Gray Ghosts and Fire

CAN EFFORTS TO RESTORE THE NORTHERN GOSHAWK RENEW THE FIRE-PRONE FORESTS THEY INHABIT?

By Richard T. Reynolds, Douglas A. Boyce Jr., and Russell T. Graham

Credit: Christie Van Cleve

When the *Wildlife Society Bulletin* published an article in 1990 based on three years of northern goshawk (*Accipiter gentilis*) nest monitoring on the North Kaibab Ranger District in Arizona (Crocker-Bedford 1990), it ignited a conflict between the timber industry and environmentalists on how to best manage forests.

Changes in forest structure from logging were reported to have caused reduced breeding and nest productivity in the area's ponderosa and mixed-conifer forests and led to a large goshawk population decline.

Wanting to halt tree cutting until the goshawk's long-term survival and nest productivity were assured, environmentalists filed a petition to list it as threatened in 1991. That petition and two more that followed were denied due to a lack of "substantial information" on the hawk's habitat and demography, but the controversy between conservationists and the wood products industry was not over. It only intensified.

A species of woodlands throughout the Northern Hemisphere, the northern goshawk preys on birds and mammals including grouse, woodpeckers, rabbits and squirrels. In North America, goshawks occupy forests from the boreal region of Canada and Alaska south to Mexico (Squires and Reynolds 1997). Its blood red eyes, cobalt blue back, silver breast and elusive behavior contribute to this hawk's alias — the "gray ghost."

To address environmentalists' concerns and minimize detrimental management effects by the Forest Service, the southwestern regional forester established two groups in 1990 to benefit the goshawk. The Goshawk Scientific Committee, made up of

◀ **The blue back, red eye and white superciliary stripe above the eye identify an adult northern goshawk.**

goshawk researchers and forest ecologists and managers, would review goshawks' habitat needs and "develop management recommendations based on the best available science." A Goshawk Task Force — a large group of resource managers and scientists from federal, state and local governments; academia; conservation groups; and the wood products industry — would review management options including those developed by the committee and recommend a path forward.

In over two years of meetings and deliberations, the committee not only helped recover goshawk habitats. It also helped restore these fire-adapted forests.

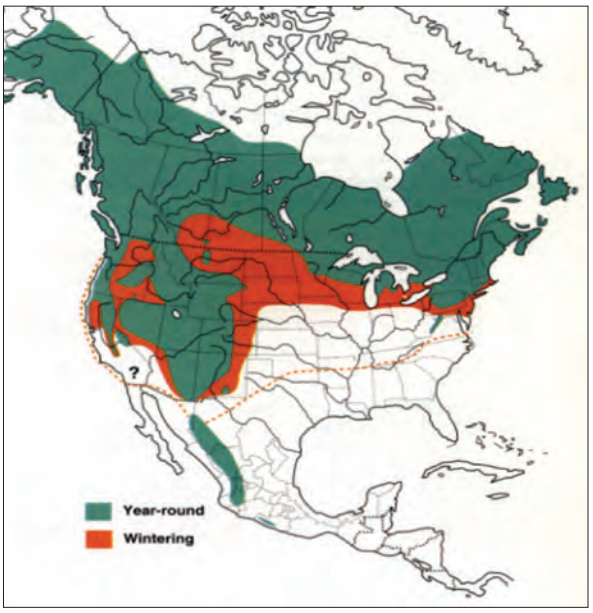
More than goshawks

As committee members set out, they recognized where goshawks live — mostly within and below forest canopies. The habitat structure best suited to them occurred in mature forests in the open space below the canopy. As with most predators, they hypothesized, goshawk survival and reproduction are food limited. Breeding goshawks would have to hunt for a broad suite of prey species over large areas to meet their food needs. As a result, the committee reasoned, effective habitat management for goshawks must also include the diverse habitats of their many prey species and areas with the full suite of desired habitats would best support goshawk survival and breeding.

But these forests had changed. Ponderosa pine and mixed-conifer forests evolved with frequent surface fires (hence their moniker "frequent-fire forests"), but a century of fire suppression had resulted in population explosions of young trees, invading small grass-forb-shrub openings as well as filling the subcanopy space. Meanwhile, the focus of logging on large trees reduced the abundance of older trees.

These changes highlighted the dynamic nature of fire-adapted forests. The committee recognized that to be effective in the long run, management recommendations would need to include active management options. To sustain the desired landscapes, the committee set out to develop a landscape management strategy that would create and conserve multiple predator and prey habitats.

The final goshawk habitat recommendations were published in 1992 as RMRS-GTR-217, a general technical report of the Rocky Mountain Research Station (RMRS). The report described desired landscape characteristics at the scale of a goshawk breeding territory — about 6,000 acres. These included forests in six centrally located, 30-acre alternate nest areas. Surrounding the nest areas were a desired mix of forest hiding cover for fledgling goshawks and prey habitats in a 420-acre post-fledging family area (PFA). Around the PFA was a 5,400-acre foraging area (FA), with a mix of prey habitats and forest structures suited to goshawk foraging behavior.



Credit: R.T. Reynolds

◀ **The North American range of the northern goshawk.**

Nest areas contain nest trees, roosts and prey handling sites, with a higher density of large trees and a higher canopy cover compared to the surrounding landscape — a composition developed strictly for the breeding goshawks. Desired PFAs comprised hiding cover for recently fledged goshawks mixed with prey habitats — and prey — where fledglings could develop flight and hunting skills during the six to eight weeks when they depend on adults for food.

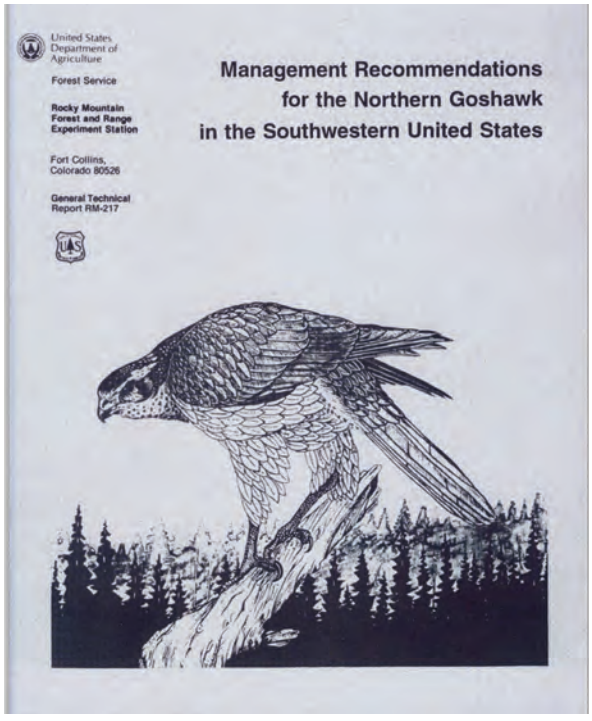
Forests within the PFA and FA included habitats for 14 prey species. Groups of mid-age and old cone-producing trees with interlocking crowns support tree squirrels. Snags sustain woodpeckers and other cavity nesters. Logs benefit ground squirrels and rabbits. Small grass-forb-shrub openings support ground squirrels, grouse, turkeys, doves and rabbits. Because most of the 14 prey require a mix of these forests and open habitats within their home ranges

(Reynolds et al. 1992; Reynolds et al. 2006), the resulting desired condition was a fine-scale mixture of small groups of mid-aged to old trees with interlocking crowns and small grass-forb-shrub openings between the tree groups.

Research has shown that goshawks have high territory fidelity, and if the environment remains stable, territory locations also remain stable for decades (Reynolds et al. 2017). To sustain the desired territory-level mix of habitats of the goshawk and its prey, the committee used a 1,000-year planning horizon to account for changes in forests resulting from tree establishment, growth, mortality, succession and forest disturbances, including logging. Because older forests support the highest diversity and abundance of goshawk prey (Reynolds et al. 1992), sustaining older tree groups through the 1,000 years required tree ages from seedling to old trees that over time comprised a fine-scale shifting mosaic of habitats, young to old.

Acceptance and opposition

On reviewing the committee's unique predator and food web approach, the task force endorsed it and the regional forester accepted the recommendations, issuing a 1996 record of decision that amended all 11 southwestern national forest management plans to incorporate them. Forest plans provide sideboards for managing landscapes by establishing standards (must do's) and guidelines (should do's) to achieve desired outcomes.



Credit: R.T. Reynolds

A Forest Service document provided management recommendations for conserving the habitats of plants and animals in the goshawk food web in southwestern ponderosa pine and mixed-conifer forests.

Other Forest Service regions — the Alaska, Intermountain, Rocky Mountain and Pacific Northwest regions — relied on these recommendations for developing their own goshawk management strategies. Although the committee's original task was to conserve goshawk habitat, its recommendations covering a diversity of prey morphed from a single-species conservation strategy to one encompassing multiple species.

Criticism continued, nonetheless, from individuals within federal and state agencies and environment groups who shared the prevailing view that goshawks need extensive tracts of old-growth. This viewpoint did not align with the committee's call for active management in areas departed from the desired habitat conditions.

The volatility required undercover law enforcement agents to protect committee members at one large, multiple-interest group meeting. The controversy was so heated that The Wildlife Society interceded with its own technical review of the GTR-217 with a focus on two issues: goshawk ecology and habitat needs, and the implementation of the goshawk management recommendations in southwestern forests.

The Society's review found the report's "scope and the review of the biology of northern goshawks (to be) excellent." The "science basis of the … recommendations were sound and would benefit other plants and animals." The recommendations represented "an innovative approach to forest management because they encourage forest managers to consider forest ecosystems as assemblages of interacting species of plants and animals" (Braun et al. 1996). An unsolicited review in the *Journal of Forestry* concluded that "the underlying management strategy (of the goshawk recommendations), while superficially another example of a narrow, single-species focus, is in fact a coarse filter approach that includes a mosaic of age and structural classes intended to provide habitats and food chains for a broad spectrum of wildlife species, including goshawk prey species" (Long and Smith 2000).

Nonetheless, some in the wood products industry expressed concern about how the recommenda-

tions would affect access to timber on public lands. Some forest managers, dubious of the benefits of managing landscapes for goshawks, called it "goshawk farming," complaining that the approach was single-species management.

In 2003, an industry group filed a Federal Data Quality Act (DQA, Public Law 106-554) petition seeking to correct what it perceived as errors in the report. The petition demanded that the Forest Service retract its goshawk-based 1996 forest plan amendments, withdraw and destroy the report — including copies in all research libraries — and publish a retraction in the Federal Register.

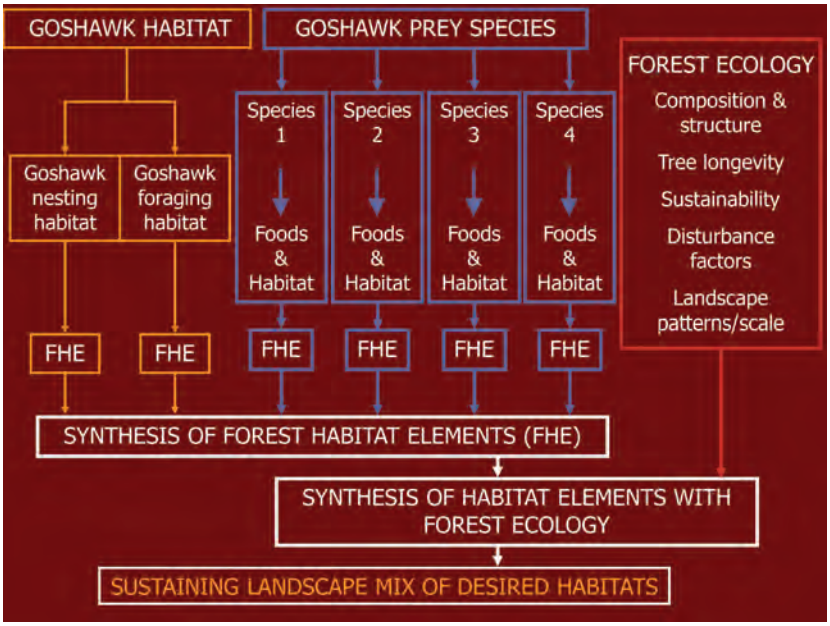
RMRS contracted the Ecological Society of America to conduct an independent review of the report, the petition, and our point-by-point rebuttal of the petition. The report was "scientifically accurate, meets the DQA guidelines, and is accurate, clear, transparent, and unbiased," the ESA concluded. Based on this and an internal review, the RMRS denied the petition. After the petitioners requested reconsideration, an Agriculture Department panel consisting of a wildlife biologist, an economist and a legislative affairs director reviewed the case and denied the reconsideration.

Fighting fire

In subsequent decades, several members of the committee collaborated with forest managers in New Mexico and Arizona to demonstrate how to achieve the desired conditions for the goshawk on the ground.

One site, a goshawk territory near Eager, Arizona, was treated in 2007. Four years later the 2011 Wallow Fire, the largest crown fire in Arizona's history, burned 538,000 acres of pine and fir forests in the Apache-Sitgreaves National Forest. When it hit the demonstration site, the fire penetrated a few hundred feet before dropping to the forest floor. It continued as a low-intensity surface fire until reaching the far side, where it returned to the canopy and continued its destructive course. Word quickly spread of the effectiveness of the goshawk recommendations at stopping catastrophic fire.

Impressed with the Wallow Fire's change in behavior, the regional forester established another team in 2011. This team brought the lead author of GTR-217 together with fire, forest and animal ecologists to extend the plan into a management framework for restoring ponderosa pine and mixed-conifer forests. Restoring these frequent-fire forests (FFF) should improve many ecosystem services including biodiversity and would allow the return of low-severity surface fire and a reduction of high-severity fire risk.



Credit: R.T. Reynolds

▲ **Our approach synthesized goshawk habitat needs with prey habitats and vegetation ecology in southwestern ponderosa pine and mixed-conifer forests.**

The team reviewed literature on the ecology, historical reference conditions and restoration studies of these forests and revisited 20 years of lessons learned during implementation of the GTR-217 recommendations. The desired conditions it came up with included a predominant composition of fire-resistant and shade-intolerant trees, like ponderosa pine, and a fine-grained spatial pattern of grouped trees, scattered individual trees, snags and logs in a matrix of open grass-forb-shrub vegetation (RMRS-GTR-310).

Unlike the previous plan, which called for small tree groups and openings, the new framework recommended ranges in the size of areas occupied by tree groups, the number of trees per group and the sizes of openings between tree groups (Sanchez Meador and Moore 2010; Sanchez Meador et al. 2011; Larson and Churchill 2012). The regional forester accepted GTR-310's framework for restoring these FFF as the best available science and endorsed it as a guide for managing them. The region subsequently used it as a template for updating the FFF-desired conditions in its recent forest plan revisions.

Credit: R.T. Reynolds

▲ **Prior to fire suppression, southwestern ponderosa pine forests in Arizona had tree groups with interlocking crowns dispersed within an open grass-forb landscape.**

As it turned out, our original food-web-based syntheses of predator and prey habitats identified forest conditions that characterized the very evolutionary environment of the plants and animals in southwestern FFF ecosystems. The alignment of the goshawk recommendations with historical structure and spatial patterns in these forests was accidental, but it increased our confidence that the desired mix of vegetation will sustain goshawk populations. The plants and animals in the hawk's food web evolved in just such a fine-scale mix, historically maintained in a feedback relationship between vegetation and frequent low-severity fire (Larson and Churchill 2012).

Similarly, the desired conditions in GTR-310 should sustain FFF ecosystems by improving their resistance and resilience to disturbances such as forest-killing fire. It seems to us that keeping these forests and their diversity of habitats alive and functioning is imperative if adaptive responses to future disturbances and climates are to occur.

Completing the circle

Three decades have passed since the goshawk controversy erupted. In the same year the scientific committee was established, an intensive study of goshawk habitat and demographics on the Kaibab Plateau began — one that has now added significantly to our knowledge of goshawk demographics and population limiting factors.

With our new research data, we will test the hypothesis that the desired conditions in GTR-310 will sustain goshawk populations. The test will relate the 3-dimensional forest structure derived from LiDAR and tree species composition in each of more than 100 territories to 20 years of our documented goshawk survival and total reproduction in each territory. The forest conditions on the most productive territories will then be compared to the GTR-310 desired habitat conditions. While our hypothesis is being tested, implementation of the restoration framework should, in the interim, lower the risk of losing goshawk and prey habitats to catastrophic wildfire.

Difficult problems like the southwestern goshawk issue are not easily solved, and the full story emerges only after decades of research. Finding ecosystem-based solutions to complex management problems can exceed individual careers. The notion that "it takes a village to raise a child" also holds true for species, we found. It takes a village of resource managers and scientists working together to keep the gray ghost — and the plants and animals in its food web — alive and productive for centuries into the future. ■

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