Ending empty forests

Management and sustainable use of wildlife in tropical production forests

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Keystone cat: The loss or depletion of top predators in forest ecosystems can trigger ecosystem collapse. *Photo: Fotonatura*

Unsustainable levels of hunting for consumption or trade are often associated with extractive industries (logging, mining) in the tropics. These industries facilitate access to remote forests by opening roads in previously inaccessible areas, thus providing access to markets and transforming hunting from a largely subsistence activity into a commercial one (Thibault and Blaney 2003, Poulsen *et al.* 2009). Increased human densities are linked to company infrastructure and camps, as they offer better facilities than existing urban centers (Nasi *et al.*, 2008) and attract people (workers, family members and traders) into areas that were formerly sparsely populated. As much as 29% of currently forested areas in Central Africa are likely to have increased wildlife harvesting pressures due to the access and market opportunities provided by new logging towns (Laporte *et al.* 2007).

The depletion of wildlife (defaunation) linked to over-harvesting threatens the food security and livelihoods of many forest-based communities and impacts important fauna-dependant ecological processes. It thus has the potential to negatively impact forest ecosystems more broadly than the mere removal of fauna, by creating 'empty forests' (Redford 1992). Although only ecological aspects will be considered here, livelihood issues are as, if not more, important to consider, as harvested wildlife populations are reduced to densities whereby they cease to ensure sustained livelihoods for dependent populations.

How is forest resilience impacted by defaunation?

Although every organism contributes to ecosystem processes, the nature and magnitude of individual species' contribution vary considerably. Most ecosystem processes are driven by the combined activities of many species. Plant regeneration (loss of pollinators, seed dispersers and seed predators), food webs (loss of top predators or of their prey), and plant diversity (change in herbivory patterns, increased pests) are amongst the various processes dependent upon the presence of fauna. Therefore activities such as hunting have the potential to impact not only targeted species but the ecosystem more broadly. Species performing similar roles in ecosystem processes and having similar trophic status or life-history constitute what have been termed functional groups. Species within these groups, such as grazing mammals, large predators, perennial grasses, or nitrogen-fixing microbes, are functionally similar despite their uniqueness in genes, life history, and other traits. It is therefore often difficult to determine the relative contribution of a given species to ecosystem processes as several species may contribute in similar ways. Some of these predicted changes have been empirically demonstrated while others have yet to be demonstrated or have so far proved to be inexact.[1]

'Keystone species', 'ecosystem engineers', or organisms with high 'community importance value' are species or groups whose loss is expected to have a disproportionate impact on the ecosystem when compared to the loss of other species. As hunters prefer large animals (given a choice) and as these large animals are often keystone species, the local extinction of these animals results in dramatic changes to ecosystems.

1 *The interested reader can refer to Bennett and Robinson (2000), Wright (2003), Stoner et al. (2007a), Wright et al. (2007b), Şekercioğlu et al. (2004) for reviews and discussion on ecological impacts of defaunation in general and to Galletti et al. (2006), Forget and Janzen (2007), Nuñez-Iturri and Howe (2007), Stoner et al. (2007b), Wright et al. (2007a), Terborgh et al. (2008) or Vanthomme et al. (2010) for specific empirical examples of ecosystem processes modified due to changes in faunal composition.*

Top predators (e.g. large cats, raptors, crocodiles) impact biodiversity by facilitating resources that would otherwise be scarcely available to other species (e.g. carrion, safe breeding sites) or by initiating a trophic cascade[2] (see Sergio *et al.* 2008 for a comprehensive discussion). Local extinction of these predators can trigger large changes in prey populations, which in turn dramatically alters browsing or grazing to the point where large regime shifts or ecosystem collapse happen (e.g. Johnson *et al.* 2006). Elephants and other mega-herbivores can play a tremendous role in modifying vegetation structure and composition through their feeding habits (differential herbivory, seed dispersal) and movements in the forest (killing a large number of small trees). Their impact on vegetation has in some cases appeared to be positive (Goheen *et al.* 2004), in others negative (Guldemond and Van Aarte 2008), but they do have a strong impact on vegetation dynamics. Two similar forests will undergo different succession and regeneration patterns based on the presence or absence of elephants, as shown by long term studies in Budongo (no elephants) and Rabongo (large elephant population) forests in Uganda (Sheil and Salim 2004). Ungulates such as wild pigs (*Sus* spp., *Potamochoerus* spp., *Tayassus* spp., etc.), tapirs and antelopes are among the most active seed dispersers or predators. A significant change in their population densities will have a major effect on seedling survival and forest regeneration (e.g. see Beck 2006 or Peres and Palacios 2007).

Human extractive activities in tropical forests (including but not restricted to hunting) are therefore disruptive processes and can trigger numerous, yet not completely understood, mechanisms (compensatory or predation rate changes) or effects (trophic cascade or keystone effects), which will in turn alter, in a more or less significant way, the overall function, structure and composition of the ecosystem. As forest resilience is dependent upon all these processes and functions (see Thompson, p. 16, and Thompson *et al.* 2009 for a review), it is very likely to be impacted by the loss of biodiversity linked to the direct and indirect impacts of defaunation.

Sustainable use of wildlife in production forests

Although the negative impacts of timber or other natural resource extraction on forest biodiversity are well-documented, the role of well-managed logging concessions as potential 'wildlife reservoirs' compared with unsustainably managed forests is also increasingly recognized (see Sayer and Boedhihartono, p.11, and Clark *et al.* 2009). Indeed, well-managed and certified production forests can be an important addition to protected areas, which are often too small, fragmented or ineffectively managed to support wide-ranging or rare species. Forest industries can promote the sustainable use of biodiversity and human livelihoods by moving toward sustainable practices that explicitly consider the direct and indirect effects of their activities on wildlife (Aviram *et al.* 2003, Bass *et al.* 2003). Extractive industries can mitigate the negative impacts of their operations on wildlife by controlling and managing bushmeat hunting in their concessions through appropriate measures (Nasi *et al.* 2008), such as guaranteeing the importation or development of affordable protein alternatives for their workers and their families, preventing the use of company vehicles for bushmeat hunting, limiting access to forest roads to company vehicles, and rendering roads that are no longer required for logging impassable for vehicles. Through local enforcement and control, companies can ensure that their workers hunt legally (with proper licenses and permits) and impose penalties or fire workers who break the law. Forest industries may also formalize hunting territories within their management plans and prioritize access to the original inhabitants of the area (Poulsen *et al.* 2009). Other suggested practices include banning commercial hunting on concession grounds, establishing conservation zones within the concession where hunting is forbidden, prohibiting unselective hunting methods such as snare hunting and trap hunting, and producing educational and information materials for both the public and staff (Meijaard *et al.* 2005). Wherever possible, local governance structures and customary sustainable use by indigenous and local communities should be strengthened, in addition to other measures to achieve sustainable wildlife management.

Maintaining/increasing the resilience of hunted forests

Hunting for food or wildlife products is one of the oldest human practices; it will not go away and repressive measures and protection alone will not suffice. Solutions lie in managing the exploitation of the resource to maintain both the conservation and economic value of forest ecosystems.

The CBD Liaison Group on Bushmeat met in October 2009 at the World Forestry Congress in Buenos Aires, and elaborated national and international recommendations for the sustainable use of bushmeat that are relevant to the sustainable use of wildlife overall (CBD 2009). They include eleven national-level and nine international-level recommendations, cutting across various themes such as climate change, health, science and alternative means of subsistence.

The recommendations highlight the need to engage the private sector and extractive industries and recognize the role that forest certification schemes designed to include wildlife management measures can play to maintain healthy and resilient forest ecosystems. Members of the International Tropical Timber Organization (ITTO) can contribute to implementation of many of the CBD Liaison Group's recommendations, as follows:

- The responsibility for wildlife management should be transferred whenever possible to local stakeholders, who have a vested interest in maintaining the resources, while the capacity of these empowered local communities should be built and strengthened to ensure that they have the capacity to exercise these rights.
- National governments should increase their capacity to monitor levels of bushmeat harvesting and consumption and incorporate this information in national statistics to inform policy decisions and planning.

2 *A trophic cascade is a series of interactions that "cascade through the community, transmitted by a chain of strongly interacting links" (Paine 1980). In its simplest form, a cascade takes place when a consumer influences at least two other trophic levels, such as when a predator limits the populations of its prey, which in turn limits the populations of its own prey(Sergio et al. 2008).*

- While an effective network of protected areas is critical to ensure the conservation of wildlife, populations outside protected areas are also essential, and management should encompass the largest possible landscape scale.
- The development of alternative food and income sources is necessary, as wildlife cannot sustainably support current or future livelihood needs, but these palliative measures alone (such as farming, ranching and captive breeding) are unlikely to be effective in conserving wildlife resources. In the long term, there is no substitute for effective management of the resource for protection and production.
- To achieve conservation and sustainable use of wildlife resources, capacity building and public awareness are needed at national and local levels, including governance and law enforcement, wildlife monitoring and management and livelihood alternatives; collaboration across government, private and public sectors is also required.
- The conservation and sustainable use of wildlife resources are enhanced through the use of the most ecologically benign (e.g. species-specific), cost-efficient, and humane hunting methods.

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