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CONFERENCE OF THE PARTIES TO THE CONVENTION ON BIOLOGICAL DIVERSITY SERVING AS THE MEETING OF THE PARTIES TO THE CARTAGENA PROTOCOL ON BIOSAFETY
Fourth meeting
Bonn, 12-16 May 2008
Item 16 of the provisional agenda*

SOCIO-ECONOMIC CONSIDERATIONS (ARTICLE 26, PARAGRAPH 2)

Note by the Executive Secretary

I. INTRODUCTION

1. In accordance with the medium-term programme of work adopted in decision BS-I/12, the Conference of the Parties serving as the meeting of the Parties (COP-MOP) to the Biosafety Protocol considered, at its second meeting, an item on socio-economic considerations, in particular cooperation on research and information exchange on any socio-economic impacts of living modified organisms, especially on indigenous and local communities (paragraph 2 of Article 26). The Parties decided, *inter alia*, to request Parties, other Governments and relevant international organizations to provide to the Executive Secretary, their views and case studies, where available, concerning socio-economic impacts of living modified organisms (paragraph 5 of decision BS-II/12). The Executive Secretary was requested to prepare a synthesis of the views submitted for consideration by this meeting.

* UNEP/CBD/BS/COP-MOP/4/1.

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2. The Executive Secretary had received twenty submissions by 20 December 2007. Four submissions were received from the following Parties: Colombia, China, Norway, and South Africa; and one submission from the United States Government. There were also fifteen submissions from organizations:two from inter-governmental organizations – the Food and Agriculture Organization (FAO) and the World Health Organization (WHO); and thirteen from the following non-governmental organizations: the All India Crop Biotechnology Association, the Argentine Council for Information and Development of Biotechnology (ArgenBio), BASE Investigaciones Sociales, the Biotechnology Coalition of the Philippines, the Brazilian Council for Biotechnology Information, the Centre for Chinese Agricultural Policy of the Chinese Academy of Sciences, CropLife Australia Limited, Friends of the Earth International, the Global Industry Coalition (GIC), the International Service for the Acquisition of Agri-Biotech Applications (ISAAA) 1/, the Public Research & Regulation Initiative, the Network for a GM-Free Latin America (*Red por una América Latina Libre de transgénicos*, RALLT), and the Third World Network.

3. Information on Parties' cooperation in research and information exchange on socio-economic considerations as contained in the first regular national reports on the implementation of the Cartagena Protocol on Biosafety has also been considered.

4. Any submissions received after 20 December 2007 are not considered in this synthesis but are included in the compilation of submissions (document UNEP/CBD/BS/COP-MOP/4/INF/1). In addition, where the submissions consisted of case studies or research papers, these have been added to the Biosafety Information Resource Centre of the Biosafety Clearing-House so that such information could be shared widely with others consistent with the invitation made by the Parties to the Protocol at its second meeting.

5. Section II of the present document contains an analysis of the relevant information on socio-economic considerations as contained in the first regular national reports on the Protocol. Section III contains a synthesis of the information received by the Executive Secretary pursuant to the request from decision BS-II/12. Section IV includes relevant information from other processes under the Convention on Biological Diversity and the Biosafety Protocol while section V suggests some elements of a draft decision for consideration by the fourth meeting of the Conference of the Parties serving as the meeting of the Parties to the Protocol.

II. ANALYSIS OF RELEVANT INFORMATION FROM THE FIRST REGULAR NATIONAL REPORTS ON THE IMPLEMENTATION OF THE PROTOCOL

6. Question 61 of the format for the first regular national reports on the implementation of the Protocol asked: "Has your country cooperated with other Parties on research and information exchange on any socio-economic impacts of living modified organisms, especially on indigenous and local communities?". There were three possible answers to the question: 'yes – significant extent'; 'yes – limited extent'; or 'no'.

7. Fifty-two first regular national reports have been considered in the analysis in the document on monitoring and reporting prepared for this meeting – 50 reports from Parties and two from non-Parties. 2/

1/ The ISAAA submitted two briefs, one by James and one by Brookes and Barfoot. The latter was more specific to socio-economic considerations and much of the relevant information from the former was also contained in the latter so just the Brookes and Barfoot has been incorporated into this synthesis. Both of the briefs are, however, available through the Biosafety Information Resource Centre of the Biosafety Clearing-House.

2/ See document UNEP/CBD/BS/COP-MOP/4/13. For a list of the countries and regional economic integration organizations included in the analysis, see the annex of the latter document.

Of these, 51 responded to question 61. One respondent (2 per cent) answered yes, it had cooperated with other Parties on research and information exchange on socio-economic impacts of living modified organisms, especially on indigenous and local communities, to a significant extent. Twelve respondents (24 per cent) answered yes, to a limited extent, while 38 respondents (75 per cent), including the two non-Parties, answered no.

8. Question 62 asked the respondents to provide further details on their responses to the questions on socio-economic considerations, including question 61. Some respondents provided the following information in relation to their efforts to promote cooperation on research and information exchange on any socio-economic impacts of living modified organisms

9. Belgium reported that, in 2005, its Federal Ministry of Environment financed a research project by a research team at the University of Leuven on the socio-economic impacts of genetically modified organisms (GMOs). On the basis of some case studies previously developed by the research team, the project aimed to establish a methodology for the study of socio-economic impacts following the scope of the wording in the Protocol. Rather than focusing on the GMO innovation, the research instead looked at the case by case relevance of GMO cultures by comparing these to other types of cultures and technologies that are potentially able to solve the same problem, considering impacts for and from the environment, agricultural practices, health, the local population's expectations and incomes (both producers and consumers), the market, etc. The work included case studies in both developed and developing countries.

10. Cameroon noted that its scientists and institutions have not yet been directly involved in research on genetic modification.

11. Ghana commented in its first regular national report that, as concerns cooperation on research and information exchange on socio-economic impacts, researchers in the country frequently use literature by foreign writers in the process of preparing their papers, in which case written permission is usually sought and the sources acknowledged. Mexico reported that it has not had inter-governmental exchange of information on socio-economic impacts but that it has had some experiences through different research groups in the academic sector.

12. In its first regular national report, the Syrian Arab Republic responded that it had, to a limited extent, cooperated with other Parties on research and information exchange on socio-economic impacts of LMOs. The report referred to a lengthy list of collaborative research projects most of which do not appear to deal directly with socio-economic impacts although it may not be possible to determine the entire content of the research solely from the title of the project.

13. Uganda reported in its first regular national report that socio-economic considerations are part of the collaborative research efforts being undertaken by different Ugandan individuals and institutions

III. SYNTHESIS OF VIEWS AND INFORMATION SUBMITTED ON SOCIO-ECONOMIC IMPACTS OF LIVING MODIFIED ORGANISMS

A. Specific examples of research and information exchange on socio-economic impacts of living modified organisms

14. In addition to the responses provided through some of the first national reports, some countries and organizations have provided the following information on cooperation in research and information exchange on socio-economic impacts of living modified organisms.

15. China's submission stated that the country has, in recent years, undertaken research on the socio-economic impacts of genetically modified (GM) cotton, GM rice and GM poplar trees. Nonetheless, it

stated that China has carried out relatively little research on the socio-economic impacts of LMOs and is facing many obstacles and impediments. The submission stated that China has a complex ecological environment, that its economy developed on an imbalanced basis and that the country is short of research staff and financial support. Finally, the rapid development of LMOs is said to be presenting big challenges for monitoring and management.

16. South Africa stated that socio-economic factors are considered during its decision-making process but it recognizes the need for the development of some guidance frameworks. It is felt that as the scope of LMOs and experiences therewith increases, the socio-economic dimension will also enjoy increased prominence in the regulatory system.

17. The Food and Agriculture Organization (FAO) reported that it published an "Annotated bibliography on the economic and socio-economic impact of agricultural biotechnology in developing countries". The document brings together a wide range of assessments of the economic and socio-economic impact of agricultural biotechnology, including LMOs in developing countries. FAO also published a major review, the 2003-2004 State of Food and Agriculture report, which explores the potential of agricultural biotechnology – especially transgenic crops – to meet the needs of the poor. This review considers socio-economic impacts.

18. FAO also organized an "International Dialogue on Agricultural and Rural Development in the 21st Century: Lessons from the Past and Policies for the Future" in Beijing, China in September 2005. The dialogue was to cover the role and impact of biotechnology in agriculture and rural development under the theme frontiers of science for agriculture in the 21st century. 3/

19. The World Health Organization (WHO) reported that it finalized a study in June 2005 entitled "Modern food biotechnology, human health and development: an evidence based study". The study examines the implications of modern food biotechnology on human health and development and was developed with input from other key organizations, notably FAO and the United Nations Environment Programme. The premise for the report was that GM food production could have a significant influence on human health and development in the future, and the aim was to create a broader knowledge base to achieve consensus on the broader evaluation and application of biotechnology. The report reviews evidence in several broad areas related to genetically modified foods, including currently available products, the assessment of risks and benefits, the broader socio-economic impact, ethical considerations, intellectual property rights as well as existing regulatory capacity in countries. The study concluded that continuous case-by-case assessment of genetically modified organisms is necessary. Although no scientific proof of such effects has yet been presented, it is said that some monitoring efforts related to potential long-term effects of these products will also probably be necessary.

20. WHO also stated that the high number of sector-based regulations further tests the overstretched capacity of developing countries and presents challenges to develop a fully coherent policy and regulatory framework for modern biotechnology. In general, more holistic evaluations of GM production are needed. Because of the complexity of such evaluations, further progress on international harmonization in the broader fields of assessing and promoting sustainable agriculture, biodiversity and socio-economic development as they relate to the further development of agricultural biotechnology and health, is also needed.

21. The Global Industry Coalition pointed to the example of information sharing on the socio-economic benefits of biotechnology taking place with CropLife International's Database of Benefits and Safety of Biotechnology. 4/ This database provides access to peer-reviewed research studies that meet

3/ The paper and relevant information are available at http://www.fao.org/es/ESA/beijing/topics_04.htm.

4/ The database is available via http://www.croplife.org/biotechdatabase.

agreed-upon criteria for high quality and which highlight important impacts of agricultural biotechnology products and technologies.

22. In addition to the information on research and information exchange on socio-economic impacts of living modified organisms described in some of the submissions and the first national reports, many of the submissions themselves can be considered research on this topic.

B. Scope of socio-economic considerations and methods for taking them into account

23. In its submission, Norway recalled paragraph 5 of decision BS-II/12 and paragraph 1 of Article 26 of the Protocol. It also recalled the annex to decision VI/7 of the Conference of the Parties to the Convention, in which it is stated that environmental impact assessment is "a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human health impacts, both beneficial and adverse" (paragraph 1(a) of the annex to decision VI/7).

24. Norway is of the opinion that socio-economic aspects may be relevant to decisions concerning LMOs and it stated that this is reflected in Norwegian legislation on the production and use of genetically modified organisms. In 1993, Norway introduced the Gene Technology Act to ensure that the production and use of LMOs in Norway takes place in an ethically and socially justifiable way, in accordance with the principle of sustainable development and without detrimental effects on health and the environment. Norway explained that the purpose of taking these factors into account is to ensure the appropriate level of protection in balancing/weighing the possible risks to health and the environment of the LMO under consideration against possible benefits of the release.

25. Under the Act, Norway has introduced regulations relating to impact assessment. According to section 17 of appendix 4 to the regulations, an impact assessment is to give an account of consequences of LMOs other than those on the environment and human and animal health, including positive or negative effects in relation to sustainable development; ethical considerations that may arise in connection with the use of the LMO; and any favourable or unfavourable social consequences that may arise from the use of the LMO.

26. Norway also elaborated on the Norwegian Biotechnology Advisory Board (BAB), which considers and offers its opinion on LMO applications in Norway, with special emphasis on ethical aspects, benefits to society and sustainable development. According to the submission, the BAB has to date pointed out that several of the LMOs considered do not provide any benefits to Norwegian society either because they are not relevant for cultivation in the Norwegian climate or because they are resistant to insects which are not found in Norway. The BAB has also considered the socio-economic consequences of LMOs that are resistant to herbicides or insects but has not so far been able to come to a clear and unambiguous conclusion on these types of LMOs and whether their introduction reduces the use of herbicides. The overall conclusion of the BAB on socio-economic issues related to LMOs is that there are very few published studies which address these issues and that research is needed.

27. Norway noted that socio-economic considerations have not been decisive in the decisions taken so far pursuant to the Norwegian legislation on LMOs. Norway has encountered some difficulties in obtaining the information necessary to consider socio-economic issues properly. Possible reasons for this include that the issues considered relevant were not specified in Norwegian legislation until December 2005 and that Norway, as a consequence of the Agreement on the European Economic Area, participates in the LMO authorization procedures of the European Commission (EC). So far, all applications for deliberate release, including the marketing of LMOs, that have been considered by Norway have been submitted through the EC and EC legislation does not require notifiers to consider issues of socio-economic impacts when submitting an application. The Norwegian competent authorities are currently coordinating a national project to examine how the concepts of sustainable development and benefit to

society can be put further into operation for both the authorities and the notifiers. The project will also use two LMO notifications as case studies to assess the possibilities of reaching a conclusion regarding socio-economic impacts with the available knowledge for these two cases.

28. According to the submission from the United States, Parties must first analyse the impacts of LMOs on the conservation and sustainable use of biological diversity and only then may they consider socio-economic issues arising from those impacts. The submission stated that any broader interpretation of socio-economic considerations falls outside of and is inconsistent with the scope of the Protocol. The United States commented that when considering socio-economic issues as part of the decision-making process, Parties should take a balanced approach that considers socio-economic benefits that may accrue from the use of LMOs. The submission also noted that Article 26 of the Protocol also requires that as Parties take account of socio-economic considerations, they do so in a manner consistent with their other international obligations such as those under the World Trade Organization (WTO) and its *Agreement on the Application of Sanitary and Phytosanitary Measures* (SPS Agreement).

29. Friends of the Earth International recalled paragraph 1 of Article 26 of the Protocol and stated that the scope of the activities under consideration in the paragraph would refer to import and domestic procedures so it includes a non-exhaustive list of activities such as transit, handling and use of LMOs. They added that LMOs may be introduced into the biodiversity of a certain context and if they have negative impacts in the territories where they are introduced and on the livelihood of the people occupying such territories, this would fall within the scope of Article 26. Furthermore, socio-economic considerations arising from impacts on human health also need to be included in the light of Articles 1 and 4 of the Protocol.

30. Friends of the Earth International also advocated that the impact of LMOs on biodiversity, the livelihoods of local and indigenous communities and human health should include direct, indirect and long-term impacts. They felt that it should be possible for socio-economic considerations to form the basis for measures that restrict or ban GM crops. They also listed examples of mechanisms for taking socio-economic considerations into account, namely:

- The inclusion of socio-economic impacts in current risk-assessment and risk-management procedures;
- The creation of a specific socio-economic evaluation in decision making for LMO impacts. Associated with this could be the establishment of a new body with the specific purpose of evaluating socio-economic impacts, or mandating an existing body with relevant experts to undertake this task;
- Adequate public consultation on socio-economic aspects that ensures effective access to information and public participation prior to decisions related to LMOs, including referenda.

31. Friends of the Earth International asserted that the Parties to the Protocol should explore how the views and experiences of farmers, indigenous communities and any group impacted by LMOs may be properly taken into account in biosafety decision-making and should consider providing more specific guidance on this issue

32. In its submission, the Global Industry Coalition (GIC) stated that paragraph 1 of Article 26 of the Protocol places several constraints on the consideration of socio-economic impacts of LMOs. The submission asserted that Parties must limit any consideration of socio-economic impacts of LMOs to those impacts on the conservation and sustainable use of biological diversity as broadening the scope and type of socio-economic considerations to those beyond this limitation would be inconsistent with the provisions of the Protocol, reduce the transparency of the regulatory process and increase the overall cost and length of time required in regulatory decision-making. A further limit is that such considerations may only be taken into account to the extent that they are consistent with Parties' existing international obligations. The submission suggested that obligations under the WTO agreements and those from other

international standard-setting bodies could provide guidance to the Parties on this issue and stated that decisions and guidance provided under the Protocol must take this limitation into account and avoid outcomes that would jeopardize Parties' abilities to comply with their other legal obligations.

33. GIC elaborated on the SPS Agreement within the WTO. The SPS Agreement allows WTO Members to take economic factors into account when assessing the risk to animal or plant life or health and determining the appropriate measures to be applied. These economic factors include: the potential damage in terms of loss of production or sales in the event of entry, establishment or spread of a pest or disease; the costs of control or eradication in the territory of the importing Member; and the relative cost-effectiveness of alternative approaches to limiting risks (see Article 5.3 of the SPS Agreement). GIC stated that WTO Members must then apply the least trade restrictive measure in meeting their appropriate level of protection. GIC claimed that, to be consistent with the existing international obligations found in the SPS Agreement, relevant socio-economic considerations under the Protocol would have to be limited to a clearly defined economic analysis that addresses the potential impact, either positive or negative, when applying sanitary and phytosanitary measures that affect trade of LMOs.

34. GIC advocated that work on socio-economic considerations under the Protocol should focus on cooperation and research exchange as per paragraph 2 of Article 26. It stated that discussions should be limited to the mandate in the Protocol and to the current programme of work that focuses exclusively on cooperation in research and information exchange. GIC does not believe that it would be useful or appropriate for Parties to expend resources to create new programmes of work or other additional activities in this area

35. The Dano article 5/ submitted by Third World Network advocated the use of socio-economic impact assessments as a method for taking socio-economic considerations into account in decision-making. Such assessments can help regulators and civil society to weigh the potential benefits of GMOs against their potential risks and adverse impacts on different socio-economic spheres. The article pointed to the example of the Philippines, which had initially set forth the importance of socio-economic impact assessment in the drafting of its national biosafety framework. However, the final regulatory framework did not make such assessments a mandatory part of the application for GMO releases. This experience illustrates that, despite the presence of a mature framework for environmental impact assessments from which lessons can be learned, the development of tools for socio-economic impact assessment remains a challenge to policy-makers, regulators and civil society organizations.

36. Part of the submission from RALLT stated that it is impossible to consider the impacts of Roundup Ready soy separately from the impacts of the herbicide package. It advocated that the technological package that accompanies GM seeds be included in the scope of socio-economic considerations under the Protocol.

C. Types of socio-economic considerations

(a) Impacts related to soil fertility and soil structure

37. The study by Trigo and Cap submitted by ArgenBio noted that the export of soybeans from Argentina results in a net loss of soil fertility. The cost of 'restocking' the soils with the phosphorous exported in soybeans over a 10-year period was estimated to be US$ 2.3 billion. This cost is less than the accumulated benefits from the production of herbicide-tolerant soybeans over the period of 1996-2005, which they calculated to be US$ 19.7 billion.

5/ Please refer to the annex for a bibliography of the research papers and studies submitted to the Secretariat, and which are referenced in this synthesis.

38. Trigo and Cap found that small farmers in particular have chosen to rely on herbicide-tolerant soy. They stated that the high area planted with soy indicates the absence in small farming systems of the minimum required rotations needed to maintain soil fertility in the medium and long term.

39. Trigo and Cap also stated that the net export of nutrients will be negatively reflected in the productivity of the area currently planted with soy sooner rather than later. They characterized the loss of fertility as a negative externality or a market failure as there is a lack of price signals that could induce the economic agents, through market mechanisms, to introduce adjustments to the system of production to address the problem. They called for the design and implementation of targeted policies to generate the incentives for landowners and tenants to start accounting for the social costs incurred through the loss of soil fertility. Such policies would encourage the actors to incorporate the cost of lost soil fertility into their private cost structures, inducing them to improve the environmental sustainability of farming systems, including soybeans.

40. Trigo and Cap also noted a reduction in the content of organic matter in soils subjected to soybean monoculture (without rotation with maize, for example.) This is similar to the loss of soil fertility in that it is unsustainable in the long-term but it is much harder to quantify as, apart from anything, there is no substitute for organic matter on the inputs market.

41. The article by Pengue submitted by Third World Network also examined transgenic crops in Argentina and similarly noted the net export of nutrients from Argentina in the form of soybeans. He wrote that "[i]f the natural depletion were compensated with mineral fertilizers, Argentina would need around 1,100,000 metric tons of phosphorous fertilizers at a cost of US$330,000,000 in the international market". 6/ Pengue predicted that if the trend continues, nutrients from Argentinean soils will be totally consumed in 50 years. Pengue characterized the export of nutrients as part of Argentina's 'ecological debt' that is not reflected in the market prices for soybeans and other exported produce. He stated that if the tools of ecological economics were applied by incorporating the externalities, agricultural outcomes would be very different. He also commented that the degradation of the soil structure and potential for desertification are two of the results of the over-exploitation associated with the monoculture production of GM soybean.

42. The Altieri paper submitted by Third World Network commented that the persistence of Bt toxins in soils may have negative impacts on nutrient cycling processes. Small farmers rely on local residues, organic matter and soil micro-organisms for soil fertility, which can be negatively affected by soil-bound toxin. By losing such ecological services, poor farmers will become dependent on fertilizers with serious economic implications.

43. The submission from the Biotechnology Coalition of the Philippines, on the other hand, argued that growing Roundup Ready corn meant minimal ploughing so the nutrients in the soil were preserved.

44. The Brookes and Barfoot brief submitted by the ISAAA stated that the adoption of GM crops – and herbicide-tolerant varieties in particular – allows for no-till and reduced-till farming systems. This, in turn, reduces tractor fuel use for tillage, enhances soil quality and reduces soil erosion. A shift from conventional tillage to reduced- or no-tillage is said to increase the amount of crop residue returned to the soil and decrease the decomposition rate of soil organic matter.

45. Brookes and Barfoot commented on the reported increased soil degradation levels in the humid and sub-humid regions of Argentina over the two decades to the late 1990s. They stated that, over the past ten years, there has been an intensive programme of research and technology transfer targeted at

6/ See Pengue at p. 317. It is unclear whether this figure is per year or in total.

encouraging Argentine growers to adopt reduced- or no-till systems as these, and no-till in particular, were recognized as being able to play an important role in reducing soil degradation.

46. The Joensen chapter, submitted by BASE Investigaciones Sociales, noted that the use of agrochemicals affects soil composition by depleting soil fertility.

(b) Impacts of LMOs on non-target organisms and the prevalence of pests

47. The submission from the Biotechnology Coalition of the Philippines found that beneficial insects and other non-target organisms thrive on Bt corn farms and there is a remarkable presence of such organisms in Bt corn fields over conventional fields. Furthermore, the reduced pesticide use associated with Bt corn also creates benefits for beneficial insects.

48. The Qayum and Sakhari study submitted by Third World Network found that the incidence of sucking pest was higher in fields of Bt cotton and was longer in duration requiring Bt farmers to spray once or twice more than non-Bt farmers. Farmers following non-pesticide methods did not spray at all. The study raised the question of whether Bt cotton is the carrier of new diseases not seen until now. This was based on a new virus infestation; symptoms of leaves curling first on Bt cotton, then on other Bt hybrids; leaves reddening followed by the wilting and dropping of leaves and cotton bolls; and bacterial leaf blight, which was observed to be more intense on Bt cotton than on non-Bt cotton.

49. The Pengue study commented that the appearance of glyphosate-tolerant weeds is becoming a common occurrence in Argentina. He noted that the appearance of such weeds implies a further increase in the application of herbicides and that farmers are re-establishing their use of the herbicide 2,4-D to deal with difficult-to-control weeds.

50. The Joensen chapter found that modifications in cultivation systems such as conservation farming (direct sowing) and the appearance of GM soy varieties are causing changes in the weed populations not just in quantity but more importantly, in the appearance of certain species that are normally uncommon. The chapter stated that Roundup Ready soy itself can become a problem as it remains in the soil after harvest and germinates out of season.

51. The Brookes and Barfoot study noted that one impact of GM herbicide-tolerant traits is a greater reliance on a limited range of herbicides, raising questions about the possible future increased development of resistance to these herbicides. They commented that some degree of reduced effectiveness of glyphosate and glufosinate against certain weeds may occur and, to the extent that it does, this will increase the need to include low dosages of other herbicides. They stated that this may marginally reduce the level of net environmental and economic gains derived from the current use of GM technology.

52. According to RALLT, the large volume of chemicals used in the production of GM crops has generated an increase in soil pathogens and a change in weed communities particularly in the appearance of new varieties with herbicide tolerance due to the greater use of glyphosate.

53. The Joensen chapter recounted a situation from the Argentine province of Entre Rios, where one beekeeper lost 50 hives because of crop spraying on a neighbouring Roundup Ready soy farm. In another case, a man in Córdoba reported damage to his orchards from nearby spraying of glyphosate. He found it difficult to take action against those responsible for the damage and his activities promoting awareness in his area had also caused him some problems.

54. For insect-resistant crops, the Brookes and Barfoot study pointed to a number of more intangible economic benefits, including where some Indian cotton growers have reported knock on benefits for bee keepers as fewer bees are now lost to insecticide sparying.

55. The Rulli chapter submitted by BASE Investigaciones Sociales pointed to fruit trees in Paraguay affected by spraying, which stunts the maturation of the trees' flowers and means the trees do not develop fruits. Contamination causes economic losses in production and affects people with the long-term impacts of impoverishment and rural expulsion. She also noted that the plants most affected by spraying tend to be the subsistence crops.

56. The Altieri paper stated that the introduction of transgenic crops could affect the biological balance of insect communities within traditional agroecosystems on which small farmers rely for insect pest control. Altieri wrote that the disrupted biocontrol mechanism may result in increased crop losses due to pests or increased use of pesticide by farmers with potential consequent health and environmental hazards. He also suggested that a cross of transgenic maize with teosinte could create problem weeds that out-compete wild relatives and upset farmers' management practices.

(c) Impacts related to land use

57. The Pengue article noted the opening of new agricultural frontiers in important eco-regions of Argentina, in areas rich in biodiversity. He stated that, especially in the Pampas, soybean production has in the past five years, displaced 4.6 million hectares of land dedicated to other production systems such as dairy, fruit trees, horticulture, cattle and some grain. Pengue wrote that the displacement is creating impacts on food security and these are expected to worsen. Furthermore, the expansion will definitely impact the ecological integrity of marginal areas, which still exhibit approximately 90 per cent forest cover and an important part of the acreage of soybean expansion will be new land, which implies deforestation and biodiversity loss. Pengue noted that there has been a deep transformation of land use in the form of an intensification of production and extensive production on new lands with new varieties of soybeans bred specifically for such lands.

58. Rulli noted that the destruction of forests in Paraguay has affected the subsistence of the population. They face decreasing access to non-agricultural food resources from fishing and hunting as well as decreasing access to non-food resources such as wood, medicinal plants and honey. The lack of wood is said to be of great concern as the local population depends on wood for building their homes.

59. RALLT reported the expansion of soy has displaced other cultivation (e.g., rice, maize, sunflowers and wheat) and has pushed these activities into marginal areas.

60. Trigo and Cap commented on 'soyafication' concerns in Argentina including crop expansion into fragile ecosystems. The evolution of Argentinean agriculture between 1996 and 2006 included the significant expansion of planted area and increased productivity of the land. They stated that in the Pampean region, the increase in planted area has been done at the expense of pastures and by double-cropping. In the north-western and north-eastern regions, a significant part of the increase in planted area came from pastures as well as from land originally covered by native forests that had undergone a degradation process. Regarding this latter expansion, they found that there was little objective information to assess the impacts of soybean expansion into the fragile ecosystems of the north-western and north-eastern regions and that the expansion began before the introduction of herbicide-tolerant soy.

(d) Gene flow and co-existence

61. The first regular national report of the European Community referred to the non-binding recommendation issued by the European Commission on 23 July 2003 containing guidelines for the development of national strategies and best practices to ensure the coexistence of genetically modified crops with conventional and organic farming. The Recommendation aims to ensure that no form of agriculture is excluded from the European Union and that consumers and producers have a choice with regard to agricultural produce. It is up to the Member States to develop measures for coexistence,

informed by the guidelines provided by the Commission. In 2006, the Commission issued a report on the national implementation of co-existence measures (COM(2006)104 final) and will report again on this issue in 2008. Furthermore, paragraph 5 of Article 31 of Directive 2001/18/EC 7/ states that, every three years, the Commission will publish a summary based on the reports of the Member States on the measures taken to implement the Directive.

62. The Norwegian submission also included information on the issue of co-existence. Pursuant to Article 31 of EC Directive 2001/18/EC, a report on the deliberate release of GMOs, including an assessment of, *inter alia*, the socio-economic implications of deliberate releases and placing on the market of GMOs was submitted in August 2004. The socio-economic implications that are discussed in the report are mainly the issue of co-existence of genetically modified crops with conventional and organic farming. Norway reported that it is in the process of establishing measures for co-existence. As part of this process, the Norwegian Food Safety Authority has prepared a draft regulation on the growing of genetically modified plants while the Norwegian Agricultural Authority has drafted a regulation on compensation for economic loss due to the presence of LMOs in a crop. The draft regulations are under consideration by the Ministry of Agriculture and Food.

63. The submission from CropLife Australia noted that even when multiple transgenic fields are adjacent to conventional fields, levels of pollen flow are likely to be below current internationally-accepted thresholds for adventitious presence for the most sensitive markets. It stated that other countries currently producing GM crops have co-existence among specialty (e.g. organics), non-GM and GM production. Furthermore, according to CropLife Australia, the agronomic benefits are said to be greater than the additional costs that may be incurred to meet identity preservation requirements.

64. Friends of the Earth International described contamination by authorized and unauthorized GM crops as two types of socio-economic impacts. They noted that there are impacts on conventional farmers from contamination with authorized GM varieties. They provided the example of Canadian farmer Percy Schmeiser, his lost research and economic costs from being sued by Monsanto. They also referred to organic farmers experiencing contamination from GM crops and associated pesticide use and the economic costs associated with this contamination.

65. The Pengue study stated that gene flow from GM soybean production in Argentina is creating adverse impacts on organic farming.

66. The Dano chapter commented that GMO contamination of conventional crops and of wild and weedy relatives poses serious threats to biodiversity and the genetic base for long-term food security.

67. The Rulli chapter noted that the intensification of large-scale monoculture, transgenic technology and the lack of a rotation cycle generate an ecosystem that does not permit co-existence with other crops or farmers. Furthermore, the plants most affected by spraying tend to be the subsistence crops.

(e) Impacts related to yields, inputs and products/outputs

68. Some of the submissions commented that the use of living modified organisms had increased yields thereby raising farmers' incomes. In the case studies submitted by the Biotechnology Coalition of the Philippines, the extra income was used by the farmers to buy a car, send the children to college or save for more land. Other submissions noted mixed impacts with the cultivation of LMOs resulting in increased yields in some countries or regions of a country and no impact on yields elsewhere. One submission stated that the difference in yields between Bt and non-Bt farmers in certain districts of

7/ EC, *Directive 2001/18/EC of the European Parliament and of the Council of 12 March 2001 on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC* [2001] O.J. L. 106/1.

Andhra Pradesh in India was insignificant and that non-Bt farmers and farmers using non-pesticidal methods gained more economic benefits than Bt cotton farmers.

69. Two of the submissions discussed other socio-economic impacts arising from the impact of LMOs on yields and/or on the products from the cultivation of GM crops. CropLife Australia expressed the view that the approval of GM canola in Australia would allow Australian farmers to sow earlier, achieve better weed control and avoid the yield and oil penalties inherent in triazine-tolerant canola. The organization estimated that if half the triazine-tolerant canola in Australia was replaced by GM canola, there would be an annual national benefit of $160 million in increased value of production plus additional significant environmental benefits as a result of the facilitation of direct drilling techniques. 8/ The Brookes and Barfoot brief identified a number of more intangible economic impacts from the adoption of GM crops. They stated that most of these have been important influences for the adoption of the technology. For herbicide-tolerant crops, these include the reduced likelihood of 'knock-back' effects in comparison to conventional crops where the application of post-emergent herbicides may result in crop damage. Similarly, they stated that herbicide-tolerant crops eliminate the potential damage caused by soil-incorporated herbicide residues in follow-on crops.

70. A number of submissions also stated that the use of living modified organisms had reduced farmers' expenditures on inputs (e.g., seeds, pesticides, fuel for machinery, labour), also raising farmers' incomes. Other submissions noted variable impacts of the use of LMOs on expenditures with decreased use of or expenditures on inputs in some countries or regions of a country, no impacts elsewhere and/or increased use of or expenditures on inputs in other countries or regions of a country.

71. The Brookes and Barfoot brief calculated the cost farmers pay for accessing GM technology relative to the total gains derived and said that the total cost was equal to about 26 per cent of the total farm gains across the four main GM crops (i.e., GM soy, maize, cotton and canola.) According to the brief, the total cost is equal to about 13 per cent of total farm income gains for farmers in developing countries while the cost is about 38 per cent of the total farm income gain for farmers in developed countries.

72. Some submissions noted that farmers growing GM crops could command price premiums for their products because they were of higher quality. One reason given for such premiums was lower levels of toxins – such as aflatoxin or mycotoxin – in the product. Another reason was that the improved weed control associated with herbicide-tolerant crops resulted in cleaner crops with higher harvest quality leading to higher levels of quality premiums in some regions.

73. Some submissions noted that the cultivation of GM crops allowed double-cropping in certain contexts. CropLife Australia estimated that if half the currently cultivated types of canola in Australia were replaced with GM canola, an additional 200,000 hectares of canola could be grown in low rainfall regions. This would also lead to an increase in wheat production in rotation in the additional canola area due to canola's ability to suppress diseases and pathogens. Trigo and Cap noted that the combination of wheat with herbicide-tolerant soybeans allows double-cropping in areas of Argentina where it was not feasible before. This is said to be one of the main economic determinants of changes in farmers' behaviour which was reinforced by a sharp drop in the price of glyphosate. Brookes and Barfoot pointed to instances, such as for some cotton growers in India, where insect-resistant crops have a shorter growing season, allowing some farmers to plant a second crop in the same season. In the case study submitted by the All India Crop Biotechnology Association, the Bt cotton grown by the farmer had a shorter harvesting time allowing him to plant maize in rotation and earn additional income.

8/ The submission did not state whether these figures are in US dollars, Australian dollars or another currency.

74. A few submissions discussed aggregate economic benefits from GM crops including, in some instances, the distribution of these benefits. The Trigo and Cap study calculated the total accumulated benefits in Argentina for the period from 1996 to 2005 for herbicide-tolerant soybeans, insect-resistant maize and insect-resistant cotton. In the case of herbicide-tolerant soybeans, the estimated total accumulated benefits, net the substitution for other activities (sunflowers, cotton, pastures) was nearly US$ 20 billion with over 75 per cent of these benefits accruing to farmers and the rest to seed suppliers, herbicide suppliers and the national government. The estimated benefits for insect-resistant maize and cotton were said to be smaller, approximately US$ 480 million and US$ 20 million respectively. For insect-resistant maize, farmers and seed suppliers each received over 40 per cent of the benefits and the national government approximately 15 per cent; for insect-resistant cotton, farmers received over 86 per cent of the benefits, seed suppliers nearly 9 per cent, and the national government the remainder.

75. The Galvão report submitted by the Brazilian Council for Biotechnology Information stated that the adoption of herbicide-tolerant soybean in Brazil has allowed farmers to save close to US$ 1.4 billion. Furthermore, the benefits of GM soy and GM maize are said to be distributed along the supply chain from the technology producer to the rural producer, the feed producer and finally the consumer in the form of lower prices. Galvão also calculated the benefits accumulated by producers and technology holders (seed and herbicide producers) between 1996 and 2007 as being between US$ 1.6 billion and US$ 2.1 billion. He noted that 71 per cent of this benefit, based on market prices, was captured by farmers through lower production costs. The remainder went to the technology holders. He also stated that the increased productivity of GM soybeans would seem to explain their adoption as the price of soybeans in the late 1990s to early 2000s dropped in comparison to the price in the early 1990s.

76. The Brookes and Barfoot brief stated that the impact on farm incomes in GM-adopting countries has been very positive. They calculated the total farm income benefit between 1996 and 2005 to be US$ 24.2 billion or US$ 27 billion if gains from double-cropping of soybeans in Argentina are included. They claimed that the positive impact derives from enhanced productivity and efficiency gains and that developing country farmers have acquired 47 per cent of the total US$ 27 billion farm income benefit.

77. The Hu study submitted by the Centre for Chinese Agricultural Policy stated that the commercialization of both Bt cotton and GM rice in China has substantial welfare effects, which could amount to US$ 5.2 billion by 2010.

78. A couple of the submissions commented in general on the profitability of growing GM crops. One of the studies summarized in the submission from the All India Crop Biotechnology Association found that gross margins were higher for Bt over conventional cotton and a number of the studies considered in the submission found that profits were higher for Bt cotton farmers over non-Bt cotton farmers. A study cited in the submission from CropLife Australia indicated that growing glyphosate-tolerant canola would provide consistently higher on-farm returns than growing triazine-tolerant canola. Brookes and Barfoot described the intangible economic benefits associated with the use of GM crops as being more difficult to quantify but stated that these benefits are considered by many farmers as a primary reason for adopting GM crops and in some cases, farmers have been willing to adopt for these reasons alone, even when the measurable impacts on yield and direct costs of production suggest marginal or no direct economic gain.

79. PRRI felt that any solution that can be put into the crop seed lessens the cost of inputs and decreases environmental impacts.

(f) Impacts related to employment and labour

80. A few submissions commented on the impacts of LMOs on the overall employment situation in different countries. Trigo and Cap calculated that the release of herbicide-tolerant soybeans may have contributed to the creation of almost 1 million jobs to the Argentinean economy, representing 36 per cent

of the total increase in employment over the period covered by the study, i.e. 1996-2005. The Brookes and Barfoot brief also reported that the significant productivity and farm income gains they identified elsewhere in their study have, in some countries, made important contributions to income and employment generation in the wider economy. They cited figures from Argentina stating that the economic gains resulting from the increase in soybean production since 1995 are estimated to have contributed towards the creation of 200,000 additional agricultural-related jobs.

81. A number of submissions noted either that less labour is required for the production of GM crops or that GM crops allowed farmers to shift labour away from tasks such as weeding and the application of pesticides to other activities. The Public Research and Regulation Initiative submission stated that herbicide-resistant maize can free up labour for farmers, allowing them to cultivate more of their arable lands, spend more time on family affairs and allow farmers with HIV/AIDS and with reduced physical capacity to continue farming.

82. Some submissions pointed to the cultivation of GM crops as bringing relief and being stress free. The Biotechnology Coalition of the Philippines commented that GM crops made farming more comfortable and convenient and allowed farmers to rest and relax, to spend time on other productive activities and to spend more time with their families. GIC pointed to studies contained in the CropLife International Database of the Benefits and Safety of Biotechnology as demonstrating that biotechnology-derived crops offer growers a superior tool to protect their crop yields from pests resulting in better peace of mind for farmers and more free time for them and their families. The Brookes and Barfoot brief noted some intangible economic benefits related to impacts on labour from the adoption of GM crops, including, in the case of herbicide tolerant crops, greater management flexibility that comes from a combination of the ease of use associated with broad-spectrum, post-emergent herbicides and the increased window for spraying. In the case of insect-resistant crops, impacts are said to include taking away the worry of the occurrence of significant pest damage and a convenience benefit from less time spent on walking the fields or applying insecticides.

83. On a similar theme, the Galvão report stated that, the level of quantitative and qualitative benefits of GM soy for producers in the mid-west and northeast of Brazil was compromised by the unavailability of adapted seeds. Furthermore, the productivity of the GM soy varieties that were available was not competitive with that of conventional seed and the direct economic result was mostly inferior. Nonetheless, the adoption of GM soy in these regions has continued to increase due to the perception that the qualitative benefits were big enough to offset the lack of quantitative benefits. These qualitative benefits include greater simplicity and ability to manage fields.

84. Some submissions noted the reduced availability of agricultural work due to the cultivation of LMOs. The Dano article noted that most GM seeds available on the market today were developed for the needs of farmers in developed countries where labour is a major production cost. This is very different from the household farming situation that characterizes agriculture in many developing countries where labour is readily available, abundant and often cheap. She suggested that the introduction of herbicide-tolerant GM crops that eliminates the need for weeding or tilling of the soil, will potentially have grave long-term impacts on rural labour. Fewer labour requirements would mean less employment opportunities for poor agricultural workers. The Rulli chapter found a trend among small farmers in Paraguay to look for employment at other farms to augment their low income due to the poor productivity of their own harvest. At the same time, though, the implementation of technological packages of transgenic soy and mechanization of monocultures implied a drastic reduction in the amount of employment offered in the dominant soy areas. RALLT noted that GM soy production in Argentina resulted in the use of machinery for direct sowing which had the effect of displacing rural labour. In the case of Roundup Ready soy, the use of herbicides to control weeds has resulted in less demand for labour for tasks such as the preparation of beds for seeding, the application of herbicides, the mechanical control of weeds, and the manual control of herbicide-resistant weeds.

85. Pengue commented that thousands of small- and medium-scale farmers have been forced out of the production system due to the intensification of soybean production.

86. Two submissions commented on the impacts on women arising from the effects of LMOs on labour. Noting that herbicide-tolerant GM crops eliminate the need for weeding, the Dano article also commented that weeding is often one of the primary tasks of women so eliminating such a task would marginalize women. The Joensen chapter referred to the port complex of San Lorenzo which is the most important export centre in Argentina and which is the site of construction of oil milling plants for oil and biodiesel. The busy port has resulted in the development of a booming sex trade with young women, the vast majority of whom are under the age of 18, being brought in from villages.

(g) Impacts related to international markets and market access

87. Two submissions commented on how the cultivation of LMOs has had no impact on access to international markets. The Galvão report stated that exports of soybean have doubled between 1997 when GM soy was first introduced to Brazil and 2007 demonstrating that the use of GM soy has not had negative impacts on access to either traditional or new markets. The submission from CropLife Australia stated that the feared adverse impacts on export grain markets if GM canola was introduced to the country are unfounded. CropLife Australia cited an early report which observed that GM crops have the potential to influence Australian and global trade and improve crop productivity, making agricultural production more sustainable and expanding the range of agricultural products. It further argued that there is some sensitivity in particular markets to GM crops but little to no evidence of general price discrimination or market access problems. It commented that there are also no significant price premiums for non-GM canola.

88. Another two submissions discussed economic vulnerability from reliance on the export of one genetically modified commodity, in this case soy. Trigo and Cap noted that one of the concerns associated with the 'soyafication' of Argentina is excessive dependence on the export of a single commodity. They stated, however, that soyafication concerns should not be considered a demerit of the clearly positive balance of the first decade of GM crops in Argentina. The Pengue study commented that the overwhelming dependence on transgenic soybeans makes farmers and Argentina vulnerable to changes in global commodity markets.

89. Finally, three of the submissions examined the impact of GM production on market prices for certain commodities with one also discussing the impacts of GM cultivation for China's balance of trade and that of other exporters. Brookes and Barfoot noted that the majority of both global production and trade in soybeans is now accounted for by GM production and thus, GM production effectively influences and sets the baseline price for commodity-traded soybeans and derivatives on a global basis. They reasoned that, given the significant cost savings and farm income gains provided by GM soy to growers, it is likely that some of these benefits will have been passed down the supply chain in the form of lower real prices for commodity-traded soybeans. They concluded that the current baseline price for all soybeans, including non-GM soy, is probably lower than it would otherwise have been if the new technology had not been adopted. Furthermore, a similar benefit from the transfer of farm income benefits from the use of GM technology associated with maize, canola and cotton has probably also occurred although to a lesser extent because the global production of genetically modified varieties of these crops is lower.

90. Trigo and Cap also calculated the level of accumulated savings in worldwide consumer spending due to greater soybean production in Argentina attributable to the release of herbicide-tolerant varieties and found the amount to be an estimated US$ 26 billion.

91. The Hu study stated that the yield increase and labour savings associated with Bt cotton will reduce the supply price and decrease imports of cotton into China. Exports will also rise, improving the

Chinese balance of trade. It stated that the lower supply price of cotton will also lower the supply price of textiles in China. There would be a negative impact on other major cotton exporters but it is stated that the lower price for cotton would have little effect on other textile-producing countries. For rice, the submission stated that adopting GM rice in China would also cause the price of rice to fall. The impact on major rice importers, such as Africa and rice-deficit developing countries in Asia, would be negligible while major rice exporters in Southeast Asia would experience a drop in net export revenues but the magnitude of the drop should not be too large as China is not a major rice exporter.

(h) Health-related impacts

92. Some of the submissions commented on the relationship between the cultivation of LMOs and access to health care. Rulli asserted that the degradation of the small farm economy results in a lack of economic resources to allow people to afford private health care. The Joensen chapter reported that in the village of Loma Senes, the majority of people affected by the use of pesticides on Roundup Ready soy fields are poor labourers who, in some instances, do not have access to social welfare or state healthcare. In one of the studies considered in the submission from the All India Crop Biotechnology Association, the Bt villages had higher incomes than non-Bt villages. The higher incomes meant that the women in the Bt villages, particularly the Bt farmers, reported more pre-natal care visits and higher rates of trained assistance at child birth and the children of Bt farmers were better immunized. Furthermore, these parameters on maternal and child health were time sensitive meaning that the benefits of Bt cultivation appeared to increase with time.

93. A number of the submissions commented that the cultivation of LMOs reduced pesticide applications which, in turn, had health benefits for farmers and farm workers.

94. A few submissions noted that the use of LMOs allowed farmers to switch from pesticides that were more toxic to the environment to pesticides that are less toxic to the environment. Trigo and Cap noted that according to data from 2001, the release of herbicide-tolerant soybeans in Argentina triggered a substantial increase in the use of glyphosate, both in total volume and in the number of applications. They stated that glyphosate is classed as 'virtually non-toxic' by the World Health Organization and so creates low health risks. Furthermore, the release of herbicide tolerant soybeans and the use of glyphosate also induced an 83 per cent drop in the use of WHO Class II herbicides and a total phasing out of the ones classified as Class III, both of which are more dangerous to human health. More specifically, the increased use of glyphosate was said to have also resulted in a decrease in the use of atrazine, a herbicide with high residual effects.

95. The Brookes and Barfoot brief used two indicators to examine the impacts from levels of pesticide usage: active ingredient use and the environmental impact quotient. The latter is said to distill the various environmental and human and animal health impacts "of individual pesticides in different GM and conventional production systems into a single 'field value per hectare' and draws on all of the key toxicity and environmental exposure data related to individual products". 9/ Thus when speaking of environmental impacts, their study is also referring to impacts on human and animal health. They calculated that overall, between 1996 and 2005, there has been a 15.3 per cent net reduction in the environmental impact on the cropping area devoted to GM crops and that the total volume of active ingredient applied to crops has also fallen by 7 per cent. They stated that, in absolute terms, since 1996, the largest environmental gains have arisen from the adoption of GM herbicide-tolerant soybeans. This is said to be mainly due to the large share of global GM crop plantings devoted to GM herbicide tolerant soy. The volume of herbicide use is said to be 4.1 per cent lower and the environmental impact 20 per cent lower than levels that would have likely arisen if the GM crop area had been planted with conventional varieties. In some countries, though, and notably in South America, the adoption of GM

9/ See Brookes and Barfoot at p. xi.

herbicide-tolerant soybeans also coincided with increases in the volume of herbicides used and the environmental impact relative to historic levels. In this light, the reduced environmental impact largely stems from reduced greenhouse gas emissions facilitated by the change in production system from conventional tillage to no- or low-tillage. They calculated that, in 2005, the majority of the environmental benefits associated with lower insecticide and herbicide use have accrued to developing country farmers.

96. CropLife Australia calculated that if half the triazine-tolerant canola grown in Australia was replaced by GM canola, there would be significant environmental benefits as a result of reducing the use of triazine. The latter is said to have a higher environmental impact than glyphosate and glufosinate-ammonium.

97. The submission from the Public Research and Regulation Initiative stated that Bt crops can lead to reductions of cancer-causing mycotoxins in maize.

98. On the other hand, certain submissions pointed to greater health risks associated with the cultivation of LMOs and the associated spraying of pesticides. The Pengue study noted that farmers are beginning to use combinations of glyphosate with other herbicides such as 2,4-D to deal with difficult to control weeds. He stated that the expansion of the area on which GM soybeans are being grown and the more intensive use of pesticides show a strong increase in the overall relative contamination risk.

99. RALLT discussed the decomposition of glyphosate, which can degrade into formaldehyde, a known carcinogen. The submission also discussed polyoxyethylene amine (POEA), a surfactant used to treat plants to increase the efficacy of glyphosate. RALLT stated that POEA has a much higher toxicity than glyphosate and causes various human health problems including gastrointestinal problems, alterations to the central nervous system, respiratory problems, the destruction of red blood cells and skin irritation. In addition, POEA contains dioxin, which causes cancer and damage to the liver and kidneys in humans.

100. The Joensen chapter also reported that crop spraying is responsible for the disappearance from the Entre Ríos province of Argentina of the owl, a predator of rats. The consequent proliferation of rats in the countryside also means an increase in carriers of leptospirosis, causing animal infections and, to date, two human deaths.

101. Some submissions drew links between the cultivation of LMOs and negative health impacts on neighbouring communities. Rulli and Joensen both noted negative health impacts on humans and animals. RALLT reported on a study done in the neighbourhood of Ituzaingó, where agrotoxins were found in the soil and the water as well as in the blood of children between four and 14 years of age. Rulli and RALLT linked the cultivation of GM soy and crop spraying to cases of respiratory and digestive ailments, headaches, miscarriages, birth defects, deregulation of metabolism, malnutrition, stress, gastritis, psychological problems, leukaemia, cancer, malformations, and others.

102. The Rulli chapter pointed to the health impacts of working in silos loading and unloading grain. She stated that health and safety conditions in the silos are lacking and most workers have breathing problems due to the dust and the agro-toxins in the grains. There is also a lack of protective equipment for the fumigation work.

103. Two submissions commented on dietary impacts from the cultivation and consumption of LMOs. Pengue noted the consumption of less and lower quality protein with the expansion of soy in Argentina and that poor people can no longer afford a diverse diet. The submission from RALLT referred to children who are intended to benefit from a program of food aid in the form of GM soy. It stated that the children receive transgenic soy that contains residues of glyphosate and other pesticides. A study cited by the submission found that the children do not like to eat the GM soy as it is not part of their culture and it causes stomach problems. The submission also referred to substitution of cow’s milk with soy milk

resulting in calcium deficits and a greater probability of anaemia given limitations in the body's ability to absorb the iron present in soy. RALLT also stated that the GM soy consumed in Argentina contains toxic residues.

(i) Food security and food sovereignty related impacts

104. A number of submissions felt that the cultivation of LMOs would have negative impacts on food security and food sovereignty. The Dano chapter commented that the cultivation of GM crops in the developing world threatens household food security due to the conversion of land traditionally planted with food crops for production of commodity crops for industrial use and export. She recommended that socio-economic impact assessments look into the impacts of the widespread promotion of GM crops for industrial use on overall food security of communities in view of land limitations and the declining productivity of agricultural land due to intensive production.

105. The Rulli chapter found that when families of *campesinos* (small-scale farmers or peasants) started soy cultivation, there was a tendency for it to displace subsistence crops and families became more dependent on market factors outside their control. Soy cultivation was said to weaken cohesive family patterns because subsistence farming is discontinued in the long term and there is a trend to look for outside farm work or to migrate temporarily. The displacement of *campesinos* was also said to have consequences for the rest of Paraguay as the *campesinos* produce the market foods that sustain the population.

106. RALLT stated that the expansion of soy is jeopardizing food sovereignty. Argentine families have replaced protein from meat with products derived from soy. With the establishment of soy as the principal food crop, the cost of other foods has increased and has also required the massive import of products whose high costs make it difficult for them to be accessed by the population.

107. Pengue stated that Argentina has lost its food diversity and food sovereignty by concentrating on a few commodities for export without adding value to these commodities.

108. Altieri noted that the traits that are important to indigenous farmers could be traded for transgenic qualities that may not be important. He considered that in this scenario, risk will increase and farmers will lose the ability to adapt to a changing biophysical environment and produce relatively stable yields with a minimum of external inputs while supporting their communities' food security.

109. Altieri went on to state that the social impacts of local crop shortfalls resulting from genetic uniformity or changes in the genetic integrity of local varieties due to genetic pollution can be considerable in the margins of the developing world. In the extreme periphery, crop losses mean ongoing ecological degradation, poverty, hunger and even famine. He believes that the local skills and resources associated with biological and cultural diversity should be available to rural populations under these conditions of systemic market failures and lack of public external assistance.

110. On the other hand, the Galvão report stated that the low income of most of the Brazilian population means that the broader adoption of biotechnology with the distribution of economic benefits along the supply chain would result in better access to food products, particularly for the lower-income population.

(j) Impacts on land tenure, rural-urban migration and communities

111. Some of the submissions commented on the impacts of LMOs on traditional ways of life and farming practices. Altieri stated that the introduction of transgenic crops into regions of genetic diversity could spread the characteristics of the altered grain to local varieties favoured by small farmers, diluting the natural sustainability of these races. The effect of compromising maize biodiversity was also said to

compromise the associated systems of agricultural knowledge and practice along with the ecological and evolutionary processes involved.

112. Rulli stated that the soy boom that occurred in Paraguay around the year 2000 was realized in large part through the sale of land and the migration of the *campesinos*. In general, she stated that all communities have experienced important changes in the natural landscape with the expansion of soy. The destruction of landscape has a strong influence on the well-being and dynamics of *campesino* communities and massive deforestation is accompanied by community disappearance and isolation. The residents of the last *campesino* areas feel constantly threatened and condemned to extinction and that there is a general feeling among *campesinos* that the expansion of monocultures implies a degradation of their economy. The campesinos feel cornered by the monoculture model and would prefer to keep their *campesino* identity but with little choice, most end up migrating to cities.

113. RALLT stated that in a large part of the regions outside the Pampas, the expansion of the agricultural frontier has produced not only the appropriation of land and water but has also prevented other agricultural and livestock activities and has disrupted the way of life of the rural population. Friends of the Earth International noted the economic failure of GM crops as having a negative socio-economic impact on farming communities.

114. On the other hand, in one of the studies considered in the submission from the All India Crop Biotechnology Association, the Bt villages had higher incomes and also had more markets than non-Bt villages and a higher average number of shops than non-Bt villages. The higher incomes also meant that more Bt villages had drinking water facilities, electricity and street lights.

115. Some of the submissions also found an increase in violence due to the introduction of LMOs. The Joensen chapter noted that there are fears of threats and harassment for speaking out about the impacts of crop spraying. This has the effect of creating self-censorship. RALLT stated that the rural exodus has been increasing at an alarming rate and as a consequence, crime and violence have increased as a result of the marginalization.

116. Rulli found that the letting of land by *campesinos* in Paraguay to foreigners is a main factor causing violence and tension in communities partially because it is very difficult to talk to the producers about indiscriminate crop spraying. At the community level, she noted that the arrival of soy brought more armed forces into some communities, usually where the population resisted crop sprayings. She also noted occurrences of violence when peasant organizations reacted to the illegal selling of land to soy producers and took action to re-occupy their plots.

117. A number of submissions found that the introduction of LMOs had led to migration from rural areas. For example, the Rulli chapter stated that the expansion of GM soy cultivation in Paraguay has contributed to the expulsion of *campesinos* from their land. She noted that 50 per cent of the area into which soy expanded between 1995 and 2006 had once belonged to *campesino* families and had been appropriated through sale, rent or eviction. She estimated that this amounted to an expulsion of 9,000 families per year. Furthermore, the two areas with the longest-standing soy crops are also the two areas with major problems in land ownership.

118. Rulli also found that the letting of land to generate income only occurs within the soy sector and it corresponds to a lack of competitiveness of *campesino* production. The *campesino* is said to let his land when he does not trust his own production capacity, if inputs are too expensive and/or when he is highly indebted. She noted that such letting results in impoverishment because it implies an inability to supply food to the family and it causes the breakup of the family as some members must look for employment and migrate. This, in turn, is said to result in the rupture of the communitarian family agriculture dynamic.

119. Rulli found that the increased value of land caused by soy cultivation is an irresistible temptation and leads to migration of campesino families. Of the displaced families interviewed for the research in the chapter, the majority had lived in the vicinity of soy monocultures and they considered crop spraying to be one of the main reasons for leaving as well as an absence of protection and a lack of infrastructure, education and health resources in rural areas.

120. She found higher rates of migration in communities with higher levels of soy in the period coinciding with the entry and expansion of GM agriculture in the country. Polls, according to her study, show that families which feel less threatened by the soy model are the least likely to migrate. As the threat perception rises, the intention to migrate also rises. She also found that farm size did not correlate to a desire to migrate but that youth are most likely to migrate because they face the most difficulty in finding land.

121. Rulli also found that the cost of inputs for mechanized soy agriculture were too high for family agriculture. Easier access to financing for soy production seems to be one of the main factors promoting soy cultivation among *campesinos*. Credits are given in the way of inputs for production, which creates dependency on these products. In addition, private institutions offer credit to small producers asking for land as a guarantee, knowing that the producers will not be able to cover their expenses. Then, a year later, the land is taken away. She described the debt mechanism as one of the main methods for gradually taking possession of *campesinos*' lands. She found that one-third of the displaced persons had some level of debt.

122. RALLT reported that the growth of soy has resulted in the displacement of rural communities and, in the cases of Paraguay and Brazil, in the displacement of indigenous peoples.

123. On the other hand, Trigo and Cap challenged the widely-quoted consequence of the increase in the rate of rural to urban migration due to the expansion of soy cultivation in Argentina. In counties where agriculture grew the most, they found no correlation between this process and a reduction in the number of households with unsatisfied basic needs.

124. The Galvão report found that 65 per cent of soybean produced in Brazil comes from small producers and farmers and that the adoption of GM soy plays an important role in the maintenance of the incomes of small- and medium-sized farmers, helping them to stay in the countryside.

125. Two submissions commented on the impact of rural to urban migration on cities. Rulli wrote that once the displaced person arrives in his or her migratory destination, as well as suffering the typical disadvantages related to abandoning a home, in the majority of cases, his or her economic, social and cultural rights are also unfulfilled. Furthermore, the great majority of *campesinos* displaced to cities wind up in shantytowns in effect facing a double displacement from first leaving their land and then leaving the city.

126. RALLT found that with millions of families leaving rural areas, the population on the borders of cities has grown considerably.

(k) Impacts from opportunity costs and from the balance of costs and benefits

127. The Galvão report stated that the cost for Brazil of not taking part in biotechnology would have been higher than the costs of taking part. He found that the lost benefits to corn producers from not adopting biotechnology will reach US$ 6.9 billion over the next ten years. This amount consists of lost cost reductions and lost increases in productivity. At the same time, the lost benefits to cotton producers would be US$ 2.1 billion. Furthermore, he commented that while both farmers and technology holders

captured benefits from the adoption of GM soy in Brazil, the level of these benefits could have been much higher based on the experience in the United States and Argentina.

128. Galvão was also of the view that, as with any technology, the adoption of biotechnology also incurs costs, mainly those associated with product labelling and certification. He stated that the regulatory environment has to consider measures that guarantee consumers' right to information based on valid scientific premises but must also seek an equilibrium that preserves generated benefits.

129. According to the submission from CropLife Australia, Australia stands to lose between $1.5 billion and $5.8 billion in gross national product over the next ten years if GM crops are not adopted. The adoption of GM canola could provide significant economic advantages now worth an estimated $157 million annually for farms. Australia was said not to be realizing a price premium for producing non-GM canola; to be missing significant agronomic and environmental benefits; and to be missing out on new biotechnology developments such as drought tolerance and more efficient use of nitrogen that could keep Australia competitive.

130. Hu estimated that the macro-economic gains of adopting GM crops in China far outweigh public research expenditures on biotechnology.

131. Trigo and Cap pointed to a strategy of short-term profit maximization by small farmers in Argentina, which results in long-term environmental unsustainability. The short-term profit maximization is not, however, necessarily causally linked to the commercial availability of herbicide-tolerant soybean varieties. They advocated public policy to balance private socio-economic gains with social and environmental sustainability aspects. They also noted that there are concerns with the soyafication of Argentina and stated that debate is needed on ways to optimize the potential of new innovations and limit potential negative effects they might cause. They commented that a realistic look at the new technologies that might be forthcoming leads to the conclusion that it is very unlikely that another case like herbicide-tolerant soybeans will be available in the near future.

132. Pengue wrote that short-term economic objectives ignore mid- and long-term socio-economic effects which threaten the future sustainability of agriculture in Argentina and have placed society at risk.

(l) Impacts of LMOs on competition and small versus large farmers

133. Dano advocated including the issue of control over agricultural production and relations to production in socio-economic impact assessments. Similarly, Pengue pointed to the concentration of agribusiness as a socio-economic consequence of the introduction of GM soy.

134. Brookes and Barfoot stated that both large and small farmers have adopted GM crops and that size of operation has not been a barrier to adoption.

135. RALLT stated that the use of technology in the form of GM seeds, agrotoxins and machinery for direct sowing are out of reach for small producers. Such technology requires large initial investments and, to be efficient, also requires large areas of land.

IV. RELEVANT INFORMATION FROM OTHER PROCESSES UNDER THE CONVENTION AND THE PROTOCOL

136. The potential environmental, cultural and socio-economic impacts of genetically modified trees are also being considered within the framework of the forest biodiversity programme of work under the Convention on Biological Diversity. In paragraph 3 of decision VIII/19B, the Parties requested the Executive Secretary "to collect and collate existing information, including peer-reviewed published literature, in order to allow SBSTTA to consider and assess the potential environmental, cultural, and

socio-economic impacts of genetically modified trees on the conservation and sustainable use of forest biological diversity, and to report to the ninth meeting of the Conference of the Parties". The Executive Secretary prepared a note on this matter for consideration by the 13th meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) (document UNEP/CBD/SBSTTA/13/INF/6, see also the compilation of views in document UNEP/CBD/SBSTTA/13/INF/7). These documents are also to be forwarded to the ninth meeting of the Conference of the Parties to the Convention.)

137. SBSTTA prepared draft recommendation XIII/2 as a result of its in-depth review of the forest biodiversity programme of work at its 13th meeting held in Rome, Italy from 18 to 22 February 2008. Paragraphs 1(r) and 2(j) of the draft recommendation concern, *inter alia*, the cultural and socio-economic impacts of genetically modified trees. The draft recommendation will be further considered at the ninth meeting of the Conference of the Parties.

138. At the first meeting of the Conference of the Parties serving as the meeting of the Parties to the Protocol, the Parties adopted decision BS-I/5 which, amongst other things, adopted the Coordination Mechanism for the implementation of the Action Plan for Building Capacities for the Effective Implementation of the Cartagena Protocol on Biosafety. The Fourth Coordination Meeting of Governments and Organizations Implementing and/or Funding Capacity-Building Activities was held in New Delhi, India from 11 to 13 February 2008. One of the items considered during the meeting was capacity-building initiatives for and experiences gained in addressing socio-economic considerations in decision making regarding living modified organisms.

139. The meeting observed that while Parties have identified socio-economic considerations as one of the key elements in the capacity-building Action Plan requiring urgent action, specific issues and needs have not yet been identified. Further, at present, only a limited number of biosafety capacity-building initiatives deal with the issue of socio-economic considerations under the Protocol. However, it was reported that socio-economic issues are being addressed in some other national decision-making processes not related to living modified organisms, including environmental impact assessments and social impact assessments. The meeting concluded that in order to effectively address the capacity-building requirements with respect to addressing socio-economic considerations in national decision making, specific issues and needs have to be identified. See also the report of the meeting in document UNEP/CBD/BS/COP-MOP/4/INF/22.

140. The meeting recommended to COP-MOP, in the context of addressing the biosafety capacity-building needs of developing countries and implementing respective biosafety capacity-building initiatives, to:

(a) Invite Parties, other Governments and relevant stakeholders to submit to the Executive Secretary information on ongoing and planned biosafety capacity-building initiatives that include activities related to socio-economic considerations in national LMO decision making;

(b) Invite Parties to identify their needs and appropriate processes to build awareness and exchange information and experience on socio-economic considerations related to national LMO decision making;

(c) Request the Executive Secretary to review existing biosafety capacity-building initiatives to determine if and how socio-economic considerations are identified as needs and included in the capacity-building activities;

(d) Request the Executive Secretary to conduct an analysis to determine if and how socio-economic considerations are already taken into account in national LMO decision-making processes through legal frameworks and other mechanisms;

(e) Request the Executive Secretary to convene a group of experts to identify issues that are related to socio-economic considerations in national LMO decision making, and methodologies and experience currently used to assess socio-economic impacts in other decision making processes, with the view to supporting the identification of biosafety capacity-building requirements.

141. The Parties may wish to take these recommendations into consideration when drafting their decision.

V. ELEMENTS OF A DRAFT DECISION

142. Based on the above information, the Conference of the Parties serving as the meeting of the Parties to the Protocol may wish to:

(a) Invite Parties, other Governments and relevant organizations to continue to share their research methods and results on socio-economic impacts of living modified organisms through the Biosafety Clearing-House;

(b) Note the discussions on the potential cultural and socio-economic impacts of genetically modified trees taking place within the framework of the forest biodiversity programme of work under the Convention on Biological Diversity; and

(c) Note the recommendations on capacity-building and socio-economic considerations from the Fourth Coordination Meeting of Governments and Organizations Implementing and/or Funding Capacity-Building Activities and request the next coordination meeting to further consider capacity-building and cooperation among Parties for research and information exchange on any socio-economic impacts of living modified organisms, especially on indigenous and local communities.

Annex

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