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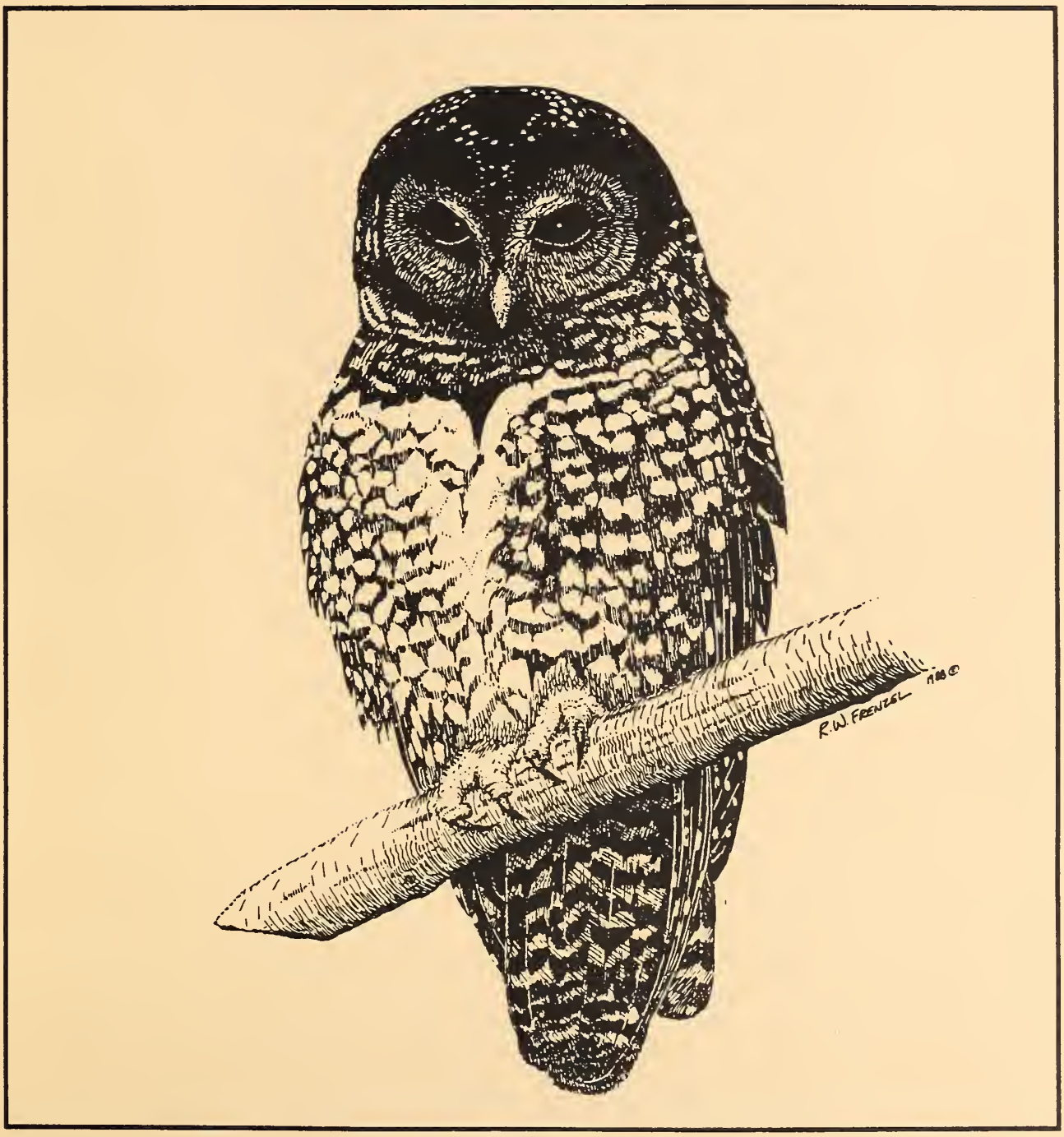
Questions and Answers on

A Conservation Strategy for the Northern Spotted Owl

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Abbreviations Used in This Paper

BLM	Bureau of Land Management (USDI)
D.b.h.	Diameter at breast height
ESA	Endangered Species Act
FS	Forest Service (USDA)
FSEIS	Final Supplement to the Environmental Impact Statement
FWS	Fish and Wildlife Service (USDI)
HCA	Habitat Conservation Area
ISC	Interagency Scientific Committee To Develop a Conservation Strategy for the Northern Spotted Owl
NFMA	National Forest Management Act
NPS	National Park Service (USDI)
PNW	Pacific Northwest Research Station
SOHA	Spotted Owl Habitat Area
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior

Contents

Introduction

These questions and answers are intended to help clarify *A Conservation Strategy for the Northern Spotted Owl: Report of the Interagency Scientific Committee To Address the Conservation of the Northern Spotted Owl,* published in May 1990, in Portland, Oregon. The Interagency Scientific Committee To Address the Conservation of the Northern Spotted Owl (ISC) was chartered under an agreement between the USDA Forest Service (FS), USDI Bureau of Land Management (BLM), USDI Fish and Wildlife Service (FWS), and USDI National Park Service (NPS). Under their charter, the ISC issued a conservation strategy for the northern spotted owl *(Strix occidentalis caurina)* throughout its range in western Washington, western Oregon, and northwestern California.

The U.S. Senate Committee on Energy and Natural Resources (Senator Dale Bumpers, Chair) held a hearing on 31 May 1990, in which written questions were posed to the ISC by Senators Bumpers, Mark Hatfield, James McClure, and Malcolm Wallop, and by Senator Hatfield on behalf of Governor Booth Gardner of Washington, Governor Neil Goldschmidt of Oregon, Senator Brock Adams of Washington, The Northwest Forest Industries Council, The Northwest Forest Resource Council, and The Bureau of Water Works, City of Portland. The ISC subsequently responded to those questions in writing. Because the responses help explain many facets of the strategy, the ISC believes that a general distribution of these questions and answers would benefit managers of resource agencies, biologists, and others interested in the strategy.

Some of the questions and answers were identical or very similar. In the interest of brevity and clarity, these questions and answers have been combined. These changes and routine editing were not intended to change emphasis or the meaning of the original questions and answers. In the unlikely event that some difference has occurred, the editors are responsible; the original questions and answers must be considered definitive.

> ***Note:*** Numbers in parentheses preceding each question refer to questions in the document, "Answers to Questions Submitted to the Interagency Scientists Committee by the United States Senate Committee on Energy and Natural Resources, Senator Dale Bumpers, Chairman," to aid in cross-reference.

Owls and Owl Habitat

1. (130)

Question **Do spotted owls use only old growth throughout their home range?**

Answer Typically, the owls do not use only old growth. Studies of habitat use have shown that they select older forest types for foraging, but also use younger forest types at least occasionally. In general, use is positively correlated with stand development: old, multilayered stands receive the most use, and clearcuts and nonforest types the least. This pattern shows—in most forest types in Oregon, Washington, and northern California—that old forest is clearly preferred habitat, and younger stands are much less used. In the Douglas-fir/western hemlock area, stands younger than about 40 years receive very little use, indicating they are poor habitat for spotted owls.

2. (4, 62, 63)

Question **The ISC report states that owl habitat has been steadily declining with the harvesting of old-growth timber. Has a corresponding decline occurred in the number of spotted owls?**

Answer Northern spotted owls are closely associated with old-growth forests of several types. Spotted owl numbers have declined as the amount of suitable habitat has declined, but whether population loss has been in direct proportion to habitat loss is less certain. Some researchers have argued that stands of suitable habitat at lower elevation on more productive sites may well have supported greater densities of owls than do high-elevation stands because of the greater abundance of prey related to higher site productivity and milder climates at low elevations. Nearly all old-growth timber stands on such low-elevation sites have been logged, leaving old-growth timber at relatively high elevations and on steeper ground. Thus, a greater proportion of the probable numbers of spotted owls have been lost from such areas.

3. (62, 63)

Question **What direct evidence exists that the spotted owl population is declining, given that we do not know how many owls are alive now nor the size of populations in the past?**

Answer Spotted owls were first identified as a species of concern because of their association with old-growth forests and the decline in the acreage of such forests. This strong relation to suitable habitat has been repeatedly demonstrated, and the association seems abundantly clear to us. The association was clear to the FWS Listing Team and, we believe, is also clear to most biologists. Political pressure has led to repeated studies to assure that previous studies were indeed correct (see appendices F, G, and H, ISC report). Bart and Forsman (unpubl.) formally documented the change in density of spotted owls as old forests are replaced with younger forests; they compared densities in areas dominated by clearcuts and young forests with adjacent areas where old-growth forest was more abundant (appendix G, table G8). Computation of rates of population change based on measures of rates of birth and death likewise confirm significantly declining

numbers of resident adults on both study areas where sufficient data exist to allow calculations. These results are easily interpretable because the measures of birth and death on the study areas are consistent among years.

Analysis by the FWS Listing Team also indicates dramatic population declines. In addition, numerous observations have been made of spotted owls disappearing from study sites concurrent with the harvest of the suitable owl habitat. We hold that all of these sources provide sufficient support that accurate measures of rangewide populations in the past to compare against current numbers are not needed to determine, with a high degree of certainty, that a marked population decline has occurred and is continuing.

The ISC report clearly demonstrates the general preference of spotted owls for suitable habitat (which is most commonly found in mature and old-growth forests) and the many times higher densities of owls found in such forests. Such habitat is being removed by logging at the rate of some 64,000 acres per year on FS lands in Washington and Oregon alone. Such logged areas will not return to suitable habitat conditions for at least 80 to 150 years. We assume—as we believe most biologists would—that habitat loss and population size are related for any species.

The burden of proof should be the reverse of what is represented in the question. Because common sense, logic, experience, biological theory, and historical evidence indicate that a species' number declines with loss of habitat, what is the proof that the population of the northern spotted owl is not declining?

In the operative sense, this question became moot when the FWS Listing Team recommended that the northern spotted owl be listed as "threatened" throughout its range, and the FWS Director so decided. Unless that decision is somehow overturned or altered by the political process, the subspecies is considered officially to be in decline. This decision was based on a separate analysis done by the FWS (Anderson, David R., and others. 1990. 1990 status review, northern spotted owl, *Strix occidentalis caurina*. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service. 95 p.).

4. (133)

Question **Do you have an accurate inventory of how many spotted owls exist today in Oregon, Washington, and northern California?**

Answer No. A complete inventory or census of spotted owls throughout its range does not exist. Further, a complete inventory is unlikely ever to exist because costs and logistics of such an undertaking are prohibitive. Likewise, no complete inventory exists for any wildlife species in the United States where numbers are more than several thousand and where the range of the species is broad. To make a point, we have no complete inventory of trees either. Population estimates gained through sampling are the common criteria for all kinds of plants and animals. To imply that an absence of "a complete inventory" is an uncommon weakness is inaccurate.

5. (169)

Question **How would you define the terms "spotted owl nesting areas" and "spotted owl nesting pairs?"**

Answer Spotted owl nesting areas are specific locations where spotted owls construct nests, lay and incubate eggs, and fledge young. Habitat selected and used by a nesting pair of spotted owls can be described at several spatial scales, including the actual tree that holds the nest; the forest stand in the immediate vicinity of the nest tree; the complex of forest and other vegetative stands within the foraging home range of the pair; and the broad landscape, at sub-basin scales, that encompasses the pair's home range and those of other adjacent pairs. To ensure successful management for spotted owl nesting pairs, habitat conditions should be provided at each of these scales. Spotted owl nesting pairs are male and female owls that form a pair, mate, and nest, and the female lays eggs. The nesting or evidence of nesting, such as sightings of young, must be observed to classify it as a nesting pair. Spotted owls do not necessarily nest every year, so the pair need not be observed nesting each year to be classified as nesting. Similarly, spotted owl nesting areas need not have nesting pairs every year to be so classified.

6. (109)

Question **Managed forest in northern California contains spotted owls. Did your report consider that managed forests in Oregon can also contain spotted owls?**

Answer We knew, from earlier work by Drs. Forsman, Meslow, Irwin, and others, that some spotted owls were present on State and private lands in Oregon and Washington. The low densities reported from managed stands in both States, however, led us to believe that owls on private lands comprise a small portion of the population. Furthermore, we have no assurances that private land owners in either State will protect known owl pairs, or manage their lands to provide good owl habitat. That being true, we did not rely on private lands in Oregon and Washington as a source of habitat for spotted owls in the future.

7. (29)

Question **Why does the report state that current FS definitions of suitable owl habitat in California are "open to question" and "not adequate?"**

Answer Recent studies in California have shown that spotted owls are breeding there in a wider variety of habitats than accounted for in the FS standards and guidelines drafted before that information became available. The FS in California is currently addressing this matter.

8. (127)

Question **Am I correct that your Committee found that the spotted owl surveys conducted in 1989 by private land owners on managed second-growth forests in California provided you with important information that helped the Committee define the nature of suitable spotted owl habitat in northern California?**

Answer Yes.

9. (158)

Question **How much of a drop in owl populations would occur if we stopped logging tomorrow on all National Forest land that contains spotted owls?**

Answer We don't know. To provide the best answer would require knowing, rather precisely, how many owls are there, where they are, whether they are singles or pairs, and the habitat conditions within which each pair or single exists. Then, each situation would have to be analyzed and projections made as to the short- and long-term outcomes for the survival of those individuals. We do anticipate a significant decline in the population over a period of 10 to 20 years, however, even if all logging stopped on all Federal lands with spotted owls. An estimate could be based on the capacity of the habitat to support spotted owl pairs, but that process would provide a maximal estimate of carrying capacity, not actual population size.

10. (35)

Question **We have heard over and over that current forest management activities "fragment" spotted owl habitat. What data show that this fragmentation negatively affects spotted owls?**

Answer The data suggest a negative relation between forest fragmentation and owl occupancy. At least two recent studies indicate that the owls select less-fragmented areas for nesting. In addition, owls in heavily fragmented forests tend to have larger home ranges than owls in more uniform forests. This finding suggests that owls in more fragmented forests must cover more ground to obtain adequate food, which puts energetic and physiological stress on both foraging adults and nestlings. Ramifications of such "foraging theory" are that, in highly fragmented habitats, adults cannot be expected to be as successful in producing young as in less-fragmented habitats. Common sense also indicates that spotted owls are apt to be more exposed to predators, such as great horned owls and goshawks, in more open or fragmented habitats. Increase in home range or movements impaired by fragmentation increases energy expenditure. Fragmentation of forests has been suggested to provide opportunity for barred owls, a close relative and potential competitor of spotted owls, to extend its range into spotted owl habitat. These relations seem logical and likely but are not yet proved. Common sense also suggests that the burden of proof should be on the side of demonstrating that fragmentation does not diminish the quality of owl habitat. Fragmentation can be very quickly induced and only very slowly corrected.

11. (34)

Question **As one moves south in the range of the northern spotted owl, particularly in the Klamath Province, stand fragmentation is a natural phenomenon produced by aspect, soil type, and climate regime. How is this fragmentation different from human-caused fragmentation, and why is it not detrimental to spotted owls?**

Answer Natural fragmentation of forests is a fact of life and is sometimes just as detrimental to spotted owls as human-caused fragmentation. A good example is the North Cascades National Park, where high elevation areas devoid of tree-cover fragment the old-growth habitat into narrow corridors along drainage bottoms. Natural fragmentation is usually different from the patterns created by timber harvest, however.

Human-caused fragmentation tends to be characterized by sharp edges between harvest blocks, distinct differences between cut and uncut areas, relatively even-aged stands of trees, a much finer "grain" or scale at which habitat is subdivided, and a network of relatively uniform-sized blocks or harvest units. By contrast, natural fragmentation is generally characterized by indistinct boundaries between stands, uneven-aged stands, a range of stand ages from young to very old, and an irregular pattern of large and small patches of vegetation. Thus, the kind of fragmentation caused by logging has been different from that caused by fire, windstorms, and other natural phenomena. The fragmentation patterns produced by modern silviculture truncate succession at about 40 to 80 years.

Natural fragmentation probably has less impact on spotted owls than does fragmentation caused by logging and silvicultural treatment. This statement should be regarded as an informed hypothesis, however. We know of no research that has addressed this issue per se. In short, extensive fragmentation of suitable owl habitat is believed to diminish habitat quality. This statement is probably true of all fragmentation—natural or human-induced. The difference is that one is under management control and the other is not.

12. (44)

Question **Your report concludes that fragmentation of habitat from timber harvesting is one of the greatest threats to the northern spotted owl. I am disturbed that the ISC reached this conclusion even though no scientific study has shown fragmentation of habitat to harm spotted owls, and three scientific studies have found fragmentation of habitat to have no harmful effect on spotted owls. Can you explain why your Committee reached a conclusion contrary to all three of the studies on this subject?**

Answer We are not sure which studies you refer to here, but our interpretation and the interpretation of the FWS Listing Team is different from the statements in your question. Recent studies by Dr. Joseph Meyer and Dr. William Ripple indicate that core areas of spotted owls tend to be located in areas that are less fragmented than the surrounding landscape. Although the results are not conclusive, a trend for home ranges to be larger in more fragmented landscapes is apparent where old-growth and mature forests have been greatly reduced in extent.

We think that focusing only on the issue of fragmentation is a mistake; fragmentation is just a measure of the amount of structural heterogeneity in the landscape. It does not take into account the kinds or amounts of vegetation that are present, or the degree of difference between adjacent stand types. Thus, a valley that has been entirely clearcut has a very low fragmentation index, whereas the same valley with a mosaic of clearcuts and old growth would have a high fragmentation index. The mixed landscape would certainly be better habitat for a spotted owl than the clearcut. Landscape issues are complicated, and when you try to reduce them to just the issue of fragmentation, they become essentially meaningless. We considered the evidence on fragmentation, amounts of habitat used, and potential predation problems, and reached the conclusion that spotted owls probably will reproduce and survive best in forests that are relatively unfragmented.

Another problem in considering the effects of fragmentation is that habitat loss and fragmentation are highly correlated in many, perhaps nearly all, cases. Determining if decline in owl numbers or density in an area is attributable to habitat loss, to fragmentation, or to some combination of the two is difficult. We believe that habitat loss and simultaneously produced fragmentation create a set of circumstances that do not favor spotted owls.

13. (33)

Question **Fire has been a constant factor in the forest in California and parts of Oregon and Washington. How has the last 100 years of fire suppression affected spotted owl habitat? How did the eruption of Mount St. Helens affect spotted owl habitat?**

Answer Questions about fire are difficult to answer because the results of fire and fire suppression have so many facets. On the one hand, fire suppression may have improved some habitat by allowing stands to develop a multilayered overstory. On the other hand, fire suppression may have allowed large amounts of woody debris to accumulate, which then abetted very hot burns that wiped out entire stands. Also, fire suppression may have reduced the extent of habitat loss from fire, but this effect may be balanced with the increased incidence of human-caused fires as a result of increased presence of people in the forests. Under fully natural conditions, fire was an unquestionably important factor in maintaining the multilayered structure of the forest preferred by spotted owls. This structure may be difficult for managers to create because management goals typically have just the opposite effect of fire. Fires tend to kill the small understory trees and leave the large overstory trees unharmed, but management is usually aimed at removing the large overstory and releasing younger trees.

The eruption of Mount St. Helens leveled some 60,000 acres of good spotted owl habitat that harbored pairs of owls. Many years will pass (80 to 150) before most of the area is again suitable for spotted owls. Catastrophic events such as occasional large fires, volcanic eruptions, windstorms, and other natural events can negatively influence owl viability over the long run. A better understanding of the frequency, extent, and probable location of such events and their short- and long-term effects on owls and owl habitat would be useful in providing for long-term management.

14. (128)

Question **Will information from the surveys now being conducted on one million acres of State and private second-growth land be important to defining the nature of suitable spotted owl habitat in Oregon?**

Answer We have not seen the information, but we hope it will help define suitable habitat. Simply describing vegetative conditions where an owl has been located does not by itself provide a sufficient definition of suitable habitat, however. What proportion of the population of owls selects each vegetative condition must also be known. The habitats selected most consistently are likely those providing owls better resources, and in which owl pairs are more fit for survival and reproduction. Searching a particular type of habitat, finding an individual organism there, and analyzing the vegetative conditions is not a scientific method of determining suitable habitat. We expect the studies you have cited to follow strict scientific methods; then, they will provide useful information to expand our understanding of spotted owl habitats.

The Strategy

Scientific Credibility

15. (12)

Question **Your report is described as "credible." What exactly makes it credible?**

Answer The scientific credibility of the conservation strategy we have presented results in part from use of the scientific method in its development. The key features of the plan (including the geographic distribution, number, size, configuration, and connectivity of HCAs) were all tested with the best available quantitative data and other information, including modeling. When these data suggested conservation responses other than those in the tested strategy, the plan was adjusted accordingly. After several such tests and adjustments to their results, the plan conforms with current understanding of all aspects of the biology of the northern spotted owl.

Credibility also derives from the credentials, experience, reputation, and "credibility" of those who prepare any report. The ISC team members were selected with these criteria in mind, and information on each team member—detailed in the ISC report—can be readily evaluated. Each Federal agency concerned with the northern spotted owl was represented—The Forest Service (FS), the National Park Service (NPS), the Fish and Wildlife Service (FWS), and the Bureau of Land Management (BLM). Each State wildlife agency (California, Oregon, Washington) was represented. Academia, industry, and environmental organizations were represented. All representatives had experience and credentials appropriate to the task, and 13 of 17 team members had long-term experience with spotted owl research, management, or both.

How a team operates is also important to credibility. The process we used was open: all sessions (including field trips) could be attended by anyone who cared to participate, for the first 4 months of the 6-month process. During the last 2 months, the 17-person team worked in relative seclusion to prepare the final report.

All (we believe) pertinent published literature and reports on spotted owls were examined, and information considered germane was synthesized and used in our deliberations. All ongoing research known to us was reviewed. Field biologists doing spotted owl monitoring or management were consulted. Federal land managers were interviewed in their offices and in the field. We consulted with leading experts in silviculture, ecology, wildlife biology, and conservation biology. The report was subject to peer review by reviewers selected, at our request, by the presidents of five learned professional societies (The Wildlife Society, Society of American Foresters, Society for Conservation Biology, The American Ornithologists' Union, and The Ecological Society). The final report carefully documents all aspects of the process. Scientific credibility is accorded by the scientific community; peer review and subsequent supporting letters from learned societies indicate that the report is scientifically credible.

16. (2, 155)

Question **Does the ISC consider the proposed strategy optimal for the northern spotted owl? Do you think that a less-optimal approach would suffice to save the owl but without such devastating economic impacts? Do experts on the northern spotted owl concur that the Committee's conservation strategy is the best one for protecting the owl?**

Answer The ISC strategy is not the optimal strategy. The biologically optimal strategy would be to stop all cutting of presently suitable habitat and near-suitable habitat immediately and to grow much forest land back to suitable habitat over the entire range of the owl. The proposed strategy is a compromise that gives a good probability of success in preserving the owl in viable numbers, well distributed across its range, and allowing continued cutting of some suitable habitat. The strategy could easily be made more optimal for the owl by increasing the number and size of the Habitat Conservation Areas (HCAs), decreasing the distance between them, improving habitat within and between them, extending the strategy to private lands, and so on. Each such action would cause further declines in the timber supply. The ISC strategy allows a possible reduction of 50 percent in the extant population. This reduction is likely unprecedented in a management strategy proposed for a threatened species.

Most, if not all, spotted owl experts (including those on the ISC) agree that stopping all harvest of suitable owl habitat immediately and the soonest possible recruitment of additional suitable habitat would be best for the owl.

17. (52)

Question **In your conservation strategy for the spotted owl, did you calculate confidence intervals or other statistical measures for defining the scientific certainty of your conclusions?**

Answer Whenever possible, appropriate statistical methods were used to verify the validity of our conclusions. Estimates of many parameters, including the finite rate of population change, for example, were tested for significance—that is confidence intervals were calculated as part of the test. The assertion that owl populations are declining was supported for two of the three populations tested. An additional example of the use of statistical methods was our investigation of the relation—found to be positive—between occupancy rates of random sample areas (appendix K, p. 217, ISC report) and the amount of suitable habitat.

18. (53, 57, 81)

Question **Do you have any ways of calculating how likely to be correct your conclusions about the current and future prospects of the spotted owl are? Do you have any way of knowing if your best judgment may be incorrect?**

Answer No satisfactory model exists for computing an exact persistence likelihood for the spotted owl—or any other output from the forest. But owl management scenarios can be compared and ranked in terms of how likely they are to contribute to the species' long-term viability. For example, we can state that the system of HCAs we have proposed in our conservation strategy has a substantially higher likelihood of

providing for long-term persistence than a system of clusters of 2 to 5 single-pair Spotted Owl Management Areas (SOHAs). We can also state that if current rates of habitat loss from timber harvest continue into the future, the population will continue to decline.

Anytime a decision is made in the absence of complete knowledge, whether the correct decision has been made cannot be known with certainty until the event has happened. Natural resource management decisions are subject to similar uncertainty, as are all plans derived by human beings and in all fields that require management decisions. That is why we stressed in the report—and in our answers to these questions—that application of this or any such conservation strategy should be treated as a working hypothesis, to be validated and amended as indicated by research and monitoring.

Note that, although no satisfactory mechanisms exist to compute precisely the amount of timber that is apt to be available in 100 or even 10 years, we predict timber harvests on the best estimates we can make now. Concern about predictability of outcomes in natural resource management should be the same across all management scenarios, including those predicting timber, water, grazing, wildlife, and recreation outputs from managed forests. Included are such questions as long-term preservation of site productivity under forest management. The world of natural resource management is filled with various degrees of uncertainty, but it is a general condition and not limited to managing for spotted owls. Questions about the reliability of predictions should also be asked about economic and social analyses that project consequences of the strategy we propose. Management of biological systems is uncertain by its nature.

19. (49, 50, 51)

Question

Do you agree that wildlife biology—the study of animal behavior—is inherently more subjective than sciences like chemistry or physics? Do you agree that scientific certainty is inherently lower in wildlife biology than in the "hard" sciences?

Answer

The discipline of wildlife biology consists of considerably more than ethology, the study of animal behavior. Wildlife biology includes—among other disciplines—anatomy, physiology, genetics, animal health, parasitology, nutrition, veterinary medicine, systematics, bioenergetics, systems analysis, pathology, population biology, plant and animal ecology, biometrics, and other biological subdisciplines—as well as ethology.

In general, the study of wildlife biology, like that of chemistry or physics, is the investigation of the patterns and processes that characterize the system of inquiry. All three disciplines attempt to make predictive statements about the behavior of systems and must include the probabilistic nature of either biological or physical processes. Predictive uncertainty must not be confused with subjectivity.

Biological systems are no less deterministic than physical systems. Predictive statements about the behavior of both biological and physical systems entail degrees of uncertainty. We are, for example, very uncertain about the future climate of the Earth, even though climatological studies are almost exclusively based on physics. Predictive uncertainty increases, as a rule, with complexity. Life systems are inherently complex.

20. (45, 46, 47)

Question **Isn't the field of "conservation biology," on which the ISC strategy is based, a brand new scientific field that developed during the 1980s and is recognized, even by its defenders, to be in its infancy—a field without a standard textbook and in which no classes have been offered in universities until the past 3 or 4 years? Would the Committee agree that the field of conservation biology has not yet been fully accepted as an area of scientific endeavor equal in rigor to sciences like physics and chemistry? Have any conservation strategies for wildlife species, based on principles of conservation biology, ever been tested in the real world?**

Answer Some people refer to conservation biology as new, but it is new only in label, not in substance. Conservation biology synthesizes information from and applies the resources, tools, and techniques of both pure and applied sciences (including wildlife biology, theoretical population biology, ecology, and genetics) to resolve the challenges that accelerating loss of biological diversity presents. Other roots and facets of conservation biology include plant geography, zoogeography, and landscape architecture, which are disciplines that date back more than a century. What might be fairly viewed as new is the systematic application of rigorous empirical data and theoretical models in the conservation planning arena—an arena that historically has rarely included scientific methods as the basis for problem solving. The ISC report is no more based on conservation biology than it is on wildlife biology, forestry, ecology, biometrics, genetics, ethology, and other biological fields.

The component areas of scientific endeavor that make up the multidisciplinary field of conservation biology have long been represented in university curricula and general texts. Courses in conservation biology per se generally use three basic references: *Conservation Biology: An Evolutionary-Ecological Perspectives* by Soulé and Wilcox; *Conservation Biology: The Science of Scarcity and Diversity* by Soulé; and *Viable Populations for Conservation* also by Soulé, as well as diverse source material from other established fields.

The ISC wholly disagrees with the contention that conservation biology lacks rigor. Indeed, the application of scientific methods to conservation planning assures that process is as rigorous as other sciences, including chemistry and physics. That the hypotheses and experiments in different fields can differ greatly in structure, content, and complexity is a given; all else is value judgment.

In its reauthorization of the Endangered Species Act (ESA) in 1982, Congress facilitated the resolution of conflicts between land development and conservation with the so-called "Habitat Conservation Plan" process of Section 10 (2). Congress justified the amendment by pointing to the San Bruno Mountain Habitat Conservation Plan, which focused on the mission blue butterfly as a model. Since the amendment, habitat conservation plans or agreements have been successfully implemented for the fringe-toed lizard, the Bay checkerspot butterfly, and several other species.

21. (37)

Question **Dr. Eric Forsman, ISC member, has stated for 15 years that spotted owls require old-growth forest to survive. Is the ISC report credible in light of the fact that Dr. Forsman wrote the section that concludes spotted owls require old-growth forest to survive?**

Answer Dr. Forsman has consistently maintained that spotted owls in Oregon and Washington prefer older forests. He has never published anything that says spotted owls occur only in old growth. He has pointed out that spotted owl densities in Oregon and Washington tend to be relatively low in young, even-aged forest and relatively high in old-growth forests. These findings have been confirmed by other researchers. Dr. Forsman and many other researchers have also pointed out the consistency with which spotted owls in Oregon and Washington select older forests for foraging and roosting, as evidence that such forests are the preferred habitat of the subspecies. We know of no data that refute these findings. To suggest that Dr. Forsman may be biased is not in keeping with the high regard in which he is held by his colleagues—including all the members of our team.

Dr. Forsman is one of the world's most knowledgeable scientists on spotted owls and is so recognized by that part of the scientific community concerned with owl biology. His contributions to the ISC's work add scientific credibility to the effort. Any scientific treatment of the spotted owl that did not include Dr. Forsman's work would be flawed. We know of no scientist experienced in the field who questions his knowledge, skill, dedication, or ethics. His monograph on the northern spotted owl, the classic publication on the subspecies, was recognized by his peers when he was given the Publication Award of The Wildlife Society (the professional society for wildlife biologists).

The ISC decided through consensus which team member should address each subject in the report. Each chapter had several primary authors, and the entire ISC reviewed all of the chapters. The complete report was then peer reviewed. We agreed, again through consensus, that we were all proud to sign the report. As a result, the report in its entirety is a Committee report—each and every part. The ISC, collectively, stands by all the chapters in the report and the integrity of each and every member of the team.

Nowhere does the ISC report state that spotted owls "require" old growth. In fact, the ISC report emphasizes that appropriate stand structure is the significant attribute—not age. At present, however, the vast majority of stands with appropriate structure are in mature and, especially, old-growth forests.

22. (108)

Question **Why does the ISC believe the Committee should collect information that would allow the strategy to be defended in a court of law?**

Answer The matter of a conservation strategy for the spotted owl is obviously a contentious issue that has already engendered several legal actions. Expecting HCA size to become a matter of some similar attention, should our recommended strategy be implemented in whole or in part, is thus probably not unreasonable. If newspaper accounts are to be believed, both industry and environmental advocates have assured the public that court actions are imminent. Therefore, an assumption concerning defense in a court of law seems quite reasonable to us.

Size of the HCAs

23. (10, 23)

Question **On 6 February 1990, ISC member Dr. Jared Verner wrote a professor in Finland asking for information about birds on islands in the Baltic Sea that the professor had studied. Dr. Verner wrote: "Our thoughts are converging on about 20 pairs [for HCAs], but we lack good empirical evidence from birds to help us make that decision...." As of 6 February 1990, did the ISC lack good empirical evidence to support your decision on the size of HCAs? Why did your Committee first decide how large the HCAs should be, and then begin looking for empirical evidence to support your decision?**

Answer On 6 February 1990, we were still seeking all the evidence we could find to test our hypothesis the HCAs with 20 or more pairs would provide for relatively long-lasting subpopulations of spotted owls. We did not decide how large the HCAs should be and then seek empirical support for that decision. The ISC considered many alternative HCA sizes and tested them with empirical and theoretical (modeling) data. We soon recognized that aggregations of multiple pairs of spotted owls would be sustained much longer than single pairs. We reached a tentative conclusion to recommend large blocks containing some number of multiple pairs well before February 6.

Our initial efforts to map large blocks of habitat led us to conclude that a size large enough for about 20 pairs of spotted owls was feasible in terms of how habitat existed on the ground. Locating reasonably compact tracts of suitable habitat with more than 20 pairs proved difficult because of previous loss of habitat to fire and logging. At that point, we began to seek empirical and modeling data to test the hypothesis that 20-pair HCAs would be too small for subpopulations to persist for several decades with low-to-moderate rates of immigration and emigration. Both types of data supported a conclusion that subpopulations of 15 or more pairs tend to survive for such reasonably long periods, if they are supplemented with some amount of exchange of individuals between subpopulations. Based on monitoring results to date, however, we know that all periodically occupied territories are unlikely to be occupied by breeding pairs at any given time. Consequently, we concluded that HCAs should be large enough to provide for 20 or more potential pairs, which we anticipated will give reasonable assurance of at least 15 actual pairs occurring per HCA at any given time.

24. (28, 103)

Question **The ISC recommendation that HCAs be large enough to hold 20 pairs of owls is based on studies of birds on islands off the British coast and the coast of California. Do birds living on islands differ from birds living in the forests of the Pacific Northwest? Why do you consider it acceptable to use information from various places (Hawaii, Great Britain, Arizona, New Mexico) to develop criteria for the size and spacing of the HCAs and yet you apparently reject information from northern California in developing size and quality criteria for habitat suitability in areas outside of California?**

First, we did not use information from other places to reach decisions about the spacing of HCAs; those decisions were based on known dispersal distances of 56 juvenile northern spotted owls.

Second, we assume that the information you refer to from northern California is that spotted owls are breeding in relatively young, second-growth forests in the coastal redwood belt of northwestern California. Our answer is based on this assumption.

Some aspects of animal biology tend to be more consistent from species to species than others. This consistency is part of the reason that medical researchers have been able to use a variety of nonhuman animals in studies that later have significant applications in human health. Of course, the best test comes when the actual target population provides the data. When seeking to determine the number of pairs of spotted owls that could interact in a subpopulation with a reasonable expectation of being intact in, say, 75 to 100 years, we could not use information based on studies of spotted owls because that information does not exist. But the components of population ecology that would determine what that number of pairs might be are more similar in other bird species than, say, in lizards or small mammals. Consequently, we sought information that would likely be most comparable to spotted owls—information from other bird species.

When possible, we sought information from relatively large-bodied, nonmigratory birds (see explanation in appendix O, p. 288, 289, ISC report). These species all had traits similar to owls that would be important in determining some relatively stable population size. For example, all are capable of flight; all have annual reproductive cycles and potential reproductive rates that are similar; all tend to disperse from natal areas to seek mates elsewhere; all communicate vocally (such communication is important in locating mates, and even in locating general areas in which to seek mates); and probably all have floaters (nonterritorial birds) as part of their population, when populations or subpopulations are at or near the carrying capacity of the habitat. The general similarity in these attributes among species we considered led us to believe that a subpopulation of about 15 to 20 pairs would be about equally stable for all relatively large-bodied, nonmigratory bird species. Consequently, inferences from one species meeting those criteria likely apply generally, for other such species, regardless of where they are from or the general habitat type to which they were adapted.

Most of the bird species, especially in the British island examples, are strong fliers, so the relatively short water gaps (mean distance = 4.4 miles) between islands and mainland are probably not extreme barriers to their dispersal. Similarly, spotted owls can probably disperse relatively successfully through a forest with reasonably continuous distribution of relatively large trees. The dispersal distances required by the separation between HCAs proposed in our strategy, however, are greater than those between the British islands and the mainland. Consequently, the minimum size of a relatively stable population of spotted owls would probably be somewhat larger than indicated by the British island study. On the other hand, it is probably somewhat smaller than indicated by the California Channel Island study. We believe our recommendations concerning the number of pairs needed in HCAs are consistent with these interpretations.

Plant communities, on the other hand, tend to be very different in many of their response patterns. Redwoods in coastal California attain conditions in 60 to 80 years that structurally resemble stands in the Oregon Cascade Range or in coastal Washington that we know require at least 150 years to develop. Generally, Douglas-fir trees cannot attain diameters at breast height of 30 inches or more in 60 years. Growing conditions differ, and tree species differ. North-coastal California is blessed with high rainfall, generally long growing seasons, coastal fog, and good soil. Redwood trees tend naturally to grow relatively fast, and new trees grow from the stumps of cut trees. They thus use the extensive root system already in place, which enables them to regenerate faster into stands of large trees than do Douglas-fir. Information from Oregon and Washington is already available to show that forests there cannot attain conditions suitable for breeding spotted owls as quickly as can redwood forests in coastal California.

25. (168, 171)

Question **How would you define the term "viable" spotted owl habitat? How many acres in the average HCA would meet this definition?**

Answer The term "viable spotted owl habitat" is not one we use. "Suitable," "marginal," and "superior" habitat are the terms used in the report. Were we to define viable spotted owl habitat for a single pair, it would be habitat that provides for all the life needs of spotted owls—including foraging, roosting, dispersal, nesting, and successful fledging of offspring—over a prolonged period. Such habitat would also allow for variations in prey densities and environmental conditions, such as weather and catastrophes, so that the site is occupied over time as much as possible; would become readily recolonized as owls die or emigrate; and would have a high likelihood of maintaining adequate forests in suitable condition over the long term. This definition is closest to what we term superior habitat (appendix F, ISC report).

26. (98)

Question **If the northern spotted owl depends on old-growth timber for essential habitat, why are managed, second-growth forests included in the proposed HCAs?**

Answer Where Federal lands presently occupied by second-growth forests are included in HCAs, the intention is that these forests will mature to become suitable habitat for reproducing pairs of owls. To succeed over the long term (100 years), suitable habitat must be replaced at an equal or greater rate than it is lost. Therefore, recruiting habitat from younger stands maturing into suitable habitat is essential and must be accounted for in long-range plans. No dependence on such habitat to support owls in suitable habitat is expected in the near term.

27. (172)

Question **What percentage of the average HCA is now cut over, or in second-growth forests of less than mature forest age?**

Answer We estimate, without detailed analysis, that about 40 percent of the Federal lands within HCAs have been logged or are in second growth.

28. (139)

Question **The ISC report suggests protecting some second-growth areas in northwest Oregon and southwest Washington that we understand are not owl habitat today. I believe the Committee's view is that these areas will eventually become owl habitat. Given the possibility of natural events such as fires and windstorms, have you looked at the statistical probability that these areas can be expected to become owl habitat (that is, old growth)?**

Answer We conducted no statistical analysis of the effects of catastrophic events such as fire on the future structure and composition of second growth. The reason was that no studies to date have quantified the frequency, location, intensity, and effects of catastrophes and their effects on second growth. Studies currently underway will analyze past events and management activities in managed stands, and they will begin to provide such knowledge. This subject requires further study and monitoring, regardless of the assumptions made in the owl plan. The statistical probabilities would vary from stand to stand for a variety of reasons. That such a stand could attain 100+ years of age is just as likely as for any stand managed for timber. We do not assume that the stand would ever be old growth, only that it would, likely, in time, become suitable habitat for owls.

On the average, suitable spotted owl habitat, which includes both superior and marginal habitat, comprises about 50 percent of the total acreage in HCAs on National Forests. On BLM lands, the percentage of suitable habitat falls to 25 to 30 percent. This lower percentage is mainly because designated HCAs include previously logged areas that we expect will grow back into suitable habitat and remain in such condition for a much longer time than would occur in forests managed for timber production.

29.

Question **The ISC strategy contemplates that 1,750 to 2,000 pairs of spotted owls will be permanently protected on Federal lands alone. Fewer than 1,750 pairs of spotted owls have actually been inventoried on Federal lands to date. Is the strategy intended not merely to prevent a decrease in the spotted owl population but actually to produce a larger population than is known to exist today?**

Answer No. About 2,000 pairs of northern spotted owls have been located in the past 5 years. We estimate that 3,000 to 4,000 others—in pairs and singles—exist currently. Few, if any reserved areas, which make up the core of this strategy, have been completely inventoried for spotted owls. The conservation strategy we propose would provide for an estimated 1,772 owl pairs—about 44 to 59 percent of the number currently estimated to exist. The proposed conservation strategy envisions a significant decrease from current numbers.

Location of the HCAs

30. (170)

Question **How were the individual spotted owl HCAs defined geographically?**

Answer The process included examining maps provided by the BLM, the NPS, and the National Forests that portrayed spotted owl habitat and showed locations of known spotted owl pairs. The habitat was classified according to whether it was in Wilderness Areas, lands allocated for uses other than timber production, or lands suited for timber production. Starting, where possible, from blocks of spotted owl habitat in Wilderness Areas or other areas not designated for timber production—to minimize the effect of the strategy on timber supply—we developed a network of HCAs using the standards and guidelines outlined in the ISC strategy (appendix Q). Based on dispersal data for juvenile owls, we spaced the larger HCAs (for 20 or more pairs) no farther than 12 miles apart and smaller HCAs (for less than 20 pairs) no farther than 7 miles apart. Amounts of suitable spotted owl habitat and presence of spotted owl pairs guided the exact placements. We ran through this drill enough times to obtain the most efficient placement in terms of satisfying the needs of the owl and minimizing impact on timber supply. Other arrangements are obviously possible and are allowed if the standards and guidelines are followed and no net loss of owl pairs occurs.

Distance Between HCAs

31. (25, 117, 118, 119)

Question **The ISC used something called the "Delphi approach" to decide how far apart the HCAs should be. The Delphi approach is a process of using professional judgment to make a decision where scientific data are unavailable for making it. Do you agree that any time the Delphi approach is used, reasonable, responsible people could easily reach different conclusions about the correct decision—such as in the issue of how far apart HCAs should be?**

Answer The Delphi approach cannot function, as the question suggests, in the absence of data. Rather, it is used when information is incomplete. The more information available, the more reliable the conclusions that can be drawn from it. In determining the spacing between HCAs, we had extensive, but incomplete information on the dispersal capabilities of spotted owls. Consensus was not immediately reached among the ISC on the spacing for HCAs as supported by the dispersal data. Consensus resulted from an iterative process in which all members of the team presented their assessments and all members had the opportunity to reassess positions in light of arguments presented by other team members and advisers.

Based on our lengthy discussions of appropriate distances between HCAs, we concluded that the distance between large HCAs (20+ pairs) should be within the observed dispersal distance of at least two-thirds of all radio-tagged juveniles. This recommendation was included in our draft report, which was reviewed by five technical experts selected by professional societies. They were aware that this decision was based on a Delphi approach (best collective judgment of experts in the

field considering what empirical data were available). Only one reviewer, Dr. John Wiens, questioned this process. In our follow-up conversations with Dr. Wiens, he responded that he could suggest no better method for arriving at the decision and that he was satisfied with the two-thirds guideline that we adopted.

Note that the Delphi approach was used only once in developing the ISC strategy—to determine the distance between HCAs of 20 or more pairs. Our two-thirds guideline obviously struck a balance between opposing extremes, a balance that our Committee believed would produce a high likelihood of long-term viability of the owl.

Given the amount of available dispersal data and the task of developing a conservation strategy for the long-term persistence of the spotted owl, we believe that groups of other scientists with our collective knowledge about general animal ecology, wildlife biology, the vital role of dispersal in population dynamics, and—most important—spotted owl biology and population dynamics would reach similar conclusions about this aspect of our strategy. And we believe if a different consensus were reached, it would more likely favor HCA's being closer together rather than farther apart.

32. (16, 120, 122, 123, 124)

Question **I understand that the data for juvenile dispersal estimates were based on radio-telemetry studies, and that significant mortality has been documented from placing radio transmitters on juvenile spotted owls. In the report, you note that existing research shows that the average distance for dispersal of owls in the field was 18 to 19 miles, even when the owls carried transmitters. Why did you use these data to support assigning a 12-mile maximum distance between the large HCAs, and even shorter distances between smaller HCAs?**

Answer Mortality has been documented among juvenile owls equipped with radio transmitters, but whether such mortality is different from that of juveniles without radios has not been proved. Even assuming, however, that radio-tagged juveniles have a higher mortality rate than do unradioed birds, our analysis of available data from 56 radio-tagged juveniles failed to show any trend in dispersal distance related to how long a given juvenile carried a radio transmitter (see appendix P, p. 306, ISC report). Instead, dispersing juveniles apparently moved quickly about as far away from their natal area as they were ever likely to go. An earlier-than-normal death, therefore, seems unlikely to measurably bias our estimate of mean dispersal distance. We believe these data are the best available, and we were comfortable using them for this purpose.

The only alternative data on dispersal distance came from birds wearing aluminum leg bands. Probably all experts would agree that aluminum leg bands are much less likely to affect a bird's behavior and survival than would a heavier, bulkier, harness-mounted, back-pack radio transmitter. The median "final dispersal distance" of radio-tagged birds was 16.4 miles, and the comparable value for banded birds was 8.4 miles. Because data from banded birds were constrained by search area (which would tend to produce lower than true estimates of mean and median dispersal distances), we judged the data from radio-tagged birds likely to be more accurate (see appendix P, p. 307, ISC report).

If we erred in judging how far apart to place HCAs, the dispersal distances were more likely over rather than under estimated, considering the results from the banding data. Therefore, a much better argument can be made that the distance between HCAs should be decreased rather than increased.

33. (84, 120)

Question **What was the scientific method used to verify whether the distance between HCAs called for in the plan is in fact required for the protection of the spotted owl?**

Answer Our conservation strategy is a hypothesis (or, more correctly, a set of hypotheses) that only time, monitoring, and further research can confirm or deny. Thus, the scientific method used is one of hypothesis testing. Such testing would be needed for any conservation strategy, however, or for any other natural resource management strategy including timber management.

34. (32)

Question **Given the inherent stability of HCAs containing 15 or more pairs, what is the rationale for spacing HCAs such that two-thirds of the juveniles produced will be able to successfully disperse between HCAs? Why not one-third or one-half, as opposed to two-thirds? What is gained or lost by changing the distance between HCAs to meet these different percentages?**

Answer First, the conclusion that HCAs with 15 or more owl pairs are "inherently stable" is misleading. Such HCAs would tend to contain owls for a much longer period than, say, HCAs of only 5 or 10 pairs, but we believe that both the empirical and modeling data show conclusively that even units of 15 pairs would ultimately decline to extinction without periodic immigration of owls from other areas. The HCAs depend on each other—with the units connected in what is called a metapopulation—to maintain numbers of owls in all units. When conditions are good for breeding in one HCA, they may be poor in another, so a drop in numbers in the poor site could be compensated by immigration from the good one. In another year, conditions on these sites may be reversed, so the net exchange of birds would go in the other direction. We believe that dynamics such as these are essential to long-term viability of the spotted owls. Such interactions would be absent without many HCAs located close enough to each other to facilitate movement of owls among them.

Second, even if time verifies our hypothesis that 15-pair HCAs would be enough, in a well-distributed metapopulation of such units, to provide for long-term viability of the owls, providing sufficient habitat for only 15 pairs in each HCA will not give the result intended. Because birds die or leave their territories from time to time, at any given moment an HCA large enough for only 15 pairs would be expected to have fewer than 15 full pairs that are compatible and capable of breeding. For this reason, HCAs need to provide for more than 15 pairs. The information available to us indicated that 20 or more pair HCAs would be sufficient to provide the cushion needed.

Third, guidelines for spacing were based on observed dispersal distances of 56 radio-tagged juveniles (see table P1, p. 305, ISC report) and all other information yet available on the dispersal behavior of juvenile spotted owls. Success of our

proposed strategy depends on frequent dispersal of juveniles between HCAs, which means that they must be separated by distances well within the known dispersal ranges of juveniles. We were unable to determine a fully objective method to set a safe distance between HCAs, based on owl dispersal distances. That the distance need not include the observed dispersal distance of all juveniles studied seemed obvious to us. But we also believe the distance must be well within the known dispersal distances of at least half of all juveniles. We concluded that the dispersal distance between large HCAs (20+ pairs) should be within the observed dispersal distance of at least two-thirds of all radio-tagged juveniles.

Just because the HCAs are spaced within the dispersal distance of two-thirds of marked birds does not mean we can assume that two-thirds of them will indeed find another HCA and be able to establish a territory there. Some two-thirds are assumed to have a chance to reach another HCA; the number that actually do succeed are likely well below two-thirds. Of those that do reach another HCA, only a fraction will find a vacant territory.

What would be gained or lost by changing the distances between HCAs to something more or less than our two-thirds guideline could not be fully assessed until some different rules were adopted. Understand, of course, that uncertainty also exists with our guideline. We have generated a hypothesis that needs to be tested by monitoring. But lowering the standard to, say, one-third (distance enough to include the known dispersal distance of one-third of observed juveniles) would have three effects. First, many fewer HCAs would be provided because they would then be farther apart, so much less total habitat would be provided to assure long-term viability of spotted owls. Second, the lower number of HCAs would reduce the total number of owl pairs provided for in HCAs. Third, the effectiveness of dispersal by owls between HCAs would be significantly reduced, making individual units of 15 to 20 pairs less stable because of reduced immigration of birds from other areas. Such a change in the guidelines would reduce the likelihood of long-term viability of the northern spotted owl an unknown but significant amount. The ISC considered such an option to produce an unacceptable risk for the owl. Accepting a reduction of present owl numbers by, say, three-fourths compared to the currently proposed one-half is apt to lack both scientific credibility and legal acceptability.

Increasing the guideline to include the known dispersal distance of, say, three-fourths of all observed juveniles would have the opposite effect: it would increase the total amount of habitat in HCAs for owls; the total number of owls in HCAs; the effectiveness of dispersal by owls among HCAs; and the likelihood of long-term viability of the northern spotted owl an unknown amount.

Our two-thirds guideline obviously struck a balance between opposing extremes, a balance that the ISC believed would produce a high likelihood of long-term viability of the owl. Furthermore, if this question were addressed by other teams of scientists with our collective knowledge, we believe they would settle on a guideline very near the one we proposed. If expert opinions differed, we believe they would most likely differ in the direction of giving more consideration to the banding data. In either case, such assessment would result in reducing the distance between HCAs.

Professional Judgment in HCA Design

35. (55)

Question **Do you agree that the Committee sometimes did not have reliable empirical data on which to base its recommendations, that you then had to use your best judgment based on limited data, and that a substantial amount of such professional judgment is inherent in your proposed strategy?**

Answer Empirical data were available for analysis and inference for all key components of our conservation strategy. Obviously, all scientists lust after more empirical data no matter how much such information is at their disposal—as do we. The information on spotted owl biology is extensive and improving rapidly. No discoveries in the past 5 years have shaken the basic information that undergirds the ISC strategy. As we stated in our report, we believe inadequate or incomplete understanding of owl biology is no excuse for inaction.

If by "professional judgment" you mean appropriate analysis, and the rigorous use and examination of available data, the answer is yes. If you mean that much of the work was based on subjective and nonrigorous interpretation and lack of analysis, the answer is no. The maps of HCAs in Washington, Oregon, and Califomia are the result of tests of many hypotheses, in which we used all available data on the spotted owl to attempt to disprove. The resulting conservation strategy is one that was supported by the available data. Where professional judgment was used, the identification of risk was clear and is so noted in the ISC report. The degree of professional judgment exercised was not more (and quite likely less) than is commonly applied in other branches of natural resources management.

Professional judgment was never invoked in the total absence of empirical data. In some areas, however, additional data would have increased our degree of certainty. One example is where we estimated probable rates of occupancy in HCAs from presence of suitable habitat. Another is where we used data from other species to provide insights into appropriate subpopulation sizes for HCAs. These instances are clearly and intentionally pointed out in the ISC report. Where judgment was applied, it was the consensus of a group well qualified to exert such judgment. Where the team used professional judgment, it was based on having a team that included 13 members well experienced in owl research and management, and all team members were highly qualified professionally. That team had just completed the most comprehensive review of literature, management, ongoing research, monitoring, and applicable ecological theory ever undertaken on the northern spotted owl. The collective judgment of such a team should not be taken lightly. Collective professional judgment is always brought to bear in producing any management plan, whether for determining how a lawyer represents a client or how a timber management program is derived. The test is whether that judgment is indeed expert, based on existing and accepted theory, tested by what empirical information is available, and open to peer scrutiny. We strived to meet all of those criteria.

In our professional judgment, the extinction of the owl is an irreversible process; the reservation of suitable habitat from cutting is not. If monitoring indicates that the owl populations are faring better than we presently anticipate, or if research and adaptive management make possible producing owls in managed forests at acceptable densities, forest stands of suitable habitat that are reserved by the proposed strategy can be quickly put on the market, cut, and processed into wood products. Given present knowledge, we can cut suitable owl habitat very quickly but replace it only very slowly over several hundred years—if at all.

Use of Modeling To Test HCA Design

36. (111, 112, 113, 114)

Question **Were Dr. Noon's models developed during deliberations of the Committee? Were they published or reviewed before the ISC report was released? Have they been tested or validated in any way?**

Answer Two models were used to test aspects of the conservation strategy. Dr. Noon was not the primary researcher in developing either model, so referring to them as "Dr. Noon's models" is inappropriate. Dr. Roland Lamberson, Department of Mathematics, Humboldt State University, and Dr. Robert McKelvey, Department of Mathematics, University of Montana, were the primary developers of the individual territory model, which has not been published. It has been presented, however, at several scientific meetings, including the annual meetings of the American Institute of Biological Sciences and the Resource Modeling Association. The cluster model, developed primarily by Dr. Lamberson, has not been published.

The models were reviewed by Dr. Russell Lande, University of Chicago; Dr. John Wiens, Colorado State University; Dr. Michael Gilpin, University of California; and Dr. Larry Harris, University of Florida. Dr. David Anderson, FWS, also received drafts of appendix N, which contained the models, for his review and evaluation. In addition, the ISC had informal meetings with Dr. Mark Boyce, University of Wyoming, and his postdoctoral associate, Dr. Joseph Meyer, at which the details of the model were discussed. The individual territory model is similar to a model developed by Dr. Lande, which has been peer reviewed and published. The cluster model is similar to a model developed by Mr. Daniel Doak, University of Washington, which was peer reviewed and published.

The individual territory model and a prototype version of the cluster model were developed before the first convening of the ISC. During our deliberations (October to March), the cluster model was extensively developed and refined.

The models have not yet been validated, but they make several predictions, some of which can be tested over relatively short periods (3 to 5 years). Testing these predictions is largely contingent on implementing the conservation strategy suggested by ISC. Testing model predictions was viewed by the ISC as an integral part of implementing the strategy and was framed in the context of adaptive management. The models have, however, been informally tested. That is, we have asked whether model output is consistent with our understanding of spotted owl biology

and life history and consistent with insights gained from the study of the population dynamics of other wildlife species. In general, validation of models that project the population statistics of long-lived organisms is difficult. One reason is that consequences of current management decisions on species' population status are often not expressed until well into the future. That is, substantial lags occur in the response of the population to significant changes in its survival and fecundity (birth and death) rates. The existence of these lags is one of the main reasons that population modeling is a necessary component of conservation planning.

Note that no decisions in the ISC strategy were based on models alone. Each decision point (hypothesis) was tested by applicable theory, empirical data, and a model. The use of models was only one tool used at each decision point.

37. (110, 116)

Question **Was the model of clusters of spotted owl territories the tool used to select the correct size of HCAs? Does the model ignore the several million acres of permanently protected spotted owl habitat outside of the HCAs?**

Answer The computer model was not used to select the size of HCAs; it was used to test various hypotheses about the size and their likelihood to provide for long-term occupancy by pairs of owls. The original set of hypotheses on HCA size was based on population studies of other wildlife species occupying patchy environments; constraints on HCA size set by the forested landscape in Washington, Oregon, and California; and the distribution of current and potential suitable owl habitat.

All known clusters of owl pairs within Wilderness Areas and National Parks were included in HCAs, as a first step, to minimize the effect of the ISC strategy on timber supply. The ISC did not ignore these areas. Acres set aside from timber harvest, for whatever reason, are often confused with acres of suitable owl habitat; the amount of owl habitat in Parks and Wilderness Areas is some fraction of the forested acres within them. In contrast, data suggest that habitat within reserved lands on National Forests (including Wilderness Areas) is not, on average, as suitable for spotted owls as habitat in nonreserved lands suitable for timber harvest (see appendix K). As a result, no large owl population centers were assumed in our simulation models to exist outside of the HCAs. Note, though, that as much as 40 percent of the acreage in HCAs was already reserved from timber harvest for other purposes, further casting doubt on the assumption of "several million acres" of owl habitat.

38. (121)

Question **Why did the ISC rely on the cluster model even though it is based on radio-transmitter data on juvenile spotted owl mortality?**

Answer No parameter estimates used in our population simulation models were based on data radio-transmitted from owls.

39. (115)

Question **Do you have any way to determine whether the models accurately represent what happens to spotted owls of the Pacific Northwest?**

Answer The structure of the models was based exclusively on our current understanding of the biology and life history of the northern spotted owl. The specific values assigned to the variables of the models were based primarily on estimates of the vital rates (survival and fecundity values) from northern California. If we used estimates of adult owl survival from the Roseburg District of BLM lands in Oregon for an example, all of our population simulations showed the owl going extinct. We were only able to demonstrate a nonzero population equilibrium based on the demographic data from the California study area. Models were not used in isolation. They were used in conjunction with theory, empirical data, and common sense. Empirical data show strong association between owls and mature and old-growth forests. Empirical data show owl abandonment of areas where suitable habitat is removed. Empirical data show that 60 to 70 percent of what was probably suitable habitat has been lost over the past 100 years. Empirical data show that at least 70,000 acres of suitable habitat has been lost per year through logging on Federal lands alone. Demographic studies show population declines. The general pattern is clear, as documented in the ISC report and the report of the FWS Listing Team. The subspecies has now been officially listed as "threatened" throughout its range. Application of common sense and logic leads to the same conclusion. The models were used to determine if the empirical evidence, common sense, and theory made sense when rigorously examined in combination. They did.

Lands Outside of the HCAs

40. (71, 146)

Question **The ISC report recommends that lands declared unsuitable for timber production under the Forest Plans not be put back into the timber base. Does this stipulation cover all types of lands that fall into this category, including the existing SOHA system, stream corridors, backcountry areas, and intensive recreation areas? What criteria were used in deciding which, and how much, forested land outside of the HCAs need be declared unsuitable for timber production for the owl conservation plan? The BLM has a much lower withdrawal than does the FS. How can the policies of both agencies meet the requirement here?**

Answer We need to clarify this question by distinguishing between our recommendations for application inside and outside HCAs. Under our proposed strategy, all lands inside HCAs (including lands now withdrawn from the timber base) would be excluded from timber harvest until research in areas outside HCAs clearly shows how to harvest timber without negatively impacting the breeding and dispersal of spotted owls. Because extensive areas of high-quality habitat for spotted owls exist outside of proposed HCAs that will likely be cut, we anticipate an eventual decline in the total number of owls to about 40 to 60 percent of their present population, if our strategy is implemented as proposed. Opportunities for the needed research are abundant and widespread outside of the HCAs. We strongly recommend that these opportunities be exploited for research and demonstration.

With one exception, all lands now designated as unsuitable for timber harvest outside HCAs would remain withdrawn from the timber base. The exception is lands now designated for SOHAs that were not included in HCAs. As specified in the rule

set (for example, see p. 29, ISC report), "At least 80 acres of suitable owl habitat should be designated as HCAs around activity centers of up to seven known pairs of owls per township in the forest matrix." The "forest matrix" is defined as all forest lands outside of designated HCAs. Many of these locations will undoubtedly be in existing SOHAs, which means that all but 80 acres of SOHAs selected to be among the seven possible activity centers per township in the forest matrix would be opened for timber cutting under our proposal. All lands now in SOHAs that are not in HCAs or other allocation precluding timber harvest and that are not selected to be one of the seven possible activity centers per township would be available for timber harvest.

Available information on juvenile spotted owls indicated that they are unlikely to restrict dispersal movements to corridors of habitat specially designed and managed for dispersal. Instead, therefore, we envision a general forest landscape between HCAs that will enable juveniles to disperse through it without too many being killed by predators or starving to death. For the most part, excepting checkerboard ownerships where timber cutting has been intensive under short rotations of less than 80 years (that is, BLM lands), current management practices should satisfy this objective over the long term. Included as acceptable dispersal landscape are visual corridors, riparian corridors, and streamside-management zones, which contain possible stopover spots. In addition, forests on lands incapable of commercial timber production because of low site index, on soils prone to slumping or with unacceptable erosion rates, and in special management areas for pileated woodpeckers and pine martens also provide habitat that we believe to be suitable to support dispersal of juvenile owls. Finally, in a fully regulated forest with a rotation schedule of only 80 years, 50 percent of the landbase would support trees at least 40 years old. Taken together, these various conditions would generally assure a forest coverage of at least 50 percent in trees at least 11 inches in d.b.h., and with a canopy cover of at least 40 percent (the 50-11-40 rule) now and for the next 100 years. Discussions with several forest managers assured us that this coverage would exist nearly everywhere in the forest matrix within the range of the northern spotted owl. Exceptions may occur where timber cutting has been unusually heavy—particularly where rotations of less than 80 years were anticipated or where managers have held roadless areas in the timber base despite their status being held in limbo, forcing premature returns to roaded areas for additional timber cutting. Where such exceptions occur, they may be symptoms of other problems related to sustained yield.

All forest components may be counted toward the 50-11-40 rule, including riparian corridors, visual corridors, and so on. Management guidelines for those components are assumed to have well-founded reasons in their own right. To move away from those guidelines would revoke the basis or justification for implementing them. Further, based on our understanding of Forest Plans and their land allocations that provide patches of habitat more suitable for owls, we determined that these areas more closely provided for the desired future conditions outside the HCAs than did the 11-inches-d.b.h. provision of the 50-11-40 rule.

We view the 50-11-40 rule as assuring adequate suitable conditions for dispersing spotted owls. We believe that to go below those conditions would approach the minimum for successful dispersal. We consider managing a conservation strategy

for a threatened species for minimal habitat conditions imprudent—particularly in a strategy that gives up 40 to 60 percent of the population extant at the time of listing.

The BLM lands in Oregon, because of the checkerboard land ownership and relatively rapid (as compared to FS lands) liquidation of mature and old-growth timber by BLM and private land owners, are particularly deficient in dispersal habitat. Note that the 50-11-40 rule is applied by ownership class—that is, BLM is requested to meet the rule only on its own lands. Hence, the checkerboard ownership would not be the cause of BLM's inability to meet the rule. The BLM's 2-year plan, in which all harvest of suitable habitat will occur in the forest matrix, would apparently exacerbate an already weak link in the owl strategy. In areas of mixed ownership, the compliance with the 50-11-40 rule would be computed separately for each owner, based on their proportion of ownership (see appendix Q, p. 327, ISC report). These prorated quotas for Federal lands would be required for 3 years after the conservation strategy is implemented. At the end of that period, the interagency body appointed to oversee the plan would reevaluate the 50-11-40 rule as it applies to lands in mixed ownership (as for most BLM lands). We allowed the marginal conditions on BLM lands, during this interim, only because of the better condition of FS lands and the impacts on timber harvest rates on the more heavily cut BLM lands.

Another exception may be lands that were cut and not successfully regenerated because of a variety of problems. Where research (such as from the COPE Program) has developed technology to reforest those sites, and reforestation has occurred, such lands should be restored to "suitable for timber production" and not reserved from timber cutting.

41. (85)

Question **Why was the inclusion of young forest (as future stepping stones) considered integral to the strategy?**

Answer We assume you are referring to the recommended HCAs in northwest Oregon and southwest Washington where mature and old-growth forest stands are rare. There, the habitat needs to be recovered or replaced over time. Setting up HCAs in habitat-deficient areas is intended to allow the forest in the HCAs to develop into suitable habitat in the future. Even before they mature into suitable habitat, they will contribute to improved habitat conditions for dispersing owls. The HCAs in these areas are "recommended" (not "designated") for State lands. Because the northern spotted owl is listed as "threatened" by the State of Oregon (as an example), we think that giving the State a chance to contribute materially to the recovery of the subspecies over time is appropriate.

42. (19, 92)

Question **What is the basis for the numbers in the "50-11-40" rule for forests outside the HCAs? If only 30 percent of the areas between HCAs were in favorable owl habitat, might that amount be no less effective in providing connectivity between the HCAs than the proposed 50 percent?**

Answer The 50-11-40 rule was adopted because it provided a forest condition on the landscape in space and time that would provide suitable habitat for owls to move

through in relative safety from predators and with some chance to obtain food—particularly during juvenile dispersal. Stands under 40 years of age are characteristically more dense and less inhabitable by species such as the owl. Assuming a standard rotation of 80 years under fully regulated conditions, having 50 percent of the forest land over 40 years of age at all times is a reasonable expectation. The 40-percent canopy closure was chosen as a minimum amount of cover easily attained and retained after thinning in stands in this age-class throughout the range of the owl. The monitoring program will provide insight into whether the percentage actually necessary should be less than or greater than the recommended 50 percent. We believe that shorter rotation ages will produce less area of suitable habitat for dispersal.

43. (100)

Question **The intent and scope of the recommended 50-11-40 management prescription for forest land outside HCAs is not clear. Would this standard apply to all forest land outside HCAs? Or would it apply only to corridor-type areas between HCAs? In either case, does the ISC suggest that this standard apply to private as well as public forest land?**

Answer The standard applies to all forested land under Federal management (FS, BLM, NPS) between HCAs and within the occupied range of the owl. Because dispersing owls do not disperse in straight lines, so far as is known, specific corridors have not been laid out. The 50-11-40 rule does not apply to private land. Some of those lands will contribute to owl habitat, however, by having trees 11 inches in d.b.h. with 40 percent or more canopy closure at some time during their rotation.

44. (93)

Question **What is the impact of the 50-11-40 rule on proposed thinnings in quarter-townships that do not meet the rule? Would stands in those townships have to stagnate until the quarter-township meets the 50-11-40 standard?**

Answer If a given stand were currently of age and condition for commercial thinning and was contributing to meeting the 50-11-40 rule, a thinning that did not reduce the average diameter at breast height below 11 inches and the canopy closure below 40 percent would be in keeping with the rule. Under these criteria, most commercial thinnings could be completed. Precommercial thinnings would be acceptable and desirable because thinned stands would more quickly attain an average diameter of 11 inches or more. The 40-percent canopy closure portion of the rule was considered to allow for thinning of "stagnated" stands while still contributing to meeting the rule. In fact, commercial and precommercial thinnings can be considered likely to produce stands meeting 50-11-40 conditions faster than would occur otherwise.

45. (79)

Question **The ISC report suggests the 50-11-40 rule as a guide to silviculture prescriptions for private lands that are in some way linked to HCAs. Can the same kind of management be applied to HCAs on Federal lands in California?**

Answer The purpose of the 50-11-40 rule is to ensure that minimum conditions for dispersal will exist between the HCAs—not within them. Because stands resulting from applying the 50-11-40 rule are not likely to provide for all the life needs of spotted

owls, applying this type of management to HCAs on Federal lands would not be appropriate. The HCAs are intended to provide for all life needs of spotted owls and afford the pairs found in them adequate conditions to perpetuate the species; the 50-11-40 rule is designed to facilitate dispersal among the HCAs. Again, we emphasize that the ISC report makes no demands on private land.

46. (94)

Question **Would it be acceptable to apply the 50-11-40 rule to drainage basins, rather than quarter-townships, as called for in the conservation strategy?**

Answer We see no reason why not—in theory. Experience shows that such an approach is filled with pitfalls, however. The track record for managers in this regard is not good. The quarter-townships were used for ease of calculation because most data on forest condition are gathered and stored by ownership, not by drainage. Whatever record-keeping unit is determined must be maintained in perpetuity, however. In too many instances, boundaries established for record-keeping have been changed to give the appearance of following a habitat rule. The record-keeping areas cannot be too large to mask effects of not meeting the 50-11-40 rule. Some sensitivity analysis may be needed to determine an appropriate size for an analysis unit.

47. (143, 144, 148)

Question **To control harvest in the areas between HCAs, the report advocated retaining existing considerations for other resource values such as wildlife trees and down wood. What does "existing" refer to? Also, the BLM plans now in existence call for much less of these two resource values than do the FS Forest Plans about to be adopted. What retention of wildlife trees and down wood are considered necessary?**

Answer "Existing" refers to the amounts specified in either completed Forest Plans or the estimated final Plan for those Forests that are completing them. For the BLM, "existing" refers to the plans under which they are now operating. We consider the BLM attention to wildlife trees and down wood to be marginal, but perhaps the best that can be expected in the short term. We were unwilling to advocate similar management on FS lands, however. We hope that the BLM will provide more attention to these attributes of spotted owl habitat in their new plans to become final in 1992, and their administrators have indicated willingness to consider these issues. We see the BLM lands as the weak link in the strategy, but we also accept that BLM managers will need some time to adjust to giving more consideration to wildlife than has been traditional.

48. (152)

Question **The ISC report (p. 148) states that "where a quarter-township contains multiple ownerships, the percentage is computed separately for each owner based on the amount of the ownership." Thus, the report stipulates that each owner in each township would be responsible for adherence to the rule on its lands. With BLM's checkerboard ownership, pattern—alternating sections with private land—that means only half of the township would be formally under the rule. Would the direction become the 25-11-40 rule because only half of one-half (one-quarter) of the township would be required to meet the size and crown closure requirements?**

Answer This condition would be true if none of the private land ever meets the criteria of having 11-inch-d.b.h. trees with 40-percent canopy closure. Some (perhaps much) of the private land, depending on the rotation age selected for such lands, will meet the criteria at a given time. The ISC considers the habitat on BLM lands and intermixed private lands, as it relates to dispersal of owls, to be marginal at present and apt to get worse. The application of the 50-11-40 rule to BLM lands may result, depending on what private landowners do, in a lesser standard than that on FS lands only because a stiffer requirement would have a short-term effect that would reduce timber harvests well below 70 percent of the present rates in some areas. The situation is not fully satisfactory, but it appears to be the best possible, given prevailing political and economic constraints in the short term. The proposed strategy calls for reevaluation after 3 years. In some instances, BLM lands can be coupled with FS lands to improve conditions. If dispersal is satisfactory, standards on FS lands may be reexamined. If dispersal is less than satisfactory, the standard may have to be raised on BLM lands.

Please note that the ISC report does not place a requirement on private lands. Note also that the inability to meet the 50-11-40 rule on BLM lands is not related to the checkerboard ownership; it is due solely to the condition of BLM lands. The size of HCAs on BLM lands could be doubled to make the HCAs comparable to those of FS lands if the same standard of owl welfare seemed desirable. We emphasized that 50-11-40 forest conditions are meant to be provided continually, over time, even if actual stands that contribute to these average conditions change in structure as timber is cut and regrown. If, for example, BLM chooses to measure compliance to the 50-11-40 guideline by averaging in conditions on private land (which would be ideal), they would have to project how long such conditions would exist and what would be available when the timber on the private lands is to be harvested.

49. (89)
Question **Several proposals have been made to modify the annual sale quantity of timber outside of the HCAs. How would that affect the ISC strategy?**

Answer The answer depends on what the modification is and its extent. Some modifications could have a considerable negative impact. Our strategy assumes that the landscape between HCAs will be maintained in a habitat condition in which at least some spotted owls can survive long enough to move from one HCA to another. That is why we proposed the 50-11-40 rule. We also assumed that many pairs outside of HCAs would persist for some time because they occupy areas where harvest is forgone, selective harvest practiced, or rotations in excess of 80 years are maintained for some other reason, such as visual restraints or soil problems. If those restrictions were relaxed to provide for increased timber harvest, the risk to the owl would increase to some degree. If no allowance was made to assure dispersal habitat between HCAs, this decision could greatly alter the estimates of persistence times for HCAs that we used in deriving the strategy.

The proposed changes would have to be evaluated to see if they would adversely influence conditions for dispersal of owls between HCAs. If these changes produced conditions that would reduce the probability of successful dispersal, the plan would be weakened and the probability of long-term success reduced. The degree of reduction in the probability of success would depend on the degree of departure from current plans.

50. (147)

Question **The ISC report states that "many management practices, including those associated with certain timber-harvest methods, provide habitat attributes conducive to spotted owl dispersal. Examples include visual corridors, riparian corridors, and streamside-management zones, all of which contain possible stopover spots. These habitat areas tend to be linear in configuration." The report endorses retaining these allocations in the Federal plans. What characteristics of these lands (rotation length, stand structure) make them essential to the proposal? As an example, the Willamette National Forest is proposing to retain 10 big trees at harvest in some visual and partial-retention areas to increase the usefulness of these areas as wildlife corridors as the next stands grow up underneath the trees. Is this structure what you had in mind? What rotation length would be adequate in these areas for the necessary habitat?**

What is the scientific basis for endorsing visual corridors and other areas where timber harvest will be moderated? How much of the forest should be dedicated to these types of allocations? Where should they be placed vis-a-vis the HCAs for maximum effect? The maps of the Mount Hood and Willamette National Forests' proposed allocations for their draft Forest Plans show some visual corridors that (approximately) connect adjacent HCAs. Other visual corridors lead off the Forest into the Willamette Valley, such as the Clackamas River visual corridor, but do not connect to other HCAs; in fact, that corridor heads down the road to Estacada and Gresham. Do we want to encourage owls to head in that direction? Does the location of visual zones or riparian zones vis-a-vis the HCAs matter from the standpoint of the conservation strategy for the owl?

Answer Dispersal of spotted owls between HCAs is an essential requirement if the proposed strategy is to succeed. The ISC was aware that some land allocations preclude timber harvest and others prescribe rotations of more than 100 years. These types of allocations result in forest stands with structural attributes important to the security of dispersing spotted owls by providing cover, foraging areas, and roost sites. The 50-11-40 rule prescribed for the areas outside the HCAs provides only marginal security for dispersing spotted owls. We believe that initiating management totally at such marginal scales is not prudent because it increases the probability of failure. Stands in long rotation provide some extra measure of security needed to enhance the probability of successful dispersal.

The response of spotted owls to new silvicultural practices is, for the most part, unknown and untested. The rotation ages necessary to produce spotted owl habitat are not known precisely and probably vary considerably with plant community and circumstances. We assume that the more closely stand structure mimics conditions of suitable or superior habitat, the more likely it will be useful to and used by owls. Silviculturists can make projections based on site-specific data, but actual empirical data are not available. The ISC strategy calls for research outside of the HCAs and analysis of past activities to answer these important questions.

The ISC did not propose or approve abandonment of any special management zone on behalf of the proposed owl management strategy. For example, visual

corridors not connecting HCAs should be retained. As our report points out (p. 26-27, 309), juveniles commonly do not, so far as is known, disperse along topographic or vegetational corridors. Thus, corridors—such as these retained along roads to screen the public from clearcuts and leading to, say, Estacada or Gresham—may or may not lead dispersing owls astray, but their retention does provide foraging and nesting habitat.

51. (173)
Question **Did you assume that areas outside the HCAs that serve to make corridors unnecessary will be managed similarly to the way they are currently managed? For example, did you assume that "scenic" or "riparian" areas would continue to be classified as such?**

Answer Yes. We determined, based on the Forest Plans and some designations made by the BLM, that land allocations and designations for various purposes would provide for spotted owl dispersal. In appendix Q, the standards and guidelines for implementing the ISC strategy call for no decrease in classification of forested lands that are not suited for timber production without evaluating the effect on habitat to support owl dispersal capability. These lands include roadless recreation areas, scenic corridors, riparian areas, and places where soils or forest regeneration problems may follow logging. Lands with longer rotations than lands dedicated to timber production were also recognized as providing important habitat for dispersing spotted owls. Should the land allocations be changed, the issue of corridors would need to be reexamined. Our approach was designed to minimize negative effects on timber supply. Designation of corridors with more rigid standards and guidelines for management as prime dispersal habitat is the alternative, but it would dramatically increase the impact on timber supply.

52. (149)
Question **What is the scientific rationale for the 50-11-40 rule?**

Answer We have information on the stand conditions that owls use for feeding. Most feeding occurred in superior habitat typified by old-growth conditions, but significant amounts of feeding did occur in younger stands. We concluded that stands that met the 50-11-40 rule would support feeding, support roosting for dispersing juveniles, and likely cover enough of the intervening landscape to allow reasonable protection from predators during dispersal and enough food to prevent starvation—although this assumption would require monitoring to evaluate. We encouraged (but did not delegate) private landowners to participate because it would increase the likelihood of providing for long-term viability of the populations.

53. (150)
Question **Why do you need both the 50-11-40 control and the visual corridors and other areas where timber production will be moderated? Do they fulfill different habitat requirements—that is, one foraging habitat and the other dispersal habitat? What vision of the way the forest would look under the 50-11-40 rule and visual corridors drove you to this combination?**

Answer The visual corridors and other areas where timber production will be "moderated" contribute to meeting the 50-11-40 rule—that is, they are not in addition to the

requirements of that rule. We estimated the combination of factors to provide habitat suitable for dispersing owls, and perhaps to support some pairs, without instituting the formal requirement of dedicated corridors of habitat between HCAs. We believe such dedicated corridors would be much more costly in terms of their effects on the annual sale quantity and would be no more satisfactory for supporting successful owl dispersal than the other areas described.

The quality of habitat in areas reserved from timber harvest or dedicated to long-term rotations is more likely on average, over the long-term, to provide better dispersal and foraging habitat than stands on shorter rotations under the 50-11-40 rule.

54. (27)

Question **Does the ISC strategy represent maintaining a minimum viable population? If not, what is gained by this planned increase in protection over what is needed for viability?**

Answer What is needed for viability is a social as well as a scientific question. The scientific part of the question has an easy answer: What is needed to be as sure as possible of future viability of the species is to provide as much habitat as possible, as widely distributed and for as long as possible. One rule in conservation biology is that viability is best (scientifically) defined as a 95 percent or greater probability that the species will endure for at least a century. The ISC plan barely provides for this. The social (economic and political) effects of a "save it all" strategy led the ISC to consider a conservation strategy that required less than the ideal solution of "save it all and grow lots back." "Minimum" is a term that has fallen into disuse in the FS because once a minimum was defined, it quickly became the maximum that would be accounted for in management. Operating at minimum levels almost ensures failure over the very long term.

55. (80)

Question **Given the different conditions in California, can the minimum distance of 12 miles between HCAs be increased and still adequately protect the owl? Alternatively, could the percentage of juvenile owls thought necessary to successfully disperse between HCAs be lowered and still provide adequate dispersal in California?**

Answer No. No adequate data exist to support a contention that dispersal distances are any different in California than they are elsewhere in the range of the owl. The guidelines on distances between HCAs were based on knowledge of dispersal distances of radio-tagged juvenile spotted owls—many of these in California. We do believe, however, that a greater variety of habitat types can contribute to meeting the 50-11-40 rule in California than in Oregon and Washington. For example, hardwoods such as tanoak and live oak with well-developed structure (for example, 30 to 50 feet high with relatively open understory beneath a dense crown) could contribute to meeting the 50-11-40 rule.

56. (6)

Question **Would you support a gradual phase-in of your plan, as some people have suggested?**

Answer We are not clear what the consequences to our strategy of a gradual phase-in would be because the question does not indicate what that process would entail. If a phase-in means making additional timber sales in HCAs or reducing the quantity or quality of dispersal habitat as described in the strategy, it would decrease the effectiveness of the strategy and increase the risk for the owl. We would not support that. The greatest threat to spotted owls is the combination of the loss and fragmenting of habitat caused by logging, which is leading to increasing isolation of pairs from other pairs. We are concerned that this threat would worsen under a gradual phase-in.

57. (125)

Question **Is the ISC strategy a single, integrated proposal with every element required for you to have confidence that it will succeed?**

Answer The answer depends on what adjustments to the proposed strategy were proposed. Some alterations would enhance chances of success and some would decrease them. The answer, in any case, is not simply yes or no. The changes would be incremental in terms of evaluating the probability of success over a specified period. Logically and in keeping with the intent of NFMA and ESA, any increased risk inherent in altering parts of the strategy should be compensated for by strengthening other parts. Such possibilities include increasing HCA size or number, moving HCAs closer together, or improving habitat between HCAs.

58. (26,43)

Question **Does adopting the proposed ISC strategy constitute multiple use of National Forest land in the Pacific Northwest?**

Answer We believe that preserving species that occur on National Forests became, by definition, an accepted "multiple use" with the passage of the NFMA (with attendant regulations) and the ESA. Besides, the finding of the FWS that the subspecies is "threatened" seems likely to make the issue of whether preserving species listed as threatened is an appropriate multiple use of mere academic interest.

59. (41)

Question **If adopting the ISC strategy were deferred for 5 years, and the existing SOHA system left in place, will the spotted owl go extinct in the next 100 years? Will the strategy still be valid if it is adopted in 5 years?**

Answer First, we cannot be certain that the owl would go extinct within the next 100 years—though the probability would increase. We believe, however, that it would be essentially eliminated from major portions of its current range—certainly as a functioning part of the ecosystem. Some of those locations would likely be critical to the long-term viability of the subspecies. An example of such an area is the Shasta portion of the Shasta-Trinity National Forest, which is a critical link between the northern and California subspecies of the spotted owl.

Second, our strategy as presently described simply could not be implemented in 5 years if the current rates of logging are maintained under existing or preferred alternatives. Continued logging in proposed HCAs would reduce pair occupancy in many of them to well below the 15 to 20 pairs now believed to be present or

potentially present. To be consistent with the strategy, then, this would require reducing distances between the affected HCAs. The entire mapping effort would need to be redone. After 5 years of "business as usual," that this could be done in a way that would provide reasonable assurance for long-term viability of the northern spotted owl seems unlikely.

60. (88, 157)

Question **Does the strategy assume any reduction in owl populations in the near term, such as the next 10 to 20 years? If so, could you explain what will cause that reduction?**

Answer Owl populations will indeed decline in the near term, even with execution of the ISC strategy, because not all suitable spotted owl habitat would be maintained. Much currently (and historically) suitable habitat occurs outside the HCAs, and these areas would be subject to forest management activities, such as logging, that would reduce or eliminate its suitablility as habitat for spotted owl pairs. Further, we believe that the owl population will decline to some unknown, but significant, degree even if all cutting of suitable habitat ceased. This belief results from the likelihood that birds displaced from suitable habitat by past logging or natural causes such as fire are already occupying marginal habitats and are less likely to survive and contribute to population viability over the long term.

61. (42)

Question **Would it be accurate to state that the ISC strategy makes protecting the northern spotted owl the highest management priority for all lands subject to the strategy, both inside the HCAs and in the other lands you call the "forest matrix," and permits other uses on all those lands only to the extent those uses do not conflict with protecting the spotted owl?**

Answer The conservation strategy makes protecting the northern spotted owl, the habitat, and the ecosystem it "indicates," the highest management priority inside HCAs. Other lands in the forest matrix have been allocated to various uses under newly adopted Forest Plans or preferred alternatives under plans pending adoption. The ISC recognized that allocating some land to preclude timber harvest along with applying the 50-11-40 rule would satisfy requirements for dispersal habitat for owls and, perhaps, other associated species. If alterations of management plans occur in the forest matrix between HCAs, the habitat conditions anticipated under these new plans should be reevaluated to ensure adequate dispersal habitat. This need is an additional constraint on management added to others already present, such as protecting water yield and quality and soil stability. Describing the constraints imposed by owl management as "highest management priorities" is not accurate, any more than is so considering any other constraint imposed now or in the future for any other purpose. Our intent was to minimize the effects of these constraints for owls by "overlapping"; that is, where we could, we put HCAs in or partially in Wilderness Areas, Parks, and other areas reserved from timber cutting.

Federal Agency Plans

62. (174)

Question **In developing your plan, did you assume that new Forest Plans would be in place, or old ones?**

Answer The ISC strategy was based either on final Plans, such as the Siskiyou National Forest's Plan, or those being put in final form. These draft plans can be considered the Forest's best estimate of the final Plan.

63. (91)

Question **Did the Committee consider the impact to the owls of just implementing the final Forest Plans (SOHAs)? If so, how would owl populations be affected in comparison to the ISC strategy during the next 10 years?**

Answer We did not evaluate the impact of implementing the Forest Plans during the next 10 years. We know that about 64,000 acres of suitable owl habitat are being logged annually on FS lands in Oregon and Washington alone. Projecting this 10 years into the future gives a total removal of 640,000 acres, or about 10 percent of all remaining suitable spotted owl habitat (see p. 14, ISC report). Assuming full implementation of the Forest Plans, the amount would be reduced to some 319,000 acres of harvest of suitable habitat over the next 10 years. This harvest does not include the logging that would occur on FS lands in California or of suitable owl habitat on BLM lands in Oregon. Without a detailed analysis of where this logging would occur relative to existing owl pairs, the effect on the owl population cannot be stated with certainty. Because biologists searching for owls in areas being considered for timber sales during the past 2 years have located owls in an unusually high percentage of such areas, we believe that the effect of logging on owls over the next 10 years under the current strategy will be considerably greater than the rate of reduction of suitable habitat. Further, depending on where those sales are in relation to proposed HCAs, the impact could keep an effective conservation strategy from being implemented after 10 years of additional cutting of perhaps 700,000 acres of suitable habitat.

The main principle guiding the ISC strategy was crafting a plan to provide for long-term viability of the subspecies; 10 years is far too short a time to make such an evaluation.

64. (40)

Question **Your plan appears to require the FS to lock in place permanently all land set-asides in the current group of final (and some draft) Forest Plans. Did the ISC really intend to immobilize the entire forest planning process on these Forests to protect the northern spotted owl, and to prohibit the FS from changing any of the current final or draft Plans?**

Answer The ISC strategy does not require anything of the FS. We analyzed the condition of habitat between HCAs that would exist under the preferred alternatives of new Forest Plans and determined that such conditions would be adequate to support dispersal of owls between HCAs with the addition of the 50-11-40 rule. If such land allocations were maintained, dedicated corridors of habitat between HCAs would

not be needed. Our intent was to hold impacts on annual timber sale quantity down, not to "immobilize" FS planning. But if changes in the Plans would diminish the quality of habitat between HCAs for dispersal of owls, the question must be reopened and some means to provide habitat for dispersal provided. An option of capturing and transferring owls between HCAs or raising owls in captivity and releasing owls in HCAs to compensate for dispersal has been suggested, for example, but this technology is not proved and not in keeping with the aim of the ESA and the NFMA to provide habitat capable of maintaining a viable population. Such techniques are reasonable alternatives only when no other alternatives exist.

65. (70)

Question **The proposed final Forest Plan on the Willamette National Forest has about 50 percent of the forested land available for timber harvest, and the proposed final Forest Plan on the Umpqua National Forest has about 70 percent of the forested land available for timber harvest. What evaluation criteria led you to endorse the land allocation in these plans?**

Answer Our examination of sample areas and personal knowledge about the field situation by the ISC team showed that various allocations already in place to protect resources through reservation from timber cutting would complement the 50-11-40 rule by providing patches or stringers of more-mature trees and better owl habitat. Our intent was to increase the probability of adequate connectivity by incorporating whatever of these areas (such as stream corridors, visual corridors, and soil withdrawals) currently or potentially exist. The percentage of the land base dedicated to timber production is significantly altered by establishing the HCAs, and the comparison you present does not consider that.

66. (145)

Question **Do your statements endorsing "present direction" and "existing considerations" also apply to BLM lands? The BLM has not yet made public their new land and resource management plans. Did you have access to their upcoming draft plans now being prepared? Do the statements refer to the existing plans finished in the mid-1980's? The BLM plans allocate a much higher percentage of their forested land to intensive timber production than does the FS (over 85 percent outside of the BLM Medford District compared to an average of 60 percent for the FS). If plans that have the vast majority of forest land in timber production are acceptable on BLM lands, why aren't they acceptable on FS lands?**

Answer The reference to BLM lands would apply to the mid-1980 plans. Once again, these allocations were intended to complement the connectivity supplied by the 50-11-40 rule. They are important to enhancing dispersal of any owls that may be present. If, through monitoring, the amount of reserve that works best within the 50-11-40 rule applied to BLM lands is determined, then adjustment may be possible.

The situation for dispersal habitat on BLM lands is not good and getting rapidly worse. We consider the BLM lands to be the weak link in the proposed strategy, but for the short-term maybe their current condition is the best that can be hoped for. Past cutting practices based on the dedication of those lands to intensive timber production, distribution of those cuts, some relatively short rotations, and the

practices on private lands within the checkerboard have foreclosed many options for managing spotted owls over the short term. The condition of these lands does not mean this situation is or should be acceptable on lands where conditions are better and options greater—that is, on FS lands; accepting the lowest common denominator would not be in keeping with a viable conservation strategy.

We are deeply concerned that the strategy put forward by BLM as the "Jamison Plan" is not detailed enough for the ISC or FWS to determine the effect of over 2 years of continued cutting of suitable owl habitat on the already limited options on BLM lands. Understanding how BLM can refrain from cutting in HCAs, maintain all currently dedicated SOHAs, follow the 50-11-40 rule wherever possible, and save more jobs than would be achieved under full adoption of the ISC strategy is extremely difficult. Apparently, the BLM proposes to follow the ISC strategy but continue to hold the HCAs in the timber base for 2 years. How this can be achieved except by a significant departure from sustained-yield forestry is difficult to see. The exact consequences are impossible to determine from the information available to us. If departure is the strategy for the next 2 years to keep the cut higher than if the HCAs are removed from the timber base and to adjust the cut in 2 years if the ISC strategy is accepted at that time, then the results will be even more severe. The consequences should be explored thoroughly before the Jamison Plan is accepted.

67. (109, 153)

Question **Does the ISC expect BLM to make up for deficiencies in meeting the 50-11-40 rule on intervening private land? If it is acceptable in townships that contain BLM land alternating with private land to require that only 25 percent of the quarter-township meet the rule, why is this lower requirement not acceptable in townships where FS and BLM control all the land?**

Answer The BLM lands and interspersed private lands do not presently satisfy the needs for dispersal habitat because of checkerboard ownership and past cutting practices on both BLM and private lands. But we believe the current situation is the best we can hope for under the circumstances. Note that even this lesser requirement, compared to FS lands, has created a furor that has distressed both elected and BLM officials. The marginal condition of BLM lands, however, is no excuse to transfer that standard to FS lands, where more options remain. The BLM is not expected to make up the discrepancies on private land. Note, however, that exempting private lands reduces the contribution of BLM lands, compared to FS lands, even more critically. Any lesser strategy for these BLM lands is apt to have severe consequences on the ability of owls to disperse. Also, note that the 50-11-40 rule applies only to the BLM lands, not to the private lands in the checkerboard; blaming the inability to meet this rule on BLM lands based only on the checkerboard ownership will not withstand scrutiny.

Private and State Lands

68. (31)

Question **Why do the managed private forest lands in California support about one-half of all spotted owls in northern California, but private lands in Oregon and Washington support less than 10 percent of the owl populations in those States? Based on your answer, then, why can the lands not be managed the same way?**

Answer Spotted owls on private lands in northern California occur in two very different types of forest: coastal redwood and interior mixed conifer. The coastal redwood forests are a unique type not found elsewhere in the remaining 93 percent of the range of the owl. The mixed conifer stands in the interior of California on private lands are generally at lower elevations than are FS holdings. Private foresters have described their management scenario to us, as follows: The selective harvest of a portion (25 to 40 percent) of the dominant overstory with retention of hardwoods, snags, and wood on the forest floor leads to retention of many old-growth forest characteristics that apparently allow owls to occupy many such stands.

Repeated entries into these stands to remove trees over several decades has led to a change in tree species composition and to an eventual conversion cut (clearcut) to allow reestablishment of the desired composition (pine and Douglas-fir dominance). At the point of clearcut harvest, the stands will cease to be acceptable spotted owl habitat for about 60 to 80 years. The choice of selective harvest for a portion of the rotation is a product of site quality, forest type, economic climate, and the management philosophy and goals of the owners.

Public forest lands in northern California are routinely managed under a clearcut regimen and rotation length that preclude occupancy by owls for 60 to 80 years after initial harvest. On the more mesic forest lands of Oregon and Washington, both private and public, Douglas-fir is the dominant species, and it is harvested by clearcut logging followed by replanting of Douglas-fir. A 50- to 100-year rotation is practiced. In this scenario, like that on public lands in northern California, characteristics of suitable spotted owl habitat do not have time to develop and, if they do, they are not sustained for long before they are terminated by cutting of the trees.

Through innovative silviculture and adaptive management (appendices R and S), managers may be able to provide features and characteristics of old-growth forests in managed forest stands and accommodate spotted owls. We advocate experimenting with such schemes in the forest matrix between HCAs to demonstrate the capacity of managed stands to support owls. When data exist to demonstrate that appropriate habitat to support adequate numbers of owls can be provided through management, the question of opening HCAs to such management should be considered anew.

The situation in northern California is ecologically unique. Circumstances of forest type, past forest management, and land ownership are such that we believe the concerned parties can cooperate to develop a strategy that will provide 250 pairs of owls from private lands on a continuing basis. The strategies developed may prove applicable to managing other habitats, but that remains to be seen.

69. (97)

Question **Why did the ISC's report include several hundred thousand acres of private forest land in Oregon within the proposed HCAs? The ISC report advocates that private land within HCAs provide "foraging habitat." How would private land management have to change to meet that requirement? Does the Committee advocate that private land intermingled with Federal land outside the HCAs meet the 50-11-40 rule, too?**

Answer The boundaries around the HCAs in Oregon were drawn around areas large enough to support 20 or more pairs of spotted owls where that was possible. To simplify the maps, private lands were included because ownership patterns would cause boundaries that followed only Federal land perimeters to be disjunct and confusing. The strategy was developed to apply only on Federal ownerships (and on State lands if the States chose to participate). Suggestions are offered to private landholders on how they might use silvicultural techniques and forestry practices (50-11-40 rule) that might lessen the effects of logging on spotted owl habitat inside the HCAs.

Managing lands to provide foraging habitat would focus on rotations of 80 to 100 years, with emphasis on leaving large scattered trees, snags, logs, and other "legacies" of the more diverse mature and old-growth forest. Applying the 50-11-40 rule to private land would be strictly voluntary on the land owner's part. The ISC report exempts private land from mandatory inclusion. If the rule is not applied and monitoring demonstrates the need for adequate connectivity within the landscape, some further measures to provide it on public lands may have to be used if private lands are not contributing. The owls have no sense of who owns the land—they react to habitat condition. In intermingled ownerships, habitat may be a problem for this species in the long term if all parties are not cognizant of and responsive to the needs.

Most private lands will have stands of trees that are 11 or more inches in d.b.h. with 40-percent canopy closure for at least some time during a rotation. Those that do will contribute to providing feeding and dispersal habitats.

The ISC report makes no demands on private lands whatsoever—not within and not between HCAs, and we have not attempted to predict the likelihood of private land owners' adopting the 50-11-40 guideline.

70. (154, 161, 165)

Question **Many of the HCAs extend onto private and State land. These land owners cannot be forced to manage their land under the guidelines proposed in the ISC strategy. Can the strategy succeed without some designation of State and private lands within the HCAs? What will happen to the owl population if private and State land owners refuse to participate?**

Answer No intention of requiring compliance by private or State landholders is expressed in the ISC report. Private lands included inside of the HCA boundaries are not subject to any constraint; private lands were included only to allow drawing the outside boundaries for proposed HCAs.

Outside of Federal ownerships, State ownerships seemed to provide the best chance of maintaining owls in viable numbers over the long term in some areas—particularly in southwest Washington and northwest Oregon—because of the public (albeit, State) ownership. Note that these lands were included inside dashed lines and identified as a "recommended HCAs" as opposed to "designated HCAs." The different terminology was used to recognize that these State lands were presently dedicated to intensive timber production by law. Such management is unlikely to sustain owls over the long term. The States have recognized, however, that the owl is "endangered" (Washington), "threatened" (Oregon), or "a species of special concern" (California), and the States may wish to provide, over the long-term, habitat that would enhance the chances of the subspecies persisting in areas where no Federal ownerships exist.

Without a commitment by the States to back up the concern expressed by their listing decisions, little long-term chance exists for sustaining viable owl populations in southwest Washington (which probably assures long-term isolation of the Olympic Peninsula population) or northwest Oregon. This isolation would increase the risk to long-term viability of the spotted owl throughout its range. It does not mean that the conservation strategy would be unsuccessful on the Federal lands alone. It does, however, mean that appropriate management on those Federal lands becomes even more critical. As the range is compressed, the risk increases. As populations are isolated, the risk increases. Countering that increased risk by decreasing the risk where the strategy is actually applied is logical, and that could be done by increasing numbers or sizes of HCAs, decreasing distances between HCAs, improving habitat within and between HCAs, or extending the strategy to include private lands.

71. (75)

Question **If a recovery plan that includes private lands is adopted by the FWS under the ESA, what regulations can be imposed on timber harvesting on private lands? On State-owned lands?**

Answer A recovery plan is intended to identify the goals and objectives that the FWS believes are necessary to remove a species from the list. Such a plan carries no regulatory requirement for any land owner. In developing a recovery plan, the Service considers what is feasible as well as what may be necessary to remove the species from the list. All recovery activities that would be recommended for any lands—Federal, State, or private—would fully include public participation in discussions before any recommendation that would affect those lands would be identified. The ISC is not expert on the intricacies of applying recovery plans, and we are not privy to the intent of the Service regarding what such a plan may be. This question is best addressed to the FWS.

72. (72, 73)

Question **If the northern spotted owl is listed under the ESA and no critical habitat is designated at the time of listing, what regulations under the Act, if any, apply to timber harvest activities on private and State lands? If critical habitat is designated?**

Answer The FWS and the courts are responsible for interpreting the ESA and regulations issued pursuant to it; they will need to answer this question.

73. (65)

Question **Many people believe that the States of Washington, Oregon, and California either lack the legal authority to adopt your conservation plan or will refuse to adopt it. If this happens, can your plan work?**

Answer Yes. The risk would increase for long-term viability of the spotted owl, however. All three States have recognized the special status of the subspecies by listing it as threatened, endangered, or of special concern. For State agencies or governments to pressure the managers of Federal lands to be concerned about State-listed species, but exhibit lack of commitment in managing State lands, would be inconsistent. State lands, whether or not they are ever committed as HCAs, represent the most realistic chance to maintain owls in southwest Washington and northwest Oregon. We recognize, however, that land-use decisions are the business of the States. We proposed. Their job is to dispose, when it comes to State lands and in keeping with their own listing of the subspecies.

Alternative Plans

74. (36)

Question **The Committee's charter required you to suggest possible options for conserving the northern spotted owl. You prepared only a single plan, which does not offer options for protecting the owl. Why did ISC disregard the instructions?**

Answer We believe we followed the instructions. We were given several tasks to perform, listed below with results:

- We were asked to develop a scientifically credible conservation strategy for the northern spotted owl.

  We developed—as clearly instructed—a single strategy, which was delivered on the due date.

- We also received several short-term assignments to be achieved during 1989-90.

  A. Review the biological basis of the FWS Draft Criteria for the review of timber sales and the basis for conference opinions.

  The ISC reviewed the criteria and orally reported to the FWS that they were appropriate for the circumstances existing at that time (circumstances have

changed with the issuance of the ISC report and the listing of the subspecies as threatened).

B. Assess whether current land management strategies of the agencies are reserving options that will allow for long-term strategies to conserve the northern spotted owl.

This assignment was achieved and is included in appendices C and D of the ISC report. We found that adequate options were not being preserved.

C. Provide recommendations to preserve the necessary conservation options from the time the charter was issued and the conservation strategy completed.

We reviewed the provisions of Section 318 and agency guides and considered them adequate in the short term, which was defined as FY 1990, during which a conservation strategy would be developed. Further, we determined that the pressures on the FS and the BLM to meet the Section 318 targets, enlarge SOHAs, and stay out of "significant old growth" already instituted too many overriding constraints to allow considering options halfway through the fiscal year. The question implies, incorrectly, that the assignment was to develop an array of options; a single strategy was our assignment.

- We received several long-term assignments to be achieved in 1991 and beyond.

A. Define habitat relationships for the long-term conservation of northern spotted owls.

This assignment was achieved in 1990 and is included as appendices F, G, and H of the ISC report.

B. Suggest possible options to achieve the amount and configuration of habitat for long-term northern spotted owl configuration throughout the range.

The ISC did consider other options but found each one of them unsatisfactory in terms of the probability of achieving long-term viability, increased impact on annual sale quantity without commensurate improvement in long-term viability of the owl, or both. Potential options to be pursued under the concept of adaptive management are described in appendices R and S of the ISC report. We believe that no strategy that had even greater costs in terms of suitable owl habitat reserved, at least temporarily, from cutting would have been seriously considered.

We considered the options analyzed by the FS Final Supplemental Environmental Impact Statement (FSEIS) on spotted owl management. We believe that none of these options would provide for long-term viability for the owl, with the exception of alternative L (save all old growth). We could not support or recommend any of them because they would likely be unsuccessful or, for alternative L, politically unacceptable. Further, this task was to be addressed

in 1991 and beyond, which is logical enough given that we cannot evaluate options until clear signals about the situation exist. What conservation strategy will be adopted is still unclear. Only after a strategy is adopted can recommendations be made on how to preserve options. But we know that options cannot be preserved without preserving adequate amounts of habitat—another instance of "no free lunch."

C. Evaluate current research efforts and recommend research, monitoring, and inventory programs to answer existing critical questions and to track the adequacy of management strategies and recommendations.

We did not address this issue because these points are impossible to consider meaningfully until the particular conservation strategy is selected for implementing.

All reports were submitted on time. The four agency heads who appointed the ISC and chartered its activities have not indicated that we failed to follow their instructions. On the contrary, they have commended the ISC for the prompt and efficient achievement of its mission.

75. (1)

Question **What alternative conservation strategies did the ISC consider before choosing the one put forward in the report? Why was this one chosen? Did the other alternatives offer greater or less protection?**

Answer The ISC considered a variety of strategies, some of which offered greater and others less protection than the one we advocate. The strategy was selected because the six scientists who signed the report (the ISC team was composed of 17 members) were satisfied that the strategy was scientifically credible and sufficient to provide for a secure population of northern spotted owls, well distributed throughout their range, for the next 100 years. The conservation strategy is in fact an amalgam of strategies: large habitat blocks where possible, smaller blocks where necessary, blocks well-connected by appropriate habitat, and an adaptive management plan to test the development of innovative silviculture to provide spotted owl habitat in a managed forest context. The alternative strategies considered (including those described in the Forest Service's FSEIS) either offered inadequate protection to the owl or had much more impact on the annual sale quantity than the strategy we selected, without commensurate increases in protection for the owl.

76. (68, 142)

Question **We have heard that the ISC considered at least five other approaches including the dedication of all forest lands to "long rotations." The report does not mention these other options and why they were rejected. What comprehensive options for ensuring survival of the northern spotted owl, other than the report's recommendations, were seriously considered by the Committee? Why were these other options rejected?**

Answer The options described below are among those given serious consideration by the ISC:

- Long rotations of 150+ years on all lands;
- A continuous corridor 12 miles wide, throughout the range of the species, in which timber cutting would be terminated;
- Large HCAs (30, 40, and 50+ pairs), with smaller HCAs in between;
- Current prescribed HCAs connected by corridors 3 to 6 miles wide;
- Current HCAs with individual SOHAs around all sites with pairs of nesting owls outside the HCAs;
- Current HCAs with individual SOHAs outside the HCAs and a continuous 6-mile-wide corridor connecting HCAs;
- Distances between HCAs of less than 12 miles;
- All alternatives described by the Forest Service's FSEIS for spotted owl management; and
- Stopping all harvest of owl habitat.

Among the reasons for rejecting options was the question of what connectivity design was necessary; many alternatives for such connectivity mentioned above exceeded our final recommendation, which we believe to be adequate.

Additionally, other options produced an increased effect on annual sale quantity without appreciable compensating increases in the probability of success in maintaining owls. Other options we considered to be unlikely to be successful and therefore lacking scientific credibility. We could have presented each of these schemes, but we lacked time to fully develop each of them, and given the political furor over the ISC recommendation, further development would have been an exercise in futility. We would be happy to fully develop these alternatives if they were to be seriously considered and had any chance of adoption. Every political pressure is to find "some innovative way" to reduce the economic impacts of the strategy that we did recommend.

77. (30)

Question **Because current definitions of habitat for owls are not fully applicable in California and many instances have been reported of spotted owls using managed forest habitats, why have you chosen only the single strategy of preservation across the entire range of the owl? What do we gain in terms of viability in choosing only preservation over some forms of low-intensity management?**

Answer Although examples of spotted owls occupying managed forests have been reported in all areas of the subspecies' range, our examination of the data led us to believe that the best habitat for spotted owls in all parts of the range of the subspecies is old forests. The single exception may be the redwood zone, where owl densities are quite high in 50- to 80-year-old stands that make up some 7 percent of the owl's range; the structure of such stands is much more diverse, however, and thus more suitable for spotted owls than in comparable-aged, managed stands of other conifer species that we visited. Most other areas where we have seen owls in relatively young stands include mixtures of young forest with inclusions of older forest. Such areas typically have significantly lower densities of spotted owls than in undisturbed

old forest. If we are going to greatly reduce the habitat of a species (as our plan proposes), then we should try to maintain the remaining habitat in the best condition possible. To reduce the population 50 percent while providing the survivors with only marginal habitat would be extremely risky and, certainly, in our minds not "scientifically credible." Therefore, we opted to provide the survivors with what we believe is good-quality habitat of appropriate size, appropriately spaced, and appropriately connected.

Silvicultural regimes may be developed that will produce suitable owl habitat of high quality. The ISC report recognizes this possibility and suggests research to test that hypothesis. But because proof does not presently exist, betting the future of a threatened species on such a hypothesis is simply not "scientifically credible."

78. (66, 138)

Question **If we accept as a fact that the spotted owl is in some peril as a species, do other strategies exist that would ensure the owl's survival? For example, could we elect to concentrate our protective efforts in a smaller geographic area where owl populations are relatively healthy, rather than throughout its range, and still meet the survival objective? Would such an alternative result in allocating less acreage to owls?**

Answer Yes, other strategies might also ensure the owl's survival. Certainly, any strategy that saves more habitat in larger HCAs, or more HCAs of the same size but located closer together, or both or dedicating corridors of mature forest habitat between HCAs would increase the chance of the owl's survival over a 100-year period. If we reduce the protective efforts to something less than proposed in our strategy, however, we would increase the chance that the owl would experience localized, and perhaps ultimately, general extinction. The importance of maintaining a population over an extensive geographic area is to provide the only hedge we can against major catastrophic events. This strategy of spreading the risk is the "den Boer effect" referred to on p. 285 of the ISC report.

For example, suppose that the Oregon Coast Ranges were exempted from the conservation strategy. This decision would eliminate one major avenue for maintaining north-south population continuity throughout the current distribution of the spotted owl. A major catastrophic event in the Cascades (for example, the explosive eruption of Mount Hood or a fire the scale of the Tillamook burns or "the '21 blowdown" in Washington State) could interrupt the only other major avenue for north-south gene flow. It could isolate the Washington population from the Oregon population for decades, even centuries. Each remaining subpopulation would then need to maintain viability without immigration from the other. We did not assess the risk of such an event, but it is finite and would simply add to the risks of survival for the subspecies.

Further, if the choice were made to compress the presently occupied range of the owl, it would be prudent to compensate for the increased risk by increasing the number and size of HCAs in the remaining range, decreasing the distance between HCAs, and dedicating corridors of mature trees between HCAs, where the owl is to be maintained. Such compensations would likely offset any gains from a triage decision to let owls go locally extinct in other parts of the presently occupied range.

79. (22)

Question **The ISC report notes that the chance of establishing viable spotted owl populations in portions of the range is very low. Do you agree that a plan could be developed that would avoid the extinction of the northern spotted owl without maintaining a viable population of northern spotted owls on the Olympic Peninsula in Washington? Do you agree that a plan could be developed that would avoid the extinction of the northern spotted owl without maintaining a viable population of spotted owls in the Oregon Coast Ranges?**

Answer We accepted our charge with the understanding that we were to develop a scientifically credible conservation strategy for the northern spotted owl consistent with the requirements and specifications of the ESA and the NFMA. Our understanding of these pieces of legislation led us to devise a strategy that would maintain a viable, well-distributed population. We are not willing to depart from this position that is clearly inherent, at least to us, in existing law and regulations. We believe we were and are mandated to obey the law. Further, reduction in the numbers or the geographic distribution of a species increases the risk to that species. Because we are already accepting the likelihood of a reduction in numbers of as much as 50 percent from the present population, which is already much less than the population of 100 years ago, we do not think simultaneously amputating portions of the range is wise. If such amputation is seriously contemplated, we strongly recommend increases in the sizes and numbers of HCAs and reducing the distance between them in those areas where owls will be accommodated, to compensate to some degree (though by no means fully) for loss of range and genetic variability.

80. (82, 126)

Question **If substantial parts of the plan could not legally or practically be implemented, what recommendations would you give as to whether the balance of the plan should be implemented? What are the essential components of the plan?**

Answer Every significant deviation from the prepared strategy would decrease the probability of success. Deviations could occur in numerous ways and in various degrees of departure—and to hundreds of combinations of ways and degrees. The key elements of the plan are the distribution of the population within the range: adequate cluster sizes of breeding pairs; adequate habitat within and between clusters; and distances between clusters that enhance exchange of birds between clusters. Further, some conservation strategy will have to be implemented to meet the requirements of the ESA and the NFMA. We believe that a satisfactory plan will have to withstand scientific scrutiny and potential legal challenge. Alterations that weaken some part of the plan can likely be compensated for, to some degree, by increasing numbers and sizes of HCAs, moving HCAs closer together, improving habitat between HCAs, or extending the strategy to non-Federal ownerships.

81. (9)

Question **Could the ISC strategy be implemented in parts of the owl's range while in other areas, such as on the Olympic Peninsula, a different approach be taken?**

Answer We believe that the approach we have suggested is just as applicable to the Olympic Peninsula as it is elsewhere in the range of the owl. We discussed other approaches for areas like the Peninsula and decided that they either presented too much risk for the owl or were so restrictive that they stopped all timber harvest. Further, we cannot evaluate "a different approach" unless we know exactly what that approach is. We make no claim to infallibility, and other means may ensure the owl's survival. But if any such means exists, we were not able to uncover it. We should acknowledge that chances for success of the strategy would be well served by increasing the number and size of HCAs, decreasing distance between them, and maintaining additional older forests between them.

82. (60)

Question **Federal agencies have been following spotted owl management plans in Oregon and Washington for 10 years that are far less drastic than the plan you proposed, and far more owls are known today than 10 years ago. What real evidence do you have that the existing agency plans have not been working adequately to protect the spotted owl?**

Answer First, understanding the answer to this question depends on understanding the nature of animal population responses to declining habitat. For example, imagine the response of a fish population to a drying lake. As the lake level drops, surviving fish are crowded into a smaller total area and eventually into remaining pools in deeper parts of the lake. Population density increases, at least for a time, in these pools. If we were to sample populations only in these pools, without reference to the lake as a whole, we would conclude that the fish population is healthy—even healthier than before. Such a phenomenon—called "packing"—has been shown to occur in numerous well-studied examples among vertebrate species, including birds. The same phenomenon, based on available data, appears to be occurring with spotted owls in Oregon and Washington today. Further, the more intensively the search for individuals of a species, the more will be found until all of them are located. As research intensity and monitoring have increased and covered new areas, more "new" birds have been located. This increase is a result of increased search effort, not increased population. Given the rate of habitat loss, this increase in "known" birds is unlikely to reflect any increase in population.

One consequence of packing will be the inability to detect, at an early date, whether the current management plan (whatever it is) is working. Owls displaced when their home ranges are logged will be forced to find some replacement habitat; thus, even single-pair SOHAs that have been vacated by natural causes (for example, predation or disease) will be reoccupied faster than would occur in a stable population because many more owls (displaced owls plus juveniles) will be seeking new habitat. This increase in displaced owls will create a lag in the ability to detect a decline in the occupancy of SOHAs, even though such a decline will be inevitable when all suitable habitat not now in SOHAs or reserved for other reasons has been logged and all displaced owls have either died or managed to find unoccupied suitable habitat.

All demography data presently suitable for analysis show a declining population of northern spotted owls. This decline includes populations in three demographic study areas: a small but statistically significant decline on FS land in northwestern

California, a large and statistically significant decline on BLM lands in southern Oregon, and a small but not statistically significant decline on FS land in the Olympic Peninsula.

In several areas, but especially in the demographic-study area in northwestern California and on BLM lands in southern Oregon, evidence indicates a higher than normal rate of immigration of adult birds into the population. The source of these birds is probably from loss of breeding habitat in their home ranges in areas recently logged or burned.

The turnover rate (rate of loss and replacement of one or more members of a pair) is extraordinarily high on BLM lands in southern Oregon. Such conditions tend to occur in other species where habitat amount, condition, or both are declining to the point that birds cannot generally reproduce well. Breeding may be attempted but often fails. Divorces are frequent. Populations tend to shrink back to only the best remaining habitat. We believe the evidence from spotted owls on BLM lands in Oregon indicates that such a phenomenon is now in progress there.

Numerous studies of birds and other groups of vertebrate animals (not cited in our report) all point in the same direction. Small populations tend to "wink out" (go extinct) relatively quickly. We know of no exceptions to this pattern, so we believe it is the same for spotted owls. The spotted owl management plans now in place in Oregon and Washington provide relatively isolated patches of suitable habitat (SOHAs) for small clusters of owl pairs or for single pairs. These patches sometimes occur in pairs or triplets fairly close together. But even populations of three pairs have generally winked out relatively quickly for all other species studied to date. Current management plans acknowledge the importance of dispersal among owl sites to maintain population viability, and they follow guidelines for the distance between SOHAs not unlike those recommended in our strategy—a 6-mile separation for single-pair SOHAs and a 12-mile separation between units with two or three pairs. These distances apparently assumed some necessity for the dispersing owls to be able to locate other owls in suitable habitat. But if the 6-mile separation is based on some "safe" dispersal distance, then the loss of a pair from a single-pair SOHA automatically increases the distance that dispersing owls must travel to have any chance of finding other owls on suitable habitat, and they have much smaller "targets" then a 20-pair HCA. Current management plans assume that only about half of all available SOHAs will be occupied at any given time (because the amount of suitable habitat provided is considerably less than that shown to be used by radio-tagged spotted owls). With an occupancy rate of 50 percent, the true distance between occupied single-pair SOHAs would be considerably more than 6 miles, which was judged to be "safe" when the current management plan was adopted.

When the FS implemented current spotted owl management plans in Oregon and Washington, Wilderness Areas and other lands dedicated to uses other than timber production were assumed to provide relatively large clusters of pairs of spotted owls in the same general area—much as we have proposed in our 20-or-more-pair HCA strategy. Most of these Wilderness Areas had not been inventoried by the time the current plan was implemented, so how many owls actually were there is unknown. About 871,000 acres of suitable habitat are included in Wilderness Areas, and about

625,000 acres of suitable habitat in land allocations precluding timber cutting. This acreage represents about 12 percent of all forest land on Forests with spotted owls and about 36 percent of the combined remaining habitat of some 1,496,000 acres. The amount and arrangement of suitable owl habitat in these areas indicate that from 2 to 15 pairs probably occur in each of the various Wilderness Areas, with an average cluster probably capable of supporting about 5 pairs. Our strategy incorporates these Wilderness Areas, although by themselves they fall far short of meeting the needs for long-term viability of spotted owls.

Whether or not the proposed strategy is "drastic" is not a biological description. We have proposed a strategy that we think is likely to succeed to replace one that was likely to fail. Failure is drastic in the biological sense, as is a strategy with an acknowledged "poor" chance of success. The strategy proposed gives up a significant portion of the population remaining, in such a way as to maintain owls and still allow continued cutting of suitable habitat. Such a strategy is certainly drastic (but still defensible) when dealing with a threatened subspecies.

83. (13, 132)

Question **The FS has empirical data from the spotted owl monitoring inventories, conducted over the last 2 years, indicating that the network of SOHAs currently in place may be working as predicted, with only moderate long-term risk to the owl. Why did you dismiss this alternative? What data did the ISC rely on in concluding that the SOHA plan was not working?**

Answer The SOHA-monitoring program has provided estimates of the proportion of SOHA sites occupied by pairs of owls in 1988 and 1989. The proportion of SOHAs occupied in each year has been relatively high, which is not surprising because the SOHAs were established, whenever possible, around known pairs of owls, and many—perhaps most—have not yet been disturbed by logging. Additional stands of suitable habitat adjacent to the SOHAs also contribute to the value of the SOHA to owls. Until these adjacent stands are cut, whether the SOHA will indeed provide for a pair is difficult to determine. Because many SOHAs contain less area of suitable habitat than is found within the average home ranges of pairs that have been studied, this possibility is open to serious question. From 2 years of pair occupancy data, assessing whether the SOHA system is working to provide for the owl's long-term viability is impossible. To assess the likelihood that the SOHA network would provide for the long-term viability of the spotted owl, dynamics of single-pair and small clusters of SOHAs were modeled. These models, and the insights they provided, are discussed in appendix M of the ISC report.

In general, model results suggest that single-pair and small cluster SOHAs have a very low likelihood of providing for the long-term persistence of the spotted owl. The FSEIS on which the current strategy is based gave the chances of success over 100 years as "poor."

An additional limitation of the SOHA-monitoring program, revealed by model simulations, is that pair occupancy rate is not a sensitive indicator of the general trend of spotted owl populations over the short term (the next 10 to 30 years). The continued loss of suitable habitat outside of the SOHA network displaces a large number of adult owls. Those owls that survive the loss of habitat crowd into the

remaining suitable habitat (that is, the SOHAs), resulting in high occupancy rates. During periods of habitat loss, high occupancy rates (high densities in smaller areas) arise even though the total population is declining.

The Record of Decision, signed by the Chief of the FS, that established the current strategy assumed that options for managing the owl's habitat would not decline substantially over the next 5 to 10 years. We believe differently, based on our analysis of the situation.

84. (20)

Question **Regional (R6) Forester John Butruille, in his written comments to the FWS spotted owl listing team, stated last December that the "Forest Service believes that listing the spotted owl under the Endangered Species Act is not necessary for its long-term conservation." He also stated, "The northern subspecies of the spotted owl is viable and will remain so for the long term, well distributed throughout its geographic range in National Forests in the Pacific Northwest." Are these comments, based on agency implementation of the SOHA system, in error?**

Answer In the Record of Decision implementing a SOHA strategy from the Forest Service's FSEIS, the Chief of the FS chose to accept a certain level of confidence of ensured viability for spotted owl populations. The chosen alternative provided, at best, only a "moderate" chance of maintaining viable populations over a 50-year period and a "poor" chance for 100 years. The Regional Forester's comments were intended to assert that the Chief's decision would be carried out and that spotted owls would be provided for, as stipulated in the management guidelines accompanying the decision. Mr. Butruille's statement was based on information and analysis that were available to him at that time. Information available now and that developed during our deliberations led us to conclude that the current FS strategy for the northern spotted owl will not succeed over a 50-year period. Of course, the FWS has since evaluated the situation and declared the subspecies as "threatened throughout its range." Again, this decision is a matter of judgment, based on the evaluation of extant information. Times and circumstances change.

85. (61)

Question **The FS has adopted a new and different spotted owl management plan every other year for the last decade, and every time it adopts a new plan it tells us that the last plan was incorrect. What reason do we have to believe that the ISC strategy is any better than any of the previous plans?**

Answer To say these plans were "incorrect" is incorrect. They were inadequate to give a high enough probability of success to satisfy the public, the scientific community, and, ultimately, the courts. That is why our charge was to develop a "scientifically credible" strategy. That is a first and was mandated by circumstances. Unless the laws are changed, scientific credibility seems to be a prerequisite for a plan that will stand challenge.

Societal interests change. Research studies provide new information on the species' requirements and population status. These two factors combined have led to revisions of the spotted owl management plans over time. Every revision has been

to increase the size and amount of habitat because greater evidence has been found of threats to the viability of the populations, and because administrative, political, and social interests have indicated that we are willing to allow a greater allocation of habitat to the species. The reasons that we believe the strategy we present is a decided improvement over previous plans are clearly spelled out in the report (appendix O). The peer reviewers expressed the opinion that the ISC report was a marked improvement over current plans, with a strong probability of success compared to a "poor" chance of success for the current strategy documented in the FSEIS.

86. (8, 167)

Question **The Director of the BLM has stated that he wants his staff to reexamine the spotted owl situation on the lands his agency manages to see what other options exist besides your plan. What do you think about this?**

Answer We applaud any better way or better options that can be developed. We assume, however, that these other options will be as well based in science as is the ISC report; all thought processes and assumptions will be as carefully documented; the names and credentials of the developers will be revealed; scientific peer review will be conducted and made available for scrutiny; and the plan will be developed through a fully open process where all concerned may observe the deliberations. Alternative strategies must also be fully evaluated in terms of the long-term probability of supporting a viable population of northern spotted owls. Short-term plans are not the biological question. Short-term protection of pairs of owls is not an adequate, scientifically credible substitute for developing a long-term strategy. The shortcomings inherent in a short-term plan are carefully documented in the ISC report. Such short-term "fixes" can give the illusion of protecting the owl while actually doing severe damage to long-term chances of survival. We defined "long term" as measuring at least a century. For long-lived species like the spotted owl that also reproduces at a low rate, "long term" might better refer to multiple centuries to facilitate evolutionary change.

We look forward to examining any options that may be superior to the strategy we have prepared. If they are indeed superior, the ISC will quickly recommend adoption of the alternative strategy in place of the one we have suggested. The "Jamison Plan" put forward by the BLM does not contain sufficient detail nor the exposure of developers and reviewers necessary for examining its scientific credibility and chances of success.

87. (102)

Question **Could a plan be developed to avoid the extinction of the spotted owl without maintaining a viable population, well distributed throughout its range?**

Answer We interpreted our charge, and the concepts of "well distributed" and "viable," as meaning that the species should be maintained in its native environment and have the opportunity to interact with other species and to adapt and evolve. Anything less pulls the species out of the context of its environment and, by definition, creates a nonviable population. A species is effectively and ecologically extinct when it no longer functions in the environments in which it evolved. Also, the occupied range on National Forests cannot be reduced without violating the regulations issued

pursuant to the NFMA. We suspect that compliance with the intent of the ESA precludes purposeful local extinctions suggested by your question. This question might best be asked of FWS legal counsel.

88. (64)

Question **If your goal were to avoid the extinction of the subspecies, do you believe you could adopt a conservation plan based entirely on FS lands in Oregon only, or Washington only, or California only?**

Answer Such a conservation strategy could be devised. Long-term chances of success, however, would be considerably less because of the increased risk inherent in concentrating the population in a smaller area. Amputation of parts of the range would severely compromise the adaptability of the species because such amputation reduces genetic variations that are apt to have developed under varying selection pressures. Such concentration magnifies the effect of any large-scale environmental catastrophe that will, inevitably, occur within the much reduced range. Further, a geographically limited strategy would require a dramatic increase in reserved lands within the selected area to maintain adequate numbers to assure a good chance of long-term viability.

In short, such a strategy would require increases in number and sizes of HCAs, and decreases in distances between them in the area selected for owl conservation. These changes would offset any gains for timber supply in areas amputated from the occupied range. We also believe that this limited strategy would not be in keeping with the NFMA and the ESA and would require a change in law, regulations, or both to be a politically possible course of action.

89. (59)

Question **Would you reevaluate your proposed strategy if you learned that the northern and California subspecies of the spotted owl are actually the same?**

Answer No. Genetic exchange occurs across a boundary between subspecies in the same way that it occurs within the distribution of either subspecies on each side of the boundary. Furthermore, this matter has recently been reviewed by the Committee on Classification and Nomenclature of the American Ornithologists' Union. This is the only group with authority to rule on taxonomic matters concerning birds of North America. Their ruling (August 1989) was that the northern and California subspecies of the spotted owl are still valid and the boundary between them remains at the Pit River, in north-central California.

Further, the owl's viability must be considered across its range. The question of subspeciation has nothing to do with the circumstances the species faces in southwestern Washington, for example. As we stated earlier, we proposed a strategy that would satisfy our charter. The NFMA requires that the FS maintain the owl (as any other species) in viable numbers across its range. A change in classification would have no effect on that requirement. Similarly, if the northern and California subspecies were combined, the bird would still be threatened in a large portion of its range as evidenced by the FWS listing of the northern spotted owl across its range.

We dealt with the situation as it exists—the American Ornithologists' Union has specified the subspeciation and informed us that no reconsideration was imminent. Simply, subspecies status does not confer any greater or lesser degree of viability. The major factors negatively influencing the species in Oregon, Washington, and California apply regardless of taxonomic status.

90. (69, 101, 140)

Question **Is restoring the owls to areas where they do not exist today an essential part of the survival strategy or were you simply trying to meet the mandates of the ESA to restore it throughout its range? Does the "well-distributed" requirement pose a greater and more demanding management burden on the FS than just avoiding the extinction of a native wildlife species?**

Answer The conservation strategy we propose does not restore owls everywhere they have occurred in the past; it increases their densities in some areas, such as the northern Oregon Coast Ranges and southwestern Washington, where spotted owl populations are currently either very low or at risk of extirpation over the short term. The NFMA is specific in directing that species be maintained "well distributed." The ESA recognizes species at risk "in all or significant portions of their range." The ESA makes no demand to restore the species to all formerly occupied habitat, however. Maintaining a species well distributed throughout its range markedly enhances its chances for continued existence—as recognized in both the ESA and NFMA. The ISC was following both what we considered the direction of the law and dictates of biological theory by attempting to maintain the spotted owl well distributed throughout its range.

Species with habitat constricted or poorly distributed are at risk of decline and extinction. "Just avoiding extinction" has little meaning in the long run; maintaining a population that is not well distributed has a high probability of resulting in extinction during a catastrophe, prolonged adverse weather, or some other detrimental set of circumstances. Further, our intent was to obey extant law. The NFMA (rather, the regulations issued pursuant to it) requires the FS to maintain viable populations well distributed within the planning area. The National Forests contain the vast majority of spotted owl habitat.

Forest Management and Research in HCAs

91. (130, 131)

Question **Why do the HCAs not allow forest management activities?**

Answer The intent of the HCAs is to provide a network of large blocks of habitat for northern spotted owls until reasonable certainty exists that forest practices are available for producing and maintaining equally good habitat. Such management can then be applied in HCAs. Proven technology to achieve that end does not currently exist. Because extant populations will be greatly reduced (perhaps by 50 percent or more) by cutting, we believe that ensuring that the quality of the habitat retained within HCAs must be as high as possible. Data from telemetry studies indicate that unmanaged old forests are the best habitat for spotted owls, so we recommended

that existing old forests in HCAs should be left unmanaged, and that some previously harvested stands be allowed to develop in an unmanaged condition.

Our plan does not rule out management activities that do not significantly reduce the amount of habitat. We discourage, but do not rule out, road building. We also would not be averse to soil stabilization projects, stream improvement projects, and the like, that do not adversely affect the forest cover.

92. (17)

Question **The conservation strategy recognizes the development of spotted owl habitat in certain young, intensively managed stands. Research results to this point from northern California are cited. The report also recognizes the likelihood that forest management may provide both owl habitat and timber products, and suggests that such prescriptions be tried on private land. Why is it completely disregarded and categorically prohibited on Federal lands?**

Answer We did not disregard forest management to produce or sustain owl habitat nor did we categorically prohibit management to create spotted owl habitat on Federal lands. Quite the contrary, we encouraged such management. We stated, however, that we viewed the development of silvicultural prescriptions for spotted owl habitat as largely experimental, and proposed that those prescriptions should be tested outside of the HCAs before they were applied within them. Saying that some wildlife biologists and some silviculturists believe that a silvicultural prescription can be developed that will work to produce owls and timber, and then relying on that faith in a management strategy, stretches the bounds of "scientific credibility." When any prescription is applied to a recovery plan for a threatened species, it must be examined to see if it complies with the ESA.

93. (5, 10, 78, 86, 163)

Question **At a recent House joint subcommittee hearing, Dr. Jerry Franklin, Chief Plant Ecologist, FS, Pacific Northwest Research Station, characterized the ISC strategy as a minimal-risk plan and suggested that experimenting with "new forestry" in some of the HCAs might be an acceptable risk. Are techniques such as those developed through Dr. Franklin's research acceptable within HCAs?**

Answer The conservation strategy we advocate is not, by any stretch of the imagination, a "minimal-risk plan." Some 60 to 70 percent of the habitat (and perhaps more) for the subspecies has disappeared over the last 90 to 100 years with, one can most reasonably assume, a similar or greater decline in owl population. In addition, the proposed conservation strategy anticipates the loss in a worst-case scenario of perhaps 50 percent of the population extant in 1990. Our strategy cannot be characterized as a minimal-risk plan.

At the present time, we view new forestry as largely experimental; we have no evidence that it can be carried out in a way that will reliably and consistently produce habitat for spotted owls. Theoretically, producing such habitat should be possible, but many hurdles must be overcome before a strategy that relies on such techniques could be considered scientifically credible. Until such time as the

techniques are proved, we believe that research must be limited to areas outside of the HCAs. The strategy we propose makes HCAs the keystone for success, and they are not the place for experiments.

The proposed strategy makes tens of thousands of acres of suitable habitat available for harvest or experimental manipulation that were reserved in SOHAs outside the boundaries of HCAs. Experimenting with new forestry can and should take place in those areas. The strategy calls for such experimenting, but it should not take place in HCAs until silvicultural methods have been proved to provide results in keeping with spotted owl conservation.

The ISC discussed this question at length and agreed that the best approach would be to concentrate research in forested areas outside of the HCAs. At least half of the known owl population and much high-quality habitat occur outside of HCAs. The idea that such research cannot be done outside of the HCAs because all or most of the owls and all or most of the superior habitat are inside the HCAs is incorrect. Even though we emphasized it, the fact that our strategy allows for timber to be cut on nearly half of the remaining suitable owl habitat has not been widely recognized. As that habitat is cut, it will provide ample opportunity to test the effects of new forestry on spotted owls. Our intent is to maintain the HCAs in the best possible condition for the subspecies. That means allowing cutover areas to regenerate, and not logging suitable habitat areas in the HCAs. In the long term, if we find that new forestry techniques will provide habitat of equal quality for spotted owls, then implementing such techniques in HCAs should be evaluated anew.

94. (18)

Question **How successful can the experiments be to demonstrate compatible forest management and spotted owl habitat maintenance when you are allowing the experiments only on marginal owl habitat?**

Answer The question's implication that all of the superior spotted owl habitat is contained in the proposed HCAs is incorrect. Large amounts of high-quality habitat exist (perhaps as much as half of what remains) in the forest matrix between the HCAs. The plan, then, allows for the cutting of extensive areas of high-quality habitat. We anticipate that large numbers of spotted owls will be eliminated from the population over time as the areas between the HCAs are cut. No reason exists to believe that the results of experiments conducted outside of HCAs will be any different from experiments conducted inside them.

95. (67, 141)

Question **Could extensive owl research definitively describe the so-called "structure" that seems to make old-growth forest the owl's preferred habitat? If so, how long would it take to determine if modified forest management practices might have a reasonable chance to replicate that structure in second growth?**

Answer Current research is aimed at characterizing the attributes of forest stands used by spotted owls. Teasing apart the specific attributes of the forest and its structure that cause owls to be successful or unsuccessful is extremely difficult, however. Simple occupancy by owls is not sufficient to demonstrate adequacy of the forest stands they use. We need to document adequate survival and reproduction rates

(lambda = 1.0+) of a sample of owl pairs over time (10 years) in each region where some modification of current forest management practices is attempted. Such a research effort will require teams of forest and wildlife scientists experimentally manipulating forest landscapes on the scale of Ranger Districts. Optimistically, several to many decades will be required to gain sufficient information before shifting from an HCA-based conservation strategy to one that relies on managed forest would be prudent. The length of time required to make such a determination will be a function of the resources devoted to the study and the time required for the forest to develop after experimental manipulations. Such research is specifically suggested in appendices R and S of the ISC report.

Most observations of owls in second growth (outside of northern California) indicate that they are associated with nesting areas of residual older trees surrounded by 40- to 80-year-old stands. Such stands may be difficult to produce in a shorter period. For this reason, we recommended that "category 4 HCAs" of 80 acres of suitable habitat be left when areas that contain nesting owls are logged. This tactic may allow the area to support owls much sooner. Another approach is to determine if presently suitable habitat can be selectively logged and still remain suitable. That experiment can be done in a much shorter period of 5 to 20 years. We are very unsure of these answers and would feel more comfortable working with silviculturists to design appropriate study approaches. Such research planning is being, or will shortly be, considered; it is encouraged as part of the adaptive management section of the ISC report.

96. (21, 129)

Question **In the methods section of your conservation strategy, you noted that "hands on" management of habitat and animals would be considered. The management strategy, however, does not address such activities as translocating owls and developing and using artificial nest structures, which are usually associated with a species that is threatened with extinction. Was this section accidentally left out of the discussions, or did you have a specific reason for not including it in any of the management recommendations?**

Answer The ISC report does advocate (appendices R and S) hands-on management of habitat outside of HCAs that may demonstrate the ability to maintain owls in managed forests through innovative silvicultural practices. We discussed translocation and pen-raising in deliberations but not in the report. Such options as these are usually last resorts to be used when nothing else can be done. The species in question then usually moves to endangered status. Use of such techniques is prima facie evidence of a breakdown in viability of the population that must be overcome. No place in the current range of the owl requires such measures now. The population on the Olympic Peninsula, if it is indeed demographically isolated, may be an exception if genetic problems develop. Transplanting owls might be useful for avoiding genetic problems, but would almost certainly not stave off a population decline if the problem is demographic isolation of the population and a poor or zero immigration rate from other populations. We believe that transplanting and breeding in captivity to allow actions that would make existing habitats "nonviable" to support owls would be in direct conflict with the objectives of the conservation strategy and the mandates and intent of NFMA and ESA, now that the species is identified as threatened.

Existing data are inadequate to indicate that installing nest boxes or platforms would be either biologically or cost effective in maintaining a well-distributed, interbreeding population. Captive rearing and artificial habitat are commonly used only as desperation measures and run counter to the intent of providing suitable habitat. The welfare of a species and its habitat are joint considerations. At the moment, numbers of birds are not the critical problem. Habitat loss is the problem. To justify continued habitat fragmentation and loss on the crutch of artificial breeding is not in keeping with either the ESA or the NFMA.

Data available from demographic studies indicate that the survival rate for juveniles is 0.20 and 0.50 for subadults. If these survival rates were applied to pen-raised owls (and that is almost certainly optimistic), only 10 of every 100 released would survive to breeding age. Whether these owls would enter the breeding population is unknown. For any real chance of success, the birds would probably have to be raised in the place they will occupy. Spotted owls are fed by the parents from spring until fall, so raising young artificially would be expensive. If successful, pen-raising would have to continue over a period of centuries. Extensive surveys would also have to be conducted yearly to discern vacant territories—a highly expensive, complex process. Quick fixes and simple solutions are, more often than not, not the panacea they may seem.

97. (77, 99))

Question **A massive northern spotted owl inventory is currently being conducted on private forest land—primarily in managed, second-growth stands—throughout northern California, western Oregon, and western Washington. What evidence would this effort have to produce to convince the ISC to reexamine the fundamental assumption in the report that large blocks of forest land must be placed totally off-limits to all management activities to ensure the survival of the owl?**

Answer Management activities within HCAs are not prohibited. For example, the ISC encourages regeneration of logged stands and fire protection, and road building is discouraged but permitted. Any management that can be shown to provide short- or long-term benefit to owls is possible, once it has been proved.

We would not classify the survey effort as "massive," but the effort is important. Several other things would need to happen. First, the density of spotted owls in young, even-aged stands would have to shown to be near that recorded in habitat now defined as superior. Second, populations in such stands would have to be shown to be self-sustaining; that is, they reproduce and survive well enough over a long enough period to indicate that the population is viable and not a mere population "sink" for other, more productive areas. Third, these relations would have to be documented in different regions because findings from one region may not apply to another area with a different forest type and prey base. At the very least, such studies should be done on the east slope of the Cascades, in southwest Oregon, the western hemlock zone (northwestern Oregon, western Washington), the coastal redwoods, and the northwestern California mixed conifer zone. Fourth, some means must be found to ensure that suitable habitat on such areas would be sustained over time; that is, if stands 70 years old did in fact provide adequate habitat, but were harvested at age 80, the benefit to owls would be limited.

Although we are aware that some of the surveys conducted by industry personnel in California have been successful in locating owls in good numbers, we are equally aware that previous surveys on State and private lands in northwestern Oregon and Washington have documented many fewer owls in much lower densities. We do know that spotted owls occur on industry lands in Oregon and Washington, but most such owls located to date have been in unmanaged stands of old growth or unmanaged stands characterized by a mix of young, mature, and old-growth forest. Very few pairs have been found in even-aged, intensively managed stands in Oregon and Washington.

98. (15)

Question **Spotted owls are certainly not sensitive to human disturbance. Why has the ISC chosen to prohibit road building in HCAs? Can you point us toward any data in the report that substantiates this recommendation?**

Answer The report did not prohibit road construction in HCAs. We suggested roads be placed in HCAs only when no feasible alternative was possible. Road construction diminishes the quality of habitat by creating edge and reduces the amount of habitat by the loss of forested land displaced by the road. Our reasons for these recommendations had little to with owls' reactions to people.

Owls are generally tolerant of human presence; the limits of this tolerance are not known, however. Putting owls in any more frequent contact with humans than necessary increases the probability that some of those humans may intend harm to the owls. Given the tension surrounding the issue, the probability of harm coming to owls from increased human contact may increase. But, again, the primary rationale for discouraging roads in HCAs was related to habitat.

99. (134, 135, 136, 137)

Question **Could a new dam be constructed and a new reservoir be created in an HCA such as in the Bull Run watershed? Could blowdown salvage be done to reduce fire danger and the threat to high-quality water? What about stream-channel or landslide rehabilitation? If the answer to one or more of these questions is "not under the present concept of an HCA," then what kind of guidelines can be written for creating or managing this HCA that will ensure that we can both protect owl habitat in the Bull Run and provide for a continued supply of high-quality water?**

Answer The ISC designated the Bull Run area as an HCA because of its strategic location in an attempt to enhance habitat connectivity across the Columbia River. Timber management was already constrained by the watershed classification, which would dampen the effect of the designation on timber supply. The area includes large amounts of suitable owl habitat; making the Bull Run area an HCA would help reduce the loss of other land from the timber base that might be so designated. The ISC assumed that the FS and the City of Portland could and would design a set of standards and guidelines for managing the watershed to both protect owl habitat and provide a supply of high-quality water. We reiterate—ISC recognized that the primary reason for the classification of the Bull Run watershed is providing high-quality water and that a special plan would be required for the area.

100. (87)

Question **Did the ISC consider harvest of special products (such as mushrooms and salal) to be appropriate within HCAs?**

Answer The ISC considers all forest uses that do not alter habitat suitability for owls or that can be expected not to influence owls adversely as compatible uses in HCAs. The harvest of mushrooms and salal are examples of consumptive uses that seem to meet these criteria. The ISC recommended establishing an oversight committee to deal with questions such as these, which are certain to crop up regularly.

101. (83)

Question **What responsibilities would the oversight committee have for implementing the conservation strategy?**

Answer We recommended that the oversight committee review any proposed alterations in the strategy—such as shifts in location of HCAs or road locations or timber sale layout—to assure compliance with the intent of the strategy considering real world, day-to-day problems of management. This recommendation was intended to provide required flexibility and enhance the chances for success of the strategy.

Socioeconomic and Environmental Effects of the Strategy

102. (3)

Question **Did you consider economic impacts when you arrived at your recommendations?**

Answer Yes, qualitatively so. The best strategy to ensure owl welfare would be to stop all harvest of suitable habitat. We derived a strategy far less sweeping to account for economic and social realities and existing habitat conditions. We believe, however, that the strategy presented will, if followed, ensure a high probability of maintaining a viable population well distributed across the range of the subspecies over a 100-year period.

103. (24)

Question **Dr. Verner wrote in a letter, that "our group has the force of Federal law behind it, as a Congressional bill passed last fall requires agencies to implement our plan or explain in writing to Congress why they decided against it." Would you please explain the inconsistency between this statement and the statement in your report that your Committee merely proposed a plan and that it was up to others to decide whether to adopt it?**

Answer The personal letter from Dr. Verner to a colleague neither states nor implies that our Committee has or had any authority to implement ISC recommendations. It merely points out that a decision about implementation may involve both agencies and Congress. Further, the ISC, as a whole, did not believe that our recommendations had the "force...of law" behind them and did not operate on that assumption during our deliberations.

104. (38)

Question **Did you intend for the FS to adopt the ISC strategy without conducting any further environmental or economic analysis?**

Answer We had no intention other than to submit a "scientifically credible conservation strategy" by the designated reporting date, as we were charged to do. What the agency heads do with the report is up to them and is certainly not under our control. Our report clearly anticipated that economic and social analysis would quickly occur. We even cautioned that the analysis would likely be limited to the issue of owls and timber supply (jobs), and that it should be expanded to cover other areas of concern.

105. (14)

Question **Is the protection offered under the strategy sufficiently better to warrant the overwhelming increased socioeconomic impact?**

Answer We simply do not believe, after consideration of all available information, that the current (SOHA) strategy will succeed in maintaining viable populations over the long term (100 years or more). The FS analysis of the current strategy in the FSEIS accords it a "poor" chance of success over a 100-year period and only a "moderate" chance of success over a 50-year period. The definition of moderate in the Forest Service's FSEIS was precise and quantitative; it does not impart much hope for long-term persistence of the subspecies. We are surprised that anyone is shocked that we concur with the FSEIS in this regard; we believe those assessments to be optimistic. So, the question is more appropriately stated as, "Is the cost of retaining the northern spotted owl in viable numbers well distributed across its range socially and politically acceptable?" That question is more appropriately answered by appointed and elected officials and, ultimately, by the American people.

Whether the increased costs are "overwhelming" is a matter of political judgment and is not a biological consideration. We do believe, however, that such costs are inherent in any strategy.

Proceeding along present lines of management is likely, we believe, to fail in terms of sustaining viable populations of owls. In turn, this outcome does not seem to us to be in keeping with the NFMA or the ESA and regulations issued pursuant to those acts. This view is merely the opinion of our group of scientists; we are not experts in matters of law.

Estimates of the economic and social impacts of applying the ISC strategy have become confused—particularly as reported in the press and as expounded by various players in the controversy. For example, a study by Oregon State University economists was reported in the press as saying that the strategy we propose was apt to cause the loss of 50,000 jobs in Oregon. What the report said was that the cost of implementing the ISC strategy was estimated to be about 6,000 or so jobs. Another 6,000 or so jobs were estimated to be lost as a consequence of applying the preferred alternatives in Forest Plans. The other 38,000 jobs to be lost were predicated on the assumption that the ISC strategy would be applied to private lands. No recommendation was made to apply the strategy to private lands in the ISC report. The loss of 6,000 jobs is not a trivial matter—but it is also not

50,000 jobs. We recommend careful perusal of any such economic analyses to discern precisely what they do and do not say. The ISC report did not impose requirements for private lands—not within HCAs nor between HCAs nor anywhere else. Analyses may legitimately extend consideration beyond the recommendations in the ISC report, but the analysts should clearly say what they are doing. Projections of economic and social effects are, like the ISC strategy, hypotheses. Results differ dramatically depending on assumptions inherent in the analyses, and these assumptions should be carefully examined in considering such reports. So far, estimates of lost jobs have run from several thousand to well over 100,000.

106. (11, 159, 162, 164)

Question **Should criteria other than spotted owls and jobs be considered in evaluating the costs and benefits of your plan?**

Answer The ISC report states that other aspects of forest management should be evaluated, including effects on water quality and quantity, scenic values, soils, fisheries, other wildlife, biodiversity, and recreation. Otherwise, the consequences of the proposed strategy have been limited by administrative decision and political realities to only two matters of potential concern—owls and timber supply (that is, jobs). The issue and the ramifications of the strategy we propose are far broader than that. To consider the strategy in such a narrow framework is to trivialize the issue at hand.

107. (39)

Question **If the FS finds that your plan would produce environmental or economic impacts, what flexibility have you given the FS to modify your plan to reduce the impacts?**

Answer Neither the FS nor any of the other land management agencies that chartered the ISC require dispensation of flexibility from ISC. The conservation strategy we presented is advisory; the agencies have the authority to deal with the strategy as they choose. How much credibility the strategy would have if it were extensively modified is quite another question, however. We clearly stated in our report (p. 45) that:

We were asked to do a scientifically credible job of producing a conservation strategy for the northern spotted owl. We have done our best and are satisfied with our efforts. We have proposed. It is for others—agency administrators and elected officials and the people whom they serve—to dispose. That is the system prescribed in law. It seems to us a good one. We can live with that.

108. (156)

Question **Assume for the moment that our only concern is to protect the owl, and we did not need to consider the economic impacts. Would the ISC still have made the same recommendation?**

Answer No. We would have recommended stopping all harvest of mature and old-growth timber and acting to produce more suitable habitat in the shortest possible time. Because most spotted owl populations studied to date are declining in numbers both from habitat loss and from demographic conditions, applying the ISC strategy would not be the best plan for maximizing future viability of the subspecies.

109. (96)

Question **The conservation plan recommendations assume a static universe, but if it is implemented, changes in land-use patterns and ownership are likely. Has how these changes will affect markets, products, and the owl itself been considered?**

Answer The FS and BLM have prepared a report on the probable economic and social consequences of implementing the proposed strategy. The ISC made no such analyses. Other groups such as State governments, the timber industry, environmental groups, and various consultants are also preparing analyses of markets, forest products, and so on. An array of highly variable answers will undoubtedly accrue from these studies, from which answers may be chosen. Each of these studies makes different assumptions about markets, land-owner intent under various scenarios, land ownership, and so on—answers to suit all tastes. The assumptions are the key to interpreting these analyses. Evaluating the assumptions is just as important as evaluating the results of the analyses. We did not assume a static universe so far as habitat was concerned and specifically mentioned producing and recruiting habitat, as well as shifts in land-owner objectives related to wood price, law, and so on.

110. (162, 166)

Question **As a wildlife ecologist, could you address the desirability of setting aside large reserves of old-growth forest?**

Answer The question begs a question—desirability for what purpose? Setting aside large reserves of old-growth forest should be beneficial to wildlife species associated with such habitat conditions. This benefit, in turn, is related to maintaining the old-growth ecosystem, including the invertebrate and plant communities. Such maintenance could be a key attribute to any scheme of preserving biodiversity because old growth, as we know it, is unlikely to recur under managed forest regimes. This concept moves the discussion away from a single species, at best an "indicator species," to a larger question of landscape ecology and ecosystem management. As a general rule, large habitat blocks are much more likely to function as a specialized habitat, much more likely to persist over time, and much more likely to harbor more species of plants and animals common to that habitat than smaller blocks. The choice of the owl as an indicator species was fortunate because of its large home-range size. An HCA of a size to support 20 or more pairs is likely large enough to accommodate any presently occurring species.

111. (7, 159, 160)

Question **Would your plan benefit other species besides spotted owls? Can you state with confidence that the ISC strategy would adequately provide for all of these species?**

Answer

The proposed strategy would benefit all species associated with mature and old-growth habitats and those favored by the same habitat structure that produces suitable habitat for spotted owls. Aside from considering spotted owl prey species (including flying squirrels, wood rats, and other rodents), we made no formal assessment of effects on other species, nor was it the Committee's charge to do so. Although we did not analyze the effects of the strategy on water quantity, quality, and the timing and rate of discharge, benefits to aquatic life seem likely as well.

Note that we have recommended adaptive management as part of our strategy, through which spotted owl habitat of the future might be provided in managed forests and the HCAs abandoned. How such a scenario, if and when it did become a reality, would influence other species is much less certain.

The FS publication *Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington* reports that 206 vertebrate wildlife species feed and 207 species breed in old-growth forests in western Oregon and Washington. A much smaller number of species have a primary association with old growth. Although the northern spotted owl was chosen by the FS as an indicator species for old-growth ecosystems and their associated vertebrate fauna, to what extent other species would benefit from actions to benefit spotted owls is unclear.

Problems may arise with the spotted owl HCA's being too far apart, not well enough connected, or both for some of the smaller, less motile species associated with old growth. One of our assumptions, however, was that linkages, at least for spotted owls, would occur from other land and species allocations, at least on National Forest lands. The 50-11-40 forest conditions between HCA's might also serve to help link populations of old-growth associates, although this assumption would require research and monitoring to determine its validity. At present, no quantitative assessments of effects of the ISC strategy are available for other species. The species in question would likely be much better provided for than they are at present, however.

We believe that consideration of the costs and benefits of the strategy we recommend be extended beyond the analyses of timber supply to include the appraisal of effects on water quality and quantity, other wildlife, fisheries, recreation, scenic values, and so on. The issue is more complex than owls and jobs—it always has been.

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