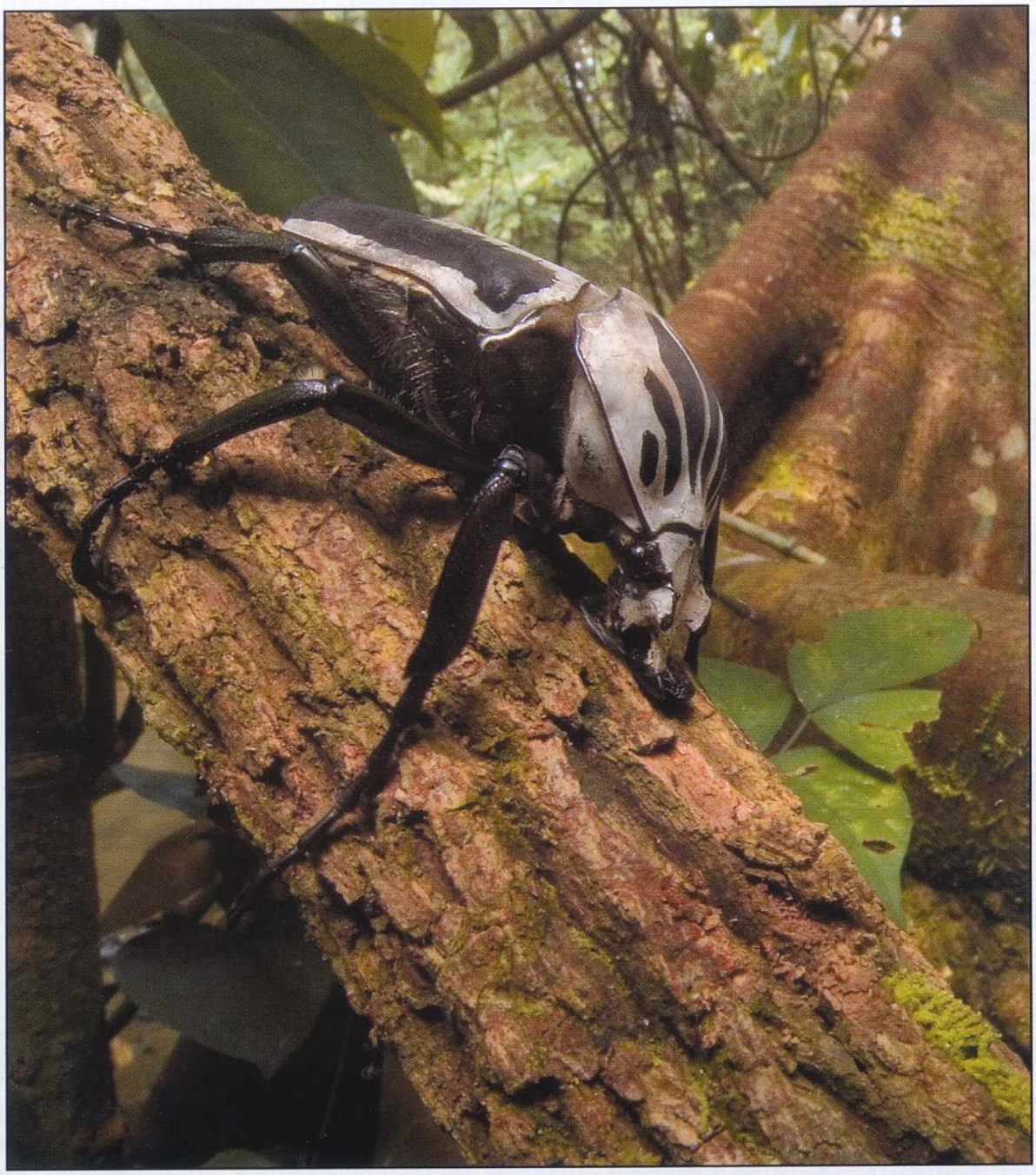
# WINGS

## ESSAYS ON INVERTEBRATE CONSERVATION



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# The Ecological and Cultural Functions Of Invertebrates in the Congo River Basin

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One of the entomologically richest, yet least studied, regions of Africa is the interior Congo River Basin. Forests of this region have been called Earth's "second lung" (after the Amazon Basin forests) and harbor an immense diversity of invertebrates. In these tropical rainforests live people of several cultures whose lives and livelihoods are intimately tied to invertebrates, which, in turn, help keep their forest ecosystems healthy.

Extending across several countries and encompassing a network of major river systems, the Congo Basin covers a vast portion of central Africa, most of which is accessible only by trek, pirogue (dugout canoe), or, sometimes, four-wheel drive through swamp forests that are barely passable even during the brief dry season. Environments include permanent and seasonal rivers, huge lakes, permanent swamp forests, seasonally inundated forests, and occasional upland forests, as well as patches of marsh and dry and wet savannah. Much of the primary forest has been converted to agricultural use with extensive shifting (slash-and-burn) agriculture and plantations of cacao, coffee, oil palm, and rubber trees. In this array of environments resides a strikingly diverse and largely unstudied entomofauna.

**Common denizens of the forest floor, African giant black millipedes are key players in recycling nutrients bound up in litterfall. *Archispirostreptus gigas*, photographed in the Congo Basin by Bruce G. Marcot.**

There is a long history of European and American collection of invertebrates of the Congo Basin. Early surveys included the 1903- 1905 Expedition of the Liverpool School of Tropical Medicine to the Congo by R. Newstead, J. E. Dutton, and J. L. Todd; and the 1909-1915 American Museum Congo Expedition by Herbert Lang and James Chapin. The latter survey was conducted in northeastern Belgian Congo (later renamed Zaire, and now the Democratic Republic of the Congo), during which more than a hundred thousand invertebrate specimens were collected. Subsequent surveys by Belgian and other biologists during the early and middle twentieth century involved intensive collections. There is a large body of publications on these surveys, although most of them are rare in American libraries and almost non-existent in African libraries. The Africa Museum of Belgium houses some ten million insect specimens from the Congo—which are well organized and available for study there—but, even so, knowledge of Congo insects is scattered and difficult to access. Efforts by Scott E. Miller of the Smithsonian's National Museum of Natural History (and Xerces Society board member) include development of an online checklist of insects of sub-Saharan Africa and a bibliography of African entomological and biodiversity literature, but online digital libraries remain to be developed and the literature is still largely out of reach. Beyond these collections, surveys, and species lists, little ecological research has been conducted.

It is likely that a large proportion of the native mollusk, arachnid, and insect species of the Congo Basin are at least regionally endemic. They may have evolved new forms to fill environments that have been periodically isolated by climate shifts. Indeed, oscillations in climate may be the ultimate factor responsible for the current invertebrate diversity, with the climate having shifted possibly more than twenty times over ten million years. Periods of aridity in the Congo Basin caused the spread of savannahs and dry woodlands, forcing moist forests and wetlands into isolated locations. Populations of plants and animals likely diverged genetically under such isolated conditions, and, when rejoined during wetter periods, retained their unique identities. Such selective forces have resulted in the adaptive radiation of many terrestrial and arboreal forms, including some primates as well as bird, amphibian, and reptile species; these forces may also be one reason for the high invertebrate diversity present today.

Invertebrates play critical roles, both negative and positive, in the lives of many villagers, among them Bantu and Pygmy. Some of the worst diseases, including malaria and schistosomiasis, are directly caused or vectored by air- and water-borne invertebrates. On the positive side, a U.N. Food and Agriculture Organization study concluded that invertebrates contribute significantly to the diets and livelihoods of people of the Congo Basin, and serve as key sources of protein, carbohydrates, and vitamins, as well as of traditional medicine. Many people in rural villages subsist largely on manioc (cassava) and maize grown in shifting-cultivation plots that are slashed and burned from the forest landscape; they obtain protein mostly from insects, fish, and occasional bushmeat. A study by P. A. Gomez conclud-

***Les chenilles*—edible caterpillars—are gathered by the children in Congo villages. People in the region are known to eat over forty species of caterpillars. These emperor moth caterpillars are *Imbrasia ertli* (family Saturniidae) photographed in the Congo Basin by Bruce G. Marcot.**

ed that, on average, 12 percent of animal protein consumed by people in the southern Congo Basin was from insects.

One important food source in the Basin is edible caterpillars, known as *les chenilles* to the French-speaking Congolese. They are a delicacy eaten raw or roasted until charcoal-blackened and crunchy. According to a study by F. Malaisse, the caterpillars supply a greater percentage by weight of protein, fat, and energy than do meat or fish, and locally up to 40 percent of the total animal protein consumed can be in the form of caterpillars. Dried caterpillars are made into flour, which is fed to children to stave off malnutrition. Caterpillars are also gathered and sold downriver to city markets, thereby contributing to the local economy.

Over forty species of caterpillars are eaten in the Congo Basin, foremost among them *Anaphe* spp. (Notodontidae) and the large silk moths *Imbrasia ertli* and *Cirina forda* (Saturniidae). Other species might not be scientifically identified or their life histories may not be known. In the western region of the Democratic Republic of the Congo, I was able to catalogue at least ten native tree species from which the caterpillars are harvested. Even though some of these trees, including lifake (*Entandrophragma angolensis*) and wenge (*Meletia laurentii*), are important sources of lumber, local villagers have learned to protect those trees from which they harvest the caterpillars. Certain species of caterpillars probably are closely associated with certain species of trees in the Congo Basin, as is true for New Guinea. Thus, conserving caterpillar trees is a good example of sustainable management, by maintaining some mature forest that is a valuable resource for food and trade other than timber.

**Some colonies of army ants have more than two million individuals. These invertebrates play an important ecological role in African forests. *Dorylus* sp., photographed in Guinea by Piotr Naskrecki.**

Local villagers have also learned to mine large, old, downed logs for certain species of termite larvae, which they use as bait on hook and line to catch particular fish. Again, this sort of local knowledge has proven significant in preserving large downed wood and decaying tree stumps, which also serve as important sources of coarse organic matter and macronutrients for keeping the soil and forest vegetation healthy.

As in most forest ecosystems, invertebrates play key functional roles in forest renewal. Soils of the Congo Basin, as with those in many tropical areas, are thin and laterize easily (lose soluble nutrients in favor of insoluble metals such as iron oxide and aluminum hydroxide). Nutrients leach out by the third or so rotation of an agricultural crop, and yields diminish in quality and quantity. The plot is then left fallow to be reclaimed by the forest, aided by chewers and decomposers such as the ubiquitous millipedes that recycle the plant litter.

Also prevalent in both primary and secondary forests are swarms of army ants, called *les fourmis*. Two kinds are recognized: *les fourmis magnans*, black ants with very painful bites; and the more common red ants, *les fourmis rouge*, whose individual bites are less painful but which attack in swarms. It is unknown if these are only two species, or several.

On nearly every forest trek, in all conditions, I encountered the ants. During hikes, someone toward the front of the line would shout, *"Les fourmis! Les fourmis!"* and everyone would start a rather comical high-step dance and sprint forward to avoid getting covered by the biting insects. On night outings into the forests to track down owls, primates, and other nocturnal creatures, I ran into swarms of *les fourmis* and several times was bitten head to boots: You cannot see the ant swarms at night in

the dark forests until they are all over you and send the pheromone signal to begin biting all at once. I found the ants to be both diurnal and nocturnal; to occur in dry, wet, young, and old forest; and to be prevalent even after heavy rain (although I was told that the rain drives them away).

The diversity and abundance of army ants likely play key ecological roles and contribute to the maintenance of biodiversity in several ways. They flush many other invertebrates, which are then eaten by insectivorous birds; they can greatly reduce prey populations of leaf-litter arthropods and small vertebrates; and their raiding swarms prey on many animals and thereby serve to redistribute nutrients throughout the forest's terrestrial, understory, and canopy communities. However, if ever there were a factor to dissuade lay-public ecotourism—beyond the difficulties of travel, obtaining water, and the lack of infrastructure—it will be *les fourmis*.

**Soldier army ants have strong mandibles and a formidable bite. *Dorylus* sp., photographed in Guinea by Piotr Naskrecki.**

What is the future of forest and habitat conservation for invertebrates in the Congo? Much of the primary forest of the central Congo Basin has been converted to shifting-cultivation agriculture. Large-scale commercial logging is underway or planned in many areas, and moderate community forest planning at the village level is just beginning. The success of this planning depends in part on addressing and overcoming the tremendous obstacles of poverty, poor nutrition, disease, and war.

In central Africa, the local people generally do not have a concept of wilderness as forest land devoid of human use and presence. Thus, instead of promoting plans that focus on forest reserves, conservationists face the challenge of understanding the needs of the local people and helping them craft appropriate-use guidelines at the village level to protect and sustain their livelihoods. Efforts such as protecting the trees on which caterpillars live and leaving termite-filled downed trees will help invertebrate habitat. Invertebrates, being both nutritionally and economically important, can be a component of conservation strategies. With this approach, there may be a future for invertebrates and people alike in this harsh and diverse land.

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