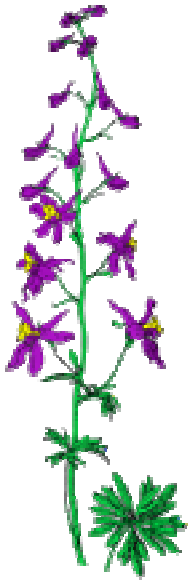
Old Growth at a Crossroads:

U.S. Forest Service Northern Region National Forests noncompliance with diversity provisions of their Forest Plans and the National Forest Management Act Regulations

August, 2003



Jeff Juel
The Ecology Center, Inc.
801 Sherwood Street, Suite B
Missoula, Montana 59802
406-728-5733
ecocenter@wildrockies.org
www.wildrockies.org/teci

The Ecology Center is a citizen conservation organization founded in 1988, dedicated to protecting the remaining wildlands and wildlife of the Northern Rockies region.˚ The Ecology Center works to enforce environmental laws and ensure that stewardship of our public lands is based on sound science and sustainable practices.˚

Introduction

The United States Forest Service Northern Region is composed of 13 national forests, including all those in the state of Montana and those in the northern half of Idaho.

The purpose of this report is to investigate the Forest Service s level of compliance with federal regulations that implement the National Forest Management Act, more specifically those parts of the regulations dealing with old-growth forests and the wildlife species that depend upon them. The information is important because of the increasing demands placed on national forests to meet natural resource needs, resulting in reduced habitat for many forest species. This report is especially timely since the forest plans of the national forests of the Northern Region have exceeded their intended 15-year lifetimes, and the Forest Service is beginning the legally-mandated forest plan revision process.

The National Forest Management Act

The 1976 National Forest Management Act (NFMA) provides guiding principles for the management of our national forests. NFMA required the Secretary of Agriculture to promulgate regulations that set out the process for the development and revision of the land management plans

Those regulations, which set out the details of Forest Service implementation of NFMA, were written in 1974, then amended and adopted in 1982. The NFMA regulations (36 CFR⁄219 *et seq.*) require the Forest Service to develop **forest plans** for all national forests. The steps in forest planning include gathering inventory data, analyzing the management situation, forming management alternatives with public comment, and estimating and evaluating the potential effects of implementing the various alternatives. After Forest Plan approval, the effects of its implementation are to be continuously monitored and evaluated. Forest plans are to be completely revised once every 15 years essentially new plans are to be developed, again in conformance with the requirements of NFMA and the NFMA regulations.

Compliance with NFMA occurs at various levels. NFMA implementing regulations must be consistent with the National Forest Management Act. In turn, Forest Plans must be consistent with the NFMA implementing regulations, which specify how Forest Plans are to be written and implemented. Finally, the Forest Service must implement management that is consistent with the Forest Plans. NFMA reads: Resource plans and permits, contracts, and other instruments for the use and occupancy of National Forest System lands shall be consistent with the land management plans. This report investigates compliance only at the latter two levels 1) consistency of the Forest Plans with the implementing regulations and 2) consistency of Forest Service management with the Forest Plans.

Old Growth and Old-Growth Species in the Regulations and the Forest Planning Process

The NFMA regulations do not explicitly require protection of old-growth forests, possibly because they were developed before the term old growth became widely used. The regulations address old growth indirectly, however, in provisions calling for the protection of biodiversity and maintaining sufficient habitat to support viable populations of all plant, fish and animal species. And without exception, the Forest Plans of the national forests of the Northern Region, all adopted in the late 1980s, recognize old-growth forests as a component of biological diversity necessary for sustaining many wildlife species. For example, the Forest Plan of the Kootenai National Forest states, Roughly 58 wildlife species on the Kootenai find optimum breeding or feeding conditions in the old successional stage, while other species select old-growth stands to meet specific needs. [1]

The definition of old growth regardless of the location or setting generally includes old, live trees with many of them in varying stages of decay, large snags, large downed logs, multiple canopy layers, and patchy horizontal canopy cover. When native forests are converted

[1] Kootenai National Forest Plan, Appendix 17 page 2.

to plantations of young trees by clearcut or similar logging techniques, such structures are eliminated or severely reduced. Even partial cutting or so-called salvage logging reduces the amounts of these structures relative to an unmanaged forest. Since these structures provide habitat components absolutely necessary for some wildlife species, the reduction of diversity of habitat components leads to fewer species being able to use the forest, causing a reduction in biological diversity of the forests as a whole. The remaining native or lightly managed forests containing these structures thus have increased value for maintaining biological diversity. **Essentially, old-growth forests are a surrogate, or proxy, for measuring biological diversity in the national forests.**

To ensure the protection of biological diversity, the NFMA regulations require the Forest Service to: **inventory**, evaluate **diversity**, maintain **viable populations**, select **management indicator species**, and **monitor and evaluate** forest plan implementation (Table 1).

Table 1. Sections of 36 CFR 219 (NFMA regulations) relating to diversity and old-growth forests.

Require-ments	Definitions	Relevant Clauses of NFMA Regulations
Inventory		Each Forest Supervisor shall obtain and keep current inventory data appropriate for planning and managing the resources under his or her administrative jurisdiction. [219.12 (d)]
Diversity	The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan. (219.3)	Forest planning shall provide for diversity of plant and animal communities. ...Inventories shall include quantitative data making possible the evaluation of diversity in terms of its prior and present condition. (219.26)
Viable Population	Having the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area. (219.19)	Provide for adequate fish and wildlife habitat to maintain viable populations of existing native vertebrate species. [219.27(a)(6)]
Management Indicator Species (MIS)	The species selected because their population changes are believed to indicate the effects of management activities. [219.19 (a)(1)]	Identify and select MIS [219.19 (a)(1)]. Establish objectives for the maintenance and improvement of habitat for MIS [219.19 (a)]. Planning alternatives shall be evaluated in terms of both amount and quality of habitat and of animal population trends of the MIS [219.19 (a)(2)].
Monitoring and Evaluation	A program that considers the effects of management on land, resources, and communities adjacent to or near the National Forest [219.7(f)].	Monitoring shall provide a quantitative estimate [219.12(k)]. Population trends of MIS will be monitored and relationships to habitat changes determined [219.19(a)(6)].

The regulations require forest plans to have standards and guidelines for land and resource planning and management. Relevant standards may include the amount and distribution of old-growth forests, and methodology for measuring the amount of old growth. The regulations also require forest plans to select management indicator species (MIS) and to contain provisions for periodic monitoring and evaluation of the effects of implementing forest plans.

Old-growth Management Indicator Species (MIS)

To meet the requirements to maintain and enhance native and desired non-native species the Forest Service adopted management indicator species (MIS) because their population changes are believed to indicate the effects of management activities (36 CFR⁄219.19). These species are selected from five categories:

1. Endangered and threatened plant and animal species
2. Species with special habitat needs that may be influenced significantly by planned management programs
3. Species commonly hunted, fished, or trapped;
4. Non-game species of special interest
5. Additional plant or animal species whose population changes indicate the effects of management activities

Each National Forest in the Northern Region has selected at least one MIS explicitly because the species is believed to depend on old-growth habitat. Some national forests also chose MIS for similar habitat needs, such as mature forests or snags for cavity nesting. Table 2 displays management indicator species selected by each Northern Region national forest.

Table 2. Management Indicator Species of the Northern Region National Forests

National Forest	Old Growth and other related MIS
Beaverhead	northern goshawk (Douglas-fir forests), pine marten (spruce-fir forests)
Bitterroot	pine marten, pileated woodpecker
Clearwater	northern goshawk & pileated woodpecker; also pine marten (mid- to high-elevation mature forests)
Custer	northern goshawk
Deerlodge	pileated woodpecker (Deerlodge & Philipsburg Ranger Districts), northern goshawk, and northern three-toed woodpecker

Flathead (1986)	Barred owl, pileated woodpecker, and pine marten
Flathead (after Forest Plan Amendment 21)	gray wolf, peregrine falcon, grizzly bear, Canada lynx, northern goshawk, boreal toad, common loon, wolverine, harlequin duck, fisher, flammulated owl, black-backed woodpecker, Townsend s big-eared bat, northern leopard frog, northern bog lemming.
Gallatin	pine marten (moist Spruce sites); northern goshawk (dry Douglas-fir sites)
Helena	pileated woodpecker and northern goshawk; also pine marten for mature tree and hairy woodpecker for snag dependent species
Idaho Panhandle	northern goshawk, pileated woodpecker, pine marten
Kootenai	pileated woodpecker (for both old growth and cavity nesting habitat)
Lewis and Clark	northern goshawk; also northern three-toed woodpecker for tree cavity-conifer
Lolo	pileated woodpecker, northern goshawk
Nez Perce	pileated woodpecker, northern goshawk, pine marten, and fisher

Along with MIS, the Forest Service maintains a list of ÅsensitiveÅs species. Sensitive species are defined by the Forest Service Manual (FSM 2670.5) as plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by: a) significant current or predicted downward trends in population numbers or density; or b) significant current or predicted downward trends in habitat capability that would reduce a species existing distribution. The Northern Region s list of sensitive wildlife species includes some that depend upon old-growth habitat, such as the northern goshawk, wolverine, fisher, flammulated owl, black-backed woodpecker, and Townsend s big-eared bat. The Canada lynx, recently listed as a ÅthreatenedÅs species under the Endangered Species Act, is an old-growth dependent species that was previously on the Northern Region s sensitive species list.

MIS Monitoring Requirements in Forest Plans

The NFMA regulations require the Forest Service to monitor the effects of forest plan implementation, and periodically report the monitoring results. Specific to MIS, the NFMA regulations at 36 CFR ´219.19(a)(6) require: Population trends of MIS will be monitored and relationships to habitat changes determined. This means that, on a regular basis, the Forest Service is to perform sampling of MIS populations, assess the changes experienced by the

habitats of each MIS, and synthesize those two sources of information to make a determination as to the relationship between habitat changes and the resulting population changes for each national forest.

The Forest Plans in the Northern Region vary in how they respond to the monitoring requirements of the NFMA regulations relating to old-growth habitat and old-growth MIS. Table 3 summarizes the monitoring requirements contained in each of the Forest Plans.

Table 3. Old Growth and Old-Growth MIS Monitoring Requirements by Forest

National Forest	Monitoring Requirements
Beaverhead	Monitor old-growth acres/number of animals annually, reporting every 5 years.
Bitterroot	Acres of old growth by habitat type, land class, and management area, to be measured every 3 years and reported every 5 years. Pine marten and pileated woodpecker populations will be monitored in relation to habitat changes, based on 3 transects annually, reported annually.
Clearwater	MIS population trends will be monitored and reported every 5 years.
Custer	Forest Plan does not contain requirements to monitor old growth or old-growth MIS
Deerlodge	Monitor old-growth habitat in order to respond to any unacceptable deviation from past measurements. To be monitored annually and reported every 5 years.
Flathead (before Forest Plan Amend. 21)	Monitor barred owl (hooting count); monitor pileated woodpecker (rapping count); number of pine marten pelts from Montana Dept. of Fish, Wildlife, and Parks records.
Flathead (after Forest Plan Amendment 21)	Monitor occupancy of old-growth forest by old-growth associated wildlife species; monitor bird distribution, productivity, and survivorship in monitoring stations; monitor distribution of forest carnivores; monitor vegetation composition, structure, and pattern, in relationship to estimated range of natural variability by Subbasin; monitor proportion of old-growth forest and patch sizes, by Subbasin and watershed; Monitor implementation and effectiveness of restoration efforts by Potential Vegetation Group.
Gallatin	Determine population trends of old-growth MIS and their relationships to habitat change, reporting every 5 years.
Helena	Monitor old-growth habitat (pileated woodpecker, hairy woodpecker and goshawk) and pine marten track counts. Measuring annually and reporting every 5 years.
Idaho Panhandle	Monitor population trends of old-growth MIS, measuring annually and reporting every 5 years.

	reporting every 5 years.
Kootenai	Monitor pileated woodpecker population levels, measuring annually and reporting every 5 years. Measure old-growth habitat amount and condition annually, reporting every two years. Measure cavity habitat condition and amount annually, reporting every 5 years. Measure habitat for indicator species and population trends, monitoring annually and reporting every 5 years.
Lewis & Clark	Monitor population levels of MIS and their relationship to habitat trends. Annually monitor active nesting territories for northern goshawk and report annually; measure percent optimum habitat for northern three-toed woodpeckers annually and report every 5 years.
Lolo	Monitor habitat for old-growth MIS. As monitoring technology becomes available, population trends will be monitored. In the interim, habitat parameters such as old-growth acres and condition, and snag densities will be monitored as an indicator of population trends. Monitor effectiveness of old-growth habitat areas that are harvested on every timber sale, reporting every 5 years. Monitor post-sale snag densities on 10% of timber sales, reporting every 5 years.
Nez Perce	Monitor population levels of old-growth MIS, reporting every 3-5 years.

As Table 3 indicates, the Forest Plans for the Custer, Beaverhead, Bitterroot, Deerlodge, Flathead, Helena, and Lewis & Clark national forests do not explicitly require monitoring of population trends as required by the NFMA regulations. Of those, the Custer, Deerlodge, and Flathead forest plans have no requirements to conduct MIS counts whatsoever, whereas the Beaverhead, Bitterroot, Helena, and Lewis & Clark forest plans contain some kind of requirement to count the species but don t state that determining population trends is the point of the monitoring.

Table 3 also shows that monitoring requirements found in the Beaverhead, Bitterroot, Deerlodge, Flathead, Helena, Kootenai, and Lolo forest plans explicitly require the Forest Service to periodically measure the amount of old-growth habitat, or keep track of changes in habitat for old-growth MIS.

Perhaps a better test of the forest plan monitoring requirements consistency with the NFMA regulations MIS monitoring requirements would consider which are written to specifically seek an understanding of the relationship between changes in old-growth habitat and population numbers of the MIS. Forest plans for the Bitterroot, Gallatin, and Lewis & Clark national forests are the only ones whose monitoring requirements are written in this way.

Old-Growth Inventories in Northern Region Forest Plans

As stated above, the NFMA regulations don t mention old-growth forests and therefore don t specifically require the Forest Service to keep inventories of old growth. But the regulations as, 36 CFR⁄219.26 do require that Inventories shall include quantitative data making possible the evaluation of diversity in terms of its prior and present condition.

Perhaps the most significant, and concrete step taken policy-wise by the Forest Service regarding old-growth forest inventories came in 1989. At that time, Forest Service Chief Dale Robertson charged all Regional Offices to develop ecological definitions of old-growth types within their boundaries, to aid in performing old-growth inventories across all National Forest System land. Regions with support from Research shall continue to develop forest type old growth definitions, **conduct old growth inventories**, develop and implement silvicultural practices to maintain or establish desired old growth values, and explore the concept of ecosystem management on a landscape basis. (See Appendix 1 page 57, emphasis added.) In response, in 1992 a team of Northern Region specialists released a report (Green et al., 1992) to serve as the tool for inventorying old growth on each national forest. Green, et al. (1992) arrived at definitions of the various types of old growth found in the Region, and the report included criteria for areas to be considered old growth (See Appendix 1).

There is wide variation among the Northern Region national forests as to how their forest plans treat the issue of inventorying and protecting old growth. Some forest plans require retention of a minimum percentage of the Forest as old growth. Although individuals of most species may not use an area as large as an entire national forest, the Forest Service recognizes that sustaining populations is an issue that must be dealt with in the larger landscape context: Distributions of common wildlife species as well as species at risk encompass much larger areas than typical project areas and in most cases larger than National Forest boundaries. [2] Some Forest Plans require protection of a certain percentage of old growth within smaller geographic areas, such as by watershed, in response to the NFMA regulations requirements that wildlife habitat must be well-distributed. Some Forest Plans have both forest-wide and distribution standards. Still other Forest Plans have no numerical requirements for old-growth protection nor provisions for maintaining an old-growth inventory. Table 4 illustrates the various approaches found in the Forest Plans.

Table 4. Summary of Northern Region forest plans old growth requirements*

National Forest	Forest Plan requirements for old growth
Beaverhead	Maintain at least 10% of the Douglas-fir and spruce component of each timber compartment as old growth. (Timber compartments are roughly 10,000 acres)
Bitterroot	Maintain either 3% or 8% of the suitable timber in each major

[2] Dry Fork Vegetation Project Environmental Assessment, Lewis and Clark National Forest, Appendix D at page 9, March 2000.

	drainage as old growth, depending on Management Area.
Clearwater	Maintain at least 10% of the Forest in old-growth habitat, selecting at least 5% of each timber compartment to manage as old-growth habitat.
Custer	Meet the habitat requirements for a minimum viable population of old-growth dependent species.
Deerlodge	Manage 5% of each timber compartment for old growth
Flathead (after adoption of Amendment 21)	Minimize management actions within existing old growth to those actions necessary to restore or maintain old-growth composition and structure consistent with historical succession and disturbance regimes.
Gallatin	Maintain at least 10% of each timber compartment containing suitable timber in old-growth condition.
Helena	Manage 5% of each third order drainage for old growth.
Idaho Panhandle	Maintain at least 10% of forested land as old growth, reflecting approximately the same habitat type series distribution as found on the Forest. In timber compartments that have old growth as 5% of the forested portion, maintain at least 5% as old growth.
Kootenai	Maintain at least 10% of the Forest land below 5,500 feet in elevation as old growth, and 10% of each major drainage on the forest as old growth, distributed among the various major habitat types.
Lewis & Clark	Retain 5% of commercial forest land within each timber compartment as old growth.
Lolo	No quantitative old-growth standard
Nez Perce	Maintain 10% of the total forested acres as old growth, maintaining no less than 5% within each prescription watershed or combination of watersheds totaling 5,000 to 10,000 acres.

**Note: some of the requirements displayed are simplifications of what is written in the Forest Plan.*

Current status of Northern Region National Forests old-growth inventories

Beaverhead National Forest

The Beaverhead Forest Plan old-growth standard requires that for each timber compartment, 10% of the Douglas-fir and spruce component will be maintained in old-growth condition, that old-growth stands will be range from ten to several hundred acres in size, and that the old-growth stands will normally be selected in areas not allocated to timber management. The

Forest Service has stated that there is no inventory of old growth for this national forest.[3] Apparently the closest thing the Forest has to an old-growth inventory is an electronic database list of timber stands under the category Potential Old Growth — Field or Remote .[4] The Forest Plan has no definition of potential old growth. With the presently available information, it is impossible to assess whether the Forest is maintaining 10% of the Douglas-fir and spruce component in each timber compartment as old growth, as required by the Forest Plan, or if old-growth habitat is well-distributed across the Forest.

Bitterroot National Forest

The Bitterroot Forest Plan contains standards for old-growth management that take into account the importance of old-growth patch size and distribution for maintaining viable populations of old-growth dependent species. For example, within some Management Areas[5] (MAs), the Plan specifies that old-growth stands should be 40 acres in size or larger and indicates that old growth should be distributed over the management area.

The Forest Plan requires some MAs (specifically, MAs 1, 2, 3a, 3b, and 3c) to contain a minimum percentage of old growth. In MA 1, the Forest is to maintain 3% of the suitable timberland within each third order drainage as old growth. In MAs 2 and 3a, the Forest is to maintain 8% of suitable timberland in every third order drainage as old growth. In MA 3b, the Forest is to maintain 50% old growth in fisheries riparian areas and 25% old growth in nonfisheries riparian areas. And in MA 3c, the Forest is to maintain 8% of non-riparian suitable timberland in each area of MA 3c as old growth.

The Bitterroot National Forest has stated that the old-growth inventory is almost complete, and has provided numbers for areas that had been at least partially surveyed for old growth.[6]

Data provided by the Forest Service gives total acres contained in Management Areas 1, 2, 3a, and 3c by third order drainage, along with the percentage inventoried as old growth. The tentatively inventoried old-growth totals in each of MAs 1, 2, 3a, and 3c respectively, are 37,649; 20,704; 22,102; and 3,053 acres.[7] However, the data do not display the number of acres of suitable timberland in each third order drainage, for those MAs. As the wording of the standards indicates, that information is needed to demonstrate compliance with the minimum percent old-growth standards.

The data for some third order drainages lists acres under a category of no survey and for other third order drainages, no data were reported. This is because those third order drainages are located in Wilderness or roadless areas with no acreage of MAs 1, 2, 3a, 3b, or 3c.[8] Also, there are no numbers provided for acres of old growth in MA 3b. This is because Management Area 3b

[3] January 31, 2002 letter responding to a Freedom of Information Act request.
[4] Ibid.
[5] National Forests are divided into various Management Areas, which each having a different resource emphasis as determined during the Forest Planning process.
[6] November 19, 2002 letter responding to a Freedom of Information Act request.
[7] Ibid.
[8] John Ormiston, Bitterroot NF, personal communication 12/6/02.

is a part of all the Management Areas adjacent to streams . [9] This suggests that some areas of old growth must be double-counted to show compliance not only with the MA 3b standard, but a standard for another MA as well.

As the old-growth inventory information stands, it is not possible to adequately determine compliance with the quantitative Forest Plan standards.

Clearwater National Forest

The Clearwater Forest Plan has a standard requiring the Forest Service to maintain at least 10% of the Forest in old-growth habitat. The Forest Plan also specifies that the old growth should be distributed by selecting at least 5% of each roughly 10,000-acre watershed (timber compartment) or a combination of smaller watersheds (subcompartments) within forested nonwilderness areas to manage as old growth. When not enough actual old growth is found during timber sale project analyses, the Forest Plan requires allocation of replacement old growth to meet the 5% distribution standard. The Forest Plan gives no criteria for selecting replacement old growth.

The Forest Plan states that the minimum patch size that can be considered old growth is 25 acres. Forest Plan guidelines suggest that old-growth stands should be distributed across the major habitat types found in the Forest in proportion to the occurrence of those habitat types. Furthermore, the Forest Plan suggests that for Pileated Woodpeckers a 300-acre stand should be managed as old growth in each 10,000-acre watershed. This 300-acre patch is recommended to be contiguous, but if not available it may be divided into 100-acre units as long as they are contained within two square miles. Finally, these patches are recommended to be at least 200 yards wide at some point.

The Clearwater National Forest has estimated there is 152,685 acres of old growth in the non-Wilderness portion of the Forest, and has estimated there are 37,000 acres of old growth in the Selway-Bitterroot Wilderness[10]. These figures total 189,685 acres, which is 10.3% of the Forest. However, Forest Service documents show that when preparing timber sales for many geographic areas, the field verification process revealed that the Forest had significantly overestimated the amount of old growth thought to be in the area. This is likely because something like 75% of the timber stands on the Clearwater had never been surveyed on-the-ground, with the vast majority of old growth having only been tentatively identified using less precise remote survey methods.[11] Adding to this uncertainty is the fact that replacement old growth (allocated during project analysis to meet the 5% distribution standard) is included in the total 189,685-acre (10.3%) estimate.

Given these uncertainties, the Clearwater NF old-growth inventory was subjected to litigation in federal court when the Forest Service proposed logging old growth. In the case, *Wilderness Society v. Bosworth*, the Plaintiffs alleged that the old-growth status reports used to support the Forest Service s claim that it was meeting the 10% standard failed to account for the overestimates discovered during field verification. The Court agreed, and enjoined the Forest

[9] Ibid.
[10] Data from FOIA response/letter dated February 1, 2002.
[11] December 11, 2001 email message from the Clearwater National Forest.

Service from logging old growth on the Clearwater because it could not prove it was meeting the forest-wide 10% Forest Plan standard.

Custer National Forest

The Custer Forest Plan provides vague standards regarding old growth protection. It states, Old growth will be managed to at least meet the habitat requirements for a minimum viable population of old growth dependent wildlife species. The Forest Plan does not state what constitutes a minimum viable population of the northern goshawk, which is the management indicator species selected by the Forest Plan for old-growth habitat.

The Forest Service indicates they use an electronic database to track old growth on the Custer, in a category called saw timber sized. [12] This category includes stands of trees as small as 9 inches diameter breast height.[13] Since what the Custer NF counts as old growth includes stands of trees that are much smaller than currently accepted (i.e., Green et al., 1992) criteria, the old-growth inventory s accuracy is very questionable. Thus, it is impossible to tell how much of the Forest is old growth or if it is well-distributed across the Forest, as required by NFMA regulations.

Deerlodge National Forest

The Deerlodge Forest Plan old-growth standards require that 5% of each timber compartment will be managed for old growth. The Forest Service has stated that there is no inventory of old growth for this national forest.[14] Apparently the closest thing to an old-growth inventory is an electronic database list of timber stands under the category Potential Old Growth — Field or Remote (Ibid.). The Forest Plan has no definition of potential old growth. With the presently available information, it is impossible to assess whether the Forest is maintaining 5% of each timber compartment as old growth, as required by the Forest Plan, or if old-growth habitat is well-distributed across the Forest.

Flathead National Forest

The Forest Plan for the Flathead National Forest, written in 1986, did not contain quantitative standards for protecting old growth. However, following an administrative appeal of the Forest Plan, the Chief of the Forest Service directed the Flathead National Forest to amend the Forest Plan, and in the interim the Flathead was directed to maintain at least 10% old growth in each third order drainage. In 1999, the Flathead NF adopted Forest Plan Amendment 21, Management Direction Related to Old Growth Forests. The Amendment does not set a quantitative standard, but it does require the Forest Service to maintain all existing old growth. However, the Amendment does not prohibit logging old growth, allowing logging to restore old growth: Vegetation management within old growth shall to the extent feasible retain old growth composition and structure consistent with native disturbance and succession regimes. (Flathead National Forest 1999). Amendment 21 also requires specific numbers of old-growth components

[12] March 27, 2001 letter responding to a Freedom of Information Act request.
[13] Ibid.
[14] January 31, 2002 letter responding to a Freedom of Information Act request.

(snags, replacement snags, and pieces of coarse woody debris) be retained in all timber sale cutting units. Amendment 21 also dropped the original Forest Plan old-growth indicator species and adopted as indicator species the Forest s list of Threatened, Endangered, and Sensitive species, including those that depend on old growth for habitat.

When its complete old-growth inventory was requested, the Forest Service referred to copies of landscape assessments rather than providing specific locations of old-growth stands or the amount of old growth in the Forest.[15]

Gallatin National Forest

The Gallatin Forest Plan standard for old growth requires the Forest Service to maintain 10% of each timber compartment containing suitable timber in old-growth condition. The Forest Service has indicated that there is no forest-wide old-growth inventory.[16] This is because old growth allocations are only completed on a project-by-project basis, for example when an area is being analyzed and prepared for a timber sale.[17] Only 40 of a total of 139 compartments forest-wide have had their structural stages analyzed.[18] The available information is not adequate to determine if sufficient, well-distributed old-growth habitat exists on the Gallatin.

Helena National Forest

The Helena Forest Plan standards for old growth require the Forest Service to manage 5% of each third order drainage as old growth. The Forest Service has indicated that they do not have a forest-wide old-growth inventory for the Helena NF because old-growth allocations are made on a project-by-project basis, i.e., when timber sales are prepared for specific geographic areas.[19] A forest-wide inventory is in process. [20] Current information is inadequate to tell whether the Helena NF is maintaining at least 5% of each third order drainage as old growth, as required in its Forest Plan.

Idaho Panhandle National Forests

The Forest Plan for the Idaho Panhandle National Forests contains a standard to maintain 10% of the forested portion of the land as old growth, and the Plan also specifies that the distribution of old growth should be across forest habitat types, reflecting approximately the same habitat type series distribution as is found on the Forest. The Forest Plan also states that the Forest Service is to maintain at least 5% of the forested portion of those old-growth management units that have 5% or more existing old growth.

The accuracy of the IPNF old-growth inventory has also been subject to recent litigation. Leading up to litigation, Forest Plan Monitoring and Evaluation reports consistently stated that 213,542 acres (9.2%) had been identified as old growth. When doing analyses for timber sales, the Forest Service has validated the inventory for the geographic area in question. As was the case

---

[15] March 19, 2002 letter responding to a Freedom of Information Act request.
[16] February 11, 2002 letter responding to a Freedom of Information Act request.
[17] Ibid.
[18] Ibid.
[19] Personal communication, Dennis Heffner of the Helena NF, October 21, 2002.
[20] Ibid.

with the Clearwater NF litigation, in court Plaintiffs alleged that the forest-wide inventory did not take into account Forest Service documents revealing that some areas previously assumed to be old growth turned out to not meet old-growth criteria during field verification.[21] The Court agreed, stating that the IPNF database has been found to overstate old growth by 32-56% (U.S District Court of Washington, 2002[22]).

There is differing information as to how much old growth is in each of the old-growth management units. Forest Service information showed that 78 of the forest s 164 total old-growth management units (47.6%) lacked 5% allocated old growth.[23] Confusingly, more recently the Forest Service stated it does not have information on the amount of old growth in the old-growth management units.[24]

Subsequent to initiation of the litigation, the IPNF issued Forest Plan Monitoring and Evaluation Reports that presented updated old-growth data. The Fiscal Year 2001 report represents 250,259 acres (10.8%) of old growth on the Forest. However in response to a Freedom of Information Request for documentation on the additional old growth, the IPNF was unable to provide it.[25]

There is still significant doubt as to the accuracy of the old-growth inventory on the Idaho Panhandle NF, and whether it can be relied upon to conclude that Forest Plan old-growth standards are being met.

Kootenai National Forest

The Kootenai Forest Plan states, At any time 10% of the Kootenai National Forest land base below 5,500 feet in elevation will be in an old-growth timber condition, providing habitat for those wildlife species dependent on old growth timber for their needs. The old growth will be spread evenly through most major drainages, and will represent the major forest types in each drainage. The Kootenai National Forest designates Management Area 13 to provide the special habitat necessary for old-growth dependent species.

MA 13 actually did not represent the 10% old growth at the time of Forest Plan adoption. Forest-wide, there are 1,865,000 acres of national forest land below 5,500 feet in elevation[26] but the Forest Plan only allocated 124,230 acres (6.67%) to MA 13.

A recent Forest Service report shows a total of 115,725 acres (or 6.2%, of the national forest land below 5,500 feet in elevation) are considered old growth.[27] This is approximately 70,775 acres short of meeting the 10% forest wide standard. The same report also indicates that 154 of the 255 compartments, or 60% of them, have been completely reviewed and an additional 47 compartments, or 18% of them, were partially inventoried. The Forest Service has identified

---

[21] Jan. 16, 2001 Declaration submitted by author to the Court, based upon Forest Service documents.
[22] Federal Court Order dated March 29, 2002 in the case *Lands Council v. Vaught*.
[23] Idaho Panhandle NF letter dated November 28, 2000.
[24] FOIA response/letter dated October 15, 2002.
[25] Ibid.
[26] Page 2 of Fiscal Year 2001 Forest Plan Monitoring and Evaluation Report, published September 2002.
[27] Ibid.

at least 10% old growth in 135 of the 279 compartments, or 48% of them, forest wide.[28]

More recently, in the context of litigation, the Kootenai NF has claimed it has now identified 10.3% of the forest land below 5,500 feet as old growth. On June 27, 2003, the U.S. District Court s ruling rejected the figures as tentative, stating Whether it turns out that the Forest Service is factually right is a matter for the agency to reconsider in light of its full inventory of the forest and the opportunity for public comment. [29]

Lewis and Clark National Forest

The Lewis and Clark Forest Plan requires the Forest Service to maintain 5% of the commercial forest land within each timber compartment as old growth. Old-growth allocations on the Lewis and Clark National Forest are completed on a project-by-project basis, when timber sales are prepared for specific geographic areas[30]. A recent Forest Service report shows that a total of 82,279 acres on the Forest meet their criteria for old growth and that 31,313 of those acres are allocated for retention to meet Forest Plan Standards[31]. That report displays old-growth acres according to project area or landscape assessment area. Project areas and landscape assessment areas are generally much larger than timber compartments, the latter being the subject of the Forest Plan 5% old-growth standard. Hence, the report is not adequate to show whether or not the Forest Service is maintaining the quantity and distribution of old growth as required by the Lewis and Clark Forest Plan.

Lolo National Forest

The Lolo National Forest s 1986 Forest Plan contains no quantitative standard for old growth. The relevant Forest Plan standards were rather vague and related to monitoring old-growth acres and condition. The Forest Plan set Management Area 21 as the MA designated for old-growth habitat, to be well-distributed over the Forest. MA 21 standards set minimum stand sizes of at least 30-40 acres and required the old growth to be well-distributed, without specifying what that meant. In 1994, the Lolo National Forest adopted a discretionary guideline of maintaining 8% of the forest land as old growth.[32] However, MA 21 is not nearly 8% of the entire Forest. The Forest Plan Final Environmental Impact Statement states that the Lolo National Forest is made up of 2,112,597 acres. Eight percent of that is 169,008 acres, but the Forest Plan only allocated 41,303 acres to MA 21 only about 2% of the Forest.

Recently, the Forest Service stated that Lolo National Forest old-growth inventories are done during broad scale landscape studies that occur when timber sales are prepared for specific geographic areas, and that the Forest does not have a single, comprehensive forest-wide inventory.[33]

---

[28] Results of analysis by Ecology Center s Bill Haskins, November 27, 2002, based upon Kootenai NF information.
[29] Federal Court Order dated June 27, 2003, page 23 in the case *Ecology Center v. Castaneda*
[30] 10/24/02 personal communication with Lewis and Clark NF s Chuck Marks.
[31] Forest Plan Monitoring and Evaluation Report for Fiscal Years 2000 — 2001, page 42.
[32] April 29, 1994 Old Growth Strategy letter from Forest Supervisor to District Rangers.
[33] 10/24/02 personal communication with Lolo NF Biologist Mike Hillis.

Nez Perce National Forest

The Nez Perce Forest Plan requires 10% of the total forested acres be maintained as old growth. The Forest Plan also specifies that at least 5% of the forested acres in each prescription watershed or combination of watersheds totaling 5,000-10,000 acres will be maintained as old growth, thus incorporating distribution as part of its old-growth requirements. The Forest Plan further states that if less than 5% of a particular watershed is in old-growth condition, the Forest may assign the additional acres from an adjacent drainage to make up the deficiency.

It is difficult to tell how much old growth it takes to meet the 10% requirement because of ambiguities concerning the amount of forested acres . The Forest Plan indicates that the Nez Perce National Forest contains 2,218,040 acres (Forest Plan FEIS at B-1) but only 1,972,717 acres are actually Forested Land (Forest Plan FEIS at B-4). Also, the Forest Plan states that the Forest Plan establishes management standard for lands administered by the Nez Perce National Forest and that (t)his excludes 117,073 acres in the Hells Canyon Wilderness and National Recreation Area, which is administered by the Wallowa-Whitman National Forest (Forest Plan at I-1). The Forest Service also did not intend to include MA 20 (the MA designated to contain the Forest s old growth) in designated Wilderness.[34] If the 766,224 acres of Wilderness, Wild and Scenic Rivers, and Research Natural Areas, as described in the Forest Plan FEIS are subtracted from the total acres managed by the Forest, that leaves a total of 1,089,420 acres for which the 10% Forest Plan standard would seem to apply.

Ten percent of this total figure is 108,942 acres, yet the Forest Plan allocated only 64,659 acres to MA 20. This only represents about 5.9% of the total acreage. However, the Forest Plan states, there are approximately 35,570 acres of this management emphasis which occur as inclusions in other management areas (Forest Plan at III-56). Including those acres that occur in other Management Areas, the total acres included in MA 20 plus other MAs managed as old growth would come to 100,229 acres. This would represent a total of 9.2%, which would seem to approach the Forest Plan standard of 10%. But this could be misleading, because the Forest Plan does not specify exactly how much in each of the other MAs that make up the 35,570 acres of this management emphasis occur as inclusions in other MAs. This means that some of this 9.2% could include double-counted acres. Adding to the confusion is that the Forest Plan states that MA 20 itself contains inclusions of other management areas (Forest Plan at III-56) totaling 156,650 acres, and some of those MAs are considered suitable for timber management by the Forest Plan. Obviously, the issue is very unclear. Because of these unresolved ambiguities it is currently not possible to determine whether or not the Forest Service is maintaining the total amount of old growth the Forest Plan requires.

Based on a recent response to a request under the Freedom of Information Act (FOIA), the Nez Perce National Forest also does not have a single, comprehensive forest wide inventory[35]. As with many other national forests in the Northern Region, old-growth inventories are generally only accomplished for project areas during assessments prepared for timber sales.[36] Hence, the old-growth inventory is incomplete.

---

[34] 11-13-02 personal communication with Nez Perce NF s Dave Green.
[35] February 22, 2002 letter responding to a Freedom of Information Act request.
[36] Ibid.

Analysis of old-growth MIS monitoring from Northern Region National Forest Monitoring and Evaluation Reports

Forest Plan Monitoring and Evaluation Reports were analyzed for old-growth MIS monitoring results, following from NFMA regulations that require Population trends of the management indicator species will be monitored and relationships to habitat changes determined. [36 CFR⁄219.19(a)(6).] Generally, only reports from 1996 to present (over the past five fiscal years) were analyzed, because monitoring requirements (as displayed in Table 3) require reporting at least every five years. This also corresponds to NFMA regulations requirements: The Forest Supervisor shall review the conditions on the land covered by the plan at least every 5 years to determine whether conditions or demands of the public have change significantly. (36 CFR⁄219.10.)

Beaverhead National Forest

The most recent Forest Plan Monitoring and Evaluation report, for fiscal year 2001, evaluates the effects the Mussigbrod and Middle Fork fires on individual resources by Forest Plan Monitoring. That report states, the amount of spruce-fir and mature-old lodgepole pine forests totally consumed and the use of burned areas by marten need to be determined so that the fire s impact on pine marten population viability can be evaluated and the amount of Douglas-fir and mature-old lodgepole pine forests totally consumed and the use of burned areas by goshawks need to be determined so that the fire s impact on northern goshawk population viability can be evaluated. The report for fiscal year 1999 focused on riparian habitat health, stream channel condition, water quality, and fish habitat conditions, not responding to the Forest Plan old-growth MIS monitoring requirement. Likewise, a Forest Monitoring and Evaluation Report for fiscal year 1998 also was narrowly focused, on Vegetation Treatment. Prior that the most recent report was for fiscal year 1996, which stated, There were no projects implemented in 1996 believed to adversely influence old-growth indicator species or the related wildlife community. Thus, we conclude that monitoring reports provide no indication of population trends of MIS, and no understanding of the relationship between changes in old-growth habitat and population numbers of the MIS.

Bitterroot National Forest

Monitoring reports for fiscal years 1997-2001 had essentially the same information for the pine marten. They reported miles of transects monitored for marten tracks (750) from 1988-1996, that one marten track was seen for approximately every 6.7 miles transected, and that We have now established a baseline population index with which to compare future information.

The fiscal year 1997 report stated: Over 550 miles of transects have been systematically run since 1988 and for the 2001 report the total miles of transects increased to 865 miles. Over those 865 miles, the Forest Service recorded for pileated woodpeckers an average of 0.20 calls or sightings per mile of transect. Yearly sightings/calls per mile are reported in the 2001 report also.

That report identifies many possible sources of variability in the data over the years, which makes it difficult to determine whether pileated populations are changing, and if so, why.

The reports provide no indication of population trends of pine martens, did not indicate any clear trend in pileated woodpecker populations, and present no understanding of the relationship between changes in old-growth habitat and population numbers of either MIS.

Clearwater National Forest

Monitoring reports for fiscal years 1997-2001 provide no indication of population trends of old-growth MIS. The reports include statements such as Trends in population numbers are correlated with overall old-growth acres maintained on the Forest as directed by the Forest Plan. A normal population of pileated woodpeckers and goshawks were commonly observed across the Forest and coincide with maintenance of old-growth habitat. Also, reports state that pine martens are very common in higher elevations and continue to be trapped with no limits or harvest restrictions being considered. Reports mention that new locations of northern goshawk nests have been found on Potlatch Corporation lands in the Clearwater River basin. Monitoring reports provide no indication of population trends of MIS, and therefore advance no knowledge of the relationship between changes in old-growth habitat and population numbers of the MIS.

Custer National Forest

The Custer National Forest has not issued Forest Plan Monitoring and Evaluation Reports in the last five fiscal years, and even if it had, the Forest Plan doesn t require monitoring of its habitat or population trends.

Deerlodge National Forest

The Forest Service administratively combined the Beaverhead and Deerlodge National Forests in the mid-1990s, and reports for years subsequent to fiscal year 1996 are the same for the Beaverhead NF (see above). The 1996 report stated that twenty goshawks were observed on the Forest since 1994 and that most goshawk surveys were being done in conjunction with project analyses. The Deerlodge NF s reporting provides no indication of population trends of old-growth MIS, and thus offer no data on the relationship between changes in old-growth habitat and population numbers of old-growth MIS.

Flathead National Forest

Since Amendment 21 changed the Forest Plan monitoring requirements in 1999, this report analyzes MIS monitoring under both monitoring regimes. Prior to Amendment 21, the Flathead National Forest issued a single report for fiscal years 1993-1997. That report states that a total of 221 habitat blocks were delineated during project planning from 1992-1997, and that transects for pileated woodpeckers and barred owls were conducted from 1990-1992. The report includes a table with the number of transects completed and number of individual birds or pairs of birds observed. The report also provides a table with the number of pine marten trapped for each of four years, and a table indicating the number of marten track transects run for three different periods and the number of tracks found. None of the data are represented as indicating population trends.

A single Forest Plan Monitoring and Evaluation Report has been issued since Amendment 21 was adopted in 1999, one entitled Forest Plan Monitoring and Evaluation Report 1998-2000. It has no mention of indicator species as per before Amendment 21, and no information on the monitoring items relating to old growth or old-growth MIS as adopted by Amendment 21.

The Flathead NF has provided no reporting of population or habitat trends of any old-growth MIS and has not demonstrated an understanding of the relationship between changes in old-growth habitat and populations of old-growth MIS.

Gallatin National Forest

The Gallatin National Forest has only issued monitoring and evaluation reports twice in the past six years, those being for fiscal years 1996 and 1997. Previous to that, reports were issued for fiscal years from 1988-1992. There was no old-growth MIS information in the two most recent reports**.**

Helena National Forest

Over most of the past 10 years, monitoring and evaluation reports were part of the landscape assessment process covering a relatively small part of the Forest. The Helena did issue forest-wide Monitoring and Evaluation Reports for fiscal years 2000 and 2001.

The fiscal year 2001 report states that the pileated woodpecker and hairy woodpecker sightings are noted in Northern Region Land Bird Monitoring surveys and in biologists project field notes. It also states that the Forest conducts annual surveys of known nest sites. Pine marten track surveys were conducted in conjunction with Canada lynx track surveys. The same report mentions results of goshawk nest site surveys and detections of hairy woodpeckers, pileated woodpeckers, and goshawks in the Land Bird Surveys but no mention of pine marten detection. The fiscal year 2000 report provides similar, but less detailed information. Monitoring reports for fiscal years 2000 and 2001 provide no interpretation of the survey data in regards to population trends of old growth, mature forest, or snag-dependent MIS. Thus, any relationship between changes in old-growth habitat and population numbers of old-growth MIS are unknown.

Idaho Panhandle National Forests

Monitoring reports for fiscal years 1997-2001 provide no indication of population trends of old-growth MIS. The 1999, 2000 and 2001 reports did not report on old-growth MIS. The 1997 and 1998 reports discussed nest site surveys for the northern goshawk but stated that because monitoring efforts were not consistent, population trends were impossible to determine. The 1998 report discussed pine marten surveys in 1992, 1993, 1995, and 1997 but stated that population trends are unknown. The 1998 report states that the Forest has done very little pileated woodpecker monitoring, mentions the Northern Region Land Bird program, and indicates available data is insufficient for determining population trends. This strongly implies that any relationship between changes in old-growth habitat and population numbers of old-growth MIS are unknown.

Kootenai National Forest

Monitoring reports for fiscal years 1997-2001 were analyzed for information on population trends of old-growth MIS. Only the 1997 report contained such information. It cites data collected in the Northern Region Land Bird program during 1994, 1995, and 1996 and mentions personal observations by Forest biologists. The Land Bird program sampled 530, 579, and 545 points on the Kootenai those three years, respectively, with observations of 49, 32, and 48 pileated woodpeckers. Although the data do not clearly determine population trends, the Kootenai anticipates the Land Bird program to continue on the Forest, contingent upon available funding.

On June 27, 2003, the U.S. District Court ruled directly on the issue of MIS monitoring on the Kootenai, with the Judge s order reading: the Forest Service is out of compliance with monitoring requirements and ruling, It is not clear that the Forest Service knows enough about native wildlife species to assure viability of old-growth dependent species.

Lewis and Clark National Forest

Since issuing a Forest Plan Monitoring and Evaluation Report in 1994, the Lewis and Clark National Forest has only issued two reports, one for Fiscal Year 1999 and one for 2000-2001. Only information from the 2000-2001 report is discussed herein, because it summarizes the monitoring of all goshawk nest territories to date (1990-2001).

The Forest monitors known nesting territories, noting the number active the year surveyed. The number of known territories grew fairly consistently, from zero in 1990 to 35 in 2001. However not all known territories were monitored each year as few as zero five different years up to 32 in 2001. There were fewer than 10 active territories documented most years. The four latest years of monitoring found 0, 10, 11, and 9 active territories respectively, and most years there were far fewer. Because of the variability of monitoring efforts, the population trend is not clear. Information on observations of northern three-toed woodpeckers is not provided. Thus, MIS monitoring results offer no data on the relationship between changes in habitat and population numbers of the MIS.

Lolo National Forest

Monitoring reports for fiscal years 1997-2001 were analyzed. Although a Forest Plan standard (requirement) is to Monitor habitat for old growth MIS and population trends will be

monitored as monitoring technology becomes available, no information on population trends of old-growth MIS is presented. There is a Forest Plan requirement to monitor how logging in old-growth stands affects old-growth habitat. Such information is presented for timber sales that affected old growth, along with discussions on how well snag retention requirements for timber sales have been met, but there is no reporting on the logged areas conformance with old-growth criteria. And none of the monitoring reports present interpretation of the relationship between changes in old-growth habitat and the populations of old-growth MIS.

Nez Perce National Forest

The fiscal year 2001 Monitoring and Evaluation Report stated that surveys were undertaken for pileated woodpeckers in only one year since 1992, and that no formal surveys were undertaken for pine marten and fisher. The report also states that three known goshawk nest territories were monitored, with no goshawk use of the territories noted. No pine marten, northern goshawk, or fisher surveys were mentioned in the fiscal year 2000 report. The fiscal year 1999 report mentions four sets of marten tracks observed on a single 18-mile transect. The 1999 report mentions call-playback tape surveys for goshawks, with approximately 180 call stations and approximately 2000 acres surveyed, mentions two sightings, and mentions monitoring of two known nest sites that proved to be inactive that year. The 1998 report states that one set of marten tracks were observed on the 18-mile loop, and that no fisher tracks were seen. The 1997 report states that fisher and marten surveys were not undertaken due to inadequate funding, and that no new goshawk nests or sightings occurred that year. Monitoring reports from the past five years provide no indication of population trends of any of the old-growth MIS. Thus, any relationship between changes in old-growth habitat and population numbers of old-growth MIS on the Nez Perce National Forest remains unknown.

Summary

From this review of Forest Plan Monitoring and Evaluation Reports issued by Northern Region national forests from at least the past five years, it is clear that none of them present data sufficient to reveal population trends of their management indicator species. Furthermore, none of the Northern Region national forests appear to have investigated the relationship between old-growth MIS habitat changes and old-growth MIS population numbers.

Conclusions

This report investigated how Forest Plans and Forest Service management have complied with NFMA regulations in regards to old-growth forests and the wildlife species that depend upon old-growth habitat. All of the forest plans for Northern Region national forests have been implemented for at least 15 years, which was their maximum lifespan as intended by NFMA. The results of this report are rather striking, in that it appears that many of the promises made for protection of biological diversity have not been kept.

Perhaps most striking is the failure of all Northern Region national forests to properly track population trends of old-growth management indicator species (MIS) during the life of the

forest plans. This means that the Forest Service lacks the data to be able to understand how old-growth MIS populations change in response to management-induced or other changes to their habitats. The Northern Region national forests have not complied with the NFMA regulations requirement: Population trends of the management indicator species will be monitored and relationships to habitat changes determined. [36 CFR⁄219.19(a)(6).]

Another striking finding is that the accuracy of national forest old-growth inventories is highly questionable. Four of the national forests have forest plans that require a certain amount of old growth be maintained forest-wide. Three of those forests (Clearwater, Idaho Panhandle, and Kootenai) have been involved in litigation that challenged the accuracy of their forest-wide old-growth inventories. In each case, a federal court ruled the inventory was not accurate enough to insure that the total amount of old-growth habitat required by the forest plans was actually being maintained. The fourth, the Nez Perce National Forest, does not currently have a comprehensive forest-wide old-growth inventory.

Of the other nine national forests of the Northern Region, none have forest plans that explicitly require keeping forest-wide old-growth inventories, although some contain implications in that direction. Of those nine, only the Bitterroot represents itself as having an essentially complete forest-wide inventory. However, not even the Bitterroot s inventory is satisfactorily in harmony with forest plan allocation requirements.

In sum, none of the national forests in the U.S. Forest Service Northern Region have complied with the biological diversity requirements of the National Forest Management Act as applied to old-growth forests and the wildlife species that depend upon them. The amount of old growth that currently exists on these forests is apparently unknown. As the Forest Service enters the revision phase for new forest plans, none of the national forests has collected the data that would allow them to understand how their management under the original forest plans has affected population trends of these wildlife species. This is not what Congress envisioned when NFMA was passed into law.

Appendix 1

Green, P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann, 1992. Old-growth forest types of the northern region. Northern Region, R-1 SES 4/92. Missoula, MT.

To download or view a copy of this reference, go to:
http://outerlimits.wildrockies.org/Ecosystem_Defense/Science_Documents/Green_et_al_1992.pdf