

# On the Conservation of *Oroxylum indicum* (L.) Vent.- A Threatened Medicinal Plant

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## Abstract

Human activities have affected the environment since time immemorial in a number of ways. The present paper deals with the effect of human activities on the threatened medicinal plant (*Oroxylum indicum* (L.) Vent.) in the Kumaun Himalaya and the conservation strategies to save this plant.

**Keywords:** Conservation, Threatened medicinal plants, *Oroxylum indicum* (L.) Vent.

## Introduction

Human beings have been modifying their environment since time immemorial in a number of ways without giving much thought to the long term ecological consequences. Though low magnitude human activities usually do not lead to palpable changes in the ecosystems but those of chronic and high magnitude have visually the discernible impacts. The most obvious changes include local extinction of species, changes in community structure and composition, and modification of biophysical features in a landscape. This phenomenon is leading to continuous erosion of forest cover and the forest products (cf. Samal *et al.*, 2004 vide Kala *et al.*, 2006). Human activities affect the world's climate, as industrial processes, farming activities, burning of fossil fuels etc. produce greenhouse gases that enhance the heat-trapping capability of the earth's atmosphere, thus resulting in temperature increase. There are many other causes of rarity in medicinal plant species, such as habitat specificity, narrow range of distribution, land-use disturbances, introduction of non-natives, habitat alteration, heavy livestock grazing, explosion of human population, fragmentation and degradation of population. Shifting phenological events and distribution ranges may seem of little importance at first glance, but they also have the potential to cause great challenges to species's survival (Cavaliere, 2009).

*O. indicum*, belonging to the family Bignoniaceae, is a medium-sized deciduous tree, with a few branches towards the upper half or at the top. Bark is rough, thick and brownish-grey in colour. Leaves are large, tripinnate up to 1.5 m long. Inflorescence is in terminal raceme; flowers large, fleshy, dark-purple (Duthie, 1960), dark-red, dull-white or dull-purple coloured. Capsule flat, curved, sword-like, with numerous winged seeds (Fig. 1).

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It is a plant with many uses. In India its roots are used in the Ayurvedic preparation called 'Dasamoola' considered to be an astringent, anti-inflammatory, antihelmintic, antibronchitic, antileucodermatic, antirheumatic, antanorexic which also finds used in the treatment of leprosy etc. (cf. Manonmani *et al.*, 1995 vide Jayaram and Prasad, 2008). Various parts of this plant are utilized by rural people to cure many diseases. The root bark is useful in biliousness, fevers, bronchitis, intestinal worms, vomiting, dysentery, leucoderma, asthma, inflammation, anal troubles (Kirtikar and Basu, 1935). Fruit is used in leucoderma, otopyrrhoea, neuralgia, rheumatoid arthritis, cephalalgia, ulcer and splenomegaly. Seeds are used in otopyrrhoea, neuralgia, rheumatoid arthritis, cephalalgia, ulcers and splenomegaly (Shah, 2007). Bark, fruits, leaves and roots are used in fever, dysentery, diarrhoea, epilepsy, miscarriage, jaundice, piles, purgative, small pox, pimple, dysuria, rheumatism, dyspepsia, induce conception, oedema, headache, tonic, vermifuge, stomachache, chest pain, cholera and colic (Adhikari *et al.*, 2003). In Kumaun, the fruit is used in the treatment of dysentery, vomiting and waist pain. It is used to cure dandruff and skin diseases of animals. The stem bark, flowers, leaves and seeds are used to cure skin diseases (Damari). The seed is also used to cure pimple, to check the baldness and falling of hair (Pande, 2011). It has been categorized as a vulnerable medicinal plant by the government of India (Kumar and Ved, 2000).



Fig. 1: *Oroxylum indicum* (L.) Vent.

### Erosion of *O. indicum*

Owing to the indiscriminate collection, over exploitation and uprooting of whole plants bearing roots, *O. indicum* has become vulnerable in Karnataka and Andhra Pradesh and endangered in Kerala, Maharashtra, Madhya Pradesh and Chhatisgarh (cf. Darshan and Ved, 2003 vide Gokhale and Bansal, 2006; cf. Ved *et al.*, 2003 vide Gokhale and Bansal, 2006). It is vulnerable in Andhra Pradesh and Karnataka, endangered in Kerala and Maharashtra (Darshan and Ved, 2003). According to Sarin (2003), its demand is low. In South-West Bengal its occurrence is limited (Das and Chattopadhyay, 2003). Problems related with its natural propagation and indiscriminate exploitation for medicinal purpose have pushed *O. indicum* to the list of endangered plant species of India (Tiwari *et al.*, 2007). The following reasons are involved to make *O. indicum* a rare species and responsible for its sporadic distribution in Kumaun Himalaya.

1. Outer hills converted into agricultural land.
2. The plant requires species-specific edaphic/climatic environment which is changing continuously due to human activity.
3. *O. indicum* is a valuable medicinal plant. The root, stems, leaves, flowers, fruit and seeds have been used to treat a great variety of human and animal ailments for millennia causing some species to prosper and others to suffer. *O. indicum* is one of the sufferer species due to over-exploitation, habitat destruction and fragmentation and enclosement in deciduous forests. Its use continues today, to such an extent that overharvesting of the tree is one of the threats to its survival (Fig. 2.G, 2.I, 2.J & 2.N).
4. Shyonak is not a fast-growing species and has low population sizes.
5. Various human activities such as agriculture, deforestation, expanding urbanization, coal mining and road construction have caused tremendous habitat destruction of *O. indicum*.
6. Frequent land slides and forest fires have also led to depletion of *O. indicum* (Fig. 2.R, 2.S & 2.T).
7. Young seedlings are sensitive to frost and to drought, many dying off in the hot season in dry situations exposed to the sun (Troup, 1921).
8. The leaves and barks of *O. indicum* are badly exploited by cattlemen (Fig. 2.C) and also eaten by wild animals (Fig. 2.O).

9. This plant has very complicated flowers with highly specialized pollination mechanisms and species-specific pollinators resulting in low fruit and seed setting. It has self-incompatible and Bat-pollinated (chiropterophilous) flowers. Due to its self-incompatibility and reliance on bats, *Eonycteris spelaea* for pollination, the future survival of *O. indicum* appears to depend on the survival of this nectarivorous bat. Serious declines in populations of *E. spelaea* from hunting increases the pollination failure in *O. indicum*. The rapid stigma closure of *O. indicum* flowers also reduces the probability that other generalized nectarivorous animals will replace *E. spelaea* as effective pollinators (Srithongchuay *et al.*, 2008). Thus, decline in pollinator populations may affect *O. indicum* more than other plant species that are pollinator generalists.
10. Compared with plant species pollinated by multiple animal species, the likelihood of pollination failure resulting from the decline in populations of *Eonycteris spelaea* will be much more intense in *O. indicum* (Srithongchuay *et al.*, 2008).
11. The seed setting is poor and seed viability low.
12. Destruction of young aerial plant parts by caterpillars (Fig. 1.P) (Pande *et al.*, 2011).
13. The seedlings are highly susceptible to microbial/fungal decay (Fig. 1.Q).
14. Some of the mechanisms of collection adopted by the local people are harmful to existing populations.
15. The lopping of branches or leaves in the Kumaun region has negative effects on its population.
16. Collection of immature fruits, seeds for religious uses also decrease its population.
17. There are no apparent direct economic gains from Shyonak species and consequently of policy makers, people and researchers, are unaware of its over-exploitation..
18. Erosion of traditional beliefs and rapid socio-economic advancement has led to the deterioration of sacred groves. Fading respect towards traditional knowledge among youngsters is one of the causes of concern.
19. Transformation of traditional worship of nature into formal Hindu practice, which is called Sanskritization like shifting the focus to idols than a simple stone, building temples which requires clearing of the area by cutting down trees.

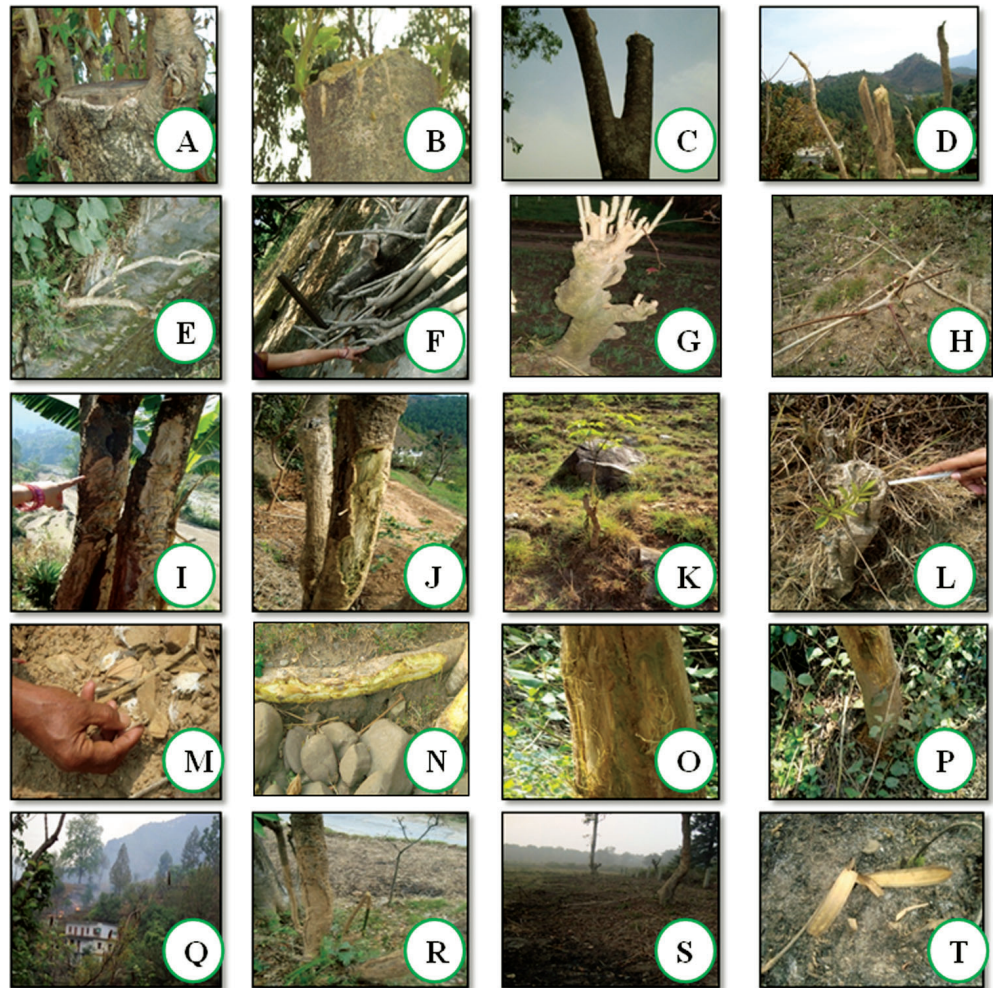


Fig. 2: Erosion of *O. indicum*: A & B- The main trunk cut at base; C & D- The young trees also cut down; E- Small tree fell down; F- The branches kept on the well; G- Plants cut for the fodder purposes; H- After collecting the fodder the branches were thrown uselessly; I- Badly removed bark from the trunk; J- Badly removed bark from the trunk; K- Smaller plant also destroyed; L- A plant removed from the border of cultivated field; M- Seeds rotten in the cultivated field; N- Root bark is also removed; O- Main trunk was scrubbed/rubbed by wild animals; P- Main trunk was scrubbed/rubbed by wild animals; Q- Destruction of plants by fire; R- Destruction of plants by fire; S- Destruction of seeds by fire; T- Destruction of capsules and seeds by fire.

### Conservation

Conservation of medicinal plants is receiving increased attention all over the globe in view of their erosion, and resurgence of interest in herbal medicines for health care (cf. Franz, 1993 vide Manjukhola and Dhar, 2002; cf. Gupta *et al.*, 1998 vide Manjukhola and Dhar, 2002). *O. indicum* is depleting or becoming rare in its natural habitat in Kumaun. Despite this situation

nobody has paid attention on this highly economic plant. This species is of conservation concern because of the low numbers of individuals and restricted distribution in the central Himalayas. The State Forest Research Institute, Department of Environment and Forests in Arunachal Pradesh, northeastern India, is encouraging the development of plantations of medicinal plants, including *O. indicum*, which will provide work and also protect wild plants from being over-harvested (S. F. R. I., 2001).

#### Ways to save *O. indicum* in Kumaun Himalaya

There is an urgent need for both ex-situ as well as in-situ conservation of Shyonak. Shyonak is very difficult to maintain in gardens. Conservation of Shyonak is a challenge to biologists. Concentrated and co-ordinated efforts by universities, forest departments, and local communities are needed to make save Shyonak of Kumaun region. Keeping in view the status of *O. indicum*, its sensitivity to anthropogenic impacts and its increasing demand in the market, called for conservation and propagation of this plant. Micro-propagation is the only viable means to get its planting material. Hardening of plant material is another critical step in re-introduction of planting material, which needs to be standardized. The following are the probable and appropriate steps which make save the threatened medicinal plant (Shyonak) in Indian Central Himalaya.

1. Protecting the habitats of Shyonak.
2. Study on pollination biology and fruit setting in Shyonak to know constraints in sexual reproduction and production of seeds.
3. Establishment of proper methods for storage of seeds and protection of seedlings from microbes/fungi and to study the suitable edaphic and climatic factors to maintain *O. indicum* and thus finally, develop package of practices to grow, maintain and protect Shyonak.
4. Chemical and biological control of insects harmful to *O. indicum* is essential.
5. Training is essential for forest officials in identification, protection and maintenance of Shyonak. Forest department needs to raise nurseries of this high value medicinal and aromatic tree (Fig. 3.A & 3.E) and execute population recovery programmes in various reserved forests.
6. Volunteers and non-government organizations can also be motivated to grow such species along the fringes of forests, stony areas, waste places and borders of cultivated fields.

7. Co-ordinated efforts among researchers, forest officials and people are essential to grow, maintain and protect Shyonak and to undertake restoration programs of this threatened species.
8. Popularization of Shyonak and its identification through workshops, greeting cards, calendars, and photographs and distribution of planting materials to nurseries, botanical, private and home gardens.
9. Micro-propagation and re-introduction of Shyonak and making some provision for financing the micro-propagation and hardening of Shyonak.
10. Establishment of field gene bank and Cryo-preservation of germplasm of Shyonak.
11. Limiting destructive activities such as mining, constructions and burning on plateaus where it grows is also one of the important activities to conserve this plant.
12. Incentives be given to the local communities for maintaining and restoring Sacred Groves (SGs). In Kumaun, it is conserved in the temple at Nivadkheda (Gaulapar), Haldwani, Sirauli and Kaseri, and at Chhurmul devta mandir, Bageshwar (Fig. 3.C & 3.D).
13. Protection of bat populations and their roosts is necessary for maintenance and survival of this plant.
14. We have to follow a number of regulations framed to collect the medicinal plants to ensure the plant does not die out or disappear from its natural habitat.
15. It is extremely necessary for researchers, environmental managers and others to understand the special nature and uniqueness of Shyonak habitats and the significance of their global conservation.
16. Awareness programmes should be strengthened by the forest department, environmental ministry and NGOs which will be the first step towards the long term conservation of forest resources.
17. In addition to this, awareness programmes among particularly the young generation, locals, villagers, tourists etc. about the importance of this plant and its habitat is also the need of the hour. Until and unless viable options are provided to the local people (especially those who inhabit nearby or adjoining area of Shyonak habitat and exploit it) for sustaining their economic condition, no step for conservation of its biodiversity will be successful.

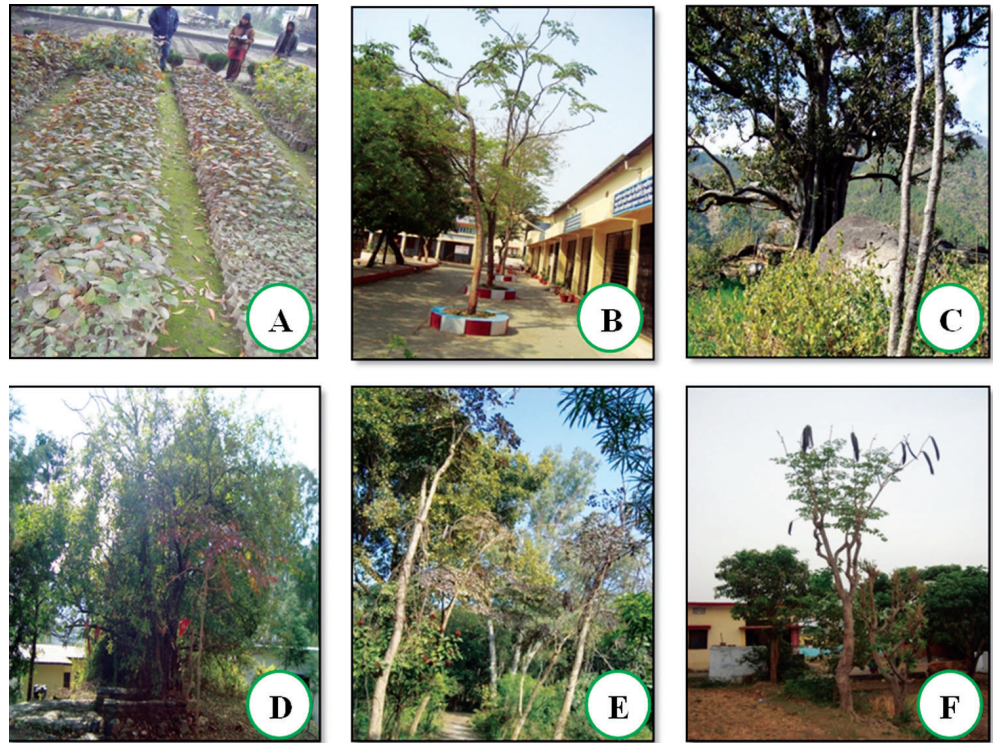


Fig. 3. Conservation of *O. indicum*: A- Nursey prepared by forest department at Lal Kuwan; B- Planted at MBPG college, Haldwani as an ornamental plant; C- Conserved in Sacred grooves by Kumaunies at Siruli and Kaseree, Gangolihat; D- Conserved in Sacred grooves by Kumaunies at Churmul Devta Mandir, Bageshwar; E- Planted along the road side at Choe, Ramnagar; F- Conserved near the houses by the villagers at Damuadhunga, Haldwani.

Apart from the above, another cause for concern is lack of proper inventory of ecologically sensitive sites of rare, threatened and endemic species. This calls for better conservation planning and site specific action plans so as to restore the special habitats and threatened plant populations. Unless preventive as well as remedial measures are taken, the rich floral diversity of the state will not be able to withstand the burgeoning anthropogenic pressures.

### Acknowledgements

The authors are grateful to the Head, Department of Botany, Prof. J. S. Rawat, Director of NRDMS and Deptt. of Geography, Kumaun University, S. S. J. campus, Almora, for useful suggestions given by them for the preparation of this manuscript.



## References

- Adhikari, R.S., Babu, M.M., Saklani, P.L. and Rawat, G.S., 2003. Medicinal trees of Uttaranchal state: distribution, use pattern and prospects for conservation. *Indian Forester* 129(2): 243-267.
- Cavaliere, Courtney, 2009. The Effects of Climate Change on Medicinal and Aromatic Plants *HerbalGram* 81:44-57. Viewed at <http://cms.herbalgram.org> (accessed on 18/02/2012).
- Darshan, Shankar and Ved, D.K., 2003. A balanced perspective for management of Indian Medicinal plants. *Indian Forester* 129(2): 275-288.
- Das, Nilanjana and Chattopadhyay, R.N., 2003. Inventory of forest-based medicinal plants- A case study in South West bengal. *Indian Forester*. 129(1): 69-79.
- Duthie, J.E., 1960. Flora of the Upper Gangetic Plain and of the adjacent Siwalik and Sub-Himalaya tracts. Botanical Survey of India, Calcutta. 3: 42-43.
- Franz, C., 1993. Domestication of wild growing medicinal plants. *Plant Res. Dev.* 37: 101–111.
- Gokhale, M. and Bansal, Y.K., 2006. An anowal of importance of endangered tree *Oroxylum indicum* (Linn.) Vent. *Nat. Prod.* 5(2):112-114.
- Gupta, A., S. K. Vats and B. Lal, 1998. How cheap can a medicinal plant species be? *Curr. Sci.* 74: 555–556.
- Jayaram, K. and Prasad, M.N.V., 2008. Genetic diversity in *Oroxylum indicum* (L.) Vent. (Bignoniaceae), a vulnerable medicinal plant by random amplified polymorphic DNA marker. *African Journal of Biotechnology* 7(3):254-262. Viewed at <http://www.academicjournals.org/AJB> (accessed on 24/08/2011).
- Kala, C.P., Pitamber, P., Dhyani and Bikram S. Sajwan, 2006. Developing the medicinal plants sector in northern India: challenges and opportunities. *J. Ethnobiol. Ethnomed.* 2: 32. Viewed at <http://www.ethnobiomed.com/content/2/1/32> (accessed on 4/04/2011).
- Kirtikar, K.R. and Basu, B.D., 1935. Indian Medicinal Plants. M/S Bishan Singh Mahendra Pal Singh, Dehra Dun, M/S Periodical Experts, Delhi, 3: 1839-1840.
- Kumar, Ravi K. and Ved, D.K., 2000. 100 red listed medicinal plants of conservation concern in southern India, foundation for revitalization of local health traditions, Bangalore, India, pp.: 1-467.
- Manjukhola, Sumit and Uppeendra Dhar, 2002. Conservation and utilization of *Arnebia benthamii* (Wall. ex G. Don) Johnston– a high value Himalayan medicinal plant. *Curr. Sci.* 83(4): 484- 488.

- Manonmani, S., Vishwanathan, V.P., Subramanian, S. and Govindasamy, S., 1995. Biochemical studies on the antiulcerogenic activity of cauvery 100, an ayurvedic formulation in experimental ulcers. *Ind. J. Pharmacol.* 27: 101-105.
- Pande, Bhawana Joshi, 2011. Unreported traditional uses of *Oroxylum indicum* (L.) Vent. in Kumaun Himalaya. *J. Non-Timber Forest Products* 18(4): 321-324.
- Pande, Bhawana Joshi, Sandeep Kumar and Gupta, R.C., 2011. An entomofauna recorded on threatened medicinal plant- *Oroxylum indicum* (L.) Vent. at experimental site in Almora, Uttarakhand. *J. Non-Timber Forest Products* 18(3): 227-230.
- S.F.R.I. Information Bulletin No. 12 (2001), Economic Development Through Medicinal Plants, State Forest Research Institute, Department of Environment and Forests, Government of Arunachal Pradesh, Itanagar. Viewed at [http://sfri.nic.in/pdf\\_files/Medicinal%20Plants.pdf](http://sfri.nic.in/pdf_files/Medicinal%20Plants.pdf) (accessed on 24/10/2010).
- Samal, P.K., Shah, A., Tiwari, S.C. and Agrawal, D.K., 2004. Indigenous health care practices and their linkages with bio-resource conservation and socio-economic development in Central Himalayan region of India. *Indian J. Trad. Knowled.* 3:12-26.
- Sarin, Y.K., 2003. Medicinal plants raw materials for Indian drug and pharmaceutical industry-I. An appraisal of resources. *Indian Forester* 129(1): 3-24.
- Shah, Rakesh, 2007. Nature's Medicinal Plants of Uttaranchal (Trees, Shrubs and Climbers). Gyanodaya Prakashan, Nainital. Revised pp. 377-378.
- Srithongchuay, Tuanjit, Bumrungsri, Sara and Sripao Raya, Ekapong, 2008. The pollination ecology of the late-successional tree, *Oroxylum indicum* (Bignoniaceae) in Thailand. *J. Trop. Ecol.* 24(5): 477-484.
- Tiwari, Sharad, Kanchan Singh and Pankaj Singh, 2007. In vitro propagation of *Oroxylum indicum*- An Endangered Medicinal Tree. *Biotechnology* 6(2): 299-301. Viewed at <http://scialert.net> (accessed on 18/05/2010).
- Troup, R.S., 1921. Silviculture of Indian Trees, Vol. I to III. Oxford University Press, London.
- Ved, D.K., Kinhal, G.A., Ravikumar, K., Mohan, K., Vijayshankar, R. and Indresha, J.H., 2003. Threat assessment and management prioritization, FRLHT Bangalore, pp.: 87-88.

