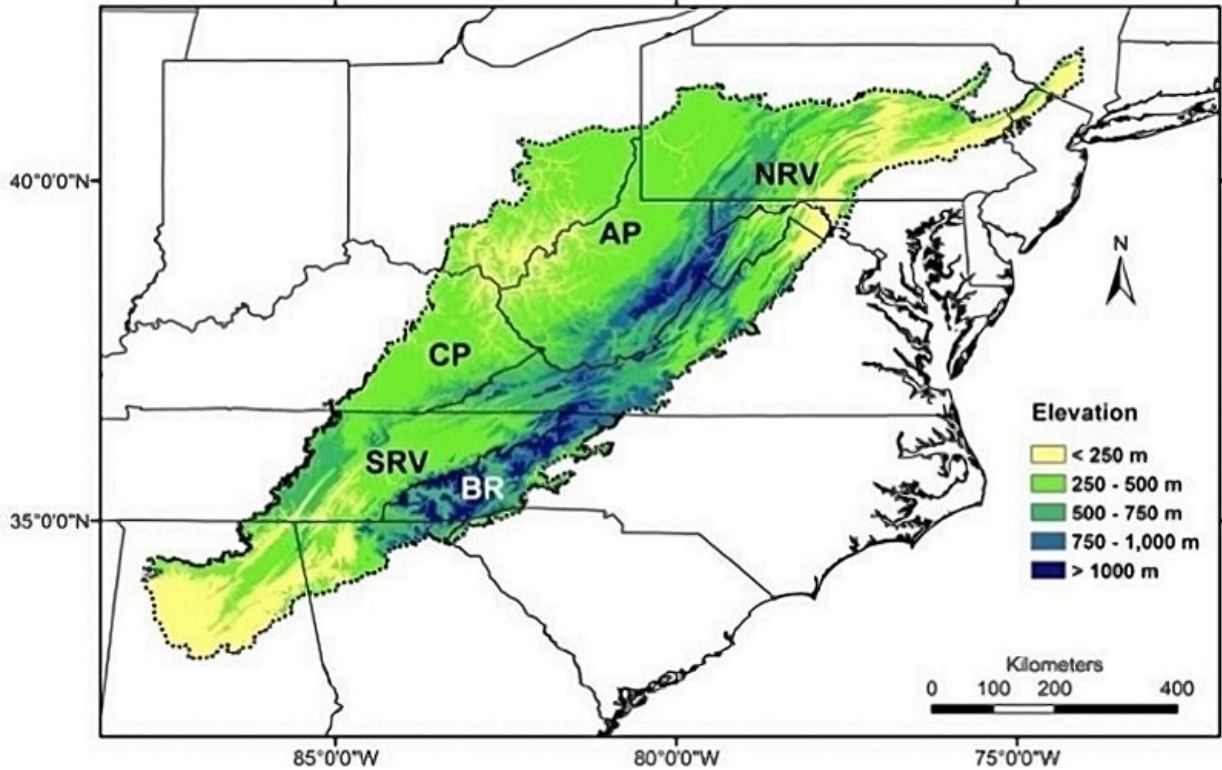


# Protecting species on the move

June 29 2021, by Kendall Daniels



A map of the team's research region. Credit: Gengping Zhu from the University of Tennessee Knoxville

As temperatures and sea levels rise as a result of climate change, flora and fauna are migrating into new and unknown lands to survive. Some animal species will have to move farther north to stay cool, while trees and plants will have to increase the breadth of their seed distribution to ensure the success for generations to come.

And just as they are adapting to change, our ideas of how we successfully engage in conservation needs to as well.

With a grant from the National Science Foundation's Dynamics of Integrated Socio-Environmental Systems program, an interdisciplinary team of researchers from Virginia Tech; the University of Tennessee, Knoxville; and the University of Southern California are helping conservation agencies and other stakeholders across state and local boundaries to rethink biodiversity protection approaches for this new era of climate change.

"Conservation efforts have often traditionally been established around this notion that species exist within certain places and not others," said Todd Schenk, an associate professor in the Urban Affairs and Planning Program of the School of Public and International Affairs at Virginia Tech. "It has become clear that that is not true anymore, if it ever was. We are reaching the point where climate change and other global change drivers are changing ecosystems at rapid rates."

As we increasingly see the impacts of climate change on ecosystems, managers, researchers, environmental planners, and other stakeholders are asking the question: How do we deal with the migration of entire ecosystems when our [conservation efforts](#) are primarily focused on particular places and constrained by political boundaries?

With this project, the team of researchers will be zooming in on one of the most biologically diverse regions in the temperate world: the central and southern Appalachian Mountains. The region will serve as a test-case landscape for the development of a more dynamic vision of conservation.

Within the lower 48, Appalachian ecosystems stand out for their incredible biodiversity. Covering an area of 737,000 square miles and

home to tens of thousands of species, these mountain ecosystems have played, and will continue to play, critical roles in enabling species movements as the climate changes.

The Appalachian Mountains transect 13 states. Taking into account all of the [federal agencies](#), state agencies, tribes, and nonprofit organizations that share responsibility for their protection, the Appalachian Mountain range is a prime example of the management challenges that will arise as species face new, growing threats.

Schenk said that there is one issue that is well worth noting: our state lines. Long ago, state borders were drawn largely without considering certain ecological features.

"Our boundaries are rarely drawn on the basis of ecosystems, like river basins or watersheds, to begin with," said Schenk. "If anything, we have done the opposite. Many states have rivers that serve as boundaries. Of course, we didn't draw political boundaries accounting for the ecology of regions. We drew them for other reasons."

For those in charge of environmental policy, planning, and management, these artificial boundaries become all the more problematic.

Environmental changes are going to inevitably cross these boundaries, which necessitates significant coordination across those boundaries.

"Much that we do as a society to protect species is ultimately tied to fixed geographies," said Paul Armsworth, an ecologist at the University of Tennessee, Knoxville, and principal investigator on the project. "We protect special places on the landscape in nature reserves or ask state agencies to lead on protecting species found within their borders. But, we are going to need much more flexible and dynamic approaches if we are to continue to protect species as climate change accelerates."

Researchers believe this kind of collective thinking is going to require cultural and institutional changes within natural resource management agencies and conservation NGOs, and facilitating such changes takes time.

With the help of artificial intelligence, the team will be able to quantify these changes over time and alert state and federal agencies to plan accordingly.

"If all we do is react to change once it has happened, then the conservation community is always going to be in crisis mode, but we can get ahead of the game," said Bistra Dilkina, the team's computer science co-PI from the University of Southern California. "If we harness modern computational approaches, we can predict how species will respond to the changing climate and where and when ecological changes are coming on the landscape. Doing so will let us explore what kinds of new governance collaborations are going to be needed to be ready when those changes arrive."

To explore these issues further, the team is planning to directly engage agency officials and others who are responsible for integrating climate change into State Wildlife Action Plans (SWAPs). With each state adhering to its own plan, coordination to tackle wicked problems, like climate change, can be difficult. Coordination is essential.

"There isn't tight integration across those state boundaries," said Schenk. "Folks that make these plans have a responsibility to their state and their state only. They aren't going to suddenly start making plans for the other states. So, a key question is 'how do we coordinate, while recognizing that those [political boundaries](#) aren't going away?'"

The team is also seeking knowledge from those who have cared for the land long before Europeans arrived. Various Indigenous tribes inhabit

the central and southern Appalachian Mountain ranges, and the team will be learning from them, while helping them enhance their management approaches in the face of a changing climate.

"They are critical partners in this project given their longer-term relationships and stewardship with the land," said Schenk.

With the blending of various kinds of research expertise and experts from different organizations, the team is confident this new project can really make a difference to future conservation in the Appalachian region and beyond.

"At their core, environmental problems like [climate change](#) are really people problems," said William A. Hopkins, professor of wildlife in the College of Natural Resources and Environment and the associate executive director of the Fralin Life Sciences Institute. "We must address the human dimensions of these complex issues if we have any hope of ultimately halting or reversing their effects on the environment and society. The collaboration between ecologists, social scientists, and computer scientists on this NSF-funded project exemplifies the kind of innovative approaches needed to solve these challenges."

The Fralin Life Sciences Institute is taking bold steps to foster and support similar collaborations and strategic partnerships with colleges and other institutes at Virginia Tech.

"We recently co-located faculty with diverse expertise from five colleges in Steger Hall to tackle problems related to rapid environmental changes. With coordination with the Institute for Society, Culture, and Environment, we were able to bring in Todd Schenk," added Hopkins.

Schenk emphasized that the NSF Dynamics of Integrated Socio-Environmental Systems program represents a rare and exciting

opportunity for researchers. Not only will researchers across disciplines be working together, but those within and outside of academia will be working together as well.

"This program will be integrating social and environmental fields, which is so critically important to issues like effective conservation," said Schenk. "It is really neat to see everyone—from federal agencies to the Fralin Life Sciences Institute—come together to see such an emphasis placed on genuine, sustained, and deeper collaboration that extends past academia."

Provided by Virginia Tech

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