CONSERVATION PRIORITIZATION

Restoration where it pays off

Economic analysis of a large-scale restoration project in the Brazilian Atlantic Forest finds that spatial prioritization efforts could provide an eightfold increase in conservation cost-effectiveness.

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International commitments to restore degraded or deforested land, such as the Bonn Challenge, are driving restoration efforts across the globe[1]. In the scramble to meet these ambitious spatial targets, we might risk making rash decisions, allocating restoration efforts in an opportunistic manner to places where the area goals are most easily met. At the same time, such goals present a uniquely extensive opportunity to apply methods for systematic conservation planning that have been developed over the past few decades[2], and thereby achieve outcomes that are better for conservation and carbon sequestration without compromising local livelihoods. One such endeavour is taking place in the context of the revised Brazilian Native Vegetation Protection Law. Writing in *Nature Ecology & Evolution*, Strassburg et al.[3] report how spatial prioritization could provide an eightfold increase in cost-effectiveness of conservation in the Brazilian Atlantic Forest.

Systematic conservation planning has been a focus of conservation research since the late 1990s, and current spatial optimization tools provide efficient solutions to increasingly complex problems. Systematic conservation planning methods are designed to reveal synergies and tradeoffs among the many competing interests around land use, providing support for decision-making processes[4,5]. State-of-the-art methods can nowadays address almost any problem imaginable, be that protected-area allocation or restoration. The main bottlenecks are located instead in data availability and quality, as well as in transfer of knowledge to practice, although advances are being made on both fronts. Strassburg and colleagues' study succeeds in bringing together high-quality data and top-notch methods, while also engaging stakeholders in the process from step one, greatly increasing the chances of having an impact on implementation of the policy.

The revised Brazilian Native Vegetation Protection Law from 2012 requires farmers to maintain 20% of farm area under native vegetation[6] (Fig. 1). If there isn't enough existing vegetation to fulfil this requirement, farmers must either restore habitats on their own land or offset elsewhere. Strassburg et al. explore the differences between policy scenarios: restoring up to 20% of vegetation on each farm separately versus allowing offsetting where it makes most sense from the perspective of biodiversity conservation and carbon sequestration. The authors collected an impressive dataset covering modelled distributions for 785 endemic species, data on above-ground carbon sequestration potential, restoration costs for projects of varying sizes obtained from non-governmental organizations, and opportunity costs to farmers when arable land is restored and lost from agriculture.

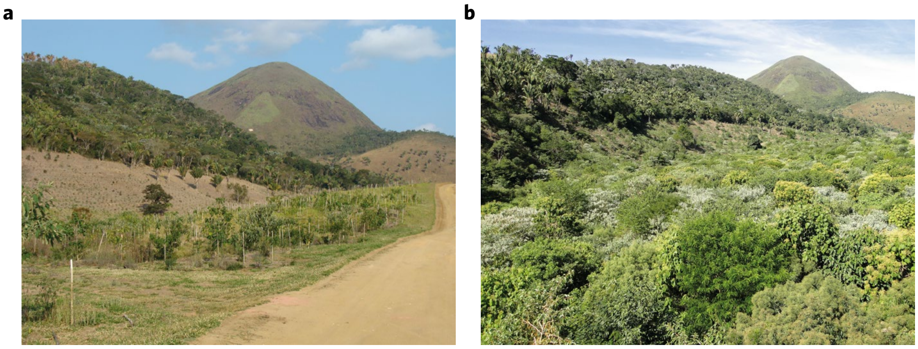

Fig. 1 | Atlantic forest restoration. a,**b**, Photos of a region in the Teresópolis area of Brazil in September 2010 before (**a**) and in July 2012 after (**b**) a restoration project. Credit: André Nave, Bioflora Restoration Technology.

Strassburg et al. then used customized linear-programming software for their optimizations. The analyses cover a total of 362 alternative scenarios with varying emphases on biodiversity, carbon sequestration and costs. The impact of restored area on species extinctions was assessed using the species–area relationship. A further aspect adding to the realism of the analyses is that the authors considered the influence of project size on its cost-effectiveness: larger restoration projects have lower costs per area and higher biomass accumulation due to edge effects.

The results are striking: the two most extreme policy options have an eightfold difference in cost-effectiveness. The suggested compromise solution provides a 257% increase in avoided extinctions, 105% increase in carbon sequestration and 57% decrease in costs as compared with the baseline where conservation is equally distributed among landowners. Accounting for the influence of edge effects on expected extinctions would have probably increased the differences further. This amounts to compelling evidence for the usefulness of optimization tools.

Challenges remain with repeating what was done in other settings, as similar data, expertise and workforce are not always available. There were also factors the model did not account for, such as the perspective of landowners, which can be a delicate issue. When dealing with privately owned land, complications arise from individual attitudes and preferences regarding the policy options, the general perception of the legitimacy of the policy and compliance issues, although landowner attitudes can also be accounted for in the prioritization if such data can be obtained[7]. There would typically also be other benefits from local scale restoration, which the authors discuss but do not account for in the analyses. Examples of these include the provision of ecosystem services on the local scale, which would be compromised if restoration is concentrated to large projects in specific areas. This is, however, not unique to restoration but applies to all conservation, and is ultimately a value judgement rather than a flaw in the analysis.

As time and options for halting the environmental crisis are running out, we cannot afford to make mistakes, and it is especially crucial that current policies are planned and applied by considering the best available knowledge. The use of spatial prioritization tools is a key factor in maximizing the impacts of restoration projects. Strassburg and colleagues' work is valuable because they model specific policy options in collaboration with stakeholders, providing detailed guidance for policy choices and implementation. It can be hoped that their results will find their way into practice, and also help spread the word on the immense potential provided by the existing planning methods, so that other regions and restoration initiatives will follow suit. ❐

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References

1. Verdone, M. & Seidl, A. *Restor. Ecol.* **25**, 903–911 (2017).
2. Margules, C. R. & Pressey, R. L. *Nature* **405**, 243–253 (2000).
3. Strassburg, B. B. N. et al. *Nat. Ecol. Evol.* https://doi.org/10.1038/s41559-018-0743-8 (2018).
4. Ball, I. R., Possingham, H. P. & Watts, M. in *Spatial Conservation Prioritization: Quantitative Methods and Computational Tools* (eds Moilanen, A., Wilson, K. H. & Possingham, H. P.) 185–195 (Oxford Univ. Press, Oxford, 2009).
5. Moilanen, A., Kujala, H. & Leathwick, J. R. in *Spatial Conservation Prioritization: Quantitative Methods and Computational Tools* (eds Moilanen, A., Wilson, K. H. & Possingham, H. P.) 196–210 (Oxford Univ. Press, Oxford, 2009).
6. Soares-Filho, B. et al. *Science* **344**, 363–364 (2014).
7. Paloniemi, R. et al. *Conserv. Lett.* **11**, 1–10 (2018).

Competing interests

The author declares no competing interests.