



THE WILDLIFE SOCIETY

5410 Grosvenor Lane • Bethesda, MD 20814-2197
 Tel: (301) 897-9770 • Fax: (301) 530 2471
 E-mail: tws@wildlife.org

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 If not received,
 please
 call

301-897-9770

To: Ernest Ables, President, Idaho Chapter, TWS
 Fax: (202) 885-6226
 From: Ruth Goldstein, Wildlife Policy Intern, TWS
 Fax: (301) 530-2471
 Date: 31 May, 1995

1 Dan Edge
 Fax 503-737-3590

Re: ESA Hearing

Dr. Ables:

Please find included excerpts from the National Academy of Sciences ESA report and Senator Gorton's ESA Reauthorization bill (S. 768). I have also included an article from the Environment and Energy Study Institute which does a good job of summarizing Gorton's bill and its implications. Issues you may want to comment on are: critical habitat (definition and importance); the definition of harm and taking (Sen Gorton's bill would include only direct harm against the animal, not habitat destruction); and the importance of the ESA in general. TWS does not yet have an official policy on ESA reauthorization, but I hope the information I have included will help you with your comments.

As I stated on the phone, TWS was not given a slot on the witness list, but there will be an opportunity for 20 individuals to make comments of 2-3 minutes at an open microphone. When you get to the hearing, inquire about putting your name in the lottery for an open mike slot. Senator Kempthorne's office in D.C. is also accepting written testimony for the record for an indefinite amount of time after the hearing.

Senator Dirk Kempthorne
 367 Dirksen Senate Office Building
 Washington, D.C. 20510

Let me know if you have any questions. I would appreciate a copy of any statements you make on behalf of the Idaho Chapter of TWS.

Sincerely,


 Ruth Goldstein

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104TH CONGRESS
1ST SESSION**S. 768**

To amend the Endangered Species Act of 1973 to reauthorize the Act,
and for other purposes.

 IN THE SENATE OF THE UNITED STATES

MAY 9 (legislative day, MAY 1), 1995

Backwood
 Mr. GORTON (for himself, Mrs. JONES, Mr. SHEDDEN, Mr. BREAUX, and Mr. BAGWELL) introduced the following bill, which was read twice and referred to the Committee on Environment and Public Works

A BILL

To amend the Endangered Species Act of 1973 to
reauthorize the Act, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*
 2 *tives of the United States of America in Congress assembled,*

3 SECTION 1. SHORT TITLE; TABLE OF CONTENTS; REF-
 4 ERENCES.

5 (a) SHORT TITLE.—This Act may be cited as the
 6 “Endangered Species Act Reform Act of 1995”.

7 (b) TABLE OF CONTENTS.—The table of contents of
 8 this Act is as follows:

Sec. 1. Short title; table of contents; references.

Sec. 2. Purposes.

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TITLE I--ENSURING THE INTEGRITY OF THE LISTING AND
CRITICAL HABITAT DESIGNATION PROCESSES

- Sec. 101. Requiring peer review.
- Sec. 102. Considering State, local, and foreign government activities.
- Sec. 103. Improving the collection and analysis of scientific information.
- Sec. 104. Improving public hearings in the listing process.
- Sec. 105. Considering breeding populations in making listing determinations.
- Sec. 106. Providing equal access to judicial review.
- Sec. 107. Setting a standard for emergency rulemaking.

TITLE II--BROADENING THE RECOVERY PLAN TO CONSTITUTE A
CONSERVATION PLAN AND MAKING THE CONSERVATION PLAN
CENTRAL TO THE IMPLEMENTATION OF THE ENDANGERED
SPECIES ACT OF 1973

- Sec. 201. Providing for coordination of conservation decisionmaking for a species after the listing determination; ensuring timely, comprehensive and effective conservation plans.
- Sec. 202. Providing transition periods for conservation plan preparation.
- Sec. 203. Making technical and conforming amendments to ensure that conservation objectives and plans are the focus of management under the Endangered Species Act of 1973.

TITLE III--IMPROVING THE CONSULTATION AND CONFERENCING
PROCESSES FOR FEDERAL AGENCY ACTIONS

- Sec. 301. Clarifying the consultation and conferencing standards.
- Sec. 302. Identifying when consultation is required.
- Sec. 303. Making the consultation deadlines binding.
- Sec. 304. Enhancing applicant participation.
- Sec. 305. Specifying the reasonable and prudent alternatives identification process.
- Sec. 306. Clarifying the relationship of the consultation requirement with the land management planning requirements for Federal lands.
- Sec. 307. Further clarifying Federal agency responsibilities.
- Sec. 308. Clarifying the effects of secondary impacts.
- Sec. 309. Requiring risk assessment and cost benefit analyses in the consultation process.
- Sec. 310. Eliminating the Endangered Species Committee.

TITLE IV--ENSURING THAT THE COMPLIANCE PROCEDURES AND
STANDARDS FOR NON-FEDERAL PERSONS ARE NOT MORE
BURDENSOME THAN THE PROCEDURES AND STANDARDS AP-
PLICABLE TO FEDERAL AGENCIES

- Sec. 401. Establishing consultation procedures with respect to private actions.
- Sec. 402. Defining the taking prohibition in accordance with the intent of Congress.
- Sec. 403. Clarifying the application of taking prohibitions.
- Sec. 404. Authorizing the issuance of general permits.
- Sec. 405. Improving the non-Federal conservation planning process.
- Sec. 406. Encouraging exchanges to protect habitat on non-Federal lands.

TITLE V--PROVIDING FOR HABITAT CONSERVATION INCENTIVE
PROGRAMS

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- Sec. 501. Providing for cooperative management agreements.
 Sec. 502. Providing for habitat reserve grants.

TITLE VI—OTHER AMENDMENTS MAKING THE ENDANGERED SPECIES ACT OF 1973 MORE EFFECTIVE AND LESS BURDENSOME

- Sec. 601. Providing guidance for the release of experimental populations.
 Sec. 602. Recognizing captive propagation as a means of recovery.
 Sec. 603. Clarifying the application of prohibitions to threatened species.
 Sec. 604. Encouraging research on alternative methods and technologies.
 Sec. 605. Modifying enforcement authority.
 Sec. 606. Providing adequate notice of hearings.
 Sec. 607. Ensuring the protection of private property rights.
 Sec. 608. Ensuring the use of water rights in accordance with existing State laws.
 Sec. 609. Providing for Federal cost-sharing of implementation costs imposed under conservation plans or agency consultations.
 Sec. 610. Enhancing public educational opportunities.

TITLE VII—AUTHORIZING INCREASED APPROPRIATIONS

- Sec. 701. Reauthorizing the Endangered Species Act of 1973.

1 (c) REFERENCES TO ENDANGERED SPECIES ACT OF
 2 1973.—Except as otherwise expressly provided, whenever
 3 in this Act an amendment or repeal is expressed in terms
 4 of an amendment to, or repeal of, a section or other provi-
 5 sion, the reference shall be considered to be made to a
 6 section or other provision of the Endangered Species Act
 7 of 1973 (16 U.S.C. 1531 et seq.).

8 ~~*~~ SEC. 2. PURPOSES.

9 ~~The purposes of this Act are:~~

10 (1) ~~to improve and protect the integrity of the~~
 11 ~~programs established under the Endangered Species~~
 12 ~~Act of 1973 (16 U.S.C. 1531 et seq.) for the con-~~
 13 ~~servation of endangered species and threatened spe-~~
 14 ~~cies;~~

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1 (2) to ensure the scientific validity of decisions
2 to designate the species and the critical habitat of
3 the species;

4 (3) to ensure balanced consideration of all im-
5 pacts of decisions implementing the Act;

6 (4) to make the conservation planning process
7 central to, and reduce the number of decisions need-
8 ed for, the implementation of the Act;

9 (5) to provide for equitable treatment of non-
10 Federal persons and Federal agencies under the Act;

11 (6) to ameliorate the impact of the Act on, and
12 provide less costly and time-consuming procedures
13 for, non-Federal lands; and

14 (7) to encourage non-Federal persons to con-
15 tribute voluntarily to species conservation.

16 **TITLE I—ENSURING THE INTEG-**
17 **RITY OF THE LISTING AND**
18 **CRITICAL HABITAT DESIGNA-**
19 **TION PROCESSES**

20 **SEC. 101. REQUIRING PEER REVIEW.**

21 Section 4 (16 U.S.C. 1533) is amended by adding
22 at the end the following:

23 “(j) PEER REVIEW REQUIREMENT.—

24 “(1) DEFINITIONS.—In this subsection:

25 “(A) ACTION.—The term ‘action’ means—

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1 with the requirements of this section applicable to
2 preparation of a conservation plan or conservation
3 objective.

4 "(t) STANDARD OF REVIEW.—The standard for judi-
5 cial review of any decision of the Secretary, or a Federal
6 agency under this section shall be whether the decision
7 is arbitrary, capricious, an abuse of discretion, or other-
8 wise not in accordance with law.

9 "(u) OTHER PLANS PROTECTING LISTED SPE-
10 CIES.—Any conservation measure that provides protection
11 to a species listed as endangered or threatened that is car-
12 ried out under a plan developed under the Pacific North-
13 west Electric Power Planning and Conservation Act (16
14 U.S.C. 839 et seq.) shall be considered to be part of the
15 conservation plan for the species for the purpose of any
16 cost-sharing arrangement under section 16."

17 ~~(b) DEFINITION OF CRITICAL HABITAT.—Section 3~~
18 ~~(16 U.S.C. 1532) is further amended in paragraph (7) (as~~
19 ~~redesignated by section 103(c)(1))—~~

20 (1) by striking "(7)(A)" and all that follows
21 through the end of subparagraph (A) and inserting
22 the following:

23 ~~"(7) CRITICAL HABITAT.—~~

24 ~~"(A) IN GENERAL.—The term 'critical~~
25 ~~habitat' for an endangered species or a threat-~~

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* 1 ened species means the specific areas within the
2 geographic area occupied by a species at the
3 time the species is listed in accordance with sec-
4 tion 4 that contain such physical or biological
5 features as—

6 “(i) are essential to the persistence of
7 the species over the 50-year period begin-
8 ning on the date the regulation designating
9 the critical habitat, or any revision of the
10 regulation, is promulgated; and

11 “(ii) may require special management
12 considerations or protection.”; and

13 (2) in subparagraph (C), by striking “which can
14 be”.

15 (c) CONFORMING AMENDMENTS.—

16 (1) Section 6(d)(1) (16 U.S.C. 1535(d)(1)) is
17 amended by striking “section 4(g)” and inserting
18 “section 4(f)”.

19 (2) Section 10(f)(5) (16 U.S.C. 1539(f)(5)) is
20 amended by striking the last sentence.

21 (3) Section 7(a)(1) of the Land and Water
22 Conservation Fund Act of 1965 (16 U.S.C. 460l-
23 9(a)(1)) is amended by striking “section 5(a)” and
24 inserting “section 5A(a)”.

1 (2) NON-FEDERAL PERSON.—Section 3 (16
 2 U.S.C. 1532) is further amended by inserting after
 3 paragraph (15) (as added by section 301(b)) the fol-
 4 lowing:

5 “(16) NON-FEDERAL PERSON.—The term ‘non-
 6 Federal person’ means a person other than an offi-
 7 cer, employee, agent, department, or instrumentality
 8 of the Federal Government or a foreign government,
 9 acting in the official capacity of the person.”.

10 SEC. 402. DEFINING THE TAKING PROHIBITION IN ACCORD-
 11 ANCE WITH THE INTENT OF CONGRESS.

12 Section 3 (16 U.S.C. 1532) is further amended by
 13 striking paragraph (25) (as redesignated by section
 14 103(c)(1)) and inserting the following:

15 “(25) TAKE.—

16 “(A) ~~IN GENERAL.—~~ The term ‘take’
 17 means to harass, harm, pursue, hunt, shoot,
 18 wound, kill, trap, capture, or collect, or to at-
 19 tempt to engage in that conduct.

20 “(B) ~~HARM.—~~ In subparagraph (A), the
 21 term ‘harm’ means to take a direct action
 22 against any member of an endangered species
 23 of fish or wildlife that actually injures or kills
 24 a member of the species.”

Does not take into account habitat destruction

Ernest Able * Fax - 208 -
885 6226
EESI Weekly Bulletin

Background on refuge system: Two laws govern national wildlife refuge operations: The Refuge Recreation Act of 1962 and the National Wildlife Refuge Administration Act of 1966. They provide general guidelines on recreation and conservation uses and how additional acreage can be obtained, but are virtually silent on important management issues, such as compatible use. Nor is the overall purpose of the refuge system articulated in either law.

Schallenberger says he supports "organic" legislation to define the purpose of the system. Sen. Bob Graham (D-Fla.) proposed a bill last year (S. 823) that would set out the purpose of the system and address compatibility and planning issues. Schallenberger praised Graham's bill and said he could support a similar measure.

* **Young's bill:** Young is expected to introduce his wildlife refuge reform bill May 18. Staff, who have been working with the Fish and Wildlife Service on the bill, indicate that it will articulate the overall purpose of the system and clarify the meaning of compatible use. The bill is based in part on the Graham bill, but a subcommittee source emphasized, "This is not the Graham bill, this is the Young bill."

* **Schedule:** A hearing on Young's bill is scheduled for Thursday, May 25, at 10 a.m., in 1324 Longworth.

Witnesses: A witness list had not been finalized at press time; however staff expect to invite Graham and other members who have sponsored bills addressing specific refuges, including Reps. Norman Y. Mineta (D-Calif.) and Marty Meehan (D-Mass.); and representatives from the U.S. Fish and Wildlife Service, Wildlife Management Institute, Wildlife Legislative Fund of America, International Association of Fish and Wildlife Agencies, National Wildlife Refuge Association, National Rifle Association and National Audubon Society.

Contacts: Harry Burroughs, majority, 226-0200; Karen Steuer, minority, 226-2311.

Mary Lehman

Biological Diversity

* Senate set to begin ESA debate

The Senate is set to begin a dialogue that will probably take the better part of this year and maybe the next on reauthorization of the Endangered Species Act.

Sen. Dirk Kempthorne (R-Idaho), who chairs the Environment and Public Works subcommittee that has jurisdiction over the law (Drinking Water, Fisheries and Wildlife), and Sen. Harry Reid (D-Nev.), the subcommittee's ranking minority, have announced the

first round of field hearings to receive input from citizens, public officials and local interest groups and industries that are affected by the law.

Kempthorne hopes the hearings, which will be held over the Memorial Day recess, will be attended by members of the subcommittee as well as other members of Congress from the neighboring areas.

The first hearing will be in Roseburg, Ore., on Thursday, June 1; and the second will be in Lewiston, Idaho, on Saturday, June 3. An aide to Kempthorne said Sens. Bob Packwood (R-Ore.) and Mark O. Hatfield (R-Ore.) plan to attend the Roseburg hearing. Environment and Public Works Chairman John Chafee (R-R.I.) is also expected to attend at least one of the field hearings. Subcommittee staff are still trying to set up field trips in conjunction with the field hearings so members can see firsthand some protected species and critical habitat areas.

Gorton bill: Meanwhile, Sen. Slade Gorton (R-Wash.) became the first member of the 104th Congress to offer an ESA reauthorization bill (S. 768), which he introduced on May 9. The bill is co-sponsored by Sens. J. Bennett Johnston (D-La.) and Richard Shelby (R-Ala.) Some observers predict the bill will not be taken seriously by the left or the right; the left believes it is too radical a departure from the current law, while some on the right says it doesn't go far enough, particularly in affording private property protections.

The bill introduced last week is virtually identical to a draft that Gorton circulated in the Senate in early April when he was seeking co-sponsors. (See story in May 8 *Weekly Bulletin*, p. 18) One of the changes in the final draft is a provision exempting some private property from the law. Gorton calls for exemptions for privately held land consisting of five or fewer contiguous acres and land on which activities are not likely to jeopardize the continued existence of a species.

Gorton struck a provision in his earlier draft that exempted state and local officials from being penalized for performing any duties in accordance with state or local law that conflicted with the federal law.

The transition period for preparing conservation plans has also been revised. Under the provision, species already on the endangered or threatened list will be put into two categories, rather than the three "tiers" Gorton had proposed earlier.

For species that are threatened or endangered in more than one state, the secretary would be required to publish a conservation objective within 210 days (compared to 120 in the earlier draft), a draft conservation plan within one year (it was six months) and a final conservation plan within 18 months (it was one year).

For species listed in one state, a conservation objective must be published "as expeditiously as possible." Requirements for draft and final conservation plans are not specified.

EESI Weekly Bulletin

In making a determination of whether a species is endangered or threatened, the secretary would have to count populations in captivity, including those in zoos; universities; and federal, state and local government breeding programs. For fish species, hatchery populations shall be included.

As part of the listing process, the secretary must appoint an assessment and planning team of biologists, economists and land use specialists from the public and private sectors to determine the biological importance of the species, range and habitat, current population, future population trends, "practicality" of recovery, and management measures needed to recover or reduce risks to the species. The team must prepare a report within 180 days that considers, among other things, direct and indirect economic and social impacts of a listing on the public and private sector.

Based on this assessment, the secretary could do one or three things: require a conservation plan to bring about full recovery of the species; require species and critical habitat protections as long as benefits outweigh "human and economic" costs to the public and private sectors, including individuals and organizations; or take no federal action, other than enforcement against activities that result in a taking of the species.

The term take would be limited to harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing or collecting a species. The 1973 law defined the taking of a species in the same way. But a 1975 regulation issued by the Interior Department expanded the definition of taking to include habitat modification or degradation, which some critics say went beyond congressional intent. The term harm would be limited to a "direct action" by a person that actually injures or kills an endangered species.

Takings would not include incidental takings that result from otherwise lawful activities in territorial seas and other exclusive economic zones not designated as critical habitat, as long as the species is not a fish. Sources say this provision is to accommodate the shrimping industry, whose members complained during one ESA field hearing about an Interior Department rule requiring that they use turtle-safe nets. The provision would also benefit fisherman who prefer using conical-shaped nets, called trawls, which can snag turtles, dolphins and other pelagic species.

The bill eliminates the Endangered Species Committee, a cabinet-level body that can grant economic development exemptions for construction projects and other activities, even if they would result in the extinction of a species. Instead of the so-called "God Squad" granting exemptions, the secretary of the Interior or Commerce department would do so. The secretary of Defense may also grant a waiver if needed for national security reasons. The president could also grant exemptions in major disaster areas.

Under Section 7 of the current law, federal agencies must consult with the Fish and Wildlife Service or the

National Marine Fisheries Service if a proposed development project could harm a protected species. The process has been blamed for halting or delaying economic activities on public lands, including getting salvage timber to market.

Gorton would eliminate the problem by making the consultation process voluntary if the agency determines that its actions are "consistent with the provisions of the final consultation plan," consistent with a cooperative management agreement or incidental taking permit, address an imminent threat to public safety, or involve routine maintenance of a federal or non-federal facility.

Consultation on an agency action must occur within one year of the date the application is submitted to the Department of the Interior or the Department of Commerce. If the deadline is missed, the requirements are "deemed met" by the applicant and the agency may proceed with its project.

Peer review could be requested by any individual for an agency decision to list a species as threatened or endangered, de-list a threatened or endangered species; or designate critical habitat. Peer reviewers would be any qualified individual with appropriate knowledge, training or experience, as long as he or she is not employed by or receiving a grant from the Department of the Interior or the Department of Commerce.

"Incidental takings of species would be allowed by permit under Gorton's proposal, allowing a host of economic activities to occur without the threat of delay because of the possibility of harm to a protected species." An incidental take permit would be issued for a wide range of activities including routine operation of any structure, building, road, dam, airport or other facility, or for irrigation or construction in progress at the time a species is determined to be threatened or endangered.

Critical habitat is redefined to mean only the specific area occupied by the species when it is listed and only if the area is essential to the survival of the species for 50 years. Habitat protections could no longer be extended to areas where the benefits of exclusion outweigh the benefits of protecting the area, unless it is determined based on "best scientific and commercial data" that failure to designate the area as critical habitat will create an imminent threat to the species existence. In addition, proposed critical habitat designations must be submitted to the commissioner of the Bureau of Labor Statistics. Each of the commissioner's concerns must be responded to in writing.

To provide an incentive for habitat conservation on state and local government lands, the bill proposes cooperative management agreements that will govern the administration and management of the area. The agency must agree to regulate activities that might "not otherwise promote conservation of the species to which the agreement applies," promote the conservation of the species, and ensure the agreement is adequately funded. Approval and implementation of the agreement are not subject to the National Environmental Protection Act.

1A Feb 4

EESI Weekly Bulletin

The advantage for state and local governments is that they would no longer have to comply with Section 5 requirements governing coordination of species conservation efforts and Section 7 consultation requirements.

The bill advocates that the federal government share 50 percent of the costs of complying with a conservation plan incurred by any individual or federal power marketing administration. A 50 percent federal cost-sharing requirement is mandatory if compliance costs exceed \$10 million.

Gorton would significantly increase funding for the law, which has received an average annual appropriation of \$39 million since it was enacted in 1973.

The bill authorizes \$110 million in FY '96 for the Department of the Interior, increasing to \$160 million by the year 2001. It authorizes \$15 million for the Department of Commerce in FY '96, increasing to \$40 million by 2001. The Department of Agriculture would receive \$4 million in annual appropriations to carry out the law.

In addition, the bill calls for \$20 million per year for cooperative management agreements, \$20 million per year for non-federal conservation planning and \$20 million per year for habitat reserve grants, which would be awarded to individuals and state or local governments to preserve habitat that 1) significantly contributes to the protection of a threatened or endangered species; 2) is dedicated for a specific period to species protection; and 3) that advances the interest of species protection.

Fate of the bill: Gorton called the bill "the ultimate sunshine law," saying leaders will be held accountable and federal officials can no longer "hide behind the curtain of federal laws and court mandates."

Claims that his bill is radical are being made by "extremists," Gorton said, adding, "The bill brings people into the process and it provides incentives for local people and communities to take actions on their own for species conservation. That's not radical, that's common sense."

Staff on Kempthorne's drinking water subcommittee, where Gorton's bill will be referred, said no action has been scheduled. An aide to Kempthorne said he will give serious consideration to any measure referred to his subcommittee, but added that it will probably be up to Chafee, the full committee chair, to determine when the bill will be taken up.

Drinking water subcommittee contacts: Janet Coit, majority, 224-~~6776~~; David Hoskins, minority, 224-0748.

Fax: 914 x 9134
(202) Janet Coit
224-2322

Jim Tate 224-4717

Biological Diversity

House task force opens Washington debate on ESA

After holding seven field hearings in five states on reauthorization of the Endangered Species Act, a House Resources Committee task force will continue its work with at least two more Washington, D.C., hearings, which will feature interest groups and scientists.

When the Endangered Species Task Force finished a round of field hearings in late April, Chairman Richard Pombo (R-Calif.) invited House members to testify at the first of a handful of Washington hearings on the issue. On May 10, the task force heard from about 20 House members who talked about the strengths and weaknesses of the law.

The next Washington hearing will be Thursday, May 18. A variety of interest groups are expected to testify.

Another Washington hearing will be scheduled in the next few weeks to take testimony from scientists and biodiversity experts. A study by the National Academy of Sciences on the Endangered Species Act, which is expected to be delivered to Congress May 24, will likely be discussed.

One source indicated that the task force may also hold another field hearing on the East Coast. The source could not say when or where the field hearing would be. One possible site is Maryland's Eastern Shore, which is in Rep. Wayne Gilchrest's district. Gilchrest, a Republican on the task force, has repeatedly urged his colleagues to visit the Eastern Shore to see firsthand how well the Endangered Species Act has worked there. Gilchrest began planning a field hearing in March and had invited several witnesses, including national and international experts on biodiversity, but was told by task force staff that the hearing would not be authorized unless the witness list was limited to residents of Gilchrest's district.

Last week: On May 10, the task force heard testimony from 13 Democrats and 10 Republicans, who took turns criticizing and defending the law. Task force members and witnesses were cordial, with almost none of the angry accusations and rhetoric that surrounded the first few field hearings.

Gerry Studds (D-Mass.), the ranking minority member on the task force, urged his colleagues at the start of the hearing to engage in an honest debate on the Endangered Species Act and to stop making demons of environmentalists who support the law and federal officials who enforce it.

"Let's call a cease fire on tree frogs and the Audubon Society...let's have some semblance of courtesy in dealing with one another. Given what little we know about species, the proper course should be one of caution and humility," Studds said.

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**SCIENCE AND THE
ENDANGERED SPECIES ACT**

**Committee on Scientific Issues in
the Endangered Species Act**

Board on Environmental Studies and Toxicology

Commission on Life Sciences

1995

National Research Council

PREPUBLICATION COPY

Preface

The Endangered Species Act (ESA) is an important legislative tool for the protection of threatened and endangered species in the United States. The ESA asserts a legal claim on behalf of those species in the United States to habitat that sometimes conflicts with competing management goals for both private and public lands. It is inevitable that these conflicts play out in the political arena. Our committee was asked to provide advice on scientific aspects of the ESA and to consider whether the act is "protecting endangered species and their habitats." We have endeavored to restrict our advice to the areas where science can better inform the public policy debate. The distinction between science and public policy is often fuzzy, because the possession of scientific knowledge and the implementation of that knowledge are so closely linked. Our goal in this report has been to explore and illuminate the knowledge side of the equation.

Since the original passage of the ESA in 1973, scientific knowledge has been anything but static. Our understanding of biological species, in terms of their genetic and phylogenetic integrity, has greatly expanded since 1973. A rich array of new experimental tools have been acquired from both genetics and computational biology during the past two decades and these have helped to drive a revolution in the traditional sciences of taxonomy and systematics. At the same time, new theoretical constructs have been elaborated that have given greater depth to definitions of species.

Species are composed of systems of populations (metapopulations) that have both temporal and spatial dimensions. The temporal history of individual species and of the migrating continental land masses that contain terrestrial habitats is known in much greater detail today than in 1973. The earth is dynamic and contemporary biological diversity is the unique realization of this long history of change. The time scales involved in biological change are long relative to human generations and, as a consequence, it is easy for us to see the biological world as static. Nothing could be further from the truth. Modern biology reveals that species are reservoirs of unique genetic adaptations to multifaceted physical and biological environments. The accumulation of these diverse adaptations is the result of a shared evolutionary history that typically involves hundreds of thousands of years of genetic continuity. The extinction of a species constitutes the irreversible loss of a suite of unique genetic adaptations that have been acquired (much like interest) over a long history of investment.

Rates of extinction are uneven over geological time. Several episodes of major extinction are now recognized including the Permian-Triassic event (245 million years ago) when approximately 65% of terrestrial species became extinct and the Cretaceous-Tertiary event (65 million years ago) when approximately 90% of terrestrial and marine reptiles became extinct. When viewed on a global scale, the present era constitutes yet another major episode of biological extinction. In contrast to the past, however, the present cause of extinction is a single biological species that has become so successful and so exploitive that it threatens to destroy the very capital that is necessary for its own long-term survival. That single species—humankind—is capable of rational analysis and planning, so that it can influence its own long-term destiny.

The earth's non-human biota is crucial to humans' long-term survival. We depend on the photosynthetic capability of green plants for the oxygen that we breathe and for virtually all of our food and energy requirements. The ability of green plants to grow is in turn dependent on a fixed supply of nitrogen (nitrates and nitrites) that are largely the product of a specialized group of microorganisms (Rhizobia). Many of our modern drugs have been derived from biotic sources. The list of human dependencies on the complex web of biological species is virtually endless.

Habitat, the spatial dimension of species, is absolutely crucial to species survival. Habitat is the theater in which the network of interactions between the physical and biological worlds play out.

The landscape theory of habitat emphasizes the heterogeneity, complexity and dynamic character of the physical and biological environment. The metapopulations of species are distributed on this shifting mosaic. If these are the scientific realities, then how do we match science to wise habitat conservation?

The authors of the ESA recognized that species conservation must include strong provisions for habitat conservation. These provisions included a trigger (threatened or endangered status of a species that caused certain legal prohibitions (jeopardy and taking restrictions). The law provides for the recovery of species through the designation of critical habitat and through the elaboration and implementation of recovery plans. During the 20-year evolution of the ESA, additional provisions have been added, including additional mechanisms for habitat conservation, and others aimed at the resolution of conflicts engendered by ESA prohibitions. The committee was not charged with reviewing how the ESA is implemented by various federal agencies and did not directly address this question. We do, however, have several recommendations that would help improve the administration of the ESA if they were adopted (see Chapters 4 and 10, for example).

In general our committee finds that there has been a good match between science and the ESA. There are, of course, points where the agreement between science and the ESA is poorer. These include lack of timely designation of endangered or threatened status and similarly timely removal from these categories when recovery goals have been achieved. Survival habitat should be identified and designated for protection if necessary when species are listed as endangered. We have been able to align the "distinct population segment" language of the ESA with our contemporary understanding of evolutionary units. We hope that such alignment helps to achieve Congress's intent that distinct population segments be listed only sparingly and on a sound scientific basis and thus reduces the danger that the ESA itself could be jeopardized by carrying that language to an absurd extreme.

The analytical tools to evaluate species health have been greatly developed in recent years. The emergence of extinction theory from population genetics and ecology, the combination of demography and genetics in population viability analysis and the extension of risk analyses into the realm of biological conservation promise to lead us to wiser allocations of effort in the future. The field of ecosystem management has also emerged as a significant field of applied biology, in part as a response to the need for a more global view of conservation imperatives. The rich growth of these areas of science has also illuminated areas where our knowledge is still inadequate. In response to the charges given our committee, we attempt to identify areas of critical scientific uncertainty.

To paraphrase the great 20th century ecologist G. E. Hutchinson, species are the actors in the ecosystem theater. To sustain a viable future for our descendants, we must find ways to preserve both species and ecosystems. The ESA is a critically important part of our efforts to conserve species and thereby conserve ecosystems. By virtue of the habitat restrictions that accompany endangered status, species that happen to share habitat with an endangered species gain a measure of protection. The 20-year history of the ESA has validated its focus on species endangerment. Species are objective entities that are easily recognized. Their health and needs can be assessed and sound scientific management plans can be implemented. Despite this, the task of managing each of the vast multitude of species on a case-by-case basis is beyond human capabilities. This is further compounded by the fact that many species remain undescribed. A challenge for the future is to find more integrated mechanisms to sustain both species and ecosystems that do not depend on case-by-case management.

It was my great good fortune to work with a knowledgeable, effective, and collegial committee. The various chapters of this report are the product of much hard work and spirited debate. I want to express my deep gratitude to the committee—including H. Ronald Pulliam, who resigned from the committee when he assumed the directorship of the National Biological Service in May 1994—for their wisdom, patience and cheerful acceptance of the tasks imposed by this project. On behalf of the committee, I thank Project Assistant Adrienne Davis for attending to our many needs. Staff Officer

Patricia Peacock was a source of much practical experience in conservation policy and she was a diligent editor and critic. Project Director David Policansky contributed his vast experience in science policy, especially in the realm of conservation policy, to this project. David Policansky and Pat Peacock also wrote, rewrote and edited many sections of this report. They contributed greatly to the finished product. Finally, thanks to the many representatives of public agencies—especially the Fish and Wildlife Service—and private groups who made written and oral presentations to our committee. They added an essential dimension to our understanding of the complex issues that surround the ESA.

Michael T. Clegg
Chairman

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INTRODUCTION

Species extinctions have occurred since life has been on earth, but human activities are causing the loss of biological diversity at an accelerating rate. The current rate of extinctions is among the highest in the entire fossil record, and many scientists consider it to have reached crisis proportions. The 1973 Endangered Species Act (ESA) and its subsequent amendments are the latest in a long line of federal legislation designed to protect wildlife. The ESA is the broadest and most powerful law to provide protection for endangered species and their habitats. The economic and social costs of complying with the ESA have been controversial in some cases. Because of those controversies, and because the act is being considered for reauthorization, it has been receiving much attention recently. That attention led to the request for this study to be conducted by the National Research Council (NRC).

The ESA defines three crucial categories: "endangered" species, "threatened" species, and "critical" habitats. ("Subspecies" of plants and animals and "distinct population segments" of vertebrates can also qualify for protection as species under the ESA.) Endangered species and their critical habitats receive extremely strong protection; it is illegal to take any endangered species of animal (or plant in some circumstances) in the United States, its territorial waters, or the high seas. In addition to this direct prohibition, Section 7 of the act prohibits any federal action that will jeopardize the future of any endangered species, including any threat to designated critical habitat. The act also requires the secretaries of interior and commerce to use programs in their agencies in furtherance of the act and requires other agencies to "utilize their authorities in furtherance of the purposes of [the act] by carrying out programs for the conservation of endangered species and threatened species." The 1978 and later amendments to the ESA established a requirement for recovery plans to be prepared by the U.S. Fish and Wildlife Service for inland species and by the National Marine Fisheries Service for marine species, unless the secretary "finds that they will not promote the conservation of the species." Those plans are required to include specific population goals, timetables, and estimated costs.

The strength of the ESA lies with its stringent mandates constraining the actions of private parties and public agencies. Once a species is listed as threatened or endangered, it becomes entitled to shelter under the act's protective umbrella, a far-reaching array of provisions. Critical habitat must be designated "to the maximum extent prudent and determinable" and recovery plans, designed to bring the species to the point where it no longer needs the act's protections, are required if they will promote the conservation of the species. Funds for habitat acquisition and cooperative state programs are authorized. Federal agencies must ensure that their actions are not likely to jeopardize the survival of listed species nor adversely modify their critical habitats. Agencies are also required to use their authorities to promote endangered species conservation.

In addition to the Section 7 prohibition of any federal action that jeopardizes an endangered species or its critical habitat, Section 9 prohibits the taking of an endangered species of fish or wildlife¹ (or, by regulation, of threatened species). Sections 7 and 9 are major sources of the act's power as

¹ Section 9 provides somewhat lesser protection to plants, making it unlawful to "remove or reduce to possession any such species from areas under Federal jurisdiction . . . or remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any law or regulation of any state . . .".

well as numerous controversies. In particular, the prohibition against taking endangered species has raised questions among private landowners: *taking* is fairly broadly defined in the ESA and even more broadly in some regulations. How broad the definition of taking in regulations should be is currently undergoing review by the U.S. Supreme Court. The court's decision will be important in determining the future of some of the controversies about the taking prohibition.

As human activities continue to affect species populations and their habitats, two major questions arise concerning the ESA. First, the focus of this report: is the ESA soundly based in science as an effective method of protecting endangered species and their habitats? The second question—of great public importance, but not part of this committee's charge—concerns the desired public policy with respect to protecting endangered species and their habitats, i.e., what are the costs and benefits, and to what extent is the public willing to incur the costs?

THE PRESENT STUDY

In November of 1991, Senator Mark Hatfield, Representative Thomas Foley, and Representative Gerry Studds wrote to the chairman of the National Research Council requesting a study of "several issues related to the Endangered Species Act." The request focused on scientific matters related to the act. After receiving funding from the U.S. Fish and Wildlife Service in September 1992, the NRC's Board on Environmental Studies and Toxicology convened the Committee on Scientific Issues in the Endangered Species Act. The committee's membership includes expertise in ecology; systematics; population genetics; wildlife management; risk and decision analysis; the legal, legislative, and administrative history of the Endangered Species Act; economics; and the implementation of the ESA from public and private perspectives. The committee's statement of task is based very closely on the letter of request from the three members of Congress (see Appendix A).

The committee was asked to review the following issues and to evaluate how they relate to the overall purposes of the Endangered Species Act:

- **Definition of species.** The committee was asked to review how the term *species* has been used to implement the ESA, and what units would best serve the purposes of the act.
- **Conservation conflicts between species.** The committee was asked how frequent or severe conflicting conservation needs are when more than one species in a geographic area are listed as endangered or threatened under the ESA, and to make recommendations to resolve these conflicts.
- **Role of habitat conservation.** The committee was asked to evaluate the role of habitat protection in the conservation of species and to review the relationship between habitat-protection and other requirements of the act. ★
- **Recovery planning.** The committee was asked to review the role of recovery planning under the act and to consider how recovery planning could better contribute to the purposes of the act.
- **Risk.** The committee was asked to review the role of risk in decisions made under the ESA (such as what constitutes sufficient "endangerment" to require listing of a species, what constitutes jeopardy, adverse modifications, reasonable and prudent alternatives, taking, conservation, and recovery). It was also asked to review whether different degrees of risk ought to apply to different types of decisions (e.g., should an endangered species be at greater risk than a threatened species to justify listing?) and to identify practical methods for assessing risk to achieve the purposes of the act better while providing flexibility in appropriate circumstances to accommodate other objectives as well.

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• **Issues of timing.** The committee was asked to review the timing of key decisions under the ESA and to consider ways of improving such timing under the act to serve its purposes better while minimizing unintended consequences.

The committee held meetings in Washington, D.C., and Irvine, California, where it received briefings from federal officials, congressional staff, Senator Mark Hatfield, Secretary of the Interior Bruce Babbitt, members of private conservation organizations and of private industry, and other experts. It has also made use of many sources of information, including previous NRC reports; documents and studies done by other agencies; and relevant published literature from scientific journals, symposia, and books.

* This report reviews scientific issues related to the ESA. The overall conclusion is that the ESA is based on sound scientific principles. Many scientific advances have been made since the ESA was passed in 1973, and they provide opportunities to improve the act's implementation, especially with respect to identifying species, subspecies, and distinct population segments, with respect to estimating risks of extinction, and economic and decision analyses. Although it is difficult to quantify the effectiveness of the act in preventing species extinction, there is no doubt that it has prevented the extinction of some species and slowed the declines of others. It is equally clear that the ESA by itself cannot prevent the loss of many species and their habitats. Instead, the ESA is best viewed as one part of a comprehensive set of ways of protecting species and their habitats. The committee was not asked to comment on the social and political decisions concerning the ESA's goals and tradeoffs, and it has not done so. Nonetheless, they are and should be an important part of the policy discussions about the ESA.

EXTINCTIONS

Extinction is an essential part of evolution. In the past 20 years, we have learned a great deal about the earth's physical and biological history. Over the past 500 million years, at least five mass extinctions have occurred, with as much as 84% of the genera of marine invertebrates disappearing from the fossil record. Those extinctions were associated with major physical events. Today, we are again witnessing a major extinction. Unlike the earlier ones, which affected some kinds of organisms and some kinds of habitats more severely than others, today's extinctions are affecting all major groups of organisms in all nonmarine habitat types (the marine environment has not yet been affected as much as terrestrial and freshwater environments).

We do not know how many species of organisms live on earth, but there are many ways of estimating the rate of extinction in various habitats and in various kinds of organisms. The major cause of the current extinctions is human activity, and most estimates suggest that human activity has significantly increased the background extinction rate², perhaps by orders of magnitude. Such activities include direct alteration of habitats by forestry, agriculture, fishing, and residential and commercial development; indirect alteration of habitats by pollution of water, air, and the soil; alteration of ecosystems by introductions of exotic organisms and the spread of diseases; removal or

²Although the number of documented extinctions might appear to be small compared with the number of species alive, it is the rate of extinctions that is important. Even the mass extinctions of the past took many thousands of years to occur; the current rate of extinctions appears to be comparable to the rates during those events.

alteration of sources of food and shelter for organisms by human use of natural resources, and unregulated harvesting, hunting, and fishing.

THE SPECIES CONCEPT

Species of organisms are fundamental objects of attention in all societies, and different cultures have extensive literatures on the history of species concepts. The Endangered Species Act (ESA) defines species to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." In the act, the term *species* is used in a legal sense to refer to any of these entities. In addressing its use in the ESA, one must remember, however, that *species* has vernacular, legal, and biological meanings.

Many societies have notions of kinds of organisms, usually organisms that are large and conspicuous or of economic importance. The term *species* can be applied to many of those kinds and can be accurate as a scientific and vernacular term, because the characteristics used to differentiate species can be the same in both cases. Largely for this reason, the question of what a species is has not been a major source of controversy in the implementation of the Endangered Species Act. Greater difficulties have arisen in deciding about populations or groups of organisms that are genetically, morphologically, or behaviorally distinct, but not distinct enough to merit the rank of species—i.e., subspecies, varieties, and "distinct population segments."

In particular, questions have arisen about how to recognize "distinct population segments." To help in identifying them, the committee introduces the concept of an evolutionary unit (EU)³. An EU is a group of organisms that represents a segment of biological diversity that shares a common evolutionary lineage and contains the potential for a unique evolutionary future. Its uniqueness can be sought in several attributes, including morphology, behavior, physiology, and biochemistry. Because any specified group of organisms can be claimed to have a unique evolutionary future, a basic characteristic of an EU is that it is distinct from other EUs. In most cases, an EU will also occupy a particular geographical area. Most currently recognized species and subspecies are EUs.

Distinction implies an *independent evolutionary future*. Estimates of distinctiveness (i.e., circumscription of EUs) are based on genetic, molecular, behavioral, morphological, or ecological characteristics. Any single method will often be inadequate to identify an EU (that is, to provide compelling evidence of distinctiveness). The question of distinctiveness and the associated inference of an independent evolutionary future usually requires the careful integration of several lines of evidence.

Committee Conclusion. The ESA is clear that species and subspecies of "fish or wildlife or plants"—defined in the act to include all members of the plant and animal kingdoms—are eligible for protection. The ESA's emphasis on distinct population segments—i.e., taxa below the rank of subspecies—is soundly based on science.

Committee Recommendation. The committee concludes that the ESA's inclusion of species and subspecies is soundly justified by current scientific knowledge and should be retained. Often, competent systematists will be required to delineate subspecies, and sometimes species as well.

Committee Recommendation. To help provide scientific objectivity in identifying population segments, the concept of the evolutionary unit (EU) should be adopted. The EU is a segment of

³ Similar but not identical to the National Marine Fisheries Service's Evolutionary Significant Unit; see Chapter 3.

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biological diversity that contains a potential for a unique evolutionary future. To clarify the analyses, identifying an EU should be separate from deciding whether it is in need of protection.

Committee Conclusion. The ESA explicitly covers species and subspecies of all plants and animals. As currently written, however, it covers taxonomic units below the subspecies level (i.e., distinct population segments) only for vertebrate animals. There is no scientific reason (other than lack of knowledge) to exclude any EUs of nonvertebrate animals and plants from coverage under the ESA. Although the way organisms are divided into kingdoms has changed since the ESA was enacted in 1973, current scientific knowledge about how species concepts apply to these organisms does not lead us to recommend that coverage be extended to prokaryotes and most single-celled eukaryotes, such as yeasts.

Committee Conclusion. Application of the EU concept should not result in any substantial change in the application of conservation laws. We hope it will move decisions of eligibility for protection away from arguments only about taxonomic ranks and into a realm where more substantive views about the degree to which populations are evolutionarily significant and new techniques can be applied.

HABITAT

Habitat—the physical and biological setting in which organisms live and in which the other components of the environment are encountered—is a basic requirement of all living organisms. It embraces all components of a species' environment. The relationship, nationwide, between vanishing habitats and vanishing species is well documented. The ecological relationship is simple and fairly general: species diversity is positively correlated with habitat area. A corollary of this relationship is that if habitat is substantially reduced in area or degraded, species occurring in the wild will be lost. Therefore, habitat protection is a prerequisite for conservation of biological diversity and protection of endangered and threatened species. The Endangered Species Act, in emphasizing habitat, reflects the current scientific understanding of the crucial biological role that habitat plays for species.

The question has been raised whether critical habitat should be determined at the time of listing or whether it should be deferred to the time of recovery planning. Because of public concern over economic consequences, the designation of critical habitat is often controversial and arduous, delaying or preventing the protection it was intended to afford.

Committee Recommendation. Because habitat plays such an important biological role in endangered species survival, some core amount of essential habitat should be designated for protection at the time of listing a species as endangered as an emergency, stop-gap measure. As discussed below, it should be identified without reference to economic impact. Economic review may need to remain linked to critical habitat determination in the ESA, and determination of areas essential to the recovery of a species, including areas not currently occupied by that species, can be especially complex. Hence we suggest designation of survival habitat.

Survival habitat would be designated at the time of listing of an endangered species, unless insufficient information were available or harm to the species would occur. For this purpose, survival habitat would mean the habitat necessary to support either current populations of a species or populations that are necessary to ensure short-term (25-50 years) survival, whichever is larger; survival habitat would receive the full protection that the ESA accords to critical habitat. Because of its emergency nature, no economic evaluation would be conducted before designating survival habitat. The designation of survival habitat (and its protection under the ESA) would automatically expire with the adoption of a recovery plan and the formal designation of critical habitat. Subsequent recovery

planning would include designation of critical habitat as currently defined in the ESA (including economic evaluation) to include areas necessary for species recovery.

Because essential survival habitat is identified in our recommendation without reference to economic impact, and because it might not be sufficient to ensure long-term survival and recovery of endangered species, the committee views it as an emergency, stop-gap measure until critical habitat can be designated and a recovery plan can be completed, not as a substitute for those measures. Indefinite delays in designating critical habitat and formulating recovery plans after designation of survival habitat might cause harm to economic interests and to the endangered species itself. Therefore, implementation of this recommendation needs to include ways of preventing that delay from occurring.

Committee Recommendation. The committee endorses regionally based, negotiated approaches to the development of habitat conservation plans. Guidance from FWS for the development of such plans should include advice on the development of biological data, such as demographic and genetic analyses, habitat requirements of the species involved, reserve design, and monitoring, and it should also include advice on descriptions of management options and application of risk analyses in consideration of alternatives.

RECOVERY

The ultimate goal of the ESA is to recover threatened and endangered species. Recovery is "the process by which the decline of a threatened or endangered species is arrested or reversed, and threats to its survival are neutralized, so that its long-term survival in nature can be ensured." Despite increased attention from Congress, recovery plans are developed too slowly and recovery planning remains handicapped by delays in its implementation, goals that are sometimes not scientifically supported, and the uncertainty of its application to other federal activities.

No recovery plan, however good it might be, will help prevent extinction or promote recovery if it is not implemented expeditiously. Indeed, the failure to implement a recovery plan quickly can also increase the disruption of human activities, because of the resulting uncertainty among other causes.

Committee Recommendation. To reduce uncertainty and permit the planning of activities not directed at species recovery, all recovery planning should include an element of "recovery plan guidance," particularly with regard to activities anticipated to be reviewed under sections 7, 9, and 10 of the ESA. FWS should convene a working group to develop explicit guidelines for the application of data to the construction of recovery objectives and criteria. To the degree possible, the guidance should identify activities that can be assumed to be consistent with the requirements of those sections, activities that can be assumed to be inconsistent with them, and activities that require individual evaluation. Topics would include a habitat-based approach to recovery; a logical, hierarchical approach to analysis of ecological and genetic data on the species; guidance for demographic modeling, stressing the inherent uncertainty of such modeling; outlining future research needs and how the research will contribute to species and habitat management; and an effective monitoring scheme.

Several habitat-related features of the ESA differ without scientific basis, in particular, standards applicable to the protection of plants and to the determination of jeopardy and modification of critical habitat, and different standards of protection on public and private lands. For example, Section 9 fails to protect endangered plants from habitat modification to the same degree that it protects animals, especially on private lands.

Committee Conclusion. The biological differences between animals and plants underlying their taxonomic separation offer no scientific reason for lesser protection of plants. The biological and

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physical requirements of species—including endangered and threatened species—do not vary according to the ownership of the habitats that they occupy. Therefore, there is no *biological* reason to have different standards for determination of "jeopardy," "survival," or "recovery" on public and on private lands (there could of course be other kinds of reasons).

Committee Conclusion. Public agencies and individual public servants on public lands behave differently from private landowners, both corporations and individuals, on private lands, because their rewards and incentives are different. Therefore, requirements applied equally on private and public lands will not necessarily provide the same degree of protection, although the *biological* standards or criteria on which the regulations are based are the same. It follows, then, that different mechanisms may be needed for avoiding endangerment and achieving recovery on public and private lands.

Committee Conclusion. The act and its regulations distinguish between species "survival" and "recovery" for purposes of determining jeopardy to species and adverse modification of their critical habitats. Survival and recovery are points on a continuum. Clearly, if a species does not survive, it cannot recover. It is less obvious, but still true, that any action that jeopardizes recovery also decreases the probability of long-term survival.

Committee Recommendation. To permit a rational evaluation of survival and recovery goals, estimates should be provided of probabilities of achieving various goals over various periods. The periods should be expressed both in years and in generation times of the organism of concern. Evaluation of long-term and irreversible impacts should be conducted in terms of long-term recovery of the species. Although it will often be difficult to make these estimates, even the attempt to make them will have value by requiring an objective analysis and by requiring assumptions to be specified.

CONSERVATION CONFLICTS BETWEEN SPECIES

Because plants and animals are linked to other organisms in ecosystems in a variety of ways, it is inevitable that conflicts will arise when attempts are made to protect individual species of plants or animals. One of the charges presented to the committee concerned conservation conflicts between species.

Committee Conclusion. We have found few well-documented cases where management practices focusing on particular species protected under the Endangered Species Act result in direct conflict with the needs of another.

It is possible that this low number stems from lack of knowledge of the ecological networks of which threatened and endangered species are part; from the fact that comparatively few species are currently listed and that recovery plans have been formulated for even fewer; and from the inadvertent protection for other listed species under some current recovery plans. We expect that our knowledge of such conflicts and the potential for their occurrence will increase as ecologies of listed species become better known, more recovery plans are formulated, and habitat for conserving endangered species becomes more constricted.

Committee Conclusion. Under current policies, the greatest potential for conflicts in protecting species and for management of individual species will arise in situations in which habitat reductions—especially extreme reductions—themselves are the causes of endangerment and the habitats of listed species are largely overlapping.

Committee Conclusion. The most effective way to avoid conflicts resulting from management plans for individual species is to maintain large enough protected areas to allow the existence of mosaics of habitats and dynamic processes of change within these areas. In addition to, and as part of, this strategy, multispecies plans should be devised to ensure the maintenance of habitat mosaics and ecological networks. Habitat (in the broadest sense) thus plays a crucial role in protecting individual target species and, ultimately, in reducing the need for listing additional species. When insufficient habitat is available to resolve such conflicts, other factors must be evaluated to resolve the conflicts, such as the consequences of various management options on each species, the ecological importance of the species, and the distribution of the species.

ESTIMATING RISK

The concept of risk is central to the implementation of the ESA. The main risks involved in the implementation of the Endangered Species Act are the risk of extinction (related to the probability of both biological and nonbiological events) and the risks associated with unnecessary expenditures or curtailment of land use in the face of substantial uncertainties about the accuracy of estimated risks of extinction and about future events. Since the passage of the ESA, there have been enough developments in conservation biology, population genetics, and ecological theory that substantially more scientific input can now be used in the listing and recovery-planning processes. Numerous models have been developed for estimating the risk of extinction for small populations. Although most of these models have shortcomings, they do provide valuable insights into the potential impacts of various management (or other) activities and of recovery plans. In particular, they are valuable for comparing the likely effects of alternative management options and of alternative adverse effects on the species.

Despite the major advances that have been made in models for predicting mean extinction times, the existing methods still have substantial limitations. Often, risk factors are not well known. Most of the models deal with only one risk factor at a time and fail to incorporate the interactive effects of multiple risk factors on reducing the time to extinction. This might result in a tendency for such models to underestimate the risk of extinction. Efforts to integrate various sources of random variation (genetic, demographic, and environmental) into spatially explicit frameworks are badly needed.

Most extinction models primarily address the mean time to extinction. Because decisions associated with endangered species usually are couched in fairly short time frames—less than 100 years—models that predict the cumulative probability of extinction through various time horizons would have greater practical utility than current models.

Committee Conclusion. With only a few exceptions, biologically explicit, quantitative models for risk assessment have played only a minor role in decisions associated with the ESA. They should play a more central role, especially as guides to research and as tools for comparing the probable effects of various environmental and management scenarios.

Committee Conclusion. Results from population-genetic theory provide the basis for one fairly rigorous conclusion. Small population sizes usually lead to the loss of genetic variation, especially if the populations remain small for long periods. If the members of the population do not mate with each other at random (the case for most natural populations), then the effect of small size on loss of genetic variation is made more severe; the population is said to have a smaller *effective size* than its true size. Populations with long-term mean sizes greater than approximately 1,000 breeding adults can be viewed as genetically secure; any further increase in size would be unlikely to increase the amount of adaptive variation in a population. If the effective population size is substantially smaller

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than actual population size, this conclusion can translate into a goal for survival for many species of maintaining populations with more than a thousand mature individuals per generation, perhaps several thousand in some cases. An appropriate, specific estimate of the number of individuals needed for long-term survival of any particular population must be based on knowledge of the population's breeding structure and ecology. If information on that species is lacking, information about a related species might be useful.

MAKING ESA DECISIONS IN THE FACE OF UNCERTAINTY

To ensure that ESA decisions protect endangered species as they are intended to in a scientifically defensible way requires objective methods for assessing risk of extinction and for assigning species to categories of protection according to that risk. Standards for assigning species to categories should be quantitative wherever possible and, when this is not possible, qualitative procedures should at least be systematic and clearly defined. Major advances in both theory and methods of estimating risk of extinction allow us to base listing and recovery decisions on scientific principles. In the past, many ESA decisions have failed to meet the guidelines suggested by current scientific thinking, listing species as endangered only when populations had dropped to the point where extinction was imminent and proposing recovery goals that left the species still at high risk of extinction.

Committee Conclusion. We can find no scientific basis for setting different levels of risk for different taxonomic groups, such as plants or animals, or for public versus private actions that may affect listed species. However, it is critical to understand that because public and private entities may behave differently, different management policies may be required for public and private lands in order to achieve the same *biological* risks for listed species in the two settings. No implementation of the ESA can be fully successful without recognizing these differences.

Committee Recommendation. To the degree that they can be quantified, the levels of risk associated with endangered status should be higher than those for threatened status. Once a species no longer qualifies for threatened status, it should be considered recovered and delisted. Levels of risk to trigger ESA decisions should be framed as a probability of extinction during a specified period (i.e., $x\%$ probability of extinction over the next y years). Although some crises may call for short time horizons (on the order of tens of years), ordinarily it will be necessary to view extinction over longer periods (on the order of hundreds of years) so that short-term solutions do not create long-term problems. The selection of particular degrees of risk associated with particular periods as the standards for listing species as endangered or threatened reflects both scientific knowledge and societal values.

Although the objectives of the ESA are not intrinsically conflicting, the act must be implemented with limited budgets, and so conflicts can arise in determining how to allocate funds among listed species, all of which qualify for the act's protection. Scientific considerations, such as whether a species or its habitat possesses unusually distinctive attributes or whether protection of a taxon would confer protection on other candidate taxa and their habitats, should be used to help set priorities for action. Decisions to set priorities for implementation of the act are often difficult and controversial, and the procedures for making them should be explicit and well documented. Structured methods, such as decision analysis, can improve both the substance of these decisions and the justifications offered for them.

Meeting the objectives of the act can sometimes conflict with other human objectives, such as development of private or public property harboring listed species. The act prohibits consideration of human objectives unrelated to species protection in decisions regarding listing, "take," and "jeopardy,"

but directs that these other objectives be taken into account in decisions about critical habitat and implementation of recovery plans. Tradeoffs between species protection and economic or other benefits or costs must be evaluated. Again, because these tradeoff decisions are often difficult and controversial, it is important to use well-structured and explicit methods for making them.

ESA decisions are inevitably based on limited information, and so agencies are obliged to act in the face of uncertainty about species status and the impacts of proposed activities. Decisions in the face of uncertainty carry the prospect of being wrong in various ways and with varying, and often asymmetrical, consequences. For example, managers concerned with delisting a formerly endangered species must be wary of two types of errors: delisting when the species is actually still in peril, and failing to delist when the species has truly recovered to the target level. Each type of error has both biological and nonbiological consequences. The first error has adverse biological consequences for the endangered species—it would be irreversible if the species became extinct—and, perhaps, positive socioeconomic consequences for sectors whose activities may have been constrained by recovery guidelines. The second error has neutral to positive consequences for the species but potential negative socioeconomic consequences. It is not possible to minimize the risks of both types of errors simultaneously. A decision rule that guards against the first will allow too many of the second and vice versa. To set acceptable rates for each type of error, both the likelihood and the magnitude of biological and nonbiological benefits and costs must be weighed in a decision-analytic framework. These decisions are too complicated and too consequential to be entrusted to unaided intuition.

If not examined explicitly, this asymmetric error structure can bias decisions under the act to the detriment of endangered species, especially if they are based on analyses that do not take the asymmetric risk function into account. Although the wording of the ESA suggests that the "burden of proof" to show no effect is on those proposing to modify habitat or harm a listed species, the way that hypothesis tests are phrased and error rates are set can put the burden on those attempting to show that a species should be listed or that a development proposal should be denied or modified.

Committee Recommendation. Because the structure of hypothesis testing related to listing and jeopardy decisions can make it more likely for an endangered species to be denied needed protection than for a nonendangered species to be protected unnecessarily, decisions under the act should be structured to take explicit account of all the types of errors that could be made and their consequences, both biological and nonbiological. The phrasing of the null hypothesis and setting of error rates should reflect societal, as well as scientific, judgments about what level of risk is acceptable for which types of errors.

TIMING

The committee's comments on the timing of key decisions under the ESA are incorporated in discussions of various other topics. In particular, timing is considered in discussions of recovery planning (where the committee concludes that recovery plans are developed too slowly and recovery planning remains handicapped by delays in implementation) and identification of survival habitat (whose designation is recommended to overcome the effects of delays in designation of critical habitat).

BEYOND THE ENDANGERED SPECIES ACT

The Endangered Species Act's goal is the prevention of species extinction, and its legal apparatus to protect endangered species is strong. It does not appear to have been intended as an

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overall policy act for the preservation of all of the nation's ecosystems and biota. It is, as the committee understands it, intended as a safety net.

Committee Conclusion. Although it is impossible to quantify the ESA's biological effects—i.e., how well it has prevented species from becoming extinct—the committee concludes that fewer species have become extinct than would have without the ESA. In other words, the ESA has successfully prevented some species from becoming extinct. Retention of the ESA would help to prevent species extinction. Some changes, as outlined in this report, would probably make the act more effective and predictable, and provide a more objective basis for its implementation.

Committee Conclusion. It is also clear that some species have become or are almost certain to become extinct despite the protection of the ESA. In other words, the ESA cannot *by itself* prevent all species extinctions, even if it is modified. Therefore, the committee concludes that additional approaches to the management of natural resources will need to be developed and implemented as complements to the ESA to prevent the continued, accelerating loss of species. Indeed, many federal, state, and local governments and private organizations are developing such approaches.

- **Ecosystem management.** Despite diverse definitions of ecosystem management and despite scientific uncertainties, it is clear that managing ecosystems and landscapes as an addition to the protection of individual species can lead to improved natural-resource management and can help reduce species extinctions. Properly implemented, it can also help to reduce uncertainty and thus reduce economic disruptions.

- **Reconstruction or rehabilitation of ecosystems.** Restoration ecology is a growing discipline. Many ecosystem functions have been improved or restored by such activities, and reconstruction or rehabilitation of ecosystem functioning holds much promise for the protection of endangered species. It is not usually possible to return an ecosystem to some prior pristine condition, however. Many ecosystems have been so altered that it is difficult to decide what prior condition we might want to return to. The trajectory taken by the ecosystem to get to its current condition is not retraceable in the way that a highway is, because many events occur in an ecosystem's history that are not precisely reversible. Genetic variability is lost; evolution occurs; exotic species are introduced; human populations in the region increase, and people develop dependence on a variety of modern technologies, cultures, and economic systems; and other natural and anthropogenic environmental changes affect the range of biophysical and socioeconomic possibilities for future states of the system. In brief, the past provides opportunities for the future but also constrains it. Thus, attempts to rehabilitate ecosystem functioning should keep these constraints in mind, so that inappropriately high expectations are not generated.

- **Mixed management plans.** Often, resource managers manage areas either for protection of biota or for human use. It is increasingly difficult to keep people and the effects of their activities separate from wildlife sanctuaries. Although such sanctuaries (e.g., national parks, wilderness areas, wildlife refuges, marine sanctuaries) are indispensable for protecting endangered species, greater attention needs to be paid to developing mixed-use areas. These would be urban recreation areas or residential and commercial developments adjacent to untrammeled areas designed to improve opportunities for wildlife while maintaining opportunities for human activities. Although the value of this approach is becoming increasingly recognized, its development is still in the early stages.

- **Cooperative management.** Various experiences with cooperative management—the sharing of planning and decision making by various government and nongovernment groups—have had some success. To some degree, habitat conservation plans represent an example of this approach, but it is likely that cooperative management will be necessary in cases where the strict requirements of the Endangered Species Act have not yet been applied. It is important to include the major interested parties without having so many interests involved that consensus is difficult to reach.

- **Revised economic accounting.** Too often, economic calculations underlying public and private decision making are incomplete. Often, they cover too short a time span, and they often exclude nonmarket values. A short-term loss might turn into a long-term gain: for example, losing an economic activity today might provide opportunities for greater economic activities of different types at some time in the future. Again, the validity of expanding economic accounting to cover longer periods and to include nonmarket values is becoming more widely recognized but it is still in the early stages of development.

SCIENCE, POLICY, AND THE ESA

This committee was asked to review the scientific aspects of the ESA and it has done so. It has not uncovered any major scientific issue that seriously hinders the implementation of the act, although its review has suggested several scientific improvements. Many of the conflicts and disagreements about the ESA do not appear to be based on scientific issues. Instead, they appear to result because the act—in the committee's opinion designed as a safety net or act of last resort—is called into play when other policies and management strategies or their failures, or human activities in general, have led to the endangerment of species and populations. In some cases, policies and programs have been based on sound science, but other factors have prevented them from working. The committee does not see any likelihood that those endangerments will soon cease to occur or that the ESA can or should be expected to prevent them from occurring. It therefore concludes that any coherent, successful program to prevent species extinctions and to protect the nation's biological diversity is going to require more enlightened commitments on the part of all major parties to achieve success.

To conserve natural habitats, approaches must be developed that rely on cooperation and innovative procedures; examples provided for by the ESA are habitat conservation plans and natural community conservation planning. But those are only a beginning. Many other approaches have been discussed in various fora. They include cooperative management (sharing decision-making authority among several governmental and nongovernmental groups), transfer of development credits, mitigation banks, tax incentives, and conservation easements.

An analysis of these and other policy and management options is beyond this committee's charge, but sound science alone will not lead to successful prevention of many species extinctions, conservation of biological diversity, and reduced economic and social uncertainty and disruption. But sound science is an essential starting point. Combined with innovative and workable policies, it can help to solve these and related problems.