Impact of Bryo-Diversity depletion on Land Slides in Nilgiri Hills, Western Ghats (South India) –A Study

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Abstract: Since the existence of Nilgiri hills, bryophyte- the miniatures of plant kingdom play an important and crucial role in the stabilization of Blue Mountains ecology. Unlike Himalayas, the landslides were rare in the area, but with the time and changing global environment it had become a common sight. Significantly ever increasing population and vehicular traffic is the prime reason for them, to cater the need, roads are periodically broadened by cutting road sides destroying the habitat as also the inhabiting species. Bryophytes, are efficient soil binders that regulate the soil moisture and provide substrate for future plant succession. The habitat loss and nudeness of substratum gives impetus to rapid soil erosion that further enhances the problem of their very survival. The present communication provides significance of these avascular cryptogams in environmental assessment, ecological balance and their role in decreasing the pore pressure to check land slides.

Keywords

Bryophyte, Nilgiri hills, Pore pressure, Landslides, Soil binders.

Introduction

Nilgiri hills –the Blue Mountains is the largest range of peninsular India having about 24 peaks in western Tamil Nadu. It is the tri-junction point of Tamil Nadu, Karnataka and Kerala. The hills are separated from the Karnataka plateau to the North by Moyar river and from the Anamalai hills and Palani hills to the south by the Palghat gap. The Nilgiri district of Tamil Nadu lies within these mountains. Its cardinals are 11° 08' to 11° 37' N latitude with a span of 130 km, 76° 27' E to 77° 4' E longitude spreading in 185 km, Central location is 11°22′30″N 76°45′30″E11.375°N 76.75833°E. Its area is about 2,479 square kilometers (957.1 sq m). The area was commissioned as Biosphere Reserve in the year 2000 as a part of UNESCO world network of Biosphere Reserve. It also comes in the category of Hot Spots of biodiversity. Among hill stations it is unique as it has 2700 species of flowering plants, 160 species of fern, innumerable non-flowering plants like mosses, liverworts, fungi, algae and lichens (Venu and Sanjappa, 2001). Most part of these hills have grassland and shrub lands interspersed with sholas that has been much disturbed or destroyed by extensive tea plantation, easy vehicular movement or transportation coupled with non native *Eucalyptus* and *Accaia*.

Unlike Himalayas these hills are formed by stable and hard textured igneous rocks. These hills are irrigated by two monsoons; south west monsoon laden winds on south western face make the area rich in diversity, and the other is scanty south east monsoon on the south eastern parts of the hills. The annual rainfall of the region ranges between 500mm to 1200mm (Meher-Homji, 1992). Until recently, the land slides were of rare occurrence in the area with the changing time for past few years, land slides become a common sight. The maiden landslide occurred in the Western Ghats in 1978 making their entry in an anxious era of calamity. The frequency of land slides has increased in recent years with major slides occurred in 1993, 1995, 2002, 2006 and very recently in the year 2007(Vaani et al, 2008; Kumar and Bhagavanulu, 2008), landslides occur as a consequence of various physiographical triggering factors. Rainfall is one such factor and in the Nilgiris landslides have been demonstrated to be the reflection of increased pore pressure during the rainy season (Ramaswamy et al, 2006). (see Plate-1).

The present work is an attempt to correlate the occurrence of land slides with the depletion of bryophyte diversity in Nilgiri hills.

Observations

The hills of Nilgiris are divided in 3 types of vegetation cover: 1. Forests which are chiefly tropical and sub tropical type and can be categorized into Tropical wet evergreen forest, Tropical semi-evergreen forests, Tropical moist deciduous forests and Thorn forests. 2. Grasslands and 3. Water bodies. The human intervention like deforestation may cause the soil to lose its binding capacity ultimately leading to landslides during heavy downpours. The major problem in Nilgiri hills is deforestation. Between 1849 and 1992, the shola were reduced to their half (Kumar and Bhagavanulu, 2008; Bist, 1999). Previous studies on deforestation and land use changes in

Western Ghats (Champion and Seth, 1968; Sharma *et al*2002) showed a loss of 25.6% in forest cover between 1973 and 1995.

Bryophytes play a significant role in controlling the main cause of land slides i.e. Pore pressure during rainy season. These plants reduce the formation of pores in soil as they have the ability to colonize and grow rapidly in nearly all conceivable habitats. Terrestrial forms are ecologically very important as they grow in a variety of life forms contributing the component of montane forest ecosystem due to high degree of soil binding capacity besides water holding capacity (Smith, 1982; Richards, 1987; Glime, 2007) suggested that spores and vegetative fragments of bryophytes on bare rock and soil surfaces could help to prevent erosion, mosses like *Barbula* Hedw., *Bryum* Hedw., *Campylopus* Brid., *Ceratodon* Brid., *Dicranium* Hedw., *Entoshodon* Schwaegr., *Fissidens* Hedw., *Fabronia* Raddi, *Floribundaria* Fleisch., *Funaria* Hedw., *Himantocladium* (Mitt.) Fleisch., *Hymenostomum* R. Brown., *Hyophila* Brid., *Hypnum* Hedw., *Hydrogonium* (C. Muell.) Jaeg., *Isopterygium* Mitt., *Macromitrium* Brid., *Physcomitrium* (Brid.) Brid., *Philonotis* Brid., *Garckea* C. Muell., *Isopterygium* Mitt., *Vesicularia* (C. Muell.) C. Muell., *Glossadelphus* Fleisch., *Sphagnum* L. and *Plagiothecium* B.S.G., along with liverworts like *Plagiochasma* Lehm. et Lindenb., *Reboulia* Raddi, *Targionia* L. and *Lunularia* Adans. etc occurring in Nilgiri hills are important pioneers on new road banks helping to control erosion. The protonemata, spores and vegetative fragments of bryophytes forms mats and cushion that cover and bind exposed substrate. Bryophyte such as *Sphagnum* L. (Hotson, 1919) reach water saturation during rainy season and release it when require in a regulated way therefore reduces the pore pressure and maintaining the moisture of its surrounding (Welch, 1948; Ando, 1972). The rhizoidal system of bryophytes is such that instead of deeply penetrative in the substratum they only cover the substratum (Tansler and Chick, 1907).

Since 9 years the bryo-diversity is of the region has been critically examined. Several taxa of mosses like *Actinodontium* Schwaegr., *Aerobryum* Doz. et Molk., *Anoectangium* Schwaegr., *Archidium* Brid., *Atrichum* P. Beauv., *Barbella* Fleisch., *Barbula* Hedw., *Bartramia* Hedw., *Bartramidula* Bruch et Schimp., *Braunia* B.S.G., *Campylodontium* Schwaegr., *Ctenidium* (Schimp.) Mitt., *Dicranoloma* (C. Muell.) Schimp., *Distichophyllum* Doz. et Molk., *Entoshodon* Schwaegr., *Hedwigidium* P. Beauv., *Platydictya* Berk., *Lyellia* R. Br. , *Porotrichum* (Brid.) Hamp., *Philonotis* Brid., *Garckea* C. Muell., etc earlier reported from the region (Dabhade, 1998; Lal, 2005; Verma et al, 2011; Alam et al, 2011) are now endangered. In case of Liverworts Nilgiri hills hosted 75 species as obligate terricolous including the previous valid reports while only 45 species are collected in several recent collections which clearly show a declining trend in terricolous diversity. The Nilgiri hills, having 29 rare and endangered species of terricolous liverworts which are facing continuous pressure by one way or the other (Alam, 2009). It is evident from the present study that with increasing human activities in Nilgiri hills and broadening of the roads and by doing so habitat of these miniature plants are mercilessly bulldozed by the road engineers while cutting the road sides in a very short time and the road sides become barren again and it will take a long time to reestablish the vegetation. This activity is the greatest factor of species extinction and several taxa which were occurring in past are not present in their native places and this extinction

is still continue e.g. several previously well known species of *Riccia* L., *Athalamia* Falc., *Marchantia* L., *Lepidozia* (Dum.) Dum., *Bazzania* Rodway, *Jackiella* Schiffn., *Fossombronia* Raddi, *Riccardia* S.F. Gray, *Aneura* Dum., *Asterella* P. Beauv., *Plagiochasma* Lehm. et Lindenb, *Exormotheca* Mitt. etc. (Alam, 2009) are not presently not occurring in the region. Significantly all these are good soil binders.

By conniving the ecological role of these plants, the ecosystem of Nilgiri hills has now become fragile as each and every species in an ecosystem has its particular role and its absence causes disturbance, leading to strange incidents that happen in Nilgiri hills and will become common to the region in near future if roads cutting is continued.

Discussion

"Earth has enough for everyone's need but not for anyone's greed"- a saying of Mahatma Gandhi fits appropriate in today's environmental circumstances, with increasing population and excessive use of nature by humans make the tougher and compact ecosystem into a fragile one.

Bryophytes are the high altitudinal plants and envelope the forest floor and aid in moisture conservation along with the soil binding which checks the soil erosion in steep hilly regions. Although they are very minute and seem economically useless but they are fundamentally important in ecosystem maintenance as they trap moisture and acts as pioneer species in barren rocks as suggested by Crum (1973), Richards (1987), they studied the role of bryophyte species as soil binders, the effects of trampling on mosses and considered the mosses to have a potential role as inhibitors of soil erosion. Ando (1972) listed several bryophytes and their role in erosion prevention. Sowing spores and vegetative fragments of some species of bryophytes on bare areas where erosion is likely to occur (Glime, 2007).Welch (1948) added that the netted and webbed protonemata forms mats, covering the exposed substrata and are quite effective in preventing soil erosion. Horikawa (1952) demonstrated that some bryophytes absorbs 3.2 to 12 times as much water as dried plants weight.

Conclusion

All these are the evidences in favour of bryophytes' importance basically the terrestrial forms as efficient soil binder and moisture controller in hilly ecosystems (Richardson, 1981; Proctor, 2000). But increasing human population along with their demands, these ecosystems has upset day by day and this changes the set pattern of past. Therefore the situation is alarming and there is a need to restore the ecosystem by checking the habitat loss because nature is quite when it remain as natural.

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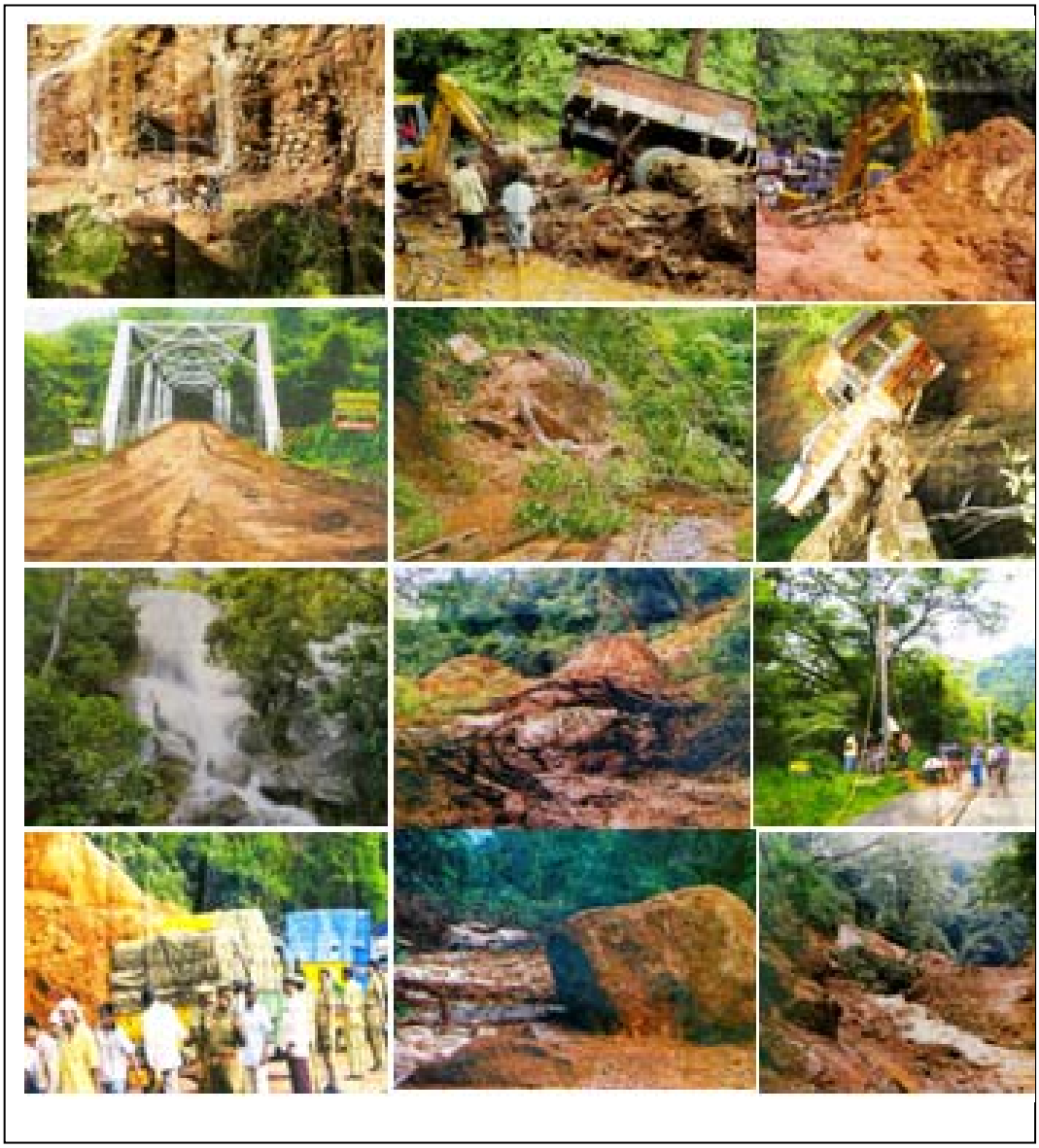
Plate -1



The Fury of heavy land slides in inner Nilgiris and State Highway connecting Ootacamund to Mettupalayam via Coonoor (Nilgiri hills)