 billion in value for redeployment in businesses that are strategically aligned with our future as a global science company".(Du Pont 1990 Annual report p.2).

[159] For an in depth profile of the acquisition see *Fortune* September 28th 1998, pp.78-84

The new company, called Pharmicia had, in 1999, combined sales of $17 billion and was Monsanto's second attempt to merge with another large life science company, after an attempt to do so with American Home Products, was abandoned on Oct 13th 1998 as "not in the best interest of their respective shareholders."[160] The merger with Pharmicia Upjohn does not mean the end of Monsanto however, as the agricultural business side of the new merged company has become a separate legal entity with its own publicly traded stock and stand alone board of directors.

In 1999 Monsanto's net sales totalled $9.1 billion, an increase of 26% on the previous year, of this, the agricultural products sector accounted for $5.1 billion, with increased seed sales amounting to $1.3 billion compared with $670 million in 1998.[161] Primarily this dramatic increase in seed sales was the result of a spending spree in 1997/1998 during which Monsanto acquired Agracetus and Calgene, Asgrow Agonomics, Holden's Foundation Seeds, DeKalb, PBIC, the Brazilian seed company Sementes Agroceres and Cargill's international seed operations in Central and Latin America, Europe, Asia and Africa.

In India, Monsanto acquired a 26% interest in the Maharashta Hybrid Seed Company (MAHYCO) also forming with them a 50/50 joint venture, MM Biotech Pvt Ltd to develop transgenic crops. Monsanto was also given

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[160] Monsanto/AHP joint press release 13th Oct 1998.

[161] Figures are taken from Monsanto's *Form 10-K Annual Report* for the fiscal year ended December 31, 1999 submitted to the US Securities And Exchange Commission.

permission by the Indian Foreign Investment Promotion Board (FIPB), to buy a 51% interest in E.I.D. Parry's seed division. In May 1998 Monsanto also announced their intention to acquire Delta Pine Land, the largest cotton seed supplier in the World, however they withdrew from the deal in December 1999.[162]

Monsanto are of course not the only company who have been consolidating their position in the market place. The merger between Hoechst and Rhone Poulenc at the end of 1998 spawned the new company Aventis, with overall sales for the crop science division of €4,061 million, €244 million of which were from seeds. This makes, Aventis the largest 'crop protection' company in the World, even if they still have some way to go to match Pioneer Hi Bred, now a wholly owned subsidiary of DuPont, in seed sales. Aventis' position in agro chemicals is also soon to be overtaken by a new company Syngenta, formed by, a merger between Novartis' agrobusiness and Astra Zeneca, itself only formed in April in 1999, whose combined crop protection sales for 1999 would amount to $6,404 million[163] compared to Aventis' $4085 million. Novartis is currently the third largest seed company in the world, the merger

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[162] Monsanto pulled out of the deal after it was scrutinised by the Justice Department, citing the lack of progress with anti trust regulators as their reason for not going ahead with the acquisition. Monsanto's decision has cost them dear however, while they still receive 70% of the premium charged to farmers by Delta Pine Land for the genetically modified Bollgard® and Roundup Ready® cotton seed that they produce under license from Monsanto, not only did Monsanto have to pay a $61 million dollar contractual fee for not going ahead with the acquisition of Delta Pine Land, they also face in addition, a billion dollar law suit. The cost of Monsanto's spending spree left them with around a $6 billion dollar debt, this meant not only financial restructuring for the company but also redundancies for many of Monsanto's employees. The size of the debt also supplies a major reason for the attempted merger with American Home Products and finally with Pharmicia Upjohn. The combined debt of Pharmicia Upjohn and Monsanto was $6.8 billion dollars at the time of the merger in 1999.

with AstraZeneca also brings in to the Syngenta stable, a 50% share in Advanta B.V. a company which despite being the 5th largest seed company in the world and which itself has made over 30 acquisitions since 1995 suffered an operating loss in 1999 of $6 million.

In September 1997 Du Pont paid 1.7 billion for a 20% share in Pioneer Hi Bred the largest seed company in the world, who, at the time of Du Pont's part acquisition had annual sales of $1,784 million. In 1998 Du Pont's 20% of Pioneer's sales was worth $361million; given Pioneers future potential therefore, the $7,691 million DuPont paid for the other 80% of Pioneer in October 1999 seems reasonable with sales for 2000 probably in excess of $2 billion. As Du Pont's 1999 annual report states "this was a major step in our overall strategy to more fully integrate biology into our science and technology base. As a result, we will be able to develop new generations of products for food and feed crops, food ingredients, industrial applications and nutrition science."[164] In 1999 DuPonts, existing crop protection nutrition and health sales amounted to $2.6 billion

The significance of these acquisitions, lie partially in the fact that ten seed companies now account for something over 30% of the worlds seed sales. However, in certain areas, the percentage is higher, for example just 5

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[163] Zenneca's crop protection sales in 1999 amounted to $2,657 million while Novartis' were $3,747 million.

[164] Du Pont 1999 Annual Report p.2.

companies control 75% of global vegetable seeds.[165] When it comes to transgenic seeds, the market is dominated by Monsanto, who, in the US are estimated to control 88% of seed sales, with Aventis (AgrEvo) and Novartis accounting for just 8% and 4% respectively.[166] Monsanto's 1999 submission to the US Securities And Exchange Commission states that;

> "Roundup Ready® corn volume increased more than 100 percent from the prior year's sales in the United States. Continued increased demand for crops developed through biotechnology - especially Roundup Ready® soybeans, corn and cotton, YieldGard® insect-protected corn, and Bollgard® with Roundup Ready® cotton - generated substantially higher technology fee revenues from these crops in 1999. Worldwide acreage of crops developed through biotechnology increased over 49 percent to approximately 88 million acres for the 1999 crop season compared to 59 million acres in the 1998 crop season. In addition, the technology fee for Roundup Ready® soybeans in the United States increased approximately 25 percent in 1999. As a result, technology fee revenues increased 51 percent over prior year revenues."[167]

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[165] RAFI Communiqué 30/3/99

[166] *Ibid* and see also James, C. (1999) "Global Status of Commercialized Transgenic Crops: 1999" *ISAAA Briefs* No.12: Preview. (Ithaca, NY: ISSAAA).

[167] 1999 Annual Report to the US Securities And Exchange Commission (Financial Information for Fiscal Year ending 31st 1999 p.11).

In the years 1998 and 1999 the most common trait found in transgenic crops was that of herbicide tolerance accounting for 71% of global acreage.[168] With the patent rights on Monsanto's herbicide Roundup having expired in all countries except the United States, IPRs on GM crops, and the licensing agreements under which farmers agree to grow the transgenic seeds, provide a means of maintaining Roundup's market dominance through tying in the use of Roundup as a term of the license. Not only therefore do farmers pay an additional technology fee to use the patented crops, they also pay premium prices for their herbicide. Monsanto's dominance in the transgenic seed market is built on their pre existing market for Roundup, with other seed companies such as Pioneer Hi Bred or Delta Pine Land, licensing the technology from Monsanto in order to insert Roundup Up Ready technology into varieties controlled by them. The realignment of the agribusiness sector therefore is less about a move from inputs (agrochemicals) to outputs (crops), and more about maintaining inputs and increasing outputs.

The increasing dominance of a small number of companies in the international seed market has significant implications for the diversity of seeds available in future to farmers, with some companies having already suggested that in a few years they may well only be offering transgenic crops for sale. Possible echoes from the future were heard on the 28th June 2000 when Seminis, the world's largest vegetable seed corporation and a company whose sales of US $531 million in 1999 make it the fifth largest seed company in the world,

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[168] James (1999) *op.cit. n.*166

announced that as a cost cutting measure it would eliminate from its catalogue 2,000 varieties, or 25% its current 8,000 varieties across 60 species of fruits and vegetables.[169] Although Seminis are not currently involved in GM technologies, they provide an example of what is likely to be a future trend with fewer seed companies offering less and less varieties to farmers.

We saw in Chapter 1 that potential for further expansion in transgenic cotton, corn and soybean is limited in the US, due to the success already achieved in that market. In order to expand, companies like Monsanto and DuPont will need to develop new markets, in 1997 Monsanto for example, considered that the global acreage appropriate to *YieldGard* and *Roundup Ready* corn to be at least 268 million acres,[170] providing some insight into their acquisition of seed companies in the two thirds world. As the life science companies pursue their expansionist policies, farmers in the two thirds world will come under the same form of regime as American farmers, a regime which is created either through plant variety provisions, in relation to non GM crops, or, licensing agreements for patented GM technologies. In both cases IPRs extend the control over farmers available to life science companies, so that, accompanying their new technologies are practices that farmers will have to adopt as a consequence of their planting particular seeds, seeds which may, eventually, be the only ones offered for sale by large seed companies. In the end farmers in the two thirds world may well be nothing more than contractors

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[169] Seminis has a presence in 120 countries with 70 research stations in 19 countries and production sites in 32 countries. It controls 40% of US vegetable seed market see RAFI News Release 17 July 2000.

for the life science companies,[171] a proposition which it perhaps goes without saying, poses far reaching consequences for the maintenance of agricultural biodiversity.

4.3.3 Disciplining Farmers - Territorialising Spaces

In the Introduction to *Justice Nature and the Geography of* Difference David Harvey makes an observation and for that matter a criticism that could be levelled at the arguments that run throughout this work when he states;

> "The reduction of everything to fluxes and flows and the consequent emphasis upon the tranistoriness of all forms and position has its limits. If everything that is solid is always instantaneously melting into air, then it is very hard to accomplish anything or even set one's mind to do anything. Faced with that difficulty the temptation is strong to go back to some simple foundational beliefs (whether these be a fetishism of the family on the right or of something called "resistance" on the left) and dismiss the process-based arguments out of hand ..." Harvey then continues however "... while I accept the general argument that process, flux and flow should be given ontological priority in understanding the world, I also want to insist that this is precisely the reason why we should pay so much more careful attention

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[170] Monsanto company Annual Report 1997 pp.17.

[171] On the changing nature of grain production in the US see Hamilton, N. (1994) "Why Own the Farm if you can Own the farmer (and the Crop)?: Contract Production and Intellectual Property Protection of Grain Crops" *Nebraska Law Review* 48; and for other examples of changing agricultural pratices in relation to seeds and contracts see, Louwaars, N. (2000), "Seed Regulations and Local Seed Systems." *Biotechnology and Development Monitor*, No.42, pp.12-14, Vellema, S. (2000), "Contractual Maize Seed Production." *Biotechnology and Development Monitor*, No. 42, pp. 8-11.

to what I shall later call the "permanencies" that surround us and which we also construct to help solidify and give meaning to our lives. While it is true everything can be reduced to flows ... we are in daily practice surrounded by things, institutions, discourses and even states of mind of such relative permanence and power that it would be foolish not to acknowledge these evident qualities."[172]

In many ways the quotation from Harvey above contains the essence of what this chapter, and for that matter much of this thesis, has been about. I have been attempting to show how what Harvey terms "permanencies" come about, attempting to examine how facts are maintained through time and space; how performances and relationships of power come into being, of how techniques and strategies of power are deployed. Although I argue that the materiality we experience is relational, the product of the coming together of polymorphic social networks, the regions and borders which define those relationships created by the interconnections of those networks, reality conceived as relational materiality is no less real, it has a permanence which is experienced, no more and no less abstract, all be it that material relationships are constantly moving, as objects pass through regions and borders.

Much of this chapter has been concerned with examining some of the mechanisms through which seeds and in particular GM seeds are provided with meaning, in which they derive their social materiality. This meaning

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[172] Harvey, (1996) *Justice Nature and the Geography of Difference* (Oxford: Blackwell

needs to be maintained over geophysical distances, in order that life science companies can prevent the loss of control over their seeds. One mechanism through which this is achieved is through the extension of IPRs. John law argues that in order to secure the circulation, mobility and durability of mobiles, of human and non human objects in time-space, you need to deploy texts, devices and disciplinary practices.[173] The devices in this case are the seeds, the texts are IPR laws and licensing agreements and the disciplinary practices are the modifications to farmers behaviour brought about through their acquiescence in treating GM seeds differently, in no longer experimenting, or saving seed, in choosing one variety or indeed crop over another, and of introducing new tillage and farming techniques required by the licensing agreements.

Transgenic seeds provide a means by which their developers can transform space and control farmers, the TRIPs mechanism provides a framework for producing fact maintenance and as such provides a means for expressing power through performance. When Monsanto introduced their transgenic crops to American farmers they also introduced technology fees and stringent contracts, they set about changing the culture of farmers, not only the way they farmed but their expectations and beliefs about farming. IPRs provided a means through which they could undertake this project, a means through which their actions could be justified and through which farmers could be

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Pubishers) pp.7-8.

controlled through time and space. This form of ordering is now being extended ever further to include farmers in the two thirds world, to discipline farmers and reterritorialise their land, homogenising and overcoming topological differences, in order to make greater acreages suitable for transgenic crops. Of course any method of ordering is always imperfect, and so while IPRs provide a means of controlling farmers, if more suitable means of enrolling farmers could be found, less imperfect means of ensuring that farmers are disciplined can be introduced then we are likely to find the makers of GM crops moving towards these methods to maintain their narratives.

I have argued throughout this thesis that in order to achieve the 'successful' distribution of their seeds, the manufacturers of GM crops must seek to do more than merely engineer particular genetic characteristics into their modified seeds. For, it is also necessary that the biotic offspring of these genetic machinic complexes become the embodiment of particular sets of non-genetic characteristics, so that, for example the modified seeds are regarded as 'advanced,' 'high yielding', or 'green'. In addition, those within the biotech world must not only deploy a number of strategies and mechanisms to maintain this added value as though intrinsic to the seed itself, but also, create alliances with others in order to achieve this task. By so doing the creators of these 'hopeful monsters'[174] can control, at a distance, not only their progeny,

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[173] See for example Law, J. (1986) "On the methods of Long Distance Control: Vessels, Navigation and the Portuguese Route to India" in John Law (ed) *Power Action and Belief: A New Sociology of Knowledge* (London: Routledge & Keegan Paul) pp.234-262.

[174] The term is adopted from the novel of the same name by Nicholas Mosley. Mosely uses the term as a metaphor to explore the extent to which evolution and the environment interact, one working on the other and vice versa, hopeful monsters are not only thrown up and

but importantly the farmers themselves, adapting the farmers practices in relation to seeds, (re)ordering the farmers conceptions of time and space, their relation to locality and place, (re)territorialising, folding and stratifying space and thus ultimately changing the relationship between farmers and agricultural diversity.

The genetically modified seeds which are the foci of this thesis should be considered as meeting places of multiple social networks, boundary objects whose existence lies simultaneously within and without, both inside and outside of the networks which generate their social materiality. They are points of obligatory passage,[175] necessarily mobilised by all the actors involved in our narrative, non-human objects whose meanings must be stabilised if they are to achieve the results envisaged by their creators, yet which, despite these strategies of capture, remain sites of encounter and struggle. This is because "orderings are never complete"[176] rather attempts at social ordering are only ever partial. Thus, the seeds are not only the focus of different modes of ordering within the biotech industry; scientific, technical and economic networks, whose actors must ally themselves, adopting shared strategies and mechanisms if they are to achieve their particular goals, but

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interact with their environment but the environment also creates or allows hopeful monsters to survive. As the central character of the book replies when asked what hopeful monsters are "they are things born perhaps slightly ahead of their time; when it is not known if the environment is quite ready for them." pp.71 (London: Minerva, 1991)

[175] Callon, M. (1986) "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay" in John Law ed. *Power Action and Belief: A New Sociology of Knowledge* (London: Routledge & Keegan Paul).

[176] Law, J. (1994) *Organising Modernity* (Oxford: Blackwells) pp.104.

they are also, the focus of those who resist these modes of ordering, farmers, environmentalists, and others.

The worlds I have described within this thesis, are worlds of multiple hybrid objects, objects that should be considered as part human, part non-human, inscribed and embodied objects; objects which are not only acted upon but are capable of acting and speaking for themselves; objects in possession of a degree of agency all be it a partial and fragile one. Seeds therefore must also be considered as networks, as assemblages, or, programs of action, into which humans and non-humans are enrolled, and, around which their specific roles are co-ordinated.

Because process of enrolment and translation are only partially successful, that is that human and non-human objects are continually open to (re)programming, or more specifically in our case that farmers are still capable of treating genetically modified seeds as they would 'normal' seeds, we have seen the need to both deploy and maintain numerous series of disciplinary practices. In the United States we have seen how the re-education of farmers has included the hiring of college students and retired agricultural extension agents to teach farmers about property rights,[177] the taking out of advertisements on the radio and in farm journals[178], the use of Pinkerton Detectives to police property rights[179] and the taking to court of farmers

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[177] *St Louis Post Dispatch,* Monday, April 8th 1996.
[178] *St Louis Post-Dispatch,* Sunday, May 3rd 1998.
[179] *Omaha World Herald,* Thursday, April 9th 1998.

accused of "brown bagging".[180] In other words, the biotech companies have needed to mobilise and deploy law in the shape of intellectual property rights, patents and plant breeders rights, in an to attempt to discipline farmers and change their understanding of how they should farm.

4.4 The birth of GURTS: Control beyond TRIPs

On March 3rd 1998, United States Department of Agriculture (USDA) and Delta and Pine Land Co.[181] were granted a patent, US 5,723,765,[182] for one of the most controversial uses of genetic technologies yet developed. It introduces a technology that more successfully translates the requirements of the seed manufacturers into the genetic makeup of the seed itself. The patent, entitled *The Control of Plant Gene Expression,* runs to 55 claims, and is in part a continuation of a previous application that has subsequently been abandoned. [183] As the patent itself states "the invention relates to transgenic plants that have been modified such that expression of a desired introduced gene can be limited to a particular stage of plant development, a particular plant tissue, particular environmental conditions or a particular time or location."[184] In other words, the patent defines a number of means through which it is possible to restrict the characteristics of second generation seed

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[180] *St Louis Post-Dispatch,* Sunday, September 21st 1997.

[181] On May 11th 1998 Monsanto announced that it had reached an agreement to acquire Delta Pine Land Co. subject to the approval of its share holders. On May 21st 1999, the two companies announced that while they both wished to continue with the merger the time frame for this to occur had been extended until December 31st 1999.

[182] See also WO 94/03619.

[183] Ser. No. 08/283.604 filed Aug 1st 1994.

[184] US 5,723,765.

produced by GM crops which, in its ultimate formulation includes the controlling of the seeds germination.

The assignees of patent US 5,723 765, Delta and Pine Land Co. and the United States Department of Agriculture, refer to these new methods of genetic control as Technology Protection Systems (TPS), however, those NGOs, farmers and environmental activists concerned with the introduction of GM crops, dubbed these new systems as "Terminator Technologies;" a term which has captured the imagination of the media with the associated imagery of the films starring Arnold Schwarzenegger. The international scientific community now appears increasingly to refer to them however, as Genetic Use Restriction Technologies, or, GURTs for short. These technologies are not only designed to provide 'in-built' genetic protection against farmers seeking to re-use second generation seed without the producers authorisation, but also, it is claimed, are a means of preventing the spread of particular genetic traits into the wider environment.

4.4.1 Genetic Use Restriction Technologies GURTs

Genetic use Restriction Technologies come in two varieties, V-GURTs which work at the varietal level, preventing the propagation of second generation seed by inhibiting its ability to germinate, and, T-GURTs which although allowing germination inhibit specific genetic traits unless activated by a chemical inducer. In both cases, the plants are genetically modified so that an inhibitor or disrupter gene is added to the DNA of the GM plant. When there is no chemical or other external inducer present, an inhibitor gene coding for a

disrupter protein prevents the growth of either the plant or the specific trait that the plant has been modified to produce, by suppressing the function of the other modified genes. When an inducer is present the inhibitor gene is repressed, the disrupter protein is not produced and the plant can either grow normally or express the genetically modified trait/s that it was designed to produce.

In a statement, dated the 14th of May 1999, made to the secretariat of the Convention on Biological Diversity (CBD), USDA outlined what they consider to be some of the potential benefits for agriculture of the technology described by US 5,723 765. According to the statement, because the control of plant gene expression "protects specific plant varieties with genetically engineered desirable traits from unauthorised regeneration and ensures benefits sharing for those who accomplished the improvements. ... The TPS may enhance investment in the research to develop high-value crop varieties, because companies will have more prospects for a fair return on their investment."[185] USDA therefore, reiterate, the same proposal that we have seen above in relation to the extension of IPRs to biotechnological products and process. Without the ability of companies to protect their property, the argument appears to run, there would be little investment in agricultural research and farmers would only have a limited variety of crops to choose from.

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[185] Statement by USDA on the control of plant gene function faxed to the Secretariat of the CBD on 14th May 1999 reproduced in UNEP (1999c) *Consequences Of The Use Of The New Technology For The Control Of Plant Gene Expression For The Conservation And Sustainable Use Of Biological Diversity - Supplementary Information* UNEP/CBD/SBSTTA/4/Inf.3 p.14

In the 14th of May statement, USDA further claim that "TPS provides a way to prevent the spread of genes introduced into improved crops ... and eliminates a theoretical biosafety concern over the use of genetically engineered crops."[186] In other words, USDA are claiming that, even in the 'unlikely' event that genes from a genetically modified crop did transfer to a 'wild' relative, because the inhibitor gene would pass with it, then without the inducer being present, the genetic modification would not be activated. Not only therefore is the greater degree of control provided by GURTs over the authorised and unauthorised use of second generation seed germplasm posited as a benefit to agriculture and farmers, but GURTs are put forward as a benefit to the environment, eliminating the risk of rogue genes escaping from the field. This is a risk, it may be noted which is frequently denied, when raised in relation to GM crops generally by their opponents. Perhaps this is why the USDA statement only refers to a hypothetical risk, which in its turn is why we should perhaps consider that GURTs are of only a hypothetical benefit to the environment.

For the producers of GM crops, GURTs are considered necessary in order to protect both the biotech companies' investment in biotechnologies and importantly to protect their genetic 'property', providing a greater degree of control not only over their seeds but over over farmers than is achieved through legal mechanisms such as IPRs. Melvin Oliver is a molecular biologist

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[186] Statement by USDA to CBD *op.cit n.*186, at p.14.

who works for USDA at their laboratories in Lubbock, Texas. Described on the first page of the patent as one of the inventors of US 5,273, 765, he makes it clear where the motivation for his work on the control of plant gene expression lies when he states that "my main interest is the protection of American technology. Our mission is to protect US agriculture, and to make us competitive in the face of foreign competition. Without this there is no way of protecting the [patented seed] technology."[187]

This raises the question of who USDA believes they are trying to protect their technology from. A question to which there can surely be only one answer, the end users of the seeds themselves, the farmers. This answer then raises the still further question of which particular farmers this technology is aimed at? The answer to the second question, according to USDA, is farmers who are already using intensive farming methods. As they commented in their statement to the secretariat of the CBD, "The primary use of TPS will be in the markets of developed nations, where farmers have the technology and infrastructure to take maximum advantage of high-value crop varieties. ... The germplasm used by subsistence farmers is not the target of this technology."[188] However, the March 3rd press release by Delta and Pine Land announcing the granting of US 5, 273, 765 tells a somewhat different story, when they say that the patent "has the prospect of opening significant worldwide seed markets to the sale of transgenic technology in varietal crops

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[187] In an interview with a researcher for the Rural Advancement Foundation International (RAFI) quoted in RAFI *Communique* March/April 1998

[188] Statement by USDA to CBD *op.cit n.*186, at p.16.

in which crop seed currently is saved and used in subsequent seasons as planting seed"[189]

The farmers which Melvin Oliver is working so hard to protect US agriculture against therefore, are not so much farmers in 'developed countries' farmers already reliant on hybrid varieties, farmers who for the most part already buy their seed afresh each year. Rather, they are farmers not already hooked on hybrid varieties, farmers who save and replant their seed each year, farmers who are not already the customers of the large agrochemical and seed conglomerates. As the following extract from Delta and Pine Lands Statement to the CBD makes quite clear:-

> "The Technology Protection System (TPS) will ensure farmers a more level playing field world-wide. Farmers in some of the more developed countries have been purchasing advanced seed technologies for the past several years based upon the value of proven enhancements. TPS will stimulate breeding and marketing efforts in countries which due to lack of protection of intellectual property, have not benefited from advances currently available in the developed world. ... it will actually result in growers, particularly in less developed countries, having more options available to them, including high yielding disease resistant and even transgenic varieties. We expect this new opportunity to present farmers in developing

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[189] Delta and Pine Land Co. *Press Release* March 3rd 1998.

countries with the option of moving into production agriculture rather than their current subsistence farming"[190]

In complete contrast to their co-assignees at USDA therefore, Delta and Pine Land, openly admit that for them, the primary importance of Genetic Use Restriction Technology is the perceived ability to control subsistence farmers in developing countries. So that, where the tradition of reseeding is still the norm, GURTs, will provide a better means of disciplining the farmer than those currently available through the policing of IPRs. GURTs, as I have argued above, better translate the needs of the socio-technical networks found within the biotech industries, into the seeds themselves. The environmental futures and agricultural diversity that are threatened by these technologies, do not derive from the granting of IPRs as we have seen with other GMOs. Rather, as a June 1999 SBSTTA report makes clear "the existence or not of a patent on V-GURTs is not a problem that directly affects the farmers: it is the technology itself which prevents the saving and re-use practices, and not the eventual enforcement of patent rights."[191]

4.4.2 Terminating GURTs

For these reasons, environmental and developmental activists and NGOs in southern countries have, unsurprisingly, been extremely vocal when it comes

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[190] Statement by Delta & Pine Land Co. to the Secretariat of the Convention on Biodiversity dated 14th May 1999 reproduced in UNEP (1999c) *op.cit n.*186 at p.20.

[191] UNEP (1999d) *Consequences Of The Use Of The New Technology For The Control Of Plant Gene Expression For The Conservation And Sustainable Use Of Biological Diversity* UNEP/CBD/SBSTTA/4/9/Rev.1.

to considering the social and economic implications of GURTs for the farmers and peoples of their countries. Camilia Montecinos, works with farmers at the Centre for Education and Technology in Santiago, Chile. Responding to Delta and Pine Land's and USDA Press Release on the granting of US 5, 273, 765, she called on governments to ban the technology saying, "This is an immoral technique that robs farming communities of their age old right to save seed and their role as plant breeders. Farmers and Governments everywhere should declare use of the technologies as contrary to public order and national security"[192] In a similar vein Farhad Mazur of UBINIG in Bangladesh declared that "there are 1.4 billion poor people who depend upon the ability to save seed for their food security ... Most of these people are in South Asia - exactly where the Terminator's inventors have said they want to introduce the technology. Fighting against the Terminator is fighting for life itself."[193]

Criticism of GURTs, has however, not only been confined to those activists who's historical support for farmers rights would lead one to predict their antagonism for the new technologies. While activists such as the Karnataka Rajya Raitha Sangha in Banagalore demanded that the Indian Institute of Science cut its research ties with Monsanto[194] others, who have previously promoted GMOs such as the agriculturalist MS Swaminathan have also condemned this new twist in the GM crops debate. Swaminathan, who now works from his own research foundation in Madras, was director of ICRISAT

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[192] *New Scientist* 28th March 1998, p.22

[193] RAFI *News Release* 11th December 1998.

[194] *The Hindu* Saturday August 15th 1998.

and one of the key people in the implementation of the Green revolution. Writing an editorial in the *The Hindu* he outlines what he believes to be some of the possible consequences of GURTs :-

> "The Terminator Technology will further reduce the rights of farmer-cultivators. They will have no option except to buy seed from the seed company every year. Genetic homogeneity in crops will then become more widespread, enhancing genetic vulnerability to pests and disease. Hence, this aspect of farmers' rights needs careful consideration not only from the point of view of ethics and equity, but even more importantly from the viewpoint of maintaining genetic diversity at the field level. Large areas may be covered by the same genotype and on going efforts directed towards the revitalisation of the on-farm conservation traditions of farm families and the breeding of location specific varieties through participatory breeding methods will suffer"[195]

Such has been the concern surrounding these 'terminator technologies' in India, that, following the permissions given to Monsanto and others to start field trials on genetically modified crops, members of the Indian parliament sitting in the Rajya Sabha, responded to a call attention motion introduced by Mr KR Malkani, by unanimously demanding a ban on the introduction of TSP seeds. The then Agriculture Minister Mr Som Pal assured the Rajya Sabha that terminator genes would not be allowed into the country stating that "the

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[195] *The Hindu* Sunday, August 23, 1998.

interests of Indian Farmers would be fully protected and it is our final view that it [terminator technology] would not be allowed in the country."[196]

Quite how these assurances that the Indian government would be able to prevent the import into India of seeds containing GURTs, while India remains a member of the WTO, are hard to comprehend. For, as we have seen above, if seeds containing GURTs are patented and already marketed in other countries, India would not be able to prevent their importation under provisions in the TRIPs, SPS and GATT agreements, without facing the possibility of a case being brought in the DSB. Similarly the Biosafety Protocol for reasons discussed above would appear to be of little help.

In response to many concerns about TPS voiced during the fourth Conference of the Parties to the Biodiversity Convention (COP IV), held, in Bratislava between the 4-15th of May 1998, in its decision IV/6, the COP IV reiterated the adherence of the CBD to the Precautionary Principle and asked the Subsidiary Body for Scientific Technical and Technological Advice (SBSTTA) to compile a report for its attention on US 5, 273, 765. The report draws a distinction between three types of agricultural systems, Highly industrialised agriculture; intermediate agricultural systems; and traditional subsistence agriculture.[197] Although recognising the implications that V-Gurts may have for agricultural biodiversity through stopping the flow of seeds that might otherwise be used to improve local varieties, the report holds that "it is

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[196] *The Hindu* Wednesday, December 2nd 1998.

doubtful that new plant varieties bearing V-GURT will be designed for the subsistence sector of agriculture."[198]

This conclusion, as we have seen, appears to be contrary to the intentions of one of the developers of this technology, Delta Pine Land and so perhaps the warning that follows in the report may be more apposite, when the authors suggest that;

> "if varieties with V-GURT are indeed targeted increasingly to the traditional subsistence sector, as some companies express that they will, then we can see either ambivalent or negative impacts. In this context, the greatest concern is with the mixed sector of cash and subsistence agriculture, which is likely to adopt earlier than the more traditional sector."[199]

The risks identified by the report in this regard, are the giving up of the right to save seeds; the increased financial burden on farmers; displacement of more robust varieties; increased vulnerability to "environmental stress;" increased food insecurity; and an undue dependence on seed supply from a small number of global institutions, and that's just the recognition of the potential indirect environmental effects. When attention was turned specifically to IPRs and the introduction of V-Gurts the report suggested that

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[197] UNEP (1999d) *op.cit n.*192 at §136.
[198] UNEP (1999d) *op.cit n.*192 at § 150.
[199] UNEP (1999d) *op.cit n.*192 at § 151.

"Resolving industry's concern for the protection of intellectual property rights by use of V-GURT may indeed promote a substantial investment to develop new plant varieties, or at least old varieties with new traits. However, there are no assurances that the investment so promoted will be particularly helpful in terms of socio-economic equity and environmental sustainability ... Of greater concern is the possibility that in accepting the increased private-sector investment as a substitute for visionary public investment, there will be insufficient attention to the most disadvantaged and vulnerable group of farmers, who ironically have arguably the most important role in maintaining genetic diversity *in situ*."[200]

Following the furore surrounding, 'Terminator' technologies in the spring of 1999, Monsanto publicised the fact that that they were conferring with various prominent figures in the international agbio world including Gordon Conway, the then President of the Rockefeller Foundation. Subsequent to Conway's speech to the board, Monsanto's CEO, Robert B. Shapiro, published an open letter to Gordon Conway,[201] in which he stated that

"Though we do not yet own any sterile seed technology, we think it is important to respond to those concerns at this time by making clear our commitment not to commercialize gene protection systems that render seed sterile. It is also important to understand that the technical and

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[200] UNEP (1999d) *op.cit n.*192 at §172.

[201] October 4th 1999, the Letter was published on Monsanto's web site at http://www.monsanto.org

business utility of sterile seed technology is speculative. The specific technology over which Monsanto would gain ownership through its pending merger with Delta & Pine Land is developmental, at least five years away from any possible commercialization, and may or may not prove workable in a commercial setting."[202]

On Monday 20th December 1999 Monsanto called off their proposed acquisition of Delta Pine Land, costing Monsanto not only a contractual break up fee of $81 million, but a billion dollar law suit as well.[203] Whatever the intention of the promise made by Monsanto's Bob Shapiro following the failed acquisition he certainly no longer speaks for Delta Pine Land, whose vice president for technology transfer, Harrry Collins, is reported as having said that "we've continued right on with work on the Technology Protection System We never really slowed down. We're on target, moving ahead to commercialize it. We never really backed off."[204]

Now that Genetic Use Restriction Technologies have arrived, it remains to be seen how they are deployed in the future, certainly as far as existing

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[202] *ibid* - Shapiro then went on to say that although Monsanto were working with GURTs they are not developing any sterile seed technologies of their own, however Monsanto hold at least one patent WO 9744465 on a "Method for Controlling Seed Germination Using Soybean ACYL COA Oxidase Sequences." The patent states that "in this system, continual presence of inducer is required in order for plant development to proceed normally. If inducer is withdrawn plant development is then disrupted." §15. In other words the seeds will not germinate unless a chemical is applied to them.

[203] See "Delta & Pine Land Sues Monsanto Co. For Breach of Their Accord to Merge," *The Wall Street Journal*, Wednesday, January 19, 2000; "Monsanto Pays $81 Million Fee To Delta & Pine"; *The Wall Street Journal* Tuesday, January 4; 2000; "Spurned Firm Asks Monsanto to Pay Up," *The Wall Street Journal Europe* Wednesday, December 22, 1999.

[204] RAFI (2000) Communiqué February March 2000 p.1.

international trade rules are concerned, once plants containing GURT's have received marketing permissions in a country such as the US it will be very hard, if not ultimately impossible, for any other country to prevent their importation without facing trade sanctions. GURTs provide an additional means to IPRs by which multinational agribusiness companies can control and (re)order farmers practices through time and space.

Chapter 5

Fields of Hope: Human and Environmental Futures in a Biotechnological Age

In this, the final chapter, I intend not only bringing together some of the themes that have dominated this thesis, but also expanding upon the context in which the specific developments we have explored are taking place. Then, in the last section of this chapter I want to turn to consider two organisations, MASSIPAG in the Philippines and the Nayakrishi Andolon in Bangladesh, that I believe offer examples of the way in which peoples' spaces can be regenerated. These organisations perhaps offer both literal and metaphorical fields of hope, for human and environmental futures. These two organisations are responsive to local needs, while maintaining at their centre a real concern for the dignity and security of both today's and future generations of humans, through the adoption of sustainable, financially and agriculturally efficient production methods, that are sensitive to both environmental and cultural heterogeneity. Most importantly however, these two farmers' organisations provide an example of how to limit the power that life science companies attain, through the various mechanism of *interessment*, which we have seen mobilised through this thesis.

Throughout this thesis I have argued that biodiversity is threatened by the introduction of transgenic crops in so far as current international legal regimes whether within the auspices of the CBD, or of the WTO, further the interests of life science companies, while providing the means of restructuring spatial and temporal social relationships within multiple environments. I have suggested that in place of the heterogeneous social, spatial and temporal relationships that have resulted in a vast heritage of agricultural biodiversity, the CBD is, for the most part, characterised by a narrow concern with nature as a genetic resource to be utilised and exploited; that, despite the CBD's implicit recognition in Article 8(j) of the role of farmers' local and indigenous knowledge in the maintenance of agricultural diversity, the CBD has a reductionist narrative which works to undermine these knowledges; and, that in its recognition of IPRs the CBD provides a means by which it undermines its own limited aims.

Similarly I have argued that a number of agreements within the WTO work to facilitate trade in GMOs while potentially undermining the ability of farmers in the two thirds world, to continue practices that have resulted in current levels of agricultural biodiversity. In particular I have suggested that IPRs provide a means of securing fact maintenance for those deploying transgenic seeds, while a nationally implemented TRIPs compliant IPR regime provides a mechanism through which transgenic seeds can maintain their social materiality through time and space. As boundary objects non humans and humans have the tendency to change their behaviour patterns, orderings are always both partial and fragile, as Law remarks "the components of the

network have, as it were, no natural tendency to play the roles to which they have been allocated. they tend to want to make off on their own. Indeed, they act in the way they do only because they, too, are effects generated by a network and its mode of interaction,"[1] thus this tendency to wander needs to be curbed by the presence of texts and disciplinary practices in order to assure that transgenic seeds maintain their meaning through time and space and are treated differently to other seeds. IPRs therefore serve to extend particular visions, performing ordering tales that are not only extended in time and space, but involve an expression of power in their relational functioning.

Transgenic seeds however are also mobilised within other social networks, within agricultural and food networks, all be it that many of the actors and ordering stories remain the same. These networks too provide a means of extending control through time and space, of reordering spaces and (re)ordering farmers practices ultimately affecting agricultural diversity.

In October 1998 an open letter was circulated by Monsanto signed by 50 prominent international figures, including the father of the Green Revolution Norman Borlaug, entitled "Let The Harvest Begin." The following extract provides a taste of the philosophical vision that underpins the signatories' quest

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[1] Law, J. (1994) *Organizing Modernity* (Oxford: Blackwell Publishers) p.103.

"Finding new ways to meet our global need for food, while maintaining ecological balance, might be the greatest challenge we face in the next century... We all share the same planet - and the same needs. In agriculture, many of our needs have an ally in biotechnology and the promising advances it offers for our future... In the next century, we need food that is more plentiful and more affordable than it is today. With more productivity needed from less tillable land, we need new ways to yield more from what is left. To strengthen our economies, we need to grow our own food as independently as we can. Agricultural biotechnology can help play a major role in realizing the hope we all share. This science can help make a dramatic difference in millions of lives. Securing food for our future is the beginning of a better life for us all. Let the harvest begin."[2]

What is perhaps most startling is that although the letter recognises the need to address poverty, distribution, soil erosion and water supply, the fundamental belief in the need for biotechnology displays the taken for granted viewpoint that current farming techniques cannot feed the inhabitants of the world, it ignores the role that farmers have played and must continue to play in securing diversity and food in the two thirds world. We should perhaps not be too surprised however, as this is a story that has been repeated in different disguises for at least the past two centuries.

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[2] Monsanto News Release 10/14/98 accessed at<http://www.monsanto.com/monsanto/media/98/98oct14_Message.html>.

5.1 Malthusian (Mis)directions amid rDNA technologies

In his *Essay on the Principle of Population,* the 19th century cleric Thomas Malthus, through a "law of nature," consigned humanity to a future of poverty, disease, famine and war. The destiny of humanity was to be brought about through the interactive relationship between two constants, those of population growth and increases in agricultural productivity, for, while Malthus held that agricultural productivity increased at an arithmetic rate (1,2,3,4,5,6 ...) he also understood population to increase at a geometric rate, doubling every 25 years (1,2,4,8,16,32 ...), hence humanity's tragic fate.

Malthusian arguments persist in development strategies today, leading to a concern with 'over population' which, as Eric Ross, argues obscures other reasons for poverty, hunger, and environmental degradation, not least in so far as solutions to hunger, are often portrayed as reliant on increased agricultural productivity.[3] As Amartya Sen observes however, "Starvation is the characteristic of some people not *having* enough food to eat. It is not the characteristic of there *being* not enough food to eat. While the latter can be a cause of the former it is but one of many *possible* causes."[4]

For over fifty years the international community has continued to declare as one of its central aims, the achievement of humanity's freedom from hunger.

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[3] Ross, E. (1998) *The Malthus Factor: Poverty, Politics and Population in Capitalist Development* (London: Zed Books).

[4] Sen, A. (1981) *Poverty and Famines* (Oxford: Oxford University Press) p.1.

When the United Nations Food and Agriculture Organisation (FAO) was founded in October 1945, the preamble to the FAOs constitution stated that its purposes, were to be those of "raising levels of nutrition and standards of living of the peoples under their respective jurisdictions; securing improvements in the efficiency of the production and distribution of all food and agricultural products; bettering the condition of rural populations; and thus contributing toward an expanding world economy and ensuring humanity's freedom from hunger."[5]

Even more fundamentally the right to food, or at least the right of everyone "to a standard of living adequate for the health and well being of himself and his family, including food ..."[6] has been enshrined within Article 25 of the 1948 Universal Declaration on Human Rights while Article 11 of the 1966 International Convention on Economic Social and Cultural Rights[7] perhaps goes even further in recognising "the fundamental right of everyone to be free from hunger." What should not escape our notice however is that the right to food, or the right to be free from hunger, are qualified rights, as with the

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[5] Preamble to the FAO Constitution.

[6] Article 25 of the 1948 Universal Declaration on Human Rights GA Resolution 217A(III) GAOR 3rd ses Part1.

[7] While the wording of the first part of Article 11 is almost identical to that of the Universal Declaration, at first sight the second part appears to provide more grounds for developing obligations and duties to secure food. "11.2 The state Parties to the present Covenant recognising the fundamental right of everyone to be free from hunger shall take individually and through international co-operation the measures including specific programmes which are needed: a) To improve methods of production, conservation and distribution of food by making full use of technical and scientific knowledge by disseminating knowledge of the principles of nutrition and by developing or reforming agrarian systems in such a way as to achieve the most efficient development and utilisation of natural resources; b) Taking into account the problems of both food importing and food exporting countries to ensure an equitable distribution of world food supplies in relation to need."

preamble to the FAO's constitution access to food is linked to increased economic growth, it is a right to live within an efficient economy that provides access to food to those who can afford it. What is more, it is a right that is to be achieved as Article 11.2 of the 1966 ESCR Convention states, through improved methods of production and the reform of agrarian systems. So that while at the same time as defining a right to be free from hunger, the problem of hunger is one which is articulated as deriving from inadequate methods of production.

The World Bank too has displayed more than a nod in the direction of Malthus, for, while a brief glance at any of the annual World Development Reports will leave the reader in no doubt that at least in spirit the bank's, primary purpose is the relief of poverty, starvation and for the past decade the promotion of sustainable development, it is the means through which these goals were, and still are, to be achieved which are at issue. Although much water has passed under the bridge at the World bank since 1973, the current approach has not changed significantly since when the then incoming president of the World Bank, Robert McNamara, stated in his now (in)famous 1973 speech to the board of governors in Nairobi, that what was needed was a new strategy for 'rural development.' The World Bank was "to help the poor become productive," economically productive that is. It was necessary, according to McNamara, to "increase the productivity of the small farmer" in

order to tackle the problems of "poor nutrition, inadequate shelter and low health standards."[8]

The intervening years have seen the first Global Food Summit in 1974 and a number of World Food Days, the first of which was held on 16th October 1981, come and go. We should perhaps ask therefore, why, if the eradication of hunger and poverty has been of such central concern to the international community for at least the last fifty years, was it necessary for representatives from the majority of the World's Governments to meet under the auspices of the United Nations Food and Agriculture Organisation (FAO), in Rome between the 13th and 17th of November 1996, to discuss World food security.

That the "World Food Summit" should have been convened at all, would appear to be evidence enough that even on its own terms, those years of 'development' to which nations and peoples have been subjected, failed to achieve the most fundamental of its own aims. As Arturo Escobar observes "no aspect of development appears to be as straightforward as hunger. When people are hungry, is not the provision of food the logical answer? Policy would be a matter of ensuring that enough food reaches those in need on a sustained basis."[9] Ultimately, Escobar, like may others is attempting to understand why despite 50 years of the 'development era', the 1996 *Rome*

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[8] Address to the Board of Governors of The World Bank delivered by Robert S. McNamara at the Annual Meeting in Nairobi, Kenya on September 24th 1973 in The World Bank (1975) *The Assault on World Poverty: Problems of Rural Development Education and Health* (Baltimore: The World Bank & The John Hopkins University Press) pp.90-98.

[9] Escobar, A. (1995) *Encountering Development: The Making and Unmaking of The Third World* (Princeton, New Jersey: Princeton University Press) p.102.

Declaration on World Food Security should still need to state that "we, the Heads of State and Government, or our representatives ... consider it intolerable that more than 800 million people throughout the world, and particularly in developing countries, do not have enough food to meet their basic nutritional needs"[10]

For, as Peter Uvin observes in the 1995 *Hunger Report,*[11] since the mid 1970s, not only has there been enough food produced every year to provide a basic diet for a sum of people greater than that years' world population[12], but there remain, in addition, enough cereal reserves to protect against calamities.[13] Similarly, in 1996 the FAO stated that "the 5.8 billion people in the world today have, on average, 15 percent more food per person than the global population of 4 billion people had 20 years ago."[14] Despite this, it is the FAO's assessment that malnutrition now affects 800 million people compared with 450 million at the time of the first Food Day in 1981. Food insecurity is not necessarily therefore a problem of an increasing population outstripping agricultural production but rather what Amartya Sen calls the "acquirement

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[10] FAO (1996a) Rome Declaration on World Food Security.

[11] Uvin, P. (1996) "The State of World Hunger" in Messer, E. and Uvin, P. (eds.) *The Hunger Report: 1995* (Amsterdam: Gordon & Breach).

[12] See Lappe, Collins, Rosset and Esparza (1998) *World Hunger 12 Myths* 2nd Edition.(London: Earthscan); and, Sen, A. (1999) *Development as Freedom* (Oxford: Oxford University Press).

[13] Uvin (1996) *op.cit n.*11.

[14] FAO (1996b) *World Food Summit Plan of Action* (Rome: FAO) para. 5.

problem,"[15] the problem of acquiring enough entitlements to be able to obtain sufficient food to survive.

> "The Notion of entitlement in this context must not be confused with normative ideas as to who might be 'morally entitled' to what. The reference instead is to what the law guarantees and supports ... the entitlement of a person stands for the set of alternative commodity bundles that can be acquired through the use of various legal channels of acquirement open to that person. In a private ownership market economy, the entitlement set of a person is determined by his original ownership bundle (what is called 'endowment') and the various alternative bundles that the person can acquire, starting with each initial endowment through the use of trade and production (what is called his 'exchange entitlement') A person has to starve if his entitlement set does not include any commodity bundle with an adequate amount of food."[16]

5.1.1 Constructing Foodscapes

Food is as essential to human existence as the air we breathe, yet, as easily as the necessity of food appears to bind together 'humanity', its significance and meaning within the day to day lives of individuals re-asserts the diversity of human existence. The food we eat, the crops that we cultivate, the nature, quantity and quality of our diets are constructed by a multitude of social

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[15] Sen, A. (1995) "Food, Economics and Entitlements" in *The Political Economy of Hunger*, Drèze, J., Sen, A., Hussain, A., eds. (Oxford:OUP).

factors, within a complex web of spatial and temporal relationships. Agricultural food systems have an increasingly extended international reach within which demands for increasingly exotic ingredients, from sources further and further afield, are led by media constituted consumers located within multiple food networks, whose diets are the result of numerous cultural, economic and ideological practices.[17]

The production of food influences the material nature of our environments in much the same way, as our social and physical environments influence the food that is produced, as Susan George wrote in 1990;

> "every food system – defined as the totality of tangible and intangible means employed by a given human community for the production, conservation, distribution and consumption of food – has profound effects on the environment. There is no such thing as a 'natural' ecosystem; each one is shaped by the cultural perceptions, economic arrangements and political confrontations of human beings in their efforts to assure themselves of this most basic human necessity. It is furthermore, impossible to look at food systems as closed, static entities. Not only are dynamic historical process occurring within each society to transform them (and, with them, the environment) but interactions between food systems in

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[16] Dreze, J. & Sen, A. (1989) *Hunger and Public Action* (Oxford: Oxford University Press) pp.22-23.

[17] Watts, M. & Goodman, D. (1997) "Agrarian Questions: Global Appetite, local metabolism: Nature, culture, and industry in fin-de-siècle agro-food systems" in David Goodman and Michael J. Watts (eds.) *Globalising Food: Agrarian Questions and Global Restructuring* (London: Routledge) p.3.

different parts of the globe are taking place with increasing frequency and intensity."[18]

Thus, as food networks, become extended in time and space, as the international division of labour further separates the production of food from its points of consumption, not only are the relationships of people to their environments changed, but the effects of these changes on environments are perceived less and less by the end user of agricultural products.

Since the 15th Century, the production and consumption of food and other agricultural products, have become the subjects of increasingly extended social networks. The Venetian city state became rich on the profits of pepper, the value of which was ten times that of any other spice and comprised half the total of all spice imports into Italy. When, the Turks began blocking the overland trade routes around 1470, such was the impact on the European palette, that "Portuguese, Italian and Spanish explorers all sailed west or south in order to reach the orient."[19] The islands of Mauritus and St Helena were early victims of the colonial expansionism that followed in these sailors wake.[20] The environmental devastation that these islands suffered occurred as a direct result of the non-indigenous plants and animals introduced to the

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[18] George, S. (1990) *Ill Fares the Land (Harmondsworth: Penguin)* pp.19-20.

[19] Hobbhouse, H. (1992) *Seeds of Change Five Plants that transformed the World* (London: Papermac) pp.xii.

[20] Grove, R.H. (1995) *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism 1600-1860* (Cambridge: Cambridge University Press) and Grove, R.H. (1998) *Ecology, Climate and Empire: The Indian Legacy in Global Environmental History 1400-1940* (New Delhi: Oxford University Press).

islands by the British and Dutch East India companies in an effort to supply the crews of their ships with fresh produce. As a market for commodities such as sugar, coffee, cocoa, tea and cotton, began to be generated in Europe and America, land in 'the colonies' was turned over to their production, the colonial powers using the rest of the world as their personal market garden.[21]

This colonial legacy lives on in many countries throughout the world with the economies of countries such as the Dominican Republic reliant on the European consumer's taste for sugar, bananas and pineapples.[22] In recent years however, high value foods, such as fruits and shrimp, have begun to displace the 'traditional' commodities of sugar coffee cocoa tea and cotton. In Mexico, these new high value foods are grown by farmers under contract to US based MNC's, companies such as Del Monte, Gerber and Birdseye[23] while

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[21] See for example Juma, C. (1989) *The Gene Hunters: Biotechnology and the Scramble for Seeds* (London:Zed Boooks) and Hobbhouse, H. (1992) *Seeds of Change Five Plants that transformed the World* (London: Papermac).

[22] Raynolds, L. (1998) "Restructuring National Agriculture Agro Food Trade and Agrarian Livelihoods in the Caribbean" in David Goodman and Michael J. Watts (eds.) *Globalising Food: Agrarian Questions and Global Restructuring* (London: Routledge).

[23] For some of the environmental and economic consequences of these changes see Patnaik (1996) "Export Oriented Agriculture and Food Security in Developing Countries and India" *Economic and Political Weekly,* pp.2429-2449; and Siddiqui, K. (1998) Agricultural Exports, Poverty and Ecological Crisis Case Study of Central American Countries" *Economic and Political Weekly* September 26th A128-A136; Biswajit Dhar and Sachin Chaturvedi identify an additional problem in relation to agri business companies in India when they state that "these corporations are also engaged in acquiring asset bases of small and marginal farmers, who are selling off their lands to these corporations and ultimately joining the group of wage workers" (Dhar, B. Chaturvedi, S. (1999) *WTO Agreements and Agricultural Sector: Implications and Options For India"* (New Delhi: Research and Information System for the Non Aligned and Other Developing Countries) p.63. As I saw and heard for myself during a trip to Bangalore in 1998, the money farmers are offered for their farms seems high at the time but usually lasts little more than a couple of years, the then ex-farmers do not have the skills, or are not needed to work in the floraculture industry, a situation which has meant in some cases that they are reduced to begging. Floraculture horticulture and other hi-tech, export oriented enterprises, are now encouraged in the context of India's new economic policies, her structural adjustment program and commitments within the WTO. In Karnataka for example, changes contained in *The Karantaka Land Reforms (Amendment) Bill, 1995*

in India's Punjab, Pepsi Co. contracts with farmers to grow tomatoes grown from imported varieties.[24] The effect is to create further competition between the use of land for local consumption of food and that used for export, a situation which is exasperated still further in relation to other cash crops such as cotton or flowers. In India for example, the Agriculture and Processed Food Products Export Development Authority (APEDA) has approved nearly 150 floriculture projects mostly centred around Guragon, Bangalore and Pune[25] while, the amount of land given over to Cotton in the Warangal district of Andrah Pradesh alone increased, between 1986 and 1998 from 5,000 to 100,000 hectares as farmers pursued the supposed wealth of "White Gold."[26] This trend appears to be one which is only set to increase within the WTO framework as Dhar and Chaturvedi observe;

> "The lifting of restriction on imports of agricultural commodities and the associated decline in the competitiveness of domestic production could

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including an increased ceiling on maximum land holdings has facilitated agricultural based industries ability to purchase land see Ramesh, M.K.. (1996) Agrarian Reforms: Review of Recent Changes in Karnataka Vol.IV (1) *Voices* 48.

[24] Nanda, M. (1995) "Transnationalisation of Third World State and Undoing of Green Revolution" *Economic and Political Weekly* January 28th PE20-PE30.

[25] Prakash, TN (1996) "Globalisation and The Indian Farmer" Vol.IV (1) *Voices* pp.39-41.

[26] Tragically, in the early months of 1998 around 350 cotton farmers in Andrah Pradesh committed suicide when the cotton crop failed and farmers found themselves in a debt trap. They had borrowed heavily to buy seed, fertiliser, and pesticides, following the change from the production of traditional crops such as Jowar and Green Gram to cotton. When their crops were attacked by whitefly, boll worms and other thrips aphids and mites, partly as a result of the increased production in the area, which coupled with the persistent over reliance on chemicals meant that the pesticides proved useless and their crops failed. Tragically the farmers saw no other option, but to drink the pesticide which had played such a prominent role in creating the position in which they found themselves. (See *The Hindu*, "Editorial - Suicides by Farmers " April 21, 1998; *The Hindu*, "Editorial Where Cotton Suffocates, " February 22, 1998; *The Hindu*, "Another Farmer Suicide," March 22, 1998; *The Hindu*, "Editorial - Death by Farming", January 31, 1998; *The Hindu,* "On the Suicide of Cotton

lead to an intensification of one of the recent tendencies in agricultural production viz. the gradual shifting away from food crops towards commercial crops. This change in cropping pattern is symptomatic of the fact that the farming community perceive food crop protection to be less remunerative as compared to the commercial crops. Any competition from cheaper imports will only strengthen this process of shift in cultivation ... the pressures of global processes are contributing to changing the objective basis for the development of agriculture in the country ... developments in the agricultural sector have brought with them a more fundamental change. From being one of planning to increase domestic production so as to ensure food security domestically, the principal guiding factor for the agricultural sector in the new dispensation has been to increase trade in agricultural commodities without concern for the domestic consumption requirements. The tacit implication of this has been that the objective of ensuring food security has now been taken out of the policy making framework of the domestic governments and has been made dependant on the global surplus stocks"[27]

These global food stocks come, for example, from the US whose exports of agricultural commodities in 1996 reached an all time high of US $59.8 billion[28] although this subsequently fell to $49.1 billion in 1999. Bad weather, crop disease and a strong dollar have all played a role in the relative hardships that

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Farmers in Andrah Pradesh" February 19, 1998; *The Hindu*, "First Report of Farmers Plight Ignored" April 9, 1998).

[27] Dhar & Chaturvedi (1999) *op cit. n.*23. at pp.61-64

currently confront rural America. The Asian financial crisis at the end of the nineties has also been a significant component in the current plight of some US farmers, something which can be understood when one comprehends that forty percent of the US's agricultural exports are shipped to Asia.[29] In order to give some idea of the US overall food exports 50% of wheat, 57% of rice, 37% of soybean, 24% of corn, 35% of fruit and vegetables and 42% of cotton were grown for export.[30] In 1999 this meant that 28.8 million metric tons of wheat and 59.9 million metric tons of corn were exported.[31]

This increasingly liberalised international trade in agricultural commodities taking place within the framework of the WTO Agreement on Agriculture[32] and the implementation of structural adjustment programmes, is frequently defended on humanitarian grounds as, when the US agriculture Secretary Dan Glickman declares that "at its heart, freer agricultural trade is about feeding the world. [for] Uninhibited trade allows food to flow easily to those

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[28] USDA *Outlook for US Agricultural Trade* 30th August 2000.

[29] Remark's of Deputy Secretary of Agriculture Richard Rominger, Special Grains Conference 1998 of the International Grains Council, Buenos Aires, Argentina, December 2 1998, "Challenges of the New Millenium for Grain Markets" USDA Release No. 0500.98

[30] Remark's by United States Trade Representative, Ambassador Charlene Barshefsky at the USDA Agricultural Forum, February 24th 1997.

[31] USDA *Outlook for US Agricultural Trade* 30th August 2000.

[32] For a critique of the Agreement on Agriculture and an exploration of its potential consequences for peoples of the two thirds world see, Ritchie, M., Dawkins, K., (2000) "WTO Food and Agriculture Rules: Sustainable Agriculture and The Human Right to Food" *9 Minn. J, Global Trade* 9; Murphy, S. (1999a) *Trade and Food Security: An Assessment of the Uruguay Round Agreement on Agriculture* (London: CIIR); Murphy, S. (1999b) *Market Power In Agricultural Markets: Some Issues For Developing Countries, T.R.A.D.E. Working Papers No.6* (Geneva: South Centre); South Centre (1997) *Universal Food Security: Issues for the South* (Geneva:South Centre); Watkins, K. (1996) "Free Trade and Farm Fallacies: From the Uruguay Round to The World Food" Summit Vol.26(6) *The Ecologist* 244: Watkins, K. (1995) *Agricultural Trade and Food Security* (Quezon City, Phillipines: Oxfam).

who need it."[33] Charlene Barshefsky, the US Trade Ambassador, gives the game away however when talking to a home audience in Washington when she says "96 percent of the World's consumers live outside our country, The only way to ensure that prices stay strong and farmers and ranchers stay in business is to continue to expand markets outside the United States. Our pledge to US agriculture is based on a simple and obvious premise: trade agreements work for US agriculture."[34]

Uninhibited agricultural trade threatens to affect the continued production of agricultural biodiversity in a number of ways, just as we have seen above, local varieties can be supplanted in contract farming where particular varieties of crop are required by the contractor, while small farmers are either being encouraged to change their practices or to sell their farms in the names of development, structural adjustment and progress. So that with the move to commercial crops for export what we loose in the process are the knowledges and innovations of farmers, their narratives and their practices that once maintained the production of agricultural bio diversity in the field.

It is in this context of an increasingly liberalised international agricultural market that transgenic crops are being introduced into the two thirds world. As we saw in the last chapter 71% of all commercialised transgenic crops have been developed to be herbicide tolerant, predominately to Monsanto's

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[33] Remark's of Secretary Dan Glickman, to the International Grains Council, London, England, June 19th 1997. USDA Release No. 0196.97.

RoundUp®, while the planting of insect resistant crops in 1999 accounts for only 22 % of the global acreage of GM crops compared with 28 % in 1998. Although companies such as Monsanto argue that herbicide tolerant crops use less herbicide overall and are therefore ecologically more sound, it is the technology itself, the link between seed and herbicide, which provides the means through which to achieve the homogenisation of the conditions of production necessary for agricultural businesses to expand, and which, at the same time, provides a threat to the continued production diversity in the two thirds world. As we saw in Chapter 1, in 1999, 90% of Argentina's 7 million hectare soybean crop, was transgenic, the only way in which significant increases in the planting of transgenic soybean in Argentina can take place is if more land is given over to soybean, a crop grown for cattle feed, replacing whatever crops were grown in its place before.

Farmers in the two thirds world are once again the subject of attempts to (re)order their social practices, in place of colonial rulers however, today it is multinational life science corporations, national governments, the FAO, and others, seeking to replace the local crop varieties and heterogeneous methods of farmers, with transgenic crops and uniform methods of production in a "new green,"[35] "doubly green,"[36] or "evergreen[37]" revolution. When the

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[34] Remark's of Ambassador Charlene Barshefsky Farm Journal Forum "Prospering in the High Risk Food Economy" November 14th 1997 Washington D.C.

[35] FAO (1996) *Lessons from the Green Revolution; towards a new green revolution* World Food Summit Technical Background Document No.6 (Rome: FAO).

[36] Conway, G. (1997) *The Doubly Green Revolution: Food for All in the 21st Century* (Harmondsworth: Penguin).

FAO calls in its Global Plan of Action, for "the widespread use of improved seeds and breeds"[38] or states that, "food production and rural development, particularly in those countries with significant food security inadequacies, require appropriate and up-to-date technologies" they devalue the practices of generations of farmers.

When US Agriculture Secretary Dan Glickman states how "we believe that biotechnology is critical for feeding a hungry world in a responsible and sustainable fashion"[39] or similarly that, "biotechnology holds out our greatest hope of dramatically increasing yields ... In one hand, we have a technology that has proven safe and promises a second revolution in food production. The other hand is empty. There is no way to feed a hungry world, or an economically growing world, without embracing the future."[40] We are witnessing the devaluing of countless farmers' knowledges together with the simultaneous categorisation of farmers within the two thirds world as backward and (un)modern. In place of their heterogeneous practices, is to be applied a 'universally' applicable scientific fix, their diverse knowledges subordinated to a mythical model of scientific development as rational progress. Rather than call for "the harvest to begin" we need to question not

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[37] Swaminathan, M.S. (1997) "Uncommon opportunities for achieving Sustainable Food and Nutrition Security: An Agenda for Science and Public Policy" in *The Globalisation of Science The Place of Agricultural Research* 2nd Ed. Christian Bonte-Friedheim and Kathleen Sheridan (eds) (The Hague: The International Service for National Agriculture) pp.181.

[38] (FAO 1996b) *op cit. n.*14 Objective 3.1.

[39] Remark's by Secretary of Agriculture Dan Glickman on the State of American Agriculture Delivered at the 75th Annual Agricultural Outlook Forum, February 22nd, 1999 USDA Release No. 0065.99

only why the already abundant harvests do not reach those who most need them; we need to ask what the likely effect of the wide scale introduction of transgenic crops potentially holds for cultural and agricultural diversity; and what can be done to ensure human and environmental futures in a biotechnological age.

5.2 Globalisation and the limitation of the political

It has become fashionable during the last decade or so of the previous century and continuingly so in this the third Christian millennium, to invoke the 'process of globalisation' as a means not only for *explaining* the human suffering encountered by millions of people, but also, as a *cause* of that suffering.[41] Ironically, given his past role in developing it's theory David Harvey has more recently argued, that in regards to globalisation "the more the left adopted this discourse as a description of the world (even if it was a state to be criticised and rebelled against), the more it circumscribed its own political possibilities."[42]

At one level globalisation has become a means through which to salve our consciences, converting the concrete actions of individuals, into a singular

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[40] Remark's of Secretary Dan Glickman, to the International Grains Council, London, England, June 19th 1997. USDA Release No. 0196.97

[41] See for example, United Nations Economic and Social Council (2000) *The Realization Of Economic, Social And Cultural Rights: Globalization and its impact on the full enjoyment of human rights Preliminary report submitted by J. Oloka-Onyango and Deepika Udagama, in accordance with Sub-Commission resolution 1999/8* UN Document E/CN.4/Sub.2/2000/13; Khor, M. (2000) *Globalisation and The South; Some Critical Issues, UNCTAD Discussion Paper No.147* UNCTAD/OSG/DP/147; UNDP (1999) Human Development Report;

[42] Harvey, D. (2000) *Spaces of Hope* (Edinburgh: Edinburgh University Press) p.13

activity of anonymous authorship. A means through which, we can distance ourselves from the suffering of millions of people, by laying the blame for their anguish at the door of an inevitable historical process. When a multinational corporation relocates one of their factories, those people who lose their jobs in the process, are portrayed as the victims of globalisation, for, after all, we are told, companies have no choice but to compete globally chasing the lowest prices in a global labour market. As farmers find they can no longer grow crops at a price that will provide them with sufficient funds to survive, it is again, we are told, a result of the globalisation of agricultural food markets.

So, when, within the space of a couple of months over 300 farmers commit suicide by drinking pesticides in the state of Andrah Pradesh in India,[43] who is to blame? Those people who sold them a pesticide that didn't work? The local government and banks that gave the farmers credit to buy the pesticide? The agronomists who originally told the farmers to 'modernise' their farming practices? The chain of causation rarely extends to any of those individuals responsible for policy at the IMF, or The World Bank. They are not the responsibility of those who designed structural adjustment programmes. Nor, are they considered to be the responsibility of foreign exchange traders, economists, academics, or, it would seem, any of the other inhabitants of this world. We must, we are told once again, look towards the inevitable and anonymous, forces of globalisation for our answers. If globalisation has a

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[43] See *n*.26 *supra*

defining characteristic perhaps it is in the cries of the innocent that resonate loudly throughout the world.

A not insubstantial industry has come into being in this never ending search for the truth about globalisation, fuelled by the collapse of the soviet bloc, the apparent 'victory' of liberal democracy, market capitalism and even, so we are led to believe, 'the end of history' itself. At one extreme globalisation is portrayed, in an overly simplistic and often self-congratulatory manner, as the 'inevitable westernisation' of society. At another level, more thoughtful writers and social commentators seek to examine the complexity of extended social relationships that cannot be understood in terms of a world system where movement flows from centre to periphery and back again. Central to all discussions as to the content of globalisation, are concerns over the tensions between universalism and specificity, homogenisation and heterogeneity; indeed it is a concern with this central facet of globalisation that leads Robertson to the observation that it "is not a question of either homogenization of heterogenization, but rather of the ways in which both of these tendencies have become features of life across much of the late-twentieth-century world."[44]

In 1964 Marshall Mcluhan, provided us with two new images to play with, for we inhabited, according to Mchluan, a "new world of the global village" a

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[44] Robertson, R. (1995) "Glocalization: Time-Space and Homogeneity-Heterogeneity" in Mike Featherstone, Scott Lash and Roland Robertson (eds.) *Global Modernities* (London: Sage Publications) p.27.

world, where the "medium was the message." The advent of electricity marked a point of disjuncture, for Mchluan, more specifically the advent of communication through electronic means, marked the beginning of a new epoch in human relations. Electricity, was the medium through which localities were connected in a global network, it was electricity and electrical forms of communication, which allowed us to experience our connectivity with the other inhabitants of the globe "instantly interrelating every human experience"[45]. As he writes,

> "After three thousand years of explosion by means of fragmentary and mechanical technologies, the western world is imploding. During the mechanical age we had extended our bodies in space. Today after more than a century of electric technology, we have extended our central nervous system itself in a global embrace, abolishing both space and time as far as our planet is concerned."[46]

The notion of global implosion or compression, put forward by Mcluhan is expanded upon within the technologically determinist writing of those such as David Harvey, Paul Virrilio and Jean Baudrillard, who, analyse the processes of globalisation within the context of the increased speed of communication and information technologies currently available to some. Thus, globalisation

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[45] McLuhan, M. (1964) Understanding Media: The Extensions of Man (London: Routledege) p.358.

[46] McLuhan (1964) *op cit. n.*45 p.358

is described as producing the "annihilation of space through time"[47], where the compression of time-space, creates a shrinking world of 'hyper-reality'[48] and 'non-places,'[49] and ultimately, at least for some, leads to the creation of a global culture through the increasing proliferation of signs.

Another category of writers perhaps typified by Manuel Castells, but which would include others such as George Ritzer, focus on newly emerging business structures, modes of organisation and work patterns which have brought about the 'Rise of the Network Society.'[50] Indeed, it is these changes in organisational practices, which are said to delineate a disjuncture with the past, marking off the 'post-fordist era', and providing the distinctive elements for asserting the reality of globalisation.

> "The new economy is organized around global networks of capital management, and information, whose access to technological know-how is at the roots of productivity and competitiveness. Business firms and increasingly organisations and institutions are organised in networks of variable geometry whose intertwining supersedes the traditional distinction between corporations and small business, cutting across sectors and spreading along different geographic clusters of economic units.

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[47] Harvey, D. (1990) *The Condition of Postmodernity* (Oxford: Blackwell Publishers) in particular Ch. 12-14

[48] Baudrillard, J. (1988) *Selected Writings*, Mark Poster (ed.) (Oxford: Blackwell Publishers) Ch.7

[49] Augé, M. (1995) *Non Places: Introduction To An Anthropology Of Supermodernity*, trans. John Howe (London: Verso)

Accordingly the work process is increasingly individualised, labor is disaggregated in its performance, and reintegrated in its outcome through a multiplicity of interconnected tasks in different sites, ushering in a new division of labor..."[51]

Then, there are those such as Anthony Giddens and Ulrich Beck, who argue that globalisation is merely the outcome of high or late modernity. Their work, is strongly influenced by Habermas' examination of the differentiation and uncoupling of *system* and *lifeworld* through rationalisation, and perhaps particularly his observation that "contexts of relevance are concentrically ordered and become increasingly anonymous and diffused as the spatiotemporal and social distance grows"[52] For Giddens, Beck and others, globalisation is defined by the emergence of the 'risk society,'[53] it is a consequence of high modernity, the "disembedding" or "lifting out of social relations from local contexts and their rearticulation across indefinite tracts of time-space."[54] It is a process of trust in 'abstract systems' brought about through the "limited technical knowledge which most people possess about

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[50] Castells, M. (1996) *The Information Age: Economy Society and Culture Vol I. The Rise of the Network Society* (Oxford: Blackwell Publishers)

[51] Castells (1996) *ibid* p.471

[52] Habermas, J. (1987) *The Theory of Communicative Action: A critique of Functionalist Reason Vol.2* (Cambridge: Polity Press) p.123

[53] See primarily Beck, U. (1992) *Risk Society: Towards a New Modernity* (London: Sage Publications), Giddens, A. (1991b) *Modernity and Self Identity: Self and Society in the Late Modern Age* (Cambridge: Polity Press), Giddens, A. (1991a) *The Consequences of Modernity* (Cambridge: Polity Press), Beck, U., Giddens, A., Lash, S. (1994) *Reflexive Modernization: Politics, Tradition and Aesthetics in the Modern Social Order* (Cambridge: Polity Press)

[54] Giddens (1991b) *op cit.n*.53, p.18

coded information which routinely affects their lives"[55] perhaps again echoing Habermas' argument that "modernity's specific orientation toward the future is shaped precisely to the extent that societal modernisation tears apart the old European experiential space of the peasant's and craftsman's lifeworlds, mobilises it, and devalues it into directives guiding expectations"[56]

All these different globalisation stories, search for new ways of describing social relationship that do not draw on the language of flows from the centre to the periphery and back again, yet while focusing on specific changes in work processes, technologies or social relationships attempt to reintegrate these various disjunctures into an overarching phenomena, that of globalisation. In the most sophisticated versions of these globalisation tales such as Robertson's, Appudrai's, and Santos' there is the explicit recognition that "there is strictly no single entity called globalization; there are, rather, globalizations, and we should use the term only in the plural."[57] So, while Arjun Appadurai develops the notions of ethnoscapes; mediascapes; technoscapes; finanscapes; and ideoscapes in order to examine the disjunctures of economics, politics and culture[58] and Roland Robertson argues that globalisation results not in homogenisation, but complexity created

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[55] Giddens (1991b) *op cit.n*.53, p.19

[56] Habermass, J. (1987) *The Philosophical Discourse of Modernity* (Cambridge: Polity Press) p.12.

[57] Santos, B. (1999) "Towards a Multicultural Conception of Human Rights" in Mike Featherstone & Scott Lash eds. *Spaces of Culture, City, Nation, World* (London: Sage Publications) p.216.

[58] Appadurai, A. (1990) "Disjuncture and Difference in The Global Cultural Economy" in Mike Featherstone, (ed.) *Global Culture: Nationalism, Globalisation and Modernity* (London: Sage Publications).

through the relativisation of the self within a 'global field,'[59] there is still the apparent necessity to maintain a meta system of analysis, still routed in historical materialism, even if it is not dependent on describing the process observed as those of westernisation.

The question I have so far left unanswered, but to which I now want to turn, is that of why I consider globalisation to be not only unhelpful as a system of social analysis, but also a concept that positively limits political possibilities when targeted as something concrete against which to strategically mobilise in order to prevent human suffering. In part it is because there is all too often a spatialising geography at work within globalisation discourse, a geography which differentiates between those who are modern, and those who are not, a categorisation characterised significantly by their different relationships with space.

Consider, for example Gidddens when he states that "in pre modern societies, space and place largely coincide since the spatial dimensions of social life are, for most of the population, and in most respects, dominated by "presence" – by localised activities. The advent of modernity increasingly tears space away from place by fostering relations between "absent" others, locationally distant from any given situation of face to face interaction."[60]. This argument which can also be found in Beck's work amongst others, still

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[59] Robertson, R. (1992) *Globalization: Social Theory and Global Culture* (London: Sage), and Robertson, R. (1995) "Glocalisation: Time-Space and Homogeneity-Heterogeneity" in Featherstone, M., Lash, S., and Robertson, R., (1995) *GlobalModernities* (London: Sage)

provides for the categorisation of farmers within the two-thirds as (un)modern, while Giddens himself does not prescriptively suggest they should 'modernise,' his bifurcated categorisation and unrestrained belief in the actuality of modernity, itself provides for that possibility. Even Robertson's more sophisticated attempt to analyse globalisation, resorts to a universal global history, it's 5 phases[61] echoing Rostow's earlier 5 phases of development.[62]

Giddens' work in particular makes explicit another reason for choosing not to adopt globalisation as an analytical tool or a cause of suffering, for, with its focus on absent others, our gaze is shifted from the concrete assemblages that act as agents for polymorphic social networks extended in time-space, we are led away from the manner in which power is exercised through the ability to bring together objects in topological spaces and instead forced to concentrate on the geophysical and topographical distances which separate the actors in out ordering tales. As Esteva and Prakash more practically observe, "All institutions including the World Bank or Cocoa Cola have to locate their transactional operations in actions that are always necessarily local; they cannot exist otherwise. Since "global forces" can only achieve

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[60] Giddens (1991a) *op cit.n.*54, p.18.

[61] Robertson (1992) *op cit n.*59, p.58-59.

[62] Rostow, W. (1960) *The Stages of Economic Growth* (Cambridge: Cambridge University Press).

concrete existence at some local level, it is only there – at the local grassroots – that they can most effectively and wisely be opposed."[63]

Many of those who choose to accept globalisation as a reality accept to greater or lesser degrees that nothing can be truly global, even when asserting the existence of universal truths, so given this does it help to continue to write of globalisation as a cause of suffering or a means of social theoretical analysis, perhaps it is better to accept as does Latour that "the words 'local' and 'global' offer points of view on networks that are by nature neither local nor global, but are more or less long and more or less connected."[64] For, if nothing can be truly global, it is preferable to consider that what we observe is merely the illusion of a global universality, an illusion created by "the circulation of particulars."[65] In so doing it is these particulars, these immutable mobiles, these boundary objects or machinic assemblages, mobilised within networks more or less extended in time and space, that will, or should, become the central focus of our attention.

To counter these extended social networks, one needs to move beyond a concern with global abstractions and concentrate on the concrete expressions of power found within the social materiality of objects and practices; shifting our concern to the presences within our midst rather than absent others. It is

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[63] Esteva, G. & Prakash, M. (1998) *Grassroots Postmodernism: Remaking the Soil of Cultures* (London: Zed Books) p.25.

[64] Latour, B. (1993) *We have never been Modern*, Catherine Porter (Trans.) (London: Harvester Wheatsheaf) p.122.

for this reason that Harvey is right to recognise that focusing on globalisation places limits on the political imagination, ultimately leading to a search for global fixes which are doomed to failure. As once again Esteva and Prakash realise,

> "GATT or the World Bank are emblems, symbols or paradigms that serve to express both a set of arrangements and a balance of forces. They are unbeatable at the abstract level. For, in the abstract, they represent, no more and no less, most governments of the world, most corporate interests, etc. To struggle against them at that level tends to strengthen them. To identify the implications of GATT, to be fully aware of what it means in specific local struggles everywhere, is extremely useful. To transform such awareness into organising principles for concerting a world struggle against GATT or the World Bank, at their headquarters or their jamborees, seems to be useless or counter-productive. They are unbeatable on their own turf – as the UNCED, in Rio, aptly demonstrated. Moving beyond their turf to the local level makes it possible to see their irrelevance. In that seeing, their nakedness becomes impossible to hide. Opacity is easier to maintain when the institution is acknowledged as a global force to be contended with. Local operations and their functionaries are easier to see through; their nakedness more difficult to hide. Here local struggles can make them irrelevant at the localised level; and an

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[65] O'Connell, J. (1993) Meterology: The Creation of Universality by the Circulation of Particulars Vol. 23 *Social Studies of Science* pp.128-173.

accumulation of local struggles may well produce the formulation of a new set of arrangements."[66]

5.3 Strategies of resistance and fields of hope

I have argued throughout this thesis that the density of agricultural diversity found in the two thirds world is the product of complex spatial and temporal stories which are lived out in the diversity of experiences, practices and knowledges that farmers posses and bring to bear, on the diverse social and spatial landscapes which they not only inhabit, but themselves socially and recursively produce.

Farmers in centres of diversity have over time engaged in processes of continual interpretation and evaluation merging experience with locality, to create complex mosaics of intra species and inter species diversity in their fields. In part these strategies have evolved as a defence against food insecurity, with farmers in the two thirds world neither searching, for the most part, for reducible, or generalisable, methods of growing crops, nor, for genotypical plants that will produce an average yield across many plots of land. Rather the heterogeneous practices of farmers in the two thirds world result in multiple spatial and temporal relationships producing not only hybrid biological varieties but hybrid relationships of farmers, space, seeds and time.

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[66] Esteva & Prakash (1998) *op.cit. n*.63, p.31.

Throughout this thesis I have portrayed power as a strategy, so that, "its effects of domination are attributed not to appropriation, but to dispositions, manoeuvres, tactics techniques, functionings; that one should decipher in it a network of relations, constantly in tension, in activity, rather than a privilege that one might possess; that one should take as its model a perpetual battle rather than a contract regulating a transaction or the conquest of a territory. In short this power is exercised rather than possessed."[67]

I have drawn on this notion of power as a function of social relationships, an amalgam of ordering tales whose expression can be found in polymorphic networks topologically extended through time and space, in order to examine the manner in which power is exercised through the CBD, the Biosafety Protocol, the TRIPs agreement and other WTO agreements, suggesting suggest that their power derives from the extent to which they become obligatory points of passage for the problematisation of issues relating to the risks GM technologies pose for biodiversity. I argue that these agreements not only contain their own ordering tales, ordering tales which for the most part reflect the needs of those producing new genetic technologies, but that they also facilitate the extension of these particular ordering stories through time and space. These various agreements therefore, provide mechanisms through which the continuing territorialisation of space can be achieved, or, to be more accurate, they provide mechanisms within which the continuing

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[67] Foucault, M. (1977) *Discipline and Punish, The Birth of the Prison* (Harmondsworth: Penguin) p.26.

processes of de-territorialisation and re-territorialisation of spaces take place; providing not only a number of means through which farmers and agronomists can be disciplined, their practices modified to reflect the 'needs' of genetic technologies but also, the ability to both promote genetic technologies, stabilising the meanings of seeds as they are mobilised in time and space, while redefining the nature of the relationships between humans and biodiversity. It is in this mobilisation of social networks, in the ability to transform social practices located in communities in the two thirds world, that we are witnessing not only the exercise of power, but the threat of increasing challenges to the continued production of agricultural biodiversity.

Communities cannot be defined simply in the context of geophysical and topographical conceptions of space, to borrow Benedict Anderson's expression, communities are imagined;[68] the building of communities, as with all social organisation, takes place within topological boundaries, so that to a greater or lesser extent, all communities are diasporas, meeting places of the spatially and temporally displaced, where humans and non-humans are connected by their narratives and tales, drawn together by their ordering stories conducted in a shared vernacular. In asserting that knowledges of and about biodiversity are located throughout space and time, one has to accept that different communities may, or, indeed will, possess knowledges about

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[68] Anderson, B. (1991) *Imagined Communities: Reflections on the Origin and Spread of Nationalism* (London: Verso).

biodiversity that are encompassed by the same geophysical and topographical boundaries.

I have maintained throughout that potential threats to agricultural biodiversity do not arise exclusively from the direct biological risks that genetic technologies pose, but from the changes in social structures that are accompanying their introduction, changes to the manner and contexts in which agricultural production in the two thirds world takes place. As a consequence, assessing the risks rDNA technologies pose for our lived environments is not something that can be resolved solely by recourse to scientific methods of assessment; methods of assessment whose basis lies in mythical claims of a rational, objective and universal understanding of nature, a myth which maintains that science has the right to be the sole arbiter in assessing the potential impact of GM crops on biodiversity.

The recognition that topological generated knowledges about biodiversity will be brought to bear on the same geophysical and topographical landscapes, means however, that we must look beyond the creation of simple dichotomies in explaining away social conflicts over the potential impact of rDNA technologies on agricultural biodiversity. We must accept that this is not simply a dispute between a singular scientific community ranged against a non scientific farming community, a dispute between developed and developing countries, between North and South, or multinational capitalist enterprises versus a proletarian agricultural workforce; rather, we must accept that there are a proliferation of disputes and valid risk claims encompassing

multiple scientific, political, economic, agricultural and other social communities, disputes between differing topological communities which may be located within the same village, area, or state; communities whose narrative tales may share more with other communities thousand of miles away than with the neighbour who lives in the next house. In this context, the notions of, traditional, local and indigenous knowledge, found within article 8(j) of the CBD appear potentially too simplistic to either resolve disputes about biodiversity or provide a basis for successfully achieving its *in situ* conservation, regardless of the other criticisms I have levelled at the CBD in Chapter's 3 and 4.

Accepting the heterogenous nature of relationships with biodiversity, involves the adoption not only of a healthy scepticism towards universal truth claims, but their active resistance; replacing mechanisms which seek to reduce social and biological diversity, with social mechanisms that support the continued production of diversity. Arguably therefore, only limited gains can be made through an overly instrumentalist concern with the reform of texts such as the TRIPs agreement. Renegotiating TRIPs in order that exemptions from IPR protection could exist on agricultural, medicinal and food products, similar to the provision of the Indian Patent Act, would provide only limited gains in promoting diversity, although it would be a move consistent with a respect for the rights of some Indigenous peoples and local communities.[69] Although

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[69] Consider for example this extract from the *Indigenous Peoples' Statement on Access and Intellectual Property Rights* made by the Indigenous Peoples' Biodiversity Network, at the Second Conference of the Parties to the Convention on Biological Diversity, November 10, 1995, Jakarta, Indonesia, which states that "Intellectual property rights are alien to

modifying the TRIPs agreement would potentially lessen the ability of seed companies to control farmers practices through the deployment of IPRs, such a move would do little to counter either the potential threat from the inevitable deployment of Genetic Use Restriction Technologies, or lessen the economic dominance that has been achieved by a handful of seed, agrochemical and food manufacturers. At the same time the likelihood of significantly renegotiating the contents of the TRIPs agreement would appear negligible given the stand of the USTR, the European Union, the Cairns group and even the OAPI.

Strengthening the Biodiversity Convention and developing *sui generis* forms of IPRs such as CIRs and TRRs for reasons outlined in chapter 4, also presents limited possibilities. For, not only does the CBD construct biodiversity as a sovereign state's genetic resource, a notion that is anathema to some communities, but also the very nature of the CBD posits biodiversity as something to be exploited through the use of IPRs. In addition, any benefits which might potentially arise from the exploitation of biodiversity, may only accrue to one community, while at the same time, an exclusive focus on

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indigenous peoples and local farming communities. For us, biological diversity and indigenous knowledge are inseparable. They are a collective, inalienable, and integral part of our cultures in all ways: at the spiritual, cultural, intellectual, territorial, scientific and economic levels. Indigenous peoples' and local communities' management of biodiversity and indigenous knowledge systems have been inherently sustainable and are essential not only to the survival of the traditional livelihood systems of indigenous peoples and local communities, but to the world economy and humanity at large. We are therefore totally opposed to intellectual property rights over life forms and processes as these IPRs will never serve the interests of indigenous and local communities. In this context it is completely inappropriate to discuss access issues and intellectual property rights without first discussing the rights of indigenous peoples and local communities and how these rights will be protected and promoted. We are willing to share our knowledge and resources with humanity provided we are the ones to determine when, where, how and for whose benefit."

implementing mechanisms for benefit sharing may well overlook the initial reasons for promoting benefit sharing in the first place. That is, increasing the substantial freedoms of communities in the two thirds world, through ensuring that communities can develop culturally, socially and economically in a manner consistent with their needs, relieving economic poverty, while increasing food security, health and dignity in a manner conducive with the protection of the environment for future generations.

Should communities, particularly indigenous communities, choose to develop and implement CIRs and TRRs then it is a choice that will have to be respected, for, as the UN Draft Declaration on the Rights of Indigenous Peoples[70] rightly recognises, not only do indigenous communities possess the right to self determination,[71] but the "right to maintain and strengthen their distinct political economic social and cultural characteristics as well as their legal systems, while retaining their rights to participate fully, if they so choose in the political, economic, social and cultural life of the state."[72] Recognition of these rights cannot be maintained within a system that posits biodiversity, and its associated practices and bodies of knowledge, as the property of a sovereign state. States therefore should not assimilate to themselves the rights to grant access to biodiversity and negotiate benefit sharing agreements, rather these should be recognised as the right of local

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[70] Un Doc. E/CN.4/Sub.2/1993/29/Annex I

[71] Article 3.

[72] Article 4. Similarly Article 8 recognises that "indigenous peoples have the collective and individual right to maintain and develop their distinct identities and characteristics, including the right to identify themselves as indigenous and to be recognised as such."

communities and indigenous peoples, a right which includes the ability to say no. In this context the Andean Pact's Decision 391 and that of the Mexican Government's Ley General del Equilibrio Ecologico for example, are both found wanting. In the Mexican government's case permits to bioassay samples should never have been granted to the ICBG MAYA without the prior consent of the populations in the Chiapas regions.

More radical alternatives for ensuring human and environmental futures, that increase substantial freedoms for communities in the two thirds world and, are consistent with peoples and communities rights to development, lie outside of the networks that we have considered for the most part throughout this work. These formative projects undertaken within the auspices of organisations such as Navdanya,[73] The Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI),[74] The Honey Bee Network, and the Kisani Samvardhan Kendra[75] in India; or the *Community Committees for Agricultural Investigation* (CIAL) in Columbia and the *Community-Based Native Seeds Research Centre* (CONSERVE)[76] in the Philippines, together with projects developed within the *Community Biodiversity Development and Conservation* (CBDC)[77] and others, offer more promising visions of hope than

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[73] Navdanya (1995) *The Seed Keepers* (New Delhi: RFSTNRP).

[74] See the SRISTI web site at http://csf.colorado.edu/sristi/ .

[75] See Nellithanam, R, & Nellithanam, J. (1997) Green Revolution and Substistance Agriculture Yu Reap as You Sow *Economic and Political Weekly* 930 and Nellithanam, R, & Nellithanam, J. (1998) Return of the Native Seeds Vol.28 (1) *The Ecologist* 29.

[76] Manicad, G. and McGuire, S. (2000), "Supporting Farmer-led Plant Breeding." *Biotechnology and Development Monitor*, No.42, p.2-7.

[77] http://www.cbdcprogram.org/

those currently put forward by many international organisations, through their emphasis on farmer participatory breeding.[78]

While the peoples within these programmes are resisting the attempts being made to monopolise the right to speak on biodiversity, they are doing so by developing and extending their own topological networks. They are generating their own power relationships through their own territorialisations, this is less about engaging with the strategic manoeuvrings of multi national corporations, than it is about the regeneration of peoples spaces, encouraging diversity and heterogeneous social practices rather than standardization and homogeny. Two organisations, the Nayakrishi Andolon (New Agricultural Movement) of Bangladesh and the Magsasaka at Siyentipiko Para sa Ikauunlad ng Agham Pang-agrikultura (MASIPAG) of the Philippines, exemplify these movements; encouraging the production of diversity *in situ* through farm based breeding programmes.

5.3.1 The Nayakrishi Andolon

The Nayakrishi Andolon[79] is an organisation of 50,000 farmers, whose central aim is the integration of crop production with the enhancement of biodiversity, food security and increased quality of life, or, "ananda." Farmers within the

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[78] See also, Dev Joshi, K. (2000), "Strengthening the Farmers' Seed System in Nepal." *Biotechnology and Development Monitor*, No.42, p.15-17.

[79] The organisation has grown over the past 5 years from around 2000 farmers in 1994/5 to 50,000 in 1999. The Naykrishi Andolon started in the Tanagail area of Bangaldesh with just two centres in 1990 at Bishnupur-nalshodha village and Rupshi-gadtala village. Since that time it has expanded to cover 5 states with new centres built in Cox's Bazar in 1994, Pabna in 1995, Kushtia in 1995 and Noakhali in 1997. See further UBINIG (undated) *Nayakrishi Andolon Initiatives of Farming Communities for a Happy Life* (Dhaka: UBINIG).

Nayakrishi Andolon grow crops without the use of pesticides or chemical fertilizers,[80] which allows the development of aquaculture as part of the farming household. Emphasis is placed on the creative use of water within the flood plain eco system, rather than the use of deep tube wells, with farmers practicing intra species and inter species multi cropping techniques, crop rotation and agroforestry. The integration with rice and vegetables in the field, of fuel wood, fruit and multipurpose trees, is not only an important aspect of enhancing productivity and soil fertility but also emphasises the yield of the total farm system rather than the quantitative productivity of a single crop.

The organisational structure of the Nayakrishi Andolon is built around 'farming households' that cover a wide range of different topographical land and soil scapes, rather than attempting to overcome this geophysical diversity however, it is celebrated, with farmers encouraged to utilise their local knowledges and practices. The Nayakrishi households are also the focal point for the *in situ* and *ex situ* conservation of seed for, while diversity is maintained through a variety of practices in the field, farmers additionally conserve seed in their homes for replanting in coming seasons. As Fahad Mazhar, a director of a UBINIG, a Bangladeshi NGO, which provides support for the Nayakrishi Andolon through running and managing the Nayakrishi centres, comments,

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[80] Farmers are allowed to decrease their reliance on chemical fertilizers during initial transition.

"Nayakrishi Andolon celebrates every unique feature of each and every household and resists any idea to homogenise households. It works on the principle that biodiversity means diversity in households and their diverse knowledge. The ecological agriculture is never presented as a model, but only in terms of principles that farmers can translate into their own reality"[81]

The Nayakrishi Andolon is built around an acceptance of the heterogeneous nature of both communities and the social. While in each area where the Nayakrishi Andolon has grown, there are Community Seed Wealth (CSW) Centres, the "Veez Sampad," these are not model farms, nor places to train farmers, but meeting grounds for sharing diverse knowledges and practices between different individuals, villages, and communities. The main focal point for maintaining seeds both *in situ* and *ex situ* remains at the household level, where farmers may keep seeds for 3 to 5 years before growing them again.

Mechanisms are built into the system, which ensure that the different varieties planted throughout the Nayakrishi Andolon are maintained. If a household decides not to replant a species or variety in the next season they are required to report that decision at village level, where designated Nayakrishi seed huts, run by specially skilled farmers have taken responsibility to ensure that varieties are replanted regenerated and conserved. In this way, varietal diversity is maintained either by someone in the village or failing that, at a local level within the Nayakrishi Community Seed network. The aim is to

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[81] Mazhar, F. (undated) *Nayakrishi Seed Network; A Farmer Based Strategy to Conserve*

make sure that even if a variety or species is lost within a village, it is still available locally within the range of a cluster of villages. However, should a farming household still not find any body to replant the seed, then they are obliged to report this to the Nayakrishi Seed Network and deposit the seed at a CSW centre. The CSW centres are not gene banks, as such, and are not intended to be a centralised varietal storage facility, rather they replicate the same principles of seed collection, conservation and regeneration as in Naykrishi households. [82] Any member of the Nayakrishi Andolon can collect seeds from the CSW on the understanding that they deposit twice the quantity they received following the harvest.

5.3.2 MASIPAG

Like the Nayakrishi Andolon, MASIPAG was a reaction by farmers to their disenchantment with the green revolution: a reaction to environmental degradation, high seed and fertilizer costs, increasing problems with pests, loss of seed vitality and a general decrease in the quality of life. MASIPAG is a farmer led coalition of farmers, NGOs and scientists in the Philippines,[83] whose genesis lay in the 1985 BIGAS conference at which a cross sectorial

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and Use Seed and Genetic Resources (unpublished paper) p.3

[82] There is a complex variety of different conservation techniques and knowledges applied by women in storing seeds, while some may be dried in the shade others are dried under bright sun before being stored in a cool pace and then pored into an earthen pot called a *kalash*, on top of which are placed dry sands and maybe dried neem leaves to prevent pest attack. The mouth of the pot is then sealed with clay, or mud and cow dung, although coloured glass jars are generally used for vegetable seeds. Those seeds that are not going to be planted in the next season, are often kept with the stalk or shell that holds the seed and left to hang from the roof. For more details see Mazhar, F. (1996) "Nayakrishi Andolon: An initiative of the Bangladesh Peasants for A Better Living" p.263.

grouping met to assess the ill effects of the green revolution on the Philippine rice sector. Proposals and strategies put forward at the time included the development of an agriculture program independent of foreign involvement; attempts to address the large scale sugar, coconut and banana plantations; and, building a Filipino institution for research into rice varieties independent of the IRRI.

Following the disregard of these proposals by the Marcos government, members of the ad hoc body formed to implement the resolutions of the BIGAS conference founded MASIPAG. By 1993 there were 10,000 farmers in the organisation a figure that had risen to 30,000 farmers by the middle of 1999.[84] MASIPAG has three main objectives; the empowerment of Filipino farmers through the repossession and control of farm production and seed management; increasing the income and quality of life of Filipino farmers in an environmentally friendly and secure food system; and the *in situ* conservation of agricultural biodiversity.

MASIPAG, like the Nayakrishi Andolon, prioritises the knowledge, capabilities, skills and needs of farmers, ensuring they play the lead role in research and training, and thus enabling their individual resources to be transferred between them. In addition to a rice breeding program, MASIPAG undertakes

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[83] There are 23 NGO partners of MASIPAG, while the scientists, are mostly from the agricultural college at the University of the Philippines in Los Banos and Xavier University in Cagayan de Oro, on Mindanao island.

[84] Personal Communication with Emmanuel Yap of MASIPAG, 9th March 1999.

the collection, and multiplication of locally adapted varieties, as well as conducting research into pest management programmes, diversified farming and biofertilizer production. There are now 80 community seed banks in 40 provinces, together with a farmer based research station in Rajal Centro, Santa Rosa, Nueva Ecija.

Initially given 42 traditional rice seed varieties by another Philippine farmers organisation the Kilusang Magubukid sa Pilipinas (KMP), by 1993 MASIPAG's seed collection had reached 350 varieties, with 1000 varieties grown *in situ* by 1999.[85] Farmers are encouraged to identify the problems that they face such as poor soil and climate in order to establish criteria for selecting parent material for new varieties, they then carry out the selection, emasculation and pollination of these varieties themselves, as well as evaluating the newly created selections in on farm tests. Through this promotion of diverse socio cultural farming practices in multiple eco topographical settings MASSIPAG's farmer led experimentation and breeding programmes have produced 535 of the total 1000 varieties grown.[86]

Filipino farmers are joining MASIPAG because of the evident results that they are achieving. When a farmer first joins MASSIPAG the move from intensive agro chemical farming to MASIPAG's seed varieties and organic farming methods, often result in farmers experiencing a loss of yield, although this is

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[85] This is a little under a third of the IRRI's collection.

[86] Personal Communication with Emmanuel Yap of MASIPAG, 16th March 1999.

offset by increased financial gains.[87] Over the next 5 years however soil quality returns and the farmers start to see an increase in yield from the rice grown so that, while the national average of rice production in the Philippines is 3.8 tons per hectare MASIPAG's national average is 4.3 tons per hectare, with some individual farmers returning 7 tons a hectare.[88] As Emmanuel Yap from MASIPAG points out, there are a number of other benefits to becoming a MASIPAG farmer, which include;

> "recovering other food sources in the farm (fresh water shrimps, fishes, shells, etc.); easy integration of livestocks (rice-duck and rice-fish culture) which increase significantly farm income; reduced medical costs associated with intensive spraying of pesticides; less crop damage due to pestilence or damage from drought; improved sense of dignity as innovator, trainer and as a farmer scientist; greater legitimacy as an environmental advocate thus enhancing their ability to advocate farmers rights; broadened links with other farmers and enhanced solidarity among them"[89]

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[87] Personal communication with Emmanuel Yap of MASIPAG, October 1998.

[88] Personal Communication with Emmanuel Yap of MASIPAG, 9th March 1999. What also has to be taken into account in relation to MASIPAG's national average figure is that this includes farmers who are in the process of changing over to MASIPAG seed varieties and methods.

[89] Yap, E. (1999) R*escue of Rice Variety: Enhancing Biodiversity and the Struggle for Land* Unpublished Paper given at the "Food and Agriculture in North South Relations" conference, March 4-7, 1999, Univerisitat Pompeu Fabra, Barcelona.

5.3.3 Final Thoughts

In the first chapter I suggested that this work was inhabited by countless stories, stories of peoples, property, law, biodiversity and science. I argued that these stories were *both stories of ordering and stories which attempt social order,* they are always only partial and as such are destined never to possess an ending. The MASIPAG and Nayakrishi Andolon stories are not intended to be heroic tales of resistance and opposition to large multinational agro chemical business empires, for in many ways they neither resist, nor, oppose the Monsantos, DuPonts and Syngentas of this world. The strength of these organisations derives in part from remaining outside of the networks and relationships of power that these companies extend more or less successfully in time and space. Indeed MASIPAG and the Nayakrishi Andolon are extending their own topological networks, performing their own territorialisations and ordering tales as they recognise themselves when for example stating that the "Nayakrishi Andolon is the struggle for farming communities to transform and reorder local, regional and global economic and political relations"[90]

I have argued throughout that the social is a heterogenous amalgalm of unknowably complex relationships, a heterotopian reality in which we all to often succumb to the illusions of the utopian fantasies found in the myths of science and modernity. If there is a defining difference between the ordering

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[90] UBINIG (undated) *op cit. n.*81 (no page numbers).

stories of MASIPAG and the Nayakrishi Andolon and the narratives of the CBD, WTO and others it is their modesty. It is the acceptance of diversity, over the urge to achieve universality, and perhaps most importantly it is their focus on the achievement of substantive freedoms as both a goal, and an indicator of development. The fields of hope which these organisations both metaphorically and physically produce, provide a means whereby farmers can engage in their diverse knowledges and practices, controlling their own seeds, food security, economic independence, and sustainable environments, a prospect which I have argued throughout, for many farmers in the two thirds world may become increasingly difficult as both the consolidation of the seed industry and transgenic crops continue to further the expansionist desires of their progenitors.

In writing this thesis I have attempted to examine some of the potential consequences that rDNA technologies pose for diversity in the two thirds world. I have argued that rather than achieving the aim of conserving diversity, the CBD's mechanisms, and its own ordering narratives conflict with the socio cultural practices that have resulted in the agricultural biodiversity that currently exists, a result, in part, of the focus that the CBD places on biodiversity as a genetic resource to be exploited. I have also examined the manner in which IPRs, further the aims of those wishing to deploy rDNA technologies, arguing that they provide a means around which meanings can be stabilised and the territorialisation of both farmers fields and farmers themselves can take place. IPRs provide a means of disciplining farmers, so that GM seeds can maintain their materiality through time and space, but this

needs to be understood in the context of both the global trade rules developed within the WTO, and of agricultural and food networks that are more or less extended in time and space. Finally I have suggested CIRs, farmers rights and TRRs offer modest gains for diversity in general, while they may achieve increases in the wealth of some communities, or individuals, ultimately I have argued they provide little hope for either maintaining the social practices that have led to agricultural biodiversity or increasing the substantial freedoms of farmers in communities in the two thirds world.

Perhaps organisations such as MASIPAG and the Nayakrishi Andolon present our best hopes for maintaining diversity, this is not to say that law may not be strategically useful at various times, indeed both of these organisation have been involved in both campaigning for the re drafting of the TRIPs agreement and in producing draft laws for their respective countries. We must however, learn to accept the fluid, heterogeneous, messiness of the social, recognising our own partiality while rejecting the utopian yearnings and universalist fairytales contained within the myths of science and modernity. Such a move would be neither a life on the margin, nor the frontier, but the acceptance that we exist, not, in a world of paradigm shifts, but in social worlds of countless never ending stories whose topological borders we traverse each second of each day. Unlike these never ending social stories however, space and time determine that this particular ordering tale must now come to an end.

Bibliography

Abelson, P. (1971) "Editorial: Anxiety About Genetic Engineering" Vol. 173 *Science* 23rd July 1971 Number 3994.

Achar, K.P. *et al* (1997) *Documentation of People's Knowledge and Perceptions about Biodiversity Conservation through Peoples Biodiversity Register at Mala Vilage Panchayat, Karkala Taluk, Karnataka State*. Biodiversity Conservation Prioritisation Project (BCPP) of the Karnataka State Council for Science and Technology, Bangalore, India.

Adler, J.H. (2000) "More Sorry Than Safe: Assessing The Precautionary Principle And The Proposed International Biosafety Protocol" 35 *Tex. Int'l L.J.* 173.

Adorno, T. and Horkhimer, M. (1979) *Dialectic of Enlightenment* Trans. By John Cumming (London: Verso).

Afshar, H. & Agarwal, B. (eds.) (1989) *Women Poverty and Ideology in Asia* (London: McMillan).

Afshar, H. (ed.) (1991) *Women development & Survival in the Third World* (London: McmIllan).

Agarwal, B. (1989) "Women Land and Ideology in India" in Haleh Afshar & Bina Agarwal *Women Poverty and Ideology in Asia* (London: McMillan) pp.70-98.

Agarwal, B. (1991) "Agricultural mechanisation and Labour Use: A Disaggregated Approach" in Haleh Afshar (ed.) *Women development & Survival in the Third World* (London: McmIllan) pp.172-187.

Akeroyd, A.V. (1991) Gender, Food Production and Property Rights: Constraints on Women Farmers in Southern Africa" in Haleh Afshar (ed.) *Women development & Survival in the Third World* (London: McmIllan) pp.139-171.

Alston, P. (1988) "Making Space for New Human Rights: The Case of the Right to Development" Vol.1 *Human Rights Yearbook* 3.

Alvares, C. (ed) (1996) *The Organic Farming Sourcebook* (Goa: The Other India Press).

Anderson, B. (1991) *Imagined Communities: Reflections on the Origin and Spread of Nationalism* (London: Verso).

Anurada (1998) *Sharing with the Kanis A Case Study From Kerela, India.* (Unpublished Paper Submitted to CBD Secretariat).

Aoki, K. (1998) "Neocolonialism, Anticommons Property, And Biopiracy In The (Not-So- Brave) New World Order Of International Intellectual Property Protection" Vol.6 *Ind. J. Global Legal Stud.* 11.

Appadurai, A. (1990) "Disjuncture and Difference in The Global Cultural Economy" in Mike Featherstone, (ed.) *Global Culture: Nationalism, Globalisation and Modernity* (London: Sage Publications).

Asebey, E.J. and Kempenaar, J.D. (1995) Biodiversity Prospecting: Fulfilling The Mandate Of The Biodiversity Convention Vol. 28 *Vand. J. Transnat'l L.* 703.

Augé, M. (1995) *Non Places: Introduction To An Anthropology Of Supermodernity,* trans. John Howe (London: Verso).

Backes, C. & Verschuuren, J. (1998) "The Precautionary Principle in International European and Dutch Wildlife Law" *Colorado Journal of International Environmental Law and Policy* 43.

Baer, K.W. (1995) "A Theory Of Intellectual Property And The Biodiversity Treaty" Vol.21 *Syracuse J. Int'l L. & Com.* 259.

Bagla, P. (1999) "Model Indian Deal Generates Payments" Vol.283 *Science* 1614.

Barthes, R. (1993) *Mythologies* (London: Vantage).

Batra, S.K. (1995) *Indian Agriculture and New Economic Policy: Impact of Agro Industry No 53/95* (New Delhi: Indian Social Institute).

Baudrillard, J. (1988) *Selected Writings,* Mark Poster (ed.) (Oxford: Blackwell Publishers).

Bauman, Z. (1991) *Modernity and Ambivalence* (Cambridge: Polity Press).

Baumann, M., Bell, J., Koechlin, F., and Pimbert, M., (eds.) (1996)*The Life Industry; Biodiversity People and Profits* (London: Intermediate Technology Publications).

Beck, U. (1992) *Risk Society: Towards a New Modernity* (London: Sage Publications).

Beck, U. (1994) "The Reinvention of Politics" in Ulrich Beck, Anthony Giddens and Scott Lash (eds.), *Reflexive Modernisation: Politics Tradition and Aesthetics in the Modern Social Order* (Polity Press: Cambridge).

Beck, U. (1996) "Risk Society and the Provident State" in Scott Lash, Bronislaw Szeszynski & Brain Wynne (eds.) *Risk Environment & Modernity: Toward a New Ecology*, (London Sage Publications) p.27).

Beck, U., Giddens, A., and Lash,S. (eds.), (1994) *Reflexive Modernisation: Politics Tradition and Aesthetics in the Modern Social Order* (Polity Press: Cambridge.

Bell, J (1995) "The Hidden Harvest" *Seedling* October 1995 (Barcelona: Genetic Resource Action International).

Bellon, M. R. (1996) "On Farm Conservation as a Process: An Analysis of its Components" in Louise Sperling & Michael Loevinsohn (eds.) *Using Diversity Enhancing and Maintaining Genetic Resources on Farm - Proceedings of a Workshop held on 19th –21st June 1995 New Delhi India* (New Delhi: IDRC) pp.261-262.

Bellon, M.R, Pham, J.L. and Jackson, MT (1997) "Genetic Conservation: A role for Rice Farmers" in N. Maxted, B.V. Ford-Lloyd and J.G. Hawkes (eds.) *Plant Genetic Conservation* (London: Chapman & Hall) pp.263-289.

Benjamin, W. (1999) *Illuminations*, Trans.Harry Zorn (London: Pimlico).

Billings, P.R. (Ed.) (1992) *DNA on Trial: Genetic Identification and Criminal Justice* (Plainview, NY: Cold Spring Harbour Laboratory Press).

BIO (1994) *Comments of the Biotech Industry, Critical Synergy: The Biotechnological Industry and Intellectual Property Protection, Presentations of the Intellectual Property Committee of Biotechnological Industry Organisation at The October 17th 1994, Hearing of the US Patent and Trademark Office Sand Diego California.*

Bonte-Friedheim, C. and Sheridan, K. (eds) (1997) *The Globalisation of Science The Place of Agricultural Research* 2nd Ed. (The Hague: The International Service for National Agriculture).

Bosselmann, K. (1996) "Plants And Politics: The International Legal Regime Concerning Biotechnology And Biodiversity" *Colorado Journal of International Environmental Law and Policy* 111.

Bourdieu, P (1990) *The Logic of Practice* Trans. Richard Nice (London: Polity Press).

Boyle, J. (1996) *Shamans Software & Spleens: Law and The Construction of the Information Society* (Cambridge, MA: Harvard University Press).

Brack, D. (2000) "Multilateral Environmental Agreements: An Overview" in Halina Ward and Duncan Brack (eds). *Trade Investment and the Environment*, (Earthscan: London) pp.122-137.

Brush, S. (1994) *Providing Farmers Rights Through in Situ Conservation of Crop Genetic Resources Background Study Paper No.3 for The Commission on Plant Genetic Resources, First Extraordinary Session, November, 1994* (Rome: FAO).

Brush, S. and Stabisnsky, D. (eds.) *Valuing Local Knowledge: Indigenous People and Intellectual Property Rights* (Washington D.C.: Island Press).

Brush, S.B. (1996) "Is Common Heritage Outmoded?" in Stephen B. Brush and Doreen Stabisnsky (eds.) *Valuing Local Knowledge: Indigenous People and Intellectual Property Rights* pp.143-164.

Burhenne-Guilmin, F. & Casey-Lefkowitz, S. (1992) "The New Law Of Biodiversity" *3 Yb. Int'l Env.L* (1992) pp.43-59.

Buttel, F., Kenney, M., Kloppenburg, Jr, J. (1985) "From Green Revolution to Biorevolution: Some Observations on the Changing Technological Bases of Economic Transformation in The Third" *World Economic Development and Cultural Change* 31.

Byrne, N. (1993) "Plant Breeding and the UPOV" Vol.2 (2) *RECIEL* 136.

Callon, M. (1986) "Some Elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay" in John Law (ed.) *Power Action and Belief: A new Sociology of Knowledge* (London: Routledge) pp.207-208.

Cameron, J. & Makuch, Z. (1995) *The UN Biodiversity Convention and the WTO TRIPs Agreement: Recommendations to Avoid Conflict and Promote Sustainable Development* (Gland, Switzerland: WWF).

Cassese, A. (1986) *International Law in a Divided World* (London: Clarendon).

Castells, M. (1996) *The Information Age: Economy Society and Culture Vol I. The Rise of the Network Society* (Oxford: Blackwell Publishers).

Cecile Jackson (1995) "Environmental Reproduction and Gender in the Third World" in Stephen Morse & Michael Stocking (ed) *People and Environment* (London: UCL Press) pp.109-130.

Clunies Ross, T. (1996a) *Farmers Plant Breeders & Seed Regulations An Issue of control: A Case study of the Scottish Seed Potato Industry* (Sturminster Newton: The Ecologist).

Clunies-Ross, T. (1995) *Seeds Crops and Vulnerabiltiy: A Re-examination of Diversity in British Agriculture, A Discussion Paper* (Sturminster Newton: The Ecologist).

Clunies-Ross, T. (1996b) "Creeping Enclosure: Seed Legislation and, Plant Breeders Rights and Scottish Potatoes" Vol. 26(3) *The Ecologist* pp.110-114.

Cohen, A.P. (1993) "Segmentary Knowledge: a Whalsay Sketch" in Hobart, M. (ed) *An Anthropological Critique of Development: The Growth of Ignorance* (London: Routledge).

Conway, G. (1997) *The Doubly Green Revolution: Food for All in the 21st Century* (Harmondsworth: Penguin).

Cooper, D. (1993) "The International Undertaking on Plant Genetic Resources" Vol.2(2) *RECIEL* 158.

Correa, C. (1994) *Sovereign Rights over Plant Genetic Resources, Background Study Paper No.2 First Extraordinary Session of The Commission Plant Genetic Resources* (Rome: FAO).

Correa, C. M. (1994) " The GATT Agreement on Trade Related Aspects of Intellectual Property Rights: New Standards for Patent Protection" [1994] 8 *EIPR* 327.

Correa, C. M. (2000) *Intellectual Property Rights, The WTO and Developing Countries* (London: Zed Books/Third World Network).

Cosgrove, D. (1994) "Contested Global Visions: One World, Whole Earth and the Apollo Space Photographs" *Annals of The Association of American Geographers* 84(2) 1994 pp.270-294.

Cottier, T. (1998) "The Protection of Genetic Resources and Traditional Knowledge: Towards More Specific Rights and Obligations in World Trade Law" Vol.1(4) *Journal of International Economic Law* pp.555-584.

Coughlin, MD (1993) "Using the Merck – InBio Agreement to Clarify the Convention on Biological Diversity" 31 *Colum. J. Transnat'l L.* 337.

Crespi, C. (1995) "Biotechnology Patenting: The Wicked Animal Must Defend Itself" Vol.17 (9) *EIPRI* 431.

Crespi, T.S. (1995) "Biotechnology, Broad Claims and the EPC" Vol.(6) *EIPR* 267.

Crick, F. (1974) "The Double Helix: A Personal View" Vol. 248 *Nature* 766.

Crick, F. (1990) *What Mad Pursuit: A personal View of Scientific Discovery* (Harmondsworth: Penguin).

Crick, F.H.C. and J.D. Watson (1954) "The Complimentary Structure of Deoxyribonucleic Acid" *Proceedings of The Royal Society*, Vol .A. 223 pp. 80-96.

Crucible Group (1994) *People Plants and Patents The Impact of Intellectual Property on Trade Plant Biodiversity and Rural Society* (Ottawa: IDRC).

David, P. A. (1993) "Intellectual Property Institutions and The Panda's Thumb: Patents, Copyrights, and Trade Secrets in Economic History" in Wallerstein, Mogee and Schoen (eds.) *Global Dimensions of IPRs in Science and Technology* (Washington: National research Council/National Academy Press).

Deleuze, G. & Guattari, F. (1988) *A Thousand Plateaus: Capitalism and Schizophrenia* (London: Athalone Press).

Deleuze, G. (1988) *Foucault* (London: Athalone Press).

Dev Joshi, K. (2000), "Strengthening the Farmers' Seed System in Nepal." *Biotechnology and Development Monitor*, No.42, pp.15-17.

Dhar, B. & Rao, C.N. (1997) *Plant Breeders and Farmers In the New Intellectual Property Regime: Conflict of Interests?* (New Delhi: Centre for Study of Global Trade System and Development).

Dhar, B. (1998) "Complying with TRIPs Commitment: EMR versus Product Patent Regime" *Economic and Political Weekly*, December 19th 1998, pp.3230-3231.

Dhar, B. Chaturvedi, S. (1999) *WTO Agreements and Agricultural Sector: Implications and Options For India"* (New Delhi: Research and Information System for the Non Aligned and Other Developing Countries).

Dhavan, R, & Prabha, M. (1995) "Patent Monopolies and Free Trade; Basic Contradiction in Dunkel Draft" Vol. 37 (2) *Journal of The Indian Law Institute* 195.

Dhogra, B. (1993) *Seeds Industry of India: Seeds of Plenty of Seeds of Discontent* (Dehradun, India: Navdanya).

Doll, J. (1998) The Patenting of DNA Vol.280 *Science* 689.

Donnelly, J. (1984) "The 'Right to Development': How Not to Link Human Rights and Development" in Welch, C.E. & Meltzer, R.I. (eds.) *Human Rights and Development in Africa* (Albany: State University of New York Press).

Drengson, A. & Inoue, Y. (eds.) (1995) *The Deep Ecology Movement: An Introductory Anthology* (Berkeley: North Atlantic Books).

Dreze, J. & Sen, A. (1989) *Hunger and Public Action* (Oxford: Oxford University Press).

Drèze, J., Sen, A., Hussain, A., (eds). (1995) *The Political Economy of Hunger*, (Oxford: OUP).

Dutfield, G. (1997) *Can The TRIPs Agreement Protect Biological and Cultural Diversity?* (Narobi, Kenya: African Centre for Technology Studies).

Dutfield, G. (2000) *Intellectual Property Rights, Trade and Biodiversity* (London: Earthscan / IUCN).

Eisenberg, R. (1987) "Proprietary Rights and the Norms of Science in Biotechnological Research" Vol.97 *Yale L.J.* 179.

Enyart, J. (1990) "A GATT Intellectual Property Code" *Les Nouvelles* XXV (2) 53.

Escobar, A. (1995) *Encountering Development: The Making and Unmaking of The Third World* (Princeton, New Jersey: Princeton University Press).

Esquinas-Alcazar, J. (1993) The Global System on Plant Genetic Resources Vol.2(2) *RECIEL* 151.

ESRC Global Environmental Change Programme (1999) *The Politics of GM Food: Risk Science and Public Trust*, Special Briefing No.5 University of Sussex.

Esteva, G. & Prakash, M. (1998) *Grassroots Postmodernism: Remaking the Soil of Cultures* (London: Zed Books).

FAO (1996) *Lessons from the Green Revolution; towards a new green revolution* World Food Summit Technical Background Document No.6 (Rome: FAO).

FAO (1996a) *Rome Declaration on World Food Security* (Rome: FAO).

FAO (1996b) *World Food Summit Plan of Action* (Rome: FAO).

FAO (1997) *The State of the Worlds Plant Genetic Resources for Food and Agriculture* (Rome: FAO).

Featherstone, M. & Lash, S. (eds.) (1999) *Spaces of Culture, City, Nation, World* (London: Sage Publications).

Featherstone, M. & Lash, S. (eds.) (1999) *Spaces of Culture, City, Nation, World* (London: Sage Publications).

Featherstone, M. (ed.) (1990) *Global Culture: Nationalism, Globalisation and Modernity* (London: Sage Publications).

Featherstone, M., Lash, S. and Robertson, R. (eds.) (1995) *Global Modernities* (London: Sage Publications).

Feyerabend, P. (1975) *Against Method: Outline Of An Anarchistic Theory of Knowledge* (London:NLB).

Feyerabend, P. (1987) *Farewell to Reason* (London: Verso) p.297.

Foucault, M. (1974) *The Order of Things: An Archaeology of the Human Sciences* (London:Routledge).

Foucault, M. (1977) *Discipline and Punish, The Birth of the Prison* (Harmondsworth: Penguin).

Foucault, M. (1980) "Questions on Geography" in *Power/Knowledge*: *Selected Interviews and other writings 1972-1977* Colin Gordon (Ed.) (Hemel Hempstead: Harvester).

Fowler, C. & Mooney, P. (1990) The Threatened Gene: Food Politics and The loss of Genetic Diversity (Cambridge: The Lutterworth Press).

Fowler, C. (1995) "Biotechnology Patents and The Third World" in Vandana Shiva and Ingunn Moser (eds.) *Biopolitics; A Feminist Ecological Reader on Biotechnology* (London: Zed Books).

Franklin, R.E. and R.G. Gosling "Molecular Configuration in Sodium Thymonucleate" Vol.171 *Nature* pp. 740-741.

Freestone, D & Hey, E. (eds.) (1996) *The Precautionary Principle and International Law* (The Hague: Kluwer).

Freestone, D. (1994) "The Road From Rio; International Environmental Law After the Earth Summit" Vol 6 *Journal of Environmental Law* 193.

Friis-Hansen (1999) *The socio-economic dynamics of farmers' management of local plant genetic resources - A framework for analysis with examples from a Tanzanian case study CDR Working Paper 99.3, May 1999* (Copenhagen: Centre for Development Research).

Fujimura, J.H. (1992) "Crafting Science: Standardised Packages, Boundary Objects and 'Translation'" in Andrew Pickering (ed.) *Science as Practice and Culture* (London: University of Chicago Press).

Gadgil, M. (1997) Biodiversity: Thinking Differently, *The Hindu* Sunday April 20th 1997.

Gadgil, M. and Guha, R. (1992) *This Fissured Land: An Ecological History of India* (Delhi: Oxford University Press).

Gadgil, M. *et al* (1998) "New Meaning For Old Knowledge The Peoples Biodiversity Register Programme" (Unpublished Paper).

Gana, R. L. (1995) "Has Creativity Died In The Third World? Some Implications Of The Internationalization Of Intellectual Property Vol.24 *Denv. J. Int'l L. & Pol'y* 109.

Gana, R. L. (1996) "Prospects For Developing Countries Under The Trips Agreement" Vol. 29 *Vand. J. Transnat'l L.* 735.

Gene Campaign & Forum For Biotechnology and Food Security (1997) *Draft Act Providing For the Establishment of Sovereign Rights Over Biological Resources* (New Delhi: Gene Campaign).

Gene Campaign (1998) *Convention of Farmers and Breeders* CoFab (New Delhi: Gene Campaign).

George. S. (1990) *Ill Fares the Land (Harmondsworth: Penguin).*

Georges Benko & Ulf Strohmayer (eds.) (1997) *Space & Social Theory: Interpreting Modernity and Postmodernity* (Oxford: Blackwell Publishers).

Gertz, C. (1993) *Local Knowledge* (London: Fontana).

Ghijsen, H. (1998), "Plant Variety Protection in a Developing and Demanding World." *Biotechnology and Development Monitor*, No.36, pp.2-5.

Giddens, A. (1991a) *The Consequences of Modernity* (Cambridge: Polity Press).

Giddens, A. (1991b) *Modernity and Self Identity: Self and Society in the Late Modern Age* (Cambridge: Polity Press).

Goldblatt, D. (1996) *Social Theory and the Environment* (London: Polity Press).

Goodman, D. and Watts, M.J. (eds.) (1997) *Globalising Food: Agrarian Questions and Global Restructuring* (London: Routledge).

Government of India (1959) *Report on the Revision of The Patents Law by Shri Justice N. Rajagopala Ayyangar, September 1959* (New Delhi: Government of India) .

Government of India (1998) *Benefit Sharing Model Experimented by Tropical Botanic Garden and Research Institute (TBGRI), A National Centre of Excellence on Tropical Plant Diversity* (Unpublished Paper Submitted To CBD Secretariat).

GRAIN (1995) *Towards A Biodiversity Community Rights Regime* (Barcelona: GRAIN).

GRAIN (1999a) *Beyond UPOV Examples of developing countries preparing non-UPOV sui generis plant variety protection schemes for compliance with TRIPS* (Barcelona: Grain).

GRAIN (1999b) *Plant variety protection to feed Africa? Rhetoric versus reality* (Barcelona: GRAIN).

Grove, R. (1995) *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860* (Cambridge: Cambridge University Press).

Grove, R. (1998) *Ecology Climate and Empire The Indian Legacy in Global Environmental History 1400-1940* (Delhi: Oxford University Press).

Guijt, I., Hinchcliffe, F. & Melnyck, M. (1995) *The Hidden Harvest -- The Value of Wild Resources in Agricultural Systems -- A Summary* (London: International Institute for Environment and Development).

Habermass, J. (1986) *The Theory of Communicative Action Vol.1: Reason and the Rationalisation of Society* (Cambridge: Polity Press).

Habermass, J. (1987) *The Philosophical Discourse of Modernity* (Cambridge: Polity Press).

Habermass, J. (1987) *The Theory of Communicative Action Vol.2: The Critique of Functionalist Reason* (Cambridge: Polity Press).

Hamilton, N. (1994) "Why Own the Farm if you can Own the farmer (and the Crop)?: Contract Production and Intellectual Property Protection of Grain Crops" *Nebraska Law Review* 48.

Hamilton, N.D. (1993) "Who Owns Dinner: Evolving Legal Mechanisms For Ownership Of Plant Genetic Resources" *Tulsa Law Journal* 587.

Hardin, G. (1968) "The Tragedy of The Commons" Vol. 162 *Science* 1243.

Harraway (1985) "A Cyborg Manifesto: Science, Technology and Socialist Feminism in the 1980's Late Twentieth Century" *80 Socialist Review* 65.

Harraway, D.J. (1991) Simians Cyborgs and Women: The Reinvention of Nature (London: Free Association Books).

Harrway, D. (1991) *Simians, Cyborgs and Women: The Reinvention of Nature* (London: Free Association Books).

Harvey, D. (1989) *The Condition of Postmodernity* (Oxford: Blackwells).

Harvey, D. (1996) *Justice Nature and the Geography of Difference* (Oxford: Blackwell Pubishers).

Harvey, D. (2000) *Spaces of Hope* (Edinburgh: Edinburgh University Press).

Heller, M.A. & Eisenberg, R.S. (1998) Can Patents Deter Innovation? The Anticommons in Biomedical Research Vol.280 *Science* 698.

Hettinger, E.C (1989) "Justifying Intellectual Property" Vol. 18 *Phillosophy & Public Affairs* 31.

Hettinger, N. (1995) "Patenting Life: Biotechnology, Intellectual Property, And Environmental Ethics" *Boston College Environmental Affairs Law Review* 267.

Ho, M (1998) *Genetic Engineering Dream or Nightmare? The Brave New World of Bad Science and Big Business* (Bath: Gateway Books).

Hobart, M. (ed) (1993) *An Anthropolgical Critique of Development: The Growth of Ignorance* (London: Routledge).

Hobbhouse, H. (1992) *Seeds of Change Five Plants that transformed the World* (London: Papermac).

Howard-Borjas, P. (1999), "Some Implications of Gender Relations for Plant Genetic Resources Management." *Biotechnology and Development Monitor*, No.37, p.2-5.

James, C. & Krattiger, A.F. (1996) Global Review of the Field Testing and Commercialization of Transgenic Plants: 1986 to 1995 The First Decade of Crop Biotechnology, *ISAAA Briefs No. 1* (Ithaca, NY: ISAAA).

James, C. (1997) Global Status of Transgenic Crops in 1997. *ISAAA Briefs No. 5* (Ithaca, NY ISAAA).

James, C. (1998) Global Review of Commercialized Transgenic Crops: 1998. *ISAAA Briefs No. 8* (Ithaca, NY: ISAAA).

James, C. (1999) Global Status of Commercialized Transgenic Crops: 1999. *ISAAA Briefs No.12*: Preview (Ithaca, NY: ISAAA).

Jermy, Long, Sands, Stork, Winser (eds.) (1996) *Biodiversity Assessment: a guide to good practice*. (London: Department of the Environment/HMSO).

Jetley, S (1984) "India Eternal Waiting" in UNESCO *Women in the villages, Men in the Town* (Paris: UNESCO) pp.75-147.

Juma, C. (1989) *Biological Diversity and Innovation: Conserving and Utilising Genetic Resources in Kenya* (Nairobi, Kenya: African Centre for Technology Studies).

Juma, C. (1989) *The Gene Hunters: Biotechnology and the Scramble for Seeds* (London:Zed Boooks).

Juma, C.& Ojwang, J.B, (1992) Technology Transfer and Sustainable Development International Policy Issues (Nairobi: African Centre for Technology Studies).

Justice VR Krishna Iyer, Justice O Chinnappa Reddy, Justice DA Dessai and Justice Rajinder Sachar (1996) *Report of the Peoples Commission on GATT on The Constitutional Implications of the Final Act Embodying The Results of The Uruguay Round Of Multilateral Negotiations* (New Delhi: Centre For the Study of Global Trade System and Development).

Kameri-Mbote, A.P. and Cullet, P. (1999) "Agro Biodiversity and International Law – A Conceptual Framework" Vol.11(2) *Journal of Environmental Law* 257.

Keyala, B.K. (1999) *TRIPs Agreement on Patent Laws: Impact on Pharmaceuticals and Health For All* (New Delhi: Centre For The Study of Global Trade Systems and Development).

Khor, M. (2000) *Globalisation and The South; Some Critical Issues, UNCTAD Discussion Paper No.147* UNCTAD/OSG/DP/147.

Kjedgaard, R.H. and Marsh, D.R. (1997) "Recent Development in the Patent Protection of Plant Based Technology in the United States" Vol.19 (1) *EIPR* 16.

Kothari, A & Das, P. (1999) "Local community knowledge and practices in India" in Posey, D. (ed.) *Cultural and Spiritual Values of Biodiversity* (London: Intermediate Technology Publications & UNEP).

Kothari, A. (1997) *Understanding Biodiversity: Life Sustainability and Equity* (Hyderabad, India: Longman Orient).

Kshirsagar, K.G. & Pandey, S. (1996) "Diversity of Rice Cultivars in a Rainfed Village in The Orissa State of India" in Louise Sperling & Michael Loevinsohn (eds.) *Using Diversity Enhancing and Maintaining Genetic Resources on Farm - Proceedings of a Workshop held on 19th –21st June 1995 New Delhi India* (New Delhi: IDRC) pp.54-65.

Kumar, N. (1998) "India, Paris Convention and TRIPs" *Economic and Political Weekly* September 5th -12th 1998, pp.2334-2335.

Laird, S. Cunningham, A.B. and Estherine, L. (2000) One in Ten Thousand? The Cameroon Case of Ancistrocladus korupensis in Charles Zerner (ed.) *People Plants and Justice: The Politics of Nature Conservation* (New York: Columbia University Press) pp.345-373.

Lappe, Collins, Rosset and Esparza (1998) *World Hunger 12 Myths* 2nd Edition.(London: Earthscan).

Lappe, M & Bailey, B. (1999) *Against The Grain: The Genetic Transformation of Global Agriculture* (London: Earthscan).

Lash, S., Szeszynski, B, & Wynne, B. (eds.) (1996) *Risk Environment & Modernity: Toward a New Ecology*, (London: Sage Publications).

Latour, B. (1986) "The Powers of Association" in, John Law, (ed.) *Power Action and Belief: A New Sociology of Knowledge* (London: Routledge & Keegan).

Latour, B. (1987) *Science in Action: How to Follow Scientists and Engineers Through Society* (Milton Keynes: Open University Press).

Latour, B. (1991) "Technology is Society Made Durable" in, John Law (ed.) *A Sociology of Monsters: Essays on Power, Technology and Domination* (London: Routledge/ Sociological Review).

Latour, B. (1993) *We have Never Been Modern* (Trans.) Catherine Porter (London: Harvester Wheatsheaf).

Law J. (1999) After ANT: Complexity, Naming and Topology in John Law & John Hassard (eds.) *Actor Network Theory and after* (Oxford: Blackwell Publishers).

Law, J (ed.) (1991) *A Sociology of Monsters: Essays on Power, Technology and Domination* (London: Routledge/ Sociological Review).

Law, J. & Hassard, J. (eds.) (1999) *Actor Network Theory and After* (Oxford: Blackwell Publishers).

Law, J. (1986) "On the Methods of Long Distance Control: vessels, Navigation and the Portuguese Route to India" in John Law (ed.) *Power Action and Belief: A New Sociology of Knowledge* (London: Routledge & Keegan Paul) pp.234-263.

Law, J. (1994) *Organising Modernity* (Oxford: Blackwell Publishers).

Law, J. (1999) "After ANT: Complexity, naming and topology" in John Law & John Hassard (eds.) *Actor Network Theory and after* (Oxford: Blackwell Publishers).

Law, J. (ed.) (1986) *Power Action and Belief: A new Sociology of Knowledge* (London: Routledge).

Law, J. and Mol, A. (1995) "Notes on Materiality and Sociality" *The Sociological Review* 275.

Lefebvre, H. (1991) *The Production of Space* Trans. Donald Nicholson Smith (Oxford: Blackwell).

Leigh Star, S. & Griessemer (1989) "Institutional Ecology, 'translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39" Vol.19 *Social Studies of Science* pp.387-420.

Lesser, W. (1997) *The Role of Intellectual Property Rights in Biotechnology Transfer under the Convention on Biological Diversity ISAAA Briefs No. 3.* (ISAAA: Ithaca, NY.).

Llewelyn, M. (2000) "The Patentability Of Biological Material: Continuing Contradiction And Confusion" Vol. 22(5) *EIPR* 191.

Locke, J. (1988) *Two Treatises of Government*, Peter Laslett (ed.) (Cambridge: Cambridge University Press).

Louwaars, N. (2000), "Seed Regulations and Local Seed Systems." *Biotechnology and Development Monitor*, No.42, pp.12-14.

Louwaars, N. P. (1998), "Sui Generis Rights: From opposing to complementary approaches." *Biotechnology and Development Monitor*, No.36, pp.13-16.

Lovelock, J. (1979) *Gaia: A new Look at Life on Earth* (Oxford: OUP).

Macdonald Brown, C & Ferera, L. (1998) "First WTO Decision on TRIPs" [1998] (2) *EIPR* 69.

Macer, D. (undated) *Report on Food, Plant Biotechnology and Ethics* for UNESCO *Proceedings of the Fourth Session of The International Bioethics Committee* (Paris: UNESCO).

Macnaghten, P & Urry, J. (1998) *Contested Natures* (London: Sage Publications).

Manicad, G. and McGuire, S. (2000), "Supporting Farmer-led Plant Breeding." *Biotechnology and Development Monitor*, No.42, pp.2-7.

Mann, M. (1986) *The Sources of Social Power: Volume 1 A history of power from the beginning to AD 1760* (Cambridge: Cambridge University Press).

Mann, M. (1993) *The Sources of Social Power: Volume 2 The rise of classes and nation-states, 1760-1914* (Cambridge: Cambridge University Press).

Mansell, W. & Scott, J. (1994) Why Bother About a Right to Development" Vol.21(2) *Journal of Law and Society* 171.

Martin, M. (1998) "How to Sell A Wonder Herb" Vol.7. (12) *Down To Earth* pp.29-35.

Maxted, N., Ford-Lloyd, B.V. and Hawkes J.G. (eds.) (1997) *Plant Genetic Conservation* (London: Chapman & Hall).

Mazhar, F. (1996) "NayaKrishi Andolon: An initiative of the Bangladeshi Peasants For A Better Living" in Louise Sperling & Michael Loevinsohn (eds.) *Using Diversity Enhancing and Maintaining Genetic Resources on Farm - Proceedings of a Workshop held on 19th –21st June 1995 New Delhi India* (New Delhi: IDRC) pp.261-262.

Mazhar, F. (undated) *Nayakrishi Seed Network; A Farmer Based Strategy to Conserve and Use Seed and Genetic Resources* (unpublished paper).

McAfee, K. (1999) "Selling Nature to Save It? Biodiversity and Green Developmentalism" Vol. 17 *Environment and Planning D: Society and Space* pp.133-154.

McConnel, F. (1996) *The Biodiversity Convention: A Negotiating History* (London: Kluwer Law International).

McHughen, A. (2000) *A Consumer's Guide to GM Food From Green Genes to Red Herrings*, (Oxford: Oxford University Press).

McIntyre, O. & Mosedale, M. (1997) "The Precautionary Principle as A Norm of Customary International Law" Vol 9. *Journal of Environmental Law* pp.221-241.

McLuhan, M. (1964) Understanding Media: The Extensions of Man (London: Routledege).

Meffe, G. K. & Carroll, C.R. (1994a) "What is Conservation Biology?" in Gary K. Meffe, C Ronald Carrol and Contributors, *Principles of Conservation Biology* (Sunderland, Massachusetts: Sinauer Associates, Inc.).

Meffe, G.K. & Carrol C.R. (1994b) "The species in Conservation" in Gary K. Meffe, C Ronald Carrol and Contributors, *Principles of Conservation Biology* (Sunderland, Massachusetts: Sinauer Associates, Inc.).

Meffe, G.K., Carrol C.R and Contributors (1994) *Principles of Conservation Biology* (Sunderland, Massachusetts: Sinauer Associates, Inc.).

Menon, U (1995) "Access to and Transfer of Genetic Resources" Vol.10 (2/3) *Int. J. Technology Management* 311.

Menon, U. (1993) "TRIPs Negotiations and Indian Agriculture" Vol.52 *Journal of Scientific and Industrial Research* 296.

Menon, U. (1995) "Evolution of Intellectual Property in Plants" in B.Sharma et al. (eds.) *Genetic Research and Education: Current Trends and The Next Fifty Years* (New Delhi: Indian Society of Genetics & Plant Breeding) pp.2167-2184.

Messer, E. and Uvin, P. (eds.) (1996) *The Hunger Report: 1995* (Amsterdam: Gordon & Breach).

Mody, A. (1990) "New International Environment for Intellectual Property Rights" in Francis W. Rushing & Carole Ganz Brown (eds.) *Intellectual Property Rights in Science Technology and Economic Performance* (Boulder, Colorado: Westview Press.).

Mol, A. & Law, J. (1994) "Regions, Networks and Fluids: Anaemia and social Topology" Vol 24. *Social Studies of Science* pp.641-671.

Mooney, P. (1996) "The Parts of Life: Agricultural Biodiversity, Indigenous Knowledge, and the Role of the Third System" in *Development Dialogue* (Dag Hammarskjöld Foundation).

Mooney, P.R. (1979) *Seeds of The Earth: A Private or Public Resource?* (Ottawa: Inter Pares).

Morse, S. & Stocking, M. (ed) (1995) *People and Environment* (London: UCL Press).

Murdoch, J. (1995) "Actor Networks and the Evolution of Economic Forms: Combining Description and Explanation in Theories of Regulation Flexible Specialization and Networks" Vol.27 *Environment and Planning A* 731.

Murphy, S. (1999a) *Trade and Food Security: An Assessment of the Uruguay Round Agreement on Agriculture* (London: CIIR).

Murphy, S. (1999b) *Market Power In Agricultural Markets: Some Issues For Developing Countries, T.R.A.D.E. Working Papers No.6* (Geneva: South Centre).

Naess, A (1973) "The Shallow and the Deep, Long-Range Ecology Movement: A summary" Vol.16 *Inquiry* pp.95-100.

Nair, K & Kumar (eds.) (1994) *Intellectual Property Rights* (New Delhi: Allied Publishers).

Nanda, M. (1995) "Transnationalisation of Third World State and Undoing of Green Revolution" *Economic and Political Weekly* January 28th PE20-PE30.

Nandy, A. (ed.) (1990) *Science Hegemony and Violence: A requiem for Modernity* (New Delhi: Oxford University Press & The United Nations University).

National Committee on Plant Genetic Resources (1998) *Biodiversity and Community Knowledge Protection Act of Bangaldesh* (Draft) (Dhaka:NCPGR).

Navdanya (1995) *The Seed Keepers* (New Delhi: RFSTNRP).

Nellithanam, R, & Nellithanam, J. (1998) Return of the Native Seeds Vol.28 (1) *The Ecologist* 29.

Nellithanam, R. & Nellithanam J. (1997) "Green Revolution and Subsistence Agriculture; You Reap as You Sow" *Economic and Political Weekly* 930, May 3rd 1997.

Nozick, R. (1974) *Anarchy State and Utopia* (Oxford: Basil Blackwell).

Nuffield Council on Bioethics (1999) *Genetically Modified Crops: The Ethical and Social Issues* (London: Nuffield Council on Bioethics).

O'Riordan, T & Cameron J. (eds.) (1994) *Interpreting the Precautionary Principle* (London: Earthscan).

O'Connell, J. (1993) Meterology: The Creation of Universality by the Circulation of Particulars Vol 23 *Social Studies of Science* 128.

Oddi, A.S. (1987) "The International Patent System and Third World Development: Reality or Myth?" *Duke L.J.* 831.

Odek, J.O. (1994) "Bio-Piracy: Creating Proprietary Rights In Plant Genetic Resources" Vol.2 *J.Intell.Prop.L* 141.

Oosterhout S, van (1996) "What does in situ conservation mean in the life of a small scale farmer? Examples from Zimbabwe's Communal Areas" in Louise Sperling & Michael Loevinsohn (eds.) *Using Diversity Enhancing and Maintaining Genetic Resources on Farm - Proceedings of a Workshop held on 19th –21st June 1995 New Delhi India* (New Delhi: IDRC).

Orians, G, H. (1994) "Global Biodiveristy; Patterns and Processes" in Gary K. Meffe, C Ronald Carrol and Contributors, *Principles of Conservation Biology* (Sunderland, Massachusetts: Sinauer Associates, Inc.).

Pallemaerts, M. (1992) "International Environmental Law From Stockholm to Rio; Back to the Future" Phillipe Sands (ed) *Greening International Law* (London: Earthscan).

Parliamentary Office of Science and Technology (1996) *Patents Research and Technology – Compatibilities and Conflicts* (London:HMSO).

Patnaik (1996) "Export Oriented Agriculture and Food Security in Developing Countries and India" *Economic and Political Weekly,* pp.2429-2449.

Pauling, L. and R.B.C. Corey (1953) Vol. 171 *Nature* 346.

Pereira, W. & Seabrook, J. (1992) *Asking the Earth: The Spread of Unsustainable Development* (Mapusa, Goa: The Other India Press).

Phillips, J. & Firth, A.(1995) *Introduction to Intellectual Property* 3rd Ed (London: Butterworths).

Pickering, A. (ed.) (1992) *Science as Practice and Culture* (London: University of Chicago Press).

Posey, D. (1996) *Traditional Resource Rights: International Instruments for Protection and Compensation for Indigenous and Local Communities* (Gland, Switzerland): IUCN).

Posey, D. (ed.) (1999) *Cultural and Spiritual Values of Biodiversity* (London: Intermediate Technology Publications & UNEP).

Posey, D. and Dutfield, G. (1996) *Beyond Intellectual Property: Toward Traditional Resource Rights For Indigenous Peoples and Local Communities* (Ottawa: IDRC).

Prakash, TN (1996) "Globalisation and The Indian Farmer" Vol.IV (1) *Voices* pp.39-41.

Prescott-Allen, C. & Prescott-Allen, R. (1990) "How Many Plants Feed the World?" Vol. 4 *Conservation Biology* pp. 365-374 .

Purdue, D. (1995) "Hegemonic TRIPs: World Trade, Intellectual Property and Biodiversity" Vol. 4.(1) *Environmental Politics* 88.

Putterman, D.M. (1996) "Model Material Transfer Agreements For Equitable Biodiversity Prospecting" Vol 7. *Colo. J. Int'l. Env'l. L &Pol'y* 149.

Querol, D. (1992) *Genetic Resources: Our Forgotten Treasure, Technical and Socio Economic Approaches* (Penang, Malaysia: Third World Network).

RAFI (1994) *Conserving Indigenous Knowledge Integrating Two Systems of Innovation* (New York: United Nations Development Program).

RAFI (1995) *Communique* Sep/ Oct 1995.

RAFI (1997) *Human Nature: Agricultural Biodiversity and Farm Based Food Security* (Ottawa, Canada: RAFI).

RAFI (1998a) *Communique* March/April 1998.

RAFI (1998b) *News Release* 11th December 1998.

RAFI (1999) "Francophone African OAPI States Are Out-of-Step with OAU and other African Countries", *Geno-Types*, 24 February 1999.

RAFI (1999a) *Biopiracy Project in Chiapas, Mexico Denounced by Mayan Indigenous Groups; University of Georgia Refuses to Halt Project*, RAFI News Release 1 December 1999.

RAFI (1999b) *Messages from the Chiapas Bioprospecting Dispute An analysis of recent issues raised in the Chiapas Bioprospecting controversy with reflections on the message for BioPiracy,* RAFI Geno-type December, 22 1999.

RAFI (1999c) Communiqué March/April 1999.

RAFI (2000a) *Communique* May/June 2000.

RAFI (2000b) *"Stop Biopiracy in Mexico!" Indigenous Peoples' Organizations from Chiapas Demand Immediate Moratorium Mexican Government Says No to Bioprospecting Permits,* RAFI News Release 23 October, 2000.

RAFI (2000c) Communiqué February/March 2000.

RAFI (undated) *Enclosures of The Mind*: *Intellectual Monopolies* (Ottawa: RAFI/IDRC/CBDC).

Ramesh, M.K.. (1996) Agrarian Reforms: Review of Recent Changes in Karnataka Vol.IV (1) *Voices* 48.

Rapp. R.T. & Rozek, R.P. (1990) "Benefits and Costs of Intellectual Property Protection in Developing Countries" Vol.24 (5) *Journal of World Trade* 750.

Rathmann, G.B. (1993) "Biotechnology Case Study" in Wallerstein, Mogee and Schoen (eds.) *Global Dimensions of IPRs in Science and Technology* (Washington: National research Council/National Academy Press).

Raven, P & Wilson E.O. (1992) "A 50 Year Plan for Biodiversity Surveys" Vol. 258 *Science* 1099-1110.

Raynolds, L. (1998) "Restructuring National Agriculture Agro Food Trade and Agrarian Livelihoods in the Caribbean" in David Goodman and Michael J. Watts (eds.) *Globalising Food: Agrarian Questions and Global Restructuring* (London: Routledge).

Redgwell, C and Bowman, M (1995) *International Law and The Conservation of Biological Diversity* (London: Kluwer Law International).

Reichman, J. H. (1999) "Securing Compliance With The TRIPs Agreement After US v India" Vol.1 (4) *Journal of International Economic Law* 585.

Reid, W., Juma, C. (1992) *Property Rights and Genetic Resources* (Nairobi: African Centre For Technology Studies).

Rifkin, J. (1998) *The Biotech Century* (New York: Jeremy P. Tarcher/Putnam).

Rissler, J & Mellon, M. (1996) *The Ecological Risks of Engineered Crops* (London: The MIT Press).

Ritchie, M, Dawkins, K (2000) "WTO Food and Agriculture Rules: Sustainable Agriculture and The Human Right to Food" *9 Minn. J, Global Trade* 9.

Roberts. T (1994) "Broad Claims for Biotechnological Inventions" Vol.(9) *EIPR* 373.

Robertson, R. (1992) *Globalization: Social Theory and Global Culture* (London: Sage).

Robertson, R. (1995) "Glocalization: Time-Space and Homogeneity-Heterogeneity" in Mike Featherstone, Scott Lash and Roland Robertson (eds.) *Global Modernities* (London: Sage Publications).

Roht-Arriaza, N. (1996) "Of Seeds And Shamans: The Appropriation Of The Scientific And Technical Knowledge Of Indigenous And Local Communities" Vol.17 *Mich. J. Int'l L.* 919.

Roht-Arriazza, N. (1997) "Of Seeds and Shamans the Appropriation of the Scientific and Technical Knowledge of Indigenous and local Communities" in Bruce Ziff and Partima v. Rao (eds.) *Borrowed Power Essays on Cultural Appropriation* (New Brunswick, New Jersey: Rutgers University Press).

Ross, E. (1998) *The Malthus Factor: Poverty, Politics and Population in Capitalist Development* (London: Zed Books).

Rostow, W. (1960) *The Stages of Economic Growth* (Cambridge: Cambridge University Press).

Rubin, S. and Fish, S. (1994) "Biodiversity Prospecting: Using Innovative Contractual Provisions To Foster Ethnobotanical Knowledge, Technology, And Conservation" Vol. 5 *Colo. J. Int'l. Env'l. L &Pol'y* 23.

Ryan, M. (1998) *Knowledge Diplomacy: Global Competition and the Politics of Intellectual Property* (Washington DC: Brookings Institution Press).

Sachs, W. (1993a) "Global Ecology and the Shadow of Development" in Wolfgang Sachs (ed.), *Global Ecology: A new Arena of Political Conflict* (London: Zed Books).

Sachs, W. (ed.) (1993b) *Global Ecology: A new Arena of Political Conflict* (London: Zed Books).

Sands, P. (ed) (1992) *Greening International Law* (London: Earthscan).

Santos, B. (1999) "Towards a Multicultural Conception of Human Rights" in Mike Featherstone & Scott Lash eds. *Spaces of Culture, City, Nation, World* (London: Sage Publications).

Schoenbaum, (1997) *International Trade And Protection Of The Environment: The Continuing Search For Reconciliation* 91 Am. J. Int'l L. 268.

Schoreder, R. (2000) "Beyond Distributive Justice: Resource Extraction and Environmental Justice in the Tropics" in Charles Zerner (ed.) *People Plants and Justice: The Politics of Nature Conservation* (New York: Columbia University Press).

Schrell, A. (1996) "Are Plants (Still) Patentable?: Plant Genetic Systems (EPO Decision T356/93)" Vol.18 *EIPR* 242.

Seiler, A. (1998), "Sui Generis Systems: Obligations and options for developing countries." *Biotechnology and Development Monitor*, No.34, pp.2-5.

Sell, S.K. (1998) *Power and Ideas: North South Politics of Intellectual Property and Antitrust* (New York: State University of New York Press).

Sen, A. (1981) *Poverty and Famines* (Oxford: Oxford University Press).

Sen, A. (1995) "Food, Economics and Entitlements" in Drèze, J., Sen, A., Hussain, A., (eds.) *The Political Economy of Hunger*, (Oxford: OUP).

Sen, A. (1999) *Development as Freedom* (Oxford: Oxford University Press).

Sennet, R. (1999) "Growth and Failure: The new Political Economy and Its Culture" in Mike Featherstone & Scott Lash eds. *Spaces of Culture, City, Nation, World* (London: Sage Publications).

Sessions, G. (ed) (1995) Deep Ecology for the 21st Century (Boston: Shambhala Publications Ltd).

Shelton, D. (1992) "What Happened in Rio to human Rights" *3 Yb. Int'l Env.L* 75.

Shields, R. (1997) "Spatial Stress and Resistance: Social Meanings of Spatialization" in Georges Benko & Ulf Strohmayer (eds.) *Space & Social Theory: Interpreting Modernity and Postmodernity* (Oxford: Blackwell Publishers).

Shiva, V. & Holla-Bhar, R. (1993) "Intellectual Piracy and the Neem Tree" Vol.23 (6) *The Ecologist* pp.223-227.

Shiva, V. (1990) "Reductionist Science as Epistemological Violence" in Ashis Nandy ed. *Science Hegemony and Violence: A requiem for Modernity* (New Delhi: Oxford University Press & The United Nations University).

Shiva, V. (1991a) *The Violence of The Green Revolution* (London: Zed Books).

Shiva, V. (1991b) "Dispossession of Knowledge: Theft of Third World Resources and Intellectual Property" in *Third World Resurgence* No.8 April 1991.

Shiva, V. (1993) *Monocultures of The Mind: Perspectives on Biodiversity and Biotechnology* (London: Zed Books).

Shiva, V. (1995) *Biodiversity Based Productivity: A Framework for an Alternative Assessment for Sustainable Agriculture* (Dehra Dun, India: Research Foundation For Science Technology and Natural Resource Policy).

Shiva, V. (1997) *Biopiracy: The Plunder of Nature and Knowledge* (Boston, MA: South End Press).

Shiva, V. (1998) *Globalisation of Agriculture Food Security and Sustainability* (New Delhi: Research Foundation for Science Technology and Ecology).

Shiva, V. and Moser, I. (eds.) (1995) *Biopolitics; A Feminist Ecological Reader on Biotechnology* (London: Zed Books).

Shiva, V. Jari, A. Bedi, G. and Holla Bhar, R. (1997) *The Enclosure and Recovery of The Commons* (New Delhi: RFSTE).

Shivji, I.G. (1989) *The Concept of Human Rights in Africa* (London: Codesria).

Siddiqui, K. (1998) Agricultural Exports, Poverty and Ecological Crisis Case Study of Central American Countries" *Economic and Political Weekly* September 26th A128-A136.

Singh Nijar, G. (1998), "Community Intellectual Rights Protect Indigenous Knowledge." *Biotechnology and Development Monitor*, No.36, pp.11-12.

Song, Y. (1999), "Feminization of Maize Agricultural Production in Southwest China." *Biotechnology and Development Monitor*, No.37, p.6-9.

South Centre (1997) *The TRIPs Agreement: A Guide for the South. The Uruguay Round Agreement on Trade-Related Intellectual Property Rights* (Geneva, Switzerland: The South Centre).

South Centre (1997) *Universal Food Security: Issues for the South* (Geneva:South Centre).

Sperling, L. & Loevinsohn, M. (eds.) (1996) *Using Diversity Enhancing and Maintaining Genetic Resources on Farm - Proceedings of a Workshop held on 19th –21st June 1995 New Delhi India* (New Delhi: IDRC).

Stamm. O.A. (1993) "Intellectual Property Rights and Competitive Strategy: A Multinational Pharmaceutical Firm in Wallerstein, Mogee and Schoen (eds.) *Global Dimensions of IPRs in Science and Technology* (Washington: National research Council/National Academy Press).

Star, S.L. & Greisemer, J.R. (1989) "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39" Vol.19 *Social Studies of Science* 387.

Subramanian, A. (1990) "TRIPs and the Paradigm of the GATT: A tropical Temperate View" Vol. 13(4) *World Economy* 509.

Surenda, L. & Gopalakrishnan (1995) "Intellectual Property, Seeds, The Future of Farmers and Farming" (1995) 5 *Supreme Court Cases* (Jour) 10.

Swaminathan, M.S. (1997) "Uncommon opportunities for achieving Sustainable Food and Nutrition Security: An Agenda for Science and Public Policy" in Christian Bonte-Friedheim and Kathleen Sheridan (eds) *The Globalisation of Science The Place of Agricultural Research* 2nd Ed. (The Hague: The International Service for National Agriculture).

Swaminathan, M.S. (1998) *Report of The Expert Committee on Biodiversity Constituted by The Ministry of Environment & Forests* (New Delhi: Govt of India).

Swaminathan, M.S. (1998), "Farmers' Rights and Plant Genetic Resources." *Biotechnology and Development Monitor*, No.36, pp.6-9.

Swanson, T. (1995) (ed) *Intellectual Property Rights and Biodiversity Conservation: An Interdisciplinary Analysis of the Values of Medicinal Plants* (Cambridge; Cambridge University Press).

Thrift, N. (1996) *Spatial Formations* (London: Sage Publications).

Tilahun, S. and Edwards, S. (eds.) (1996) *The Movement for Collective Intellectual Rights* (Addis Ababa: Institute for Sustainable Development).

Tiwari, R. & Das, A. (1996) "Documentation of Local Crop Varieties Evolving A Participatory Methodology" in Louise Sperling & Michael Loevinsohn (eds.) *Using Diversity Enhancing and Maintaining Genetic Resources on Farm - Proceedings of a Workshop held on 19th –21st June 1995 New Delhi India* (New Delhi: IDRC) pp.66-78

Tolba, M.K. (1992) *Saving Our Planet: Challenges and Hopes* (UNEP/ Chapman & Hall: London).

Touraine, A. (1995) *Critique of Modernity* (Oxford: Blackwell Publishers).

UBINIG (undated) *Nayakrishi Andolon Initiatives of Farming Communities for a Happy Life* (Dhaka: UBINIG).

UNCTAD (1974) *The Role of The Patent System in the Transfer of Technology to Developing Countries* TD/B/AC.11/19.

UNCTAD (1975) *The International Patent System as an Instrument for National Development* TD/B/C.6/AC.2/3.

UNCTAD (1991) *Trade and Development Report* UNCTAD/TDR/11.

UNCTAD (1994) "Agreement on Trade Related Aspects of Intellectual Property Rights" *Trade and Development Report 1994 (Supplement)* UNCTAD/TDR/14.

UNDP (1999) *Human Development Report* (New York: UNDP).

UNEP (1995a) *Report of the First Meeting of the Conference of the Parties to the Convention on Biological Diversity* UNEP/CBD/COP/1/17.

UNEP (1995b) *Report of the Open-Ended Ad Hoc Group of Experts on Biosafety* UNEP/CBD/COP/2/7.

UNEP (1995c) *Report of the Second Meeting of the Conference of the Parties to the Convention on Biological Diversity* UNEP/CBD/COP/2/19 .

UNEP (1996a) *Agricultural Biodiversity under the Convention on Biodiversity a Note by the Executive Secretary* UNEP/CBD/COP/3/14.

UNEP (1996b) *Report of The First Meeting of The Open Ended Ad Hoc Working Group on Bio Safety* UNEP/CBD/BSWG/1/4.

UNEP (1996c) *The Convention on Biological Diversity and the Agreement on Trade Related Intellectual Property Rights (TRIPs: Relationships and Synergies* UNEP/CBD/COP/3/23.

UNEP (1996d) *The Impact of Intellectual Property Rights Systems on The Conservation and Sustainable Use Of Biological Diversity And On the Equitable Sharing of Benefits From Its Use: A Preliminary Study* UNEP/CBD/COP/3/22.

UNEP (1997a) Report of the Second Meeting of the Open-Ended Working Group on Biosafety UNEP/CBD/BSWG/2/6.

UNEP (1997b) Report of the Third Meeting of the Open-Ended Ad Hoc Working Group on Biosafety UNEP/CBD/BSWG/3/6.

UNEP (1997c) Compilation of Draft Text Prepared by the Secretariat on Selected Items UNEP/CBD/BSWG/3/4.

UNEP (1997d) *Compilation of the Views of Governments on the Contents of the Future Protocol* UNEP/CBD/BSWG/2/2.

UNEP (1998a) Report of the Fourth Meeting of the Open-Ended Ad Hoc Working Group on Biosafety UNEP/CBD/BSWG/4/4.

UNEP (1998a) *Report of the Fourth Meeting of the Open-Ended Ad Hoc Working Group on Biosafety* UNEP/CBD/BSWG/4/4.

UNEP (1998b) Report of the Fifth Meeting of the Open-Ended Ad Hoc Working Group on Biosafety UNEP/CBD/BSWG/5/3.

UNEP (1998c) *Revised Consolidated Text of The Draft Articles* UNEP/CBD/BSWG/5/Inf.1.

UNEP (1998d) Draft Negotiating Text UNEP/CBD/BSWG/6/2.

UNEP (1998e) *Access to Genetic Resources and Means for Fair and Equitable Benefit Sharing Case Study Submitted By Switzerland* UNEP/CBD/COP/4/Inf.16.

UNEP (1998f) *Report of the International Workshop Best Practices For Access to Genetic Resources* UNEP/CBD/COP/4/Inf/10.

UNEP (1998g) *Addressing the Fair and Equitable Sharing of The Benefits Arising Out of Genetic Resources; Options For Assistance to Developing Country Parties to The Convention on Biological Diversity* UNEP/CBD/COP/4/22.

UNEP (1998h) *Measures to Promote and Advance The Distribution of Benefits From Biotechnology in Accordance with Article 19* UNEP/CBD/COP/4/21.

UNEP (1998i) *Benefit Sharing Case Studies Aristocladus Korupensis and Prunus Africana Submission by the United Nations Environment Programme* UNEP/CBD/COP/4/Inf.25.

UNEP (1998j) *Synthesis of Case Studies on Benefit Sharing* UNEP/CBD/COP/4/Inf.7.

UNEP (1999a) *Decisions Adopted By The Conference Of The Parties To The Convention On Biological Diversity At The First Part Of Its First Extraordinary Meeting Cartagena, 22-24 February 1999*, UNEP/CBD/ExCOP/1/3 Annex1 - Decision 3.

UNEP (1999b) Report of the Sixth Meeting of the Open-Ended Ad Hoc Working Group on Biosafety UNEP/CBD/EXCOP/1/2.

UNEP (1999c) *Consequences Of The Use Of The New Technology For The Control Of Plant Gene Expression For The Conservation And Sustainable Use Of Biological Diversity - Supplementary Information* UNEP/CBD/SBSTTA/4/Inf.3.

UNEP (1999d) *Consequences Of The Use Of The New Technology For The Control Of Plant Gene Expression For The Conservation And Sustainable Use Of Biological Diversity* UNEP/CBD/SBSTTA/4/9/Rev.1.

UNEP (2000a) *Agricultural Biological Diversity: Review Of Phase I Of The Programme Of Work And Adoption Of A Multi-Year Programme Of Work Report on the negotiations for the revision of the International Undertaking on Plant Genetic Resources* UNEP/CBD/COP/5/INF/12.

UNEP (2000b) Report of the Extraordinary Meeting of the Conference of the Parties for the Adoption of the Protocol on Biosafety UNEP/CBD/EXCOP/1/3.

UNEP (2000c) *Indicative List Of Activities That Could Be Carried Out Under The Tasks Identified In The Programme Of Work On Article 8 (J) And Related Provisions Of The Convention On Biological Diversity* UNEP/CBD/WG8J/1/INF/1.

UNEP (2000d) *Report Of The Panel Of Experts On Access And Benefit-Sharing Contents* UNEP/CBD/COP/5/8/.

UNEP/IISD (2000) *Environment and Trade – A Handbook* (Geneva: UNEP/IISD).

UNESCO (1984) *Women in the villages, Men in the Town* (Paris: UNESCO).

United Nations Economic and Social Council (2000) *The Realization Of Economic, Social And Cultural Rights: Globalization and its impact on the full enjoyment of human rights Preliminary report submitted by J. Oloka-Onyango and Deepika Udagama, in accordance with Sub-Commission resolution 1999/8* UN Document E/CN.4/Sub.2/2000/13.

USDA (2000) *Outlook for US Agricultural Trade* 30th August 2000.

Uvin, P. (1996) "The State of World Hunger" in Messer, E. and Uvin, P. (eds.) *The Hunger Report: 1995* (Amsterdam: Gordon & Breach).

Vaitsos, C. (1972) "Patents Revisited: Their Function in Developing Countries" Vol. 9(1) *Journal of Development Studies* 71.

van Beek, W. E. A (1993) "Processes and limitations of Dogon Agricultural Knowledge" in Hobart, M. (ed) *An Anthropological Critique of Development: The Growth of Ignorance* (London: Routledge).

van der Ploeg, J. D. (1993) Potatoes and Knowledge in Hobart, M. (ed) *An Anthropolgical Critique of Development: The Growth of Ignorance* (London: Routledge) pp.209-227.

Vavilov (1951b) "Phytogeographic Basis of Plant Breeding," Vol. 13 *Chronica Brittanica* pp.14-53.

Vavilov, N.I. (1951a) "Origin, Variation, Immunity & Breeding of Cultivated Plants," Vol. 13 *Chronica Brittanica.*

Vavilov, N.I. (1992) *Origin and Geography of Cultivated Plants* (Cambridge: Cambridge University Press).

Vellema, S. (2000), "Contractual Maize Seed Production." *Biotechnology and Development Monitor*, No. 42, pp. 8-11.

Verma, S.K. (1995) "TRIPs and Plant Variety Protection in Developing Countries" Vol.17 (6) *EIPR* 281.

Verma, S.K. (1996) "TRIPs Development and Transfer of Technology" Vol. 27 (3) *IIC* 331.

Vogel, J. & Ingram, G. (1993) "Biodiversity or Genetically Coded Functions The importance of definitions" Vol.2 (2) *RECIEL* 121.

Vogel, J. (1994) *Genes for Sale: Privatization as a Conservation Policy* (Oxford: Oxford University Press).

Walden, I (1993) "Intellectual Property in Genetic Sequences" Vol.2(2) *RECIEL* 126; Llewelyn, M. (1994) "Industrial Applicability/Utility and Genetic Engineering: Current Practices in Europe and the United States" Vol.16 (11) *EIPR* 437.

Wallerstein, Mogee and Schoen (eds.) (1993) *Global Dimensions of IPRs in Science and Technology* (Washington: National research Council/National Academy Press).

Ward, H. & Brack, D. (eds.) (2000) *Trade, Investment and the Environment* (The Royal Institute of International Affairs & Earthscan: London).

Watkins, K. (1995) *Agricultural Trade and Food Security* (Quezon City, Phillipines: Oxfam).

Watkins, K. (1996) "Free Trade and Farm Fallacies: From the Uruguay Round to The World Food" Summit Vol.26(6) *The Ecologist* 244.

Watson, J. (1981) *The Double Helix; A Personal Account of the Discovery of the Structure of DNA, A new Critical edition ed Gunther S, Stent.* (London Wiedenfield and Nicholson).

Watson, J. and F.H.C. Crick (1953) "Molecular Structure of Nucleic Acid; A Structure for Deoxyribose Nucleic Acid" Vol 171 *Nature* pp. 737-738.

Watson, J.D. and F.H.C. Crick (1953) "Genetical Implications of the Structure of Deoxyribonucleic Acid Vol.172 *Nature* pp. 964 – 967.

Watson, J.D. and F.H.C. Crick (1953) "The Structure of DNA" *Cold Spring Harbour Symposia on Quantitive Biology*, XVIII pp. 123-131.

Watts, M. & Goodman, D. (1997) "Agrarian Questions: Global Appetite, local metabolism: Nature, culture, and industry in fin-de-siècle agro-food systems" in David Goodman and Michael J. Watts (eds.) *Globalising Food: Agrarian Questions and Global Restructuring* (London: Routledge).

WCED (1989) *Our Common Future* (Oxford:OUP)

WCMC/ IUCN/ UNEP/ WWF/ WRI (1992) *Global Biodiversity: Status of the earths living Resources* (London: Chapman Hall).

Weiszacker, C. von (1996) Biodiversity Newspeak in Miges Baumann, Janet Bell, Florianne Koechlin and Michel Pimbert, (eds.) *The Life Industry; Biodiversity People and Profits* (London: Intermediate Technology Publications).

Weizsacker, C. von (1993) "Competing Notions of Biodiversity" in Wolfgang Sachs (ed.) *Global Ecology: A new Arena of Political Conflict* (London: Zed Books).

Welch, C.E. & Meltzer, R.I. (eds.) (1984) *Human Rights and Development in Africa* (Albany: State University of New York Press).

Whitcombe, J.R., Pere, R. Jones, S. and Josh, A. (1999) "Farmer Participatory Crop Improvement. IV The spread and Impact of a Rice Variety Identified by Participatory Varietal Selection" Vol.35 *Experimental Agriculture* 471.

Wijk, J. van (1995), "Plant Breeders' Rights Create Winners and Losers." *Biotechnology and Development Monitor*, No.23, pp.15-19.

Wilkins, M.H.F., A.R. Stokes and H.R. Wilson, (1953) " Molecular Structure of Deoxypentose Nucleic Acids" Vol. 171 *Nature* pp. 737-740.

Wilmutt *et al* (1997) Viable Offspring Derived from Fetal and Adult Mammalian Cells" Vol. 385 *Nature* pp.811-813.

Wilmutt, I. Campbell, K. & Tudge, C. (2000) *The Second Creation* (London: Headline Book Publishing).

WIPO (1992) *Guide On The Licensing Of Biotechnology* (Geneva: WIPO).

WIPO (2000) *Intellectual Property Needs and Expectations of Traditional Knowledge Holders, Draft Report on Fact Finding Missions on Intellectual Property and Traditional Knowledge* (Geneva: WIPO).

WIPO (2000) *Intellectual Property Needs and the Expectations of Traditional Knowledge Holders: World Intellectual Property Organisation (WIPO) Draft Report on Fact Finding Missions on Intellectual Property and Traditional Knowledge (1998-1999) July 3rd, 2000.*

World Bank (1975) *The Assault on World Poverty: Problems of Rural Development Education and Health* (Baltimore: The World Bank & The John Hopkins University Press).

World Conservation Monitoring Centre (1994) *Biodiversity Sourcebook* (Cambridge: WCMC & IUCN).

WRI/ IUCN/ UNEP (1992) *Global Biodiversity Strategy: Guidelines for Action to Save, Study, and use Earth's Biotic Wealth Sustainably and Equitably.*

Wright, S. (1994) *Molecular politics: Developing American and British Regulatory Policy for Genetic Engineering, I1972-1982* (Chicago: Chicago University Press).

WTO (1994) *Report by Ambasador H Ukawa, Chariman of the group on Environmental Measures and International Trade to the 49th Session of the Contracting Parties WTO/L/7402*

WTO (1995) *Environment and Trips* WT/CTE/W/8.

WTO (1996) *Report (1996) Of The Committee on Trade and Environment* WT/CTE/1 §178.

WTO (1999a) *Background Document to the High Level Symposium on Trade and Environment Geneva 15th –16th March 1999* (Geneva: WTO).

WTO (1999b) *Preparations for the 1999 Ministerial Conference, Proposal for Establishment of a Working Party on Biotechnology in WTO, Communication from Canada, 4 October 1999,* WT/GC/W/359WT/GC/W/359.

WTO (1999c) *Preparations for the 1999 Ministerial Conference, Proposal of Japan on Genetically Modified Organisms (GMOs), Communication from Japan, 4th October 1999*, WT/GC/W/365.

WTO (1999d) *Preparations for the 1999 Ministerial Conference, Negotiations on Agriculture, Measures Affecting Trade in Agricultural Biotechnology Products, Communication from the United States, 27 July 1999,* WT/GC/W/288.

WTO (1999e) *The Relationship Between The Convention On Biological Diversity (CBD) And The Agreement On The Trade-Related Aspects Of Intellectual Property Rights (TRIPs); With A Focus On Article 27.3 (B)* WT/CTE/W/125.

WTO (1999f) *Preparations For The 1999 Ministerial Conference, The TRIPS Agreement, Communication from Kenya on behalf of the African Group 29th July 1999* WT/GC/W/302.

WTO (1999g) *Preparations For The 1999 Ministerial Conference Implementation Issues to be Addressed Before/At Seattle Communication from Cuba, Dominican Republic, Egypt, El Salvador, Honduras, India, Indonesia, Malaysia, Nigeria, Pakistan, Sri Lanka and Uganda, 1st October 1999* WT/GC/W/354.

WTO (2000a) *Protection Of Biodiversity And Traditional Knowledge – The Indian Experience, Submission by India, 14 July, 2000,* WT/CTE/W/156 & IP/C/W/198.

Wynne, B. (1996) "May the sheep Safely Graze? A reflexive View of The expert lay knowledge Divide" in Scott Lash, Bronislaw Szerszynski & Brian Wynne (eds.) *Risk Environment & Modernity Towards a New Ecology* (London: Sage Publications) pp.44-83.

Yamin, F. (1995) *The Biodiversity Convention and Intellectual Property Rights* (Gland, Switzerland: WWF).

Yap, E. (1999) R*escue of Rice Variety: Enhancing Biodiversity and the Struggle for Land* Unpublished Paper given at the "Food and Agriculture in North South Relations" conference, March 4-7, 1999, Univerisitat Pompeu Fabra, Barcelona.

Zerner, C. (ed.) (2000) *People Plants and Justice: The Politics of Nature Conservation* (New York: Columbia University Press).

Ziff, B. and Rao, P.V. (eds.) (1997) *Borrowed Power: Essays on Cultural Appropriation* (New Brunswick, New Jersey: Rutgers University Press).

Zweifel, H. (1995), "Modern Biotechnologies in Agriculture: Impact on women in the South." *Biotechnology and Development Monitor*, No.23, pp.10-13.