

been considering regulatory approval of genetically engineered (GE) fish with growth-promoting genes since the late 1990s. This decision has been stalled in part because of continuing controversy over genetically engineered organisms in food and agriculture. Environmental and consumer groups and scientists are concerned about the environmental risks of GE fish, including adverse effects on native populations, relatives, or other species of predators or prey from the introduced fish if they were to escape or were intentionally released. Many in the aquaculture industry are excited about the potential of GE fish to resist disease, grow faster, or have fewer resource needs (thus improving the environment). As the regulatory agency with primary responsibility for GE animals, the FDA will need to carefully consider its authority in this area under NEPA.

The FDA will also be faced with considering ethical principles in its decision making about GE animals. Federal agencies like the FDA are asked to weigh the risks, benefits, and costs of their decisions (to use, in effect, a utilitarian ethical framework) to comply with the order of the Executive Office of the President (1993). However, procedural justice, autonomy, inherent objections on fundamental grounds ("playing god"), and the integrity of the regulatory approval system are also prominent in GE animal oversight, as reviewed by Thompson (2007).

SEE ALSO *Animal Ethics; Environmental Policy; Food Safety; Genetically Modified Organisms and Biotechnology; Risk Assessment; U.S. Department of Agriculture; U.S. Environmental Protection Agency.*

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U.S. FOREST SERVICE

The United States Forest Service (USFS) administers 155 national forests and twenty national grasslands—some 193 million acres of land—in forty-four states, Puerto Rico, and the Virgin Islands. The USFS was established in 1905 within the U.S. Department of Agriculture to

administer the nation's newly created national forests and the related forestry programs of the federal government. The creation of the USFS was a key event of the Progressive-Era conservation movement as it gained definition and broad public and political support during the presidency of Theodore Roosevelt (1858–1919, president 1901–1909). Since then the USFS has played an important role in the evolution of conservation policy, science, and practice; it has been both a generator and barometer of changing environmental values and ethics. A major force in shaping American natural-resource management, it has had a broad influence on forestry and environmental policy internationally, at other levels of government, and in the private and nongovernmental sectors.

ORIGINS AND EVOLUTION OF THE USFS

By the mid-1800s, widespread clearing of the forests of the eastern United States for farming and for timber, fuel, and other forest products had begun to raise concerns among protoconservationists. In his classic *Man and Nature; or, Physical Geography as Modified by Human Action* (2006 [1864]), George Perkins Marsh critically examined deforestation and its impact on climate, soil conditions, hydrologic dynamics, watershed function, and forest plant and animal life. Correcting the "terrible evils" of deforestation, Marsh wrote, was among "the most obvious of the duties which this age owes to those that are to come after it" (p. 279). Through his writing and his advocacy Marsh influenced those who later created the USFS, echoing his mandate to "care for the moral and material interests of our own posterity" (p. 279).

In the three decades following the Civil War, the rapid development of the mid-continent's cities, towns, and farms, along with the advent of new sawing, milling, and transportation technologies, led to the near-complete removal of the white pine forests of the upper Great Lakes. As these forests were depleted, devastating slash fires often followed in the wake of the loggers and fed growing fears of a "timber famine."

As public attitudes and political sentiment began to shift, the federal government took its first concerted actions on behalf of forest conservation. In 1876 Congress appointed Franklin B. Hough (1822–1885) as a special agent in the Department of Agriculture, charged with assessing the state of the nation's forests. In 1881 Hough's responsibilities were expanded within a new Bureau (later Division) of Forestry, the precursor to the USFS. The Forest Reserve Act of 1891 empowered the president to withdraw forestlands from the nation's public domain and to designate them as forest reserves under the administration of the U.S. Department of Interior.

Over the following fifteen years 100 million acres of forest reserves were created, primarily in the western states and territories. The Organic Act of 1897 directed the Secretary of Interior "to make such rules and regulations and establish such service as will insure the objects for which forest reservations are created..." (U.S. Congress 1897). Those "objects" were "to protect and improve the forests for the purpose of securing a permanent supply of timber for the people and insuring conditions favorable to continuous water flow" (U.S. Congress 1897). Under the Transfer Act of 1905, the reserves were renamed national forests. The Transfer Act shifted responsibility for their administration to the Department of Agriculture, where the old Division of Forestry was reassigned and rechristened as the U.S. Forest Service.

These developments exposed latent philosophical tensions in the emerging national conservation movement. The change in nomenclature from *forest reserves* to *national forests*, with the implication that the nation's forest estate was not to be set aside but used, revealed the movement's clashing values. Utilitarian conservationists (often identified with Roosevelt's "chief forester," Gifford Pinchot) stressed the instrumental value of the nation's forest resources and the need for efficient, scientifically informed forest management. In its classic formulation the USFS administration of the national forests was to serve "the greatest good for the greatest number over the long run." It pursued this policy by applying principles of sustained-yield silviculture developed in the European forestry tradition. By contrast, preservation-minded conservationists (often identified with the author and naturalist John Muir) emphasized the intrinsic, aesthetic, and spiritual values of forests and pushed for their protection from the incursions of settlers, loggers, grazers, miners, and dam builders. The clash of these schools played out most famously in the extended conflict over a proposed dam (eventually approved in 1913) on the Tuolumne River in Yosemite National Park's Hetch Hetchy Valley.

The timber values of the national forests dominated USFS management goals and actions through the twentieth century. The service's views and values did not, however, go unchallenged. Through the 1920s and 1930s scientists, foresters, and conservationists, within and beyond the USFS, began to champion a wider variety of forestland assets: water, wilderness lands, wildlife, and recreational opportunities. Aldo Leopold, who joined the USFS in 1909 and spent the first half of his career working in the agency, became a leading voice for recognition of the full spectrum of forest values and for their effective integration into conservation planning. Leopold's appreciation of the implications of ecology for sustainable land management drew on his own early field experience in the national forests of the American Southwest. Leopold's land ethic, by emphasizing the integrity,

diversity, and self-renewing capacity of ecological communities—what he termed "land health"—sought to bridge the divergent utilitarian and preservationist strains of conservation thought; all forest values, he held, depended on the healthy functioning of the forest as a whole.

POST-WORLD WAR II DEVELOPMENTS

The end of World War II brought new pressures to bear on the national forests and the USFS. Before the war exploitation of timber resources was concentrated in the nation's private forestlands. After the war the baby boom (and the corresponding construction boom) across the United States increased demand for timber from the national forests. Large-scale industrial forestry operations became the norm, most visibly in the form of expanded clear-cutting. In the USFS narrowly defined economic values overwhelmed ecological rationales for better integrated forest management.

At the same time the more urban and suburban postwar generation took to the national forests in growing numbers for recreation, which became an increasingly important use of forestlands. This shift in turn contributed to a widening public awareness of environmental values and the rise of the environmental movement. Thus, as material and recreational demands on the national forests intensified, so did the movement for protection of roadless wildlands within the forests, culminating in passage of the Wilderness Act in 1964.

In an attempt to reconcile these competing public demands—and by implication the varied interpretations of the "greatest good"—the USFS followed the mandate of the Multiple Use and Sustained Yield Act of 1960 (MUSY). MUSY directed that the national forests be "administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes" (U.S. Congress 1960). MUSY stated that all of these uses should be accorded equal importance and directed the USFS to "[achieve] and [maintain]... a high-level regular output of the renewable resources of the national forest without impairment of the land's productivity" (U.S. Congress 1960). MUSY's goals proved difficult to realize. In the absence of any robust set of common values or shared commitment to land health, multiple competing interests continued to strive for predominance in national forest management, and the USFS remained a magnet for political controversy.

By the late 1980s an array of intractable forest management issues were playing out on the national stage: forest fragmentation, with its attendant impacts on biological diversity; delineation and protection of the remaining roadless areas in the national forest system;



The Northern Spotted Owl. In 1986 the U.S. Forest Service initiated steps to protect the spotted owl from extinction by limiting timber sales in mature portions of National Forests, the species' natural habitat. This sparked a lengthy and heated controversy between environmentalists and the timber industry when measures to protect the spotted owl may have led to layoffs and decreased business for loggers and mill workers. In 2008 the spotted owl continued to be classified as a threatened species.

PHOTO BY JOHN AND KAREN HOLLINGSWORTH/U.S. FISH AND WILDLIFE SERVICE.

the impacts of heavy grazing on forests, grasslands, watersheds, and riparian communities; disruption of historic fire regimes because of a century of fire suppression and postwar development at the urban/wildland interface; intensified recreational demands on forests; and local timber economies that were faltering because of mechanization, dislocation, and the impacts of the globalizing economy. Caught between the intensified scrutiny of the environmental movement (and especially the deep ecology-inspired Earth First! Movement) on the one hand and the property rights-focused wise-use movement on the other, the USFS (and other public land agencies) found itself torn between the opposing forces of forest

utility and forest protection. The struggle in the late 1980s and early 1990s over the fate of the northern spotted owl and the logging economy in the national forests of the Pacific Northwest was emblematic of the broader effort to overcome conservation's philosophical divide. Out of this complex set of circumstances, foresters and other resource managers began to revisit their philosophical foundations and to search for a new management paradigm. In the USFS this trend was reflected by the formation, in 1989, of the Forest Service Employees for Environmental Ethics (FSEEE). This self-criticism within the forest service, and within professional forestry more generally, was evidenced in other land-management agencies and in the natural-resource management professions. One result was the emergence of *ecosystem management* as a potentially more integrated and unified approach to land stewardship. Embracing a broader range of intrinsic and instrumental values, recognizing the dynamic nature and scale-dependent processes of ecosystems, and acknowledging the active and mutual influence of human and natural communities, ecosystem management (and its variants) remained as of the early 2000s a work in progress, subject to varied interpretations and vulnerable to changing political forces. It has, at minimum, ushered land ethics back toward the center of discussions about national forest management, USFS decision making, the public interest, and "the greatest good."

As the USFS enters its second century, it continues to play a leading role, nationally and internationally, in shaping the ethos of the conservation/environmental movement. Even as the demand for forest products ("green"-certified or otherwise) continues, national forests are increasingly appreciated for nontimber values and services: as water sources, carbon sinks, and biodiversity repositories; as anchors for whole and sustainable landscapes; as open space and settings for healthy human communities; and as classrooms for an increasingly land-detached public. The USFS faces the challenge of managing the national forests in response to shifting demographics, new scientific knowledge, and uncertain economics, even while facing continuing threats from invasive species, habitat fragmentation, accelerating climate change, and other widespread forces of environmental change.

SEE ALSO *Conservation; Ecology: III. Ecosystems; Environmental Law; Forests; Hetch Hetchy; Marsh, George Perkins; Muir, John; Pinchot, Gifford; Preservation; Resource Management; U.S. Department of the Interior; Utilitarianism; Wilderness Act of 1964.*

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U.S. NATIONAL PARK SERVICE

The design of the U.S. national parks and the management philosophy of the National Park Service (NPS) have grown out of the mainstream principles and practices of American landscape design. The agency's two main missions are (a) to protect natural scenery, cultural features, and wildlife of the parklands and (b) to make them accessible for public enjoyment. The tensions between these two goals make up much of the history of the NPS and have spawned many changes and posed many challenges in the management of the National Park System.

FOUNDING VISION OF NATIONAL PARKS' DESIGN AND MANAGEMENT

The three men who most heavily influenced the initial design and management philosophy of the national parks were George Perkins Marsh (1810–1882), Andrew Jackson Downing (1815–1852), and Frederic Law Olmsted Sr. (1822–1903). Marsh advised the nation to set aside lands as public parks and preserves and to protect its natural resources (1864). Downing translated the idea of wilderness into design concepts. He was, according to NPS historian Linda Flint McClelland, “intensely aware of the tremendous influence that primeval nature, with its dramatically changing landforms, variations of light and shadow, sounds of moving water, and enveloping vegetation could exert on the human senses” (1997, p. 20). He introduced the picturesque style to the United States, adapting English landscape garden techniques to heighten the observer's experience of nature. Olmsted elaborated this tradition, creating systems designed to promote the circulation of human traffic amid a series of pictorially composed views. Olmsted's recommendations—which became the guiding principles of the NPS—articulated the model for national parks: Undiminished nature should be made accessible, accommodating development while subordinating it to the environment and scenic values. Accordingly, park designers adopted naturalistic approaches to landscape preservation and development, integrating roads and structures into their native surroundings and minimally disrupting topography and vegetation to provide recreational access and to educate the public about their environment's natural and cultural legacies.

ORIGINS, PUBLIC EXPECTATIONS, AND PARK MANAGEMENT

The first national park in the history of the United States—and the world—was Yellowstone National Park, created in 1872. The year 1890 saw the creation of Yosemite, Sequoia, and General Grant national parks as the idea of protecting unique natural environments became a solidly entrenched feature of U.S. policy. The park system expanded over the ensuing quarter century, culminating in the founding of the National Park Service in 1916.

J. Baird Callicott has argued that humans go to the wilderness in a spiritual quest to engage the natural world and counter the alienation fostered by modern urban civilization (1998). Fittingly, then, the law that founded the NPS, the National Park Service Organic Act of 1916, expressly set down the service's dual purposes: “to conserve the scenery and the natural and historic objects and the wildlife” and “to provide for the enjoyment of same,” but so as to “leave them unimpaired for the