Ecological consultants: serving on the front lines of species and ecosystem conservation

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I was investigating a large forested urban park in Pittsburgh with a soil scientist and stream geomorphologist to select monitoring locations for a project aimed at controlling erosion and stormwater runoff (https://youtu.be/caCGP0ZRxnA). The site was strangely barren of understory vegetation – too barren to be explained solely by overabundant deer populations, as even plants normally avoided by deer were absent. While the stream contained many gravel bars, indicating sedimentation, the geomorphologist pointed out the banks were mostly stable and therefore not the likely sediment source. He pointed to the outdated and unmaintained stormwater control measures along nearby trails and roadways as contributors to the problem, but much of the erosion appeared to be coming from the hillsides that lacked layers of vegetation to slow the water and hold the soil together. A kick of a boot unearthed an unexpected culprit: a particularly bad infestation of the invasive earthworm *Amynthas agrestis*. The entire humus layer had been replaced with a 10-cm-thick layer of worm castings, which easily rolled down the hillsides during rain. These worms are known to disrupt soil ecosystems, contributing to poor plant performance (Chang *et al.* 2017). Solving the sediment and runoff problem was clearly going to require an interdisciplinary approach to address these issues within constraints of client goals, existing park uses, historic preservation, and project budgets. – *TN*

While not all projects in ecological consulting are this interdisciplinary, most require interaction with fields such as civil engineering, landscape architecture, geology, environmental chemistry, and cultural resources (eg archeology) – after all, most problems that require ecologists' insight are not entirely ecological in nature. Byers (2018) broadly described qualities and qualifications of ecological consultants who work in ecosystem restoration, especially internationally. Here, we describe in more detail the types of work ecological consultants typically perform in helping clients meet their regulatory requirements. In so doing, ecological consultants not only serve on the front lines of environmental protection but also work to correct and reverse negative impacts to species and ecosystems. Our focus is on US scenarios, though analogies can be made to other countries.

First, let us differentiate ecological consulting from environmental consulting. While many firms employ ecologists in their environmental practices (it's all the same to the clients), issues addressed by ecologists and environmental scientists overlap very little. Specifically, ecologists consult on issues dealing with organisms and ecosystems, whereas environmental scientists consult on pollution in air, water, and soil.

Although specialized ecological consulting companies do exist, most ecological consultants are employed by civil engineering companies. The reason is that civil engineering projects typically involve land disturbances – whether they be a roadway, shopping center, pipeline, or wind farm – that have the potential to impact protected organisms and ecosystems. That protection stems from two federal laws – the Clean Water Act (CWA) and the Endangered Species Act (ESA) – and their state and local counterparts (or counterparts in other countries). The consultants' job is to keep the client compliant with those regulations, especially the CWA.

Clients hire ecologists to help them comply with CWA's protection of ecosystems, specifically streams, lakes, coastal waters, and wetlands. Ecological consultants help their clients identify these protected resources and plan their projects to avoid, minimize, and mitigate impacts to them. Ecologists provide the expertise in determining the locations of wetlands or other regulated waters and describe their conditions and functions. Following federal and often also state guidelines, consultants identify the boundaries of the protected resources so developers can stay out of them! Wetland boundary determination requires skills in plant identification and community classification, as well as interpreting soil and hydrological features.

If the project cannot avoid impacts, the law requires that such impacts be minimized, and permit applications prepared – another task for ecological consultants. These permits require ecologists to analyze data and concisely describe the project and its effects to regulators. CWA also protects water quality; because biological communities (eg macroinvertebrates and fish) are often used as indicators of water quality, ecologists are hired to determine their status and a project's effects on them.

Ecologists also help clients comply with ESA's protection of organisms – specifically, endangered and threatened species and the ecosystems on which they depend. To that end, the consultants must be able to identify the protected species and understand their habitat needs and life history to determine how the proposed project may affect them. If adverse effects to listed species are likely, ecologists work on behalf of their clients to develop plans to minimize and mitigate those impacts.

Ecologists working with threatened and endangered species are usually specialists in a group of related taxa: for example,


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Figure 1. Ecosystem restoration involves consulting professionals from many disciplines, including ecologists. Here, restoration practitioners and land surveyors are checking elevations and monitoring stability and vegetation at a stream restoration site.

bats, mussels, or plants. Often, they are cross-trained in related fields such as aquatic or wetland assessments. Their work is similar to that described for CWA compliance – they perform field surveys for the presence of certain species and their habitats. Sometimes an ecologist may survey for a particular species while they are assessing the presence of wetlands and streams.

A consulting specialty that integrates both CWA and ESA is ecological restoration. Restoration ecologists aim to mitigate, or offset, negative effects by "assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" (SER 2004). Restoration ecologists work with stream, wetland, and endangered species specialists to identify and quantify the functions of the degraded site and devise plans to improve its ability to provide the desired level of function (Figure 1). The project described in the introduction involves restoration ecologists working with landscape architects, engineers, and others, to devise a plan to restore riparian vegetation, slow down runoff, restore floodplain connectivity of the stream, and reduce sediment load.

Regardless of specialty, ecological consulting requires the ability to work in a team, often for long hours in remote locations; skills in communicating with the public, clients, and regulators; and attention to detail. Like every profession, ecological consultants often face situations that require honesty and some finesse. Clients usually have expectations for promptness and cost and probably won't be thrilled if you discover a protected resource in the middle of their project area. Not surprisingly, some clients don't appreciate the need for environmental preservation or restoration, and perceive these as irritating obstacles to their project's success. However, most clients understand that environmental regulations are important and view them like other factors that constrain their project, such as existing roads, utilities, or zoning requirements.

If you are interested in a career in ecological consulting, we have the following advice: (1) Obtain a bachelor's degree in ecology, environmental biology, or natural resources (eg wildlife biology or fisheries biology). A master's or doctorate is not required for entry-level positions, and many employers have continuing education programs that help pay for your advanced degree after you are employed. (2) Before graduation, obtain practical hands-on field experience that demonstrates your ability to work on relevant subjects for long hours under a variety of conditions. Ideally, obtain at least one internship with a consulting firm. Obtain as much experience starting as early as possible in your education. (3) Demonstrate that you can communicate to specialist and non-specialist audiences in oral and written form. (4) Network! Attend local or regional professional association events (national association meetings tend to be more academic). Ask to meet with ecological consultants in your area to learn more about the field. Try to do this in the "off season" (typically winter) when they are more likely to have time. Most will be willing to talk with you for an hour or so if you come to their office and will probably be impressed that you took the initiative. (5) Prepare a professional résumé and a cover letter that addresses the needs of the company. Use the careers office at your university and find a professor with some consulting experience who can offer advice.

Finally, you may encounter people who eschew consulting because they perceive it enables ecological destruction rather than conservation – ignore them! Protecting our ecological systems and natural resources requires regulatory agencies and developers to work together to implement conservation priorities as established in law. Developers rely on ecological consultants to prevent them from running afoul of their legal responsibilities. Ecological consultants therefore work on the front lines of conservation. Because ecological consultants serve at the vanguard of environmental protection, it is a noble profession and one that demands top ecological talent.

References

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Supporting Information

Additional, web-only material may be found in the online version of this article at http://onlinelibrary.wiley.com/doi/10.1002/fee.1941/suppinfo

