Maximising Data Collection

Training Parataxonomists to Survey Tropical Forest Canopies

By
Yves Basset

The parataxonomist trade

DANIEL Janzen and Winnie Hallwachs created the first parataxonomist course in 1989 in Costa Rica, in collaboration with the Instituto Nacional de Biodiversidad. The term 'parataxonomist' was coined as a parallel to 'paramedic', meaning that parataxonomists stand 'at the side' of taxonomists (Janzen *et al* 1993). In contrast to local informants, museum technicians and taxonomists (see discussion of each profession and its duties in Basset *et al* 2000), the expertise of parataxonomists is in collecting specimens, mounting them, preliminarily sorting them to morphospecies (i.e. unnamed species diagnosed with standard taxonomic techniques), and databasing the relevant information. Their work results in quality material that can be deposited in national collections and used for taxonomic studies. Although their role is more active than that of local informants (e.g. 'tree-spotters'), they cannot be seen as an alternative to professional taxonomists.

The term 'parataxonomist' has been used in different contexts and this is a source of confusion. Ultimately, all personnel involved in the collection and study of biological specimens may be viewed as 'parataxonomists': from local collectors, students, professional zoologists or botanists focusing on ecological studies, to taxonomists operating outside of their range of expertise. Here the emphasis is on local people living in relatively rural areas of the tropics and who have been specifically trained for parataxonomist duties by professional biologists, within the context of research projects.

The work of parataxonomists is usually most cost-effective when studying groups of small and species-rich organisms that may require microscopic observation and/or specific preparation for deposition in museums (e.g. herbaria specimens, pinned insects and preparation of their genitalia, etc.). Although parataxonomists often study plants (e.g. Beehler 1994), fungi (e.g. Bills & Polishook 1994), terrestrial arthropods (e.g. Janzen 1988; Longino & Colwell 1997; Novotny *et al* 2002), or benthic macroinvertebrates (Fore *et al* 2001), their skills may be useful for the study of many other taxa, including vertebrates.

Currently, despite much talking and the relative hype behind the term, sometimes even discernible in policy documents (e.g. UNEP 2001), one must acknowledge that few research projects routinely involve parataxonomists, especially in the tropics. Although the programme of work of the Global Taxonomy Initiative of the

Convention on Biological Diversity (see UNEP 2001) strongly encourages the development of parataxonomists, this advice has rarely been followed. A search in Biological Abstracts™ (1969–2001) provided only 6 records with the keyword 'parataxonomist'.

The question that must be asked is Why? Despite the appeal of the concept, many workers may still be suspicious of the quality of the data that may be recorded and archived by parataxonomists (see discussion of this in Fore *et al* 2001). By 'data quality' many workers imply 'data accuracy', but these are two different issues. Scientific methods in natural sciences differ from those in nuclear physics. For example, due to the high spatial and temporal heterogeneity of ecological factors in tropical rainforests, high numbers of replicates, even at the expense of lower accuracy, are likely to shed light on interesting biological patterns. Although parataxonomist work may result in lower accuracy of data, data quality may indeed be higher than the traditional work of the lone scientist(s), due to increased replicates and additional side-experiments.

Advantages and rewards of the parataxonomist strategy

These advantages have been discussed in detail elsewhere (Novotny *et al* 1997; Basset *et al* 2000) and can be summarized as follows:

1. Efficiency of fieldwork is comparable to that of professional biologists and allows collecting at simultaneous locations with a higher number of replicates. The amount of biological material collected may be considerable (e.g. Novotny *et al* 2002) and sampling efficiency is significantly higher in projects working with parataxonomists than in those not relying on them (Basset *et al* 2000). The feasibility of more ambitious projects with complex protocols is enhanced and allows, for example, the implementation of simultaneous inventories and biological monitoring within the study areas.
2. Preparation of high-quality biological material ready for deposition in permanent systematic collections may also be comparable to that of museum technicians. Local preparation of specimens may sometimes be advantageous. For example, reared moths and butterflies killed by freezing just prior to mounting often represent better specimens than those collected by e.g. light trapping.
3. The ecological information associated with the biological material may also be considerable. Knowledge of the environment by local people may be essential and profitably integrated in research projects. In addition, parataxonomists can be trained to perform side experiments that may be of high benefit for the interpretation of distribution data (see Novotny *et al* 1999 for such an example).
4. The time-lag between the initiation of the study and the publication of results, is often rather long for studies of megadiverse systems (e.g. Erwin 1995), and may be significantly reduced (see Basset *et al* 2000). This may be a particular advantage for conservation studies in which time is pressing and the need for action high.
5. The indirect but positive effects of local involvement in research projects should not be underestimated. Involvement of village communities in ecological research may demonstrate to them the value of undisturbed forests on their lands. Collateral education of local people by fellow parataxonomists may also be significant.

How to improve the training and accuracy of parataxonomists

The correlation between the data generated in sorting insect material to morphospecies by non-specialists (parataxonomists) and similar data obtained in sorting to species by expert taxonomists depends crucially on the standards of training and support, including provision of identification aids and quality control (e.g. Cranston & Hillman 1992; Fore *et al* 2001). Several tactics can ensure successful training of parataxonomists. First, the feedback of professional taxonomists during the life-time of the fieldwork is essential, in order to validate the morphospecies assignment of problematic groups (but not necessarily to name or describe species at that time). Second, recent developments in computer hardware make digital photography a useful and relatively cheap tool. Digital pictures of specimens and characters can be routinely included in sophisticated databases, and this information can be circulated readily among colleagues over the internet. Large public databases, such as Ecoport (www.ecoport.org) and taxonomic tools are also beginning to be widely available on the internet. All of these modern tools can greatly enhance the ability of parataxonomists to work efficiently and accurately.

Parataxonomy and biological monitoring

Biological monitoring usually implies specific protocols, such as nested or replicated samples, time-series or Before/After-Control/Impact designs (BACI). Long-term monitoring is best achieved with non-destructive, non-disturbing methods producing seasonal and annual replicates of the same sampling units. These protocols call for prolonged stays in the field, and parataxonomist input. For example, with the help of parataxonomists, we were able to achieve in Guiana one of the first BACI experiments proving unequivocally the influence of selective logging on rainforest insects (Basset *et al* 2001).

With the help of parataxonomists, some of the most time-consuming but inexpensive sampling methods become viable alternatives to more expensive methods of biological monitoring. It also becomes feasible to include several taxa or guilds within the sampling protocol. This represents a much more promising strategy than using the services of experts or students to monitor a species-poor taxon over relatively short periods, a bygone era of tropical bioinventories (Takeuchi & Goldman 2001).

Conclusion: parataxonomy and canopy research

The training and work of parataxonomists could be profitably put to use in conservation biology, especially in biological monitoring, and should be more often considered when planning such projects. This strategy may be particularly effective with invertebrate taxa, but not limited to them. To date, the author knows of no project specifically targeting tropical forest canopies and routinely including the work of parataxonomists. This is most unfortunate. Parataxonomists can be easily trained to use single rope techniques to access the canopy (Basset *et al* 2000) or they can use other facilities for canopy access. Parataxonomists could also represent key elements for efficient programme's of invertebrate mass-sampling, such as canopy fogging and light-trapping. Networking within various countries, groups of local parataxonomists monitoring functionally diverse canopy taxa, would also appear to be the way forward for efficient survey and biological monitoring of tropical forest canopies.

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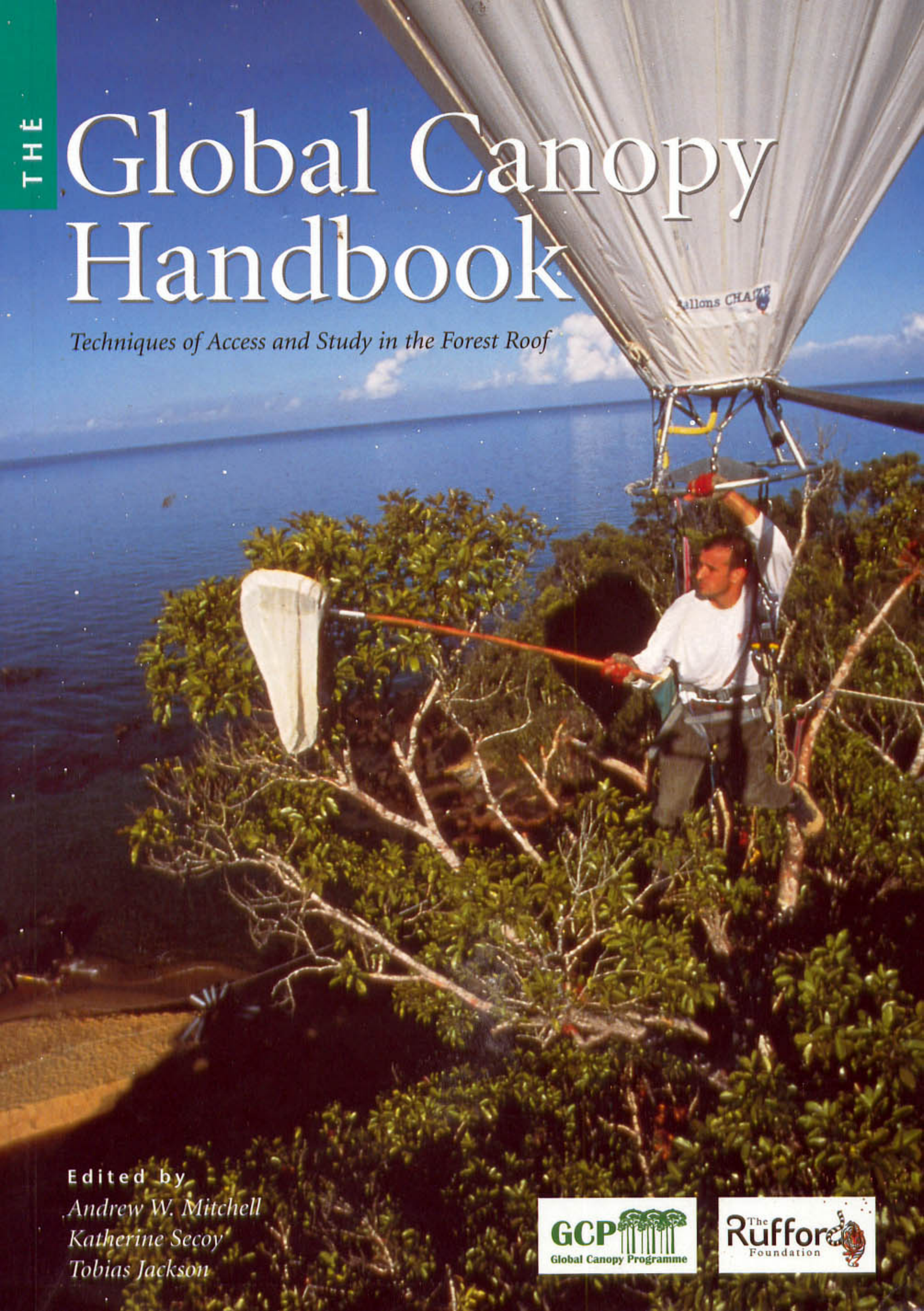

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