

A package of policies can help smallholder farmers adapt to a changing climate

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Burial chamber of Sennedjem, Scene: Plowing farmer. Credit: Wikipedia.

In the grasslands of Nepal's Chitwan Valley, local farmers rely on the production of rice and other grains to generate household income. But their livelihoods are under threat, as Nepal is experiencing the effects of climate change at a much faster rate than the global average.

As these effects worsen, it is unclear what smallholder farmers in Nepal and other South Asian countries will do. They may choose to migrate or,

due to a lack of resources, may be forced to live in seemingly inhospitable regions.

The researchers from Princeton and IIASA investigated how different climate scenarios and policy interventions could impact these smallholder farmers, or farmers who maintain less than five acres of land. Today, over 500 million households fall into this category.

They found that without any policy interventions, [crop yields](#) will suffer and farmers will lose about a quarter of their incomes on average by 2050 due to the effects of climate change. This is likely to prevent some farming households from being able to engage in labor migration, which is a crucial economic tool for many households in the region. Ultimately, these impacts will cause more households to fall into poverty and increase [economic inequality](#).

Policy interventions such as providing farmers with financial tools like [cash transfers](#) and access to insurance would help them withstand the effects of climate change, giving them the ability to migrate or produce more cash crops. In turn, this could improve community income and reduce inequality, the researchers argue in the latest issue of *Nature Climate Change*.

"People often talk about migration like it's a bad thing, but it actually depends on what kind of migration you're talking about," said lead author Nicolas Choquette-Levy, a graduate student in the Princeton School of Public and International Affairs. "If it's after a disaster, then that's an incredibly tough situation to overcome, but in a lot of cases, like Nepal, it's common for households to send a family member to work in a different city or country as a way to diversify their sources of income. Doing so means households can still meet their basic needs without being completely reliant on farming crops that are vulnerable to droughts, high temperatures, and other climate effects. In fact, over a quarter of the

entire country's gross domestic product comes from migration remittances, or money that is sent back to the country from Nepalis who have migrated abroad."

Many studies examine the interplay between climate change and migration, though the novelty with this study is in the approach, Choquette-Levy said. He and his coauthors employed an agent-based model that can simulate how individual decision making and interactions between households, such as sharing information on economic opportunities, would be affected by different policies and environmental conditions. The model allowed the researchers to look at multiple livelihood outcomes, policy approaches, and climatic effects relevant to smallholder farms in South Asia.

"The goal was to assess the gaps in previous methodology by answering three questions: How will climate change impact [smallholder farmers](#)? What decisions will they make because of this? And how might policy interventions change this?" Choquette-Levy said.

Choquette-Levy conducted the study with Matthias Wildemeersch of the IIASA Exploratory Modeling of Human-Natural Systems Research Group, as well as Princeton coauthors Michael Oppenheimer, the Albert G. Milbank Professor of Geosciences and International Affairs and the High Meadows Environmental Institute, and Simon Levin, the James S. McDonnell Distinguished University Professor in Ecology and Evolutionary Biology.

The research team chose South Asia because it is particularly threatened by climate change, meaning that farmers and policymakers will need to make challenging decisions in the coming decades. The team used real-world social, economic, and climate data from Nepal's Chitwan Valley to develop a case study and compared their results with recent trends in farmers' livelihood decisions in the region to test its validity.

Under a scenario of a global temperature increase to 1.5°C above preindustrial levels by 2050, the research team found that South Asian farmers will see a 28% drop in [household income](#) compared to a stable climate. The reductions will largely be the result of increased droughts and lost crops. Climatic stress will also limit farmers' ability to travel for work, preventing them from generating more income. In turn, there will likely be increased inequality overall.

When adding policy interventions to the model, the picture becomes a little less gloomy. Cash transfers to farmers, even in small amounts, can improve household incomes and reduce inequality, the researchers found. They may, however, not be enough for some households to prosper, especially if migration or growing cash crops seems too risky.

Two other options include index insurance—which pays out benefits for a loss of investments—and remittance banks, which smooth out the uncertainty in migrant incomes by pooling together the remittances that they send back to the farming community. Both could motivate farmers to diversify their livelihoods but may not entirely solve the problem.

According to the researchers, a package of all these policies might be the best way to increase community income and reduce inequality beyond the ability of any single policy approach by itself.

"Such a package would combine the strengths of a cash transfer, which eases the financial constraints that climate change will impose on farmers, with those of insurance and a remittance bank, which reduce the risk to farmers of trying alternative livelihoods to balance their incomes. If implemented together, these policies would give farmers the most options in determining how to respond to climate change," Wildemeersch said.

"It's time to start paying attention to this before it's too late,"

Oppenheimer said. "There is too much at stake for smallholder [farmers](#) in South Asia and elsewhere. If we act now with progressive, robust [policy interventions](#), these communities can improve their livelihoods as the world continues to be challenged by climate adaptation."

While the model focused on South Asia, it could be employed by other researchers and policymakers to investigate other regions, different crop choices, and other patterns of migration under various climate scenarios.

More information: Nicolas Choquette-Levy et al, Risk transfer policies and climate-induced immobility among smallholder farmers, *Nature Climate Change* (2021). [DOI: 10.1038/s41558-021-01205-4](https://doi.org/10.1038/s41558-021-01205-4)

Roman Hoffmann, Risk transfers support adaptation, *Nature Climate Change* (2021). [DOI: 10.1038/s41558-021-01231-2](https://doi.org/10.1038/s41558-021-01231-2)

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