



Fields of dreams

A new awareness of environmental problems is changing the landscape for scientists. In the United States, it is creating jobs for a diverse range of specialists in some unexpected areas. Potter Wickware reports.

“Ecology is rather like sex,” according to science writer Michael Allaby. “Every new generation likes to think they were the first to discover it.” Indeed, there is currently a sense of wide-eyed excitement surrounding the field as the latest generation gets to grips with its ‘discovery’. And this time around, solutions to the environment’s complicated problems are flowing from new combinations of scientific and professional talent.

Today’s wildlife biology, forestry or natural-resource group is as likely to include non-traditional posts such as environmental lawyers or mathematical modellers as more traditional roles such as geologists and telemetry specialists (see ‘A non-traditional approach’, right). And positions now tend to draw on several such backgrounds.

The term ‘ecological engineer’, for example, would describe someone who plans and develops ecologically sensitive sites, “someone grounded in biological systems who also has a good sense of how things work”, says Jason Taylor, education programme manager at the Ecological Society of America, a Washington-based professional society.

The social sciences increasingly enter the ecological equation too, adds Thomas Rice, a soil scientist at California Polytechnic University in San Luis Obispo. Rice recalls a student who came to him with an undergraduate degree in sociology, then turned to modelling the environmental effects brought about by mega-cities.

An increasing emphasis on building models for more environmental processes is causing some shortages: the

need for mathematicians and computer scientists who can aid in modelling is further exacerbated because they are also needed in other disciplines, such as computational biology. And climate science is often not the first choice or the best paid.

At the other end of the spectrum, ecological studies today depend more than ever on tools and techniques. Although solo investigators still count snails and lizards by hand at study sites, a lot of data now come from satellite imaging, aerial photography, computer simulations or ground-penetrating radar. Genomics offers entirely new data sets to help assess changes in communities as a whole, and for phylogenetic and coevolution studies, such as symbiotic relationships between birds and plants.

DRIVEN BY COMPLEXITY

It is no accident that more disciplines are intersecting at the ecological crossroads. That was the idea behind the biocomplexity initiative, an ambitious five-year programme set up by the National Science Foundation (NSF). It aims to foster core groups of scientists as they try to come to grips with ecological problems that range from the micrometre to the planetary scale.

The initiative’s conceptual origins were in physics and chaos theory. Then complexity was given a biological dimension by the work of NSF director Rita Colwell, a marine microbiologist, which associated cholera outbreaks with El Niño-driven changes in tidal-water temperatures.

The NSF currently supports biocomplexity research in five areas: coupled natural and human systems; coupled biogeochemical cycles; genome-enabled environmental science and engineering; instrumentation development for environmental activities; and materials science, engineering and society. In the current cycle 72 recipients share grants totalling about \$40 million.

In addition to independent jobs funded by research

Ecology now offers strong career prospects for a wide range of disciplines.



CAREERS AND RECRUITMENT

grants, there are many government staff positions in agencies such as the Agricultural Research Service (ARS), a branch of the US Department of Agriculture. The ARS has 8,000 staff scientists and support personnel dispersed among its 104 locations nationwide.

Mike Jawson, who leads programmes in natural resources and sustainable agriculture at ARS headquarters in Beltsville, Maryland, explains that in tandem with the traditional activities of stock and crop improvement, the ARS also works on water, soil and air quality and rangeland management. "Right now agro-ecologists — ecology-oriented systems people — are one of the main classifications we're looking to fill," he says. Highlighting ecology's hybrid complexion, recruitment adverts might have numerous headings for the same job: engineer, soil scientist, agronomist, hydrologist or ecologist.

ECOLOGICAL CHECKPOINTS

Weed ecologists and insect-pest ecologists occupy important positions under the agro-ecology umbrella. These scientists look at life cycles and behaviours and try to find checkpoints that can be exploited by prospective control agents.

"We have to make sure that the agent we're introducing doesn't harm something beneficial, and this takes a lot of research into the ecology of a region before a release can happen," says Jawson.

ARS ecologists are also active overseas. A collaborative effort in Brazil, for example, is developing its agriculture intensively while trying to avoid the mistakes made in the past by others. Erosion control in China and land rehabilitation in the former Soviet Republics of Central Asia are other big efforts.

Rangeland management is another area with bright jobs prospects. Some 40% of the United States is rangeland, and a typical problem for rangeland ecologists is what to do about the invasive salt cedar, which sucks streams dry but provides a home for a

threatened bird, the southwestern willow flycatcher.

Other government agencies with staff ecologists are the Environmental Protection Agency, the US Forest Service, the Fish & Wildlife Service, and the Natural Resources Conservation Service (NRCS). The NRCS uses a lot of master's level people, in addition to a few PhDs, says Jawson. Even NASA has a finger in the ecology pie: since 1993 the Ames Research Center in Mountain View, California, has been involved in projects that apply multispectral image analysis to remote-sensing data to model the vigour of the vegetation canopy in vineyards.

Because agency field sites are apt to be situated on or near university campuses, government research jobs tend to have an academic cast. Joint agency and university appointments are common. Staff scientists enjoy an edge over their university counterparts in their guaranteed support base, which at the ARS averages \$300,000 per year per scientist. With less time spent chasing grant dollars, more time can be spent on research and field work.

The future is bright at the ARS for an ecologist who has taken a few agricultural courses and is conversant with the issues, says Jawson. Biotechnology skills are increasingly important, with proteomics slated to be a hot new part of research at the agency. "We have had to do double advertising to fill our positions more than once, particularly for these ecology-based systems positions," he says. "There's not a huge pool out there."

Potter Wickware is a freelance science writer based in California.



Delicate balance: the salt cedar drains streams but provides a home for endangered birds.

Scott Sellwood (below left) sees full employment for environmental lawyers.

A non-traditional approach

Ecologists' skills are increasingly in demand at environmental engineering companies. The consulting firm CH2M Hill, based in Denver, employs 400 scientists, most of them trained in Earth sciences, who work at the interface of agricultural and natural systems,

according to spokeswoman Karen Steeper. And traditional large construction firms, such as Bechtel of San Francisco, typically have environmental-compliance groups closely involved in

all stages of a project.

For the tech-minded, infrastructure companies that provide maps and data, and the computer methods to interpret them, also offer opportunities. Vestra, a land-management concern in Redding, California, employs foresters, geographers, cartographers and specialists in biometrics and remote sensing. ESRI, a geographic information consultancy, has 2,500 employees in Redlands, California, and other locations.

Thirty years ago, if you wanted to build in a wetland you began by calling in the gravel trucks. Today, projects in sensitive areas usually need

Environmental Impact Reports, and in many US states only a certified ecologist can sign these pivotal documents.

Damage caused by massive hazardous-waste dumps, now being cleaned up under Superfund legislation, will keep associated professions busy for years. According to Scott Sellwood, an environmental lawyer in San Francisco, related legal actions are giving lawyers a lot of work.

There is more litigation locked up in the Habitat Conservation Plans (HCPs), a comprehensive science-based method for managing endangered species. "HCPs are

a full-employment plan for consultants and lawyers," comments Sellwood.

Another good starting place for newcomers to ecology is an internship with a public-interest group or non-governmental organization. According to Jeffery Foran, president of Citizens for a Better Environment, a Great Lakes-based group, the experience can give a student a broader and more realistic perspective than is possible from behind university walls. "Advocacy is acceptable when done correctly and based on good strong scientific information," he judges. P.W.

