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Sustainable Landscapes – Linking Conservation and Production

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Biodiversity preservation and improved agricultural productivity are not only compatible, but actually mutually reinforcing in a very wide range of settings.[1]

1. INTRODUCTION

Approaches being developed under many biodiversity-related international agreements and programmes call for ecosystems to be managed to meet multiple national objectives, including providing timber, forage, fibre, and energy, retaining options for future economic use, carrying out various ecosystem services, providing ethical and aesthetic values, and supplying that nation's share of global benefits.[2] Achieving these sometimes-conflicting objectives in a time of rising expectations and shrinking government budgets will require new approaches. One

1. Jeffrey D. Sachs, Director, Earth Institute at Columbia University
2. Millennium Ecosystem Assessment (2003). *Millennium Ecosystem Assessment*. Island Press, Washington D.C.

such approach is the concept of 'sustainable landscapes'. This chapter examines the 'ecosystem approach' – as advocated by the Convention on Biological Diversity (CBD) – as the conceptual framework for sustainable landscapes and then explores 'ecoagriculture' as a practical example of the approach in practice.

2. CONSERVATION AND PRODUCTIVE LANDSCAPES

For the first time in a binding international instrument, the CBD recognises the intrinsic value of biological diversity along with its ecological, genetic, social, economic, scientific, educational, cultural, recreational, and aesthetic values. The Convention gives considerable attention to the benefits people derive from the sustainable use of biological resources.

The people who use these biological resources have many different needs, interests, cultures, and goals. The global industrial society which characterises our modern world has a tremendous appetite for the consumption of these resources as commodities. The forested areas where species diversity is richest often are remote from the centres of power, but the people who live in these areas are significantly influenced by economic decisions taken in distant capitals that affect markets for biological resources. And forest residents will themselves make decisions about resources that may sometimes result in the conversion of a forest into another form of land use or the local extinction of a species (though the evidence indicates that local people who have long lived on the land relatively seldom cause such extinctions).

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New research on how ecosystems work is being applied to conservation of biodiversity. This research is finding that many ecosystems are loose, temporary assemblages of species that each behave according to their own needs, depending on their specific physiology, morphology, demography, behaviour, and dispersal capacity. 'Because of a continual turnover of ecological conditions, local communities show a continual turnover of species, at one time gaining species because the scale of processes allows a

certain type of trait, and at others losing them again because the same trait happens to have resulted in too great a risk of extinction. Biodiversity is both the result and expression of all sorts of adaptations of life to the environmental turmoils; it can only be maintained as long as this turmoil exists'.[3] These new insights are the basis of managing dynamic ecosystems as a whole, recognising the many different habitat structures found in nature.[4] Because ecosystems are dynamic, highly complex and unique to the site where they are located, it is not sufficient to conserve just one minimum viable population of a species, or just one example of an ecosystem. Instead, we need approaches to conserving biodiversity that recognise the dynamism of systems, the dependence of local people on their natural resources, and the need to build redundancy into our systems of protecting biodiversity.

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3. THE ECOSYSTEM APPROACH TO SUSTAINABLE LANDSCAPES

The conceptual framework for sustainable landscapes arises from the 'ecosystem approach', as developed under the CBD. The ecosystem approach recognises that ecosystems must be managed as a whole, with protected areas serving as reservoirs of wild biodiversity in a 'matrix' of land that is managed to enhance its habitat value, while also providing a range of benefits to people such as food supply and income for ecosystem services. Biodiversity protection in an ecosystem management framework calls for a co-ordinated strategy that clarifies objectives, goals and investment strategies for protected areas and other land uses that influence the way people use resources. It encourages protected areas to be integrated fully within key planning frameworks, including land use and development plans, national biodiversity strategies and action plans, and strategic plans for relevant sectors (including agriculture, forestry, fisheries, tourism, energy, transport, and even the

3.Hengeveld, R. (1994). 'Biodiversity: The diversification of life in a non-equilibrium world'. *Biodiversity Letters* 2:1-10.
4. Oliver, C.D., and B.C. Larson (1996). *Forest Stand Dynamics*. Updated Edition. John Wiley and Sons.

military). Within this integrated strategy, agricultural lands need to be managed as part of the matrix surrounding protected areas, while the protected areas are managed as part of the matrix surrounding agricultural lands. Critical habitat features for wild biodiversity are thereby maintained.

Related terms that are used by some environmental planners include 'bioregional planning', 'ecoregion-based conservation', 'the ecosystem approach', 'an ecosystem-based approach', 'integrated conservation and development projects' (ICDP), 'biosphere reserves', 'landscape ecology', and 'integrated coastal zone management'; all are based on more comprehensive approaches to resource management. This idea that conservation problems should be addressed in whole ecological or landscape units based on integrated biological, physical, and socio-economic assessments stretches back at least into the 1960s, but it could be argued that this has been the de facto approach of stable rural communities throughout history.

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Sustaining multiple use over significant periods of time is challenging within a small area. But over a larger landscape, various lands can be allocated to different dominant uses, with all land uses contributing to the overall objectives of ecosystem management. Ecosystem management provides a comprehensive framework for bringing together a wide range of different approaches to conservation, helping to integrate or co-ordinate the various sectors with an interest in biodiversity. The scope of ecosystem management efforts may include activities across the entire land and waterscape, crossing ownership, political, and even international boundaries. Conserving a species of rare or threatened plant, for example, involves conserving other parts of its ecosystem, including pollinators, seed dispersers and other organisms that play significant roles in the lifecycle of the plant. Ecosystem analysis can help decision-makers consider options for landscape-scale developments. The ecosystem approach implies inter-sectoral co-operation; decentralisation of management to the lowest level appropriate; equitable distribution of benefits; use of

adaptive management policies that can deal with uncertainties and are modified in the light of experience and changing conditions; and a multi-disciplinary approach that takes into account scientific, social, and economic issues.[5]

Scientific understanding of ecosystem functioning remains very incomplete. For example, it is not known how much biodiversity can be lost from an ecosystem before essential services (such as nutrient cycling) begin to be affected. Some ecologists argue that the health and stability of ecosystems are correlated with biodiversity, so reducing diversity may compromise the integrity of the system. Others contend that ecosystem properties are determined by the functional traits of dominant species, or the composition of functional groups. This implies that at least some species may be redundant. A more balanced view is that while ecosystem processes may reflect the activities of a few dominant species, systems with greater diversity are more likely to contain the most productive species as well as those which play more subtle roles in the functioning of ecosystems.

Sensible ecosystem management, therefore, calls for conserving all of the elements of the system, recognising that the incompleteness of scientific knowledge makes it risky to lose any of the pieces. Managing ecosystems and landscapes with a unified strategy that addresses the needs of their inhabitants as an integrated whole can be a cost-effective approach to biodiversity conservation. It addresses the worry that a simple focus on managing populations of particular species of interest will cause conservationists to fall farther and farther behind in the overall effort to conserve biodiversity, as funding is unlikely to ever be sufficient to address the individual needs of every species. Models based on new understandings of ecological relationships can help inform ecosystem management that benefits all species, or at least ensures that trade-offs are well-informed decisions.

Managing ecosystems and landscapes with a unified strategy that addresses the needs of their inhabitants as an integrated whole can be a cost-effective approach to biodiversity conservation

5. Slocombe, D. S. (1991). *An Annotated, Multi-disciplinary Bibliography of Ecosystem Approaches*. Cold Regions Research Center; Wilfred Laurier University , Waterloo, Ontario, and IUCN Commission on Environmental Strategy and Planning, Sacramento, CA.
Grumbine, R.E. (1994). 'What is ecosystem management?' *Conservation Biology* 8:27-38.
Miller, K.R. (1996). *Balancing the Scales: Guidelines for Increasing Biodiversity's Chances Through Bioregional Management*. World Resources Institute, Washington D.C.

Ecosystem management calls for the emergence of new types of land use planning institutions and tools to co-ordinate public and private investment, regulate zoning, and monitor changes in the condition of biodiversity.[6] Sectoral policies, legal frameworks, and some types of policy instruments to promote biodiversity will typically be developed at the national or state level, ideally with ample consultation and input from stakeholders. However, because so much landscape management – by definition – must be undertaken within a defined geographic area, policy design and governance must be tailored to local conditions, with local input. The old model of watershed or river basin planning, for example, imposed theoretically 'optimal' solutions that had little or no buy-in from actual land managers and were, therefore, often ignored in practice. They left little scope for local experimentation with alternative solutions to achieve environmental goals. New approaches provide more flexibility for on-going adaptation of programme designs, and more opportunities for partnerships with NGOs, public agencies and the private sector.[7] While decision-making draws on the expertise of technical and policy specialists, to estimate the likely outcomes of different options, final policy design will typically reflect a negotiated outcome among different farmer groups, environmental organisations, and other resource user groups.[8] Without a genuine 'buy-in' of stakeholders to policy objectives and strategies, implementation is unlikely to be effective. New techniques of interactive landscape planning can be invaluable in such co-operative processes. The trend towards decentralisation of authority in line agencies could have positive implications for integrating agriculture, forestry and biodiversity, as the sectors would be less compartmentalised and accountability to local stakeholders would be greater.[9]

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6. McNeely, J.A. (1999). *Mobilizing Broader Support for Asia's Biodiversity: How Civil Society Can Contribute to Protected Area Management*. Asian Development Bank, Manila.
7. Barborak, J.R. (1995). 'Institutional Options for Managing Protected Areas'. pp. 30-38 in McNeely, J.A. (ed.). *Expanding Partnerships in Conservation*. Island Press, Washington D.C.
8. MacKinnon, J., MacKinnon, K., Child, G. and J. Thorsell (1984). *Managing Protected Areas in the Tropics*. IUCN, Gland.
9. Place, F. and A. Waruhiu (2000). *Options for Biodiversity in Eastern and Southern Africa. A report on a regional workshop on 'Mainstreaming Agriculture into Forestry: Towards Systemic Biodiversity policies'*, Nairobi, Kenya, 21-22 November 1999. International Centre for Research in Agroforestry, Nairobi.

4. AGROBIODIVERSITY AND ECOAGRICULTURE

Conventional wisdom holds that modern farming is largely incompatible with wildlife conservation. Thus policies to protect wildlife typically rely on land use segregation, establishing protected areas from which agriculture is excluded (at least legally). Farmers are seen as sources of problems by those promoting this view of wildlife conservation; and indeed farmers may not always appreciate wildlife on their land. However, adopting a sustainable landscapes approach demonstrates that farming systems can make important contributions to biodiversity conservation. These contributions can be enhanced by new technical and policy research.

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Over a third of the global agricultural extent is in high-intensity systems that generally use high levels of agrochemicals for continuous cropping, and often reshape land and waterways. The rest of the agricultural extent is under extensive farming systems that use far fewer inputs, but require relatively large expanses of land to produce relatively low crop and livestock yields. Agriculture is necessary to feed people, but both broad types of agriculture have had notable negative impacts on wild biodiversity:

- Nearly half of all temperate broadleaf forest and tropical and subtropical dry forest, and a third of temperate grass and shrubland, have been lost as wildlife habitat, through conversion to agricultural use; conversion rates are especially high in Asia and Europe.[10]
- Irrigation is practised on over 250 million hectares, and uses over 70 per cent of all freshwater used by people – up to 89 per cent in some low-income countries – often diverting water resources needed by land-based and aquatic wildlife.[11]

10. Williams, P.H. *et al.* (2003). 'Integrating biodiversity priorities with conflicting socio-economic values in the Guinean-Congolian forest region'. *Biodiversity and Conservation* 12: 1297-1320.
11. Postel, S. (1999). *Pillar of Sand: Can the Irrigation Miracle Last?*, WW Norton and Company, New York.

- Over half of the world's wetlands – among the planet's most valuable wildlife habitats – have been converted to agriculture.
- Farming has led to significant soil degradation on 16% of all crop, pasture and forestland worldwide, and half of all land within the agricultural extent, thereby affecting the diversity of soil micro-organisms.[12]
- Excessive use and poor management of crop nutrients, pesticides, and penned livestock wastes are a major cause of habitat pollution that can kill wildlife directly or impair reproduction.

Can ways be found to reduce, or even reverse, the impacts of agriculture on wild biodiversity? Given present agricultural technologies and policies, most farmers can increase biodiversity significantly only by reducing production and livelihood security. Initiatives to promote more ecologically sensitive farming systems (called 'sustainable', 'regenerative', or 'organic' agriculture) are expanding, often with positive impacts on wild biodiversity, but they focus mainly on preserving 'useful' wild species, such as pollinators or beneficial soil microfauna.

Some ecologists calculate that even if the existing protected areas do continue as wildlife habitat, 30-50 per cent of their species may still be lost because such isolated protected areas do not contain large enough populations to be viable, especially for large species with relatively low populations

Such evidence suggests a need to redouble efforts to establish protected areas 'off limits' to agriculture. But this is not sufficient. One review showed that of over 17,000 major sites already devoted to conserving wild biodiversity, 45 per cent (accounting for 20 per cent of total protected land area) have at least 30 per cent of their land used for agriculture. Most of the rest are islands within a 'sea' of agriculture. Some ecologists calculate that even if the existing protected areas do continue as wildlife habitat, 30-50 per cent of their species may still be lost because such isolated protected areas do not contain large enough populations to be viable, especially for large species with relatively low populations.

12. Scherr, SJ. (1999). 'Soil Degradation: A Threat to Developing Country Food Security by 2020?' IFPRI Food, Agriculture and the Environment Discussion Paper 27. International Food Policy Research Institute, Washington, D.C.

An essential strategy for conserving wild biodiversity, especially that found in highly populated, poor rural areas around the world, is to convert agriculture that is destructive of biodiversity into a new type of agriculture: 'ecoagriculture'.[13] Ecoagriculture, which builds on the concept of 'ecosystem management', refers to land-use systems that are managed simultaneously to achieve improved livelihoods, conserve biodiversity, and enhance sustainable production at a landscape scale. For ecoagriculture, enhancing rural livelihoods through more productive and profitable farming systems becomes a core strategy for both agricultural development and conservation of biodiversity.

Ecoagriculture encompasses two sets of strategies for land and resource management. First, it increases wildlife habitat in non-farmed patches in agricultural landscapes, creating mosaics of wild and cultivated land uses, by:

1) Creating new protected areas that also directly benefit local farming communities (by increasing the flow of wild or cultivated products, enhancing locally valued environmental services, or increasing agricultural sustainability);

2) Establishing habitat networks and corridors in 'in-between' spaces that are compatible with farming (such as hedgerows or windbreaks); and

3) Raising the productivity of existing farmland to prevent or reverse conversion of wild lands, along with explicit measures to protect or restore the biodiversity value of uncultivated lands.

Second, ecoagriculture enhances the habitat quality of productive farmlands, by:

4) Reducing agricultural pollution through new methods of nutrient and pest management, and farm and waterway filters;

5) Modifying the management of soil, water and natural vegetation to enhance habitat quality; and

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13. McNeely, J.A. and S.J. Scherr (2003). *Ecoagriculture: Strategies to Feed the World and Save Wild Biodiversity*. Island Press, Washington D.C.

6) Modifying the mix and configuration of agricultural species to mimic the structure and function of natural vegetation.

These strategies are supported by real-life experience. For example:

- Veterinary research to develop a livestock vaccine against rinderpest, a viral disease, has not only protected domestic cattle in East Africa, but also protected millions of wild buffalo, eland, kudu, wildebeest, giraffe and warthog that share rangelands and reserves, and that are also susceptible to the disease.[14] New park zoning and use regulations, as well as communications systems with local herders, are needed for successful co-management to take full advantage of such opportunities.
- Crop breeders in the U.S. are developing native perennial grains (such as bundleflower, leymus, eastern gamagrass, and Maximilian sunflower) that can be grown more sustainably with much less environmental damage in dryland farming regions.[15] The systems are not yet economically competitive, but yields have reached 70 per cent of annual wheat varieties, while production costs are lower; habitat value for wildlife is many times higher than in conventional wheat fields. Promoting these species will require changes in agricultural subsidy policies.
- In the humid tropics, research has demonstrated the benefits for both sustainability of production and biodiversity conservation of farming systems that 'mimic' the structure of the natural forest ecosystems. Millions of hectares of multi-strata 'agroforests' in Indonesia produce commercial rubber, fruits, spices and timber, often in a mosaic with rice fields and rice fallows. The number of wild plant and animal species in these agroforests are often nearly as high as in natural forests. Maintaining these systems involves policy reforms to strengthen

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14. Woodford, M. (2000). 'Rinderpest or cattle plague'. Briefing Note of 26 January for Future Harvest Foundation, Washington D.C.
15. Pimm, S.L. and P. Raven (2000). 'Extinction by numbers'. *Nature* 403:843-845

farmers' tenure claims, and 'level the playing field' with subsidised rice production. [16]

- In Central America, researchers are developing modified systems of shaded coffee with domesticated native shade tree species, that maintain coffee yields while also diversifying income sources and conserving wild biodiversity. Farmer adoption of these systems has been promoted through changes in public coffee policy to favour shade systems, technical assistance, and in some cases price premiums in international markets for certified 'biodiversity-friendly' coffee.[17]

To have a meaningful impact on biodiversity conservation at global or regional scales, ecoagriculture must be broadly promoted. In some cases, ecoagriculture systems can be developed by using available components and information from scientific and local knowledge, and by improving these through trial and error to design landscapes that address both local livelihood and conservation objectives. But in most cases major scientific initiatives will also be required, using sophisticated methods and tools from various disciplines. Indeed, ecoagriculture is feasible now in large part because of the greater capacity to find synergies through scientific management. Advances in conservation biology, agricultural ecology, plant breeding, ecosystem monitoring systems, and computer-based modelling are revolutionising the ability to understand and manipulate wildlife-habitat-agriculture interactions, to the benefit of both people and the rest of nature.

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5. POLICIES TO PROMOTE SUSTAINABLE LANDSCAPES

The previous discussion demonstrated the importance of developing new approaches to sustainable landscapes. Experience has shown that new policy and institutional approaches are also essential to making this transition.

16. Tomich, T. *et al.* (2001). 'Agricultural intensification, deforestation, and the environment: assessing tradeoffs in Sumatra, Indonesia', pp. 221-244. In Lee, D. and C. Barrett, *Tradeoffs or Synergies? Agricultural Intensification, Economic Development, and the Environment.* CAB International, New York.
17. Giovannucci, D. (2001). *Sustainable Coffee Survey of the North American Speciality Coffee Industry.* World Bank, Washington D.C.

Establishment of clear legal property rights is important for wild biodiversity conservation, to establish the legitimacy of conservation areas and actions. Of particular concern are recognising local farmers' rights in protected area designation and management, protection of indigenous rights in biodiversity-rich areas, integration of biodiversity considerations into water rights regimes, and rights over wild genetic resources. In addition, payments to farmers for carbon, water, salinity control or other environmental services could potentially be combined to generate payments high enough to justify farmer investment in ecoagriculture. The implications of markets for environmental services such as this are explored in detail in Chapter 4.

5.1 Recognising farmers' rights in protected area designation and management

Formal authority over at least some natural resource management has been devolved to local levels in many developing countries over the past decade, such as Bolivia, Zimbabwe, Indonesia, India, and the Philippines. This reform should make it easier for local people to play a role in designing and managing protected areas

The first generation of protected areas for biodiversity were largely established on public lands or under eminent domain by national government agencies. In many cases, these lands had been actively used, or claimed under customary rights, by local communities. Losses suffered by local people were particularly important in shifting cultivation systems where fallow lands were presumed to be 'unused', and for common lands important for extractive activities. Recognition of this issue has led to the incorporation of safeguards to protect local land and usufruct rights, many of which are now reflected in the various international environment conditions, including the CBD. Mechanisms for protection and compensation of any losses arising from protected area status designation are now also part of national legislation in many countries.

Formal authority over at least some natural resource management has been devolved to local levels in many developing countries over the past decade, such as Bolivia, Zimbabwe, Indonesia, India, and the Philippines. This reform should make it easier for local people to play a role in designing and managing protected areas. But even where the enabling policy framework exists, the devolution processes poses some immediate problems, given the

weaknesses of local authorities. In many countries, local administrators and elected officials have little training in biodiversity and natural resource management, and limited resources at their disposal, while some customary resource managers may be disempowered.[18] Efforts to strengthen local governance of natural resources can help to protect farmers' rights in natural resource policy.

5.2 Indigenous land rights for biodiversity conservation

A high proportion of remaining wild biodiversity is found in areas of traditional indigenous settlement where indigenous resource management systems are still functioning. For example, 30 per cent of the remaining natural forest in Mexico – and that with the greatest biodiversity – is on lands controlled by indigenous people.[19] However, in many developing countries, as a result of colonial rule, nationalisation of natural resources at independence, or the establishment of protected areas, indigenous claims to natural resources have been weakened or even denied. In the process, traditional rules regulating resource access have lost their legitimacy, invariably leading to over-exploitation of resources. Even where land tenure for agriculture is secure (through titling or usufruct rights to individuals or communities), indigenous people have often lost rights to manage natural resources.

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As early as 1975, the South Pacific Conference on National Parks and Reserves recommended that governments 'provide machinery to enable the indigenous people involved to bring their land under protection as national parks or reserves without relinquishing ownership of land, or those rights in it which would not be in conflict with the purposes for which the land was reserved'. Many recent initiatives have been successful in establishing indigenous people's rights to manage protected areas, to conserve both biodiversity and compatible agricultural systems. Some 80 per cent of Latin America's natural forest is now under

18. Place and Waruhiu (2000) *op.cit.*
19. Scherr, S.J., White, A., Kaimowitz, D. (2001). *Strategies to Improve Rural Livelihoods through Markets for Forest Products and Services.* Forest Trends and the Center for International Forestry Research, Washington, D.C.

indigenous control.[20] In Nicaragua, the Miskito people have formed their own NGO to manage the Miskito Coast Protected Area, overseen by a commission including government, regional, NGO and community representatives.[21] In the Philippines, a local NGO established by the Ikalahan Tribe is managing the 14,730 hectare Kalahan reserve in Luesan. They are implementing an integrated programme of community forest management and the extraction of non-timber forest products leading to production of jams and jellies from forest fruits, extraction of essential oils, collection and cultivation of flowers and mushrooms, and manufacture of furniture.

5.3 Water rights for biodiversity protection

Complex sets of ground, surface and irrigation system water rights in agricultural areas govern access by farmers for irrigation and for livestock, by industrialists for processing needs, and by settlements and cities to provide domestic water supplies. Only recently has water been legally reserved in some parts of the world to preserve wildlife habitat. State law in California, for example, prohibits water transfers that would have an unreasonable impact on fish, wildlife or other instream uses. The US Endangered Species Act prohibits water transfers that could harm or harass listed species or cause a significant loss of their habitat. In Mexico, the water law of 1992 requires that quality of water required in the discharge be specified in the granting of water rights, and the responsible national agency can restrict water use in the event of damage to ecosystems, overexploitation of aquifers and other environmental impacts. Increasingly, processes being developed for negotiating water rights among diverse stakeholders in a catchment or irrigation district include negotiators representing the interests of biodiversity conservation.[22]

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20. White, T.A., Martin, A., 2002. 'Who Owns the World's Forests?' Forest Trends and Center for International Environmental Law, Washington, D.C.
21. (Barzetti, V., (ed.), 1993. 'Parks and Progress: Protected Areas and Economic Development in Latin America and the Caribbean'. IUCN and Inter-American Development Bank, Washington D.C.
22. Meinzen-Dick, R. and G.Makombe, (1999) 'Dambo irrigation systems: indigenous water management for food security in Zimbabwe.' In Knox McCulloch, A., Babu, S. and P. Hazell (eds). *Strategies for Poverty Alleviation and Sustainable Resource Management in the Fragile Lands of Sub-Saharan Africa*. Proceedings of the International Conference held from 25-29 May, 1998. Entebbe, Uganda.

5.4 Property rights for genetic resources

The rising dominance of private companies rather than public sector research institutions in genetic improvement of agricultural species, and the promising commercial prospects for genetically modified organisms (GMOs) in agriculture and other sectors, have ushered in a period of intense debate and conflict about 'property rights' for genetic resources. Who 'owns' a gene? Who should benefit from the commercial application of that gene? Will patenting of genetic improvements restrict farmers and local people from using and distributing the native plants or indigenously-developed varieties that were the original source of the gene? Should farmers be compensated financially for past or current in situ conservation of genetic material from valuable domesticated or wild plants and their wild relatives? If so, how? The ultimate legal frameworks that are established internationally and nationally to govern these rights will have a profound effect on farmer, agribusiness, environmentalist and research incentives to maintain, control and access biodiversity.

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Today's bioprospector must meet the CBD's Article 15 requirements for prior informed consent, access on mutually agreed terms, and the fair and equitable sharing of benefits. They must also address issues of intellectual property rights and technology transfer; obtain appropriate permits to collect, enter land, and export and import materials; satisfy phytosanitary (for plants) and CITES requirements; and ultimately meet regulatory requirements for product safety standards. Thus bioprospecting depends for its success on the shared and realistic expectations of the partners and their ability to meet each other's needs. The Philippines has already introduced restrictive legislation governing access to genetic resources, while access and benefit-sharing measures have been concluded or are under development in Australia, Fiji, India, Indonesia, Malaysia, Thailand, and elsewhere.[23]

23. ten Kate, K. and S.Laird (1999). *The Commercial Use of Biodiversity: Access to Genetic Resources and Benefit-Sharing*. Earthscan, London

6. CONCLUSIONS

Converting the potential benefits of sustainable landscape into real and perceived goods and services for society at large (and especially for local people) requires a systems approach, as suggested above. Elements of this approach include:

- At the national level, an integrated set of protected areas encompassing various levels of management and administration, including the national, provincial, and local governments, non-governmental organisations, local communities and indigenous peoples, the private sector, and other stakeholders.[24]
- Within the framework of the market-based economic systems that are becoming increasingly widespread, greater participation by the civil society in economic development that extends to the management both of productive landscapes and protected areas, especially for tourism and the sustainable use of certain natural resources.[25]
- A fairly large geographical scale (sometimes called a 'bioregion') for resource management programmes, within which protected areas are considered as components in a diverse landscape, including farms, harvested forests, fishing grounds, human settlements, and infrastructures.[26]
- Co-operation between private landowners, indigenous peoples, other local communities, industry and resource users; the use of economic incentives, tax arrangements, land exchanges and other mechanisms to promote biodiversity conservation; and the development of administrative and technical capacities which encourage local stakeholders, universities, research institutions, and public agencies to harmonise their efforts.

Converting the potential benefits of sustainable landscape into real and perceived goods and services for society at large (and especially for local people) requires a systems approach

24. McNeely (1999). *op.cit.*
25. Szaro, R.C. and D.W. Johnston eds. (1996). *Biodiversity in Managed Landscapes*, Oxford University Press, Oxford
26. Miller (1996). *op.cit.*

A programme for sustainable landscape management that includes biodiversity conservation needs to include both firm governmental action and alliances with the other stakeholders. National governments cannot delegate their role of guarantors of the conservation of a country's natural heritage, so the appropriate authorities need to build the capacity to fulfil their regulatory and management duties and responsibilities. But civil society can share certain rights and responsibilities regarding the management of living natural resources after careful preparations and an adequate definition of roles and responsibilities. Given the interests of NGOs, business, indigenous peoples, and local communities who live within or close to protected areas, alliances should be created among stakeholders that enable each to play an appropriate role according to clear government policies and laws.

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Managing for sustainable landscapes requires the development and actual implementation of sustainable production systems adapted to the different kinds of ecosystems. These should include, among others, the scientific, technological, economic, social, financial, and educational components which are required to ensure sustainability. The exact mix of goods and services to be provided from any particular landscape should be based on dialogue among industry, government, academics, hunters, local municipalities, and the environmental community, thereby bringing a measure of democracy to the landscape and enhancing the likelihood of sustainability.