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SUSTAINABLE MANAGEMENT OF LAND THROUGH CULTIVATION AND CONSERVATION OF BROOM GRASS (*Thysanolaena Maxima*) IN THE KALIMPONG AND DARJEELING DISTRICT OF HIMALAYAN REGION

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ABSTRACT

The Himalayas is known for its beauty and being abode of the natural resources. *Thysanolaena maxima* is one of the major non-timber forest products of these districts and naturally grows in the hilly lands as undergrowth. It also has medicinal value, with a decoction of the roots used as a mouthwash during fever and the dried paste of fresh roots is applied on the skin to check boils. The Darjeeling and Kalimpong hill area is formed of comparatively recent rock structure that has a direct bearing on landslides. As climate change advances and temperatures increase however, the restoration of the ecological corridor will become more important as plant and animal species migrate uphill to cooler places.

INTRODUCTION

Darjeeling is fondly called "Queen of the Hills" and it is gateway to the pristine beautiful Himalayas. Darjeeling is one of the districts in the state of West Bengal in the foothills of the Himalayas. The district is famous for its beautiful hill stations and Darjeeling tea. Geographically, the District is made of hills and the plains. The Darjeeling hill area is formed of comparatively recent rock structure that has a direct bearing on landslides. Soils of Darjeeling hill areas are extremely varied, depending on elevation, degree of slope, vegetative cover and geo-lithology. The Himalayas serve as the source of natural resources for the District Administrative Set-up. The district comprises four subdivisions: Darjeeling Sadar, Mirik, Kurseong and Siliguri. Darjeeling is the district headquarters. Siliguri has a municipal corporation instead. The community development blocks are divided into rural areas with gram panchayats and census towns. Geographically, the district can be divided into two broad divisions, the hills and the plains. The entire hilly region of the district comes under the Gorkhaland Territorial Administration, a semi-autonomous administrative body under the state government of West Bengal. The council covers the two hill subdivisions of Darjeeling, Kurseong and Kalimpong district.

The foothill of Darjeeling Himalayas, which comes under the Siliguri subdivision, is known as the Terai. Kalimpong is also a district in the state of West Bengal, India. It was formed on 14 February 2017, after splitting from the Darjeeling district as the 21st district of West Bengal. It consists of the Kalimpong Municipality with 23 wards and three community development blocks: Kalimpong I, Kalimpong II and Gorubathan consisting of 42-gram panchayats. However, heavy monsoon precipitation is however a very common cause of the landslides. Soils of Darjeeling and Kalimpong hill areas are extremely varied, depending on elevation, degree of slope, vegetative cover and geolithology. The Himalayas serve as the source of natural resources for the population residing in the hill.

ISSUES OF LANDSLIDES AND FOREST DEGRADATION

The villages of Darjeeling Himalayas, has been gaining more attention due to the increasing number of landslides every monsoon. Beside this the issue of urbanization and development has further led to forest degradation. De (2004) states that the anthropogenic activities such as the unscientific uses of the slope for construction, deforestation and the development of towns and tourism industry are also responsible for the increase of the vulnerability of landslide in this region. Mukherjee (2013) informs states that the environment of which land is a vital component, acts as a highly sensitive system means of sustainability to all forms of life.



Fig.1. Landslide Prone areas of Kalimpong Districts

Darjeeling Himalaya has been bestowed with some of the outstanding natural features, however presently this beautiful hill station faced severe problem from various natural hazards, climate change and other regional specific problem. Trends reflecting exploitation of natural resources at rates much higher than those resources get replenished are presently evident all through the hill. While dramatic increase demand is identified to be the basic cause of widening the gap between resource exploitation the affluent regions, population the strongest determinant of such trends. Consequence of these trends appears as deterioration in quality in terms of deforestation, poor biological productivity and utility hydrological imbalances, other natural hazards and economic disparity. Bhutia (2014) have stated that the major issues are due to pressure of human population and cattle grazing on the hill areas and indiscriminate felling of trees for commercial purposes have led to rapid depletion of forest cover and reduction in the productivity of land, impairing the economic condition of the hill regions. Traditional agriculture practices like shifting cultivation have been responsible for exposure of the thin soil-cover leading to accelerated erosion of both soil and forest cover. Other activities like construction of roads, dams, and unplanned buildings have further aggravated the situation. With the depletion of forests in hill areas, flooding has increased during the rainy season and extended periods of drought have become a recurring feature in the plains, particularly in North Bengal. Availability of water in hill areas has also suffered due to lower water retention capacity caused by the loss of forest cover. This has led to the problems of sand-casting of fertile plains and silting of harbours, reservoirs and river beds, besides additional hardship for hill people.

Sumantra and Raghunath (2016) states that the Darjeeling Himalaya region is the most vulnerable to a landslide as well as avalanche, fall, slump disaster. The primary effects of the June-July landslide disaster are the disconnection of the roads, loss of lives, the breaking of bridges, etc. Causes of Landslides in Darjeeling Himalayas during June-July, 2015. The people have lost their home and suffered homelessly and took shelters that are provided by state government. Since the developmental activity is increased in the mountainous region, thereby, the land use management is significant to reduce the vulnerability of the landslides. Landslide is a common natural phenomenon seen in mountainous territory of Darjeeling Himalaya. It is the most unavoidable of natural dangers that undermine the economic and social advancement of Darjeeling Himalayas. It brings an extraordinary death toll and substantial harm to land and property.

SUSTAINABLE LAND MANAGEMENT THROUGH TIGER GRASS OR BROOM GRASS

It is a fact that that Darjeeling and Kalimpong in the post-modern era comprises of six T's -Tea, Teak, Tourism, Toy Train, Tiger Hill and Trekkers' paradise. We can have another T's in the form of *Thysanolaena maxima* (Broom grass). *Thysanolaena maxima* (Roxb.) belongs to the Poaceae or Graminae family. It is commonly called tiger grass, broom grass and bouquet grass in English, Jhadughasin Hindi; amliso in Nepalesephooljhadu in Assamese (Bisht and Ahlawat, 1998). Broom grass is locally known as 'Amriso' is one of the important sources of income for livelihood in these districts.

Broom grass received its name because people construct sweeping brooms out of the large flower heads. It is a multi-purpose plant.



Fig 2. Flowering of Broom grass (*Thysanolaena maxima*)

It is an important non-timber forest resource which used for cleaning floors, lime washing of building walls, its leaves and tender culms make good forage and its woody culms are used for fuel and as mulch material (Mohiuddin and Alam, 1987). Its tender twigs are good cattle feed for improving milk production and also elephants feed on the whole plant and there are also reports that its fruits have antifertility properties (Mudgal and Pal, 1980). The study carried out by Landicho *et al.*, (2020) suggests the need for the establishment of a tiger grass-based agroforestry model to showcase the viability of crop diversity to address socio-economic concerns of the upland farmers, and integration of woody perennials and soil and water conservation measures to address the need for ecological restoration of the watershed. As designed, the tiger grass-based agroforestry model aims at addressing a balance between the socioeconomic and ecological concerns of the entire farming household and in the long run, for sustainable natural resource management of the CALSANAG Watershed in Romblon (Philippines). Besides creating hillside stabilization and serving as household brooms, its leaves provide fodder for livestock during the dry season, and people can burn the stalks as fuel or use the broom grass as mulch to protect the soil.

MORPHOLOGY

Huge tufted grass, up to 3 m tall, culms solid, leaf-sheaths at least the upper ones, tight, glabrous, terete, smooth, the nodes glabrous, margins with some short stiff hairs towards the throat; blades lanceolate-acuminate, abruptly contracted to a short petiole for a subcordate base, acuminate to a fine point, glabrous, the margins



Fig 3. Roadside view of the wildy growing Broom grass (*Thysanolaena maxima*)

scaberulous, upto 50 cm long and 7 cm wide; ligule a shallow membrane 1-2 mm deep, backed by short stiff hairs; Inflorescence a huge and drooping panicle 60 - 90 cm long or more wide at anthesis, the axis and branches at first rounded, ultimately, capillary, not sharply angled; spikelets numerous, often in pairs on a common peduncle, each pedicel distinct; lower glume clasping, ovate-acute,

obscurely 1 nerved, upto 6.5 mm long; upper glume more transparent; lower-lemma lanceolate-acuminate, sub-hyaline, with 1 or 2 long setose hairs near the margin; upper lemma lanceolate-acuminate, 3 nerved, green between the nerves, hyaline thence to the margin, with stiff setose hairs along the hyaline portion on both sides; palea a narrow, 2 nerved, hyaline scale; stamens 2 (3); stigmata 2, plumose; reddish brown, the rachilla continues as a flattened process with an expanded tip, beyond and behind the upper lemma. The aspect of the spike lets changes with the onset of anthesis when the upper lemma emerges and its setose hairs gradually adopt a stance at right angles to the lemma's surface (Bisht and Ahlawat, 1998).

CULTIVATION OF BROOM GRASS

It grows wild in the hills of the north-eastern region of India and in Darjeeling and Sikkim Himalayas, being a recently domesticated plant, little is known about its growth features, productivity, and plantation management (Tiwari *et al.*, 2012). Most of the farmers practiced "slash-and-burn" to cultivate tiger grass as a single crop and hence, the forest cover has declined (Landicho *et al.*, 2020). Hence cultivation of the cropping should be carried with scientific and technical inputs so as to get the desired results.

NATURAL REGENERATION

It can regenerate through seeds under general conditions. Seed dispersal can be affected by water in some areas. It disseminates through by wind to long distances due to their lightweight. It flowers during June-July and bears inflorescence on the shoot apex at the end of vegetative growth. It regenerates through seeds under natural condition. The seeds mature during February to March and disseminate by wind to long distances due to their lightweight. Seed dispersal is also affected by water in some areas. The seed germinates in the beginning of the rainy season. The seedling establishment and the growth is good on loose and exposed areas such as landslides and freshly disturbed soil especially near road construction sites where light availability is good (Bisht and Ahlawat, 1998).

ARTIFICIAL REGENERATION

The Cultivation of artificial regeneration has been adapted from Bisht and Ahlawat, 1998. Cultivation of broom-grass is comparatively easy and grows on wide range of soils requires fewer financial inputs. The planting can be done by seeds or rhizomes. (Bisht & Ahlawat, 1998).

NURSERY TECHNIQUES

Small mother beds 2m x 1m are prepared and sowing is done by broadcasting 5 to 10 g seeds in each bed. The germination starts after two to three weeks of sowing. After 4 to 6 weeks the seedlings are either transplanted to other beds at spacing of 10 cm x 10 cm or in the polythene bags filled with a mixture of soil, sand and farm yard manure in a ratio of 1:2:1.



Fig. 4. Cultivated Broom grass (*Thysanolaena maxima*) in Suntalakhola area of Kalimpong

SITE DEVELOPMENT AND PLANTING: Planting carried out in weed free area. The pits of size 30cm* 30cm* 30cm with a spacing of 2.5m x 2.5m are dug out and left for weathering one month before planting.

1600 seedlings are required for planting of one hectare area in the fertile plain land. While for jhum lands or hilly areas planting in contour lines or on the bunds of terraces at a spacing of 1.5 x 2.0 m is good and about 2500 to 4000 plants are required for one hectare area. The plantation does not require much after care after planting but 3 to 4 weeding's and soil working in the first year and three similar operations in subsequent years are necessary for obtaining good return.

HARVESTING AND RATIONING

Harvesting of the Brooms (inflorescences) is carried out in the months of March. It is harvested when the panicles become tough and its colour changes to light green or red. Brooms are made of 30-35 dried inflorescences which are bundled and sold in the market. In the second year the leaves can be harvested in the month of August for the purpose of fodder. The ratoon of this grass can be taken upto 5th or 6th year of planting.

YIELD: The yield is low in first and fifth year. The highest yield is obtained in the third year. The maximum growth takes place from 2nd year onwards when annual increment in number of culms per tussock is very high.

MARKETING: The traders in Siliguri collect broomstick from the cultivators through agents. An agent establishes a rapport with the villagers in his operational area and fixes purchase rate with the cultivator by mutual consent. After closing the deal, the agent gives a token advance to the cultivators as a deposit for the assurance of the crop supply. In certain cases, the agent lends huge sums of money to the needy cultivators who in turn have to accept the purchase rate and the terms dictated by the agent (Shankar *et al.*, 2001)

ECONOMICS OF BROOM GRASS: Bisht and Ahlawat (1998) estimated cost of cultivation, yield and economic returns of cultivation for the experimental plantation raised at Lathow, Namsai in Arunachal Pradesh which gives a general idea about the economics of cultivation. However, it varies according to labour efficiency, wages, soil fertility, cultural practices, market price and demand, etc. Kalita *et al.* (2019) undertook a field survey on status and potentiality of this cash crop for economic upliftment of the rural people of Karbi Anglong district of Assam found a gross return of Rs 5.21 lakh and a net return of Rs 3.62 lakh from a hectare of land in four years with a B:C ratio of 3.28. The highest yield was recorded in the third year and thereafter declines gradually necessitating its replanting after six years of planting. Jamir and Yanak (2022) studied and concluded that plantation at a density of 1500 plants per acre gave highest net present value of ₹74124.04/acre up to three harvests.

BROOM GRASS CULTIVATION IN DARJEELING: Broom grass cultivation is a good profitable enterprise especially in hilly areas which can create employment opportunity for both male and female and play a vital role in poverty reduction. Several NTFPs, such as amliso, may be promising in arresting soil and nutrient erosion, controlling landslips, reconstructing vegetation cover and canopies, and enhancing ecosystem productivity. Considering the multifaceted ecological benefits, the forest department has encouraged cultivation of amliso in the hills of Darjeeling Himalaya. (Shankar *et al.*, 2001).



Fig. 5. Harvesting of the Broom grass (*Thysanolaena maxima*)

Table 1. Expected yield and income from the cultivation of broom-grass / ha

Sl. No.	Particulars	Yield			
		1 st year	2 nd year	3 rd year	4 th year
1	Av. yield of culms/tussock	18	60	225	180
2	Total yield of culms (from 1600 tussock)	28,800	96,000	3,60,000	2,88,000
3	Total No. of brooms or Jhadu (Av. 35 Sticks/Jhadu)	822	2740	10,285	8,228
4	Total income (@ Rs. 4 per Jhadu)	3,288	10,960	41,140	32,912

Recognizing the link between poverty and environmental degradation, the Tanahun District Forest Office in Nepal wanted to work with local communities to establish leasehold forests, whereby local communities lease government land for a period of 35 years, agreeing on sound management practices such as planting trees and growing broom grass, so that people and the environment would both benefit. Through the USAID-funded Hariyo Ban Program, WWF partnered with the Forest Office and communities to provide support for this initiative. Hillsides are turning green, and the forest is regenerating. People report that they are seeing wildlife in the area again. In addition to helping local communities thrive, broom grass is laying the foundation for restoring a major ecological corridor. Its fibrous root mat effectively protects the top soil and nutrients from erosion on hill slopes, in landslides affected areas and in agricultural fields as the water run-off and soil loss are reduced by up to 88% compared with bare areas (Bhuchar, 2001, Sharma et al., 2001).

CONCLUSION

Hence it can be concluded that taking up Broom grass cultivation would not only benefit the conservation of the Ecology. But would enhance the improvement of the livelihood of the common people who are dependent of forest and live in the degraded forest. Thus it is essential that Broom grass cultivation should be taken in the project mode for the benefit of the environment and community as a whole in a sustainable way.

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