Impacts of Invasive Plants on Songbirds: Using Song Structure as an Indicator of Habitat Quality

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Invasive species can alter habitat quality over broad scales, so they pose a severe threat to songbird populations. Through our long-term research program supported by BEMRP, we have found that changes in habitat quality induced by exotic plants like spotted knapweed can lead to subtle yet profound changes in songbird populations. For example, in knapweed-invaded habitats compared to those dominated by native vegetation, we detected no change in abundance of adult chipping sparrows—but we observed delays in breeding that led to reduced breeding productivity and increased turnover of adults between breeding seasons. Knapweed invasion caused declines in native plants that led to declines in insects serving as key food sources for songbirds and other vertebrates. This resulted in diminished habitat quality for songbirds.

Our results illustrate the rippling impacts of invasive species on songbirds. Results also underscore the importance of measuring parameters other than abundance when assessing population status of songbirds, as abundance is not necessarily correlated with habitat quality. This presents a particular challenge to natural resource managers charged with monitoring songbird populations to assess changes in habitat quality, especially since monitoring tools for songbirds are currently limited primarily to count-based methodologies that yield information on abundance alone. Furthermore, measures of population status that are sensitive to changes in habitat quality are difficult to derive, particularly at scales relevant to management.

Aubree Benson sporting song-recording equipment and holding a chipping sparrow captured for color-banding to allow tracking of individuals. Aubree led song recording efforts and wrote a senior thesis using data from the study. (Photo by Tricia Rodriguez)

Chipping sparrow marked with bands used to track individuals. Tracking birds and recording songs are part of a study of impacts of weed invasion on populations. (Photo by Aubree Benson)

Using understandings obtained from our research and in collaboration with Erick Greene at the University of Montana, we are testing a novel method for assessing songbird population status and habitat quality that is based on an easily measured parameter—song structure. Song structure refers to the array of song types sung by a species in a particular area. Song types in birds are much like human accents, varying by locale. In many migratory species, young birds acquire their one signature song with its particular accent by learning from their neighbors in their first breeding year. Areas of high habitat quality should have low turnover of breeding adults between years. Therefore, high quality sites are dominated by older birds who learned their song on-site and therefore sing in the local accent. In contrast, areas of low habitat quality should have relatively few older birds to serve as teachers and songs should exhibit greater variety since they were likely acquired in other places. These differences in learning environment may ultimately affect song structure, as young birds settling in high-quality sites readily learn the local accent from their older neighbors, maintaining the song tradition by returning in subsequent breeding seasons. Those settling in low quality habitats learn a mix of songs from various neighbors and disperse in future seasons.

We are using 2 years of field data to link changes in habitat quality caused by spotted knapweed invasion to differences in song structure at invaded compared to native-dominated sites. In 2005 and 2006, we recorded songs of more than 200 individually marked chipping sparrows at seven sites on the Lolo National Forest in western Montana. Preliminary

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more wood volume growing annually on National Forests than being harvested or burned. Therefore, he recommends the Forest Service focus less on tree-growth research and more on what the National Forest System can do to satisfy National Environmental Policy Act requirements while providing a sustainable supply of wood.

Pat is unaware of any collaboration or partnership between Research and private foresters. This indicates that Research needs to do a better job informing the public about research taking place. He believes the agency needs to realize "industry actually knows something." Opportunity exists for researchers and private foresters to collaborate in developing useful forest management tools and techniques. For example, Pat's company utilizes dead wood in a unique way; yet few agency managers or researchers "have come to see what we do, what improvement we do, any thoughts we've got." As a result, the agency seems unaware that markets are changing and how.

Useful technology transfer could be improved between researchers and private industrial foresters. For example, Pat suggested that district ranger stations, supervisors' offices, and Research Stations provide indexes of locally conducted research in their foyers. Annotated bibliographies of this research by category and location would be helpful to private foresters and the public.

Relevancy is the basic question, Pat thinks. Who chooses what projects to research or conveys their needs and ensures scientific answers? This leads to the issue of Forest Service Research maintaining independence and credibility. Connell believes Research should serve the National Forest System, providing information it needs. According to him, independence and credibility mean research that can be replicated. Without this, there's a validity problem. Pat affirmed researchers require great autonomy for best science.

Pat believes Research provides data and information to National Forest System management about issues, but does not make management decisions. Moreover, informing and sharing "best science" seldom convinces those with ideological opposition to embrace sound projects.

Pat is disturbed by the mantra of forest restoration being necessitated by past fire suppression. In reality, he thinks fuels are accumulating because timber harvest has ground to a halt. "Right now we're growing more than we're burning [through all types of fires]. We have made a social change of opinion that we are willing to have our wood fiber supplied by Canada [and] want the National Forests to become de facto National Parks," he says. Moreover, he thinks the agency's ability to attack fires while they're reasonably small has diminished because there are fewer agency and industrial crews working in the woods.

According to Connell, Research needs to provide information and tools to help managers analyze implications of "No Action" alternatives in projects: "Basically the No Action alternative is taking a photograph, and all subsequent proposed actions are compared to [this] photograph. In truth, there's no such thing as a static forest. You can't actively manage when you create an inactive, inanimate icon as a control."

From start to finish, the Forest Service Research relevancy question is dependent on context. It must be answered in terms of what research results are needed, by whom, when, where, and for what purpose.

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analyses support the idea that song structure may be an important indicator of habitat quality—songs at native-dominated sites formed cohesive neighborhoods that were more similar to each other than those at knapweed-invaded sites. Sampling at additional sites over a range of habitats will be necessary to evaluate song structure as a broadly applicable measure of population status. Given the links between song learning, turnover rates, and habitat quality in songbirds, song structure may serve as a new and improved means of monitoring population status, including impacts of invasive species.

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restoration projects. We then retraced the route we used for the public tour and Chuck shared concerns expressed by the public on their tour.

These chances to interact—public to manager to researcher—take time and commitment, but it's worth it to share information and perspectives while out in the forest together. It has been a key part of BEMRP's efforts to work in partnership and share research results with others.

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works." This partnership helps managers understand what's "best science" and keeps researchers "grounded with what's real." Researchers are regarded as independent, so researchers' involvement gives managers' decisions credibility. These days, much of a forest manager's job is social science-related. "I wouldn't want BEMRP to lose sight of that," he says.

Dan sees a role for BEMRP in travel management. This effort will require considerable social science research because people deeply value the National Forest, traveling through it by different means and for different reasons.

Outside the job, Dan pursues his passion for the outdoors by traveling, mountain biking, backpacking with Sharon and sons Dylan and Torrey, and fishing. "My real passion is golf. It's a game that demands 100 percent focus. You can't play golf and think about work."

Wildland fire, lands, wilderness dams, and travel management—these challenges promise an exciting journey for Dan. Given his eagerness to work with diverse publics and openness to scientifically based research on management issues, Dan's vision of quality land stewardship and customer service is becoming a reality on the Stevensville Ranger District.