



THE UNIVERSITY OF TRANS-DISCIPLINARY  
HEALTH SCIENCES & TECHNOLOGY



# Principles and practices of sustainable use and sustainable harvesting

*Contribution to Twenty Second Meeting of Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 22) of the UN Convention on Biological Diversity (CBD)*



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# Principles and Practices of Sustainable Use and Sustainable Harvesting

Deepa G B, Jagannatha Rao R\*, Suresh H M, Arthur Selwyn Mark and Balakrishna Pisupati<sup>1</sup>

**Sustainable use is defined as “The use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations”**

Convention of Biological Diversity (CBD)<sup>2</sup>, 1992, Article 2

## 1. Introduction

Forty percent of the world's economy is based directly and indirectly on the use of biological resources<sup>3</sup>. Availability of natural resources for the future generation depends on the current harvesting and usage patterns, and impact of such activities on the species survival and functioning of ecosystems. Thus, sustainable use forms the basis to realize intergenerational equity.

In the recent past, human-linked activities have led to fast degradation of habitats. Over-exploitation, unscientific and unsustainable use of biodiversity and its components have led to the loss of species and habitats. Unsustainable harvesting of plant species is one of the major causes for decline in their population. It has been estimated that around one fifth of the global plant species are under threat category<sup>4,5</sup>. According to International Union for Conservation of Nature (IUCN) Red List database, more animal and plant species are pushed towards threat category in developing countries. In Ecuador alone, around 2,358 species are recorded as threatened based on IUCN Red List Version 2017-1, which is highest in the world<sup>6</sup>. Scientists estimate that dozens of plant and animal species are going extinct every day and the extinction rate is 1000 - 10000 times higher than the natural extinction rate<sup>7</sup>.



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<sup>2</sup> <https://www.cbd.int/doc/legal/cbd-en.pdf> (Accessed on 7<sup>th</sup> July 2017)

<sup>3</sup> [www.cbd.int/sustainable/](http://www.cbd.int/sustainable/) (Accessed on 5<sup>th</sup> August 2017)

<sup>4</sup> Sharrock S. 2011. Global Strategy for Plant Conservation (GSPC). Botanic Gardens Conservation International, UK. P 6.

<sup>5</sup> IUCN. 2010. Plants under Pressure: A global assessment. IUCN Sampled Red List Index for Plants. Royal Botanic Gardens. Kew, UK.

<sup>6</sup> [www.iucnredlist.org](http://www.iucnredlist.org) (Accessed on 7<sup>th</sup> August 2017)

<sup>7</sup> Chivian, E. and A. Bernstein (eds.) 2008. Sustaining life: How human health depends on biodiversity. Center for Health and the Global Environment. Oxford University Press, New York.

Sustainable use is one of the most effective tools to protect and conserve biological resources. The experience gained from sustainable use can be applied to all biodiversity components such as agriculture, fisheries, forestry, tourism, water management and other sectors. Therefore, utmost importance is given to sustainable use of biodiversity at ecosystem level with landscape management as it is linked to health and livelihoods of the current and future of mankind.

The Convention on Biological Diversity (CBD) identified the need for sustainable use of biological resources as one of its three over-arching objectives and provided definition for it. Prior to CBD, the Convention on International Trade on Endangered Species (CITES) in 1975 concentrated extensively on regulating the international trade of endangered and threatened species for protecting them from extinction. The CITES Strategic Vision 2008-2020 focuses on sustainable use of flora and fauna<sup>8</sup>. The ecosystem approach is one of the significant tools and strategies for the holistic management of natural resources (land, water and bio resources) that promotes conservation and sustainable use. With its twelve principles, it focuses on adaptive management of ecosystem and its functions<sup>9</sup>. It recognizes that humans, with their cultural diversity, are an essential element of ecosystems.



<sup>8</sup> [www.cites.org](http://www.cites.org) (Accessed on 5<sup>th</sup> July 2017)

<sup>9</sup> Secretariat of the Convention on Biological Diversity. 2004. The Ecosystem Approach, (CBD Guidelines) Montreal: Secretariat of the Convention on Biological Diversity 50 p.

## 2 The Addis Ababa Principles

In 2004, the Conference of Parties to CBD met in Addis Ababa, Ethiopia to articulate general guidelines and principles that were adapted as 'The Addis Ababa Principles and Guidelines for Sustainable Use of Biodiversity' that consists of fourteen interdependent principles and methods for implementation of these principles (see Box 1).

### Box 1: Addis Ababa Principles and Guidelines for Sustainable Use of Biological Diversity:

- Principle 1** Supportive policies, laws, and institutions are in place at all levels of governance and there are effective linkages between these levels.
- Principle 2** Recognizing the need for a governing framework consistent with international national laws, local users of biodiversity components should be sufficiently empowered and supported by rights to be responsible and accountable for use of the resources concerned.
- Principle 3** International, national policies, laws and regulations that distort markets which contribute to habitat degradation or otherwise generate perverse incentives that undermine conservation and sustainable use of biodiversity, should be identified and removed or mitigated.
- Principle 4** Adaptive management should be practiced, based on:
- Science and traditional and local knowledge;
  - Iterative, timely and transparent feedback derived from monitoring the use, environmental, socio-economic impacts, and the status of the resource being used;
  - Adjusting management based on timely feedback from the monitoring procedures.
- Principle 5** Sustainable use management goals and practices should avoid or minimize adverse impacts on ecosystem services, structure and functions as well as other components of ecosystems.
- Principle 6** Interdisciplinary research into all aspects of the use and conservation of biological diversity should be promoted and supported.
- Principle 7** The spatial and temporal scale of management should be compatible with the ecological and socio-economic scales of the use and its impact.
- Principle 8** There should be arrangements for international cooperation where multinational decision-making and coordination are needed.
- Principle 9** An interdisciplinary, participatory approach should be applied at the appropriate levels of management and governance related to the use.
- Principle 10** International, national policies should take into account:
- Current and potential values derived from the use of biological diversity;
  - Intrinsic and other non-economic values of biological diversity and
  - Market forces affecting the values and use.
- Principle 11** Users of biodiversity components should seek to minimize waste and adverse environmental impact and optimize benefits from uses.
- Principle 12** The needs of indigenous and local communities who live with and are affected by the use and conservation of biological diversity, along with their contributions to its conservation and sustainable use, should be reflected in the equitable distribution of the benefits from the use of those resources.
- Principle 13** The costs of management and conservation of biological diversity should be internalized within the area of management and reflected in the distribution of the benefits from the use.
- Principle 14** Education and public awareness programs on conservation and sustainable use should be implemented and more effective methods of communications should be developed between and among stakeholders and managers.



They also highlight the importance of adaptive management and education for ensuring sustainability in use of biological resources. The principles consider legal, economic and social processes<sup>10</sup>.

In addition, several regional and global initiatives provided guidance to countries and stakeholders on sustainable use and sustainable management of biological resources and ecosystem goods and services. Some of the significant ones include the Satoyama initiative which is a global initiative that promotes conservation and the sustainable use of biodiversity<sup>11</sup>. This initiative highlights on landscape level approach for maintaining and rebuilding human influenced natural ecosystem through sustainable utilization to prevent long term decline of biodiversity. The Aichi biodiversity targets adopted in 2010 by the parties to CBD also focus on sustainable use through goal B and target 7. The National Biodiversity Strategies and Action Plans (NBSAPs) also recognize the need to focus on sustainable use of biological diversity<sup>12</sup>.

In 2007, IUCN, German Federal Agency for Nature Conservation (BfN), TRAFFIC International and WWF framed principles, which are known as International Standard for Sustainable wild Collection of Medicinal and Aromatic Plants (ISSC-MAP)<sup>13</sup>. The Standards provide guidelines and tools to collectors, producers and decision makers for the planning and implementation of a sustainable resource management system based on the Good Agricultural and Collection Practices (GACP) (Box 2). Fair trade version 1.0, 2006 focused on relation between collectors and buying company, and introduced the concept of fair trade to the wild plant collection<sup>14</sup>. In 2010, a comprehensive standard Fairwild standards (Version 2.0) was developed combining the guiding principles of ISSC-MAP and Fairwild Standards (Ver 1.0, 2006) by including elements such as fair trade and certification<sup>15</sup> (See Box 3). The University of Trans Disciplinary Health Sciences and Technology (TDU) formerly known as Foundation for Revitalisation of Local Health Traditions (FRLHT) was one of the members in the advisory board for drafting ISSC-MAP and field testing of the standard in 2007 (Box 4).

IUCN has exclusively formed a Specialist Group on Sustainable Use and Livelihoods to promote conservation and livelihoods through enhancing equitable and sustainable use of wild species and their associated ecosystems.

<sup>10</sup> Secretariat of the Convention on Biological Diversity. 2004. Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity (CBD Guidelines) Montreal: Secretariat of the Convention on Biological Diversity 21 p.

<sup>11</sup> [www.cbd.int/sustainable/bestpractices/](http://www.cbd.int/sustainable/bestpractices/) (Accessed on 7<sup>th</sup> July 2017)

<sup>12</sup> [www.cbd.int/nbsap/](http://www.cbd.int/nbsap/) (Accessed on 7<sup>th</sup> July 2017)

<sup>13</sup> Medicinal Plant Specialist Group. 2007. *International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP)*. Version 1.0. Bundesamt für Naturschutz (BfN), MPSPG/SSC/IUCN, WWF Germany, and TRAFFIC, Bonn, Gland, Frankfurt, and Cambridge (BfN-Skripten 195).

<sup>14</sup> [www.imo.ch](http://www.imo.ch) (Accessed on 29<sup>th</sup> December 2017)

<sup>15</sup> [www.fairwild.org](http://www.fairwild.org) (Accessed on 5<sup>th</sup> August 2017)

**Box 2: International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP)**

**Principle 1: Maintaining Wild MAP Resources**

- 1.1 Conservation status of target species
- 1.2 Knowledge based collection practices
- 1.3 Collection intensity & species regeneration

**Principle 2: Preventing Negative Environmental Impacts**

- 2.1 Sensitive taxa and habitats
- 2.2 Habitat management

**Principle 3: Complying with Laws, Regulations and Agreements**

- 3.1 Tenure, management authority & use rights
- 3.2 Laws, regulations & administrative requirements

**Principle 4: Respecting Customary Rights**

- 4.1 Traditional use, access rights & cultural heritage
- 4.2 Benefit sharing

**Principle 5: Applying Responsible Management Practices**

- 5.1 Species/ area management plan
- 5.2 Inventory, assessment & monitoring
- 5.3 Transparency & participation
- 5.4 Documentation

**Principle 6: Applying Responsible Business Practices**

- 6.1 Market/ buyer specifications
- 6.2 Traceability
- 6.3 Financial viability
- 6.4 Training & capacity building
- 6.5 Worker safety & compensation

**Box 3: Principles of Fairwild standards (By merging ISSC-MAP and Fairwild Standards - Ver 1.0)**

**Wild Collection and Conservation requirements**

**Principle 1: Maintaining Wild Plant Resources**

- Conservation of target species
- Knowledge based collection practices
- Sustainability of collection rate

**Principle 2: Preventing Negative Environmental Impacts**

- Sensitive taxa and habitats
- Habitat (Landscape) management

**Legal and Ethical issues**

**Principle 3: Complying with Laws, Regulations and Agreements**

**Principle 4: Respecting Customary Rights and Benefit-Sharing**

**Relationship with collectors**

**Principle 5: Promoting Fair Contractual Relationships between Operators and Collectors**

**Principle 6: Limiting Participation of Children in Wild-Collection Activities**

**Principle 7: Ensuring Benefits for Collectors and their Communities**

*Box 3 continued...*

## **Fair labour conditions for workers in the collection company**

**Principle 8:** Ensuring Fair Working Conditions for all Workers of Wild-Collection Operations

### **Management and business practices**

**Principle 9:** Applying Responsible Management Practices

- Species/area management plan.
- Inventory, assessment and monitoring.
- Implementation of sustainable collection measures by collectors.
- Training and capacity building.
- Transparency and participation

**Principle 10:** Applying Responsible Business Practices

- Market/buyer specifications.
- Traceability
- Financial viability and accountable trade relations

**Obligation of Fairwild companies towards their suppliers and buyers as well as obligations of buyers (Importers and traders)**

**Principle 11:** Promoting Buyer Commitment

### **Box 4: Field implementation of ISSC-MAP in India**

The International Standard for Sustainable wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) with 6 principles and 18 criteria addressing ecological, social and economic requirements for sustainable wild collection of MAPs was field implemented in 6 countries, viz., India, Bosnia-Herzegovina, Nepal, Brazil, Lesotho and Cambodia under a project title “Saving the plants that saves livelihood”. In India, sustainable collection of 5 species (*Ailanthus triphysa*, *Piper nigrum*, *Salacia chinensis*, *Myristica dactyloides*, and *Coleus barbatus*) were undertaken at 4 sites, 2 sites in Karnataka by Foundation for Revitalisation of Local Health Traditions (FRLHT) and 2 in Uttarakhand by TRAFFIC, India. The experience in implementation of the guidelines and principles has resulted in case studies. These case studies have provided a lead in development of Fairwild Standards (Version 2.0).

### 3. Bushmeat and sustainable wildlife management

Bushmeat is defined as “the meat of wild animals harvested in tropical and sub-tropical countries for food and non-food purposes including medicinal use”<sup>16</sup>. Hunting wild animals for bushmeat is practiced in tropical Americas, Asia and Africa. According to the Center for International Forestry Research (CIFOR)<sup>17</sup>, approximately 5 million tonnes were still being consumed per year in the Congo Basin. Over 30 years of data shows that due to the shortage of fish supply, there is a decline in mammal populations of 41 wildlife species due to bushmeat as protein supplement<sup>18</sup>.

Hunting pressure on wild animal populations (mammals, reptiles, amphibians and birds) is increasing rapidly for the meat and contributes to unsustainable harvest of bushmeat. Protected areas which serve as breeding grounds for animal species are not effectively protected to allow regeneration of populations. This can lead to the disruption of ecological and evolutionary processes, changes in species composition within ecosystems and a general reduction in biological diversity, creating “empty forests”<sup>19</sup>.

Another major concern is that animal diseases can easily be transmitted to humans during hunting and preparing bushmeat for sale.

Efforts have been made to tackle the problems and challenges associated with bushmeat and solutions to address them by providing sustainable solutions so that long term food security for human populations is ensured and animal species are saved from extinction.

The CBD constituted a Liaison Group on Bushmeat and its first meeting was held in October 2009 to elaborate on national and international recommendations towards the sustainable use of bushmeat<sup>20</sup>.

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<sup>16</sup> Secretariat of the Convention on Biological Diversity. 2011. Livelihood alternatives for the unsustainable use of bushmeat. Report prepared for the CBD Bushmeat Liaison Group. Technical Series No. 60, Montreal, SCBD, 46 pages.

<sup>17</sup> <https://forestsnews.cifor.org/23924/ebola-and-bushmeat-in-africa-qa-with-leading-researcher?fnl=en>

<sup>18</sup> Brashares, J. S.; Arcese, P.; Sam, M. K.; Coppolillo, P. B.; Sinclair, A. R. E.; Balmford, A. (2004). "Bushmeat hunting, wildlife declines, and fish supply in West Africa". *Science* **306** (5699):1180-1183.

<sup>19</sup> Nasi, R., Brown, D., Wilkie, D., Bennett, E., Tutin, C., van Tol, G. and Christophersen, T. 2008. Conservation and use of wildlife-based resources: the bushmeat crisis. CBD Technical Series no.33

<sup>20</sup> The full report of the Bushmeat Liaison Group meeting is available at [www.cbd.int/doc/?meeting=LGB-01](http://www.cbd.int/doc/?meeting=LGB-01)

#### 4. Understanding Sustainable Use

Growing human population and the changing consumption patterns are posing a great threat to the biodiversity as there is increase in the consumption of resources. As the demand is growing, unsustainable and over exploitation of the resources is also rising to a level which will have irreversible effects. Box 5 provides the effects of trade on the populations of plants and animals and strategies for their conservation.

##### **Box 5: Trade and Conservation of components of biological diversity**

The plants and animals are threatened due to international trade for the live or parts such as meat, skin, fibre, claws, horns, bones, ivory, roots, flowers and so on that poses high value as food, ornamental, medicinal and others. Trade of wildlife or biodiversity components is rampant in Asian, African and South American countries. Whale meat is a delicacy in many countries. Poaching the whales for meat is one of the major reasons for the decline in number of various species of whale. Rhinos are hunted for the horns that are very valuable, the black rhinos are classified as endangered species. Elephants are poached for meat, bones and ivory. Many fur-bearing animals, like cheetah, tiger, Tibetan antelope, vicuna, lemur and others have decreased to very low levels due to hunting for their furs, which are in high demand and fetch huge prices in the international market.

Several valuable plant species, like Taxus, Ginseng, West Indian mahogany, Berberis have reduced to a very small numbers. Collectors have depleted many orchids in the wild to a critical level, and many fish and birds have been threatened by unrestricted hunting for the pet trade.

The main objective of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is to ensure that trade will not cause the extinction of plant or animal species. The appendices of CITES are periodically revised.

*In situ* conservation strategies for conservation of wild plants and animals have been attempted and are successful. Sustainable use of the biodiversity can contribute to the conservation of flora and fauna. Cultivation and domestication also help in conservation, as these strategies reduce pressure on wild species. Economic incentives help in conservation and sustainable use, as in the case of vicuna, NTFP extraction and wildlife tourism/ ecotourism.

Article 10 of the CBD mandates all the Parties to take suitable measures to deal with sustainable use. Accordingly, all the six national reports prepared by the Parties for consideration by the Conference of Parties (COP) report on actions related to sustainable use. In addition, the NBSAPs also refer to country specific sustainable use related action, albeit with not of detail of what the actions are the impacts of such actions thus far. In spite of all these unsustainable uses and over exploitation of resources pose major threats to all areas of biodiversity. Some of the common ways by which Parties are currently addressing the issue of sustainable use include, organic farming and growing crops that are not water intense in agriculture, sustainable harvesting practices and certification in forestry, setting

quotas in fisheries, sustainable wildlife management through wildlife tourism that are all leading to conservation and sustainable use as well as provide livelihood opportunities to the local communities in the long term.

However, compared to the focus that the conservation and access and benefit sharing objectives of the CBD, the sustainable use objective is still receiving very limited support, both at policy and practice levels. One of the key reasons is the lack of species and/or ecosystem specific principles and guidelines

## 5. Strengthening the sustainable use agenda of biodiversity under CBD

Decision II/7 of second meeting of the Conference of the Parties (CoP 2) to the CBD took into consideration Articles 6 and 8 of the CBD that was further strengthened by Decision III/9 of CoP 3. This called for development for national strategies and action plans, and also emphasised on the importance of capacity building and financial resources for implementation of articles 6 and 8. The Decision also urged the parties to set measurable targets to achieve conservation and sustainable use of biological diversity.

Decision IV/4 of CoP 4 highlighted the need for conservation and sustainable use of inland water ecosystems and requested the parties to develop and implement sectoral and cross sectoral plans for conservation and sustainable use of biological diversity of inland water ecosystems. Some of the important recommendations were to undertake valuation of inland water biodiversity, and establishment and implementation of appropriate laws and policies to support conservation and sustainable use of inland waters biological diversity.

Decision V/6 of CoP 5, adopted the ecosystem approach as the primary framework for action. This strategy promotes conservation and sustainable use in an equitable way by integrated management of land, water and bio-resources. In April 2002, the CBD adopted the Global Strategy for Plant Conservation (GSPC) which provides a policy environment by setting targets for addressing conservation and sustainable use of plant diversity. Decision V/24 recognised sustainable use of biological diversity as a cross-cutting issue.

Decision VI/13 of CoP 6 recognised the challenges of sustainable use of biodiversity in balancing the needs of livelihood of communities and conservation of resources. This decision also appreciated the vital role played by women in conservation and sustainable use of biological diversity.

The Addis Ababa Guidelines and Principles for Sustainable Use of Biodiversity were adapted at the CoP 7 through decision VII/12. Emphasis was made to identify links between the Addis Ababa guidelines and the ecosystem approach. The need for more elaborations on domesticated species, breeds and varieties were ascertained. In the context of sustainable use was also highlighted through this Decision.

Decision VIII/21 of CoP 8 recognised the importance of marine and coastal biodiversity, and conservation and sustainable use of deep sea bed genetic resources beyond the limits of national jurisdiction. It emphasised on building capacities related to deep sea bed biodiversity, promotion of scientific and technical cooperation, technology transfer and exchange of information.

The recommendations from the Liaison Group on Bushmeat for the conservation and sustainable use of bushmeat were endorsed for implementation through the Decision X/32 of CoP 10.

Decision XI/ 11 of CoP 11 discussed new and emerging issues related to conservation and sustainable use of biodiversity such as the impacts of organisms and products resulting from synthetic biology techniques that may have impacts on the conservation and sustainable use of biological diversity. Decision XI/14 recognized the importance of implementation of sustainable use including customary sustainable use in achieving the Aichi Biodiversity Targets and the Strategic Plan for Biodiversity 2011-2020. Effective sustainable wildlife management by customary sustainable use was recognised in Decisions XI/ 25.

In spite of all the Decisions and related implementation actions, key challenge to deal with implementation remain in the form of need to develop specific set of critical indicators for monitoring of sustainable use in each of the sector at the local, regional and global levels.

## 6. Dealing with Sustainable Use

Based on more than fifteen years of field work undertaken, it is now proposed to establish a set of principles for field-based sustainable harvesting and use actions in the realm of flora. The following section provides relevant details in this regard.

The basic idea behind sustainable harvesting is that a biological resource should be harvested within the limits of its capacity for self-renewal. In addition, the manner of its harvest should not degrade the environment in any ways<sup>21</sup>. The simplest definition for sustainable harvesting can be the use of plant resources at the levels of harvesting in such a way that the plants are able to continue to supply indefinitely<sup>22</sup>, which places an emphasis on maintenance of species population in the wild irrespective of high demand from all over the world. It is important to conserve the populations of many commercially exploited species in the wild, which face the threat of going culturally, ecologically and commercially extinct.

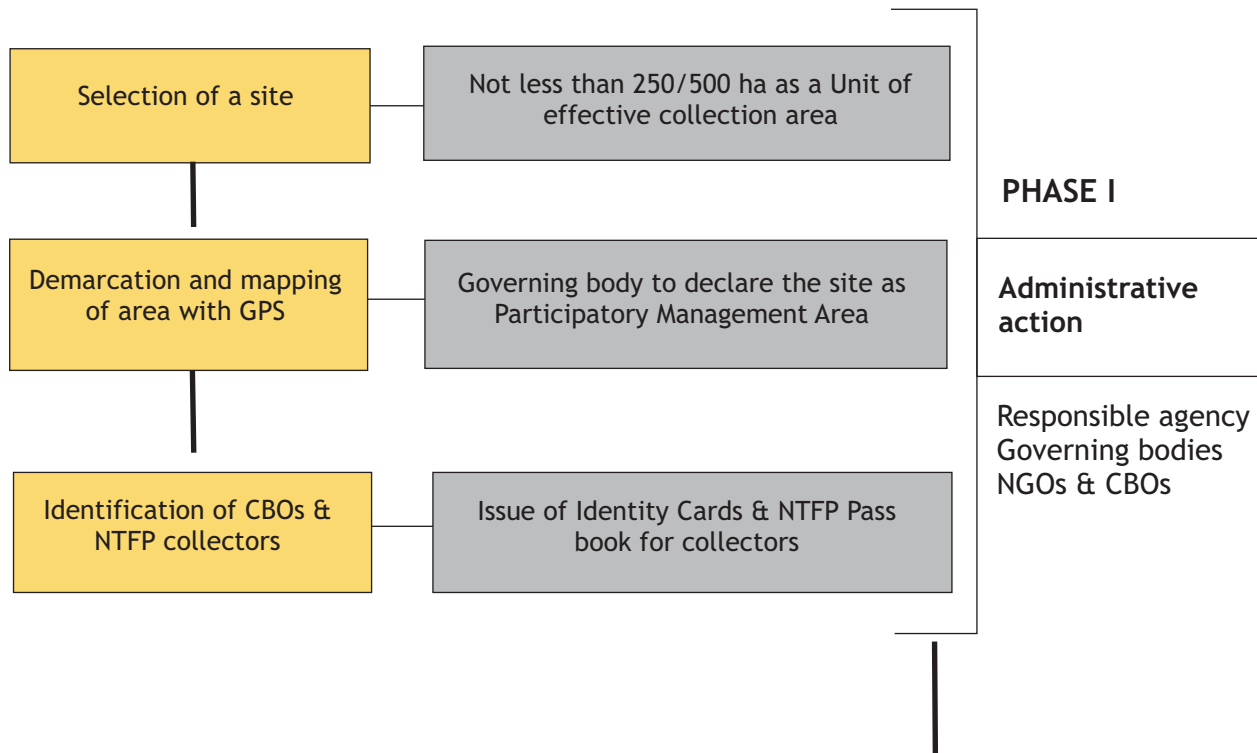
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<sup>21</sup> Hamilton, A. 2005. Resource assessment for sustainable harvesting of medicinal plants. In: The International Botanical Congress (Vienna) on Source to Shelf: Sustainable Supply Chain Management of Medicinal and Aromatic Plants. 21-22 July 2005.

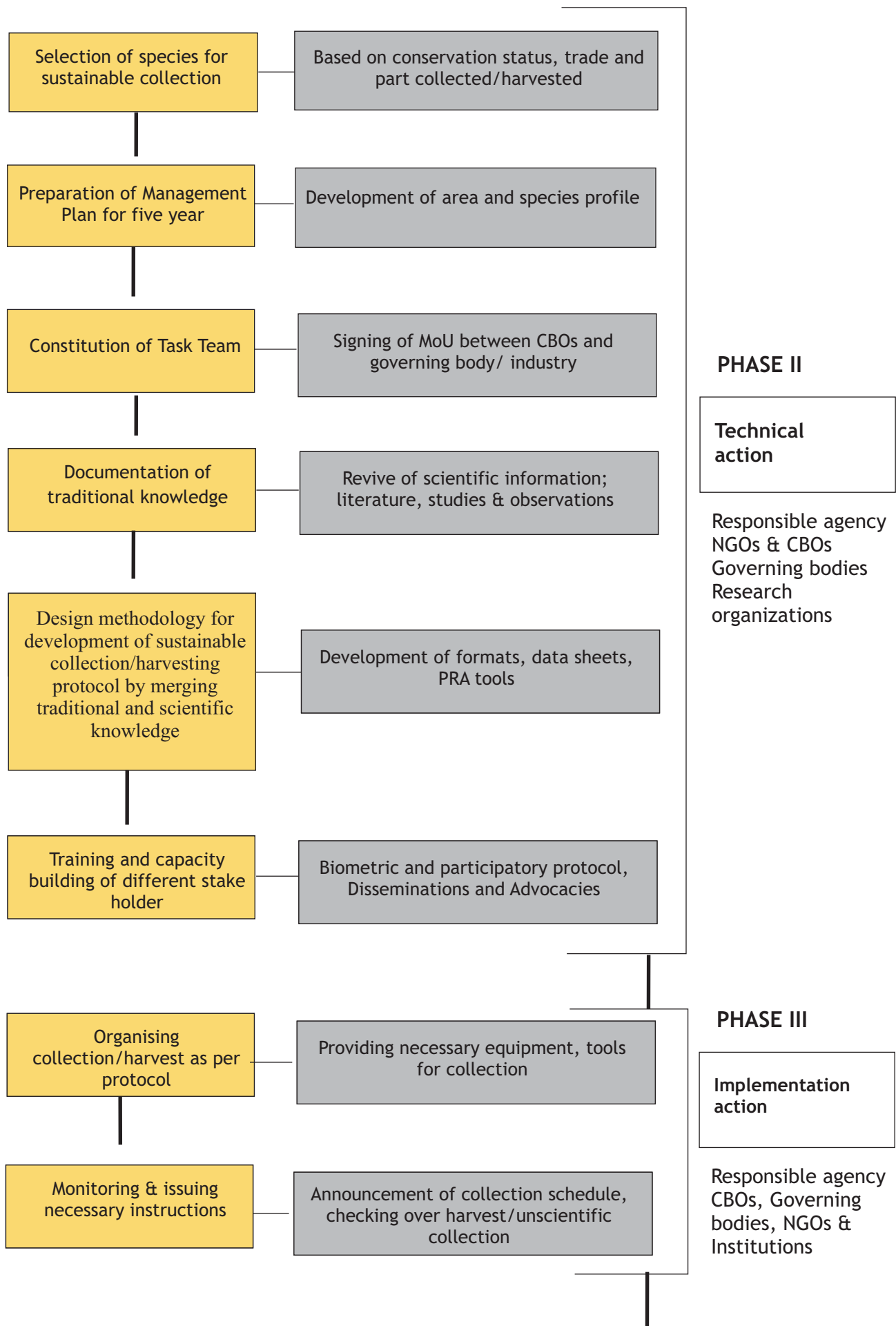
<sup>22</sup> Wong, J.L.G., Thornber, K. and Baker, N. 2001. Resource assessment of non-wood forest products. FAO. Rome, Italy.

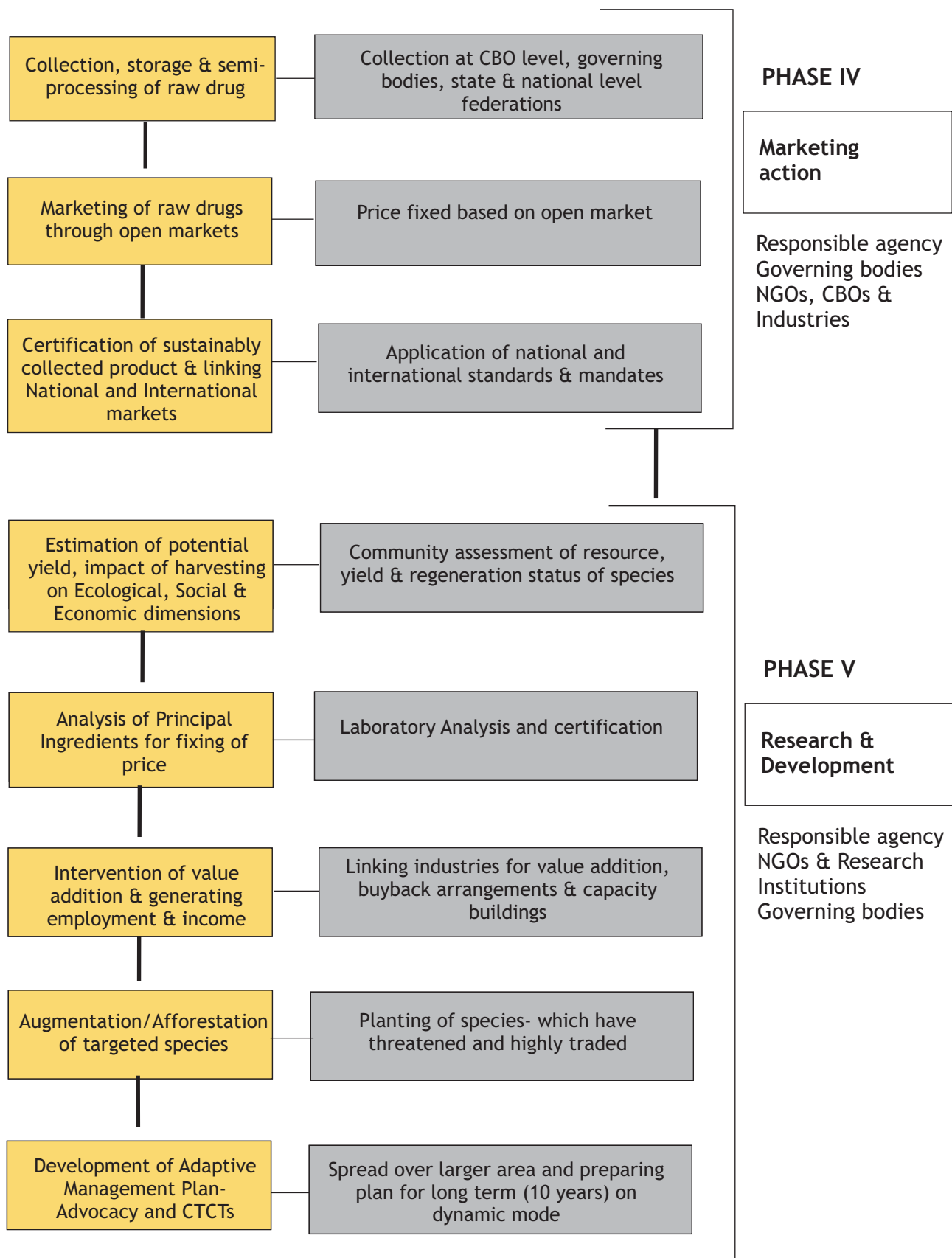
Through our field work we, till date, have developed species specific sustainable wild collection protocols for 48 species that are medicinally important for different parts harvested available within diverse geographical locations in India. The list of species is provided in annex 1. A separate publication is forthcoming on such species-specific protocols. The lessons learnt during the field implementation of sustainable harvesting methods have been consolidated and a five-phase implementation practice (Figure 1).

**Figure 1: Action Flow Chart for practicing sustainable harvesting of wild species**









## 7. Dissemination of best collection practices

Based on the field work and using the five-step process of harvesting, a number of training and capacity building programs for stakeholders on biometric and participatory protocols, resource assessment, resource augmentation, formation of cooperatives and monitoring impacts were undertaken. The participatory approaches for sustainable harvesting of NTFPs was designed, developed and field implemented. (See Box 6)

### **Box 6: Participatory sustainable harvesting of NTFPs, an initiative of TDU**

Non Timber Forest Products (NTFPs), more particularly those of medicinal value, are among major sources contributing to economic development of local communities. These also play a major role in upliftment, enhancement of cultural life style and healthcare of tribal and rural people. A large number of local communities rely upon forest products for bonafide use and commercial purpose to generate livelihood. The value chain of NTFP involves different stakeholders who operate from collection of resources from wild to the end consumers of the medicines and other finished products. Rural populations harvest NTFPs for livelihood, socio-economic and cultural purposes, traders for value addition and sale, while end users use them for medicinal, spices, cosmetic and nutraceutical.

Ever increasing demand for NTFPs has put a great pressure on the resources. Around 80% of export raw material from India comprise dried plants, extracts and isolated ingredients, and rest of the exports are finished medicinal products such as homeopathic and ayurvedic medicines. There is a potential to further processing and value addition of raw materials, there by generating employment to the rural poor.

The situation has been further aggravated by destructive and unsustainable harvesting and inefficient trade practices. The impact of these practices has been relatively less understood and there is a general lack of strategies for achieving sustainability in collection and conservation.

Unscientific collections from wild had led to the threat of extinction and suffer severe genetic loss in the wild. There is an urgent need to frame a strategy for an appropriate management of NTFPs/ medicinal plants growing under widely varying habitat conditions in the country to meet the local needs and also to maintain the biodiversity. Sustainable harvesting can improve the livelihoods of people through supplementary income and employment. All this can and should happen with active involvement of the local people with the cooperation of all relevant stakeholders of the sector.

Complex system of sustainable harvesting, processing and trade have always been hard to understand without standard methods and models and has been a challenge in introducing transparency in marketing, proper quality control and standardisation.

The issues related to uncertainty in developing sustainable harvest methodologies such as local knowledge, tenure rights, empowerment and autonomy to local institution, institutional capacity, political system affecting the equity and resource access, market policy, trade linkages, etc., need to be taken care through a well-developed and operationalised adaptive management strategy.

A decade and a half back, TDU (Formerly Foundation for Revitalisation of Local Health Traditions - FRLHT) recognised the global concern on sustainable use of wild medicinal NTFP resources and initiated designing methodology for participatory sustainable harvesting.

*Box 6 continued...*

TDU initiated the development of multi-dimensional, participatory, scientific and institutional framework for participatory approach for sustainable harvesting of NTFPs, the rationale behind designing methodology for sustainable harvesting of medicinal NTFPs through participatory approach emerges from the fact that there is an immense traditional knowledge with the local people about best practices and methods for sustainable harvesting of quality products. In this context, a methodology for designing participatory management and planning a sustainable harvest of medicinal NTFPs has been taken-up in India.

This framework provides for a decision-making matrix for sustainable management, which emphasises on optimisation of quality of produce as well than only on quantity of produce, since sustainable harvesting is a function of quantity and quality. While the quantity is a function of biological/ ecological potential, the quality reflects the economic concerns.

In India, initially with Oxford University and Department for International Development (DFID), developed participatory science for planning methodology and field implementation for sustainable harvesting of 6 species viz., *Decalepis hamiltonii*, *Limonia acidissima*, *Gymnema sylvestre*, *Cinnamomum malabattrum*, *Garcinia gummi-gutta* and *Vateria indica*. Following this, “National Programme on Promoting Conservation of Medicinal Plants and Traditional Knowledge for Enhancing Health and Livelihood Security” supported by United Nations Development Program (UNDP) and Ministry of Environment, Forests and Climate Change, Government of India, where sustainable harvesting practices for 17 species were developed. Later to this, the concept and field implementation of sustainable harvesting of 11 species was developed under Global Environment Facility (GEF) supported program on “Mainstreaming conservation and sustainable use of medicinal plants in three Indian states”.

The National Medicinal Plants Board (NMPB), Government of India has recognized the efforts and wide spread the lessons learned to various states in India under the central scheme of “Sustainable collection, value addition, ware housing and marketing of RET and high traded medicinal plants”. TDU is playing a vital role in developing sustainable harvesting techniques for species of conservation concern and high traded in the states of Karnataka, Kerala, Nagaland, Tripura and Manipur.

## 8. Principles of sustainable harvesting

The following are a set of principles that were developed using the above framework, complimenting the already available guidelines and other frameworks.

### **Principle 1: Resource mapping, estimation and value analyses**

*This principle enables the local community to understand the availability of resources, potential quantity that can be harvested, their conditions in the wild and impacts of destructive harvesting. Further, it also provides for understanding the value of products harvested through value chain and the benefits realised by the different stakeholders involved and their roles and responsibilities in conservation of resources.*

Through this Principle, involve the local community in estimation of resources, preparation of resource map and value chain assessment. They should also observe business as usual approaches, impacts of destructive harvesting and existing value chains. Such actions enable them to develop alternative value chain models along with sustainable harvesting of selected species to prepare participatory management plan for its execution on the basis of adaptive management strategy.

**Principle 2: Participatory approach involving local community in conservation**

*Participatory approach integrates people of different socio-economic status, establish a need based and objective oriented local institution, thereby identifying roles and responsibilities, their dependency on the resource and their contribution towards conservation and sustainable use of wild resources.*

This principle enables the local community in the identification and selection of species and site for sustainable collection based on the criteria and, planning the methodology for sustainable harvesting by considering the traditional knowledge. The criteria for selection of species include: (a) species providing higher livelihood opportunities so that the local community takes responsibility in sustainable management of the resource; (b) highly traded species; (c) species with different parts harvested; (d) species collected only from wild; (e) endemic species.

**Principle 3: Documentation, assimilation and application of traditional harvesting knowledge**

*Documentation of indigenous knowledge related to phenology of the species, distribution, climate and productivity, animal interaction, regeneration, propagation, cultural and spiritual relevance, building local and species profile, medicinal values and traditional uses, harvesting patterns and processing.*

This principle helps the local people for documentation of traditional knowledge related to harvesting practices, ensuring customary rights of forest dwellers by involving them only without external labour forces, merging scientific information with traditional knowledge to develop good harvesting practices, and recognising the association between community and the resources.

**Principle 4: Development of sustainable harvesting protocols, tools and field implementation**

*To evolve species specific and location specific sustainable harvesting practices/ good collection practices/ best practices by consulting traditional knowledge and academic knowledge, that will be implemented in the field by establishing institutional mechanisms.*

This principle enables to develop species specific sustainable harvesting practices (SHPs) which are comprehensive and holistic that has ecological understanding of species, its collection, value addition and marketing.

**4.1 Development of sustainable harvesting protocols:** The components of SHP include species and location profile, distribution, phenology, morphology, threat status, medicinal uses, propagation technique, resource assessment, good collection practices and post harvesting technique. Five core elements of sustainable harvesting framework are: (i) What to collect (part harvested)? (ii) What stage to collect (quality)? (iii) When to collect (season and frequency)? (iv) How to collect (method of harvest)? and (v) How much to collect (quantity)? (see Figure 2)

Figure 2: Elements for sustainable harvesting framework



**4.2 Institutionalization:** Field implementation of sustainable collection methods requires the participation of the local community. Enabling the local community-based organizations (CBO) to involve in planning, field execution of sustainable harvesting and monitoring socio-economic and ecological impacts of harvesting, thereby reconsider the Decision-Making Matrix (DMM) under adaptive management strategy.

**4.2.1 Memorandum of Understanding (MoU):** The CBO can enter MoU with governing body such as Forest Department or local Forest Management Committee for their mutual roles and responsibilities to be exercised by ensuring the participation of other stakeholders viz., traders, self-help groups, Biodiversity Management Committee (BMC) members, local administrative bodies and industries. This brings transparency in the process where different stakeholders are involved. MoU is also signed between resource/ knowledge providers (individuals and/ or group) and the user of such resources for sharing the benefits arising from the use of bio-resources and related knowledge.

**4.2.2 Identification and registration of collectors:** The CBO will ensure identification and registration of local collectors, undertake the capacity building, issue identity cards, organize collection, post harvesting interventions, marketing and benefit sharing.

**4.2.3 Task Team:** A multi stakeholder *task team* representing the intergeneration and gender equity, which undertakes resource assessment, implementation of sustainable harvesting techniques and monitor impacts of sustainable harvesting of resources. The activities of the task team are guided and monitored by the BMCs and/ or local forest management committees.

**Principle 5: Training, Capacity building and dissemination**

*This principle describes various dissemination and capacity building programs for different stakeholder groups involved in the process. They are designed to develop and enhance the adaption of sustainable harvesting methodology.*

The importance of developing a communication strategy for different stakeholder groups engaged in the process is critically important. This enables sharing of information of methodology and its achievements to seek their suggestions in order to reconsider the adaptive management strategy. Interpersonal communication is useful at the local community level where as other stakeholders can be effectively reached through group/ mass communication.

**Principle 6: Interventions for post harvesting techniques and market linkages**

*Post harvesting techniques such as drying, storage, value addition, labelling and branding fetch higher price in the market, also generate additional income and employment to the local people. Value added products linked directly to the herbal industries to ensure supply of quality raw material and provide health security. Marketing is an important intervention for sustainably harvested produces, as this is the only available economic incentive to the stakeholders that compensates for their involvement in the sustainable collection activities.*

Need assessment for post harvesting techniques has to be undertaken and species-specific protocols can be developed based on the market requirement.

The economic value chain involves multiple actors from collection to the industry/ end product. To maximise the economic benefits to the grass root level stakeholders (collectors), direct linkage with the industry is essential. As industry is the ultimate stakeholder of this sector, it can be engaged directly in the value chain to exercise the roles and responsibilities in conservation, resource augmentation, utilisation and monitoring.

**Principle 7: Linking trade, price and conservation principles and practices**

*It is to integrate stakeholders having different roles and responsibilities in the value chain of the resource collection, value addition and marketing. The idea is to directly link the primary stakeholders (collectors and village level institutions) from the resource base into marketing and trade of sustainably collected resources by assimilating possible value addition technologies at the local level to generate additional income and employment, thereby encouraging and enhancing the participation of stakeholders in conservation of resources. The capacity of the primary stakeholders is built on negotiation on price fixing and benefit sharing.*

Enhancement of skills of different stakeholders on the importance of sustainable harvesting, post harvesting techniques, marketing and certification improves the economic value chain and the economic incentives directly reaches the primary stakeholders and the dependent community. Certification of the sustainably harvested produces is one of the important aspects to fetch higher prices at national and international markets. Price fixing and benefit sharing is another crucial area in the trade of natural resources. Empowering the local dependent community on these issues will provide good economic benefits to them, thereby aiding in conservation of the resources. As the proverb '*Nature pays so it stays*' goes, sustainable harvesting provides livelihood by offering additional employment and income, so conservation of resources is taken care for long term use by the current and future generations.

**9. Linking principles and practices for sustainable harvesting with international mandates**

The principles and practices for sustainable use and sustainable harvesting of biological components that are presented here are relevant to different international guidelines and targets. These principles can prove to be useful tool to support delivery of goals and targets of international agreements. These details are provided as follows.



**Table 1: Comparing the principle and practices on sustainable harvesting that support the international guidelines**

Sl. No.	Global conventions/ guidelines/ targets	New principles
1.	<p><b>Convention on Biological Diversity (CBD)</b>            Article 7: Identification and monitoring of biodiversity conservation and sustainable use            Article 8(j): Traditional knowledge, innovations and practices            Article 10: Sustainable use of Biological components            Article 11: Incentives and measures            Article 12: Research and training            Article 13: Public education and awareness</p>	<p>Principle 1: Resource mapping, estimation and value analyses            Principle 3: Documentation, assimilation and application of traditional harvesting knowledge            Principle 4: Development of sustainable harvesting protocols, tools and field implementation            Principle 5: Training, capacity building and dissemination</p>
2.	<p><b>Global Strategy for Plant Conservation (GSPC)</b>            Objective III: Plant diversity is used in a sustainable and equitable manner            Targets 12: All wild harvested plant-based products sourced sustainably.            Target 13: Indigenous and local knowledge innovations and practices associated with plant resources maintained or increased, as appropriate, to support customary use, sustainable livelihoods, local food security and health care.</p>	<p>Principle 3: Documentation, assimilation and application of traditional harvesting knowledge            Principle 4: Development of sustainable harvesting protocols, tools and field implementation</p>
3.	<p><b>The Ecosystem Approach</b>            Principle 2: Management should be decentralized to the lowest appropriate level.            Principle 4: Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context.            Principle 10: The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.            Principle 11: The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.            Principle 12: The ecosystem approach should involve all relevant sectors of society and scientific disciplines.</p>	<p>Principle 3: Documentation, assimilation and application of traditional harvesting knowledge            Principle 4: Development of sustainable harvesting protocols, tools and field implementation            Principle 7: Linking trade, price and conservation principles and practices</p>

Sl. No.	Global conventions/ guidelines/ targets	New principles
4.	<p><b>Addis Ababa Principles and Guidelines for Sustainable Use of Biodiversity</b></p> <p>Principle 4: Adaptive management should be practiced, based on (a) Science and traditional and local knowledge, (b) Iterative, timely and transparent feedback derived from monitoring the use, environmental, socio-economic impacts, and the status of the resource being used; and (c) Adjusting management based on timely feedback from the monitoring procedures</p> <p>Principle 5: Sustainable use management goals and practices should avoid or minimize adverse impacts on ecosystem services, structure and functions as well as other components of ecosystems</p> <p>Principle 6: Interdisciplinary research into all aspects of the use and conservation of biological diversity should be promoted and supported</p> <p>Principle 7: The spatial and temporal scale of management should be compatible with the ecological and socio-economic scales of the use and its impact</p> <p>Principle 9: An interdisciplinary, participatory approach should be applied at the appropriate levels of management and governance related to the use</p> <p>Principle 11: Users of biodiversity components should seek to minimize waste and adverse environmental impact and optimize benefits from uses</p> <p>Principle 12: The needs of indigenous and local communities who live with and are affected by the use and conservation of biological diversity, along with their contributions to its conservation and sustainable use, should be reflected in the equitable distribution of the benefits from the use of those resources</p> <p>Principle 14: Education and public awareness programs on conservation and sustainable use should be implemented and more effective methods of communications should be developed between and among stakeholders and managers</p>	<p>Principle 1: Resource mapping, estimation and value analyses</p> <p>Principle 2: Participatory approach involving local community in conservation</p> <p>Principle 3: Documentation, assimilation and application of traditional harvesting knowledge</p> <p>Principle 4: Development of sustainable harvesting protocols, tools and field implementation</p> <p>Principle 5: Training, capacity building and dissemination</p> <p>Principle 7: Linking trade, price and conservation principles and practices</p>

Sl. No.	Global conventions/ guidelines/ targets	New principles
5.	<p><b>Aichi Targets</b></p> <p>Goal B: Reduce the direct pressure on biodiversity and promote sustainable use</p> <p>Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity</p>	<p>Principle 4: Development of sustainable harvesting protocols, tools and field implementation</p>
6.	<p><b>Fairwild Standards</b></p> <p>Principle 1: Maintaining Wild Plant Resources</p> <p>Principle 2: Preventing Negative Environmental Impacts</p> <p>Principle 3: Complying with Laws, Regulations and Agreements</p> <p>Principle 4: Respecting Customary Rights and Benefit-Sharing</p> <p>Principle 5: Promoting Fair Contractual Relationships between Operators and Collectors</p> <p>Principle 6: Limiting Participation of Children in Wild-Collection Activities</p> <p>Principle 7: Ensuring Benefits for Collectors and their Communities</p> <p>Principle 8: Ensuring Fair Working Conditions for all Workers of Wild-Collection Operations</p> <p>Principle 9: Applying Responsible Management Practices</p> <p>Principle 10: Applying Responsible Business Practices</p>	<p>Principle 1: Resource mapping, estimation and value analyses</p> <p>Principle 2: Participatory approach involving local community in conservation</p> <p>Principle 3: Documentation, assimilation and application of traditional harvesting knowledge</p> <p>Principle 4: Development of sustainable harvesting protocols, tools and field implementation</p> <p>Principle 5: Training, capacity building and dissemination</p> <p>Principle 6: Interventions for post harvesting techniques and market linkages</p> <p>Principle 7: Linking trade, price and conservation principles and practices</p>
7.	<p><b>Sustainable Development Goals</b></p> <p>Goal 1: No poverty</p> <p>Goal 2: Zero hunger</p> <p>Goal 3: Good health and wellbeing</p> <p>Goal 5: Gender equality</p> <p>Goal 8: Decent work and economic growth</p> <p>Goal 10: Reduced inequality</p> <p>Goal 12: Responsible consumption and production</p> <p>Goal 16: Peace, justice and strong institutions</p>	<p>Principle 1: Resource mapping, estimation and value analyses</p> <p>Principle 2: Participatory approach involving local community in conservation</p> <p>Principle 3: Documentation, assimilation and application of traditional harvesting knowledge</p> <p>Principle 4: Development of sustainable harvesting protocols, tools and field implementation</p> <p>Principle 5: Training, capacity building and dissemination</p> <p>Principle 6: Interventions for post harvesting techniques and market linkages</p> <p>Principle 7: Linking trade, price and conservation principles and practices</p>

## 10. Challenges in practicing sustainable wild harvesting of wild species

The challenges in framing the participatory sustainable harvesting protocols and their practices include (1) large numbers of species are ecologically threatened and traded in large volumes. Their diversity, ecology, habitat and pressure on the resource have posed severe problems in maintaining the biological diversity; (2) the need to develop good collection practices specific to each species and situation; (3) unpredictable and often unrecognised environmental factors that influence annual yield of wild populations; (4) unclear land and resource tenure and management authority; (5) the large number and variety of products, uses and markets; (6) long, complex supply chain between source and market; (7) lack of proper post harvesting techniques as present for agriculture produces; (8) lack of customer awareness on better quality of produces.

Added to these challenges, there is limited recognition of economic, social and ecological value of wild resources, and a wide spread uncertainty on *who is responsible for ensuring that wild resources are used sustainably?*

## 11. Case Studies

Case studies related to sustainable use of biological diversity have been presented in Annex 2. These case studies highlight the decrease in population of flora and fauna due to trade. They also address the issues related to unsustainable/ unscientific extraction or harvesting that pose detrimental consequences on the species survival. The case studies also highlight the endeavours made by various organisations, governmental and nongovernmental agencies for conservation of such flora and fauna using sustainable use as a tool. Seven case studies that have been chosen to be part of this paper cover various biodiversity components under different sectors and from diverse countries. These case studies showcase the efforts exerted by these countries to address the agenda of sustainable use of biological diversity. The following table provides a brief description of, each of the selected case studies.

**Table 2: Description of the case studies**

Sl. No.	Case study title	Brief description	Relate to the sustainable harvesting principles presented in this paper
1.	Guidelines for the sustainable harvesting of traditional medicinal plants in Zimbabwe	This case study provides the efforts in development of sustainable harvesting techniques for various plant parts harvested.	Principle 4: Development of sustainable harvesting protocols, tools and field implementation
2.	The medicinal and aromatic plants programme in Asia (MAPPA), Nepal	Centered around conservation and sustainable use of medicinal and aromatic plants. The main focus of this case study is the involvement of local community to help them in generation of livelihood opportunities.	Principle 1: Resource mapping, estimation and value analyses Principle 2: Participatory approach involving local community in conservation Principle 3: Development of sustainable harvesting protocols, tools and field implementation Principle 4: Training, capacity building and dissemination
3.	Community based management of Vicuna, a camelid that yield fibre in Bolivia	Highlights unsustainable commercial exploitation resulting in drastic reduction in the Vicuna numbers. Participatory sustainable management of this animal has resulted in economic and ecological benefits.	Principle 1: Resource mapping, estimation and value analyses Principle 2: Participatory approach involving local community in conservation Principle 4: Development of sustainable harvesting protocols, tools and field implementation Principle 7: Linking trade, price and, conservation principles and practices
4.	Promotion of International standard for sustainable wild collection of medicinal and aromatic plants in Cambodia	For testing and field implementation of International standard for sustainable wild collection of medicinal and aromatic plants, <i>Amomum ovoideum</i> and <i>Cinnamomum cambodianum</i> were selected. Sustainable collection techniques, capacity building of the local community, pre and post harvesting techniques and linking market for better prices were undertaken.	Principle 1: Resource mapping, estimation and value analyses Principle 2: Participatory approach involving local community in conservation Principle 4: Development of sustainable harvesting protocols, tools and field implementation Principle 5: Training, capacity building and dissemination Principle 6: Interventions for post harvesting techniques and market linkages

Sl. No.	Case study title	Brief description	Relate to the sustainable harvesting principles presented in this paper
5.	The Zambezi basin wetlands conservation and resource utilization in Africa	This case study is a good example of ecosystem approach for sustainable use of biological diversity and involvement of multi nations to prevent the ecological degradation of wetland resources due to unsustainable use. The sustainable use of wetland resources has improved the living conditions of the local communities in terms of better health, education and, food and livelihood security.	Principle 2: Participatory approach involving local community in conservation Principle 3: Documentation, assimilation and application of traditional harvesting knowledge Principle 4: Development of sustainable harvesting protocols, tools and field implementation
6.	Norwegian whaling - based on a balanced ecosystem	High trade value for the whale meat has resulted in unsustainable harvesting and mindless hunting. To conserve the whale population, whaling in Norway is based on the principles of whale protection and sustainable harvesting by following quota system. Regulation on whaling has resulted in ban on illegal whaling and whale population is recovering.	Principle 4: Development of sustainable harvesting protocols, tools and field implementation
7.	Sustainable collection of fruits of <i>Terminalia chebula</i> in India	This case study highlights on the sustainable harvesting and post harvesting techniques can help in good quality raw material and price appreciation of Non-Timber Forest Produces (NTFPs).	Principle 1: Resource mapping, estimation and value analyses Principle 2: Participatory approach involving local community in conservation Principle 3: Documentation, assimilation and application of traditional harvesting knowledge Principle 4: Development of sustainable harvesting protocols, tools and field implementation Principle 5: Training, capacity building and dissemination Principle 6: Interventions for post harvesting techniques and market linkages

## 12. Conclusions

Despite widespread inclusion of sustainable use of biodiversity as an element in national biodiversity strategies and actions plans, as well as in other biodiversity-related national strategies and action plans, unsustainable use in many sectors, notably agriculture, fisheries and forestry; and hunting, remains a major cause of biodiversity loss<sup>23</sup>. According to the review of implementation of Article 10 of the CBD, effective implementation of Article 10 is hampered for many Parties by a range of obstacles, including: lack of political will and of human and financial capacity, inter alia for the establishment and enforcement of management plans; lack of cross-sectoral integration and coordination; poor operationalization of the definition of sustainable use; lack of understanding and implementation of the concept of adaptive management; difficulties in establishing thresholds and indicators to measure progress, and lack of monitoring capacities; and unsustainable, unauthorized and unregulated activities.

Application of the Addis Ababa Principles and Guidelines to a level that would be usable for users of biodiversity, such as farmers and foresters, is a challenge. One obstacle is that the concept of sustainable use does not have clear, widely accepted operational definitions, criteria and indicators within relevant sectors.

Several Parties lack a permanent system to monitor the state of biodiversity and the use of biodiversity, and as a result, have difficulty assessing the degree to which the use of biodiversity is influencing the state of biodiversity. Limited knowledge on the current levels of harvesting of many resources, such as medicinal plants, hampers the establishment of sustainable levels of use and indicators to measure progress.

In many cases, the scientific basis for sound decision-making on the sustainable use of biological resources is insufficient. While the precautionary approach and adaptive management can temporarily bridge gaps in knowledge, further research is needed to improve sustainable exploitation of natural resources, and to monitor impacts of natural resource use.

Given the above, this publication provides a roadmap for Parties and stakeholders to better understand the science of sustainable harvesting and use, elaborates a number of principles for consideration to implement Article 10 of the CBD and provides specific examples and case studies to further strengthen field-based actions on sustainable use.

It is time that the second objective of the CBD, i.e. sustainable use receives its due attention to support effective implementation of the Convention and achieve desirable results in stopping biodiversity and ecosystem degradation.

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<sup>23</sup> <https://www.cbd.int/doc/meetings/sbstta/sbstta-14/official/sbstta-14-07-en.pdf> (accessed 20 June 2018)

## Annex 1: Species for which sustainable harvesting techniques developed in India

Sl.No	Name of the species	Habit	Part harvested	IUCN Conservation status*
1.	<i>Acacia concinna</i>	Liana	Fruits	Not assessed
2.	<i>Acacia pennata</i>	Liana	Bark	Not assessed
3.	<i>Aegle marmelos</i>	Tree	Fruits	Vulnerable-regional
4.	<i>Ailanthus triphysa</i>	Tree	Resin	Not assessed
5.	<i>Andrographis paniculata</i>	Herb	Whole plant	Not assessed
6.	<i>Asparagus racemosus</i>	Liana	Underground parts	Not assessed
7.	<i>Azadirachta indica</i>	Tree	Fruits	Not assessed
8.	<i>Baliospermum montanum</i>	Shrub	Underground parts	Vulnerable-regional
9.	<i>Buchanania lanzen</i>	Tree	Fruits	Near Threatened-regional
10.	<i>Canarium strictum</i>	Tree	Resin	Vulnerable-regional
11.	<i>Celastrus paniculatus</i>	Liana	Fruits	Near Threatened-regional
12.	<i>Chlorophytum tuberosum</i>	Herb	Underground parts	Least Concern-global
13.	<i>Cinnamomum sulphuratum/C. tamala</i>	Tree	Leaves	Vulnerable-global; regional
14.	<i>Cissus quadrangularis</i>	Climber	Stem part	Not assessed
15.	<i>Costus speciosus</i>	Herb	Underground parts	Not assessed
16.	<i>Decalepis hamiltonii</i>	Liana	Underground parts	Endangered-global
17.	<i>Desmodium gangeticum</i>	Shrub	Whole plant	Not assessed
18.	<i>Dioscorea hispida</i>	Climber	Underground parts	Not assessed



Sl.No	Name of the species	Habit	Part harvested	IUCN Conservation status*
19.	<i>Embelia tsjeriam-cottam</i>	Shrub	Fruits	Vulnerable-regional
20.	<i>Garcinia gummi-gutta</i>	Tree	Fruits	Near Threatened-global
21.	<i>Garcinia indica</i>	Tree	Fruits	Vulnerable-global
22..	<i>Gloriosa superba</i>	Climber	Underground parts	Vulnerable-regional
23.	<i>Gymnema sylvestre</i>	Climber	Leaves	Not assessed
24.	<i>Hemidesmus indicus</i>	Climber	Underground parts	Not assessed
25.	<i>Illicium griffithii</i>	Tree	Fruits	Not assessed
26.	<i>Limonia acidissima</i>	Tree	Fruits	Not assessed
27.	<i>Mammea suriga</i>	Tree	Flower buds	Not assessed
28.	<i>Myristica dactyloides</i>	Tree	Fruits	Vulnerable-regional
29.	<i>Nilgirianthus ciliatus</i>	Shrub	Underground parts	Endangered-global
30.	<i>Ocimum basilicum</i>	Herb	Leaves	Not assessed
31.	<i>Phyllanthus amarus</i>	Herb	Whole plant	Not assessed
32.	<i>Phyllanthus emblica</i>	Tree	Fruits	Vulnerable-regional
33.	<i>Piper longum</i>	Climbing shrub	Fruits	Near Threatened-regional
34.	<i>Piper nigrum</i>	Climber	Fruits	Not assessed
35.	<i>Pongamia Pinnata</i>	Tree	Seeds	Not assessed
36.	<i>Pseudarthria viscida</i>	Shrub	Whole plant	Vulnerable-regional
37.	<i>Rauwolfia serpentina</i>	Shrub	Whole plant	Endangered-regional
38.	<i>Rubia cordifolia</i>	Climber	Underground parts	Vulnerable-regional

Sl.No	Name of the species	Habit	Part harvested	IUCN Conservation status*
39.	<i>Salacia chinensis/S. fruticosa</i>	Climbing shrub	Underground parts	Not assessed
40.	<i>Sapindus emarginatus</i>	Tree	Fruits	Not assessed
41..	<i>Semecarpus anacardium</i>	Tree	Fruits	Not assessed
42.	<i>Swertia chirayita</i>	Herb	Whole plant	Vulnerable-regional
43.	<i>Syzygium cumini</i>	Tree	Fruits	Not assessed
44.	<i>Tamarindus indica</i>	Tree	Fruits	Not assessed
45.	<i>Terminalia arjuna</i>	Tree	Bark	Near Threatened-regional
46.	<i>Terminalia chebula/T. bellirica</i>	Tree	Fruits	Vulnerable-regional
47.	<i>Tinospora sinensis</i>	Liana	Stem part	Vulnerable-regional
48.	<i>Vateria indica</i>	Tree	Fruits	Vulnerable-global

\* Based on IUCN Red List Criteria and Categories Version 3.1 assessed the conservation status through Conservation Action Management Prioritisation Workshop organized regionally

## **Annex 2: Case Studies on Sustainable Use and Sustainable Harvesting**

Some of the case studies on sustainable use of biological components are given below:

### **Case study 1: Guidelines for the sustainable harvesting of traditional medicinal plants in Zimbabwe<sup>24</sup>**

In Zimbabwe, there exist sound traditional knowledge of medicinal plants and their uses. Majority of the population depend on the medicinal plants for their health security. Different parts such as root, flower, leaves, bark, fruit and others are harvested for medicine preparation. The growing demand for medicinal plants has given rise to over harvesting of the resource. As a result of unscientific and unsustainable harvesting, the resource is depleting. Therefore strategies are required for sustainable harvesting of medicinal plants. Long-term availability of the medicinal plants aids in protection of health and livelihood security of local community particularly the collectors and folk healers, and also helps in preservation of indigenous medicinal knowledge.

To ensure the availability of medicinal plant resources for the use of current and future generations, general guidelines were prepared based on participatory process with inputs from scientists and different stakeholders, with the financial support from GEF. These guidelines were aimed to help traditional healers to practice collection methods that support sustainability of the resources as well as the environment. The guidelines are in-line with the principles of 'Caring for Earth' prepared in partnership by IUCN, WWF and UNEP and, International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP). Specific guidelines for root, bark, leaves and fruit harvest as well as post harvesting techniques were developed.

The guidelines include, (1) Timing of harvesting: Specification about the season, date or time of day the harvesting is carried out; (2) Material to be harvested/ part harvested: Collect mature and healthy material; (3) Harvesting techniques: Different techniques for different part harvested; and (4) Harvesting equipment and storage.

These guidelines were converted to a manual, which serve as a reference material to people who harvest wild medicinal plants.

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<sup>24</sup> <http://projects.nri.org/adappt/docs/HarvestingGuidelines.pdf> (Accessed on 26<sup>th</sup> May 2017)

## Case study 2: The Medicinal and Aromatic Plants Programme in Asia (MAPPA), Nepal<sup>25</sup>

The Medicinal and Aromatic Plants Programme in Asia (MAPPA) is an initiative by International Centre for Integrated Mountain Development (ICIMOD) in Nepal. MAPPA is a strategic research, collaboration and networking program that focus on conservation and sustainable use of medicinal and aromatic plants for livelihood security of rural people. This program in Nepal has enabled the local people to upgrade their resource management systems through capacity building and participatory management. The local community members were involved in sustainable NTFP management and decision-making processes. Under different projects, MAPPA has developed techniques of propagation, domestication and harvesting practices for selected NTFPs. The activities adapted for NTFP resource management are:

- (1) Selection of medicinal and aromatic plants: The site and species for sustainable management were selected based on the priorities of the local communities.
- (2) Participatory inventory of NTFPs in the community forests: Inventory and resource assessment of medicinal plant resources available in the project area was undertaken by involving different stakeholders such as NTFP collectors, folk healers and others. The adaptive knowledge helped in creation of ownership and awareness about degradation of resources among the local communities.
- (3) Observation of traditional and adaptive knowledge practices: Data on traditional harvesting practices was collected and merged with the scientific technologies. To enhance the productivity, sustainability and quality of the produces, *in situ* management, cultivation and sustainable harvesting approaches were adapted.
- (4) Propagation, domestication and harvesting technology: Nursery and propagation techniques were developed. The planting materials were sourced from the wild. Seasonal calendars were prepared for sustainable harvesting.
- (5) Institutional strengthening and policy support: *In situ* management, cultivation and sustainable harvesting were integrated into the forest operation plan.

The program concluded that sustainable management of NTFPs must link ecological and economic aspects. Qualitative and quantitative data on resource base provide a basis for designing and development of sustainable management practices.

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<sup>25</sup> Kinhal GA and Jagannatha Rao. 2008. Adaptive management of medicinal plants and non timber forest products. ©. Bishen Singh Mahendra Pal Singh, Dehra Dun, India.

### **Case study 3: Community based management of Vicuna, a camelid that yields fibre in Bolivia<sup>26</sup>**

Vicuna is a camelid and close relative of Llama, which live in the high alpine areas of the Andes, South America. The soft wool obtained from the wild animals is very expensive in the international market and used for production of clothing and accessories.

Vicuna populations in the high Andes of Argentina, Bolivia, Chile, Ecuador and Peru fell to a critically low level due to hunting and unsustainable extraction of the fibre from the live animals. In 1974, the population of Vicuna was only 6,000 and declared as endangered. Thereafter, this animal was included in the appendix of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and a ban was imposed on trade in their fibre. After the ban, there has been dramatic recovery and the population rose to 3,50,000. Though there was a shift in level of threat category, active conservation programs are still relevant to protect Vicuna from poaching and habitat loss.

In the international market, the fibre fetches high price, the extraction provides a considerable income for the local community. So, live shearing of Vicuna for a high-value international market is being promoted as a mechanism to secure both sustainable Vicuna populations and local livelihoods.

Sustainable management strategies were developed based on the data collected from traditional hunters and scientists. Communities and authorities developed guidelines that included seasonal closures, internal zoning and plans for the commercial use of wildlife and implemented them. The sustainable harvesting model that involves community is more effective as the conservation efforts provide economic incentives to the local people and inculcates positive attitude towards conservation of resources.

This community-based conservation effort of vicuna provide an excellent case study for the sustainable use of wildlife outside protected areas.

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<sup>26</sup> Ryan R.J. McAllister, Desmond McNeill, Iain J. Gordon, 2009. Legalizing markets and the consequences for poaching of wildlife species: The vicuna as a case study. *Journal of Environmental Management* 90 (1). Pp. 120-130

#### Case study 4: Promotion of International Standard for Sustainable wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) in Cambodia<sup>27</sup>

In Cambodia, medicinal plants are used in the traditional medicine and sourced mostly from wild. As this is the only healthcare available, demand for the medicinal plants is ever increasing. The demand is overshooting the supply of the resources. So unscientific overharvesting of medicinal and aromatic plants is practiced. This is posing threat to the wild medicinal plants in Cambodia.

Unmindful collection of medicinal and aromatic plants (MAPs) has led to the decline in the species population. In addition, there is no national regulation of harvest and trade of wild MAPs, which has resulted in very little awareness with regard to the importance of sustainable collection of wild plant resources. The local communities also collect medicinal plants for their livelihood, so it is important that any exploitation of these resources, particularly in the volumes commonly demanded by international trade, be sustainable.

Two species were selected for testing and field implementation of International Standard for Sustainable wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) viz., *Amomum ovoideum* and *Cinnamomum cambodianum*. Resource assessment was undertaken for these two species to understand the harvesting potential. Realising the importance of involving

local community for implementation of sustainable harvesting techniques, the project created awareness among the local community on the process of implementation of principles and guidelines for sustainable collection of MAPs.

The community was keen to participate, because illegal collection by outsiders was a problem and people were convinced that establishing community management of the resources, in co-operation with the protected area management regime, could help reduce this problem and hence result in economic benefits for the local communities. In the process, the capacity and skill of the local community were developed on tools and techniques for sustainable collection including pre and post harvesting methods, thereby creating a sense of ownership among them. The project also created market linkage for the selected two species. The good quality collection by following sustainable harvesting techniques has yielded in good price in the market, thus provided economic incentive to the local community.

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<sup>27</sup>Kathe, W.; Pätzold, B.; Leaman, D.; Timoshyna, A.; Newton, D.; Khou, E.; Kinhal, G.; Sapkota I.B.; Pasha, M.K.S.; Ndam, N.; Melisch, R.; Bundalo, S.; Honnef, S.; Osborn, T.; Buitrón, X.; and Liu, X. (2010). *Wild for a Cure: Groundtruthing a Standard for Sustainable Management of Wild Plants in the Field*. TRAFFIC International.

## Case study 5: The Zambezi basin wetlands conservation and resource utilization in Africa<sup>28</sup>

Conservation of the Zambezi Basin wetland ecosystems was the main goal of this project by encouraging their sustainable use. This was an integrated, multi-national initiative to prevent ecological degradation due to unsustainable use of the wetland resources. To achieve the goal, strategies for wetland conservation and to address community's health and livelihood needs were developed and implemented. Resource-based management protocols were developed in consultation with traditional and scientific knowledge that facilitated in sustainable use of resources.

Economic valuation of goods and services provided by the wetland biodiversity has led to the regional policies and enhanced awareness among the local community about the benefits of conservation and sustainable use of wetland biodiversity.

This project has enhanced the living conditions of the local community in terms of improved health, education, food security, income and cultural values. For achieving the conservation goals, it is important to meet the basic needs of the community and also provide appropriate economic incentives.

One of the important learning from this case study is to first address the wellbeing of the community before addressing the issues related to conservation and implementation of conservation strategies.

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<sup>28</sup> R.D. Smith and E. Maltby. (2003). Using the Ecosystem Approach to Implement the Convention on Biological Diversity: Key Issues and Case Studies. IUCN, Gland, Switzerland and Cambridge, UK. x + 118 pp.

## Case study 6: Norwegian whaling - based on a balanced ecosystem<sup>29</sup>

The population of whales is depleting due to hunting, accidental/ incidental mortality, environment degradation due to pollution and climate change. Two species of whales are in the danger of extinction. International Convention for the Regulation of Whaling focuses on development of whaling for the benefit of the consumers of whale products. Thus, the objective of conservation is explained as sustainable utilization.

In mid 1970s, the populations of many whale species were improved by management strategies for whaling. In 1986, International Whaling Commission (IWC) imposed restriction on commercial whaling due to dwindling population of whales. Conservation Management Plans (CMPs) are an important conservation initiative of the IWC with an aim to protect and rebuild vulnerable whale populations. Quotas are set on the basis of procedures developed by the Scientific Committee of the International Whaling Commission (IWC) for the stocks that can be harvested sustainably.

In Norway, whaling involves hunting of the minke whale for the whale meat. For centuries, in coastal Norway, whale hunting has been practiced for commercial purposes. Commercial whaling due to high demand has resulted in decreased whale numbers. Though Norway is not bound to the moratorium on whaling imposed by IWC, it has initiated management of resources based on the scientific advices that support the concept of ecosystem approach. The Norwegian whaling is based on the principle of protection and sustainable harvesting of marine resources. In 2013, the quota set by Norwegian government in Northeast Atlantic Ocean was 1286 minke whales, only 660 whales were caught.

The whaling season begins in April and ends in August/September, before the breeding season starts. In Norway, all vessels have been installed with an electronic monitoring system for registering all whaling activities. Whaling regulations are monitored by the authorities. A DNA register was also created in 1997 to determine whether whale products in the market derived from legitimate whaling, or from illegal whaling.

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<sup>29</sup> <https://www.regjeringen.no/en/topics/food...and.../whaling...whaling/id2505089/> (Accessed on 26<sup>th</sup> August 2017)



## Case study 7: Sustainable collection of fruits of *Terminalia chebula* in India<sup>30</sup>

*Terminalia chebula* commonly known as Myrobalan is a deciduous tree, whose fruits have high medicinal value. Apart from this, the fruits of chebula are used in tanning industry. In India, it is traded more than 10000 MT/ year.

Due to the high demand for fruits in the herbal as well as in tanning industries, the fruits are collected by following destructive harvesting methods such as lopping the branches and plucking immature fruits. This has resulted in increased mortality of the trees and decreased regeneration, thereby decreasing the fruit yield year by year. Regeneration in *Terminalia*

*chebula* is also difficult as the percentage of seed germination is very low. As it is a tree species, fruiting starts at the age of 10-15 years.

In India, in the state of Karnataka, a pilot project was undertaken to study the quantity of fruits available for collection, development of sustainable harvesting technique and marketing of the collected fruits.

Initially the study area was mapped for resource availability. Later traditional collection practices were documented. By merging traditional collection practices and the modern scientific techniques, sustainable harvesting techniques were developed for collection of fruits of *Terminalia chebula*. The sustainable harvesting techniques emphasised collection of 80% matured/ fallen fruits. During the process of drying, it was observed that the fruits were turning to black. This deteriorates the quality of the fruits and the collector gets lesser price in the market. Trainings were organized to orient the collectors on sustainable and post harvesting techniques. The study's intervention of drying the fruits on a rock or concrete platform retained the golden colour of the fruits, thereby ensuring the quality.

A market survey to determine marketing and pricing of the fruits was also undertaken. Before the project intervention, local traders were purchasing at Rs. 5-6 for a kilogram (kg) of fruits. After implementation of sustainable harvesting and post harvesting techniques such as drying on the rock and grading the fruits based on size and colour, the fruits were directly marketed to an herbal industry in Kerala through Forest Development Agency (FDA), which is a government agency for collection and marketing of Non-Timber Forest Produces (NTFPs). After deducting the expenditures on transportation and other administrative costs, each collector received Rs. 10.35 per kg of fruit. This study demonstrated >75% price appreciation by adapting sustainable harvesting and post-harvest methods.

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<sup>30</sup> Final Technical Report "Sustainable Harvest, Augmentation and Marketing of Selected Medicinal plants raw material (Collected & Cultivated) through Forest Development Agency (FDA) structure of Forest Department", (Project No. NMPB KR-02/2007), 2012, FRLHT, Bengaluru

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