Protecting biodiversity in production landscapes

A guide to working with agribusiness supply chains towards conserving biodiversity

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Foreword

The ever increasing world population is placing great strains on biodiversity and the ecosystem services that support the production of agricultural commodities needed to meet current global demand. Problems arising from the continued degradation of ecosystem services are already apparent with commodity prices rising dramatically and food shortages becoming common in many countries. While climate change is partially responsible, much of the blame can be placed on the continued use of unsustainable farming practices that have reduced farm yields in many developing countries. The reduced production is a two edged sword; not only does it lead to food shortages but it also negatively affects social and economic development in the effected countries – all factors that have a major impact on the rural poor.

The FAO and the World Bank have forecast that food production will need to double by 2050 to meet the demands of a greatly expanded population. Current public and private initiatives to improve production methods and performance are making some progress but the often fragmented approaches taken have not set a pace that will allow this enormous target to be met. It is essential that governments, farmers, agribusiness corporations and other stakeholders fully coordinate their efforts if sustainable agricultural production practices are to become a driving factor for achieving food security and national social and economic growth.

The UNDP, as the lead UN Agency for poverty reduction and provision of support to developing nations, can help to coordinate the diverse interests of the various stakeholders and assist governments in developing effective programs to implement biodiversity friendly and sustainable agricultural production. The UNDP has a proven track record in biodiversity conservation and rural development projects involving both public and private funding. Over the last 10 years, the UNDP has participated in over 200 private sector and foundation partnerships. In partnership with the Global Environment Facility (GEF), the UNDP Ecosystems and Biodiversity (EBD) programme currently supports biodiversity management initiatives in over 120 countries around the world. The GEF global portfolio has a cumulative value of more than USD 2 billion in GEF financing and public private co- financing. With offices in 166 countries, the UNDP is in a unique position to work with governments and agribusiness stakeholders to develop a fully coordinated approach to protecting biodiversity and implementing fully sustainable agriculture.

Recognizing the urgent need to accelerate the change to fully sustainable agricultural production, the UNDP established the Green Commodities Facility (GCF) in 2009. Its mission is to work with governments, local producers, and national and global marketing companies to mainstream sustainability of the production and sale of agricultural commodities. The GCF was established to manage a global portfolio of country level commodity development programmes to institutionalize methods for protecting natural resources. It also assists with scaling-up production to meet increasing demand and boost local economic development. GCF projects are largely carried out in-country to ensure that the strategies being developed and implemented fully reflect national requirements.

This publication provides an outline of the problems associated with unsustainable agricultural practices and presents recommendations for accelerating the change to fully sustainable and biodiversity friendly agriculture. It is hoped the suggested changes will be thought provoking. Readers requiring further information, or those considering the need for assistance to help launch new sustainability and trade improvement initiatives, are urged to contact the Green Commodities Facility via the nearest UNDP country office.

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Yannick Glemarec, Executive Coordinator, UNDP-GEF and Director Environmental Finance

Executive Summary

Biodiversity is being lost at a rate that will have significant economic and social implications around the world if this deterioration is allowed to continue unabated. Much of this loss may be attributed to the need to produce more food supplies for an ever-increasing world population.

Most of the world's food production is sold to national or international buying companies rather than to the end consumer. Many of these companies sell the raw produce onwards to processing companies or wholesalers, thus forming a chain of companies involved in getting the produce from the farm to the consumer.

Supply chain operations have major impacts on both biodiversity and national economies. Businesses are by far the largest contributor to biodiversity loss due to the scale of production required to meet the demands of national and international supply chains. There is an urgent need for governments, producers and other stakeholders to work closely to develop market-based mechanisms and establish policy and legislative environments that provide incentives for farmers to adopt fully sustainable practices.

This publication examines the impacts of agricultural supply chain activities on biodiversity and ecosystems and provides recommendations for the conservation policies that are needed to preserve this vital resource. It is intended to provide government policy-makers with guidelines for developing strategies for involving agricultural supply chains in the drive for biodiversity protection and the implementation of sustainable development. The publication may also interest those in the private sector, community groups and NGOs interested in implementing fully sustainable agricultural production.

Chapter One explores the main causes of biodiversity loss and discusses the economic and social impacts that may occur if the losses are allowed to continue. It discusses the relationship between the operation of supply chains and biodiversity and ecosystem services.

Chapter Two explains how supply chains operate and examines agricultural supply chain activities that affect biodiversity and degrade the resilience of ecosystem services. This discussion is followed by a review of the impact of widely used farming practices and recommendations for adopting farming techniques needed to implement sustainable production. The chapter also addresses the importance of maintaining genetic stocks, and how the introduction of internationally recognized product standards can help the transition to more biodiversity-friendly farming practices.

Chapter Three focuses on the role of government and the importance of supply chain policies that protect biodiversity and ensure the long-term sustainability of agricultural production.

Chapter Four considers the implications of markets and money; the main factors driving supply chain operations to participate in sustainable development initiatives. The chapter demonstrates that markets and money are playing an increasingly important role in conservation as consumers become aware of the need to protect the environment and place demands on suppliers to meet improved production standards.

Case studies and examples have been used throughout to illustrate many of the points raised in the report.

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Acronyms and abbreviations

Acronym	Meaning
AAUs	Assigned Amount Units
BCtA	Business Call to Action
CAMBio	Central American Markets for Biodiversity
CBD	United Nations Convention on Biological Diversity
CDCF	Community Development Carbon Fund
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CERUs	Certified Emission Reduction Units
CITES	United Nations Convention on the International Trade of Endangered Species
ERUs	Emission Reduction Units
EU	European Union
EU ETS	European Union Emissions Trading Scheme
FAO	Food and Agriculture Organization
FCPF	World Bank's Forest Carbon Partnership Facility
FLO	Fair Trade Labeling Organizations International
GCF	UNDP Global Commodities Facility
GEF	Global Environment Facility
GHGs	Greenhouse gases
GIM	Growing Inclusive Markets
GIS	Geographic Information Systems
GNP	Gross National Product
GSB	Growing Sustainable Business
ICRAF	International Center for the Research of Agro-forestry
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IFDC	International Finance Development Company

IFOAM	International Federation of Organic Agriculture Movements
IPM	Integrated Pest Management
JI	Joint Implementation
LULCF	Land use, land use change and forest activities
MEA	Millennium Ecosystem Assessment
MFP	Multi-functional platform
MODIS	Moderate Resolution Imaging Spectroradiometer
NASA	National Aeronautics and Space Administration, U.S. Government.
NGO	Non-governmental organization
PES	Payment for Environmental Services
RA	Rainforest Alliance
RMUs	Removal Units
SAN	Sustainable Agriculture Network
SMBC	Smithsonian Migratory Birds Center
TEEB	The Economics of Ecosystems and Biodiversity report
TNC	The Nature Conservancy
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Convention on Climate Change
U.S.	United States
USDA	U.S. Department of Agriculture
VCS	Voluntary Carbon Standard
VERs	Verified Emissions Reductions
WBCF	World Bank Carbon Fund
WHO	World Health Organization
WWF	World Wildlife Fund
WTO	World Trade Organization

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Biodiversity conservation and supply chain management

This chapter discusses the main causes and impacts of the continued loss of biodiversity and then looks at the relationship between supply chain operations and biodiversity and ecosystem services. Areas addressed include:

- The social and economic importance of biodiversity;
- Causes of biodiversity loss and ecosystem degradation;
- The financial and cultural impacts of allowing biodiversity loss to continue;
- The link between biodiversity and agricultural production; and
- The relationship between supply chain operations and biodiversity.

Why biodiversity matters

Biodiversity is the term used to describe the variety of life at all levels, from genes to species and ecosystems. The continued presence of biodiversity is fundamental for ecosystems to be in a position to provide the many services upon which humanity depends. Ecosystem services include the provision of food, water and shelter, regulatory services including flood and disease control, cultural services such as spiritual and recreational benefits, and supporting services such as the cycling of nutrients. While every person in every country depends on these services and the biodiversity that underpins them, those with the most direct links are the poorest and most vulnerable people (MEA 2005).

Unfortunately, biodiversity is being lost at an ever-increasing rate. The Millennium Ecosystem Analysis (MEA) concluded that almost 60% (15 out of 24) of the ecosystems services that support life on earth and underpin human well-being are being degraded or used unsustainably as a direct result of human activities. Overall, species have declined by 30% between 1970 and 2003, with the number of crucially endangered species increasing by 7% between 2004 and 2006 (WWF 2006). Unless positive action is taken now to prevent further damage to ecosystems, the next mass extinction will take place within decades rather than over millennia.

The MEA asserts that the major direct causes of biodiversity loss are habitat destruction, the spread of invasive species, pollution (through the release of industrial and agricultural pollutants into air water and soil), climate change and overharvesting. The accelerating biodiversity loss is also attributable to a combination of economic development and a rapidly increasing global population. The need to boost world food supplies has resulted in the conversion of many forests, grasslands and wetland areas into farmland so as to increase agricultural production, and resulting in loss of biodiversity and degradation of ecosystem services. In many cases, the problem has been compounded by the overexploitation of many natural resources in order to meet the demand for new products and services.

The pressures on biodiversity and ecosystem services are expected to increase dramatically over the next few decades as the global population is conservatively predicted to increase to more than 10 billion people by 2050 (www.un.org/esa/population/). The extent of forecast growth raises concerns about the ability of

A forest cleared by "slash and burn" methods in Peru

natural and managed ecosystems to provide the food supplies and other natural resources needed to meet the demands of a vastly expanded human population.

The loss of biodiversity has many consequences beyond the loss of species. A reduction in the diversity of life can lead to ecosystem degradation, resulting in serious and potentially irreversible impacts. For example, the loss of forests can greatly reduce natural protection from flooding and erosion control as well as an ecosystem's ability to store water – factors that directly affect human well-being and productivity. The reduction in biodiversity also weakens the resilience of ecosystems to withstand climate change or expanding human activity. This extends the risk of further ecosystem degradation, and the attendant loss of vital ecosystem services.

The loss or degradation of ecosystem services also has significant economic implications since business and ecosystem services are inextricably linked. Enterprises not only affect biodiversity and ecosystem services, but also rely on them. For example, pharmaceutical companies rely on biological and plant resources; agricultural companies rely on soil fertility and pollination; and manufacturers need access to water and raw materials. Ecosystems that are degraded or out of balance are not in a position to supply the quantity and/or quality of services required to maintain profitable levels of production. This can affect the profitability of the companies involved and generate an adverse impact on economic development in general. Yet many enterprises routinely fail to recognize the link between healthy ecosystems and the viability of their business interests – thus exposing their companies to increased risk of shortages of essential services and resources.

In addition, degradation of ecosystems generates significant social impacts. Individuals, especially those directly dependent on ecosystems to provide food, shelter and water, may experience shortages of supply that will directly affect or even jeopardize their existence. Others may find that the religious, cultural and recreational aspects of their lives are affected by changing landscapes and diminishing species.

The cost of these economic and social impacts of ecosystem degradation is immense. For example, the value of losing forest ecosystems has been estimated at over €28 billion per year for the period between 2000 and 2050. Net present value calculations peg these losses to between €1.35 trillion and €3.1 trillion, using discount rates of 4% and 1% (Braat and Brink 2007). The marine environment also has a very high value. Another report estimates the overall human welfare benefits from coral reef ecosystems to be US$172 billion annually (Martinez et al. 2007). In 2009, is was estimated that the cost of destroying just one kilometer of coral reef, based only on the value of fisheries, tourism and shoreline protection, ranged from US$137,000 to US$1.2 million over a 25 year period (Barber and Pratt 1997).

Wetland in Brazil

Impacts of agriculture on biodiversity

Agriculture occupies more than 60% of all habitable land on Earth and accounts for about 70% of human freshwater use. The sector depends directly and profoundly on healthy ecosystems, for nutrient rich soil, water flows, pollination, and genetic diversity that can increase the long-term viability of common crop species. Agriculture can have severe negative impacts on biodiversity through land-clearing, the introduction of non-native species, excessive water use, habitat conversion, and soil and water contamination. It can also be possible to have biodiversity value in cultivated landscapes, for example by planting native species and preserving some of the natural aspects of an area.

Source: www.ifc.org/BiodiversityGuide

Despite the evidence, the importance and value of natural services remain largely unrecognized by both national and international economic markets. The lack of economic valuation has contributed in many countries to governments failing to recognize the urgent need to update legislation, policy frameworks and land management practices in order to counter the problem of ecosystem degradation. It is emphatically the case that this situation must be rectified if important natural resources are to be preserved for the benefit of future generations.

The development of a relatively straightforward method of defining the value of ecosystem services, the cost of unsustainable land use, and the distribution of the benefits and costs between business and the population in general would be very useful tools for government and business planners alike. Full development of these tools will require a closer level of cooperation between governments, research organizations and private organizations, if acceptable solutions are to be found.

Biodiversity and agricultural production

The recent growth in world population has led to increased demands for greater supplies of food. While some countries have been able to meet the increased demand by improving productivity on existing farms, others (especially developing countries) do not have the resources to achieve the required growth in output without the conversion of more land to agricultural use. However, while many people assume that the slash and burn practices of subsistence farmers used to convert forest to farmland are the greatest cause of biodiversity loss, major commercial enterprises are responsible for substantially greater clearance of fragile natural resources as companies seek to capitalize on the opportunities offered by increasing consumer demand.

The damaging impact of agribusiness on biodiversity has occurred on three fronts. The first is directly linked to the expansion or establishment of major farms, ranches and plantations owned by corporate enterprises. The second is an indirect impact resulting from the influence of agribusiness purchasing power on independent farmers who must increase revenues and sales to agricultural-based business by expanding farmland. The third impact is a result of the political and financial leverage that major corporations have for acquiring the most fertile agricultural lands, thus forcing local rural people that depend on agriculture for subsistence to move to forested areas – again increasing deforestation, loss of habitat and degradation of local ecosystems.

Land clearance operations in developing countries are generally carried out in fragile ecosystems with little resilience. Farms established in these areas are often underfunded and cannot afford fertilizer or other crop inputs, this resulting in a relatively quick decline in soil fertility. Such a decline can be very expensive for affected countries, with an IFDC report stating the African continent alone loses an estimated $4 billion worth of soil nutrients per year.

The practice of slash and burn in Southern Madagascar

Slash and burn agricultural field, DRC

The world food price crisis of 2007-2008

The world food price crisis of 2007-2008 triggered a significant increase in foreign acquisitions of farmland in Africa, Latin America, Central Asia and South-east Asia by countries seeking to ensure food security or sources of biofuels. A recent study conducted by the International Food Policy Research Institute has indicated that up to 20 million hectares have been sold or leased since 2006. While some of these transfers have brought much-needed investment money to poor countries, some transfers have included land used for small-scale subsistence farming or nomadic herding, with the change to private ownership depriving many customary land users of access to the land involved. In other cases, the transfers involved undeveloped land that required large-scale clearance of forests and wetlands prior to cultivation, with the accompanying loss of habits. Even protected areas have not escaped cultivation:

'In the sparsely populated Gambella region of southwestern Ethiopia, a massive expansion of foreign agribusiness operations is gobbling up roughly a million acres of open woodland bush that is home to the annual migration of more than a million antelope known as white-eared kob. The region lies within the boundaries of Gambella National Park, but neither the Ethiopian government nor a major Indian agricultural company, Karuturi, are paying any attention to park boundaries as Karuturi plows up more than 1,000 acres a day to grow rice, maize, sorghum, oil palm, and sugar cane. And for this far-flung corner of Africa, the development of Gambella may only be the beginning, as international agribusiness eyes similarly rich lands in the newly designated nation of South Sudan'. *Yale Environment 360 (Fred Pearce)*

The reduction in productivity arising from lower fertility in turn drives many farmers to consider clearing more forest in order to maintain income levels. This is a vicious cycle that can only be broken by providing farmers access to credit facilities and extension services that teach methods of improving production and other revenue-generating activities to maximize income from current farm land.

Deforestation is not the only cause of biodiversity loss within and adjacent to areas of production. For instance, pollution, chemical run-off, excessive use of herbicides and the introduction of alien invasive species also contribute to loss of biodiversity. The combined effect of these factors is illustrated in Figure 1.

To address these issues, governments in developing countries must work closely with the various stakeholders involved in the production of agricultural goods in order to develop national policy frameworks that ensure that land use practices are changed so as to reflect an ongoing concern for maintaining ecosystem functions.

Policies need to be put in place to provide farmers with incentives to adopt biodiversity-friendly principles on their farm, such as the planting of shade trees amongst the primary crop or along field margins and internal roads or pathways. Where the adoption of techniques that create habitats is not feasible, farmers should be encouraged to use agricultural practices that will help to minimize impacts on biodiversity both locally and in adjacent areas.

Habitat conversion → Deforestation → Loss of genetic diversity → Loss of ecosystem resilience → Loss of watersheds → Reduced water table → Soil erosion → Loss of many seed dispersal mechanisms → Loss of major pollinating vectors → Loss of soil fertility and structure from continual zero input farming → the spread of invasive alien species and super weeds → Pollution from agricultural inputs entering waterways → Desertification

Figure 1 From habitat conversion to desertification – an increasingly common phenomenon

These actions will not only improve the sustainability of crucially important production landscapes for future generations, but will also create opportunities for primary producers to increase revenues by improving productivity. Such actions can also open the door for local businesses to access new green markets and/or payments for environmental services such as carbon sequestration and watershed protection.

The scale of global agriculture

The scale of global agricultural production is vast. The Food and Agriculture Organization (FAO) estimates that the top 20 agricultural commodities had a global production value of over $ 1.446 Trillion in 2009 (FAO 2009). This scale is further reflected by the establishment of approximately 48 major commodity exchanges worldwide, trading in over 95 agricultural commodities.

The general price level of an agricultural commodity, whether at a major terminal, port or commodity futures exchange, is influenced by a variety of market forces that can alter the current or expected balance between supply and demand. Many of these forces emanate from domestic food, feed and industrial-use markets and include consumer preferences and the changing needs of end users; factors affecting the production processes (such as the weather, input costs, pests and diseases); relative prices of crops that can substitute in either production or consumption; government policies; and factors affecting storage and transportation.

Agricultural production also uses very large areas of land. FAO statistics indicate that over 1.4 billion hectares were used for the harvesting of agricultural products in 2009. Large areas of land are used for crop production in both developed and developing countries. This is illustrated in Table 1 below which provides statistics for the area harvested in the five largest producing countries for each of the top ten crops ranked by area harvested.

What is an agricultural commodity?

Agricultural commodities are typically goods that are produced in large volumes. Those of the same type are visually indistinguishable from one another and are sold at a set terminal market price irrespective of the commodities source of origin. Examples of agricultural commodities include sugar, rice, tea, coffee and cotton. However, there are some exceptions to a common pricing structure. When buyers request specific product origins, commodity price differences can apply – as in the instance of cocoa from Ghana compared to that of Indonesia. These price differences are based on various attributes (duty, shipping, product quality, etc.) as the physical appearance of the product remains much the same.

Farmer inspecting maize crops in Mozambique

Table 1 Area harvested in 2009 for the top ten area intensive agricultural commodities
Total area harvested 1,435,349,190

Rank	Commodity	Major producers	Area harvested (Ha)	Pct total area	Production (Tonnes)
1	Wheat	**Global production area:**	225,622,452	15.7%	
		India	27,750,000	12.3%	80,680,000
		Russian Federation	26,632,900	11.8%	61,739,800
		China	24,291,081	10.8%	115,115,364
		United States of America	20,181,100	8.9%	60,314,300
		Kazakhstan	14,329,400	6.4%	17,052,000
		Sub Total	113,184,481	50.2%	334,901,464
2	Maize	**Global production area:**	158,628,747	11.1%	
		United States of America	32,209,300	20.3%	333,011,000
		China	31,203,727	19.7%	164,107,560
		Brazil	13,791,200	8.7%	51,232,400
		India	8,330,000	5.3%	16,680,000
		Mexico	6,223,050	3.9%	20,142,800
		Sub Total	91,757,277	57.8%	585,173,760
3	Rice	**Global production area:**	158,300,068	11.0%	
		India	41,850,000	26.4%	133,700,000
		China	29,881,590	18.9%	196,681,170
		Indonesia	12,883,600	8.1%	64,398,900
		Bangladesh	11,354,000	7.2%	47,724,000
		Thailand	10,963,100	6.9%	31,462,900
		Sub Total	106,932,290	67.6%	473,966,970
4	Soybean	**Global production area:**	99,501,101	6.9%	
		United States of America	30,907,000	31.1%	91,417,300
		Brazil	21,750,500	21.9%	57,345,400
		Argentina	16,767,500	16.9%	30,993,400
		India	9,790,000	9.8%	10,050,000
		China	9,190,123	9.2%	14,981,221
		Sub Total	88,405,123	88.8%	204,787,321
5	Barley	**Global production area:**	54,059,705	3.8%	
		Russian Federation	7,722,000	14.3%	17,880,800
		Ukraine	4,993,500	9.2%	11,833,100
		Australia	4,088,000	7.6%	8,098,000
		Spain	3,045,300	5.6%	7,348,500
		Turkey	2,977,330	5.5%	7,300,000
		Sub Total	22,826,130	42.2%	52,460,400
6	Sorghum	**Global production area:**	39,969,624	2.8%	
		India	7,530,000	18.8%	7,250,000
		Sudan	6,652,500	16.6%	4,192,000
		Nigeria	4,736,730	11.9%	5,270,790
		Niger	2,544,720	6.4%	738,661
		Sub Total	23,697,840	59.3%	27,179,671

Rank	Commodity	Major producers	Area harvested (Ha)	Pct total area	Production (Tonnes)
7	Millet	**Global production area:**	33,692,327	2.3%	
		India	10,500,000	31.2%	8,810,000
		Niger	6,513,140	19.3%	2,677,860
		Nigeria	3,749,600	11.1%	4,884,890
		Sudan	2,357,920	7.0%	630,000
		Mali	1,520,440	4.5%	1,390,410
		Sub Total	24,641,100	73.1%	18,393,160
8	Rapeseed	**Global production area:**	31,120,565	2.2%	
		China	7,278,013	23.4%	13,657,012
		India	6,300,000	20.2%	7,201,000
		Canada	6,104,500	19.6%	11,825,400
		France	1,480,810	4.8%	5,588,730
		Germany	1,471,200	4.7%	6,306,700
		Sub Total	22,634,523	72.7%	44,578,842
9	Seed Cotton	**Global production area:**	30,430,889	2.1%	
		India	10,310,000	33.9%	12,207,000
		China	4,951,830	16.3%	19,131,000
		United States of America	3,112,270	10.2%	6,330,180
		Pakistan	3,106,000	10.2%	6,338,000
		Uzbekistan	1,317,000	4.3%	3,419,800
		Sub Total	22,797,100	74.9%	47,425,980
10	Beans. Dry	**Global production area:**	25,563,866	1.8%	
		India	6,000,000	23.5%	2,440,000
		Brazil	4,099,990	16.0%	3,486,760
		Myanmar	2,850,000	11.1%	3,000,000
		United Republic of Tanzania	1,266,870	5.0%	948,974
		Mexico	1,205,310	4.7%	1,041,350
		Sub Total	15,422,170	60.3%	10,917,084
	Totals for Sected Products		509,471,904	35.5%	1,747,324,252

Source: faostat.fao.org

While large areas of land are currently used for agriculture, it is evident that significantly more land will be needed in order to meet the needs of the rising world population unless significant steps are taken to improve productivity per hectare. Some of the increased demand will be met by increasing productivity of existing farmlands. However, this requires a good understanding of crop management practices and the financial resources to purchase the required crop inputs; and these are two resources that may not be available in developing countries, where the bulk of agricultural commodities are produced.

Two combine harvesters in action in a wheat field, France

A farmer applying fertilizer, Ouagadougou

Regardless of access to resources, most farmers, and their governments, will not want to forego the economic opportunities offered by increasing demand.

It is therefore expected that the current practice of converting ecosystems to farmland will continue in many developing countries. The scale of land clearance is expected to be huge and will have a devastating impact on biodiversity and ecosystem services if current unsustainable farming and land clearance practices are allowed to continue unabated.

The 'green revolution' has helped a number of countries escape the need for large-scale conversion of forest to farmland by significantly increasing the productivity of existing farmlands. The revolution started in the 1940s was largely due to the life work of Nobel Laureate, Dr Norman Borlaug, and resulted in new agricultural techniques that provided significant increases in productivity through controlled application of fertilizers, pesticides, irrigation, selective crop breeding and double cropping. According to Borlaug (2002):

"Biotechnology helps farmers produce higher yields on less land. This is a very environmentally favorable benefit. For example, the world's grain output in 1950 was 692 million tons. Forty years or so later, the world's farmers used about the same amount of acreage but they harvested 1.9 billion tons – a 170% increase. The global population would have needed an additional 1.8 billion hectares of land, instead of the 600 million used, had the 1950s farming methods prevailed. If we had continued practicing conventional farming, we would have cut down millions of acres of forest, thereby destroying wildlife habitat, in order to increase cropland to produce enough food for an escalating population. And we would have to use more herbicides, damaging biodiversity even more. Technology allows us to have less impact on soil erosion, biodiversity, wildlife, forests, and grasslands."

The new agricultural techniques developed by the green revolution can offer some relief from the large-scale conversion of forests to farmland. However, farmers in many developing countries simply cannot afford the training, crop inputs and the select seed stock needed to make the green revolution a reality. Government funding could help to alleviate some of the financial problems, but some countries have experienced a lack of funds, compounded by a lack of understanding of the long-term socio-economic losses involved with forest clearance practices. The costs of the continuing damage to ecosystems are incalculable since many natural resources that are being depleted or lost cannot be replaced. Continued unsustainable agricultural practices, together with climate change

Worker pruning the branches of a cocoa tree in Brazil

issues, are expected to reduce productivity per unit area of land further in many regions. This will result in lower incomes for both individuals and businesses in many agriculture- dependent areas – with the resulting loss of revenues for governments as taxable incomes and/or export revenues decline.

Increasing production through land clearing rather than investing in improved production practices is common in many developing countries and has proven to be a highly unsustainable approach. This practice should be avoided as far as possible since its continuation will lead to further loss of biodiversity, thus reducing the ability of ecosystems to provide essential services such as soil fertility and water regulation. Both services have a direct bearing on agriculture and a reduction or failure in either area will reduce productivity per unit area, thus forcing farmers to consider further clearance of forests, grasslands and wetlands to provide a larger area for cultivation.

The type of crops found in a production landscape can also have a direct bearing on biodiversity. For example, shade grown cocoa can provide better habitats for biodiversity than unshaded cocoa or a monoculture of palm oil. The type of crop can also affect the type and amount of fertilizers, fungicides, pesticides, and irrigation required to optimize productivity – all factors that can adversely affect biodiversity and ecosystem services if used incorrectly. Some crops also tend to deteriorate soil fertility while others, such as legumes and clover, can fix nitrogen back into the soil and thus improve overall soil fertility, as well as serving as a source of fodder to increase the number of livestock the land area could support.

These problems will not be resolved without government involvement and cooperation from all those involved in the production and marketing of agricultural commodities. New and well-directed policies for land use and maintenance of biodiversity need to be implemented as a matter of the highest priority if the benefits derived from ecosystems are to remain available for future generations.

Understanding the supply chain

A supply chain – also known as a value chain, a supply network or supply pipeline – is a process that involves the movement of a product or service from the producer to the end customer. The primary function of an agriculturally orientated supply chain is to transform raw materials into a finished product that is delivered to the customer.

A supply chain typically consists of the seven broad functional areas, shown in Figure 2.

The terms ‘upstream’ and ‘downstream’ are frequently used in relation to supply chain activities to provide an easily understood indication of the direction of product movement through the chain. *Upstream* refers to activities that are at or close to the production of a raw material. This would include land preparation, growing and harvesting, procurement of materials, and transport to the point of packaging or manufacture. *Downstream* activities include product processing, distribution and retailers that sell finished products to the end consumer. These definitions are depicted in Figure 3 on the next page.

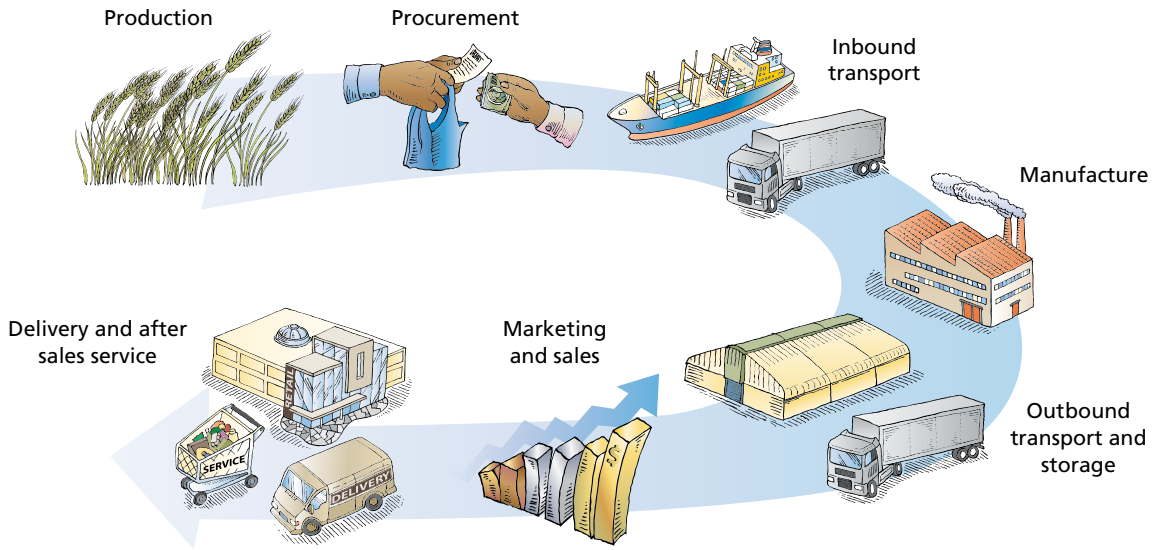


Figure 2 The flow of an agricultural supply chain

Supply chains are the vital links that allow many farmers to sell agricultural produce and commodities without having to deal directly with national or international consumers. Since they aggregate demand from many consumers, supply chains tend to buy in large quantities, thus simplifying sales activities for the producer. But since supply chains do buy in bulk, they can have a major influence on farmers' decisions regarding what to produce, how much to produce, and what quality of product is required to provide a reasonable chance of completing a sale. Such outcomes may in turn affect the sustainability of the area of production. It is therefore essential that decision-makers have a good understanding of the functions of supply chains and how supply chain operations can affect land use practices.

Manufacturers of complex products may need many agricultural commodities for manufacturing purposes and often depend on many different suppliers to source the raw materials. Every supplier seeks to maximize revenues as the product passes through their hands. In many cases, supply chain transactions occur between companies that have little or no interest in the other companies involved in other areas of the supply chain.

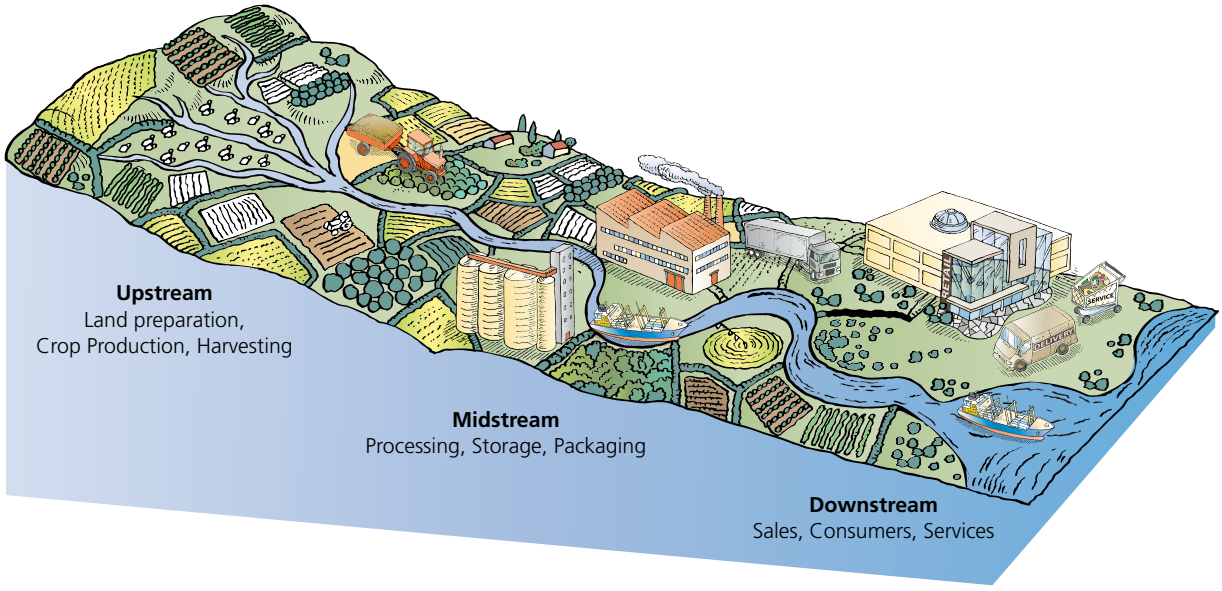


Figure 3 Upstream and downstream flows in an agricultural supply chain

Supply chains for some products can be very complex systems due to the large number of stages occurring between the production of agricultural commodities and the manufacturing and delivery of finished products to the consumer at the end of the chain. For instance, some supply chains include wholesalers at both the upstream and downstream ends of the supply chain and use different storage facilities for each stage of production. Different modes of transportation can also be involved between each stage of the production process. The final make-up of the supply chain varies in proportion to the complexity of a specific commodity and can result in a relatively large number of companies being involved with a single product. This complexity is indicated in the examples of coffee and rice supply chains given in Table 2. The rice example is based on supply chain operations in Cambodia while the coffee example illustrates practices in Brazil.

Table 2 Typical agricultural supply chain stages for production of rice and coffee

Coffee Supply Chain	Processed Rice Supply Chain
 Green coffee berries in Uganda	 A community of farmers harvesting bundles of rice seedlings, Cambodia
• Land preparation and planting • Harvesting • Trimming • Beans de-pulped (beans separated from cherries) then washed and dried • Sold to wholesaler or co-operative • Transport from farms • Middlemen procure beans • Remainder sold to exporters • Exporters sell to roasting companies • Warehousing of beans • Companies roast and blend beans, then bagged and prepared for onward sales • Coffee beans purchased by manufactures for further processing (e.g. instant coffee, ground coffee, whole beans). • Packaging for domestic and export markets • Warehousing • Transport of finished products to wholesalers and retailers • Sold to end consumer	• Land preparation and planting • Harvesting • Sold to traders • Drying of rice • Sold to commercial mills • Transport from farms • Manufactured to bran • Bran stabilization • Solvent extraction for oil • Refinery • Packaging for domestic and export markets • Transport to distributors and wholesalers • Warehousing • Transport to retailers • Sale to end consumer

While the farmers producing the crops have the greatest direct impact on the land, many governments do not fully recognize that policies and practices originating in supply chains, sometimes far from the place of actual production, can and do have a major impact on local activities and ecosystems. Supply chain policies can also have a negative effect on local markets if major operators perceive a risk of unreliable supply in a given area or country. This perception can cause the company to source similar products from other countries at lower cost, with greater reliability and/or where regulation is less constraining. The consequent loss of market

share can have significant effects on the economy of a country at both local and national levels.

Supply chain operations have major impacts on both biodiversity and national economies. Businesses are by far the largest contributor to biodiversity loss due to the scale of production required to meet the demands of national and international supply chains. There is thus a strong need for policies and regulatory frameworks that conserve biodiversity by inducing supply chains to support sustainable production objectives. For some businesses, this may mean discontinuing the practice of maximizing production of natural resources at minimum cost. For others more aware of the need for new approaches to reduce risks of supply shortages, governments may still need to take action to strengthen legislation and policies that ensure that sustainable production becomes the norm and not the exception. There is a clear need for governments, producers and other stakeholders to work closely in order to develop implementation of market-based mechanisms that can provide incentives for farmers to adopt sustainable practices.

It should be noted that failure to gain industry cooperation in establishing sustainable supply chains can lead to a number of difficulties for both local businesses and various levels of government. One of the main risks of continuing unsustainable production relates to loss of money, or money foregone, due to an inability to maintain or increase total output to meet demand. This affects individuals and communities within the landscape, as well as local businesses and government agencies/departments, due to loss of revenues. In some cases, the country's balance of payments can be adversely affected, compounding the problem of reduced taxation revenues.

These losses (or revenues foregone) can be further exacerbated by the increased costs that governments must bear if they have to enact and enforce new standards and procedures to implement and maintain sustainable production. These added costs are inevitable if the government wishes to avoid continuing degradation of production landscapes and the accompanying water shortages, increased erosion and perhaps even desertification that would otherwise occur. Continued unsustainable practices will also be costly for future generations. The loss or degradation of ecosystems services will negatively affect many lifestyles. For example, shortages of clean water will increase health risks and raise the cost of water purification affecting both individuals and industry; loss of biodiversity will deprive future generations of genetic diversity, medicines, food security and social and cultural opportunities, and loss of flood protection and erosion control will affect everyone in the related area.

Declining soil fertility associated with unsustainable production will affect both communities and governments since reduction in output – or at least the inability to increase output to meet demand – will have a severe impact on both local and national revenues and could also have a negative effect on food security. Trying to extend small incomes to more people will result in increased poverty, contributing to urban drift for those unable to adequately sustain themselves in their home environment. Lower revenues can also result in closure of businesses and create social or cultural problems if individuals are unable to meet their financial commitments.

The following case study provides a good example of a project that is proving effective in helping to improve local livelihoods and rural development.

Strengthening the capacity of the hibiscus supply chain in Sudan

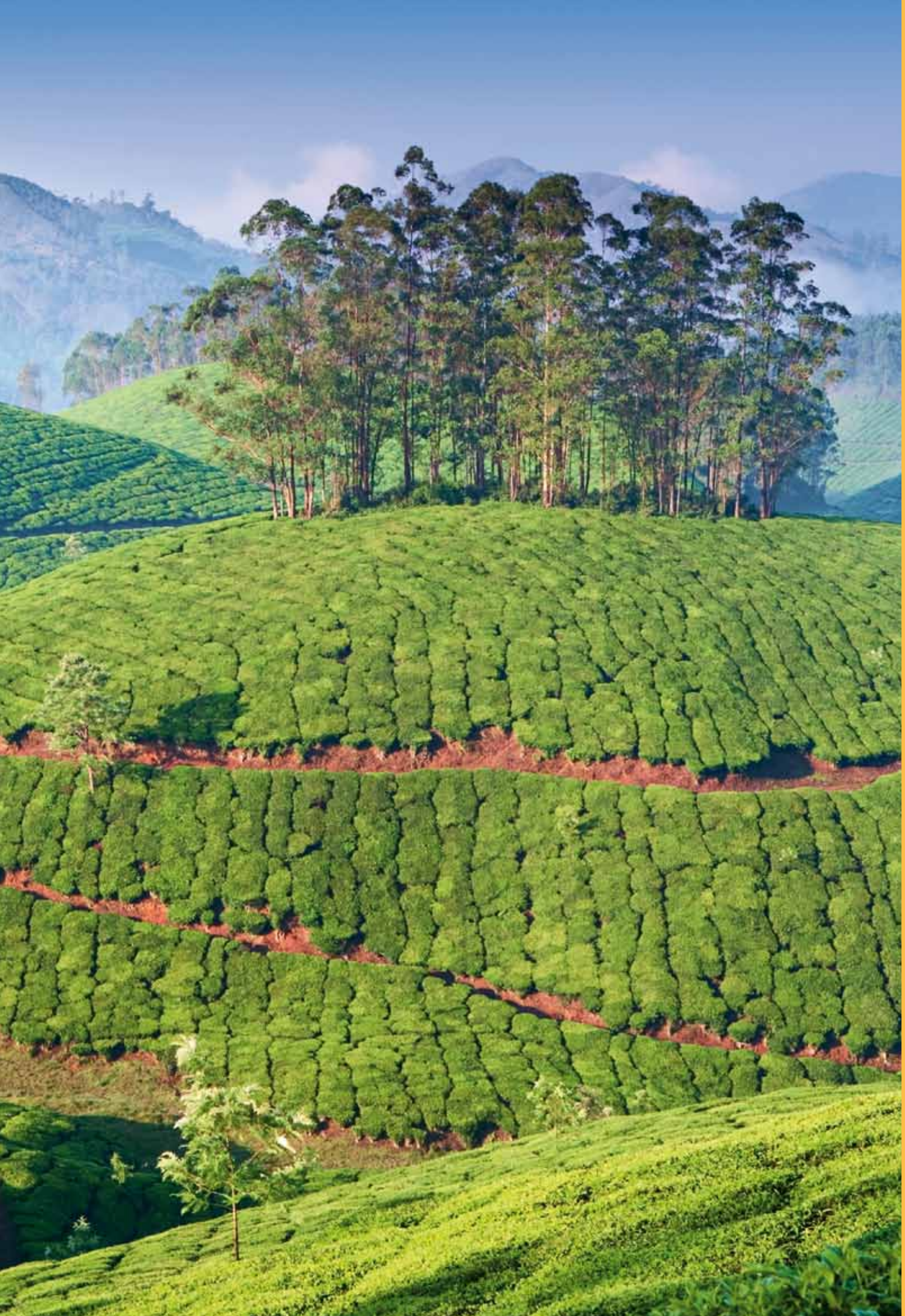
Hibiscus is a valuable cash crop in Sudan with about half of the 2008 crop of 18 thousand tons being exported for the production of herbal teas. The majority of primary producers are poor rural women with little if any expertise in marketing their produce. With this in mind, the UNDP Country office worked with the Government of Sudan and Kräuter Mix GmbH (a large hibiscus buyer) to strengthen the local hibiscus tea supply chain in 2010. The project aims to develop rural economies and improve local livelihoods, especially that of the poor Sudanese women and girls who are hibiscus farmers. The project buys back guarantees, maintains stable supply chain contracts with flexible margins to ensure stable prices, and works closely with farmers and traders to comply with international quantity and product specifications, meeting quality, traceability and documentation according to World Health Organization (WHO) Guidelines on Good Agricultural and Collection Practices (GACP) guidelines, to ensure a strong value chain and additional income and employment for more than 5000 rural farmers.

2

Protecting biodiversity through improved agricultural practices

This chapter explains how agribusiness supply chains operate and examines supply chain activities that affect biodiversity and degrade ecosystem services. This is followed by a review of common farming practices and recommendations for implementing sustainable production. The chapter concludes with a discussion on the importance of maintaining genetic stocks and how internationally recognized product standards can help the transition to biodiversity friendly practices. Specific areas addressed include:

- The impact of agricultural production on biodiversity and ecosystem services;
- The positive and negative effects of widely-used farming practices;
- The need for biodiversity friendly farming and sustainable agricultural production;
- The importance of identifying and protecting genetic stocks; and
- A summary of well known international product standards and certification schemes.



The impact of agricultural production on biodiversity and ecosystem services

The production of agricultural commodities is one of the leading causes of biodiversity loss today (WBCSD 2006). This trend is expected to continue as demand for food and other agricultural commodities increases, unless steps are taken to introduce more biodiversity-friendly and sustainable farming practices.

The major impact on biodiversity is caused by loss of habitats resulting from conversion of forests, grasslands and other areas to farmlands. Some farming practices, such as excessive or inappropriate application of fertilizers and herbicides, methods of cultivation and the type of crop produced, also lead to the loss of beneficial insects, micro-organisms and flora and fauna that contribute to maintaining the ecosystem goods and services vital to agricultural production. It is important to note that the reduced ability of ecosystems in terms of providing essential services affects not only the farms responsible for the degradation, but also those living in adjacent areas and locations further downstream.

The very nature of farming means that agricultural production has a significant impact on biodiversity. This impact will only increase as the scale of farming expands to meet the growing demand for food. Many farmers are attempting to meet rising demand by increasing productivity on existing holdings through intensive farming practices; however, both farmers and other businesses are turning to the conversion of forests and other habitats for cultivation or grazing purposes in order to take advantage of high commodity prices. Intensive farming practices can increase pressure on biodiversity, resulting in a reduction of on-farm habitats (Donald 2004), while large-scale irrigation systems can have disastrous effects on the replenishment of water tables needed to sustain rivers, wetlands and lakes. On the other hand, those clearing land also have a direct effect on biodiversity resulting from loss or fragmentation of habitats – again with significant degradation of ecosystems and the services they provide, and potentially accompanied by spin-off effects that affect the sustainability of farm production or livelihoods in adjacent communities.

The major impacts on biodiversity and ecosystem services resulting from agricultural production include:

Trees in central Sudan have been cut for firewood

1. **Habitat conversion**: Conversion of forests, grasslands and wetlands to farmland results in loss or fragmentation of habits. This in turn contributes to degradation of ecosystem services such as flood and erosion control. Genetic stocks can also be diminished or lost during land clearance work. Large-scale forest clearance also results in the release of substantial amounts of carbon dioxide and loss of carbon sinks. Activities undertaken as a result of foreign acquisition of large tracts of land by foreign companies, and in some cases, by government initiatives, are major causes of conversion of land to agricultural use today.

2. **Water usage:** Approximately 70% of all water usage has been attributed to agriculture (Baroni et al. 2007). Many areas are affected by lowering water tables and water shortages as a result of large-scale irrigation. (The vast reduction in the size of the Aral Sea is a prime example in this regard. Inefficient irrigation systems not only waste significant amounts of water, but can also contribute to increasing salinity levels, resulting in reduced productivity or desertification).

Large-scale spray irrigation

3. **Pollution:** Excess or inappropriate application of crop inputs such as fertilizers, herbicides and pesticides can result in damage to surrounding areas via run-off or spray drifting into surrounding areas. Chemicals carried by run-off from farms may cause the widest impacts by affecting water supplies for those downstream, potentially causing biodiversity losses and the need to purify water for consumption or business use. Even fishing and tourism activities can be affected by damage or destruction of coral reefs and other marine, lake and river ecosystems.

4. **Inappropriate cultivation techniques:** Farming in hilly areas without due regard for contour consideration can lead to extensive erosion during rainy periods while over-cultivation of fragile soils can lead to wind erosion, soil compaction and loss of soil micro-organisms – all factors contributing to reduced productivity of the affected land.

A farmer aerating the soil in Senegal

5. **Introduction of invasive species:** New species introduced for crops, shade or pest control can become invasive and spread much further than originally intended. Invasive species are a major threat to ecosystems because they can lead to overcrowding or replacement of native species. This can have a significant effect on local and global economies.

6. **Farming in marginal areas:** Planting and clearing forest in marginal areas can be risky for the wider landscape. Forest trees can be difficult to re-establish and micro-climates once offered by forest canopies are lost, leading to drier conditions and loss of habitats. Furthermore, the abandonment of farms following the depletion of soil fertility and/or lack of access to water can result in accelerated soil erosion and increased numbers of invasive species.

The effects of commonly used farming practices on biodiversity

It is not only land clearance to expand or establish farms that is adversely affecting biodiversity. Many practices used on established farms also significantly contribute to the degradation of ecosystem services. Some effects such as erosion and lowering of water tables are readily apparent while others, such as the reduction in genetic diversity, are not so obvious. This latter factor is important since genetic diversity is needed to tolerate emerging disease strains and to adapt to changing climatic conditions; a significant consideration since only 30 of the 20,000 edible plants identified to date are used to provide 90% of global food requirements (Pfaf 2011). Loss of just one of these important species could have a serious impact on global food security creating problems for future generations.

Table 3 provides a summary of production methods commonly used in developing countries. Typical impacts on biodiversity for each type of production are also listed.

Table 3 Typical impacts of agricultural production techniques on biodiversity

Production	General concept	Disadvantage to Biodiversity
Rainfed	Dominant production system in many developing countries – relies on naturally occurring rainfall for crop productivity	• Rainfed systems are frequently transformed into irrigated lands that compete with vegetation for ground water. • Soil exhaustion and erosion if effective land care measures not taken
Shifting Agriculture	Producers clear a patch of forest for agriculture and/or to establish land tenure.	• One of the leading causes of biodiversity loss from deforestation and habitat destruction • Slash and burn practices commonly used • Nutrient loss in primary and secondary forests from burning to release nutrients • Shifting agriculture leads to continuing biodiversity loss as plots of land are abandoned in favor of new areas • Loss of forest genetic diversity
Pastoral	Livestock raised in open pastures for food, hides and other products	• Cattle-rearing is the leading cause of tropical deforestation in Latin America (Boucher et al. 2011) Increasing demand for meat produce has lead to significant deforestation rates for the development of agro-pastoral farming systems • Loss of endemic cattle breeds that are drought-tolerant, adapted to harsh environments
Irrigated cropping	18% of total agricultural land uses irrigation to enhance crop productivity	• Ground water pumping can exceed water recharge rate, lowering the water table and leading to water shortages for aquatic ecosystems and causing species extinction, species immobility (from dams and lack of sufficient waterways for movement), increase in salinity in waterways making them intolerable
Monoculture plantations	Monoculture refers to planting of a single crop instead of growing a variety of different crops.	• Reduces genetic diversity on farm • Typically associated with increased use of agrochemicals • Older varieties with disease tolerance slowly disappear since farmers use modern high-yielding varieties • Traditional diversified low intensity farming practices largely abandoned

Sustainable biodiversity-friendly farming

The current rate of degradation and/or consumption of natural resources for the production of agricultural commodities cannot be allowed to continue if long term food security is to be achieved. Governments and all stakeholders in the food industry need to work together to introduce and maintain fully sustainable, biodiversity-friendly farming practices. The need to protect and maintain biodiversity in production landscapes while simultaneously increasing agriculture productivity is a controversial area. This is an extremely important issue that affects biodiversity in production landscapes as well as in adjacent areas. The issues involved need to be fully understood since the fate of biodiversity within protected areas is inextricably linked to the broader landscape context (Vandermeer and Perfecto 2007; Wallace et al. 2005) including how the surrounding agricultural landscape is designed and managed. It is essential to find ways of increasing agricultural productivity while using biodiversity-friendly means of production.

The Principle of Sustainability

Sustainability implies the use of resources at rates that do not exceed the capacity of nature to replace them. Thus water is consumed in water basins at rates that can be replenished by inflows and rainfall; greenhouse gas emissions are balanced by carbon fixation and storage; soil degradation and biodiversity loss are halted; pollutants do not accumulate in the environment; and capture fisheries and other renewable resources are not depleted beyond their capacity to recover. Sustainability also extends to financial and human capital; food production and economic growth must create sufficient wealth to maintain a viable and healthy workforce, and skills must be transmitted to future generations of producers. Sustainability includes resilience so that the food system is robust to transitory shocks and stresses. *The Future of Food and Farming 2011. The Government Office for Science, London.*

The application of best management practices for cropping can help increase yields while conserving biodiversity. The best practices outlined below are currently followed by most farmers in developed countries. Unfortunately, many of these practices are overlooked in developing nations due to lack of knowledge or resources to apply them.

Integrated Pest Management (IPM): IPM calls for development of an overall programme for the management and control of pests and diseases. It is based on the positive identification of pests and diseases present on a farm so that pest control programmes can be specifically tailored to existing problems rather than using broad spectrum pesticides that also kill beneficial insects. In many cases, IPM depends on protecting and encouraging natural pest controls such as owls and hawks that prey on rats and mice. Weather conditions also play a part since spraying should not take place on windy days due to problems caused in adjacent area from over-spray.

Water conservation: Water should be conserved by using micro-sprays or drip irrigation systems instead of conventional high volume methods of irrigation.

Irrigation dripper

Reduced soil tillage: Traditional tillage operations were carried out to remove weeds, mix in soil additives like fertilizers, form the soil into rows and furrows for irrigation, and prepare the surface for seeding. These practices are now slowly being phased out in favor of less disruptive and more environmentally friendly methods. No till practices avoid the need for ploughing altogether. This practice reduces the release of soil carbon, helps prevent soil erosion, loss of organic matter, degradation of soil aggregates, and the death or disruption of soil microbes and other organisms including mycorrhiza, arthropods, and earthworms. Planting on hill sides should be minimized with contour cultivation used to minimize erosion prior to establishment of the crop.

Reduced inorganic chemical inputs: While additions of inorganic (synthetic) reactive nitrogen fertilizers may increase plant/yield productivity in the short term, it can lead to serious environmental degradation in the long run. Inorganic fertilizers have caused acidification of soils and water resources, eutrophication of coastal marine ecosystems, and loss of biodiversity in terrestrial and aquatic ecosystems (Galloway and Cowling 2002). In another report (Clark et al. 1999), it was shown that organic and low-input systems had comparable yields when compared to conventional systems in tomato, safflower, corn and beans, in some instances higher than conventional systems.

Use of organic fertilizers: Soil management is critical to maintain soil structure and health, soil pH, the level of exchangeable cations and soil carbon. This practice should be encouraged by adopting more organically based fertilizers or composting on site.

Improved planting material: Plant breeding and transgenic material can significantly increase yield per unit area, therefore requiring less land to achieve a given output than that required by farmers using inferior

planting material. In addition to increased yields, transgenetic material, as in the instance of cotton, can significantly reduce the need for pesticides because plants are more tolerant to pest attack.

Crop rotation: Crop rotation, followed by fallow periods, should be carried out on a regular basis to reduce soil depletion and minimize the spread or persistence of crop specific diseases.

Weed removal: Weeds should be removed at regular intervals to minimize waste of soil nutrients. The use of inorganic chemicals to control weeds should be reduced to avoid contamination of harvested crops. Weed removal by hand through organized community gatherings or hired labor can prove to be a cost effective approach in many developing countries.

Disposal of waste: All harvest waste and unwanted by-products should be disposed of in an environmentally friendly manner.

Silvopasture: Silvopasture combines forestry with grazing of domestic animals and can provide optimum economic returns for graziers since many forage grasses grow as well or better in shade than in open pastures. Tree arrangements can create effective silvopasture systems with animal stocking density dependent on soils, climate, and the selected tree and pasture plant species.

Biodiversity conservation: Natural habitats are conserved as far as possible by using land sparing techniques. This should be supplemented by the creation of habitats by reinstating riverine areas, planting hedgerows and establishing other protective areas and buffer zones around the farm.

There are two landscape level solutions to improve biodiversity protection. These are:

1. **Intensive farming with land sparing:** This approach calls for intensifying agricultural production on existing cleared land to improve crop production per unit area while sparing a portion(s) of the farm to grow back to a wild state to function as a refuge for biodiversity. This approach helps to reduce the need for expansion of the area under cultivation since the increase in productivity helps meet increasing demand. The effectiveness of land set asides (land sparing) in maintaining biodiversity will depend on the level of habitat fragmentation and the accessibility to other suitable habitats for species mobility. Current discussions on the benefits of set asides now tend to focus on the amount of land required to adequately conserve biodiversity in the area. This aspect has been under study for some time and has yet to be fully understood, but it has been established that land set asides are more effective in countries with less intensive agriculture; especially if a higher

Farmers' fields in Nepal

Spraying a mango tree attacked by termites, using a motorised knapsack sprayer

percentage of land can be removed from production (Scherr and McNeely 2007). It has also been observed that, in some cases, smaller set asides may be adequate to maintain biodiversity if the adjacent land areas are ecologically managed (Blann 2006).

2. **Low-intensity farming:** This approach calls for using sound land and crop management practices while minimizing the use of synthetic crop inputs. Results can be enhanced by simulating natural habitats to help maintain and protect biodiversity on the farm. It is suggested that implementing low-intensity agriculture will greatly benefit biodiversity given that at least 50% of all native species found in forests also occur in farm landscapes (Blann 2006). However, a key issue to consider as a result of low-intensity production is the possibility of a decline in crop yields. These yield reductions typically occur from reducing the application of crop inputs that encourage yield production and manage problematic pests. In other instances, the loss of farmland to create forest habitats can also affect farm output (Green et al. 2005).

It has been suggested that non-intensified biological approaches to production can lead to increased yields and result in large financial savings (Uphoff et al. 2006). For instance, farmers adopting biodiversity-friendly crop management practices would benefit from reduced costs by minimizing expensive agro-chemical crop inputs, improved soil organic carbon and other soil properties, and an improved number of beneficial insects. The switch to fully sustainable practices will also reduce the risk of degrading farm ecosystems, which in turn minimizes the risk of yields declining in the future.

Low-intensity farming may be most applicable to developing countries where yields per hectare are already relatively low compared to developed countries. The lower cost of labor in many developing countries suggests that labor intensive practices (such as weeding and pruning) can be carried out to improve yields without significantly increasing production costs. The use of best practices for biodiversity-friendly farming can lead to increased yields as well as providing opportunities to participate in certification markets and the possibility of receiving Payments for Environmental Services (PES). The introduction of mixed cropping or agro-forestry concepts could also provide an alternate source of farm income while significantly contributing to the protection of biodiversity.

Sustainable agricultural production

Fully sustainable agricultural production can only be achieved on a long-term basis by providing protection for biodiversity. Agricultural intensification, while applying the land sparing concept, and the adoption of low-intensity agriculture through biodiversity friendly production, are both attractive methods. But both can

UNDP's 'Growing Sustainable Business' initiative

The Growing Sustainable Business (GSB) initiative is UNDP's flagship partnership platform for pro-poor investment. It enables the private sector to make a greater contribution to poverty reduction and sustainable development by brokering pro-poor, commercially viable activities with corporate partners. Since it began in 2004, UNDP has established local programmes in more than 15 countries. GSB is currently involved in more than 50 projects worldwide - in agriculture, energy, water, ICT, financial services and manufacturing. To date, GSB has worked with more than 75 companies – from developed country multinationals to local small- and medium-sized enterprises – supporting investments of between US$10,000 and US$23 million.

In Tanzania, GSB (Growing Sustainable Business) and Unilever have established a locally-owned supply chain for Allanblackia seed oil which has a variety of commercial uses, giving farmers a promising new source of income. In the coming years, it is envisioned that several thousand additional farmers will join the scheme, earning up to US$400 a year in addition to their regular income.

In Turkey, a GSB adviser helped establish the country's first ever bank-led microcredit initiative which allows young entrepreneurs to set up their own business. With an US$11 million loan portfolio, the project can support 1,000 young people a year for a period of three years to set up new enterprises.

In Malawi, GSB is helping 3,200 smallholder coffee farmers to maximize their revenue potential by assisting them in finding ways into new markets, thereby contributing to the financial sustainability and expansion of the smallholder coffee farmers model.

result in an initial reduction in crop yields leading to a reduction in farm revenue. This possibility is likely to cause many farmers to resist adopting biodiversity-friendly farming unless it can be demonstrated that adopting more sustainable methods of cultivation will lead to larger yields or improved farmer margins over the long term. The adoption of schemes such as Certification or Payments for Ecosystem goods and services (PES) can assist in this area; however, convincing farmers that the long-term benefits will outweigh initial costs could take some time. It may therefore be necessary to consider implementing some form of financial incentives if delays in implementing sustainable production are to be minimized.

Subsidizing farmers for applying biodiversity-friendly practices is an interesting concept and one that was used successfully in Europe to launch land sparing practices. However, it is possibly not the best long-term solution due to the drain on public funds. Reducing the productivity for a given area of land will also not help to meet the growing problem of food security, in view of FAO's prediction of a 70% increase in global agricultural requirements by 2050. An analysis (Rudel et al. 2009) demonstrates that between the 1970s and 2005, most national yields in Europe increased through the adoption of intensification practices; however, total cultivated area did not decline, raising questions on whether the concept of intensification will result in a decline in cultivated land area.

There is no simple answer to the question of which farming approach will work best in a given country. Intensive farming with land sparing may work well in some areas, but not in others. The same situation applies to low-intensity agriculture which may be better suited to areas with traditionally low productivity per land area than more developed regions. Or perhaps the best solution might well be a combination of the two approaches. For instance, the introduction of agro-forestry or other biodiversity-friendly farming adjacent to protected areas would establish effective buffer zones. Intensive farming might best be used in areas with high soil fertility with land sparing selected in conjunction with adjoining farms that also participate in the land sparing concept. A cooperative approach would increase the overall size of the regenerated areas and possibly enhance inter-relationships between protected habitats.

The most effective approach to implementing fully sustainable farming in a given area can only be determined after a thorough review of a variety of issues, such as the prevailing economic conditions, the type of production involved, availability of labour or machinery, and soil and climatic conditions, etc. This is a very specialized area and some countries may require assistance in order to establish guidelines for sustainable farming practices. Those needing further information on this subject may contact the Green Commodity Facility via their nearest UNDP Country Office.

Red Panda threatened by habitat loss

Governments in developing countries will also need to consider a number of other issues if fully sustainable farming is to be successfully introduced. There is an overriding need to establish an enabling policy environment that will cater to the introduction of incentives for sustainable production, gain support from supply chains, and provide farmers with an understanding of the benefits of conserving biodiversity and changing to sustainable farming practices.

The following case study provides a good example of how international development agencies, governments and other interested parties can work together to help farmers move toward biodiversity-friendly farming.

Mainstreaming biodiversity in the coffee sector in Colombia

Colombia's coffee sector, which employs more than 500,000 producers and makes up 12.4% of GDP, is based largely in the Andean Mountain region. The UNDP, along with UNDP Colombia, the Colombian Coffee Federation (FNC), GEF, and Colombian Ministries of Environment, Housing and Territorial Development, Agriculture and Rural Development, in tandem with other global players, have formed an initiative to generate economic incentives for coffee producers to grow biodiversity-friendly coffee. The project increases small-scale farmer income from certified and non-certified products, strengthens municipal capacity to advance landscape-based planning in the coffee-producing region to preserve farms' ecological viability, and replicates successful outcomes in other coffee landscapes through strategic partnerships with key stakeholders. By catalyzing these forms of payment for ecosystem services, the project will conserve biodiversity in globally important hotspots in the coffee landscapes of western-central Colombia.

Identifying and cataloguing genetic stock

Sustainable agricultural production is directly linked to the preservation and maintenance of crop genetic diversity. Even the most promising modern day phenotypes bred to achieve higher yields and disease tolerance are dependent on the preservation of wild populations for continued crop development. The long-term availability of genetic diversity is a vital link in ensuring crop productivity since an outbreak of new pathogen strains could significantly reduce production of an agricultural commodity; these are events that have occurred many times in the past (FAO 2010). Genetic engineering played a major role in overcoming these outbreaks – a result that might not have occurred if genetic diversity had been allowed to deteriorate to the point where the required genetic resources had lost variability and a consequent loss of flexibility.

Many governments and companies are now supporting efforts to catalogue and maintain different parent material which can be used by breeding programmes

Variety and Seed Industry Development, Afghanistan

that target specific traits such as drought tolerance and yield attributes. However, many plant hybrids can suffer in terms of loss of genetic diversity and succumb to new strains of diseases. This factor is explained by the Red Queen hypothesis (Van Valen 1973), which states that interaction between species is a major factor in evolution, and species that fail to adapt to changes in others they are co-evolving with will become extinct. Organisms need to continually evolve in order to develop traits that will enable the species to tolerate new pest and disease pressure. If the Red Queen hypothesis holds true, the continued loss of genetic diversity will slowly erode the ability of species to maintain fitness and crop productivity. Or even worse, crops will eventually begin to fail – a major problem if we are to meet global food demand. This prospective danger underscores the need to act now to protect genetic diversity if future generations are to benefit from this valuable resource.

It is critical that governments and businesses that are reliant on agricultural commodities invest in initiatives that conserve genetic diversity for each economic crop. For example, in the 1960s, the U.S. wheat crop was saved from an epidemic of stripe rust by incorporating genes from wild wheat in Turkey into new varieties. This example demonstrates the importance of crop protection strategies. Although there are thousands of public and private gene bank collections, plant breeders and geneticists can only work with available materials. Emphasis must be placed on preserving natural populations that are in a position to naturally diversify and adapt to climate change through the process of natural evolution.

One practice that specifically needs to be addressed is the rapid conversion of land for short-term profit-oriented ventures that frequently fail to consider the value of the genetic pool that is destroyed in the process. It may be difficult to value genetic resources, but governments and businesses must take action to prevent the continuing loss of significant biological assets that can protect national crops and provide additional revenues by providing genetic stock for future breeding programmes and benefit sharing agreements.

But big businesses are not the only ones that can benefit from preserving genetic diversity. Many species of agricultural and medical importance are also found on small holdings. Governments, businesses and research organizations should work together to establish funds that can be used to provide individuals

and local communities with incentives to maintain areas of high genetic importance. Genetic resources, if properly managed, can also provide sources of income for smallholders.

Revenue generation from genetic resources through supply chains

The Dutch company Health and Performance Food International signed an access and benefit sharing agreement with Institute of Biodiversity Conservation and Ethiopian Agricultural Research Organization. An important part of this agreement was a license bought from the Ethiopian government for planting and harvesting Ethiopian teff in the Netherlands and marketing the product for national and international sales. Five percent of the net profits and 10 Euros per hectare of land where teff is cultivated in the Netherlands will go to the government of Ethiopia. This initial agreement is for 10 years and demonstrates the sustainable revenue that can be generated from conserving wild populations (Gebreselassie 2009).

Production standards and product certification

The successful implementation of biodiversity-friendly production will require a number of factors to be considered – one of which is product certification. There are now many agriculturally based certification schemes that have included biodiversity-friendly production into their standards, with each scheme customized to cater for a particular commodity. For instance, some coffee production standards support the development of natural forest ecosystems by planting overhead forest trees; whereas applying the same method to wheat production would not be feasible. It is also important to understand that there is not one certification scheme that is fully focused on biodiversity. This is because certification schemes also incorporate standards that assist in the alleviation of socio-economic issues such as labor rights and gender. Whatever the case may be, the development of certification schemes is a booming business, with over 70 different agriculturally-related certification schemes in the market today.

The certification schemes that adopt biodiversity-friendly production practices typically achieve this by promoting some or all of the following production practices at the farm level:

- Banning forest clearance, including slash and burn
- Wildlife protection by prohibiting hunting, trafficking
- Planting riparian strips and providing corridors between farms and forested areas to improve mobility and habitat diversification
- Increased use of renewable energy sources; using wood products for fuel instead of coal or other fossil fuels
- Cropping methods that simulate natural ecosystems
- Protecting waterways by creating vegetation buffers and zero tolerance zones
- Use of genetically modified crops to increase yields and reduce reliance on pesticides
- Reduced applications of chemical fertilizers, pesticides and herbicides

A sign at a farmer field school on the border of a rice paddy, Sierra Leone

Benefits of Certification and Supply Chain Assistance in São Tomé and Príncipe

Farmers on the islands of São Tomé and Príncipe, off the coast of West Africa, are again enjoying the sweet taste of success thanks to high-quality, organic Fair Trade cocoa. Cocoa was introduced to the islands in the mid-nineteenth century and represented 95% of exports by 1990. But by the late 1990s, the crop was in severe decline, partly because of a crash in the price of the commodity. The reductions in exports left about one quarter of the farmers living below the poverty line with many losing faith in cocoa as a source of income. In order to reverse the industry's decline, an initiative supported by the United Nations International Fund for Agricultural Development (IFAD) and Cafédirect, a British Fair Trade firm, was launched to help farmers produce Fair Trade certified beans. The initiative encouraged farmer-owned cooperatives to process their own cocoa, which allowed the farmers to cut out the middlemen who took a large chunk of the profits. Farmers now benefit from receiving five times the price for their cocoa. Cocoa production also increased from 50 tons in 2004 when the programme began, to over 600 tons of organic Fair Trade beans by mid 2010. The success of the IFAD-Cafédirect -funded initiative has allowed many farmers to invest in home improvements and consider purchase of items, such as bicycles, generators, radios and refrigerators – items that were beyond the reach of many farmers before the programme started. The co-operatives are also investing in primary healthcare clinics and better sanitation to improve living conditions.

Source: www.bbc.co.uk/news/world-africa-12261276

Not all certification schemes are marketed on the basis of conserving biodiversity. Many well-known schemes, such as Organic and Fair Trade, are marketed for their health and/or socio-economic implications. These schemes have been very successful, resulting in annual growth rates of 18 to 22% over the last two years.

In recent years, certification schemes that promote biodiversity conservation have also made good headway. For example, the Rainforest Alliance, one of the more widely-marketed biodiversity eco-labels, has attracted participation by Mars Incorporated and Nestlé S.A., two of the world's largest food and confectionary companies. Certification schemes are a market-based instrument for conserving biodiversity that can produce improvements in production landscapes.

A group of farmers at a Farmer Field School (FFS)

Most agriculture-related certification schemes are based on the use of production standards that have generally been established following extensive research, field trials and consultation with industry stakeholders. These standards have been formulated by many different organizations including governments, NGOs, retailers and their growers, or through global associations such as the ISEAL Alliance, a global association for social and environmental standards. Farmers are required to adopt the production standards in order to meet the overall requirements of a certifying body. In return, farmers can be rewarded financially in the form of premiums paid by the product buyer and thereby gain access to new markets.

The benefits that farmers gain from being certified depends on the certification system adopted. For example, Fair Trade certification guarantees farmers a minimum price for products. Organic and bird-friendly certification allows famers to sell their produce at a premium. Other certification systems, such as the Rainforest Alliance and the Better Cotton Initiative, do not provide a price premium. Instead, certification grants farmers the access to new markets as well as farmer-training that typically results in yield improvements. We can see that each of these systems has its inbuilt advantages and disadvantages.

But simply establishing a set of production standards is no guarantee of consumer acceptance or benefits for the farmer. For instance, results from a consumer study in the U.S. showed that consumers were not willing to pay a premium for beef, tomatoes, or apple products labeled as "Sustainably Produced." This would suggest that the launch of green labels should be accompanied by a more intensive marketing campaign in order to raise public awareness of the environmental benefits that can be derived from buying products with this label. Many certifying organizations have recognized

this pitfall, and have consequently carried out extensive advertising and consumer education programmes so as to convince consumers to buy products that carry their label of certification.

Many certifying organizations have also recognized the need to maintain consumer confidence by ensuring that products associated with a given scheme actually meet the quality or production standards promised by the certification programme in question. This latter objective is generally achieved by requiring farmers to submit audit reports that confirm compliance with the required production standards. Evidence of compliance then provides the farmer with the right to use of the certifying label and to receive any price incentives offered under the programme. Typical audit options are outlined below:

- 1st party auditing: Private sector or farm programmes are voluntary and may complement or act independently of mandatory government auditing requirements.

- 2nd party auditing: Government policies will typically stipulate mandatory compliance to selected certification systems of production practices as part of sector regulation. The regulations would also set forth monitoring and reporting requirements.

- 3rd party auditing: This is a voluntary tool available to organizations that wish to demonstrate corporate social responsibility by having their operational areas certified against a "sustainable" standard that goes beyond 2nd party regulatory requirements, and thus requiring a further level of auditing performance.

Extension workers facilitating sharing of knowledge

Each of the seventy or so agricultural certifying schemes is based on sets of standards that are specifically intended to address the concerns of the organization that has established the programme. These standards can vary significantly from scheme to scheme as can the benefits that farmers and others in the supply chain can expect to receive from participation in the scheme. The sheer number of certification systems currently in use undoubtedly causes some confusion among primary producers and other industry stakeholders.

To overcome this pitfall, governments need to work with farmers, certifying agencies and other stakeholders in order to establish clear guidelines on the benefits the various certification schemes can provide. This will place farmers and others in the local supply chain in a much better position for adopting the certification scheme(s) most suited to their needs.

Table 4 presents a summary of the biodiversity conservation aspects of eight well-known international certification systems. These systems have been selected on the basis of market size and their success in securing business and market support from investments in establishing sustainable production. The socio-economic aspects of these systems have not been included in order to conserve space. It should be noted that there are many other certification systems that also include biodiversity standards.

Helping farmers with the certification costs

Some donor organizations are assisting farmers with the initial costs for certification and funding training programs designed to help farmers comply with certification requirements. For instance, the UNDP is providing funding to assist farmers in gaining 4C Association and Rainforest Alliance (RA) certification in Latin America while the United Nations Environment Programme (UNEP) is working with the RA to train cocoa farmers on RA certification in West Africa. This is a step in the right direction, but it does raise the question of what will happen when the donors leave and the farmers have to pay the ongoing costs of compliance audits.

Table 4 Comparison of large internationally recognized certification schemes

Biodiversity Focus	SAN-RA	FLO	Bird Friendly (SMBC)	IFOAM	Utz	Forest Stewardship Council	USDA Organic
Banning forest clearance	Yes Primary/ Secondary forest	Yes Primary only	Yes – verify production areas that do not have any legal protection status	Yes but not specified	Yes Primary forest	Yes forest conversion controlled with exceptions	No standard
Wildlife protection	Yes -	No standard	Yes – specifically birds, tree diversity and secondary plant diversity	Not prohibited	Yes	Yes – conservation of genetic diversity, high conservation value areas, & safe guards critical species	Yes – indirectly through strict control of synthetic chemical application
Creation of corridors between farms and forested areas	Yes to some extent-unsuitable farm area reforested & disturbed riparian strip recovered	No standard	Yes to some extent - strict shade tree and canopy layer requirements	No standard	Yes but less specific then SAN standards	Yes to some extent through rules for maintaining forest ecological function	No standard
Cropping / practices that simulate natural forest ecosystems	Yes–but no recommendations on tree habit. Farms can still be certified if they don't meet standards but show they plan to meet the goal and are working toward it	No standard	Yes – minimum 40% shade with recommendations for the diversity and size of trees that make up the forest canopy	No standard	Yes on several counts i.e. forest regeneration, ecological function	Yes to some extent through maintaining ecological function	No standard
Protecting waterways by vegetative buffers	Yes	Yes	Yes – five meters from each side of small streams and ten meters along rivers	No standard	Yes – but not specific for coffee	Yes – specifies water resource protection but not detailed	No standard
Fuel wood usage and renewable energy	Yes	Yes	Not specified	No standard	Yes	No standard	No standard
Use of genetically modified crops	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited
Reduced synthetic chemicals	Yes – prohibits the use of Class I and II WHO chemicals and standards for reduced pesticide applications	Yes – prohibits Class I and II WHO chemicals and reduced pesticides and herbicides country specific	Yes – Prohibits the use of most synthetic chemicals through USDA organic certification	Yes – all synthetic chemicals	Yes – 3 year phase out of SAN prohibited list	Yes – avoid use of Class I and II WHO chemicals	Yes – Prohibits the use of most synthetic chemicals

Certification schemes can provide incentives for adopting ecologically-sensitive production practices; but this does not come without costs. Participants in most schemes are required to pay a registration or joining fee. Farmers are also faced with the additional operating costs that may be incurred to comply with production standards, as well as paying for the compliance audits. Additional farm costs can also arise from the need for additional labour hours to implement certification standards instead of using the time on other revenue-generating activities., Buyers, manufacturers and retailers will also face added costs to meet price premiums or other incentives offered to farmers under the programme. And, in the end, it is likely the consumer will pay more for the certified product; unless the companies involved are willing to absorb the extra costs in order to minimize the market share risks associated with price increases.

The cost of certification has been a contentious issue for farmers and retailers alike due to the expense involved in becoming certified and the ongoing financial burden that follows for compliance audits. The initial cost of certification varies from scheme to scheme, making it difficult to provide a direct costs assessment using a comparative approach such as cost per unit area; a factor that makes it difficult for many farmers to decide which, if any, of the certification schemes will provide the best return on investment.

The Better Cotton Initiative

The Better Cotton Initiative (BCI) was established to make global cotton production better for the people who produce it, for the environment and the sector's future. This has been achieved by farmers adopting better production practices consistent with Better Cotton Initiative production standards. For example, impact assessment studies from the FAO-European Union Integrated Pest Management Programme for Cotton in Asia, implemented from 1999 to 2004 (in Bangladesh, China, India, Pakistan, Philippines and Vietnam) attributed impacts in terms of farmer's return, improved health of farming communities and reduced environmental contamination from heavy pesticide use. The savings from reduced use of inputs had a direct impact on the cost-benefit ratio and therefore on livelihoods. BCI is continuing to expand its activities and expects to work with around 150,000 farmers during the 2011–12 season (Better Cotton Initiative 2010).

The combined cost of initial certification and audits can also place the advantages of certification beyond the reach of many small holders. The cost can be alleviated to some extent if farmers form community groups or cooperatives where the group or cooperative is certified rather than the individual farmers; however, some form of financial assistance through grants, access to low cost loans, or via donor- funded projects that target sustainable production may still be required during the initial stages of certification.

Many businesses are also financially assisting programmes designed to train and capacitate farmers on various sustainable production standards. This more aggressive push from the business community is a direct response of growing consumer concerns regarding continued unsustainable production methods. Indeed businesses are now more aware of the repercussions of unsustainable production, ranging from the security of supply to business reputational risk which can result in loss of market share and thus business profit. These training programmes are a vital step on the path to sustainable production and it is essential that businesses and government alike continue to assist farmers in adopting sustainable production standards.

One of the main barriers faced by biodiversity-friendly certification schemes are the negative effects that some production standards have on farm yields. For example, limits on pesticide usage are a common area for standardization in order to protect on-farm biodiversity. These standards are usually based on banning pesticides that are non-selective, or chemicals that are banned in developed countries. But the stipulated pesticide may be prohibitively expensive or not registered for use in some developing countries. It is essential that certifiers engage local farmers on the type of pesticides and fertilizers that can be used, and agree to an adoption schedule rather than placing an immediate and outright prohibition on the use of synthetic chemicals altogether, as in the case of organic certification. This approach will allow producers to change to more biodiversity-friendly production while minimizing initial costs.

In another example, shade management has been specified by some certification schemes in order to recreate natural habitats in farm areas. These schemes recommend the use of overhead shade trees amongst the crop to improve on-farm biodiversity. Unfortunately, this approach can have a detrimental impact on farmer yields due to light/yield interactions.

Cotton production in Brazil

Considering that all 30 major food commodities grown today are typically shade-intolerant, it is difficult to create and enforce standards that require farmers to use overhead shade trees. Irrespective of this fact, some certification schemes that detail overhead shade requirements (such as coffee) are in some cases ineffective in maintaining farm tree cover. This is because farmers can opt for a total reduction in overhead shade through the removal of tree crowns – transforming trees into living stumps – while still passing the audit process and gaining access to any market advantage the certification scheme may offer. This anomaly is a result of loopholes in certification schemes which allow farmers to ignore parts of a spectrum of standards while still passing certification audits.

The practice of farmers intentionally circumventing production rules could result in bad publicity and reputational risk to the certifying group and other stakeholders if it became common knowledge. It could be argued that tightening the audit rules or changing the wording of the standards would solve this problem; however, this would certainly not solve the problem in the eyes of the affected farmers. Some flexibility should be built into the production standards. Rules that look good on paper may be suitable in one area, but they may not be appropriate or economically feasible in another.

Identifying these types of problems can best be achieved by ensuring that farmers of both large and small holdings are consulted during the standard development stage

Horticultural Production in a Senegal village

Forestry Unit inspecting rows of tree seedlings

so that a wider variety of opinion can be considered. The shade tree standard described earlier is a typical example. In this case, the removal of tree crowns to reduce losing yield obviously reduced the chance of the standard achieving its intended conservation goals. A minor change to these standards that would allow the farmer to plant the required number of trees but along field or farm boundaries, within set-asides or to be intercropped, rather than just being planted within the cropped area, would probably have less affect on yields, thereby reducing a reluctance on the part of farmers to comply fully with the established standards.

The importance of creating production standards that farmers will actually comply with cannot be overstressed. Since the overall aim of biodiversity standards is to conserve and protect biodiversity in the area, any attempts made to apply standards that allow farmers to ignore or circumvent the standards in question will lead to little chance of achieving national biodiversity goals. Regardless of the certification system adopted, it is important that governments take steps to ensure that farmers fully understand the benefits that could be derived from adhering to the certification scheme. It is equally important that certifiers actively manage the certification process in order to ensure that the resulting product does in fact meet all requirements. Failure in the certification process can lead to non-compliant products, which in turn results in campaigning and consumer groups losing faith in the certification scheme – with a potential loss of market. Governments must also be actively involved in ensuring that standards proposed by certification schemes are aligned with national biodiversity conservation action plans.

Certification is an important market based stepping stone for the development of sustainable production practices and biodiversity conservation. The next step will be to institutionalize production standards within the national framework – moving beyond international third party certification. However, before this can occur, governments and famers need to familiarize themselves with the requirements of certification schemes, how standards are incorporated into day-to-day farming practices, and the benefits that can be derived from biodiversity-friendly cropping practices. Until this is realized, it will be a difficult task indeed for government agencies to promote overarching national production standards. The adoption of international certification schemes may be costly in the short to medium term, but it will be the best way forward in order to implement biodiversity-friendly production until nationally developed strategies for production and monitoring can be devised.

3

Policy prerequisites for supply chain participation in biodiversity-friendly production

This chapter focuses on the role of government and the importance of supply chain policies that protect biodiversity and ensure the long term sustainability of agricultural production. Areas discussed include:

- The role of government and the importance of effective supply chain related policies;
- The need to review existing conservation and agriculture related legislation;
- Recommendations for developing effective sustainable production policies;
- The importance of policy monitoring and enforcement;
- The need to strengthen institutions and develop human capacity; and
- The importance of effective policies governing land use, ownership and rights of access.

Supply chain policies

Business policies have a significant impact on biodiversity since they govern the practices followed by supply chain companies in the course of doing business. Each company involved in the supply chain is usually dependent upon at least one other company along the chain. Its policies will therefore be affected by the policies of the other corporate entities in the chain, policies established by governments in the countries in which the supply chain conducts business, and, in some cases, policies established by institutions funding one or more of the chain's activities. These policies, many originating far down the supply chain, can play an important role in the battle to protect biodiversity since they can provide an incentive for local businesses to adopt sustainable practices; for failure to do so could result in loss of supply contracts.

Prices offered by companies along the supply chain are not the only factors affecting production of commode ties; other less obvious factors may have an equal or even greater impact on biodiversity. For instance, corporate policies that traditionally demanded the lowest possible operating costs have frequently contributed to unsustainable production, resulting in loss of biodiversity and degradation of ecosystem services in many countries.

Shareholder influence on corporate policies in the United States

Shareholders are exerting pressure for companies to introduce greener polices. According to Ceres, the Boston- based network of investors and environmental groups, a total of 96 environmental resolutions were filed by shareholders during this year's round of proxy voting during annual meetings of American companies.

Fortunately, many companies have become aware of the long-term risks associated with unsustainable practices and are changing corporate policies to reflect a greener approach. Unfortunately, most changes in corporate policies to date have focused on reducing carbon emissions resulting from transportation services and other major supply chain operations with little attention paid to improving the sustainability of activities upstream in production landscapes where most biodiversity loss occurs. The reluctance to address

Forest cleared for new agricultural plantings, Thailand

Cocoa flower cushion, Ghana

upstream conservation issues may be partly attributed to a desire to maximize short term returns by reducing operating costs as far as possible. In other cases, delays in implementing sustainable practices may result from a lack of awareness or even lack of concern about the impact that company policies may have on biodiversity in production landscapes. The latter factor frequently occurs when primary producers are in developing nations that may not have, or do not enforce, strict policies with regard to the protection of biodiversity during sourcing. This lack of policy and/or enforcement makes it possible for many companies to postpone or ignore the need to implement biodiversity-friendly production practices. Whatever the cause for the lack of action, it is essential that the senior management of these companies be convinced of the benefits that can be derived from protecting biodiversity.

Supply chain benefits from sustainable production

- Reduced long-term supply risks;
- Opportunities for sales to emerging green markets;
- Potential for new revenue from PES; and
- Reduced reputational risk from unsustainable production and the accompanying loss of market share. (Better Cotton Initiative 2009).

A significant amount of concerted planning and action will be required if more company directors are to be convinced that continuing to sanction unsustainable production practices will undoubtedly result in future raw material shortages – with the accompanying loss of market share. Investments made to protect biodiversity can significantly reduce this risk and help to ensure the long-term profitability of the company. This will outweigh any increase in operating costs for many businesses. Governments will need to lead the way by working closely with institutions, organizations, supply chain businesses and other stakeholders in order to ensure that more managers are made fully aware of the risks of unsustainable production and the benefits that can be derived from biodiversity-friendly production practices the risks of unsustainable production and the long term benefits that can be derived from biodiversity-friendly production practices.

The role of government

Major supply chain companies are becoming increasingly involved in certification programmes and various round table initiatives to define and implement voluntary environmental and social welfare standards for commodity production. These initiatives have resulted in the establishment of some worthwhile development and capacity-building projects; however, there is a limit to the extent to which these sometimes

fragmented and competing initiatives can be supported by market forces. Furthermore, they do not reduce the level of government involvement needed to ensure that effective legislation is in place to provide a fair and functional legal system, local access to credit facilities, provision of national tax or other incentives programmes, and other essential services. It is therefore essential that governments play a leading role in the process of conserving biodiversity and thereby protecting vital ecosystem services.

The successful development of biodiversity friendly supply chains, like many other development activities, is predicated on good governance. Businesses that perceive a sound regulatory environment are far more likely to spend money voluntarily to protect biodiversity than businesses faced with a restrictive policy environment or scenarios in which investors face risks from government instability or corruption. While it is important that government decision-makers realize that they are responsible for ensuring timely action is taken to preserve biodiversity, it is also of the essence that they ensure that action is taken in order to establish a business environment where investment is encouraged if biodiversity is to be protected and prospects for long-term economic development are to be enhanced.

Supply chain participation in the protection of biodiversity can help to reduce government costs and ensure sustainable use of natural resources; however, voluntary supply chain participation is unlikely to occur unless effective government policies are in place to protect biodiversity, encourage business development, and provide opportunities for new investment. The process of establishing and implementing the new reforms must be clear and transparent while monitoring and enforcement activities must also be seen to be fair and free from corruption. These fundamental principles must be met if initiatives to establish biodiversity-friendly production are to be successful.

On the other hand, implementing overly restrictive conservation policies and enforcement procedures, or practices that are not viewed as fair and transparent by the business community, may well hinder economic development as supply chains reduce in-country investment or move their operations to other countries that offer lower operating costs or a reduced risk of instability or corruption. Establishing effective lines of communications with supply chain operators during both planning and the implementation of new policies can help to ensure the transparency of overall conservation goals. Governments must lead the way in this process and ensure that appropriate policies are put firmly in place so as to give full encouragement to supply chain participation.

Many countries have already begun to implement sustainable development policies that facilitate the transition to biodiversity-friendly supply chain operations. A number of these initiatives include the development or reform of policies that enable businesses

Supply Chains Help to Conserve Biodiversity in Production Landscapes

The following case studies provide excellent examples of how supply chains can help to conserve production landscapes to the benefit of biodiversity, farmers and companies throughout the supply chain.

Cadbury Plc has made a 74 million U.S. dollar investment to establish the Cadbury Cocoa Partnership (CCP). The CCP works with government institutions and NGOs to establish projects aimed at implementing sustainable production by conserving biodiversity and ecosystem services in production landscapes. The resulting projects cover a variety of important areas including furthering research on environmental protection issues, improving farmer training in conservation and crop management practices, improving health and livelihoods for farmers, and also identifying incentives that could be used to conserve and protect biodiversity.

Nestlé announced its "Nescafe Plan" for sustainable coffee production in August 2010. The plan calls for Nestlé to invest 500 million Swiss Francs to address responsible farming, sourcing and consumption across its coffee supply chain. For farm related aspects of the plan, Nestlé will be supported by the Rain Forest Alliance, other members of the Sustainable Agriculture Network (SAN), and the 4C coffee association to provide improved planting stock, establish 300 best practice demonstration farms, and provide technical assistance to 10,000 coffee farmers a year. Nestlé will also ensure all directly purchased green coffee with meet 4C sustainability standards by 2015.

The 'Green Economy' initiative

Box 15- The 'Green Economy' initiative launched by the Government of South Africa represents a positive move by governments in this direction. Under this program, the National Treasury is currently working to refine 'green incentives' for industry while the National Environmental Management Biodiversity Act of 2004, allows: "The Minister to enter into a biodiversity management agreement with any organization or organ of state or any other suitable person, regarding the implementation of a biodiversity management plan, or any aspect of it." This allows the Minister to enter into an agreement with a number of companies in order to establish a sector-wide environment management plan.

Forest area in Burundi

and investors to benefit financially from activities that protect ecosystem function. This approach helps to encourage supply chain participation since it overcomes at least some of the barriers for businesses to invest in biodiversity protection.

Unfortunately, progress on implementing reforms has been slow in many developing countries. Some of the delays may be attributed to a lack of awareness of the long-term impact that biodiversity loss and ecosystem degradation will have on the country's economy. Without credible information in this regard, many government decision-makers are unable to gain political support for moving ahead with the initiatives needed to protect these vital resources. In other cases, politicians with vested interests in maintaining the status quo also contribute to delays in establishing reforms in this area. These barriers need to be overcome if effective government policies for sustainable production are to be established in a reasonable timeframe.

Reviewing government conservation policies

Government polices intended to prevent the loss of biodiversity and degradation of ecosystem services have been established for some time in many countries (see box 15). However, policies of this type have yet to be fully developed in many developing nations. The continuing loss of biodiversity, combined with the newer threat of climate change, indicates that these policies should be reviewed (or established) to ensure they are effective, up-to-date and reflect current conditions. Not only do governments need to protect food security by encouraging fully sustainable production practices, but they also need to provide a policy environment that caters to investment in business development. This is not a simple task, in view of the number of government

Tea plantation in a Rwandian marshlands

ministries and other stakeholders involved. On the other hand, policies that can encourage the implementation of sustainable agricultural practices will pay large dividends – not only in terms of food security but also by maintaining ecosystems for the benefit of future generations.

Government policies governing the sale or lease of larger areas of land (over 1,000 hectares) should be carefully reviewed in light of the recent upsurge in investment in large tracts of agricultural land. While some of these investments have proven to be beneficial, others have adversely affected local communities previously dependent on the land for subsistence and cultural activities. Government policy in this area should require detailed environmental and social impact assessments to be carried out by a recognized organization before the land sale or lease is approved. At a very minimum, these assessments should address the current uses of the land and the impacts the sale or lease will have on local inhabitants, biodiversity and genetic stocks, and also the extent of use or consumption of natural resources.

Furthermore, the land transfer policies should require the participation and informed consent of community leaders and current land users prior to approval of the sale or lease. Any resulting contract should preserve rights of access to customary land and impose clear and legally binding conditions of sale or lease. The contract should also require the investor to provide a deposit or liability bond that would be forfeited in the event of default on the terms and conditions of contract. In addition, the investor should be required to pay for an annual audit of compliance to be carried out by an independent and mutually acceptable agency. Further details of recommended policies and practices for investors, governments, civil society and development agencies may be found in an International Institute for Environment and Development report entitled "Land Grab or Development Opportunity?". This publication may be obtained at www.iied.org.

There is likely to be some opposition to any change in government policy. Those considering updating national policies to protect biodiversity may need to overcome some or all of the barriers noted below, if the new practices are to be introduced effectively, including:

- Stakeholders with vested interests may vigorously oppose changes in policy.
- Lack of political will to support the need for implementing new policies and procedures.
- Lack of public participation and stakeholder involvement can create resistance to change and limit cooperation between stakeholders.

- A shortage of human resources and/or expertise in government institutions can limit the ability to act in a timely and effective manner.

- Excessive taxation and other government fees can severely restrict development.

- Lack of scientific capacity for supporting data collection and analysis can prevent identification of appropriate baseline conditions and hinder monitoring changes.

- Lack of effective public-private partnerships can increase government costs for implementing new practices and monitoring performance.

- Loss of traditional knowledge can significantly reduce the availability of information needed to support the development policies designed to meet local conditions.

- Lack of international cooperation may limit regional efforts to address mutual environmental and economic development issues effectively.

Reviewing conservation related legislation

Government policy intended to cater to the transition to sustainable development must be supported by appropriate legislative documentation if the policies are to be legally and fairly enforced. Existing legislation may be adequate in many cases; however, as in the case of policies, the legislation should be reviewed to ensure that it fully reflects current conditions and the objectives of new or revised policies. Amended legislation can then be prepared as required in order to legalize and support the policies prior to implementing any changes in policy.

The new or revised Acts and/or regulations must clearly define and support the country's policies for protecting biodiversity. The need to encourage a speedy transition to sustainable supply chain operations indicates that business-related legislation should also be reviewed to ensure that it reflects a fair and open business environment and improves prospects for overall economic growth. In both cases, the legislation should minimize bureaucratic red tape while still ensuring the protection of consumers, businesses and the government from unscrupulous operations. Care should also be taken to avoid inadvertently providing too much bargaining power to a given sector or market segment.

Policy formulation

Every effort should be made to ensure that new or revised legislation is written, and as far as is possible, in plain language and in terms that the average business person can understand. This will benefit individuals and small businesses that need to understand the rules and procedures set forth in the legislation, but who cannot afford to seek expensive legal advice on a regular basis. Governments will also benefit from this approach, as a better understanding of the contents of the legislation will help to reduce the number of complaints – or excuses from those found to be in breach – to the effect that the legislation was not adequately understood.

A comprehensive review of relevant Acts, regulations or other legislative documents will involve a significant amount of time and effort in view of the number of different areas involved. Areas involved include legislation that governs environmental protection and general conservation measures, and land acquisition, usage and tenure. Business-related legislation is even more diverse and includes general business licensing requirements, such as foreign ownership restrictions and audit and financial reporting requirements, taxation, government levies including import and export charges, subsidies, and areas relating to the conduct of business. A review of the above-mentioned areas will require a major effort to be expended. However, as in the case of the policy review, significant long-term benefits can be derived from establishing an effective legislative environment.

Steps for developing effective sustainable production policies

Governments considering the revising or the establishing of policy in order to pave the way for sustainable biodiversity-friendly production should ensure that full consultation is undertaken with all relevant stakeholders

National Platform of Production and Trade of Costa Rican Pineapple

The National Platform of Responsible Production and Trade of Costa Rican Pineapple is a 24 month-long multi-stakeholder and inter-institutional dialogue, implemented by the Vice-presidency of the Republic, and facilitated by the United Nations Development Programme (UNDP) Green Commodities Facility, with financial support from the Dutch cooperation agency, ICCO. It is already coordinating actions among major stakeholders of this supply chain, such as producers and companies involved in production and exports of pineapple from Costa Rica, national and international buyers, civil society organizations, and relevant ministries. The dialogue by these stakeholders will evolve around the definition of a model for responsible production and trade of pineapple in Costa Rica. The model is constructed through an inter-institutional and cross-sectoral definition of the main positive and negative impacts of pineapple production in Costa Rica, and will represent the multi-dimensional vision of the different stakeholders involved in the supply chain. This process is conducted through specialist thematic task forces, lead by volunteer parties of the Platform. To-date there exist technical taskforces on soil management (led by Dole), sustainability indicators (led by Walmart) and a taskforce on economic incentives (led by EcoAgriculture Partners). These task forces feed information to the plenary in order to inform and develop a national strategy. This strategy will then be implemented by Platform partners in order to achieve reform at the sector level. *Source: http://www.greencommodities.org/*

from the outset. Frank and open discussions are essential for ensuring that all parties are aware of the concerns and priorities of others, and these discussions will therefore provide a measure of transparency with regard to the overall reform process. One approach vis-a-vis establishing the necessary communications channels is for government to form a study panel or steering committee. Such a committee would include representatives from the various government ministries and stakeholders involved. This approach has been used in the past, but experience indicates that the large committees needed to cater to a wide range of stakeholders can be inefficient. While this is undoubtedly the case, smaller committees tend to reduce the scope of ideas presented and can place serious strains on the workloads of those involved.

The UNDP offers an alternative approach that may be of interest to governments in developing countries. The UNDP Green Commodity Facility (GCF) was established in 2009, with a mandate to work with government institutions, supply chains and NGOs so as to mainstream sustainability in the production of agricultural commodities. The GFC supports national policies and focuses on improving commodity production through forming strong partnerships with relevant ministries and local stakeholders, and bringing them together with progressive and committed manufacturers, retailers and traders to work towards strategic plans for improving agricultural production.

The GCF programme is based on establishing national commodity specific platforms to provide a country focus on increasing production and trade of sustainable agricultural commodities. Projects focus on reducing conversion of natural habitat into farmland, increase biodiversity within existing production landscapes, improve water management, reduce ecological and carbon footprints of production, protect food security, and ensure sustainable livelihoods for rural communities involved with targeted supply chains. A typical example of GCF's involvement in projects of this type is illustrated by the case study above:

The national GCF platforms provide opportunities for a wide range of stakeholders to liaise and develop strategies for implementing fully sustainable commodity production. Stakeholders typically involved include:

- National government institutions responsible for production and the environment.
- Providers of public and private extension services.
- Municipalities and other institutions involved with land use planning within production landscapes.
- Rural communities and organizations that may be affected by the effects of commodity production.
- Supply chain businesses including primary producers, manufacturers, traders, buyers, and other related businesses.
- Non Government Organizations (NGOs)

In view of the wide range of opinions likely to be held by stakeholders, it is essential that the process of establishing national platforms be facilitated through a

known and respected neutral interlocutor. The UNDP is internationally respected for its work in acting as a neutral facilitator of dialogue between various institutional stakeholders and leading discussions on the most sensitive issues, and it can therefore play a pivotal role in bringing parties to agreement on a number of pressing environmental and trade promotion issues. The GCF, as the front line representative of UNDP commodity programmes, works with governments and other stakeholders by the coordination of meetings for working towards the development of national commodity platforms. Both local and international scoping papers and technical advice are used to stimulate discussion and support the need to establish sustainability as the key pillar of agricultural competitiveness and rural development strategies.

The GCF presses into service a step-by-step approach for establishing a national platform to coordinate the sustainable development of a specific sector. The initial step involves a comprehensive baseline assessment of the positive and harmful impacts arising from current production practices. This is followed by a review of best practices which can be applied to improve environmental and social performance. Finally, any barriers, or other issues that must be addressed in order to effectively transform the sector, are identified for subsequent action. Public-private dialogue is undertaken at all stages of the review in order to ensure that key stakeholders are involved from the outset. The resulting document then acts as a tool for further discussions at a platform level with stakeholders using the review to guide in-depth discussions and development of:

- A national strategy to achieve improved sustainability in production;
- A work plan for implementing the national strategy; and
- A national programme for sustainability within the target commodities.

Once a strategy has been officially supported by government and key stakeholders, the UNDP GCF continues to work with the government and other platform stakeholders so as to provide guidance and assistance during programme implementation. This systematic approach to production and trade will help to ensure the transformation to fully sustainable production landscapes with minimal delays.

Boosting productivity and the income of women farmers in West Africa

In 2008, the UNDP launched a regional programme for establishing 'multi-functional platform' (MFP) enterprises in West Africa. These MFP enterprises are aimed at boosting the productivity and income of women farmers through vocational training and by the provision of low-cost facilities to mechanize labor-intensive activities such as shelling shea nuts prior to the production of shea butter. The programme was initially introduced in Mali, Senegal and Burkina Faso with financial support from donors such as the Bill and Melinda Gates Foundation, Aarhus United, the Shell Foundation and Luxembourg Aid. Benefits included the average earnings of women involved in the programme increasing from $11 to $55 per month. The increase in productivity also offered opportunities for millers, welders and repair people. The programme has continued to be expanded, and a total of 1,835 platforms have now been implemented in Burkina Faso, Mali, Senegal, Guinea, Ghana, Niger and Togo. To date, the programme has provided benefits to over 100,000 women and provided approximately 15,000 new jobs.

Minimizing bureaucracy

Excessive bureaucracy, or 'red tape', can severely hamper the development of business opportunities, resulting in the loss of income and other opportunities at many levels. It is strongly recommended that the processes companies must follow in order to conduct business and develop sustainable practices be streamlined as far as possible. Such an approach not only alleviates the manifold difficulties for investors and business people, but reduces the workload for government departments and agencies.

The lengthy processes illustrated above have significantly increased administration and production costs for legitimate businesses, resulting in high prices at the point of sale. This has created incentives for unscrupulous operators to ignore the bureaucratic process and carry out illegal felling operations at night, this in turn leading to unsustainable extraction practices in many areas. Hasty and furtive operations have also led to a massive waste of felled trees, since only the best sections of the trees are utilized in many instances, with the remaining timber left to rot. Furthermore, these illegal logging operations are obviously not monitored

The Tanzanian timber extractive industry

This industry supplies a large variety of hard and soft woods to local and international markets. The industry is thriving but many of the timber species face overexploitation. Although there are many factors that contribute to the unsustainable timber extraction, one of the most important of these stems from the sheer number of applications and approvals that must be obtained from different departments, institutions and other decision-makers before a company can register a business and begin harvesting timber in Tanzania. The seven steps involved in the latter process are illustrated below:

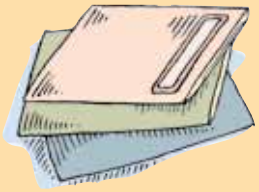
1

Company is required by the Tanzanian government to identify the area where the company would like to harvest tree timber species before beginning discussions with authority bodies.

2

This process is started by submitting an application to the local village government official to seek approval to selectively harvest timber species. This is the beginning of the registration process.

3



Assuming successful application at the village level, the extraction company is required to submit an application to the District Forest Officer (DFO) and then to the Harvest Commission (HC) board who also need to give approval.

4

Following approval by the DFO and the independent HC board, permission is then granted to apply for the certificate of registration to the regional national resource advisor (RNRA).

5

Following the submission and approval of registration from the RNRA, the company then needs to apply for a license for harvesting and collection of forest produce from the District Forest Officer (DFO).

6

Following DFO license approval the license must be presented to the village government. Only then can the company begin their harvesting operation. Removal of logs from the community to the saw mill and thence to the point of sale also requires the company to obtain several additional permits.

or regulated and therefore the actual rate of extraction is unknown (Makala and Ball 2009). Unfortunately, the inefficiencies noted above are not restricted to the Tanzanian timber industry, and similar problems can be found in other countries. Many governments need to consider ways of minimizing red-tape and effective procedures for implementing new and streamlined procedures, if fully sustainable production practices are to be established.

Despite best efforts to minimize bureaucracy, the practices required in order to implement a fully enabled environment can frequently lead to a large number of policy-making and/or regulatory agencies being involved in the process. This can lead to problems for businesses, since the process of getting information or decisions from all agencies involved can be very time-consuming. The sheer number of steps involved can also lead to misunderstandings that could result

Giant logs loaded on a boat for transport

in some agencies being completely overlooked. It is therefore recommended that a one-stop clearing house for green business be established in the producing country so as to provide a single point of contact for both the general public and businesses. Such a clearing house will greatly streamline the public/business/government interface on sustainable production and land use issues, and should result in a speedier process and lower operating costs for all concerned.

One-stop shop: Clearing house for green business

The clearing house should be a multi-purpose agency that can provide up-to-date information for businesses and the general public interested in sustainable development polices and processes. Its primary function should be to provide business owners and investors with information on government policies and advice on possibilities offered by emerging green markets. It should also provide prospective and existing business owners with assistance in completing all required government application forms and other relevant documentation that must be prepared in order to gain business licenses or government approval of other business-related matters.

Key functions of a Clearing House include:

- Inform the public, business owners and investors about government policies and procedures related to sustainable production and protection of the environment.

- Distribute up-to-date information on national standards and Codes of Conduct.

- Advise all stakeholders in producer industries on biodiversity protection strategies and requirements for their respective industries.

- Provide documentation and guidance on best practices for the development of sustainable supply chain businesses and protection of their respective environments.

- Participate in stakeholder meetings for the various commodity stakeholder platforms in-country to discuss issues and provide information that relates to sustainable production and biodiversity.

Monitoring and enforcement of new legislation

The best biodiversity protection policies are unlikely to achieve their objectives if governments solely rely on voluntary compliance. Most individuals and businesses will take shortcuts where possible. First and foremost, the legislation that governs environmental policy must contain provisions for penalties that may be applied in the event of contravention of the rules and regulations. The legislation also needs to clearly state those agencies that are responsible for monitoring compliance with policy requirements and applying penalties in the event of contravention of the law.

Strengthening institutions

The introduction of a new policy environment is likely to require strengthening of both government institutions and supply chain businesses. Governments will need to consider if changes in the structure or organization of government agencies will be required to implement

the new policies effectively. Some changes in business practices may also be required to allow companies to comply with new regulations and take advantage of business opportunities that may arise from the new policy environment.

A functional organizational review can be helpful for determining if any changes are required. These reviews usually start at the bottom of the organization and list each function that must be performed at various stages in the organization. The number of staff required to efficiently carry out the functions would also be identified during this phase. This would normally be followed by a review of current staffing to determine if new positions need to be created or redundant ones removed. The structure of the organization should then be analyzed to ensure that similar job functions are grouped within common management areas in order to minimize lines of inter and intra group communications. A review of this nature can be a time-consuming exercise; however, it will ensure that functions or responsibilities imposed by new policies are not inadvertently overlooked. Streamlining an organization can also lead to a significant improvement in response times, as well as lowering operating cost by improving overall efficiency.

The processes involved in monitoring the environment, providing advice to biodiversity policy- makers, disseminating information and coordinating programmes, are complex issues and require specialized skills. Governments can cater to these diverse needs by establishing a management group or department that specializes in biodiversity policy development. Such a move could have significant initial budgetary implications, but the long-term returns from sustainable use of production landscapes, and protection of biodiversity in general, will pay major dividends over the course of time. Businesses will also need to assess the need for any new skills required to take full advantage of those business opportunities offered by new government policies – as well as ensuring that someone is on hand who has the knowledge necessary to avoid penalties that might apply for non-compliance with new regulations.

Developing human capacity

Staff training and development will be a key factor in ensuring that those governments and businesses that are affected by new policies can respond to the new challenges and opportunities in an efficient manner. Training requirements should initially be identified as part of the overall review of each institution or business, and a formal training programme should be established to develop the in-house skills needed for efficient operation. The effectiveness of the training programme can be enhanced if care is taken to match the most appropriate personnel with the specific type of training required. In other words, it will be appropriate to select the trainees from those who have the motivation and ability to learn new skills and not merely send an employee for training because "it is their turn". Training programmes should be reviewed annually to ensure that the training provided has achieved the desired improvement in terms of performance.

Training does not come without cost in most instances, and government officials and supply chain managers will need to commit funds and other resources for this purpose on an annual basis if the move to sustainable

Suggestions for organizational reviews to strengthen government institutions and supply chain businesses

- Where possible, group all personnel responsible for tasks that are related to a specific function, or require special skills, in common management units to reduce the breadth of knowledge required by line management staff.
- Identify any vacant positions that must be filled if the organization is to function effectively.
- Identify any positions that may have been rendered redundant by changing responsibilities
- Review the relationship between line managers and senior management to determine if changes are needed to streamline internal communications.
- Avoid management structures that have managers reporting directly to another higher level manager who has no other responsibilities since one of the managers would normally be totally redundant.
- Ensure that the review includes a survey intended to identify any special skills, tools, office facilities or additional training that might be required to carry out responsibilities in a professional and timely manner.

Staff training

and biodiversity-friendly production is to become a reality. While training can be expensive, a well-designed training programme can provide significant benefits. A trained work-force will be more efficient than a poorly-prepared one, and this will result in the faster completion of assigned objectives and lower operating costs.

Training is not the only factor involved in improving staff performance. Human resource management practices may also need to be updated in order to reflect changing conditions and work requirements if effective use is to be made from investment in human resources. A well-designed management system can also help to reduce the turnover of trained employees if it includes provision for providing incentives for high achievers. Recognition and/or reward should be given to those achieving above-average standards while a programme of additional training or behavioral modification should be agreed with those staff members who are working below acceptable levels. However, recognition or criticism of performance cannot be fairly administered unless the staff member involved has a clear understanding of the duties and responsibilities required by his or her role. This problem can be resolved by ensuring that clear, concise and up-to-date job descriptions are provided to each employee affected by the incentive programme.

Monitoring changes in biodiversity and sustainability

It will also be necessary to monitor changes in biodiversity and the quality of ecosystem services resulting from the implementation of new polices to determine the extent of progress made. This work should be undertaken by suitably qualified personnel and must be carried out on a regular basis. The results of the survey should be compared to the baseline figures to determine if the new policies are producing the intended result within acceptable time frames. Any significant deviations from the intended results should trigger a review of the overall situation to determine if any changes in policies or procedures are needed to ensure that conservation objectives are achieved in a reasonable time frame.

While this type of monitoring will involve some cost for governments, this work must be carried out if governments are to be kept up-to-date regarding the effects of policy changes. These costs could be significantly reduced by obtaining cooperation from supply chains. For instance, many businesses involved with agricultural commodities have established crop survey teams in larger-producing countries. These teams visit production areas regularly to collect up-to-date crop information.

Supply chain cooperation in environmental monitoring in Ghana

The Ghanaian government's mass spraying program for the control of cocoa pests and diseases could be enhanced significantly if private sector forecasting teams included pest and disease information in their crop monitoring activities. This information could be used to: i) assist government spraying operations to reduce non-essential spraying. This would save money on inputs as well as minimizing biodiversity loss through minimizing chemical applications that kill non-targeted species such as important pollinators and beneficial insects; and ii) function as a front line monitoring programme against the introduction and spread of invasive alien species. An example of problems created by a failure to monitor the spread of crop diseases comes from Brazil. Over a five-year period, Brazil was transformed from an exporter of cocoa to a net importer, following the rapid spread of witches' broom Crinipellis perniciosa, an aggressive and lethal fungal disease of cocoa. The disease also caused socio-economic problems and could have been the cause for the conversion of many cocoa farms to pastoral/annual crops – effectively eliminating most biodiversity in the affected farms. Had local supply chains been involved in the enhanced monitoring and reporting practices noted above when witch's broom first appeared, it is possible that the spread, and the degree of damage, caused by the infestation could have been significantly reduced.

Birds collected for data collection and analysis on biodiversity

With a little additional effort, the teams could gather information relevant to government needs during these visits. The collected data would then be forwarded to the appropriate government agency, providing timely information on changes in production areas. Up-to-date information on local conditions, sometimes far from government offices, would be very helpful for governmental planners involved with programmes to minimize biodiversity loss. This information could be provided at little additional cost to the company – but with a considerable reduction in governmental cost for collecting data required for research and assessment of programmes, such as those for the control of pests and invasive species.

International policy

Policies established by international organizations can affect governmental policies for establishing sustainable agricultural production. For instance, current and proposed international agreements on trade and related issues can have an impact on the decisions made by government in this regard. Some international agreements or treaties will directly affect legislation and regulations within the source countries. In other cases, the proliferation of environmental regulations being enacted in other countries may have a direct impact on local production requirements. The EU restrictions governing the use of certain chemicals in agriculture production and limiting residual traces in imported products is a typical example of the latter case.

Governments planning new measures to protect biodiversity will need to consider policies established by a number of international organizations in order to ensure that proposed conservation methods will not conflict with current or planned international agreements or treaties. The polices and standards established by the World Trade Organization (WTO), the Convention on Biological Diversity (CBD), and the Convention on International Trade in Endangered Species (CITES) will all have a direct or indirect bearing on new conservation initiatives for member countries.

Land use, ownership and rights of access

Even the best conservation initiatives can be thwarted if appropriate attention is not paid to establishing effective policies on land use and defining the rights of access to land. Customary or subsistence farming uses are vital issues that must be evaluated in the course of government planning for the protection of biodiversity and sustainable agricultural production. Land tenure

policies are equally important since poorly defined ownership, rights of access and rights or use can lead to uncertainty on the part of individuals concerned, and with businesses creating a barrier to investment.

Land use planning

Land use planning is a complex process that involves a significant number of steps if the desired objectives and outcomes are to be achieved. Such steps are too numerous to discuss in detail in this publication; therefore the brief discussion given below has been restricted to providing an overview of the subject. Those interested in more detailed information may find an FAO document entitled "Guidelines for Land Use Planning" to be of interest.
(www.fao.org/docrep/t0715e00.HTM)

Land use planning

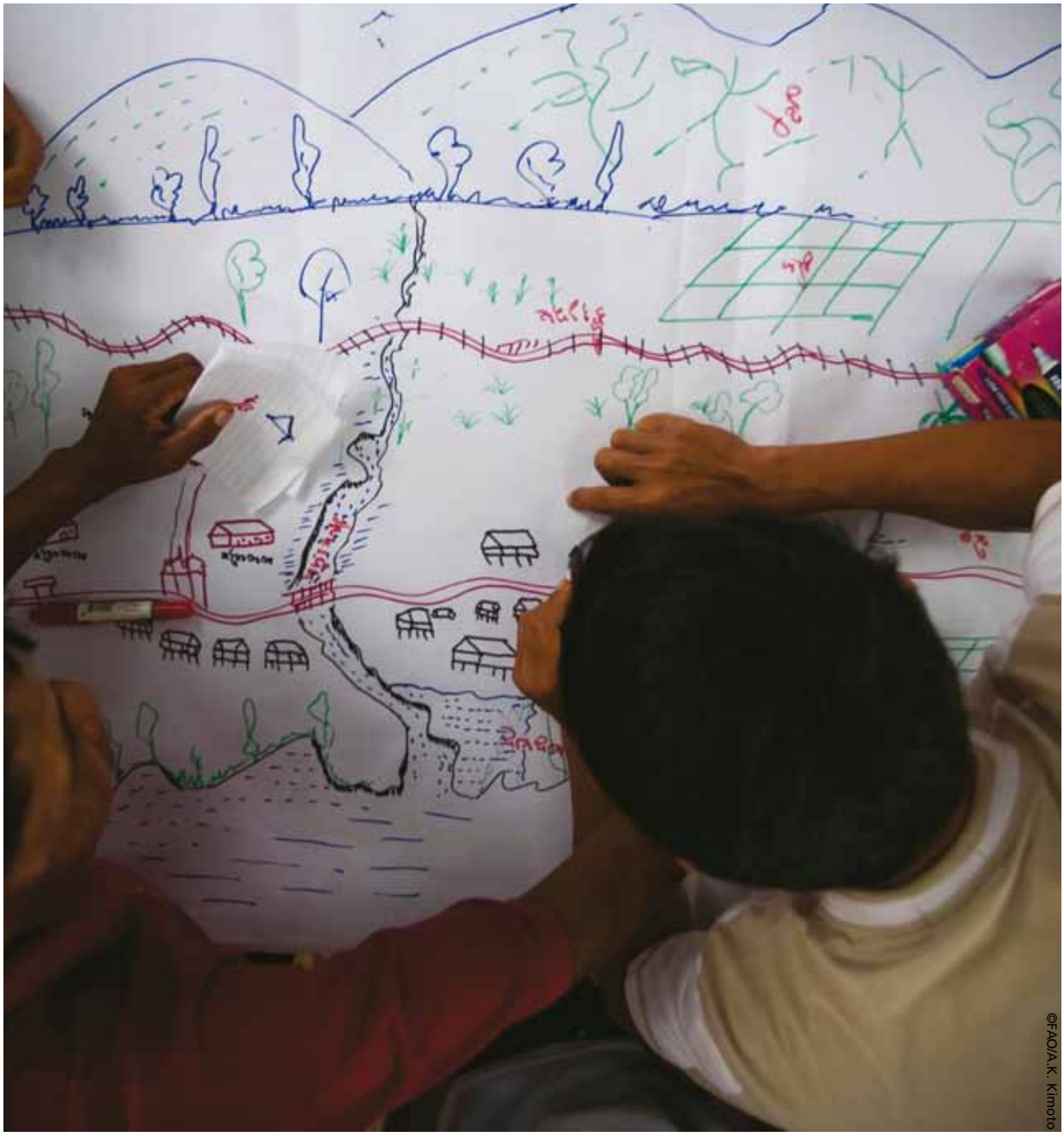
Effective land use planning is an essential step on the path to protecting biodiversity and establishing the sustainable use of production landscapes. Sound land use policies are required in order to ensure that the activities undertaken are in keeping with the area involved, and that they do not unnecessarily deprive people of benefits from use of the land and its resources for other purposes. For instance, granting permits for clear felling of large tracts of forest for agricultural purposes might benefit a foreign investor, but residents of the area could suffer from the loss of a source of food, shelter, medicines and clean water. Land use planning should not be restricted to countries where demands for agricultural land and activities such as forestry, tourism and urban development are greater than the land available, and it is also an essential practice for countries where land is still plentiful if biodiversity loss and the accompanying degradation of ecosystem services are to be avoided.

Before any decisions can be made with regard to land use, decision-makers need to understand what the landscape looks like, what the landscape supports, who are the users and what changes can be made without affecting economic prosperity, ecosystem functions, and the cultural values that the landscapes contain. As a result, land use planning usually commences with a detailed assessment of current usage patterns, the potential offered by land and water resources, and current social and economic conditions. The review needs to include all types of land and water use including fishing, agriculture, pastoral, forestry, mining, wildlife conservation, tourism and infrastructure projects such as dams, highways, and other building sites, so that a comprehensive list of current land usage is obtained. This information would normally be gathered at local, district and national levels, so that the land use practices best suited to the needs of the people can be identified while considering the need to protect resources for future generations.

Trans-boundary Agro-Ecosystem, Rwanda

The information gathered during the review is normally presented in a report containing a description of existing and proposed land use, maps, and summaries of the supporting data and statistics used to compile the report. The report is then used to determine the formal objectives of land use policies which will normally define the best usage of land that is considered to be economically viable, sustainable over the long term, and acceptable to the local population. The information-gathering and review activities should be considered on-going processes that are carried out at regular intervals in order to identify changes occurring at the local, district and national levels. These regular reviews will enable any required amendments to the land use plan to be effected before any noted environmental or economic problems can become firmly established.

It is important to note that land use planning processes are most effective when a variety of stakeholders participate. The importance of involving individuals, communities and businesses at the local level in both the review and planning stages cannot be overestimated.



Community learning about mapping through a training course

This helps to build local ownership of new land use practices that may affect significantly local lifestyles. Without participation, attempts to implement new land use policies are likely to meet with strong resistance at the local level that no degree of enforcement will be able to fully overcome.

Land use planning tools

Landscapes are complex, and land use planners require a considerable understanding of landscape structure and functions in order to avoid the repercussions of poor planning decisions. A number of tools have been developed so as to aid in the information-gathering and planning process. Some of the most commonly used tools are outlined below:

Maps: Maps are an essential tool for those involved in land use planning. A one-page map can display a vast amount of user-friendly information that would otherwise require many pages of text and the duplication of tables. A number of different types of maps are commonly used to avoid overwhelming the user with too much detail. These maps present information on such diverse topics as land topography, water resources, current land uses, vegetation by type and area, areas affected by invasive alien species, conservation areas and associated wildlife corridors and migration routes. Vegetation maps are basic necessities of land use planning. In the late 1970-1980's, vegetation maps were based on ground surveys, typically took years to produce, and were frequently out-of-date by the time they were printed. Recent technological and methodological advances now allow these maps to be created in a fraction of the time. Countrywide vegetation maps can now be generated from moderate resolution imaging spectroradiometer data available from the NASAMODIS project (www.modis.gsfc.nasa.gov). This type of imagery differentiates between forested and non-forested areas and also provides information on plant seasonality, which in turn allows users to differentiate between various types of vegetation. However, while local knowledge is important in terms of complementing and verifying land satellite imagery, extensive ground surveys are usually no longer required, and this produces significant savings in both time and money.

Geographic Information Systems (GIS): Geographic information systems are a powerful software based tool used to create visual representations that combine geographic information with other data such as types of soil and vegetation, species distribution, population, and poverty levels. These systems have undergone significant development over the past decade and now provide readily accessible and user -friendly planning tools for land use and business planners. Additionally, these tools are extremely versatile and have become an essential tool for a number of applications, including land use planning, ecosystem modeling, transportation and infrastructure planning. For instance, a GIS database could be used to provide maps of factors affecting production landscapes, such as farm boundaries, types of crops, soil conditions, protected areas, water resources, the spread of invasive species, and other items of interest to land use planners and those interested in establishing more sustainable production. These maps could also be overlaid with other useful information, such as areas covered by multi-national buying networks, local economic conditions, population and so forth, to further increase their versatility. GIS provides improved accessibility of information, speeds the identification of factors that shape landscapes, and advances the adaptive reasoning of decision -makers – which generally encourages more informed decisions and forward thinking (Swihart and Moore 2004).

Land tenure

Land tenure has been defined by the FAO as the relationship, whether legally or customarily defined, among people (individuals or groups) with regard to land. (For convenience, "land" is used here to include other natural resources such as water and trees.) Land tenure is an institution whereby rules have been invented by societies to regulate behavior. Rules of tenure define how rights to land use are to be allocated within societies. These rules define how access is granted to rights to use, control, and transfer land, as well as associated responsibilities and restraints. In simple terms, land tenure systems determine who can use what resources for how long, and under what conditions.

The rights and obligations provided by land tenure practices should be fully reviewed when planning new policies designed to cater to sustainable supply chain operations. Well-defined policies will simplify enforcement to a considerable extent. On the other hand, vague or poorly defined rights of land use will fail to provide a business environment that will stimulate further investment in agricultural production landscapes. Land tenure practices that fall into the latter category will need to be amended if the initiative to implement sustainable production, and encourage further investment, is to be successful.

4

The influence of markets and money on greening supply chains

This chapter discusses the implications market forces have supply chain participation in sustainable development initiatives. Specific areas covered include:

- The relationship between markets and biodiversity;
- Market oriented conservation initiatives and natural resource management systems;
- Uses and design of Payment for Environmental Services (PES) schemes;
- Methods and sources of funding conservation initiatives; and
- Government subsidies

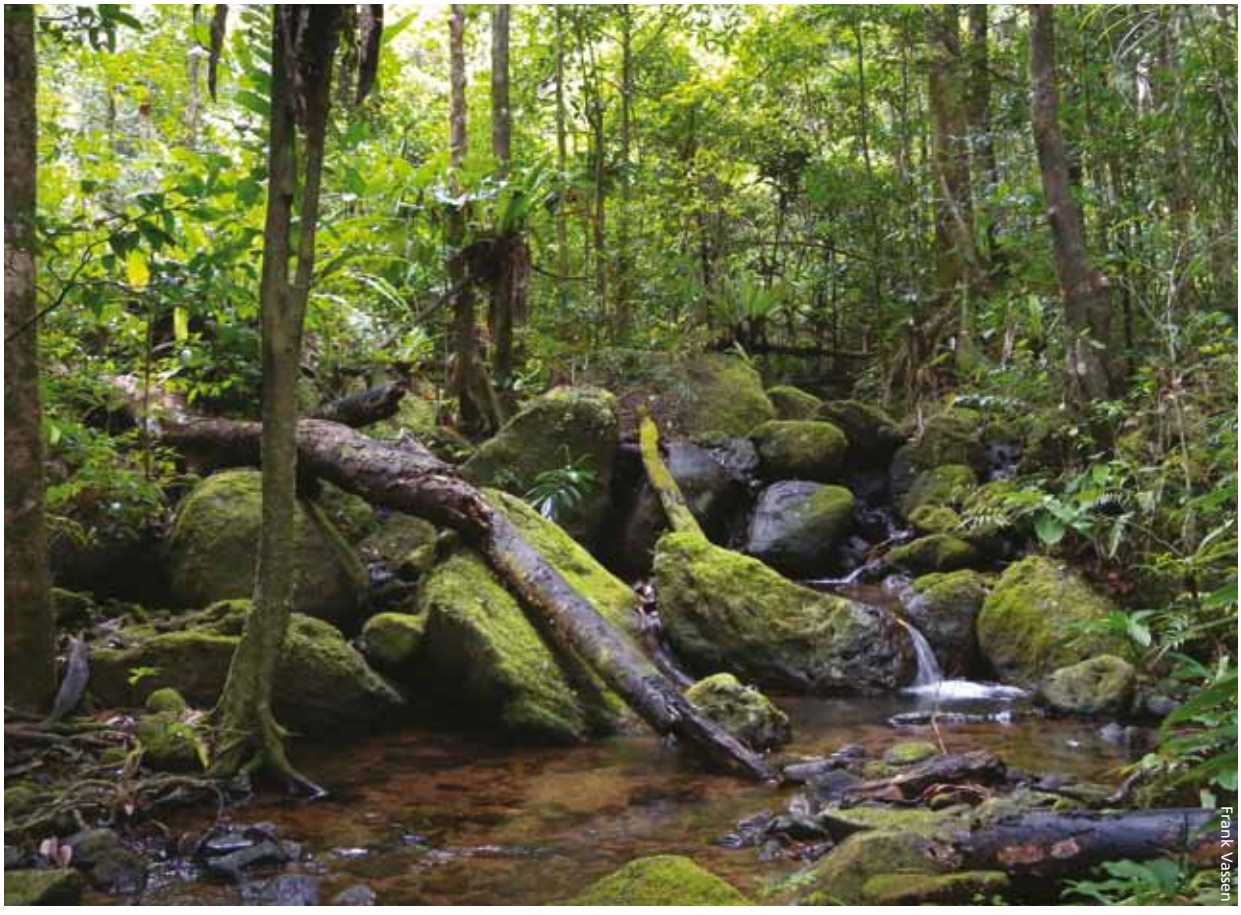

EKT EKP 2002

The Market Value of Biodiversity and Ecosystem Services

Placing measurable values on biodiversity and ecosystem services is difficult. However, establishing costs associated with degraded ecosystems can be a simpler task. For instance, the costs of purifying water polluted by agricultural run-off and industrial production are known to be sizable. Climate change and the degradation of ecosystem protection against flooding and erosion result in costs for affected parties (and insurance companies), which can be established during post-event restoration work. The loss of biodiversity and habitats and the resultant degradation of scenic value cause loss of tourism income and recreational and cultural opportunities – a factor that can be estimated in monetary terms. If failed or degraded ecosystems can generate costs, it is evident that they must have a significantly higher value if left intact and in fully functioning order.

While biodiversity and ecosystem services may not have a current market value, they do provide mankind with benefits that may be either irreplaceable or enormously expensive to duplicate once the services have degraded beyond a given threshold. For instance, forests provide some non-market goods including improving water quality, air quality, aesthetics, and carbon sequestration with an estimated value of between US$2 to 5 trillion per year – or about 2 to 5 times as much as the financial sector losses on Wall Street during the recession. But this represents only a fraction of the overall value provided by ecosystem services.

Even smaller projects can represent significant value for those that live nearby or depend on the natural resources of an area for a living or subsistence. TEEB estimates the benefits derived from ecosystem services in the Masoala National Park (2,356 square kilometers in total) in Madagascar have a net present value (NPV) of US$116,497,800. Details of the benefits and estimated values are shown on the following page:



Lowland rainforest, Masoala National Park, Madagascar

Table 6 The value of ecosystem goods and services

	Benefit	NPV (US$)
Eulimur fulvus albifrons	Medicinal plants for traditional and pharmaceutical use.	1,577,800
	Erosion control – reducing downstream sedimentation	380,000
	Carbon storage from avoided deforestation	105,110,000
	Recreation and tourism – 63% international visitors	5,160,000
	Forest products – food, medicines, and materials for construction and weaving	4,270,000

Many companies currently responsible for unsustainable production fail to recognize the long term market value of the ecosystem services their operations are currently degrading; or choose to ignore the issue in order to maximize short term profits. This further emphasizes the need for governments to work with supply chains to ensure they are fully aware of the market value of the natural resources lost or degraded by unsustainable production practices.

Market-oriented conservation initiatives

One of the main reasons for continued unsustainable production practices and the resulting loss of biodiversity has been attributed to market failure (Bräuer et al. 2006). This market failure – the inability of markets to fully allocate resources efficiently – is generally considered to be a result of market players ignoring the costs, or externalities, imposed on those not directly involved in the market. For example, agricultural run-off can pollute water sources. This in turn can result in destruction of fish stocks and reefs resulting in loss of income for those in industries totally unrelated to farming. Additional costs can also be incurred as a result of the need to purify water for human consumption and other purposes. These factors are unlikely to be considered by those in the bakery product market using flour derived from farms causing the run-off. Many initiatives have been launched to counter this lack of attention by markets. Some of the major steps taken in recent years are presented below.

Ecolabels

Ecolabels are illustrative logos added to product packaging to show consumers that the materials used in the manufacture of the product were produced in accordance with the specific standards established by the ecolabel. The practice was set up to improve consumer awareness of the need for supply chains to adopt sustainable practices in order to protect and maintain biodiversity and ecosystem goods and services. The increased consumer awareness is resulting in consumer demand placing pressure on producers and retailers to adopt sustainable practices or face possible loss of reputation and market share.

Nonpoint source pollution from a farm field during a rain storm

Colourful shopping carts entice consumers

Ecolabeling systems were originally initiated by NGOs and are now also being established by government agencies in a number of countries. The concept has seen dramatic growth over the past few years with over 400 ecolabels currently in use globally. These cover a variety of products and services, ranging from food and forest products to tourism, energy and textiles. The food sector has by far the largest number of ecolabels with approximately 90 currently in use. The majority of these are used to certify organic production while some are based on sustainable biodiversity friendly production and fair trading practices.

The potential for consumer demand to drive businesses to conform to eco-friendly practices offers a promising alternative to traditional regulatory methods of protecting the environment. For instance, market pressures that motivate business decision makers to adopt sustainable business policy will reduce government costs for conservation, freeing up public funds for other pressing issues. Thus, the adoption of certification schemes that underpin ecolabels could prove to be an important entry point for developing country governments wishing to use markets to make upstream operations in agricultural supply chains more biodiversity friendly.

Ecolabeling schemes are a relatively new initiative for conserving biodiversity. NGOs and others have spent millions of dollars on marketing campaigns to raise awareness of manufacturers, retailers and consumers on the environmental benefits derived from safe and

Bird friendly coffee certification

The Smithsonian Migratory Bird Center (SMBC) has made a well-known effort to establish stringent environmental criteria for shade grown coffee. In order to carry the trademarked "Bird Friendly" label, coffee must be grown under a minimum of 40% shade cover throughout the year. The SMBC recommends using minimum of at least ten different species of shade trees of varying heights to attract a variety of birds. A minimum height of 12 to 15 meters is required for some of the trees and there are some restrictions on species that can be planted. Inspectors are required to verify that trees are not excessively pruned and to check that epiphytes and parasitic plants such as mistletoe have not been removed from shade trees since these contribute to biodiversity in general as well as providing resources for birds. Bird-Friendly certification has primarily focused on growers in Central and South America, but is now expanding to Africa.

sustainable production. If an ecolabel is to be successful, manufacturers need to carefully select the ecolabel or labels they choose to support since their product packaging will also carry the ecolabel. In other words, ecolabeling is creating the need to sell a brand on top of a brand.

The development of ecolabels has paid dividends over recent years, particularly in North America. For instance, the sales of Fair Trade bananas, chocolate, coffee and other products under its banner had climbed from £836m in 2009 to £1.17bn in 2010 (Milmo 2011). The Organic Trade Associate also announced significant gains with sales of organically labeled foods reaching $26.7 billion in 2010. This is a 7.7 percent increase from 2009, which itself was 5.1 percent higher than 2008 (OTA 2011). It is evident that ecolabeling has become a powerful market based tool and developing country governments need to evaluate how best to enter this lucrative market, while working towards CBD national biodiversity action plans.

The certification standards on which ecolabels are based vary considerably from label to label (see Chapter 3 for a summary of conservation related certification schemes). For instance, the Fair Trade label is largely oriented towards developing trade and social welfare while most organic labels are primarily based on the health attributes of the product.

Others, such as the Bird-Friendly ecolabel, are more closely related to protecting biodiversity and the

Local market in the Democratic Republic of Congo

environment. It is therefore important that government decision makers understand exactly what standards an ecolabel is based upon and relate these to national biodiversity conservation goals prior to supporting any specific label. If the government's highest priority is based on establishing sustainable production practices, adopting Fair Trade principles alone may not be the best approach due to its focus on socio-economic principles. In this case, and if Fair Trade certification is considered to be of benefit, governments may also wish to consider supporting one or more biodiversity oriented ecolabels designed to protect biodiversity and production landscapes.

Government decision makers must also find a balance between satisfying farmers' needs for income while maintaining biodiversity and the ecosystem goods and services biodiversity provides. Third party certification schemes may offer the best initial alternative since they offer immediate access to establish and grow international green markets and some buyers offer premiums for certified products. Locally developed certification standards could then be developed and implemented once national markets have matured and sufficient expendable income becomes available to support locally certified green products.

Governments must also determine the best approach to minimizing the cost of certification to encourage farmer uptake. This could be from developing locally reputable certifiers trained by the ecolabel accrediting

Local community in rural Brazil

body and/or through technical and financial assistance provided by international organizations and through the private sector.

Unfortunately, certifying a product is not a guarantee of higher income for participating producers. International markets are highly competitive and producers may have to sell their produce at lower prices in traditional markets if international demand for the certified product is low. Certification schemes can help to improve farmer income but governments may need to implement additional measures if food security and poverty reduction are the main drivers behind implementing certification.

Producers that wish to use ecolabels must first gain certification from certifying agents appointed by the ecolabeling organization. The actual cost of certification depends on many factors including the size of the farm or cooperative to other items such as administration and annual audit fees. For example, initial start up costs for organic certification in America range from approximately US$600 to US$33,000 for farms with incomes between US$30,000 to US$10 million respectively, while smallholders can obtain organic certification at costs ranging between US$90 and US$1,300. Fair trade certification is only available to cooperatives comprising smallholders, and costs range between US$2,000 to US$4,000 depending on the size of the cooperative (REF).

On the whole the cost of obtaining and maintaining certification can be expensive and may be cost prohibitive for smallholders with relatively low earnings. Some certification programmes have attempted to overcome this problem by being financially supported by development organizations and NGOs that aim to assist farmers to achieve certification. However these externally funded programmes only reach out to a limited number of farmers and farmer groups. The reality is that many farmers will struggle to finance the cost of certification unless they form well managed farmer organizations. Many business, NGOs and donor organisations are now financially and technically assisting the formulation of farmer organizations.

Carbon trading under the Kyoto Protocol

The emission of greenhouse gases (GHG) is considered to be a major factor influencing climate change and affecting the distribution and, in some cases, the very existence of biodiversity. The need to reduce GHG emissions has been recognized by the parties to the Kyoto Protocol in addition to the need to alleviate the cost of alleviating emissions. These two factors contributed to the development of a mechanism to allow trading reductions in GHG emissions to allow market forces to determine the most economical approach to reducing green house gas emissions.

The trading of emission reductions was made formal under Article 17 of the Kyoto Protocol, which established targets for limiting or reducing GHG emissions for 50 industrialized nations. The allowed emissions are divided into 'Assigned Amount Units" (AAUs) and countries with units that will not be used may sell the excess capacity to countries that expect to exceed their emission targets. This scheme established a new commodity that is now traded in the carbon market (so called because carbon dioxide is the principle greenhouse gas targeted by the Protocol).

AAUs are but one of the emission units that may be sold under the Kyoto Protocol emission trading scheme. Other units, also equivalent to one ton of carbon dioxide (CO2), are also tradable under the scheme:

Kyoto Protocol

Trader assessing the market

- Removal Units (RMUs) are derived from land use, land-use change and forest (LULUCF) activities such as reforestation.
- Emission Reduction Units (ERUs) are generated by Joint Implementation (JI) projects.
- Certified Emission Reduction Units (CERUs) are generated from Clean Development Mechanism (CDM) projects.
- All transfers, sales and acquisitions of these units are tracked and recorded through the registry systems established under the Kyoto Protocol.

Joint Implementation and the Clean Development Mechanism

Joint Implementation (JI) projects facilitate trading of Emission Reduction Units between those countries that have made an emission reduction or limitation commitment under the Kyoto Protocol (Annex B Parties). Joint Implementation offers countries a flexible and cost-efficient means of fulfilling a part of their Kyoto commitments, while the host Party benefits from foreign investment and technology transfer. A Joint Implementation project must provide a reduction in emissions by sources, or an enhancement of removals by carbon sinks, that is additional to what would otherwise have occurred.

Satellite image showing deforestation in Haiti. This image depicts the border between Haiti (left) and the Dominican Republic (right)

The Clean Development Mechanism (CDM) became operational in 2006 and allows Kyoto Protocol Annex B countries to implement an emission-reduction project in developing countries. A CDM project must provide emission reductions that are additional to what would have otherwise occurred and can earn saleable certified emission reduction credits, each equivalent to one ton of CO_2, which can be counted towards meeting Kyoto targets. The mechanism stimulates sustainable development and emission reductions while giving industrialized countries some flexibility in how they meet their emission reduction or limitation targets. There are over 1,650 registered CDM projects that are expect to produce Certified Emission Reductions (CERs) amounting to more than 2.9 billion tons of CO_2 equivalent during the 2008-2012 commitment period (UNFCCC 2011).

Verified Emission Reductions

Verified Emission Reductions (VERs) offer an alternative to Certified Emission Reductions (CERs) and are created by projects that are not registered under the CDM programme. Like CERS, VERs are based on the concept of 'additionality'. That is, the credits are only granted for reductions in GHG emissions that would not have occurred if the project had not taken place. International companies are now trading VERs on voluntary markets. However, the price of a VER is generally lower than that of a CER (see www.carbonpositive.net). Certification of the integrity of offered VERs is still required and is conducted by UN-accredited third party verifiers. Reference may be made to www.ctrade.org/vers for further details of trade development in these emission reduction units.

Carbon Offset Credits

Offset credits are carbon assets that reward emissions reductions undertaken by installations outside of the scope of carbon markets. For example, waste management is not covered by the European Union Emissions Trading Scheme (EU ETS); but if a European project developer invests in power and heat production from municipal waste methane, it can receive offset credits corresponding to the GHG emissions savings. Offset credits are granted to project developers against the assurance that their project reduces total GHG emissions. The quantity of credits issued depends on a comparison of the forecast project emission levels with the "business-as-usual" scenario, which depicts what the emissions would have been without the emissions reduction project. Only the net reduction is eligible for offset credit. Once verified, these emission reductions lead to the delivery of carbon offset credits that may be exchanged on secondary markets.

The main offset credits today are provided by two project mechanisms established by the Kyoto Protocol:

i) Joint Implementation and

ii) The Clean Development Mechanism (this is the most important in terms of the number of credits generated).

Only these two mechanisms benefit from United Nations approval. The offset credits they generate are accepted both on the Kyoto Protocol and the European Emissions Trading Scheme markets. Other credits also exist for entities willing to offset part or all of their GHG emissions on a voluntary basis. The proficiency and rigor of the project developers selling such credits vary greatly, hence providing a very wide range of quality. Today, the development of private labeling is underway to give buyers more assurance of the reality and reliability in some of these credits (UNFCCC 2011).

Tradable Permits

Tradable permits are a transferable right to use fixed amount of common resources or the right to emit a substance that can create a specified level of pollution. The use of these permits effectively allows market forces to affect company decisions on the best approaches to take to meet overall conservation and environmental protection policies established by governments. This is a significant departure from conventional command and control regulation where a regulatory body simply establishes maximum allowances or caps for consumption or abatement. Areas where tradable permits can be used to complement conservations measures include:

- Land clearance;
- Pollution control;
- Wetland preservation;
- Access to clean water;
- Fishing limits or quotas;
- Forestry and non-timber products;

Wetland, Gouldsboro State Park, Monroe and Wayne Counties

- Protection of plants and genetic stock;
- Access to tourist areas for sightseeing or hunting; and
- Limiting types of agricultural or pastoral production.

Many conservation policy makers are moving towards the use of market-based instruments as first choice since they can generally be implemented at lower cost to business and society in general. However, this approach does not fit all situations and it may be necessary to employ a combination of market-based instruments and command and control measures to produce an effective level of protecting biodiversity.

Regulatory and legal measures

Regulatory and legal measures, also known as command and control systems, provide compulsory measures that govern the actions of firms and individuals. Monitoring and enforcement procedures are required if these are to be successful with penalties being applied for those failing to comply with policy requirements. Regulatory methods can be more expensive for businesses to implement since they are generally less flexible than economic instruments, thus depriving companies the opportunity to determine the lowest cost approach to meet conservation objectives.

Regardless of the method or methods selected, monitoring and enforcement of policies is essential if the measures are to achieve the desired results. This will undoubtedly add costs for governments. However, without fair and predictable monitoring and enforcement, it is likely that many businesses and individuals will find ways of avoiding compliance – especially if that might be seen as a method of reducing production costs.

Carbon markets and supply chains

Business supply chains, particularly large multinational businesses that dominate many agricultural commodities, are significant contributors to global GHG emissions. Carbon markets provide these businesses with the option of offsetting their emitted GHGs by buying carbon credits from projects that fix and store carbon in developing countries. The fact that carbon offset projects are generally cheaper to implement in developing nations creates opportunities for governments in those countries to increase in-country investment. Carbon projects can also help in the conservation of biodiversity if the projects are steered towards biodiversity friendly activities such as reforestation and sustainable agriculture.

The carbon trading programmes offered by the CDM, the EU ETS and other independent carbon trading exchanges are an important source of finance for greening supply chains. Developing country

A tropical forest in Liberia

governments, through appropriate national institutions, can work with supply chains and national farmers to development carbon offset projects that implement sustainable production practices. This aids conservation efforts and also provides an additional source of income for farmers from the sale of emission reductions. For example, projects that assist farmers in establishing land offsets, or moving from intensified cropping practice to more sustainable inter-cropping with forest trees or other beneficial plants, would benefit biodiversity and help maintain ecosystem goods and services.

Market-based natural resource management systems

The protection and maintenance of biodiversity and ecosystems has traditionally been affected by regulatory and legal frameworks, often referred to as 'command and control' systems. These have not always proven successful and are now being supplemented or replaced by a number of financial and market related tools collectively referred to as 'market-based instruments' or 'economic instruments'. These instruments are generally considered to be divided into three

Three-pole one-line rig catching Bigeye tuna in the Galapagos Islands area

Table 7 Types of natural resource management systems

Market Functions	Rights and Ownership	Financial Instruments
• Labelling and certification • Consumer awareness programmes to establish new markets • Reduction of barriers in existing markets	• Usage or access rights • Tradable permits • Quotas • Offset schemes	• Tax incentives • Subsidies and other finance assistance • Performance bonds • Deposit-refund systems • Emission charges • Production or usage charges • Penalties for non-compliance

subsets that either create markets for tradable rights and permits or apply monetary factors such as taxes, subsidies, fees and fines.

Funding conservation initiatives

Budgetary constraints are one of the many problems facing governments considering implementing measures to protect biodiversity and green supply chains. Competition for access to government funds is usually intense with many sectors claiming the need for priority. In many instances, the matter is relatively easy for politicians to resolve since spending a given amount to build schools or hospitals presents visible results of the expenditure. The situation for investment in conservation is not as clear, in most cases, the results are not as visible and politicians may find it hard to justify major expenditures without being able to demonstrate some form of return on investment. This problem frequently stems from lack of reliable information that provides an indication of the value the conservation investment will return to the population over the long term; or the extent of the loss the country will have to bear if no action is taken.

Payments for Environmental Services (PES)

Payments for environmental services offer a source of funding for conservation programmes that provide incentives for meeting or exceeding specified targets. They also offer the additional benefit of being an effective method of supplementing or replacing "command and control" systems established for the preservation or restoration of ecosystem goods and services.

PES schemes are based on the use of market forces to offer financial incentives for land and/or marine users to protect the environment rather than depending on enforcement laws or regulation on which traditional command and control systems rely. PES can be structured to address protection of many of the ecosystem services or benefits. However, current trends tend to restrict these schemes to carbon sequestration, water quality, watershed protection, biodiversity and, more recently, scenic considerations. The schemes are essentially a voluntary contract between users of the land or marine resource and those with vested interests in ensuring that specific ecosystem benefits are maintained and delivered. Carbon sequestration markets are currently growing faster than biodiversity related markets partly due to increasing international attention on the need to reduce GHG emissions and partly a result of the difficulty in placing economic values on biodiversity.

Payments under PES schemes are generally tied to ensuring the relevant ecosystem benefit is maintained or enhanced in areas where the benefits would have been degraded under normal business as usual scenarios. In all cases, the funding agency will require

Landscape of a forest in Colorado, en:United States

an independent third party to verify that the land user has delivered the conservation actions defined in the PES contract.

While the objective of most PES schemes is to protect biodiversity or maintain one or more ecosystem services, the methodologies employed can vary substantially from scheme to scheme. For example, the United States' Conservation Reserve Programme, one of the longest running PES schemes, is a public-private partnership that rents land for conservation and wildlife habitat protection. The programme budgeted US$1.7 billion in 2010 to pay landowners to plant long-term, resource-conserving covers on approximately 33.8 million acres of environmentally sensitive land to improve water quality, control soil erosion and enhance habitats for waterfowl and wildlife.

Money is not the only factor being used to provide incentives under PES schemes. For instance, the Chinese government established the Grains for Green programme in 2000, which uses grain for payment. This large-scale programme addresses erosion and downstream sedimentation problems by providing farmers with grain in exchange for stopping deforestation and for converting cultivated land on hillsides to forest, orchards or pasture. The use of grain for payment also helped the Chinese government to address overproduction of grain crops without the need to impose production restrictions thus helping both its internal economy and the environment under the same project.

Erosion-vulnerable unterraced upland cropping on the hills, Kunming, Yunnan Province, China

The International Centre for Research in Agro-forestry (ICRAF) RUPES programme in Sumatra, Indonesia is another example of a non-monetary PES project. In this case, the programme provides farmers with land tenure in return for adopting agro-forestry in their "illegal" coffee gardens.

Most PES schemes are substantially smaller than the American and Chinese examples noted above. Some, such as the Pico Bonito Forest programme in Honduras, are tailored to provide returns to those in limited areas rather than primarily focusing on country wide benefits. The Pico Bonito programme was established as a profit oriented venture by the Pico Bonito National Park Foundation and EcoLogic Development fund to protect biodiversity, reduce soil erosion and enhance watersheds within the park and surrounding areas. The project has received CDM approval and generates carbon credits through reforestation and improved agro-forestry practices with 0.45 to 0.55 million tons of carbon forecast to be sequestered by 2017. These credits are sold through the World Bank BioCarbon Fund with a portion of the proceeds being returned to local communities as shareholders in the project. A further 0.5 million tons of carbon credits are expected to be generated by avoided deforestation by replacing current destructive practices, such as slash and burn agriculture, with sustainable production methods that help conserve and maintain biodiversity. The project also provides hundreds of jobs in reforestation and agro-forestry for inhabitants of local villages generating alternate incomes that allow the communities to adopt new practices and abandon their previous reliance on slash and burn agriculture.

Funding for PES schemes can come from public funds, International organizations, NGOs, the private sector, or some combination thereof. Major sources include the Global Environment Fund, the UN Reducing Emissions from Deforestation and Forest Degradation (REDD) programme, the World Bank, the World Wildlife Fund, Conservation International, The Nature Conservancy, and various private investment banks.

Depending on the source, funds may be provided in the form of grants, technical assistance and/or loans to assist in meeting the costs of national capacity building, including preparation of PES projects, and payment

Montañas de la Sierra de Agalta, Olancho. Honduras

for verified successful performance under approved projects. The majority of payments made to date relate to climate change mitigation issues such as carbon sequestration and emission reduction programmes. However, funding is also available to support general conservation programmes aimed at introducing sustainable production practices and protecting biodiversity and vital ecosystem services.

Designing PES projects

Carefully designed PES schemes can serve the dual purpose of reducing government costs for implementing and maintaining conservation programmes while also offering a potential source of revenue for landowners and communities. However, not all PES projects launched to date have been successful resulting in a waste of funds and loss of investor confidence. It is therefore essential that governments ensure that any proposed PES schemes are carefully considered and thoroughly planned if they are to be successful in gaining financial support from supply chains. This will require a good working knowledge in a number of areas including the impact of agriculture and forestry on biodiversity and ecosystems, conservation practices, and economics. Government investment in building capacity in these and other related areas can bring significant benefits in conservation and poverty relief by establishing a sound and credible design for those considering investing in new projects. Establishing carbon and/or biodiversity centers of knowledge in existing institutions can help to minimize government costs in this area.

The two major barriers to establishing an effective PES scheme are finding a source of funding and the general perception that biodiversity and ecosystem services are public goods. The perception of free public goods has led many businesses to ignore the value of biodiversity thus leading to the steady deterioration of ecosystem services over recent years. The free goods perception, together with lack of traditional economic or market values for biodiversity, has also hampered investment in PES projects since many private investors do not consider that investing in conservation will help their profitability. These barriers can only be overcome by government initiatives to assist local institutions and NGOs to develop a firm understanding of the need for and value of conservation measures.

Governments in developing countries will also need to ensure that an enabling legal and policy environment (discussed in Chapter 3) is in place if investments in local or national PES projects are to be realized. Policy areas such as land tenure, business and conservation

Slash and burn agriculture (citemene), NE Zambia

Tropical palms in an oak forest in Central Veracruz, Mexico

regulations, and enforcement all affect investment risk and need to be clearly defined and fully operational if investor confidence is to be gained. On the other hand, weak governance or dysfunctional government institutions will lead to higher risk and transaction costs thus making it harder for PES project developers to establish a viable business plan with respect to costs and returns over the life of the project. Failure to gain full understanding and voluntary participation by the communities and businesses involved in the production landscape can also contribute to a less than satisfactory outcome.

The mixed success of PES schemes to date indicates that projects need to be carefully tailored to fit the environment they are intended to benefit. Different approaches will be required for various landscapes with further variation possibly being required to gain the voluntary participation of affected communities and businesses. UNEP has prepared a Primer on PES Design that provides detailed guidelines on the various areas to be considered during the design of PES systems.

The Climate, Community and Biodiversity Alliance, a partnership of research institutions, corporations and NGOs, has developed a set of standards to assist in the preparation of PES projects. The Climate, Community and Biodiversity Project Design Standards have been established to evaluate and validate land-based carbon mitigation projects in the early stages of development to build project credibility in the eyes of government, investors and other key stakeholders. Emphasis is placed on projects that simultaneously address climate change, support local communities and conserve biodiversity (www.climate-standards.org). These standards listed below are intended to be used in conjunction with carbon accounting standards to allow carbon sequestered from the related projects to be verified.

- The Clean Development Mechanism – www.cdm.org
- The Voluntary Carbon Standard (VCS) – www.v-c-s.org
- The Gold Standard – www.cdmgoldstandard.org
- The Carbon Fix Standard – www.carbonfix.info

Other Conservation Funding Sources

Funding for protection of biodiversity and the environment can come from a variety of sources other than those noted above. Three major sources are government

Conserving soil water in Kenya

taxes and other charges, international financial organizations, and the private sector.

Government taxes and charges

The cost of establishing and maintaining conservation programmes could be financed by general taxation revenues. However, these are usually in short supply and governments may be faced with heavy demands for funding other sectors leaving little, if any, available for conservation initiatives. Environment taxes and charges may offer some relief in this regard. For instance, taxes or other charges could be levied on resource usage and/or the emission of pollutants. These can not only provide funding for conservation but can also reduce the level of revenue required from other forms of taxation. Taxation or charge mechanisms will need to be carefully structured to be high enough to attract attention to inefficient resource usage or excessive emissions, but not so high as to render production economically unfeasible.

Tax rebates, while reducing government revenue streams, should also be considered as part of the taxation package since these can provide businesses with an economic incentive to conserve resource usage and minimize pollution if the rebates are of a substantial nature. These will require clear and concise targets to be established for the area involved and careful monitoring of performance to confirm the level reductions achieved prior to issuance of a rebate. Offering rebates or reductions in Value Added Taxes on items such as organic fertilizer can also offer financial incentives for farmers to adopt more eco-friendly practices.

Access charges to protected conservation areas represent another source of income to support many government conservation programmes. Separate charges or licenses may also be levied for rights to harvest materials, genetic stocks, and wildlife in protected areas. Again, a careful balance needs to be maintained to ensure a source of revenue without raising the cost of related activities to the point where demand is adversely affected.

International Funding Sources

The Global Environment Facility (GEF) is the world's largest multilateral environment fund. Established in 1991, it is the financier of biodiversity conservation projects and is the funding mechanism for the Convention on Biological Diversity (CBD), the **United Nations Framework Convention on Climate Change (UNFCCC), the Stockholm Convention on Persistent Organic Pollutants (POPs)** and the **UN Convention to Combat Desertification (UNCCD).** To date, the GEF has allocated $9.5 billion towards projects that improve the global environment. This has been supplemented by more than $42 billion in co-financing and involved over 2,700 projects in 165 countries.

Cabbages growing on a farm in the Kibirichia area of Mount Kenya

The GEF is the leading financier of efforts to "mainstream" biodiversity into development by changing the trajectory of development to reduce the threats posed to biodiversity by the production practices of different economic sectors. GEF financed mainstreaming initiatives take two forms: (i) mainstreaming biodiversity into development at the landscape level, often by improving land use planning and management and encouraging the adoption of biodiversity friendly production practices in sectors such as agriculture and forestry, and (ii) mainstreaming biodiversity management into product supply chains. This work seeks to use the power of markets and supply chains, to influence production practices on the ground, and develop incentives to adopt and sustain sound practices that reduce pressures on biodiversity. These two approaches are frequently combined in projects reflecting the fact that both types of interventions are needed to address biodiversity loss. Currently, GEF financed biodiversity projects are influencing production practices over an area of 265 million hectares globally.

GEF funding priorities are decided at national level by GEF recipient countries. Countries work with GEF Agencies, which include UNDP, the World Bank, The United National Environment Agency and other UN agencies and Regional Development Banks. These agencies assist countries to develop their project concepts and to implement initiatives on the ground, while also distilling and disseminating knowledge. The GEF is administered by an independent Secretariat and governed by an independent Council which establishes financing priorities and approves project funding.

SGP The GEF Small Grants Programme

The GEF also operates a **Small Grants Program** (SGP) which provides grants of up to US$ 50,000 for community led initiatives. Funding is provided for a variety of projects that provide environmental benefits such as biodiversity conservation and climate change mitigation. It has also been provided to finance local supply chain initiatives aimed at conserving biodiversity. Projects are implemented by the UNDP and the GEF has provided $495 million to fund some 12,000 individual projects in 122 countries.

Central American Markets for Biodiversity (CAMBio)

In 2007, UNDP, Global Environmental Facility (GEF) and the Central American Bank for Economic Integrations (CABEI), partnered to support the mainstreaming of biodiversity conservation and sustainable use within small, micro- and medium-sized enterprise (SMME) development and financing in five Central American countries (Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua). SMME agricultural activities like cacao and coffee cultivation, cattle breeding, wood extraction, aquaculture, sugarcane production, tourism, and agrochemical intensive vegetable production all threaten the region's remarkable biodiversity. The project removes business and finance barriers to catalyze biodiversity-friendly investments in SMME in Central America. The project also generates biodiversity benefits by encouraging transformed production and service sector practices and related investments that positively impact biodiversity. CAMBio has created opportunities for people of low incomes to create businesses in the production of organic pineapple jam, shade-grown coffee and eco-tourism.

Further information in the GEF, including information on accessing GEF finance, can be obtained on the GEF web site: www.thegef.org; information on the SGP can be accessed on www.sgp.undp.org.

The Sustainable Trade Initiative (IDH) has been established to help make sustainability the new norm and to deliver impact on Millennium Development Goals. IDH programs work through public and private interests to achieve economic empowerment of producers, sustainable economical growth and development of the private sector in origin countries. It also focuses on sustainable consumption and trade in western markets and addressing environmental and social issues on a global scale. IDH programmes involve a number of sectors including food (cocoa, tea, cotton, coffee, soy, palm oil, spices), aquaculture, stone, tourism, timber and electronics.

IDH is initiated and funded by the Dutch government with a five year match funding capacity of € 100 million. When companies invest in sustainable production and trade, IDH may match fund these investments to a maximum of 100%. The match funding of IDH helps generate and accelerate hundreds of millions of auditable investments from multinational companies such as Unilever, Ahold, Mars and IKEA, towards the sustainable transformation of international supply chains.

IDH programme is designed around achieving social and environmental sustainability targets. Examples of such targets include the number of smallholders trained, volumes of certified products on the market, number of hectares of rainforest protected, the percentage of sustainable market share. Full details of the IDH program may be obtained at www.idhsustainabletrade.com

The Common Fund for Commodities (CFC) is an intergovernmental Institution that was established within the framework of the United Nations. The fund essentially focuses on financing commodity development activities through the provision of grants and loans for the production and marketing of agricultural commodities in developing countries. The core business of the CFC is to combat rural poverty in agricultural landscapes by ensuring greater productivity and increased socio-economic status of smallholder farmers, as well as enhanced export earnings from commodities. This objective has been pursued over the past 20 years with the fund leveraging over 500 million USD, almost double that of its own contribution, to meet the agricultural development needs of 106 member countries.

CFC funded projects usually address a combination of commodity development needs, these include improved product quality and quantity; the diversification of crops; the establishment of producer cooperatives and traders organizations; promoting the adoption of environmental friendly production i.e. climate change mitigation; on-farm biodiversity conservation; conducting field research; the transfer of technology and the development of legal and policy frameworks. Depending on the various development aspects of the project, an array of different partners can execute and implement CFC funded projects. These could include UN agencies, government agencies with a mandate to conserve natural resource i.e. Ministry of agriculture, associations, foundations and NGOs.

CFC funded projects range from about 120,000 to 2 million USD and project co-financing is expected. Details on how to apply for CFC funding may be found in the CFC document entitled "Manual for the Preparation and Management of CFC funded Projects" available from http://www.commonfund.org/Projects/Project_Manual.

Private Sector Funding

The private sector also represents a source of funding for implementing and maintaining sustainable production, conserving biodiversity and reducing poverty in local communities. For example, Cadbury PLC has invested US$74 million to create a more sustainable cocoa supply chain for its global cocoa procurement requirements. The programme is based on engaging government departments and NGOs to formulate and monitor projects that contribute to the Cadbury Cocoa Partnership's four sustainability pillars. The scheme works within existing government systems to improve farmer training in crop improvement and sustainable practices and also addresses environmental, fair trade and livelihood issues. Incentives for farmers to conserve biodiversity and protect production landscapes are also included in the programme. The success of this programme illustrates the need for governments to engage in discussions on conservation and greening supply chains within downstream elements of supply chains – since this is where funding is most likely to be allocated for this type of investment.

Cadbury Cocoa Partnership's Four Sustainability Pillars

1. Improving cocoa farmer incomes: by helping farmers increase their yields and produce top quality beans.
2. Introducing new sources of rural income: through microfinance and business support to kick start new rural businesses and introduce additional income streams such as growing other crops.
3. Investing in community led development: to improve life in cocoa communities e.g. supporting education through schools and libraries, supporting the environment through biodiversity projects, and building wells for clean water.
4. Working in partnership: developing a pioneering model which will be led from the grass roots. Farmers, governments, NGOs and international agencies will work together to decide how the funding is spent and work with local organisations to turn plans into action.

Source: http://trade.ec.europa.eu/doclib/docs/2008/march/tradoc_138097.pdf

Subsidies

Subsidies are a typical command and control finance mechanism used to stimulate growth and/or conservation in targeted sectors. They have traditionally focused on providing industry stakeholders with financial incentives to perform certain activities policy makers believe will positively influence the economy. This emphasis on economic growth has resulted in many subsidy programmes having little regard to the impact the subsidy will have on national biodiversity assets. The depletion of aquifers from subsidized irrigation, the pollution of waterways from subsidized agrochemical applications, and the loss of wildlands resulting from subsidies that encourage land races and/or conversion of land to biodiversity unfriendly uses are typical examples of subsidy policies that have indirectly impacted biodiversity and degraded ecosystem goods and services – priceless assets that are almost impossible to replace once lost.

Some subsidies have been specifically designed to address biodiversity and environmental concerns. For instance, agricultural subsidies are being put in place to encourage farmers to reduce dependence on traditional fossil based fertilizers with their potential for run-off pollution. Other subsidy programmes reward farmers for creating biodiversity set-asides and refraining from cultivating sensitive areas such as watersheds, sloping ground and species rich areas.

Unfortunately, many new subsidies and policies that consider biodiversity usually only attempt to manage threats rather than resolve them. A recent study in Europe concluded many agricultural environmental subsidy schemes were ineffective in protecting farmland biodiversity.[1] This was a result of poorly designed programmes rather than the concept of using subsidies as a conservation tool. In fact, there are many subsidies that have been successfully implemented to achieve biodiversity objectives. These schemes had clear objectives, adequate area specific targeting, employed realistic approaches and were quantitative and time limited (Bräuer et al. 2006).

Subsidies may take different forms including direct subsidy, auction and compensation. The pros and cons of these approaches are shown in the following table:

Table 8 Types of Subsidies

Type	How it works	Weakness	Strengths
Subsidy	Uniform Compensation Payment	Farmers are over-compensated Cost-efficiency not optimal	More cost-efficient then compensation payment design
Auction	First price sealed bid auction	Farmers are still over-compensated Could be improved with scoring based on location of reserve plots	Better cost-efficiency than subsidies and compensation payments, although farmers may still be over-compensated
Compensation payment	Payment per hectare after subtracting edges and corners of adjacent farm	Better spatial pattern Farmers are still over-compensated	Helps minimize reserve aggregation Provides the best spatial pattern but more costly to implement

Source: Bamiere, et al. (2010).

Palm oil plantation in Cigudeg, Bogor, Indonesia

While subsidies can be an effective tool for gaining supply chain cooperation in conservation initiatives, they are the subject of intense debate by members of the World Trade Organization (WTO) and other international and regional organizations. Subsidies related to production are the main area of concern for many parties since the financial assistance to producers can allow products to be sold at less than normal market prices thus distorting international trade. Production subsidies have also been used to reduce local prices so that local products are substituted for imports.

A number of developing countries currently have exemption for export subsidies. However, the WTO General Council has mandated these countries must phase out these subsidies by the end of 2015 or face the possibility of countervailing taxes being levied by importing countries. Least developed countries, and developing countries with a gross national income per capita of US$1,000 or less in constant 1990 dollars, are generally exempted from penalties under the WTO guidelines.

There are fewer objections to subsidies aimed at conservation and establishing sustainable agricultural practices. These types of subsidies are allowed by the WTO under its 'Green Box' policies provided they are government funded and cause minimal distortion to trade. These restrictions do not apply to subsidies directed at products intended for local or national consumption as these are considered to be matters of national concern.

The provision of subsidies affecting products destined for export markets is a complex matter. Those countries considering implementing subsidies of this type are therefore urged to discuss the proposed subsidy programmes with their trading partners, the WTO, and other organizations with which they have trade agreements, prior to implementing any new subsidy programme that might affect import or export markets.

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