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Forest Service

Rocky Mountain Research Station

Air, Water, and Aquatic Environments Program

Providing scientific knowledge and technology to sustain our nation's forests, rangelands, and grasslands

Science BRIEFING

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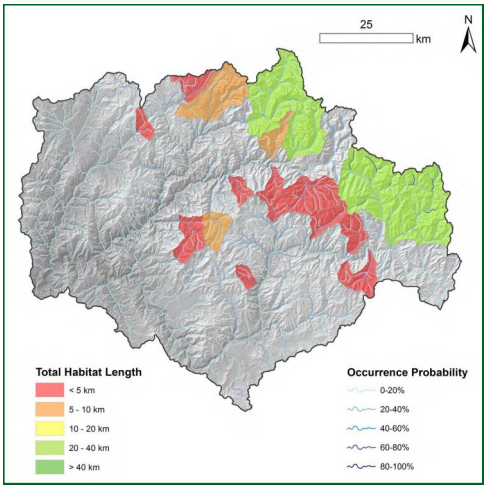
Application of a Spatially Explicit Decision Framework for Fish Conservation

BACKGROUND

Biologists are considering climate trends in planning and assessment, and resource management agencies are adopting climate change policies. As such, managers need tractable approaches to assess the vulnerability of populations and habitats and to guide the prioritization of limited management resources.

RESEARCH

Research Activity: RMRS scientists demonstrate one approach to tackle the complex issues and uncertainties associated with climate change.



Probability of occurrence and predicted occupancy of bull trout in the Boise River basin in the absence of brook trout. The map show the probability of occurrence for each segment estimated by the BN under future environmental conditions.

They present examples of two pertinent types of management problems linking climate change scenarios to fish populations. The first management decision involves strategic spatial prioritization of limited conservation resources. The objective was to rank a number of streams, watersheds, or populations for conservation, restoration, or some other purpose that requires a strategic allocation of limited management resources. As an example, they focused on habitat potential related to climate change scenarios for bull trout (*Salvelinus confluentus*) populations across the Boise River basin in central Idaho. The second problem illustrates a yes-or-no decision about a specific management action among streams. This example focuses on removing or maintaining fish barriers in streams containing isolated populations of westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) threatened with invasion by a nonnative competitor (brook trout, *Salvelinus fontinalis*), and whether this decision changes in the context of future climate conditions.

In both cases, the research made use of Bayesian networks (BNs) to translate each decision problem into a quantitative tool and implemented these models under historical and future climate projections. The spatial prioritization BN predicted a substantial loss of habitat for bull trout by the 2080s and provided a means to map habitats and populations most likely to persist under future climate projections. The barrier BN applied to three streams predicted that barrier removal decisions were likely robust under the climate scenario considered.

KEY FINDINGS

- Fishery managers should incorporate local and regional climate change projections into future management decisions.
- A structured decision framework, coupled with analytical tools and spatial data sets, can help integrate climate and biological information to evaluate management alternatives.
- Using relevant management issues, climate change scenarios can be linked to fish populations to demonstrate the benefit of structuring the decision-making process.
- Using a spatially explicit decision framework enables managers to: synthesize current understanding about climate effects on fish populations, refine critical management questions and clarify objectives, formalize model assumptions, and identify key uncertainties requiring further investigation.

MORE INFORMATION

- www.treesearch.fs.fed.us/pubs/43351

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Keywords: *climate change, fish conservation, structured decision framework, analytical tools, spatial data sets, Bayesian networks (BNs)*

 Science Briefings can be found online at: http://www.fs.fed.us/rm/boise/AWAE_home.shtml