

Harvesting non-timber forest produce

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Non-timber forest products (NTFP) are seen as a win-win solution to save forests while providing livelihoods to forest dwelling communities.¹ Unlike logging, mining, or forms of agriculture, selective harvest of NTFP is not considered pernicious to forests, and is proposed as a tool to stem massive forest losses occurring globally. Particularly in the tropics, it is argued that NTFP could aid conservation by providing local communities an economic incentive to keep forests intact.² In addition to its practical significance for many communities, harvesting NTFP can be associated with social and cultural identities.

Despite providing a means of livelihood for many marginalized communities, harvesting NTFP remains a

deeply contested issue across the world.³ The quandary partly arises from an unclear picture of whether NTFP harvest can remain sustainable and economically viable in an increasingly modern, connected and market-driven world, especially when subject to the wider demand net and fluctuations of distant markets.⁴ In the fast-changing economies of developing nations, does traditional knowledge of NTFP remain a relevant skill? Answering these questions require us to examine which way the current evidence points about NTFP harvest as a conservation tool, and whether the contours of this debate are dependent on geographical and cultural contexts.

In India, an estimated 50 million forest-dependent tribal people harvest NTFP with an additional 200-300 million non-tribal people directly or indirectly participating in harvesting

1. B. Belcher, M. Ruíz-Pérez and R. Achdiawan, 'Global Patterns and Trends in the Use and Management of Commercial NTFPs: Implications for Livelihoods and Conservation', *World Development* 33, 2005, pp. 1435-1452; Forest Products, Livelihoods and Conservation 1, Center for International Forestry Research, 2004; Non-Timber Forest Products in the Global Context. Springer-Verlag Berlin Heidelberg, 2011.

2. Non-Timber Forest Products in the Global Context, *ibid.*; C.M. Peters, Sustainable Harvest of Non-timber Plant Resources in Tropical Moist Forest: An Ecological Primer. The Biodiversity Support Program, 1994.

3. Non-Timber Forest Products in the Global Context, *ibid.*; B. Belcher and K. Schreckenber, 'Commercialisation of Non-Timber Forest Products: A Reality Check', *Development Policy Review* 25, 2007, pp. 355-377; J.E.M. Arnold and M.R. Pérez, 'Can Non-Timber Forest Products Match Tropical Forest Conservation and Development Objectives?' *Ecological Economics* 39, 2001, pp. 437-447.

4. B. Belcher and K. Schreckenber, *ibid.*; J.E.M. Arnold and M.R. Pérez, *ibid.*

activities.⁵ Spanning a broad gamut of plant products – fruits, seeds, leaves, bark, roots, flowers, cane, bamboo, honey and lichens etc., NTFP are harvested across a variety of ecosystems and landscapes.⁶ It is perhaps this pervasiveness of NTFP harvest in India that renders debate on the merits of NTFP harvest versus its detriment to conservation to become polarized, even acrimonious. Admittedly, attempting a simplistic abstract of this multidimensional issue is challenging. However, a few clear dividing lines that appear to demarcate the debate are the legal provisions for forest access in India.

The Wildlife Protection Act (1972) and Forest Conservation Act (1980) govern access to forest areas and define permissible activities within different administrative classes of forests – reserved forests, wildlife sanctuaries, national parks, and tiger reserves. The Forest Rights Act (2006) devolves harvest decisions to forest-dwellers as a community right towards forest use.

Those who strongly espouse the Protected Area system assert that wildlife is seriously imperilled in India and continued use of forests degrades forest quality and is detrimental to long-term conservation. Harvest is in ideological conflict with top-down management and a centralized, protectionist approach to conservation, and accessing forests for harvest is associated with other illegal activities such as hunting. However, there are

5. R.U. Shaanker et al., Livelihood gains and ecological costs of non-timber forest product dependence: assessing the roles of dependence, ecological knowledge and market structure in three contrasting human and ecological settings in south India. *Environmental Conservation* 31, 2004, pp. 242-253.

6. G. Shahabuddin and S. Prasad, 'Assessing Ecological Sustainability of Non-Timber Forest Produce Extraction: The Indian Scenario', *Conservation and Society* 2, 2004, pp. 235-250.

situations where state management of forests has created or reinforced power imbalances, disfavoured some of the poorest citizens who necessarily rely upon forests for sustenance or livelihood.⁷ Particularly offensive are situations where there is an embargo on the poor using forest resources while large corporations are allowed to clear forests for mines or industries despite local opposition.

The proponents of NTFP harvest also contend that harvesting plant products is a self-regulating, benign, and relatively non-destructive use of the forest that offers local communities an incentive to keep forests intact. Further, they argue that local forest-dwelling communities have a right to utilize forest resources in a self-determined manner. Thus, the main debate about NTFP seems more to do with the classic dichotomy of forests as cultural and livelihood entities versus forests as inviolate museums of natural history – the last bastions to stem human-caused decimation of nature and wildlife.⁸

The subject of forest access is a whole other Pandora's box, and beyond the scope of this article. In this article, we try to analyse based on available data whether NTFP harvest *per se* is ecologically damaging or not. Next, we examine whether and how harvesters plan harvest activities to make it sustainable. Regardless of whether NTFP harvest remains valued for its cultural and artisanal purposes, we argue that the evidence points to it becoming an increasingly peripheral economic activity, espe-

7. A. Agrawal and E. Ostrom, 'Collective Action, Property Rights, and Decentralization in Resource Use in India and Nepal', *Politics and Society* 29, 2001, pp. 485-514.

8. M. Krishnadas, T. Nair and D. Karnad, 'Equality in Conservation: Comment on Bawa et al. 2011', *Conservation Biology* 27, 2013, pp. 422-424.

cially in large mixed-use landscapes that are well connected to markets and provide opportunities for employment and livelihoods beyond the confines of forests. In places where NTFP harvest remains a primary livelihood option, the lack of adaptable institutions, regulatory mechanisms, or supply chain management makes the economic incentives modest at best while the ecological consequences are usually negative.

Harvest can be broadly classified as subsistence and commercial. Many NTFP are used to make items of household or cultural significance, but a sizable variety of products are harvested to sell. Commercial NTFP harvest could offer marginalized communities a potential link to the mainstream, helping ease them into a standard market economy. By definition, economic viability of commercial harvest is linked to markets, thus being prone to vicissitudes of demand and supply. In such cases, a legitimate question is whether the quantity of harvest needed to make NTFP economically viable is also ecologically sustainable?⁹ Moreover, in populous countries such as India, can harvest be a reliable income source for enough number of people living within or around forest, without ecological damage?¹⁰ Furthermore, harvest practices and intensity clearly vary by product

9. J.E.M. Arnold and M.R. Pérez, op. cit., 2001.

10. R.U. Shaanker et al., op. cit., 2004; L. Mandle, T. Ticktin, S. Nath, S. Setty and A. Varghese, A Framework for Considering Ecological Interactions for Common Non-Timber Forest Product Species: A Case Study of Mountain Date Palm (Phoenix Loureiroi Kunth) Leaf Harvest in South India', *Ecological Processes* 2(21), 2013; A. Varghese and T. Ticktin, 'Regional Variation in Non-Timber Forest Product Harvest Strategies, Trade, and Ecological Impacts: The Case of Black Dammar (Canarium Strictum Roxb) Use and Conservation in the Nilgiri Biosphere Reserve, India', *Ecology and Society* 13(2), 2008.

and geographical context,¹¹ so can we generalize sustainability for one product or location to other contexts?

Globally, the evidence is mixed about ecological consequences of NTFP harvest.¹² Tolerance of a plant species to harvest varies with life stage (e.g. seedling vs. adult); while whole plant harvest and bark removal tends to be unsustainable, fruit and leaf harvest have greater potential for sustainability. High harvest levels usually require additional management to maintain healthy plant regeneration. Because studies often focus on one plant species and just one or few populations, generalizations are unlikely to be accurate beyond species or site. Whether the wider plant community or other ecological interactions are affected have rarely been explored. There is also no clear consensus on whether NTFP harvest is economically beneficial to the harvesters. Catering to local markets alone may be ecologically viable but not economically lucrative. On the other hand, catering to wider markets – usually associated with higher harvests – results in positive economic outcomes but negative ecological outcomes. When market demands are high, ‘outsiders’ also extract, and the increased harvest is more likely to result in resource degradation. It is noteworthy that NTFP harvest as a vehicle for both conservation and rural development has been called into question when data are analysed from across multiple countries.¹³

11. T. Ticktin, ‘The Ecological Implications of Harvesting Non-Timber Forest Products’, *Journal of Applied Ecology* 41, 2004, pp. 11-21.

12. Ibid.; I.B. Schmidt, L. Mandle, T. Ticktin and O.G. Gaoue, ‘What do Matrix Population Models Reveal About the Sustainability of Non-Timber Forest Product Harvest?’ *Journal of Applied Ecology* 48, 2011, pp. 815-826.

13. B. Belcher, M. Ruiz-Pérez and R. Achdiawan, 2005, op. cit.; Forest Products, Livelihoods and Conservation 1, 2004, op. cit..

In India, the most comprehensive review of the ecological impacts of harvest is by Shahabuddin and Prasad. Notably, they were unable to conduct a quantitative meta-analysis of harvest impacts due to lack of relevant data. Although they outlined the multiple dimensions of NTFP harvest that needed investigation to assess ecological sustainability, thirteen years on, we still do not find studies that have examined NTFP harvest along those multiple lines.

Even though Shahabuddin and Prasad underscored the need for long-term demographic monitoring of NTFP species to assess sustainability, we are aware of only three studies that have done so. Of these, one study examined long-term demographic trends of harvested *Amla* trees,¹⁴ whereas another examined short-term (1-2 years) demographics of mountain date-palm.¹⁵ Data remains sparse for NTFP quantities harvested from different forests, the value chains and market linkages for harvested products, and ecological impacts of different harvest intensities.¹⁶ In such data vacuum, there is limited basis to assess sustainability.

To explore the linkage between markets and harvest, we combined semi-structured interviews and ecological correlates of NTFP harvest practices in three locations in Western

14. T. Ticktin, R. Ganesan, M. Paramesha and S. Setty, ‘Disentangling the Effects of Multiple Anthropogenic Drivers on the Decline of Two Tropical Dry Forest Trees’, *Journal of Applied Ecology* 49, 2012, pp. 774-784.

15. L. Mandle and T. Ticktin, ‘Interactions Among Fire, Grazing, Harvest and Abiotic Conditions Shape Palm Demographic Responses to Disturbance’, *Journal of Ecology* 100, 2012, pp. 997-1008.

16. P. Davidar, M. Arjunan and J. Puyravaud, ‘Why do Local Households Harvest Forest Products? A Case Study From the Southern Western Ghats, India’, *Biological Conservation* 141, 2008, pp. 1876-1884.

Ghats.¹⁷ We aimed to examine whether patterns of NTFP harvest were related to market demand, whether harvest were organized by community-defined rules, and map the trade routes and actors in the supply chain for the major products. We highlight some preliminary, qualitative results we found for market demand and harvester behaviour.

We found that in the three regions only the poorest households harvested NTFP – families perceived as being low in the caste hierarchy. Harvesters focused on three species *Myristica dactyloides*, *Myristica malabrica*, and *Garcinia gummi-gutta*, and harvested seasonally to correspond with fruit availability. Most respondents harvested to sell and supplement their household incomes. Consequently, decisions of how much and what to harvest were driven by market demand and product prices; the highest market value products were harvested.¹⁸

Individual harvesters decided where and how much to harvest, maximizing quantity during the season. No community discussions about regulating harvest or planning for sustainability were undertaken even though the general perception was that fruit availability decreased due to increased competition. Because trees were uncut, regeneration was perceived as being healthy. However, this perception may partly reflect the very rudi-

17. Although some include animal products within the purview of NTFP, we restrict this article to plant based products only.

18. *Myristica* are harvested for the bright-red coat surrounding the seeds, and *Garcinia* a souring agent, is increasingly being used for supposedly anti-diabetic and anti-obesity properties. Because wild nutmeg, *Myristica dactyloides* and *Myristica malabrica*, were the two most heavily harvested products, we are now conducting ecological surveys on assessing recruitment patterns of these two species, comparing high-harvest sites with ecologically similar sites with low or no harvest.

mentary natural history knowledge we found among harvesters. Overall, our data suggests an open-access condition with increasing competition, leading to potentially inefficient harvesting practices – perhaps related to low ecological knowledge – that might be reducing profits (per unit harvest effort) for individual harvesters.

Theoretically, NTFP harvest may be seen as a coupled socio-ecological system.¹⁹ In reality, demonstrating the relevant feedback between social decisions and ecological impacts can be difficult for plants with life cycles that work at very different time-scales from human economic imperatives. Assessing patterns, let alone mechanisms, of changes to biodiversity at community or trophic levels is even more challenging.²⁰ Despite these challenges of finding an overarching theoretical framework, NTFP research needs long-term site- and product-specific information on harvest rates, population dynamics of harvested species, and assessing wider impacts of harvest on plant community and plant-animal interactions.

Socio-economic studies are critical to understand the role of markets and changing economic opportunities on the relevance of NTFP harvest. Because NTFP harvest is context-dependent, harvest policies could benefit from a broad classification in the economic roles played by NTFP²¹ – e.g. subsistence vs supplementary strategies coupled with long-term impact assessments. When such classification can incorporate differ-

ences in management regimes, market contexts and ecological characteristics of the product, policies could accommodate more contextual flexibility instead of one size fits all.²²

Of course, NTFP harvest may not be the best way to empower rural or tribal communities or even achieve conservation targets.²³ Long-term economic prospects of marginalized groups may sometimes be better served by helping people move into alternative economic activities rather than remain tied to forest-based livelihoods.²⁴

Alternatively, could stable income from NTFP be best obtained through plantations of sought after products? After all, products that are commercial cash crops today – rubber, coffee, chocolate, cardamom – were but NTFP not so long ago. Should we consider current cash-crop plantations

22. NTFPs range from large and whole plants and animals to smaller parts such as fruits, leaves, flowers, seeds, roots and bulbs, bark, honey, insects, resins, horns, skins, and many more. Second, there is tremendous variation in volumes extracted, used, and traded; from just a small handful of a particular product during times of need (such as bark from a medicinal tree to hundreds of thousands of tons of product on an annual basis (such as fuelwood, some fruit species, fibre products). Third, much of what is extracted is by rural communities with little formal record-keeping. Fourth, the assessment of sustainability is almost impossible; for most NTFP species there is insufficient biological knowledge of growth and mortality rates, productivity, reproduction, and responses to harvesting. Lastly, confusion and inconsistencies remain in what is an NTFP and what does not. De Beer and McDermott (1989) provided the most widely known definition from their work on the economic value of NTFPs in Southeast Asia, defining NTFPs as encompassing ‘all biological materials other than timber which are extracted from forests for human use.’

23. Forest Products, Livelihoods and Conservation 1, 2004, op. cit.

24. J.E.M. Arnold, C. Leidholm, D. Mead and I.M. Townson, Structure and Growth of Small Enterprises in the Forest Sector in Southern and Eastern Africa’, *World Development* 22, 1994, pp. 1881-1894.

(coffee, rubber, cardamom etc.) as intensively managed forests with new species/communities maintained by humans? Could NTFP plantations fit into this idea of a continuum of forests, striving towards a balance between production and biodiversity? Intermediate intensity systems may meet the economic needs of local people (income diversification, risk spreading, efficient labour, and land use) with relatively low biodiversity impacts. Some scientists have suggested that restoring degraded forests for NTFP species might offer a long-term compromise between harvest and conservation.²⁵

Ultimately, any NTFP policy is irrevocably yoked to the relevance of NTFP as an economic tool. Despite the potentialities, commercial-scale harvest has been especially viewed with caution due to the pitfalls of meeting consumer demands and managing complex value-chain relationships.²⁶ The time needed for systematic investigation of potential ecological changes to biodiversity from harvest, especially of slow growing plant species, might be outpaced by the rapidly changing economic opportunities in developing countries such as India. Indeed, given the mismatch between changing socio-economic opportunities, the inherently slow pace of science, and the tardiness of knowledge being translated to policy, NTFP harvest might become an irrelevant debate.²⁷ Evidence from developed countries sug-

25. M.S. Ashton, I.A.U.N. Gunatilleke, C.V.S. Gunatilleke, K. Tennakoon and P.S. Ashton, ‘Use and Cultivation of Plants that Yield Products Other than Timber From South Asian Tropical Forests, and Their Potential in Forest Restoration’, *Forest Ecology and Management* 329, 2014, pp. 360-374.

26. B. Belcher and K. Schreckenberg, 2007, op. cit., pp. 355-377.

27. C.L. Gray, M. Bozigar and R.E. Bilsborrow, ‘Declining Use of Wild Resources

19. J. Liu et al., Complexity of Coupled Human and Natural Systems’, *Science* 317, 2007, pp. 1513-6.

20. Non-Timber Forest Products in the Global Context, 2011, op. cit.; W. Dijkman, R.G.A.B. And and P.A. Zuidema, Dynamics and Sustainability of Non-Timber Forest Products Extraction, 1995 (details??).

21. See B. Belcher et. al., 2005 for details.

gests that harvest declines as rural households become more integrated into wider markets, and alternative products or production means are found for NTFP.²⁸

We belabour the obvious in saying that the future of the NTFP debate – indeed its very existence – is unpredictable. But, could NTFP provide a means for some rural households to withstand economic uncertainties while the next generation transitions to the modern economy? We don't know for sure, but in the interim site-specific ecological knowledge, especially long-term monitoring is imperative to determine ecological viability of harvest. Alongside, it may be necessary to have harvest rules and monitoring mechanisms. Whether such rules and mechanisms to regulate harvest are best created and implemented by local harvesters alone, or in conjunction with governmental agencies, NGO intermediaries, public-private partnerships, or a combination of these options, needs to be determined via dialogue between relevant actors.

Planning harvest practices as per assessments of ecological impacts from well designed studies of NTFP could provide an intersection for ecologists, forest managers, and local communities to work together. Indeed, robust, long-term data on consequences of NTFP harvest might provide the neutral discussion ground for advocates of both sides of the NTFP debate to discuss the merits and acknowledge the fallacies of their respective positions. Future dialogues based on information, rather than ideology alone, would provide more fruitful avenues to negotiate relevant policies for NTFP harvest.

by Indigenous Peoples of the Ecuadorian Amazon', *Biological Conservation* 182, 2015, pp. 270-277.

28. B. Belcher and K. Schreckenberg, 2007, op. cit., pp. 355-377.