



LETTERS

India's state of Bihar suffers from floods that will likely become more frequent with climate change.

Edited by Jennifer Sills

India needs an effective flood policy

Several Indian states are currently suffering from devastating floods that have killed hundreds and rendered millions homeless (1, 2). Flooding in the state of Bihar has been a chronic problem for decades (3), but few concrete steps have been taken to effectively manage these deluges. For the past 50 years, the government policy in the Kosi River Basin—a river known for flooding—has been to build new embankments and reinforce old ones (4) without properly taking environmental and geomorphic factors into consideration. Himalayan rivers carry a tremendous amount of sediments, and the embankments severely constrict the river flow, resulting in massive siltation in the channel beds, which at some locations are now higher than the adjacent floodplains (5). The geomorphic transformation due to embankments has made flooding worse (4).

Climate change will result in even more destructive floods in the future (6). The Bihar government acknowledged this trend in their disaster management plan for 2015 to 2030 (7) yet has taken no concrete science-based steps to address the growing threat. This year, for example, the government blamed Nepal for the devastating floods (8), and the official mitigation policy remained centered on embankments (9).

It is imperative that the government adopt strategies grounded in robust science to minimize future flood damage. For example, reconnecting parts of the river to its historical floodplain could mitigate harm from flooding. Where substantial riverbed aggradation has occurred, silt should be removed from the channel to ensure that it is below the floodplain. Where appropriate, embankments should be removed or lowered to distribute flood water over a larger area. Remaining embankments should be set farther back from the river to provide additional areas to accommodate flooding as well as areas where water can be safely diverted from the main channel and into the former floodplain. This “room for the river” approach has been successful elsewhere (10). The project should be developed in collaboration with all relevant stakeholders, including those across state and international borders, and it should be designed to account for relevant risk factors such as the probability of high-magnitude floods and the future changes in precipitation, streamflow, population, land cover, and flood frequency and magnitude.

The recurring floods in Bihar in the past decades have been devastating. Bihar has lost 3% of its gross state domestic product due to flooding (11) and is among the poorest Indian states (12). India's most vulnerable people will suffer even more due to climate change if sustainable long-term strategies are not adopted with urgency. Implementing such a project would be challenging and expensive; an effective plan is likely to have

substantial monetary costs and may require relocating large numbers of people away from floodplains. However, the benefits of such a project have been shown to outweigh the costs and challenges (10).

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REFERENCES AND NOTES

1. “Monsoons slam South Asia, displacing millions in Bangladesh and India,” *The New York Times* (2020).
2. “Bihar: Destroyed lives and submerged homes in flood-hit India,” *BBC News* (2020).
3. J. A. Rorabacher, *Econ. Polit. Wkly.* **43**, 45 (2008).
4. R. Sinha, G. V. Bapalu, L. K. Singh, B. Rath, *J. Indian Soc. Remote Sens.* **36**, 335 (2008).
5. R. Sinha *et al.*, *J. Hydrol.* **570**, 156 (2019).
6. H. Ali, P. Modi, V. Mishra, *Weather Clim. Extrem.* **25**, 100212 (2019).
7. Government of Bihar, “Roadmap for disaster risk reduction 2015–2030” (2015); <http://disastermgmt.bih.nic.in/BCDRR20152030.htm> [in Hindi].
8. “Bihar Floods: Parliamentary Standing Committee questions Bihar Government over floods, but officials blame Nepal: Sources,” *NDTV* (2020).
9. Government of Bihar, Water Resources Department (2015); www.fmiscwrdbihar.gov.in:8090/Plan_New_Flood_ProWrk.aspx.
10. S. L. Postel, *Replenish: The Virtuous Cycle of Water and Prosperity* (Island Press, 2017).
11. Y. Parida, S. Saini, J. R. Chowdhury, Economic growth in the aftermath of floods in Indian states. *Environ. Dev. Sustain.*, **10.1007/s10668-020-00595-3** (2020).
12. Government of India, National Institution for Transforming India. SDG India Index and Dashboard, iTech Mission (2019); <https://sdgindiaindex.niti.gov.in/#/ranking> (click the second tab at the top: “No Poverty”).

10.1126/science.abe2962

Traditional Knowledge underlies One Health

The degradation of natural environments is a major driver of disease spread from animals to humans (1). The One Health strategy, which links human, animal, and environmental health, has been central to discussions about recovering from the coronavirus disease 2019 (COVID-19) pandemic and preventing the spread of the next zoonotic disease (2). However, scientists and policy-makers often overlook evidence that the One Health paradigm is already embedded in Indigenous values, worldviews, and laws (3). To maximize the effectiveness of the One Health approach, Indigenous principles and inputs should inform both the way it is taught in emerging One Health academic programs and university courses and its application (4) from the Arctic (5) to the tropics.

Traditional Knowledge held by Indigenous Peoples is not only a knowledge system; it is also a process (6) by which resilience to past environmental change and previous disease outbreaks was achieved. Traditional Knowledge holders are intimately familiar with environmental histories and with ways of living respectfully and reciprocally with the land (7). With this knowledge and these processes, they can guide adaptation strategies and ecological restoration plans to achieve sustainability, aided by Western science (8).

The vital role of Indigenous Peoples' lands and the success of Indigenous environmental stewardship in sustaining thriving habitats and biodiversity are well documented (9). The numbers of bird, mammal, reptile, and amphibian species on lands that are managed or co-managed by Indigenous Peoples are equal to or higher than the numbers of species on protected lands (10). Investment in Indigenous Protected and Conserved Areas (11, 12), Indigenous guardian programs, and land-based education are essential to a One Health agenda.

As we mobilize knowledge for recovery and reimagine the ways in which we live and consume in the wake of COVID-19—and amid the ongoing climate and biodiversity emergencies—partnering with holders of Traditional Knowledge can help drive systemic change by transforming our relationships with the Earth and with each other.

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REFERENCES AND NOTES

1. Secretariat of the Convention on Biological Diversity, "Global Biodiversity Outlook 5" (2020); <http://cbd.int/gbo/gbo5/publication/gbo-5-en.pdf>.
2. J. H. Amuasi *et al.*, *Lancet* **395**, 1543 (2020).
3. K. Hueffer, M. Ehrlander, K. Etz, A. Reynolds, *Int. J. Circumpolar Health* **78**, 1607502 (2019).
4. S. Montesanti, W. E. Thurston, in *Case Studies in One Health: Solving Complex Problems in a Changing World*, S. Cork *et al.*, Eds. (5m Publishing, 2015), chap. 28.
5. Sustainable Development Working Group (SDWG) and Arctic Council, "One Health: Operationalizing One Health in the Arctic: Achievements report" (2017); https://oarchive.arctic-council.org/bitstream/handle/11374/1956/One-Health-Report-for-May-2017_final-SAO-edit.pdf.
6. F. Berkes, *J. R. Soc. New Zealand* **39**, 151 (2009).
7. R. W. Kimmerer, in *Traditional Ecological Knowledge*, M. K. Nelson, D. Shilling, Eds. (Cambridge University Press, 2018), chap. 3.
8. F. Mazzocchi, *Anthropocene Rev.* **7**, 77 (2020).
9. C. J. O'Bryan *et al.*, *Conserv. Biol.* doi.org/10.1111/cobi.13620 (2020).
10. R. Shuster *et al.*, *Environ. Sci. Pol.* **101**, 1 (2019).
11. Indigenous Circle of Experts, "We rise together: Achieving pathway to Canada Target 1 through the creation of Indigenous Protected and Conserved Areas in the spirit and practice of reconciliation" (2018); https://static1.squarespace.com/static/57e007452e69cf9a7af0a033/t/5ab94aca6d2a7338ecb1d05e/1522092766605/PA234-ICE_Report_2018_Mar_22_web.pdf.
12. T. T. Tran *et al.*, *Biol. Conserv.* **241**, 108271 (2020).

COMPETING INTERESTS

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10.1126/science.abe2401

Swiss law would weaken wildlife protection

In September 2019, the Swiss parliament approved a change to the law on hunting and protection of wild mammals and birds (1). The modified law is likely to substantially harm already threatened species. In response, concerned citizens collected signatures to trigger a referendum vote. On 27 September, the people of Switzerland will decide whether the country will enact this law (2).

The proposed change to the law introduces a new category of species called "protected but hunted," which includes the wolf (*Canis lupus*) and the ibex (*Capra ibex*). The new rules would allow people to cull the wolf population, the latest minimum count of which is 70 (3), during 5 months of the year. The hunting season of the ibex would be extended from 3 to 4 months.

Checks and balances in wildlife conservation would be methodically weakened by the change. The list of "protected but

hunted" species will be open to changes by executive decrees of the Federal Council, without requiring parliamentary approval. Nature protection organizations will have fewer opportunities to litigate against decisions to hunt. The modification would further reduce federal power over hunting by delegating decisions to kill "protected but hunted" species to the cantonal states.

The law would also disregard science and conservation efforts by introducing justifications for hunting "protected but hunted" species that are based on non-hazard criteria. Hunting of species in that category would be allowed for unspecified hunting reasons, to keep populations at an arbitrarily suitable level, to prevent damages to livestock and infrastructure before any damage has occurred, and because the animals attract the attention of people. The hunting of "protected but hunted" species would be allowed even in strictly protected game reserves.

These legal changes were proposed despite the United Nations' call for a focused effort on biodiversity goals in 2020 (4). They are an affront to the principle of non-regression of environmental laws (5). Switzerland, one of the world's wealthiest countries, should oppose narrow sectorial interests and work to preserve and restore biodiversity.

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REFERENCES AND NOTES

1. Confédération Suisse, "Loi fédérale sur la chasse et la protection des mammifères et oiseaux sauvages: Modification du 27 septembre 2019" (2020); www.admin.ch/opc/fr/federal-gazette/2019/6267.pdf [in French].
2. Le Conseil Fédéral, "Modification de la loi sur la chasse" (2020); <https://www.admin.ch/gov/fr/accueil/documentation/votations/20200927/modification-de-la-loi-sur-la-chasse.html> [in French].
3. K. Vogt *et al.*, "Vingt-cinq ans de présence du loup en Suisse: Bilan intermédiaire" (KORA Bericht Nr. 91f, 2020); www.kora.ch/fileadmin/file_sharing/5_Bibliothek/52_KORA_Publikationen/520_KORA_Berichte/KORA_Bericht_91_F_25_ans_du_loup_en_Suisse.pdf [in French].
4. I. Andersen, "2020 resolutions for nature" (United Nations Environment Programme, 2020); www.unenvironment.org/news-and-stories/video/2020-resolutions-nature.
5. M. Prieur, in *Elgar Encyclopedia of Environmental Law*, M. Faure, Ed. (Edward Elgar Publishing Limited, 2018), pp. 251–259.

COMPETING INTERESTS

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10.1126/science.abe6191

Traditional Knowledge underlies One Health

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Science **369** (6511), 1576.
DOI: 10.1126/science.abe2401

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