

CASE STUDIES

Biodiversity

THE ROLE OF BIODIVERSITY RESEARCH - SOME INTRODUCTORY COMMENTS

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'Biodiversity is vital to healthy forests, while proper forest management is vital to the maintenance of biodiversity' (Wilson, 1993).

1. INTRODUCTION

On all three main levels of the hierarchy of life - that of genotypes, species, and ecosystems - biodiversity encompasses most of the fundamental issues in modern biology, especially the central theme that is evolution. On all these levels, the diversity - almost by definition - presents a broad spectrum of variation and numerous gaps in knowledge and unresolved questions. If we are to meet the expectations of our national and international funding agencies, who are prepared to spend a limited amount of money on biodiversity research, we need to prioritise our research topics to comply with our duties enshrined in the Convention on Biological Diversity.

The evolutionary dimension of biodiversity also implies that curiosity-driven, rather than policy-driven, research questions are often foremost - and perhaps justifiably so - in the minds of the academic community. At the same time, there is fierce competition within that academic community for the limited contract funds, and specialists of various levels of biodiversity research sometimes alas see fit to claim their own branch of science to be the single holy grail to solve all the problems associated with the biodiversity crisis. In this minefield of conflicting interests and opinions, the Tropenbos Foundation attempts to carry out applied research on biodiversity as an integral part of its aims to work towards the sustainable management and conservation of tropical forest ecosystems. Not an easy task! No wonder that the Tropenbos organisation spent much energy and time in developing a policy document on prioritising biodiversity research (Lammerts van Bueren and van Duivenvoorden, 1996). By its general nature, the document can serve as a model to test the applicability of biodiversity research in general. Thankfully, the document does not discriminate between any of the specialisations that claim to contribute crucially to our understanding of biodiversity. It simply offers a model to identify research needs, depending on the goals set and the existing knowledge gaps for a certain area, group of organisms, or ecosystem.

It is difficult to address the concrete impact of biodiversity research on nature conservation and forestry policy. Nevertheless, the fact that all recent policy documents on sustainable forestry and land use - at the local, national, regional, and global level - are imbued with biodiversity issues, gives credit to the effectiveness of disseminating the research results on biodiversity. As a concrete and shining example, Costa Rica comes to mind (Heywood and Watson, 1995). Here the Government is stimulating its biodiversity to become the best documented and researched of any tropical country in the world, while at the same time reaping huge benefits from this policy. Ecotourism has become the number-one capital earner for the country, and at the same time local communities are thriving through the development of their traditional knowledge systems of useful plants and animals into more widely marketable products, and through bioprospecting for new

medicinal compounds. I have never been to Costa Rica, and cannot judge whether this summary

statement paints too rosy a picture of reality or not. I am afraid it does.

Many are aware that conserving biodiversity at all levels is a long-term, global, and human self-interest. Intact rain forests would not have burnt to the extent that logged-over and otherwise disturbed forests burnt this year in South-East Asia. Nobody would like to miss the medicinal compounds that are still being discovered in tropical rain forest species. Non-timber forest products from the tropical forest of endless diversity depend, for their sustainable production, on a more or less intact forest. We are talking about a very high percentage of (locally) economic plants in tropical floras: 7,000 PROSEA plant species out of a flora of c. 35,000 species, or 20%, have an economic use (Jansen *et al.*, 1991). The ecotouristic value of intact, species-rich forests, giving shelter to endangered species such as the Sumatran Tiger, Orang Utan, and Rhinoceros, or the majestic parasitic flowers of the genus *Rafflesia*, is also considerable.

In our policy-driven approach, we need to come up with solutions that are a compromise between maximum societal return for the local or international communities, and conserving as much biodiversity as is compatible with that primarily economic objective. Nevertheless, at the end of the day, the conservation of the millions of species of animals, microbes, and plants is, in my opinion, also an ethical problem, based on the conviction that, as the most powerful species on this planet, Man must accept the responsibilities of good stewardship over his fellow creatures. This motivation, also echoed by the late Marius Jacobs in his award-winning book on the Tropical Rain Forest (Jacobs, 1988), but as old as Genesis and enshrined in all other religions, may be as effective in directing conservation policy of governments and peoples as any study of the potential commercial value of medicinal plants and other non-timber forest products in a primary or secondary forest. With this statement, I definitely do not wish to discourage research, but simply to indicate that the question ‘Why should we conserve this or that species or ecosystem?’ does not always require a scientific or commercial answer.

So what type of research should be prioritised? I give some personal priorities in a number of simple questions:

1.1 What and where?

Tree species composition and distribution comes first to mind. Trees are, after all, the defining elements in forest ecosystems, and they present the greatest biomass. Despite the fact that Tropenbos is supporting projects to prepare user-friendly manuals to help identify the most important forest species, our knowledge of tree species composition at all Tropenbos sites is still fairly fragmentary. The need for such mundane knowledge is indeed urgent: in the harbour of Yokohama, shiploads of mixed tropical timbers arrive with totally wrong species assignments and consequently erroneous end-use categories, at the cost of millions of dollars to the producers. In other words, waste through ignorance remains a major obstacle to the wise use and sustainability of tropical forests (Sudo, 1994). A proper taxonomy and tree and timber knowledge would help. Research and capacity-building in these areas must remain a high priority for Tropenbos. The species diversity of other groups of organisms like pollinators, mycorrhizal fungi, and so-called umbrella species that are sensitive monitors of ecosystem integrity (e.g. apes and other mammals) equally deserves our attention.

A sound taxonomy is also needed to underpin any short-cut methodology to assess biodiversity by classifying forest species into so-called ‘functional groups’.

The hot topic of ecolabelling in tropical forestry would remain hot air, if we would fail to put in proper biodiversity criteria. That again can only be implemented with proper biodiversity expertise at the species level.

1.2 Ecosystem dynamics - impact assessments

How does the forest react? What are the impacts of various human pressures (from gathering rattans and fruits, via low to heavy logging)? A Tropenbos study on the botanical diversity in the tropical rain forest in Guyana (Ek, 1997) addresses the impact of logging on the plant diversity in Greenheart forest of Guyana. The on-going study by the botanical team of the Wanariset Site on the tree composition of secondary forests of East Kalimantan (Kessler *et al.*, 1994) can also be seen as a study on the effects of logging and other activities (e.g. slash-and-burn practices) on botanical diversity.

The entire research programme >Biodiversity of Disturbed Ecosystems= of NWO/WOTRO in the Netherlands is geared to these problems. A number of selected organismal groups (pioneer trees, but also flatworms, butterflies, ants, snails, mycorrhizal fungi) of putative key-stone or indicator nature are being studied in variously disturbed forests to increase our understanding of the response and dynamics of tropical forests.

All environmental impact assessments that are now legally required by most governments should in principle also answer some of the above questions. Nevertheless, whether such assessments have much real effect on conservation and sustainable use should be monitored as well.

1.3 How to remedy and restore?

How effective is enrichment planting in disturbed forests? (And is it diverse enough?) What to do to make a deranged Orang Utan part of a semi-natural population again? These themes are, for example, very prominent in the MOF-Tropenbos Kalimantan programme, with profound effects on government policy for sustainable forestry. Research into the propagation of indigenous *Dipterocarpaceae* has led the way to these successes (Smits, 1994).

1.4 Lessons from sustainable traditional use

What can we learn from sustainable traditional use by local populations? Tropenbos has solidly incorporated non-timber forest products (NTFP) in its research programmes in South America, Africa, and South-East Asia, with various emphasis on traditional use and potential economic yield, including regional, national and international marketing (Ros-Tonen *et al.*, 1995). Further studies, fully incorporating ethnobotanical and socio-economic aspects, are needed.

1.5 How to involve the local population?

The involvement of the local population is crucial to support a sustainable policy of wise use and conservation (Heywood and Watson, 1995). This formula has, reputedly, worked well in Costa Rica. Is Tropenbos doing enough in this field at all its sites?

1.6 How to monitor?

Forest management and conservation measures need to be monitored for their effectiveness. All too often, well-intended measures have adverse effects in the real world. For the proper monitoring of species biodiversity, sufficient base-line data for tropical forests are often lacking. This could be remedied by making the wealth of information associated with biological collections accessible to policy-makers (see below).

2. SYNERGISTIC PROGRAMMES

In the Netherlands and the international arena, there are many programmes and projects that address

some of the above issues. Below, I will briefly review those that are associated with Themes 1, 2, 3, and 6. For a full review of Dutch programmes, see also Simons (1997).

2.1 Dutch programmes

The core research programmes of the Research Schools Biodiversity, Functional Ecology, ICG (Geo-Ecological Science), and Sense, and of research institutes such as IBN/DLO institutes, include the biodiversity of tropical forests. For instance, the long-term Flora and Fauna Malesiana Projects, coordinated by the Rijksherbarium/Hortus Botanicus and NNM/Naturalis in Leiden, respectively, the Flora of the Guianas, coordinated by the Utrecht Herbarium, and the ECOSYN Project on the Flora of Tropical West Africa by the Herbarium in Wageningen, underpin much of the biodiversity studies in Tropenbos sites.

The NWO/WOTRO Priority Programme on Biodiversity of Disturbed Ecosystems has several projects that are being conducted on Tropenbos sites, and focuses largely on tropical forest ecosystems (see above).

The Netherlands Government envisages a Biodiversity Stimulation Research Programme in the period 1998-2003 for biodiversity in the Netherlands, jointly with a separate programme in the Philippines. The themes of that programme are still to be decided, but probably a multidisciplinary project in Mindanao will result.

2.2 International initiatives

There are numerous international initiatives on biodiversity. Some of the most important ones are mentioned here.

Diversitas - an International Programme of Biodiversity Science, incorporating Systematics Agenda 2000/International and Species 2000 (an electronic catalogue of life on earth) - has an ambitious programme that sets priorities for global stock-taking of the world's species, their interactions, ecosystem functioning, etc. (Diversitas, 1996). Several groups of people in the Netherlands are involved in the programme. Science ministers of the OECD countries have taken the initiative to develop a programme for Biodiversity Informatics as a MegaScience. The European Science Foundation Network on Systematic Biology is currently developing an ESF research programme, with due emphasis on tropical species. Acknowledging the urgent shortage of taxonomists, especially in tropical countries, to provide the necessary expertise to carry out these programmes, the Conference of Parties to the Convention on Biological Diversity has called for a 'Global Taxonomic Initiative' for capacity building, including taxonomy, to enable developing countries to develop and carry out an initial assessment for designing, implementing, and monitoring biodiversity programmes. This initiative will be taken forward during a first international workshop in Darwin, Australia, in February 1998.

3. CONCLUSION

The number of on-going national and international programmes and initiatives (including the Tropenbos programme itself) may seem impressive, but should not fool us into complacency that enough research is being conducted. The funding of the international initiatives I mentioned is minimal, nil, or still 'forthcoming' in the most optimistic scenarios. The core-funding of the Research Schools and other research institutions, and the way in which their academic performance is evaluated, also restricts the possibilities for policy-driven research on tropical rain forests.

It disturbs me that new research initiatives so often and easily ignore existing programmes and expertise. In the realm of biodiversity information, the zoological, botanical, and mycological collections in the Netherlands and their counterparts in the Tropenbos countries harbour a tremendous wealth of information that cries out to be made accessible as base-line information for future monitoring. Why not capitalise on 200 years of botanical, mycological, and zoological - or rather floristic and faunistic - research, and database the collection information for selected taxa and regions, making full use of GIS with the often detailed geographical information on the specimens labels? Such baseline data would make all inventories of small plots in primary, secondary, or plantation forests so much more meaningful, and would open possibilities of long-term monitoring. The 'Global Taxonomic Initiative' also emphasises the under-utilisation of existing collections.

In conclusion, all six themes mentioned above still present so many gaps in our knowledge that intensified research efforts are required to inform sustainable forestry and conservation in the tropics with the sorely needed basic facts.

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Achievements

- The biodiversity issue has entered all policy fora.

Challenges and Problems; Information Needs

- Shortage of taxonomists world-wide.
- Poor integration of research programmes.
- Under-utilisation of existing information in collections.
- Limited involvement of local communities in research.

Points for Future Research

- Investigation of tree species composition and distribution.
- Development of the functional diversity concept as a short-cut to biodiversity.
- Response of species and communities to all forms of forest use; environmental impact assessments.
- Restoration of degraded forests.
- Mobilisation and application of sustainable indigenous use of the forest.
- Development of monitoring techniques of forest management.

Conclusions

- Justification of biodiversity conservation must be driven not only by economic and social but also by ethical arguments.