

HANDBOOK ON INTEGRATED ASSESSMENT OF AGRICULTURE¹

INTRODUCTION

At the World Summit on Sustainable Development (WSSD) governments adopted a plan of action to pursue the primary objectives of sustainable development including poverty eradication, changing unsustainable patterns of production and consumption, and protecting and managing the natural resource base for economic and social development.

Throughout the plan, special attention is paid to the agriculture sector. It is a sector highlighted for important for poverty eradication, with a focus on infrastructure, transportation and access to markets, food security, and technology transfer. It is also highlighted as vital to promote the protection and management of the natural resource base for economic and social development. Issues including land-use and water-use and management are fundamental in the agricultural sector. Managing these resources in an integrated manner is essential to sustainable development.

In a globalizing world, the WSSD Action Plan indicates that integrated planning should be adopted to identify the impacts of trade, investment and capital flows on sustainable development. To this end, the United Nations Environment Programme (UNEP) has been directed to cooperation with other organizations including other UN agencies and the World Trade Organization (WTO) to cooperate on issues related to trade, environment and development and to use assessments as tools to identify the linkages between the three policy areas. In response, UNEP has begun work on strategic integrated planning for sustainable development at all levels. This *Handbook on Integrated Assessment of Agriculture* is a major contribution to that work, building past work of UNEP and contributing to the fulfillment of the goals that were set out at the WSSD.

Agriculture is an economic sector of primary importance in environment and development terms. Agricultural activity covers around a third of the world's land surface and provides a livelihood for many of the world's poorest people. Ninety-six per cent of the world's farmers live in developing countries where agriculture provides the main source of income for some 2.5 billion people.² Nearly three-quarters of the workforce in Least Developed Countries (LDCs) are employed in agriculture. The agriculture sector in developing countries is critical to food security, poverty reduction and economic growth.

In developed countries, agriculture has different impacts on sustainability, but is no less important. In higher income countries typically 25 per cent of the population lives in the countryside.³ Over the past few decades, agriculture has shifted away from employing traditional practices to emerge as large-scale enterprises concentrating production in the hands of fewer, larger, players that feed into corporate, capital intensive, food processing industries. Production methods employed to satisfy increasing demands for inputs have adapted to produce high yields, relying on intensive land and water use and other techniques such as monoculture and intensive livestock production.

Agriculture can have positive or negative impacts on the economy, the environment and development. These will depend on scale, type, and intensity of farming as well as on agro-ecological and physical factors and on climate and weather. Farming can lead to deterioration in soil, water and air quality, and to loss of natural habitats and biodiversity. These environmental changes can have important

¹ **This paper is unedited. All footnotes will be finalised and made consistent with references to be included in the final draft.**

² Oxfam. 2002. "Boxing Match in agricultural trade: Will WTO negotiations knock out the world's poorest farmers?" Oxfam Briefing Paper #32. November.

³ 2002 *World Development Indicators*. Table 3.1.

implications for the levels of agricultural production and food supply and can limit the sustainable development over time. However, farming can also provide sinks for greenhouse gases, conserve biodiversity and landscapes and help prevent floods and landslides. Changing patterns of production are driven by technological change and efforts to produce more, more efficiently.

Trade in agriculture can impact dynamics already at work in the agricultural sector directly and indirectly. This includes issues associated with scale, type and intensity of farming, production practices, technology use and other variables that will contribute, or detract from, movement towards sustainability. Liberalisation negotiations that cover trade in the agricultural sector are underway in a number of fora in various regions. Key issues that are the subject of these negotiations, including under the WTO's Agreement on Agriculture (AoA), include reducing existing barriers, opening markets, disciplining domestic support payments and promoting development.

In light of the potential for trade to impact important economic and other processes that will affect future directions for agricultural production, it is important to understand these linkages, inform policy makers and develop mitigating measures that can help ensure that growth occurs in a way that supports sustainable development. An integrated assessment can contribute to this goal.

UNEP considers it timely to focus this Handbook specifically on the agricultural sector. Building on work underway in fora such as the WSSD and the UN Convention on Biological Diversity (CBD), this Handbook both relies on, and contributes to, UNEP's previous work on integrated assessments, presented in its *Reference Manual on the Integrated Assessment of Trade and Trade Related Policies* (hereafter, the *Reference Manual*). The Handbook also incorporates lessons learned from UNEP's Round I and Round II country studies, a number of which focus on the agricultural sector. The Handbook has been developed in parallel with UNEP's Round III series of studies, which focus on trade liberalisation for the agriculture sector, with specific emphasis on rice. All these country studies illustrate the application of techniques for integrated assessment, based on empirical evidence in a range of developing countries.

This Handbook on Integrated Assessment of Agriculture (hereafter the *Handbook*) also serves as a contribution to other projects underway, led by the Economics and Trade Branch (ETB) of UNEP, and in particular, recent work on *Strategic Integrated Planning (SIP) for sustainable development*.⁴ SIP is intended to enable planning for environment and development issues in the broad context of sustainable development. It combines techniques for environmental assessment and integrated planning. It is intended to strengthen existing planning tools and processes. While its scope extends beyond agriculture and beyond trade, this report, in identifying key linkages between trade, economics, environment and development within the context of agriculture can contribute to the body of literature that supports a parallel approach to integrated, *ex-ante*, planning that advances sustainable development.

This Handbook presents a range of environmental and related economic and social issues that might be taken into consideration when assessing the impact of trade-related policies. Consistent with the *Reference Manual*, it emphasises the importance of an open, participatory process for integrated assessment and presents a range of methodologies for conducting assessments in the agricultural sector. It also proposes relevant indicators and policy responses. The *Handbook* highlights important distinctions between and among countries in terms of, *inter alia*, their production patterns (for example traditional *vs.* industrial production) and their trading patterns (for example net food importer *vs.* exporter), which will shape the issues associated with any integrated assessment (IA).

This handbook is intended to provide guidance to individuals, research organisation, governmental organisations and policy makers at the national level in undertaking integrated assessments in the agricultural sector.

⁴ AIDEnvironment and UNEP, ETB. 2003. Strategic Integrated Planning (SIP) for sustainable development: Principles and analytical framework. January. (Concept version for discussion).

Section I presents an introduction to the agricultural sector and provides vital context for the IA. It outlines key issues and policies associated with the sector from an economic perspective, including the importance of agricultural products in trade. It also considers associated environmental and social issues. Practitioners are encouraged to undertake a similar exercise in order to frame, at the outset, the issues for further analysis. A comprehensive description of the sector or issue under investigation whether it be agriculture generally or one issue within the sector, will help later efforts to circumscribe the exercise, select indicators, and begin to identify relationships between economic, environmental and social variables for further analysis.

Section II, *Setting the Stage*, identifies three areas for elaboration that will provide direction to, and a framework for, the assessment itself. Taken from UNEP's *Reference Manual*, these areas are: purpose, focus, and circumscribing an assessment. An IA might have more than one purpose. Given the importance of agriculture to the economies, environments and development of many countries throughout the world, gaining an improved understanding of linkages between forces of liberalisation and core sustainability issues may be one over-arching goal of any IA. In addition, the negotiations of the AoA are entering a critical phase at the WTO. Countries might undertake an IA to inform policy makers and negotiators of potential impacts on sustainability prior to the end of the negotiations. Alternatively, following the negotiation, an IA can help countries design policy measures to mitigate potential negative impacts of liberalisation on sustainability, or enhance any positive impacts.

The general focus of an IA based on this handbook is the agriculture sector, which will be defined in its trade terms by the specific negotiating or planning scenario that is contemplated. The IA should focus on key components of prospective trade talks. In some cases these issues will be defined by negotiations at the WTO. For countries that are not members of the WTO, the breadth of the AoA can nevertheless provide guidance for negotiations covering a range of issues. These include issues associated with market access, export and competition and domestic support, as well as other trade-related and non-trade issues. The AoA will be referred to throughout this study by way of example, because of its comprehensive breadth and because as a core WTO Agreement it is expected to garner broad multilateral support in its final form and serve as a benchmark for further bilateral and regional agreements in the agricultural sector.

This handbook also provides guidance for circumscribing and IA in more specific terms allowing a user to select priority issues or commodities within in the agriculture sector for a detailed assessment. Under the ISIC classification "agriculture" typically includes fisheries and forestry. For the purposes of this handbook agriculture is limited to the farm sector including commodities such as crops (grains, oilseeds and rice) and livestock. In addition to selecting specific commodities or issues within the broader agricultural sector, this section provides guidance on identifying key sustainability issues that might be the focus of the assessment. It further encourages a user to identify the geographic locale that will be examined, including physical characteristics of the area or region that might influence the variables that are selected for analysis in the later stages of the assessment.

Section III addresses four key questions to consider when designing an integrated assessment as directed by UNEP's *Reference Manual*. These questions are:

- What is the timing of the assessment?
- What is the approach to information, consultation and participation?
- How can the assessment contribute to capacity building?
- What are the indicators that will be used in the assessment?

A sample of potential economic, environmental, and social indicators that might apply to an IA on agriculture is included in Section III.

Section IV builds on previous work undertaken by UNEP in its *Reference Manual* and country studies, and considers relevant techniques and approaches to IA that might be applied to the agricultural sector. It focuses, in particular, on ways in which practitioners can apply both quantitative

and qualitative techniques and effectively demonstrate correlation between and among the key components of sustainability in the sector. In so doing, a series of questions are presented, related to various processes that can be examined to link trade induced economic change to environmental and social impacts. These include those identified by the Organization for Economic Cooperation and Development (OECD) such as scale, structure and product effects, among others, and incorporate additional variables that apply to agriculture.

Section V addresses issues related to policy development, which should be the ultimate goal of any IA. In some cases these responses will be directly related to the trade agreement under negotiation. In addition, given that changes due to technical progress and general economic development can be as pronounced as those brought about by an extension of commitments on agricultural trade liberalisation an IA should also focus on non-trade related policies promoting sustainability in agricultural production, in parallel with trade-related agricultural reform. This second range of policy response focuses on complementary environmental and social policies that could emerge from *ex-ante* or *ex-post* assessments. They might accompany the implementation of a trade agreement at the outset, or be put in place following the negotiation of an agreement in order to enhance any beneficial effects or mitigate negative impacts of the liberalisation and associated economic activity. The effective implementation of policy responses will involve follow up and monitoring through appropriate government agencies and domestic relevant players.

I. CONTEXT: LINKS BETWEEN AGRICULTURE, SUSTAINABILITY AND TRADE

This section outlines serves to illustrate elements that might be included by way of introduction to the agricultural sector in an assessment. Setting the context should highlight relevant economic, environmental and social variables associated with the sector as well as consideration of issues that characterise production and trade flows.⁵

Core sustainability issues associated with agricultural practices will vary greatly between and among regions and issues. The central purpose of such an introduction is to determine or illustrate the relevance and importance of agriculture to sustainability issues in a particular context. This might include highlighting sustainability issues at a broad, sectoral level as well as those that are unique to a particular issue, region or ecosystem. Information gathered in this preliminary exercise can help frame the assessment and guide the selection of appropriate indicators and suggest specific areas for analysis in later stages of the exercise.

Box 1: Context: Links between agriculture, sustainability and trade

- Economic Issues
- Environmental Issues
- Social Issues
- Trade Issues

A. ECONOMIC ISSUES

The structure of agricultural production varies throughout the world. However, there is a general differentiation between countries that are highly developed and rely on modern production practices, and those that are reliant on more traditional production methods and technologies. In some highly developed economies, the structure of agricultural production is now vertically integrated and agriculture in the developed world has taken on a quasi-industrial character. It has come to be characterised by fewer, but larger and more technologically advanced farms than ever before. In the United States, for example, in the early 1940s six million farms produced the nation's food. By 1995 less than one million farmers accounted for 95 per cent of a substantially increased total farm output.⁶

Box 2: Economic issues

- Average farm size
- Average yield size
- Evolution of the employment/job opportunities in the farm sector
- Rural unemployment levels
- Rate of creation of food processing business
- Total farming incomes
- Average earnings of farmers and farm workers
- International commodity prices & national commodity prices
- Price of staple foods
- % of GDP attributed to agriculture
- Agricultural productivity
- Farm management practices
- Agri-environmental expenditures
- Total production/input costs

The trend towards commercialisation in agriculture that has occurred in the industrialised world has not only resulted in larger farms and increased output, but has also led to changes in production methods including, *inter alia*, tillage methods, use of pesticides, fertilisers and genetically modified organisms (GMOs), increased mechanisation, and increased irrigation. In the United States irrigated acreage increased from 39 million acres in 1969 to 53 million acres in 1993.⁷ In short, in a number of

⁵ The agricultural sector covers a wide range of activities. For the purposes of this Handbook, "agriculture" refers to the farm sector, including crop and livestock production. In some cases, the structure of the industry is such that it might be difficult to consider one issue in isolation where a number of issues are inextricably linked. For example, a study on livestock production might usefully include an analysis of relevant issues upstream, such as feed production and/or downstream such as processing. In this case the Handbook will provide guidance on selecting related issues or sectors to include in the IA.

⁶ USDA. 1995. Economic Research Service, OTO.

⁷ USDA. 1995. Economic Research Service, OTA 1995, Table 2-3.

developed countries, production has been transformed by technological innovation that has resulted in high productivity of both land and labour, translating into greatly increased yields.

An emerging trend in production in some industrialised agricultural sectors is the increasing acceptance of GMOs in production, particularly in areas of the Americas, including the United States. Another trend is toward intensive livestock operations. Poultry and other livestock production have increasingly become separate specialities, leading to large feeding operations. The size of these operations pose major problems of waste management and disposal, and are a source of air and water pollution, which may be multiplied by improper disposal and the mismanagement of manure.⁸

In many developing countries farming is typically carried out on a smaller scale, employing a relatively larger percentage of the population in more labour-intensive production without the range of modern technologies available to farmers in the industrial world. In developing countries, agriculture provides the main source of income for some 2.5 billion people and nearly three-quarters of the workforce of the LDCs are employed in agriculture.⁹ The majority of farmers are typically middle to low-income, in some cases subsistence producers, operating on small lots channelling a proportion of their crop to the marketplace to meet household income needs and to purchase other goods and services. Production tends to focus on primary as opposed to processed products. The percentage share of value added in the agricultural sector in different strata of the developing world lags well behind that of high-income countries (although it still exceeds the manufacturing sector by a considerable margin).¹⁰ Therefore, production in the developing world tends to be sensitive to commodity prices. If prices are low, seasonal workers will rely on temporary work in the off-season (often outside the community) to meet their income needs.

Small-scale farming is characterised by low levels of diversification, and reliance on traditional practices and technologies. Under these conditions, increases in production tend to come not from increases in yields due to efficiencies or technologies, but from an increase in the amount of land under cultivation which can put increasing pressure on marginal lands.¹¹ Table 1 indicates that percentage areas of arable land are increasing in developing countries as more and more land is transformed into cropland.

Practices such as contour plowing and terracing assist farmers working in poor soils and/or on sloping lands. In many LDCs systems of relatively long rotation between crop cultivation and fallows (shifting cultivation) is a dominant practice. The fallow period plays the important role of replenishing the fertility of the land by allowing natural vegetation to grow. In contrast with the developed countries, biomass (vegetation) is an important factor of production in many developing countries. A study in the Côte d'Ivoire found that biomass accounts for roughly 17 per cent of the agricultural gross domestic product (GDP) and a number of studies of Sub-Saharan Africa suggest that there is a connection between declining agricultural productivity and agricultural intensification associated with population growth and exploitation of natural resources.¹²

⁸ Runge and Fox 1999.

⁹ Oxfam. 2002. (BM)

¹⁰ Josling 1998.

¹¹ For example, in the past 20 years, agricultural expansion in the Cote d'Ivoire has come about largely through the movement of production onto more marginal lands, particularly sloping lands. In the 20 year period between 1965 and 1985, primary forests were reduced by 66 per cent and the area under cultivation doubled. Shifting cultivation following felling of forests is common (FAO Basic Foodstuffs:25).

¹² See Lopez 1998.

Table 1

Land Use							
	Land Area Thousand km ₂	Land Use					
		Arable land % of land area		Permanent cropland % of land area		Other % of land area	
		1999	1980	1999	1980	1999	1980	1999
World	130,100	10.2	10.5	0.9	1.0	88.9	88.5
Low Income	32,536	11.8	13.2	1.0	1.4	87.1	85.4
Middle Income	66,644	7.9	8.8	1.0	1.0	91.0	90.2
Low & Middle Income	99,180	9.5	10.2	1.0	1.2	89.5	88.6
East Asia & Pacific	15,969	10.1	11.8	1.5	2.6	88.4	85.5
Europe & Central Asia	23,771	37.1	11.7	3.1	0.4	59.8	87.9
Latin America & Carib.	20,062	5.8	6.6	1.1	1.3	93.1	92.1
Middle East and N. Africa	10,995	4.5	5.1	0.4	0.8	95.1	94.1
South Asia	4,781	42.5	42.4	1.5	2.1	56.1	55.4
Sub-Saharan Africa	23,603	5.5	6.5	0.7	0.9	93.8	92.6
High income	30,920	12.0	11.6	0.5	0.5	87.5	87.9
Europe EMU	2,537	26.2	25.1	4.6	4.4	69.2	70.5

Source: Adapted from 2002 World Development Indicators, table 3.1, p. 136.

Despite growth in amounts of arable land, there has been a general trend over the last decade towards declining levels of agricultural output. Although total agricultural output throughout the world has been rising in the past decade, world crop and livestock production has increased at rates below the average of preceding periods. (Table 2) Total world agricultural output growth in 2000 is estimated at only 1.2 per cent. The preliminary estimates for 2001 suggest even lower output growth of 0.6 per cent, the lowest rate since 1993. In both years, this implies a decline in global per capita production. The lower agricultural output growth achieved in the last two years is the result of slowdowns in production in both developed and developing countries. The developed countries experienced an actual decline in production in 2001 as the net result of a decline in the developed market economies and a strong recovery in production in the countries in transition.

In all developing country regions, output growth was lower in 2000 and 2001 than in 1999, with the most favourable output performance being recorded in Latin America and the Caribbean, the only developing country region not to experience a decline in per capita production in 2001. In Sub-Saharan Africa, agricultural output has been trailing population growth for most of the last three decades.¹³

Table 2

Output								
	Gross Domestic Product		Agriculture		Manufacturing		Services	
	average annual % growth		average annual % growth		average annual % growth		average annual % growth	
	1980-90	1990-2000	1980-90	1990-2000	1980-90	1990-2000	1980-90	1990-2000
World	3.3	2.7	2.5	1.4	..	..	..	2.9
Low Income	4.5	3.2	3.0	2.5	7.8	2.6	5.5	5.1
Middle Income	3.3	3.6	5.2	2.0	4.6	6.2	3.6	3.9
Low & Middle Income	3.5	3.5	3.4	2.2	4.9	5.7	3.9	4.1
East Asia & Pacific	7.9	7.2	4.4	3.1	10.4	9.9	8.6	6.4
Europe and Central Asia	..	-1.5	..	-2.3	..	..	..	1.6

¹³ FAO. 2002.

Latin America & Caribbean	1.7	3.3	2.3	2.3	1.4	2.6	1.9	3.4
Middle East & N. Africa	2.0	3.0	5.2	2.6	..	3.8	2.4	4.5
South Asia	5.6	5.6	3.2	3.1	7.0	6.6	6.5	7.1
Sub-Saharan Africa	1.6	2.5	2.3	2.8	1.7	1.6	2.4	2.6
High Income	3.3	2.5	1.4	0.0	..	..	....	..
Europe EMU	2.4	1.9	1.1	1.3	..	1.2	2.9	2.2

Source: Adapted from 2002 World Development Indicators, Table 4.1, p.206.

According to UN Food and Agriculture Organisation (FAO), the same is true for food products. For example, world cereal utilisation for the end of 2002 was forecast at 1,935 million tonnes, up 1.7 per cent from the previous season. Continuing weak cereal prices in international markets and large cereal supplies were among the main factors for the faster expected expansion in overall cereal usage. Total cereal utilisation is exceeding world production for the second year in a row. World cereal reserves by the close of the 2001-2002 season were expected to decline sharply. World cereal stocks by the close of the seasons ending in 2002 were forecast to reach 587 million tonnes, down 8 per cent from the previous season's level.¹⁴

B. ENVIRONMENTAL ISSUES

Agriculture is a critical sector for the global environment. By virtue of its large land and water requirements, agriculture uses and affects a greater share of most nations' natural resources than any other industry.¹⁵ Agricultural activities have a direct impact on the full range of environmental media including water, land, biodiversity, and air. These impacts are affected by such issues as production techniques and access to inputs, infrastructure and technology. This section considers key variables from the four broad environmental media. It also includes agricultural inputs as a cross-cutting issue affecting all four media.

Box 3: Environmental issues

- Water Water Quality
 Water Quantity
- Land Erosion/Rates of erosion
 Soil Quality/Soil degradation/
 Nutrient quality of the soil/ soil
 retaining capacity/water retaining
 capacity
 Land Use/Changes in Land Use
- Biodiversity Species/Habitats/Land Use
 Crop Genetic Diversity
- Air GHG Emissions
 Air quality
- Inputs: Pesticide and Fertiliser Use

1. Water

Agriculture represents 70 per cent of global water use¹⁶ and has impacts on water quality and water quantity.

(a) Water Quality (Freshwater quality)

Agricultural practices can be a source of water pollution as a result of agricultural runoff and seepage of fertilisers and pesticides into sources of groundwater, as well as directly into surface water. Groundwater contained in underground aquifers is particularly susceptible to nitrate contamination from fertiliser and manure. The risk of nitrate groundwater contamination is a function of both soil drainage and the levels of fertiliser and manure application, which rise in direct proportion to agricultural activity and will depend on the mix of crops.

Water pollution can also occur in streams and rivers in agricultural areas due to soil and fertiliser runoff. Runoff can cause siltation, and contribute to nitrogen and phosphates in surface water.

¹⁴ FAO. 2002.

¹⁵ Ervin 1997.

¹⁶ FAO.

Cropping patterns can add to this pollution, for example, where patterns exist of crops that require higher levels of fertiliser such as soybeans and maize, or where increasing stock densities exist as a result of the intensification of livestock production. Indicators of the state of water quality include oxygen content in the water and nitrate content in the surface water. Water quality risk indicators include levels of fertilisers and pesticides, soil quality, intensity of activity and mix of crops.

The processing of livestock also requires large amounts of hot water and steam for sterilisation and cleaning. Runoff from feedlots tends to contain high levels of nutrients, salts, pathogens and oxygen demanding organic matter. The main polluting component associated with this activity is wastewater that can contain biodegradable organic compounds, suspended solids, nutrients and toxic compounds that can result in a reduction of dissolved oxygen and the deterioration or destruction of aquatic ecosystems. This impact tends to be exacerbated with the size of the operation and is not as serious when there is no concentration in a given area.¹⁷

(b) *Water Quantity (Freshwater resources)*

Agricultural practices can also affect water quantity. Irrigation practices in the agricultural sector has an impact on water quantity as a number of countries rely heavily on irrigated crops for both domestic use and for export. In Mexico, for example, agricultural irrigation accounts for 38 per cent of total water consumption. Indeed, despite the fact that much of Mexican agriculture is rain-fed, irrigation is the basis for all export oriented crops including wheat, alfalfa, soybean, cotton and horticultural crops.¹⁸ Over 80 per cent of the country's water supply is used without charge for agricultural irrigation, and an estimated 50 per cent of this water is wasted through inefficiencies in irrigation water management.¹⁹ The continuing expansion in irrigated agriculture and water use means that there is growing competition for scarce water resources and greater stress on the water needs of aquatic habitats (wetlands, lakes). Intensity of use can be measured by such indicators as levels of groundwater, gross freshwater abstractions per capita and by major uses.

The efficiency of use will impact levels of water consumed for irrigation in agriculture. Levels of efficiency can be measured by economic efficiency and technological efficiency. In some OECD countries, for example, the price of water paid by farmers is substantially lower than that paid by other industry and household users. From a technological perspective, summary results of agricultural water use and comparison with water resources for 90 developing countries conducted by the FAO reveals that on average irrigation efficiency was around 38 percent in the reference period 1998. This varied from 25 percent in areas of abundant water resources (Latin America) to 40 per cent in Near East/North Africa and 44 per cent in South Asia where water scarcity calls for higher efficiencies (Table 3).

Table 3 Freshwater resources

	<i>Total renewable water resources (km³)</i>	<i>Irrigation water requirements (km³)</i>	<i>Water use efficiency</i>	<i>Water withdrawal for agriculture (km³)</i>	<i>Water withdrawal as percentage of renewable water resources</i>
Latin America	13409	45	24%	187	1%
Near East and North Africa	541	109	40%	274	51%
Sub-Saharan Africa	3518	31	32%	97	3%
East Asia	8609	232	34%	693	8%
South Asia	2469	397	44%	895	36%
90 developing countries	28545	814	38%	2146	8%

Source: FAO

¹⁷ Verheijen *et al.*, 1996, FAO.

¹⁸ Turrent 1997, cited in Nadal 1999.

¹⁹ OECD (Agr. indicators).

2. Land

Agricultural production also affects land and agricultural practices can either contribute to, or detract from, soil quantity (erosion) and soil quality (degradation).

(a) *Soil Quantity/Desertification and Erosion*

Erosion is an important issue for policy makers because some aspects of soil degradation are only slowly reversible (declining organic matter) or irreversible (erosion). Erosion can occur through processes related to water, wind or tillage. In the United States, it is estimated that agricultural activities are responsible for around 60 per cent of total soil erosion with the remaining 40 per cent coming from natural events such as fire, flood, drought, and activities such as forestry, conservation and off-road vehicle use.²⁰ Terraces help reduce loss of topsoil even when steeply sloped land is cultivated. Minimum tillage can preserve soil and prevent erosion and, through reduced tractor use, can conserve energy. Contour plowing—following the natural contours of the land—can help prevent rain-induced erosion on sloping lands. Farming on marginal land brings encourages erosion. Erosion can be minimised through the adoption of conservation tillage and no-till practices, less intensive production, and the removal of marginal land from production.

(b) *Soil Quality/Degradation*

The quality of agricultural soils is also linked to agricultural practices. Damage can occur through a number of processes. For example, the intensification of livestock production can contribute to nitrogen content in soil. Farming on marginal land also brings with it dangers of soil degradation which can impair the long-term productivity of the soil. On the other hand, effective crop rotation—growing different crops in succession on the same land—can return organic matter to the soil. Issues related to soil degradation can be remedied through land retirement and the adoption of soil conserving crop management practices such as conservation tillage crop residue management and land retirement. Land degradation reduces agricultural productivity and is thus a major factor affecting food security and poverty reduction in rural areas. Globally, soil fertility declined about 13 per cent between 1945 and 1990. In Central America this figure was 37 per cent and in Africa 25 per cent.²¹

3. Biodiversity

Because agriculture is a major land-using activity it has impacts on biodiversity. These include wildlife habitats and wild species as well as species diversity including crop genetic diversity. Data and other gaps remain about the impacts of habitat contraction, fragmentation or destruction on plants and animals. The relationship between changes in land use and changes in biodiversity are not necessarily proportional and significant effects can arise from small changes. That is, the accumulation of small changes in land cover linked to land use poses the greatest challenge in implementing biodiversity conservation programs. Among the most important cause of biodiversity loss relates to changes in forests. This also impacts communities. It is not easy to quantify the effects of relationships between trade policy reform and conservation policy.²² Nevertheless, there are some important issues that need to be examined as relevant to an IA.

(a) *Wildlife Habitats*

According to the International Union for the Conservation of Nature (IUCN), the single greatest source of biodiversity loss is linked to the loss of habitats and ecosystems. IUCN estimates that habitat loss and degradation affects 89 per cent of all threatened birds, 83 per cent of threatened mammals and 91 per cent of threatened plants.²³ For example, in 1995 agricultural activities in the United States were estimated to affect 380 of over 660 wild species listed as threatened or endangered.²⁴

²⁰ OECD (Agr. Indicators).

²¹ 2002. World Development Indicators.

²² UN CBD paper.

²³ Jeff McNeely and Sara Scherr. 2001. "Common Ground, Common Future". IUCN and Future Harvest. (CEC)

²⁴ OECD. (Agr. Indicators).

The main threats to wild species from agriculture originate from converting grasslands, forests and wetlands to cropland and grazing. In industrialised countries, in particular, the need for increased inputs such as feed grains has led to increasing field sizes, as well as other production related impacts such as diminished crop diversity, fewer crop rotations and the increased use of agrochemicals. In the US Great Plains, for example, 99.9 per cent of native prairie tall-grass and 30 per cent of prairie short-grass has been converted to intensive crop production, much of it corn, soybeans and wheat. At least 55 grassland wildlife species are now listed as threatened or endangered as a direct result and 728 are candidates for listing.²⁵

Land use conversion is often closely associated with deforestation. Tropical rainforests, which contain approximately 50 per cent of the world's biodiversity, have, since 1950, declined by more than 200 million hectares as a result of contributing factors such as ranching and crop cultivation.²⁶ The contribution of agriculture (including crop and livestock production) to deforestation in some regions of the world exceeds the impact of forestry (Box 4) .

Box 4: Estimates of the main causes of deforestation (% of total deforestation)

Region	Crops	Livestock	Forestry
South America	25	44 ¹	10
Asia	50-60	Negligible ²	20
Africa	70	Negligible	20

¹ 70 per cent in Brazil
² Philippines and Indonesia to some extent.

Source: Bruenig, 1991, reprinted from FAO.

(b) *Species Diversity*

Not complete

(c) *Non-Native (Invasive) species*

Not complete

(d) *Crop Genetic Diversity and GMOs*

It is estimated that approximately 7,000 crop varieties are used world-wide to produce food.²⁷ However, modern large-scale agricultural production relies on an increasingly narrow and homogenous group of plant genetic resources for the majority of the world's food output. Modern agriculture tends to emphasise monoculture, which can impact plant diversity through selective cultivation and plant breeding thereby narrowing the genetic base for agricultural products. Today, less than 100 species of plants comprise 90 per cent of the world's total food crops.²⁸

In addition to declining diversity based on the introduction of monoculture, an emerging trend associated with intensive production in some countries is the increasing acceptance of GMOs.²⁹ Some commentators have documented a trend towards the use of open-pollinated seed varieties (OPVs) and

²⁵ Samson and Knopf 1994, cited in Runge and Fox 1999.

²⁶ FAO, Livestock-Environment interactions.

²⁷ CEC 2002.

²⁸ Lori Ann Thrupp. 1998. Cultivating Diversity: Agrobiodiversity and Food Security. World Resources Institute. Washington DC.

²⁹ Genetically modified plant varieties are the result of genetic engineering, and more traditional plant breeding. GMOs were first introduced commercially in the United States in 1996 in corn (maize), cotton and soybean crops. By 1998 more than 500 genetically modified plant varieties were available in the United States accounting for 28 per cent of the areas planted to maize, soybean and cotton, amounting to 2.57 million hectares. In 1998 nearly 40 per cent of the US soybean crop was genetically modified (mainly herbicide resistant) together with 25 per cent of corn and 95 per cent of cotton (mainly insect resistant). Other countries including Canada, Argentina, South Africa, Spain, France, Mexico, China, Australia and Brazil have also planted genetically engineered crops although in far less quantities (Runge and Jackson, 1999).

hybrids, away from local materials. This is particularly acute in industrialised countries, while reliance on traditional materials is still apparent in developing countries.

Increasing reliance on modified plant forms can pose potential risks to the long-term stability of crop production and present the threat of widespread and potentially catastrophic plant/pest disease. The importance of maintaining a base of genetic diversity for agricultural crops is important for developed and developing countries alike.³⁰ The genetic diversity of crop varieties tends to be most important for more marginal and diverse agricultural environments. In developing countries and/or in economics where subsistence farming is an important economic sector, the selection of seeds is often part of producers' strategies to cope with difficult environmental and climatic conditions such as drought, irregular rain fall, frost, winds, pests and poor soil.³¹ Traditional producers operating under these conditions will often rely on various combinations of seed varieties and dates of sowing to ensure a viable crop. Indeed, this use of genetic diversity in production is one of the most powerful resources available to many traditional producers.³²

Despite some opposition to GMOs, particularly in Europe,³³ commercial producers in some developed countries could have an interest in maintaining markets for GMOs. In 1997, combined savings on weed and insect control by producers in Canada and the United States were estimated at \$465 million.³⁴ Some commentators point out that for less developed countries, whose agricultural output is dominated by a single crop due to poor environmental or climatic conditions, genetically modified inputs hold out prospects for diversification in their crop base, including movement towards higher value, export-oriented crops.³⁵

4. Air

(a) Air Quality

Agricultural practices can also impact air quality. For example, impacts from intensive livestock production occur from waste through the release of particulates and methane, but also reactive organic compounds and ammonia. Additional impacts on air can come from ozone-depleting substances such as methyl bromide, a fumigant used for pest control in soil and in storage of commodities.³⁶

(b) Climate Change

Expanding farm production can also have impacts on greenhouse gas (GHG) emissions. In OECD countries agricultural GHG emissions contributed about 8 per cent of total emissions in 1995-1997 (in CO₂ equivalents). The contribution of agriculture to the main GHG, carbon dioxide (CO₂), is only about 1 per cent. However, it accounts for 60 per cent of total OECD nitrous oxide (N₂O), and nearly 40 per cent of methane (CH₄). In developed countries, main contributors are livestock manure and the use of inorganic fertilisers. Methane combined with other gases produced in less volume by livestock (such as carbon dioxide, ozone, nitrous oxide and other trace gases), together form greenhouse gases. Indeed methane itself is considered second only to carbon dioxide in its impact as a greenhouse gas.³⁷ One estimate puts the contribution of livestock to global warming at between 5 and 10 per cent.³⁸

³⁰ This was illustrated during the southern Corn Leaf Blight attack on the US corn crop in 1970. The pest was turned back through the use of plant varieties held in storage by seed companies (Runge and Fox 1999). Seed banks may not substitute for *in situ* conservation of genetic diversity relied upon for much subsistence or traditional production, particularly in countries without the capacity to manage an effective seed bank program.

³¹ Nadal 1999.

³² Garcia Barrios et al., Cited in Nadal 1999.

³³ In Europe opposition to GMOs is particularly strong. In England at least five major food chains have announced their intention to avoid GMO ingredients. In Switzerland, Nestle announced a temporary halt on GMO product use, and Russia announced that after 1 July 1999 any imported GMO product would require testing and licensing (Kinsey 1999 cited in Runge and Jackson 1999).

³⁴ Runge and Jackson 1999.

³⁵ World Bank 1999.

³⁶ WTO 1997.

³⁷ Runge and Fox 1999.

³⁸ Henning *et al.*

Reducing methane from beef depends primarily on improved breeding and feeding technologies and manure storage. In developing countries important contributors are crop residues, biomass burning and wetland rice cultivation. In addition to effects on land, deforestation contributes to global CO₂ emissions.

Agriculture can also play a role as a sink for GHGs by removing carbon from the soil. According to the OECD, improvements in tillage practices, cover cropping and crop residue management in Canada and the United States are resulting in an improvement in the role of agricultural soils as a GHG sink. Indeed, the OECD estimates that about 50 per cent of carbon sequestration can be achieved by adopting soil conservation and improving crop residue management (e.g., reduction of stubble burning), 25 per cent by changing cropping practices (e.g., increases in soil cover), and much of the rest through a combination of land restoration and converting cropland to pasture.³⁹

Indirect, production and processing issues associated with agriculture such as modes of transportation will also have impacts on GHG and climate change. Energy use in intensive farming operations can also be significant and have associated effects on emissions. The US Department of Agriculture (USDA) estimated in 1993 the fuel and electricity component of food at 3.5 per cent of the total costs and transportation at 4.5 per cent.⁴⁰

5. Management/Agrochemical Inputs: Pesticide and Fertilisers

Agrochemicals, including pesticides and fertilisers, have impacts economic issues associated with agriculture through production and yields, as well as all environmental media. The use of chemical fertilisers and pesticides in an effort to increase production can impact soil and water quality. Substitutes for natural vegetation brought about by decreased fallow period, can include the use of fertilisers the construction of drainage and other infrastructure. Such increased use can affect soil quality, and ultimately water quality. Soil is also affected by salinization or the acidification arising from the use of ammonium sulphate is a source of nitrogen in soils. In addition, exposure to agrochemicals can impact human and animal health through their airborne application and through residues in water, soil and food.

Technology and infrastructure can mitigate these impacts by, for example, providing for efficient drainage of salt. But high cost hampers the development and use of these technologies, particularly in developing countries.⁴¹ Additional production strategies that can mitigate impacts are techniques such as integrated pest management (IPM) and the application of other organic techniques to farming.

(a) Integrated pest management

Integrated pest management is a technique that is available to counter any need for increasing use of agro-chemicals. It involves the use of biological controls for pests such as predators and sterile insects. These practices are all relatively labour intensive, require extensive human capital, and do not necessarily contribute to large increases in yields in a competitive market. The use of IPM is one measure that should be factored into consideration of the intensity of pesticide use.

(b) Organic Farming

Not done

C. SOCIAL ISSUES

³⁹ OECD (Agr. Indicators).

⁴⁰ ODA 1995, Table 2-6.

⁴¹ Turrent 1997, Nadal 1999.

Agriculture is rooted in the fabric of many societies. This is true with regard to the very large producers that tend to characterise production in the industrialised world, but where the “family farm” continues to be important to the social fabric of rural communities. It is also tremendously important for countries in the developing world that rely on large amounts of subsistence and traditional production for both domestic consumption and for export and where the vast majority of the population live in rural areas.

Box 5: Social Issues

- Poverty/Farm Income
- Migration/Urbanisation
- Rural Development/Property Rights
- Food Security
- Equity/Gender Equity
- Human Health
- Traditional Knowledge and Culture

1. Poverty/Farm Income

Poverty is overwhelmingly rural, with some 70 percent of the poorest people in developing countries living in rural areas. Twenty-three per cent of the world’s population lives on less than \$1 per day.⁴² Although the number and proportion of poor people in cities are expected to grow rapidly in the next decades, the majority of the poor will continue to live in the countryside. So reducing poverty and ending hunger require attention to the rural economy and to rural development.

According to the World Bank, between 1990 and 1999, rural areas that experienced economic growth also experienced poverty reduction. Over that decade the number of people living on less than \$1 a day fell from 1.3 billion to 1.2 billion, and the proportion of people living in extreme poverty fell from 29 per cent to 23 per cent.⁴³ Most of these gains were made in the two fastest growing regions, East Asia and Pacific and South Asia. However, in Europe and Central Asia, which experienced economic decline over much of the period, both the number and the proportion of people living on less than \$1 a day increased. In Sub-Saharan Africa, the Middle East and North Africa the poverty rate declined slightly, but not fast enough to reduce the number of people living in extreme poverty. In addition, Latin America and the Caribbean, have experienced slow economic growth and poverty reduction

About 900 million of the world’s poor people live in rural areas, most of them farmers, many of them untouched by the yield advances in industrial countries. Yet for many developing countries agriculture is the main source of economic growth, which is the cornerstone of poverty reduction. Therefore, sustainable agriculture and increasing productivity are essential for these countries. Increasing food production to meet the needs of a growing population will create pressures on the environment including pesticide pollution, water table depletion, biodiversity loss, and soil degradation is undertaken without adequate land-use management. Nevertheless, public investment in agricultural research and improved technologies could allow increasing production in developing countries in ways that impact natural resources less harmfully. In the UK, for example, it took more than 1,000 years to increase wheat yields from 0.5 to 2 tones a hectare (in the 1950s) but only 40 years to triple yields to 6 tons a hectare, due to modern technologies.⁴⁴

Degradation of natural resources affects the rural poor more than others because they tend to rely on fragile natural resources for their livelihoods. Overexploitation of natural vegetation, an important factor in production in rural communities in developing countries, may lead to significant loss in income for those communities and the countries.⁴⁵ Falling wages could well put increasing pressure on migration flows, or impose greater pressures on the natural resource base of agriculture as producers either abandon production or increase production. One commentator has estimated that in some developing countries, a macroeconomic adjustment that causes real wages to fall 10 per cent

⁴² 2002. World Development Indicators.

⁴³ World Development Indicators. 2002.

⁴⁴ 2002. World Development Indicators.

⁴⁵ Lopez, 1998.

would cause and increase in area cultivated of about 1.4 per cent.⁴⁶ These pressures can be aggravated by limited access to crop insurance, credit, and technical assistance in many communities.

As economies develop, employment off the farm become more important for providing jobs and reducing poverty. Workers follow a diverse array of opportunities, often sending much of their income back home. The new activities, generally linked to agriculture and infrastructure, contribute 30-50 per cent of total income in rural areas. The new activities off the farm provide work in the slack periods of the agricultural cycle. Studies of African farm households suggest that 15-65 per cent of farmers also work off the farm and that 15-40 per cent of family labour hours go to such income-generating activities. Much non-farm activity in developing countries, especially that of women is not taken into account. Attempts to alleviate poverty through off-farm work contributes to migration and urbanisation with the related sustainability issues associated with those issues (see below).

2. Migration/Urbanisation

Important migration can affect the health of rural communities and institutions as well as reduce the human capital available for production and maintenance of the land, both of which are labour intensive in many developing countries. Environmental degradation is both a cause and an effect of migration. Populations can migrate away from marginal lands in search of more fertile ground or economic adjustments with regard to the allocation and pricing of national resources can result in migration from rural to urban areas. In the countryside, excessive migration means that rural populations decline and households get smaller, affecting social networks, community institutions and land use and conservation practices.⁴⁷ This can lead, among other things to a decline in productive rural populations. Moreover, a number of traditional agricultural practices and sustainable production methods such as terracing, minimum tillage practices and contour plowing rely on labour intensive maintenance. When terraces are abandoned, for example, severe storms can cause erosion.

Migration into cities can also affect the health of urban centres. By 2005, over half the world's people will live in cities. In Latin America and the Caribbean 75 per cent of the population already lives in cities. This figure is expected to climb to 83 per cent by 2030. Comparable figure for Asia and the Pacific are 37 and 53 percent and for Africa are 38 and 55 per cent. Twenty cities now have populations over 10 million.⁴⁸ In the next 30 years almost all population growth will be concentrated in urban areas. The pace will be fastest in developing countries, where the urban population is forecast to increase from 1.94 billion to 3.88 billion. The number of people in African cities will jump from 297 million to 766 million or more than the total populations today. In Asia the urban population will almost double from 1.35 billion to 2.61 billion.⁴⁹ Sustainability impacts that may result from increasing urbanisation include rising urban poverty rates. In many parts of the developing world in particular, urban poverty rates already exceed 50 per cent.⁵⁰

In addition, farmers in countries experiencing rapid urbanisation may face the challenge of supplying growing urban populations with an affordable and safe food supply. Food distribution chains may be inadequate to deal with the additional strains of having to supply increasing urban populations. In some areas of the world, urban sprawl is encroaching on prime agricultural land. This tends to move production further away from centres. In some parts of the world, long distances, bad roads, and poorly maintained trucks already cause spoilage of 10 to 30 per cent of produce. Where these and other services (such as storage facilities or slaughterhouses) are already under pressure, increased costs will be associated with investment necessary to produce and transport food safely over longer distances to service urban populations. With these populations growing at rates of up to 10 per cent per year these costs may be prohibitive for many countries.

⁴⁶ Lopez 1998.

⁴⁷ See Nadal 1999.

⁴⁸ FAO.

⁴⁹ 2002. World Development Indicators.

⁵⁰ FAO.

3. Rural Development/Property Rights.

Access to quality services and physical infrastructure is often worse in rural areas than in urban areas, with or without poverty. An urban bias, particularly in developing countries, imposes substantial costs on almost all rural economic activity and development.⁵¹ The physical infrastructure, such as transport, energy, and water supply, available for agricultural production in rural areas remains limited. Similarly, access of rural populations to electricity, in-house water supply and telephones is limited, and of the 2.4 billion people in the world without access to improved sanitation, 2 billion live in rural areas.⁵² This lack of infrastructure and access to basic services is ultimately bad for markets, which thrive on good transport and information.

Property rights regimes can also impact the way land is cultivated, providing resources for environmental supports or encouraging a respect for values other than short-term profitability. Some commentators question the effectiveness of communal forms of property in achieving a socially efficient allocation of natural resources while others are of the opinion that communities are able to develop controls on the use of common property resources to allow for their efficient exploitation. This is dependent, in part, on the strength of local institutions and communal controls and their ability to prevent individual farmers from overexploiting the natural resources without accounting for the social or environmental costs of cultivation and clearing the land.

4. Food Security

All countries, and in particular developing countries, consider food security to be an important issue. Yet, in a number of countries, unsustainable expansion of agricultural production into new areas, driven by short-term population pressures and food needs, takes priority over long-term issues of resource conservation. Coupled with little institutional or legal pressure to constrain this process so as to protect the resources, such expansion could reduce the capacity of countries to provide for longer-term food security.

The rise in food production has outpaced population growth in all regions except Africa. Most of the increase in production has been achieved through efficiencies requiring small increases in cropland. However, productivity gains have led to falling food prices which can serve as a disincentive to produce. In other cases it can further encourage excessive production, for domestic consumption and for export. Food security is associated with a wide range of variables including food availability, access to food, food consumption and nutritional status (Box 6).

Millions of people in developing countries still need emergency food assistance as a result of natural and human-caused disasters. According to FAO's latest estimate, there were 815 million undernourished people in the world in the period between 1997 and 1999. 777 million of these were in developing countries, 27 million in countries in transition and 11 million in developed market economies.⁵³ More than half the undernourished people (61 per cent) are found in Asia, while sub-Saharan Africa accounts for almost a quarter (24 per cent). In terms of the percentage of undernourished people in the total population, sub-Saharan Africa, where it is estimated that one-

Box 6: Variables associated with food security	
Factors	Variables
Food Availability:	Food Production Food Imports Food Storage
Access to Food:	Poverty Market Integration Access to markets
Food Consumption:	Food use practices Food intake
Nutritional status:	Anthropometry Micronutrient deficiency
Source: 2002. World Development Indicators.	

⁵¹ 2002. World Development Indicators.

⁵² 2002. World Development Indicators.

⁵³ FAO 2002.

undernourished in 1997-99. Sub-Saharan Africa is followed by Asia and the Pacific where 16 per cent of the population are undernourished. Globally, over 150 million children under five are malnourished, because of low incomes and poor food distribution.⁵⁴

A range of mechanisms is considered important for countries considering food security. For example, trade is one means, through imports, and increasing exports to finance imports. Other mechanisms are stockpiling, and increasing domestic production. In some countries support and some degree of protection might be necessary to protect and encourage domestic production.

5. Gender Equity

Agriculture is a sector that relies on a higher proportion of women in the workforce than men, in many communities. In many countries and regions, women have a significant role in both farming and post harvest activities. Often a complex set of rights and obligations reflecting social and religious norms prevail in rural communities which dictate the division of labour between men and women and act as constraints to women farmers. In Sub-Saharan Africa, for example, women contribute between 60 and 80 per cent of the labour for food production, both for household consumption and for sale. Population pressures and off-farm employment opportunities for men have led to an increasing proportion of women becoming *de facto* farm managers, and women tend to work longer hours than men.⁵⁵

Despite this important contribution, women do not always have the same access as men to land rights, capital, access to inputs such as fertiliser, support services and credit. This disparity results in differentials in productivity to the detriment of women. In some countries, access to education allows more men to find off farm employment, while women are seldom able to find off-farm work.⁵⁶ In sub-Saharan Africa women are particularly disadvantaged compared with men because they farm smaller plots of land with more uncertain tenures. Women's access to land is further limited by legal and institutional and customary factors that mitigate against their owning or inheriting land.

6. Human Health/Farmworker Health and Consumer Health

Agricultural practices can influence food quality and safety and impact human health. A number of the agro-chemicals used in agriculture fall into categories classified by the World Health Organization as extremely or highly hazardous to human health.⁵⁷ Appropriate protection such as adequate protective clothing, masks and eye shields may not always be available to farm workers applying agro-chemicals with backpack and other sprayers.⁵⁸ One study conducted by FAO in the Philippines indicated a high frequency of eye, skin and respiratory problems amongst rice farmers using pesticides and showed that the probability of these problems rises by 30-50 per cent even with low pesticide use.⁵⁹

In addition to direct contact with farm workers, residues from agro-chemicals can lead to high nitrate levels in drinking waters as well as soil contamination which can affect both animal and plant habitat and populations, as well as human health. Depending on the method used for application the impact of pesticides may not be confined to their area of application. Where spraying occurs using low-altitude aircraft or tractor drawn applicators, residues can be transmitted long distances in the atmosphere or in water. There is also evidence that residues from agro-chemical use exist in food, such as rice grain, that poses risks to consumers.

⁵⁴ 2002. World Development Indicators.

⁵⁵ FAO 2002.

⁵⁶ FAO 2002.

⁵⁷ FAO. Basic Foodstuffs report. P. 40.

⁵⁸ Nadal 1999.

⁵⁹ FAO, Basic Foodstuffs, p. 40

7. Traditional Knowledge and Culture

In many cases, the rural poor, living at the margin of subsistence, in ecologically vulnerable areas have assets that include social ties and an understanding of their local conditions. The community structures and institutions that support labour intensive production practices will be affected by migration and other forces induced by changing production practices. Excessive migration can lead to intergenerational divisions and a loss of traditional knowledge, for example, with respect to the use of genetic resources.⁶⁰ Even in cultures that are very resilient, the traditions handed down from one generation to another can be weakened by the spread of ideas, goods and advertising from abroad.

D. AGRICULTURE AND TRADE

Agriculture is a critical sector for world trade. In 2001 world trade in agricultural was value at \$547 billion and agricultural products represented close to 10 per cent of the global trade in merchandise and over 40 per cent of global trade in primary products.⁶¹

1. Trade Flows

Agricultural trade is important for all regions of the world, with the possible exception of the Middle East. In 2001, its relative importance in terms of share of exports in merchandise trade is highest in Latin America (18.1 per cent), Africa (14.7 per cent), and North America (10.5 per cent) all of which exceed the world average of 9.1 per cent (Table 4).

Table 4

Share of Agricultural Product Share in Trade (by region, 2001)					
Share in total Merchandise Trade, %			Share in total Primary Products trade %		
	Exports	Imports		Exports	Imports
World	9.1	9.1	World	40.9	40.9
North America	10.5	6.0	North America	58.3	32.7
Latin America	18.1	9.3	Latin America	45.6	45.7
Western Europe	9.2	9.9	Western Europe	56.0	46.6
C./E. Europe/Baltic States/CIS	8.7	10.5	C./E. Europe/Baltic States/CIS	21.0	43.1
Africa	14.7	15.3	Africa	20.5	56.9
Middle East	3.3	13.4	Middle East	4.3	62.2
Asia	6.7	9.7	Asia	46.7	35.0

Source: WTO International Trade Statistics 2002, table IV.5, includes trade between EU members.

In terms of its importance in share of exports of primary products, North America (58.3 per cent), Western Europe (56.0 per cent), Asia (46.7 per cent) and Latin America (45.6 per cent) all rank above the world average of 40.9 per cent. These share rankings indicate in part the relative dominance of the developed regions of the world in global merchandise trade.

The United States was, in value and volume terms, by far the largest single country exporter of agricultural products in 2001. The US share of the global market has diminished by 3.8 per cent since 1980 but at \$77.27 billion, the value of its exports of agricultural products is still almost twice that of second place France, whose exports were valued at \$41.51 billion in 1997. The highly-industrialised economies including the EU and the United States were overwhelmingly dominant as both exporters and importers of agricultural products in 2001. However, the relative importance of agricultural trade to economies in Asia, Latin America and Africa is rising and increasingly non-OECD countries such as Brazil, China and Argentina rank among leading exporters and importers (Table 5).

Table 5

⁶⁰ See Nadal 1999.

⁶¹ WTO International Trade Statistics 2002, table IV.3, includes trade between EU members

Top 15 agricultural exporters and importers (2001)					
	Value \$bn	Share in world %		Value \$bn	Share in world %
Exporters			Importers		
EU members	213.53	39.0	EU members	235.51	39.7
EU to rest of world	57.81	10.6	EU to rest of world	79.78	13.5
United States	70.02	12.8	United States	68.40	11.5
Canada	33.57	6.1	Japan	56.94	9.6
Brazil	18.43	3.4	China	20.12	3.4
China	16.63	3.0	Canada ^c	15.55	2.6
Australia	16.56	3.0	Mexico	12.79	2.2
Argentina	12.20	2.2	Korea, Rep. Of	12.50	2.1
Thailand	12.06	2.2	Russian Federation ^a	11.40	1.9
Mexico	9.07	1.7	Hong Kong, China retained imports	11.06 6.43	- 1.1
Russian Federation ^a	8.17	1.5	Taipei, Chinese	6.99	1.2
New Zealand	7.97	1.5	Switzerland	5.65	1.0
Malaysia	7.19	1.3	Indonesia	5.35	0.9
Indonesia	7.02	1.3	Saudi Arabia	5.01	0.8
Chile	6.97	1.3	Malaysia	4.83	0.8
India ^b	6.41	1.2	Thailand	4.83	0.8
Above 15	445.80	81.4	Above 15	472.32	79.6

Source: WTO International Trade Statistics 2002, table IV.8 "EU members" includes trade between EU members. ^a Includes WTO Secretariat estimates. ^b 2000 instead of 2001. ^c Imports are valued f.o.b.

Within agriculture, international trade in livestock and livestock products accounts for about one sixth, by value, of all agricultural trade. Meat exports - mainly of bovine, pig and poultry meat - make up about half the total value. As a group, the developed countries account for more than three-quarters of world trade in livestock and livestock products. As a group, developing countries are net importers, with dairy produce being the biggest single import item. At the same time, consumption of livestock and livestock products in the developing world is expanding rapidly, presenting new market opportunities for both exporters and domestic producers.

World cereal trade in 2001-2002 was forecast to reach 236 million tonnes, 2 million tonnes higher than in the previous season. Overall, aggregate cereal imports by the developing countries were expected to change little compared with the previous season's level, but imports by the low-income food-deficit countries were likely to increase by some 1.8 million tonnes, to 74 million tonnes, reflecting higher imports by several countries in Asia.⁶²

Since the 1990s developing countries, whose share of world industrial exports has been increasing steadily, have not managed to increase their share of agricultural exports. Many developing country exports still face high tariffs and other barriers in developed country markets and their attempts to develop processing industries are hampered by tariff escalation. This is particularly problematic for the least developed countries, where agriculture often constitutes the single most important sector in the economy.

Nevertheless, WTO statistics show that developing countries as a whole have seen a significant increase in agricultural exports.

A number of developing countries that depend on imports for their food supply are concerned about possible rises in world food prices as a result of reductions in subsidies in industrialised countries. Although higher prices can benefit farmers and increase domestic production, the WTO has attempted

⁶² FAO 2002.

to address concerns of net-food-importing countries through instruments such as the Decision on the Possible Negative Effects of the Reform Programmes on Least Developed and Net-Food Importing Developing Countries. As a result of this decision the Food Aid convention was recently renegotiated and concluded in July 1999 in the International Grains Council.

2. Trade Rules

Since 1994, global agricultural trade has been governed at the multilateral level by the Uruguay Round's Agreement on Agriculture, which imposed broad, binding, disciplines upon farm trade and brought the sector under the WTO for the first time. The Agreement on Agriculture converted non-tariff barriers into tariff equivalents and bound all tariffs. It also subjected export subsidies on agricultural production to disciplines. In addition, domestic policies that affect production of, and trade in, agricultural products became subject to a set of rules and bindings with the aim of disciplining these policies and making them more transparent.⁶³ Nevertheless, agricultural markets remain heavily protected compared to other sectors such as manufacturing. While tariff levels for manufacturing average between 5 and 10 per cent among WTO members, agricultural tariffs average around 40 per cent.

The 1994 Agreement on Agriculture was the first phase in what has become a lengthy process for trade-related reform in this sector. Article 20 of the Agreement on Agriculture commits WTO members to continue negotiations to reform agricultural trade. Further to Article 20, negotiations commenced at the beginning of 2000. The negotiations seek to achieve reform that results in "substantial progressive reductions in support and protection resulting in fundamental reform." Phases I and II of the negotiations have been completed and in late 2002 WTO members entered Phase III.⁶⁴

Box 7: The Doha Ministerial Declaration and agriculture

In November 2001 the fourth WTO Ministerial Conference was held in Doha, Qatar. The Doha Declaration, issued on 14 November 2001, launched new negotiations affecting a range of subjects. It reconfirmed the WTO's commitment to its long-term objective of establishing a fair and market-oriented trading system through fundamental reform encompassing strengthened rules and specific commitments on support and protection. It confirmed and elaborated on the objectives of the agricultural negotiations, making them more explicit and building on the work already underway. It also set out a timetable with deadlines and agriculture became part of the single undertaking whereby virtually all the negotiations will end by 1 January 2005.

At Doha, WTO Members committed themselves in particular to comprehensive negotiations to achieve substantial reforms in market access, reductions of export subsidies (with a view to phasing them out), and substantial reductions in domestic supports that distort trade. The ministers made special and differential treatment for developing countries integral in new commitments and in any relevant new or revised rules and disciplines. The outcome should be effective in practice and should enable developing countries to meet their needs, particularly those associated with food security and rural development. The ministers also took note of non-trade concerns including environmental protection and confirmed that non-trade concerns will be factored into the agricultural negotiations. Modalities for further commitments, including provisions for special and differential treatment, are to be established no later than 31 March 2003.

⁶³ Other WTO agreements that have important impacts on agricultural trade include the Agreement on Subsidies and Countervailing Measures (SCM), the Agreement on Sanitary and Phytosanitary Measures (SPS), the Agreement on Technical Barriers to Trade (TBT) and the Agreement on Export Licensing. The SPS Agreement, for example, provides for countries to take measures to protect human, animal and plant health while at the same time establishing rules to prevent countries from using arbitrary and unjustified health and environmental regulation as disguised barriers to trade.

⁶⁴ Phase III of the negotiations focuses on modalities.

II. SETTING THE STAGE

A. PURPOSE

The *Reference Manual* points to the need, at the outset, to articulate the purpose of the IA. This will guide choices to be made in the subsequent stages of implementation and policy recommendations. Integrated assessment of trade-related policies or trade liberalisation agreements can have various or multiple purposes. Five potential purposes associated with an IA (Box 8) are described in detail in Section II of UNEP's *Reference Manual*.

In the context of this Handbook, specific references can be highlighted. From a planning perspective, the focus may be on informing the negotiators about existing possibilities to assess the options open to them and on the possible consequences of these options. The Handbook could also help develop policy packages using what may be likely to emerge from the negotiations, in order to promote agricultural trade that promotes sustainability.

Box 8: The aims of integrated assessment

- Clarifying the linkages between trade, environment and development
- Informing policy makers throughout Government
- Informing negotiators
- Developing policy packages
- Increasing transparency in decision-making

Work remains to be done to clarify the relationships and develop credible and comprehensive approaches to analysing the interrelationship between trade, environment and development. Integrated assessment of trade-related policies can clarify the linkages between trade, environment and development. In the long term, a better understanding of these relationships can encourage policy makers to develop, and stakeholders to support, sustainable development strategies and policies. Integrated assessments can contribute to this.

In the context of present and future negotiations and policy development in the agricultural sector, including associated policy reform in key regional trading blocs such as the EU (on the CAP, for example), integrated assessments can contribute to informing policy makers throughout government of the implications of proposed trade policies and the directions of the relevant reforms through intragovernmental co-operation and capacity building.

An IA undertaken in advance of, or in parallel with, trade negotiations can contribute to policy in a number of ways. First, it can help the country or region that has undertaken the assessment to identify policy priorities and put forward an integrated negotiating position. It could also direct the pace and/or scope of trade liberalisation, which includes the proper sequencing of trade liberalisation to ensure that effective national environmental policies exist in vulnerable sectors. If undertaken comprehensively, the results of an integrated assessment can help countries develop trade policies in a co-ordinated way that reflects the interdependence of economic, environmental and social goals. An integrated assessment that includes all relevant government departments should help to build capacity and consensus within government.

An integrated assessment can contribute to the policy process in this context through identifying sustainability issues associated with the trade agreement and in particular the modalities for specific liberalisation. It can also help through its participatory process identify a range of issues that reflect the political and economic interests of various non-public sector communities. Recently the rising interest of the general public in trade have involved special processes, conducted by legislative and other bodies, to solicit the views of a broad array of stakeholders.

The results of an integrated assessment can assist countries to design complementary economic, environmental and social policies at the national level to accompany the trade-related policy or agreement, as well perhaps at the international level. These policies can be designed to promote any beneficial impacts of the trade related policy or trade liberalisation agreement, or to mitigate any negative impacts. Additional policies could be implemented as necessary as a result of monitoring or review processes. In some cases such policies could be useful to assure public support for liberalisation at home. Likewise, at the international level, they can help build confidence and trust in trade liberalisation process. In both cases the implementation of appropriate policies can support sustainability.

Finally, the opportunity to involve non-governmental actors in the process should help strengthen national capacities and incorporate the inclusion of multiple points of view in the decision making process. At a time when national governments and international institutions are receiving calls for reform of policies

that govern openness and transparency in trade-related matters, such an approach might help allay fears based on lack of information.

B. FOCUS

At the outset of an integrated assessment the focus of the study should be clearly defined and delineated. Typically, an IA will have as its subject a specific trade related policy or agreement. This Handbook refers often to the WTO's AoA. Key provisions in the AoA will influence bilateral and regional trade agreements that are negotiated, where countries seek to ensure consistency with WTO rules. Therefore, while many of the issues suggested in this Handbook are taken from the WTO's Agreement on Agriculture, they are broadly applicable to other trading relationships where similar themes will emerge. This is true also for countries that are not members of the WTO. These countries might nevertheless wish to undertake an IA of agriculture and issues such as market access, domestic support or export competition might be applicable in the context of other bilateral and regional trading arrangements.

1. Issues for Negotiation

Key issues associated with agricultural negotiations should be considered in an IA. In broad terms, negotiations that aim to contribute to further liberalisation of agricultural trade can be broken down into the following general categories:

1. Market Access: Tariff Reduction and Tariff rate quotas
2. Export and Competition
3. Domestic Support

Box 9: Status of negotiations at the WTO

Phase One occurred between March 2000 and March 2001. Proposals were submitted from 121 countries or 85 per cent of the WTO's membership. Phase Two was launched at the stock-taking meeting on 26-27 March 2001 and lasted until February 2002.

Phase Two consisted of detailed discussion on the issues raised in the first phase, organised by topic. The meetings were "informal" with no official record except for the chairperson's summary. Papers are usually off-the-record "non-papers".

In March 2002 WTO Members entered into the phase of negotiations on the AoA which will develop commitments on modalities. Modalities are essentially targets (including numerical targets) for achieving the objectives set out in the Doha Declaration: "substantial improvements in market access; reduction of, with a view to phasing out, all forms of export subsidies; and substantial reductions in trade distorting domestic support." The modalities will be used for members to produce their first offers to "comprehensive draft commitment."

The Doha Declaration sets a deadline for the development of a draft commitment as no later than the Fifth Ministerial Conference, which will be held in Cancun, Mexico in September 2003, and will include a stock-taking session.

In addition to these broad categories, there are a range of ‘other’ issues that will be part of the negotiations, at least at the WTO. Special treatment for developing countries will be an important part of the discussion on modalities for export subsidies/competition, market access and domestic support; and non-trade concerns will be taken into account. In addition, an IA should take into consideration a number of conditioning factors that could affect trade independently of new rules on liberalisation. These include, *inter alia*, other international trading regimes, macroeconomic and microeconomic factors and prices.

(a) *Market Access: Tariff Reduction and Tariff Rate Quotas*

Market access typically includes tariffs, tariff rate quotas, tariff quota administration, special safeguards, importing state trading enterprises and other issues. In general, the tariff levels on manufactured goods imported into developed countries are now low, with access limited through administrative protection such as supply management schemes, product standards or other non-tariff measures. In order to support higher domestic prices, import duties or quotas are sometimes erected so that the schemes are not undermined by cheaper imports.

In developing countries, protection tends to be higher and access to local markets for goods and services remain more restricted. The UR lowered some barriers to access for developing countries into developed countries through limits on import restrictions, in exchange for developed country access to markets of developing countries through lower tariffs. Agricultural exports are a much higher share of total exports for most developing countries than developed countries. The incidence of high tariffs in agriculture relative to manufacturing is of concern for exporting countries. A number of developing countries also face issues associated with tariff escalation—the imposition of higher duties on processed products to protect domestic processing industries—which, can hamper the development of processing industries in countries that produce raw materials.

Agricultural products are protected only by tariffs as all non-tariff barriers had to be eliminated or converted to tariffs as a result of the Uruguay Round (UR) through a process known as tariffication whereby all import bans, quotas, and other restrictive measures were converted to bound tariffs. Despite the AoA, many agricultural tariffs remain high, and tariff levels tend to increase with the degree of processing undertaken. According to the OECD, recent estimates indicate that average agricultural tariffs are in the region of 60 per cent compared to industrial tariffs that rarely exceed 10 per cent.⁶⁵

In some cases, the calculated equivalent tariffs were too high to allow any real opportunity for imports. A system of tariff-rate quotas (TRQ) was created to maintain existing import access levels, and to provide minimum access opportunities.⁶⁶ Lower tariffs were applied to imports below a certain quantitative limit (in-quota rate), and higher rates (out-of-quota) applied to imported goods after the quote had been reached. Discussion since the UR has focused on the high levels of tariffs outside the quotas, as well as the quotas themselves.⁶⁷

Box 10: Multilateral Market Access Regime

The 1994 Agreement on Agriculture provided for average tariff cuts for all agricultural products of 36 per cent for developed countries in the six years between 1994 and 2000, and 25 per cent for developing countries over ten years (1994-2004). It also provided for minimum reductions per product of 15 percent for developed countries (1994-2000) and 10 per cent for developing countries (1994-2004).

The market access negotiations covering tariffs include both tariffs on quantities within quotas and those outside. Several countries want the negotiations to deal with tariff quotas: to replace them with low tariffs, to increase their size, to sort out what they consider to be restricting and non-transparent

⁶⁵ OECD Policy Brief, 2001.

⁶⁶ Forty-three WTO members currently have a combined total of 1,425 TRQs in their commitments.

⁶⁷ In general, OECD countries’ TRQs are under-utilised—the average OECD rate of utilization (fill rate) has fallen over time, from 67 per cent in 1995 to 57 per cent in 1999.

allocation methods, or to clarify which methods are legal or illegal under WTO rules in order to provide legal certainty.

Exporters are concerned that their ability to take advantage of tariff quotas can be handicapped because of the way the quotas are administered. Sometimes they also complain that the licensing timetables put them at a disadvantage when production is seasonal and the products have to be transported long distances. Increasing minimum access under tariff-quotas, and setting a ceiling on the maximum rate of tariff or tariff equivalents would be in the interest of most exporting countries and would lead to rising world prices of some agricultural commodities.

Some countries see tariffs and other import barriers as necessary in order to protect domestic production and maintain food security. Some developing countries say they need flexibility in deciding the level of import duties they charge to protect their farmers against competition from imports whose prices are low because of export subsidies.

In the area of market access, measures for special and differential treatment are being considered for developing countries, new WTO members and economies in transition. Some developing countries consider that their tariff should be conditional on the reduction by developed countries of trade-distorting domestic support and export subsidies. Small, "single commodity" exporters are calling for their trade preferences in developed countries to be preserved and strengthened, while some countries find that certain preference schemes unfairly discriminate against other developing countries.

Safeguards are an important issue related to market access. They are contingency restrictions on imports taken temporarily to deal with special circumstances such as a sudden surge in imports. At the WTO, the Agriculture Agreement has special provisions on safeguards that differ from normal safeguards as follows:

- higher safeguards duties can be triggered automatically when import volumes rise above a certain level, or if prices fall below a certain level; and
- it is not necessary to demonstrate that serious injury is being caused to the domestic industry.

The special agricultural safeguard can only be used on products that were tariffed — which amount to less than 20 per cent of all agricultural products. They cannot be used on imports within the tariff quotas, and they can only be used if the government reserved the right to do so in its schedule of commitments on agriculture.⁶⁸ In practice, the special agricultural safeguard has been used in relatively few cases. As part of the agricultural negotiations, proposals range from continuing with the provision in its current form, to its abolition, or its revision to prevent its use on products from developing countries. Some developing countries have proposed that only they would be allowed to use special safeguards — developed countries would not be allowed to do so. The right to use the special agricultural safeguard will lapse if there is no agreement in the negotiations to continue the "reform process" initiated in the Uruguay Round.

⁶⁸ 38 WTO members currently have reserved the right to use a combined total of 6,072 special safeguards on agricultural products. The numbers in brackets show how many products are involved in each case, although the definition of what is a single product varies. (WTO)

(b) Export Subsidies and Competition

Export subsidies are one response to lower prices, higher supports, and surpluses that tend to be generated by domestic support schemes. Export subsidies have traditionally been used to remove surpluses and their price depressing effect from the market. The subsidised exports of surpluses from developed countries can depress prices on the international market, with heavy consequences for farmers in developing countries. Export subsidies are an issue for other countries to the extent that they affect world prices and market conditions. For potential agricultural exporting countries export subsidies reduce prices and make it difficult for countries that do not use them, to compete. For importers, they can bring short-term benefits in terms of lower import prices. The key difference in interests among those developing countries with interests in agricultural trade lies between those who are net importers and those who are net exporters. There is a strong interest on the part of developing countries exporting agricultural commodities to devise rules to prohibit export subsidies.

Box 11: Export subsidies in the AoA

The 1994 Agreement on Agriculture disciplined export subsidies in agriculture but did not ban them. The Agreement reduces the value of export subsidies (outlays) by 36 percent over the six years between 1995 and 2000 for developed countries, and by 24 per cent over ten years (1995-2004) for developing countries. The Agreement also reduces the volume of subsidised exports by 21 per cent in developed countries between 1995 and 2000 and by 14 per cent in developing countries over the ten years between 1995 and 2004.

Least-developed countries do not have to reduce subsidies.

Countries using export subsidies

In brackets are the numbers of products involved for each country.

Australia (5)	Iceland (2)	Romania (13)
Brazil (16)	Indonesia (1)	Slovak Rep (17)
Bulgaria (44)	Israel (6)	S Africa (62)
Canada (11)	Mexico (5)	Switz.-Liech. (5)
Colombia (18)	New Zealand (1)	Turkey (44)
Cyprus (9)	Norway (11)	United States (13)
Czech Rep (16)	Panama (1)	Uruguay (3)
EU (20)	Poland (17)	Venezuela (72)
Hungary (16)		

The AoA includes certain temporary exemptions for developing countries, allowing them to subsidize marketing, cost reduction and transport (Art 9.4)

Source: WTO.

Only 25 WTO members use export subsidies (Box 11). They are only allowed for products on which commitments have been made to reduce the subsidies and countries without commitments are prohibited from subsidising agricultural exports. A select group of countries continue to apply high levels of export subsidies in specific focused on specific agricultural products and commodities. For example, subsidised exports account for an important share of world trade in dairy products.

Some developing countries argue that domestic producers are handicapped in the face of imports that are subsidised both at home and in export markets. This group includes countries that are net food importers. The net food importing countries would also benefit from an adjustment period if world prices rise as a result of negotiations to eliminate export subsidies abruptly. The elimination of export subsidies over a longer period of time might help net food-importing countries and least developed countries adjust to the prospect of higher food bills.

In addition many countries would like to extend and improve the rules for to preventing governments circumventing their commitments on export subsidies through the use of instruments as state trading enterprises, food aid and subsidised export credits. However, in some developing countries, state trading enterprises might fill gaps where the private sector is too weak to trade or to compete with large foreign traders, or might serve government objectives such as food security.

(c) Domestic Support

Growing agricultural trade in the post-war era has in part resulted from agricultural and related trade policies which have artificially supported the prices of some crops relative to others, and subsidised the prices of many inputs such as water, fertilisers and pesticides. Rates of support have decreased in a number of OECD countries since 1997, but overall producer support continues to rise among developed economies, in some cases exceeding 50 per cent of the value of production. In many industrialised countries and economies in transition, production subsidies have encouraged

environmentally destructive farming, including the use of chemical fertilisers and pesticides and the abandonment of traditional practices such as rotating crops and fallowing fields. These shifts can accelerate soil erosion and the accumulation of chemicals in lands, water, threatening the long-term stability of global agriculture.

The OECD estimates that agricultural policies in industrialised countries cost consumers and taxpayers over \$300 billion every year; farmers receive more than one third of their incomes from government programmes. According to the OECD, these supports reduce economic efficiency and disrupt international markets, at the expense of competitive suppliers, including those in developing countries, often failing to protect farmers and harming the environment.⁶⁹

Domestic support measures can include subsidies directed towards crops under programmes that support domestic agricultural prices at levels higher than prevail in world markets. They can also include input subsidies such as those used to purchase chemical and other inputs. Subsidies might also provide farmers with access to natural resources such as land and water at costs that are lower than market values.

Where subsidies are directed at specific crops, levels of price support will affect decisions that are taken at the farm level on what crops to plant. Thus, farmers will make decisions about what to plant and how much in response to government programs as well as market forces. In the past, government price support payments have encouraged a commodity mix narrower than would be the case if payments were not restricted to certain crops. This can have important environmental implications as well as economic implications. Payments directed at one crop can encourage excess, intensive, cultivation of the subset of commodities receiving the support. Excess production reduces the diversity of cropping practices on the farm and encourages continued planting of crops with reduced rotations. If government payments are based on a farm's average yield, farmers will be inclined to raise yields, beyond the point that market forces might dictate. Payments have traditionally been made on units of production. This creates an incentive to maximise yields per hectare and can lead to extremely high levels of fertiliser and other chemical inputs.⁷⁰ Subsidisation based on production does not favour the small family farm or traditional methods or production, and creates surplus.

Input subsidies include subsidies to purchase chemical and other inputs, or the use of natural resources such as land and water (for irrigation) at costs substantially lower than market values (Box 12). In developing countries, one estimate suggests that \$13 billion is lost per year on public irrigation projects. Similar schemes are often available for use of federal lands for grazing. Domestic schemes that include low fees for grazing on public lands exist in North America and Australia. These practices can encourage environmentally destructive farming and overgrazing.⁷¹

Box 12: Example of domestic support

In California's Central Valley, some farmers can buy a thousand cubic metres of water from a federal project—enough to irrigate a few hundred square metres of vegetables—for \$2.84 even though it cost the government \$24.84 to deliver it. Because of the fertile soil and favorable climate, however, the water is actually worth between \$80 and \$160 in the valley, based on what farmers pay for water from the state government.

Level of agricultural subsidies in developing countries have been found to correlate clearly with higher rates of pesticide and fertiliser use, thus increasing the potential for water pollution and soil degradation.⁷² A number of commentators have noted that domestic input subsidies effectively amounts to “paying the polluter”.⁷³

⁶⁹

⁷⁰ Runge 1994.

⁷¹ Malin 1996.

⁷² Repetto 1995; Malin 1996.

⁷³ Anderson; Runge.

In developing countries farmers are typically taxed rather than subsidised; that is, their product is extracted at below market prices—food prices are held below market levels in response to the political influence of urban consumers and to suppress the cost of living of the urban poor and generate revenue for industrial expansion.⁷⁴ While these policies can depress production, they do not necessarily conserve natural resources and do not necessarily result in reduced output. In order to maintain per capita levels of living at the household level, these farmers are often forced to use their resources at rates that are ultimately unsustainable. Poor farmers might be compelled to farm marginal lands subject to erosion and runoff, or to clear forests, in order to earn a subsistence level of income. In some cases subsidies are paid to reduce the costs of inputs and increase yields, leading to their over-application and consequent soil and water contamination.

The 1994 Agreement on Agriculture includes reductions in both the values of subsidies and the volume of subsidised exports. Rules were put in place to reduce distortions caused by support payments and encourage reform away from the most trade-distorting forms of support, towards mechanisms and instruments deemed to be minimally or non-trade distorting. At the WTO subsidies are typically identified as green (permitted), amber (slow down) and red (restricted) boxes. However, the Agreement on Agriculture has no red box—it includes an amber box, a blue box and a green box.

Box 13: Countries that can use the amber box

Argentina	Hungary	Papua New Guinea
Australia	Iceland	Poland
Brazil	Israel	Slovak Republic
Bulgaria	Japan	Slovenia
Canada	Jordan	South Africa
Chinese Taipei	Korea	Switz.-Liechtenstein
Colombia	Lithuania	Thailand
Costa Rica	Mexico	Tunisia
Croatia	Moldova	United States
Cyprus	Morocco	Venezuela
Czech Republic	New Zealand	
EU	Norway	

Source: WTO.

(i) Amber Box

Domestic subsidies that are classified in the amber box are the most distorting forms of support and are subject to reduction requirements. The impacts of these measures are expressed in the aggregate measures of support (AMS).⁷⁵ AMS is a numerical measure representing domestic policies considered to have the greatest potential to affect production and trade—those that are considered trade-distorting. The AMS is defined as “the annual level of support, expressed in monetary terms, provided for an agricultural product in favour of the producers of the basic agricultural product or non-product-specific support provided in favour of agricultural producers in general.”

The AMS is subject to a number of exemptions. In particular, the Uruguay Round carved out two categories of exemption from the calculation of AMS and therefore sheltered them from the application of the GATT rules. They are the so-called “blue box” and “green box” policies.

(ii) Blue Box

The blue box includes domestic support measures that are tied to programmes that limit production. It is an exemption from the general rule that all subsidies linked to production must be reduced or kept within defined minimal (*de minimis*) levels. Policies within the blue box include those that provide direct payments under production-limiting programmes tied to acreage control provided they are made on the basis of field area and yield (number of head for livestock) or a maximum of 85 per cent

⁷⁴ Surland 1991; Runge 1994.

⁷⁵ Under the Agreement on Agriculture, AMS support provided to farmers is reduced by 20 per cent in developed countries over six years (1994-2000, with 1986-1988 as a base period). For developing countries, the commitment is 13 per cent over ten years. The required reduction is not commodity specific. Thirty-four WTO members have commitments to reduce their AMS. WTO members without these commitments have to keep within 5 per cent of the value of production (i.e., the *de minimis* level) — 10 per cent in the case of developing countries.

of base level production. In 1994 this exemption included US deficiency payments as authorised under the 1990 Farm Bill and EU compensation payments under the reformed Common Agricultural Policy (CAP). Since 1994, the United States has removed the acreage-set-aside conditions for receiving direct payments for cereals. This change effectively decoupled payments from output levels and moved the subsidy into the green box. Countries using blue box subsidies claim they distort trade less than amber box subsidies. Currently, the only members notifying the WTO that they are using or have used the blue box are: the EU, Iceland, Norway, Japan, the Slovak Republic, Slovenia, and the United States (no longer using the blue box).

(iii) *Green Box*

Green box measures are exempted from reduction. The green box includes subsidies that are considered the least distorting forms of support—having no, or minimal, trade distorting effect. They include measures that provide support that is not based on current production or factors of production. These exemptions include provisions related to environmental and conservation objectives along with other eligible policies related to advisory services, domestic food aid, decoupled income support, income insurance and safety-net programmes, set aside payments (if land is retired for a minimum of three years) and policies that encourage early retirement. Green box subsidies have to be government-funded (not by charging consumers higher prices) and must not involve price support. They tend to be programmes that are not directed at particular products, and include direct income supports for farmers that are not related to current production levels or prices. “Green box” subsidies are allowed without limits, provided they comply with relevant criteria.⁷⁶

“Green” is not an environmental designation, although certain agro-environmental policies are considered to have sufficiently small impacts on trade to qualify for the exemption. Green box payments apply to environmental programmes under the following conditions: eligibility for payments “shall be determined as part of a clearly defined government environmental or conservation programme, including conditions related to production methods or inputs.” In addition, the amount of the payment, “shall be limited to the extra cost or loss of income involved in complying with the government programme.”⁷⁷

Box 14: The WTO’s “other non-trade issues” related to agriculture

Negotiations on agriculture sometimes cover “non-trade” concerns. These include, *inter alia*, food security, food safety, rural development, environment and others issues. In some cases, an integrated assessment might include as part of its focus, relevant non-trade concerns.

Trade and Environment. The Doha Declaration is also concerned with how trade and the environment can be mutually supportive including through consideration of the relationship between WTO rules and specific trade obligations on MEAs,¹ procedures for exchanging information, and reducing or eliminating barriers to trade in environmental goods and services.

Food Safety. Increased global food trade and a series of major food safety incidents (including outbreaks of BSE and concerns about GMOs) have resulted in heightened consumer awareness. SPS and technical regulations, and food safety risk levels may vary greatly among countries due to differences in technology, indigenous plant and livestock populations, food production practices, patterns of consumption directed by culture and demographic or climatic factors.

Rural Development. Several developing countries advocate various special provisions for dealing with problems of food security, rural poverty and other issues related to rural development.

Consumer Information and Labelling. Voluntary or mandatory labelling could be a way to deal with some non-trade concerns — such as animal welfare or information on genetically modified organisms — without distorting trade.

⁷⁶ Countries appear to be making an effort to design policies that are consistent with green box requirements. Green box support in OECD countries doubled between the period 1986-88 and 1995-98 and has been higher than AMS over the entire implementation period of the Agreement on Agriculture. OECD Policy Brief. 2001.

⁷⁷ Runge, 1999.

2. Independent Conditioning Factors

At both the domestic level and at the international level there are a number of trade-related and non-trade related forces that shape agricultural production and can influence trade flows. Forces, including international prices for commodities and other macroeconomic forces can affect agricultural production and related environmental and social impacts. There are thus a number of considerations that should be taken into account when planning a comprehensive IA for agriculture (Box 15). In some cases, for some issues and regions these factors will be of relatively more or less importance. Where relevant, however, some attempt should be made to take into account independent effects that are generated by these and other conditioning factors.

Box 15: Independent conditioning factors

- International trade negotiating context
- International environmental context
- Macroeconomic and microeconomic activity
- International commodity prices
- Domestic law and policy initiatives
- Climate
- Conflict

(a) *International Trade Negotiating Context*

Trade negotiations do not take place in isolation. Any IA should attempt to take into account parallel processes that might be underway in other fora, multilaterally, bilaterally or regionally. This includes considering the specific context of the agreement. For example, an IA looking at the WTO's Agreement on Agriculture should consider the influence of the 2000 Doha Development Agenda put forward in the Doha Declaration. The Doha Declaration put development at the heart of the trade agenda and WTO members agreed that the Agreement on Agriculture should enable developing countries to "take account of their development needs, including food security and rural development." This could include an increased focus on the removal of domestic supports and export subsidies in OECD countries, reductions in tariff peaks for certain products to allow greater market access for developing countries. It could also include flexibility in rules that apply to developing countries that would allow them to support and protect agriculture and rural development to help ensure the livelihoods of their large agrarian populations whose farming is different from the scale and methods in developed countries. An increased emphasis on subsidies and protection could help ensure food security, support small-scale farming, compensate for lack of capital, and/or prevent the rural poor from migrating into already over-congested cities. The Doha Development Agenda might also include capacity building measures such as improving basic information related to trade including economic statistics and customs data.

(b) *International Environmental Context*

International commitments on the environment under such Conventions as the UN's Framework Convention on Climate Change (FCCC) and its Kyoto Protocol and the Convention on Biological Diversity (CBD), as well as other regional trade agreements (such as NAFTA, the FTAA or APEC) can impact the environmental and social impacts of agriculture.

(c) *Macroeconomic and Microeconomic activity*

It is extremely difficult to disentangle macroeconomic, market or policy factors in explaining trends in trade. However, recent UNEP case studies show that independent macroeconomic activity can be as important, if not more important than trade liberalisation in determining countries' trading positions.⁷⁸

⁷⁸ UNEP Synthesis Report, Round Two Country Studies. 2002.

It is important to take into account, in planning, the macroeconomic and microeconomic conditions that can affect trade flows. Among the most important variables to consider are: domestic macroeconomic forces (such as inflation and interest rates, government debts and deficits, for example); microeconomic changes in each economy (such as processes of deregulation and privatisation, for example); and major fluctuations from international forces (such as exchange rates and balance of payments deficits, for example). In some countries, the role of the “informal sector” in the economic could also be an important conditioning factor.

Box 16: Importance of macroeconomic context

“When examining a specific sector, it was observed that currency devaluation or market distortions, such as price distortions, had a large role to play in determining environmental, economic and social effects. Compared to macroeconomic policies and trade-distorting policies, trade liberalization policies proved less influential in determining production and consumption effects and hence environmental effects.”

Source: UNEP 2002:7 (Synthesis report)

(d) *International Commodity Prices*

Export prices for primary agricultural commodities have been dropping steadily since 1995. Between May 1996 and January 2000, the FAO total foodstuffs price index declines by some 38 per cent. The index stabilised in 2000 and 2001 but weakened further in January 2002.⁷⁹ Among the major foodstuffs, the decline in prices has been most pronounced for cereals and for oils and fats. Coffee prices have also been severely depressed. In 2001 prices fell to their lowest level since 1973.⁸⁰ After coffee, cotton has suffered the most pronounced decline. Average prices in 2001 were down to 50 per cent of their level in 1995.⁸¹ Weakening non-fuel commodity prices had negative implications for many developing countries that depend heavily on primary commodity exports and had unfavourable consequences for their terms of trade.

(e) *Domestic Law and Policy Initiatives*

There are a range of non-trade issues that have important impacts on agricultural practices and markets. This ranges from domestic measures related to farm policy reform, to international prices for agricultural commodities, to regional policies such as the EU’s Common Agricultural Policy (CAP). Other impacts that might not be apparent in a trade analysis are the effects of growing vertical integration and intra-firm trade which is supported by more liberal trading regimes and in particular by increasing foreign direct investment (FDI). In Canada, for example, US affiliates exported roughly 9 per cent of their total production to the US market in 1996.⁸² This intra-firm trade is not reflected in official trade statistics. Any changes in these regimes or programs will have impacts on agricultural production, shifting between crops to respond to price levels, and other impacts that may need to be considered when undertaking an Integrand Assessment in this sector. Additional factors such as independent regulation on the environment on water quality, pesticides, waste disposal, food quality and safety and animal welfare can influence agricultural production. At the same time, development in technology, structural changes in the agro-food sector and farming practices, as well as the evolution of consumer demands, for example for organically produced food, are increasingly influencing environmental performance.

(f) *Climate*

Another independent variable that can also impact agricultural production is climate, and the impacts of weather patterns such as El Niño. Indeed, perhaps more than in any other sector, weather patterns and natural disasters can affect global production and trade in agricultural products. In addition, a dependence on weather contributes to the vulnerability of the rural poor in many parts of the world. For example, in several parts of Africa, the reduced 2001 maize harvest was caused by bad weather and led to food shortages. In Malawi, floods affected more than 600,000 people. In Zambia, emergency food aid is required for almost 1.3 million people following the poor 2001 maize harvest.

⁷⁹ FAO 2002.

⁸⁰ FAO 2002.

⁸¹ FAO 2002.

⁸² Vaughan, 2002.

In Zimbabwe, the 2001 maize output declined by 28 per cent from the level of the previous years. In Asia, a severe winter for the third consecutive year is threatening the already fragile food supply for thousands of herder families in Mongolia.

(g) *Conflict*

Conflict and displacement of populations as refugees as a result of conflict can affect food security at the national and regional levels, both during a conflict, when trade might be more difficult and imports might not arrive, and in its aftermath. For example, military operations and civil strife in Chechnya continue to affect food production. Thousands of people have been either internally displaced or have taken refuge in neighboring countries. In the Near East, the food situation in Afghanistan remains grave. Years of insecurity and war, coupled with severe drought have exposed a number of farmers to hardship. Civil strife in African countries such as Guinea, Liberia and Sierra Leone will also affect the food supply.⁸³

C. CIRCUMSCRIBING AN ASSESSMENT

This Handbook has as its focus the agricultural sector. As indicated in the Reference Manual, approaching the analysis from a sectoral perspective necessitates the development of clear criteria for the selection of sectors to investigate that includes particular issues (such as specific crop, or meat), particular geographic regions (including regions, countries of ecosystems) or particular sustainability impacts.

1. Selecting Specific Issues for Assessment

There are a vast number of issues that exist within the general rubric of the “agricultural sector” even when it is limited to the farm sector, excluding fisheries and forestry. These range from such commodities as grain (*inter alia*, wheat, maize and barley) oilseeds, (*inter alia*, soybeans, rapeseed and related products such as soybean oil, sunflower oil, rapeseed oil and palm oil), and livestock (*inter alia*, pigs, cattle, sheep, goats, horses and buffaloes). It can also include beverages such as coffee and tea or key inputs into other sectors such as textiles, cotton, jute, hemp and others.

This Handbook is focused on the agricultural sector. Nevertheless, within that sector, criteria can be applied in order to select appropriate issues to include in an IA or planning exercise. Criteria for selecting issues within a broad sector are elaborated on in the *Reference Manual* (Box 17).

Box 17: Criteria for Selecting Priority Sectors/Issues

- The sector is important to the national economy and in particular in its contribution to export revenues.
- The sector relates directly or indirectly to major environmental media and natural resources.
- The sector relates directly or indirectly to important issues of equity and social well being including food security.
- The sector has been, or might become, the subject of changes in the economic rules induced by trade-related policies.
- The sector is one with significant trade flows in both volume and financial terms and is experiencing changes in trade flows.
- The sector is one where one might expect, *a priori*, that there are important sustainability effects attributable to trade-related policies.

⁸³ FAO 2002.

An approach to planning that considers one commodity in isolation runs the risk of ignoring important impacts between issues and sectors.⁸⁴ An expansion of the field of analysis to cover related cross-sectoral effects can be guided by the criteria from the *Reference Manual* (Box 18).

Box 18: Criteria for Considering Related Sectors

- Is there a related sector that is a major input into and/or consumer of the sector under consideration?
- Are there related economic or environmental dynamics from other sectors that are necessary to the operation of the sector under consideration?
- Is there a related sector that has proliferating ecological impact on the sector under consideration?

2. Geographic Region

Geographic limitations should be identified for an IA. There is some evidence to suggest that IA with a national or regional scope are more feasible at this time than those with a global scope. In some cases, IAs should focus on specific ecosystems or particularly vulnerable areas of particular importance in the context of agriculture. In addition, this section should identify any geographic characteristics that could impact on production and sustainability with respect to specific commodities of interest. For example, in relatively arid cropping environments, grain is normally produced at the extensive market, while in humid environments, higher levels of intensity are found.

3. Sustainable Development Priorities

A number of sustainability issues related to the agricultural sector are discussed in Section I of this Handbook. By this point in an integrated assessment, the context for the sector should be developed and may point to sustainability priorities in the context of a particular IA. For example, the grains sector might be associated generally with issues including the destruction of natural habitats due to field enlargement; the displacement of indigenous species and reduction of biodiversity especially due to the promotion of high-yielding varieties, an associated increase in manufactured fertiliser and pesticide inputs, pulmonary diseases from dry milling and water pollution from wet milling.⁸⁵ Key issues associated with rice production might include soil nutrient imbalance and depletion, soil erosion (particularly for upland rice), salination of irrigated lands and farm worker safety and pesticide residue.

An IA should consider prioritising issues of greatest concern where one might expect, *a priori*, important linkages to trade-related policies, on a case-by-case basis.

III. QUESTIONS TO CONSIDER IN DESIGNING AN INTEGRATED ASSESSMENT IN THE AGRICULTURE SECTOR

A. TIMING

An important procedural question for the application of an assessment methodology is when the assessment is conducted and how long range the effects considered should be considered. A key starting point is whether the assessment considers the effects of a trade agreement prior to its negotiation (*ex-ante*), throughout the process of negotiation or following its final ratification (*ex-post*). Issues related to timing are discussed at length in Section III of the *Reference Manual*.

For example, an IA that focused on the negotiations of the WTO's Agreement on Agriculture would be considered an *ex-ante* analysis, up to the point that the Agreement is concluded. This allows for relevant environmental and social issues to be brought forward for consideration by negotiators and other practitioners at relevant points in the remaining negotiations, such as appropriate stock taking

⁸⁴ For example, in its study on cattle feedlots, the CEC's analysis extended back to the feed-grain sector, and forward to the beef-processing sector. CEC 1999.

⁸⁵ FAO basic foodstuffs, 26.

meetings. It also require techniques for assessment that can project, with some degree of accuracy, the likely impacts of various scenarios for negotiation on priority issues. For planning purposes, assessments will necessarily be *ex-ante*.

Once the agreement has been negotiated, any IA of the AoA will necessarily become *ex-post*. That is, there will be no opportunity to influence the final outcome of these particular negotiations, and the impacts of the agreement can be examined. *Ex-post* reviews are critical for understanding the linkages, based on empirical evidence, between trade liberalisation, development and the environment since they identify the concrete impacts of trade liberalisation as opposed to projected ones. *Ex-post* reviews can identify relevant policy measures to mitigate negative impacts or to promote positive impacts. In addition, the results and lessons drawn from *ex-post* assessments help define the content and methodological frameworks of an *ex-ante* review and inform preparations for future trade liberalisation agreements. *Ex-post* assessments can be the basis for future *ex-ante* assessments.

B. INFORMATION, CONSULTATION AND PARTICIPATION

The approach to IA adopted by UNEP relies on strong multistakeholder participation in the process.⁸⁶ According to UNEP's *Reference Manual*, meaningful public participation offers the following advantages to those undertaking an integrated assessment:

- **Co-operation.** Provides opportunities for co-operation and co-ordination within and between government and civil society, building trust among the participants and leading to the creation of long-term collaborative relationships.
- **Expertise.** Introduces a broad range of ideas, experiences and expertise to enrich the integrated assessment, enhancing the knowledge of policy makers and motivating the development of the broadest range of policy solutions.
- **Ownership.** Provides participants with a sense of "ownership" over the final product thereby reducing the potential for serious conflict and increasing the likelihood of improved and lasting solutions.
- **Capacity Building.** Ensures that the interests of groups that have traditionally played only a marginal role in policy development can be incorporated into the goals as well as the processes of decision making, building capacity and social capital among those groups.
- **Trust.** Builds trust among various stakeholders in the process and the final product thereby providing governments with a tool to generate widespread support for sound liberalisation initiatives.

An IA in the agricultural sector should include a wide range of stakeholders. In the first instance, this should include stakeholders with the power, authority and responsibility over the issues who are in a position to invoke policy change. Typically, this would include representatives from all levels of relevant government departments including those responsible for agriculture, trade, environment, and development issues and, for specific issues, could extend to departments such as health. It might also include parliamentarians and members of the opposition.

A second group of critical stakeholders in this context would be individuals or groups with claims over the resources such as landowners, farmers and community groups including women and indigenous people. These groups will have direct knowledge of the issues, and a direct interest in the outcome of the IA and should be included from the beginning. The participation of local communities and in particular those groups with a claim on the resources (such as the land) can be crucial in determining the success or failure of policy measures taken to mitigate or enhance environmental and social issues identified in an IA. In some cases, they will be in the best position to implement and monitor any necessary measures to promote sustainability at the local level. This outcome is most

⁸⁶ UNEP 2002. See also, WWF 2002 Position Statement Elements of an Effective Multistakeholder Process and WWF 2000. *Stakeholder Collaboration: Building Bridges for Conservation*. Washington DC: WWF. September.

likely to occur is measures respect the ethnic, customary and legal rights of the stakeholders, which can be assured by their direct involvement in the process.

Other groups with more indirect control over the resources, but interest in the issues should include representatives from non-governmental organisations representing both environment and development issues, consumer organisations, labour organisation, and industry organisations representing companies involved in production, processing and trading of agricultural commodities and products.

In its past work on IA, UNEP has encouraged groups undertaking the work to establish National Steering Committees to help guide their country studies. Box XXX illustrates such a group, established for a recent IA undertaken in China on behalf of UNEP.

Box 19: UNEP Country Study on the Cotton Sector in China: Members of the project's National Steering Committee

- Ministry of Agriculture
- Ministry of Foreign Trade and Economic Cooperation
- State Environment Protection Administration
- Chinese Textiles Association
- Beijing University
- International Economics and Trade University
- Chinese Academy of Agricultural Sciences
- Jiangsu Agriculture and Forestry Department
- Jiangsu Environmental Protection Administration
- Nanjing Agricultural University
- Jiangsu Tongyu Fabric Group Company
- Delegate of Cotton Farmers

Source: UNEP 2002.

Given the propensity of rural populations in many parts of the world to be among the world's poorest people, methods for consultation should be developed that include funding, take into account limited access to technology, and make specific for the ability of vulnerable rural communities to participate in a meaningful way.

C. CAPACITY BUILDING

An integrated assessment in the agricultural sector can help build capacity, focusing on specific issues of capacity that might be relevant in this sector taking into account the importance of rural communities and civil society. Capacity building is an essential ingredient of economic growth as well as poverty eradication. In the long-term, capacity building is required to ensure that the vision of sustainable development is broadly shared, provides the basis for policy making and thereby becomes an achievable goal. In all cases, an IA should consider and highlight where possible, key contributions that can be made through the interactions between agriculture, trade and sustainability, on the capacity of countries to promote sustainable development.

In the context of agriculture this link is particularly important. For example, developing countries represent two thirds of the WTO membership, most of the undernourished population of the world, and 96 per cent of the world's farmers. Typically these farmers do not have the technological capacity to take advantage of new means for increasing production and distribution in a way that guarantees a safe and steady supply of food. Developing country proposals at the WTO in Phase III of the negotiations on the Agreement on Agriculture typically emphasise the need for adequate and operational special and differential treatment provisions to further policy objectives in terms of food security and poverty reduction and improve their capacity to trade on a level field with more developed nations.

Box 20: Benefits of capacity building

Capacity building can promote:

- availability of technologies
- storage facilities and transportation networks for agricultural products
- agricultural research
- data collection
- training in production techniques and training of government officials
- access to multilateral organisation through institutional and legal capacity
- access to multilateral trade remedies
- compliance with international

Issues of capacity include access to trade remedies as well as the negotiation of beneficial trading rules. For example, many developing countries lack the resources and the expertise to engage in long drawn out disputes surrounding anti-dumping and countervailing measures.⁸⁷ Some developing countries tend to feel ill-equipped to take part in formulating the international standards related to agriculture established in such bodies as the International Standardisation Organisation and the FAO/WHO Codex Alimentarius Commission, and favoured under the WTO's Agreements on Technical Barriers to Trade (TBT) and Sanitary and Phytosanitary Measures (SPS). This is compounded in some cases by the small scale of their export operations, their greater vulnerability to disease outbreaks and pest infestations, and inadequate public health and veterinary services. One study notes that these rules were written principally to protect the health of livestock in developed countries and since the cost of the compliance with international standards is "possibly prohibitive", the study recommends technical and financial assistance to developing countries to help them meet SPS requirements and participate in standard setting.⁸⁸

Compliance with WTO rules and obligations and preparing legal briefs in trade disputes make heavy demands on the resources of LDCs. Capacity building measures including multilateral technical and financial assistance, developed through a comprehensive IA could improve notification records and compliance.

D. INDICATORS

This section presents an illustrative selection of specific indicators for the agricultural sector.⁸⁹ Tracking impacts requires identification of indicators that can be measured to show changes over time. Indicators should be selected on a case-by-case basis and should be specifically tailored to likely impacts. There are a number of indicators related to agriculture that have been compiled by organisations including the World Bank, the OECD and UN agencies which reflect core environmental concerns related to agriculture, such as those discussed in Section I of this Handbook.

Box 21: An indicator is...

“A parameter [a property that is measured or observed], or a value derived from parameters, which points to, provides information about, describes the state of a phenomenon/environment /area, with a significance extending beyond that directly associated with a parameter value”

Source: OECD. 2001. *OECD Environmental Indicators: Towards Sustainable Development*.

The selection of indicators will rest on the specific issues being examined. Selection will also depend on geographic locations and the priorities of those undertaking the IA. There may be limitations with respect to data availability. Where this is a major hurdle, proxy indicators might be selected, and note should be made to encourage the collection of additional necessary data for future assessments and policy-related activities.

Box 22: Criteria to select agricultural indicators

- Linked directly to the results and recommendations of the assessment;
- Meaningful in terms of sustainability;
- Able to show trends over time;
- Easily understood by non-specialists;
- Relevant to trade policy and “flanking” policy initiatives;
- Linked to existing monitoring programmes and institutional capacity to evaluate the results; and
- Measurable without the commitment of an unacceptable level of financial and personnel resources.

⁸⁷ See Oxfam, *Boxing Match*

⁸⁸ Roberts 1998.

⁸⁹ It relies heavily on recent work in this field by the OECD as well as the development of key indicators for agriculture developed in conjunction with UNEP's Reference Manual, work of other UN agencies and development indicators published by the World Bank. A general overview of indicators for integrated assessment can be found in Section III of UNEP's Reference Manual.

Tables that present, by way of example, a series of specific indicators for the agricultural sector covering economic, environmental and social domains appear below. They are intended only as a guide for selecting appropriate indicators for individual IAs, whose selection can be guided, among other things, by the criteria in Box 22.

Table 6

Economic Indicators for Agriculture	
GDP	% of GDP attributed to agriculture Agricultural productivity Agricultural output
Structure of Production	Number of farms Average farm size Average yield size Crop mix – changes in food crop production
Employment	Farm employment Employment/job opportunities in the farm sector Rural unemployment levels Rate of creation of food processing businesses
Income	Total farming income Average earning of farmers and farm workers Agri-environmental expenditures Levels of agricultural support
Prices	International commodity prices Price of staple foods

Table 7

Indicators for Environment and Natural Resources	
Freshwater Quality	Water quality trends Oxygen content in surface waters Nitrate content in surface waters Groundwater? Water quality risk indicator Water quality state indicator
Freshwater Resources	Intensity of use – gross freshwater abstractions per capita Water use intensity Water use efficiency Water use technical efficiency Water use economic efficiency Amount of water diverted for irrigation Intensity of use by major uses (e.g., irrigation) Irrigation technology
Land	Stock of Agricultural land Agricultural land use Area of land under agriculture Change in land areas covered by forest for agricultural use Soil Degradation (desertification/erosion) and soil quality <ul style="list-style-type: none"> • Rates of erosion Risk of soil erosion by water <ul style="list-style-type: none"> • Risk of soil erosion by wind • Nutrient quality of the soil Landscape Structure of Landscapes <ul style="list-style-type: none"> • Environmental features and land use patters • Man-made objects (cultural features) Landscape Management Landscape costs and benefits Land Conservation <ul style="list-style-type: none"> • Water retaining capacity • Off-farm sediment flow (soil retaining capacity)

	<p>Livestock densities</p> <ul style="list-style-type: none"> • Numbers of heads of cattle, pigs, sheep and goats per km² of agricultural land • Nitrogen and phosphate generated by livestock manure per km² of agricultural land <p>Crop mix Organic farming Soil Cover Land Management practices</p>
Biodiveristy	<p>Wildlife Habitat</p> <ul style="list-style-type: none"> • Total protected area as a % of national territory • Intensively farmed agricultural habitats • Semi-natural agricultural habitats • Habitat matrix • Land use patterns such as change in land areas covered by forest for agricultural use <p>Wild Species</p> <ul style="list-style-type: none"> • Number of threatened species (mammals, birds, vascular plants, fish, reptiles, amphibians) • Wild species diversity • Levels of non-native (invasive species) <p>Crop Genetic Diversity</p>
Energy Resources	<p>Energy consumption for agriculture Existence of renewable energy sources</p>
Air Quality	<p>Climate Change Gross agricultural greenhouse gas emission CO₂ emissions intensities (per capita, per unit of GDP) in agriculture Emission intensities for other GHGs (such as methane CH₄, nitrous oxide N₂O) in agriculture Air Quality</p> <ul style="list-style-type: none"> • Emission of sulphur oxide (SO_x) • Emissions of nitrogen oxide (NO_x) <p>Urban Air Quality</p> <ul style="list-style-type: none"> • SO_x concentrations in selected cities • NO_x concentrations in selected cities
Use of Agro-chemical Inputs	
Nutrient Use	<p>Nitrogen balance Nitrogen efficiency</p>
Pesticide Use and Risks	<p>Pesticide use – areas sprayed by pesticides Use of non-chemical pest control Use of Integrated pest management Pesticide risk</p>

Table 8

Indicators for Social well-being, Development and Equity	
Poverty and hunger	<p>Proportion of population living on less that \$1 per day Share of poorest quintile in national consumption Stunting of children under five Prevalence of underweight children (under 5 years of age) Proportion of population below minimum level of dietary energy consumption Prevalence of malnutrition among children under age 5</p>
Education	<p>Farmer education</p> <ul style="list-style-type: none"> • Net enrollment in primary education • Proportion of pupils starting grade 1 who reach grade 5 • Literacy rate of 15-24 year olds
Gender equality	<p>Farmer gender distribution Ration of girls to boys in primary, secondary and tertiary education Ratio of literate females to males among 15-24 year olds</p>
Health	<p>Proportion of population with access to improved sanitation Access to health care</p>

	Pesticide residues in water soil and food Proportion of population with sustainable access to an improved water source
Property Rights	Proportion of population with access to secure tenure
Urbanisation	Proportion of population living in cities Rates of migration to from rural areas to cities
Culture and traditional knowledge	Integration of cultural dimension at all levels of development cooperation; Recognition, preservation and promotion of cultural values and identities including traditional knowledge; Recognition, preservation and promotion of value of cultural heritage.
Food security	Food Availability (level of food production, food imports, food storage) Access to Food (poverty, market integration, access to markets) Food consumption (food use practices, food intake) Nutritional status (anthropometry, micronutrient deficiency)
Food Safety	Average distance from depots to vulnerable communities Quality of storage depots Quality of transportation networks Residue of pesticides on grains and other food
Demographics	Age of farmers "Farm" family size Ratio of female to male rural household heads Ratio of subsistence farmers to waged agricultural labourers Ration of male to female time inputs to farming

IV. APPROACHES AND TECHNIQUES FOR INTEGRATED ASSESSMENT

[NB. This section is incomplete. It contains some information related to assessment of agriculture using standard techniques such as those included in the Reference Manual. It also contains a series of questions that might be posed, in order to help establish correlation between economic and regulatory changes induced by trade, and sustainability. This is a draft, and will be reviewed in light of discussion on 17-19 February, as well as techniques proposed for the Strategic Integrated Planning for sustainable development, being undertaken by UNEP ETB]

There is some agreement that an integrated assessment can best be undertaken using a mix of methodologies. The precise nature of this mix of techniques will depend on a number characteristics directed by the scope of the IA itself. For example, concrete empirical data might be available for an *ex-post* assessment, while an *ex-ante* assessment might rely on projections. Similarly, a study that prioritises biodiversity, might rely on indicators that are necessarily qualitative, whereas one that examines industrial pollution intensities, more associated with manufacturing, may have access to reliable reported statistics.

In all cases, the approaches and techniques employed will be dependent to some degree on the availability of data in the countries and with respect to the issues covered by the assessment. This is particularly true where practitioners seek to model proposed scenarios that might emerge from negotiations yet to be undertaken or completed. A lack of reliable statistics and time-series data can hamper efforts to project, with any degree of accuracy, prospective future impacts. In addition, where countries or regions typically rely, to a large degree, on an informal economy, efforts to model projected change can become even more uncertain. Nevertheless, even where challenges exist with respect to data availability, IAs should be viewed as opportunities to identify data gaps and encourage the collection of relevant information for future endeavours.

Experience in UNEP's country studies that have focused on an agricultural issue suggests that a number of quantitative methodologies are difficult to apply in practice to integrated assessment where issues are at the same time very complex, and subtle relationships can have important sustainability impacts. Therefore, qualitative analysis has dominated in the country studies undertaken thus far. This

has occurred in part because of the *ex-post* nature of many of the existing studies, where researchers can rely on existing data for application to after-the-fact impacts of liberalisation.

Further work might be necessary to support integrated assessments that use both qualitative and quantitative evidence, through case studies or formal economic and/or ecological modelling techniques. Nevertheless, at present a reliance on existing quantitative material and modelling has proved useful to identify trade and investment flows, and economic impacts of trade. For an *ex-ante* assessment researchers should consider the utility of projecting the trade and economic impacts of liberalisation using modelling techniques, or rely on existing models being run by organisations attempting to project possible impacts of the agricultural negotiations.

Drawbacks might be encountered when using some quantitative techniques to examine non-economic factors. There is no consensus on appropriate indicators for environmental and social variables such as those used in economics and environmental and social variables are subject to problems in their valuation. This has hampered theoretical and empirical efforts to marry economics, environmental and/or social indicators into a synthetic model incorporating multiple effects. Where the adoption of quantitative techniques are not practical or feasible, a qualitative analysis can usefully suggest environmental and social effects that often require a regional or local level treatment to ascertain specific impacts. A qualitative analysis is also particularly useful for examining implications of trade agreements and trade policies on environmental laws and regulations.

The theory and practice of carrying out environmental assessments of trade agreements is evolving and more work is needed to improve existing methodologies and to develop new ones.⁹⁰ Nevertheless, the practice of IAs that incorporate economic, environmental and social impacts will rely increasingly on a combination of qualitative and quantitative techniques.

Quantitative assessments are most helpful at this stage in projecting the trade and economic impacts of liberalisation scenarios. They are also of potentially great benefit in taking into account independent effects of conditioning factors such as prices and exchange rates. A quantitative approach that incorporates scenarios can include a “no-trade” scenario, where a researcher wants to include a strong “counterfactual” component in the analysis. Other scenarios could be based on gradations in levels of liberalisation on issues related to the negotiations on agriculture such as tariffs, export subsidies and domestic support.

Modelling is an expensive proposition and beyond the reach of a number of researchers engaged in undertaking IAs. Nevertheless, access to data generated by existing models can be very useful in projecting the anticipated impacts of trade. Where modelling is not possible in the first instance, and effort should be made to canvass the literature for institutions that are running relevant modelling exercise, or to use published data generated from such models.

A general description of general and partial equilibrium models applicable to IA is available in Section IV of UNEP’s *Reference Manual*. A widely used Applied General Equilibrium (AGE) model dealing with trade-environment interaction is that of the Global Trade Analysis Project (GTAP).⁹¹ GTAP has proved to be a useful tool for estimating probable trade and economic impacts of trade liberalisation and is widely used as an agricultural model to assess liberalisation. It usually comprises a multi-region, applied AGE model, in which numerous factors including transportation margins, changes in world savings, changes in investment, and cross-sectoral effects of liberalisation can be estimated. For example, data from GTAP suggested that as a result of the 1994 Agreement on Agriculture, agricultural protection would fall by about one fifth or more in advanced and newly industrialised economies, but would remain extremely high compared with that for manufacturing. Moreover a GTAP model predicted that agriculture in low and middle-income economies would

⁹⁰ OECD. 2000. *Assessing the Environmental Effects of Trade Liberalisation Agreement: Methodologies*.

⁹¹ Developed by the Center for Global Trade Analysis in Purdue University, Version 3 of GTAP divides the world economy into 37 industries/sectors in 20 countries and 10 composite regions or country groups.

remain effectively taxed relative to other sectors because manufacturing assistance would come down by a similar amount.⁹² This information provides some basis for an analysis of potential sustainability impacts.

Partial equilibrium models can be applied to a specific commodity or ecosystem. If the countries rely heavily on commodity exports the trade liberalisation component of an IA could be analysed using small models involving few countries. A recent country study undertaken on behalf of UNEP examined the cotton sector in China using a partial equilibrium model incorporating a number of elements (including scenarios) with some degree of success (Box 23).

Box 23: The JAPA Model (Jiangsu Agricultural Policy Analysis)

The Country study on Cotton in China employed a JAPA model, which consists of a data bank, a series of econometric models, a partial equilibrium model and an interactive display system.

The JAPA model was used to establish a baseline projection for 2002, and then a scenario analysis on the impact of increasing agricultural imports. The scenario analysis generated by the model, based on increasing imports, was then used to assess the economic, social and environmental impacts of trade liberalization, based on the level of cotton production and the use of inputs under existing methods of production. The study undertook an economic valuation of the social and environmental impacts to undertake the integrated assessment. A cost-benefit analysis was conducted to assess the social, economic and environmental impacts of trade liberalization. The researchers acknowledge the difficulties associated with undertaking a valuation of environmental impacts. Nevertheless, the model scenario generated the following results based on an indication that large imports of wheat, cotton and corn will have an enormous economic impacts:

- Economic impacts:
 - Helps to solve shortages of cotton and corn that were projected
 - Sown area and output decrease
 - Price decreases of agricultural products
 - Producer surplus and farmers' income decrease
- Social impacts:
 - Promote agricultural production structure adjustment, according to comparative advantage
 - Utilization rate of cultivated land decrease; valuable land lies waste
 - Reduction in self-sufficiency rates of agricultural commodities
 - Agricultural employment decrease
 - Poverty and social instability
- Environmental impacts:
 - Reduction in the application of chemical fertilizers and pesticides
 - Cultivated land may be lost.

Source: UNEP 2002. Cotton Sector study

Efforts to forecast issues associated with agricultural negotiations can also rely on lessons learned from past, *ex-post*, assessments. There is a growing body of literature documenting experience in a number of countries and for a number of issues that can assist practitioners develop approaches to forecasting that are based on solid, qualitative analysis linking trade, economic, environmental, and social variables.

Efforts to generate quantitative data can be used in combination with other analytic techniques such as those described in Section IV of the *Reference Manual*. Building on this work, and on the experience of the country studies, this key variables have been identified that can transmit changes in economic activity in the agricultural sector into environmental and social impacts and thereby demonstrate causal links, or at least correlation, between economic changes induced by trade and sustainability.

An IA can attempt to identify ways in which provisions of agricultural negotiations governing market access, domestic support, export subsidies and other non-trade issues will likely have on trade flows and economic activity with respect to the issues under investigation and related to the relevant

⁹²

geographic locale. Trade effects will depend in part on the amount of production and development that is export oriented, bearing in mind that food security continues to be an important factor in domestic production development. Trade impacts can be aggravated by any ongoing protectionism in developed countries and the subsidisation of food exports that compete with certain developing countries commodities such as rice, sugar, soy, beans and maize. A number of the preliminary, but critical, issues related to changing trade flows, the application of protectionist measures and other issues such as changes brought about by associated macroeconomic forces, can be forecasted using existing modeling techniques.

Changes in the rules governing agricultural trade will, to varying degrees for different countries and with respect to different commodities, influence the economic performance in the sectors and influence the overall scale of agricultural activities, the structure of agriculture in different countries, the mix of inputs and outputs, the production technology and the regulatory frameworks. These adjustments in turn will impact on the international and domestic environment and society by increasing or reducing pressures that contribute to, or detract from, sustainability. Environmental impacts can be traced through pollution effects in such medium as air, water, and land; health and safety from exposure to pollution; and resource effects due to changes in demand for natural resources that contribute to resource exhaustion and/or degradation.⁹³ The adjustments will also impact on the wellbeing of societies, and in particular rural societies who depend upon agriculture for their livelihoods. Social impacts can be traced through variables such as those identified in Section I including, for example, health, income, prices and access to basic services. The direction and magnitude of the effects will depend on the state of the environment and on the production impacts of further agricultural trade liberalisation, on the strength of institutions and the flexibility of communities as well as on the environmental regulations in place and the existence of a social safety net.

In some cases impacts on agricultural sustainability, induced by trade might be direct. In other cases, impacts will come about through economic changes and production related changes induced by changes trade rules and trade flows. A detailed analysis suggesting causation or correlation should be undertaken in order to link trade-induced changes in the agricultural sector to impacts on sustainability.

Approaches have been developed to categorise impacts of trade related policies and trade liberalisation in ways that allow for relationships to be traced from economic impacts of trade through to environmental and/or social impacts, incorporating relevant avenues for analysis and including both quantitative and qualitative techniques. Taken together, an analysis based on relevant processes that transmit trade-induced economic change with sustainability impacts can form the basis of a Causal Chain Analysis (CCA) to trade impacts of trade liberalisation on key components of sustainability (Box 24). In some cases, where data is available, this can be complemented with input of quantitative data

⁹³ OECD. 1994. *Methodologies for Environment and Trade Reviews*. Paris: OECD.

Box 24: CCA applied to the agricultural sector

Assuming a proposal for a new sectoral trade agreement to remove all import duties in all countries on a single agricultural commodity. The agreement is expected to increase, to varying degrees, both agricultural impacts and exports in most countries (i.e., there is a cause-effect link between the proposed agreement and foreign trade). This initial “foreign trade effect” will cause changes in levels (positive and negative) of production, income, employment and investment in the agricultural sector in most of these countries (which could have a further feedback effect on foreign trade). Because of linkages between the agricultural sector and other sectors in each country, there will also be some changes in production levels etc. in other sectors – and these changes may have a feedback effect on the production levels etc. in the agricultural sector. As a result, the initial foreign trade change will have an aggregate effect on production levels etc. in each country which will be spread across many economic sectors. As a result of this causal chain of events within the economic sector, there are likely to be some changes in core economic indicators of sustainability.

The removal of import duties on this agricultural commodity may also have some environmental impacts. This may be due, for example, to changes in the output level of this agricultural product (and of other agricultural production, industrial goods etc., which have changed as a consequence) and/or to changes in their composition, technology of production and location. This is likely to lead to some changes in environmental indicators of sustainability. Depending on the nature, scale and significance of these environmental changes, they may have a feedback effect on the levels of the economic and social sustainability indicators.

The removal of import duties on the agricultural commodity may also have social impacts. Agricultural communities, whose exports of this commodity have increased, will improve their material well-being and poverty levels could be reduced. The opposite may be the case in those countries where imports of the commodity have risen. There may also be differential effects on males and females, depending on the role of each in its production. Changes in government revenues (due to the removal of the import duty and consequential changes in other tax revenues) may lead to changes in public expenditure levels for health and education. Because of inter-sectoral linkages, consequential social impacts may be experienced in some non-agricultural communities. As a result, there may be some changes in the core social indicators. In turn, these may have some feedback effects on the economic and environmental indicators.

Source: Taken from, *Further Development of the Methodology for a Sustainability Impact Assessment of Proposed WTO Negotiations, Final Report to the European Commission*, 5 April 2002, pp32-33.

The questions issues presented below are illustrative of the types of issues that might be developed in each IA on a case-by-case basis depending on the priority sustainability issues (Section I), the purpose and scope of the assessment, including its geographic location (Section II), as well as the timing, indicators, and the result of any consultations (Section III). They are intended to supplement the general approach to IA discussed in Section IV of the *Reference Manual*, building on work of other organisations such and with specific reference to the agricultural sector. A number of the UNEP country studies have applied an analytical approach to IA in the agriculture sectors, generating useful information about the impacts of structural adjustment policies (Box 25).

For each general issue, a series of questions are posed which are included simply to illustrate the types of questions that might be addressed in an analysis that relies on data collected through research, or using quantitative forecasting techniques. These questions are not exhaustive, and are developed to encourage a practitioner to identify similar avenues whereby changes in trade rules and economic and regulatory impacts induced by trade might impact sustainability in the agricultural sector.

Scale. Trade policies that liberalise trade can affect the overall level of economic activity. This can translate into higher rates of use of natural and environmental resources/services. The net effect of the overall improvement in economic activity, including investment in environmental projects, brought about by trade liberalization is hard to predict. On one hand, there could be greater pollution from

increased economic activities, on the other hand, depending on the production practices in place, levels of crop mix and other factors, greater pollution might not occur.

Scale impacts related to the environment tend to occur in the direction of increases or decreases in agricultural production that comes about as a result of liberalisation. That is, where trade liberalisation leads to a decrease in production, there may be a reduction in the negative environmental impacts of agriculture. On the other hand, rural communities might be impacted negatively, as livelihoods and incomes are affected. Where trade increases production, negative impacts on the environment might increase. Again, social issues might not follow that typical line of analysis.

Depending on the levels of economic activity, output and trade expected to come about as a result of the tariff reductions, and removal of domestic and other support included in the Agreement on Agriculture, scale impacts should be considered in an IA.

- What are the impacts of increased production and growth in output on the key indicators of sustainability selected in the IA? For example, how does increased production affect species diversity? How does growth in output in the livestock sector affect GHG emissions?
- What are the impacts of scale on production facilities? Are farmers expanding to enlarge existing operations? Are newcomers entering the sector?
- What are the scale impacts in regions where agriculture represents an increasingly important share of exports, in what crops and using what technologies?
- What are the related sectors (such as transport, energy, chemicals) that are impacted through scale impacts and increasing levels of inputs, and should they be considered?

Product

These are effects related to the flow of products (or services) between countries. Some of these products may be environmentally friendly while some may be hazardous to the environment. The effects therefore can be positive or negative, depending on the nature of the products traded as well as their volume. Positive product effects occur when the traded commodities are environmentally sound products, and negative, when the products traded are environmentally sensitive/harmful.

Examples of general questions:

- What are the main trade flows impacted by the liberalisation?
- Do increases in trade flows offer new pathways for the import or export of non-native species?
- Is trade encouraged in non-GM crops of foods?
- Is trade encouraged, or discouraged, in processed products?
- What are the impacts of trade on organic products?

Box 25: The Export Crop Sector in Nigeria

Economic Impacts

Positive:

- Trade liberalization has led to the improved contribution of agriculture to Nigeria's gross domestic product.
- Trade liberalization offers opportunities for unskilled and semi-skilled people to work on the cocoa and rubber farms as well as rubber processing factories.
- The rate of abandonment of old cocoa trees has reduced, thereby leading to a more productive use of natural resources.
- Crop farmers obtained higher incomes arising from trade liberalization, which conferred higher output prices during the SAP period.

Negative:

- Trade liberalization has brought about higher disparities in income among farmers in the same community.
- It has led to an unsustainable use pattern of natural resources, as over tapping of rubber was engaged in, as well as the fact that marginal lands were being cultivated.

Environmental Impacts

Positive:

- The cultivation of cocoa and rubber unlike arable crop farming, has led to the prevention of erosion on farms and the formation of a good ecosystem given the canopy formation pattern and dropped leaves from the trees
- The low level of soil nutrient depletion as a result of nutrient re-cycling by the roots of the crops.

Negative:

- The destruction of biodiversity arising from expansion of farm lands.
- The increased incursion into marginal lands may set in degradation processes leading to decreases in soil productivity
- As a sequel to low output prices, farmers have virtually abandoned their rubber trees and the canopy has broken down due to the felling of over tapped trees. It is just a matter of time before serious soil degradation starts to set in.
- The total petroleum hydrocarbon of the samples obtained in rubber processing factories was of high concentration and dangerous to the community.

Social Impacts

Positive:

- Improvements in the standard of living of export crop farmers – some of them own luxury cars such as the Peugeot 505 and 504, and build houses with concrete and roofed with iron sheets.

Negative:

- Prevalence of minor diseases such as body itching, painful sensations in the eyes and swollen hands arising from the use of agrochemicals.
- Misuse of agrochemicals for the treatment of toothache and stomachache by farmers' households.
- The tree crop promotion only supports the male farmers and discriminates against women as the land tenure systems in the southern areas of Nigeria do not allow women to inherit lands and rarely can they purchase farmlands without the permission of their husbands.

Institutional/Regulatory Impacts

Positive:

- Removed the bureaucracy in the marketing of export crops, as farmers can sell their products to any buyers.

Negative:

- There is no monitoring or regulatory device for buyers of exportable produce from the farmers, leading to the sub-standards grading of products and reduction of the value of commodities.
- The buyers, in an attempt to attract the farmers, gave out agrochemicals that in most cases have been adulterated and ineffective on the farm.
- If the prices of agrochemicals had not been relatively too high, their use would have led to serious environmental degradation arising from lack of regulatory agencies at the grassroots level, to advise on the appropriate levels and use that will be environmentally friendly.

Externality Issues. Agriculture is a sector that is the target of government policies that translate, *inter alia*, into various forms of subsidies, supply management and taxation schemes. Liberalisation is expected to lower the level and frequency of price-depressing interventions such as subsidies and domestic support measures. At the same time, price increasing tariffs and other measures are also supposed to decline. Reduced levels of trade protection in importing regions increases demand for imported food products, which can stimulate growth. At the same time, the reduction in export subsidies on exports can reduce total supply from some major exporting regions.

- Does a reduction in domestic support applied in developed countries lower incentives for the over-application of pesticides and fertilisers, lower pressure on the conversion of vulnerable or ecologically significant lands into arable production, and lowers other kinds of production pressures including irrigation withdrawals? What are the implications for the environment and society?
- Will removing subsidies encourage farmers to adopt higher levels of economic and production efficiencies, including concentrating production intensities and altering crop outputs? Evidence from NAFTA suggests that trade liberalisation has led to the concentration of large scale or factory-type livestock production areas as a means to lower production costs and remain competitive.
- Crop specific price interventions can encourage a commodity mix narrower than would be the case if payments were not restricted to certain crops. Would removing these supports encourage diversity in cropping practices on the farm and encourage continued planting of crops with reduced rotations?
- Payments that have traditionally been made based on units of production encouraging farmers to maximise yields per hectare and leading to high levels of fertiliser and other chemical inputs. This does not support the family, small-scale farm, or traditional methods of production and can create surplus which drives prices down. What are the environmental and social implications of removing crop specific price supports?
- Where input subsidies encourage the overuse of pesticides and fertilisers, or provide the use of natural resources such as land and water at costs substantially lower than market values, what are the environmental and social implications of removing these supports?
- What are the impacts on food security of reduced total supply that might occur as a result of the removal of export subsidies?
- What will the impact of removing domestic supports and exports subsidies be on prices?
- How will changes in prices affect net food importing countries?
- For countries with a capacity to increase production, will changes in prices provide an incentive or a disincentive to increase production and export revenues?
- Will the removal of supports lead to effects on land conversion, intensity of livestock production, or adoption of technologies that promote conservation such as Integrated Pest Management practices?

Structural Issues. Trade liberalization can lead to changes in the composition of goods and services in the country as it specializes and trades those goods where it has comparative advantage. If the changes favor the less-polluting industries, then, positive environmental effects could be realized. Trade liberalization may also result in the removal of subsidies, quotas, or other trade-restrictive measures that hinder attainment of allocative efficiency. On the other hand, the products where the country has comparative advantage may have higher pollution intensity. They could also be produced only with more extraction of the country's natural resources. Without the appropriate environmental policies negative environmental effects may occur.

- How have structural changes in the livestock (pig, poultry, beef, dairy) industry occurred? Have these changes led to higher livestock densities, in what regions, what are main concerns with respect to environmental and human health?
- Have falling prices for specific commodities led to increased production or diversification? What are the environmental and/or social consequences of this structural change?

- Has concentration of livestock production at the regional level occurred? This can impact upstream and downstream enterprises. For example, regional clusters with several feed suppliers and livestock processes and other specialised services might appear. The overall effect of further trade liberalisation on regional clustering of livestock operations is difficult to quantify, largely because of the influence of other factors driving structural change, such as technological developments and varying environmental standards and regulations across different regions.
- Trade liberalisation is expected to influence a change in the location of agricultural production between regions. If a contraction in agricultural production is expected in countries that maintain the highest levels of trade protection and an expansion in agricultural production in other countries, what are the implications for land use?

Production Practices, Techniques and Technology. Commodities traded need not refer only to goods and services; they also include technologies used in production activities. For example, expansion of farm production will have immediate impacts on land use and land use change. The extent of that change in land use depends on the type of crop and crop production method introduced. In general, examples of land use change associated with the farm sector have include the clearing of primary forests, including tropical forests, for arable lands, and the conversion of natural prairies and grasslands for crop growing or livestock grazing as well as the draining of wetlands either for irrigation of land conversion purposes.

Trade policies or agreements can trigger transfer of technologies that can be harmful or friendly to the environment. There is a positive technological effect when the trade policy allows the flow of environmentally friendly technologies that translates to a reduction of pollution per unit of economic output. On the other hand, a negative technological effect occurs in case the trade policy/agreement induces transfer of harmful technologies. Mix effects are those that come about as a result of changes in the mix of agricultural and non-agricultural goods produced and consumed, holding constant the scale of economic activity, such as a decrease in the share of food production and land in production, and an increase in manufacturing.

- What is the impact of prices and the extent to which incomes of producers and exporters could rise, and is this likely to offset the effects of a decline in subsidised inputs at the farm level, encourage more environmentally friendly production techniques, or take marginal land out of production?
- Where are the effects of liberalisation likely to be most acutely felt, by sector or by geographic locale, and are these sectors and locales well placed to take advantage of efficiencies that prevent moves toward environmentally degrading techniques to intensify production?
- Is trade liberalisation likely to result in a changing product mix, product shifts, output substitution and move towards crops that are more or less pollution intensive requiring increased irrigation and use of chemicals, taking into account their value?
- Is increasing liberalisation expected to encourage intensive production techniques, an increased reliance on inputs, and increases in land under cultivation?
- What are the potential economic, environmental and social implications of GMOs in the trading system?
- Do conflicts over GMOs raise problems for food importing countries seeking to maintain adequate supplies and for less developed countries seeking to use GMOs to explore a largely unrealised potential for enhanced food production?
- What are the impacts of production practices on organic nitrogen surpluses and other soil related properties?
- What are the levels of pesticide and fertiliser use and how might these be impacted by trade-induced economic change? Often the environmental impact of pesticide and fertiliser application depends on site-specific characteristics such as climate and soil type.
- What are the impacts on biodiversity associated with an expansion in farm production in developing countries?
- What are the impacts on biodiversity of a contraction in farm production in developed countries?

- Are there conflicts between social groups associated with changing production?
- What are the social impacts on forest dwelling indigenous groups?
- Are vulnerable groups such as small-scale farmers and the rural poor, negatively affected?
- What are the impacts on forests?
- What are the potential impacts in the longer term due to increases of input use?
- What is the likelihood of appropriate government responses?

Physical Infrastructure. This relates to the character and environmental impact of the physical infrastructure that supports site-specific production units and connects them to their inputs, customers and stakeholders. In examining the environmental impacts of infrastructure, the following variables should be considered: existing infrastructure capacity, correlation of capacity with concentrated activity, choke points, competitive corridors, transportation/ transmission scale, and inter-modal shifts in transportation. **(to be continued)**

Regulatory and Institutional Issues. Regulatory effects consider the impacts of trade policies and agreements on environmental laws and regulations. Where provisions to mitigate environmental effects are included in trade agreements, then, positive environmental impacts can result. Positive regulatory effects could also occur when the trade measures do not impinge upon the ability of governments to implement effective environmental policies. On the other hand, negative regulatory effects occur if provisions of trade agreements undermine the ability of governments to set standards for environmental protection.

- Assess whether the SPS Agreement, and the risk assessment methodologies that it currently relies on, well placed to address emerging issues that could involve questions of biological risk assessment.
- Given the complexities behind procedures involved in the application of SPS measures, consider how to participate more effectively in the SPS Agreement.
- Are technologies to support relatively environmentally friendly production techniques universally available and how, including through allowable support measures, can their availability be ensured at the lowest possible cost?
- Do appropriate tools exist to ensure the ongoing preservation of biodiversity?
- Are parallel environmental and resource conservation policies appropriate to be taken in conjunction with trade liberalization?
- Are national institutions, regulatory regimes, and domestic social structures and, if necessary, safety nets, in place to support agricultural reform?

V. POLICY RESPONSES

UNEP has adopted an approach to IA that prioritizes the policy relevance of the work. Therefore, as put forward in the Reference Manual, the final stage of any IA is to develop policy responses based on the findings of the research and analysis. UNEP's approach to developing policy responses at a general level is described in Section V of the *Reference Manual*. This section examines examples of policy measures that might be relevant to promote sustainability in the agricultural sector, in the context of the WTO's Agreement on Agriculture.

At a general level, the *Reference Manual* puts forward criteria to guide the selection of appropriate policy responses (Box 27).

In this context, emphasis is placed on policy recommendations that are practical and enforceable. To be practical, policies should take into account existing political and policy realities, including associated policy objectives. For example, many environmental outputs are jointly produced with agricultural commodities. Any policy action aimed at internalising environmental costs and benefits may affect the quantities produced and consumed of the commodity and therefore the related trade flows, prices and incomes. The higher the conflict, the greater the risk of imposing a burden on others, and the lower the degree of fairness/equity and the political acceptability.⁹⁴

Box 26: Criteria for selecting policy responses

- Sustainable development priorities. Options should address the countries sustainable development priorities including development interests, environmental protection priorities, capacity and institutional dimensions, impact on poverty, and social imperatives.
- Regulatory consistency. Options should be practical and consistent with domestic and international legal regimes and policies.
- Policy coherence and co-ordination. Options should be designed to avoid duplication and to be consistent with other measures proposed.
- Level of resources. Options should be cost effective and should be prioritized depending on the urgency and the level of resources available.
- Feasibility of the policies.
- Existing capacity. Are the existing regulatory, institutional and financial capacities in the affected areas sufficient to implement appropriate policy options?

To be enforceable practitioners should consider enforcement needs at the farm level, which involves compliance monitoring and sanctioning. Where actions are implemented through markets, such as inorganic fertiliser or pesticide tax, there is no need for compliance monitoring at the farm level. The more difficult the measurement of the required farm obligation or outcome, the greater the enforcement cost (budgetary cost and environmental losses associated to the degree of non-compliance). For example, prescriptions that can be observed visually (e.g., land set-aside, establishment of green covers or landscape features) are easier to monitor and enforce than non-visible constraints which require sophisticated technical equipment to get reasonable compliance records.⁹⁵

Typically, policy responses should include a broad range of approaches including command and control, market-based incentives, and institutional policies. Moreover, in identifying relevant policies within an IA, a researcher should also take into account issues of timing, and address issues where policy intervention is urgent. Finally, in identifying appropriate policy responses, care should be taken to identify the spatial focus of that policy in terms of the farm level, the national level, the regional level or the global level. According to the OECD, respective clearly defined and accepted property

⁹⁴ See OECD, 2001. Improving the Environmental Performance of Agriculture, policy Options and Market Approaches.

⁹⁵ OECD 2001.

rights and reference levels may be the single most important factor determining the acceptability of any policy action.⁹⁶

1. Trade-Related Policy Responses

A policy response that suggests the adjustment of a trade-related policy or a trade agreement might arise out of an *ex-ante* assessment. Adjusting a policy or an agreement is one response that can occur prior to or during a negotiation in response to an issue of concern raised in an integrated assessment. Adjustments might also be made within mechanisms proposed within a trade liberalisation agreement such as a dispute resolution process that allows for a significant environmental or social voice and a carving out of exceptions designed to promote sustainability by protecting environmental or social priorities. These adjustments might be made within national negotiating positions at points during the negotiation where review of existing commitments is called for. Alternatively, the results of an *ex-post* assessment can modify the development of prospective trade-related policies for future agreements.

In some cases, trade-related changes can simply include levels of flexibility in implementation of negotiated provision of a trade agreement. The emphasis in LDCs and other vulnerable countries (such as single commodity producers, or small island developing states) as well as low income net food importing countries might be on securing adequate and reliable supplies of staple foods. Specific measures might be considered to increase flexibility, enhance production for domestic consumption and protect the livelihoods of low-income farmers. Specific trade-related provisions could include exempting food-security crops from tariff reduction commitments and renegotiating tariff bindings for these products where they are considered too low. It might also include the design of new Special Safeguard Mechanisms available to developing countries in response to import surges, and the exemption of domestic support measures for food-security goals from reduction commitments. Middle income countries that are net exporters might seek reduction in trade barriers. Low income net food importers might seek support for key crops or livestock to encourage import substitution or to relieve poverty.

Other policies that could be put in place in conjunction with trade agreements are policies to encourage access to technologies to support diversification and capacity building. Dependency on single commodities can come about in some cases as a result of the natural resource endowments of a country and can be aggravated by trade preferences in developed country markets. Efforts could be included in negotiations to include technical assistance to help single commodity producers diversify. This could include access to technology and support for diversification of commodity base or, where possible, into other economic sectors such as tourism and manufacturing. Underlying this discussion is the question of whether a liberal trade regime would favour some developing countries with inherent advantages in agriculture, or whether other developing countries would be hurt by more liberal trade.

The exceptions in Article XX of the GATT with respect to SPS measures are important for agriculture. Some countries may be required to invest in resources, infrastructure and regulatory mechanisms to develop appropriate SPS standards in order to expand export capacity. Countries in a position to do so, at the domestic level, should invest in meeting international SPS standards, in areas such livestock production and export. In other countries, this might require external assistance.

Where important issues related to sustainability are identified, a commitment could be made to pursue those issues in committees set up under the trade agreement that are designed to work through the timing and implementation of provisions of the agreement. Where a trade agreement or a trade measure is seen to have large environmental or social impacts there may be time, as a result of an *ex-ante* integrated assessment, to propose a parallel regime that will consider environmental and/or social

⁹⁶ Improving the Environmental Performance of Agriculture, policy Options and Market Approaches, OECD 2001.

issues in conjunction with the implementation of liberalisation. In some cases this could occur at the national level. In others, where issues cannot be dealt with domestically, because of their regional nature or where capacity issues exist, it might be appropriate to propose such an institutional response at the regional or even multilateral level – through existing institutions or through the creation of new ones.

2. Implementing Complementary Environmental and Social Policies

In general in integrated assessment, policies that are not necessarily related to trade might be developed to address the findings of the work. This is especially true when looking at a sector such as the agricultural sector which touches on such a broad range of environmental and human issues and as such is vitally important for sustainability.

For the most part, the environmental and social issues that will be impacted by changes in agricultural trade fall under the purview of domestic, national government. Where trade related changes cannot be identified, or cannot be agreed on, to mitigate and negative impacts, and enhance positive impacts, countries should resort to domestic policy. As a rule, national governments are in the best position to develop and implement appropriate policies, taking advantage of the gains brought about by trade, but at the same time, ensure that their domestic policies are sound, and focused in such a way that they can offset potential impacts on sustainability.

Therefore, an IA should also focus on non-trade related policies promoting sustainability in agricultural production, in parallel with trade-related agricultural reform. These policies could emerge from *ex-ante* or *ex-post* assessments. These might accompany the implementation of a trade agreement at the outset, or be put in place following the negotiation of an agreement in order to enhance any beneficial effects or mitigate negative impacts of the liberalisation and associated economic activity.

UNEP has classified such complementary policies into three general categories: market based instruments, command and control policies, and institutional support. Typically a mix of policies is recommended to allow flexibility, control costs and address the very broad range of issues likely to arise in an IA (Box 28).

1. Market based instruments

Market-based instruments might usefully be used to address market distortions arising from environmental and social externalities. In some sectors government support measures can promote the unsustainable use of a resource, or encourage the use of a resource that is ultimately unsustainable. In some cases those who reap the benefits from over-exploitation or from degradation do not pay the full costs, and those who preserve natural resources or who pay the costs of conservation gain few of the benefits. In some cases the welfare effects of liberalising trade would be ambiguous if environmental externalities were left uncontrolled, and can only be assured if such externalities are internalised by appropriately targeted measures. A range of market based instruments that might be implemented in response to the findings of an integrated assessment, in an effort to promote sustainability. These

Box 27: Bananas in Ecuador

- Establish a database of capital goods that constitute “certified clean technology” and apply significant import tariff reductions
- Grant preferential credit rates to businesses that wish to adopt clean technology processes
- Promote environmental certification
- Promote price fixing policies that take into account social and environmental externalities and are competitive in international markets
- Encourage capacity building and technology transfer by creating special programs among producers and exporters
- Institute awards for excellence in environmental and social practices
- Strengthen institutions that can address the internalization of sustainable policies for Ecuador’s banana production

Source: UNEP, 2002. “Ecuador Banana Sector”

might include tax policies, subsidies, deposit refund systems, exchange rate policies, funds, user fees and administrative charges, monetary and credit charges.⁹⁷ In some cases, the implementation of market based instruments are necessary, where revenues are not sufficient to impose and enforce traditional command and control policies. Local authorities often do not have the necessary financial, human and technical resources. There are cities whose municipal authorities have a budget of one dollar per year per inhabitant. This could necessitate partnerships with the private sector. It could also generate revenues for further projects to support sustainability. In Nigeria, for example, a recent IA recommended the application of an effluent charge on pollutants arising from the activities of rubber processing industries and any others to minimise or eradicate the untreated petroleum hydrocarbon generated by their factories.⁹⁸

Specific policies will be discussed further as they relate to agriculture and sustainability and will include input from the meeting.

2. Command and Control policies

Command and control policies rely on the direct control of market flows by governments rather than on the functioning of prices system in the marketplace. Command and control policies might include measures such as land zoning, licensing, strengthening property rights and legal reform. These include regulatory measures, standard setting, property rights, insurance and liability related policies.

Governments at all levels have an important part to play in regulating on issues that affect agriculture. For example, local governments and authorities are responsible for establishing regulations for food hygiene and trade. Local governments are also often responsible for road construction, which is crucial to get food to markets. Governments are also responsible for implementing laws and policies with respect to land-use planning and zoning. This includes identifying appropriate tracts of land for agricultural use vis a vis commercial use, as well as areas that should be protected for their inherent environmental or social value. Expanding cities need more and more infrastructure, transport facilities, slaughterhouses, and food supply and distribution issues that should be taken into consideration in urban planning. Governments can also play a key role in creating a favorable climate for investment.

Specific policies will be discussed further as they relate to agriculture and sustainability and will include input from the meeting.

3. Institutional Support

Specific policies will be discussed further as they relate to agriculture and sustainability and will include input from the meeting.

⁹⁷ For a more detailed description of individual policies, see Section V of UNEP's *Reference Manual*.

⁹⁸ UNEP. 2000. (Nigeria study).

Box 28: Examples of institutional policy responses

- A Fard Development Advisory System should be evolved to advise non-producers of cocoa and rubber on appropriate environmentally friendly and profitable enterprise combination of new-other export crops.
- The Federal ministry of health should ensure the availability of more health services to rural areas where cocoa and rubber are produced to assist in the treatment of ailments that might result from the exposure to agrochemicals, and adopt safe methods of pesticide application.
- Publicity and education programmes on how to use the chemicals should be developed.
- Federal and state ministries of information in co-operation with other relevant departments should revise and improve on the long-standing methods of disseminating agricultural information to farmers, including pictorial presentation since most farmers are illiterate, and through the radio.
- A supervisory marketing agency led by government, but including stakeholders, that can monitor the sale and promote the production of cocoa and rubber in an environmentally friendly manner and oversee the supply and use of appropriate agrochemicals.
- Capacity building programmes on environmental issues should be organised by the Federal ministry of environment and academic institutions (this will require outside funding).
- Increase research for export crops, including research on disease resistance and high yielding varieties on data generation and on training.

UNEP. Nigerian case study.