Harvests shrinking? Challenges for sustainable harvesting of non-timber forest products

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Humans have lived in and around forests for tens of thousands of years and have been using forest to meet their daily requirements of food, shelter and even clothing. These include a number of forest products such as fruits, seeds, mushrooms, foliage, tubers, medicinal plants, spices, stem, bark, resins, oils, animals and birds including their fur and feathers, etc and these are often considered as non-timber forest produce (NTFP). These NTFP products were earlier popularly known as minor forest products, with timber being considered as a major produce. Over the years, these NTFP which were harvested for subsistence are now being harvested for meeting the livelihood requirements. In fact, the NTFP products support the livelihood of number of forest fringe and forest dwelling communities not only in India but across South-east Asia, Africa and many other parts of the world.

Why are NTFP's harvested?

A vast majority of the NTFP's harvested today are used locally by the communities that harvest them for food or for medicine or for construction (bamboo). Some of the NTFP's are sold in small amounts to others in the community or to outsiders who visit these forests and these provide small cash benefits to the local communities. These however, are never documented and seldom is known of their economic value or their contribution to the local economy. Some studies suggest that more than one-third of NTFP's are consumed in local economies without actually entering the market. These NTFP's which are a source of subsistence as well as livelihood for over 100 million people, are often promoted as a win-win strategy to not only provide livelihood options to the forest dwelling and forest fringe communities but also as a means to conserve these forest resources (Shaanker et al 2004). However, there are few NTFP resources which are not harvested for subsistence but largely for meet the livelihood requirements.

In India, some of the NTFP products that are harvested on large scale include some medicinal plants, fruits such as amla (*Phyllanthus emblica* and *P. indofisheri*), tendu leaves (*Diospyros melanoxylon),* Shikakai (*Acacia concinna),* grasses for making brooms, honey, sal seeds (*Shorea robusta*), bamboos, rattans etc. Some of these high value NTFP products are controlled by the state governments which regulate their sale and trade. The states have over the years,

ensured large scale profits from these NTFP resources often at the cost of the local collectors (who are often paid only for their labor) and at the cost of sustainability of these resources.

The pods of *Parkia*, one of the important NTFP species being sold in the Imphal market by the local communities

Does large-scale harvesting impact NTFPs?

Many NTFP species which were harvested sustainably in the past (for subsistence use) have over the years harvested in large quantities largely to meet the market demand. In recent years, there have been a number of studies that have reported both for and against such large-scale harvesting on the ecological impacts as well as on the sustainability of these NTFP resources. While one side, overharvesting of some NTFP species have resulted in many of the species becoming endangered in the wild. For example, many populations of medicinally important plant species such as Ashoka (*Saraca asoca*), *Coccinium fenestratum* etc have become locally extinct. The bark and wood of the Ashoka tree is widely used for a number of ailments and hence is harvested destructively from the forests. Extensive harvesting of the bark results in the death of the tree and hence, many populations in western Ghats, there is complete lack of adult trees as they are stripped of their bark.

On the other side, some NTFP species are over-managed, resulting in plantation type areas where other non-NTFP species are cleared. For example, many Tendu plantations are cleared of other vegetation thereby making them less bio-diverse than the natural forests. The tendu leaves (*Diospyros melanoxylon*) which are used for wrapping tobacco for making bidis, not only provides livelihood for a large number of people but also fetches a huge royalty for the Governments. With more revenues coming for the Government, there has been more pressure to increase the areas under tendu plantation. Similarly, the bamboo and rattan plantations in Western Ghats, have become monoculture plantations resulting in reduced biodiversity in these regions. Commercial extraction of NTFP species, thus could have serious consequences on the population of the species both at the ecological as well as at the genetic level.

Populations of many important species such as Ashoka tree (*Saraca asoca*, above picture) have become locally extinct

What are the ecological impacts of harvesting?

The shift in harvesting of NTFP's from subsistence level to a large-scale commercial level has had significant impacts on these NTFP resources. Commercial extraction of NTFP often involves larger volumes of harvest and often at higher frequency and intensity which disrupts the sustainability of these resources. Over harvesting can lead to reduction in population size of the species, could alter the population structure (with older individuals being eliminated from the population) and could lead to fragmentation and isolation of populations (Stanley et al 2012). While the impacts of harvesting may not be uniform across all the species harvested, species that are often harvested destructively are impacted the most. For example, species for which the reproductive parts are harvested (such as amla) or species for which the entire individual is harvested (in some rattan species), the harvesting could have severe impact. Even within species, the impact could be different. In case of rattans, there are single stemmed rattan (only a single stem) or multistemmed (a number of stems) arising from a single plant. In case, a single stem rattan is harvested, it would mean the death of that plant, while in case of multistemmed species, harvesting few stems would still enable the plants to bounce back. Harvesting non- reproductive parts such as resins and gums, bark, leaves etc too could affect the physiology, growth and reproduction of the species besides making the individual susceptible to pests and diseases. Harvesting resins or gums involves damaging the bark and making cuts on the stem of the tree from where the gums or resins ooze out. Making too many cuts would result in the plant being susceptible to fungal infections. The plant would also delay or advance its flowering due to the injury. However, as mentioned, the impacts are severe if the entire plant, bulbs, roots and the reproductive parts such as flowers and fruits are harvested. The most direct ecological impact of harvesting is its impact on the survival, growth and regeneration of the species. A number of studies have shown that overharvesting of fruits of Amla (*Phyllanthus emblica*) and Tare (*Terminalia bellerica*) have resulted in lower regeneration (new individuals growing from seed) of these species in the wild. Selective harvesting of large-sized fruits from only few individuals could also mean that these individuals may not regenerate and new seedlings will germinate only from individuals which bore either small sized or irregular shaped fruits. So, while natural selection prefers best individuals to

reproduce, harvesting best individuals would mean that only individuals discarded by harvesters are allowed to reproduce.

Overharvesting of Amla fruits (*Phyllanthus emblica*) could result in reduced regeneration of the species in the wild

What happens to the genetic diversity in case excessive harvesting is carried out?

Similarly, overharvesting can also lead to reduction in the genetic diversity (over the years) especially in species in which the reproductive parts are harvested. Genetic diversity is the basis for adaptability of a species to changing environment and to respond to various biotic stresses. Selective harvesting, reduction in population size and fragmentation of populations could lead to mating between closely related individuals leading to inbreeding depression in these small fragmented populations. Inbreeding depression is the reduced biological fitness of the offspring due to breeding between very close relatives. Poor fitness would result in that individual having very low immunity and could succumb to diseases and pests. Small population sizes could also reduce the number of pollinators and dispersers visiting these patches thereby reducing the geneflow and constraining the overall genetic diversity of the species further. Overharvesting thus could not only impact the individual but could also impact the population and could diminish the long-term survival of the species (Stanley et al 2012).

Does genetic diversity matter?

A decrease in genetic diversity could also endanger the ability of a species to survive in the ecosystem. Genetic diversity in a species could be reduced through a number of processes consequent to harvesting. For example, through a process often called as genetic drift where a chance disappearance of a particular individual harboring a unique or rare gene could result in change in the diversity of the species. For example, there are few individuals of a Jackfruit in Western Ghats which have a unique character of bearing fruits on the roots that come out of the soil. These can be easily harvested as they are close to the ground. However, their unique character has also made them prone to harvesting even before the fruits are matured. This pre-harvesting would result in immature seeds of this plant never to germinate resulting in this unique character being completely lost from the population. Similarly, disruption or

fragmentation of populations could lead to reduced gene flow or mating within the population. A highway, for example, cutting across a national park could separate individuals across and never allow the pollinators or dispersers to cross over resulting in isolation of individuals. Overtime, these small genetic changes in the population can have cascading effect and could result in altering the genetic configuration (or genetic identity) of the populations.

Can NTFP harvesting be banned?

In India, collection of NTFP products supports significant part of the livelihood of scores of forest dwelling and forest fringe communities. In fact, some recent estimates report that 100-250 million people in India, depend on the NTFP resources for meeting either their subsistence requirement of food and shelter or for their livelihoods (Shahabuddin, and Prasad. 2004). Besides, these NTFP species provide these communities food and nutritional security especially in the times of agricultural distress. In fact, many NTFP species are harvested to meet specific nutritional requirement of women and children especially during pregnancy and child birth. Similarly, a number of medicinal plants are used by the communities and local healers to treat various ailments. Studies have also shown that involving communities in utilizing these NTFP resources also ensures that resources are adequately conserved. Thus, it is clear that banning harvest is not the solution and promoting ecologically sustainable NTFP harvest as a win-win strategy to meet both the livelihood needs as well as sustainable goals should be championed.

NTFP species supports the livelihood of number of forest dwelling communities

What is sustainable harvest?

A number of definitions exist; but sustainable harvest involves harvesting at a rate not exceeding the natural rate of a species to regenerate in the landscape. In other words, harvesting should not jeopardize the ability of the species to maintain in the ecosystem. This definition,

however, does not take into account the fact that harvesting deprives other fauna, which are dependent on these resources. It only takes into account the necessity of maintaining harvesting intensities that, least distorts the original population structure and the genetic diversity of the species. Sustainable harvest is akin to removing individuals at a rate much less than the species is able to reproduce. It is like a tiger eating one deer a week from a population of 100 deers, but the deer population gives birth to more than two individuals a week.

A number of NTFP species are harvested and sold locally for subsistence

How can harvesting be made sustainable?

This has been a million-dollar question among scientists, resource managers as well as policy makers over the last few decades as to which method or at what levels of harvest can be considered as ecologically sustainable. A number of parameters including harvesting volume (within plant and within population), harvesting time and season, frequency of harvest, harvesting parts and harvesting techniques need to be considered to develop sustainable harvesting methods (Ticktin 2004). A clear understanding of how harvesting impacts the population and alters the genetic diversity is needed to determine the sustainable harvesting limits of these important forest resources (Ravikanth and Setty 2017). Further, it would be important to understand the rate of growth (how much a plant can grow in a given time) and regeneration (how many can it multiply) of NTFP species, if different methods of harvest techniques are employed. Since a large number and different type of NTFP species are harvested, it is difficult to suggest one uniform method for sustainable harvest. Since different parts are harvested, there would be varying response of a species to recover. This again would depend on the varying environmental factors aiding recovery. Thus, it seems too complicated to suggest one uniform method. It is therefore important to consider the needs of the

communities depending on these NTFP resources, the species per se as well as the need and ease of monitoring the species.

What are the specific plans for sustainable harvesting?

The specific plan for sustainable harvesting of NTFP species requires monitoring the health of the harvested species both at the individual level as well as at the population level. The population health is ensured by ensuring adequate regeneration of the populations. One of the challenges in ensuring adequate regeneration especially when reproductive parts such as fruits and/or seeds are harvested is to ensure systematic rotations. The other option is to ensure that some percentage of the resource is left untouched. This could be accomplished either by harvesting only low hanging fruits or harvesting alternate years. However, this is difficult to implement unless communities are provided information and the necessary knowledge about the usefulness of such measures (Ravikanth and Setty. 2017). Similarly, large-scale cultivation and domestication of over-exploited NTFP species, whose demand would continue to increase, could be systematically encouraged and promoted. The key challenge however would be to not only ensure the conservation of the genetic diversity of the NTFP species but also ensure the balance between the local livelihoods and ecological sustainability.

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