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From the Chief Editor's Desk

The July issue of Field Forester brings with it the smooth transition of leadership with Honorable Shri. Anil Dave taking over as the Minister of State (Independent Charge) of the Ministry of Environment, Forest and Climate Change from his predecessor Honorable Shri Prakash Javdekar, who has moved on to the Ministry of Human Resource Development as a Cabinet Minister. The editorial team of Field Forester takes this golden opportunity to express heartfelt gratitude to the outgoing Minister, Shri Javdekar for his leadership and guidance during his tenure and extends a warm welcome to the new Minister. This issue contains within itself the fragrance of sandal with an article on the subject; conservation issues related to diverse landscapes ranging from the low-lying Vayals or swamps of Tamil Nadu and Kerala, to the land slide prone Shivalik foot hills of Himachal Pradesh. This issue places the income generation aspects of participatory forest management approach at the centre stage by including articles on economic potential from chir pine needles, vermi-composting and ecotourism activities. The new emerging area of payment for ecosystem services is also covered in a case study from Palampur, Himachal Pradesh. Another core forestry subject is silviculture which is attended to through articles on recalcitrant seeds and rehabilitation of Lantana infested areas. Finally this issue explores the connected issues of wildlife and local communities in articles on elephant corridor management in Tamil Nadu and conflict resolution in Pong Lake Sanctuary in Himachal Pradesh.

RP Singh

FOREST MANAGEMENT

Conservation of Vayals and Swamps

The unique ecosystem of waterlogged grasslands is yet to be explored for its distribution, services and ecological significance

V. Pugalenthi

ayal is a colloquial word in Tamil and Malayalam for seasonally waterlogged meadows or wet meadows. These meadows or grasslands are classifiable as "wetlands" under Article 1.1 of the Ramsar Convention which states that "wetlands are areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters". This ecosystem falls under the category "Ts" i.e seasonal/intermittent freshwater marshes/pools on inorganic soils of Ramsar's Classification System for Wetland Type. Vayals for us is the never-ending lush green paddy fields which is our food source. All the natural swampy meadows which are valuable habitats for wetland plants, numerous invertebrate, amphibians, reptiles, aves and small mammals have been converted into farmlands. In spite of providing important ecological services and covering all the strata of a food web, this ecosystem has not received the deserved attention.

They are always wet and moist,

dominated by members of Cyperaceae and Eriocaulaceae and there may be small streams which originate from these marshy meadows. Availability of fresh grasses, sedges and water makes these habitats ideal for wild animals especially herbivores. Thus vayals play an important role in maintaining forest biodiversity and water regime. This unique wetland ecosystem is not so far explored for its distribution, services and ecological significance. Recently, a preliminary study on 'Vayals of Mudumalai Tiger Reserve' (Pushpakaran and Gopalan, 2013) shows that exotic weeds pose a major threat to this ecosystem and without proper conservation and management strategies, this unique wetland ecosystem may be lost forever. A study on amphibians and reptiles of vayals' ecosystem in Parambikulam wildlife sanctuary (Bhupathy and Banugopan, 2000) shows that these communities have a proximate linkage to the vayal ecosystem. Baseline data regarding distribution, extent, services and threats is needed to develop strategies for conservation and management of this unique wetland ecosystem.

Swamp ecosystem

The swamp, wetland ecosystem is characterised by mineral soils with poor

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drainage and by plant life dominated by trees. The latter characteristic distinguishes a swamp from a marsh, in which plant life consists largely of grasses. Swamps are found throughout the world. They exist in areas with poor drainage and sufficient water supply to keep the ground waterlogged, and they have a high enough supply of minerals in the water to stimulate decay of organisms and prevent the accumulation of organic materials.

During periods of very heavy rains, a swamp can act as a natural flood control device, as excess runoff can be temporarily stored in its basin. Swamp vegetation varies with climate. Grasses, rushes, and sphagnum moss predominate in temperate climates; cypress and mangrove predominate more tropical regions. in Lush vegetation provides great protection for nesting waterfowl and fish as well as a hospitable habitat for many types of small mammal such as beaver and otter. Swamps that are drained make excellent agricultural land because of the high organic content of the bottom sediments. In addition, rising land values and demand have encouraged the drainage of many swamplands. However, a problem associated with recently drained swamps is oxidation of the thick peat deposits forming the soil, which can result in subsidence of the land and such problems as cracked walls, broken underground pipes, and buckled roadways. The increased use of drained swampland for urban construction, with its associated acres of blacktop paving and storm sewers, results in greater runoff and increases

the probability of flooding and pollution in these regions. Swamp drainage also destroys the nesting areas of many wildlife species. However, swampy depression typically means a thick mat of living and dead organic matter floating on the water surface and a low level of oxygen in the water below. *Marsh* implies a large area of wetland where the dominant vegetation consists of low-lying grasses, rushes, and sedges.

Topography and water supply are the two most important features in determining the distribution of freshwater swamps. The nature of soils and bedrock is of importance in determining the drainage in a region, but wetlands may exist locally on any base from sands to impervious rock.

The flow of water through wetlands is slow because of low gradients and retarding effects of the vegetation. Dead plant matter settles rather than being washed away. The slow replacement and lack of turbulence in the water result in a low rate of oxygen supply. Decay of the dead vegetation quickly uses up what oxygen is supplied, so that the mud and bottom waters are low or lacking in oxygen content. Under these conditions, the decay of organic matter is incomplete. This causes an accumulation of the more resistant fraction (humates and tannins) in the substratum. The familiar swamp water varies from yellow to such a deep brown that it resembles strong tea or coffee,

The number of plant species in swamps is few compared to the numbers that grow on well-watered but not waterlogged land. Cattails (*Typha*) and common reeds (*Phragmites*)



are familiar swamp species around the world. Papyrus, sedge, is widespread in the tropics. Bald cypress is an example of a tree adapted to growth in swamps, but gums, willows, alders, and maples are also common. Tropical swamps have many tree species, including palms.

Salt swamps are formed by seawater flooding and draining, which exposes flat areas of intertidal land. Regularly flooded, protected areas develop mangrove swamps in tropical and subtropical regions. Mangroves will grow in pure sand at the edge of the sea. Extensive swamps develop mainly where land runoff is sufficient to bring a supply of sediments that accumulate and extend the swamp.

Tropical swamp trees often develop buttresses that apparently help support though buttresses are also them, common on many upland trees in the tropics. Generally, all swamp trees lack deep-growing roots. Roots tend to stay near the surface, probably because of the lack of oxygen in the soil. Being near the surface gives a large lateral spread to the root system, which also gives the tree support against lateral stresses from winds or water flow. The shallowness of the roots also often produces the appearance of buttresses in temperate swamp trees because the beginnings of the roots, usually hidden in the soil, are visible at the surface.

Different species of trees that grow in temporary swamps differ considerably in their resistance to submersion, i.e., to lack of oxygen. This is serious during the submersion period but is not a problem in drier periods, at least in the shallow layers of the soil. The tops of mangrove trees shelter a diverse group of animals that are unaffected by seawater, because they never contact it. In general, swamp animals are little affected by wetland conditions except as those conditions affect the species of trees growing in the swamp. Whereas the diversity of plants is limited by the stresses that the presence of water entails, the animal diversity is more a reflection of the plant diversity than the nature of the water supply.

Without proper conservation and management these wetlands would be lost forever. A closer look at the complexity of these *vayals* may help us put proper management tools in place to ensure the conservation of these fragile ecosystems.

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FOREST MANAGEMENT

Methods of handling recalcitrant seeds

Unlike orthodox species, in which viability is best preserved by maintaining a minimal respiration rate, it seems active respiration is needed for survival of seeds of most recalcitrants

S VIMAL KUMAR

Recalcitrant Seeds are those which cannot survive drying below relatively high moisture content (often in the range 20–50 per cent wet basis) and which cannot be successfully stored for long periods.

The term 'recalcitrance', defined as obstinate disobedience, refers to seeds that undergo no maturation drying as the final phase of development, tolerate very little post-shedding desiccation and are often chill-sensitive. Such seeds are unstorable by any of the methods used for air-dry orthodox seeds. Since these terms were introduced by Roberts in 1973, much of the widely-disseminated literature has been systematically collated to afford an overview of recalcitrant seeds, particularly those of crop species (Chin and Roberts, 1980). Two major unresolved issues emerged from that overview: there was no explanation of the basis of recalcitrant seed behaviour, and no successful storage regimes had been established. The present contribution deals with progress that has been made towards an understanding of the responses of post-harvest, recalcitrant seeds in terms of their cell biology.

Objectives

• To identify/classify the recalcitrant seeds in Tamil Nadu

мілімим	MODERATE	нідн
Fair amount of water loss tolerated	Moderate amount of water loss tolerated	Little water loss tolerated
Germination slow in absence of additional water	Moderate germination rate in the absence of rate in the absence of additional water	Fast germination in absence of additional water
Lower temperature tolerated	Most species are temperature sensitive	Most species are temperature sensitive
Temperate/tropical distribution eg. Quercus, Araucaria	Tropical distribution eg. Theobroma, Hevea	Tropical forests and wetlands eg. Avicennia marina

TYPES OF RECALCITRANCE

The continuum to account for varying degrees of recalcitrance (Farrant et al., 1988)



- To develop the storage technique for the recalcitrant seeds
- To develop the better seed germination technique for recalcitrant seeds
- To improve the seed viability inorder to establish the nurseries, thereby establish the good plantations
- To preserve the germplasm of important recalcitrant seeds

Scope of Recalcitrant Seed Handling

Recalcitrant seeds include a number of large seeds that cannot withstand appreciable drying without injury; it is of interest that the overwhelming majority of recalcitrant species listed by King and Roberts (1979) are woody. Temperate species such as *Quercus* and Castanea are commonly stored moist only for short periods over winter. Reduction of storage temperature to near freezing will prolong longevity. Bonner (1973a) found that it was possible to store acorns of Quercus falcata for 30 months and still obtain over 90 per cent germination at the end of the period, provided that temperature was maintained at 3°C and moisture content (MC) between 33 per cent (initial) and 37 per cent (final). A lower MC or a higher temperature (8°C) both reduced germination. For Quercus robur, the MC should be maintained above 40 per cent (Holmes and Buszewicz, 1956; Suszka and Tylkowski, 1980). Recent research in Poland has demonstrated good results from storing this species at >40 per cent MC in air-dry peat or air-dry sawdust in milk cans at -1°C. It is important to allow free entry of oxygen and this is ensured by inserting several strips of cardboard at intervals between the lid and the edge of the can. In these conditions, germination after three winters was in the range of 38-75 per cent and after five winters was still about 12 per cent (Suszka and Tylkowski, 1980). Temperatures below -5°C killed all the acorns, while a temperature of +1°C encouraged excessive pre-germination (60-75 per cent after three winters, with radicles up to 25 cm long, compared with 12 per cent and radicles <0.5 cm long at -1°C). There may be possibilities of storing seeds after emergence of radicles. Research in Poland (Suszka and Tylkowski, 1982) has indicated that best results are obtained with the recalcitrant Acer saccharinum by maintaining MC at the same percentage (50-52 per cent) as when the seeds were freshly collected. For A. pseudoplatanus in the UK, a minimum MC of 35 per cent is recommended (Gordon and Rowe, 1982), while in Poland an MC of 24–32 per cent and a temperature of -3°C have proved suitable to store Samaras over three winters (Suszka 1978a).

Most short-lived recalcitrant tropical species are constituents of the moist tropical forests, where conditions conducive to immediate germination (high humidity and high temperature) are prevalent throughout the year. Typical genera are *Hevea, Swietenia, Terminalia* and *Triplochiton,* as well as a number of Dipterocarp genera such as *Dryabalanops, Dipterocarpus* and *Shorea* and some species of *Araucaria. Dryabalanops* is injured if dried below 35 per cent MC but still survives only about three weeks at over 35 per cent MC (King and Roberts, 1979). *Triplochiton* seed is naturally shortlived but can be stored for up to 22 months at a temperature of around 6°C and amoisture content of between 12 and 25 per cent (Bowen and Jones, 1975). *Azadirachta indica* seeds also have a short period of viability, although the species occurs in dry, not moist, tropical forests and it is not clear whether it is a genuine recalcitrant or simply a shortlived orthodox species.

Orthodox and recalcitrant species sometimes occur within the same genus. In Acer and Ulmus, genera in which both orthodox and recalcitrant seed behaviour occur, the distinction in North American species is clearly between spring and fall-seeders. A. rubrum and A. saccharinum flower and seed in the spring. Their seeds are not dormant, and their storage behaviour is clearly recalcitrant. Other Acer species have fall-maturing seeds, which are dormant and orthodox in nature at maturity. The same occurs in Ulmus. Seeds of U. crassifolia and U. serotina mature in the fall, and are orthodox in storage behaviour. Spring-seeding species of Ulmus are "weakly" recalcitrant (Bonner, 1984b). In Araucaria, A. cunninghamii and other spp. in the Eutacta taxonomic group behave as orthodox. In Queensland seeds of A. cunninghamii of five provenances were air dried and stored at varying temperatures in sealed and unsealed containers. At the higher temperatures, +1.7°C and -3.9°C, germination started to drop after 17 months' storage and after eight years

was down to about half the initial germination rate in sealed containers and about one-third in unsealed containers. At the lower temperatures of -9.4°C and -15°C, germination after eight years' storage was little changed from the initial (41-44 per cent compared with initial 49 per cent) (Shea and Armstrong, 1978), and there was virtually no difference between sealed and unsealed containers. The rate of viability loss at the higher storage temperatures varied from provenance to provenance, but all stored better at the lower temperatures. Moisture content was not recorded but under local conditions air-dry seed is normally in the range of 16-23 per cent (Kleinschmidt, 1980, cited in Tompsett, 1982). Later trials with Papua New Guinea A. cunninghamii have shown that seeds can be dried from 21 per cent to 7 per cent MC without any effect on initial germination rate; effects on storage life are still under investigation (Tompsett, 1982). A. hunsteinii in the Intermedia group and A. angustifolia, A. araucana and A. bidwillii in the Colymbea group are apparently recalcitrant. Arentz (1980) found that high viability of A. hunsteinii could be maintained for at least six months by storage at 3.5°C and high MC; 37 per cent was significantly better than 32 per cent. Research reported by Tompsett (1982) confirmed that MC should be maintained above 32 per cent. Placing the seed in a polythene bag of 25 microns thickness inside a second bag is effective in maintaining viability. The double thickness of polythene maintains a high MC but allows for

some exchange of oxygen which is necessary to preserve viability of *A. hunsteinii*. *A. angustifolia* also needs a high MC; seeds died if dried to less than 25-30 per cent (Tompsett, in press).

For some temperate recalcitrant species, as indicated above, a relatively low temperature (just above or just below 0°C) has been found beneficial in extending the life of the seeds; low temperature to some extent compensates for the high MC which must be maintained to prevent the early loss of viability. In some tropical species, seeds are quickly killed if temperature is reduced too low, just as they are quickly killed if MC is reduced too low. Among woody species cited in King and Roberts (1979) are Theobroma cacao (killed below +10°C), Mangifera indica (damaged below +3° to +6°C) and, among the dipterocarps, Hopea_helferi, Hopea odorata and Shorea ovalis (damaged below, respectively, +5°C, +10°C and +15°C). This susceptibility to chilling damage at temperatures above 0°C compounds the difficulty of storing these recalcitrant species, which seldom maintain viability for more than a few weeks or at most months. This compares with a normal seeding periodicity of several years in most dipterocarps, so there is no possibility of conserving seeds in a viable condition from one good seed year to the next.

Unlike orthodox species, in which viability is best preserved by maintaining a minimal respiration rate, it appears that active respiration is necessary to survival of seeds of most recalcitrants. Thus damage to recalcitrant seeds has been reported not only from inadequate MC and too low a temperature but also from lack of oxygen, e.g. in Araucaria hunsteinii (Tompsett, 1983), Hevea brasiliensis and Quercus spp. (cited in King and Roberts, 1979). Whereas some temperate recalcitrant species have been stored successfully for several years, seed longevity in tropical recalcitrants can be measured in days or weeks. The amount of research on tropical species is still small, especially on forest species, and it is possible that seed longevity could be prolonged beyond a few weeks if the best combination of seed maturity, speed, conditions and degree of drying, and most suitable storage temperature could be determined for each species. King and Roberts (1979) suggest a research strategy.

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WILDLIFE CONSERVATION

Elephant corridor issues and management

The long-term survival of a large-bodied, far-ranging animal such as the elephant can be ensured only through maintaining viable populations within viable habitats

S MAHES

Asian Elephant (Elephas he maximus), the largest terrestrial mammal and highly intelligent, was declared as National Heritage Animal in 2010. It is declared as an endangered animal by CITES and comes under Schedule I of the Wildlife Protection Act, 1972. There are about 30,000 elephants in India (60 per cent of the global population) with 32 elephant reserves and 88 elephant corridors in India. It is a 'Keystone species' and plays an important role in the ecosystem. The loss of elephants from an area would cause the existing ecosystem to collapse. Many species of animals and plants benefit from elephants. The status of the elephant can be the best indicator of the status of the forests.

Wildlife Corridor

A wildlife corridor or green corridor is an area of habitat connecting wildlife populations separated by human activities or structures (such as roads, development, or logging).

The long-term survival of a largebodied, far-ranging animal such as the elephant can be ensured only through maintaining viable populations within viable habitats. For maintaining such habitats it is vital to maintain large, unfragmented landscapes of several hundred square kilometres at a minimum in the short term, and certainly several thousand square kilometres to ensure long-term viability.

Importance of corridor

· Genetic diversity: Corridor allows



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an exchange of individuals between populations, which may help prevent the negative effects of inbreeding and helps to increase the genetic diversity (via genetic drift) and also help facilitate the re-establishment of populations that have been reduced or eliminated due to random events (such as fires or disease).

- **Colonisation:** Facilitates the animal in its search for food, water and mats.
- **Migration**: Species that relocate seasonally can do so more safely and effectively when it does not interfere with human development barrier to attain the benefit of favourable climatic conditions.

Elephants have already been observed increasingly using the vacated areas confirming that giving them "Right of passage" is the best way to protect their future.

Causes for corridor destruction

- Habitat fragmentation due to plantation crops, agriculture and allied activities.
- Development such as roads, railways, buildings, and farms can destroy plants and disrupt animals in the region.
- Furthermore, natural disasters such as wildfires and floods can leave animals with no choice but to evacuate. If the habitat is not connected to a safer one, it will ultimately lead to death. A remaining portion of natural habitat is called a remnant, and such portions need to be connected, because when migration decreases, extinction increases.

 Development of villages, schools, Institutions, multi-storeyed buildings, etc., in the habitat corridor.

Problems due to corridor destruction

- Increased human-animal conflict
- Loss of wildlife population
- High degree of species extinction
- Ecological and environmental imbalances
- Threat to the existence of life on earth

Corridor Status in India

India has an estimated wild population 25,000-30,000 about elephants, of roughly 60 per cent of the world's Asian Elephant population. These range across 32 Elephant Reserves spread over forests in northeast, central, northwest and south India. Of the 88 elephant corridors identified, 12 are in north-western India, 20 in central India, 14 in northern West Bengal, 22 in northeastern India and 20 in southern India. Of the total, 77.3 per cent of the corridors are being regularly used by elephants. Fragmentation of elephant habitat was found to be most severe in northern West Bengal followed by north-western India, north-eastern India and central India, respectively.

The least fragmentation was noted in southern India. Only 28.5 per cent of the corridors in the country are one kilometre or below in length. However, on a regional basis, about 65 per cent of the corridors in southern India are one kilometre or below in length. In southern India, 65 per cent of the corridors are under the Protected Area network and/or under Reserve Forests

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and 65 per cent of the corridors are fully under forest cover. In comparison, for example, 90 per cent of the corridors in central India are jointly under forest, agriculture and settlements and only 10 per cent are completely under forest. On a country-wide basis, only 24 per cent of the corridors are under complete forest cover. Settlements and the resulting biotic pressure in corridors are serious issues and throughout India, only 22.8 per cent corridors are without any major settlements.

Corridor Management

The National Elephant Corridor Project: The Project uses three basic approaches to secure elephant corridors throughout the country.

- Land purchase and facilitating voluntary relocation
- The Wildlife Trust of India assists the State Forest Departments in securing corridors by mediating between the authorities and locals settled in the corridors.
- Community participation by providing eco-development support

Project Elephant: This was launched by the Government of India in 1992 as a Centrally Sponsored Scheme with the following objectives:

- To protect elephants, their habitat and corridors; and
- To address issues of man-animal conflict

Monitoring of Illegal Killing of Elephants (MIKE) Programme: Mandated by the COP resolution of CITES, the MIKE programme started in South Asia in 2003 with the following objectives:

- To measure levels and trends in the illegal hunting of elephants;
- To determine changes in these trends over time; and
- To determine the factors causing or associated with such changes, and to try and assess in particular to what extent observed trends are a result of any decisions taken by the Conference of the Parties to CITES.

Other Activities for Corridor Management:

- Creating awareness among the public
- Formation of National Elephant Conservation Authority (NECA)
- All elephant corridors may be



declared as a protected area

- Early warning system can be materialised in all elephant reserves.
- Establishment of artificial cross links with vegetation

Corridor Issues

The area taken up for case study was the Coimbatore and Pollachi Forest Division. Several incidents were identified that raise cause for concern. Some of these are:

Elephant corridors in Palakkad gap near Walayar in Coimbatore district: Two tuskers were fatally hit by a train between Podanur and Madhukarai near Coimbatore in 2008. This stretch forms part of a number of elephant corridors in the Palakkad gap near Walayar, and about 15 elephants died here between 2000 and 2010. When the tracks were relaid, they became virtual death traps for migrating herds. The tracks are placed at a level much lower than the rest of the ground and clambering up to escape a train is not easy.

Thadagam valley corridor: A herd entered a ravine along a check dam at Kanuvai near Coimbatore, close to the Thadagam valley, which is an active elephant corridor. Constructions,



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mainly brick kilns, that have come up on this corridor force the elephants to find other routes during their migration. This herd eventually moved to the nearby reserve forest.

Valparai plateau of Pollachi division: There is a herd of elephants on the Valparai plateau. About 150 years ago, British planters converted most of the 220 sq km plateau into tea and coffee plantations, destroying prime rainforests and reducing the streams and nullahs in them to grassy swamps. Elephants now move between forest





patches through the tea gardens and use the swamps to rest and feed on the grass.

The picture shows a female elephant comes charging on Moyar Road in the Mudumalai Wildlife Sanctuary.

A herd migrating to distant forest patches is often stranded in the tea estates on the Valparai plateau. When they are forced to remain there for long hours because of human activity, they usually make merry in the garden and then raid nearby ration shops, noonmeal centres or homes for food.

A former employee of a tea estate owned by the Tamil Nadu Tea Plantation Corporation Limited, or Tantea, shows the kitchen of a tenement damaged by a herd that came looking for rice, salt and *daal*. Tea estates have reported an increase in incidents of elephants attacking ration shops, noonmeal centres and homes. Kallar corridor: The forest department proposes to build a flyover on the elephant corridor in Kallar at the foothills of Nilgiris, to bring down the increasing man-animal conflict.

Forest department secretary Hans Raj Verma, accompanied by VK Melkani, principal chief conservator of forests, collector, Ms. Archana Patnaik, visited Kallar to look at the proposal to construct a flyover linking hairpin bend 1 and 2, where elephants cross over frequently.

Conclusion

Through proper corridor management, creating awareness among public, formation of National Elephant Conservation Authority (NECA), declaring all elephant corridors as protected areas, early warning system in all elephant reserves and by establishment of artificial cross links with vegetation, elephants and elephant corridors can be conserved effectively and sustainably.

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JOINT FOREST MANAGEMENT

Rehabilitation of *Lantana*-infested areas with participation of right holders

The main reason behind the success of rehabilitation of areas infested with Lantana in Himachal Pradesh is involvement of local people in the work

Artee Maithani, Neha Chaudhary

antana camara (family Verbenaceae) is a tropical American ✓ species cultivated as ornamental plant in the past due to its beautiful flowers. It was introduced in 1809 in Calcutta Botanical Garden as an ornamental plant. It grows well up to an altitude of 2000 metres above mean sea level. It has drawn the attention of foresters and environmentalists because it invades the subtropical open areas and creates problem in natural regeneration of native species, grasses, thus reducing floral diversity of the place. It has been declared as 'Weed of National Significance' by more than 60 countries across the globe.

In Himachal Pradesh, the problem of alien weeds had been recognised as the primary management subject during the International Year of Forest, 2011.A survey was done in March 2011, which showed that Lantana had invaded 1.5 lakh hectares of forest lands.

Background

A villager said that there was a good forest before, but due to fire the whole forest burnt and *Lantana* (locally called

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phool lakdi) covered the whole area. People soon realised that *Lantana* was growing vigorously, checking growth of desired species by suppression, and cutting of light, competition for nutrients and water.

It was also found that after its eradication, it comes again due to its wide dispersal range, less prone to being eaten by birds and animals, and high seed production and tolerance of wide range of environmental conditions. As the eradication was not sufficient, the need for rehabilitation of *Lantana* treated areas has been raised.

Rehabilitation of *Lantana* infested areas

After 2011, forest officials made a strategy for eradication and rehabilitation of infested areas. They involved local people in this work. After one time removal of *Lantana*, they distribute the treated land among the right holders. Right holders protect that part of forest land, cut the grasses and, in return, eradicate *Lantana* if it arises again. This is a best example of sharing of responsibilities and benefits.

According to DFO Kunihar, BO Kuthar range, Forest guard Dadba

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RFO trainees, FTI&RC Sundernagar, HP

Circle-Wise Incidence of Exotic Weed Infestation in Forest Areas

Circle	Forest Area under the Invasion of				
	Lantana	Ageratum	Parthenium	Eupatorium	Total
Nahan	21,456.99	4,302.51	4,260.73	595.87	30,616.10
Bilaspur	55,941.55	0.00	0.00	0.00	55,941.55
Mandi	7,900.00	2,360.00			10,260.00
Hamirpur	12,680.00	0.00	0.00	0.00	12,680.00
Dharamshala	47,403.00	12,810.00			60,213.00
Shimla	4,060.89	0.00	1,100.00	0.00	5,160.89
Rampur	0.00	0.00	0.00	0.00	0.00
Chamba	4,631.77	132.91	68.50	85.40	4,918.58
Kullu	575.70	0.00	284.30	137.25	997.25
WL (S)	475.06	683.98	611.44	190.50	1,960.98
WL (N)	1,160.00	54.00	0.00	1,239.00	2,453.00
WL (GHNP)	0.00	0.00	0.00	0.00	0.00
	156,284.96	20,343.40	6,324.97	2,248.02	185,201.35

(Based on field data collected by field offices during January-March 2011)

Source: Strategy_Mgmt. of Invasive Alien Plant Species, Version-1.3 (June 2011)

beat and data collected from different sources, we came to know that rehabilitation of *Lantana* infested areas includes following measures:

- To set up biennial monitoring protocols to keep watch over the spread of exotic weeds and to take immediate remedial measures to remove recent infestation.
- Complete rehabilitation of infested areas. Shift from one time removal of weeds to complete rehabilitation of the treated areas.
- Comprehensive systems of longterm follow up action with appropriate budgetary support.
- Reliance on only mechanical/ manual methods in view of their

environmental concerns.

- Natural reliance of native flora to be the basis of rehabilitation action. Natural regeneration of indigenous plant species on treated sites will be encouraged and facilitated to establish towards better environmental and ecological services, including fodder, fuel, water recharge, etc.
- No exotic plant species should be planted on treated areas.
- Rehabilitation has to start from low-intensity infested areas and to progress into areas with heavy infestation. This is because low intensity infested areas have more chances of spreading.

- Priority should be given to rehabilitation of heavily infested critical habitats, for example, grazing grounds near habitation.
- Participation of multi-stakeholders.

Methods for strategy implementation

- Forest beat was the unit of rehabilitating exotic weed infested areas. It showed comprehensive visible impact and quick results of rehabilitation action.
- Forest beats with lowest infestation were selected first. Within the selected beat, rehabilitation action again started from areas with least infestation.

CRS Method

Most economic and accepted method of removal of Lantana was CRS (Cut root stock) method, i.e. cutting the main root below the coppicing zone (a transition zone between stem base and root stocks) to prevent coppicing. Main root stock of Lantana was cut 3-5 cm below the soil surface by hitting the root stock 3-4 times. While hitting the root stock, blade of the digger gets lodged into main tap root. After drying the clumps, the clumps may be used as a fuel or burnt at the same time, or all the dried clumps may be collected at one place and then burnt. Best time for removal of Lantana is just before rainy season when the plants are not flowering and fruiting. After eradication of Lantana, broadcasting of ripe seeds of local grasses with cow dung has been done in order to maximise the chances of its germination. A calendar

of rehabilitation activities was being made. Three years of intensive maintenance of the treated areas and periodic follow up was done in every three years. Thereafter, an integral programme was put in place till the area gets fully rehabilitated.

Economic Benefits

From a patch of 5x5 square metre area of Lantana rehabilitated part, we can easily get one unit of grass (1 bhara=20 poole). So, in one hectare area we have approximately 400 bharas of grass. Market rate of 1 bhara is Rs 150. Therefore, total income from 1 ha area per year is Rs 60,000. While the cost of rehabilitation of 50 per cent Lantana infested area, including maintenance cost, according to the norms mentioned in working plan is Rs 19,350 per ha. So, there is a net profit of Rs 40,650 per ha. Right holders of the area do not sell the grass. And now, there is no need to purchase fodder for their cattle.

Present Status

Eradication of *Lantana* is being done in various places and the treated land is distributed among the right holders for protection of area. The Forest Department also monitors and performs maintenance work for two years.

The participation of user group reduces the maintenance expenditure of the Forest Department, with better results. Now the treated area is fenced with live hedges like Agave and Euphorbia, having healthy growth of local grasses and regeneration of *Mallotusphillipiensis, Bauhinia varigata, Bauhinia vahlii, Murraya koengii,* Dudonia viscosa, Bamboo, Indigophora pulchella, Cassia fistula, Acacia catechu, Woodfodiafruiticosa, Ficus roxburghii and Pinus roxburghii, etc. Hopefully, it will very soon become a good forest. This is a best example of sharing of responsibilities and benefits.

Other Recommendations

- Furniture making from stalks.
- Medicinal uses as leaves of *Lantana* have antimicrobial, fungicidal and insecticidal properties. (Traditionally it was used in herbal medicines for cancer, skin itches, leprosy, rabies, chicken pox, measles and asthma).
- Bio-fuel can be prepared from the

uprooted or CRS cut clumps (this will reduce the risk of fire by burning slash of eradicated *Lantana*, along with prevention from air pollution).

Results

The integrated strategy of both eradication and rehabilitation is successful for the problem of obnoxious weed. The main reason behind the success of rehabilitation of areas infested with Lantana is involvement of local people in this work as well as the efforts of dedicated forest staff. It will be a successful example for the whole world to emulate if each person says that this is my forest and its conservation is my duty.

JOINT FOREST MANAGEMENT

Chir Pine Needles—from threat to opportunity

Pine needle-linked income generation in Darlaghat Range of Kunihar Forest Division has proved to be a successful endeavour

Pooja Payal and Poonam Silori

The State of Himachal Pradesh has 66 per cent of forest land with coverage of one-fourth area of Pinus roxburghii forest. Pine needles fall off during the summer season and are highly susceptible to fire due to the presence of a highly inflammable resin in them. Every year, thousands of hectares of forest areas are destroyed by forest fire in the State. Pine needles degrade very slowly and are also a hindrance to the regeneration of other forest species. Thus, the growth and survival of other species becomes difficult in a pure forest of pine. Pine needles are acidic in nature and percolation of acid in the humus also degrades the fertility of the soil by destroying soil building microorganisms. The soil in the area becomes susceptible to erosion, decreasing the productivity of the area. This difficulty forced the Forest Department to plan for worthful treatment of pine needles. Meanwhile, the cement factory at Darlaghat (Solan), the Ambuja Cement factory (ACF), took an initiative by using pine needles as fuel in the factory. This idea generated plentiful employment opportunities with forest

regeneration and protection.

The Ambuja Cement Foundation (ACF) is the main consumer of pine needles in the area. ACF, along with the Forest Department, is collecting pine needles and using them as a factory fuel from 3.000 hectares of forest area. Pine needles have high calorific value and find suitability in using them as factory fuel. This reduces the emission of greenhouse gases from the factory as well as plays a major role in prevention of forest fire to a large extent. The strategy of ACF for collection of pine needles includes identification of fire sensitive areas, awareness programmes in villages and involvement of Self Help Groups, Yuvak Mandals, Joint Forest Management Committees and Village Development Committees. Self Help Groups and Yuvak Mandals are directly

Table: Collection of pine needles is as follows (year wise)*

	-
Year	Quantity (in metric tons)
2012-13	128
2013-14	189
2014-15	303
2015-16	344

*As per the data provided by the ACF

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engaged with the ACF for the collection of the pine needles on individual basis, while the ACF provides an overall payment to the JFMCs, VDCs or FDCs for the collection work according to the area cleared.

During the visit to the ACF, it was informed that the total collection of pine needles in 2015-16 has been estimated to be 344.89 MT, which generated a total annual revenue of Rs 1,298,963 to the local community. Also it helps in protecting forests from fire, encouraging regeneration of other species and will motivate people to generate additional income in future.

The environmental concern due to pollution by factory emissions led to an initiative for collection of pine needles in the year 2012. For the purpose, the region was divided into two parts, Danoghat and Kashlog, from where the pine needles are collected every year with the involvement of the local community. Village Development Committees and Forest Development Committees were involved in Danoghat area whereas Self Help Groups and Yuvak Mandals were involved in Kashlog area.

The pine forests are spread alongside the road, so they are most vulnerable



Interaction with Mr Pradeep Kumar, Area Programme Manager and other members of Ambuja Cement Foundation

FIELD FORESTER | JULY 2016



Interaction with villagers of Gyana village in the Kashlog area

to catch fire at these places due to anthropological activities on the roads. These areas have been identified as firesensitive areas and pine needles are collected 50-100 metres upward and downward sides of the road. As per the data of Range Office Darlaghat, there are three major fire sensitive zones in Darlaghat covering a total area of 476.40 hectares.

The Forest Department, being a central agency in forest concerns,

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has the responsibility to improve forest wealth. As this area falls under Kunihar Forest Division at Darlaghat, so the Department has tried to provide livelihood opportunities to the community by forming FMCs and VDFCs. The Department helps in identifying fire prone areas, organising meetings and awareness campaigns in the area.

During the visit to the village, it was noted through the interaction of

the locals that all the activities in the area were community oriented. Self Help Groups and Yuvak Mandals were involved in the collection of the needles. Pine needles were collected from April to June, varying for different durations in different areas. The pine needles were to be collected before monsoon because they become useless for fuel after the onset of the monsoon. The workers used creepers to extract the needles from the forest and filling the bags to carry them to the road for further transportation to the plant. Bailing machines are used to form bails of pine needles at the road itself, which makes it easier to be carried in large quantities in trucks. The workers are paid Rs 1.65 per kg collection of pine needles. According to the Panchayat Pradhan and villagers of Gyana in Kashlog area of Darlaghat, mostly women are involved in pine needle collection. The pine forest is associated with Punica granatum, Zanthoxylum alatum, Bombax ceiba, Murraya koenigii, and other shrubs and grasses here.

The area of this village is 20 hectares and it gives the output of 14-25 metric tonne collection of pine needles in 22-25 average days annually. Pine needle collection is a part-time work as an additional source of income for the people here and provides Rs 5,000 per season as an average income. ACF ensures timely payment against the collection work done by the villagers.

A success

The part-time work has added to the income of the local people in different villages in Darlaghat. Villagers are receiving multiple benefits by collection of pine needles other than income generation. Pine needle collection work is done in the fire sensitive zones and fire lines of the forest. In this way, villagers have also realised that pine needle collection has prevented their forest from fire, which is an important asset for them. When pine needles are cleared off the forest floor, it assists regeneration of grasses, which are used by the villagers as cattle fodder. The efforts are appreciated by the people in the area, which will surely lead to introduction of more public-oriented activities in the forest area for the benefits of both the forest as well as the community.

Recommendation

There should be an increment in the daily wages so that more villagers are encouraged for this good cause. Extra benefits in wages should be given to workers collecting needles from the interior areas as those areas are more prone to fire incidents. Chir pine needles can also be used as raw material in handicrafts to promote cottage industries in rural areas other than being used as fuel. Avani, an NGO in Uttarakhand, has been working in the field of sustainable development by devising methods and applications for the processing of Chir Pine needles multiple ways, like briquettes in and charcoal making. These skill development techniques can be applied in Kunihar division too, as it has a flourishing Chir Pine forest. This will provide employment to the villagers as well as protect the forests too.

JOINT FOREST MANAGEMENT

Payment for ecosystem services at Palampur

The Palampur water governance initiative is not only a trailblazer, but also promises to improve the quality of water supply to the city in the near future

Shalini Joshi & Shashi Dev

Palampurisa city situated in the foothills of the Dhauladhar Range of Himalayas in Kangra District of Himachal Pradesh. It is surrounded by beautiful tea gardens and pine woods. The Palampur water governance initiative is the first Payment of Ecosystem Services (PES) initiative in India between two public entities, the Municipal Council and the Village Forest Development Society.

Background

As Mr Dheeman, Assistant Director of Himachal Eco Development Society told us, the Forest Department worked very hard in Kangra District. Two Indo-German projects-Indo-German Dhauladhar Project (1980-1989) and Changer Project (1993-1999) were implemented in this district. One of the main objectives of these projects was social output, capacity building of people/social development and socio-economic upliftment of villagers ecological rehabilitation. through Fulfillment of this objective formed a strong base for payment of ecosystem services at Palampur.

Introduction

Now, the story begins with Gram Panchayat, Bundala, which is about 8 kms from the main Palampur city. It consists of three hamlets-Bohal, Odi and Mandai of revenue village Bohal. The main source of clean water to Palampur city is Bohal Spring, in Bohal village. The Bohal Spring catchment spreads across 286 hectares and is inhabited by 62 families. The forest that lies within the Bohal catchment area is called "Bheerni forest". The inhabitants primarily belong to the Gaddi caste and every household is engaged in animal husbandry. Considering the good quality of drinking water of Bohal Spring, the Palampur municipal council purchased land around the spring in 1950. They fenced the area to protect it from contamination. They provided a tap near the spring and one at middle of village for the domestic use of villagers and the rest of the water was turned towards Palampur city.

As time passed, population of the village increased and to fulfill their livelihood requirement, their cattle population also increased. Therefore, grazing pressure on Bheerni forest increased. In 1990s, as a result of

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overgrazing and extensive lopping by villagers, the lower ranges of forest degraded. Thick forests of Oak and Rhododendron were severely harmed. This situation got worse when nearby village, Zhanzhra, closed their village forest for grazing and their grazing pressure also came on Bheerni forest. At the same time, a cloud burst took, resulting in heavy damage.

Due to all these incidents and initiatives of the Forest Department, people finally came to know about importance of thick forest and women village of formed an unofficial organisation to protect their forest. They also appointed a man for taking care of forest; he was named "Rakha". Rakha was paid a sum of Rs 10 by each family everymonth.Later,bycontinuousefforts of the Forest Department and Mr Vijay Guleria of HPEDS, villagers registered their Mahila Mandal as Village Forest Development Society (VFDS) under the Society Registration Act of 1860, under the Himachal Pradesh Participatory Forest Management rules 2001. The HP Participatory Forest Management Rules authorise elected VFDS to protect and manage local forest area.

A success story

This VFDS of Bohal village and the Forest Department worked so well that by year 2009 the degraded forest of Bheerni was converted into a thick, grazing-free forest. As a result of protection of this forest, a dramatic change took place. Bohal Spring which discharged 8 l/s water in 1950 and was reduced to 2 l/s in 2000, again showed an increase in water discharge of 2-3liters per second in lean season in 2009. Hydrogeologist of ACWA-DAM has identified the potential infiltration and recharge areas of Bohal Spring and their study came to the conclusion that due to protection of the Bheerni forest, increase in water supply of Bohal Spring occurred. They also suggested that further protection of forest area above Bohal village and undertaking some water harvest activities can help increase infiltration and recharge of groundwater in this area, which will ultimately result in increase of water supply in Bohal Spring.

The Initiative

GTZ (German Technocrat Union) is one of the main international corporation agencies supporting watershed





development in India through development of natural resource management-based panchayat. Microplans impact monitoring and evaluation of environmental services based on upstream and downstream linkage. Following the study and workshop of GTZ, GoHP formed Palampur water governance initiative.

Palampur water governance initiative aims at providing long-term drinking water quality security and source sustainability to Palampur from Bohal Spring. To fulfill this aim, an agreement between VFDS Bohal and PMC was signed on October 16, 2010. The key features of the agreement are:

- The agreement is for period of 20 years from the date of signing.
- The PMC will start with an initial payment of Rs 10,000 per year. The amount payable will increase by 10 per cent after every five years.
- VFDS will invite the PMC for a joint inspection twice a year for a visual assessment of the implementation of the high infiltration zone sub plan.

Observations

• We visited village Bohal and found some problems like open defecation, use of compost and NPK fertilisers near the spring, which is ultimately deteriorating the quality of water.

- As said by villagers and seen by us, PMC is not taking care of the spring's area as there is a heavy infestation of weeds.
- The Forest Department is also in the process of eradication of weeds nearby Bheerni protected forest.

This is a real success story from the point of view of the Forest Department that they convinced and made traditional shepherds aware about the conservation of forest and converted them into protectors of the forest.

Last but not the least, the work done by former forester, Mr Dheman, Mr Vijay Gularia and several other environmentalists and foresters is worth appreciating. Plaudits should also go to the sincere efforts of illiterate Gaddi women, along with Rakha of the forest, Mr Jagat Ram, to save the precious forest catchment area. This model of payment of ecosystem services must be implemented wherever possible.

JOINT FOREST MANAGEMENT

Thada: A desert that turned green...

The Swan River Integrated Watershed Management Project in Himachal Pradesh has not only provided better livelihood opportunities for villagers in the landslide prone Shivalik foothills, but also improved the landscape and environment of the region

Sparsh Kala & Shipra Sharma

When the population residing in rural areas, India claims to be one of the most rapidly progressing nations. The soul of our country lies in villages. Rural development thus becomes a prime objective of the government and the Forest Department has got a pivotal role to play in this context. This success story is dedicated to one of such works done by the government for the upliftment of poor and deprived sections of society as also stabilising and protecting the natural landscape and environment.

Study Area

The study was carried out in Thada Panchayat area of Una District in Himachal Pradesh from October 12-18, 2015. The catchment of Swan River of Una district is characterised by fragile and vulnerable Shivalik Hills and sparse vegetative cover. Swan, which is one of the tributaries of Sutlej River, was known as 'River of Sorrow' as it overflows the banks during monsoons and causes severe soil erosion, landslides, deposition of sand on fertile agricultural land which

renders it infertile, besides threats to life and property.

Looking into severity of problems in this fragile Shivalik foothill area and to reverse the trend of degradation of natural resources in the catchment area the State Government initiated "Swan River Integrated Watershed Management Project" in 2006-07 with the financial assistance from Japan International Cooperation Agency (JICA). HP State Forest Department is the nodal department for this project. Besides that, the Department of Agriculture, Horticulture and Animal Husbandry of the State are the participating Departments in the Project. Financial outlay of the Project is about Rs 220 crore and duration of implementation is nine years (2006-07 to 2014-15), although there has been an extension of one year in the period and the project culminates in March 2016.

Extent of the Project

Una District has 235 Panchayats, out of which 181 Panchayats fall in the catchment of Swan River. The catchment of this river is divided into 42 sub-watersheds. Out of these, 22 subwatersheds having geographical area of 619 sq km, which covers 96 Gram Panchayats of the catchment area that have been selected for the treatment. Gram Panchayats were selected for and implementation planning in four phases. Following participatory micro-planning process, Panchayat Development Plans (PDP) have been prepared in all the selected Gram Panchayats. Participation of Gram Panchayat has been ensured through the formation of Panchayat Development Committees (PDC), which is a Panchayat-level registered body. These PDCs are responsible for planning and implementation of livelihood improvement activities.

Grant-in-Aid (GIA) is released by the Project directly to PDCs for the execution of livelihood activities. Broad objectives of this project are to regenerate the forests, protect the agricultural land and enhance agricultural and forestry production in the catchment area of the Swan River by carrying out the watershed management integrated activities. These activities comprise afforestation, civil works for soil and water management, soil protection and land reclamation and livelihood improvement activities, thereby improving living conditions of people, including the poor, in the catchment area. The Project lays the foundation of success as target groups of benefitted people give their heart and soul to carry out the forestry and engineering works along with protection of plantations and civil structures which have been established under the Project.

This study brings forth some experiences of the Project with reference to Thada Panchayat area, where there has been a tremendous change in terms of irrigation and other water-related facilities. Thada was earlier characterised as a desert due to excessive run off and soil erosion as it lies in a slopey terrain and, hence, the productivity of agriculture was quite low while people had almost no knowledge about horticulture crops. The area was secluded with no connectivity to the main city. Cattle health was an issue and it caused low productivity of milk, which was one of the sources of earnings for the villagers. As a result, villages in Thada Panchayat were homes to poor and backward people who were basically small and marginal farmers and could not earn much due to natural washing away of fertile soil and no irrigation facilities.

The Project came as a boon for the villagers and gradually their problems started disappearing as there was construction of many civil and engineering structures that helped in reducing the run-off and storing agricultural and other water for purposes. Crop diversification took place, productivity increased and the Forest Department helped villagers in establishing horticulture crops in their fields, which gave them more returns. They were provided with high yielding seeds and were given trainings for implementing better and modern agricultural techniques. Livelihood is an important aspect of the Project and for the successful implementation there was micro-planning in each Panchayat. Immediate entry point activities were initiated. This helped the Project staff and the Forest Department gain the

S.No	Activity	Sub Activity	Area/Number
1.	Afforestation	i. Govt. Land	310 Ha
		ii. Private Land	100 Ha
2.	Soil Conservation	i. Veg. Shrub Barriers	187 Ha
	Works	ii. Dry stone check dams	837
		iii. Drop Structures	59
	iv. Embankments	1	
	v. Silt Detention Structures	18	
	vi. Causeways	1	
	vii. Foot Bridge	2	
		viii. Water Storage Tanks	5
		ix. Water Holding Structures	11
3.	Soil protection &	i. Vegetative field boundaries	20 Ha
La	Land Reclamation	ii. Crate wire structures	129
		iii. Conveyance systems	500 Rmt

Some factual data that defines the project has been summarised in the table.

*Works done by the Forest Department (Nodal Agency)

S.No.	Activity	Sub Activity	Area/Number
1.	Livelihood	i. Village Paths	3 (1.545 km)
		ii. Mangers	179
		iii. Chaff Cutter	126
		iv. RRWH Tank	10
		v. Cow Sheds	23
	vi. Horticulture Demo Plots	10	
		vii. Horticulture plants	2385
2.	Institutional	i. Self Help Groups	5
Buil	Building	ii. Water User Groups	3
3.	Pisciculture	i. Water Holding Structures	3
		ii. Seeds poured	32500
		iii. Members	29

*Works done by the Social Staff of project (Livelihood generation)

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confidence of the villagers. The villagers then came forward for the creation of self-help groups, water user groups, plantation protection groups, etc., which gave them a permanent source of earning as well as helped the Project get established successfully.

There are two major aspects of Project-Forestry works and the generation. Since Livelihood the Forest Department is the nodal agency, works like afforestation, soil conservation and land reclamation are carried out by dedicated forest staff while livelihood aspect is fulfilled by the social staff. Livelihood activities exposure visits, include trainings, supply of better techniques and raw material for agriculture and, the most important, women empowerment. This may be regarded as one of the striking achievements of the Project that it has empowered the rural women to an extent that they are no more deprived of their rights and are working parallel with the men of their society.

Other miscellaneous works include Establishment of Aloevera and Lemon Grass nurseries, veterinary health camps, supply of good quality high vielding seeds and seedlings of horticulture and agriculture species, promotion of pisciculture and poultry, trainings of women SHGs, establishment of Sombhadra Women Association Network (SWAN) federation. The estimated amount of money spent for the upliftment of Thada Panchayat is Rs 250 million. This includes all the forestry, engineering as well as livelihood works. In comparison to the development of people in terms of awareness, standard of living and their social and moral awakening, this amount seems to be a meager one. Who says money can't buy happiness!

COMMUNITY INVOLVEMENT

Ecotourism – key to successful and sustainable management

Residents of the designated Ecozone around the Great Himalayan National Park have been successfully involved in the effort

Usha Puri & Tanuja Parihar

The Great Himalayan National Park (GHNP) is the first National Park of Himachal Pradesh, located in the Kullu District. GHNP was formally declared a National Park in 1999, covering an area of 754.4 sq km ranging from 1500 to 6000 m in altitude. The Ecozone, an additional 256.6 sq km area, is associated with GHNP. In 2014, it was declared as a World Heritage Site by UNESCO. The Park supports a unique biodiversity. A total number of 832 plant species, representing 128 families and 427 genera, has been recorded from GHNP.

Among these, Himalayan Musk Deer and Snow Leopard are endangered while Himalayan Tahr and Western Tragopan are endemic to Western Himalaya. In GHNP, Sairopa is the main tourist station in Tirthan Valley and all tourism activities are controlled from Forest Range Office, Tirthan (Sairopa). Community based ecotourism activities are being conducted by the Forest Department at Sairopa and an NGO, Biodiversity Tourism and Community Advancement (BTCA), is playing an important role in managing and organising various tourism activities in GHNP. In 1994, two major changes were made in land use around the Park. A buffer zone of 5 km from the Park's western boundary, covering 265.6 sq km and including 2,300 households in 150 villages, was delineated as an Ecozone. Around 16,000 people residing in the Ecozone are poor and dependent on natural resources for their livelihoods.

After establishment of the Park, the utilisation of natural resources in the Park was prohibited to conserve

Flora	No of species	Fauna	No of species
Angiosperm	794	Mammals	31
Gymnosperm	11	Birds	209
Ferns	27	Reptiles	12
		Amphibians	09
		Insect	125

Biodiversity of the Park

(As recorded in HQ-GHNP)

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A view of GHNP



Meeting with Dir GHNP at Shamsi (Kullu)

the landscape, biodiversity and endangered species. As a consequence, villagers were deprived of a substantial part of their income. To address this socio-economic issue, the Park authorities have encouraged villagers to make a local organisation named 'Sahara'. In 2008, Sahara gave birth to a fresh organisation, BTCA, which got registered in 2009. The main objectives were protection of environment and biodiversity conservation by making it socially feasible and economically viable for local community and uplifting poorest and lowest caste families living



Meeting with BTCA members at Sairopa

in the Ecozone area of GHNP and women empowerment.

Before the establishment of GHNP, villagers were totally dependent on forest for all their needs, like medicinal herbs for use and sale, animal poaching for their feed and cattle grazing. But when these activities were prohibited, BTCA generated employment for men belonging to the Ecozone villages through ecotourism activities. Self help groups were created for women and named WSCG (Women Saving and Credit Group). These women were trained in making pickles, jams, apple

Year	Income from FRH	Income from tourist centre	Income from	Income from sale of map	Total income
			permit fee	and books.	(Rs)
2013-14	56200	145950	67750	-	269900
2014-15	98300	114770	135420	450	348940
April 2015	68640	129740	137380	500	336260
to July 2015					

Income generated by Biodiversity Conservation Society of wildlife range Tirthan (Sairopa)- General abstract.

(As per record of Range Office, Tirthan)

chips, juices, handlooms and charcoal by pine needles, vermi-compost and organic farming, etc., by the Forest Department through BTCA. Men were trained as guides, porters and in catering, camping, wildlife and other activities related to ecotourism. It engaged them in productive activities and they were diverted from forest exploitation.

The Forest Department allotted entry cards to 170 men of Ecozone area with the objective to provide registration and employment to the locals so as to safeguard the tourists and decrease any chances of theft or mishap in the Park area. As many as 10 groups were



Trekking in GHNP

made from among these cardholders. Each group contained 12 to 17 members, including guides, cooks, porters, etc. These groups are allotted duties by BTCA rotationally for proper management and distribution of work. Each tourist pays Rs 1500 for each day. Trekking in GHNP can be done by two ways-one, inside the Park, which is either for a day or multiple days, and two, on the periphery of Park in Ecozone villages. There is a 8-km journey from Gussaini towards the Park entrance at Rohilla. The Park has good camping facilities and trekking huts on the way to facilitate tourists. The speciality of the Park lies in the fact that no roads are made inside the Park and all the tracks are pedestrian. This is the secret of untouched and natural beauty of the Park. First camping point is at Rolla (2100m), which is 10 km from Gussaini. Next points are at Nada (3300m), Majhoni (3800m) and, the last point, Teerath at 4000m altitude. Trekking till the last point and back takes 7 days. One can enjoy the trekking and watch various endemic and vulnerable flora, fauna like snow leopard, brown beer and ibex and beautiful landscape of Park.

Number of tourists in GHNP

Year	Indian	Foreigner	total
2002	116	07	123
2003	147	15	162
2004	219	35	254
2005	155	45	200
2006	101	39	140
2007	206	20	226
2008	103	21	124
2010	192	20	212
2011	234	39	273
2012	230	37	267

(As per record of range office Tirthan)

Various reasons which attract tourists to GHNP are:

- Beautiful meadows, snow covered peaks.
- Sightings of rare and endangered wildlife.
- Lakes and glaciers, waterfalls.
- Cultural facets like fairs, temples, handicraft, folk dance and different customs.
- Bird watching, especially of pheasants like Western Tragopan and Monal.
- Adventurous activities like trekking, rock climbing, river crossing, angling, etc.

Observations

We met Mr BS Rana, CF/Director, GHNP, at headquarter Shamsi (Kullu), from where all ecotourism activities are controlled according to the carrying capacity of the Park. During our interaction with Mr Gopal Thakur, Director of BTCA, and other members of BTCA, we observed that they are successfully executing their work with sustainable management of Ecozone area and the Park.

Apart from enjoying the biodiversity and scenic beauty during our trekking from Gussaini to Rolla (inside GHNP), we also observed the catering and camping arrangements there. We interacted with guides, porters (members of Self Help Group), tourists and local people of Ecozone area and noticed that they all were satisfied. Local communities were content by getting employment and actively participating in all tourism activities carried out by the Forest Department and BTCA.

The Forest Department has a good coordination with local people. As a result, they are successfully and sustainably managing all ecotourism activities in a hilly and undulating



Interaction with local people



Range office Sairopa

terrain of the Park with conservation of biodiversity and providing better facilities to tourists. The number of tourists is increasing per year and the socio-economic condition of local people is improving day by day. The GHNP sets a good example of community based ecotourism at Sairopa and represents the best way of sustainable management and protection. Therefore, ongoing ecotourism activities the and the set up of the department to manage such activities provide an inspiration which may be successfully implemented in other protected area networks too.

Acknowledgement

We are grateful to all the officers/ people who supported and provided us valuable information regarding the case study along with Mr BS Rana, CF/ Director GHNP; Mr Gopal Thakur, Head/Director of BTCA; Mr Kripa Shankar, DFO, GHNP; Mr Joginder Singh, ACF, GHNP,; Mr Roshanlal, BO Tirthan Range, Sairopa; All members of BTCA and local people.



FOREST MANAGEMENT

Sandalwood as a key resource

The remaining sandal trees need to be protected effectively and natural sandal-bearing areas should be preserved

PV Anbu

mong Indian forest trees, sandal (Santalum album L.) has been rated as the most precious and valuable forest tree, and is well known for its fragrant wood and oil. The fragrance is derived from the heartwood of Santalum album which is obtained from natural forests. S. album is indigenous to peninsular India and its natural distribution is across about 9,600 sq. km. This limited distribution, and the complexity involved both in germination and in host-specificity imperils the existence of this species in the near future. The tree is facing extinction owing to wanton felling by smugglers. Yield is 2.5-6.2 per cent depending on age of the tree, and soil, climatic and genetic factors.

Why should sandal resource be managed?

The sandal tree plays a major role in the international market, contributing to trade in materials of great commercial importance such as timber (scented heartwood), oil, perfume and medicine. The heartwood (both stem wood and root wood) of *Santalum album* is prized in the market for its oil and the wood is also used for carvings, trinket boxes

and other utility items. Because of its economic value, the trees are often felled illegally, converted into various forms and smuggled out. The situation was particularly grave in the early 1980s and onwards, leading to extinction of tress and threatening the species.

Sandalwood is sacred and is used in religious ceremonies and is an important ingredient in'*homa'* (*havan*), a Sanskrit word which refers to any ritual in which making offerings into a consecrated fire is the primary action. Among the Buddhists, sandalwood is burnt during prayers and meditation. The sapwood is white or yellow and not scented, and is used in preparing turnery items and *agarbattis*.

Sandalwood oil is obtained by steam distillation of heartwood powder. It is expensive and sold by weight. In 2012, the cost of 5 g of oil sold at the Karnataka Government outlet was Rs 1,500, which works out to be Rs 300,000 per kg. Sandalwood oil is a pale yellow to yellow viscous liquid, with sweet, fragrant, persistent, spicy, warm, woody, animalic, milky and nutty notes. It is extensively used in perfumery, cosmetics, aromatherapy and the pharmaceutical industry. The oil is used as a flavouring substance in food products such as frozen dairy

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FRO (T), TNFA, Coimbatore

desserts, candy, pan masala, baked food, gelatin, puddings and also in alcoholic and non-alcoholic beverages. The oil is approved for use by the US Food and Drug Administration, Flavour and Extract Manufacturers Association, Council of Europe and Joint FAO/WHO Expert Committee on Food Additives.

On account of acute scarcity of sandalwood oil, search for novel synthetic raw materials imitating the characteristic odour profile of sandalwood oil has become a challenging task. Extensive studies are being carried out to investigate the structure–odour relationship. The oil is

used for its therapeutic effects in Ayurveda, Chinese and Tibetan medicinal systems. It is used in the treatment of common colds, bronchitis, fever, dysentery, piles, scabies and infection of the urinary tract, inflammation of the mouth and pharynx, liver and gall-bladder complaints and as an expectorant, stimulant, carminative, digestive and as a muscle relaxant. Sandalwood oil elevates pulse rate, skin conductance level and systolic blood pressure and brings about higher ratings of attentiveness and mood in humans.

Present status of sandalwood resource

Sandalwood as a prospective economic resource had played an important role in many of Krishnadevaraya's (the famous ruler of Vijayanagara Dynasty) expeditions to different parts of the Deccan during the early part of the 16th century. Tipu Sultan who ruled the Kingdom of Mysore had declared sandalwood tree as a royal tree and took over sandalwood trade of the state on a monopoly basis around 1792. This practice was continued by the later Maharajas of Mysore and subsequently by the Karnataka Government until recently. The extraction and disposal of sandalwood came under the jurisdiction of the Forest Department in 1864. The classification of the sorted sandalwood into 18 classes was introduced in 1898.

Over 70 years ago, nearly 90 per cent of the natural sandalwood distribution occurred in the southern part of Karnataka and northern part of Tamil Nadu. Excessive harvesting without replenishment of this invaluable resource has substantially reduced the sandalwood industry, resulting in global shortage and soaring of market prices. Importantly, *S. album* has been categorised as 'vulnerable' by the International Union for Conservation of Nature (IUCN) in 1997.

Today, sandalwood distributions are sparse and devoid of larger girth classes; mature trees have been mostly vandalised. The major cause of the decline of sandalwood has been smuggling. A serious affliction from which sandalwood suffers is the spike disease and the economic losses caused by it are heavy. The other reasons of paucity of sandalwood include forest fires, absence of adequate number of seed bearing trees, lack of established plantations and heavy demand by the Sandalwood Oil Factory. Sandalwood production (referring to the quantity of sandalwood auctioned) in Karnataka and Tamil Nadu has dwindled considerably. Apart from Karnataka



and Tamil Nadu, sandalwood is found in Kerala. Marayoor (40 km from Munnar in Idukki district) is the only place in Kerala where sandal trees grow naturally. In 2011-12, 45.15 tonnes of sandalwood was extracted from this region. The monopolistic rule on sandalwood had prevented anyone excepting the personnel of Forest Department to harvest and sell it.

Unlike the situation with major commercial timber tree species such as teak, sal, pine, deodar, oak, acacia, eucalyptus, casuarina, willow and poplar in India, sandalwood stands out as one species for which no organised plantations have been established. Realising the disadvantages of this and taking cognisance of the grim situation, the Governments of Karnataka and Tamil Nadu promulgated the Karnataka Forest (Amendment) Act 2001 and the Tamil Nadu Forest (Amendment) Act 2002, respectively. The former Act clearly stated that 'every occupant or the holder of land shall be legally entitled to the sandalwood tree in his land'. At that point of time, the owners had no option but to sell sandalwood exclusively to the Forest Department. The debate on the consequences of this amendment has, however, paved the way for encouraging community and private entrepreneurs to cultivate sandalwood, which is in great demand.

The diminishing sandal population has led to the resulting decline in supply of sandalwood oil for pharmaceutical industries, *agarbatti*, handicrafts and other industries. The international market has been weakened by both diminishing and fluctuating production and poor supply in recent years.

Measures for sandal resource management

For effective management of the resource, various aspects of sandal need to be considered, such as:

- Economic and legal aspects
- Interspecific hybridisation,
- In-vitro and in-vivo regeneration and multiplication,
- Cell and molecular approaches,
- Improved clonal forestry techniques, and
- Pest management utilisation.

The silviculture and management of sandal should involve:

- Improvement in nutrient and moisture status of the soil by constructing a series of small-scale soil conservation structures.
- Protection against grazing by fencing small areas with a stone wall or barbed wire supported from outside by a thorny impenetrable vegetative fence; maintenance of these fences is much more important than establishing additional areas.
- Employing tribal watchers from local settlements for protection against grazing and fire.
- Providing incentives to the people of forest villages for complete protection of specified sandal regeneration areas against grazing and fire.
- Planting of fruit-bearing species which attract birds for enhancing ornithodispersal of sandal seeds.

Recommendations

For future management:

Since much of the sandal wealth and natural sandal-bearing area have been lost, at least the remaining sandal trees are to be protected effectively and remaining natural sandal-bearing areas are to be preserved. Steps to be taken are as follows:

- Full protection against biotic interference such as fire, grazing, browsing, and hacking.
- Existing sandal-bearing areas are to be fenced and protected.
- Smuggling activities are to be curbed by intensive protection measures and laws, with the help of local people, NGOs and other local bodies.
- Smuggling and export of sandal oil should be rigidly controlled.
- Large-scale sandal plantations are to be raised in natural sandalgrowing areas.
- Dibbling of pelletised sandal seeds in and around bushes, advance work areas, ripping areas and other workings are to be carried out on a large scale every year.
- Private farmers and plantation owners are to be encouraged to plant more.
- Existing laws, rules and regulations are to be relaxed and modified to suit the public interest.
- Sufficient funds are to be provided for sandal regeneration and protection schemes.
- Enterprises depending on sandalwood and its products are to be encouraged to establish large-scale captive plantations of their own.

- Private tree-growers are to be encouraged to introduce sandal as one of the progressive high-value tree species such as teak and others.
- People in urban and rural areas are to be given free saplings to plant in their home yards every year on a large scale, and are to be encouraged to grow and save such a highly valuable, sacred, endangered tree.
- A condition is to be imposed on every Range Forest Officer in the state to raise at least 10,000 seedlings of sandal compulsorily, and to plant these on a large scale.
- Techniques for easy sandal regeneration through seeds are to be developed (seed technology); fastgrowing, quality wood-yielding, superior varieties in the existing stock are to be identified.
- The Department should organise 'Sandal Week' (or Day) every year, and should supply free of cost sandal seeds and seedlings to families.

For research:

- Collaborative research should be undertaken to develop high-quality planting stock; modem techniques, such as plant tissue culture, molecular biology and genetic engineering, application of multimolecular markers for the early identification of promising clones, and selection of 'candidate plus trees' (CPT), should be used.
- Gene banks to exploit genetic diversity, both within and between species, should be developed for future genetic improvement through breeding and other modem techniques.



- Silvicultural practices should be developed, including application biofertilisers of like 'vesicular arbuscular mvcorrhiza' (VAM), nitrogen-fixing bacteria. intermediate and long-term hosts, and integrated pest management, taking into consideration different eco-climatic and agro-chemical conditions and a package of practices to be made available to growers.
- *Sandal plantations* should be encouraged as a profitable proposition, for which present laws need to be liberalised, as proposed by the Tamil Nadu Forest Department, in the direction of free trade.
- *Uniform extraction and transport policy* should be formulated and followed in order to regulate the industry on a viable commercial basis.
- Conventional breeding methods for genetic improvement of sandal should be given more emphasis.
- *Tissue culture* techniques should be scaled up from the laboratory and linked with foresters for field evaluation in order to assess their commercial viability.
- 'Candidate plus trees' from different provenances need better identification, and a suitable methodology should also be evolved to delineate genetic and environmental factors.

- *Wide-ranging provenance studies* should be undertaken.
- *Exchange of scholars* between the sandal-growing countries should be encouraged and Internet facilities on sandal made available.

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COMMUNITY INVOLVEMENT

Functioning of tree grower societies

Tree growers who were innovative, seeking information about tree growing activities and who had higher awareness about Forestry Extension activities, did possess a higher chance of becoming a member of the TGS

V Irulandi¹, T T Renganathan² & M Ramasubramanian³

extension roup concept has gained momentum in recent times. It has replaced individualist public extension system, which was in vogue for a very long period. In line with this development, farmer's groups have been organised by government departments, private organisations and NGOs to help farmers gain maximum advantage from their farm produce. Farmers are being mobilised into groups and the nomenclature varies according to the nature, size and structure.

The present study will be helpful in improving the effective functioning of TGS' and creating a platform for the tree growers to share their knowledge on tree-growing practices and marketing trends on trees and their products.

Farmers' Interest Groups, Farmers' clubs, Farmers' Commodity Groups, Farmers' Associations, Farmers' Societies are some of the nomenclatures assigned for the congregation of farmers. The recent addition to this list is the Farmer Producer companies through suitable amendments in the Companies Act. Primarily, the mobilisation of farmers' group will help farmers in marketing the produce, getting inputs for a reasonable price, credit in a hassle-free manner and ultimately improving their economic status. Realising the benefits of groupbased approaches, Tree Grower Farmer Associations have been mobilised by different service providers.

TGS are characteristically umbrella organisations and their prime objective is to represent the interests of private tree growers before the Forest Department and other line departments at the State and district level to influence and achieve their objects. These associations help tree growers in buying expensive equipment for forestry works, especially planting equipment to be shared among members and reducing the fixed cost burden.

Higher market price for wood produces could be achieved through joint marketing and bulk orders. The expenditure for raising seedlings in private lands could be lowered for small and marginal farmers. These farmers in their individual capacity may not be able to influence policymakers and cope up with market fluctuations,

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whereas members of TGS together can organise for collective actions in the field of private forestry and provide its members, forward and backward linkages inevitably needed for tree cultivation.

TGS in Tamil Nadu

In Tamil Nadu, a well-established Forestry Extension network system has been developed and Forestry Extension programmes are being implemented through FEC created in all 32 districts. Presently these centres are engaged in activities such as production and supplying of quality seedlings, organising training to farmers, publicity and awareness creation activities, formation of demonstration plots in the farmer's land and taking up tree cultivation programmes in farmer's land.

One important activity of FECs is to facilitate the functioning of TGS to augment the potential of farmlands for the cultivation of tree crops. Twentyseven TGS were formed in various districts about a decade back.

Despite the fact that TGS are being promoted with greater enthusiasm by the Forestry Extension wing, the diffusion of the concept among the members has not been satisfactory. Most of the TGS in different districts were defunct and a few are functioning with lesser activities. Though benefits from such farmer's societies elsewhere were found to be abundant, it was necessary to analyse the reasons responsible for poor functioning of TGS and to find out the strategies for strengthening the activities of TGS in Tamil Nadu. Keeping this in mind, a study was contemplated with the following objectives.

- To analyse the functioning of TGS in Tamil Nadu.
- 2. To predict the willingness of tree growers to become members of TGS.

Theoretical orientation

Perusal of studies of Singh and Ballabh (1982), Shankar Narayanan (1991), Saxena (1987), Gupta (1989), and Shah and Ballabh (1986) revealed that cooperative organisation should а perform procurement, storage, processing and marketing cost effectively, if it is to successfully compete with private traders engaged in these activities. Judging the quality of wood is a difficult task for the personnel of Tree Growers Cooperative Society and it requires a lot of hands-on experience and skill to do so and determine its price accordingly. TGS personnel will need to beg, borrow and steal expertise in this area from private traders engaged in timber business.

Case studies conducted by Gupta (1989), Mishra et al (1982), Raju and Sarabhai (1992), Saxena (1987), Singh and Bhattacharjee (1991) identified the following issues in the healthy functioning of TGS: hassles in securing revenue wastelands on lease, choice of tree species, harvesting and transport of trees grown on private lands, equitable benefits. distribution of financial viability, integration of procurement, storage, processing and marketing activities

According to Ballabh and Kramer (1992), for the success of Tree Grower Cooperative Societies (TGCS), two things are of paramount importance:



exclusive property right of TGCS to the land on a long-term lease of at least 30 years and its enforcement to restrain non-rights holders from using the resource; and, ability of the TGCS to coordinate and regulate the use of the resource by its members to avoid "freeriding".

Singh and Balooni (1994), in their working paper, indicated that TGCS hold high promise as an instrument of promoting farm forestry in India on a sustainable basis. They can disseminate technical information to potential tree growers and train them, supply quality saplings and fertilisers and pesticides, provide or help secure institutional credit and arrange for marketing of farm forestry produce at remunerative prices more cost effectively than any other organisations.

Rakesh and Rajesh (1999) proposed a natural resource accounting system which could be used with the conventional financial accounts of village-level TGCS operating under the umbrella of the National Tree Growers' Co-operative Federation.

Christian and Annemarie (2012) highlighted that small holder's market access improves not only as a result of Small Holder Marketing Cooperatives (SMC), networking and negotiation with key actors in the public and private sector, but also due to improved interrelationship among SMCs and other type of farmer's organisations. Peer-to-peer relationship with other SMCs is critical for mutual learning, collaboration and collective action.

Methodology

The study was undertaken in Tamil

Nadu and 245 farmers were selected from eight districts, representing five agro-climatic zones of Tamil Nadu which have higher potential for treegrowing activities. The respondents were selected using snowball sampling, wherein word of mouth of potential tree growers and opinion of the Forestry Extension officials were taken into consideration.

The selected respondents were enquired about the functioning of TGS in their respective districts. Out of 245 respondents, 84 were found to be members of TGS and they were considered for further data collection regarding functioning of the Societies.

А well-structured pre-tested interview schedule was constructed to pursue the objectives of the study, which included four components, namely awareness about TGS, perception about benefits of participation in TGS, constraints in functioning of TGS and suggestions to overcome the constraints in functioning of TGS. Items for the study of TGS to be included in the interview schedule were finalised through discussions with the office bearers and members of TGS and prospective tree growers in different agro-climatic zones of Tamil Nadu.

The awareness of the tree growers about TGS was studied using five items, namely awareness of existence of TGS, member in TGS, payment of membership fee, satisfaction with functioning and attendance during meetings of TGS. All these items were scored with the help of Yes or No questions, wherein '2' score was given for 'yes' response and '1' score for 'no' response. Similarly, the perception about the benefits of participation in TGS, constraints prevailing in the functioning of TGS and suggestions to improve the functioning of TGS were studied using 'yes' or 'no' responses, which were given scores of '2' and '1', respectively.

Analysis of data

The four components of the study were analysed using simple percentage analysis. The second objective of the study was pursued using binary logistic regression. The response of the respondents, namely willing to join TGS or unwilling to join TGS, was coded '1' and '0' and the predictors of the willingness was studied through binary logistic regression. Binary logistic regression (which will be referred to simply as logistic regression) is regression applied to a dichotomous dependent variable, where the dependent variable is not the raw data values, but instead is the odds of the event of interest occurring. Specially, the general equation for logistic regression is:

In (Odds) = α + $\beta 1X1$ + $\beta 1X2$ + βkXk .

The terms on the right are the standard terms for the independent variables and the intercept in a regression in a regression equation. However, on the left side is the natural log of the odds and the quantity 'In (Odds)' is called a logit. It can vary in principle from minus to plus infinity, thus removing the problem of predicting outside the bounds of the dependent variables. The odds are related to the probability by: Odds = Prob / 1-Prob.

This is a liner relationship with the independent variables in logistic regression, but it is linear in the log odds and not in the original probabilities. Since we are interested in the probability of an event, i.e., the higher code in a dichotomous variable, the logistic equation can be transformed into an equation in the probability. It then has this form:

Prob (event) = $e\alpha$ +B1X1 + B2X2 + + BkXK 1 + $e\alpha$ +B1X1 + B2X2 + + BkXK

This equation cannot be estimated with the least-squares method, instead the parameters of the model are estimated using a maximum likelihood technique. We derive coefficients that make our observed values most "likely" for the given set of independent variables.

Results and Discussion

In line with the methodology set forth, the data was collected and the results were tabulated. The following section deals with the results and discussion of the study.

Awareness and participation in the TGS

The primary thing that needs to be understood is the level of awareness of tree growers about the functioning of TGS, since any action starts with awareness. The results are presented in Table 1 and Table 2.

The perusal of Table 1 revealed that almost two-third (60.41 per cent) of respondents did not know the existence of TGS in their villages. One-third

Table 1. Distribution of respondents according to their Awareness about Functioning of Tree Grower Societies

(Multiple response) (n = 245)

C No.	Awareness about functioning of TGS	Yes		No	
5.110.		No	%	No	%
1	Awareness about existence of TGS	97	39.59	148	60.41
2	Member in TGS	84	34.29	161	65.71

Table 2. Distribution of respondents according to their participation and involvement in the activities of Tree Grower Societies

(Multiple response) (n = 84)

C No	Awareness about functioning	Y	Yes		No		
S.No. of TGS		No	%	No	%		
1	Payment of membership fee	55	65.48	29	34.52		
2	Members attending the meeting regularly	75	89.29	9	10.71		
3	Satisfaction with functioning	57	67.86	27	32.14		

(34.29 per cent) of respondents enrolled themselves as members in TGS. These members were also part of the few TGS which are functioning with limited activities.

It is evident from Table 2 that only 65.48 per cent of members have paid the membership fee. It is conspicuous there existed gap between that being a member in TGS and paying membership fee. Since the members could not realise any tangible benefits from the society, they were bit hesitant to pay the membership fee. Further, the societies were poorly patronised by the Forestry Extension personnel. Had the benefits of being member of society been explained in a pacifying way to the farmers by the Forestry Extension personnel, the participation of members

in terms of payment of membership fee could have enhanced, which would have facilitated sustenance of Society activities.

Out of 84 members, majority of them (89.29 per cent) were reported to attend the meeting regularly. Nearly twothirds (67.86 per cent) of respondents were satisfied with the functioning of the society.

The point to ponder here is that the officials of Forestry Extension wing of Forest Department had invested lot of time to create TGS in 27 districts of Tamil Nadu. The observation of investigator of present research in the field does not commensurate with the amount of efforts taken by officials of Forestry Extension wing. Most members in the TGS conveyed to the investigator that

Table 3. Distribution of respondents according to their perceptions ab	out
Functioning of Tree Grower Society	

				•	
S No.	Porofita	Y	es	N	lo
S.NO. Benefits		No.	%	No.	%
1	Got to know the fellow Tree growers	61	72.61	23	27.39
2	Chance to interact with fellow Tree growers	66	78.57	18	21.43
3	Improved my expressiveness and developed self confidence	72	85.71	12	14.29
4	Understanding the collective approach	69	82.14	15	17.86
5	To know about technical information on tree growing	74	88.09	10	11.91
6	Got to know market information	77	91.66	7	8.34
7	Avoidance of middle men	70	83.33	14	16.67

the facilitation of officials of Forestry Extension wing is not forthcoming and they failed to sustain initial efforts. The Forestry Extension officials are to be trained in mobilising the farmers, understanding the group dynamics and facilitating the members to renew the registration of the society.

Perceptions about benefits of participation in TGS

The perceived opinion of the members of TGS about the benefits of participation is paramount important to assess its sustainability. The data pertaining to their perceived opinion about benefits of participation in the society is presented in Table 3.

An important benefit that whopping majority of members (91.66 per cent) indicated was to know the market information by being a member of the society. This would result in avoidance of middlemen, which is again reported by majority of (83.33 per cent) members as a benefit. It is evident that the expectation of members to get reliable, timely market information, such as demand, supply, price of timber and other forest produces, is steadily increasing. Hence, the Forestry Extension system needs to invigorate itself to improve its information system to provide needed market details to members of the societies.

(Multiple Response) (n = 84)

Majority (88.09 per cent) of members of TGS endorsed the benefit of getting to know technical information about tree growing by being a member of society. Further, the membership in the society has improved their expressiveness and developed self confidence, as reported by majority of members (85.71 per cent). The TGS gave an opportunity

			multiple	response	5) (II – 0 1)
C No.		Yes		No	
S.No.	Constraints prevail	No.	%	No.	%
1	Dominated by few persons	48	57.14	36	42.86
2	Lack of fund to run the society	70	83.33	14	16.67
3	Lack of infrastructure facility	76	90.48	8	9.52
4	Inadequate knowledge to handle society matters	58	69.04	26	30.96
5	Time constraint	55	65.48	29	34.52

Table 4. Distribution of respondents according to constraints in prevailed functioning of Tree Grower's Society

to the members to meet the Forestry Extension officials and have interaction with them, helping them to get technical information about tree growing. Further, the meetings, which are being organised by TGS, helped members to express their ideas and to engage in transfer of each other ideas.

The indirect consequence or benefit of being a member of TGS is that understanding the collective approach, which has been reported by nearly four-fifths of the respondents (82.14 per cent). The group extension concept is fast emerging, like Farmers' Interest Groups (FIGs), Commodity Groups, Farmer Producer Companies (FPCs), in agriculture and the farmers are increasingly realising the benefits of working in groups.

Approximately, three-fourths of the members of TGS reported that they got to know fellow tree growers (78.57 per cent) and they had chances to interact with fellow tree growers (72.61 per cent), respectively.

The prime aim of mobilising farmers' groups is to provide a platform wherein

farmers with diverse backgrounds share their experiences, which can be more location specific and farmer friendly than technologies delivered through formal extension system.

(Multiple Perpenses) (p - 94)

Constraints in the functioning of TGS

The constraints in functioning of TGS are presented in Table 4. The prime constraint expressed by vast majority of members (90.48 per cent) was the lack of infrastructure facilities such as office space, furniture, computer accessories with internet facility and staff, which are essential to hold meetings and governing day-to-day activities for effective functioning. The other constraint which was expressed by majority of members (83.33 per cent) was the lack of funds to run the society.

Another constraint which hampered the functioning of the society as reported by nearly two-third (69.04 per cent) of members was inadequate knowledge to handle society matters. This is the crucial point to be borne in mind by the officials of Forestry Extension

Table 5. Distribution of respondents according to their suggestions to improve the functioning of Tree Grower Societies

(Multiple responses) (n = 84)

S No.	Suggestions	Yes		No		
5.110.	S.No. Suggestions		%	No.	%	
1.	Provision of funds and creating Infrastructure facilities	84	100.00	-	-	
2.	Creation of awareness about the existence of the society	75	89.28	9	10.72	
3.	Periodicity of meeting must be ensured	68	80.95	16	19.05	
4.	Democratically elected office bearers	45	53.57	39	46.43	
5.	Renewal of registration and auditing	31	36.90	53	63.10	
6.	Providing market information	78	92.86	6	7.14	
7.	Involving members in raising nursery and vermi-compost production	17	20.24	67	79.76	

wing; they have to seriously think of imparting knowledge about working and mandatory activities of the society, renewal of society and maintenance of records and accounts.

Time constraint has been reported by nearly two-thirds (65.48 per cent) of members of the society. Although, the members were eager to take part in the meetings organised by the societies, due to various timely agricultural works they could not find time to participate. The society must fix a particular date in a month for the periodical meeting, which will enable members to attend by adjusting their other works.

Nearly half (57.14 per cent) of the members felt domination by few persons as one of the constraints. Any group is bound to have such individuals who need to be tackled diplomatically by other members and office bearers. Training on group dynamics for office bearers as well as members proved to be an effective solution for such problems.

Suggestions to improve the functioning of TGS

Suggestions to improve functioning of TGS had been sought from members of the society. The results are given in Table 5.

Provision of funds and creation of infrastructure facilities was the suggestion endorsed by all members (100 per cent) of TGS who were interviewed. For any institution to thrive and sustain its functions, funds and infrastructure are very vital. The members and office bearers might have felt the onus while conducting the meetings/functions/*melas*, during which they need to arrange facilities like meeting hall, furniture, public address system and refreshment. Hence, they have prioritised this suggestion among others.

Providing market information to the members of TGS by the Forestry Extension wing was suggested overwhelmingly (92.86 per cent) by majority of members. At the end of the day, good market price for the produce would be the ultimate expectation of any farmer toiling in the field. In the absence of proper market information system, the middlemen pocketed a lion's share of profit by exploiting the ignorance of the farmers. Many studies suggested that price spread for tree produces could be restricted through effective market regulatory mechanism, which will provide proper market intelligence. This is the reason why members felt that suitable mechanism should be devised for providing market information.

Another important suggestion expressed by majority (89.28 per cent) of the members was the creation of awareness about the existence and benefits of society. As it was discussed in Table 2 that the awareness among the Tree growers about the existence of TGS was very low, the members felt this as a vital suggestion. This suggestion should be taken care of by the Forestry Extension system through intensive campaigns and meticulous publicity.

Majority of members (80.95 per cent) suggested regular conduct of society meetings. Though the Forestry Extension wing has formulated a system to have periodical meetings through TGS, it is not being conducted regularly due to paucity of funds for arranging transport and refreshment. Members also did not evince interest in attending the meetings due to the assumption that they will not be getting enough relevant technical information on tree growing and allied activities. This indicates that a policy decision needs to be taken for allotment of corpus fund, infrastructure and provision of updated technological information through appropriate experts in the relevant fields.

Nearly half (53.57 per cent) the members felt that office bearers for TGS must be chosen in a democratic way so as to avoid dominance of a few members. This is true with many organisations and hence, this should be streamlined by adopting an acceptable method.

Renewal of registration and auditing of the accounts was the statutory provision as stipulated in the Societies Registration Act. Many TGS did not follow the procedure of renewal of registration, which has affected the functioning of societies. Hence, a few members (36.90 per cent) suggested that this statutory provision should be adhered to scrupulously.

About one-fifth of members (20.24 per cent) suggested that they should be involved in nursery raising and vermi-composting pertaining to some government schemes, so that they will get to know about the techniques of nursery raising and vermi-composting. A suitable policy decision is to be taken to consider this suggestion.

Willingness of tree growers to become members of TGS

Another dimension of the study was to assess the willingness of the tree growers to become members of TGS, which might have been influenced by



Step	-2 Log likelihood	Cox and Snell R Square	Nagelkerke R Square
1	64.209	0.410	0.602

Та	bl	e 6	5.	Mod	e	summa	ry of	log	istic	coefficients	
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Table 7. Classification	table to check the	predictive ability	of the Logistic model
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	Predicted				
Observed	Willingness to member of grower s	Percentage			
	Unwilling	Willing	concer		
Willingness to become member	Unwilling	5	22	81.50	
of Tree Grower Society	Willing	7	70	90.90	
Overall percentage			88.50		

*The cut value is 0.500

several factors. Since the dependent variable willingness to become member of TGS was dichotomous and was scored '1' and '0' for willing and unwilling responses, respectively, the appropriate model would be logistic regression, which will predict the willingness of tree growers, given their profile and other influencing factors. The results of logistic regression are given in Table 6.

Table 6 presents two important estimates, namely Cox and Snell R² and Negelkerke R². It is evident that both R² values indicated moderate variance in the dependent variable (Willingness to become member of TGS) due to selected independent variables. Among the two measures, Negelkerke R² is to be preferred, since it achieves maximum value of 1. In this case, it could be interpreted that 60 per cent of variance in willingness to become member of the societies is predicted by selected independent variables.

Another measure which is important

to be interpreted from logistic regression is classification. Table 7 gives the measure of how well the model performs in its ability to accurately classify cases in the two categories of the variables willing and unwilling to become a member in the TGS.

The overall predictive accuracy is 88.50 per cent. Hence, the model is going to have a good predicting ability. Table 8 presents the Logistic regression coefficients.

In logistic regression, the original model is in terms of the log of the odds ratio, or logit. In logistic model, 'B'coefficients are the effect of 1 unit change and is independent variables on the log odds. The Exp (B) column presents the exponentiated value of B.

In the present analysis, two variables, namely 'Innovativeness' and 'Perception towards Forestry Extension activities', were found to be significant at one per cent level of probability. Another variable, namely 'Information

Predictors	В	S.E.	Wald	df	Sig.	Exp(B)
Area under tree cultivation	0.070	0.051	1.923	1	0.166	1.073
Decision making pattern	-0.088	0.096	0.833	1	0.361	0.916
Information seeking behaviour	0.725	0.421	2.961	1	0.055	2.065*
Innovativeness	1.578	0.537	8.640	1	0.003	4.847**
Income from tree crops	0.000	0.000	0.061	1	0.804	1.000
Marketing orientation	0.125	0.182	0.472	1	0.492	1.133
Access to forestry production technologies	0.039	0.027	2.129	1	0.145	1.040
Perception towards Forestry Extension activities	2.867	1.288	4.956	1	0.026	17.58**
Adoption of tree growing practices	0.078	0.088	0.788	1	0.375	1.081

Table 8. Logistic regression coefficients

seeking behavior', was significant at five per cent level of probability.

It could be interpreted that if a tree grower had high perception towards Forestry Extension activities, the odds of his willingness to become member of TGS would increase by a factor of 17.58 units. In other words, the willingness of a tree grower to become a member of TGS improves 17 times if he had high perception towards Forestry Extension activities. If an individual perceives highly about a phenomena/activity, he tends to move towards that. The perception towards Forestry Extension activity carried out by Forestry Extension wing will act as a catalyst to have a opinion about forestry. Further, the societies are mobilised by Forestry Extension wing and the benefits of being a member of the society has been reinforced in most of the meeting of the wing. Hence, if a tree grower had a high perception about Forestry Extension

activities, there is a likelihood that he will become a member of TGS.

Similarly, if a tree grower is innovative, the odds of his willingness to become a member of the society would increase by a factor of 4.84 units. In other words, the willingness of a tree grower to become a member of the societies improves four times if he is innovative. Obviously, any farmer who wishes to practice agriculture innovatively, he tends to look for innovative practices which are in the offing through any means. The Forestry Extension wing, which is promoting TGS, is also known for transferring innovative tree growing practices. Hence, innovative tree growers might have formed an opinion to join the societies anticipating the benefits of being a member.

Yet another variable, 'Information seeking behaviour', was also found to be significant, which implies that the odds of a tree grower to become a member of the societies would increase by a factor of 2.06 units and hence, the likelihood increased two times if he had higher information-seeking behaviour. There is no doubt that if a tree grower is seeking information from various sources, including Forestry Extension wing, his orientation towards this institution will grow and ultimately there exists a possibility of him becoming a member of TGS.

In a nutshell, tree growers who were innovative, were seeking information about tree growing activities and who had higher awareness about Forestry Extension activities did possess a higher chance of becoming a member in TGS. This reveals the active role to be played by Forestry Extension wing to conduct regular meetings, campaigns, demonstrations in the villages, which will indirectly help tree growers to join as members of TGS.

Conclusion and suggestions from the study

Twenty-seven TGS have been formed in Tamil Nadu with the guidance of Forestry Extension wing. During the study, the researcher found that renewal of registration has not been done in many TGS; many TGS were not functioning and some were functioning with limited activities. The following suggestions were made for the revival and successful functioning of these TGS.

• The study indicated that many respondents were not aware about the existence of the TGS, some were aware of its existence but they did not actively participate and paid

membership fees because they did not realise any tangible benefits. The Forestry Extension wing must take tangible action to organise a participatory workshop for two days by gathering all Executive Committee members (EC) of 27 inviting few TGS, successfully functioning TGS members of other States and some successful tree growing farmers. They should be requested to share their experiences and deficiencies in TGS functioning and identify appropriate solutions to remove the deficiencies and also find ways and means for successful functioning of the TGS.

- There is a need to organise training programmes exclusively for the Executive Committee Members to familiarise them with strategic planning, accounting, financial management and capacity building related to run TGS successfully.
- A corpus fund of at least Rs 10 lakh may be provided to each TGS from the State fund to undertake initial activities, such as organising workshops, procuring few tools and implements, to meet office expenses, maintain little corpus fund, etc. Thereafter, the TGS has to sustain itself to make its own arrangement to run the society by mobilising funds from various sources.
- The Executive Committee must play a proactive role in enrolling more members and collection of membership fees. In addition to that, it also must organise periodical meetings by inviting successful tree growers, financial institutions, wood-



based industries, EC members from successfully functioning TGS in the State, etc., to share their experiences and infuse enthusiasm among the members for better participation in the TGS and tree growing activities.

- The study also revealed that respondents are poorly informed about market information. Therefore, TGS can act as a service provider with respect to providing market information, prevailing demand and supply status of tree products, value addition of tree products, promotion of income generation activities such as nursery raising, vermi-compost production, renting tools and equipment and any other activity bringing income to the TGS.
- The Forestry Extension wing must play a proactive role in providing market information, tree products' demand and supply status and overall smooth functioning of TGS.
- It was found that EC members were not being elected in democratically; and, this was true for many TGS. Hence, the Forestry Extension wing must play a leading role to streamline the processes in selection of EC members by adopting acceptable methods.
- TGS branches may be formed at taluk level, which will be useful to enroll more members and facilitate in reaching a large number of farmers.

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COMMUNITY DEVELOPMENT

Impact of vermicomposting on income generation and use of fertilizers

The introduction of vermicomposting technoique has not only increased income of farmers in the Kullu district, but also resulted in a decrease in the use of chemical fertilizers. It is a success story that can be replicated in other parts of the country.

Harish Negi & Hem Chandra Gahtori

ermicomposting was one of the flagship programmes under the livelihood enhancement component of the World Bankaided Mid-Himalayan Watershed Development Project, which was conducted between October 20005 and March 2016 in 10 districts of Himachal Pradesh. With the help of Common Interest Groups (CIGs), vermicompost was produced in good quantities so as to meet the demand of local farmers. Some progressive farmers not only fulfilled the demand, but also earned some income by selling vermicompost to nearby areas.

Vermicomposting is a very simple method of producing good quality manure with the help of a special type of earthworm, named *Eisenia foetida* (Tiger worm, red-coloured) from cow dung and other biotic materials. This small intervention has the potential to change the lifestyle of rural people.

The economy of Himachal Pradesh, a hilly State, is mainly based on agriculture and horticulture. the majority of the State's population lives in villages. Agriculture and animal husbandry are strongly related to each other. Villagers, along with agriculture, rear cattle for their livelihood. It is a better idea to produce vermicompost with a small input so that the farmer gets good fertilizer from the cow dung of the cattle in order to get more production of their crops. On the one hand, the use of vermicompost has enhanced the production of vegetables and other crops, on the other it has maintained soil quality and reduced the use of chemical fertilizers. Earlier, cow dung used to be seen strewn around in the villages, but now vermicompost pits have also improved the hygiene conditions in the villages. We observed these changes when in October 2015 we visited many villages in Kullu Division under the Mid-Himalayan Watershed Project.

Objective

The main objective of vermicomposting istoenhancethelivelihood opportunities of rural people by generating income directly and indirectly. Farmers can generate income directly by selling

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vermicompost or indirectly by saving money which was earlier used to purchase chemical fertilizers from the market.

General characteristics of vermicompost

Vermicompost is the excreta of earthworms which is capable of improving the health and nutrients' status of the soil. Vermiculture is a process by which all types of biodegradable waste-farm waste, kitchen waste, bio waste of agroindustries. livestock based waste. etc.-are converted into nutrient-rich vermicompost while passing through worm gut. Vermi worms are used to act as biological agents to consume the waste and to deposit excreta.

Working in Kullu Division

At the village level, a group of women known as Common Interest Group (CIG) is formed. One-day training is provided to the group. For the preparation of vermicompost pits, DWDO provided aid to the members of the group in 90:10 (project and beneficiary share) ratio. The special earthworms are also provided by the project.

The beneficiaries are selected on the following criteria:

- Poor /Vulnerable as per GPWDP (Gram Panchayat Watershed Development Plan) survey.
- (ii) Should have at least one cow.
- (iii) Should have one *bigha* or more land.
- (iv) Should have adequate dry leaves.
- (v) Should have adequate water

availability for maintaining the required moisture level.

The pit

A pit of 15x9x1.5 cft size is dug. Floor of the pit is left as natural and the sides are supported by walls made of brick or stone. The pit is divided into two parts by a perforated wall. The site selected for the pit should be shady. After the preparation of the pit, it is filled with 10-15 days old cow dung, followed by other bio waste. This is done in layers and finally 5-8 kg earthworms are placed over them. After a short while, the worms move into the layers. The pit is then covered by gunnybags. The material is kept moist. After two-and-ahalf months, the vermicompost is ready.

Vermicompost's impact

We visited many gram panchayats in Kullu division-Bashona, Bhargran, Naraish. Khokhan, Iarad. Hurla, etc.-and almost all the families there are now aware of the benefits of vermicompost. Whether they are members of CIGs or not, they all have adopted vermicomposting technique. A few farmers in some villages are selling vermicompost at Rs 7-10 per kg in nearby areas. The income of other farmers who are not doing so has also risen as this technique has resulted in increased production of vegetables, fruits and other crops. When we asked some beneficiaries why they were not selling vermicompsot as a few others, they replied that they themselves needed the fertilizer and were using vermicompost for their fields and orchards. Farmers said that after using



At Hulan–Hira Lal with compost

Patlikuhal compost

Compost pit of Hulan

Сгор	Per <i>bigha</i> production before use of vermicompost (in Qtl)	Per <i>bigha</i> production after use of vermicompost (in Qtl)
Tomato	15-20	30-35
Cauliflower/ Cabbage	10-15	18-25
Pea	4-6	8-10
Cucumber	25-30	35-40
Maize	2-3	6-8
Apple	15-20	35-40

Increase in production after Vermicompost usage in Kullu area

vermicompost, their dependency on chemical fertilizers had decreased. Some beneficiaries said that had completely stopped using chemical fertilizers. But some were of the view that for better production chemical fertilizers were a must. As chemical fertilizers are available in open market, it was tough to estimate the decrease in their usage, but according to farmers, there was definitely a decrease.

Heeralal, resident of village Hulan, is selling around 300 bags (150 quintal) per season. He also informed that when his orchard was under a disease attack, he was totally dependent on the income generated by the sale of vermicompost. In village Patlikuhal, Mrs Kaikati Devi was earning livelihood by selling 200 to 300 35 kg bags of vermicompost per year since 2009 and the number of customers was increasing continuously.

In Hurla village, Mrs Dhani Devi's family was earning about Rs 5 lakh per year by using vermicomposr, instead of Rs 60,000 earlier in her 12 *bigha* land.

In Jarad village of Parvati Mandal, Mrs Prema Devi's BPL family was earning about Rs 50,000 compared to Rs 12,000 per annum by organic vegetables production. The family had purchased a Jersey cow and a mobile phone also.

Conclusion

Aftervisiting many villages of Kullu area and meeting many farmers there, it can be summarised that vermicomposting is now a known technique for villagers now. It's all due to the support of watershed development project. The project not only had demonstrated this activity at the village level and motivated people, but also helped them financially to adopt this technique. Use of vermicompost is a vital step towards healthy food and better environment.

techniques like vermiwash and If mahapanchgavya (MPG) are also used as pesticides by farmers, it will definitely enhance the income of villagers as well as reduce harmful effects of chemicals on the agro-ecosystem. Such successful and participatory projects can be replicated in other parts of the country also to generate or assist livelihood opportunities of local people. It will certainly improve relations and understanding between public and the Forest Department.



WILDLIFE MANAGEMENT

Conflict resolution in Pong Lake Wildlife Sanctuary

A low level of community involvement has raised a number of conflict issues in Pong Wetland, a Ramsar site. More needs to be done to increase livelihood opportunities for local people so as to make conservation initiatives successful

Santosh Kumar Pant and Shantanu Patowary

Pong Dam, on Beas River at Pong (Kangra District of Himachal Pradesh), is an ambitious project of Rajasthan Punjab and Haryana to fulfil the requirements of irrigation and electricity. The Pong Wetland is a part of Maharana Pratap Sagar, the reservoir of the Pong Dam. It is the largest manmade wetland in northern India which potentially offers a transitory resting reserve for migratory birds coming in winter from the Trans-Himalayan zone.

After getting proclamation of the sanctuary in the year 1983, it took 16 more years to be finally notified in 1999. Amidst all this, the Government of India declared it as the wetland of national importance in the year 1994. The Bhakra Beas Management Board (BBMB) is the owner of the land in the sanctuary.

The wetland earned the status of wetland of international importance and became the first Ramsar site of Himachal Pradesh in 2002.

Importance of the Pong Wetland

The wetland offers a transitory resting site for migratory birds such as bargeese, ruddy headed shelducks, pintails, coots, pochards, gulls, grebes, cormorants, mallards and numerous waders coming from the Trans Himalayan zone. Many waterfowl, such as terns, lapwings, skimmers, sarus cranes and spot-billed ducks, lay their eggs in the mud flats and surrounding areas in the wetland during summer.

Various Stakeholders and Conflicts

The flora and fauna around the lake hold first right on the lake. Arrival of guest avian fauna is sufficient to show the richness of this habitat. Locals, management people, NGOs, people concerned with tourism trade and revenue, etc., are other stakeholders of the lake. Wildlife wing of the Forest Department is active here for the improvement of habitat as well as for providing alternative livelihood opportunities to the stakeholders of the sanctuary.BBMB, Tourism Department, Fisheries Department and Revenue and Watersports Department are other

Trainee Range Officers

stakeholders from the management point of view.

The use of the drawdown area and the reservoir for cultivation and fishing, respectively, by stakeholders is the major conflict between the Forest Department and stakeholders in the sanctuary. According to local residents, improper and biased rehabilitation planning is the main cause behind all conflicts. These compelled plans led to huge unemployment in fringe villages. The attachment of locals with their society and land stopped them from vacating the area. This resulted in illegal sowing on the mud-flats, formed with the receding shoreline between October and March. Fishing is another source of livelihood in the area. Decreased fish production and diversity affects the arrival of large cormorants, darters and other fish eaters.

Forest Management versus Others

Conservation of floral and faunal diversity is the prime objective of the Forest Department. Unresolved settlement issues of oustees breached the trust between the government agencies and locals, which has been resulting in acts of cultivation in the mud-flats and mud splits every year. These regions are also preferred by the bar-headed geese, ruddy shelducks and other waterfowls.

Large exposed area in summer leads to more biotic interference by local people, cattle of nomadic Gujjars and stray animals. This increases the chances of trampling of eggs of many waterfowl species which lay their eggs on ground.

Political interference is also a big concern as it becomes a barrier for a forester in executing the plans and policies launched by the government.

Use of small fishing nets, interference in bird areas and killing of small fish to use them as bait for bigger fish species may hamper the migration of birds in near future. Regulation of fishing, tourism and other revenue-generating activities, which can destruct the bird habitat sometimes, has become a major issue of conflict between the Forest Department and others.

Resolution of Conflicts

As unemployment is the major cause of all the issues in the sanctuary area, the Forest Department is trying to provide alternative livelihood opportunities to the locals. With the formation of Pong Lake Conservation Society, presided over by the Secretary, Forest and Environment, Himachal Government, the Department is trying to provide a platform to all stakeholders. Wildlife wing of the Forest Department is providing Rs 1-2 lakh to the Fisheries Department for fish seeding in the lake.

Eco-development and bird protection committees have been formed to involve communities in development and protection activities in the sanctuary. Various village development committees have been formed to provide villagers with some source of income. Selected cobblers in the village are paid Rs 400 per dead animal to bring the body to the Vulture Feeding Centre. Trainings for executive staff and local communities are carried out under capacity building programmes.

According to Mr DS Dadwal, ACF (Wildlife), Pong Lake Sanctuary, a management plan is being prepared for the sanctuary area under which Nagrota Surian is proposed as Permanent Research and Training Centre to provide alternative livelihood opportunities to the locals. He said that they have requested BBMB officials to maintain the water level up to 1340-1350 feet until Lohri (people traditionally do not perform sowing after Lohri festival), to protect the bird habitat by discouraging sowing in the exposed area. Plantation of fruit-bearing species has been done in the Rancer Island, a roosting site of herons, egrets and other birds.

Conclusion

In the context of wildlife, public participation is much needed. The

Forest Department is a nodal agency in the sanctuary area. The efforts of forest officials active in the sanctuary area are noticeable. The increasing public participation resulted in a decrease in poaching, illicit hunting, etc. People are thinking of organic farming (as initiated in Dehra village). Level of awareness is increasing. Joint programmes with Tourism, PWD, Fishery and Electricity departments have been initiated. There is still some need to encourage the lower level of officials by strengthening staff (only 9 Forest Guards are performing the duty against 25 sanctioned posts) with regular funding to accelerate forest activities in the area.

Reference

Pong Lake - An International Ramsar Site in Need of Management Interventions; author DS Dadwal, local residents of fringe villages and staff on duty.

Note: Articles may be sent at the following email ID: fieldforester@gmail.com

Contributions Invited

The Field Forester invites articles from serving as well as retired forest officers and others working in the forestry sector. The Field Forester offers a unique platform for forestry professionals to share their work and experiences. The article should be interesting and entertaining to read and should be written in a lively and concise style.

Evaluation and Review System

There will be two layers of review of the contributions; Faculty and the Directorate review. Evaluation and review at the faculty level in the training institutes/academies will be undertaken under the guidance of Director/Principal/Head of the institutions. Even very specialized and technical topics shall be presented in simplified format so that frontline staff and forest community are able to appreciate and understand the topics. Articles shall be written in a popular style, easily understandable and in simple English.

However depending on the response to this programme, arrangements can be made for translation of the magazine into the vernacular. A short note about the contributor and the reviewer shall accompany the article. The note shall contain name, age, postal and e-mail address, course, academic accomplishments, and important assignments held. The evaluation would be done on following criteria:

- a. Style: The article should be interesting and informative. The introduction should draw the reader in and convince them that the remainder is worth reading. The remaining should be written in a lively and concise style, and should leave the reader convinced of the importance of the topic.
- b. Structure: The article should be within 1000 words, and formatted in 1.5 line spacing in Times New Roman 12 point font.
- c. Organization:
 - Instead of an abstract the article will give information on the location, the period when the field work was carried out
 - Integration the article organized in a coherent form and all ideas are clearly leading to a single main argument.

The review at the Directorate level will be done through an editorial board constituted by the DFE, which will be responsible for the content, design and review of the journal articles. The editorial board shall consist of expert/experts constituted by DFE and reconstituted every year, which would screen contributions and recommend their publication. Articles previously published elsewhere, or simultaneously sent for publication elsewhere, may be accepted with modifications. Article submitted shall carry a declaration that the article is original. The Editor would reserve the right to reject articles without assigning any reason and articles not found suitable will be sent back.



Directorate of Forest Education

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