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Cooperate to save a changing planet

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A lack of regional and international collective action is the greatest barrier to achieving global environmental sustainability. Game theoretic experiments suggest that introducing shared goals could offer a path forward.

Can we prevent climate change from devastating communities and ecosystems worldwide? Can we feed the world without triggering a catastrophic loss of biodiversity? And can we bring about global sustainability without jeopardizing the needs of the vulnerable? On one level, the answer to these key questions is a resounding yes: remarkable progress on these fronts could be achieved with technical solutions that already exist[1]. But implementing these solutions will require meaningful collective action from nations, corporations and individuals, in spite of the short-term costs this will impose. Writing in *Nature Sustainability*, Tu et al.[2] shed light on how such environmental stewardship could be achieved by examining how students play games designed to mimic common-pool resource use.

In an 1833 lecture, British writer William Forster Lloyd noted that individuals have an incentive to overexploit shared resources because each person reaps the entire benefit of what they extract, but the costs resulting from environmental depletion are shared by all[3]. This misalignment of incentives was later formalized mathematically in the context of fisheries[4] and explained by game theory, which showed that choices that are rational for the individual can lead to collectively bad outcomes in strategic interactions[5]. Such issues form the basis of the situation described as a 'tragedy of the commons'[6], which has been used to argue that in the absence of effective top-down governance, overexploitation of common-pool resources is all but assured.

In the Anthropocene, societies face intertwined governance challenges related to common resources that span local and global scales. For example, at the local scale, healthy forests can improve water quality, which supports aquatic ecosystems and enhances local recreation opportunities (Fig. 1). Yet forests can also act as a carbon sink and reduce greenhouse gas concentrations. These gases form a global resource that shapes the climate trajectory of the planet. Despite recent progress in finding climate solutions, a binding global agreement that would stabilize Earth's climate system and avoid the most damaging consequences of climate inaction has not materialized. The narrative of the tragedy of the commons might seem to suggest that the present situation is hopeless.

Decades of scholarship by American economist Elinor Ostrom implies otherwise[7]. Bottom-up systems for managing resources across the globe have shown that collective action can achieve stewardship of shared resources. These findings are buttressed by modelling that has identified mechanisms capable of sustaining cooperation in common-pool resource systems[8]. Much of the work in this area has made the simplifying assumption that people make decisions strictly in their own immediate self-interest.

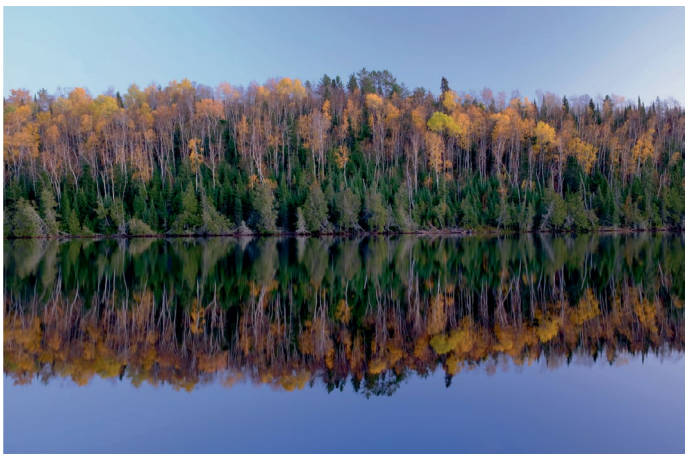

Fig. 1 | Changing seasons in Superior National Forest. Many terrestrial and aquatic ecosystems contain common-pool resources. For example, carbon sequestration in forests can reduce global greenhouse gas levels. Healthy forests also affect local resources — they improve water quality and support fish populations, both of which contribute to local recreation opportunities. Behavioural experiments and theoretical modelling suggest that shared goals can propel cooperative governance of these types of resources.

However, there have been calls to integrate more nuanced and realistic representations of human behaviour into models describing how humans interact with the environment by drawing on behavioural economics and psychology[9]. In such multi-disciplinary studies, combining theory with experiments could help to identify opportunities to scale up cooperation and collective action aimed at achieving sustainability in the global environmental commons[10].

Tu et al. present the results of a game in which players extract resources from a common pool and explore contexts in which these players cooperate to prevent losses that result from resource overexploitation. Their work adds to a growing body of literature on human behaviour in situations where players' strategies impact the environment and alter future pay-offs. These games more closely resemble the reality of society's environmental dilemmas than the games that are usually used to study the drivers of human cooperation.

The authors' experiments were designed such that two groups played the game simultaneously. In some cases, incentives were structured so that each player would receive a pay-off that was proportional to the total amount of resources they extracted. In other cases, 'shared goals' were induced by awarding pay-offs only to players in the group with the highest collective pay-off. This approach rewarded groups with individuals who took actions that increased the long-term pay-offs for all members, even if they were personally costly for the individual.

Shared goals increased cooperation and decreased the likelihood of environmental collapse. In the absence of these goals, resource

collapse and declining pay-offs predominated, resembling a tragedy of the commons. The game theoretical model by Tu et al. showed that outcomes of the two different treatments could be explained by differences in the level of selfishness or selflessness of players over time. This combination of theory and experiment is a key step towards improved understanding of the drivers of sustainable behaviour.

Although the existence of shared goals can align people's incentives towards cooperation in the commons, it remains an open question where such incentive structures are likely to exist or how they might be constructed in real-world environmental systems. Research on the evolution of cooperation has pinpointed mechanisms, including reciprocity, that promote cooperation in static environments, but work remains to be done to identify the unique challenges and opportunities that dynamic environments pose for cooperation.

Technically feasible solutions exist for many of society's most pressing environmental challenges. Yet, year after year, collective action towards global environmental stewardship has fallen short. One of the most crucial advances still to come is an understanding of what it will take to achieve multi-national cooperation to reduce global greenhouse gas emissions. A possible solution, suggested by the analyses of Tu et al., is to design environmental agreements that elicit shared goals among signatories, either directly, through suites of incentives that align national interests, or indirectly, by appealing to the collective aspirations represented by the 2030 Agenda for Sustainable Development (go.nature.com/3bjxh7a). The synthesis of theoretical modelling and behavioural experiments presented by the authors represents an innovative approach to understanding how to stimulate cooperation in a rapidly changing and unpredictable world.

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Competing interests

The author declares no competing interests.