

Eco-restoration potential in the degraded watershed areas of the western ghats

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Abstract :

The Western Ghats in the Kolhapur District, Maharashtra forms the watershed area for many east flowing and a few west flowing rivers which originate in the mountainous region. The forested areas in the watershed play a significant role in rejuvenating the rivers and are vital for their sustenance. In the recent past the region has undergone degradation of its natural resources (water, soil, flora and fauna) due to increasing man made threats in region like mining, roads, dams, growth centers and hill station development, monoculture, legal and illegal tree cutting, terracing, forest fires, agricultural expansion, fuel wood collection, poaching of wildlife, changing pattern of traditional agricultural practices of shifting cultivation and 'Raab'. The locals are still heavily depended on the natural resources in the region for their livelihood and are directly affected by its degradation. There is urgent need to undertake measures for protection and restoration of natural resources in the region. This can be achieved by integrated watershed development and management as well as considering innovative approaches of socio economic incentives to locals for their participation in the efforts of nature protection. The paper discusses eco-restoration potential of Western Ghats in Kolhapur district through development of carbon sinks in the privately owned hilly areas by undertaking vegetation, soil and water conservation efforts.

Keywords: Eco-restoration, watershed, threats, Western Ghats. Carbon sequestration

Introduction:

Forest form a significant and integral part of the mountainous area due to inaccessibility and thus harbour excellent biodiversity and provide with critically important ecological services. The FAO categorizes the ecosystem services provided by the forested mountain areas in provisional services (e.g. timber extraction); regulating services (e.g. carbon sequestration, water cycle regulation); and cultural services (e.g., the role of forests in local belief systems and customs), (FAO 2011). The forest in the Western Ghats are the source of water for the plateau and valley regions for drinking and irrigation as major rivers and their tributaries originating here and provide water sources to the vast Deccan plains. With ever increasing exploitation of natural resources in the region the ecosystem services provided by these mountain ranges are in grave danger.

Western Ghats are rich in floral and faunal diversity and have been included among the 34-biodiversity 'hot spots' in the world as despite being rich in biodiversity they are also under serious threat. Because of their uniqueness and natural heritage potential, the Western Ghats have been recently declared as the "World Heritage Site" of global importance by UNESCO (2012). The Western Ghats show high species richness as well as high species endemism. Arising from the narrow Konkan and Malabar coasts, this mountain range runs for 1600 km North- South between river Tapi in Gujarat and Kanyakumari in Tamilnadu covering an area approximately equal to 1,60,000 sq km. The four major types of vegetation in the Western Ghats is evergreen, semi-evergreen, moist

deciduous and dry deciduous. The highest levels of endemism are found in the evergreen forests. These forests occur within a 200-1,500-meter elevational range and 2,500- to 5,000-mm rainfall range. Semi evergreen and moist deciduous forests occur primarily in the states of Maharashtra, Goa and Karnataka within an elevational range of about 300-900 meters. The moist deciduous forest type occupies the largest area within the Western Ghats. It occurs within an elevational range of 500-900 meters in areas with mean annual rainfall of 2,500-3,500 mm. The dry deciduous forests occur on the leeward side of the Western Ghats Mountain Range within an elevational range of 300-900 meters in areas of 900-2,000 mm mean annual rainfall. (CEPF report, 2007)

The Northern Western Ghats in Maharashtra, also known as the 'Sahyadari' mountain range, are unique geomorphology i.e. laterite plateaus, slopes and saddle formations and rich in their local floral and faunal diversity. The hill range runs approximately 800 km north south between 15°60' to 20°45' N latitude and 72°60' to 74°40' E longitude, covering about 58,400 sq km of area from 63 talukas in 11 districts. (i.e. Thane, Raigad, Ratnagiri, Sindhudurg, Nashik, Dhule, Ahmednagar, Pune, Satara, Sangli and Kolhapur). In terms of percentage to the total Western Ghats Region, Maharashtra accounts for 38% of the total taluk's and 36.4 % of the total area. The mountain range varies in height from 200m to 1500m MSL with an average of 1200MSL the highest being at Kalsubai 1646 m in Ahmednagar district. The annual average rainfall ranges from of 2000 to 7000 mm, and is directly of great

ecological and socio-economic significance to the Deccan plateau and Indian peninsula. . The region forms the upper catchment of major rivers of southern India like the Krishna, Godavari and Bhima, Kaveri and several of their tributaries. The forests on saddles and around plateaus on the slopes of the Ghats, running along the western coast and on spurs in the eastern direction, form the vital component of the watershed area of the drainage replenishing the rivers in the valley.

Western Ghats region is facing forest degradation and deforestation for a long time. However, the intensity and expanse of this activity has exponentially increased over the last two decades. A study of period spread over 70 years from 1920s to 90s reported the annual rate of deforestation to be 0.57% in the Western Ghats (Menon and Bawa, 1997). Another study by Jha et. al. (2000), revealed that the annual rate of deforestation varied between -0.73 to 1.84% for the period 1973 to 1995 in the states of Karnataka, Kerala and Tamil Nadu, with the forest protection accounting for the negative rate of deforestation. Forest degradation resulting in conversion of dense forest to open forest, an open forest to scrubland has been a result of land use change and exploitation of forest resources. Study on the forest cover change detection in the Western Ghats of Maharashtra by Panigrahy, et. al. (2010), indicate that there is loss of dense forest at an annual

rate of 0.72% and of open forest at 0.49% during the span of 20 years from 1985-87 to 2005.

Study area:

The Western Ghats in Kolhapur district runs in the north south direction, covering a total distance of (165 kms). The crest line of the Western Ghats forms the western boundary of the district. The Ghats rise on an average from a height of 600 M to 1000 M along the crest. The terrain in Kolhapur district is mainly hilly in the west as district is formed of the main Sahyadri range on the west and spurs extending in the north east and east. The Udgiri Plateau peak point along the crest line forms the highest peak in the region at 1053 m. There are six major spurs further extending in the east and North east **direction** in the district originating from the Western Ghats dividing the district into watershed regions of different rivers originating in the Western Ghats. The six major ranges are Vishalgad-Panhala Range, Phonda-Savgaon Range, Khanpur- Mudhol Range, Bhudargad Nipani Range (North Ghatprabha Spur/ Chikodi Range), Samangad Range and Malprabha-Gandharvagaad Range (Fig. 1). These spurs divide the Kolhapur region in six major valleys of the Warna, Panchaganga, Dudhaganga, Vedganga, Hiranyakeshi and Ghatprabha Rivers.

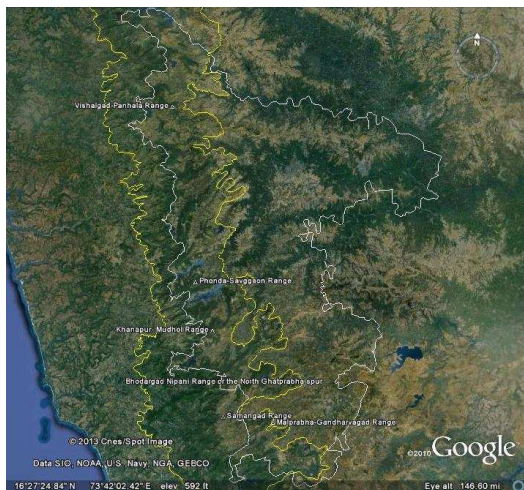


Figure 1: Six major ranges in the Kolhapur district

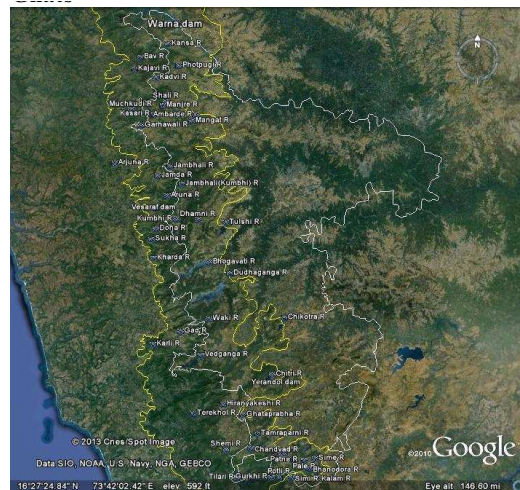


Figure 2: Rivers originating from the Western Ghats

The eastern spurs of the Western Ghats and the descending western spurs forms the origin of the major East flowing and West flowing rivers and there tributaries. A total of 26 East flowing rivers and 25 West flowing rivers originate from the Western Ghats in south Maharashtra (Samant et.al. 2011). (Table 1 and 2)

Table 1: List of East flowing Rivers originating in the Western Ghats of South Maharashtra

Sr. no	Major river	Tributary	District	Sr. no	Major river	Tributary	District
1	Warna	Warna	Satara	14	Tulshi	Tulshi	Kolhapur
2		Potphugi	Kolhapur	15	Dhamni	Dhamni	Kolhapur
3		Kadvi	Kolhapur	16	Bhogawati	Bhogawati	Kolhapur
4		Ambarde	Kolhapur	17	Dhudganga	Dhudganga	Kolhapur
5		Shali	Kolhapur	18		Waki	Kolhapur
6		Kanasa	Kolhapur	19	Vedganga	Vedganga	Kolhapur
7	Kasari	Kasari	Kolhapur	20		Chikotra	Kolhapur
8		Manjre	Kolhapur	21	Hiranyakeshi	Hiranyakeshi	Sindhudurg
9		Garhawali	Kolhapur	22		Chitri	Kolhapur
10		Mangat	Kolhapur	23		Ghatprabha	Sindhudurg
11	Jambhali	Kolhapur	24	Tamraparni	Tamraparni	Kolhapur	
12	Kumbhi	Kumbhi	Kolhapur		25	Chandvad	Kolhapur
13		Saraswati	Kolhapur		26	Patne	Kolhapur

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Sr. no	Major river	Tributary	District	Sr. no	Major river	Tributary	District
1.	Shastri	Shastri	Ratnagiri	14	Terrekhol	Terrekhol	Sindhudurg
2.		Bav	Ratnagiri	15	Tilari/ Chapora	Tillari	Kolhapur
3.	Kajvi	Kajvi	Ratnagiri	16		Pale	Kolhapur
4.	Muchkudi	Muchkudi	Ratnagiri	17		Bhandora	Kolhapur
5.	Kodavli	Arjuna	Ratnagiri	18		Sime	Kolhapur
6.	Sukha	Sukha	Sindhudurg	19		Kalam	Belgaon
7.		Jamda	Sindhudurg	20		Bandra	Kolhapur
8.		Aruna	Sindhudurg	21		Simi	Belgaon
9.		Waghotan	Sindhudurg	22		Potli	Belgaon
10.		Dona	Sindhudurg	23		Gurkhi	Belgaon
11.	Kharda	Kharda	Sindhudurg	24		KharaI	Sindhudurg
12.	Gad	Gad	Sindhudurg	25		Shemi	Sindhudurg
13.	Karli	Karli	Sindhudurg				

Table 2: List of west flowing Rivers originating in the Western Ghats of South Maharashtra

Threats to forest ecology in the watersheds areas of western ghats:

Dams: Since tributaries and major rivers originate here, the forested mountains in the high rainfall areas in Western Ghats are the source of water for the plateau and downstream river basin regions for drinking and irrigation. In order to meet the increasing water demand and boost agriculture productivity in the plains several dams have either been constructed or proposed on almost all major tributaries and rivers in the region. The construction of dams has resulted in various environmental issues. Due to their location in the inaccessible upper catchments in the watersheds, significant deforestation has taken place in construction and submergence of the dams. This enhanced construction of roads and transportation in the earlier non accessible regions. Besides, dams have been causing social unrest among the hill habitants who are either displaced due to dam construction without proper rehabilitation and or are without adequate compensation as per the norms. They remain devoid of any benefits for sacrificing their ancestral lands and livelihood for the society and lead a miserable life of refugee, as experienced by thousands of dam affected people. There are 37 small and large dams in the Western Ghats area of Kolhapur district. There is an evident increase in the water spread area of dams in the Western Ghats of Kolhapur district. (Panigrahy, et. al. 2010)

Roads: The existing and proposed roads and 'Ghats' (roads through mountain pass) in the hilly terrain have been cutting across the Western Ghats eco-sensitive mountains to cut short the distance between two destinations causing much disruption of the intact forest tracts or leading to fragmentation of forest. There are already 7 existing 'Ghats' in the Western Ghats portion of Kolhapur and 3 more are proposed. While proposing new roads through forests and hills convenience and benefit of few, often outsider commercial interests, gain priority over local needs and negative and permanent environmental impacts of the activity. Vested interests and ad hoc political interventions often influence the design making against environmental priorities.

Mining: Bauxite mining is an existing threat to the existence of forest and regional ecology in this area with 8 ongoing mines and 4 proposed mines in the region. The effectiveness of the Environmental Impact Assessment carried out is doubtful and much inadequate as permission is granted to the mines despite being in the hilly forested catchments of dams in the vicinity and adjoining to the reserved forest, wildlife sanctuaries and now project tiger area. Also there is urgent need to carry out scientific fresh EIAs for individual mines as well as Cumulative EIAs for the cluster of mines. The monitoring of mining operations and compliance of various laws and regulations is also lacking in the ecosensitive World Heritage region.

Stone quarry: The small hillocks forming the spurs of the extensive stretch of the Western Ghats in the region are under danger of extensive stone quarrying due to improper site selection, over exploitation and lack of monitoring for compliance of regulations.

Land use changes: The region is undergoing extensive land use changes from the traditional pattern mainly on account of, developmental activities, changing crop patterns in the agriculture, agricultural expansions and alterations leading to terracing for sugarcane cultivation; Fall of traditional agricultural practices like shifting cultivation has lead use of the fragile mountain slopes for terracing and plantation of exotic species like pineapple plantations. The booming tourism in the region has caused constructions of hotels, exploitation of local natural resources like water and fuelwood and has lead to urbanizations. In absence of strict norms for constructions of buildings there is haphazard growth of resorts and hotels, by cutting trees, altering habitats, polluting the water sources, exploitation of resources in the eco sensitive area. Thus, making it difficult for locals to continue their traditional livelihood and access the resources at affordable price.

Wind mills: as a government policy to encouraging nonconventional energy production at the time of energy crises in the state, Wind mills get boost from the government and the projects do not have to comply for EIA or public consultations, which is normal restriction for any business activity. Therefore the wind mill farms coming in the forested hilly region often emerge on the plateaus and posses a greater threat to the local ecology and forests as the roads for carrying the equipment often cuts through the forest on the slopes, thus providing accesses to the inaccessible forest patches. This causes permanent and non repairable damage to the fragile plateau and neighbouring slope ecosystems.

Local requirements are not considered and changing aspirations: Majority of the people residing in the Ghats are still depended on the forest for their basic requirements of fuel wood, timber, agricultural practices, fodder, fishing, medicinal plants, to some extent for food. Increasing industrial demands and profits involved in their extraction and trade have resulted in locals cutting down the existing natural vegetation on own lands as well adjoining forests and revenue lands in the hilly region. With increasing population pressure the demands for basic necessities of fuel wood, timber, and fodder have also lead to over exploitation of the resources without managing the forest for meeting the future needs.

Changing Agricultural Pattern: The traditional practice of shifting cultivation which was earlier found to be sustainable ensuring environmental stability through long

fallow periods has seen a downfall with the decline in community management of the system. The change in the system has resulted in over exploitation of land through one of the following fates of the shifting cultivation lands, reduction in fallow periods, terracing of the land, plantations of exotics, wood cutting on the land or selling of the lands to outside investors. Also in regions where subsistence agriculture was followed, now with availability of water due to dams in the region the cropping pattern has changed drastically in to cultivation of cash crops like sugarcane.

Eco-restoration and carbon sequestration as a mitigation measure:

Increasing human activities has resulted in significant loss of Biodiversity, decrease in forest area and loss of Carbon content. According to the World Bank Report (2004), forests directly support 90% of people living in extreme poverty. In order to deal with deforestation and degradation of forests financial feasible mitigation measures need to adapted.

There is a need to consider the application of newly emerging financial sources for restoration efforts. Carbon trading under Clean Development Mechanism of Kyoto Protocol, the Forest Carbon Partnership Facility, Forest Investment Program and United Nations initiative on REDD+ (Reduced Emissions from Deforestation and forest Degradation) in developing countries are a few examples for deriving at national as well as local level.

Along with carbon sequestration, forest provides with multiple benefits like, water and soil conservation, fuel wood and timber provision, NTFP (Non-timber forest products), etc. Forest degradation and deforestation can be avoided through adapting of available restoration measure leading to biodiversity conservation.

Eco-restoration potential in the degraded watershed areas

The potential for eco-restoration in the degraded Watershed areas of the Western Ghats in Kolhapur district can be determined following a series of steps that required for eco-restoration. The first step towards accessing the potential for Eco-restoration in the degraded watershed areas is to firstly define the restoration goals. Any restoration effort requires people's participation and it is of substantial importance to consider social relevance in the eco-restoration effort as the next step. The final step for any restoration effort requires identification of sites with due consideration to their existing original root stock, disturbance regime and ecological significance.

Defining Restoration Goals: Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed (Society for Ecological Restoration International Science and Policy Working Group, 2004). The reference ecosystems in case of eco-restoration of degraded watershed can be any

ecosystem in the region with depicting the degraded ecosystem before any disturbance. Reserved forest areas or Sacred Groves in the Watershed which have been protected from any disturbance can act as reference ecosystems for the restoration effort.

People's Participation: Over the period of time the local aspirations and needs change and are reflected in their decisions regarding their livelihood, household shifts and abandonment of traditional occupations. The younger population tend to migrate for better livelihood opportunities and assured steady income with less hardship as compared to those residing in the remote areas in the Ghats. As a result the older population is left behind who are unable to bring the land under cultivation. This is the main reason why the hilly agricultural lands remaining fallow.

Identified sites - Based on their disturbance regime and ecological significance:

The degraded watershed areas in the Western Ghats of Kolhapur region can be restored depending on the availability of land and ownership of the land. The first step toward eco-restoration of the Watershed areas is categorization of the land based on its availability. Consideration should also be given to existing land use pattern, its economic inputs and outputs, willingness and ability of the locals. In the present circumstances the land categories that can be considered as potential for eco-restoration are:

1. Forest Department land: The lands adjoining forests and Protected Areas belonging to the forest department, which were earlier covered with forest but are now in degraded state, can be considered suitable for reforestation as it is cost effective to undertake restoration activity immediately due to availability of root stock for easy regeneration by just offering proper protection
2. Revenue Department land: The degraded vegetation on the Revenue land in the region is used by villagers for collection of fuel wood, grazing livestock and even for shifting cultivation. These lands have a very good potential for afforestation by desired local species in collaboration of social forestry department and local community.
3. Private / Owned land: There are vast tracts of lands either private, owned or encroached in the remote hilly regions with sizable degraded natural tree cover which do not support any sustainable agriculture on the steep hill slopes. Mostly marginal farmers or non pastoral nomads cultivate this land with minimum output by traditional farming practice of shifting cultivation and raab practice which is detrimental to the growth of vegetation and ecology of the region. Also as the farmers abandon agriculture as it is no longer subsistence or there is lack of new generation entering in traditional farming, the lands remain fallow. These now less productive lands owing to their important location in the ecosensitive watersheds, when afforested, will provide for bilateral benefits of fuel

wood, timber, fodder, non-timber forest produce to locals and can also be used as carbon sinks thus allowing farmers to get direct incentives for protecting, conserving the natural vegetation on owned or community lands, in addition to the long term ecological benefits to the region.

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