Forest Genetic Resources in Central America: The Challenge of Conservation

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Introduction

The forests of Central America are suffering severe deforestation due to a complex array of social, economic and political factors. Large tracts are being cleared and converted to low-yielding extensive cattle ranching; commercial crops have displaced small farmers, obliging them to push back the forest frontier in search of fertile soils; and selective logging is thinning out and impoverishing the species composition of the remaining forest cover.

The region's forests are important in different ways to each of a diverse array of stakeholders. Within the region, the largely rural population depends heavily on forest products such as firewood; artisanal woodworking and commercial saw milling are of major economic importance; forests help stabilise water runoff, thereby safeguarding supplies to urban centres and reducing flooding risk; and the existence of adequate forested land is crucial to the sustainability of traditional swidden agriculture. Forests are also of great social, cultural and aesthetic importance for the region's increasingly urbanised population.

The forests are also of global importance. They represent a key genetic resource for farmers and plantation foresters world-wide; examples of globally-important Central American tree species include *Albizia guachepele, Bombacopsis quinata, Calliandra calothyrsus, Calophyllum brasiliense, Cedrela odorata, Cordia alliodora, Gliricidia sepium, Leucaena* spp, *Liquidambar styraciflua* and *Pinus caribaea* (var. *hondurensis*). Industrial concerns in the more developed world view the forest cover as a valuable sink for the CO_2 which their activities generate. The more general population tends to value the forests as potential sources of medicines and for their scientific, aesthetic and 'existence' values.

Each of these stakeholder groups requires different things from conservation (see Table 1). This paper examines how each of the principal strategies for conservation

Rural Development Forestry Network Paper 21f, Summer 1997
ODI, Portland House, Stag Place, London SW1E 5DP, UK

(*in situ*, *circa situ* and *ex situ*) can respond to the diversity of interests, in particular regarding the conservation of genetic resources.

Table 1: Different Stakeholders' Interests in Conservation

Stakeholders	Forest Characteristics Required to be Conserved
Small farmers in Central America	• Adequate availability of forest products of desired characteristics (timber and NTFPs); • High within-population genetic diversity, to produce the phenotypes required for a wide range of different products and services; • Good genotypic quality of trees to provide seed for some specific uses; • High between-population genetic diversity, to allow provenance selection for some specific uses; • High soil fertility for shifting agriculture.
Global small farmers	• Adequate availability of good genotype trees, to produce quality seed for some specific uses; • High between-population genetic diversity, to allow provenance selection of trees for some specific uses; • With some MPTs, high within-population genetic diversity to lessen risk and provide a range of services.
Artisanal and commercial timber users (world-wide)	• High frequency of trees of good phenotype.
Plantation foresters (world-wide)	• Adequate availability of good genotype trees to produce seed; • High between-population genetic diversity, to allow provenance selection.
Urban population (in Central America)	• High water captation and infiltration rates; • Low levels of erosion; • Absence of contaminants; • High aesthetic quality and interest.
Wider global population	• High aesthetic quality and interest; • High genetic diversity of all flora and fauna; • High level of intactness.
Global industry	• Good ability to absorb CO_2.

In Situ Conservation

Historically, protected areas have been managed to exclude what were seen as the harmful activities of local people. The long-term interests of the broader population in conserving protected areas have often only been served at the cost of severe social and economic impacts on the local populations whose activities have been restricted (Barrance, 1996; Guha, 1997).

Only relatively recently has it been recognised that protected areas can be managed and conserved successfully without incurring this conflict of interests. In a number of cases, non-timber forest products (NTFPs) have been successfully exploited by local people in protected areas with significant benefits to them in terms of economic income, nutritional status, availability of other forest products and services, and community cohesion; and with no significant adverse impacts on the conservation value of the areas concerned. In fact, NTFPs can contribute to conservation, by providing local people with an incentive to collaborate in the protection of the forests which provide the NTFPs, providing them with economically-attractive alternatives to forest clearance and strengthening community cohesion to help them resist external pressures on the forests. Examples are butterfly and terrapin farming by villagers, promoted by Friends of the Earth (Spain) together with the Costa Rican government and local NGOs in the Caño Negro Refuge in northern Costa Rica (García, pers. comm.), and the formation of resin extraction cooperatives among small landowners in the Río Plátano Biosphere Reserve in Honduras, with the support of World Neighbours (Chenier, pers. comm.).

NTFPs are not always the answer, however; it may not always be possible to find NTFPs which provide a sufficiently attractive alternative to forest clearance. In addition, protected areas may have to have core zones that remain completely untouched in order to meet ecologists' requirements that the forest's ecological processes are maintained. Here NTFP development would not be permissible.

Ecotourism can provide an important source of income, in the form of user fees, which can contribute to the management and conservation of protected areas. It is most developed in Costa Rica, but parks such as La Tigra in Honduras also depend heavily on user fees to meet their management costs. As with NTFPs, ecotourism can conflict with the strict ecological conservation of protected areas unless

carefully managed. It can also conflict with the water supply function of protected areas unless proper waste management practices are introduced and measures are taken to prevent path erosion.

Well-planned and controlled timber harvesting, using low-impact technologies, may be an appropriate option in some situations, though not normally in protected areas. This can provide local people with an incentive to protect the forest against fire, illegal felling and conversion to agriculture, in order to safeguard the possibility of future timber harvests; while providing them with income and reducing their dependence on the agriculture that is often a primary cause of deforestation. Indigenous cooperatives in Intibucá in the west of Honduras, for example, are carrying out small-scale selective logging in second-growth pine forests, using oxen to extract the logs. The sustainability of the operation is ensured by the state forestry authority setting limits on the volumes to be cut per hectare, and a forester approved by the authority marking the trees to be felled.

The keys to minimising conflicts between different interest groups are: adequate consultation; participation; and zoning, to match the management practices required by different interest groups to the areas most suitable for them. These three activities were combined in a participatory mapping exercise coordinated by Friends of the Earth (Spain) in the Los Guatuzos Wildlife Refuge in southern Nicaragua. Local communities were asked to prepare maps of where they considered that different activities should be allowed in the reserve; these were then overlaid onto maps of the zonation proposed by reserve planners and areas of potential conflict between the two interest groups were thereby identified for further discussion (García, pers. comm.).

In all of the examples given, alleviation of unsustainable pressures on the forest depends upon those currently responsible for these pressures being given the chance to participate in and receive benefits from the activity proposed. For the small-scale logging in Intibucá to be effective, for example, the timber cooperatives need to be open to all, including shifting agriculturalists.

Circa Situ Conservation

In much of the Pacific lowlands of Central America, deforestation of dry forests has already reached a point at which there is virtually no intact forest left to include in

protected areas. The hedgerows and small forest remnants around village water sources are the last bastion of dry forest species and their protection is vital to permit gene flow between members of their populations, and as stepping stones and corridors for fauna.

In such situations conservationists are obliged to accept that people and agriculture are integral and dominant elements of the ecosystem. Recognising that the satisfaction of their needs is the primary concern is the only way of achieving conservation in these areas.

Some of the traditional agroforestry systems used by small farmers in the dry zone actually contribute to conservation, as well as meeting the farmers' own needs. Farmers tend naturally regenerated trees of *C. alliodora, G. sepium* and *Leucaena salvadorensis* in their fields in the south of Honduras, pruning them as necessary to reduce competition with their crops and to shape them for particular end-uses. Hughes *et al.* (1995) consider that management by small farmers is the main reason why populations of some *Leucaena* species in Mexico have survived.

Extension organisations can help to bulk up degraded and fragmented natural populations of native species by increasing their promotion in agroforestry development programmes. In many cases they provide good alternatives to the exotic species which are often promoted by extension professionals. In the south of Honduras, for example, the native *L. salvadorensis* is superior in many respects to the commonly-promoted exotic *L. leucocephala* (Hellin & Hughes, 1993). Even where native species show inferior growth rates, this is often compensated for by their greater familiarity, easier availability of seed and reduced need for external support.

In some cases, however, exotics may still meet local peoples' needs better than native species. There may therefore be a conflict of interest between what is best for the smallholder and what is best for genetic conservation. The use of exotics can negatively affect native species by replacing them in agroforestry systems and, in the case of genera such as *Leucaena*, by hybridising with them. At the population level, the likelihood of hybridisation between introduced and native material is far greater, leading to the risk of a blurring of provenance distinctiveness. This would reduce the possibilities of identifying specific provenances suited for particular end uses and site conditions (the scale and importance of this diversity has been amply

demonstrated in provenance trials world-wide, such as those coordinated by the Oxford Forestry Institute). The introduction of exotic provenances may result either from conscious decisions based on their superior performance, or from a simple failure to take provenance into account when supplying seed from central seed banks.

In reality, it would be impracticable (even if it were morally acceptable) to attempt to avoid negative impacts on native species and populations by concealing the advantages of the exotic and promoting the native species or provenance in its place. The choice of species used in extension programmes is in the hands of extensionists rather than conservationists, so local peoples' needs are normally likely to win the day. There would also be no way of preventing informal seed transfer between farmers.

NTFPs have an important role to play in *circa situ* conservation as well as in protected areas. Activities such as iguana farming, for example, promoted by the Fundación Pro Iguana Verde in Panamá and Costa Rica, can help to encourage the conservation of the small forest remnants. These play a vital role in agriculture-dominated areas as stepping stones for fauna and for tree gene interchange. At the same time, this activity can provide an importance source of protein and income to small farmers (Werner, pers. comm.). Tree seed also has potential as an NTFP: the NGO World Neighbours coordinated a large collection of *G. sepium* from wild trees in the Linaca valley of southern Honduras, to supply to another NGO in Haiti, paying local people for the seed by weight. While such collections provide income to local people and thereby an incentive to protect seed trees, it is difficult to ensure that the seed comes from good quality trees with a sufficient physical separation to avoid the risk of inbreeding. An alternative would be to pay royalties to tree owners for the right to collect seed from their trees. This would make life more difficult and expensive for seed banks; however, it might be justified given the potential benefits and resale value which they can expect from the seed.

Ex Situ Conservation and Tree Breeding

Genes of species under threat of population degradation can be conserved by planting them in *ex situ* conservation plantings. These have the benefits that they are less vulnerable to the forces of deforestation than *in situ* populations, and the

genes which they conserve are more readily accessible for management and potential use (CMGGR, 1991). They tend, however, to distort natural patterns of diversity due to the unnatural selection pressures which operate within them, and they fail to conserve ecological systems and interrelationships. They also require intensive long-term management and protection, which may be difficult to guarantee.

The production of saleable seed from *ex situ* conservation plantations, as practised by the ODA-funded CONSEFORH project in Honduras (Gibson, 1993), is one way of ensuring that they are maintained in the long term. However, the objectives of seed production and genetic conservation are not always compatible. Industrial-type plantations require seed which has been intensively selected for specific traits; to achieve this, seed production stands have to be selectively thinned, which is anathema to the conservation of diversity. The production of seed of multi-purpose trees (MPTs) for use by small farmers within the region can, however, be combined successfully with genetic conservation, as MPT diversity is valued as a means of risk aversion and of producing a range of different end-products and services (Simons, MacQueen & Stewart, 1992). Plantations in which the maximum of diversity is maintained throughout their life, by avoiding selective thinning, would satisfy the needs of both seed supply and conservation.

Conclusions

The diversity of stakeholders with interests in how the forests of Central America should be managed poses a major challenge to conservationists. However, as the examples presented in this article have shown, with a sufficiently innovative approach it is often possible to find commonalities of interest and thereby to identify conservation strategies which minimise conflicts.

Several elements are of key importance if non-conflictive conservation strategies are to be identified. A detailed and open-minded analysis of the precise interests of the different stakeholders is essential. Recognition that the interests of small farmers may often lie in diverse, rather than highly selected material, for instance, highlights the opportunity to combine seed production with the conservation of genetic diversity. Dialogue and participation in the planning process will help different stakeholders to acknowledge the validity of each others' interests and

allow them to contribute their suggestions as to how they may be reconciled. The fact that many examples of 'conservation through use' are based upon traditional management systems makes the participation of local people in the search for solutions especially important. Creative thinking is required on the part of all those concerned; the search in the forest for NTFPs or other opportunities for sustainable and non-conflictive management should be mirrored by imaginative searches for areas of potential demand in the market place.

Despite the opportunities which exist for reconciling the interests of different stakeholders, some of which are presented in this paper, there will always be occasions in which conflicts of interest occur which cannot be reconciled. In such cases it is important to avoid the risk of 'falling between two stools' by attempting compromise solutions to bridge the gap between fundamentally irreconcilable stakeholders, which end up satisfying none of them. It is therefore important at an early stage to take firm policy decisions as to who are to be the primary intended beneficiaries of conservation or development programmes.

References

Barrance, A J, (1996), 'Social Impact Considerations in Protected Area Planning', MSc Thesis, University of Wales, Aberystwyth.

Committee on Managing Global Genetic Resources, (1991), 'Managing global genetic resources: forest trees', National Academy Press, Washington D.C.

Gibson, G L, (1993), 'Genetic conservation of native hardwoods in the degraded dry forests of Honduras', in: 'Proceedings of IUFRO Conference "Breeding Tropical Trees", Cali, Colombia, October 1992'.

Guha, R, (1997), 'The Authoritarian Biologist and the Arrogance of Anti-Humanism: Wildlife Conservation in the Third World', *The Ecologist* 27(1), 14-20.

Hellin, J J, & Hughes, C E, (1993), *'Leucaena salvadorensis:* conservation and utilisation in Central America', Serie Miscelánea de CONSEFORH 39-21/93. CONSEFORH, Siguatepeque, Honduras.

Hughes, C E, Sorenson, C, Bray, R, & Brewbaker, J, (1995), *'Leucaena* Germplasm Collections, Genetic Conservation and Seed Increase', in: 'Proc., Leucaena Workshop. Bogor, Indonesia, January 1994', ACIAR.

Simons, A J, MacQueen, D J, & Stewart, J L, (1992), 'Strategic concepts in the domestication of non-industrial trees', in: 'Tropical trees: the potential for domestication and rebuilding of forest resources. ITE Symposium No. 29, Edinburgh, August 1992', R R B Leakey & A C Newton (eds.).

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Editors of this paper: David Brown & Kate Schreckenberg
Layout: Joanne Burrell
Printed by: Russell Press Ltd, Nottingham
on recycled paper

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The Rural Development Forestry Network is funded by the EUROPEAN COMMISSION