CHAPTER 3 • AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter shows the present condition of the study area and the changes expected from implementing the alternatives that are described in Chapter 2. The "no action" alternative sets the environmental base line (i.e., affected environment) for comparing effects of the alternatives. The "no action" baseline for this EIS represents the management direction in forest plans (approximately 1988) prior to adoption of interim Mexican spotted owl and northern goshawk management direction.

The major issues (see Chapter 1) define the scope of environmental concern for this programmatic assessment of amending forest plans to include Mexican spotted owl and northern goshawk management guidelines. The environmental effects (changes from present base line condition) described in this chapter reflect the identified major issues and other key elements of the environment. Issue numbers are shown in brackets ([ ]) after appropriate Chapter 3 subheadings to cross reference the effects with the major issues. The text of this chapter summarizes the key portions of the various specialist reports generated by the interdisciplinary team. In the text that follows, the specific specialist reports are cross referenced to the Project Record by a document number in parenthesis "()". A complete listing of the Project Record Documents that were used in the development of this environmental impact statement can be found in Appendix A.

The environmental effects presentation includes discussion of short-term (next 10 to 15 years) and long-term (200+ years) effects. The analysis has shown that there is little difference in any of the alternatives in the short-run. However, major differences between alternatives have been noted within the context of the 200+ year time frame.

Vegetation [Issue 3]

Vegetation is described in terms of insect and disease risk, fire risk/fuel loadings, forest structure and forage production.

Insect and Disease Risk (29)

Affected Environment

The affected environment is discussed in terms of the overall risk to insect and disease damage in the primary forest types that comprise the bulk of Mexican spotted owl and northern goshawk habitat.

Pinyon-Juniper - In general, insects and disease are of minor importance in the pinyon-juniper communities. However, as stands of pinyon and juniper continue to mature and increase in density, increased insect and disease activity can be expected. This will be especially evident during periods when trees are further stressed by other factors such as drought. Such conditions may result in severe, localized ips beetle outbreaks, causing a high percent of pinyon pine mortality, which will alter the stand structure and species composition in outbreak areas.

Ponderosa Pine/Pine-oak - In the Southwestern Region, the ponderosa pine and pine-oak type is the largest forested area. About 38% of the ponderosa pine and pine-oak stands are infected with dwarf mistletoe. There is some evidence that the incidence of ponderosa pine dwarf mistletoe has increased during the last century (personal communication, D.Conklin). Shelterwood silvicultural treatment has been used to replace diseased stands using natural regeneration. Clear cutting and planting have been only used on a very limited basis. Treatment units have been generally 20 acres or more to limit spread of the parasite back into the unit from the edges. Lightly infected stands have often been treated using group selection/patch cuts.

Pest epidemics have a greater potential of fragmenting habitat in ponderosa pine and pine-oak types than in the mixed conifer type because diseased pines often die and the remaining component of the forest will not maintain quality habitat. Dwarf mistletoe, root disease, and bark beetles are the main factors of tree mortality though drought is often a contributing factor. Though most of these pest agents are quite host specific, dry site conditions prevent the conversion of ponderosa pine and pine-oak stands to mixed conifer stands.

Mixed Conifer - The greatest insect and disease problem with this type has been with defoliating insects. Usually mortality results only in small openings, but catastrophic changes can occur primarily on poor sites (e.g., mesic white fir habitat types). Often other insects and diseases will contribute to tree mortality in heavily defoliated trees. This type is periodically defoliated by western spruce budworm, approximately

every decade, and the epidemics were longer for the more current outbreaks because of increases in Douglas-fir and white fir due to fire suppression and previous management practices. A severe outbreak may result in enough top kill that existing quality habitat would be seriously degraded. Prudent thinning, particularly where pine can be favored over fir, can lessen the impact of defoliating insects and may help maintain long term Mexican spotted owl and northern goshawk habitat.

In the past, bark beetle outbreaks in the mixed conifer type have usually consisted of a few small, widely scattered pockets of Douglas-fir, white fir and ponderosa pine mortality. However, at times larger outbreaks of these insects have occurred. Many mixed conifer forests have a declining ponderosa pine component due to competition with more shade tolerant species. Dwarf mistletoe infection and bark beetles often hasten the loss of the pine, which contributes to an overall loss in species diversity.

When forests are composed of few tree species and when the desired predominant species die, these forests may not be quality habitat. In a Douglas-fir/ southwestern white pine/white fir forest infected with Douglas-fir mistletoe and white pine blister rust, Douglas-fir and southwestern white pine may be eventually killed, leaving only white fir, thus reducing biological diversity.

Root disease agents are insidious contributors to forest decline in this type. As the area of mixed conifer type increases throughout the region, so will the incidence and effects of root disease. Forest openings tend to get larger over time and Mexican spotted owl and northern goshawk habitat will be degraded. Forests impacted by large Armillaria root rot centers will change a part of the forest gradually and cause an impact for a long period of time. It may take 20 or more years for the oldest parts of the disease centers to revegetate with forest tree species.

Spruce-Fir - This forest type has some unique insect and disease responses. Spruce beetle has caused extensive mortality of Engelmann spruce in the past, leaving only scattered white fir in some heavily infested forests, which has reduced the species diversity quality that is characteristic of good habitat.

Environmental Effects

Alternative A - The risk of damage at epidemic proportions is expected to increase over time. Limitation or delay of insect and/or disease suppression activities may result in serious habitat fragmentation later in the epidemic. Future pest damage and fragmentation may occur if disease suppression activities are not allowed. Diseases such as dwarf mistletoe may degrade Mexican spotted owl and northern goshawk nesting and rearing areas with time.

Alternatives C and F - The risk of damage to habitat is expected to increase over time and is greater than Alternative A because less mixed conifer area is available for treatment. The emphasis on uneven-aged management may lead to increases in susceptibility to western spruce budworm outbreaks and an increase in the incidence and severity of dwarf mistletoe. Limitation or delay of insect and/or disease suppression may result in serious habitat fragmentation if disease suppression activities are not allowed. Diseases such as dwarf mistletoe may degrade nesting and core areas with time. Alternative F will have slightly reduced risk in the mixed conifer type on the Apache National Forest because of the established demonstration area.

Alternatives D and G - The risk of damage to suitable habitat is expected to increase over time and is greater than the risk associated in Alternatives A, C and F. Limitation or delay of insect and/or disease suppression may result in serious habitat fragmentation later in the epidemic. Future pest damage and habitat fragmentation may occur if disease suppression activities are not allowed. Diseases such as dwarf mistletoes and root diseases may degrade protected and restricted Mexican spotted owl habitat with time in areas where large reserve trees are infected. Spread of these pathogens to surrounding regeneration will preclude the development of replacement habitat as the larger trees are killed. Alternative G will have a slightly reduced risk to insect and disease outbreaks and effects in the pine type because the average tree density requirements in Alternative G are slightly less that Alternative D.

Alternative E - There is an increase in the number of acres where management activities to reduce pest damage would be permitted. The increased activity would result in fewer catastrophic losses than in the other alternatives.

In the short-term of 10 to 15 years, there is no discernible difference in the insect and disease risk between alternatives. Long-term risk from damage to habitat condition from insect and disease agents is ranked by alternative from highest risk to lowest risk as follows: D, G, C, F, A and E, respectively.

Fire Risk/Fuel Loading (28,33)

Affected Environment

Before this century, most vegetation types in Mexican spotted owl and northern goshawk habitat had evolved with fires of natural or human-caused origin. The frequency and intensity of fires varied greatly because of variation in fuel and weather. A combination of fire effects did occur across vegetation types, depending on the key variables of climatic conditions, fuels, and topography. This resulted in a mosaic of vegetation.

Exclusion of fire since the late 1800's has resulted in unnaturally high accumulations of litter and down woody material. Dense thickets (1-5 inch diameter breast high (dbh)) and pole stands (5-12 inch dbh) have been established as even-aged groups and dominate much of the landscape. Vegetation changes over the past 100 years have shown a general pattern of increased dominance of woody plants and less herbaceous ground cover. Frequent fires reduced tree densities, which allowed higher densities of herbaceous plants and grasses. These plants, which often supplied the fuels to carry fires, were effectively removed by intensive grazing which allowed higher densities of pine, juniper, and Gamble oak to become established. Much of the current dead and down woody material is present due to effective fire suppression.

Management activities that change species composition, age distribution, and stand structure affect fire regimes. The structural factors which determine crown fire potential are canopy closure, fuel ladders, and canopy height. Management activities such as spacing of planted trees, thinning of planted trees or natural regeneration, pruning of trees, and growth characteristics of selected species can either contribute to or discourage crown fires. The species that are selected for a site, through active management or the indirect effects of fire suppression, can affect the intensity with which ground fuels burn.

Once a site has been affected by catastrophic fire, re-establishment of target conditions for Mexican spotted owl (MSO) or northern goshawk habitat could take well over 200 years depending on how severely an area burned. Pine/oak and mixed conifer habitat as described by the MSO Recovery Plan for target conditions maybe essentially lost indefinitely after stand-replacing events. In 1994 alone, at least 40,000 acres of desired habitat conditions were impacted by catastrophic fire in the Region. All or portions of 20 MSO territories were lost from 1989 to 1994. Since 1989, fires like the Shelly, Divide, Dude, Burgett, Bridge, Pigeon, Ryan, Rattlesnake, and Rincon to name a few have all impacted MSO habitat for the long-term. Table 2 depicts large fire effects to Mexican spotted owl habitat from 1989 to 1994 and also shows estimates of the percent area predicted to burn next decade. Not all of the predicted burn area will have "stand replacement" type impacts (Source: B.Higgins).

Table 2 - Large Fire Effects to Mexican Spotted Owl Habitat (1989-1994) and Predicted Decadal Impacts (1994-2005)

	FIRE EFFECTS			
Cover Type	Acres Lost	Complete Canopy Loss Percent	#Owls Affected	Next Decade % Predicted to Burn
Pinyon-juniper	37700	31.2	0	1.2
Ponderosa pine	71400	35.9	3	4.1
Pine-oak	103100	39.7	5	14.3
Mixed conifer	55200	16.4	10	6.0
Spruce-fir	21400	4.4	0	12.2
Oak woodland	30400	9.2	2	4.1

Fire history suggests that in the absence of minimal vegetation management, those alternatives with the least treatment allowed, would be the most costly in terms of fire fighter safety, suppression costs, and resource damage. Suppression expenses for fires are estimated to range from $250-$500 per acre (Source: personal communication with D.Winner, July 20, 1995). The costs for planning and implementing prescribed fire treatments is approximately 1/10 of what it costs to suppress fires with less risk to firefighters ($25-$50 per acre). Alternatives, which promote more treatments of dense stand conditions, reductions of unnatural fuel loadings, and healthier forest conditions, would be most beneficial for a multitude of reasons including protection and improvement of Mexican spotted owl and northern goshawk habitat.

Environmental Effects

General Fire Suppression Effects: These effects would occur during fire suppression activities in any of the alternatives; however, each alternative is predicted to vary to the frequency and intensity of expected wildland fires and, therefore, the associated fire suppression activity will also vary.

As a consequence of wildland fires, fire suppression activities are taking place with greater frequency in the habitat of Mexican spotted owls and northern goshawks. The suppression actions can have both direct and indirect effects on these species. Line construction with hand tools and chainsaws along with water delivered by engines are the earliest suppression actions taken against unplanned ignition.

As initial attack progresses into extended attack, heavy equipment such as dozers might assist in line construction. All forms of line construction methods have the potential to impact habitat and possibly nesting/ roosting animals through felling of trees and surface disturbance.

Often as part of initial/extended attack efforts, aerial retardant is delivered to slow the spread of a wildfire in support of the ground resources. Retardant drops can impact nesting or roosting owls if applied to nest or roost sites. As wildfires grow beyond extended attack capabilities, the above potential impacts are amplified further. The likelihood of impacts to animals and their habitats increases.

Backfiring and burn-out tactics can also create intense pockets of burning where fires merge and fuel loads are heavy. These suppression actions, however, are often temporary displacement impacts. Spotted owls will return to nest and roost sites after the heat subsides. As long as the stand structure remains intact, spotted owls have been observed to return either immediately after suppression activities or the following breeding season. Examples of this response include the Gila National Forest where prescribed natural fires (PNF) have burned through areas currently occupied by spotted owls (Boche, pers. comm). Jeff Whitney (USFWS, Albuquerque, NM) observed little or no response by northern spotted owls to suppression activities on the Klickitat Incident near Yakima, Washington in 1994. Radio-telemetered spotted owls on the Elk Complex, Klamath National Forest in 1987 and the Tyee Complex on Wenatche National Forest in 1994 moved out of the area being burned out and returned after the heat and smoke subsided (George Sheppard, pers. comm).

Fire suppression can also impact the owls and goshawks indirectly. The prey base can be displaced or killed from burnout operations that entrap animals between the firing operation and the main fire. The less mobile species like squirrels, woodrats, and deer mice might seek refuge in logs or burrows. If heavy fuel loads are present, this could result in intense heating of subterranean sites and logs used as escape refuge, which could cause additional mortality.

Rodents may also be displaced from areas where food is scarce immediately after a fire. Herbaceous vegetation, however, is often increased following a fire by reduced canopy closure and litter layer. This vegetation response of grasses and forbs can occur within the same growing season and enhance the food supply for prey. A reduced understory and litter layer may also provide improved foraging conditions where prey are easier to catch.

Fire Risk Effects: Due to the varying levels of treatment under each alternative, the consequences of fire suppression described above will vary in terms of costs and impacts to the species and their habitats. The application of management ignited fire (MIF) and prescribed natural fire (PNF) will result in lower intensity fire behavior when unplanned ignitions occur. This in turn minimizes the need for suppression actions. The Gila National Forest PNF program is an example of how fire can be applied as a management tool. Reduced suppression costs and impacts are anticipated in areas like the Gila wilderness. Other examples include the Coconino National Forest where the Hog/Red Hill Prescribed Fire project is currently reducing fuel loads in and adjacent to two Mexican spotted owl territories. This will minimize risks of high intensity, stand-replacing fires in the project area. Other ameliorating results of prescribed fire include raising the crowns in the understory which reduces the likelihood of crown fires from the laddering effect. Dense thickets and pole stands are also thinned or removed.

Variation of fire risk effects between alternatives is not substantial over the next 10-15 years. All the alternatives allow for prescribed fire to reduce fuel loads and stand densities. The main difference exists in the amount of mechanical treatment allowable under current forest conditions to restore forest health (see Vegetation and Insect and Disease sections) and the long-term conditions that will develop as a result of the silvicultural treatments.

Projecting the next decade based upon the last six years, fire is expected to move about 304,000 acres of cover types commonly used by spotted owls (mixed conifer and pine-oak) away from suitable (Source: B.Higgins). Thirty-two percent of this could be expected to be converted to aspen, oak brush or grassland. Overall, 532,000 acres of forest may burn in large, intense fires. Experience from other parts of the interior West including the Boise NF in Idaho indicates some expectation for more severe fire effects than projected here, especially if major insect outbreaks precede the fires.

Alternative A would allow for an aggressive fuels management program. Burning would likely be less restricted than for Alternatives D, E and G, and as with all other alternatives, the primary limitations have been, and would continue to be, project funding related.

Alternative A concentrates harvesting on generally less than 30% of an analysis area and targets the overstory for removal rather than thinning. This leaves as much as 70% of an area in dense stand, heavy fuel load conditions. This may also result in homoge-

neous, even-aged stands over time. Even though prescribed fire can be applied throughout an entire area to reduce fuels loads and thin sites, this would likely be difficult to accomplish in many areas due to the density of stands left unthinned. Merchantable timber and the large tree component would be more vulnerable to prescribed fire under Alternative A than D, E and G, which promotes thinning of 5-12 inch trees for the next 10-15 years. The number of suppression efforts would be higher under Alternative A in place of PNF's and prescribed fire projects advocated by Alternatives D, E and G.

Alternatives C and F do not address fire as a management tool for MSO's but may provide some limited opportunity for improving and maintaining goshawk habitat. No habitat modification would be allowed in MSO core areas which prevents any use of fire to reduce small diameter fuel loads. This would also include the quarter mile buffer around the perimeter of cores if the location of the nest and/or roost site is unknown. Alternatives C and F would also restrict the annual number of territories where activities like burning can take place. This would be limiting on forests like the Gila, Lincoln, and Coconino. Prescribed fire would not be allowed within 1/4 mile of active goshawk nest sites during the breeding season. Fire risk would remain high but somewhat less than Alternative A.

Alternative D encourages the use of prescribed fire for maintaining goshawk and spotted owl habitat. The same thinning practices discussed above would be applied to reduce dense pole stands and thickets in MSO habitat. However, there would be less treatment in goshawk foraging areas than the other alternatives. This would result in greater fire risk due to higher stand densities than Alternatives E and G, especially in the pine and pine/oak types.

Alternative E is similar to Alternative C. Alternative E differs in recommending more treatment to goshawk habitat resulting in more open sites. With a lower basal area coupled with aggressive use of prescribed fire, Alternative E would lead to the least long term risk of severe fires when compared to the other alternatives.

Alternatives D, G and E, therefore, would allow for treatments in the next 10-15 years to reduce fuel loadings and stand densities in restricted and unrestricted MSO areas, but the long-term outlook of maintaining target conditions across the landscape is not favorable. Alternatives D and G are limited in the extent to which an area can be thinned under the MSO Recovery Plan. Recommended minimum target conditions are set at densities for both pine/oak and mixed conifer forest types, which exceed the historic stand densities. Without a more aggressive restoration approach, it is unlikely that the short-interval, low intensity fire regime can ever be re-established across the landscape. If the mixed conifer in the Southwest is presently at or above target conditions, this would eliminate any treatments that modify stand structure or density. The mixed conifer type would continue to be impacted by wildland fires.

Alternative G would promote and support prescribed fire and thinning of trees less than 9 inches diameter breast high (DBH). This would move the pine/oak and mixed conifer toward restoration except in Protected Areas. These areas would allow for treatment of only the small diameter (less than 4 inch DBH) material and would remain vulnerable to stand-replacing fires. Since no thinning is allowed and prescribed fires are restricted to the non-breeding season (1 September - 28 February), conducting any burns in Protected Areas would be more expensive and restrictive in the prescription. The risk of losing large diameter dead and down material is higher under first entry burns during this period since the heavier fuels have dried out over summer. The optimum time to ignite for treating small diameter fuels and retaining large diameter fuels would be dry periods in late winter and spring while heavy fuels are still saturated.

In the Restricted Areas, an aggressive fuels management program can be applied. This would be particularly important for treating areas around PAC's. Mechanical thinnings could reduce dense pole stands (5-9 inch dbh) and thickets (1-5 inch dbh) across the landscape. Thinning by use of fire has had only limited success and is non-selective in which trees are removed (Sackett, pers. comm). Edminster recommends thinning dense sites to 10-15 stems/acre of the healthiest trees in the pole diameter range (5-9 inch dbh) prior to burning (Presented at Symposium on Restoration Ecology, Flagstaff, AZ, 1995).

Prescribed fire can be aggressively applied with no seasonal restrictions outside of PAC's. Alternative G would be most liberal in its acceptance of burning throughout the year with minor restrictions in goshawk nest areas if occupied. This allows for the flexibility fuel managers would need to effectively reduce the ladder fuels and restore areas to more natural fuel loads. Sites can also be selected to thin around large, old growth trees like oaks, pine, and Douglas fir to protect this valuable component. Over the life of the MSO Recovery Plan and EIS (10-15 years), Alternative G will slowly move the forest condition toward restoration through the use of mechanical and prescribed fire treatments. Fire risk would be the least of all alternatives with the exception of Alternative E.

Summary: In summary, based on the level of treatments possible under each alternative and the likelihood of implementing projects with the constraints of the MSO Recovery Plan, fire risk and severity would range from highest to lowest as A,C,F,D,G and E, respectively. If it is further assumed that adaptive ecosystem management will progress to where natural processes and disturbance agents such as fire are acceptable, the standard and guideline alternatives driven by the MSO Recovery Plan (Alternatives D and G) and the other standards associated with Alternative E would be most effective at reducing fuel hazards and fire intensity in the long term.

Forest Structure (33)

Implementation of management standards and guidelines for Mexican spotted owl and northern goshawk will primarily affect forest structure on lands classified as suitable for timber harvest. However, the following discussion shows the existing and projected forest structure on all forested lands to better depict the cumulative effect of amending the forest plans.

A six-class vegetation scheme is used to describe the vegetation structural stages of a forest ecosystem (abbreviated "VSS" classes). The purpose of the classification method is to provide a common language between the public and Forest Service employees whereby each can visualize the forest developmental stages. The six stages are grass-forb/shrub-seedling (0 - 1" diameter breast high (dbh)); sapling forest (1 - 5" dbh); young forest (5 - 12" dbh); mid-age forest (12 - 18" dbh); mature forest (18" dbh and larger); and old forest (meets Regional minimum dbh, age, and number of tree required standards). Stand density index (SDI) is calculated for each forest stage and the stage with the highest density is selected for the classification. SDI is also used to determine the canopy closure class (open; moderately closed; or closed) and whether a stand is single or multiple storied.

Affected Environment

Current major influences on the forested landscape composition and structure are fire, insects, disease, and timber harvest. The role of many natural agents in today's "unnatural" forest conditions are outside of their natural range in at least some respects. (See sections on fire, insects and disease.)

Prior to European influence, the density of trees was much lower in most of the Southwestern landscape than it is today. Conversely, grasses, forbs and shrubs were much more prevalent. Stem and canopy maps done by Pearson at Fort Valley indicate the earlier ponderosa pine forest might better be described as a savannah, with trees in groups comprising between 10 and 40 percent of what are densely forested landscapes today. Evidence also indicates much of the mixed conifer type was also much more open, maintained by frequent, low-intensity fire. The spruce-fir, aspen and upper elevation mixed conifer types may have looked much like they do today in relatively undisturbed areas; however, they comprise only about twelve percent of the forested ecosystem.

Along with greatly increased tree densities and area covered by trees, there has also been a marked shift from ponderosa pine and aspen dominated stands toward those dominated by more shade tolerant white fir and Douglas-fir. Forest Service field stand examinations (Johnson, 1986) indicate a two percent loss of the ponderosa pine cover type and 46 percent of the aspen cover type in a recent 25-year period. Mixed conifer cover types have increased by 81 percent at the same time.

Current forest cover types in the region are displayed below in Table 3. The ponderosa pine type is further broken down into a mixed conifer sub-type and a pine-oak sub-type, both of which are identified in the Recovery Plan for the Mexican spotted owl as important for nesting/roosting habitat. A similar break-out of an aspen sub-type in mixed conifer is also displayed. Current average forest density is 103 square feet of basal area per acre.

Table 3 - Forest Acres (thousands (M) of acres) and Percent of Forest by Cover Type

	ACREAGE and PERCENTS			
Cover Type	M Acres <40% slope	M Acres >40% slope	Total M Acres	Percent Forest Type
Mixed conifer (MC)	608	561	1169	8.4
Ponderosa pine/MC	366	149	515	3.7
Ponderosa pine /oak	978	146	1124	8.0
Ponderosa pine	2648	396	3044	21.8
Spruce-fir	194	98	292	2.1
Aspen	97	27	124	0.9
Aspen/MC	57	30	87	0.6
Pinyon-juniper	4922	310	5232	37.7
Oak-hardwood	2146	196	2342	16.8
TOTALS	12016	1913	13929	100.0

Table 4 depicts the current and long term vegetation structural stage (VSS) class distribution in percent of forested acreages in the Southwestern Region.

Table 4 - Existing and Predicted Long Term Vegetation Structural Stages (VSS) in Percent by Alternative

	ALTERNATIVES				
	Exist Cond (%)	A (%)	C/F (%)	D/G (%)	E (%)
Grass/Shrub (VSS 1)	03	08	08	08	17
Saplings (VSS 2)	04	08	07	09	18
Young Forest (VSS 3)	36	25	17	16	16
Mid.Forest (VSS 4)	23	24	16	17	16
Mat.Forest (VSS 5)	30	18	26	25	17
Old Forest (VSS 6)	04	17	26	25	16

In summary, harvest patterns, the absence of frequent low-intensity fire and the ensuing ecologic response have been the primary forces leading to today's forest structure. Increasing tree densities and area occupied by trees has lead to accelerated mortality of larger, older trees, slower diameter growth rates of all trees and a major decrease in the health and vigor of the grass-forb-shrub communities. There has been a shift to later seral species as well. Risk and occurrence of some disturbance agents are well outside their natural range in Southwestern forested ecosystems.

Environmental Effects

Average basal area densities will vary in each of the alternatives. Alternative E will have the lowest average basal area density of 60 square feet per acre. Alternatives A and G will have an average basal area of 64 and 67 square per acre, respectively. The average basal area density of Alternatives C, F and D will approximate 76 square feet per acre.

It is unlikely that the composite structures in Alternatives D and G (see Table 4) could ever actually be attained across large areas at the densities nearing those specified for the Mexican spotted owl and northern goshawk nest/roost site target conditions. The high levels of VSS 5 and 6 in those alternatives arise primarily from the intent to thin all mixed conifer, pine-oak and other steep, forested areas from below, either with fire or tree cutting, while retaining all larger trees. Large fires, insect and disease effects would be expected to intervene long before the conditions displayed are approached, even if competition alone were not a barrier. The MSO Recovery Plan refers to retaining "high" basal areas in mixed conifer and pine/oak. If the term, "high", refers to densities higher than those documented in pre-European settlement forests, but not approaching target conditions, active management is likely to have some success over time without frequent major losses of forest tree structure. For Alternatives, C, E and F, it is assumed that steep forested slopes outside owl protected activity centers can be opened up or maintained similar to the desired conditions depicted in the goshawk guidelines.

If substantially lower densities of trees than present conditions are managed for, then the VSS distribution shown in any alternative (see Table 4) could probably be sustained over the long term, although none of the stages shown would be purely of the tree size indicated at stand-level scales.

In the short term, managed events, with the possible exception of implementing Alternative E, are unlikely to have profound effects upon the ecosystem in the next 10 to 15 years. This is especially true relative to forest structural changes from past management and increasingly common changes as a result of natural agents.

In large areas managed toward nest/roost site target conditions as large, intense fires continue, or possibly accelerate, forest density will decline making it unlikely the structural stages shown in Table 4 will be achieved or sustained, at least in those areas. Where fires burn less intensely, changes may bring about some restoration of natural composition and structure. In the more severely burned areas, effects will take the form of type conversion, structural simplification and loss of soil productivity. The scale of these changes will continue to be much larger than those in pre-European settlement forests. If major insect and disease outbreaks have preceded the fires, the changes brought about by the combination of insects, disease and fire are likely to be synergetic, and much more destructive. However, if areas of very high density are relatively scattered and burning/thinning programs are carried out with some frequency across large areas, the effects described above are likely to be of relatively small scale.

Sites, especially in pine-oak, attaining nest/roost target conditions of at least 20 trees per acre over 18 inches in diameter and at least 150 basal area would arise from and move toward even-aged conditions even without intense stand disturbances.

Research by Potter on the La Mesa Fire showed areas, which had been thinned any time in the past 60 years, suffered less damage than unthinned areas. Areas which had received thinning in the past 25-30 years experienced even less mortality. Large areas of the southwestern forest, especially on steep slopes and other relatively inaccessible areas, have not received any thinning. Fire effects will very likely be more severe in these areas than where thinning has been done. Ten or fifteen years of continued deferral of thinnings will likely make a difference in fire severity, both for

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previously unthinned stands and those which have not been thinned for the past ten to twenty years.

Over the longer term, actions which maintain or restore forest composition, structure and function to within natural ranges of variation are most likely to be sustainable. No alternative evaluated is expected to do this for all areas within the forest types; however, depending upon tree densities managed for over time, all alternatives except Alternative A could come close to being sustainable. In general, some areas of the forest would have sustainable structures and others would not.

Each alternative would retain at least some areas where forest conditions are radically different than in historic times. Barring major interventions, these areas will continue to increase in tree densities, with more late seral species presence than currently exist, or have ever existed. Patterns of variation in tree diameter and density would be much lower within stands than currently exist. Stands would likely move further toward even-aged conditions as natural agents (fires, insects, diseases) increasingly bring about changes well outside their natural functional modes in mid- and lower elevation forest types. Variation between stands and landscapes would likely increase for the same reason: as disturbance agents, which formerly brought about changes at small scales bring them about at larger scales, differences between size and density at larger scales are likely to go up.

All alternatives have the use of prescribed fire available to them. Funding for a prescribed fire program would likely follow national budget initiatives, which are totally unpredictable with respect to this analysis. All alternatives are equally likely to obtain funding or not to obtain funding to implement their respective habitat restoration projects. Amendment of the forest plans will provide the parameters to guide management, but forest plans are not recognized as budget documents. Congressional budget allocations will ultimately affect the implementation rate of any of the alternatives.

Outside of Mexican spotted owl protected areas, Alternative E would likely be quite successful, and is probably the most vegetativly sustainable because it would seek to manage forests more like those which have been present for millennia in the Southwest. Other alternatives, from most to least sustainable **from a forest structure standpoint only**, are A, G, F, C, and D, respectively. Alternatives C, F and D would be the most risky with long-term sustainability by attempting to carry the highest densities of trees (average basal areas of 75 square feet per acre), leading to more structural simplification and productivity loss than any other alternatives evaluated.

Aspen Trends (33)

Affected Environment

The current trend of aspen forests, stand and individual clones within stands is documented in "Sustaining Our Aspen Heritage Into the Twenty-first Century". Briefly, there has been a major decline in both the overall presence and number of places where aspen dominates in Southwestern landscapes. A number of causes have lead to this decline and continue today.

The primary regenerative strategy for aspen is to send root suckers into forest openings created by disturbances. In the past, these disturbances included fire, windthrow, and insects/diseases, either individually or in combination at various scales from one tree up to perhaps hundreds or thousands of acres (on the Carson and Santa Fe National Forests). Small scale disturbances were much more frequent and were virtually the only type in the lower elevations and on southerly slopes.

Currently, aspen suckers are frequently browsed by ungulates to the point where successful regeneration is effectively stopped. This has lead to the loss of entire clones in some cases. Ungulate numbers are probably significantly higher than they were before the extirpation of wild predators, regulation of human hunting and the advent of domestic grazing.

Aspen is very intolerant of shade. Fire suppression and management goals oriented toward creation or maintenance of higher densities of conifers have placed aspen at a competitive disadvantage. This is especially true for small clones in relatively short time periods as conifers quickly seed in and compete at the clone edges. Over the longer term, conifers have also invaded larger clones. Many former aspen sites now have a conifer overstory. Before fire suppression, at least some of these sites would have burned prior to conifer dominance, reestablishing the aspen.

Increased tree densities have lead to reduced production of grasses, forbs and shrubs. This effect, in combination with increased ungulate numbers has probably led to greatly increased browsing pressure on aspen.

Environmental Effects

In the short-term (10 to 15 years), there is no discernible difference in the alternatives relative to aspen trends.

Current declining trends would continue in the short-term until the characteristic management associated with each alternative started to influence the amount and direction of change in aspen.

Infrequent, high-intensity fire is now occurring where the common previous regime was frequent, low-intensity fire. (See fire effects section.) Fires of this type in these locations are likely to be beneficial for aspen, at least the first few times, because they may provide large areas for simultaneous, competition-free regeneration, which could disperse the effects of ungulate browsing while providing an increased production in grasses, forbs and shrubs. Over time, this may lead to loss of productivity in these sites.

Alternative A, while not mimicking natural disturbance patterns to a large degree, would provide a more frequent disturbance level and better densities of conifers that would be compatible to maintenance and eventual increase of the aspen cover type.

Alternatives C, D, F and G are likely in the long-term to generally provide for abundance of lower elevation aspen over time, although there is some possibility of continued loss of some clones. The MSO Recovery Plan will require management of about forty percent of existing aspen sites as protected or restricted habitat, unless or until a natural disturbance intervenes. At higher elevations, large fires are likely to sustain aspen for a long time. However, unnaturally high woody biomass build-up in mid- and lower elevation sites may continue, leading to very intense fires. Where the pre-fire grass/forb/shrub community has declined, soil loss may lead to long term productivity declines on former aspen sites in these alternatives. Alternative D is likely to have the most serious long term negative effects upon aspen at mid- and lower elevations, when compared to the other alternatives.

Alternative E is likely to sustain aspen in the long-term in ways most like it has existed in the Southwest in the past. It provides for disturbance patterns and competitive interactions between aspen, other plants and herbivores most like what appear to have been present prior to European settlement.

Forage Production (35)

Affected Environment

Inverse curvelinear relationships between basal area and herbage production in ponderosa pine have been demonstrated by several authors in the Southwest (H.A. Pearson, Clary, Clary and Ffolliott, Jameson, Deiter and Moore). Similar relationships have been found between canopy cover of ponderosa and pinyon pines (Jameson). Basal area and canopy cover have been shown to be well-correlated over a broad range of densities in ponderosa pine (Edminster, pers. comm.).

Ponderosa pine and pinyon-juniper cover types comprise over 70% of the forested area in the Southwestern Region. Predictions for relative amounts of forage production intended in each alternative are displayed in the table using relationships from Pearson for ponderosa pine (pine-fescue or pine-muhley habitat types). The trend of the relationship displayed for pine-grass is likely similar for other pine, lower elevation aspen and mixed conifer types as well. There has probably been some change in the amount and composition of the understory in the upper portion of the mixed forest and spruce-fir due to heavy sheep grazing early this century and current use by relatively high numbers of ungulates.

Others (Gaines, Campbell and Brasington, 1954) have shown a linear relationship between herbage production and pine litter in other ecosystems. The local studies did not include any effect from directly reducing slash or litter, or of enhanced nutrient cycling, such as might occur from a fire. Therefore, the responses depicted would probably be conservative if fire were reintroduced where it was formerly frequent.

A number of grasslands and meadows at all elevations have been invaded by trees, substantially reducing their herbage production. There may have been a shift in species composition as well, due to changes in interactions between grasses, forbs, shrubs, their competitors and herbivores. In addition to recent documentation of the effects of cattle grazing upon understory and grassland communities, Rassmussen, 1941, reports a number of changes occurring on the Kaibab Plateau from deer browsing, fifteen years after the major herd die-off:

> "[Snowberry] has, in the past, been a conspicuous plant, but has been greatly limited by deer. Numerous dead plants of this species are present.... There are a number of old dead willows, Salix sp., showing evidence of having been killed by deer browsing. It is doubtful that more than a few individuals of this species are now alive on the summit of the plateau.... If an animal becomes dominant on land it would be of the type demonstrated here, where it exercises an influence over the entire community, changes the natural order of things, prevents the growth of several species of woody plants, and by selective browsing favors other species.... It is impossible to say what percentage of the various plants were utilized by the deer as food under

former conditions. At the present time, there is an unnatural condition as shown by the complete elimination of some species."

Studies similar to Rassmessen's are not common across the Southwest, but similar effects can reasonably be expected to have occurred, especially from changes in elk populations.

Environmental Effects

It is unlikely that any alternative will do much in the short run to restore a healthy grass-forb-shrub community to southwestern ecosystems. Where tree densities can be moved back toward pre-European settlement conditions, low-intensity fire reintroduced where it was formerly frequent, and overall ungulate pressures (domestic and wild) reduced, the system may move back toward its former equilibrium.

In many instances, restoration of natural processes and conditions may not be possible even if permitted by an alternative. For example, permanent impairment of site productivity from soil loss; the presence, or even dominance, of noxious weeds; or urban interface considerations could obviate good intentions. Alternatives which permit wide latitude in site-specific decision-making are more likely to be successful than otherwise. Table 5 summarizes estimated long term forage production in pounds per acre for each alternative.

Table 5 - Estimated Long Term Average Forage Production in Pounds Per Acre by Alternative

	ALTERNATIVES			
	Exist Cond. (#/ac)	A/E (#/ac)	C/F (#/ac)	D/G (#/ac)
Pinyon-juniper	54	181	130	130
Ponderosa pine	64	131	96	103
Mixed conifer	35	67	54	38
Spruce-fir	25	50	40	13

The greatest changes in forage production will occur in the pinyon-juniper and ponderosa pine types in Alternatives A and E. None of the alternatives are expected to produce any significant forage production changes in the mixed conifer or spruce-fir types.

The alternatives ranked from most improved overall forage production to least improved are E, A, G, F, C and D, respectively.

Wildlife [Issues 2, 3]

Wildlife is discussed in terms of the effects to Threatened, Endangered and Sensitive (TES) species and in terms of the effects to all other species (i.e., Non-TES species). More specific information on TES species can be found in the Biological Assessment and Evaluation documents found in the project record. The Non-TES species are discussed in broad programmatic terms as the effects relate to cover types, vegetation structural stages and forage production. The project record contains a complete listing of the species considered for this programmatic assessment.

TES Species(34)

Affected Environment

Within the Southwestern Region, there are 62 species currently listed and 8 species proposed for listing under the Endangered Species Act (ESA). In addition, 291 species found within the Region on National Forests are considered to be "sensitive". The Region's sensitive species program is designed to meet species needs, to maintain the species and their habitats, and to eliminate the need for listing under the ESA (Forest Service Manual 2670.21).

The two species of concern for these plan amendments, the Mexican spotted owl and the northern goshawk are widespread throughout the Southwest and the threat to the species is based on habitat degradation on a landscape scale. Other sensitive species within this category would be sharp shinned hawk, pine grosbeak, and the flammulated owl. Other species like the Gould's wild turkey are sensitive to landscape patterns; however, the reason the turkey is sensitive is that the limited habitat in the United States is the northern most extension of its range and it is rare because of this and not because of any changes to landscape patterns.

Many of the rare species are vulnerable to disturbances due to their limited distribution. Most species require site specific mitigation that will be proposed and analyzed within the analyses of individual projects. An accepted ecological approach is to do analyses at multiple scales, one above and one below that needed to analyze the site specific action. This type of analysis can only be done at the project level and is beyond the scope of this Regional programmatic analysis.

Environmental Effects

The implementation of new forest plan standards and guidelines on the ground will not instantaneously coincide with the issuance of the Record of Decision based on this EIS. A transition period will be needed to get to full implementation of the amendment. In the short-term of 5 to 10 years, the effect of the new standards and guidelines with respect to desired on

the ground conditions will vary little between the alternatives. The true ramifications of the differences between alternatives can be easily ascertained when reviewing the expected long-term environmental effects.

In all alternatives, the risk is high that catastrophic events will occur within the next decade (see analysis concerning forest health). With greater restrictions, areas with high tree densities continue to increase in density and the associated risk also continues to increase. It is impossible to know what the size or intensity will be for a given event. Even though fire and insects are a part of the ecosystem, the current conditions are not "normal" and represent stressed ecosystems. The impact of any event will much more likely be catastrophic. Depending on the size of the event, such a catastrophic event has the potential of fragmenting the landscape or it may have the potential to greatly reduce the number of large old trees that currently exist.

The areas most at risk are the areas with the highest tree densities. These are the areas restricted or protected for the Mexican spotted owl and the northern goshawk and these are the areas of greatest importance to the conservation of these two species. What is sustainable for these two species as well as other species tied to old forests appears to not be sustainable in the long-term (200+ years) due to losses to insects and fire. However, the ecosystem as a whole (ecosystem defined as the vegetative community with all of its associated animal component) has to be sustainable.

Alternative A is the "no action" alternative where existing Plan direction is continued. Basically this alternative would emphasize even-aged management with a rotation length not to exceed 120 years in all areas outside of areas allocated for old growth and wilderness areas. Cable logging is allowed on steep slopes. Protection for biological diversity is limited to mitigations for specific habitat needs. Mitigations are generally limited in scope (e.g., protection for the northern goshawk limited to a buffer around nest trees). Old growth associated species like the Mexican spotted owl and the northern goshawk will have limited habitat primarily associated only with the areas set aside for old growth and wilderness areas. Special habitat components, like snags and large down logs, are limited in scope with guidelines that include only a limited percentage of the suitable timber base. Surveys for the Mexican spotted owl and the northern goshawk are limited. For the northern goshawk, there is a heavy dependence on timber markers to find nesting sites. The existing grazing standards and guidelines generally call for the existing stocking to be in line with capacity in the first or second decade. Not all existing Plans have specific utilization rates for grazing animals.

The existing Forest Land Management Plans throughout the Region were documented not to be adequate for Mexican spotted owl and northern goshawk. The existing Plans would also have an adverse affect on the listed Mt. Graham red squirrel and Sacramento Mountain thistle and may cause the following sensitive species to trend toward listing: northern goshawk, flammulated owl, sharp-shinned hawk, Kaibab squirrel, Jemez salamander, Sacramento Mountain salamander, Kaibab pincushion cactus, Arizona leatherflower. Many of the aquatic species are trending toward listing under the current Plan implementation due to grazing management. The species identified are limited to those within the forested habitats. Many other species maybe impacted by current management under existing Plans; however, with the exception of grazing utilization rates, these species are in other habitats (e.g., desert, aquatic, etc.) and are outside the scope of this analysis.

The flammulated owl and the sharp-shinned hawk depend on old growth and would be adversely impacted if old growth was limited only to that designated to be set aside. Conservation strategies are being prepared for the Jemez salamander, Sacramento Mountain salamander, Kaibab pincushion cactus and may ultimately lead to amendment of Forest Plans. The Mount Graham red squirrel and Sacramento Mountian thistle have existing recovery plans. The Arizona leatherflower is a Category 1 species and is being considered for listing based on its limited range. Current mitigation is probably adequate as protection against disturbance; however, current plans do not have specific direction for this plant species.

Alternatives C and F articulate the Mexican spotted owl and the northern goshawk habitat requirements into standards and guidelines. This alternative does not represent the most current knowledge for the Mexican spotted owl that has been published in the recovery plan. The proposed demonstration area on the Apache National Forest in Alternative F would depart from the recovery plan.

Since these alternatives do not fully implement the current Mexican spotted owl recovery plan it would have an adverse affect on the Mexican spotted owl and may not lead to its recovery. The grazing utilization rates would be restricted to occupied owl and goshawk territories and would not be applied across the landscape. Numerous sensitive species tied to aquatic ecosystems may be impacted with a possible trend toward listing. The listed southwestern willow flycatcher

would continue to be adversely affected due to current grazing management.

Alternative D is very similar to Alternative G. The primary difference is that it is written in a more "regulatory" format. This alternative calls for territory establishment if a landscape approach is not used. It is recommended that a landscape approach be used (similar to Alternative G). Alternative G calls for additional surveys if needed while this alternative specifically calls for two years of surveys. Alternative D calls for all trees to be grown to at least 250 years, while Alternative G uses 200+. Alternative G recommends a range for reserve trees where Alternative D recommends 4 tpa in ponderosa pine. Alternative D recommends maintaining all existing standards and guidelines for hiding and thermal cover. Alternative G does not address it; therefore, there is no change in these standards and guidelines. Alternative D addresses old growth as it relates to "blocks".

Alternative G proposes to restore or maintain a minimum of 20 percent of the landscape as old growth. It does not specify the use of "blocks". Instead, patterns are to be provided that provide for a flow of the old growth functions and interactions at multiple scales across the landscape through time. The 20 percent is the amount of the landscape and not specific acres. Alternative G is similar to Alternative D in that all existing old growth is to be maintained.

The same standards for Mexican spotted owl described in Alt. G also apply for Alternative D. Therefore the affects on the Mexican spotted owl will be the same, not likely to adversely affect. Grazing utilization rates would apply only to occupied territories; therefore, the effects of grazing on MSO will be the same as Alternatives C and F.

In addition to not likely to adversely affect the Mexican spotted owl, Alternative D would have a beneficial affect on the following sensitive species, flammulated owl, sharp-shinned hawk, and Kaibab squirrel. Without change in grazing in all cover types, Alternative D would not change the current adverse impacts on aquatic species outside MSO and northern goshawk habitat identified in Alternative A.

Alternative E stresses conditions that favor sustainability of the vegetation over the sustainability of the northern goshawk. This alternative has many benefits over the existing standards and guidelines currently found in the Forest's Plans. It is highly likely that, as we learn more about the ecosystem and the needs of specific wildlife species, desired vegetative conditions may approach what is described in this alternative. However, as stated in the section immediately before discussion of the individual alternatives, both the vegetative communities as well as the associated animal species must be sustainable but conditions described for either side are usually different due to the lack of knowledge concerning the ecosystems.

Since this alternative does not fully implement the current Mexican spotted owl recovery plan it would have an adverse affect on the Mexican spotted owl and may not lead to its recovery. Numerous sensitive species tied to aquatic ecosystems may be impacted with a possible trend toward listing. The listed southwestern willow flycatcher would continue to be adversely affected due to current grazing management.

Standards and Guidelines for the northern goshawk are limited only to occupied areas and do not allow for population expansion or shifts. Guidelines pertaining to nest size, percent of area in VSS 4,5, and 6, and the number of reserve trees have lower values than recommended within the goshawk recommendations. It is not clear how long trees would be allowed to grow. It is stated that old growth be limited to 10 percent of the land area under management. Trees outside of these old growth areas will be allow only enough time to grow to the size defined within the different VSS classes and the VSS 6 would not have the age that would exhibit old growth characteristics.

This alternative would have an adverse affect on the northern goshawk. It may also have an adverse affect on other sensitive species, i.e., sharp-shinned hawk and flammulated owl. Listed and sensitive species tied to aquatic ecosystems that are currently being impacted by the current application of grazing will continue their adverse impact or continue their trend toward listing.

Alternative G incorporates the needs of the Mexican spotted owl and northern goshawk. The science behind the needs are contained in two publications, "Mexican Spotted Owl Recovery Plan" and "Management Recommendations for the Northern Goshawk in the Southwestern United States" (GTR RM-217, 1992). Both publications endorse the concept of managing ecosystems; however, only the Recommendations for the Northern Goshawk incorporates a long term approach. Recovery recommendations for the spotted owl are for the short term and take precedence over all other recommendations for non-listed species because of its listed status under the Endangered Species Act.

This alternative deals primarily with the habitat of these two species which consists of the forested ecosystems of pinyon-juniper, pine-oak, ponderosa pine, and mixed conifer. With the exception of grazing

management modifications, existing standards and guides outside of these ecosystems will essentially remain unchanged.

Under the Mexican spotted owl recommendations all Protected Activity Centers (PACs) and slopes > 40% will be protected with no timber harvest being allowed. All areas with ponderosa pine/gamble oak and mixed conifer vegetative types will be "restricted". In restricted areas, all sites meeting "threshold" conditions will be maintained with no timber harvest of trees > 12" dbh. The harvest of trees between 12" and 24" dbh will only be allowed within restricted areas outside of those sites meeting target conditions and only on up to 20% of the restricted areas. Trees over 24" dbh will be maintained everywhere within the restricted and protected areas. Excess trees to be harvested will be based on a "Q" of 1.4 or less. A more detailed description is contained in "Draft Mexican Spotted Owl Recovery Plan", March 1995.

Under the northern goshawk recommendations all nest sites and post-fledgling areas (PFAs) will be restricted with higher stocking levels (canopy cover). All areas outside of PFAs will have the desired stocking levels correlating to an average of 40% canopy cover with a high contrast both above and below. As stated above for both the Mexican spotted owl and the northern goshawk the landscape will contain trees that are uneven-aged allowing for more large old trees. A more detailed discussion of the recommendations are contained in, "Management Recommendations for the Northern Goshawk in the Southwestern United States".

Two listed species, Sacramento Mountains thistle and Mount Graham red squirrel, could be impacted due to the restrictions that would not allow the Forest Service to do any vegetative manipulation in "protected" areas (i.e., PACs, steep slopes, and stands that meet threshold conditions). Without being able to reduce fuels, the Mount Graham red squirrel will continue to be at greater risk to wild fires. Without being able to reduce tree densities and lessen the potential risks from catastrophic fires, springs and seeps containing Sacramento Mountains thistle will be impacted with the possible loss of springs and seeps. Within the limited habitat for these two listed species management activities necessary to implement their recovery plans will take precedence and will be exempt from the conflicting Mexican spotted owl standards and guidelines.

Possible disturbance could adversely affect the Kaibab pincushion cactus and Arizona leatherflower. A conservation strategy is being formulated for the Kaibab pincushion cactus. Alternative G has the flexibility to mitigate any adverse impacts at a project or site level. Until such time as conservation strategies, recovery plans or agreements are developed and approved, the entire range of these two species will be exempt from the proposed action except on a case-by-case basis subject to consultation with the Fish and Wildlife Service.
In addition to the forest structure, the health of the herbaceous and shrub components of the ecosystem is also important for the prey species associated with the Mexican spotted owl and the northern goshawk. To maintain this part of the ecosystem grazing utilizations rates are proposed. These rates differ based on range condition with the intent of maintaining good to excellent range conditions where they exist and to restore range that is in poorer condition. Ecologically it makes little sense to limit the utilization rate guidelines to only Mexican spotted owl and northern goshawk habitat; therefore, the utilization guidelines are being proposed across the landscape in all vegetation cover types.

For all listed species, Alternative G may affect, but will not adversely effect any species. For all sensitive species, Alternative G may impact, but no species will trend toward federal listing and there will be no loss of viability.

Due to the proposed grazing utilization rates there will be a beneficial effect on all listed and sensitive species tied to riparian and aquatic habitats where degradation of habitat due to grazing has been contributed as the primary reason for listing (e.g., southwestern willow flycatcher) or for including a species within the Regional sensitive species list (e.g., numerous native fish species).

NON-TES Species (34)

There are approximately 327 non-TES species of amphibians, reptiles, birds and mammals identified that use the forest cover types inhabitated by Mexican spotted owl and northern goshawk (See process record for the list of species and their habitat associations). Some species totally depend on one or more of these cover types and respective vegetation structural stages (VSS), while others are casual uses. Regardless of the degree of use, it is important to maintain a diversity of cover types and vegetation structural stages across landscapes to sustain healthy wildlife populations and communities.

This programmatic analysis of the alternatives is primarily based on three broad habitat characteristics that can be evaluated at the programmatic EIS level. These three wildlife habitat characteristics are cover type, vegetation structural stages (VSS), and forage

production. Cover type and VSS represent the overstory characteristics of the habitat and forage production represents the understory. The structural stages are grouped by early, mid and late stages (VSS 1&2, VSS 3&4, and VSS 5&6, respectively).

With available data, 201 birds and mammals of the 327 wildlife vertebrate species can be associated with both cover types and structural stages. The data on the associations between amphibians and reptiles and the defined vegetation structural stages are not will defined and may not be that relevant. These species may be more closely associated with other habitat features than forest structure. The group of 201 species will be used for the analysis of the alternatives and assumes that this sizable subset of 201 species is a good representation of the species that are associated with the cover types and vegetation structural stages.

The remaining 126 species comprise a group of species where cover type and structural stage association has not been determined or the species keys to other habitat attributes. Table 4 displays the distribution of cover types for the forested area in the Southwestern Region. Table 6 displays the distribution of the 203 species in five primary cover types. Some of the species overlap into more than one cover type and some species primarily prefer a single cover type. Each of these cover types are considered to be representative communities. As you move from one cover type/ structural stage habitat to another, there is a corresponding shift in wildlife community composition.

Table 6 - Number of Bird and Mammal TES and Non-TES Species in Five Primary Cover Types

COVER TYPES	NUMBER OF SPECIES
Pinyon juniper	54
Mixed conifer	53
Spruce-fir	37
Ponderosa Pine	66
Aspen	47

Cover Type. Table 7 shows the change of cover types in recent years. The most significant changes related to wildlife are the increase in mixed conifer and the decrease in aspen. These cover type changes can be attributed to fire suppression, harvesting activities, and grazing. One of the goals of forest health restoration is to reverse the current trends in type change, particularly for aspen. If not, aspen may be lost as a cover type in approximately 25 years, and aspen is an important habitat for wildlife.

Table 7 - Change in the Number of Acres (M Acres) **Per Cover Type in Region 3 (1962-1985)**

COVER TYPES	1962	1985
Mixed conifer (M ac)	1.278	2.318
Spruce-fir (M ac)	0.692	0.653
Ponderosa Pine (M ac)	8.705	8.498
Aspen (M ac)	0.486	0.283

Aspen, though only approximately 1.5% of the overall acres of the forest cover types, provides habitat for about 47 vertebrate species (compare Tables 4 and 6). But the main importance of aspen in a coniferous forest, is that it provides a broad leaf component to the landscape that invertebrates depend on.

Vegetation Structural Stage. Another trend in forest habitat has been the shift to stands that are denser, having more smaller trees (see Table 8). This trend can also be largely attributed to the lack of fire and timber harvest.

Table 8 - Changes in Trees Per Acre for Four Diameter Classes (1962-1985)

	DIAMETER CLASSES			
	1"-4.9"	5.0"-10.9"	11.0"-16.9"	17.0"+
1962	146	63	16	8
1985	158	104	26	8

Another of the goals of restoring forest health is to move from dense stands to more open, less dense, stands. This shift to more open, less dense stands will result in more and better habitat for those non-TES species that favor more open habitats

Forage Production. There has been some small changes in forage production (understory conditions) in the upper portions of mixed conifer and spruce-fir since pre-Eropean settlement. The reduced amount of change in these forest types has been due to the fact that they have been historically closed canopied which prohibits the growth of a well developed understory.

In the pinyon-juniper and ponderosa pine forests where there has been a decline in forage production. This decrease can be attributed to an increase in canopy closure, which in turn has retarded the development of diverse and healthy understory.

Environmental Effects

Cover Type. In the short-term (10 -15 years), the different alternatives will not substantially result in a change in cover types among the conifers. But in the long-term, Alternatives D, C, F, and G will result in

insect and disease infestations that will reduce the pine in the mixed conifer, which will decrease the overall diversity between cover types. Since pine is already in a downward trend and has one of the largest number of wildlife species usages of any cover types, Alternatives A, and E would be preferable for maintaining a diverse landscape for non-TES wildlife species and communities.

The most important type change is in aspen. Alternatives A and E will provide for disturbances that will help in the recovery of aspen. Alternatives C, D, F, and G will probably lead to the overall continued decline of aspen. Since aspen is an important wildlife habitat and this cover type is declining, Alternatives A and E would be the best aspen alternatives.

Vegetation Structural Stage. The most significant habitat changes the proposed alternatives will have on wildlife habitat are shifts in seral structure. Table 4 shows the percent of early, mid and late structural stages across the Region by alternative. In order to provide diversity of habitats for non-TES species, vegetation structural stages should be well distributed in approximately even proportions. That is, each stage should be well represented. No one or two stages should be predominant.

Currently, the best guidelines we have for desired conditions for the distribution of structural stages are the goshawk guidelines. These guidelines recommend for a foraging area a vegetation structural stage distribution of 20% in early, 40% in mid and 40% in late structural stages, respectively. Alternative A has the closest structural stage distribution to the goshawk recommendations, followed by C and F, then E, and, finally, D and G. Alternatives A, C, and F would provide the best vegetation structural stage distributions to provide the habitat diversity needed for the non-TES wildlife species.

Forage Production. The greatest changes in forage production will result in Alternatives A and E. The alternatives that would produce the most forage, in decreasing order, are E, A, F, C, D and G. Since understory habitat is important for many of the non-TES wildlife species and there is a need to increase understory habitats, Alternatives A and E would be preferable for non-TES wildlife.

Soil/Water/Air/Visuals [Issue 3] (31)

Affected Environment

Soil and Water: Soil and water effects for each alternative were estimated by comparing three different criteria for each alternative. The criteria used were (1) old forest acres by vegetation type and alternative, (2) acres available for management or vegetation modification, and (3) an index of water yield trends by alternative. The water yield index is also based on acres available for vegetation management and the desired future basal area for the vegetation type.

The assumption was made that old forest structural characteristics are likely to enhance watershed health and soil productivity. That is, soil infiltration rates, the ratio of stormflow to baseflow, and soil productivity will be near potentials for the sites when old forest conditions occur. It is realized this assumption is not always true. For example, younger more open stands in the pinon-juniper vegetation type are often in better watershed health than old, dense stands of pinon-juniper.

It was also assumed, for this analysis, that the more area with restrictions on vegetation modification the lower the risk for changes in soil productivity and watershed health. This assumption also is not always correct. Vegetation management is frequently a tool necessary to improve soil cover, increase woody debris on the forest floor and in stream channels, and reduce evapotranspiration. The beneficial effects on streamflow of reducing evapotranspiration through lowering basal areas in ponderosa pine, and creating openings in the mixed conifer are well documented in research literature. Also, management guidelines for woody debris, soil erosion, compaction, and infiltration are available and do not have to be tied to the Mexican Spotted Owl and Northern Goshawk standards and guidelines for implementation.

Another consideration is the ability of managers to use fire as a tool in ecosystem management. There appears to be a trend toward more destructive wild fires in the ponderosa pine and mixed conifer. Such fires frequently result in lost soil productivity, increased erosion and stream sedimentation, and large quantities of particulate matter discharged into the atmosphere. Alternatives with more management latitude provide the opportunity to use managed fire in a way that reduces the risk of destructive wildfire.

Air: Clean air standards currently are under control of environmental departments in both Arizona and New Mexico. The state's provide oversight and coordination of burning activities. Impacts to air quality will be a result of wildfire, prescribed natural fire and/or prescribed fire projects.

Visuals: Each forest plan in the Region contains specific standards and guidelines related to visual resource management. Visual Quality Objectives (VQO)

were developed in concert with other management direction during forest plan development.

Environmental Effects

Soil and Water: Given the assumptions are not valid in all cases it is difficult to compare the alternatives with a great deal of confidence. But, since the same assumptions were made for all alternatives, it is possible to rank the alternatives comparatively for each of the criteria.

The potential for detrimental soil and watershed disturbance due to management activities is the greatest in Alternative A because of fewer restrictions on steep slope operations and because there is more area available for modifications. The potential in Alternative E is slightly less than A. Alternatives C,D, F, and G have the least potential for detrimental disturbance and are about the same regarding soil and watershed effects. Considering the potential effects of destructive wildfires on soil, water, and air resources the relative effects are somewhat reversed. With Alternatives A and E having the most potential to manage and Alternatives C, D, F, and G having the least.

Comparing opportunities to manage vegetation for water yield enhancement, Alternative A has the most potential to create openings in the mixed conifer and the most potential to reduce basal area in the ponderosa pine. Thus, Alternative A seems to have the greatest potential for managing water yield. The potential with Alternative E is only slightly less than Alternative A. Alternative D seems to have the least potential for management because of slightly higher desired future basal areas in the mixed conifer, spruce-fir, and ponderosa pine. The water yield potential for Alternatives C,F and G is similar and only slightly greater that Alternative D.

Using the old forest surrogate for soil productivity and watershed health there appears to be a slight advantage with Alternatives D and G (see Table 4). Alternatives C, F, and E are similar and only slightly lower than Alternatives D and G. Alternative A has the lowest potential for improving soil productivity given this surrogate. This surrogate needs to be kept in perspective relative to the total watershed area in forest or tree vegetation. First, these watersheds or portions of watersheds are generally in pretty good soil and watershed condition anyway. Second, the maximum percentage of the forested watersheds or portions of watersheds affected by the old forest standards and guidelines is about 15 percent. Thus, dramatic effects in soil productivity and watershed health are not anticipated from any of the alternatives.

Air: Alternatives D, G and E contain the most aggressive prescribed fire program and would have the greatest potential of affecting air quality. In Alternatives A, C and F, some prescribed fire projects will occur but not to the same extent as in the other alternatives. From a programmatic perspective, state coordination of prescribed fire activities will prevent any long term air quality problems. In the vicinity of prescribed fire projects, some short term (2 to 3 day) air quality degradation will occur, but prescribed burning within properly developed prescriptions will minimize the effect. Each site specific prescribed burning project will undergo proper National Environmental Policy Act procedures, which will include complete coordination with appropriate state agencies.

During certain times of the year, lightning or man caused fires could add a cumulative effect to air quality degradation that is unplanned. Each of the alternatives has a varying fire risk that expresses the relative potential of these unplanned events. Review of the fire risk discussion at the beginning of Chapter 3 to gain further understanding on how fire risk and the potential for wildfire will vary between alternatives.

In the short term (5 to 10 years), there will be no discernible difference in air quality effects between alternatives. Differences in alternatives will gradually be noticeable as the prescribed fire programs of some alternatives are implemented. Other differences will be noted in the long term (200 years or more) and are related to the expected condition of the vegetation. Review the vegetation section presented earlier in this environmental impact statement and note the changes expected in vegetation density as expressed as percent area by vegetation structural stage (Table 4).

Visuals: Each alternative and their associated standards and guidelines can meet the visual quality objectives currently defined in forest plans. Visual resources will be protected in all alternatives.

Given the long-term expected vegetation structural stage mix (see Table 4) for each alternative, the appearance of the forest will change. In all alternatives, the forest will gradually become less visually diverse as forest growth continues at rates that exceed forest harvest. The forest will be more dense and contain more mature trees than it does today. Less management influences will be obvious to the passing scene viewer in Alternatives C, D, F and G that in Alternatives A and E.

Recreation/Services/Access [Issue 5]

Transportation System/Access (27)

Affected Environment

There are about 56,600 miles of roads on the National Forests in Arizona and New Mexico. The Forest Service has jurisdiction over about 52,200 miles of these roads. These Forest Service roads vary widely in use and condition. High standard roads for use by passenger cars are about 12% of the total road miles. High clearance vehicle roads that are not maintained for passenger cars are about 72% of the total road miles. The remaining 16% of the roads are closed for resource protection reasons.

Road densities vary from less than 1 mile of road per square mile to more than 10 miles of road per square mile. The Forest Service is closing roads that are causing the resource damage. Roads will only be closed after site specific evaluation and environmental documentation. Much road reconstruction, relocation, and closure have been accomplished as part of timber sales. If timber sale activity is reduced, other funding will have to be developed to accomplish road system maintenance and improvements. This EIS makes no site-specific decisions concerning management of roads or forest access.

Environmental Effects

Alternative A would maintain a higher level of road construction than the other alternatives, except perhaps E. Road construction would also include access roads for logging 40%+ slopes on the Apache-Sitgreaves, Gila, Lincoln, and Santa Fe National Forests. Mexican spotted owl core areas would be protected on the Apache-Sitgreaves, Carson, Coconino and Kaibab National Forests. Goshawk core areas would be protected on the Apache-Sitgreaves, Carson, Cibola, Coconino, Kaibab, and Prescott National Forests. The Fish and Wildlife Service would have to be consulted for biological opinions about on-the-ground management activities. Low volume, high clearance roads will be closed to protect watershed, wildlife resources. Public access would be highest in this alternative.

Alternatives C, D, F & G restrict new road construction in the Mexican spotted owl core areas, or Primary Activity Centers (PACs). New road construction is allowed if there is no other economically and environmentally reasonable alternative. Management activities are not allowed within 1/4 mile of active northern goshawk nest sites that would adversely affect the reproductive and rearing effort during breeding season. Construction of new roads will be restricted in core areas or PACs and northern goshawk nest sites. Low volume, high clearance roads will continue to be closed to meet a wide range of objectives, including watershed protection, wildlife habitat enhancement, riparian improvement as well as Mexican spotted owl and northern goshawk protection. Overall public access to the National Forests will not be significantly reduced as a result of these guidelines.

Alternative E environmental effects are similar to the other action alternatives except that Alternative E may result in higher levels of road construction to support the higher level of timber harvest. Some low volume roads would be opened during harvesting and closed again at the end of harvest activities. Overall, with increased activity, it can be expected that the open road miles will slightly increase under this alternative; however, public access will not be significantly increased under this alternative.

Recreation/Special Uses (30)

Affected Environment

Recreation opportunities are classified by their setting and by the probable recreation experience and activities one may undertake in each area. Opportunities in areas classified as urban, rural and roaded natural are where most of developed recreation opportunity exists. Semi-primitive recreation opportunities, where little development exists, can be obtained by traveling primitive road systems (motorized form) or by use of the Forest Service trail system (non-motorized form). Primitive recreation opportunities like wilderness are also available on National Forests.

The construction, operation and maintenance of 40 to 60 developments such as campgrounds, picnic areas and trailheads are within the area that could be influenced by Mexican spotted owl and northern goshawk management guidelines. Additionally, several ski area and resort developments could also be affected.

Environmental Effects

Recreation Opportunities - There are varying effects to recreation opportunities in each alternative. Primitive recreation opportunities like wilderness use will not be affected in any alternative. The greatest effects occur in terms of restrictions on Forest Service and private capital investments in recreation development. However, recreational special events like motorcycle racing and off-road vehicle use will also be affected by operational restrictions or permit elimination.

Urban, Rural and Roaded Natural - In this developed end of the recreation opportunity spectrum, existing facilities and their operation and use do not change across the alternatives. These sites are generally serviced by high standard roads maintained for passenger car travel which remain under all alternatives (reference transportation system effects). The primary impacts of management for the Mexican spotted owl and northern goshawk affect new construction, which has the potential to render habitat unsuitable and disturbance due to timing of construction, which has the potential to disturb nesting birds.

Recreation Development - There would be restrictions on both Forest Service and private construction during the Mexican spotted owl and northern goshawk breeding and rearing seasons (approximately March 1 to September 30) within 1/4 mile of an active nest for all action alternatives. Additionally, timing restrictions could affect construction costs and/or project economic feasibility in all action alternatives. There may be an increase of dispersed use in the more accessible developed areas as a result of reduced roading in the semi-primitive motorized recreation areas.

Existing Uses - Existing uses at developed ski area and resort sites will not change with any of the alternatives. However in some of the alternatives, ski area and resort expansion opportunities could be totally lost or be at some risk because of Mexican spotted owl and northern goshawk habitat management restrictions.

Alternative D will be the most restrictive alternative relative to recreation opportunities, development and existing uses, because of more stringent requirements for goshawk habitat. The effects of Alternatives C, E, F and G would be slightly less than Alternative D. Alternative A would have the least affect to recreation and special uses.

Commodity Production/Statutory Rights [Issues 4, 6]

Mineral and Energy Resources (36)

Affected Environment

A wide variety of mineral and energy resources occur on National Forest System lands in the Southwestern Region. These resources may be classified into 3 categories:

Locatable Minerals - Some important locatable minerals in the Southwestern Region include gold, silver, molybdenum, copper, lead, zinc, uranium, mica, gypsum, and perlite. There are approximately 192 active exploration and mining operations in the Region. The majority of this activity occurs in Arizona, although New Mexico also has a number of important active exploration and mining operations. There are roughly 16,000 active mining claims on National Forest lands in New Mexico, and about 45,000 mining claims in Arizona.

Leasable Minerals - The major leasable mineral resources in the Southwestern Region are oil, gas, and geothermal energy. There are 388 leases, covering 394,806 acres of National Forest System lands, in New Mexico and Arizona. Most of these leased lands are located on National Forests in New Mexico. Of these leases, there are 207 currently producing.

Salable Minerals - Salable minerals include common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay. In general, these minerals are of widespread occurrence, of relatively low unit value, and are useful in construction and for other industrial purposes. These mineral materials may be sold by the Forest Service at the agency's discretion. The Forest Service also depends upon mineral materials from National Forest System lands for road construction and surfacing of Forest System roads. In addition, the Forest Service issues free use permits to state and county governments for public projects such as highway construction and maintenance. There are approximately 273 active mineral material pits used by the public and/or the Forest Service on National Forest System lands in New Mexico and Arizona.

Private Mineral Rights - In addition to minerals under federal ownership, some minerals on National Forest System lands are owned by private parties. Most of the National Forest System lands in the states of New Mexico and Arizona were reserved from the public domain by executive order under authority of the Forest Revision Act of 1891. However, since that time, other lands have been acquired and made part of the National Forest System. Title to some of these acquired lands are encumbered with various reservations. Mineral rights were sometimes reserved by the private party from whom the federal lands were acquired. In other instances, minerals were separated from the surface estate prior to the federal government acquiring the surface and, as such, mineral rights are outstanding to third parties. These reserved and outstanding rights represent property interests in the land. Although the federal government owns and administers the surface, the private mineral owner has certain property rights as well. The most important of these is the right to access and develop the privately owned mineral resources. Other rights may be spelled out in individual

deeds. These property interests must be taken into account by the Forest Service in planning and implementing management activities. There are about 155,000 acres of lands with reserved and outstanding rights in the Region.

Environmental Effects

Effects on Statutory Rights - The following discussion identifies areas of potential conflict with statutory rights. Whether or not statutory rights would actually be affected would depend on each particular set of site specific circumstances. The expected effect is relatively the same in all alternatives.

All action alternatives would have possible conflicts with mining claimants' statutory rights, private mineral rights, and leasee's contractual rights. The two possible areas of conflict are:

- Delays due to Mexican spotted owl and northern goshawk survey requirements: Continued implementation of the existing guidelines would substantially delay approval of operating plans submitted by mining claimants. The existing guidelines require surveys to be conducted over a period of 1-2 years. On the other hand, federal regulations (36 CFR 228, Subpart A) require the authorized Forest Service officer to review and respond to an operating plan submittal within 30 days, with a possible 60 day extension. The timeframes required for the survey are in conflict with the timeframes allowed by regulation for processing of operating plans. During the period of delay while the surveys are being conducted, mining claimants are effectively prevented from exercising their statutory rights to explore for and remove mineral resources from their mining claims. Additional delays can be expected when formal consultation with U.S. Fish and Wildlife Service is required on the Mexican spotted owl and other listed species.

With respect to reserved and outstanding mineral rights, the federal government has even less jurisdiction over the mineral owner's actions. Any attempt to unduly restrict or delay private mineral owner's legitimate activities through implementation of the existing guidelines would be a potential conflict with statutory rights.

- Seasonal restrictions for management activities in occupied Mexican spotted owl and northern goshawk habitat are proposed in all action alternatives. The existing guidelines provide management direction for areas of occupied habitat. Generally, no activities are allowed in nest areas. However, the guidelines provide some limited exceptions.

A conflict arises, with respect to approved operating plans and lease agreements, in that the Forest Service may not have the authority to change such existing documents unless the modification is agreed to by both parties or is stipulated in the original agreement. While it might be possible to include such restrictions in new operating plans or leases, it may not be feasible to change existing agreements without the concurrence of all other parties to the agreement. With respect to private mineral rights, the federal government has even less discretionary authority.

The greatest effect would be on mining proposals in the development/production phase, where seasonal restrictions would not allow production of minerals during 6 months of the year (March - August). While exploration operations might be able to work within these timeframes, such restrictions imposed upon operations in the production phase could be so burdensome that it might preclude development of mineral resources on the claims altogether.

There would be no effect on statutory rights from Alternative A, since there would be no delays in approval of operating plans resulting from survey requirements and no seasonal restrictions on management activities. The most restrictive alternatives are Alternatives D, E and G because of the additional dispersal habitat management restrictions would require withdrawal of all areas of suitable habitat from mineral entry. Alternatives C and F, which would not require withdrawal of these areas, would have less effect on statutory rights.

Effects on Commodity Production - Implementation of standards and guidelines would reduce the number of new exploration projects and, ultimately, the number of new mines, and oil and gas wells, going into production. The reduction in new producing operations would be due primarily to the delays caused by the requirement that Mexican spotted owl and northern goshawk surveys be conducted over a 1-2 year period, and the uncertainty associated with the outcome of, and possible conditions imposed as a result of, those surveys. If a company is unable to have reasonable assurance of a return on its investment within a certain time, the project will often be abandoned, as excessive losses are otherwise incurred. Because the existing guidelines have not been in effect very long, the primary impacts would be to new, rather than existing, operations. Effects on production would not occur immediately, but would occur over a period of 10 or more years. However, as currently producing operations deplete their reserves and shut down, fewer new operations would take their place, and overall production would gradually decrease throughout the region.

Because it is impossible to predict the exact location of potential new mineral and energy discoveries, actual effects on production are difficult to determine. However, a reasonable estimate can be made based on some basic assumptions:

Roughly the following percentage of production in each state is currently coming from National Forest System lands classified as suitable habitat for the Mexican spotted owl and northern goshawk:

	Arizona	New Mexico
Leasable minerals:	0%	25%
Locatable minerals:	8%	36%
Salable minerals:	14%	11%

Assuming that roughly the same percentage of future new operations would also be located in Mexican spotted owl and northern goshawk habitat, and that the factors discussed above would impact those operations, it is probable that a certain percentage of these operations which might otherwise have proceeded to the development/production phase may instead be abandoned. Informal interviews with a number of Chief Executive Officers of mining companies conducted by the Forest Service indicate that approximately 30-50% of companies would avoid initiating projects in areas where they would be subjected to long delays. Based on this data, if 40% of potential new operations located in Mexican spotted owl or northern goshawk habitat are abandoned or never even initiated, there would be an eventual decrease in annual production. The decrease in both locatable and leasable mineral production would be greatest in New Mexico. The decrease in salable minerals would be approximately equal in both states.

The Forest Service's ability to produce mineral materials for use in road building and maintenance from pits located in suitable Mexican spotted owl and northern goshawk habitat would be reduced. In some cases, this could affect the agency's ability to manage the transportation system on National Forest lands. For example, material might have to be hauled for longer distances from pits outside of suitable habitat areas, or removal of material would need to be restricted to outside of the breeding season. This would increase costs to the taxpayer to build and maintain National Forest System roads and may affect the ability of the Forest Service to provide developed recreation sites and amenities to the public.

The greatest losses would occur in Alternatives D and G, followed by Alternatives F, C and E. The least losses would occur in Alternative A.

Landownership Adjustments (36)

Affected Environment

Land exchange is the most common method of landownership adjustment (LOA) used by the Forest Service. The Forest Service enters into land exchanges for a variety of reasons, such as consolidation of National Forest System lands, or acquisition of lands valuable for wildlife habitat or other resources. The primary goals of the land exchange program are to increase the efficiency and cost effectiveness of National Forest land management, and to better meet the resource goals and objectives identified in Forest Plans.

Forests in the region have identified specific tracts of land which are potentially desirable for exchange. The National Forest System lands identified for future consideration for potential exchange are referred to as "base in exchange". The "base-in-exchange" lands are almost all located within town limits adjacent to and/or impinged into existing private land which has been developed or partly developed. Although the "base-in exchange" lands are commonly similar to other nearby National Forest land in on-site character and resource values, most are affected in various degrees by the development or planned development. The exchange process provides an opportunity to take advantage of relative trade-offs to improve National Forest System management or to improve the quality and/or quantity of on-site natural resources.

For the last decade or longer, exchange has been the medium favored by the U.S. Congress for land adjustment transactions, rather than direct purchase with appropriated funds. Accordingly, the Forest Service has, by policy, targeted certain high-resource value tracts (i.e. riparian areas, critical wildlife habitat, endangered species habitat, Wilderness and Wilderness access, etc.) for acquisition by exchange.

Of the acreage of non-Federal land acquired through exchange, as much as 40-50% (or about 2,400 acres per year) has been valuable for special factors such as riparian areas, etc. A considerable amount of this acreage provides habitat for a variety of threatened, endangered and sensitive species, including the Mexican spotted owl and northern goshawk; and based on the data available at this time, there is likely much more owl habitat in the land being acquired than in the land identified as "base-in-exchange". Approximately 8-10% of the National Forest System lands identified as "base-in-exchange" in the Region are located within owl and/or goshawk habitat.

Environmental Effects

The existing owl and goshawk interim guidelines do not specifically address land exchange or other landownership adjustment actions. However, they do address "management activities" in general. For example, with some limited exceptions, management activities are not allowed within 450 acre Mexican spotted owl core areas, and are allowed in only about half of the 1,000 acre Mexican spotted owl territories. This direction is generally interpreted to mean that exchange of lands falling within these areas is precluded even if the exchange improves owl management opportunities. However, nothing in the guidelines would restrict exchange of lands within suitable habitat, provided no core areas or territories are involved. However, existing direction has often been interpreted to preclude lands containing suitable habitat, especially since the Mexican spotted owl was listed. Northern goshawk guidelines would have a similar effect to that stated above for the owl.

Since the existing guidelines do not specifically preclude land exchanges within owl or goshawk habitat, but since there is nevertheless a history of such exchanges being affected, some lands within Mexican spotted owl and northern goshawk habitat identified as "base-in-exchange" would not be available for exchange under any alternative.

Although roughly 25% of suitable owl habitat overlaps with goshawk habitat, the remainder of habitat for each species is different. Therefore, the sum of the total area affected by management restrictions for the two species would be greater than the area affected by either one individually. Alternatives D and G would have the highest potential of affecting land exchange opportunities followed by Alternatives C, E and F. Alternative A would have the least potential of affecting landownership adjustment opportunities.

Timber Production (33)

Affected Environment

Forest plans in the Southwestern Region provide for an allowable sale quantity (ASQ) of 390.0 sawtimber plus another 59.0 MMBF of other products for a total of 442.6 MMBF in the Region. Current forest growth across the Southwestern Region amounts to approximately 700 MMBF per year (personal communication-Bruce Higgins, June 21, 1995). Table 9 shows the Region's cut and sold volume levels for the past five years.

Table 9 - Harvest Levels (MMBF) in the Southwestern Region for Fiscal Years 1990 to 1994.

	FISCAL YEARS					
	1990	1991	1992	1993	1994	AVG
Cut Volume (MMBF)	433	344	292	191	116	275
Sold Volume (MMBF)	305	382	163	153	119	224

The cut volume represents volume that was sold in previous fiscal years, in some cases as much as five years earlier. The sold volume represents the board foot volume for all sales sold in a particular fiscal year.

Cut and sold levels have continued to decline over the past five years. The primary reasons for the decline are related to concerns for old-growth, for management needs of the northern goshawk and Mexican spotted owl, and declining Forest Service budgets. Most of the social and economic impacts from reducing timber production have already occurred from previous adoption of interim guidelines since 1989. Interim guidelines were established to address goshawk and Mexican spotted owl management until final agency action concerning guidelines is completed based on this environmental impact statement.

Environmental Effects

Annual volume estimates were made for each of the alternatives. The volume estimates include the cumulative effect of habitat management for both Mexican spotted owl and northern goshawk. Table 10 shows the board foot volume for the Region by alternative. The board foot volume has been divided into three product size groupings and a total board foot volume for each alternative. The product size groupings are: 1) sawtimber, 12.0" dbh and larger; 2) sawtimber, 9.0" - 11.9" dbh; 3) roundwood 5.0" - 8.9" dbh; and 4) total for all groups.

Table 10- Annual Board Foot (MMBF) Volume Estimates for the Southwestern Region by Alternative

	VOLUME CLASSES			
Alternative	Round-wood	Small Sawtimber	Large Sawtimber	Total
A	130	110	160	400
C	70	60	10	140
D	80	50	10	140
E	280	250	100	630
F	80	70	40	190
G	100	70	10	180

Large Sawtimber includes 12.0" dbh and larger
Small Sawtimber includes 9.0" - 11.9" dbh
Roundwood includes 5.0" - 8.9" dbh

In all alternatives except E, timber production will never return to levels nearing the Region's allowable sale quantity (442.4 MMBF). Alternative E is capable of harvesting at levels that could exceed an average annual allowable sale quantity level. None of the action alternatives will harvest the amount of large sawlogs that were harvested in the late 1980's (see Alternative A, Table 10 above). In Alternative F, timber production is expected to remain near 190 MMBF per year (very similar to 1993 levels). Alternatives C and D will be somewhat less at near 140 MMBF. In Alternative G, timber production would probably stabilize closer to 180 MMBF per year. Alternative E would provide a higher level of timber production than the other alternatives (estimated 630 MMBF per year), but volume harvested would primarily be smaller diameter products rather than large sawtimber. Alternative A represents the average annual projected harvest that was occurring during the late 1980's (400 MMBF).

Alternative A harvests 57 percent of the estimated annual forest growth. Alternative E harvests about 90 percent of the forest growth. Alternatives C, D, F and G harvest 20, 20, 27 and 26 percent of the estimated annual growth, respectively.

Economic/Rural Community [Issue 1]

Mineral and Energy Economics (36)

Affected Environment

Locatable Minerals - In 1991, an estimated $18,036,000 worth of locatable minerals were produced from National Forest System lands in the Southwestern Region.

Leasable Minerals - In 1991, production on these leases amounted to an estimated 113,000 barrels of oil, valued at $2,034,000, and an estimated 20,300,000 MCF of gas, valued at $30,450,000. This oil and gas production generated approximately $4,060,500 of royalty payments and $789,612 of rental payments to the United States Treasury. Half of this revenue ($2,425,000) from public domain lands was returned to the counties for schools and roads.

Salable Minerals - An estimated $2,689,550 worth of revenue was generated to the United States Treasury from the sale of common variety minerals in 1991, 25 percent ($672,000) of which was returned to the counties.

Environmental Effects

The estimated decrease in mineral and energy production predicted for all the alternatives would cause an associated reduction in royalties from production of leasable minerals, and in revenues from sales of mineral materials. This would, in turn, decrease the revenues returned to county governments for schools and roads. Based on the decrease in production estimated for all alternatives, approximately $265,000 less would be returned to the counties in Arizona and New Mexico. The greatest effect would be on counties in New Mexico, since New Mexico forests generate the most oil and gas revenues. There would probably be no effect on existing jobs, since few operations currently in production would be affected. However, there could potentially be a reduction in the creation of new jobs in the mineral and energy industries in the future, as a decrease in new operations is predicted.

While the effects of the action alternatives are nearly identical, Alternatives D and G would have a slightly greater effect followed by Alternatives C, E and F. Alternative A would have no effect.

Timber Production Economic Effects (32)

Affected Environment

Timber harvested from the National Forests in Arizona and New Mexico is used primarily for sawtimber (sawn wood products), pulpwood (used mainly in paper production), fence posts and poles, firewood, and Christmas trees. In addition to the products above which are sold on a market basis, large amounts of firewood are made available at little or no cost to individuals for personal use. Most of the free use firewood is made available in northern New Mexico.

Historical harvest and sold production levels are described in the Timber Production section presented earlier in Chapter 3. Sales represent a contract to buy while actual harvest occurs 1-5 years following the sale, usually at the discretion of the buyer.

Sawtimber Supplied by National Forests - National Forests are virtually the only supply source for all of the larger sawmill operators in Arizona and New Mexico. While many of the existing operators are small enough to be able to operate with small sales from the private sector, most, in fact, process National Forest timber exclusively. The primary reason for this is that there are very few remaining large areas of privately held timber in either state. Exceptions to this are the significant timber holdings of the Mescalero timber

lands in southern New Mexico, the Navajo timber lands in western New Mexico and eastern Arizona, and the White Mountain Apache timber lands in eastern Arizona. All three of these tribal organizations have existing sawmill operations sufficient to fully utilize their own supplies of timber. In recent years, all three have expressed interest in adding to their own supply by purchasing National Forest timber as well.

Most sawmill operations take place in small, rural communities. The jobs and incomes derived from this business activity represent a substantial share of the local economy. Many of the small operators are part-time and/or intermittent and while the number of jobs supported may be small, the effects on the local communities are not. Historically, the majority of all jobs and income provided by timber harvesting is attributable to harvesting and processing sawtimber volume rather than roundwood or firewood.

Jobs and Income - Jobs and income associated with the Southwestern Region timber harvest program declined sharply between 1989 and 1994. In 1989, the total number of jobs associated with the timber harvest volume of 511 MMBF was 7,800 with an associated wage and salary income of $200 million. By 1994, harvest volume was down to 116 MMBF with 2,000 jobs and $55 million in wage and salary income (TSPIRS Annual Reports). These estimated totals represent both direct employment in the timber industry (sawtimber, roundwood, fuelwood, Forest Service) as well as the associated "multiplier" effects throughout the rest of the local economy. Almost all of these "multiplier" effects occur in the private sector of the Southwestern Region's economy rather than the public sector such as the Forest Service. Forest Service jobs and expenditures have also declined somewhat, but the declines are not significant in terms of the total effects.

Jobs and income changes are directly attributable to reductions in timber supplies from the National Forests. Because of supply limitations over the last five years, a number of logging and sawmill operators in the Southwestern Region have gone out of business. While some mill operators have simply shut down, some others have been dismantled or moved to other locations, thus reducing the actual sawmill capacity within the Southwestern Region. Some of the larger sawmills which have ceased operations recently include the Stone Forest Industries mill in Flagstaff, Arizona; the Kaibab Industries mill in Fredonia, Arizona; the Kaibab Industries mill in Payson, Arizona; the Grand Canyon Forest Products mill in Williams, Arizona; the Duke City Lumber Company mill in Cuba, New Mexico; the Stone Forest Industries mill in Reserve, New Mexico; and the Bates Lumber Company mill Albuquerque, New Mexico. Most of the remaining mills in the Southwestern Region are operating at less than full capacity.

Environmental Effects

Volume Estimates - Annual volume estimates by alternative are shown in Table 10. These volumes were used to estimate the job and income effects attributable to each alternative. It should be noted that the alternative volumes represent the estimated annual harvest once the alternative management strategy is in place. Roundwood refers to timber which has a diameter too small to be used for sawtimber. It includes pulpwood, posts and poles, and commercial fuelwood. Free use fuelwood is not included. Sawtimber volume includes all trees greater than 9"DBH.

Employment and Income - Most of the job effects associated with the timber harvest are attributable to the sawtimber volumes. Since this is the case, the sawtimber estimates by alternatives can be used to compare the relative size of job and income effects. This comparison is shown in Table 11.

While the non-sawtimber related jobs and income will add some to the totals shown in Table 11, they will not significantly change the totals above. This conclusion is also based upon the assumption that roundwood products will be absorbed by the market.

Table 11 - Sawtimber Related Employment and Income Benefits by Alternative

	Alternatives				
	A	C/D	E	F	G
JOBS	3800	1000	4900	1500	1100
INCOME ($M)	$94	$25	$121	$37	$27

Social Impacts (42)

Affected Environment

This section deals with the effects of management of the national forests in the Southwestern Region on human conditions. Humans beings are complex. A wide range of human desires, needs and values can be found within every community. Because of this, some of the analysis is intended to characterize the feeling and emotional aspects of the social setting.

Small Communities - Timber production from the Southwestern Region has played an important role in

the employment and lifestyles of many small communities. Beginning in 1991, timber harvest dropped dramatically due to requirements of the Endangered Species Act for the Mexican spotted owl and to requirements of the National Forest Management Act for the northern goshawk (see Table 9). The result of this sudden downward shift in sale volume has caused a significant unemployment impact to the logging community and associated supporting services (e.g., school, county road maintenance, government services, etc.). Some of the communities most affected are Panguitch and Kanab, Utah; Fredonia, Springerville, Eager and Alpine, Arizona; and Vallecitos, Cuba and Reserve, New Mexico.

Many residents of these communities, and adjacent areas, have made their living for decades working in association with the timber industry. Many of these people are quite proud of the forest management work they have accomplished and of the contributions they have made in meeting the societal demand for wood products. For many residents of these communities the current shift in management is seriously disrupting their traditional way of life (i.e, culture and lifestyle) and sense of well-being. In short, the current setting for some individuals and businesses found in the affected small communities is very serious and unsettled.

American Indians - American Indians have used the resources on all the lands of the Southwestern Regional forests for centuries. Traditional and subsistence uses of the natural resources included procurement of food, water and shelter. Today, forest resources provide a place for employment, pinyon nut gathering, gathering forest products for ceremonial purposes and spiritual uses. Many people, regardless of ethnicity, still gather their own fire wood and use it as their primary source of heat.

Large Communities - In general, people who live in or around Albuquerque, Tucson, Phoenix, Santa Fe, Flagstaff, St. George and other communities further removed from the national forests are not dependent on the Southwestern Region National Forests for their livelihood. A general characterization of people living in or near these communities is of forest users who primarily come to the forest for recreational purposes.

Within that generalization lies a multitude of recreational pursuits. Some of these visitors wish to see the forest appear in a "natural" condition, with little sign of human activities. On the other hand, some visitors want to stay in campgrounds that have running water, picnic tables, and flush toilets. Other recreationists spend their time hunting and fishing. Many people enjoy just being in the forest setting to admire the beauty and sense of spirituality.

National and International Setting - Timber production from the Southwestern Region is only a small portion of the national total production. However, the Southwestern Region's timber production is important in the context of the southwest's economy and, in the context of certain small local communities, of critical importance. All of us use wood products daily. The papers we read, our furniture, many of our homes, and the paper we use at work are all derived from wood products. The national demand is being met from timber supply sources somewhere; and the Southwestern Region positively contributes to that supply of wood products.

The national demand for wood and the countering demand for preservation and non-consumptive uses of National Forest lands is occurring on all Forests in the National Forest system. The social setting regarding timber harvest on a national scale is described in Julia Wondolleck's book (1988) "Public Lands Conflict and Resolution" with this remark: "Controversies have arisen over where and, moreover, how timber harvesting should occur, and, additionally, over what size timber sales are appropriate. USFS silvicultural practices have been called into question. As a result, the USFS is suddenly finding itself in the midst of disputes that frequently undermine agency officials' ability to make viable decisions."

Many have become aware of this aspect of the social setting recently. In the Pacific Northwest the "jobs versus owls" issue has risen to the Presidential level. Certainly, the social setting in the Southwestern Region forests have some of the same socially contentious characteristics as those found in the Pacific Northwest.

Environmental Effects

Management of the Southwestern Region National Forests affects the communities, organizations, groups and individuals who use and enjoy this Forest for its many resources and values. In turn, forest users have impacts on the natural resources. Social impacts, as described in this section, are brought about by changes in management which contribute to changes in communities, institutions, social and cultural conditions which affect people. The personal, community and cultural changes resulting from implementation of the action alternatives will be most strongly felt by those living in, or immediately adjacent to, the communities near the Forest. Most of this analysis is about the effects these alternatives will likely have on these people and communities. The analysis includes some

discussion of regional, national and international effects.

Small Communities - The social effects expected are most directly linked to people employed by the timber production industry. However, social effects are also directly felt by local people who run businesses which support this industry. "Spin-off" effects continue through all facets of community infrastructure, including schools, hospitals and government. The following EIS section, Payments/Receipts to Counties, provides details on how county government funding is affected by federal community production levels.

Alternatives A and E - This alternative has little or no effect on the social and cultural aspects of small communities and their residents. Traditional work opportunities related to forest resource extraction would continue at levels experienced in the late 1980's. Alternative A is slightly better than Alternative E, because Alternative A harvests more large sawlog materials, which causes more job opportunities than the small material harvest associated with Alternative E.

Alternatives C, D, F and G - A comprehensive look at social effects from implementing special species protection measures is found in the Final Environmental Impact Statement on Management for the Northern Spotted Owl (EIS, Northern Spotted Owl) in the Pacific Northwest. There are many similarities to the social effects of implementing the conservation strategy for the Northern Spotted Owl and those of implementing the management recommendations for the Mexican spotted owl and northern goshawk in the Southwestern Region. Further, many of the human and community characteristics of the Pacific Northwest, closely parallel the people and communities of the Southwestern Region.

This may be illustrated with the following excerpt from the social effects section of the Environmental Impact Statement for the Northern Spotted Owl (EIS, Northern Spotted Owl):

> "In many instances, rural communities exist almost solely because of their link to the processing of the forest resource. The value of homes and businesses are thus vulnerable to changes in resource processing. In that the bulk of many families' net wealth lies in their homes, there is a concern that large changes in harvesting can have greater consequences on families than would be indicated by job displacement alone."

During trying times the need for social and government services increases. Any reduction in services is likely to have adverse impacts on individuals, families and local communities. This diminished capacity to provide services is occurring at a time when new demands upon services will very likely result from sharp increases in the number of people unemployed and dislocated by a decline in the wood products economy. Moreover, these same local services are often needed for helping communities make a transition from heavy reliance on timber to a more diversified economic base.

The kinds of human impacts described above may reasonably be expected to occur in Southwestern Region communities and associated rural areas if any of the action alternatives are implemented. The degree of impact will vary with each individual, affected business or government service. Some businesses, individuals, and local/county governments will experience significant personal and/or financial impacts.

Action alternatives ranked from the expected least impact to the most impact are F, C, G and D. Review employment and income information in the previous section to make relative comparisons between alternatives. All of these alternatives will result in over a 50 percent reduction in sawtimber related employment and income benefits from the income and benefit levels of the middle 1980's.

American Indians - National Forest opportunities will continue to be equally available to all residents of the United States. None of the proposed management alternatives are expected to result in any significant change in the present use of the National Forest lands by protected groups.

Large Communities - In general, people living in settings further removed from the national forests will be less directly affected by the management actions depicted in any of the alternatives in comparison to people who live in closer proximity to the forest. However, the manner in which the Forest is managed does have tangible and intangible effects upon these people. These effects will be most likely experienced in terms of their sense of belonging with these landscapes. The effects could be positive or negative depending on an individual's desired setting and appearance of the forest; however, none of the effects in any of the alternatives are expected to be significant, especially in the next 10 to 20 years. Proposed changes in management in any of the action alternatives will not be apparent at the landscape level in the short run (see vegetation section of Chapter 3).

National-International Setting - The largest scale national and international use of the Southwestern

Region National Forests is of people passing through, or staying on, the Forest as they travel the interstate highway system. None of the alternatives is expected to have any downward effect on visitor use nor will the change in management be even perceptable in those visual corridors.

Land Use Policies

Affected Environment

Other Federal agencies and Indian nations manage land and activities on land that provides habitat for Mexican spotted owl and northern goshawk. Bureau of Land Management activities and some activities on Indian nation lands are subject to the same consultation requirements and restrictions as Forest Service activities. The Bureau of Land Management has not adopted management guidelines for northern goshawk. Some Indian nations have proposed the northern goshawk to be a threatened species per their nation's version of the Endangered Species Act and provide some special protection.

Some of the counties in the Southwestern Region have adopted comprehensive land use plans and sets of implementing ordinances. The Catron County Comprehensive Plan is an example. Other county plans are similar. The county land use plans declare that natural resource decisions affecting the county shall be guided by the principles of protecting private property rights, protecting local customs and culture, maintaining traditional economic structures through self action, and opening new economic opportunities through reliance on free markets.

The county plans and ordinances seek to restrict traditional federal and state regulatory authority over public lands, while correspondingly increasing county regulatory authority over those lands. Although the plans and ordinances vary from county to county, they generally provide as follows:

> Federal agencies must notify the county a specified number of days prior to issuing any land management decision, and federal agencies must provide the county with a report on the proposed decisions anticipated impact on the county;
>
> Federal grazing permits shall be considered property rights, and federal agencies must notify and consult with grazing lessees or permittees a specified number of days before issuing decisions that affect lessees or permittees;
>
> The Federal government shall be limited in its ability to designate additional wilderness areas, park areas, and wild and scenic rivers within county boundaries;
>
> All Federal natural resource decisions shall be dictated by principles protecting private property rights and local customs and culture, as defined by the county;
>
> All roads on Federal lands throughout the county are declared "public roads";
>
> Planning for the recovery and management of threatened or endangered species may be done by the county, at its option, and Federal agencies must coordinate their threatened or endangered species management activities with the county;
>
> The county may prohibit the introduction of wild animals within the county, and the county may provide for the removal of wild animals from the county;
>
> The amount of federal or state land within county boundaries shall not be increased;
>
> The Federal Civil Rights Act is adopted as a county ordinance.

Environmental Effects

All the alternatives are consistent with land use plans and practices on other Federal and Indian nation lands. Activities on those lands are subject to the same Mexican spotted owl consultation requirements as activities on National Forest lands. The same activity restrictions would apply on all jurisdictions.

All action alternatives propose management standards and guidelines which have not been adopted by other jurisdictions for activities in northern goshawk habitat. Some of the Indian nations have adopted special protection measures for goshawk habitat. Since the majority of land managed by the Bureau of Land Management is lower in elevation than suitable goshawk habitat, the Forest Service goshawk standards and guidelines are not inconsistent with their plans.

None of the alternatives are totally consistent with the various county land use plans and ordinances. The county plans and ordinances seek to prevent changes to the county customs, culture and economic base from National Forest management activities. As described above in the economic and social impacts

sections, the economic base and the social fabric of many small communities and counties are impacted to some degree by all of the action alternatives.

There are no reasonable alternatives or mitigation measures that would eliminate the inconsistency between the Federal proposed action and the county land use plans and ordinances. The Forest Service believes that the plans and ordinances have no legal effect on National Forest lands because they are preempted by the Supremacy Clause of the United States Constitution and that other Federal laws such as the Endangered Species Act take precedence.

Payments/Receipts to Counties

Affected Environment

Twenty-five percent of the receipts collected by the Forest Service are returned to the states for use by the counties for roads and schools. Historically, most of the receipts collected in this Region are from the sale of timber. In 1989, total receipts were $38 million, with $32 million of the total from timber sales ($8 million from timber sales distributed to counties in Arizona and New Mexico). IN 1994, total receipts were down to $22 million with timber receipts down to $14 million ($3.5 million from timber sales distributed to counties).

While lower timber harvest volumes do not necessarily imply lower payments to counties (the dollar value of the timber sold could rise to off-set the reduced volume), large reductions in volume would require large increases in price in order to off-set declines. For example, if timber volume is reduced by one-half, then timber prices would have to double to collect the same amount of receipts from timber sales.

In addition to receipt-sharing from the National Forests, counties also receive funds from the Federal Government through the "Payments In Lieu of Taxes" (PILT) program. These annual payments are based on several factors including the acres of federal land in the county, the county population, and the amount of National Forest receipts shared with the county in the preceding year.

Environmental Effects

Because of the way the PILT formulas interact with the preceding year's National Forest receipts, most county governments (not all) will continue to receive about the same amount of money for roads (i.e., combined National Forest and PILT payments) regardless of the size of the National Forest receipt shares. That is, if Forest Service receipts go down, the PILT payment increases. If receipts go up, the PILT payment goes down. As a result, the potential for adverse impacts for most of the counties in Arizona and New Mexico is small. For the few counties that receive very large receipt shares from the sale of National Forest timber, and for which there is not a compensating PILT increase, the impacts of reduced receipts could be significant. The PILT off-set will not cover potential declines in education allocations from timber receipts.

Receipts - The county governments which are most likely to be seriously impacted by reductions in timber receipts are the ones which historically have received the greatest receipt shares. The amount of receipt shares which actually goes to county governments is determined by state law and is different in New Mexico and Arizona.

Fifty percent of the National Forest receipt shares in New Mexico are used for education and 50 percent for roads. The law also requires that the education half be withdrawn at the state level and deposited in the state-wide education fund pool which is, in turn, distributed to the state's school districts. Thus, the county governments actually receive only one-half of the receipt share allocated from forest collections (see Table 12).

In Arizona, the total receipt share is transferred to each county and each county government then allocates the money either to roads or to educational purposes (school districts). The distribution may change from year-to-year and varies widely from county to county. In 1994, the amount distributed to school districts varied from zero percent in Graham, Pima and Pinal Counties to 100 percent in Santa Cruz county. The overall average across the state was 44 percent to school districts (see Table 13).

Timber receipts are highly variable and dependent on lumber prices, types of products produced and the amount of total production. An exact prediction of future expected timer receipts is therefore next to impossible. However, a solid relative comparison of alternatives can be made by comparing 1989 and 1994 values. The 1989 values presented in Tables 12 and 13 below approximate expected timber receipts for Alternatives A and E. The 1994 values presented in Tables 12 and 13 approximate expected timber receipts for Alternatives C, D, F and G.

Table 12 - New Mexico County Estimated Timber Sale Receipts By Alternative

County	ALTERNATIVES A,E (1989 County Roads)	ALTERNATIVES A,E (1989 School Districts)	ALTERNATIVES C,D,F,G (1994 County Roads)	ALTERNATIVES C,D,F,G (1994 School Districts)
Bernalillo	$4,038	$4,038	$980	$980
Catron	$419,468	$419,468	$189,456	$189,456
Chaves	$2,239	$2,239	$1091	$1091
Cibola	$16,901	$16,901	$4,089	$4,089
Colfax	$11,230	$11,230	$4,016	$4,016
Eddy	$7,495	$7,495	$3,653	$3,653
Grant	$49,264	$49,264	$18,241	$18,241
Hidalgo	$1,327	$1,327	$252	$252
Lincoln	$22,061	$22,061	$10,306	$10,306
Los Alamos	$9,611	$9,611	$529	$529
McKinley	$10,117	$10,117	$2,448	$2,448
Mora	$29,495	$29,495	$2,485	$2,485
Otero	$31,295	$31,295	$15,251	$15,251
Rio Arriba	$155,630	$155,630	$59,917	$59,917
Sandoval	$55,484	$55,484	$6,568	$6,568
San Miguel	$54,484	$54,484	$6,009	$6,009
Santa Fe	$78,431	$78,431	$4,336	$4,336
Socorro	$33,030	$33,030	$8,000	$8,000
Taos	$41,837	$41,837	$29,925	$29,925
Torrance	$8,203	$8,203	$1,993	$1,993
Valencia	$845	$845	$205	$205
Total	$1,084,17	31,084,173	$377,583	$377,583
GRAND TOTAL	$2,168,346		$755,166	

Table 13 - Arizona Counties Estimated Timber Sale Receipts By Alternative

County	ALTERNATIVES A,E (1989 County Roads)	ALTERNATIVES A,E (1989 School Districts)	ALTERNATIVES C,D,F,G (1994 County Roads)	ALTERNATIVES C,D,F,G (1994 School Districts)
Apache	$383,671	$156,710	$127,547	$127,547
Cochise	$1,684	$1,684	$668	$668
Coconino	$2,014,400	$1,342,933	$626,789	$578,575
Gila	$43,241	$5,896	$155,315	$38,829
Graham	$2,725	$0	$540	$540
Greenlee	$676,580	$138,576	$284,919	$100,107
Maricopa	$17,083	$0	$743	$73,602
Mohave	$1,805	$1,805	$322	$215
Navajo	$325,763	$325,763	$140,138	$140,138
Pima	$2,348	$0	$1,065	$0
Pinal	$5,390	$0	$22,651	$0
Santa Cruz	$0	$2,884	$0	$1,141
Yavapai	$486,396	$162,131	$245,052	$77,385
Total	$3,961,041	$2,138,382	$1,605,749	$1,138,746
GRAND TOTAL	$6,099,423		$2,744,495	

The distribution of timber receipts in New Mexico for 1989 and 1994 is shown in Table 12. In New Mexico, the principal beneficiary of timber receipts is Catron County with about $190,000 from timber sales spent on county roads in 1994 (an equal amount went to the state education fund). Rio Arriba County was a distant second with $60,000 in timber receipts spent on county roads. Timber sale payments have declined by $1,300,000 between 1989 and 1994. Receipt declines in Catron County are attributable to lower receipts from the Apache and Gila National Forests. Rio Arriba County effects are from lower receipts from the Carson and Santa Fe National Forests.

Table 13 shows the 1989 and 1994 distributions for Arizona. Coconino County receives the largest share by far, about $690,000 for roads and $600,000 to school districts in 1994. The decline in timber receipts also affected Arizona between 1989 and 1994 but not the degree experienced in New Mexico.

The largest declines occurred in Coconino County, Greenlee County, and Yavapai County, and are attributable to lower timber receipts on the Coconino National Forest and the Apache National Forest.

Overall, the counties which are most likely to experience adverse impacts from declining timber receipts are Catron and Rio Arriba Counties in New Mexico and Apache, Coconino, Greenlee, Navajo, and Yavapai Counties in Arizona. The alternatives ranked from least effect on receipts to greatest effect are A, E, F, C, G and D.

New Mexico Payments - In New Mexico, Catron County and Rio Arriba County receive the largest amounts from the timber receipts; however, Rio Arriba County's timber receipt losses would be off-set by PILT increases. Possible declines to the state education fund will not be off-set. Examples below are based on the 1993 PILT calculations, which use the 1992 distribution and the 1991 actual receipts.

In 1993, Catron County received $128,150 in PILT and $107,000 from timber receipts for roads. An additional $107,000 from timber receipts went to the state education fund. Assuming no timber receipts to share, the county PILT payment would have remained $128,150 and the $107,000 to roads and the $107,000 to education would have been lost. Every additional

dollar or every dollar decline is thus passed on directly to Catron County with no relief from the PILT fund.

Using the same kinds of assumptions, the PILT can be estimated for Rio Arriba County. The county received about $674,000 in PILT in 1993 and $72,000 from timber receipts went to county roads and an equal amount to state school fund. If there had been no timber receipts, then the PILT payment would have simply increased by $72,000 totally off-setting the receipt loss. The $72,000 to the state education fund would, of course, not have been replaced.

Based on the assumptions, it is clear that in all cases except Catron County, PILT payments will off-set the county road money if timber sale receipts go down. There is no off-set for state education funds so declines there can only be made up from other sources such as taxes. The amount of school money involved for the state is relatively small.

Arizona Payments - The counties most directly impacted in Arizona are Apache, Coconino, Greenlee, Navajo, and Yavapai. Example calculations for Arizona counties are somewhat more complicated because the split between roads and schools varies among counties and can change from year to year but the principles are the same. With the exception of Coconino County, PILT increases would off-set county road money from timber sales; however, school district money from timber sales would be lost. The following examples are based on the 1993 PILT calculations.

In 1993, Apache County's PILT payment was $407,000 with $86,000 from timber receipts going to roads, and $62,000 allocated to school districts. If timber receipts had been zero, the PILT payment would have increased by $86,000 and the $62,000 to school districts would have been eliminated.

The Coconino County PILT payment in 1993 was $468,000. In addition, timber receipts were $1.35 million to roads and $1.15 million to school districts. If timber receipts had been zero, the PILT payment would have been $1,000,000 (increase of $532,000) so that the resulting loss of funds to the county would have been about $2 million ($1.35 million to county roads and $1.15 to county schools less the PILT increase of $532,000).

In 1993, Greenlee County received $208,000 from PILT, $99,000 in timber receipts for roads, and $88,000 from timber sales went to school districts. Without the timber receipts, PILT would have increased by $99,000 so the net loss to the county would have been $88,000 in school funds.

Navajo County PILT payment in 1993 was $233,000. Timber sale receipts to roads were $203,000 and $203,000 to school districts, In the absence of timber receipts the PILT payment would have increased by $203,000 and the school district is loss would have been $203,000.

The PILT payment to Yavapai County in 1993 was $468,000. Timber sale receipts provided $396,000 for county roads and an additional $147,000 to schools. If timber receipts had been zero, the PILT payment would have increased by $396,000 so the only loss would have been the $147,000 in school funds.

Payment Conclusions - Catron County is the only county in New Mexico where there is a significant potential for adverse effects from federal payments related to declining timber sale receipts. In all other New Mexico counties, declines in road monies would be off-set by PILT increases. While reduced timber sale receipts would result in losses to the state education fund in all instances, the total dollar amounts would be relatively small and spread out among all counties.

In Arizona, Coconino County would have the most potential risk with declining timber receipts. In 1993, the PILT off-set would have only covered about $500,000 of the $2,500,000 in timber receipts that the county received for roads and schools. All counties in Arizona are at risk of losing all school district funds from reduced timber receipts. PILT increases (except for Coconino County) would off-set all potential road money losses but none of the money allocated to school districts.

The alternatives ranked from least potential effect to payments to greatest potential effect are A, E, F, C, G and D.