ICASS POLICY BRIEF


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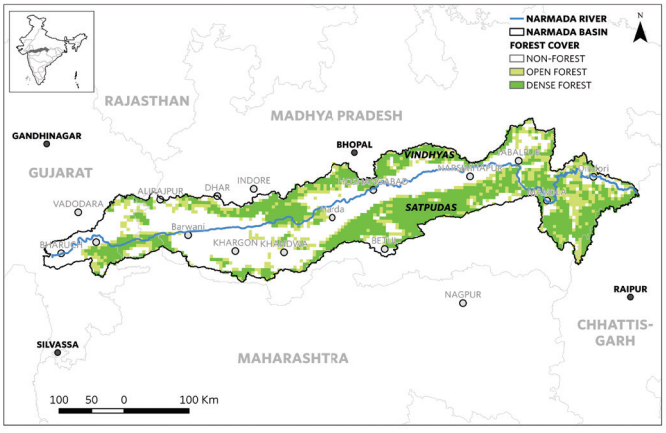
Restoration of riparian areas in the Narmada basin

BACKGROUND

Riparian areas are vegetated or partially vegetated areas adjacent to waterbodies such as rivers and streams. Depending on the landscape characteristics, they may extend from a few metres to a few kilometres from the riverbank. Riparian areas are transitional zones between aquatic and terrestrial environments, and provide crucial services to both. For example, they regulate the flow of sediments into rivers and hence impact water quality; provide organic matter and facilitate nutrient retention for fishes and invertebrates; stabilise riverbanks through the structural integrity of root systems; and regulate the volume and flow of water. When managed well, they can support both people and nature through various ecosystem services.



However, riparian areas are often degraded and in need of restoration; such restoration is, therefore, an important component of landscape management as well as river rejuvenation projects.

The Nature Conservancy (TNC), in collaboration with Indian Grameen Services (IGS), has been testing and demonstrating models for riparian restoration within the Narmada basin. These field pilots are currently underway on 38 sites comprising 222 hectares within Narmadapuram district, Madhya Pradesh. Our approach to restoration within this heavily-populated

and economically-productive region includes the following key principles:

- Restoration planning that balances ecological needs (*i.e.*, bringing back natural ecosystems) with the need for benefits to local communities (*e.g.*, products that can be harvested).
- Incorporation of both woody and non-woody vegetation (including shrubs, herbs, grasses, sedges, and reeds) into restoration plans, thereby going beyond 'tree-planting'.
- Promotion of assisted natural regeneration approaches that build on natural processes while being more cost-effective.
- Standardisation of capacity building programmes, tools, and manuals for comprehensive field implementation.
- Consideration of long-term sustainability in planning and implementation.

KEY INSIGHTS AND RECOMMENDATIONS

Operationalisation of the key principles (listed above) in the field has resulted in a set of learnings that could benefit large-scale riparian restoration initiatives. These learnings are summarised below:

1. Restoration planning that balances ecological needs with the need for benefits to local communities.

The selection of plantation material should lead to the restoration of native species in their natural patterns of diversity and distribution, while providing both direct benefits (such as fodder and fruits) and indirect benefits (such as erosion control) to local communities. These objectives may not always align, and require careful balancing in a collaborative manner. This balance is best achieved when it is based on a clear understanding of the diversity and distribution of species in intact riparian ecosystems in the region (TNC has prepared such documentation for the Central Narmada Valley region[1]). An initial

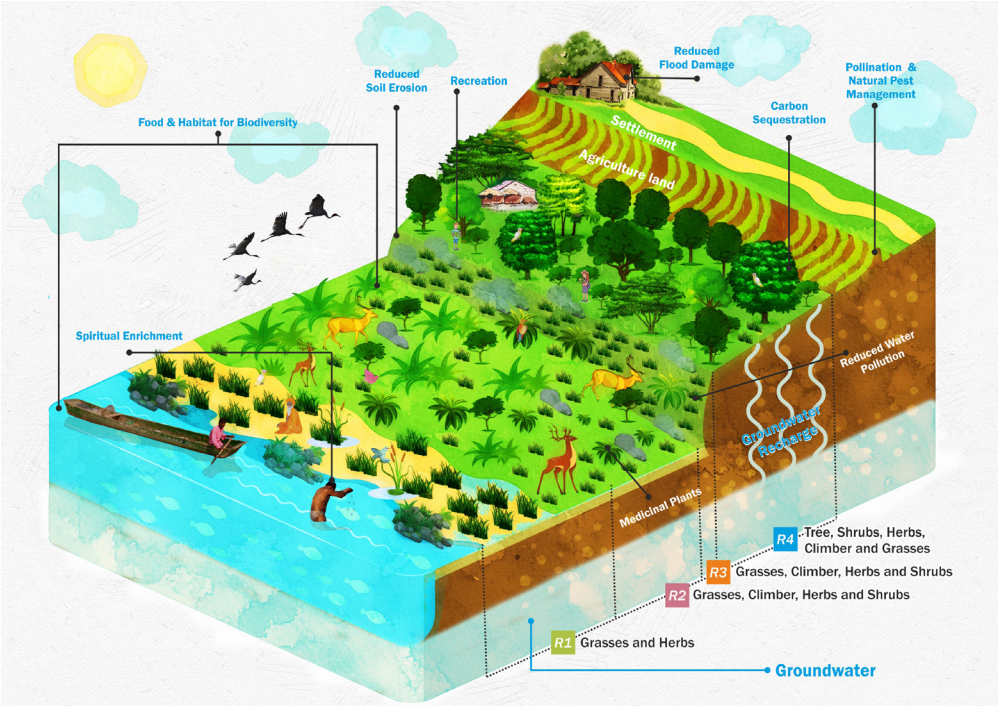
Co-development of restoration plans with local communities.

restoration plan that draws from this knowledge can serve as a base, and may then be modified to accommodate specific needs of local communities. The restoration plans so developed are founded in the ecology of the landscape but are actively adapted to serve local needs (and hence, more likely to persist over the long term). Incorporation of local needs is crucial for a landscape approach, requiring interventions on both public and private lands. Further, micro-zones within restoration sites – dedicated to either ecological or human needs – can be created within those restoration sites.

2. Incorporation of both woody and non-woody vegetation into restoration plans, thereby going beyond 'tree-planting'.

Restoration efforts typically concentrate on trees, but non-woody vegetation (including shrubs, herbs, grasses, sedges, and reeds) forms a critical component of riparian ecosystems and their resulting services. Non-woody vegetation is prevalent in a gradient across the width of the riparian zone, including semi-aquatic reeds, grasses, and sedges along the banks; terrestrial shrubs, grasses and herbs on the sloping areas leading up from the riverbed; and a range of terrestrial species that form part of the understorey in the upland areas (where trees predominate). Learnings from our pilot sites (*Case study 1*) indicate

1 https://www.tncindia.in/content/dam/tnc/nature/en/documents/india/River-Narmada-Book.pdf



Transition in riparian flora from the riverbed (mainly non-woody vegetation) through the sloping banks and to the upland areas (dominated by woody vegetation); holistic restoration requires consideration of both.

that non-woody vegetation can be planted via simple propagation methods and establishes itself rapidly. Further, it is also a useful component in stabilising slopes, thereby protecting upland agricultural land from erosion (*Case study 2*).

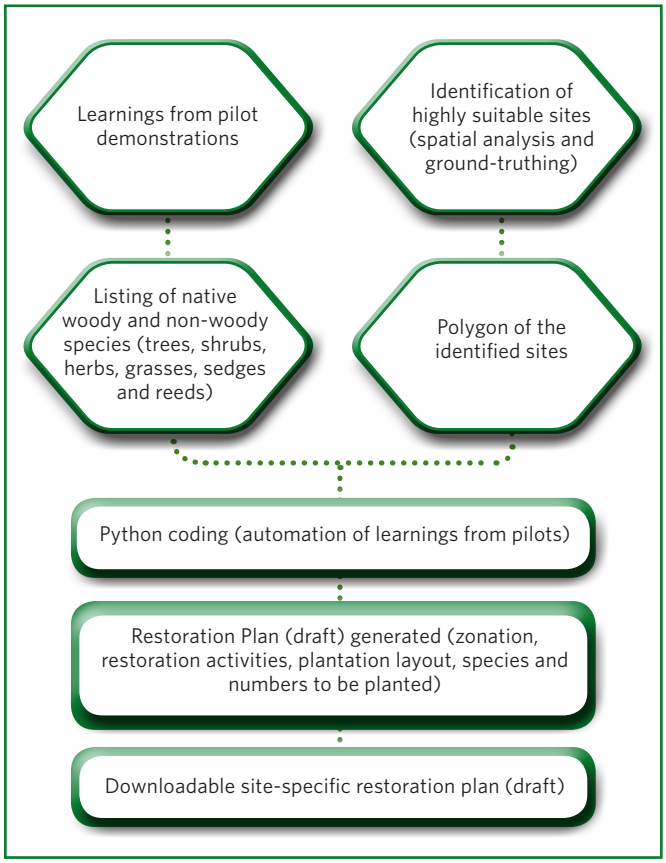
3. Promoting assisted natural regeneration approaches that build on natural processes while being more cost-effective.

Riparian restoration approaches that focus on aiding the natural regeneration of vegetation are often effective because they naturally match appropriate flora with site conditions. Remnant patches of natural vegetation that occur within restoration sites provide propagules (such as seeds) or habitat conditions (such as patches of shade) that enhance regeneration. In the context of heavily-populated riparian zones, such remnant patches of native species are often found in erosion-prone areas such as ravines, making them particularly important for protection. Protection, which is an essential element of such approaches, involves physical protection via fencing as well as social protection via commitments from local communities. *Case Study 3* provides an account of a TNC pilot site where limited plantation was combined with protection of existing patches for enhanced outcomes.

Riparian restoration site at Dhansi, depicting a combination of different restoration measures customised for natural riparian gradient.

4. Standardisation of appropriate capacity building programmes, tools, and field manuals for comprehensive field implementation.

Effective implementation of riparian restoration requires capacity to be built at multiple levels, and especially so at the field level. Learnings from our pilot indicate that local 'restoration champions' can be effective in maintaining restored sites when they are trained well. Restoration champions also require appropriate reference material to guide their work. TNC has developed such a manual in Hindi to further this goal[2], to which additional components related to monitoring, evaluation, and learning are currently being integrated. More generally, the development of restoration plans (particularly for replication and scaling) can benefit from effective integration of plantation principles, species lists and local conditions in an efficient software system that develops basic site-specific restoration plans. These basic restoration plans can then be used as the foundation for further discussion and finalisation with local communities.



Schematic of a software under development for preparation of site-specific riparian restoration plans.

5. Consideration of long-term sustainability in planning and implementation.

Survival, maintenance, and establishment of restoration sites requires institutional as well as financial support to succeed (apart from the technical needs identified above). A fundamental requirement is the genuine integration of local institutions and communities into a restoration strategy, which can be achieved by incorporating their needs from the beginning. Learnings from our pilots indicate that village level micro-plans could be one way of institutionalising

KEY FUTURE PROSPECTS

We recommend the following collaborative efforts to advance riparian restoration (within the larger context of ecological restoration) in Madhya Pradesh:

1. Greater integration of riparian considerations within planning and policies related to landscape restoration, basin management, and river rejuvenation.

A set of 'demand-side' interventions that elevate riparian restoration within larger landscapes may include three main components. A fundamental component is creating greater understanding and awareness of holistic riparian restoration. The development of a short capacity building programme for managers and policymakers could help meet this goal. A second key component involves policy analyses that identify how the specific consideration of riparian ecology can be incorporated into existing mechanisms, policies and schemes. Such 'mainstreaming' of riparian restoration into larger processes is essential for greater uptake of this relatively niche concept. Finally, the purposeful development and piloting of innovative use cases that align riparian restoration with community needs – such as the use of reed-based systems to treat grey water discharge from small villages – can increase the potential for greater acceptability and interest.

2 https://www.tncindia.in/content/dam/tnc/nature/en/documents/india/NarmadaRestorationGuide.pdf

riparian restoration within a larger set of activities prioritised by communities. Further, ensuring the permanence of restored sites needs long-term funding mechanisms (ideally, via integration and convergence with existing governmental mechanisms). Together, these form a sustainability plan that supports the long-term permanence of restored areas.

TNC, in collaboration with IGS, is undertaking a series of field pilots to restore riparian areas along the river Narmada. Three such pilots are described as case studies.

2. Greater integration of riparian considerations in ground-level support mechanisms to enhance the effectiveness of implementation.

To complement policy and management measures on the ground, three major components that enhance implementation at the field level are necessary. Firstly, capacity building for frontline staff of relevant departments as well as village representatives can help improve local leadership and awareness. Secondly, accessible knowledge products (such as field manuals) and tools (such as simplified mobile-based monitoring systems) can aid field staff in the quality of implementation. Finally, such changes may need to be accompanied by enhancements in the supply of appropriate material. These could include, for example, augmentation of the ability of nurseries to supply a greater diversity of planting material (such as non-woody vegetation). A key consideration in enhancing ground-level support mechanisms should be the variation in agro-ecological conditions across Madhya Pradesh.

Taken together, this set of proposed actions – which range from the policy through to the field – could support greater replication and scaling of riparian restoration across Madhya Pradesh.

CASE STUDY 1

RESTORATION OF NON-WOODY VEGETATION ALONG RIVER BANKS

The specific goal of this pilot was to plan and test field methods that incorporate non-woody vegetation along channels in the riverbed and along the banks. The pilot was undertaken on 10 hectares in Bandraban (Narmadapuram district, Madhya Pradesh) where the Tawa river converges with the Narmada. This area is important for biodiversity: we have recorded 70 species of terrestrial and riverine birds here (including threatened species such as the Egyptian vulture, Sarus crane and Indian skimmer), as well as fauna such as the striped hyena, blackbuck and spotted deer.

This area is also important for people: like other such flood plains, this land is used for seasonal cultivation of watermelon, muskmelon, cucumber, and bottle gourd during the summer. Repeated use of tractors to level the sand, however, had resulted in the loss

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Indian skimmer (Rynchops albicollis)

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Sarus crane (Antigone antigone)

of naturally-occurring vegetation along the channels and marshy areas near the riverbank.

To address the need for restoration in Bandraban, we first engaged with local stakeholders through five sequential community meetings to discuss the problem and potential solutions. Based on extensive inputs from these meetings, we surveyed and identified specific patches where restoration could be undertaken. These patches were selected to adjoin areas demarcated for seasonal cultivation, and therefore did not interfere with such cultivation.

Based on an existing assessment of riparian vegetation in the district as well as an evaluation of local conditions, two species were propagated at the restoration locations: *Typha angustata* and *Polygonum barbatum*. The two species were selected for a combination of characteristics: rapid growth, strong root networks, resilience to flooding, and provision of habitat for fauna such as birds. Plantlets were obtained from nearby sites along the Narmada and planted directly on to the restoration locations. The planting was carried out among the existing remnant patches of a third species, *Tamarix dioica*. Planting costs averaged around ₹85,000/hectare for this pilot (these are likely to reduce significantly when implemented on a larger scale).

The vegetation established itself rapidly and showed quick growth and propagation. Seasonal cultivators found this vegetation useful as it served as a barrier for their fields; anecdotal observations from them also suggest that these patches helped retain moisture in the soil.

This pilot demonstrated that:

- Non-woody riparian vegetation can be re-established rapidly when there is local interest and collaboration.
- There is potential for tangible and immediate benefits to people from such restoration.

Next steps include increasing the diversity of non-woody vegetation that is propagated (current efforts were limited by the availability of planting material) and extending these efforts to other similar areas along the Narmada. A total of 36 candidate shrubs, 43 herbs, 17 climbers, and 21 species of grasses have already been documented by TNC as occurring along the riparian habitats of the Central Narmada Valley region.

Aditya Mandloi

Aditya Mandloi

Before and after the plantation of non-woody vegetation at Bandraban site.

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Restored patches of non-woody vegetation adjoining seasonal cultivation on the riverbed.

CASE STUDY 2

USE OF COIR MATS ALONG WITH BAMBOO TO SECURE SLOPING BANKS

The specific goal of this pilot was to evaluate the use of nature-based products – in this case, coir mats – to aid in the restoration of steep riverside slopes. The pilot was undertaken on 10 hectares in Dongarwada (Narmadapuram district, Madhya Pradesh). This village is situated along a sharp drop to the riverbed, and consequently has suffered significant erosion of cultivated lands during the monsoons.

Aditya Mandloi

Installation of coir mat on contoured surface.

To address this problem, we installed *Bhoovastra* – a mat made of coir developed by the Coir Board, Government of India – along the land (around 45 degrees slope). After some basic contouring and smoothening of the surface, the coir mats were placed on to the soil and secured tightly with stakes. Bamboo (*Dendrocalamus strictus*) saplings were then planted through the coir mat.

To ensure the survival and growth of the newly planted vegetation, a village monitoring committee was established with community participation. This committee takes responsibility for watering and maintenance.

The use of coir mats helped the bamboo saplings establish themselves in two ways: by helping retain moisture through the summer (the plantation was carried out in January), and by reducing the exposure of roots from soil erosion. As a result, survival rates were close to 90% and the bamboo had established itself well before the onset of the monsoon. The cost for this model (averaging around ₹14,00,000/hectare) was about half of that for other comparable options such as boulder pitching (around ₹26,00,000/hectare).

This pilot demonstrated that the use of coir mats may be suitable mainly for the most vulnerable areas; it may also be more appropriate for private rather than public funding. However, costs could potentially be reduced through local production using alternative materials – an important consideration for further investigation.

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Slope stabilisation via bamboo combined with coir mat, with cultivation above and below.

CASE STUDY 3

ASSISTED NATURAL REGENERATION OF RIPARIAN AREAS

The specific goal of this pilot was to demonstrate natural regeneration through protection of existing patches, along with limited plantation as appropriate. The pilot was undertaken on 8.2 hectares in Dhansi (Narmadapuram district, Madhya Pradesh). An initial site evaluation by TNC in 2017 revealed significant impact of invasive species (such as *Lantana camara*) and uncontrolled grazing. Yet, patches of mixed secondary deciduous forest remained, containing 35 trees, 15 shrubs, 79 herbs, and 18 climber species.

From the ecological perspective, the removal of invasives and protection of remnant patches were identified as the first steps towards restoration, followed by planting activities on bare patches. The vision as well as the details for operationalising it were co-developed with the local community, including:

- Definition of the community's vision for this site.
- Arrangements for protection and sustainable use, including physical (limited fencing) and social (voluntary regulation of extraction).
- Identification of the species to be planted on bare patches, so that the local community could benefit from the usufruct.
- Institutional arrangements for support, maintenance and continued management of the site by the community.

A part of the funding for activities was leveraged via convergence with MGNREGS. Such convergence also enabled local youth to serve as custodians of the restoration site *(Paudh Rakshaks)*.

Over the years, the restoration activities at Dhansi have benefited both nature and people. Due to alignment with community needs, the survival rate of planted trees is more than 80%. The local community benefits directly from provisioning services such as fodder and fruits. Occurrence of butterflies, bees, birds, and mammals has also increased.

Blackbuck (Antilope cervicapra)

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Painted stork (Mycteria leucocephala)

Marsh crocodile (Crocodylus palustris)

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Tamilnadia uliginosa fruits being harvested from the restoration site.

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