Study predicts an uncertain future for forests

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The composition of some of our nation's forests may be quite different 200 to 400 years from today according to a recent study at the University of Illinois. The study found that temperature and photosynthetic active radiation were the two most important variables in predicting what forest landscapes may look like in the future. The uncertainties became very high after the year 2200.

Approximately 100,000 acres of forested area west of Lake Superior which make up the Boundary Waters Canoe Area was used for the study. Using computer models PnET-II and LANDIS-II, the researchers were able to simulate 209 possible scenarios, including 13 tree species and 27 possible climate profiles to predict how the landscape will look over time.

"The tools that we developed and we're using for the research project can be applied to any discipline dealing with risk and uncertainty in decision making," said U of I researcher George Gertner.

"We were dealing with the uncertainties in global change predictions using the projections established by the United Nations Intergovernmental Panel of Climate Change. These projections were based on different CO 2 reduction scenarios and global circulation models. "

The study found that the most important source of uncertainty in the forest composition prediction is from the uncertainty in temperature predictions. The second most important source is photosynthetic active

radiation, the third is carbon dioxide, and the fourth is precipitation.

"The Boundary Waters Area is significant because it's a transitional area between boreal forests - like those in Canada, Russia, Sweden, and Norway - and temporal forests," Gertner said. "So, if there are changes in the climate you'll see the changes - if it gets warmer, the temporal forests will move north. Because of its proximity to Lake Superior, rainfall is not so critical there. It's very moist. So, if you were to do a similar sort of study, say, in Illinois, temperature may not cause so much uncertainty; rainfall might."

The research was done by a team consisting of George Gertner, a statistician and quantitative ecologist; Chonggang Xu, his Ph.D. student; and Robert Scheller, a landscape ecologist at the Conservation Biology Institute in Corvallis, Oregon. They drew from the disciplines of statistics and ecology to interpret the data collected to predict the future of the forest landscape.

"You have to have an understanding of the biology, physiology, as well as statistics as it relates to uncertainty. If you don't, then the results might not mean anything. You have to be able to interpret everything and make sure it all makes sense. "

Gertner explained that in traditional uncertainty analysis, the variables are considered to be independent of one another.

"But in reality, they are all interrelated. We try to account for the actual correlation of these inputs - these relationships. And that's where the methodology is new, because of that."

The relationships of the variables are more complicated than just raising the temperature and lowering the amount of rainfall. "One scenario might be if we establish a policy to reduce CO 2 greenhouse gas

emissions by a certain level," Gertner said.

"If we have agencies around the world who adopt these policies to make these reductions, over time the scenarios predict what will happen, but with uncertainty."

The question is what to do about it? How to adapt? How to manage the forest for global change?

"The bottom line is that we have to have very robust systems that can handle this variability. It can't be rigid. If we have robust systems, whatever happens, it can handle it. Sustainability comes into play in the robustness. You try to manage those areas by having more diversity, not monocultures."

Gertner said that management can be easier with agricultural systems. "Over short intervals you can adapt very quickly. You can make big changes very quickly, but with a forest, the lifespan is 100, 200 years, so once you do something it's longer term. We need to be making policies now that will affect our forests hundreds of years from now."

Uncertainties in the response of a forest landscape to global climatic change is published in *Global Change Biology* 2009.

Source: University of Illinois at Urbana-Champaign (news : web)