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Integrated land planning is necessary to meet climate, food and biodiversity goals

While the world is a big place, humans are making greater and greater demands on the same areas of land. “This means that, unless we use the same land to serve multiple needs and coordinate this effort through planning, it is unlikely that we will have enough land for conservation, food and energy,” said Grace Wu, a professor in UC Santa Barbara’s Environmental Studies Program.

An international team of researchers looked into the tradeoffs between different land uses, revealing that strategic planning would enable progress toward global biodiversity, climate and sustainable development goals simultaneously. The study, published in Nature Communications, finds that, if an integrated method for land-use planning is employed, future land development would impact 15% fewer species and cut carbon loss by 19%.

The study provides a framework for multi-sector land-use planning that considers the, often overlapping, needs of nature conservation, agriculture and renewable energy. The paper maps these needs around the world, finding that the places needed to meet targets for protected land and productive land frequently intersect.

“There’s a tendency to think that development and conservation inevitably conflict, but that’s largely because we plan in silos,” said co-author Patrick Roehrdanz, director of climate change and biodiversity at Conservation International. “When we use a multi-sector approach to land allocation across sustainable development goals, we see that most important areas for nature can be conserved while still leaving room for development — and importantly we can also identify areas where priorities for nature and development do overlap.”

Achieving global climate goals while meeting growing demand for food will likely result in more land devoted to both renewable energy infrastructure and farming, the researchers said. However, if we also aim to meet global biodiversity goals, the allocation of these lands cannot come at the expense of nature.

“Both renewable energy and natural climate solutions play critical roles in fighting climate change,” said Roehrdanz. “But clean energy projects still use land, and if they’re built without considering nature, they can add pressure on wildlife and ecosystems – which undermine the effectiveness of natural climate solutions as well as biodiversity goals. Our study shows that better coordination can reduce those conflicts and allow both goals to succeed.”

According to the study, if future development is planned without considering nature and the benefits it provides to humanity, land demands for renewable energy and agriculture could impact nearly 1 million square kilometers of high-priority conservation areas, including the habitats of 440 threatened species and 21 gigatons of needed carbon stocks. It would also result in insufficient land availability to achieve conservation and development targets. This could be avoided with proactive and data-informed planning.

If development planning is coordinated and collaborative, the authors found that impacts on nature can be significantly reduced. This approach would reduce the potential number of species displaced by 15% and the amount of carbon lost by 19%.

“Single-sector land use planning such as planning for biodiversity or for development, which is the standard, is going to lead to worse outcomes and greater conflict,” explained UCSB co-author Ashley Larsen, a professor at the Environmental Markets Lab (emLab) in the Bren School of Environmental Science & Management. Supporting the food and energy development needed in the future while maintaining

biodiversity will require coordination and collaboration. “While perhaps obvious at a high level,” she said, “we show the magnitude of synergies and tradeoffs between siloed and coordinated approaches to land management.”

Country-level data, restoration commitments and local and Indigenous input strengthen this type of multi-sector planning and lower the potential for carbon or nature loss, according to the study. Alongside local data and perspectives, the framework is designed to be applicable regionally and nationally.

“The paper demonstrates a practical, scalable approach to multi-objective land-use planning,” said lead author Cameryn Brock, a research scientist at Conservation International at the time of the study. “Our intention is that this framework can be a useful tool for governments, companies and other decisionmakers.”

UCSB and Conservation International have partnered with Arizona State University and the Alexander von Humboldt Institute in Colombia to co-design land use models for Colombia’s conservation planning efforts. The team, led by Amy Frazier, a professor in the Department of Geography at UCSB, is working with the country’s national parks service to integrate these land-use planning scenarios into a web-based system to identify potential sites for future conservation.

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