

Farms, fields threaten frogs in lateritic plateaus



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- A new study examines how converting lateritic plateaus into paddy fields and orchards impact amphibians.
- The findings show that changes in land use impact frogs by altering their microhabitats, affecting both individual and groups of species.

Researcher highlight the importance of conserving these historically significant lateritic plateaus as they

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A study finds that rapid changes in land use, particularly agriculture, significantly impact amphibian diversity found in the lateritic plateaus of Maharashtra's northern Western Ghats due to changes in microhabitats. The study investigates how expansion of agriculture and agroforestry plantations impact amphibian diversity and abundance across natural plateaus, paddy fields, and mango and cashew orchards in the Ratnagiri region of the state.

Low-elevation lateritic plateaus in the northern Western Ghats are rock outcrop ecosystems that support endemic biodiversity. As most of these plateaus are outside protected areas and are classified as wastelands, they are increasingly being lost to human activities, especially agriculture.

The team of researchers from the Nature Conservation Foundation and the Bombay Environmental Action Group led by Jithin Vijayan found that amphibian diversity was lowest in paddy fields, while abundance was lowest in orchards, compared to the relatively undisturbed plateaus.



The lateritic plateaus of Ratnagiri are being rapidly converted to cashew and mango orchards, significantly impacting biodiversity. Image by Jithin Vijayan.

“We examined how changes in habitat or microhabitat affect amphibians, primarily frogs,” Vijayan informs Mongabay India. “We found that both mango and cashew orchards, as well as paddy fields, impact amphibians, but in very different ways. This study also underscores the need for land-use impact assessments at both the community and species levels.”

The research used community-level metrics (such as species richness and composition) alongside species-level analyses to understand the differential impacts of land use. Vijayan explains that focusing only on community-level responses, such as those of reptiles, would have obscured how individual species are affected differently.

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Community, species impact

The results showed that there was a difference in impact depending on whether land was converted to paddy fields or to orchards. Converting land to paddy fields had greater effect on the individual species as well as the community (group of amphibian species in one habitat). This impact showed up in ways including a reduced occurrence of certain species and lower species richness, which means few number of different species in the community or area. In contrast, converting land to orchards primarily had individual species-level impacts, notably reduced occurrence of certain species. This highlights how different forms of agriculture have varying effects on amphibian populations, the study notes.

The study found that at the community level, paddy had a lower mix of common and dominant species compared to plateaus and orchards. This is indicative of biotic homogenisation — the process by which the genetic, taxonomic, or functional similarities of species communities increase over time — as a likely consequence of habitat homogenisation in the form of monocropping. On the other hand, orchards and plateaus exhibited similar species richness, suggesting less disruption at the community level.

The study also highlighted the impact of land-use changes on specific, endemic species, such as the CEFP burrowing frog (*Minervarya cepfi*) and the Goan Fejervarya (*Minervarya gomantaki*), which were less abundant in modified habitats. This underscores the detrimental effects of agroforestry practices on vulnerable amphibian species. In contrast, *Minervarya syhadrensis*, a species commonly found across South Asia, was more prevalent in paddy fields, suggesting shifts in community composition due to habitat changes. The findings suggest that land-use changes may benefit certain species while negatively affecting others. Specialist species, often threatened or endemic, tend to be replaced by more generalist species, a trend that raises concerns, the researchers note.

Open ecosystems and species richness

Rohit Naniwadekar, one of the authors of the study, views the research as an indicator of the rich biodiversity harboured by open ecosystems like the lateritic plateaus. "The government recognises most of these open ecosystems as wastelands," Naniwadekar says. "But these are geologically unique regions, nearly 60 million years old, where molten lava has solidified to form the plateau. They are found only in the northern Western Ghats."

He explains that this region is exposed to extreme weather and lacks formal protection. "Despite these challenges, the unique microhabitats on these plateaus enable biodiversity to thrive." Naniwadekar adds that efforts are underway to designate the plateaus as biocultural heritage sites, partly due to the presence of petroglyphs in the area.



A rockpool on the plateau. Rockpools act as breeding grounds for frogs during monsoon. Image by Jithin Vijayan.

K.P. Dinesh, a scientist at the Zoological Survey of India who has extensively studied amphibian diversity, lauds the study for emphasising the importance of lateritic plateaus as dynamic biodiversity hotspots. "Lateritic plateaus are not wastelands," Dinesh explains. "During the monsoon, these regions retain 80 to 100 days of moisture, which frogs utilise to complete their breeding cycles." While paddy fields also retain water, he points out, they do not offer the same conditions. "There is significant human intervention in altered landscapes, such as pesticide use and excess retained water, which do not support biodiversity," he adds. Dinesh, who was not involved in the study, believes that long-term studies like this can help shift the perception of authorities, moving away from viewing lateritic plateaus as wastelands and instead encouraging their conservation or sustainable management in agroforestry practices.

Historically, some parts of the plateau were converted into paddy fields. However, the study highlights the growing trend of blasting and transforming the landscape into mango and cashew orchards. These drastic land-use changes threaten critical amphibian habitats, such as rock pools that shelter frog tadpoles and eggs during monsoon dry spells.

Plateaus vs agriculture

The plateaus naturally feature depressions that hold water, providing vital refuges for amphibians. In contrast, paddy fields fill the plateau's natural depressions with water, which is detrimental to amphibian diversity, the study notes. Similarly, for fruit orchards, especially for the prized Alfonso mangoes, plateaus are blasted, and rocks removed to leaven the surface. All these contribute to the loss of microhabitats for a unique amphibian population, according to Naniwadekar.



Despite the harsh weather and the absence of thick vegetation, lateritic plateaus of Ratnagiri are biodiversity hotspots that need to be conserved. Image by Jithin Vijayan.

The paper notes that paddy cultivation on the plateaus has decreased, giving way to a significant expansion of orchards. "More than 150,000 hectares of land in the region have been converted into mango orchards, a considerable portion of which is on the lateritic plateaus," the study reports.

Given these findings and the ongoing expansion of orchards, the researchers recommend making orchards more amphibian-friendly by retaining existing water bodies or creating new water sources within already modified orchards. "Orchards should retain more water bodies," says Vijayan. "This needs to be done in partnership with landowners, since the land is privately owned. There should also be efforts to sensitise and incentivise people willing to make such modifications to their orchards." Vijayan emphasises that the study underscores the importance of understanding the differential impacts of various land-use changes on biodiversity, to develop more effective management strategies.

Banner image: A new study from the lateritic plateaus of Ratnagiri in Maharashtra finds that frog species are significantly impacted by land conversion to paddy fields and orchards. Image of *Hydrophylax bahuvistara* by Jithin Vijayan.

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