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Science FINDINGS

INSIDE

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"Science affects the way we think together."
Lewis Thomas

THE OWL: SPOTTED, LISTED, BARRED, OR GONE?

Just when the northern spotted owl thought it was safe to go back into the forest . . .

As if its personal history hasn't been trying enough in the last two decades, the beleaguered owl now finds its prized habitat encroached upon by its very own cousin, the more aggressive eastern barred owl. Remember, this is the bird that changed the face and the fate of Federal forests across the entire Pacific Northwest. The bird that looked like it couldn't withstand the pressures of human activity. And now it may get shouldered aside by another bird? Does the Endangered Species Act of 1973 allow for this kind of "take"?

With the 1990 listing of the owl, the Endangered Species Act mandated the U.S. Fish and Wildlife Service to protect the owl everywhere. Everywhere. The pressure was on to take a larger perspective, and the reanalysis of owl data to include private lands was supposed to be regionwide. At issue immediately was the development of a section 4(d) rule under the Endangered Species Act that might authorize incidental "take" of some northern spotted owls from non-Federal forests.

Ultimately, time constraints led to the selection of Washington's Olympic Peninsula alone as a suitable "hot spot" where reanalysis would include non-Federal lands. The peninsula is unique because of the large block of relatively unfragmented habitat in the Olympic National Park, additional smaller patches on the adjacent Olympic National Forest, some suitable non-Federal habitat, and the peninsula's relative isolation from other parts of the owl's range.

But where science meets policy, from forest floor to courtroom floor, the saga usually turns on a peculiar mix of uncertainties and absolutes, and illuminates a series of inevitable time lags and simplifying assumptions. The story of reanalysis on the Olympic Peninsula fits this pattern.

Both the Interagency Scientific Committee (ISC) in 1990, and the Forest Ecosystem Management Assessment Team in 1993 had concluded that we could probably maintain a viable population of spotted owls if we did a good job of managing habitat just on Federal lands, according to Eric Forsman, the PNW Research Station wildlife biologist who has lived for so long at or near the center of the owl storm, and is a member of the reanalysis team.

Spotted owl: The northern spotted owl was listed as threatened under the Endangered Species Act in 1990. Spotted owls use large home ranges and nest, roost, and forage in predominantly older forests. Thus, rates of timber cutting through the 1970s and 1980s could not have maintained sufficient habitat for survival. (photo by Eric Forsman)

USDA United States Department of Agriculture
Forest Service

EDITOR'S NOTE

The PACIFIC NORTHWEST RESEARCH STATION study of the northern spotted owl in the 1970s and the ensuing public debate a decade later thrust us into the public policy arena from which we have never left. Our role is that of information provider. Policymakers consider our information among many factors including social values.

The information we bring to the table is usually complex. The April issue of Science Findings illustrates this complexity. Scientific inquiry about an individual species and its habitat requires modeling, assumptions, and time. Uncertainty remains after studies are done. Once policy is made, implementation continues to build new understanding, which may present implications not considered in the original policy.

Hindsight vision is 20/20 because all the facts are in. Scientific data can not offer 20/20 vision of the future. But despite its imperfections, it offers a powerful look at what might happen in the future because of decisions we make today.

Science Findings is dedicated to people who make and influence decisions about land stewardship. The goal of this publication is to help you understand the science produced by the PNW Research Station. Have we accomplished our goal in this issue? We are interested in your opinion. Please contact me with any comments.

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"Mind you, there was some serious discomfort, because simply writing off the biological significance of private lands didn't feel right, but most of us did think it could be done on Federal lands alone, particularly in geographic strongholds of the species range," he recalls.

Results of the reanalysis, published in 1995, chiefly describe most likely patterns of distribution and persistence of owls on the peninsula under the Northwest Forest Plan and benefits to the species of various levels of habitat contribution from non-Federal lands. It also takes a "What If" look at establishing habitat connections between the peninsula and other parts of the owl's range in southwest Washington.

In clear recognition of the highly flammable private lands issues looming, the reanalysis report provided conclusions and recommendations that were not completely definitive. "We certainly gave the scientific team free reign for doing objective science, but we also asked them very specific questions with known political ramifications," says Barry Mulder, spotted owl coordinator for the U.S. Fish and Wildlife Service. "In a sense, the conclusions in their reanalysis document recognized the uncertainties but also left room for flexibility in decisionmaking."

For example, some private and state lands on the west side of the peninsula–those that offer good "stepping stone" habitat to help populations on Federal lands–are being evaluated for their role in owl conservation plans, while other lands may not be involved, according to Mulder. The Fish and Wildlife Service continues to work with the State of Washington to appraise various approaches to owl conservation.

FUTURE OF OWL HABITAT IS UNCERTAIN

And what exactly were the conclusions from reanalysis? That it was "likely, but not assured," that owl populations could be maintained in many parts of the peninsula without contribution of habitat from non-Federal lands. Retention of non-Federal habitat "could result in a biologically significant contribution" to maintaining a stable population of owls in currently occupied areas. Despite this conclusion, researchers "do not believe it would fully resolve the uncertainties" about the future of spotted owls on the peninsula.

The point is not simply to spotlight delicate language. Such language was hardly a surprise under the political circumstances, which included a full decade of distress ranging from death threats to congressional testimony for both researchers and forest workers, with environmental groups gleefully stirring the pot.

The most telling word of all is "uncertainties." The reanalysis document refers to them repeatedly. Scientific uncertainty is an accepted fact of life among researchers, a fact of life which becomes deeply uncomfortable for any of them who must act in the searing heat of the political arena. There the quest is for absolutes–by Congress, environmentalists industry, and the public alike.

Martin Raphael, PNW Research Station wildlife biologist on the reanalysis team, lists the key remaining uncertainties about the owl as survival rates of juveniles emigrating from study areas and the link between habitat quality and demographic performance of the owl. Research continues in these areas.

But also included in his list of key uncertainties, along with the impact of barred owls, is the validity of the researchers' own models.

FOR FURTHER READING

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Hof, J.; Raphael, M.G. 1997. *Optimization of habitat placement: a case study of the northern spotted owl in the Olympic Peninsula.* Ecological Applications. 7(4): 1160-1169.

Raphael, M.G.; McElvey, K.S.; Gallaher, B.M. [In press]. *Using geographic information systems and spatially explicit population models for avian conservation: a case study.* In: Marzluff, J.M.; Sallabanks, R., eds. *Avian conservation: research and management.* Washington, DC: Island Press.

Forsman, E.D.; DeStefano, S.; Raphael, M.G.; Gutierrez, R. 1996. *Demography of the northern spotted owl.* Studies in Avian Biology. 17: 1-122.

Dark, S.J.; Gutierrez, R.; Gould, G.I. 1998. *The barred owl* (Strix varia): *invasion in California.* The Auk. 115(1): 50-56.

Yaffee, S.L. 1994. *Wisdom of the spotted owl.* Washington, DC: Island Press.

What does that tell us?

The 1995 report is clear on this point. "The results of the models should not be viewed as reality, but rather as a repeatable projection of the modeler's understanding of the system." This is not an unusual disclaimer about a scientific model, of course, but when the model forms the basis for dramatic changes in policy, the depth of the modeler's understanding becomes crucial.

"The landscape model that we used is best viewed as a tool for evaluating how different variables might affect each other," explains Forsman. "For example, if you vary the amount of old forest on private lands, you can see how it might affect the number of owls that would remain on adjacent Federal lands. But none of the model projections are absolutes, because the model is built on a set of simplifying assumptions about the behavior of the owls and about future conditions that could change.

"The relative numbers are what's important, not the absolutes," Raphael affirms. Researchers use absolute numbers to make the models run but do not see projected numbers in the same light. "Because the relation between any model run and reality is not known, the relative differences between land management scenarios are of most interest in interpreting results."

The reanalysis on the Olympic Peninsula called on two kinds of models: simulation and optimization. Simulation models allow a land manager to explore what alternative large-scale land management scenarios might mean in cases when whole-landscape experiments are not practical, according to Raphael. They generally include detailed and realistic biological behavior. Optimization models are best used to find efficient allocations of resources and tradeoffs between competing outputs, such as timber and late-seral forest habitat, and are more common in economics and management-science studies, he says.

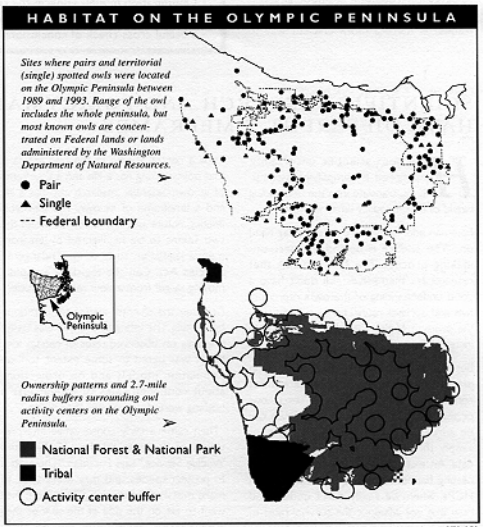
"Simply put, a simulation model can be used to evaluate an array of alternative plans, whereas an optimization model can be used proactively to design a particular plan," Raphael says. Thus a manager could compare the projected owl population under a proposed plan (such as the Northwest Forest Plan) with that under a theoretical, "ideal" plan developed through the optimization techniques.

SIMULATED MODELS HELP IN ANALYSIS OF HABITAT

For the reanalysis work, a simulation model originally used in preparing the final environmental impact statement for the Northwest Forest Plan was reused, with updated owl data. The model examined five different management scenarios including, this time, several contributions by non-Federal habitat. Results taken from that model were then used to construct and run the optimization model, to look for best use of any non-Federal habitat.

Any kind of model, however, is rife with simplifying assumptions, which must be included for the model to ever run. An example in this case is that owl dispersal was treated in the optimization model as a random, directionless process that includes no intelligent behavior on the part of the owl. Likewise, there is no allowance for weather effects on numbers of young, or of prey populations and their habitat needs. All fairly substantial issues. All set aside without malicious intent.

Because the assumptions are so crucial, the reanalysis team ran the models with three different sets of assumptions to see how the results differed. In this case, Raphael says, it was the relative differences between scenarios under a given set of assumptions that the team was most interested in.



from PNW-GTR-352

"The combination of the models suggested that additional habitat on non-Federal lands does contribute to the persistence of stable owl populations, as had been hypothesized. But this finding would apply mostly on the west side of the peninsula, where the best connections to Federal habitat already exist," Raphael says. "Running the optimization model confirmed the earlier results of the simulation model, by highlighting the particular importance of the western zone."

Combining the power of the two types of models also allowed investigators to doublecheck the existing conservation plans for the owl, to see whether an "optimized" plan would provide more habitat benefits. For the most part, considering the realities of involving non-Federal lands, existing plans look adequate and will remain in place. Current policy is an absolute, at least for the moment.

The reanalysis did suggest that the geographic location of non-Federal habitat selected for retention is important. This raises the question of reserves and land trades: "Is there a more efficient way to optimize available habitat outside of the existing legal guidelines? For example, can we give up some Federal habitat in trade for non-Federal, because it appears to be preferable to have compact contiguous reserves?" asks Raphael.

Land trades involving Federal lands and environmentally sensitive areas are legion, the precedent is clear. But how these trades might help to alleviate incidental "take" on non-Federal lands is less clear. Particularly in light of those remaining uncertainties about owl biology, and about whether it is okay to trade currently suitable habitat, in the interests of timber harvest, for habitat that it is assumed will grow and become available in the future.

"On the Olympic Peninsula, the rate of timber harvest is extremely low owing to the very high percentage of Federal land that is in reserves," says Raphael. "In fact, we assumed no harvest for the reanalysis because the timber planners told us that any harvest would most likely be in thinnings that may not destroy owl habitat."

KEY FINDINGS

- **On the Olympic Peninsula, non-Federal lands can contribute to persistence of the spotted owl, although portions of the populations are likely to persist only with Federal habitat management.**
- **Geographic locations of non-Federal habitat selected for retention are important. The western portion of the peninsula shows the greatest potential for providing habitat, since it is contiguous to existing Federal reserves of habitat.**
- **Optimization models confirm the results of earlier simulation models, and reinforce existing plans for habitat layout. Together the two models provide a useful cross-check of conclusions.**

SCIENTIFIC RESEARCH AND POLICYMAKING HAVE DIFFERENT TIMEFRAMES

How does scientific uncertainty, multiplied by simplifying assumptions, translate into the demanding world of making policy while it's hot?

Forsman addresses this classic timelag head on. "The science is behind the decision-making process. The fact remains that researchers themselves still don't have a good understanding of the owl's reproductive and survival rates," he says. "And with the invasion of the barred owl, uncertainty increases."

But it seems spotted owl policy is firmly in place, even charging ahead via habitat conservation plans (HCPs) and 70-acre owl circles, both of which Forsman believes can be adroitly mismanaged through time, or simply through misunderstanding of the data. An example: "We are trading known nesting habitat for young forest habitats in HCPs, when we really don't understand how that will influence the survival rates of dispersing owls."

Thus a central theme in the owl drama is that policymaking has a life and a timeframe of its own. Scientific research also has a life and a timeframe of its own. The inevitably fleeting nature of the relation between the two seems to be highlighted by environmental legislation such as the Endangered Species Act. Can we legislate a rapidly moving target from a slow-moving vehicle?

Consider the chain of events set in motion by a listing. The listing of the owl was based primarily on observed rates of habitat loss. But it was based to some extent, too, on population models and on projections about continued rates of habitat loss if nothing were done to alter the course.

"Then came a fairly conservative interpretation of the data by the U.S. Fish and Wildlife Service," says Forsman. "Their job is to protect species, and they don't want to make mistakes. If they are going to err, they want to err on the side of the species they are trying to protect. This doesn't mean that they don't take risks with endangered species, but they try to minimize those risks whenever they can."

For his part, Fish and Wildlife's Mulder sees the risk management partly as a communication problem. "Federal researchers have so much more experience than our field biologists who generally are not researchers. Given the implementation questions we are dealing with at the field level, we absolutely need the participation of research scientists, to check that our conclusions are at least in the ballpark."

Although Mulder has high praise for the help his agency has received from researchers such as Raphael and Forsman, he recognizes the need to formalize these kinds of working arrangements, which at present too often exist chiefly because of personal relations. Without this link, the timelags between research and implementation will remain. Or grow longer.

BARRED OWL COULD RENDER SPOTTED OWL QUESTION MOOT

And what about the famous owl's less famous cousin? The eastern barred uncertainty.

The recent arrival of the barred owl could signify full-blown species invasion with, ultimately, a winner and a loser. Or it could be the beginning of prolonged adaptation and hybridization between two members of the same genus. Both are natural, recurring phenomena in the history of evolution. Both may be helped along by cumulative human effects of many kinds.

But neither was even considered in the original analysis of spotted owl status on the Olympic Peninsula. The reanalysis simply confirmed the growing presence of the invader, and the uncertainty about its impact. Clearly, timelags do not emanate only from the demands of decisionmaking in times of political turbulence. They can show up in the woods in unexpected forms, leaving a potentially significant ecological phenomenon completely unaccounted for in current policy.

Scientific uncertainty is an accepted fact of life among researchers, a fact of life which becomes deeply uncomfortable for any of them who must act in the searing heat of the political arena.

Current policy, of course, is a fairly direct result of the astute behavior of the environmental community through the 80s. "They seized upon the implications of the owl studies, and it was indeed scientific information that led to the original injunction," says Raphael. There has been considerable pain and discomfort since that time, as scientists have been drawn into litigation to provide testimony, have found the results of their research used to formulate the Northwest Forest Plan, and have been vilified for destroying lifestyles and economic stability.

WRITER'S PROFILE

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Forsman notes that owl research has been used and misused by both sides, with increasing cynicism, to arrive at political ends. Access to data is one thing. Understanding the meaning of it is another, he says. Adds Raphael, "I believe we do have an obligation to help people understand the data, particularly the technical staff of the management agencies."

Raphael and Forsman both believe that what was ultimately important about the owl studies was that they helped change perspective about the way we view forests. It is widely accepted today that whole, intact ecosystems matter, and that no one component of a resource can be cashed in at the expense of the others. Fifteen years ago this was news, and bad news for those who believed that production of wood fiber should be the primary purpose of forest lands.

Although the ecosystem view of the forests seems firmly embedded in both scientific and political arenas, however, the invasion of the barred cousin could conceivably render the actual spotted owl question moot. In this potential scenario, the disconnect between science and policy, and the central role of timelags and uncertainties, comes startlingly clear.

Barred owl: Barred owls are slightly larger than spotted owls, are more aggressive in interactions with them, and have similar but distinct vocalizations. Because of the potential for hybridization, competition for food and habitat, and predation, the barred owl could negatively influence spotted owl populations.

LAND MANAGEMENT IMPLICATIONS

- Scientific research and policymaking operate in different timeframes. Therefore the relations between Federal researchers and agency managers must be developed and tightened at every opportunity.
- Models that assist in decisionmaking can be powerful tools, but the details of research must be clearly understood before the artificial "results" from models can be applied.
- Long-term monitoring is a crucial tool for checking the status of species populations, alongside the effectiveness of policy.

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SCIENTIST'S PROFILES

ERIC FORSMAN is a research wildlife biologist at the PNW Research Station. He conducted his M.S. and Ph. D. research on the biology and habitat use of spotted owls in Oregon. He has directed demographic studies of spotted owls since 1987. He has been a member of most of the committees that have attempted to develop management plans for spotted owls in Oregon and Washington, including the Interagency Scientific Committee and the Forest Ecosystem Management Assessment Team.

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MARTIN RAPHAEL, a research biologist with the PNW Research Station has been studying the relations between wildlife and forest habitats for 25 years. His research currently focuses on threatened or sensitive species, including the northern spotted owl, marbled murrelet, and American marten. He is especially interested in how large-scale land management practices influence population viability of these species.

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