Monitoring Ecological Responses to Climate Change

Climate

The Greater Yellowstone Inventory and Monitoring (I&M) Network (GRYN), in partnership with the Rocky Mountain I&M Network (ROMN), uses climate data collected by national networks to analyze the status and trend of five variables in GRYN and ROMN park units: temperature, precipitation, streamflow, drought, and snowpack. Warmer temperatures and changes in the form, timing, and amount of precipitation are predicted to lead to earlier snowmelt, significant reductions in snowpack, and resulting summer drought in the western mountains by the middle of the 21st century. Annual reports document the current status of climate; trend reports, produced every five years, will examine long-term variability and changes in key variables.

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Whitebark Pine

Whitebark pine has experienced a rapid and precipitous decline throughout its range due to nonnative white pine blister rust and native mountain pine beetles. A decrease in extremely cold winter temperatures due to climate change has apparently contributed to the longest, heaviest infestation of mountain pine beetle on record. In 2009, concern over this issue contributed to a federal judge ordering the restoration of Endangered Species Act protection to the Yellowstone grizzly bear. Given the ecological importance of whitebark pine, and that 98% of the species occurs on public lands, an interagency whitebark pine monitoring group—including the National Park Service, USDA Forest Service, and U.S. Geological Survey—developed a protocol and have been monitoring the status and trend of whitebark pine stands since 2004.

Amphibians

Climate change is anticipated to cause changes in the distribution and abundance of amphibians on a global scale. In the GRYN, impacts could include earlier breeding, resulting in more frequent exposure to killing frosts and a longer larval period because water temperatures warm more slowly in early spring, leading to higher larval mortality. Reduced water storage as snow, earlier runoff, and an increase in evaporation due to warmer summer temperatures may reduce habitat for adult amphibians. Since 2004 in Yellowstone and Grand Teton national parks, the GRYN has been annually monitoring the status and trend of amphibians, including the percent of area used for breeding and changes in wetland habitat availability over time.

Water Resources

Water resources in the GRYN are projected to be profoundly influenced by climate change, including changes in timing and duration of hydrologic regimes and water temperatures, altering food web interactions, species diversity, and nutrient dynamics. Substantial range reductions are predicted for salmonids due to changes in water temperature. Since 2005, the GRYN has been annually monitoring alpine lakes, rivers, and streams for five core parameters (dissolved oxygen, pH, specific conductance, temperature, and discharge), water chemistry, and macroinvertebrates.

Landbirds

Climate change is predicted to cause landbirds to shift their range, migratory patterns and timing, and interfere with reproduction. Since 2004 in Grand Teton, the GRYN has been field testing monitoring landbird density, distribution, and species richness within five habitats of concern: alpine, sage-steppe, riparian cottonwood, riparian willow, and aspen. Through long-term monitoring of birds and local climate variables, the GYRN intends to document changes in the distribution and abundance of birds that may be attributed to climate change. A broader landbird protocol applicable to all parks in the GRYN is being developed for 2011 implementation.

Vegetation Composition and Soil Stability

Sagebrush steppe is one of the most altered ecosystems in the intermountain West, with substantial portions converted to agriculture, heavily grazed, and degraded through altered fire regimes and the invasion of exotic plants. Changes in climate are expected to further alter fire regimes and increase invasive species in sagebrush steppe and low-elevation woodlands. In 2010, a monitoring protocol, which uses sampling data-collection techniques developed by the ROMN, is being developed and tested in Bighorn Canyon.