

Solution:

Bamboo Based Conservation Technology for the Rehabilitation of Degraded Ravine Lands

Submitter: ICAR

Solution Overview

What is it, and what problem does it solve? Brief 2–3 sentence description.

Bamboo based conservation technology is one of the nature-based solutions for natural resources conservation, carbon sequestration and rehabilitation of degraded land ecosystems. It thrives well in degraded land and ravine ecosystems. It provides assured protection from soil erosion from degraded land ecosystem and river bank erosion in riparian zones due to extensive net-like root system and rhizome, which act as an excellent soil binder. It helps in arresting gully head, ravine river bank extension process.

The degraded ravine lands are distributed across the country but their major presence is in four states. Total ravine area of four states Uttar Pradesh, Madhya Pradesh, Rajasthan and Gujarat is 10.36 lakh hectares. The degraded ravine lands problems where they exist, but are also the root cause for degradation of adjacent arable lands affecting production potential in a major way. The fundamental prerequisite for ensuring and uplifting livelihoods is to identify the potential land use options that increase the environmental sustainability and rejuvenate these ravine lands, which are vulnerable to climate change and land use options. Rehabilitation of ravine lands with various kinds of vegetation not only provides livelihood support but also helps natural resource conservation and carbon sequestration in long run. To address the long-term problem of degraded lands (ravines), Bamboo (*Dendrocalamus strictus*) based bio-engineering interventions for reclamation and rehabilitation, carbon sequestration and regular income generation from degraded ravine lands were developed, evaluated and demonstrated under National Bamboo Mission, Ministry of Agriculture, Govt. of India funded project.

Key Features & Benefits

Main components and why it is useful? Bullet points summarizing methods, tools, and value added.

- Bamboo is a fastest growing plant in the world with a growth rate ranging 30 to 100 cm per day in growing season. It can grow to a height of 36 m with diameter of 1-30 cm.
- It is also a highest yielding renewable natural resource.
- Bamboo plant is an effective means for natural resources conservation and carbon sequestration as it acts as a good soil binder owing to its dry and hardy nature peculiar dense clump formation and extensive inter locking fibrous root system and accumulation of leaf mulch.
- Natural capacity to regenerate through rhizomes, which play important role in preventing erosion and runoff, enhance in-situ soil moisture, water holding capacity and nutrient cycling in degraded land ecosystems.
- It also generates the plenty of oxygen, lower light intensity and protects against ultra violet irradiation and is an atmospheric and soil purifier.
- Versatile uses of bamboo products and its widespread demand make it an economically viable and eco-friendly land use option for reclamation and productive utilization of degraded lands.
- Bamboo products like bathroom sanitary and electrical products, bamboo buildings and structures for relief and rehabilitation in the wake of major disasters, laptop stand, photo frames, bamboo shoot processing, cane furniture, ply boards.
- Enhance the flora and fauna.
- Reduce the impact of climate change in addition to natural resources management for sustained productivity.
- It provides livelihood support to the bamboo growers.
- Among the bamboo based bioengineering interventions for gully beds, the lowest runoff

(48 mm), soil loss (1.5 t ha⁻¹) and nutrients loss (1.8 kg ha⁻¹) was observed in the watershed having bamboo plantation with earthen check dams made of sand bags, in comparison to control watershed (runoff 400 mm, soil loss 18 t ha⁻¹, nutrients loss 6 kg ha⁻¹).

- Bamboo based interventions could absorb more than 80% of rainfall and reduced soil and nutrient losses by 90% and 70% respectively.
- Gully head extension up to 1.5 m year⁻¹ could be brought to nil under peripheral bund supported by closed spacing bamboo plants.
- Gully bank extension up to 0.5m year⁻¹ was also reduced to about 50% in gully bank with bamboo plantation.
- Bamboo based interventions increased the soil organic carbon by 5 times (from 0.1% to 0.5%) on the degraded sites.
- Bamboo based technology can give returns upto Rs.90,000/ha.
- This is unique technology for reclamation and productive utilization of ravine lands.

Where It Works and Where It Can Work

Existing and potential target regions, agroecologies, or farming systems. Include examples if available.

India is very rich in bamboo diversity and there are 124 indigenous and exotic species under 23 genera which are found naturally and/or under cultivation. Bamboo plantation is found in every place mostly in moist deciduous, semi evergreen, tropical, subtropical and temperate areas of forest. Major Bamboo growing states in India are Andhra Pradesh, Arunapradesh, Assam, M.P., Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Orrisa and Tamilnadu.

The potential regions for bamboo based conservation technology are degraded ravine lands (3.67 M ha) along the various Rivers systems including major river system as Chambal, Yamuna, and Mahi rivers in UP, MP, Rajasthan and Gujarat, and other river systems, river bank erosion problem areas, hilly tract of north-east region, Uttarakhand, Himachal Pradesh and J&K. It can also adopt on community and pasture lands, private lands particularly in homesteads, field bund and marginal lands in semi-arid and humid regions of India.

Bamboo (*Dendrocalamus strictus*) based bio engineering interventions viz. i) Bamboo plantation in gully bed with staggered contour trenches supported by boribund checkdam. ii) close spaced

bamboo plantation as live check dams in gully bed, iii) closed spaced bamboo plants around the gully head along with peripheral bund iv) closed spaced bamboo plants along the gully bank in gully bed are recommended for ravine reclamation, carbon sequestration and regular income generation of farmers under ravine degraded lands of Gujarat, Uttar Pradesh, Madhya Pradesh and Rajasthan.

The technology successfully prevented gully head extension, stabilization of gully beds and slopes. Bamboo based technology for controlling gully head extension, gully bed stabilization, slope stabilization, terrestrial carbon sequestration, Soil health improvement, and regular income generation from degraded ravine land was found suitable for upscaling to other ravine area. This has potential to bring additional area under productive utilization thereby reducing pressure from the cultivated land in ravine affected areas.

More specifically, the technology is up-scalable in majority of the countries in south-south cooperation including BRICS countries (Brazil, Russia, China, and South Africa) and others including Bangladesh, Cambodia, Egypt, Morocco, Myanmar, Sri Lanka, and Viet Nam besides many African countries including Cameroon, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, South Africa, and Uganda, where land degradation and resource conservation problems constraint agriculture production and sustainability.

Evidence & Impact

What results has it shown? Stats, pilot outcomes, or testimonials.

Bamboo based interventions can potentially reclaim and bring to productive use of ravine lands spread over about 1 m ha area in the UP, MP, Rajasthan and Gujarat. It is estimated that these degraded lands, apart from having a present net worth of Rs 6430 million for 20 year period, strengthen the local ecosystem by building soil carbon worth 44 million ton and conserve soil worth Rs 4100 million, if one third of the ravine affected lands are put under bamboo based interventions.

Bamboo plantation and bamboo plantation in conjunction with conservation measures as trench and earthen gully plus reduced the surface runoff ranged from 40 to 71 and 60 to 100%, respectively, and soil loss from 14 to 86 and 35 to 100% for bamboo plantation and bamboo plantation with conservation measures, respectively. Soil carbon



build-up is of 41 t/ha, and it sequester CO₂ the tune of 12 t/ha. The net annual return vary from 64,000 to 89,000/ha. The estimated value of nutrients saved through bamboo based conservation technology ranged Rs. 2126- 5555/ha.

Under the current scenario, it is estimated that scientific and judicious management of ravine land would increase 10 to 50% of existing arable lands, develop irrigation facilitation for its 30 to 60% arable lands, improve cropping intensity by 9 to 28% and current yield levels by 20 to 66% with an overall improvement of 118 to 280% increase in the net returns through increased crop production from ravine lands.

Scalability & Adoption Support

Why it can be scaled and what's needed to adopt it?

Low-cost, adaptable, partner-ready, etc.

Bamboo based interventions can potentially reclaim and bring to productive use of ravine lands spread over about 1 m ha area in the UP, MP, Rajasthan and Gujarat. This technology package can be up scaled through National Bamboo Mission, Department of Agriculture and Cooperation, Ministry of Agriculture & Farmers welfare, Govt. of India, State Land Development Corporations, State Watershed Management Agencies & NGOs etc.

India is one of the signatories among 123 countries under UNCCD to achieve Land Degradation Neutrality (LDN) by 2030 by restoring the degraded lands of which degradation by soil erosion constitutes the chief contributor in the world. India has already committed to achieve the LDN target by

restoring 26 M ha degraded lands by 2030. The Bamboo based conservation technology would greatly help for treating the lands degraded by soil erosion by adopting Bamboo based conservation technology. It is nature-based solution low-cost and easily adaptable in degraded land ecosystem in many state of India.

Bamboo based conservation technology can also be adopted by Watershed Management Agencies, River Bank Erosion Control Authority, Department of Land Resources, States Land Development Corporations, Forest and Agriculture Department under various development schemes for restoring degraded land and improving the livelihood of primary stake holders.

6. Partners & Contact Info Who's involved and how to connect? List of key contact and partners + email / phone.

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