







Effect of geojute technique on density, diversity and carbon stock of plant species in landslide site of North West Himalaya


Harsh MEHTA¹  <http://orcid.org/0000-0003-2810-3573>; e-mail: harshmehta41ddn@gmail.com


Raj KUMAR^{2*}  <http://orcid.org/0000-0001-5311-0180>;  e-mail: rajcswerti@gmail.com


M Ayub DAR¹  <http://orcid.org/0000-0002-0390-6719>; e-mail: ayoubfri9@gmail.com


GP JUYAL¹  <http://orcid.org/0000-0001-9829-5457>; e-mail: juyalgp@yahoo.co.in

Sridhar PATRA^{1,3}  <http://orcid.org/0000-0003-1118-0732>; e-mail: mail2sridharpatra@gmail.com

Sneha DOBHALL⁴  <http://orcid.org/0000-0003-2250-2987>; e-mail: snehadobhal001@gmail.com

AC RATHORE¹  <http://orcid.org/0000-0002-8320-4011>; e-mail: rathoreac@gmail.com

Rajesh KAUSHAL¹  <http://orcid.org/0000-0002-0060-4870>; e-mail: kaushalrajesh1@rediffmail.com

PK MISHRA¹  <http://orcid.org/0000-0003-0594-6105>; e-mail: pkmbellary@rediffmail.com

* Corresponding author

¹ ICAR-Indian Institute of Soil and Water Conservation, 218, Kaulagr Road, Dehradun-248195, Uttarakhand, India

² ICAR- Central Soil Salinity Research Institute, Karnal-132001, Haryana, India

³ United Nations University-Institute for Integrated Management of Material Fluxes and of Resources (UNU-FLORES), Ammonstrasse 74, Dresden-01067, Germany

⁴ VCSG Uttarakhand University of Horticulture and Forestry, College of Forestry, Ranichauri-249 199, Uttarakhand, India

Citation: Mehta H, Kumar R, Dar MA, et al. (2018) Effect of geojute technique on density, diversity and carbon stock of plant species in landslide site of North West Himalaya. *Journal of Mountain Science* 15(9). <https://doi.org/10.1007/s11629-017-4768-2>

© Science Press, Institute of Mountain Hazards and Environment, CAS and Springer-Verlag GmbH Germany, part of Springer Nature 2018

Abstract: Mountainous regions of the globe experience landslides due to heavy rainfall and unplanned construction on slopes. Geojute is adopted globally as a landslide rehabilitation measure, but its impact on natural vegetation development is poorly understood. The present study was conducted to examine the impact of geojute application on vegetation restoration, ecology and carbon stock in a recently occurred landslide, during 2012. The results revealed that the geojute application improved the

richness, diversity, density and basal area of plant species at the landslide site. Likewise, biomass production, carbon stock and carbon sequestration of plant species was observed significantly higher in geojute treatments compared to control (without geojute treatment). Moreover, significant improvement in soil moisture was recorded beneath the geojute treatments. Further, results showed that the geojute is highly effective in controlling soil erosion at the landslide site. The findings of this study revealed ecological and environmental benefits of geojute application in term of improvement in vegetation recovery processes, species diversity and

Received: 20 November 2017

Revised: 09 February 2018

Accepted: 27 April 2018

percent increase in soil moisture beneath coir mat covered slopes compared to non-covered slopes. Moreover, increased soil moisture beneath geojute has also been reported by previous researchers (Vishnudas et al. 2006; Li et al. 2013; Shao et al. 2014). This indicates that the better soil moisture beneath geojute creates favorable soil physico-chemical properties that expedite plant growth which helps in rapid vegetation recovery at the landslide sites.

2.6 Soil loss

The erosion pegs status showed no visible change in soil levels (depth) in control and as well as in geojute treatments. This is due to fact that the sheet erosion was not observed in landslide site, because of the removal and subsequently equal deposition of soil around the erosion pegs. In contrast, slight to high rill formation was observed in control treatment, while, no rill formation was observed in geojute treatments (Table 4).

Overall, results illustrated that geojute is highly effective in controlling soil erosion at landslide site. The reason was that, the geojute prevents detachment of soil particles, intercepts splashed particles, improves soil contact and reduces leaching of nutrients from the soils (Rickson 1988). Moreover, greater water infiltration post geojute application improved soil moisture that reduced runoff and soil loss at the landslide site. For instance, Rickson (1992b) and Mitchell et al. (2003) have reported higher soil loss in sites that were without geojute compared to the geojute treated sites. In general, geojute techniques have great potential in conserving soil and water resources that contributes to long term ecosystem stability and services in landslide sites.

3 Conclusions

Results from present study demonstrated that geojute application successfully improved species density and basal area, which promoted the greater biomass production and carbon stock and thereby the higher CO₂ sequestration in landslide site. Moreover, geojute application improved the soil moisture regime, while reduced the soil loss, which resulted in the improved vegetation growth, species

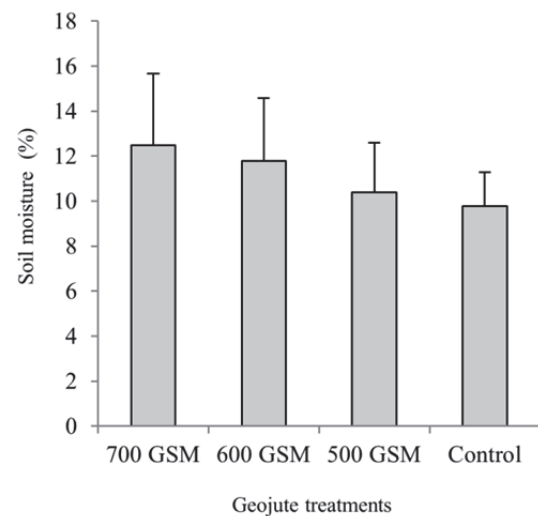


Figure 3 Variation in soil moisture content (%) (mean, $n = 5$) under different geojute treatments (GSM = gram per square meter).

Table 4 Effect of geojute on rill formation at landslide site

Treatments	No rill	Slight rill	Moderate rill	High rill	Severe rill	Very severe rill
Control	x	✓	✓	✓	x	x
500 GSM	✓	x	x	x	x	x
600 GSM	✓	x	x	x	x	x
700 GSM	✓	x	x	x	x	x

richness and diversity in such site. In general, the research demonstrates that geojute technology has the great potential to reduce soil erosion and improve the productivity of the extremely degraded landslide site. Further, the present study provides important information on improvement in vegetation characteristics post geojute application and can be useful for planning rehabilitation measures on similar landslide sites. Moreover, future studies on the impact of improved geojute technology should be initiated for sustainable management and utilization of landslides through growing ecologically and commercially important tree species.

Acknowledgement

Authors are thankful to Common Fund for Commodities and the OPEC Fund for International Development for funding to carry out this study in collaboration with National Jute Board, Kolkata, India and Jute Diversification Promotion Centre, Bangladesh.