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**COMMENTS ON THE IUCN DRAFT ON "BIOSAFETY AND GENETICALLY  
MODIFIED ORGANISMS"**

*CEESP Steering Committee members and Alejandro Nadal; Debashis Banerji; Sitanon Jesdapipat; Heike Baumüller; Maria Caridad Araujo; Marianne Jacobsen; Maryam Rahmanian; Michel Pimbert.*

**The draft IUCN paper on GMOs, "Biosafety and Genetically Modified Organisms: Background for the Enunciation of an IUCN Position and Plan of Action" was circulated among members of the CEESP Steering Committee and some members of the Commission for their comments and feedback. The draft sparked much interest and debate within the Commission. CEESP members welcomed the initiative to develop an IUCN position on a difficult cutting edge issue such as GMOs and thought that the draft document was useful as a starting point. The following is offered a CEESP contribution to the formulation of this position and is intended primarily for the use of the Council and its PPC as well as interested members of the Secretariat.**

**GENERAL COMMENTS**

Overall, the paper was easy to read and directed to a wide variety of audiences. It was useful that abstract concepts and ideas were alternated with concrete examples and cases. These are elements that should be maintained in future versions of the paper. However, CEESP members think that the structure and contents of the paper needs some major changes in order to contribute to an informed IUCN position.

In general, the draft fails to recognise that science and technology can be constructed in different ways for a variety of purposes. In order to adequately assess the usefulness of any technology, we must acknowledge that values and interests fundamentally influenced its production. Fundamental questions such as who controls the technology, who benefits from it and how, have not been adequately addressed in the draft.

The structure of the draft hampers its ability to meet the objectives set out in WCC Resolution 2.31. The “crosscutting principles”, which appear in Section III, should be promoted and should *precede* the technological issues: technological issues should be examined in light of crosscutting principles, not the other way round. They should also be expanded, currently the crosscutting principles only include the Precautionary Principle/Approach and Development (while poverty appears in a footnote). A broader approach could include: biodiversity conservation, sustainable use and equity (the three pillars of the Ecosystem Approach developed by the CBD—as well as of IUCN), community empowerment, etc.

Regarding the scientific issues, the draft fails to tackle the full implications of the the wealth of evidence that discredits the scientific foundations of the biotechnology industry. In fact, as outlined further below, the biotech industry is based on simplistic and outdated assumptions about gene behaviour which have been deeply challenged, particularly by the results of the Human Genome Project. In sharp contrast, the new genetics paints a more complex and dynamic picture in which genes and genomes are fluid and adaptable, always influencing and influenced by the cellular, physiological and ecological contexts they are embedded in. Far from supporting the claims of the biotechnology industry, the evidence actually indicates that GMO use may have catastrophic consequences. Furthermore, the evidence shows that it is not possible to use a risk assessment framework to assess GMO use (as the draft implies) since the risks are not known.

Biosafety is chosen by the draft as a fundamental axis for GMO analysis. However, this is far from being a happy choice. Biosafety is of course an important dimension of the whole issue, but in most of the literature on biotechnology and GMO’s, biosafety is a narrowly defined concept and IUCN needs to avoid falling into this usage. The draft document, as elaborated below, is not immune to this danger.

The overwhelming impression left by the draft is that it does not adequately address the myriad of complex issues at hand. Chief among these is the claimed potential of GMOs to alleviate hunger. These alleged benefits are widely disputed and yet they are the main argument in favour of GMO use. Therefore they provide a standard against which the real-world performance of GMOs must be evaluated. The draft fails to present an analysis of this important issue. Key topical concerns, such as food aid and commercial R&D of GMOs, are also left out. The few passages on socio-economic impacts are quite insufficient.

The implication for IUCN is that not only do we need to develop a more thorough understanding of the existing scientific literature (particularly the challenges to the traditional field of genetics), but also that any thorough understanding must draw also from the expertise of farmers, pastoralists, fisherfolk, consumers and other groups who are usually marginalised in any debate on “scientific” issues. Direct citizen engagement and negotiations on the content, purpose and potential risks of scientific innovations are necessary. It is vital for IUCN to develop a full picture of the

issues involved based on listening to those of the world's populations, such as poor farmers, who are likely to be affected by its positions.

### **SCIENTIFIC ASPECTS OF THE CONTROVERSY**

This section falls short of a clear rendering of how the technology works, including the basic science that makes it possible. It therefore effectively glosses over some important uncertainties regarding the technology, uncertainties that have huge implications for an examination of the impact of GMOs on the "conservation and sustainable use of biological resources and ecosystems".

The draft presents the description of genetic modification used in Annex 2 of the Biosafety Protocol, a description that is too vague in many respects and does not cover all the ground. It is important that the draft presents its own description of the technology since the conclusions that are drawn regarding implications for IUCN hinge upon the accuracy of our understanding of the technology.<sup>1</sup> It would also be useful to present the greater context of the debate by providing a description of biotechnologies in general (of which genetic modification is only one case) and to make the distinction between traditional and new biotechnologies.

#### *The theoretical basis of the biotechnology industry*

**Both the biotechnology industry and the Human Genome Project (HGP) are based on the genetic theory developed by Crick and Watson, which, simply stated, holds that genes are the unique governor of all inherited traits, and that there is a simple one-to-one relationship between genes and the characteristics of human beings. This theory has been the presumption underlying the use of recombinant-DNA technology by genetic engineers over the last 20 years. They hunt for genes that cause problems and try to insert new, more desirable genes to engineer "better" organisms. It was assumed that each gene codes for a single protein molecule, adding a unique trait to the behaviour of the organism (genes govern events in a cell by creating different proteins). In a closed, one-way, linear causal pathway, proteins were assumed to be encoded by DNA and, therefore, DNA was said to encode function. Each gene was assumed to be an independent unit of information with the environment acting as a trigger to activate pre-set programmes in DNA. It was also assumed that genes are stable, being passed on unchanged to the next generation.**

The entire enterprise has been brought into question by the HGP which supports a more complex and nuanced understanding of the way genes work, an understanding that was being advocated all along by molecular biologists opposed to genetic engineering. The draft briefly mentions the Human Genome Project, but simply states that the results were "significantly different" from those predicted on the basis of the Crick and Watson theory. In doing so, it fails to do justice to the full

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<sup>1</sup> Suggested relevant sources: The US National Institutes of Health web page; The Royal Swedish Academy of Science; and the Norwegian Academy of Science.

implications of the Project, which not only “differed” from, but actually *refuted* the very premise on which the theory is based. To refer to one of the sources used in the draft, Barry Commoner, we learn that “the most dramatic achievement to date of the \$3 billion Human Genome Project is the refutation of its own scientific rationale.”<sup>2</sup>

It is therefore necessary to present a more detailed description of the scientific findings than that found in the draft before going on to assess the impact of GMOs and the implications for IUCN.

1. One of the surprise findings of the Human Genome Project was the small number of genes found (30,000 instead of the 100,000 that were predicted based on the underlying theory). One explanation for the low gene count is the process of “alternative splicing”. Contrary to the theory, alternative splicing indicates that DNA is not the only element that decides inheritance. Furthermore, by rearranging the nucleotide sequence of a single gene to produce a range of new and different RNA sequences, “alternative splicing can be said to generate new genetic information.”<sup>3</sup>

2. The validity of the central dogma was brought into question even before the HGP findings surfaced. Research indicates that “Biological replication does include the precise duplication of DNA, but this is accomplished by the living cell, not by the DNA molecule alone.”<sup>4</sup> The replication process contains errors, the risk of which are minimised by a host of proteins to be found in the cells. These proteins work to detect and remove mismatched nucleotides from the newly synthesised DNA. The Crick and Watson theory, on the contrary, ascribes replication to DNA alone.

3. As mentioned in the draft, findings concerning infectious diseases such as scrapie, mad cow disease, and similar fatal human diseases have implications for the theory’s precept that DNA exclusively governs inheritance. The findings show that the structure of the newly formed proteins are determined not by DNA alone, and that genetic information may pass from one protein to another. But these findings do more than merely suggest – as does the draft – that the theory is, “at least, inaccurate in some cases”. Furthermore, given that the findings concern fatal human diseases, if they show the theory to be “at least” inaccurate in some cases, would it not be pertinent to also ask what the findings show “at most”?

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<sup>2</sup> Commoner, Barry, *Unraveling the DNA Myth: The spurious foundation of genetic engineering*, Harper’s Magazine, February, 2002.

<sup>3</sup> *ibid.*

<sup>4</sup> *ibid.*

**The fluidity of the Genome has uprooted the whole conceptual foundation of the methodology of genetic engineering, based on genetic determinism. A gene/DNA sequence can code for more than one protein, is controlled by many regulatory sequences, is interrupted rather than being a continuous sequence of codons, its expression is affected by the environment. Above all, the genome, despite similarities between phyla, maintains individualities of a species through a complex mechanism of intra and extra-cellular regulatory processes. This is why even though it has been found that there is only a small difference in DNA sequences between, say a chimpanzee and humans, they remain completely distinct species. Through different permutation and combination of sequences, and their regulation, stable, dissimilar, sexually incompatible units/taxons, i.e. species have been created (like at the molecular level out of just 21 amino-acids, millions of proteins have been created). Random insertion of genes can upset this fine tuned process.**

A position paper needs to settle accounts clearly with the scientific controversy as it now stands. The draft states instead that "while IUCN is not in a position to resolve this controversy, it may be in a position to evaluate certain relevant factors, particularly with regard to species and ecosystems". IUCN need not solve the controversy, but, in order to "advance leadership" it is required to have an informed assessment about the state of this technology. If it fails to do so, it may be impossible to be in a position to evaluate other "relevant factors".

#### CONSEQUENCES OF THESE FINDINGS FOR GMOS

The sections of the draft on scientific issues contain an undercurrent of the attitude that "if benefits outweigh risks then, with proper Biosafety norms, GMOs may be introduced". This approach is unfortunate and risky. Following the path-breaking revelations of the Human Genome Project, the very theoretical foundations of genetic engineering have been shaken. It is now clear that we still do not know enough to be able to definitely predict the consequences of the engineering we attempt. Therefore, the risks of unintended consequences cannot be precisely assessed. In such a situation a "risk-benefit analysis" holds little water.

The findings outlined above, raise a number of issues that demonstrate the imprecision and unknown factors involved in genetic engineering.

1. The recombinant DNA technology of gene insertion is absolutely different from the conventional hybridization technique. In hybridization, gene movement is directed by pairing processes of homologous chromosomes and alleles after fertilization. The gene, therefore, reaches its proper neighbourhood where alone, it can function normally and predictably.

In r-DNA technology, on the other hand, gene insertion is by 'gunning', bacterial 'trucking', electroporation etc., and is totally random. According to Terje Traavik (from the Norwegian Academy of Sciences), when moving new genes into cells and

organisms there is still no possibility to target the vector or transgene to specific sites within the recipient genomes. This means that modifications performed with identical recipients and vector gene constructs under the same standardized conditions may result in highly different GMOs depending on where the transgenes become inserted. There is really no control with changes in gene expression patterns for the inserted or endogenous genes of the GMO. And there is no control of whether the inserted transgene(s), or parts thereof, move within or from the recipient genome, or where transferred DNA sequences end up in ecosystems. No one denies that interspecific transfers are difficult, and the offspring unpredictable. But the fact is that even if the same gene is transferred from one plant to another plant of the same species by 2 alternative procedures, viz., conventional hybridization and r-DNA procedure, it is the performance of the latter (r-DNA product) that will be uncertain and unpredictable.

By analogy, gene movement in conventional hybridization is like partners (alleles) in a doubles game of Tennis coming to the predetermined half of the court, while in r-DNA technique it will be like throwing/shooting a human (intra-specific) or non-human (inter-specific) player onto the court. One can't possibly continue the game of tennis in this way.

Thus, Traavik concludes that it is both pertinent and relevant to ask the question whether genetic engineering at its present level of development deserves the label "technology" at all.<sup>5</sup> Perhaps some can think that instability is a normal feature in a new technology, and genetic engineering is a rather immature technology.<sup>6</sup> However, the point is that today this has serious implications for risk assessment and so-called risk management (see below).

The evidence shows that genetic engineering of food crops may lead to unintended, unpredictable effects. Alternative splicing of a bacterial gene that is introduced into another plant, for instance, could lead to proteins very different from the intended one. Such new proteins have unpredictable consequences for the ecosystem and for human health. This is more than mere paranoia: there is evidence of mystery DNA being produced in transgenic soybean crops in the United States.

Most alarming is the recent evidence that in a widely grown genetically modified food crop—soybeans containing an alien gene for herbicide resistance—the transgenic host plant's genome has itself been unwittingly altered. The Monsanto Company admitted in 2000 that its soybeans contained some

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<sup>5</sup> Traavik is not alone in bringing to our attention the issue of instability and lack of control in genetic engineering. Other names include Dr. David Ehrenfeld, Biologist/Ecologist, Rutgers University; Dr. Thomas S. Cox, Geneticist, US Dept. of Agriculture; Prof. Ruth Hubbard, Geneticist, Harvard University, USA; Prof. Jonathan King, Molecular Biologist, MIT, Cambridge, USA; Prof. Gilles-Eric Seralini, Laboratoire de Biochimie & Moleculaire, Univ. Caen, France; Dr. David Suzuki, Geneticist, David Suzuki Foundation, Univ. British Columbia, Canada; Dr. George Woodwell, Director, Woods Hole Research Center, USA. The literature on this point grows every day.

<sup>6</sup> The problems with GMOs are not limited to their applications in agriculture. Their use in vaccines and pharmaceutical products is subjected to a similar debate, even if the latter may provide a more promising opportunity.

extra fragments of the transferred gene, but nevertheless concluded that "no new proteins were expected or observed to be produced." A year later, Belgian researchers discovered that a segment of the plant's own DNA had been scrambled. The abnormal DNA was large enough to produce a new protein, a potentially harmful protein.<sup>7</sup>

Furthermore, the heavily armoured and protected r-DNA gene construct is very mobile, being able to 'jump in' and 'jump out' of organisms. It is also relatively stable in the naked form in the environment as in soil clay, gut systems etc. This property makes them highly amenable for HGT, e.g., in the development of antibiotic resistance. Naked DNA becomes a major health hazard on entering the blood stream. Further, it can act as a possible raw material (specially the CaMV35S promoter sequence) for creation of new superinfective viruses.

**Unfortunately, the real world is not as simple as the genetic engineers would like us to believe. The very few successes out of the large number of attempts have been overadvertized to sell pipe dreams. Some apparent successes like Bt crops, herbicide resistant crops, Vitamin A rice, some disease resistant crops, etc., have been possible because they are single gene traits. However, this is true for only two percent of all known diseases and of only a few plant traits. In all other cases, including cancer, heart disease and manic depression (the most common targets of the genetic engineers), causation is found to be much more complex. Many genes interacting with each other appear to play a role. Also an array of signals, including nutrient supply, hormones and electrical signals from other cells, which form the cellular environment, critically influence the course of these diseases.**

It may be noted that often the apparently successful crops are advertised as being high yielding. Actually their yield is no higher than their hybrid non-GE lines as they are not designed for that. For instance, Bt (*Bacillus thurengiensis*) cotton contains the Bt gene for the Bt toxin production and no special genes for growth promoting hormones. Promised production of transgenic crops with Higher Yield or for Drought Resistance, for feeding the hungry millions, amounts nearly to spreading a myth. Since improved breeding technologies, which facilitated a natural process, led to productivity enhancements, the reasoning has just been carried over as a claim to transgenic technology by the interested parties, as if every new technology will further enhance yields. Yield improvements in hybrids arise from transfer of a multigenic complex as also heterosis (hybrid vigour) which can obviously only occur within species. Therefore, in inter-generic, inter-phyletic single gene-host genome recombinations, the question of heterosis and increased yields does not arise. One

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<sup>7</sup> Commoner, Barry, Unraveling the DNA Myth: The spurious foundation of genetic engineering, Harper's Magazine, February, 2002.

need not be even a technical student of science to understand this. For instance, grain yield depends on many plant developmental features like good roots, healthy leaves, photosynthetic efficiency, efficient transport of food materials to the grains etc. Each such feature is multigenic. So, when transferring and expression of a single gene is difficult and uncertain, transfer of multigenic productivity traits is nearly mythical.

In sum, each living organism represents a unique genome programme. Until the functioning of these programmes that have evolved over millennia is better understood, tampering by insertion of sub-programmes such as r-DNA-gene constructs, is probably akin to small computer viruses that are capable of destroying entire systems.

“In an ordinary unmodified plant the reliability of this natural genetic process results from the compatibility between its gene system and its equally necessary protein-mediated systems. The harmonious relation between the two systems develops during their cohabitation, in the same species, over very long evolutionary periods, in which natural selection eliminates incompatible variants. In other words, within a single species the reliability of the successful outcome of the complex molecular process that gives rise to the inheritance of particular traits is guaranteed by many thousands of years of testing, in nature.”

This is not to say that no use can be found for r-DNA constructs. Their use under **containment** such as for vaccine production and the release of the non-nucleic acid product (the vaccine protein) could be considered under certain circumstances, even though some would even dispute the wisdom and safety of this act. In such cases the highly stable, mobile, r-DNA remains restricted within the lab and is not released into the environment. The danger of irreversible genetic pollution is, therefore, in principle contained.

#### **ECONOMIC AND POLITICAL/INSTITUTIONAL ASPECTS**

The draft states that the “economic/political debate is best understood by considering broadly two components: (i) risk/benefit analysis and (ii) risk management techniques”. This statement is too simplistic and therefore potentially misleading. This framework does not make room for crucial issues such as the rate of diffusion of the technology. The level of the debate in the world today on the economics of GMO introduction/diffusion is quite sophisticated. By concentrating on risk-benefit and risk-management IUCN would come out as a laggard in the field, ignorant of the state of the discussion and oblivious to the outpour of recent analytical literature.

The draft ignores the vast literature on prices and costs of introducing GMOs, and on the concentration of corporate power in the realm of the agri-bio-pharmaceutical industries, now getting closer together by virtue of developing biotechnologies. There are literally dozens of research reports on prices, costs and profitability for both

capital intensive agriculture and peasant survival strategies focusing on the diffusion of GMOs.

Marketing strategies and the impact of regulatory regimes have also been analyzed. Genetic Use Restriction Technologies (GURTs) are also critical as a technology that limits access to genetic resources to the owners and licensed users (such as the so-called "Terminator seeds"). And yet none of these issues are captured by risk-benefit and risk-management. Those variables govern the rate of diffusion of this innovation, probably one of the most important aspects of the problem at hand.

The issue of intellectual property rights is not addressed adequately. The way the international patent system operates today, through the patent offices of the leading economies, TRIPs, the Patent Cooperation Treaty and UPOV have tremendous implications for the diffusion of GMOs and biodiversity and ecosystems. The existing political-economic system is effectively acting to concentrate benefits in fewer and fewer hands.

"Patents and the evolving international legal framework that protect the new biotechnological innovations all provide strong market incentives for large corporations engaged in food and farming. Given this legal context and the kind of players involved most of the innovations in agricultural biotechnology have been profit-driven rather than need-driven. The real thrust of the new life science industry is not to make agriculture more productive and environmentally sound, but rather to generate profits and control over labour, production processes and markets."<sup>8</sup>

As an organisation dealing with issues of equity, IUCN cannot afford to sideline the tremendous consequences of existing legal frameworks surrounding GMOs for food producers that include local and indigenous communities.

"In seeking tougher intellectual property regimes, the industry generally overlooks or ignores the labour, knowledge and creativity of farmers and indigenous peoples who have shaped and co-created the genetic resources on which patents claims are made. Similarly, the emerging industrial patent system applied to living organisms and processes allows corporations to capture the intellectual contributions of public sector scientists anywhere in the world. This is why a growing number of individuals and organisations, including UNDP in its annual report two years ago, say that the patent system is grossly unfair to rural and indigenous peoples in the South."<sup>9</sup>

This affects not only communities in developing countries: witness the case *Percy Schmeiser v. Monsanto*. Research institutions are becoming increasingly privatised in

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<sup>8</sup> Michel Pimbert: GENETIC ENGINEERING, AGRICULTURE AND FOOD --- proceedings of a two day seminar held at Hyderabad on July 2 & 3, 2001, organised by the Deccan Development Society, AP Coalition in Defence of Diversity and the Centre for World Solidarity.

<sup>9</sup> *ibid.*

the North leading to further a "patent mediated apartheid" with agricultural research institutes having to pay royalties to private companies for use of genes and processes protected by patents and farmers having to pay royalties for use of seeds. These issues need to be explicitly addressed in an IUCN position paper.

The draft also leaves out trade policies, and the associated package of macroeconomic policies, including issues of public investment and subsidies, credit and insurance policies for the agricultural sector. The dynamics of price formation in the international seed and grain markets, and the role of corporate groups therein, and their impact on livelihoods and "traditional" agriculture are critical and need to be mentioned. These issues are as important as the inherent (technical) features of the GMO technology package and are key to addressing the "socio-economic impact" mentioned in Resolution 2.31.

### ***RISK/BENEFIT ANALYSIS***

A risk-benefit analysis offers a very limited framework given that it has failed to capture many of the issues that IUCN needs to address. For instance, with regard to "Evaluating Benefits", it is vital to ask how benefits are distributed. Does the growth rate of acreage devoted to GMO crops signify that there is a "benefit"? No doubt. But, for whom? The draft needs to answer critical real-world questions. Is it true that US producers benefit by using GMOs? Or could it be that big corporations such as Monsanto and Aventis reap most of the benefits? Perhaps \$US18 billion per year in subsidies to agri-business also help skew the equation? Do Argentinean producers really have a choice?

Although the data that is available may be limited in some areas, the draft could make a much better use of the data that is available (regional distribution of GMO crops, the percentage of land devoted to GMO crops, GMO seed prices compared to traditional varieties). It would also be important to not only look at rates of GMO adoption but also duration of use since many who adopt GMOs abandon them after 1-2 harvests.

The draft similarly does not mention the impact of trade regulations and import standards related to GMOs on the developing world. For example, Robert L. Paarlberg argues that new regulations in the EU on the labelling and traceability of imported GM foods and feeds increases the potential cost to – and reluctance of – exporters of adopting this new technology.<sup>10</sup>

There is little evidence that GMOs will in any significant manner help the really poor people who are hungry. The few examples that are most often presented are short-term ones, and there is little analysis of whether they have substantially benefited truly marginal and small farmers, or helped to reduce hunger.

In the section on examples of risk/benefit analysis in uncontrolled environments the draft starts with: "GMOs are expected to increase agricultural/maricultural

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<sup>10</sup> Paarlberg, Robert L., *The U.S.-EU Trade Conflict Over GM Foods: Implications for Poor Countries*, 2002.

productivity, maximizing per acre and per capita yields". More careful deliberation is required here. A position paper cannot rely on expectations about benefits.

The reference to maximizing yields needs further scrutiny. Genetic engineering has been limited by the number of genes that can be transferred (two to five) and the kind of traits that can be modified with existing gene libraries. Unfortunately, traits such as yields and drought resistance (especially when rains are interrupted at the early growth stages of plants) are governed by many more genes. For example, to directly increase yield in maize, several of the following variables need to be acted upon at the same time: size and weight of grains or kernels, size of cobs, the strength of the stalk, growth rates and maturity time spans, efficiency of intake rates, and robustness of adventitious root systems. The genetic material involved here is much more complex and state of the art genetic engineering today is unable to manipulate it. This is why genetic engineering is currently focused on applications that are much more modest. References to higher yields are left for others to pick up, in the hype of "feed the hungry" slogans.

There are some discussions and some studies over yields in the case of transgenic soybeans. But by and large there is not a big controversy over yields because they are not really affected directly by genetic engineering so far. This section ends with a misleading statement: "In general, the controversies over benefits are functions of lack of specific, statistically valid information". This is simply not true.

The paragraph on food security, where the draft appears to find benefits, is also quite misleading as a result. It suggests that where benefits exist, there may be a problem for communities as they tend to increase their reliance on these miracle varieties. But the draft leaves aside all the issues surrounding use of inputs (for the time being, GMOs are more companions than substitutes of chemical inputs). It also omits examining the issue of who will buy these crops once they hit markets: poor farmers and vulnerable communities?

In the section on examples of risk/benefit analysis in uncontrolled environments, focusing on risks, the draft looks at risks from the perspective of "side effects" or "unwanted effects" of a technology that is maturing without too many difficulties. This is very narrow. GMO technology has inherent features that are associated with serious problems. GMO technology is an immature technology and the learning curve may be long and fraught with dangerous pitfalls.

Too much faith has been put on risk assessment and risk management, when in fact, we may be dealing with uncertainty. The inherent instabilities in GMO technology appear to be more related to uncertainty than to risk. Thus, perhaps a word of caution on these methods is worthwhile given our current understanding of the processes that may take place once GMOs are liberated in uncontrolled environments.

The distinction between **uncertainty** and **risk** is relevant in this context. Frank Knight's classic distinction (from his 1921, *Risk, Uncertainty and Profit*) is useful:

Uncertainty must be taken in a sense radically distinct from the familiar notion of risk, from which it has never been properly separated. The term "risk", as loosely used in everyday speech and in economic discussion, really covers two things which, functionally at least, are categorically different. The essential fact is that "risk" means in some cases a quantity susceptible of measurement, while at other times it is something distinctly not of this character. The word uncertainty is reserved for phenomena which are not amenable to quantitative analysis. Risk proper is essentially different from uncertainty in so far as the former can be measured, while the latter cannot.

The debate on GMOs may be about true uncertainty (Knight) instead of risk given the uncontrolled aspects of genetic engineering. This becomes even more apparent when we consider the fact that most testing is usually carried out towards checking for unintended and unwanted side effects of GMOs, but very little testing occurs on unintended effects across species and even biologic kingdoms. In addition, the number of tests in ecosystems that are different from the countries where the innovating companies are located is quite limited. Thus, tests are for ecosystems of first release, and that's simply not good enough. Although very little has been published, there are many scientists willing to put out their necks for the notion that dangers are minimal. This also implies that it would be important to discuss the costs of customizing GM crops to environments that are highly diverse like those of less developed countries in the tropics.

#### *FOOD SECURITY ALTERNATIVES*

GMOs have to be weighed against an assessment of whether there are viable alternative solutions to the problems they are attempting to solve. Many, if not all, of the production problems which GM technologies are aiming to solve can be tackled in other ways by farmers - with much less risk and expense - using modern agroecological approaches that emphasise the multiple functions of agriculture. Furthermore, unlike the new biotechnologies farmer-based approaches have withstood the test of time and public acceptance in a variety of agroecosystems, regions and cultural contexts.

It is important to recognise here that hunger is not caused by a lack of food (today more food is produced per person than at any other time in history), but by social and political factors. The roughly 600 NGOs, CSOs and social movements that attended the NGO Forum for Food Sovereignty in Rome June, 2002, rallied around the common slogan: "Hunger is not a problem of means, but of rights". The myth that hunger is caused, for the most part, by a lack of food, is examined by Michel Pimbert:

Building food security depends first and foremost on social and economic reforms like land redistribution and strengthening the entitlements of the poor, rather than on technical solutions. Whilst obvious to anyone familiar with the history of famines and food insecurity, this point needs

to be repeated again and again to dispel the technical fix myth ("GMOs will feed the hungry!") propagated by corporations that largely control, - and benefit from-, the new life science industry.<sup>11</sup>

The crucial question is, "Why should the world opt for a risky and expensive technology that is likely to remain out of reach of most of the world's marginal farmers, and whose long-term impacts are at best uncertain and at worst horrifying, when there is a viable, already available alternative that is cheaper, more accessible to the poor, and ecologically sensitive?" Most governments are simply not giving organic, sustainable farming a chance because it is decentralised, involves empowering the poor, and does not depend on powerful chemical/biotech companies. Those governments that have chosen to give it a chance, such as Ethiopia, have shown its enormous potential.

If most or all the agronomic production problems can be solved through agro-ecological approaches, IUCN needs to ask, what are the comparative advantages of genetic sciences and GM technologies? How and under what conditions can the science of genetics and the new biotechnologies contribute to solving production problems in agriculture?

#### **SOCIO-CULTURAL IMPACTS**

Generally, this section touches on much more than just socio-cultural issues, therefore they should be separated to highlight them as distinct from the other issues. The section starts by asserting that GMOs "are seen" as an important contribution to food production, food security and livelihood improvement. This is misleading. There is a raging debate on the contribution of GMOs, and opponents are not just communities whose sensitivities have not been addressed. European consumers and governments have taken the lead here. The Karnataka state government decided not to allow BT-cotton to be grown as a commercial crop, till experts report on possible adverse effects of the crop. A May 2002 agreement in Australia allowed the Commonwealth to establish GMO-free zones and Tasmania declared itself GMO-free. New Zealand's government adopted strict rules in banning GMO imports and forced Australian seed giant Pacific Seeds to incinerate 30 tons of maize when it confirmed the seeds were contaminated with genetically modified material. There is obviously no consensus, as the draft appears to suggest.

The underlying assumption here is that technological progress affects sensitivities. But the assumption that GMOs represent a form of technical progress is itself highly debated. GMOs are not necessarily substituting input-intensive agriculture. They are well-suited for food systems relying on food processing, consumer niche markets and uniformity. This is not the best combination for agricultural systems based on diversity.

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<sup>11</sup> GENETIC ENGINEERING, AGRICULTURE AND FOOD --- proceedings of a two day seminar held at Hyderabad on July 2 & 3, 2001, organised by the Deccan Development Society, AP Coalition in Defence of Diversity and the Centre for World Solidarity.

UN data shows that since 1980 world cereal yields have outstripped world population growth and today there is enough food to feed everyone on this planet one and a half times over. Still, one billion human beings are hungry. This colossal case of market failure does not need a mythical silver bullet technical fix-all. Something else is missing. GMOs are not the solution to world hunger. Anyone who states this ignores everything that has been written in the past twenty years about hunger and markets. Nobel laureate Amartya Sen's work is just one good example of this type of work.

## INTERNATIONAL INSTRUMENTS AND INSTITUTIONS

When dealing with international frameworks it is important to look further into the relationship between the WTO Agreements and the Biosafety Protocol. Furthermore, IUCN could shift its focus from FAO and CODEX to The International Plant Protection Convention (IPPC). IPPC is still developing its positions and IUCN might find it easier to influence/advocate in this forum than in others.

### ***BIOSAFETY PROTOCOL AND TRANSGENES IN MEXICAN LANDRACES***

The draft centres a crucial section on the Biosafety Protocol. Although this is an important document, it has many flaws and a position paper should strive to go beyond its narrow boundaries. The Protocol's use of "living modified organisms" instead of "genetically modified organism" is one initial point that needs closer scrutiny.

The difference between LMO's and GMOs has important repercussions. One critical point is that the Advanced Informed Agreement Procedure (Art 7) is not needed for transboundary movements of living modified organisms intended for direct use as food or feed, or for processing (these are regulated by Art 11). And this is precisely the type of transboundary movement that led to the presence of transgenic constructs in Mexican maize landraces. Had the Protocol relied on GMOs instead of LMO's, this would not be the case. An analysis of this could enrich the biosafety regulatory regime. The Biosafety Protocol has not even entered into force and its flaws are beginning to show. Can IUCN afford not to look into these shortcomings?

This is clearly the type of issue one would expect to be addressed by an IUCN position paper. The presence of transgenic material in Mexico's landraces cannot be overlooked. This is the centre of origin and genetic variability for maize, and takes place in a mega-diverse country. This is the first case, but if the trend continues transgenics will be introduced in other centres of origin. The implications are critical. The problem is compounded if one considers genetic flows between maize and its wild relatives, *teosintes*, and possibly *tripsacum*, important repositories of genetic resources. Because these wild relatives reproduce without human intervention there is a distinct possibility of conferring advantages to subpopulations driving others to extinction.

## **CONCLUDING REMARKS**

At the heart of the GMO controversy lies the conviction of many civil society actors that governments and inter-governmental organisations have consistently failed to address the root causes of hunger, and have also failed to understand the need for a diversity of solutions instead of the “one size fits all” approach. As mentioned above, hunger is not a problem of means relating to technological solutions; rather, it is a problem of rights relating to the control over the means of agricultural production, food distribution systems, buying power, etc.

In order to provide a basis for the development of a sound IUCN position on GMOs, the current draft needs to address this central controversy, as well as the host of other issues raised in this paper. It will also need to present alternatives to GMOs and compare the two on the basis of an expanded set of crosscutting principles. This will require a restructuring of the paper, as well as changes to its content. The latter will require drawing more on the literature currently available, better understanding of the scientific, social and economic issues, a more critical look at the Biosafety Protocol, a clear understanding of the differences between “risk” and “uncertainty”, and a move beyond the limitations of a risk/benefit analysis as a framework for analyzing scientific uncertainties and political and economic issues.

#### **RECOMMENDATIONS FOR IUCN ACTION PLAN:**

The following is a list of proposed action points for IUCN. Although the list is long, it is not exhaustive. It is presented here as a logical conclusion to the comments presented in this paper, and as a source of ideas for IUCN action.

IUCN should take action to contribute to the following outcomes:

- Immediate ban on releases of GM crops in centres of origin and diversity of these crops;
- Moratorium on all releases of GM species of crops, trees, livestock and fish;
- Ban on research, development, release and sale of all Genetic Use Restriction Technologies (GURTs) e.g. Terminator.
- Ratification and implementation of Cartagena Protocol on Biosafety and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA);
- Adoption and implementation of national laws on biosafety;
- Ban on patents, and other IPRs, that restrict access to genes and living materials at international and national levels;
- Prohibition of use of GMOs in food aid and in emergency seed provision; and,
- Implementation of regulations to preserve the free access for all farmers and Indigenous Peoples to genetic resources for food and agriculture.

IUCN should make it a priority to contribute to the following processes:

- Facilitate participatory research on the impact of GMOs on food insecurity;

- Increase dialogue with small-scale producer organisations and CSOs on the complete range of issues concerning all genetic resources for food and agriculture - conservation, sustainable use, access, benefit sharing, governance and future management of gene banks at all levels;
- Facilitate work with NGOs/ CSOs and local small-scale producer groups to conserve, develop and sustainably use all genetic resources and to implement fully the Leipzig Global Plan of Action, the CBD programme of work on Agricultural Biodiversity, the Global Strategy on Farm Animal Genetic Resources, and the Code of Conduct for Responsible Fisheries;
- Protect traditional knowledge in accordance with the worldviews, values, needs and traditional legal systems of Indigenous Peoples;
- Work on new Treaties on Animal and Aquatic Genetic Resources, which would include formal legal recognition of the rights of pastoralists, livestock-keepers and artisanal fisherfolk and contribute to the formulation of the draft texts for these treaties through specific background reports on the implications for farmers, fisherfolk, pastoralists and other livestock/keepers, forest guardians and indigenous peoples;
- Promote projects for *in situ* conservation of genetic resources and seek increased funding for such projects with NGOs/CSOs and local communities.