Customer Story

North Carolina Museum of Natural Sciences

Challenge

Monitor patterns in mammalian population distribution around the world; understand human impact and use research findings to help inform management decisions.

Worldwide wildlife conservation begins in the backyard

Biologists team up with citizen scientists to build an important digital archive of mammal population distribution

The North Carolina Museum of Natural Sciences (NCMNS), in partnership with the Smithsonian Conservation Biology Institute, is spearheading a project to create a vast digital archive that maps the occurrence of mammalian species around the world. This database and its online counterpart, eMammal, now serves as a resource for everyone – from professional biologists to school children – to use in learning more about mammals, their distribution and how populations are changing over time.

Citizen scientists collect data in their own backyards

To create a data collection network, the NCMNS and Smithsonian have enlisted the help of public volunteers, or "citizen scientists," to help collect and process data. The way the project works is simple: camera traps are distributed to individuals who place the devices in an outdoor location near where they live. When an animal passes by a trap – be it in the forest or a field or someone's backyard – the digital camera is triggered by motion and heat sensors to take a photograph using an infrared flash.

"Camera traps are so easy to use, we can get citizen scientists to go out and collect data for us. We've developed a bunch of different tools to manage the data and to get the data from the volunteers easily," says ecologist and eMammal project coordinator Arielle Parsons. A volunteer may monitor the camera trap for several weeks before downloading the device's photo log and moving it to a new location, she says. Once volunteers log and identify timestamped images in eMammal, the data are sent to the Smithsonian Institution to be stored as vouchered museum specimens in a permanent data repository.

Data modeling helps process large multivariate data sets

The benefit to large-scale public data collection efforts, Parsons says, is that the resulting data set presents a rich picture of biodiversity and allows regional institutions like NCMNS to survey species on a much larger scale than would otherwise be possible. But practically speaking, she admits, these efforts produce huge data sets that can be difficult and time-consuming to process for individual scientists like herself who are charged with data cleaning and analysis, among other things.

Most of the time, that analysis is in the form of a distribution; occupancy models help show how different wildlife species are dispersed across a region. "There are so many variables that change over days and seasons and spatially," says Parsons. "For each camera site, we're thinking about things like habitat factors – the amount of agriculture or the amount of managed land, for example, as well as daily variables like weather – rain and cloud cover. So you can end up with a huge number of covariates and you have to pick a handful. You need to figure out which [combination of factors] is going to capture natural variation as well as possible. And that's what I use JMP® for: figuring out which variables we need to model so that we get the most accurate picture of the distribution of wildlife."

Parsons says JMP helps to determine relationships between factors by running a principal components analysis (PCA). "I could do that in R, but

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>
> Arielle Parsons, eMammal Project Coordinator

it would take me forever," she says. "In JMP, I can get a PCA with just the press of a button. There's such a learning curve with R – command line interfaces are so daunting if you're not a coder. A PCA or a correlation matrix, for example, would take me at least three or four lines of code."

The Graph Builder feature in JMP is also an important tool for data visualization once Parsons whittles down the original cohort into just nine or 10 covariates. "Sometimes the coefficient estimates will come out of the model not looking quite right, so it's really helpful to then go back to JMP and very quickly visualize the relationship between covariates and the response," she says. "We can look at the plots side by side and see whether there's actually an interaction, and this is much quicker to do with JMP than R."

Data analysis provides insight into human impact on wildlife populations

Protected areas around the world have a dual mandate: first, that land be provided for recreational use, whether consumptive (e.g., hunting or trapping) or non-consumptive (e.g., hiking and mountain biking). Second, that the natural habitat and wildlife of the region be preserved and protected. "How well we are succeeding in the second mandate while allowing the first to happen as well is part of what we are trying to determine with eMammal data," Parsons says.

The results of Parsons' analyses tell her whether variables related to recreation influence the distribution of animals more than do variables related to habitat or management practices. Parsons and her colleagues then share these findings with those responsible for making wildlife conservation and management decisions.

In its newest citizen science program, NCMNS has even partnered directly with policymakers at the North Carolina Wildlife Resources Commission to form the Candid Critters project. This statewide undertaking will be an important resource for residents and policymakers alike to better understand how humans and animals can best share public lands. Candid Critters is now set to collect data at an unprecedented level, with images deposited by volunteers into the eMammal database.

A digital archive contributes to a shared body of scientific knowledge

The project's digital archive is designed not only to advance institutional scientific research; it also serves as a public resource to educate and inspire individuals, even far from the southeastern United States, to ask and answer new questions about conservation. "We have a website portal where anyone can go and look and start playing with the data with simple data analysis tools," Parsons says. "The idea is that it becomes a public engagement project both for volunteers who run the cameras and for people who just want to play with the data. We're conscious about communicating the science we do in a way that the public will be able to digest really easily."

Thanks to a productive partnership with citizen scientists, NCMNS and the Smithsonian are now exploring human impact on a scale that wasn't possible before. And new technologies for tackling complex data sets are playing an important role in bridging the gap between research institutions and the public. For starters, Parsons says, "We'll often put some really simple graphs into the results we're sharing [with the public], and the JMP interface is the easiest way to show our data."

Solution

Enlist the help of members of the public to collect wildlife data with motion and heat-sensitive camera traps; use JMP® to prepare and process the huge volume of data that is generated by this global effort.

Results

An interactive interface in JMP has not only sped new conservation research and discoveries, it has also enabled people around the world to engage with science and the environment around them.

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