The Amazon as Ark

by N. J. Collar

The Amazon is a major public issue these days. For each of the past three years, the world's press has carried stories about areas of forest the size of West Germany – or at least Belgium – being burnt away for land by colonists. Free play with figures has been matched by deepening discomfort about the likely long-term impact of such deforestation. Apart from the sheer loss of species, peoples and habitats, speculation extends to oxygen depletion through loss of trees, global warming through carbon release, and other climatic disruption through air and sea current shifts (one scenario involving the southerly displacement of the Gulf Stream, leaving Western Europe in the grip of Siberian weather and, of course, economic ruin).

It is entirely understandable, then, that calls for action in the Amazon are shot through with a sense of the direst urgency. However, for scientists and conservationists concerned to prevent the extinction of species in the Amazon, the action needed remains, first and foremost, the pooling of knowledge, irrespective of the accuracy of reported rates of forest loss. An ubiquitous problem in wildlife conservation over the past few decades has been the domination of national decision-making by specialist interests (notably in big, charismatic mammals: the lemurs of Madagascar are a prime example). The rise of the concept of "biodiversity" has been a great and timely leveller, essentially replacing individual species with entire ecosystems and biomes as the units for conservation concern (though of course this does not mean that individual species have no place in modern conservation initiatives).

The questions that then arise concern what and where those systems are, and this is when the pooling of knowledge becomes requisite.

In response to such a need, ICBP has been working on a mapping scheme for centres of endemism, using birds as the primary indicators of areas (since their distributions and taxonomy are so much better established than comparable classes), with the subsequent incorporation of other life-form data, drawn from the widest range of sources. Our Biodiversity Project is a three-year, three-man effort, intended to yield high-quality results in a reasonable time-frame. However, in real emergencies there is a far quicker, if far cruder, way of getting such material pooled: and that is by pooling the experts themselves, all at once. During 1989 the Amazon came to be regarded as a suitable case for such treatment.

Workshop '90

Thus it was that ten days in January this year saw a major gathering of over 100 biologists and conservationists in Manaus, capital of Brazil's massive Amazonas state. "Workshop '90" was the brainchild of Tom Lovejoy of the Smithsonian Institution and Chilean Prance or the Royal Botanic Gardens at Kew, both veterans of Amazonian research. The meeting was convened by Conservation International and the Brazilian (government's) National Amazon Research Institute (INPA) and their Institute of Natural Resources and Environment (IBAMA), with funding largely from a single foundation, the W. Alton Jones, which specialises in biodiversity issues.

The aim was to identify key areas of biological diversity and endemism in the entire Amazon basin: so although the majority of the participants were Brazilian or directly concerned with Brazil, representatives from the Guianas, Venezuela, Colombia, Ecuador, Peru and Bolivia each made substantial contributions. The method was to generate bodies of mappable information from all relevant disciplines, and then conflate those data in a succession of overlays that would gradually disclose the true "hotspots". These would then become the priorities for conservation.

The structure of the meeting was pyramidal: the first day was given over to generalities and principles. The next three saw teams of experts arranged in
distinct groups, formulating their particular assessments of the distributions of species and habitats. Mammals, birds, reptiles-and-amphibians, fish, and invertebrates each had separate groups within the zoology sector, while botany had groups for plant systematics, ecology and vegetation-types. There were further groups concerned with geomorphology, climate and protected areas, although in the event these were ancillary to the two biological sectors. In the final stage, the groups pieced their maps together, one for zoology and one for botany, and then melded the two, with highest priorities where major areas of overlap occurred.

The melting pot

The first day saw key speakers acknowledge two types of limitation. First, very simply, not all the available expertise had been assembled, though not necessarily for want of trying. The high number of participants, however, gave grounds for confidence in the meeting’s overall representativeness. Second, more problematically, biological knowledge of the Amazon is very patchy, exposing deliberations at all levels to bias and error. Whole areas of the Amazon remain unexplored: for example, the entire region in Brazil to the south of French Guiana and Suriname, most of the complex river systems of the Juruá and Purus in the southwest of Amazonas province towards Acre, and almost all of the Colombian component. Moreover, so-called “explored” regions will hardly have been exhaustively covered for any group, and substantial discrepancies inevitably occur in biological knowledge within and between sites, depending on the intensity of investigation and the specialisation of the explorer.

For all this, the recent work of ecologists and biogeographers has demonstrated that there are some real patterns in the distribution and abundance of species within the Amazon. In the late 1960s and 1970s, Jürgen Haffer (an oil company geologist by profession) pioneered the theory of Pleistocene refuges: his analyses of avian distributions in South America revealed discrete areas of endemism, which plausibly indicate places where forest persisted through the great glaciations when the earth’s climate was relatively dry. As the weather grew wetter, so the forests expanded and brought isolated populations back into contact, sometimes to hybridise, sometimes to confront each other as new separate species. In other directions populations remained isolated by the breadth of the tributaries, so that one finds clines in some species that look entirely distinct on opposite sides of a river close to its junction with the Amazon but whose characters merge around the river’s headwaters.

A second feature of Amazon biogeography is the overall increase in species abundance from east to west. Ted Parker, an ornithologist of unparalleled experience of South America, produced a series of maps based on his own and others’ work to show how numbers of individual species within families increased, in some cases dramatically, with increasing proximity to the Andes. Thus at Limoncocha in Ecuador and Tambopata and Cocha Cashu in Peru the total numbers of bird species recorded are over 500, whereas on the rivers Xingu, Tapajós and Amazon at Manaus the totals are all under 400. The phenomenon is reflected in other life forms and can partly be explained by higher rainfall and partly by sedimentary enrichment of lowland soils where rivers bear water down from the Andes. However, Parker also pointed out the ornithological richness of sites recently studied on the southern fringes of the Amazon in Rondónia and near Alta Floresta at the headwaters of the Teles Pires. Several species, some of them very rare, had been found at these sites where previous evidence had suggested they were restricted to the pre-Andean lowlands. Similar evidence from the northern regions intimates that, throughout the headwater regions of the Amazon basin, species diversity is higher than in the vast central lowlands.

Theoretical obstacles

Already the biologists were confronting some theoretical obstacles. On the one hand, the river-isolated populations and species require protection for their genetic distinctiveness. On the other, the headwaters where some of those populations meet require protection for their genetic interchange and for the greater overall richness they appear to hold. For similar reasons, Haffer’s and others’ refugia (whose positions are not – or not always – dictated by watercourses) need protection; but so do the areas where the species that evolved in them make contact with their closest relatives. The irrepressible Keith Brown, whose life has been devoted to documenting the distributions of Brazilian butterflies, even presented evidence that the areas of maximum species diversity are not in zones of contact but at sites fringing them. By the close of day one it looked like we might end up blacking in the entire map of the basin.

As the final map showed, this was not too far mistaken. The ideal scenario would have involved each of the life-form groups providing repeated confirmation of previously proposed refugia, thereby both proving the theory and affording the economy for conservation to be made by the use of biogeographical science. In reality, of course, the data were simply lacking: the taxonomy and distributions of most species are not adequately known to be plotted with confidence. The mammalogists, unable to tackle the appalling soup of undifferentiated material relating to the rodents and bats, relied almost entirely on monkeys and were familiarly referred to as the primate group; the herpetologists did not include the leading expert on Amazonian lizards and reported a dearth of information on snakes and caecilians, so chiefly used frogs; the invertebrate (entomological) group depended on helenoid butterflies and certain beetles; and the ichthyologists, suffering the added headache of catering for substantial seasonal migrations, resigned themselves to pointing out massive general areas of endemism in the headwater systems.

Igapó – Amazonian flooded forest – needs special protection (Photo: D. A. Scott)

World Birdwatch 11
The final picture

There was a curious irony in some of the final pronouncements of the climatologists and geomorphologists present at the meeting. The latter produced a map (not conflated with the biological map) which depicted huge chunks of the Amazon, and much greater than any marked out by biologists, where soils are unsuitable for utilisation except through management of standing forest. The former, championed by erstwhile Brazilian environment secretary Paulo Nogueiro Neto, indicated that the survival of the biologists’ areas at their current levels of diversity depends in the long term on current levels of rainfall, and that this could only be guaranteed if 80% of the total forest area of the Amazon remains intact. Since 12% is already considered lost, on this prescription there is evidently little scope for further destruction. In effect, therefore, the other groups shaded in what the biologists could not.

The biggest gainers of all from the implementation of the plan that this map prefigures will be what Keith Brown called the “bugs.” “Believe it or not!” he ruefully chalked on a board while we deliberated over the final map, “Bugs = 10^8 individuals on earth; 97% biodiversity; 0.97% attention; 0.0097% funding.” He should be pleased, though, if the map gets taken as seriously as it was by the people who made it, and the prognosis is fair. A representative of the World Bank indicated his intention of seeking in-house funds to protect the top five areas identified in Brazil. Britain’s Overseas Development Administration is interested in supporting several forest conservation initiatives resulting from the meeting. Tom Lovejoy was scheduled to deliver the final copy of the map to incoming Brazilian president Fernando Collor in the course of February.


Many Amazon basin countries are working on plans for the zonation of lowland forest areas to cater for Indians, wildlife and sustainable development. The Amazon can certainly pay its way into perpetuity through the careful management of its existing resources. The Manaus “Mapa Amazonica” is another clear signal, not just to South America but to all who finance or are creditors of developers in the continent, that the time to replace blind destruction with rational land-use planning has come.