Counting On Diversity

Auriel Fournier – Math and Stats Editor

Conservation is hard, but in a perfect world it wouldn't be—we'd need to do something to conserve a species or ecosystem and we'd have the resources to do it. That rarely happens. Not only are resources limited, but how we decide what to conserve and how we choose to do so is never simple. Before we can decide piece of land to conserve we have to decide what we value; ne way we do that is by talking about species diversity.

Often when we start talking about conservation we have a species or suite of species we are interested in conserving, but there may also be other things we value, such as recreation or aesthetics or historical or cultural uses. Landscapes are never simple. In most areas, habitats are not large and intact. They are patchy and owned and valued by many different groups. Balancing these different interests to achieve conservation goals is hard. Some groups care only about one group of species (e.g., fish), others want to be able to enjoy the landscape by hiking or camping, while still others care more about intrinsic value, such as knowing that an endangered species has adequate habitat. All of these views are valid, of course, but balancing them is challenging. Species diversity is often part of this equation, but as simple as diversity may sound, there are many ways of evaluating it.

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Does diversity mean as many species as possible and if so, what species are we interested in—birds, mammals, reptiles, plants, insects, spiders, fish (the list goes on)? Do we want to conserve places that are strongholds for a few common or charismatic species or for rare or endangered species? How do we rank possible places to be conserved—by area, by number of species, by cost, by proximity to other properties? Conservation biology has been struggling with this its entire existence and uses metrics, or mathematical ways of assigning numbers and ranks based on what we value, to help guide our decisions.

(https://www.flickr.com/photos/cetp/8114688776/in/photolist-dn4Ugb-o9vcvM-7uzca8-qrWjXL-6Pd1g6-nf1xhJ-6PhbRy-seEvLk-HExRfs-92Ji5Z-6Ph9j9-9AeS4d-7j9uCQ-4M1mqp-6EkqLW-nh3V54-6DA5SU-9zAM1V-4y86Fc-GSoDBd-duAodz-4y85un-sw7QMz-777CUh-cy9gio-8zcyF3-cAPtgS-4QnTp6-pVrTQF-pAMJaf-GTDs2T-dCTeXf-GTDv3x-nPP1C9-rnrSKe-GTtjqG-cjMsTw-87yZCo-6Pd2Yg-mKLB2n-HPjYNt-6PcYXZ-cjuM5j-cQZbq5-5x9qzA-bcJszn-3brkWN-cjuBsQ-3zJgyn-5Sz1Fv)

Often when we are trying to conserve land, or a species, or a habitat, we put together a plan that identifies properties that we could conserve, and then ranks them. Some ways of ranking properties value the number of species (20 species at property A, 12 at property B, 5 at property C, and 13 at property D). But which is more valuable?

By one measure it’s property A, hands down. It has the most species. But what if property C has 5 species that aren't found on any other property? What if 3 are endangered? Hopefully before this process starts, we can determine how we value things. But often that evolves over time and depends on which groups we can bring to the table to help with the planning. How much money do we really have? Do we want the new area to be near other areas already being conserved? The answers to these questions are never black and white. They depend on our goals and what the organization(s) conserving the land value.

(link https://www.theguardian.com/environment/2016/jun/22/leopards-killing-of-rare-african-penguins-sparks-conservation-debate)

A current example of this is taking place outside Cape Town, South Africa. An endangered leopard has killed several endangered penguins. These kinds of situations happen more often than you might think, and the answers are complex and often depend on the scale we are looking at. This site outside of Cape Town is one of four places in the world where this species of penguin breeds, which makes it a very big deal, but the leopard is actually more endangered at the local scale. The penguins are also of interest to tourists and help bring money into the local area. Here we are faced with just two species, but we also don’t know how the other species that they live with will be impacted if one or the other changes. The leopard might be keeping numbers of other predators at a low level, or the penguins might be bringing important nutrients out of the ocean onto land which helps to nourish the surrounding plants.

The difficulty is that an ecosystem is not the sum of its parts. Twenty species and 19 species can be drastically different if that one missing species provides some vital service to others. These species are often interrelated, depending on and competing with each other. When one species goes away another may increase and become dominant, or it may decline because it depended on the missing species. With other threats to species like climate change in the mix, how losing one species will impact others can be hard to evaluate even with the best models and data.

For most species the data we need to model possible scenarios simply don’t exist. Mathematical models can help guide our decisions. They can help us evaluate choices, compare options, and incorporate information about cost but they are only as good as the information we give them. That information is both the data we have about the ecosystem, and the information about how we value the system and its components. We can give the model information about how we value different parts of the ecosystem, such as the presence of an endangered species the square kilometers that would be conserved, or the diversity of fish species. But before we use these tools we have to decide what we value, and while math can be difficult, deciding what we value is much, much harder.