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Are Forests Always a 'Good Thing'? Understanding the Linkages among Forests, Watersheds and Agriculture in the Western Ghats of India

What is the role of tropical forests in the functioning of watersheds and how does this affect agriculture and farmers? In this SANDEE study, researchers provide new insights into this issue. They find that, for a certain type of irrigation system, an increase in forest cover can actually reduce the amount of water available for agriculture. This can stop farmers growing irrigated crops and can, in turn, have a negative impact on their livelihoods.

Researchers from the Centre for Interdisciplinary Studies in Environment and Development in Bangalore, India, carried out the study. It is one of the first pieces of research of its type in south Asia. It underlines the often complex relationship between habitat conservation and agriculture, and highlights the need for environmental policy makers to take into account the social and economic impacts of their decisions. Its findings are of particular importance for policy makers across South Asia, where large populations use forests and water resources intensively.

INVESTIGATING WATERSHED SERVICES

Tropical forests provide a wide range of incredibly important 'services', such as habitats for plants and animals and food, medicines and other resources for people. These forests also supply a range of vital 'watershed services' that include groundwater recharge, flood control and soil conservation. Although these services are known to be very important, it is becoming clear that the relationship between forest cover and the 'health' of a watershed is not straightforward or always positive. It is now accepted that the effects of forest degradation or restoration on watershed functioning will vary depending on climate, spatial scale, rainfall intensity and many other factors.

From an economic point of view, it is important to know how forest cover affects the water available for agriculture. The aim of this study is to provide an understanding into this question. To do this, it focuses on a degraded catchment area in the hills and forests around Baragi village, a small hamlet in the Chamrajnagar district of Karnataka state. In this region, extensive areas of natural forests have been transformed into monoculture tree plantations, grasslands, scrub and coffee, tea and rubber plantations (for more information on the study area see the side bar).

The researchers find out how water availability affects crop choice and productivity and, in turn, assess how this affects the economic welfare of local people – in terms of farmers' income and the employment of land-less workers. They then look at how changes in forest cover would translate into changes in the amount of water available for agriculture. This allows the link between forest cover, agricultural productivity and economic well being to be established.

THE STUDY SITE

The village of Baragi lies in the Western Ghats region of India, amongst the hills and forests of Bandipur. This is in a southern fringe area that separates the Mysore region of Karnataka state from the Nilgiris in Tamil Nadu and the Wynaad region in Kerala. The plains around the Bandipur forest are dotted with irrigation tanks. The tanks, created by earthen embankments, impound the flow of streams. When they are adequately filled, water is let out of the tanks through sluices. The water then flows through channels that provide gravity-based irrigation to farmland downhill from the tanks.

This policy brief is based on SANDEE working paper No. 36-08, 'Economic impacts of changes in hydrological services from forest ecosystems: Findings from a low rainfall location in the Western Ghats of India' by Sharachchandra Lélé, Iswar Patil, Shrinivas Badiger, Ajit Menon, Rajeev Kumar from the Centre for Interdisciplinary Studies in Environment and Development, ISEC Campus, Nagarabhavi, Bangalore 560 072, India. The full report is available at www.sandeeonline.org

Baragi itself is a large hamlet, home to 392 households drawn from various castes and landholding categories. The extent of irrigated land around the village is significant. It comprises about 15% of the cultivated area; this land includes a tank 'command area' of 54.7 ha (135 acres) and a well irrigated area of 19 ha (47 acres). The productivity of irrigated lands is several times higher than that of rain-fed areas. This means that the tank irrigation system is of direct concern to a significant fraction of households in Baragi village (144 out of 392). It is also of indirect concerns to many of the landless people who work on these household's farms.

TANK IRRIGATION AND INFORMATION

The catchment area under study is drained by the Baragi stream which flows through Baragi village. Agriculture is the main occupation in the area, and the local farmers rely heavily on water from a large irrigation tank that is filled by the stream. This tank was constructed in the 19th century and then renovated and expanded to its present size in 1982. The important irrigated crops in the area include paddy and sugarcane. The main dry crops are jowar, ragi, cotton and marigold.

The farmers in Baragi make their key agricultural decisions based on the amount of water in the irrigation tank. Farmers have to decide by the end of June whether there is enough water in the tank to irrigate a four-month paddy crop during the kharif (June-Nov) season. If not, they opt to cultivate jowar (a non-irrigated crop). Similarly, if the tank is adequately filled by early

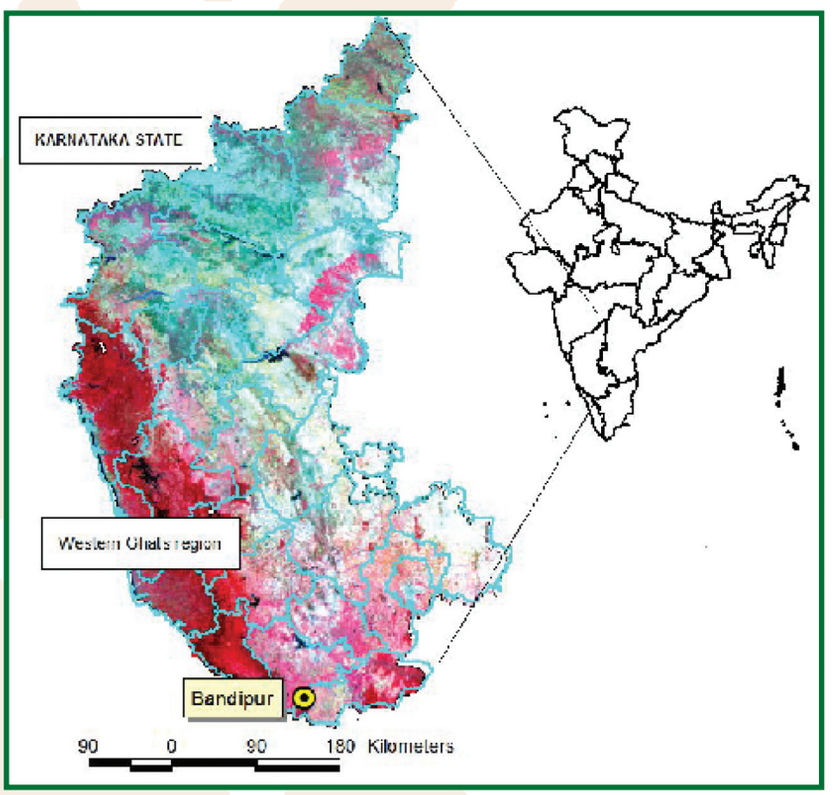

Figure 1: Location of Karnataka State (with district boundaries), Western Ghats region and Bandipur study site

December, the farmers opt for a six-month summer (Dec-June) paddy crop; otherwise they leave their land largely fallow. A total of 144 farmers own land in the area irrigated by the tank.

Two main types of information were gathered for the study. Basic socio-economic data was collected on household demographics, education, occupation, and landholdings. Data was also collected on agricultural labour, inputs, costs and production statistics. Much of this information was collected using the 'diary' method (in which farmers maintained daily notes on farming activities and inputs) and through weekly verification by field researchers. Harvest data was collected through direct observations in the field and from discussions with farmers. Data was collected during two growing seasons and about 25% of the farmers who use water from the irrigation tank took part in the survey.

WATER, EMPLOYMENT AND INCOME

The researchers first assess the impact of irrigation on income and employment. They find that if water is available for irrigation during the kharif season (i.e. if the tank fills up in June) then a farmer is able to earn an average Rs. 2,400 more than he would when water is not available and he has to grow 'dry crops'. This translates into an overall increase in net income for farmers of Rs.345,800. The researchers also find that the availability of water during this season provides an increase in the

amount of money earned by agricultural labourers. This increase amounts to about Rs.164,100 and is shared by landless labourers and small landholders who do not own irrigated land.

In the summer season, the researchers find that the availability of irrigation water provides an increase of Rs.10,500 in net income per farmer. It also more than doubles the amount of money earned by labourers and reduces the need for them to migrate out of the region in search for work.

The researchers then assess the impact of forest cover on the watershed and, in particular, on the amount of water available for irrigation. To do this they first work out how much water is flowing out of the catchment into the tank. This is then compared to the amount of rainfall the catchment receives. This analysis gives a figure of 18% for the runoff coefficient of the catchment (this is a measure of the relationship between runoff and rainfall). The next step is to compare this result with the run-off coefficient for a fully forested catchment inside the nearby Bandipur National Park. This is known to be around 12%. In practical terms, this means that there is more water available for tank storage in Baragi, where the degraded forests use up less of the water.

FOREST COVER BAD FOR FARMERS

The comparison between the run-offs from the two areas shows that the full regeneration of the forest in the Baragi tank catchment would lead to a 6% decline in the runoff coefficient of the area. The practical result of such a change would be that more rainfall would be required to fill the villagers' irrigation tank. It would also mean that the average time period between rainfalls sufficient to fill the tank would increase. The researchers calculate that, if the runoff coefficient for the catchment declined to 12%, this period would increase from approximately two years to approximately six years. Any further reduction, even by one or two percentage points, would result in a sharp increase of this time period up to ten years. The current probability that the tank fills in June is 20%, the researchers find that this probability would decline to about 7% if the catchment forest was allowed to regenerate.

Because the regeneration of the forest would reduce the runoff coefficient of the Baragi catchment and would reduce the probability of the irrigation tank filling, it would therefore reduce the probability of farmers being able to cultivate an irrigated paddy crop in either season. As the researchers show, less frequent paddy crop cultivation results in significant reductions in net income and wage employment. It therefore appears that the regeneration of the forest in the Baragi catchment would have a significant negative impact on the farmers who use water from the irrigation tank. The researchers calculate that it would result in a 49% decline in the average net incomes of these farmers and a 33% decline in the average wage for people who work on affected farms.

A COMPLEX PICTURE

Although it is clear that in the Baragi catchment forest regeneration will have negative economic impacts, this is obviously not the case for all forest areas. The outcome of the Baragi study reflects the particular way in which streams in the area are impounded and used by the local community and by the ways in which crop cultivation decisions are made. The kind of agriculture carried out in Baragi depends on a quick runoff

SANDEE

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Author

Sharachchandra Lele et.al

Editor

Rufus Bellamy

Series Editor

Priya Shyamsundar

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Possible Impacts of Catchment Forest Regeneration on the Baragi Agricultural Economy

Scenario	Season	Probability of tank filling	Expected value of net income	Expected value of employment generated
Degraded forest in catchment (Current)	Kharif	20%	459,761	150,087
	Rabi/summer	57%	815,229	80,074
	Total for year		1,274,990	230,161
Regenerated catchment forest (Simulated)	Kharif	7%	403,093	128,929
	Rabi/summer	18%	257,441	25,287
	Total for year		660,534	154,216
DIFFERENCE in expected values	Change in total annual income/ employment		-614,456	-75,945
	Change in annual income / employment per farmer in command		-4,267	-527
	% change in annual income / employment		-48%	-33%

Note: In US$, the change in expected value of total annual income in the command is ~$15,360, while that in income per farmer is $107. But these absolute values are less important than the relative values of the change.

from the tank catchment area. Forest cover therefore affects it much more significantly than it would other agricultural systems that do not rely on such irrigation systems. The researchers also highlight the fact that forest regeneration will have other positive impacts that are not taken into account in their study. These benefits might include better access to forest products or the stabilisation of groundwater supplies.

The researchers underline the specific nature of their findings and emphasise that forest regeneration does not negatively affect all communities living in forested catchment areas. However, they highlight the fact that their study shows the importance of understanding the complicated link between forest cover, water supply and agriculture - a link that is technological and social in nature. In other words, they recommend that policy-makers must move away from simplistic notions of forests being good for everything and everybody in all circumstances.