# New agroforestry maps plot environmental, social and economic benefits of trees

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Examples of agroforestry practices assessed in our suitability model. Credit: *Environmental Research Letters* (2025). DOI: 10.1088/1748-9326/adab09

There's a longstanding attitude in many farming communities that trees and agriculture don't mix. But agroforestry—the intentional integration of trees and shrubs in agricultural systems, such as planting trees as windbreaks, integrating trees on pastures, or growing tree crops intercropped with annual crops—can provide a multitude of benefits to

both farmers and landscapes. So far, in the U.S. Midwest, these benefits have gone unrealized, with vanishingly small adoption rates.

University of Illinois Urbana-Champaign researchers say strategic plans that integrate environmental, social, and economic considerations are needed to expand agroforestry throughout the Midwest. Their new study in *Environmental Research Letters* provides a foundation.

"There has been a lot of research on the agronomy and ecology side of agroforestry, including the environmental benefits these practices can offer. But we don't know a lot about the social and economic impacts. It turns out those factors dramatically shift our priorities for targeting agroforestry in certain areas," said lead study author Sarah Castle, who completed the analysis during her doctoral studies in the Department of Natural Resources and Environmental Sciences (NRES), part of the College of Agricultural, Consumer and Environmental Sciences at Illinois. Castle is now a postdoc at Yale School of the Environment and a visiting scholar at Illinois.

Castle's goal, along with co-authors Chloe Wardropper, assistant professor in NRES, and Daniel Miller, associate professor at the University of Notre Dame, was to create a tool to target agroforestry where it would provide the greatest environmental benefits while also being economically viable, socially acceptable, and suited to areas where agroforestry-relevant trees are most likely to thrive.

Mapping social attitudes and economic feasibility together with environmental data is no easy task, but the researchers did just that.

"We took all of these different data layers, normalized them so they were comparable, and combined them very intentionally to conduct a holistic assessment. One of the most helpful parts of that process was conducting key informant interviews," Castle said.

"We talked to people at Illinois Extension, USDA's National Agroforestry Center, the U.S. Forest Service, and the Savanna Institute, which is a major player in Midwest agroforestry, to get their feedback on our approach."

Ultimately, Wardropper says the team developed a map identifying areas where agroforestry could deliver the biggest impacts in terms of soil erosion, water quality, climate, and profitability for lands that are not viable for other crops. They also arrived at a high-level estimate of potential carbon sequestration if agroforestry was adopted on the most suitable land in the Midwest.

"Expanding these practices across just 5% of suitable Midwestern agricultural land could store 43 metric tons of carbon dioxide equivalent ($CO_2e$) per year," Wardropper said. "That's a major advantage over cover crops, which are estimated to store about 8.4 metric tons of $CO_2e$ per year on the same lands."

Crucially, the researchers are making their [mapping tool](#) freely available for landowners, conservation scientists, and policymakers.

"The [decision support tool](#) we're releasing allows users to tweak all the parameters for their suitability analysis," Castle said.

"Say you want to run an assessment only on one tree species, or only considering economics, or setting economics as five times more important than environmental factors. Users of the [decision support tool](#) can set their parameters based on their specific agroforestry goals and rerun the analysis to create their own maps for Midwest states, counties, and watersheds."

Wardropper notes that each agroforestry practice has its own set of spatial opportunities, and there may be an appropriate practice for nearly

every region.

"There's a divide between the edge-of-field practices like windbreaks and riparian buffers and the whole- or partial-property practices like alley cropping and silvopasture," she said. "I think it's helpful to remember that adopting agroforestry does not have to be a whole farm transformation.

"There are a lot of ways a landowner/operator can really tailor agroforestry to the types of benefits that they're looking for. For example, establishing a windbreak in a really windy Plains state can be useful and potentially a lower investment and lower cost, as far as learning new practices, than transitioning to something like alley cropping."