

## **Research Interests**

For the past five years my research has been focused on the fields of population, conservation, and landscape genetics, with an emphasis on research that provides practical answers to natural resource problems. I have tried to combine my molecular ecology work, which often takes place in the laboratory, with a strong field component, as I believe that we derive the best scientific understandings of species and ecosystems through the amalgamation of field and laboratory methods. In general, my research has been centered on the following 4 topic areas:

### **Conservation Genetics:**

The vast majority of legal actions constraining natural resource agencies involve wildlife. It is not uncommon for a management activity to be halted because of the lack of information regarding a sensitive, threatened, or endangered species. Traditional field studies, while yielding important information on species' habitat needs are expensive and time consuming, thus novel approaches are required. One recent technological advance that has improved wildlife managers' ability to make inferences regarding wildlife populations comes from the field of molecular biology. Data from molecular markers can now elucidate questions regarding a) isolation or connectivity of a target population in contemporary and historical times, b) demographic and genetic bottlenecks, c) hybridization, d) shifts in geographic range due to climate change, e) changes in effective population size, and f) delineation of appropriate wildlife management units. Furthermore, through developments in non-invasive genetic sampling (obtaining DNA by sampling forensic-type materials, thus never needing to handle an animal) we can now readily obtain samples on difficult to study species.

However, as these approaches are relatively new, much R&D and science leadership is required in both the field and the DNA laboratory to a) define the research problems hindering the field from advancing, b) develop sampling schemes to provide unbiased data; c) develop molecular markers appropriate for wildlife questions; d) develop and refine statistical methods, and e) apply these findings on the ground. Overall, the rapidly developing field of molecular biology has much to offer the wildlife biology discipline, thus I focus my R&D on turning population genetics theory and human medicine-based DNA technology into tools readily available for conservation.

### **Genetic Monitoring:**

One of the principle tasks of many wildlife managers is to understand changes in wildlife population metrics (e.g., abundance, survival) as a function of changes in natural conditions or management actions. Most of these population metrics are difficult to obtain for wildlife species, thus crude indices are often used. The field of genetic monitoring has much to offer, as genetic indices are relatively simple to obtain and have been shown to be a strong reflection of population change. The benefit from genetic monitoring is partially due to the fact that genetic samples can be collected non-invasively. Thus, it is now possible to obtain precise estimates of wildlife abundance and other commonly used wildlife metrics for traditionally difficult to study species over multiple time periods. Over the past 2 years, I have been developing the field of genetic monitoring. This includes the development of DNA-based tools for genetic monitoring, testing their efficacy, applying them in

collaboration with management, and writing synthesis reviews to advance the field. I am currently writing an NCEAS proposal to synthesize our knowledge about genetic monitoring of wildlife.

### **Landscape Genetics**

I have been interested in the statistical integration of landscape ecology principles and population genetic metrics as they fuse into the new field of landscape genetics. Landscape genetics provides new ways to more precisely define animal movements, evaluate corridors, and define population substructure using molecular genetics data. I am currently involved in a long-term, multi-species landscape genetics study in Northern Idaho. Here, we have built over 100 landscape resistance models based on putative natural and anthropogenic landscape barriers. We are currently learning how each of 4 different species (1 large carnivore, 1 mid size carnivore, and 2 small mammals) “perceives” these barriers and the landscape as a whole by correlating genetic relatedness between individuals and least cost paths between their locations. Ultimately, we will be able to advise management on what patches of land are most valuable for each species, and if corridors in the area function for multiple species, or are species specific. Future work will involve projecting these landscapes forward in light of climate change to assess how genetic connectivity will change.

### **Ecology of Threatened and Endangered Species**

Over the past 7 years I have lead field studies on several endangered species (e.g., fisher and wolverine). These field studies have focused on questions related to population demography, behavioral ecology, and habitat use. While these ecological studies are vestiges of my responsibilities prior to leading the U.S. Forest Service’s only wildlife genetics program in the nation, they are something I value tremendously and guard dearly. I believe what separates me from many other molecular ecologists is my ability to maintain these studies. More specifically, it is the opportunity that these studies provide to enter the field on a regular basis. My best natural history and research insights were inspired from times when I collected ecological field data, thus I hope to continue this work.