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## Effects of Climate Change on Wildlife and Fish

### Background:

- Scientists around the world have identified changing climate as a factor in substantial shifts in distribution and in timing of reproduction in wildlife and fish populations.
- Wildlife and fish responses to climate change depend on feedbacks among climate, land use, land cover, hydrology, and biodiversity.
- Making useful predictions requires that we have good projections of the nature, rate and variability of climate change.

### What R&D is doing

#### *Large-Scale Spatial Modeling*

- An analysis of potential national effects of climate change on wildlife habitat is being addressed by research supported by the Wildlife Habitat Policy Research Program (National Council for Science and the Environment). Scientists from RMRS will be estimating an index of climate change stress to terrestrial biodiversity in order to identify regional hotspots of climate change impacts and management options.
- The Interagency Mapping and Assessment Project (IMAP), a partnership of PNW, R6, BLM, OR ST. Dept. Nat. Res, TNC, and others can incorporate estimates of changes in wildlife and aquatic habitat caused by climate change so managers can evaluate likely future forest and range conditions.
- The LANDIS model is being used by scientists at NRS to predict climate change effects on forest composition and spatial pattern in the Midwest, Ontario and Siberia. This information could be used to predict wildlife habitat changes.
- Scientists at RMRS are developing models of vegetation change based on predictions of altered disturbance regimes and plant and animal habitats using gradient mapping from 5 yrs of microclimate sampling at 100 FIA plots in the Selkirk Mountains. Ongoing studies of bear and forest carnivore habitat connectivity will be used to refine predictions, in cooperation with the Univ. and the State of Montana and USGS.

#### *Effects on Fish*

- Scientists at SRS produced a spatial model based on current trout distribution in the southern Appalachian Mountains that predicted significant loss of trout habitat with global warming. With increasing temperature, fragmentation of habitat will increase, leaving populations in small, isolated patches vulnerable to extirpation.

- Scientists at RMRS have shown that the effects of climate change on fish will be substantial with even moderate warming but will also vary across the species range. Both drought and stream intermittency (highly hydrologically variable streams) are predicted to be more frequent/prevalent as warming increases.

### ***Effects of Loss of Snowpack***

- According to scientists at PSW, climate change will reduce the amount of snowpack in the High Sierra, potentially impacting amphibian habitats by further reducing the lake and pond water levels and resulting in drying of small lakes during the summer. Research will explore effects on mountain yellow-legged frogs.
- Scientists at RMRS are cooperating with USGS and the Univ. of Montana to project snow patterns into the future and effects on **wolverines**. They are also working with NFS managers to develop models that use direct links to forest type, temperature and snow cover to predict effects of climate change on **Canada lynx** and their preferred prey, the snowshoe hare. All of these species are dependent on persistent snow cover.

### ***Effects on Birds***

- Scientists at NRS and SRS studying silvicultural impacts on cerulean warblers and other priority forest birds have demonstrated the overall range of the cerulean has been shifting northeastward over time, probably as a result of climate change.
- Studies of Rusty Blackbird distribution at SRS will likely identify climate change as an important correlate of the species' precipitous decline in the past 40 years.

### **Importance of the Issue**

There is scientific consensus that climate change is occurring rapidly. Wildlife and fish are early barometers of climate and habitat change, and threatened and endangered species are likely to be especially sensitive to change and perturbations. Wildlife, fish, and rare plant ranges may not change in tandem with changes in habitat distribution for a variety of reasons, including dispersal barriers. Meaningful forest plans that describe management to protect biodiversity will incorporate probable effects of climate change on wildlife and fish habitats.

### **Research Benefits and Connections**

Research will allow managers to better identify needs for habitat connectivity, focus on species of most concern under climate change scenarios, and choose among management options based on likely long-term implications for biodiversity.

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