Save shola forests to combat climate change

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The native ecosystem of shola forests and grasslands in the Western Ghats, which is known as the water tower of peninsular India, keeps the streams and rivers healthy

Typical landscape of the Nilgiris upper plateau with native shola forests and grasslands that have been overgrown in patches with wattle plantations (Photo by Prashanth G.)

The health of the forests of the Western Ghats determines to a large extent the perennial flow in the streams and rivers originating from the mountains, according to a

new study

. Forests help improve both the base flow and dry season flow in streams and rivers. This in turn strengthens the climate resilience for the people living in the hills and also downstream in peninsular India. In a report submitted to the Ministry of Earth Sciences (MoES), a group of research organisations has confirmed that if the Western Ghats have to continue to be the water tower of peninsular India, the native forests have to be conserved. Till now this linkage had only been reported anecdotally. The Ashoka Trust for Research in Ecology and the Environment (ATREE), the Foundation for Ecological Research, Advocacy and Learning (FERAL), and the National Centre for Biological Sciences (NCBS) conducted the studies. The detailed hydrological studies carried out in two locations in the Western Ghats — Upper Bhavani in the Nilgiris in Tamil Nadu and Aghnashini Basin near Sirsi in Uttara Kannada district of Karnataka — have proved that natural forests have the ability to strengthen infiltration and flow into streams and rivers, Jagdish Krishnaswamy, senior fellow at ATREE and principal investigator for the study, told

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. This is both during normal periods and extreme rain events (EREs), which can become more frequent with climate change. Upper Bhavani is located at more than 2,200 m altitude on the upper plateau of the Nilgiris, and is the upper catchment for Bhavani river, which joins the Kaveri and flows into the Bay of Bengal. A combination of shola forests and grasslands are the natural vegetation in Upper Bhavani. Substantial portion of the grasslands, however, have been planted over with wattle plantations in recent decades. The Aghanashini basin near Sirsi is at 600 m altitude and has natural evergreen and moist deciduous forests, which are now being eaten into by areca plantations, grasslands and paddy fields. The region is the upper catchment of the Aghanashini river, which flows into the Arabian Sea. “Our study refutes the earlier scientific understanding that growing forests will reduce the flow in the streams due to higher evapo-transpiration,” said Krishnaswamy. “Our study has shown that natural forests increase both the base flow and the dry season flow downstream. That means even if local flow is not seen in forest streams, there is increased flow downstream in the river. This proves that forests strengthen infiltration.” The studies were done at Saimane and

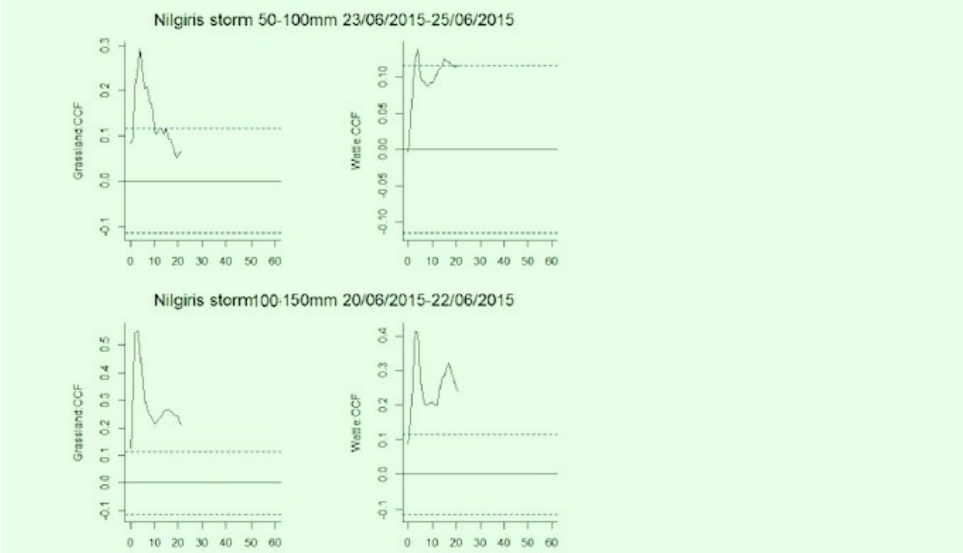


Figure 4-11: Higher cross-correlation in grassland relative to wattle suggests higher proportion of water from the rainstorm being delivered to the stream by grasslands. The secondary peak in wattle is more pronounced but in both catchments, the initial peak at ~5 hours or less is most likely rapid sub-surface flow but there is indication of deeper ground water contributing to stream flow at ~10-20 hours after the rainstorm.

Hosagadde.

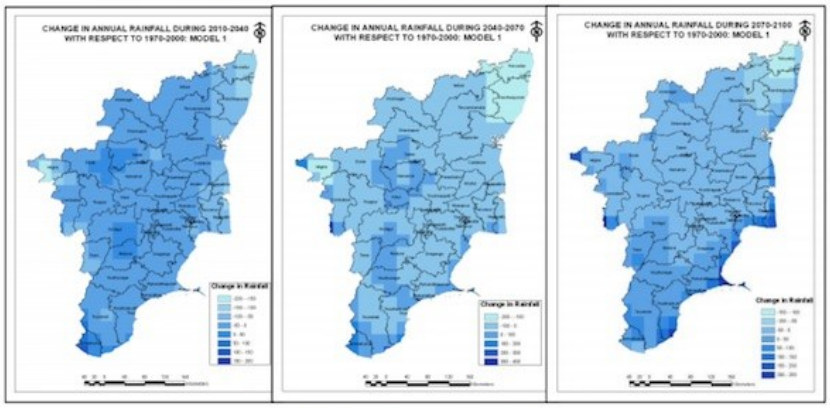
The flow dynamics of grasslands vis-à-vis wattle plantations in the Nilgiris (Source: Technical report submitted to MoES)

However, the infiltration pattern changes when other vegetation replaces the native forests. When the flow dynamics from grasslands was compared with wattle plantations, it was seen that grasslands contribute to better infiltration and a gentler water flow into the stream. This is true both for normal rains and EREs. *Shola-grassland ecosystem* In the shola-grassland ecosystem in the upper reaches of the Western Ghats, the sholas have already been proved to have a high infiltration and slow release of water into the streams. The grasslands have a higher run-off, but their flow dynamics is better than the streams starting from wattle plantations. Since the 1950s, the Tamil Nadu Forest Department has been planting wattle trees on native grasslands to produce pulpwood for industries. In recent years, the department has been toying with the idea of removing wattle plantations because of their adverse impact on water flow. For Tamil Nadu, conserving the native vegetation of the Western Ghats is of importance since the only two rivers that flow perennially — the Kaveri and the Thamirabarani — originate from this mountain range. The stream flow is also of importance for the communities living in the Nilgiris, for even during the worst dry period of summer 2017, which came after the failed monsoons of 2016,

there was water trickling out of shola-grassland streams

. In the Aghanashini basin, the results were similar, with forested tracts having better water flow dynamics than areas disturbed by plantations and other vegetation. *Moisture storage* “The less disturbed upper catchments in the Western Ghats have very high moisture storage capacity with rapid sub-surface flow mechanisms dominating storm response,” notes the study. “Soils under less disturbed ecosystems generally have high infiltration capacities in relation to observed rainfall intensities. A few of the more disturbed or degraded sites and plantations are vulnerable to infiltration-excess over-land flow. This could make them more prone to changes in hydrologic pathways in the future under higher rain intensities under climate change.”

Figure 4.6: Change in annual rainfall (mm) projections for 2010-2040, 2040-2070 and 2070-2100 with reference to baseline (1970-2000) *



*(Source:CCCAR, Anna university)

Projections on rainfall pattern change in Tamil Nadu till 2100. The Nilgiris are set to receive higher annual average rainfall in the coming decades (Source: TNSAPCC)

Since climate change is expected to make EREs more frequent, Krishnaswamy has been partnering with scientists from different institutions to study how non-urban watersheds will respond to intense, sharp rainfall. “There is clear evidence that changing rainfall intensity patterns are changing the hydrology of catchments,” he told

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. “Even those areas which are not currently flood prone can get flooded as EREs become frequent.” In a **paper** published in **Environmental Modelling and Software** journal, the team notes that as the intensity increases, the ability of watersheds to hold water sub-surface decreases. “Projected increases in rainstorm

intensity would then result in a greater likelihood of river floods in subsurface-dominated watersheds than is currently simulated by systems models omitting this additional nonlinearity." This means that at a policy level there is a need to revisit flood maps of the country and specific locations, to factor in EREs as they become more frequent in the future. The Tamil Nadu State Action Plan on Climate Change (TNSAPCC), for instance, predicts that the state could have climate-related events of higher intensity in the coming years. Quoting studies carried out by the Centre for Climate Change and Adaptation Research (CCCAR) of Anna University, the TNSAPCC states that the average annual maximum temperature for Tamil Nadu could increase by 3.1°C by 2100 from the baseline of 1970-2000. Similarly, the average annual minimum temperature could increase by 3.5°C. Rainfall change Average annual rainfall, on the other hand, could reduce by up to 9%. The rainfall pattern could shift more towards northeast monsoon, which could bring more intense cyclones and floods. Even within the decreasing trend in annual average rainfall, the high altitude agro-climatic zone of the Western Ghats and the Eastern Ghats, and the high rainfall agro-climatic zone near the tip of the peninsula could have an increase in rainfall from 10% to 25%. This means that if the natural forests of the Western Ghats are not conserved, then with increasing rains and more frequent EREs there would be increased flooding in the streams and rivers originating from the mountain chain. With floods most water would flow out without infiltration. This, in turn can weaken the perennial nature of the streams, thereby weakening the climate resilience of both the hills and peninsular India. The Western Ghats may no longer be the water tower for the peninsula. First published by

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