

TROPICAL RAINFORESTS AND SUSTAINABLE USE:THE NEED FOR GLOBAL EDUCATION

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In his presidential address on the human effects of climatic change to the Royal Geographical Society in London, Sir Crispin Tickell called for a programme of international action to avert impending catastrophes. This should include,

- the elaboration of new energy policies designed to conserve energy,
- the reduced consumption of fossil fuels, especially coal and oil,
- the promotion of more efficient vehicles, wider use of mass transport and better urban planning and building design,
- the development of alternative sources of energy, especially solar, and
- the reduced burning of fuel woods in poor countries.

These changes would involve:

- getting rid of chlorofluorocarbons and noxious emissions, and coping with the accumulating problems of waste disposal
- changes in land use to promote reforestation and wood harvesting,
- new methods of agriculture, including agroforestry, and
- the management of wilderness, deserts and human land fills through application of old and new techniques including biotechnology.

It was stressed that the problem is without precedent, is global and requires a revolution in human society as great as the 'industrial revolution' (which, directly or indirectly, has caused the current problems). Humanity must accept the need to adapt - to change diet, investment in energy, to develop desalination for fresh water, curb human population increase and inculcate understanding of the environment and its inhabitants and the urgent need for sustainable development only. International action has to be matched by national action, whereby internal structures are adapted, the environmental dimension is brought into national accounting, proper incentives and disincentives are fixed, and the necessary intellectual tools are refined. The industrial countries that have contributed most to the environmental degradation must give leadership in concerted action to cope with these problems.

Communication has a vital role to play the world over in developing this changed strategy for survival. Since existing organisations have had only limited success, perhaps the B.I.O. can achieve the necessary action through forceful education in the International University for the Bio-Environment (I.U.B.E.). Sir Crispin Tickell opened his lecture with the case of the boiled frog; put the frog into the boiling water and it will try to jump out, put it into cool water that is then boiled and it will become bemused and quietly expire. We notice and react to drastic change, but are hardly aware of changes taking place over a few generations; by the time we are ready to react it can be too late. Such is the situation that we are rapidly approaching; it requires urgent but constructive action.

Janzen and Vasquez-Yanes suggest that the tropics are destined to become a green hell, occupied by well-fed but very bored people (a fairly optimistic and positive forecast!). The only hope is to show them what tropical wildland, living classrooms and libraries have to offer in intellectual stimulation as well as material goods, as they have been doing successfully in Costa Rica while regenerating forests from scrubland.

The B.I.O. held a very constructive meeting in Athens in October 1988, more than two years ago, some very positive resolutions were produced on the environmental issues, in summary:

- to make non-sustainable activities uneconomic;
- to publicise to the consumer the destruction involved in production;
- to fund studies of environmental degradation (routes not always obvious);
- to give up dependency on non-renewable resources by diversifying resource use and promoting regeneration; and
- to fund the transition to sustainable economies largely from the drain of resources from South to North (i.e. by the developed countries).

My aim in this paper is to clarify the importance of tropical forests to the whole planet. These forests are the key targets for education to resolve current problems and to publicise the ways in which significant progress has already been made. This should relate to aspects of the aims, organisation and implementation of the International University for the Bio-Environment.

Tropical rainforests

The values and problems of tropical rainforests were reviewed by Chivers with special reference to Southeast Asia. These equatorial forests play a vital role in environmental stability, in maintaining climatic, water and soil balance and, as a reservoir of bio-diversity, support an immense genetic variety of plants and animals, many of which have significant economic potential if managed sensibly. Their economic contribution under sustained management in perpetuity is certainly orders of magnitude greater than the one-off contribution from timber extraction and forest clearance for some form of agriculture, which normally means an uneconomic and unsustainable monoculture that helps to escalate climatic instability.

Tropical forests are nature's long-term answer to poor soils; the nutrients are being juggled continuously by the complex vegetation and the wildlife that they sustain. Remove the trees and most of the nutrients are removed. Furthermore, the tree roots bind together the poor soil; remove the trees and the soil is washed away. Plantations, such as rubber and palm oil, are structurally too simple to hold the soil effectively. They are also too simple to replicate the rainforest's role as a sponge—mopping up water in the rainy (monsoon) season and letting it out slowly during the dry season. As forest covers dip below 50% in many tropical countries, we are already seeing how rain falls less often but more heavily—the annual total remaining unchanged, although in some, less maritime areas, it may be markedly decreased—so that erosive and flooding effects are increased dramatically (e.g. Furtado). In between such episodes are prolonged droughts and long-burning fires causing severe environmental and economic damage previously unheard of in these ever-wet regions (e.g. Berenstain).

The solution lies in (1) protecting key areas of forest - watersheds and unique lowland ecosystems, which, being on better soils, tend to be much richer; (2) the efficient management of extensive buffer zones to these sanctuaries for sustained yields of the great variety of plant and animal products - many as yet undiscovered—that such forests have to offer; and (3) the more efficient use of land already cleared of forest—for agriculture or housing and industry—with the development of agroforestry and reforestation projects where possible (Chivers).

Given that selective logging—the sustained extraction of small amounts of timber - is crucial to these solutions, the next priority is to promote regeneration of these and other forest resources used for foods, medicines and industrial chemicals. Our involvement with animal ecology and behaviour leads us into a hitherto neglected field—the role of fruit-eating animals in pollination and seed dispersal, i.e. in the regeneration of forests (e.g. Johns 7,8&127;; Skorupa 9; Chivers 3). This involves identifying and quantifying key plant-animal relationships to promote the regeneration of commercial products that can be harvested sustainably (e.g. Myers 10,11.)

The current management of tropical forests leaves much to be desired; too much is being over-cut and converted to other activities, both non-sustainable in the long-term. Thirty-six countries have at least 1 million hectares of tropical rainforest suitable for production, which is more than 90% of the world total (Schmidt 12). Three countries—Brasil, Zaire and Indonesia—contain well over 50% of the world's forests; hence, success in these countries is crucial. Unproductive forests are highly vulnerable to agricultural development or conversion to other uses, even if such development is unsustainable. Effective management depends on comprehensive and coordinated international expertise, cooperation and finance and national government and institution action.

Forest management

The management of tropical forests operates at three levels (Gomez-Pompa and Burley 13):

- complete conversion of original forest to suit needs of managers better (or so they may mistakenly think—disastrous in long term on any significant scale);
- some extraction without severe disturbance—manipulation and partial conservation by efficient or induced regeneration (the preferred approach, as discussed above); and
- total preservation of biological diversity or genetic variation for future exploitation (meritorious but only economically justifiable on limited scale).

Silvicultural systems involve:

- natural regeneration, in the gaps created by timber extraction;
- extracting timber, leaving seedlings of commercial species to regenerate;
- replacement of the forest, usually BY monoculture (with the disastrous consequences described above); and
- restoration of heavily disturbed areas which are in 'arrested succession.'

Whitmore addresses in particular the dynamics of gaps (resulting from natural tree falls or timber extraction) in relation to sustainable timber production, since these gaps are the source of rapid regrowth among the climax forest. Extraction could be monocyclic, relying on the next

generation of trees coming from the remaining seedlings, or polycyclic, which promotes the growth of adolescent trees thereby freed from competition for space or light. In the latter case, in particular, the mode of extraction—the kind and quantity of machines used and the damage caused—is highly significant. There are also the effects of the mats of climbers, which spread between trees, thereby bringing down trees that are not felled and increasing damage; such climbers may have products of economic value, but hitherto they have mostly been ignored. The distribution of nutrients and biomass also need to be researched, as well as the sources of regeneration of large gaps, which are unfortunately all too common. Termites have a role in the recycling of nutrients that is as yet not fully understood; nor is the demography of tree species, the different capacities for regeneration that are crucial for regrowth of managed forests. Whitmore argues that most rainforests should be managed for multiple use, that management for conservation inevitably focuses on rare animal species, not on the more functionally-significant matrix of common or widespread species ... but that perhaps reflects an ignorance of the changing approaches of conservation, where communities are generally emphasised over species.

The key to tropical forest management lies in integrating forest and society, of linking the needs of people to the potentials of the forest (Schmidt 12). He specifies the main conditions required as follows:

- land must remain in forest use after the timber harvest;
- the harvest must not degrade the soil to the point where forest tree species cannot regenerate;
- the harvest must not impair environmental and social functions of the forest;
- the harvest and silvicultural treatment must ensure adequate regeneration;
- the rate of timber harvest must not exceed the sustained yield capacity of the forest.

He has specified the following main constraints:

- effective leadership and land-use planning;
- national leadership committed to (a) current investment of direct economic benefits realisable 20-30 years into the future, and (b) population development in harmony with the optimum productive capacity of the land available;
- management programmes must have long-term stability, with stable leadership for continuity;
- effective training, from technical to doctoral, to place competent personnel in the field; and
- profitable management integrated with the national economy and world timber markets.

These are all key points to be both publicised and fully implemented. Pearce and Myers analyse economic value and deduce that total economic value equals actual use value plus option value (which includes value in use to the individual, to descendants in the future and to others, vicarious) plus existence value (unrelated to use). These values have to be appreciated in the contexts of irreversibility (forest loss is likely to be permanent), uncertainty (the future is unknown) and uniqueness (the special attributes as well as diversity and abundance of the plants and animals of tropical forests). They discuss direct use values in terms of:

- agriculture - the infusion of genetic variability to increase productivity and resistance to disease;
- medicine - the source of drugs, natural or synthetic;
- industrial - the source of various chemicals;
- environmental - water cycling (rainfall from transpiration), bind soil, mop-up carbon dioxide;
- humanitarian - welfare of the people, sustainable economies, relaxation and education.

To these should be added:

- food - plant or animal, collected or managed; and
- commercial - plant and (animal) products, especially wood, of use at home and work for furniture, construction and so forth.

Pearce and Myers go on to specify the economic cause of environmental degradation as: (1) livestock development; (2) direct tax credits in relation to land ownership; and (3) land-titling laws. For sustainable development, they argue that the value of all goods and services has to be measured, including non-use values (e.g. for climatic stability), and that these values have to be applied in terms of social equity as well as economic efficiency. For example, beef benefits go to a few whereas the cost of forest loss is borne by all. There has to be charge on users to conserve threatened species - plant or animal—that is, threatened ecosystems. The approach has to address all features - ecological, economic, institutional and developmental. Survival depends on such a comprehensive approach in support of human welfare so that intrinsic all-around worth is better recognised.

Hadley specifies the stages in rain forest regeneration and management so that the essential links between research and management can be strengthened. The process runs from national policy and law through inventories to dynamics short-term, tolerance, responses, logging damage; long-term, pollination seed dispersal and predation, regeneration banks, growth and yield models) or properties and uses of desirable species (wood properties and possibilities for secondary processing). As a biologist, it is with this end of the spectrum that I am most

concerned, and which provides the basis for the concluding discussion of education in relation to forest conservation in the broadest sense—protection and sustainable use.

Conservation education

The critical targets for education are the decision makers in government and commerce. The governments of countries with tropical forests now seem well aware of their environmental and economic importance, both locally and globally. There are intense financial pressures, however, because of the resource drain to the North and dictates of the 5-year periods within which most governments operate. This means that they can rarely act in the long-term interests of the sustainable growth of their economies, especially as they usually have escalating debts to repay. Thus, it is the governments of the North and the multinational concerns which have for too long over-exploited such tropical resources, that need to be persuaded. It may take public pressure to change priorities and practices in the ways that have been recommended above. It is the local people, whose lives are most immediately affected by the destruction of tropical forests, and it is they who must make their voices heard to governments. Enlightened environmental groups in the countries concerned and overseas are often essential links in this process; it is especially important that the public in 'user countries' become more responsible and vocal, and less selfish. It is only by such diverse channels that the change to sustainable activities will be realised. The final piece in the jig-saw is the next generation— the young the world over—who need to develop the right approach before they become too set in their ways.

Thus, education needs to be about rational use of resources on the one hand, and the rational management of these resources on the other, mindful of the various targets described above. Many examples of different facets of this spectrum can be cited, with an inevitable focus on the primates.

- A. The Virunga Volcanoes of Rwanda, home of the mountain gorilla and other wildlife, provided one of the first and most successful conservation education programmes that has since become a model for others. By quantifying attitudes before and after the educational sessions, it was possible to demonstrate a significant change of attitude among the people living around the park. After several years, 80% of the local population (rather than the 40% previously) valued the proximity of the park for its environmental and economic benefits. A relevant factor must have been the marked increase in income obtained from tourists visiting the gorillas, but so too were the other values of the forest (Harcourt 17).
- B. Orang-utan rehabilitation centres in Malaysia and Indonesia have a marked contribution in publicising the plight of one of our closest relatives and its rain forest habitat to local people and overseas tourists alike, while not significantly adding to the wild population (Aveling 18).
- C. Wasteland has been regenerated into forest in Costa Rica by the laborious and methodical efforts of Dr. Dan Janzen and his colleagues after land purchase involving national debt-swaps for nature and involvement of the local people through intellectual and economic reasoning.
- D. The last relics of the Atlantic forests of southeast Brasil are rich in endemic animals (species found nowhere else). The rescue of endangered monkeys - lion-tamarins - and their captive breeding overseas for subsequent re-introduction to suitable remaining forests have attracted much interest internationally through the zoos involved, as well as in the education programmes developed in Brasil for the local people and government officials (Kleiman et al. 19). The woolly spider monkey, or muriqui, is the other major 'flagship species' of the area, about which conservation activity can be developed (Milton 20).
- E. Similar conservation education programmes have been developed in Peru directed at local people and at the government based on the diminishing cloud forests and the rare yellow-tailed woolly monkey living there (Leo Luna 21).

Comparable publicity and education about environmentally detrimental projects have been developed in Malaysia by the Malayan Nature Society and Friends of the Earth, and by the Yayasan Hijau (Green Foundation) in Indonesia with successful outcomes.

Conclusion

Thus, there are numerous 'educational' successes that give cause for optimism in the battle for the protection and sustained management of natural resources. They have involved combined approaches of scientists and the public - intellectual and emotive reasoning - focused on the environment and economy. It is the plight of tropical forests in particular, with their unparalleled importance in terms of environmental stability and economic potential (because of the great variety and abundance of plant and animal species) that demand this urgent focus. The International University for the Bio-Environment (I.U.B.E.) could play an important role in developing and coordinating such efforts and extending them into wider fields than the wildlife biology and environmental science from which they originate. We are well aware of what is going seriously wrong on this planet, and we know how to reverse such trends and how to manage various ecosystems sustainably. The urgent problem is to persuade the decision-makers to act before it is too late. This, takes more time and involves public support to some extent, although it is an important investment for the future.

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