Journal of Phytology 2011, 3(7): 01-07
ISSN: 2075-6240
www.scholarjournals.org

JOURNAL OF PHYTOLOGY

www.journal-phytology.com

Documentation of Medicinally Important Plants from the Landslide Prone Areas of East Sikkim, India: A Survey Report

L. Lepcha[1*], S. Guha Roy[2], A. Sarkar[3], B. C. Basistha[4], M. L. Arrawatia[4]

[1]*Bioinformatics Centre, Sikkim State Council of Science & Technology, Department of Science & Technology and Climate Change, Gangtok- 737 101,Sikkim,India*
[2]*Department of Botany, West Bengal State University, Barasat, West Bengal, India*
[3]*CSIR-SRF, Laboratory of Air Pollution and Global Climate Change, Ecology Research Circle, Department of Botany, Banaras Hindu University, Varanasi-221005,Uttar Pradesh, India*
[4]*Sikkim State Council of Science & Technology, Sikkim Department of Science & Technology, Gangtok- 737 101,Sikkim,India*

Article Info

Article History

Received : 15-02-2011
Revised : 14-03-2011
Accepted : 08-04-2011

*Corresponding Author

Tel : +91-9434191983
Fax : +91-3592228764

Email: laydsimick@gmail.com

Summary

In the present study, field survey for exploring the medicinal plant biodiversity were conducted in the landslide prone areas of East Sikkim, India. Twenty five medicinally important plants were collected and identified from four distinct study areas. The comparative study has analyzed that the landslide eruptions are playing major role in scaling these medicinal plant species towards vulnerability. The present study has come up with species frequency status which helps to predict the present existing status of medicinal plant species which suggests adopting a serious concern in conserving these valuable species in the state before their extinction. The common medicinal species like *Artemesia indica, Osbekia nepalensis, Potentella fruticosa*, *Polygonum molle* are found to be under tremendous threat. The study also found some of the species already been extinct from landslide areas which have earlier occupied the region abundantly. The study shall play a major role for the researchers in monitoring the values and importance of species inhabiting such vulnerable locations and help to approach efficient mitigative measures in conserving these plant species.

Key Words: Medicinal plants, Skkim, Conservation

Introduction

Naturally Sikkim is one of the biodiversity rich hubs of the world including the valuable medicinal plants. But with the apparent changes in Climatic features leading to the disasters of biodiversity the valuable medicinal species are living in threats of becoming extinct. Landslide disaster has become a major sorrow to the state. Medicinal plants are understood to be one of the major natural resource of Himalayas. But with the constant exploitation through the emergence of various factors including the natural phenomenas like landslide, the resourceful plant species of Himalayas are now under the great threat of extinction. Landslide has become one of the major problems of Himalayas throughout the world including Sikkim. The latest global red list of plants released by the IUCN present an alarming picture: nearly 34,000 species or 12.5% of the world's flora are facing extinction[1]. Sikkim has more than 400 medicinal plants, which are equally valuable in ethnobotanical and traditional uses. According to Country report most at-risk medicinal plant species are vulnerable largely because of habitat loss and degradation. One third of the forest land areas of Sikkim are affected or devastated by landslides.

The drugs which have been used in treating various diseases are prepared from plant species. Recently intensive scientific and commercial attentions has been focused on indigenous medicinal plant species[2,3]. Some of the valuable herb plants like *Drymeria cordata* which is used mainly for the treatment of Sinus, headache and common cold, were cited more in the studied landslide areas. The present low numbers of indigenous medicinal plants found in comparison to other studied landslide areas has highlighted an indication of its vulnerability. This might result in its denudation and as result extinction from the region within decades. As explained by Plantlife International, Medicinal plants in conservation and development, 2008[4], about 15,000 species of medicinal plants are globally threatened – the causes include loss of habitat, commercial overharvesting, invasive species and pollution. The landslide eruption has distinct character to form the new succession growth of new species due to changes in chemical composition of soil ingredients. This ill effect of landslides has denudated the natural habitat of indigenous species leading to their extinction.

The selected four landslide areas are situated in East Sikkim. According to the status report on landslide studies published by Department of Science & Technology, East Sikkim possessed high rate of landslide occurrence[5]. As most of the keyzone areas of the state are located in eastern part the casualties are expected to be high here, vying from human lives, economy and environmental loss. The keyzone area like Namli (9th Mile) is located at national highway NB31A which connects the capital Gangtok with other important areas including the west Bengal state. Any sort of blockade in highway leads to serious impacts on normal life activities of Sikkim. Beto landslide is also one of the major landslide area, it is the lifeline of North Sikkim. Which is the largest district of Sikkim with huge vegetation. The disturbance cause the complete cut down in transport communication between capital

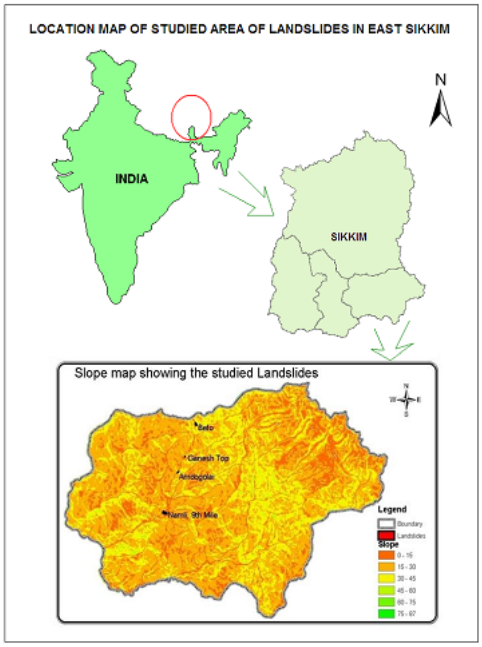
Gangtok and North Sikkim. Ganeshtok landslide is located at the top of the Chandmari,Gangtok, consists of dense human population. On top of this the place is one of the major tourist spot in Gangtok. The casualty is expected high once the natural disaster erupted here in both geographical and human lives inhabiting the region. Amdogolai landslide is located at the mid of the Gangtok, Tadong, the eruption of landslide could easily sum up to a very high casualty here. The loss of forest has maintained the excluding capability of ruining down valuable plant species that includes medicinal plant species. The study has been undertaken to find the distribution pattern of medicinal plants in major landslide prone areas of East Sikkim and reflect over the need for conservation of such valuable medicinal plants.

Material and Method

Study site

A thorough study of plant diversity was done in four landslide areas of east Sikkim, they are Beto landslide (Elevation: 5465 ft.), Namli (9th mile) landslide (Elevation: 2804 ft.) Ganeshtok landslide (Elevation: 6432 ft.) and Amdogolai landslides (Elevation: 4854 ft.) during the year of 2006-2008 (Figure 1).

Figure 1. Location map of Landslide areas



Methods for study

The areas were identified by means of GIS and Remote sensing software. The GIS software like ERDAS is been used in identifying the landslide areas. The location map, elevation map and slope map of these landslide areas were also prepared by using GIS and Remote Sensing. A field visit was done to every studied landslide areas. To find the distribution pattern of plant biodiversity 6-quadrats were taken respectively for tree, shrub and herb. For tree species 20m/20m (one time), 5ft/5ft for shrub species (2 times) and 1ft./1ft. for herb species (5 times). The frequencies of particular species in respective landslide areas were derived by applying following formula [6]-

$$\text{Frequency} = \frac{\text{Total no. of quadrats in which the species occur}}{\text{Total no. of quadrats studied}} \times 100$$

Identification of plants

The collected plant species were pressed in a news papers [7] and preserved in a herbarium sheet and get identified from the laboratory of Botanical Survey of India, Government of India, Gangtok, Sikkim. The local people also help to identify the plant.

Results and Discussion

The study has revealed twenty five (25) valuable medicinal plant species altogether from the four studied landslide areas. Though the plant species were abundant in the region but its habitat is not common or does not share the existence of same species. *Drymeria cordata* an important herbal plant is showing existence in Amdogolai (66.66%) and in Ganeshtok (83.33%) but in the two of the landslide regions Namli and Beto they occurred rarely. The finding has put some evidential facts that once all the four studied areas were habitat of species *Drymeria cordata* or abundantly shared the common habitat, but with the advent in changes in climate and environmental degradations caused by various natural disaster factors like landslides the species were forced to struggle for sustainability in the region. Among these four landslide areas three of them Amdogolai, Beto and Ganeshtok shares a common range elevation from 1500m to 2000m which means that previously the three regions formed the common habitats to many of the plant species but with the changes in environmental condition brought about by various phenomenon like landslides or soil erosions the species has lost their natural habitat. The case in point can be taken from Ladakh region of India where according to the study made by Planetlife International, 2008 many of its medicinal and aromatic plants are under threat due to increasing environmental degradation. The eruption of landslide has major effects in pattern of plant succession. Succession as described by Clements [8], in which one species, or group of species, follows another in the succession and where the preceding species alters the environment to the advantage of the following species. This model is now called Classical [9].

Summing up the above facts it is very important to conserve the natural Biodiversity of Sikkim Himalayas especially the medicinal plant areas as Sikkim is one of the richest natural biodiversity spot of the world. The study has shown the alarming scenario and the urgent need for taking effective methods to stop the further recession of valuable species by landslides disasters. As has already been explained one third of the green forest areas of Sikkim is devastated mainly by means of landslides. Though landslides are unavoidable natural disasters but its disastrous rage can be made less by applying natural technologies. The Planetlife International in its case studies and lesson learn, reveals, that recently some of the localities of countries like India, China, Kenya, Nepal, Tanzania and Uganda are facing difficulty in finding some of its popular medicinal plant species . Landslide being a natural hazard it is impossible to control it by applying human propagated technologies instead natural technologies like biological techniques including plant bioengineering are the most preferred mitigation measures in

those sensitive landslide areas. The vegetation growth will also be effected with the loss of medicinal plant species since the rhizospheric microbes will also get affected with its nutrient being lost due to the devastation of medicinal species. In Kenya along with some of the native countries of Africa,the *Aloe sp.* a type of indigenous medicinal plant helps in maintaining and enhancing the integrity of vegetation [10]. Necessary steps are being undertaken place for the conservation of *Aloe sp.* in Africa which is rated under the threatened species list due to its high exposure in these regions. Various algae and microbes depend upon the nutrients afforded by medicinal plant species. The loss of medicinal plant species from the region will lead to an interrelated ecological cataclysmic chain of events bringing about a huge loss of economic bio-resources of Sikkim. Whose impact in future can be pictured up this time itself natural way or in replicate way.

Table 1. Enumeration of Medicinal plants found in Landslide areas

Scientific name	Local name	Family	Distribution	Flowering	Fruiting	Parts used	Morphology	Medicinal uses	Study region	Frequency
Artemesia indica Willdenow	Titepati	Asteraceae	Middle and upper hill forest 2000- 5000ft	September-December	October-February	Whole plants	Perennial herb, aromatic plants c 0.5-1.5 m.	1. Used as appetiser, cures "kapha vata, asthma. 2. It is good larvicide like kerosene and feeble insecticide. 3. Blood clot	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	Rare Rare 50% 33.33%
Albizzia leebeck L.(Benthem)	Harra Siris	Mimosaceae	Lower hill forest of Sikkim	June-July	October-December	1. Root 2. Seed 3. Leaves	A medium sized tree.	1. Root cure "vata" disease of blood, leucoderma,itching, skin disease, piles. 2. Leaves good for Opthalma 3. flowers are used in asthma	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	16.66% 50% Nil Rare
Eupatarium cannabium L.	Kalijhar	Asteraceae	Temperate Himalayas, 3000 – 11000 ft	October-February	December-April	1. Root, 2. Leaves	Soft hairy perennial shrub to 2m. Leaves ovate	Used as antiseptic, Emetic,diuretic,purgative	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	Rare 33.33% 100% 50%
Osbekia nepalensis Hooker	Chulesi	Melastomataceae	Distributed to subtropical region	July-September	November-February.	1. Flower 2. Leaves	A shrub; branches with appressed hairs	Flower, pounded and applied to sores in the mouth.	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	Rare Rare 83.33% 83.33%
Potentella fruticosa L.	Chinia phal	Rosaceae	Distributed in sub alpine and alpine belt	May-July	August-September	1. Leaf 2. Whole plant.	A shrub about 0.9 rn high, branches rather slender, bark ultimately peeling off in fibrous strips	1. The shrub is astringent and antispasmodic 2. Used as spasmolytic, tonic and vulnerary 3. Used in the form of tea (or in tonic) in diarrhoea, leucorrhoea, kidney stones, arthritis and cramps.	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	Rare Rare 16.66% 16.66%
Polygonum molle D.Don	Thotne (Nep), Kendeko-pam (Lep)	Polygonaceae	Distributed in sub-tropical and temperate region.	June-September.	June-September.	1. Stem 2. Root.	Shrubby, branches stout, terete, villous	1. Possesses astringent properties and is prescribed in diarrhoea. 2. Note: The young	Amdogolai Elevation: 4854 ft. Namli Elevation:	Rare Rare

							with erect or spreading hairs.	shoot is eatable and also prepared pickle from it.	2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	Rare 33.33%
Maesia chesia D.Don	Belaune (Nep), Parmu (Lep)	Myrsinaceae	Distributed to tropical to temperate region. 2000 – 6000ft		March-April	1. Root, 2. Bark, 3. Branchlets 4. Leaves	A shrub or a small tree, 1.2-9 m high	Root, bark, branches and leaves are reported to show insecticidal	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	50% Rare 66.66% 33.33%
Choerospondias axillaries (Roxb.)Burtt & Hill	Lapsi	Anacardaceae	Middle hills 3000 ft.	April to May	October to December	Fruits ripe or unripe		Eaten fresh or pickled, used in preparing	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	Rare 33.33% Rare 16.66%
Ageratum conyzoides L.	Elame (Nep), Namyu (Lep)	Asteraceae /Compositae	Distributed in tropical and hot temperate region	May-December	May-December	1. Whole plants, 2. Leaves 3. Root.	An annual erect herb, hispidly hairy.	A decoction or infusion of the herb is given in stomach ailments such as diarrhoea, dysentery and intestinal colic with flatulence and also in rheumatism and fever.	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	50% 83.33% 16.66% Rare
Drymeria cordata (L.) Roemer Schultes	Abhijal (Nep), Ayokgim(Lep)	Caryophyllaceae	Distributed in tropical and subtropical areas (1000-2000 m)	May	May	1. Leaves 2. whole plant	A diffuse glabrous herb, branched from the base; branches 1- 3 ft.	1. The plant juice is administered in conjunctivitis. 2. Despite the plant being effective in cough, cold and headache. 3. It is also used as a medicine for snake bite, bug bite.	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	66.66% Rare 83.33% Rare
Bidens pilosa L.	Kuro	Asteraceae	Middle and low hills of Sikkim	June – July	October – Novemvber	Whole plant	An annual erect aromatic shrub with quadrangular stem.	1. Leaf juice is applied to eyes, ears to cure the complaints Used as styptic to check the flow of blood. 2. The young shoots are used for the treatment of rheumatis 3. Used to cure Leprosy and skin diseases.	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	16.66% Rare 33.33% Rare

Rubus calycinus D.Don	Aiselo (Nep), Sufokji (Lep)	Rosaceae	Widely distributed in the temperate region.	November-February	March-May	1. Root 2. Young shoot	Evergreen shrub with stout stems to 3 m covered with rufous bristles and recurred spines.	1. Roots and young shoots are used in colic pains. 2. The plant is used as astringent. Root paste is applied to treat wounds	Amdogolai Elevation: 4854 ft.	Rare
									Namli Elevation: 2804 ft	Rare
									Ganeshtok Elevation: 6432 ft.	16.66%
									Beto Elevation: 5465 ft.	16.66%
Prunus cerasoides D.Don	Paiyun (Nep), Kongki kung(Lep)	Rosaceae	Found in between 2500 – 7000 ft.	March(Big tree) October (Small tree)	Following months	1. Stem 2. Bark 3. Fruit	A middle large sized deciduous tree with crimson and white or pink colour flowers.	Stem bitter,acrid, antipyretic, refrigerant, vulnerary, cures leprosy, hallucination, burning of body, leucoderma.	Amdogolai Elevation: 4854 ft.	16.66%
									Namli Elevation: 2804 ft	Rare
									Ganeshtok Elevation: 6432 ft.	16.66%
									Beto Elevation: 5465 ft.	16.66%
Uritca dioca L.	Lekh Sisnu (Nep) Sarong(Lep)	Urticaceae	Common in hills of Sikkim		December - January	1. Root 2. Plant,flowers 3. Nettles	Herbacious,monocious or dioecious with stinging hair.	1. Root is diuretic. 2. The decoction of plnat is used as a diuretic, astringent emmenagogue, anthelmintic 3. Useful in nephritic troubles.	Amdogolai Elevation: 4854 ft.	50%
									Namli Elevation: 2804 ft	16.66%
									Ganeshtok Elevation: 6432 ft.	16.66%
									Beto Elevation: 5465 ft.	Rare
Castanopsis indica (Roxb.)ADC	Dhalne Katus(Nep) Sherobkung (Lep)	Fagaceae	Middle hills forests from1000 – 4500 ft.	October – November	August – September	Bark	An associates of *Schima wallichi*. Tree with 15m.height.	Stem bark extract is antiviral, hypotensive,diuretic and anticancerous.	Amdogolai Elevation: 4854 ft.	50%
									Namli Elevation: 2804 ft	16.66%
									Ganeshtok Elevation: 6432 ft.	Nil
									Beto Elevation: 5465 ft.	Nil
Thysanolaena maxima (Roxb.)	Amliso (Nep), Pasyor (Lep)	Poaceae		November-March	November-March	Root	Elegant perennial to 2 m. Stem solid reed like culms, forming large culms.	1. Roots are used dried or fresh. 2. A paste is made out of it and applied to check boils. 3. The root extract is indicated for use as a mouthwash	Amdogolai Elevation: 4854 ft.	33.33%
									Namli Elevation: 2804 ft	33.33%
									Ganeshtok Elevation: 6432 ft.	Nil
									Beto Elevation: 5465 ft.	33.33%
Piper retrofractum Vahl.	Chaba	Piperaceae	Lower hill forests in Sikkim.			1. Fruit 2. Roots	A glabrous fleshy perennial pungent climber fruiting spikes cylindrico-conic.	1. Fruit aromatic, stimulant,carminative, used in cough and cold and in haemorrhoidal affection. 2. Used in digestive troubles.	Amdogolai Elevation: 4854 ft.	Nil
									Namli Elevation: 2804 ft	50%
									Ganeshtok Elevation: 6432 ft.	Nil
									Beto Elevation: 5465 ft.	Rare

Bischofia javanica Blume.	Kaijal (Nep), Sumon kung(Lep)	Euphorbiaceae	Distributed to temperate region.	April-June	June-October	1. Leave 2. Bark.	A large evergreen tree, bark dark brown hearly smooth.	1. The leaves are astringent 2. They are used for sores, toothache and some eye diseases	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	Nil 33.33% Nil Rare
Mimosa pudica Linn.	Buhari jhar	Mimosaceae	Lower hills of Sikkim up to 3000 ft	June – July	Septemb er	1. Roots 2. Leave 3. Seeds	It is an undershrub growing in waste places	Cures Kapha"bililusness, leprosy, dysentery, Vaginal and uterine complaints.	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	Nil 16.66% Rare Rare
Zanthoxylum budranga Wall.	Timur	Rutaceae	Lower hills of Sikkim	March – May	June – July	1. Fruit 2. Root 3. Bark	Evergreen tree of mederate size with pale corky bark	1. Fruit is hot and bitter, digestive,appetiser removes pain. 2. Useful in heart disease.	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	Nil 16.66% Nil Nil
Schima wallichi (DC)Korthals	Chelaune (Nep), Sambrang kung (Lep)	Theaceae	From 2000 to 5000ft in Sikkim Distributed to temperate and sub-tropical region.	April-June	Novemb er-February	Bark	A large tree, the young shoots silky pubescent , the branchlets lenticillate.	Mechanical irritant and vermicide, cures gonorrhea	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	100% 50% Nil Rare
Dioscorea hamiltoni Hooker.f.	Bantarul (Nep)	Dioscoreaceae				Tuber	Wild climber, green in colour	Relieves burns	Amdogolai Elevation: 4854 ft. Namli Elevation: 2804 ft Ganeshtok Elevation: 6432 ft. Beto Elevation: 5465 ft.	Nil 16.66% Nil Nil

Acknowledgement

The study highly acknowledge Sikkim Bioinformatics SubDISC Centre, Remote Sensing and GIS Centre, Sikkim State Council of Science & Technology for providing valuable information and in assessing scientific networks, Botanical Survey of India, Government of India, Sikkim for their help in identification of species. AS also acknowledges the financial assistance in the form of CSIR-SRF from CSIR, New Delhi, India.

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