The Ecological Consequences of Managing Forests for Non-Timber Products

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HUMANS WERE HUNTERS and gatherers long before they became farmers and loggers. The fruits of hunting and gathering—non-timber forest products—continue to this day to make an important contribution to subsistence and market economies alike. Worldwide, it is estimated that several thousands of species are collected from the wild for a variety of purposes (Myers 1988); in the high-diversity forests of Amazonia, for example, more than two-thirds of all tree species are used by indigenous peoples (Secretariat of the Convention on Biological Diversity 2001). At the local community level, non-timber forest products (hereafter, NTFP) can account for 35 per cent (for example, Zimbabwe; Cavendish 1997) to as much as 60 per cent (for example, India; Hegde et al. 1996) of household incomes. And even at a global level, the estimated value of the market in herbal medicines alone (a large proportion of which is collected from the wild) is about US$ 14 billion (Secretariat of the Convention on Biological Diversity 2001).

Despite the long history of NTFP harvest (Moegenburg 2002; Posey 1982), it is only relatively recently that management of NTFP has caught the attention of conservation scientists as a means of ensuring forest conservation and as an alternative to conversion. If one were to try and attribute this altered perspective on NTFP to any one single event, it would probably be the influential article by Peters et al. (1989), which attempted to put a value on tropical forests, and demonstrated that the potential long-term economic returns from forests managed for NTFP are greater than the net returns from timber or forest conversion to agriculture. Their analysis provided a justification for tropical forest conservation that was not just biological, but economic and social as well. Since then, the idea of linking NTFP harvest with livelihoods of forest-dependent communities as an alternative to deforestation has become a widely accepted conservation paradigm (Nepstad and Schwartzman 1992; Panayotou and Ashton 1992). Similarly, the idea of including

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NTFP in diversified forest management plans to offset the costs of reduced-impact logging (Campos et al. 2001; Salick et al. 1995) is becoming increasingly accepted as a part of sustainable forest management. Even so, there is very little information on the ecological impacts of managing forests for NTFP. It is often assumed that there is little, or no, ecological impact of NTFP harvest (for example, Myers 1988) although there is evidence to the contrary (as discussed in Godoy and Bawa 1993; and see, for example, Padoch 1992).

The ecological effects of harvesting NTFP can be varied, and the impacts can range from the level of genes to individuals and populations, communities and ecosystems, all of which have important consequences (Hall and Bawa 1993; Peters 1994). At one extreme, the alteration of the genetic composition of wild populations from repeated selective harvest of the biggest, or most productive, individuals can deplete the vigour of the wild gene pool. This in turn can compromise the long-term survival of the species; it can also compromise the vigour of domesticated and cultivated populations of species drawn from such depleted wild stocks. At the other extreme, harvest of certain NTFP can lead to ecosystem degradation, for example, nutrient depletion from the export of large amounts of nutrient-rich plant parts (for example, the harvest of *Banksia hookeriana* blooms; Witkowski and Lamont 1996) or soil erosion resulting from over-harvest of species that help to stabilise soil (for example, harvest of underground portions of *Aloe vera* and *Asparagus racemosus*; Ramakrishnappa 2002). This can affect not only the availability of desirable NTFP species, but also jeopardise other values that society derives from ecosystems, such as soil and water conservation or carbon sequestration.

In a recent review of studies on the ecological effects of NTFP harvesting, Ticktin (2004) demonstrated that most studies have focused on effects at the level of individuals and populations of target NTFP species. Few studies have examined effects at the level of communities, and fewer still at the level of the ecosystem. Population-level studies rely on demographic techniques, such as population matrix models, which provide a relatively short-term picture of the population structure of a target species in a particular environment, subject to a particular management regime. Population matrix models are limited in their ability to predict impacts of NTFP harvest for populations in conditions that differ from those under which the model was developed (Boot and Gullison 1995). The specificity of such demographic approaches, and the inability to extrapolate from studies of the same species under different conditions, highlights the importance of monitoring of NTFP populations as an integral part of any harvest and management system.

Ticktin (2004) also highlights the disproportionate numbers of studies focusing on particular types of NTFP, or on certain plant life forms or life histories. Thus, there are many more studies on the effects of fruit and seed harvest than on the effects of resin or root harvest. Similarly, there are many more studies on the response of palms to being harvested than on the response of lianas or vines. Certain plant life histories, such as long-lived tropical trees, can make assessments of the

ecological impacts of harvesting especially difficult. A good example is the poster-child of tropical forest extractivism, the Brazil nut, which is almost exclusively harvested from the wild. Although studies on individual populations suggest that present high levels of extraction (as much as 93 per cent; Zuidema and Boot 2002) have little impact on the demography of wild populations, a recent continental-scale study of Brazil nut extraction shows just the opposite: despite sustained high levels of seed production in many harvested populations—given the long reproductive life-span of these trees—populations with a long history of exploitation show distinct population bottlenecks (Peres et al. 2004).

But it is not biological factors alone that determine the ecological consequences of managing forests for NTFP. The consequences of management for NTFP are determined, perhaps as importantly, by the political and socio-economic context in which such management occurs. In a comparative study of extractive reserves in the Petén of Guatemala, and in Kalimantan, Indonesia, Salafsky et al. (1993) demonstrated that despite the greater annual revenues from NTFP extraction in Kalimantan than in the Petén, extractive reserves alone were not likely to save the Kalimantan rain forest. The greater pressure for alternative land uses, the relatively poorly developed physical and social infrastructure for extraction, and the nature of land tenure and political power of harvesters in Kalimantan, may in fact make the opportunity costs of extractive reserves greater than in the Petén.

Wollenburg (1998), in a state-of-the-knowledge overview of NTFP-based enterprises as an approach to conservation, highlights the complementary multiple objectives of conserving forests, enhancing livelihoods and improving social conditions, which must be met for such efforts to be sustainable. She also discusses the distinctive features of such NTFP-based enterprises and marketing, which can influence the ecological impacts of NTFP extraction. Principal among these is that such enterprises are often based on multiple products, with varying ecological characteristics, availability and market demand, thus making enterprise development a complex proposition necessitating unique harvest, processing and marketing arrangements tailored to each product. Moreover, market demand for products of such enterprises can vary from the local to the global scale, requiring separate market analysis and strategies. Often these enterprises are—by their very nature—located in remote areas, and people involved lack formal business and financial skills required for enterprise development. Finally, compounding these factors may be the fact that such enterprises frequently are part of complex social and tenurial arrangements, with forests managed for multiple objectives.

This issue of *Conservation & Society* brings together a pan-tropical collection of articles on 'the ecological consequences of managing forests for NTFP'. Many of these articles were presented at a special symposium on this theme, at the annual meetings of the Association for Tropical Biology and Conservation in Panama City, in July 2002. A striking feature of this collection of articles is the recognition of the variety of social, economic and political factors that influence the extraction of NTFP. Uma Shaanker et al. review the ecological consequence of harvesting NTFP from genes to ecosystems, and also suggest the possibility of a win–win

scenario of forest conservation and use that minimises ecological costs while maximising livelihood gains. Velásquez Runk et al. highlight the importance of considering spatial and temporal patterns in the distribution of NTFP resources and their use when analysing the ecological consequences of managing forests for NTFP. Both Plowden, and Weinstein and Moegenburg, discuss the community-level consequences of NTFP extraction, the former considering the effects of extraction on non-human consumers of the NTFP, and the latter examining the effects of extraction on forest structure and composition. Plowden suggests the possibility of enrichment planting and of local processing and value-addition as a means of augmenting benefits to harvesters. Kathriarachchi et al., similarly, discuss the possibility of enrichment planting of NTFP in forest buffer zones as part of forest restoration strategies that could simultaneously provide NTFP to forest-margin communities. Weinstein and Moegenburg's study also considers the effects of distance from markets for an important NTFP in the Brazilian Amazon, though in their particular example subsidiary markets compensate for the distance from the main regional market in Belém, while Rai and Uhl talk about the effects of temporal fluctuations in the market for an important NTFP in India's Western Ghats. Both Rai and Uhl, and Velásquez-Runk et al. highlight the importance of tenurial security in determining the ecological impacts of harvest. And finally, Shahabuddin and Prasad, in a review of forest management for NTFP in India, suggest that such management may not always be compatible with conservation outcomes. For example, there may be ecological impacts from anthropogenic disturbances associated with NTFP harvesting that are often overlooked (for example, Ganesan and Setty, pp. 365–75). Nonetheless, managing forests for NTFP may still be the better alternative to conversion to other non-forest uses.

It has been demonstrated that extraction of NTFP goes through well-recognised phases: subsistence economies that depend on NTFP for a large part of their subsistence and livelihood needs put a high value on NTFP; as income levels rise, so too does the opportunity cost of foraging for NTFP; and in market economies the value of forests ceases to lie in NTFP, and is replaced by other values such as carbon sequestration or the conservation of the unique products of evolution (Godoy and Bawa 1993). Nonetheless, given the number of people worldwide that depend on NTFP today (more than 50 million of whom reside in India alone; ibid.), it is highly likely that NTFP as the mainstay of rural forest-dependent communities will continue well into the foreseeable future, as will our efforts to link conservation with livelihoods of such communities. While management of forests for NTFP does not automatically guarantee conservation, it certainly provides a means of preventing conversion to other non-forest uses. In the long term, such NTFP harvesting must be accompanied by appropriate incentives to minimise ecological impacts, for example, via niche markets, and certification (Weinstein and Moegenburg, in this issue), and simultaneous efforts to augment community livelihoods from alternate means, for example through agro-forestry and the restoration of degraded lands (Kathriarachchi et al., in this issue). This collection of studies is important not only because it helps highlight the variety of ecological impacts of harvesting

NTFP, but also because it underscores the diversity of factors associated with NTFP harvest that may determine and help mitigate these impacts. And so long as there are people who are dependent on NTFP, we must continue to strive for the win–win situation that both Weinstein and Moegenburg, and Uma Shaanker et al. in this issue suggest is an attainable goal, even as we seek long-term livelihood alternatives.

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