

The magnitude of erosion-induced carbon (C) flux and C-sequestration potential of eroded lands in India

Debashis Mandal | Nishita Giri  | Pankaj Srivastava

Soil Science and Agronomy Division,
ICAR–Indian Institute of Soil and Water
Conservation, Dehradun, India

Correspondence

Nishita Giri, Soil Science and Agronomy
Division, ICAR–Indian Institute of Soil and
Water Conservation, 218 Kaulagarh Road,
Dehradun 248195, Uttarakhand, India.
Email: nishi28nov@gmail.com

Abstract

Globally, soil erosion transports a significant amount of carbon (C), but the magnitude of erosion-associated loss of soil organic carbon (SOC) from India is poorly quantified. The present study quantified the C flux induced by accelerated erosion for different states of India where soil erosion is the most critical form of land degradation. The lateral transport of eroded C was estimated for individual Indian states using spatially referenced data for soil erosion rates that were assessed using the universal soil loss equation (USLE) applied to the information about 1649 soil association units and their SOC inventories across the country. The results indicated that soil erosion varies widely across the states. The states lying in the north region (Uttar Pradesh, Uttarakhand, Jammu & Kashmir and Himachal Pradesh) and all states of the north-eastern Himalayan region, Peninsular plateau (Madhya Pradesh, Chattisgarh and others) and Peninsular India (Orissa, Andhra Pradesh, Tamil Nadu, and Karnataka) showed more soil loss due to water erosion. At the national level in India, erosion transported about 4.87 Pg of soil and 115.36 Tg of C every year, which consequently emits about 34.61 Tg of C to the atmosphere. Among the states in India, Madhya Pradesh had the highest value of erosion-associated C loss (20.33 Tg C yr⁻¹), followed by Chhattisgarh, Maharashtra, Uttar Pradesh and Andhra Pradesh with losses of 9.98, 9.18, 9.11 and 8.70 Tg C yr⁻¹, respectively. The possibility of C sequestration in various degraded lands was also explored. The results revealed that between 19 and 27 Tg C yr⁻¹ could be sequestered in soils by adopting achievable technological options in erosion-affected areas of India, offering the potential to reduce approximately 24.5% of the total greenhouse gas emissions from the agricultural soils of India (94 Tg C).

Highlights

- Eroded carbon is an important factor in biogeochemical carbon (C) cycle in India.
- A new database on lateral transport of C is created for India.
- Quantity of C lost due to water erosion in India is 115.36 Tg yr⁻¹.
- Erosion control will help to reduce C emission by 19–27 Tg C yr⁻¹ from India.

KEYWORDS

eroded lands, erosion-associated carbon loss, India, potential C sequestration, soil erosion, technological options