

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This chapter describes the environmental consequences of implementing each of the alternatives on the Buck Springs Range Allotment as an individual activity and cumulatively with past, present, and future projects within the area. It also presents the scientific and analytical basis for the comparison of alternatives presented in the alternatives chapter. It summarizes the specialist reports that give much more detail on the rationale used in the effects analyses. The reports reference other reports, journal articles, and databases that support the effects described here.

Elk populations are high on the allotment as noted in Chapter 3. These large wild ungulates cause impacts through grazing and trampling that are similar to livestock. The following discussions of effects of grazing concern livestock grazing only, though it is recognized that many of the impacts are also attributable to elk grazing. Where improvements to resources are predicted, the improvements are likely to be limited based on the response of elk. The Arizona Game and Fish Department has signed a Memorandum of Understanding with the US Forest Service and the US Fish and Wildlife Service to support the guiding principles in the *East Clear Creek Watershed Recovery Strategy* (USDA 1999a). One of the tenets in the document includes management of the elk populations in balance with other resources, such as riparian areas and wet meadows. With this support, it is believed that improvements can be realized on the Buck Springs Allotment.

UNDERSTORY VEGETATION

[#66]

Alternative A excludes the management of livestock at the C or D levels (see page 4 for definitions). All action alternatives include management of livestock at the C or D levels.

Effects Common to All Alternatives

The largest effect on understory vegetation from grazing within the East Clear Creek watershed has been historic in nature. Turn of the century grazing practices resulted in simplification of the ecosystem through selective grazing of plants and increased stocking of ponderosa pine and white fir (Haines 1993). All of the action alternatives (except B: Current Management) propose actions to recover the headwater meadow systems within the allotment through a change in grazing management. In general, livestock grazing affects ecosystems through selective grazing that simplifies plant communities by either reducing the number of species or by reducing the relative abundance of these species compared to an ungrazed situation (Ambos et al. 2000; Vavra, M. et al. 1994; Hendon, B.C. and D.D. Briske. 2001; Anderson, V.J. and D.D. Briske. 1995; and Bohning, J.W. and A.P. Thatcher 1972). Additional impacts include the removal of biomass that can leave bare ground and reduce the effectiveness of riparian vegetation to withstand peak

flows. Heavy grazing at the turn of the century began this process. Current grazing strategies have greatly decreased impacts, however, when livestock are in riparian areas during the growing season, some impacts still occur. Large ungulate exclosures that have been excluded from cattle and elk for approximately 10 years demonstrate this process by displaying a wide diversity of grass, forb, and woody riparian vegetation. They also show that exclusion of livestock only would not recover the meadows (unpublished data, Mogollon Rim Ranger District).

Elk are one of the major stressors to riparian areas within the system. Elk impact meadows and riparian areas on the allotment in the same manner as livestock, however, elk can not be excluded from these areas without eight-foot fences using woven wire. Efforts to reduce impacts due to livestock management would be tempered by continued impacts due to elk grazing.

Recreationists also impact understory vegetation through trampling (especially in riparian areas) and off-road vehicle use. The use of all-terrain vehicles is increasing rapidly on the allotment, resulting in degraded riparian areas and meadows, as well as some upland areas.

Fire management has historically affected understory vegetation through a century of fire suppression that resulted in increased canopy closures and reduced understory vegetation. Current efforts to restore a more natural regime will take many years to see large-scale results.

Other planning efforts within the watershed aimed at improving riparian health and watershed conditions would also move towards improved conditions within the watershed (East Clear Creek Watershed Health Project, Victorine Urban Interface Project). The Arizona Game and Fish Department efforts to reduce elk numbers are expected to contribute to improved watershed conditions.

Alternative A: No Grazing

No permitted livestock grazing would occur within the Buck Springs Allotment. Alternative A excludes the management of livestock at the C or D levels (see page 4 for definitions).

Understory Vegetation - Upland

Removal of livestock from the allotment would improve range conditions on the uplands through a reduction in grazing pressure, reduction in soil compaction, and the reduction of overuse of forage species. If livestock grazing were the primary grazing impact, vegetative biomass would increase, effective ground cover would increase as vegetative litter accumulated. This alternative would have the greatest improvement in conditions for threatened and endangered species, soil conditions, and plant health and vigor, especially when compared to Current Management (Alt. B). Conditions would improve in key areas, such as residual vegetation heights in Mexican spotted owl areas. However,

elk would continue to graze (and regraze) preferred species, resulting in reduced health and vigor and possibly reduction in species composition (diversity) over time. Elk grazing would limit changes in upland understory vegetation.

Understory Vegetation - Riparian/Meadows

Eliminating cattle use from the riparian areas would partially meet the riparian evaluation criterion by eliminating livestock access to sensitive drainages and meadows, compared to Alternative B. Livestock would not reduce woody or riparian vegetation, break down stream banks, or compact soils. Elk use may spread out over the allotment, though continued use in meadows would limit the degree of improvement in vegetative ground cover, diversity, and total biomass. If implemented by the Arizona Game and Fish Department, planned reductions in elk populations may result in lower overall use of riparian areas and meadows.

Alternative B: Current Management

Alternative B would continue management of livestock at the C and D levels (see page 4 for definitions).

Understory Vegetation - Uplands

The distribution and control of livestock would not improve. Pasture size would remain large, continuing the trend toward large acreages of overused forage (bitten once and then rebitten as regrowth occurs). Additional acres of forage would have little to no utilization, resulting in an accumulation of old plant material that contributes over time to the death of individual plants. Cattle would continue to preferentially graze particular species, resulting in a gradual decrease in overall species composition. Conditions in some key areas, such as residual vegetation heights in Mexican spotted owl areas, would continue to be impacted, resulting in low population levels of prey species. Canyons and bluffs would not be effective barriers to yearlings, resulting in movement of livestock into pastures outside the rotation, and into riparian areas, including those identified as important to Little Colorado spinedace (LCS) recovery and survival. These barriers would be more effective for cows with calves, resulting in better compliance with pasture rotations and less access to riparian areas. No improvement in vegetative and soil conditions would be expected. Yearlings use steeper areas than cows with calves, and spread utilization over larger areas.

Understory Vegetation - Riparian/Meadows

Cows and calves would tend to use the accessible riparian areas and meadows more than yearlings, and slopes less than yearlings, resulting in more problems with control and distribution of livestock in the sensitive riparian and meadow areas. Livestock would continue to reduce biomass, woody species, and diversity of riparian species. Utilization rates would quickly reach allowable levels in riparian areas and meadows, requiring the movement of livestock out of the pastures. This would likely result in livestock passing

quickly through the allotment and removal from the allotment before the end of the season, leaving upland areas with little utilization. Conditions in meadows and riparian areas would not improve, including vegetative cover, diversity or total biomass. Wetted areas would not expand in meadows. Conditions would not improve for the Little Colorado spinedace and northern leopard frog. This alternative does not meet the objectives of improving riparian and meadow conditions.

Alternative C: Proposed Action

Alternative C would continue management of livestock at the C and D levels (see page 4 for definitions).

Understory Vegetation - Upland

Some improvements (fences making 3 pasture splits) would help control livestock access and distribution, resulting in more even forage use and fewer areas of over- and under-utilization. Herding would supplement pasture splits and increase control over livestock distribution and forage utilization. A focus on increased grazing use of the Arizona fescue to increase diversity of other native species in certain pastures must be monitored to ensure overgrazing does not occur on this species. Conditions would improve in key areas, such as residual vegetation heights in Mexican spotted owl areas that would promote increases in prey populations. Overall, adverse effects on vegetation would be the less than those outlined for Alternative B.

Pre-commercially thinning of 1500 acres would open up the treated stands enough to allow forage plants to establish, improving ground cover on those acres. The small acreage (1,500 out of 70,000 acres) would make overall effects minor.

Understory Vegetation - Riparian/Meadows

An additional 160 acres of meadows and 13 miles of riparian drainages would be excluded from livestock, allowing for increases in vegetative biomass, riparian species diversity, and woody species establishment. Improvements would be limited by continued elk impacts on riparian areas and meadows in these pastures. Conditions in large meadows would improve, however, numerous small, riparian/meadows would not be excluded from livestock, and would continue to be impacted. This alternative would improve conditions in major riparian areas and meadows, compared to Alternative B.

Alternative D: Herding and Alternative K: Modified Herding

Alternative D would continue management of livestock at the C and D levels (see page 4 for definitions).

Understory Vegetation - Upland

Herding has been very successful in some areas of the west, and is currently being experimented with on the allotment. If the concept could be successfully implemented here, it would help reduce both the over- and under-utilization across the allotment, compared to Alternative B. Cattle would be herded to areas that would benefit from grazing and away from sensitive areas and areas that had been previously grazed. Conditions would improve in key areas, such as managing for residual vegetation heights in Mexican spotted owl areas. Utilization would be more even over the allotment. Herding would be used to keep livestock in the appropriate pastures. Individual animals may escape from the main herd and return to previously grazed areas or remain behind in pastures as the cattle are moved. Risks would be negligible in the uplands if herding fails during some period, with some areas potentially being above allowable utilization.

Pre-commercially thinning of 1000 acres would open up the treated stands enough to allow forage plants to establish, improving ground cover on those acres. The small acreage (1,000 out of 70,000 acres) would make overall effects minor.

Understory Vegetation - Riparian/Meadows

If herding as a management technique is successful, many of the impacts in the riparian/meadows would be reduced compared to current management. An additional 134 acres of sensitive meadows and 13 miles of riparian drainages would be excluded by fences. Some areas would rely on drift fences at key access points, and herding to provide protection. Riparian/meadow areas would be used only as crossings as absolutely necessary. Herding would be used to keep livestock out of drainages and in the appropriate pastures. This alternative would provide the greatest protection of small meadows that are not fenced (with the exception of Alternative A: No Grazing), through herding of livestock away from these areas. Vegetative ground cover, diversity, and total biomass would improve. However, as noted previously, there may be some cattle that return to the riparian areas in previously grazed areas. Compared to Alternative B, however, this alternative would go much further in meeting the objectives.

Additional comment

Herding livestock is a promising endeavor that has not been proven to work effectively on the allotment. Major concerns with herding include the difficulty in finding experienced and committed herders, the time commitment required by the herder and the permittee, and the dense thickets of small trees found throughout the allotment that interfere with herding. Herding has been used very effectively in some areas of the west. The permittee is interested in using herding to improve the allotment and hopes to replicate his success in improving riparian areas on his Date Creek Ranch. He has been awarded several awards for riparian management.

Alternative E: Northern Pastures Emphasis

Alternative E would continue management of livestock at the C and D levels on 62% of the allotment.

Understory Vegetation - Upland

Use of the northern pastures and rest of most southern pastures, combined with the additional fences (division and along canyons), would assist in improving upland conditions compared to Alternative B. The split of two large pastures into smaller pastures, and the reduction in size of two other pastures would help control livestock distribution in these pastures and use on the forage plants. There would continue to be some over-use and over-rest of forage plants, though there would be much more even utilization than in Alternative B. Pastures that are not used by cattle would be expected to experience some upland recovery and improved range conditions, but would still be used by elk and thus would not improve as much as areas totally rested from grazing. These areas would still have to experience periodic disturbance, such as fire, so as maintain plant vigor and health.

Pre-commercially thinning of 200 acres would open up the treated stands enough to allow forage plants to establish, improving ground cover on those acres. The overall effects on a very small acreage (200 out of 70,000 acres) would be negligible.

Understory Vegetation - Riparian/Meadows

Livestock would no longer have access to the southern pastures with headwater meadows (protects 234 more meadow acres than currently), but elk would continue to impact the riparian areas and meadows in these pastures. Livestock use of the northern pastures may displace some elk into the southern pastures, where they would continue to impact meadows. Elk, however, often follow behind livestock and take advantage of new grass growth (Grover and Thompson 1986). Fences would eliminate livestock access to an additional 44 miles of riparian drainages with LCS concerns, allowing for improvements in riparian and stream function. Riparian and meadows would experience increased productivity and vegetative biomass, diversity, and vigor. This action alternative has the second to the least amount of effects to the riparian meadow system from cattle grazing.

Alternative F: Rest-Rotation

Alternative F would continue management of livestock at the C and D levels.

Understory Vegetation - Upland

The beneficial effects of yearlong rest would help offset the effects of only using half the allotment each year, but do not override the effects of elk use in the “rested” pastures. Cattle would stay longer in each pasture to meet the timeframes of the full five-month grazing season. Acceptable utilization rates are generally 5% higher for pastures rested 1 year in 2, than in pastures grazed every year. Divisions of large pastures would create six smaller pastures that would improve livestock distribution in these pastures and thus use on the forage plants. Over- and under-utilization would be substantially reduced,

improving productivity and vigor. This alternative would produce more benefits than Alternative B, but not as much as the other alternatives.

Pre-commercially thinning of 200 acres would open up the treated stands enough to allow forage plants to establish, improving ground cover on those acres. The overall effects on a very small acreage (200 out of 70,000 acres) would be negligible.

Understory Vegetation - Riparian/Meadows

An additional 394 acres of meadows and 21 miles of riparian drainages would be excluded from livestock. The remaining 18 acres of meadows and 74 miles of riparian drainages would be accessible every other year, allowing for rest and recovery during off years. There may be some improvement in vegetative productivity and diversity, but elk displaced into the rested pastures would likely severely reduce the potential for improvement. Cattle utilization is expected to be higher than in Alternative B in the riparian/meadows that are accessible and not fenced out and are scheduled for grazing that year. Acceptable utilization rates would be generally 5% higher for pastures rested 1 year in 2, than in pastures grazed every year.

Alternative G: Northern Pastures with Rest Rotation

Alternative G would continue management of livestock at the C and D levels on 62% of the allotment.

Understory Vegetation – Upland

Use of the northern pastures, combined with additional fences (division, along canyons, and spinedace-related enclosures and drift fences) as well as the benefits of yearlong rest of ½ of the grazed pastures every year would assist in improving upland conditions across the current allotment. Creating one pasture split to make smaller pastures, and the reduction in size of two other pastures would help control livestock distribution in the grazed pastures. There would be much reduced incidence of over-use and over-rest of forage plants. Elk would have exclusive use of the uplands in the southern pastures all the time, and would still graze the uplands in the rested pastures. This would offset some of the benefits expected from yearlong rest.

Pre-commercially thinning of 200 acres would open up the treated stands enough to allow forage plants to establish, improving ground cover on those acres. The overall effects on a very small acreage (200 out of 70,000 acres) would be negligible.

Understory Vegetation – Riparian/Meadows

Rest of the southern pastures would result in the exclusion from livestock of 405 out of 412 acres of major headwater meadows and an additional 43 acres of riparian drainages. The major riparian areas and the remaining seven acres of meadow within grazed pastures would be fenced out. These areas are expected to experience increased

vegetative productivity and diversity. One year of rest for one year of livestock grazing would increase the potential for improvements in those areas still accessible. However, displacement of elk to ungrazed areas may limit the degree of improvement. Utilization of 35% across the entire pasture will mitigate some of the effects of grazing in the draws and drainages that are still accessible to livestock.

Cumulative Effects

Direct and indirect effects of the project to understory vegetation include the simplification of the vegetative communities, the removal of biomass, and increases in vegetation in pre-commercial thin area. The boundary for the cumulative effects for understory vegetation is the East Clear Creek Watershed, since these effects may affect watershed condition through increases in bare ground that reduces the effectiveness of vegetation to withstand peak flows and slow overland flows. The time frame considered is the time frame of the analysis, approximately a ten-year period. We estimate that the effects may last up to about 10 years in upland areas, while the vegetation in riparian areas recover more quickly. Past, present, and reasonably foreseeable future actions that were considered in the analysis include all past timber sales since 1992, present, and future timber sales and fuels treatments (Tables 15 and 16), dispersed recreation, prescribed burns, other allotments within the watershed, all ongoing projects in the watershed (Table 17), and Forest-wide projects that may affect the project area (Table 18).

Table 15: Tree removal projects in the East Clear Creek Watershed from 1992-Present.

Project Name	Forest	Year	Total Acres
Baker Timber Sale	Coconino	2002	2,078
Barber Timber Sale	Coconino	1995	1,308
Buckhorn Timber Sale	Coconino	1993	4,764
Carr Lake Timber Sale	Apache-Sitgreaves	1995	5
Deer Lake Timber Sale	Apache-Sitgreaves	1995	2,643
Double Cabin Timber Sale	Apache-Sitgreaves	1995	1,554
Gentry Timber Sale	Apache-Sitgreaves	*	2,855
Gramma Timber Sale	Apache-Sitgreaves	1994	7,869
Hart Timber Sale	Apache-Sitgreaves	1992	2,153
Holder Timber Sale	Coconino	1992	1,765
Hospital Timber Sale	Coconino	1994	1,065
Immigrant Timber Sale	Coconino	1992	1,896
Leonard Timber Sale	Coconino	1994	2,354
Limestone Timber Sale	Coconino	1996	1,342
Lockwood Timber Sale	Coconino	1995	1,644
M-C Timber Sale	Coconino	*	580
Merritt Timber Sale	Coconino	1995	1,479
Pocket Timber Sale	Apache-Sitgreaves	2002	1,217
U-Bar Timber Sale	Coconino	*	1,889
Wiggins Timber Sale	Apache-Sitgreaves	*	2,550
Blue Ridge Urban Interface	Coconino	*	5,391
Total Acres			48,401 **
Actual Acres			34,164 **
Total Watershed Acres			247,000

A majority of the trees removed within these sales were within the dominant and co-dominant portion of the overstory.

* denotes a project in progress.

** Some of the treatments are on the same acres. The actual acres harvested from timber sales within the last 10 years is 34,164 acres.

Table 16: Future foreseeable treatments within the East Clear Creek Watershed.

Activity	Description	Status	Effects
Rim Christmas Tree Cutting	Provide fir Christmas trees for personal use designated along the Mogollon Rim.	Annual	200 acres of trees less than 10' cut. Will not affect overstory.
Victorine 10K Area Analysis	Evaluate alternative treatments to reduce live and dead fuels to protect urban interface areas and past investments in forest health.	Implement 2003	Approximately 6,000 acres of thinning proposed up to 12" dbh. Thinning on some of the same acres as Buckhorn and Limestone TS's. Will maintain some openings and create new openings.
East Clear Creek Watershed Health Improvement Project	Evaluate watershed conditions and impacts from recreation, roads, past watershed projects, with special consideration for Little Colorado spinedace habitat needs in the East Clear Creek watershed.	Implement 2003 or 2004	Approximately 9,400 acres of thinning trees less than 12" dbh proposed. Thinning on some of the same acres as Limestone, Merritt, Leonard, Lockwood and Hospital TS's. Will maintain some openings and create new openings.
Clear Creek Timber Sale	Timber harvest and fuels treatments.	NEPA in 2005	Approximately 2,000 acres of thinning of primarily thin from below prescription. Thinning up to 18" dbh
Pack Rat Fire Salvage	Timber harvest	NEPA in 2003	Approximately 500 acre of salvage of burned timber.
Maple Draw Restoration Project	Maple restoration project	NEPA in 2003	30 acres of thinning and 30 acres of prescribed burn
Blue Ridge Urban Interface	Reduce fuels in urban interface zone	Implement 2001-2005	Pre-commercial thin - 11,420 ac. prescribed burning on 14,190

The total acres potentially treated is approximately 23,350 acres. Many of these acres are the same acres treated under the timber sales listed in Table 19.

Table 17: Ongoing activities and miscellaneous other projects in the East Clear Creek Watershed considered for cumulative effects.

Activity	Description	Status	Effects
Dispersed Recreation	Camping, hiking, and other recreational activities that take place outside of developed campgrounds.	Ongoing	Affects localized soil conditions (compaction), visual quality (littering), increases fire risk, creates new roads and trails, disturbance to wildlife.
Fuelwood Gathering	Collection of dead woody material for fuelwood, including some snags.	Ongoing	Affects mostly snags (illegal harvest) and dead and down (legal harvest).
Wildfires	Vary from one tree to thousand acre fires.	Potential/future	Cumulative effects to vegetative structure, logs, snags, soil and fire risk.
Roads	Varies from high standard roads to two-tracks.	Ongoing	Affects water quality and quantity, wildlife, wilderness use, and sediment transport.
Rehabilitate Campgrounds	Rehabilitate water systems, campsites, drainage; surface access roads; re-align parking pads.	Postponed until funding available	May cut some large trees within the Blue Ridge, Rock Crossing, and Knoll Lake Campgrounds.
Coconino County Road Relocation	Relocate Forest Road 625 to Clear Creek Pines Units 4, 5, and 6.	Implement 2003	Remove trees in a very narrow path.
Clear Creek Timber Sale	Timber harvest and fuels treatments.	NEPA in 2004	Improve vegetative structure distribution and reduce fire risk.
Chevelon Canyon AMP	Update and revision of AMP.	Completed 12/1999	Decrease in total numbers, improve grazing scheme
Limestone AMP	Update and revision of AMP.	Completed 12/1999	Decrease in total numbers, improve grazing scheme
Wallace AMP	Update and revision of AMP.	Completed 12/1999	Decrease in total numbers, improve grazing scheme
Clear Creek AMP	Update and revision of AMP.	Completed 12/1999	Decrease in total numbers, improve grazing scheme
Bar T Bar and Anderson Springs Range Allotment Area Assessment	Evaluate rangeland ecosystem conditions and needs and appropriate livestock grazing use on two range allotments.	Implement fall 2003	Improve grazing schemes and watershed condition, includes treatments in pinyon-juniper. Majority of the project is outside East Clear Creek watershed.

Hackberry/ Pivot Rock AMP	Update and revision of AMP	Begin analysis in 2004	Analyze grazing strategies and livestock numbers.
Nagle Ecosystem Management Area Analysis	Assessment of existing and desired conditions with proposals for future treatments.	2003 with NEPA 2004-05	Will improve overall vegetative structure distribution and reduce fire risk.
Road Closures:	Closure of FRoad 91 at McGuire Crossing and FRoad 40 at Double Cabin Park	Spring 2001	Minimize impacts from road crossing and road locations on drainage system in East Clear Creek Watershed.

Table 18: Forest-wide projects that may have effects in the project area that were considered for cumulative effects.

Activity	Description	Status	Effects
Noxious Weeds (Three Forest Assessment)	Develop actions to treat prioritized infestations of noxious weeds across the landscape.	2004	Will contribute to reducing noxious weed spread throughout the forest.
Cross-Country Use of Motorized Vehicles in 5 Arizona National Forests	Proposes new Forest policies for road travel to close the Forests to off road travel unless signed open.	Analysis Stage	Potential to effect creation of new roads, reduce “ghost roads”, limit vehicle impacts. May improve watershed conditions through reduced impacts.
Roadless Area Policy	Proposes new national policies for the management of roadless and unroaded areas on national forest lands.	Draft EIS 4-16-03 Decision Fall 2003	Roadless areas identified in ECC and Barbershop Canyon-no roads will keep more “natural” drainage pattern in these canyons.

Additional allotments within the watershed cover 171, 000 of the 247,000 watershed acres, however approximately 130,000 acres are available for livestock grazing due to steep slopes and cattle exclosures (Table 19). Alternatives for the Buck Springs Allotment would allow livestock grazing on 0 to 53,000 acres (Table 20). This would result in livestock grazing on approximately 130,000 (53%) to 183,500 acres (74%) of the nearly 247,000 acres in the watershed (Table 20). Utilization standards and pasture rotations on all allotments ensure that grazing occurs at levels compatible with healthy vegetation.

Table 19: Gross acres and acres available for cattle grazing on additional allotments within the East Clear Creek Watershed.

Allotment Name	Ranger District	Gross Allotment Acres in Watershed	Total Net Acres Grazed
Chevelon Canyon	Black Mesa	1,701	1,701
Clear Creek	Black Mesa	17,389	13,911
Limestone	Black Mesa	55,716	33,430
Wallace	Black Mesa	39,692	31,750
Bar T Bar	Mogollon Rim	39,855	35,870
Hackberry /Pivot Rock	Mogollon Rim	16,649	13,732
TOTAL		171,002	130,394

Net acres exclude steep slopes in canyons and fenced enclosures. The Black Mesa District is on the Apache-Sitgreaves NF, the Mogollon Rim District is on the Coconino National Forest.

Table 20: Total acres available to livestock grazing by Alternatives for the Buck Springs Allotment

Alternative	Gross Acres per Pasture in Buck Springs	Acres Available for Grazing in Buck Springs	Acres Available for Grazing in the Watershed
Buck Springs Alt. A	0	0	130,094
Buck Springs Alt. B	68,010	53,067	183,461
Buck Springs Alt. C	60,078	46,222	176,616
Buck Springs Alt. D & K	59,717	45,107	175,501
Buck Springs Alt. E	43,832	33,761	164,155
Buck Springs Alt. F	66,449	51,835	182,229
Buck Springs Alt. G	45,786	35,715	166,109
Total acres in Buck Springs	70,800	70,800	
Total acres in watershed			247,000

Gross acres are the acres in all pastures, by alternative. Available acres for grazing exclude steep slopes, as well as current and proposed livestock enclosures.

Table 20 shows that Alternative A does not add cumulative acres to the effects to understory vegetation from livestock grazing. Under this alternative, approximately 53% of the understory vegetation in the watershed is available to livestock grazing. Alternatives B and F graze approximately 74% of the area with livestock, alternatives C, D, and K graze approximately 71% of the area with livestock, alternative G grazes approximately 67% of the area with livestock and Alternative E grazes approximately

66% of the area with livestock. These figures incorporate recent NEPA decisions of the Apache-Sitgreaves National Forest that reduced cattle numbers and the distribution of cattle across the landscape. These recent actions decrease the impacts to understory vegetation from livestock grazing, especially in riparian areas where cattle have been excluded. Adherence to utilization standards on all grazed acres would ensure healthy understory vegetation.

Elk can, and do, graze throughout the entire watershed, except for the very steep slopes. This occurs on approximately 200,000 acres, or roughly 80% of the watershed. Elk affect understory vegetation through grazing throughout the growing season, and during parts of the year when the plants are dormant. The results of this grazing is greatest in the headwater meadow systems across the watershed, where riparian plants are grazed heavily and the grazing tolerant Kentucky Bluegrass is the dominant species [#22,#31]. Currently there are about 150 acres of the watershed where elk are excluded. Efforts to reduce impacts due to livestock management would be tempered by continued impacts due to elk grazing.

Recreationists also impact understory vegetation through trampling (especially in riparian areas) and off-road vehicle use which reduces biomass, creates patches of bare soil, and compacts soils. The use of all-terrain vehicles is increasing rapidly on the allotment, resulting in degraded riparian areas and meadows, as well as some upland areas. While the total acres of this impact are relatively small watershed-wide, and the impacts are usually very site-specific, they occur in very sensitive areas (particularly in riparian areas and meadows).

Fire management has historically affected understory vegetation through a century of fire suppression that resulted in increased canopy closures and reduced understory vegetation. Current efforts to restore a more natural regime will take many years to see large-scale results and increases in understory vegetation. There are 5,391 acres of pre-commercial thinning that are currently being implemented under the Blue Ridge Urban Interface project. These acres, combined with the East Clear Creek Watershed Improvement Project (9,400 acres of thinning in ponderosa pine forest and 300 acres of tree removal in meadows) and the Victorine Urban Interface Project (proposes approximately 6,000 acres of thinning) would open the canopy on approximately 21,000 acres within the watershed, or slightly less than 10% of the watershed total acres, and improve the opportunity for the release and/or establishment of understory vegetation on these acres.

Within six alternatives for the Buck Springs Range Allotment, pre-commercial thinning is proposed to improve the ease of cattle grazing operations (Table 21). The additional acres proposed under Alternative C would increase the total area thinned to just over 23,000 acres in the watershed. It is felt that the small acreage proposed for thinning within this analysis would not greatly open the canopy to show a large improvement in understory vegetation. The decreases in the canopy are generally short-term in nature and are within the same acres that are available to grazing ungulates (both wild and domestic). Treatments in past, present, and future timber sales would also contribute to opening up patches of thick understory trees. The effects of these timber sales last up to

ten years. Rim Christmas Tree Project would remove about 2500 small trees over about 15,000 acres, and would have negligible effects to the understory. Openings in the forested environment from all these projects may improve the distribution of grazing animals, and Arizona Game and Fish Department efforts to reduce elk numbers may also improve understory vegetation health by decreasing the cumulative grazing impacts on vegetation.

Table 21: Pre-commercial Thinning Proposed to Improve Livestock Management

Alternative	Proposed Thinning Acres
Buck Springs Alt. A	0
Buck Springs Alt. B	0
Buck Springs Alt. C	1,500
Buck Springs Alt. D & K	1,000
Buck Springs Alt. E	200
Buck Springs Alt. F	200
Buck Springs Alt. G	200

Cumulatively, all alternatives for the Buck Springs Range allotment other than Alternative B, would reduce effects to understory vegetation through reductions in acreage grazed by livestock, increased acreages of pre-commercial thinning and improvements in livestock distribution and management. Impacts contributed by elk, recreationists, and wildfire would continue throughout the allotment. The impacts from elk and recreationists to understory vegetation would be greatest in riparian and riparian meadow areas, and the alternatives that eliminate cattle access to riparian would remove one source of impacts to understory vegetation in these sites. Pre-commercial thinning in six of the alternatives would add to recent and planned thins in other projects, and would result in opening up of dense stands of small trees and increased productivity in understory vegetation.

NOXIOUS WEEDS

[#73]

Risk Assessment

Noxious weeds can be introduced by many activities associated with livestock management. Vehicles traveling through infested areas may transport seeds or plant parts to new areas. Ranchers may transport seeds or plant parts on their clothing or personal gear, in the fur of livestock or other animals (herding dogs), or in hay brought in from infested areas. Some species are dispersed in the feces of animals. Ground disturbing activities can provide sites for establishment of noxious weeds.

Some ground disturbing or site altering activities include tree thinning, fence building, and road closures. A risk rating analysis was conducted which considered the likelihood of a specific noxious weed spreading into or within the project area and the consequence

of weed establishment. Overall, the grazing alternatives would have a moderate rating for risk of spread and establishment. Each activity would be evaluated prior to implementation to determine the risk, and to determine necessary mitigation measures.

Alternative A

No activities associated with livestock management would occur. No ground disturbing activities would occur. There would be no risk of introducing or spreading noxious weeds through livestock management.

Removal of cattle from the allotment probably would not reduce the risk of expanding bull thistle and cheat grass populations. Elk grazing would continue to occur, and could by itself result in over-utilization. Utilization monitoring would occur at a reduced level.

Alternatives B, C, D, E, F, G, and K

Russian knapweed has a risk factor rating of low for grazing alternatives, based on the limited locations of Russian knapweed near the project. The location near the Blue Ridge Reservoir would be closely monitored to prevent spread. Once established, knapweed is extremely difficult to eradicate. Some activities proposed for livestock management on the allotment were rated moderate for risk of expanding the extent of bull thistle. Some of the activities that could be ground disturbing or site altering include grazing, tree thinning, fence building, tank building, and road closures. Mitigation measures would be used during implementation to ensure that weeds are not introduced to new sites, and that existing populations do not expand due to project activities.

Grazing

Grazing by cattle and wild ungulates occurs on the allotment. All grazing alternatives include acceptable utilization levels by pasture. Utilization monitoring is conducted to protect forage resources, and livestock are moved before utilization reaches the designated levels. Bull thistle exists on many areas of the allotment. Overgrazing could provide disturbed sites for further spread. Grazing is rated as a moderate risk for spreading this noxious plant, due to its presence throughout the allotment. The best protection against further spread, is to maintain healthy vegetative communities and avoid overgrazing.

Road Closures and Tank Cleaning or Maintenance

Roads are closed with a tractor to block or obliterate the roadbed. A tractor is used to clean out or reshape tanks. Equipment such as tractors can spread noxious weeds, such as bull thistle. Mitigation measures would reduce the risk of spreading known weed groups.

Thinning

Pre-commercial size trees (up to 9" dbh) are removed using chain saws. Material is broadcast burned on site. These activities can contribute to the spread of existing populations or the establishment of new ones. To prevent the spread of noxious weeds all equipment used for thinning would be cleaned before it is moved from sites where infestations exist. The Risk Rating depends on the proximity of the project to thistle populations, the intensity of ground disturbance, and the fire intensity. Each project would be reviewed prior to implementation to determine the risk rating, and the specific mitigation required.

Cumulative Effects

The allotment is the area of consideration for Cumulative Effects. Livestock operations may potentially spread noxious weeds. Existing populations were introduced through past timber sales (especially bull thistle), recreationists and other visitors. Present and future timber sales include measures to reduce or eliminate future introductions. Forest visitors, however, continue to be potential vectors for noxious weeds. The potential acres affected by these activities cannot be estimated.

The Forest implements the Coconino, Kaibab, and Prescott National Forests Noxious Weeds Strategic Plan to reduce the introduction and spread of noxious weeds, and is participating in the Noxious Weeds, Three Forest Environmental Impact Statement to address methods for eradication of existing populations. The mitigation measures that would be implemented for the Buck Springs Range Allotment, along with these current and future plans to reduce introductions and treat existing populations would result in the containment or reduction of noxious weeds on the allotment.

OVERSTORY VEGETATION AND FOREST FUELS

[#73 and #75]

Alternative A: No Grazing

No permitted livestock grazing would occur within this grazing allotment, however wildlife such as elk and deer would continue to graze the understory. There would be little change in overstory vegetation and forest fuels.

Alternative B: Current Management

Present livestock grazing would continue and there would be no effect to overstory vegetation.

Alternatives C, D, E, F, G, and K

Grazing intensity would vary by alternative, and the amount grazed per alternative varies. There would be no effects to overstory vegetation due to grazing.

Effects on forest fuels include treatments to understory trees. Alternative C proposes to pre-commercially thin approximately 1,500 acres of dense seedling/sapling/pole stands, about 2% of the allotment. This action would open up a few stands for ease of moving livestock, provide a balanced mosaic of forage intermixed with hiding and thermal cover; increase the understory diversity of grasses, forbs, and shrubs as ground cover; reduce risk of wildfire spread in ladder fuels; improve tree growth and vigor; and increase percolation of water into the soil. Pre-commercial thinnings would occur within ponderosa pine stands in the Horse, Knolls, North and South Battleground Pastures, and would decrease cover and densities allowing more light to reach the ground. More moisture and nutrients would be available to be used by crop trees as well as understory vegetation. This is not a long-term benefit, as the crop trees would grow and eventually the canopy would close.

Thinning would reduce ladder fuels, open the canopy, and reduce production of dead forest fuels, all of which reduce the risk of a crown replacement fire. However, for a period of 2-10 years, the slash produced would add to the dead fine fuel loadings, which are the most flammable during periods of low moisture.

Long-term (10-20 years) post-treatment effects on fuel loadings would be negligible compared to pre-treatment conditions. The remaining trees would grow and occupy the spaces vacated by the cut trees. Crown volumes, crown canopy closures, and biomass production would equal or exceed pre-treatment levels and contribute to the dead/down fuel loading.

Alternative D would pre-commercially thin 1000 acres, and would have similar effects to those described for Alternative C. Alternatives E, F, and G would thin 200 acres along the FR137 road, and around Rambo Tank. These thinnings would have the same effects as in Alternative C, but would occur at negligible levels.

Cumulative Effects

Management of the Buck Springs Range Allotment would affect the pre-commercial sized vegetation through pre-commercial thinning treatments. Grazing by cattle, elk and deer affect the regeneration of aspen. The boundary for the cumulative effects for overstory vegetation is the watershed boundary (247,000 acres), since the density of trees affects watershed conditions through affects on soil condition and the movement of water through the system. The duration of the effect is approximately 10 years in nature. Timber sales, pre-commercial thins, wildfires, and prescribed burning may also affect the density of understory trees.

Tables 15 and 16 display the timber sale treatments for the last 10 years within the watershed and future, foreseeable vegetation treatments. Historically, timber sales primarily cut in the dominants and co-dominant trees in the overstory. These actions created openings. Pre-commercial thins were often a part of the timber sales.

The future and foreseeable actions treatments are primarily thinning from below which leave the dominants and co-dominants on-site. The effect of these actions will be two-fold, to create new openings while maintaining existing openings and decrease the density of the smaller trees which allows for greater growth on the remaining trees. Overall, these two types of treatments are working on many of the same acres, but in different levels of the overstory. All pre-commercial thinning, including those proposed in the Buck Springs EIS, are on sites that have had previous timber sales. Over a 10-year period, thinnings and timber sales have affected 34,164 acres or approximately 14% of the entire watershed and 15% of the forested portion of the watershed (Table 15). The Blue Ridge Urban Interface Project is currently implementing an additional 5,391 acres of pre-commercial thinning, while the East Clear Creek Watershed Improvement Project would treat another 9,400 acres. Most of these acres are the same as those affected by past timber sales, resulting in approximately 35,000 acres affected. The dynamic nature of forest stands would replace many of the openings created within 10-20 years.

Wildfire and prescribed burning may also affect tree densities. The Mogollon Rim has one of the highest incidences of lightning caused fires in the country. Up to 200 fires may start within the allotment in any one year. Most of these remain very small, but several large fires have affected the tree densities over the past 50 years, the most recent being the Dude Fire of 1990, which burned approximately 2,000 acres of the allotment.

The discussion in the understory vegetation section discloses the acreage of pre-commercial thinning proposed in the Buck Springs Allotment, as well as the acreage of future and foreseeable projects within the watershed. The total of a maximum of nearly 23,000 acres proposed for prescribed burning in the next 10 years would reduce densities of understory trees on approximately 16% of the watershed. Many of these acres that are proposed are within the openings created by the timber sales listed above, so these are not cumulative acreages above the approximately 35,000 acres of opening created in timber sales. Therefore, approximately 35,000 acres would have been affected by canopy openings within the last 10 years from timber sales, and approximately 23,000 acres of that would have maintenance of openings over the next 10 years through pre-commercial thinnings. Overall, the effects of thinnings and created openings would improve tree growth and improve forest health through reduced competition for nutrients and water. The additional 0 to 1,500 acres proposed for pre-commercial thins within the Buck Springs Range Allotment would be negligible on a watershed-scale, improving understory tree health at the local site.

Within the last 10 years, approximately 40 small exclosures have been built to protect aspen regeneration. Aspen regeneration outside of these exclosures is limited to very steep slopes only. Alternatives A, E and G remove cattle from the southern portion of the Buck Springs allotment where aspen is primarily found, which would remove the impact of cattle on aspen. Recent NEPA decisions on the Apache-Sitgreaves National Forest removed impacts of cattle in those southern pastures. Aspen regeneration would still be grazed heavily by elk and deer and may be in danger of being grazed to the point where it will no longer occur in the watershed, except in fenced exclosures.

SOIL AND WATER
[#68]

There are no effects to water rights, landform, or climate from any of the alternatives discussed below. Alternatives will discuss the effects to soil condition, riparian condition, and water quality. Table 22 summarizes the effects to soil and water measures and is found at the end of the narrative for all of the descriptions.

Alternative A: No Grazing

Soil Condition

Alternative A would have no negative impacts from cattle grazing to soil condition for both uplands and riparian areas. There would be no cattle access to the 412 acres of meadows and/or to riparian drainages. The result would be increases in effective ground cover due to increases in litter and biomass. Species diversity may not increase in the uplands; however, plants that benefit from grazing would likely decrease. Without elk grazing, soil conditions in the meadows are expected to improve. The cumulative effects section discusses the effects of elk.

Riparian Condition

Considering cattle grazing alone, Alternative A would result in increases in effective ground cover on 144 miles of riparian streams, due to increases in litter and biomass. These changes would lead to increases in wetted area perimeter in wet meadows, and movement toward proper functioning conditions of streams. Also, all wetlands would not be subject to cattle grazing or bank trampling due to cattle. The cumulative effects section discusses the effects of elk.

Water Quality

Water quality would be expected to stay within State of Arizona standards for designated uses. There would not be an effect from cattle grazing under this Alternative.

Alternative B: Current Management

Soil Condition

Alternative B would have the greatest detrimental effect to soil conditions in riparian areas from livestock grazing due to continued grazing of many wet meadows and riparian areas. Impacts to soil conditions in the uplands are similar for all action alternatives and include reductions in effective ground cover, with areas continuing to be over- and under-utilized. Grazing of riparian and upland areas would impact soil physical properties through compaction, reduced infiltration, and broken down stream banks. Soil condition in the uplands is expected to remain satisfactory, primarily due to canopy cover of conifer trees.

This alternative allows for continued livestock access to 178 acres of sensitive headwater meadows and 95 miles of riparian drainages. Meadow inventory data (1995) suggests that soil condition in headwater meadows would continue to degrade through removal of vegetative cover. Soils would be compacted on 178 acres of meadows. Soil conditions on 178 acres of meadows would remain impaired, and degrade to unsatisfactory over time. The meadows that currently have elk enclosures will maintain satisfactory soil

condition (Houston, Buck Springs, Merritt, Kinder, and General Springs). The cumulative effects section discusses the effects of elk.

Riparian Condition

This alternative allows for continued livestock access to 178 acres of sensitive headwater meadows and 95 miles of riparian drainages. Riparian areas would continue to scour out on a regular basis due to a lack of proper vegetation. There would be no improvement in functioning condition for 30 miles of accessible at-risk streams and 11 miles of accessible non-functional streams. Livestock would remove riparian vegetation in these sensitive areas, break down stream banks through trampling, remove woody riparian vegetation, and affect species diversity through preferential grazing. Impacts from cattle grazing to vegetation and bank stability would be eliminated on 4 miles of functional at-risk and 3 miles of nonfunctional streams. The three wetlands would be subject to cattle grazing, and as such would remain functional at-risk sites. The cumulative effects section discusses the effects of elk.

Water Quality

Alternative B allows the most access to live streams, however, water quality under current management meets state standards (Table 8). Acceptable conditions would continue, unless riparian areas degrade and add more sediments to the stream. Water quality could then degrade below standards set for the beneficial uses.

Alternative C: Proposed Action

Soil Condition

In upland areas, this alternative would provide some opportunity for increased utilization of upland species, distribute grazing more evenly, and favor grazing tolerant species due to pasture division fences in the uplands. The increased utilization in some areas may result in increased soil compaction, but quick pasture rotations would limit negative impacts. Some areas that are currently over-utilized would experience decreases in utilization, allowing for potential recovery through increased infiltration and decreased compaction.

The proposed action would improve soil conditions over current management (Alternative B) in meadow areas by excluding livestock grazing from an additional 160 acres of meadows. These exclusions would allow for improvements in soil conditions on 160 acres through increased vegetative productivity and biomass, increased effective ground cover, and improved water infiltration.

Riparian Condition

The proposed action would improve riparian conditions over current management (Alternative B) in riparian areas by excluding livestock grazing on 13 miles of riparian

drainages. These areas would experience increased vegetative development (especially sedge and rush communities) and productivity and biomass, which in turn would increase the ability to dissipate energy during high water flows and mitigate the damage of flooding.

This alternative provides for improvements in riparian conditions over current management, however, it would not provide as much protection to the riparian drainages as Alternatives A, D, E, and G because cattle would still access a small section of Leonard Canyon in the Knolls Pasture, Houston Draw in the North Pinchot Pasture and East Clear Creek in the McCarty Pasture. Cattle access to these areas would limit effective ground cover as litter is removed through grazing, allow for bank trampling, compact soils, stagnate or degrade functioning condition of the meadow systems, and limit riparian vegetation so that wetted area perimeters would not increase. Species diversity would favor grasses that are grazing tolerant, and riparian grass and shrub species would not increase to recover the sites. Livestock would have access to 82 miles of riparian drainages. Cattle grazing would no longer impact vegetation and bank stability on 7 miles of functional at-risk and 7 miles of nonfunctional streams under this Alternative. The three wetlands would be subject to cattle grazing, and as such would stay as functional at-risk sites. The cumulative effects section discusses the effects of elk.

The closure of the end segments of the 9713G, 9714E, 9737R, and 9737Y roads with fences would limit access to two meadows and three stream crossings/hydrologic connectivity, and thus would remove vehicular impacts to these sites. The East Clear Creek Roads Analysis [#133] displays the relative aquatic risk rating for these roads.

Water Quality

Alternative C reduces access to 13 miles of live streams over Alternative B. Water quality is expected to stay within standards, and may improve.

Alternative D: Herding and Alternative K: Modified Herding

Soil Condition

The herding alternative would have a positive effect to soil and watershed resources through the proper distribution of cattle. The use of herding would control the time and intensity of grazing animals so that impacts to soil conditions could be minimal. In the uplands, species diversity would tend to favor grazing tolerant plants because this alternative would improve utilization throughout upland areas. However, even with herding, there can be an increased negative impact to soil physical properties in areas that have had little grazing pressure in the past, through compaction and subsequent decreased infiltration. Herding would ensure that livestock would move quickly through the pastures, minimizing these negative effects. Areas that historically have been over-utilized, would have less grazing pressure, allowing for less compaction, increases in ground cover, and greater infiltration.

Riparian Condition

In this alternative, fences would exclude an additional 134 acres of meadows and 13 miles of riparian drainages over current management. Alternatives C, E, F, and G would use fencing to exclude more meadow acres. However, successful herding would keep cattle out of unfenced sensitive riparian drainages and meadows and would likely provide more protection to those areas than other action alternatives. Vegetative ground cover would improve, as would wetted area perimeter, and the proper functioning condition of these areas. The improved upland area utilization may reduce some of the negative cumulative impacts from persistent elk grazing in riparian areas by freshening up plants that may draw elk out of meadows.

The effectiveness of the herding operation would be a major concern in this alternative. The temporary failure of herding could lead to substantial impacts to riparian areas and meadows, with negative effects similar to Alternative B because there would be 44 miles of accessible sensitive meadows and 82 miles of accessible riparian drainages. Effects to riparian drainages would be the same as for Alternative C, with more potential impacts to meadows. Cattle grazing would no longer impact vegetation and bank stability on 7 miles of functional at-risk and 7 miles of nonfunctional streams under this Alternative. The three wetlands would be subject to cattle grazing, and as such would stay as functional at-risk sites. The cumulative effects section discusses the effects of elk.

The closure of the end segments of the 9713G, 9714E, and 9737R roads with fences would limit access to one meadows and two stream crossings/hydrologic connectivity, and thus would remove these stressors to these sites. The East Clear Creek Roads Analysis [#133] displays the relative aquatic risk rating for these roads.

Water Quality

Alternatives D and K reduce access to 13 miles of live streams over Alternative B. Water quality is expected to stay within standards, and may improve.

Alternative E: Northern Pastures Emphasis

Soil Condition

The impacts to upland areas would be slightly higher than the other grazing alternatives, since livestock would be in northern pastures longer with a 5% higher allowable utilization. There may be slightly higher compaction, lower vegetative ground cover, and less infiltration than any other alternatives other than G. Soil conditions are expected to improve on 412 acres of meadows due to the exclusion of cattle from these sites, which would result in increased vegetative ground cover, increased infiltration, and a decrease in soil compaction. Upland effects will be limited in acreage to the Northern Pastures, and soil conditions are expected to be maintained as satisfactory for the uplands as a whole. The cumulative effects section discusses the effects of elk.

Riparian Condition

Of all the grazing alternatives, Alternative E would have similar effects to Alternative G on riparian condition from cattle grazing in the riparian areas of the allotment, which are the least negative impacts of action alternatives. The negative impacts to riparian areas would be minimized through the exclusion of cattle from the southern pastures, protecting all major meadows and most small meadows on the allotment. Shallow drainages in the southern pastures would also be excluded from livestock grazing, protecting an additional 44 miles of riparian drainages and leaving 51 miles still accessed by livestock in the northern pastures. These measures would result in increased vegetative ground cover on all meadows and a corresponding expansion of wetted area perimeters. Excluded riparian drainages include 21 miles of at-risk streams and 12 miles of non-functional streams that would improve through increased vegetative productivity, biomass and diversity; improved bank stability; and dissipation of energy during high peak flows. The effects in rested pastures would be the same as Alternatives A, except that elk may be displaced from grazed pastures and concentrate in rested pastures. Additional proposed fencing in the northern pastures, particularly along East Clear Creek, would continue to improve riparian conditions within East Clear Creek. Cattle grazing would no longer impact vegetation and bank stability on 21 miles of functional at-risk and 12 miles of nonfunctional streams. The three wetlands would not be grazed by cattle, and as such would have the potential to improve vegetative ground cover. The cumulative effects section discusses the effects of elk.

The closure of the end segment of the 9713G road with fences would limit access one stream crossing/hydrologic connectivity, and thus would remove vehicular impacts to this site. The East Clear Creek Roads Analysis [#133] displays the relative aquatic risk rating for these roads.

Water Quality

Alternative E reduces access to 44 miles of live streams over Alternative B. Water quality is expected to stay within state standards, and may improve.

Alternative F: Rest-Rotation

Soil Condition

The Rest Rotation Alternative would have both positive and negative impacts to soil conditions. The year-long rest for all upland sites would provide an increase in plant biomass, thus improving effective ground cover. Allowable utilization is 5% higher for areas grazed one year in two, but would be more than offset by a year of rest. The extensive amounts of fencing to improve plant utilization and animal distribution would result in higher utilization and could have slightly higher negative impacts to soil physical properties than Alternatives C and D. The improved upland effective ground cover would be tempered by elk use. Soil conditions in the uplands are expected to remain satisfactory.

This alternative would provide the physical structures (fences) to exclude cattle from 394 acres of large meadows. This should provide an increase in effective ground cover and remove cattle as a trampling agent, thus decreasing compaction. The remaining 18 acres of meadows would be accessible every other year, allowing for some level of recovery through increased vegetative productivity, biomass, and, increased infiltration. Adherence to utilization standards within the meadows would also improve conditions. Under this scenario, soil condition should improve, depending on elk use. The cumulative effects section discusses the effects of elk.

Riparian Condition

This alternative would provide the physical structures (fences) to exclude cattle from 394 acres of large meadows. Fences would also exclude livestock from an additional 21 miles of riparian drainages over current management. The remaining 18 acres of meadows and 74 miles of riparian drainages would be accessible every other year, allowing for some level of recovery through increased vegetative productivity, biomass, and diversity, increased infiltration, and dissipation of energy from high peak flows. The exclusion of livestock grazing in 394 acres of large meadows and 70 miles of riparian drainages would result in improvements in the proper functioning condition of the streamcourses, especially in 9 miles of at-risk streams and 12 miles of non-functional streams. Cattle grazing would no longer impact vegetation and bank stability on 9 miles of functional at-risk and 12 miles of nonfunctional streams. The three wetlands would be subject to cattle grazing, and as such would stay as functional at-risk sites. The cumulative effects section discusses the effects of elk.

The closure of the end segments of the 9713G, 9714E, and 9737R roads with fences would limit access to one meadows and two stream crossings/hydrologic connectivity, and thus would remove these stressors to these sites. The East Clear Creek Roads Analysis [#133] displays the relative aquatic risk rating for these roads.

Water Quality

Alternative F reduces access to 21 miles of live streams over Alternative B. Water quality is expected to stay within state standards, and may improve.

Alternative G: Northern Pastures with Rest-Rotation

Soil Condition

The impact to upland area soil condition would be slightly higher than Alternative F, and similar to or less than the other grazing alternatives, since a smaller number of livestock would be in northern pastures longer with a 5% higher allowable utilization. There may be slightly higher compaction, lower vegetative ground cover, and reduced infiltration, during the grazed years than other alternatives, however a year of rest for every year

grazed would allow for overall greater plant recovery and productivity. Soil conditions are expected to remain satisfactory for upland sites.

Impacts to soil conditions from cattle grazing are minimized in this alternative through the exclusion of cattle in the southern pastures, which protects all large meadows and most small meadows. Shallow drainages would also be excluded from livestock grazing. This would have the same effects as Alternative A in these pastures, through reduced compaction, increased infiltration. Alternative G excludes cattle from 412 acres of meadows, thus removing the impact of cattle on all large meadows. The rest-rotation aspect of this alternative would also remove livestock impacts to less sensitive meadow areas (e.g., Lower Dick Hart Draw, Quien Sabe Draw) every other year, thus minimizing impacts in these areas. Alternative G should improve soil condition over time if elk numbers are reduced. The cumulative effects section discusses the effects of elk.

Riparian Condition

Of all the action alternatives, Alternative G has the least negative impacts to riparian condition from cattle grazing in the riparian areas of the allotment. The negative impact to riparian areas from cattle grazing is minimized through the exclusion of cattle in the southern pastures, which protects all large meadows and most small meadows. Shallow drainages would also be excluded from livestock grazing. These measures would have the same effects as Alternative A in these pastures, through reduced compaction, increased infiltration, increased wetted areas, and greater dissipation of stream energy. Additional proposed fencing in the northern pastures, particularly along East Clear Creek would continue to improve riparian conditions by excluding livestock from East Clear Creek proper. This alternative excludes livestock from 412 acres of large meadows and 92 miles of riparian drainages. In addition, the remaining 52 miles of riparian drainages would be accessible every other year, allowing for some recovery of 13 miles of at-risk streams and 2 miles of non-functional streams. Cattle grazing would no longer impact vegetation and bank stability on 21 miles of functional at-risk and 12 miles of nonfunctional streams. The lesser number of cattle than other alternatives would also lessen impacts. The three wetlands would not be grazed by cattle, and as such would have the potential to improve vegetative ground cover. As with all of the other alternatives, the cumulative effects from elk grazing would limit potential improvements to soil and water resources.

The closure of the end segment of the 9713G road with fences would limit access to one stream crossings/hydrologic connectivity, and thus would remove these stressors to this site. The East Clear Creek Roads Analysis [#133] displays the relative aquatic risk rating for these roads.

Water Quality

Alternative G reduces access to 43 miles of live streams over Alternative B. Water quality is expected to stay within state standards, and may improve.

Table 22: Effects on watershed measures by alternative.

MEASURE	ALT. A Grazing	ALT. B No Change	ALT. C Proposed Action	ALT. D and K Herding	ALT. E Northern Pastures	ALT. F Rest- Rotation	ALT.G North Rest- Rot.
Meadow acres Excluded / Improved	412	234	394	368	412	394	412
Meadow Acres Impacted	0	178	18	44	0	18	0
Riparian Drainages Excluded / Improved (miles)	144	49	62	62	93	70	92
Riparian Drainages Impacted (miles)	0	95	82	82	51	74 1 in 2 years	52 1 in 2 years
PFC streams Excluded/ Improved (miles)	94	41	48	46	58	48	59
PFC streams Accessed/ Impacted (miles)	0	53	46	49	36	46	36
At-risk Stream Excluded/ Improved (miles)	34	4	7	9	21	9	21
At-risk Streams Accessed/ Impacted (miles)	0	30	28	26	13	25	13
Non- functional Streams Excluded / Improved (miles)	14	3	7	7	12	12	12
Non- functional Streams Impacted (miles)	0	11	7	7	2	2	2

Cumulative Effects to Soil and Water

The boundary analyzed for soil and water cumulative effects is the East Clear Creek watershed as delineated in 1998 (247,000 acres). The time-frame considered for the analysis is ten years. Effects considered are those affecting soil condition (compaction, infiltration, effective ground cover), riparian condition (bank stability, biomass, species diversity), and water quality (sediment load, effective ground cover). Two types of activities for cumulative effects will be considered for this analysis—related grazing and related thinning. The allotment accounts for less than one percent of the total watershed acreage for West Clear Creek and Jacks Canyon 5th code watershed, which is a negligible amount and this analysis will therefore not include them.

Cumulative Effects Common to All Alternatives for Soil Condition

Several historic impacts are common to all alternatives and fall outside of the scope of the timeframe identified above—however, they are key to current existing conditions. First, in the late 19th and early 20th century, grazing animals numbers (primarily cattle and sheep) were extremely large. The effect of this large number of animals was a change in vegetative structure across the landscape. In the meadow systems, willows, sedge and rush plants were selectively grazed and eliminated from many areas. The soil binding properties of these plants were no longer present. This caused meadow systems to erode easily, which resulted in large downcuts. Many meadows were homesteads planted with Kentucky bluegrass, a non-native, grazing tolerant plant with shallow roots that contribute to excessive grazing, loss of biodiversity, and erosion.

The high number of cattle and sheep created a very favorable seedbed for conifer regeneration. The disturbed soils, combined with the new Forest Service policy of total fire suppression and increased precipitation, led to a great increase in the number of conifers established over the landscape. The resulting thick conifer stands tend to have very stable and satisfactory soil conditions due to the preponderance of needlecast from ponderosa pine trees. Past timber sales have not reduced the canopy cover enough to remove the influence of the abundant needlecast (Please refer to the overstory vegetation section for the specific projects proposed to thin trees within the 10 year timeframe within the analysis area). Machine piling of activity fuels from timber sales has reduced some of the needlecast, as well has removed coarse woody debris on a portion of the old timber sales. This negative effect to soil condition has occurred on approximately 1,500 acres on old timber sales. This negative affect is mitigated over time by new needle cast and breakage and windthrow has removed this negative effect. The proposed thinnings from many projects on 17,600 acres in upland areas would reduce tree densities in the watershed and maintain satisfactory soil conditions. Tree thinning on 300 acres of meadows (East Clear Creek Watershed Improvement Project) would improve effective ground cover on these sites (see below for a full discussion of effects to meadow soil condition).

Grazing and the increase in tree densities have contributed to current impaired soil conditions in the meadows by attracting grazing animals due to the presence of very

palatable species for grazing animals, and the decrease in forage in the uplands as forest canopies closed. The increased thinning described above would increase forage production over the landscape and may decrease the impact of grazing animals on the meadows, but this effect would probably be very slight and short-term unless there is maintenance of the thinned areas. Thinning of 300 acres within the meadows and the retention of slash on site would improve soil condition by creating a mulch and protecting the site from grazing ungulates.

A third element common to all alternatives is the existing road system. All roads within the analysis area contribute to unsatisfactory soil conditions through severe soil compaction, bare soils, and increased runoff. These conditions are expected to improve slightly over time as roads are decommissioned (7 miles of connected disturbed area work proposed to remove old road beds in drainage bottoms in the East Clear Creek Watershed Health Project and the closure of FR91 and FR40 on the Apache-Sitgreaves National Forest).

Cumulative Effects of Grazing on Soil Condition

Livestock grazing is occurring on five other allotments on approximately 130,000 acres within the watershed (Table 15). The Apache-Sitgreaves National Forests have recently completed NEPA actions on the Limestone, Clear Creek, Chevelon Canyon, and Wallace Allotments. The analyses proposed large reductions of cattle and additional range improvement fences to improve soil and water conditions. These actions have been implemented since 1999. The lower numbers, as well as range improvements to protect Leonard Canyon and total cattle exclusion on the south portion of the Limestone allotment are minimizing impacts to soil condition and soil physical properties because of the reduced number of cattle, allowing for reduced compaction, increased infiltration, and increased effective ground cover.

The Hackberry/Pivot Rock allotment also occurs within the East Clear Creek watershed. Recent range improvements (fences) have restricted cattle access to East Clear Creek proper (approximately 8 miles). In addition, there are 480 acres of meadows within the allotment—of which approximately 61 acres are protected from grazing from cattle through fencing. The biggest impact from livestock grazing on this allotment is to the riparian system and the soil condition in meadows through continued reduced infiltration, high compaction, bare soils, and increased runoff. This allotment is scheduled for a new National Environmental Policy Act (NEPA) analysis in 2004/2005.

On the Coconino National Forest, the Bar T Bar Allotment is currently under NEPA analysis. This allotment does not have access to riparian areas associated with the East Clear Creek drainage, so there would not be any direct effects to riparian function from grazing in this allotment. Upland soil conditions within the East Clear Creek watershed portion of the allotment are currently satisfactory in this allotment. The effects to soil physical properties, the ability of the soil to resist degradation and the ability of the soil to process nutrients would not be greatly changed from the current scheme in this analysis,

therefore, there should be minimal impacts to soil condition in upland positions within this watershed with the current and future grazing of this allotment.

Table 20 displays the acreage affected by livestock grazing with the East Clear Creek Watershed for alternatives for the Buck Springs Allotment. Cumulative grazed acres include acres grazed in all allotments within the watershed. Grazing animals impact soil conditions in some site-specific areas in the uplands through removal of above ground biomass sufficient enough to affect long-term soil productivity and compact the soil. This disturbance is primarily limited to water stock ponds and salt block locations and does not constitute a large acreage across the landscape (less than 1% of the watershed).

Table 23 summarizes the acres of meadow that are protected or impacted in the East Clear Creek watershed for all allotments. Impaired soils due to elk and livestock grazing occur within most meadows, or approximately 1,110 of the 1,160 acres of meadows across the watershed. The proposed alternatives for Buck Springs would decrease the acres available to cattle on impaired soils through meadow fencing, and would improve soil conditions. However, the 1995 meadow inventory indicates that elk would continue to keep soil condition impaired through season-long grazing [#22]. Therefore, the alternatives would minimize impacts to the meadows from cattle, but the overall affect from elk would continue to limit potential improvements.

Table 23: Cumulative Acres of Meadows Protected from Cattle Grazing in the East Clear Creek Watershed.

Alternative	Buck Springs Meadow acres excluded/ improved	Buck Springs Meadow acres impacted	Watershed Meadow Acres excluded	Watershed Meadow Acres Impacted	Total Meadow Acres in Watershed
Buck Springs Alt. A	412	0	860	300	1,160
Buck Springs Alt. B	234	178	682	478	1,160
Buck Springs Alt. C	394	18	842	318	1,160
Buck Springs Alt. D & K	368	44	816	344	1,160
Buck Springs Alt. E	412	0	860	300	1,160
Buck Springs Alt. F	394	18	842	318	1,160
Buck Springs Alt. G	412	0	853	307	1,160

The meadow acres that are impaired are the acres where cattle and elk have access to meadows, hence, there are effects to soils from cattle and elk grazing in these meadows.

Cumulative Effects to Soil Condition from Thinning of Conifers

The effects from pre-commercial thinning on soil condition are discussed above in the effects common to all alternatives in upland sites. Overall, pre-commercial thinning would maintain satisfactory soil conditions because the activity generally has little ground disturbance and provides material on-site for long-term soil productivity. Thinnings proposed under the current project alternatives would maintain or improve soil conditions in Alternatives C, D, E, F, G, and K through adding nutrients, reducing overstory canopy, allowing grass/forbs to re-establish, and providing ground cover. Alternatives A and B would not add to the cumulative effect from thinning.

The proposed thinning of approximately 300 acres of meadows and leaving the slash on-site in the East Clear Creek Watershed Health Project would protect meadows where slash is left on-site. This treatment has worked effectively in the Hay Meadow Restoration project, as well in pinyon-juniper sites across the Mogollon Rim District. The slash acts as protection to grass that is on-site, providing a microclimate for grass production, surface roughness, and protection from grazers. Overall, this project would improve approximately 10% of the 300 acres proposed treated areas within the watershed, so there will be an overall improvement in soil condition of approximately 30 acres (or approximately 2% of the meadows).

Cumulative Effects on Soil Condition-Summary

Overall, soil condition is expected to remain satisfactory in the uplands throughout the watershed, except at small, individual sites (salt licks and stock ponds). Cattle grazing impacts in meadow systems would decrease, depending on the alternative selected. Additional elk exclosures proposed under the East Clear Creek Watershed Health Project would improve soil conditions of meadows at Houston Draw and Dick Hart Draw (approximately 20 acres, for a total of 170 watershed acres, Table 24). Currently 150 acres of elk exclosures at Merritt Draw, Buck Springs Draw, Potato Lake Draw, General Springs, Kinder Draw, Fairchild Draw, Open Draw and Houston Draw are the only meadow acres that have satisfactory soil condition because the sites have adequate vegetative cover and are not compacted. The new exclosure sites (20 acres) would quickly attain satisfactory soil conditions. The overall effects of this project on soil condition within the watershed are so small that they do not add substantially to total impacts or improvements in soil condition.

Cumulative Effects Common to All Alternatives for Riparian Condition

The same suite of effects common to all alternatives that apply to soil condition apply to riparian condition. Grazing at the turn of the century removed the sedge, rush, and willow plants that resist degradation of the site during water flow events. These conditions caused many of the channels and meadow sites, to become vertically unstable, further degrading the riparian function.

Grazing access to riparian areas by livestock is the project action affecting overall riparian conditions within the watershed. Other past, current, or foreseeable actions that would also affect overall watershed and riparian conditions within the watershed include livestock access to riparian areas on other allotments, and wild ungulate grazing in riparian areas throughout the watershed.

Table 24: Cumulative effects of all projects on soil conditions in the East Clear Creek Watershed.

Buck Springs Alternative	Alt. A	Alt. B	Alt. C	Alt. D And K	Alt. E	Alt. F	Alt. T
Total watershed Meadow acres	1,160	1,160	1,160	1,160	1,160	1,160	1,160
B.S. meadow ac. livestock enclosures	412	234	394	368	412	394	412
B.S. meadow acre elk enclosures	24	24	24	24	24	24	24
ECC meadow ac. excluded livestock	860	682	842	816	860	842	860
ECC meadow acres elk enclosure	170	170	170	170	170	170	170
ECC meadow acres thin improve	30	30	30	30	30	30	30
Road removal acres improve	10	10	12	12	10	12	10
BS PCT upland acres improve	0	0	1,500	1,000	200	200	200
ECC PCT upland acres improve	23,350	23,350	24,850	24,350	23,550	23,550	23,350

Cumulative Effects of Grazing to Riparian Condition

Proper functioning condition assessments (PFC) for the two Forests were completed for stream reaches in 1995, 1998, and 1999. There are 300 miles of riparian streams within the East Clear Creek Watershed (226 miles on the Coconino National Forest and 74 miles on the Apache-Sitgreaves National Forest). Table 25 displays the miles of riparian streams potentially impacted by cattle grazing for alternatives in the Buck Springs allotment and within the watershed. Access is also broken down by current riparian condition. Where livestock have access to riparian streams, they may reduce riparian vegetation, break-down stream banks, and increase sedimentation, all of which may contribute to a downward trend in riparian condition. It must be noted, however, that livestock currently have access to up to 53 miles of streams in Proper Functioning

Condition, indicating that all livestock access does not contribute to declines in riparian conditions.

Table 25: Cumulative miles of riparian streams accessible and potentially impacted by livestock on the Buck Springs Range Allotment and in the East Clear Creek Watershed, by riparian condition and by alternative.

MEASURE	ALT. A no graze	ALT. B no change	ALT. C PA	ALT. D and K Herding	ALT. E North Pasture	ALT. F Rest- Rot	ALT. G North Rest- Rot.
BS Riparian Drainages Excluded	144	49	62	62	93	70	92
ECC Riparian Drainages Excluded	228	134	148	147	177	155	177
BS Riparian Drainages Accessed	0	95	82	82	51	74 1 in 2 yrs	52 1 in 2 yrs
ECC Watershed Riparian Drainages Accessed	71	165	151	152	122	144 1 in 2 yrs	122 1 in 2 yrs
BS PFC streams Excluded	94	41	48	46	58	48	59
ECC PFC streams Excluded	141	88	95	92	105	95	105
BS PFC streams Accessed	0	53	46	49	36	46	36
ECC PFC streams Accessed	15	68	61	64	51	61	51
BS At-risk Stream Excluded	34	4	7	9	21	9	21
ECC At-risk Stream Excluded	69	39	42	44	56	44	56
BS At-risk Streams Accessed	0	30	28	26	13	25	13
ECC At-risk Streams Accessed	29	59	56	54	42	54	42
BS Non-functional Streams Excluded	14	3	7	7	12	12	12
Non-functional Streams Excluded	18	7	11	11	16	16	16
BS Non-functional Streams Accessed	0	11	7	7	2	2	2
ECC Non- functional Streams Accesses	27	38	34	34	29	29	29

Recent NEPA decisions on the Apache-Sitgreaves National Forest, as well as a riparian cattle exclosures along East Clear Creek in the Pivot Rock Allotment provide protection to riparian drainages within the watershed.

In all Alternatives, other livestock grazing projects have access to 71 miles of riparian streamcourses. This is approximately 23% of the riparian drainages within the watershed. Alternative A would not add any cumulative effects to grazing from livestock. Alternative B would add 95 miles of grazing access to riparian streamcourses, for a total of 165 miles of streamcourse available to livestock grazing (55% of the riparian streamcourses in the watershed). Alternatives C, D and K would add 82 miles of access, for a total of 151 miles (50% of the riparian streamcourses in the watershed). Alternative E would add 51 miles of access, for a total of 122 miles (41% of the riparian streamcourses in the watershed). Alternative F would add 74 miles of access, for a total of 144 miles of streamcourses available for grazing once every 2 years (48% of the riparian streamcourses in the watershed). Alternative G would add 52 miles of access, for a total of 122 miles of streamcourses available for grazing once every 2 years (43% of the riparian streamcourses in the watershed).

Elk have access to nearly all riparian drainages on the allotment and within the watershed. A few small elk exclosures (about 170 acres in the watershed and approximately 5 miles of riparian streamcourse) restrict elk access to a very small amount of riparian areas and streamcourses. The impacts of elk grazing on riparian areas are similar to livestock grazing, through the removal of riparian vegetation, breaking down of stream banks, and increasing sedimentation. These impacts are additive to livestock impacts on riparian areas and streamcourses.

Many of the miles of riparian that are in proper functioning condition are in canyons are not accessed by cattle throughout the watershed. The cumulative effect of elk grazing in meadows and riparian areas would limit the positive effects gained by the fencing out of cattle in meadows and riparian areas as proposed in this project, and in other grazing allotments that occur within the watershed (Hackberry Pivot/Rock, Bar-T-Bar, Limestone, Clear Creek, Chevelon Canyon, and Wallace Allotments). Impacts would be reduced without cattle, but elk would continue to graze riparian areas and trample stream banks in meadow systems, preventing these sites from full recovery and attaining proper functioning

riparian condition. It is expected that there would be a slight improvement in the functioning condition of riparian areas, limited by persistent elk grazing. PFC assessments in riparian drainages indicate that some improvements can be attained through cattle exclusion. The paired elk and cattle exclosures across the rim are evidence that proper functioning condition of riparian areas cannot be achieved in meadows given the current level of elk grazing. The Arizona Game and Fish Department has been working to reduce the herd size within this watershed, but the reduction has not been great enough to this point to improve riparian functioning condition.

Cumulative Effects of Thinning on Riparian Condition

The thinning proposed within this analysis would have no direct effects and very limited indirect effects to riparian condition because no treatments are proposed within riparian sites.

Cumulative Effects on Riparian Condition-Summary

The no graze scenario (Alternative A) would not increase cumulative effects to riparian streamcourses. All other action Alternatives increase the cumulative impact to riparian drainages. However, action Alternatives C-K decrease impacts from the current grazing scenario (Alternative B).

Under the no graze alternative (Alternative A) for the Buck Springs Allotment, 71 miles of the 299 miles of riparian streamcourses in the watershed would be grazed by livestock (24%). Alternatives E and G would graze 122 miles of riparian streamcourses in the watershed (41%), Alternative F would graze 144 miles (48%), Alternatives C, D, and K would graze 151 miles (51%), and Alternative B would allow grazing on 165 miles (55%). Alternatives F and G would graze these streams every other year.

The cumulative impacts from elk grazing would further limit improvements in riparian condition, especially in meadows and riparian streams in meadow systems, as they remove riparian vegetation necessary to dissipate stream energies and continue to disturb stream banks. Exclosures on about 5 miles of riparian streamcourses exclude elk.

Additional elk exclosures proposed under the East Clear Creek Watershed Health Project would improve soil condition of meadows at Houston Draw and Dick Hart Draw (approximately 20 acres). The 150 acres of elk exclosures at Merritt Draw, Buck Springs Draw, Potato Lake Draw, General Springs, Kinder Draw, Fairchild Draw, Open Draw and Houston Draw are the only riparian meadow sites that currently have satisfactory soil condition because the sites have adequate vegetative cover/composition and do not have bank damage due to grazing. Soil conditions at the new exclosure sites would quickly improve to satisfactory conditions (Table 24).

Cumulative Effects Common to All Alternatives for Water Quality

Livestock management may affect water quality through the removal of vegetation and the trampling of stream banks which increases sediment delivery into streams. Other actions that contribute cumulative effects include recreation use and roads. Recreation use affects water quality by affecting riparian conditions through trampling of vegetation while roads affect water quality by being direct sediment sources to the streams. All of these actions increase potential turbidity.

The current project removes livestock access to zero to 94 miles of riparian systems. Livestock access has been dramatically reduced on three of the other five allotments within the watershed. One additional allotment is currently under analysis, while the last allotment is scheduled for analysis in 2004/2005. The discussion on cumulative effects to

riparian conditions summarizes Table 23 for the miles of streamcourses accessible to livestock within the watershed by alternative for this project.

Connected Disturbed Areas (CDAs) are problem areas where roads impact streams at crossing sites or in drainage bottoms. Within the watershed there are proposed improvements in the East Clear Creek watershed that would begin to decrease the impacts of roads on water quality—namely actions to decrease roads impacts in the East Clear Creek Watershed Health project on 7 miles of connected disturbed area sites, as well as the proposal on the Apache-Sitgreaves National Forests to close FR 91 and FR 40 at stream crossings. Recreation access to wet meadows would be restricted by actions in the East Clear Creek Watershed Health Project.

Additional measures are proposed to limit recreation impacts to Leonard Canyon, Dane Springs, Fred Haught Trail and McClintock Draw through proposals in the East Clear Creek Watershed Health project. Overall, the impacts from livestock, roads, and recreation within the watershed will be decreased through these projects.

Cumulative Effects of Grazing on Water Quality

Grazing can have negative effects to water quality through direct fecal contamination and indirectly through removal degrading soil and riparian condition that introduces sediments to water. Thinning can affect water quality through ground disturbance and potential sedimentation. Table 9 in Chapter 3 displays water quality data for the watershed.

The only value where water quality did not meet standards within the watershed was for turbidity *within* the elk and cattle enclosure—all other samples have shown that this watershed is within state standards for designated uses. Therefore, the effects of grazing, thinning and all projects result in water quality meeting standards set by the Arizona Department of Environmental Quality. There undoubtedly are some minor effects, but water quality meets standards with all activities that are occurring within the watershed. The use of Best Management Practices on all activities within the watershed are expected to keep water quality within standards within the watershed—therefore, there are no cumulative effects that would cause water quality to exceed standards set for the designated uses within the watershed.

AIR QUALITY

[#76]

Livestock grazing on this allotment and on the Forest does not impact the overall air quality. Short-term, site-specific impacts may occur when livestock are gathered or transported (dust and odor). Alternatives B through G would continue the short-term, isolated impacts to air quality from livestock presence, movement, and transport. All existing or potential short-term impacts from livestock grazing use would be removed from this allotment under Alternative A.

Treatment of thinning slash may add smoke and particulates to the air, on 1500 acres of thinning in Alternative C, 1000 acres of thinning in Alternative D and K, and 200 acres of thinning in Alternatives E, F, and G. No thinning or slash treatments would occur in Alternatives A or B.

Cumulative Effects

The area of analysis for this effects analysis is the watershed. Activities that will contribute to air quality effects are projects that propose prescribed burning. Table 26 displays areas that will have prescribed burning within the project area.

Table 26: Burning Acres Proposed within the East Clear Creek Watershed

PROJECT	ACRES	Percent of Watershed
Activity slash burning on Wiggins, Barber and U-Bar Timber Sales	5,937	2.4%
Prescribed burning ECC Watershed Health	19,800	8.0%
Prescribed Burning in Blue Ridge Urban Interface	5,391	2.0%
Prescribed Burning in Victorine Analysis Area	6,000	2.5%
Activity slash burning on Clear Creek TS.	2,000	0.8%
Proposed Thinning slash burning on Buck Springs Allotment	200 to 1500	0% 0.6%
TOTAL	39,128 to 40,628	15.8% to 16.4%

Alternatives C through G and K would treat thinning slash on 200 to 1500 acres, or 0.5% to 3.7% of the total treated within the watershed. This activity would add a very small amount of smoke to other planned treatments. All of these treatments would be spread over a period of about 10 years, creating very small impacts to the airshed. Air quality within the State of Arizona is strictly regulated by the Department of Environmental Quality (ADEQ). The cumulative effects of the proposed burns from this project, and the burning of any activity fuels created from this proposal are minimized through the regulation of air quality by approval from ADEQ.

WILDLIFE, THREATENED, ENDANGERED, AND SENSITIVE SPECIES

[#69, #101]

The effects of this project on wildlife, including threatened, endangered, and sensitive species, is summarized in Table 27 at the end of this discussion.

Effects of Alternative A: No Grazing

Game and Non-game Wildlife

Wildlife in general would benefit the most from the no-grazing alternative (Alt. A). There will be no livestock related direct effects due to disturbance of reproductive activities, mortality or displacement of individuals. Livestock will not indirectly affect wildlife through changes in habitat, changes in food and water availability, or through competition.

Specifically, livestock would not disturb ground and shrub-nesting birds during the breeding season, remove vegetation that provides vegetative cover and food for birds and small mammals, trample riparian vegetation, compact soils, or break down streambanks. Competition would not occur between wildlife and livestock for food and space.

No new structures would be constructed. No new fences would be constructed and old fences would be removed as they deteriorate, which would result in fewer hazards for animals getting caught in fences.

Habitat Components

There would be no effects on cover, snags, or old-growth. Existing earthen tanks would silt in over time, reducing this habitat for aquatic amphibians, waterfowl, and other wildlife.

Management Indicator Species

There would be no effects on management indicator species due to livestock or livestock management. Habitat capability would improve for turkeys and for prey for Mexican spotted owls and northern goshawks, as additional biomass and grass seed heads would be available for food resources. This increased biomass and productivity would also benefit elk and deer, which would also benefit from reduced competition for food and space. Habitat capability on the allotment may also increase for red-naped sapsucker, though continued impacts from elk would likely negate any improvements. Macroinvertebrates would benefit from reduced impacts to riparian habitats. Habitat capability would remain the same for red squirrels, pygmy nuthatch, hairy woodpecker, and cinnamon teal. These improvements would not likely be significant enough to affect Forest-wide trends.

Threatened, Endangered, Proposed and Sensitive Species (TEPS)

The elimination of livestock activity would eliminate most negative impacts to TEPS species associated with such activities. Some impacts would continue for a period of time, until improvements in soil condition and proper functioning conditions are realized. These improvement may not occur, due to continued impacts by elk. Livestock would

not have access to riparian habitats, headwater meadows, or key areas for other TEPS species, such as Mexican spotted owl, Little Colorado spinedace (see Fisheries Report), leopard frogs, or southwestern willow flycatcher habitat. There would be no direct or indirect impacts. Increases in plant biomass and residual vegetation heights would provide additional forage and cover for prey species for sensitive raptor species. Continued elk grazing in riparian habitats and meadows would continue to impact those habitats, and would likely limit improvements in conditions. There would be no effects from livestock on habitat for southwestern willow flycatchers or bald eagles. There may be a decrease in black-headed cowbird parasitism on riparian birds. Improvements in watershed conditions, including soil conditions and riparian function, would improve habitat for many sensitive species.

Priority Migratory Birds

This alternative would not affect forest structure. Open habitat would remain open and dense habitat would remain dense.

Management recommendations for the red-naped sapsucker include a strategy to manage for groups of aspen stands of different age classes. Aspen regeneration on the allotment is curtailed by ungulate grazing, especially wild ungulates such as elk and deer. Under this alternative livestock would not contribute to the lack of regeneration, however browsing by elk would continue to impact aspen regeneration. Current efforts on the District are being made to exclude all ungulates from selected stands of aspen, in order to allow young aspens to grow large enough to withstand pressure from ungulates.

A management recommendation for the MacGillivray's warbler includes managing upland and riparian soil conditions to improve water infiltration and retention. The removal of livestock may result in improved soil conditions in riparian areas, wet meadows and drainages. Improved water infiltration and retention would result in more reliable base flows and reduced peak flows that would improve riparian habitats.

A potential threat to the priority species is that of disturbance. Recommendations for the MacGillivray's warbler and red-faced warbler specify that livestock and human impacts should be timed to avoid the nesting season. Livestock would not be present to cause disturbance. There would also be no impacts to cordilleran flycatcher, purple martin, or olive-sided flycatcher.

Effects Common to Action Alternatives B, C, D, E, F, G, and K

Game and Non-game Wildlife

Livestock and livestock management directly affect wildlife through disturbance of reproductive activities, mortality of individuals, and displacement of individuals. They affect wildlife indirectly through changes in habitat, changes in food and water availability, or through competition (Kie et al. 1994). Elk and deer cause similar impacts.

Grazing impacts ground and shrub nesting birds during the breeding season, species that prefer dense ground vegetation, and those that depend on particular plants species preferred by livestock (Kie et al. 1994, Krueper 1996). Cowbirds follow livestock and parasitize open-nesting species such as flycatchers, warblers, and vireos (Morris and Thompson 1998). Small mammals, such as voles and shrews, are affected by loss of vegetative cover and reductions in foods such as grasses, forbs, seeds and insects associated with understory vegetation.

Livestock in the southwest are attracted to riparian areas, where they have their greatest impacts through removing understory vegetation, compacting soils, breaking down streambanks, and impacting riparian dependent species (Kie et al. 1994, Krueper 1996). Livestock can also dewater sites. In earthen tanks, a low level of grazing benefits amphibians by keeping the water column open, stabilizing earthen berms, and attracting insects. These benefits are easily negated when livestock numbers increase with high levels of organic waste, trampling, and reduced vegetation (Sredl 1999).

Competition between livestock and wildlife occurs at different times of the year, depending on the species of wildlife and their nutritional needs. Elk and cattle diets overlap substantially. Elk may prefer areas previously grazed by livestock if there is plant regrowth to consume (Anderson and Scherzinger 1975, Grover and Thompson 1986). Competition between deer and livestock occurs when forage is limited, especially during the winter and during droughts (Loft et al. 1991). Buck Springs is a seasonal allotment, and except for strays, should not have any cattle grazing in winter.

Fences pose varying degrees of barriers to wildlife. Elk and deer usually jump over fences, and young ones crawl under. On occasion, animals get caught in the barbed wire, and die through starvation or exposure. Elk, deer, and raptors are susceptible to being caught in barbed wire fences. Young unable to maneuver fences, become separated from their mothers. Avian mortality can occur from fencing, especially fences that cross water sources. Fences provide perches for raptors, but can also cause mortality when raptors collide with them (Kochert et al. 1988). Fence design and height can be mitigated to reduce the negative effects of fences. However, these wildlife specifications do not eliminate the problems. There are approximately 90 miles of existing fences. The grazing alternatives propose construction of 11 miles to 34 miles of new fences. The degree of effect on wildlife species increases with the increase in miles of fence.

Corrals are typically small in size and constructed of logs or boards. These would have negligible to no effects to wildlife. Waterlots restrict wildlife access, but are not expected to eliminate water sources, though there may be some problems in very dry years when some water sources dry up. Mitigation measures include making waterlots at least five acres in size and wiring the gates open when not needed for livestock management. Other effects would be the same as those for fences. The only effects posed by drylots would be those imposed by additional fencing.

Earthen stockpounds have altered the distribution of water on the allotment, with no area greater than one mile from a water source. The increased availability of water is

beneficial to most wildlife. Transient bald eagles, osprey, many waterfowl, and other birds find fish in some ponds. Aquatic amphibians (leopard frogs, tiger salamanders) and aquatic associated reptiles (wandering gartersnakes) find habitat. The improved water distribution allows for improved distribution of livestock. Livestock directly affect aquatic species using these tanks through removal of vegetation, compaction of soil, disturbance of egg masses, and reduced water quality (Sredl 1999). Maintenance of dirt tanks may impact habitat for certain species. Depending on the time of year the tanks are maintained, effects to amphibians, waterfowl, and other wetland-dependent species may occur.

Habitat components

Historic livestock grazing, along with fire suppression has contributed to increased regeneration of pine and mixed conifer tree species. Climatic conditions have also contributed to heavy regeneration. These stands provide hiding cover and thermal cover for wildlife, and reduced grass and forb production. Livestock numbers have since decreased to align with forage capacity of the allotment. Action alternatives propose pre-commercial thinning of pockets of thick regeneration in areas where dense sapling stands make livestock gathering very difficult, reducing hiding cover by 200 to 1500 acres. Due to the heavy regeneration that has occurred over the past 10 years, there would be sufficient cover for wildlife on the allotment after treatments.

Livestock management would have no affect on snags or old-growth on the allotment.

Livestock impact water resources through reduction of riparian vegetation, compaction of soils, breakdown of banks, and decreased water quality. Springs are especially vulnerable to impacts through the removal of vegetation and siltation due to animals walking and wallowing in them.

Management Indicator Species

Mexican spotted owl and northern goshawk are discussed under Threatened, Endangered, and Sensitive Species.

Turkeys would avoid areas with concentrations of livestock. At any one time, most of the allotment would be without livestock. Livestock reduce the biomass and seeding potential of grasses, which are important as a food source and cover for turkeys. Livestock would impact springs that provide important water and food sources.

Livestock would not impact snags or tree trunks for pygmy nuthatches. They also would not affect the availability of insects as food. There would be no impacts to Abert's squirrels, red squirrels, or hairy woodpeckers, or their habitats.

Livestock grazing can reduce fine fuels that carry fire and help to regenerate aspen. Grazing on the allotment, especially by elk, has virtually eliminated the young sprouts. Livestock may contribute to this lack of young aspen trees, which would affect red-naped sapsuckers as the older decadent trees die out.

Mule deer sometimes avoid concentrations of livestock, and move to unoccupied pastures (Holecheck 1982). Livestock may compete with deer during late summer or in periods of drought, when they feed more on browse species that are the main diet of deer. Elk and cattle sometimes compete for forage, especially in the spring and summer when elk rely heavily on grass forage. Elk often enter a pasture after cattle have left, in order to feed on the succulent regrowth (Grover and Thompson 1986).

Livestock grazing and management would not affect migration habitat for cinnamon teal in the steep walled reservoirs.

Macroinvertebrates are found in the waters of streams, ponds, and wetlands. Livestock affect macroinvertebrate communities by changing water quality through the deposition of animal waste products, removal of riparian vegetation, and the breakdown of streambanks.

The action alternatives may make slight changes in habitat capability for a few MIS on the projects area, however, these changes would not affect Forest-wide habitat or population trend.

Threatened, Endangered, Proposed and Sensitive Species

Grazing would occur in occupied Mexican spotted owl (MSO) habitat. In general, Protected Activity Centers (PACs) and protected habitats would receive light utilization rates because of high canopy closures, multistoried conditions, and high basal areas that limit understory production; and because of association with steep slopes, cliffs and distance from large meadows. In most PACs, grazing would occur on 10 to 50 percent of the area. One PAC would experience grazing on 90-100% of the area.

Restricted habitat includes mixed conifer and pine-oak forest types. Typically, mixed conifer grows in dense stands that produce little forage, and receive light grazing pressure. Pine-oak stands are more open and receive light to moderate use. Grazing reduces biomass and productivity that decrease cover and food resources for prey and fine fuels for low intensity fires (Kie et al. 1994). Degrees of utilization are defined as the following:

0-10% utilization:	No use
11-25% utilization:	Light use
26-50% utilization:	Moderate Use
51-70% utilization:	Heavy Use
71+% utilization:	Extreme Use

Meadows are considered key areas for MSO. Livestock and wildlife are attracted to wet meadows. Unfenced accessible riparian or wetland habitats generally experience 60-80 percent utilization by a combination of wildlife and livestock, with negative effects to soils, plant vigor and regeneration, and prey populations. No major meadows (> 5 acres) are within known PACs, limiting potential impacts to MSOs, though small openings within PACs would be impacted.

The majority of fence and cattleguard building and maintenance would occur outside of MSO PACs, though up to 3.75 miles of proposed fence lie within PACs. Construction of new fences, waterlots, road closures, and cattle guards would not occur in occupied PACs during the breeding season to minimize disturbance to breeding owls. This restriction may be lifted if owls are non-breeding. No activities that facilitate concentration of cattle

such as trailing, gathering, and placement of waters, salt and nutrient supplements would occur in PACs.

Livestock grazing would generally not affect wintering bald eagles. Livestock would have no effect on recruitment roosts or perch trees. There are no nesting eagles on the allotment or direct effects for breeding bald eagles or breeding habitat. Eagles are not present when livestock are on the allotment, and there is no potential for disturbance to roosting birds. If a roost is located on the allotment, a seasonal restriction on construction activities would be implemented.

Healthy riparian and watershed systems promote healthy prey populations. During the winter months, bald eagles feed on fish, waterfowl, and carrion, especially gut piles and injured animals left by hunters. The allotment exhibits the characteristics required for healthy prey populations for eagles, including healthy soil conditions and plant communities.

The nearest known suitable southwestern willow flycatcher habitat occurs greater than ten miles from the allotment and occupied habitat is greater than 20 miles away. The potential SWWF habitat on the allotment is topographically excluded from livestock grazing. Indirect impacts to potential habitat due to grazing affects on watershed condition in headwater meadows and riparian drainages are possible and vary by alternative.

Personnel would survey potential habitat to determine if habitat meets suitability requirements. If potential habitat becomes suitable, surveys would be conducted for flycatcher occupancy annually. If these sites are determined to have breeding flycatchers within 5 miles of the allotment, the Forest would consult with the US Fish and Wildlife Service and initiate actions to reduce or eliminate cowbird parasitism, as described under Mitigation Measures in Chapter 5.

Impacts to Little Colorado spinedace are addressed in the Aquatics Resources Section.

The Chiricahua leopard frog is believed to be extirpated from the allotment. Potential habitat would be impacted by activities that degrade riparian habitats. As leopard frogs have been extirpated from many riparian habitats due to non-native fish and crayfish and habitat degradation, they have found some stock tanks to be suitable habitat. Most tanks do not provide the abundant aquatic and terrestrial vegetation, undercut banks, and good water quality necessary for good habitat. Tanks that provide adequate habitat may become less suitable through the removal of aquatic vegetation, bank trampling, and the fecal contamination.

Livestock grazing would not have a direct effect on nesting peregrine falcons. Nesting habitat is typically located on cliffs inaccessible to cattle. No eyries are known to occur within one mile of the allotment.

Livestock grazing can affect prey abundance. Of the primary prey species, only doves feed predominately on seeds that could be decreased through high grazing intensities. On the allotment, pastures are used for up to 45 days per year, varying time of use on a yearly basis. Utilization standards ensure that grazing intensities are light to moderate. Therefore grazing would not affect vulnerability of these avian prey species.

Northern goshawks use areas with dense canopy cover for nesting, where cattle utilization of the forage is low to moderate. Grazing does not affect larger trees used for nesting. Activities that concentrate livestock are restricted in nest stands, to minimize disturbance.

Livestock grazing can affect prey abundance. Goshawks hunt primarily in forested conditions where cattle utilization of the forage is low to moderate, also using openings in the forest where cattle utilization is high. Goshawks feed on medium sized birds and mammals, switching to common species if one becomes rare. Pastures are used for up to 45 days per year, varying time of use on a yearly basis. It is unlikely that grazing would affect vulnerability of these prey species.

Many of the sensitive species in the Buck Springs Allotment area are riparian-dependent, including northern leopard frogs, Arizona southwestern toads, and narrow-headed gartersnakes. Habitat heterogeneity is an important component, providing shallow water with emergent vegetation for breeding, along with deeper water for escaping predators. A low level of grazing may be beneficial by keeping the water column open, by compacting the soil and stabilizing earthen berms, and by adding low levels of organic waste that attract insects. Cattle prints may provide deep mud cracks for adult frogs seeking cover from predation and desiccation.

Excessive grazing may negatively impact riparian populations by removing bankside cover, trampling egg masses, and adding high levels of organic wastes. Egg masses are usually laid in the shallows attached to emergent vegetation or debris and are the most sensitive life stage to trampling (Sredl 1999). Livestock can dewater occupied sites. Maintenance of stock ponds on the allotment has the potential to directly impact individuals, eggs, and tadpoles.

Of the sensitive plant species, the Mogollon thistle is the only one known from the allotment that might be impacted by livestock grazing on the plants. It has few spines and is found in association with abundant grass and riparian vegetation. It receives moderate grazing pressure and is likely grazed with the surrounding vegetation. These impacts are especially probable in dry years, when forage is limited. Although they have not been found on the allotment, the Mt. Dellenbaugh sandwort, Rusby's milkvetch, Flagstaff pennyroyal, Arizona sneezeweed, Eastwood alum root, and Flagstaff beardtongue could be impacted by grazing, if present.

There are six insects on the new Regional Forester's Sensitive Species List that could have potential habitat. If located on the allotment, all six could potentially be impacted by livestock grazing.

Priority Migratory Birds

The olive-sided flycatcher and the purple martin prefer open pine habitats, while Cordilleran flycatcher prefers dense canopies, red-faced warbler prefers dense mid-stories, and MacGillivray's warbler prefers dense understories. Purple martin, olive-sided flycatcher, and red-naped sapsucker associate with snags. MacGillivray's warbler and red-faced warbler are tied to varying degrees to riparian drainages (Latta et al. 1999). Therefore it is most important to maintain diverse structural components in each habitat type. In general, livestock management would not affect forest structure. Open habitat would remain open and dense habitat would remain dense. Pre-commercial thinning would decrease dense habitats on 200 to 1500 acres.

Several of the species require large snags or trees for nesting or perching. As discussed above, livestock management would have no effect on snags or recruitment snags. Livestock would not impact snags or tree trunks for pygmy nuthatches. They also would not affect the availability of insects as food. Livestock occasionally trample tree regeneration. They also reduce grass cover that results in increased regeneration. Therefore, regeneration is affected both positively (reduction of ground cover) and negatively (trampling) by livestock, and for this analysis it is asserted that overall regeneration are minimally affected by livestock. Therefore, there would be no impacts to purple martin, Cordilleran flycatcher, or olive-sided flycatcher, or their habitats.

Management recommendations for the red-naped sapsucker include a strategy to manage for groups of aspen stands of different age classes. Aspen regeneration on the allotment is curtailed by ungulate grazing, especially wild ungulates such as elk and deer. Livestock are also known to eat young aspen shoots, and contribute to the lack of regeneration.

A management recommendation for the MacGillivray's warbler includes managing upland and riparian soil conditions to improve water infiltration and retention. Alternatives would allow livestock access to varying amounts of riparian habitats and headwater meadows. Most alternatives would result in improvements in soil or riparian conditions, and a few may result in continued degradation.

A potential threat to the priority species is that of disturbance. Recommendations for the MacGillivray's warbler and red-faced warbler specify that livestock and human impacts should be timed to avoid the nesting season (Latta et al. 1999). Livestock can disrupt nesting and cause reproductive failure in birds through disturbance of nests and nestlings. They may trample nests of ground-nesting birds or bump into shrub-nesting species. Red-faced warblers are aggressive nest protectors and are very sensitive to disturbance, and may abandon their nests when disturbed (Martin and Barber 1995). Nestlings may also be jostled and fall out of the nests. These two species are primarily associated with steep slopes and riparian habitats. There would be varying degrees of access to canyons and riparian habitats, resulting in some potential disturbance. Tree nesting or cavity nesting species, such as Cordilleran flycatcher, red-naped sapsucker, olive-sided flycatcher, and purple martin are much less likely to be disturbed by livestock.

Though the Buck Springs Range Allotment management would be limited in the extent of the impacts to these species, there are also no opportunities to actively improve habitat. Measures would be taken to mitigate potential adverse effects.

Additional Effects of Alternative B: Current Management

Game and Non-game Wildlife

This alternative has the greatest potential for impacts to wildlife. Livestock would have access to 95 miles of riparian stream reaches where they would have their greatest impacts, potentially resulting in small areas with compacted soils, broken down streambanks, minimal understory vegetation, and impacts to riparian dependent species. There would be the highest levels of competition between livestock and wild ungulates. A total of 178 acres of meadows would be accessed by livestock and would likely receive high utilization levels, despite utilization standards. Some small mammals and grassland birds would be affected by the lack of hiding cover and food resources in meadows and would exist at low population levels.

No additional fencing is proposed, so this alternative poses no additional fence hazards and therefore has the least fence imposed impacts of all alternatives, except for Alternative A.

Habitat Components

There will be no effects on cover, snags, or old-growth. There would be no change in water sources; earthen tanks would continue to be maintained and livestock may dewater some sites during drought periods. Livestock impacts to springs would continue as they remove riparian vegetation, break-down stream banks, and degrade water quality in earthen tanks and some streams, affecting riparian dependent species.

Management Indicator Species

Habitat capability would remain unchanged for most MIS under this alternative. One exception is that capability for the red-naped sapsucker may decline over time on the allotment and throughout the Coconino National Forest as aspen regeneration is absent and decadent trees die and fall. However, this is likely to occur regardless of livestock grazing, due to browsing by elk.

The greatest impacts to turkeys would occur under this alternative. Livestock would graze the most acres, and reduce cover and seedheads on the most acres. Livestock would impact the greatest number of springs that provide important water and food sources.

The highest level of competition would occur between livestock and wild ungulates (mule deer and elk). This alternative allows limited livestock access to more riparian

habitat than other alternatives, and has the most potential for impacts to macroinvertebrates.

Mexican spotted owls and northern goshawks are discussed in the following section.

Threatened, Endangered, Proposed and Sensitive Species (TEPS)

Grazing would continue in all 21 PACs in the allotment, with grazing occurring in 10% to 100% of individual PACs. Meadows are considered key areas for Mexican spotted owls. Though no large meadows are found in PACs, continued heavy use of the meadows would be expected to keep prey species such as voles at low densities in those areas. Continued degradation of small meadows within PACs would be likely. Residual forage in other key areas in pine and pine-oak habitats would likely meet or be slightly below acceptable levels, since spotted owl areas tend to have dense canopies, with pine-oak generally in the uplands. Areas on slopes would likely be within acceptable levels as they tend to get light use by livestock. No improvements or additional fencing is proposed, but would likely be imposed through endangered species consultations. There would be no construction activities within PACs. Utilization within PACs would continue to be uneven, though efforts to keep utilization within 30% would retain sufficient herbaceous ground cover for prey.

Livestock currently do not access potential habitat for southwestern willow flycatchers. Continued watershed problems would cause minor indirect effects to potential habitat, through high peak flows that scour vegetation.

Grazing would occur in six northern goshawk post-fledgling-family areas (PFAs) and nest stands. Livestock gathering activities would not occur in known nest stands, and there would be no disturbance to nesting birds. No construction activities are planned. Livestock grazing would reduce biomass that provides cover and food for mammalian prey species, with some potential impacts to reproduction.

Current management would allow limited livestock access to 95 miles of important riparian habitats and 178 acres of headwater meadows, limited to some degree by riders and topography. Livestock would trample and remove riparian vegetation, break down stream banks, and impact small areas of riparian habitats used by listed species. Soil conditions in headwater meadows would continue to degrade, through heavy use by livestock and wildlife. Downstream habitats would also continue to degrade. The Proper Functioning Condition of streams would remain static or degrade. These conditions would affect sensitive fish, leopard frogs (including the proposed Chiricahua leopard frog), toads and gartersnakes. All other action alternatives exclude livestock from some of these areas.

The Mogollon thistle would be impacted by livestock grazing on the plants, especially in dry years when forage is limited. Five acres of occupied thistle habitat would be grazed.

Priority Migratory Birds

Alternative B for livestock management would not affect general forest structure. Open habitat would remain open and dense habitat would remain dense. However, combined grazing by livestock and wildlife would result in decreases in regeneration of aspen, maple, and shrub species, which provide nesting habitat for some birds.

A management recommendation for the MacGillivray's warbler includes managing upland and riparian soil conditions to improve water infiltration and retention. Alternative B would allow livestock access to 95 miles of riparian habitats and 178 acres of headwater meadows that would not improve soil or riparian conditions and may result in continued degradation.

This alternative allows the greatest access to riparian habitats (95 miles) and would have the highest level of impacts to MacGillivray's warbler and red-faced warbler through disturbance and habitat alteration.

Additional Effects of Alternative C: Proposed Action

Game and Non-game Wildlife

Overall, Alternative C would have fewer impacts to wildlife, threatened and endangered species, and habitats than Alternative B, but more impacts than Alternatives D, E, F, G and K. Livestock would have limited access to 82 miles of riparian stream reaches where they would impact small areas through removing, understory vegetation, compacting soils, breaking down streambanks, and impacting riparian dependent species. There would be moderate levels of competition between livestock and wild ungulates.

This alternative proposes 22 miles of additional fencing, which is exceeded only by Alternative F. This would result in a total of 112 miles of fencing on the allotment, creating hazards for many species. Two corrals, three waterlots, and one drylot are proposed, which add to the amount of fencing on the allotment.

Habitat Components

Hiding cover would be reduced on 1,500 acres that would be pre-commercially thinned. Animals near Road FR137 would be more susceptible to disturbance and poaching. Overall, adequate hiding cover would exist throughout the allotment. Fred Haught Spring would be protected from livestock as well as deer and elk. Portions of 10 tanks would be excluded to provide habitat for frogs.

Management Indicator Species

Habitat capability would remain unchanged for most MIS under this alternative. One exception is that capability for the red-naped sapsucker may decline over time on the allotment and throughout the Forest as aspen regeneration is absent and decadent trees

die and fall. However, this is likely to occur regardless of livestock grazing, due to browsing by elk. The Aberts squirrel may realize a slight increase due to 1000 acres of precommercial thinning. The remaining trees would grow faster, potentially increasing habitat capability in the future.

One spring and 394 acres of wet meadows would be protected from livestock, providing important habitat for turkeys.

A moderate level of competition would occur between livestock and wild ungulates (mule deer and elk).

This alternative allows limited livestock access to less riparian habitat than Alternative B and more than Alternatives D, E, F, and G and has the potential for impacts to macroinvertebrates.

Mexican spotted owls and goshawks are discussed in the following section.

Threatened, Endangered, Proposed and Sensitive Species (TEPS)

Grazing would continue in all 21 PACs in the allotment, with grazing occurring in 10% to 100% of individual PACs. Meadows are considered key areas for Mexican spotted owls. No large meadows occur within PACs, though continued heavy use of 18 acres of meadows would impact prey species in those areas. Continued degradation of small meadows within PACs would be likely. Residual vegetation in other key areas in pine and pine-oak habitats would likely meet or be slightly below acceptable levels, since spotted owl areas tend to have dense canopies, with pine-oak generally in the uplands. Areas on slopes would likely be within acceptable levels as they tend to get light use by livestock. There are 22 miles of additional fencing proposed, and 2 corrals, 3 waterlots and 1 drylot. Two miles of fence would be constructed in MSO PACs, with a seasonal restriction on construction to ensure that breeding owls are not disturbed. Portions of two roads that are in PAC's would be closed with this fencing (9713G and 9737Y) which would eliminate future driving disturbance on these roads. Utilization levels would be kept within 30% in PACs, allowing for adequate cover and food for prey species.

Livestock currently do not access potential habitat for southwestern willow flycatchers. Protection of 394 acres of headwater meadows and 13 more miles of riparian habitat than Alternative B would allow for some improvement in watershed and soils conditions that may result in slow, long-term improvement in potential flycatcher habitat.

Grazing would occur in six northern goshawk PFAs and nest stands. Gathering activities would not occur in known nest stands, and there would be no disturbance to nesting birds. A quarter mile of construction activities are planned within a PFA. Livestock grazing would reduce biomass that provides cover and food for mammalian prey species, with some potential impacts to reproduction.

Current management would allow limited livestock access to 82 miles of important riparian habitats and 18 acres of headwater meadows, limited to some degree by riders and topography. Adherence to utilization standards would minimize impacts due to livestock removing riparian vegetation, and impacting riparian habitats for listed species. Soils conditions in headwater meadows would continue to degrade on 18 acres and would improve on 394 acres. The Proper Functioning Condition of 7 miles of non-functional streams would improve in protected wet meadows and in 7 miles of functional-at-risk streams, and would likely remain static in 28 miles of functional-at-risk streams. These conditions would continue to impact habitat for sensitive fish, leopard frogs (including the threatened Chiricahua leopard frog), toads and gartersnakes in some stream habitats. Portions of 10 earthen tanks would have livestock excluded which would have the highest benefits to sensitive fish, leopard frogs (including the threatened Chiricahua leopard frog), toads and gartersnakes.

The Mogollon thistle would be impacted by livestock grazing on the plants, especially in dry years when forage is limited. Five acres of occupied thistle habitat would be grazed.

Effects to Priority Migratory Birds

Alternative C for livestock management would reduce hiding cover on 1500 acres. This change in forest structure would slightly reduce habitat for shrub nesting birds but would not affect priority migratory birds.

A management recommendation for the MacGillivray's warbler includes managing upland and riparian soil conditions to improve water infiltration and retention. Alternative C would exclude livestock access to an additional 13 miles of riparian habitats and 160 acres of headwater meadows and allow access to 82 miles of riparian habitats and 18 acres of headwater meadows. These actions would improve soil and riparian conditions on 394 acres of meadows and would likely result in improved conditions on 7 miles of functional-at-risk streams.

This alternative allows the second highest access to riparian habitats (82 miles) and would have potential impacts to MacGillivray's warbler and red-faced warbler through disturbance and habitat alteration.

Additional Effects of Alternative D and K: Herding

Game and Non-game Wildlife

Overall, Alternatives D and K are identical for environmental consequences. They have the potential for substantially decreasing impacts due to livestock management, but it also has a high risk for continued impacts. Livestock would have access to 52 miles of riparian stream reaches, restricted through herding. If herding is successful in keeping livestock away from riparian reaches, substantial improvements would be possible. If herding is only partially successful, livestock would cause some impacts, such as

reducing riparian vegetation, compacting soils, breaking down streambanks, and impacting riparian dependent species.

These alternatives propose about 13.5 miles of additional fencing, which is more than Alternatives B and G and less than Alternatives C, E, and F. This would result in 104 miles of fencing on the allotment, creating hazards for many species. One difference between Alternatives D and K is that K substitutes temporary fencing for 2.1 miles of permanent fencing. There would be slightly fewer hazards associated with Alternative K. Up to three corrals, 12 waterlots, and six drylots would be constructed, which add to the amount of fencing on the allotment.

Habitat Components

Hiding cover would be reduced on 1,000 acres that would be pre-commercially thinned. Animals near Road FR137 would be more susceptible to disturbance and poaching. Overall, adequate hiding cover exists throughout the allotment. Aspen Spring would be protected from livestock as well as deer and elk. The second difference between Alternatives D and K is that D excludes portions of six tanks to provide habitat for frogs, while K does not.

Management Indicator Species

Habitat capability would remain unchanged for most MIS under this alternative. One exception is that capability for the red-naped sapsucker may decline over time on the allotment and throughout the Forest as aspen regeneration is absent and decadent trees die and fall. However, this is likely to occur regardless of livestock grazing, due to browsing by elk. The Aberts squirrel may realize a slight increase due to 1,000 acres of precommercial thinning. The remaining trees would grow faster, potentially increasing habitat capability in the future.

One spring and 368 acres of wet meadows would be protected from livestock, providing important habitat for turkeys. Some of these protections would be structural exclosures, while a few meadows would be protected by strategically placed drift fences with herders ensuring that livestock stay out of the meadows. The remaining 44 acres would be protected through herding, which has risks of not being adequately implemented.

A moderate level of competition would occur between livestock and wild ungulates (mule deer and elk).

If herding is successful, these alternatives may provide the greatest protection to riparian habitat and wet meadows. However, there is risk of impacts to riparian streams that cannot be predicted. Therefore, they have high risk for potential impacts to macroinvertebrates.

Mexican spotted owls and northern goshawks are discussed in the following section.

Threatened, Endangered, Proposed and Sensitive Species (TEPS)

Grazing would continue in all 21 PACs in the allotment, with grazing occurring in 10% to 100% of individual PACs. As described above, herding may actually reduce overall livestock utilization in PACs, depending on the success and degree of implementation. Meadows are considered key areas for Mexican spotted owls, though no large meadows occur in PACs. Herding may limit impacts to small meadows within PACs. Residual vegetation in other key areas in pine and pine-oak habitats would likely meet acceptable levels, since spotted owl areas tend to have dense canopies, with pine-oak generally in the uplands. Areas on slopes would likely be within acceptable levels as they tend to get light use by livestock. One mile of fencing is proposed within a PAC, construction activities would take place outside of the breeding season. One fence will limit access to a PAC by fencing the 9713G road. Utilization levels would be kept within 30% in PACs, allowing for adequate cover and food for prey species.

Livestock currently do not access potential habitat for southwestern willow flycatchers. Fences would protect 368 acres of headwater meadows with fencing and drift fences and 13 additional miles of riparian habitat. Herding may protect additional meadows and riparian habitats and may allow for substantial improvements in watershed and soils conditions. However, herding must be employed strictly throughout the grazing season for these improvements to occur.

Grazing would occur in six northern goshawk PFAs and nest stands. Gathering activities would not occur in known nest stands, and there would be no disturbance to nesting birds. One mile of fence and one waterlot are planned within a PFA. Livestock grazing may reduce biomass that provides cover and food for mammalian prey species, with some potential impacts to reproduction.

Herding would be used to further limit livestock access to 82 miles of important riparian habitats and 44 acres of headwater meadows. If successful, soils conditions in headwater meadows would improve on 412 acres. The Proper Functioning Condition of streams would improve in protected wet meadows, and in functional-at-risk streams. Conditions may improve for sensitive fish, leopard frogs (including the threatened Chiricahua leopard frog), toads and gartersnakes in stream habitats. In Alternative D, portions of 6 earthen tanks would have livestock excluded which would have benefits to sensitive fish, leopard frogs (including the threatened Chiricahua leopard frog), toads and gartersnakes in tanks. There are risks that herding may not be successful, and impacts to streams and meadows would occur instead of improvements.

Herding may reduce livestock grazing on the Mogollon thistle.

Priority Migratory Birds

Alternatives D and K for livestock management would reduce hiding cover on 1000 acres. This change in forest structure would slightly reduce habitat for shrub nesting birds but would not affect priority migratory birds.

A management recommendation for the MacGillivray's warbler includes managing upland and riparian soil conditions to improve water infiltration and retention. Alternatives D and K would rely on herding to limit livestock access to 82 miles of riparian habitats and 44 acres of headwater meadows. Herding may limit potential impacts to MacGillivray's warbler and red-faced warbler through disturbance and habitat alteration.

If herding is abandoned temporarily or permanently, only the pastures designated in Alternative E would be used. The effects would then be similar to that alternative.

Additional Effects of Alternative E: Northern Pastures

Game and Non-game Wildlife

Alternative E grazes the fewest total acres of any of the grazing alternatives. Alternative G would graze fewer acres in any one year. Overall, only Alternative G would have fewer impacts to wildlife, threatened and endangered species, and habitats. Livestock would have limited access to 51 miles of riparian stream reaches where they may impact small areas of riparian streams through a reduction in understory vegetation, compaction of soils, and impacts to riparian dependent species. There would be low to moderate levels of competition between livestock and wild ungulates.

This alternative proposes 18 miles of additional fencing, resulting in 108 miles of fencing on the allotment, creating additional hazards for many species. Some fences would be removed from the ungrazed southern pastures, and fence density would be very high in the northern pastures. Four corrals, six waterlots, and two drylots are proposed, which add to the amount of fencing on the allotment.

Habitat Components

Hiding cover would be reduced on 200 acres that would be pre-commercially thinned. Overall, this reduction is negligible and adequate hiding cover exists throughout the allotment. Three springs would be protected from livestock as well as deer and elk, and portions of 3 tanks would be excluded to provide frog habitat.

Management Indicator Species

Habitat capability would remain unchanged for most MIS under this alternative. One exception is that capability for the red-naped sapsucker may improve on the allotment over time as livestock would not be using many areas with aspen. However, continued declines in aspen are likely to occur regardless of livestock grazing, due to browsing by elk.

Three springs and 412 acres of wet meadows would be protected from livestock, providing important habitat for turkeys. There would be no impacts to wet meadows larger than 5 acres. Southern pastures would likely have greater seed production, improving habitat for turkeys.

A low to moderate level of competition would occur between livestock and wild ungulates (mule deer and elk) due to several pastures being rested.

This alternative allows limited livestock access to the least riparian habitat and has the second lowest potential for impacts to macroinvertebrates of the grazing alternatives (Alternative G is lower).

Mexican spotted owls and northern goshawks are discussed in the following section.

Threatened, Endangered, Proposed and Sensitive Species (TEPS)

Grazing would continue in 20 PACs in the allotment (one not grazed), with grazing occurring in 10% to 100% of individual PACs. Meadows are considered key areas for Mexican spotted owls, and all large meadows would be protected from livestock. Elk may be displaced to spend more time in the southern pastures and meadows. Few small meadows exist in the pastures that would be grazed. Prey species such as voles would likely increase in numbers. Residual vegetation heights in other key areas in pine and pine-oak habitats would likely meet or be slightly below acceptable levels, since spotted owl areas tend to have dense canopies, with pine-oak generally in the uplands. Areas on slopes would likely be within acceptable levels as they tend to get light use by livestock. A total of 3.75 miles of fencing is proposed in owl PACs, and construction would take place outside of the breeding season. One fence on the 9713G road would close the end of the road in the PAC. Utilization levels would be kept within 30% in PACs, allowing for adequate cover and food for prey species.

Livestock currently do not access potential habitat for southwestern willow flycatchers. Protection of all 412 acres of headwater meadows and an additional 44 miles of riparian habitat would allow for substantial improvement in watershed and soils conditions, resulting in improvements in potential flycatcher habitat.

Grazing would occur in four northern goshawk PFAs and nest stands, with no grazing in two PFAs. Gathering activities would not occur in known nest stands, and there would be no disturbance to nesting birds. No construction activities are planned within a PFA. Livestock grazing would reduce biomass that provides cover and food for mammalian prey species, with some potential impacts to reproduction.

Current management would allow limited livestock access to 51 miles of riparian habitats and no large headwater meadows, limited to some degree by riders and topography. Livestock may trample and remove some small areas of riparian vegetation and impact riparian habitats for listed species. Soils conditions in headwater meadows would improve. The Proper Functioning Condition of streams would improve in protected wet meadows, in functional-at-risk streams, improving conditions for sensitive fish, leopard frogs (including the threatened Chiricahua leopard frog), toads and gartersnakes in stream habitats. Portions of 3 earthen tanks would have livestock excluded which would have benefits to sensitive fish, leopard frogs (including the threatened Chiricahua leopard frog), toads and gartersnakes in tanks.

The Mogollon thistle would be protected from grazing by livestock.

Priority Migratory Birds

Alternative E for livestock management would reduce hiding cover on 200 acres. This negligible change in forest structure would slightly reduce habitat for shrub nesting birds but would not affect priority migratory birds.

A management recommendation for the MacGillivray's warbler includes managing upland and riparian soil conditions to improve water infiltration and retention. Alternative E would reduce access to an additional 44 miles of riparian habitats and allow livestock access to 51 miles. No headwater meadows would be grazed, improving soil and riparian conditions on 412 acres of meadows. Riparian conditions would likely improve in 12 miles of non-functional and 21 miles of functional-at-risk streams.

This alternative eliminates access to 44 miles of riparian habitats, reducing potential impacts to MacGillivray's warbler and red-faced warbler through disturbance and habitat alteration.

Additional Effects of Alternative F: Rest-Rotation

Game and Non-game Wildlife

Alternative F grazes the second largest number of acres but, on a yearly basis, would graze the second smallest number of acres. Pastures would be grazed every other year. Overall, Alternatives E and G would have fewer impacts to wildlife and habitats. Livestock would have limited access to 74 miles of riparian stream reaches where they may impact small sections of riparian streams through a reduction in understory vegetation, compaction of soils, and impacts to riparian dependent species. However, these impacts would occur only every other year, allowing for riparian recovery that may mitigate grazing effects. There would be low levels of competition between livestock and wild ungulates.

This alternative proposes 33 miles of additional fencing, resulting in the highest level of fencing of all alternatives (123 miles), creating additional hazards for many species. Four corrals, seven waterlots, and three drylots are proposed, which add to the amount of fencing on the allotment.

Habitat Components

Hiding cover would be reduced on 200 acres that would be pre-commercially thinned. Overall, this reduction is negligible and adequate hiding cover exists throughout the allotment. One earthen tank would be constructed to replace an excluded stream water source. Three springs would be protected from livestock as well as deer and elk.

Management Indicator Species

Habitat capability would remain unchanged for most MIS under this alternative.

Three springs and 394 acres of wet meadows would be protected from livestock, providing important habitat for turkeys. The rest of about one-half of the allotment per year may result in increases in seed production, which would increase habitat capability for turkeys.

A low level of competition would occur between livestock and wild ungulates (mule deer and elk) due to half the allotment being rested each year.

This alternative allows limited livestock access to 74 miles of riparian habitats with about half of that occurring on a yearly basis. It has a low potential for impacts to macroinvertebrates.

Mexican spotted owls and northern goshawks are discussed in the following section.

Threatened, Endangered, Proposed and Sensitive Species (TEPS)

Grazing would continue in 21 PACs in the allotment, though portions of 7 would be grazed in even years, and portions of 16 would be grazed in odd years. Grazing every other year would reduce impacts to individual PACs, allowing for larger areas of most PACs ungrazed in any one year. Overall, grazing would occur in 10% to 100% of individual PACs. Meadows are considered key areas for Mexican spotted owls, and large meadows would be protected from livestock. Elk may be displaced to spend more time in the southern pastures and meadows. Few small meadows exist in the pastures that would be grazed. Prey species such as voles would likely increase in numbers. Residual vegetation in other key areas in pine and pine-oak habitats would likely meet acceptable levels, since spotted owl areas tend to have dense canopies, with pine-oak generally in the uplands. Areas on slopes would likely be within acceptable levels as they tend to get light use by livestock. A total of 3 miles of fencing is proposed in owl PACs, and construction would take place outside of the breeding season. One fence on the 9713G road would close the end of the road in the PAC. Utilization levels would be kept within 35% in PACs (grazed every other year), allowing for adequate cover and food for prey species.

Livestock currently do not access potential habitat for southwestern willow flycatchers. Protection of 394 acres of headwater meadows and an additional 21 miles of riparian habitat would allow for improvements in watershed and soils conditions, resulting in improvements in potential flycatcher habitat.

Grazing would occur in six northern goshawk PFAs and nest stands, with five PFAs grazed during even years and 2 grazed during odd years. Four PFAs would only be grazed every other year, reducing overall impacts. Gathering activities would not occur in known nest stands, and there would be no disturbance to nesting birds. Construction activities are planned for 1.25 miles of fence within a PFA outside of the breeding season. Livestock grazing would reduce biomass that provides cover and food for mammalian prey species, with some potential impacts to reproduction.

Alternative F would allow limited livestock access to 74 miles of riparian habitats and 18 acres of large headwater meadows, every other year and limited to some degree by riders. Livestock may trample and remove some riparian vegetation, and impact riparian habitats for listed species, on a very limited basis. Soils conditions in headwater meadows would

improve. The Proper Functioning Condition of 7 miles of non-functioning streams would improve in protected wet meadows and would likely improve in 9 to 34 miles of functional-at-risk streams, improving conditions for sensitive fish, leopard frogs (including the threatened Chiricahua leopard frog), toads and gartersnakes in stream habitats. Portions of 8 earthen tanks would have livestock excluded which would have benefits to sensitive fish, leopard frogs (including the threatened Chiricahua leopard frog), toads and gartersnakes in tanks.

The Mogollon thistle would be grazed by livestock on five acres, but only every other year.

Priority Migratory Birds

Alternative F for livestock management would reduce hiding cover on 200 acres. This negligible change in forest structure would slightly reduce habitat for shrub nesting birds but would not affect priority migratory birds.

A management recommendation for the MacGillivray's warbler includes managing upland and riparian soil conditions to improve water infiltration and retention. Alternative F would eliminate access to an additional 21 miles of riparian habitats, and allow livestock access to 74 miles every other year. Eighteen acres of headwater meadows would be grazed, improving soil and riparian conditions on 394 acres of meadows. Riparian conditions would likely improve in 12-14 miles of non-functional streams and in 21-34 miles of functional-at-risk streams.

This alternative eliminates access to 21 miles of riparian habitats and reduces access to another 35 miles, reducing potential impacts to MacGillivray's warbler and red-faced warbler through disturbance and habitat alteration.

Additional Effects of Alternative G: Northern Pastures with Rest-Rotation

Game and Non-game Wildlife

Alternative G grazes the smallest number of acres per year, and has the least grazing impacts to wildlife, threatened and endangered species, and habitats. Livestock access would be eliminated on 44 miles of riparian stream reaches and reduced on an additional 26 miles, where they may have slight impacts to riparian streams through a reduction in understory vegetation, compaction of soils, broken-down streambanks, and impacts to riparian dependent species. However, these impacts would occur only every other year, allowing for increased plant recovery and improvement in conditions. There would be low levels of competition between livestock and wild ungulates due to rest of about half the allotment each year.

This alternative proposes 13.5 miles of additional fencing, resulting in 103.5 miles of hazards for many species. Two corrals, three waterlots, and two drylots are proposed, which add to the amount of fencing on the allotment.

Habitat Components

There would be no effects on cover, snags, or old-growth. Three springs would be protected from livestock as well as deer and elk.

Management Indicator Species

Habitat capability would remain unchanged for most MIS under this alternative. One exception is that capability for the red-naped sapsucker may improve on the allotment over time as livestock would not be using many areas with aspen. However, continued declines in aspen are likely to occur regardless of livestock grazing, due to browsing by elk.

Three springs and 412 acres of wet meadows would be protected from livestock, providing important habitat for turkeys. Increases in seed production in pastures no longer available to livestock would also increase habitat capability for turkeys.

A low level of competition would occur between livestock and wild ungulates (mule deer and elk) due to rest of about half of the allotment each year.

This alternative eliminates livestock access to an additional 44 miles of riparian habitat and reduces access to another 51 miles. It has a low potential for impacts to macroinvertebrates.

Mexican spotted owls and northern goshawks are discussed in the section below.

Threatened, Endangered, Proposed and Sensitive Species (TEPS)

Grazing would continue in 20 PACs in the allotment, though portions of 7 would be grazed in even years, and portions of 15 would be grazed in odd years with one PAC not grazed. Therefore, all PACs would have a reduced level of grazing each year. Overall, grazing would occur in 10% to 100% of individual PACs. Meadows are considered key areas for Mexican spotted owls, and large meadows would be protected from livestock. Elk may be displaced to spend more time in the southern pastures and meadows. Few small meadows exist in the pastures that would be grazed. Prey species such as voles would likely increase in numbers. Monitoring for grazing compliance with MSO guidelines is included under the wildlife monitoring section in Chapter 5 of this document. A total of 1.5 miles of fencing is proposed in owl PACs, and construction would take place outside of the breeding season. One fence on the 9713G road would close the end of the road in the PAC. Utilization levels would be kept within 35% in PACs (grazed every other year), allowing for adequate cover and food for prey species.

Livestock currently do not access potential habitat for southwestern willow flycatchers. Protection of 412 acres of headwater meadows and an additional 44 miles of riparian habitat would allow for substantial improvements in watershed and soils conditions, resulting in improvements in potential flycatcher habitat.

Grazing would occur in four northern goshawk PFAs and nest stands, with three PFAs grazed during even years and one grazed during odd years. Four PFAs would only be grazed every other year and two would not be grazed. Gathering activities would not occur in known nest stands, and there would be no disturbance to nesting birds. No construction activities are planned within PFAs. Livestock utilization would be kept within levels that provide cover and food for mammalian prey species.

Alternative G would allow limited livestock access to 51 miles of riparian habitats every other year and limited to some degree by riders and topography. Livestock may trample and remove some small sections of riparian vegetation, and impact riparian habitats for listed species, on a limited basis. A year of rest may allow for additional plant recovery and improvements in conditions. Soils conditions in headwater meadows would improve. The Proper Functioning Condition of 12-14 miles of non-functional streams would improve in protected wet meadows, and in 21-34 miles of functional-at-risk streams, improving conditions for sensitive fish, leopard frogs (including the proposed Chiricahua leopard frog), toads and gartersnakes in stream habitats.

The Mogollon thistle would be protected from grazing impacts by livestock.

Priority Migratory Birds

Forest structure would not change and would not affect priority migratory birds.

A management recommendation for the MacGillivray's warbler includes managing upland and riparian soil conditions to improve water infiltration and retention. Alternative G would eliminate access to an additional 44 miles of riparian habitats, and allow livestock access to 51 miles every other year. No headwater meadows would be grazed, improving soil and riparian conditions on 412 acres of meadows. Riparian conditions would improve in 12-14 miles of non-functional and 21-34 miles of functional-at-risk streams.

This alternative eliminates access to an additional 44 miles of riparian habitats and reduces access to another 26 miles, reducing potential impacts to MacGillivray's warbler and red-faced warbler through disturbance and habitat alteration.

Summary of Effects

Table 27 summarizes the effects to wildlife and their habitats. Alternative A would eliminate all impacts from grazing to wildlife, TEPS species, MIS species, migratory birds, and wildlife habitat by livestock. Alternative B would have the most impacts to all wildlife, through continued grazing of sensitive habitats such as wet meadows, riparian habitats, and occupied MSO and goshawk habitat. However, it would not add new impacts due to additional fences. Alternative C would graze fewer acres of sensitive riparian and wet meadow habitat that would reduce impacts to riparian dependent species, while grazing a similar amount of occupied MSO and goshawk habitat. The

amount of new fencing is moderate among grazing alternatives, adding 22 miles of additional hazards.

Table 27. Summary of effects to wildlife, threatened and endangered species.

MEASURE	ALT. A	ALT. B	ALT. C	ALT. D and K	ALT. E	ALT. F	ALT. G
Acres Grazed	0	68,000	60,000	59,700	43,800	66,400	43,800
New fence Construction (miles) (new hazards)	0	0	22	13.5	18	33	13.5
#Corrals/	0	0	2	3	4	4	2
#Waterlots/ (new)	0	0	3	12	6	7	3
#Drylots (hazards)	0	0	1	6	2	3	2
Frog ponds (improve habitat)	0	0	10	6	3	8	0
Utilization Allowed in MSO PACs (mitigation)	Wildlife only	30%	30%	30%	30%	35% every other year	35% every other year
Number of MSO PACs Grazed (impacts)	0	21	21	21 with lower level use	20	7 (E ½) 16 (W ½)	7 (E ½) 15 (W ½)
Structures in MSO PACs	0	0	2 mi fence	1 mi fence	3.75 mi fence	3 mi. fence	1.5 mi fence
Structures in GH PFAs	0	0	0.25 mi fence	1 mi fence waterlot	0	1.25 mi fence	0
Number of GH PFAs grazed (impacts)	0	6	6	6	4	5 (E1/2) 2 (W1/2)	3 (E ½) 1 (W1/2)
Amount of SWWF Habitat Grazed (impacts)	None	None	None	None	None	None	None
Protection for Mogollon Thistle	No grazing	Full grazing	Full grazing	Herding	No grazing	Grazed 1 year in 2	No grazing
Headwater Meadows Protected (acres) (improve habitat)	412+	234	394	368	412	394	412
Headwater Meadows Accessible (acres) (potential impacts)	0	178	18	44	0	18	0
Riparian Drainages Excluded (miles) (potential improvement)	144	49	62	62	93	70	93
Riparian Drainages Accessed (miles) (potential impacts)	0	95	82	82	51	74 every other year	51 every other year
Likely Improvement to Unsatisfactory Soil Conditions (acres)	412	234	394	368 or more	412	394 or more	412
Likely Improvement to Nonfunctional Streams (miles)	14	3	7	7 or more	12	12 or more	12 or more
Likely Improvement to Functional at Risk Streams (miles)	34	4	7	9 or more	21	9 or more	21 or more

Alternative F would graze about the same amount of sensitive habitats as C, though grazing would occur every other year allowing for a year of rest and plant recovery for every year grazed. This alternative would result in the greatest number of miles of fence, creating hazards for wildlife. Alternatives D and K graze a few more meadow acres than C or F, but may result in much better control over distribution, allowing for more improvement in those habitats. It has a high degree of risk, if herding is not conducted in a strict manner. Fencing levels are moderate. Alternatives E and G provide the greatest protection for sensitive meadows and riparian areas by excluding most of the southern pastures. Habitat for the Mogollon thistle would not be grazed. One MSO PAC is not grazed, and 2 goshawk PFAs are not grazed. Alternative E has a moderate level of new fences, while G has the smallest amount of new fencing, other than B or A. Alternative G also adds one year of rest for every year grazed for all areas, which would result in the greatest potential for improvements in overall conditions and most PACs and PFAs would be grazed every other year, rather than yearly. Alternative G, therefore, has the least impacts on wildlife, including TEPS species.

Cumulative Effects

The boundary of consideration for cumulative effects to wildlife varies by the type or species. In most cases, the boundary for game species such as elk, deer, and turkey is based on hunt units. Most other species are analyzed within the allotment or watershed boundaries. The time frame of consideration also may vary by species. In some cases, the effects of livestock grazing and management are fairly short-term, and rapidly dissipate once livestock are removed from the system. However, there are long-term historical impacts that have accumulated over a century of grazing, that affect wildlife. Since the term of this analysis is approximately 10 years, this is generally used as the time frame for cumulative effects, except where historical impacts are discussed. If a different time frame is more appropriate for certain species, it is noted. Since livestock grazing and management result in various effects to wildlife, each effect is discussed separately.

All projects listed in Tables 15, 16, 17, and 18 were considered for this discussion. Cumulative effects on wildlife on the Buck Springs Allotment include the occurrence of adjacent allotments that overlap territories lying on the boundaries of the allotment. These include the Bar-T-Bar Allotment to the north, the Hackberry/Pivot Rock Allotment to the west, and the Clear Creek and Limestone Allotments on the A-S National Forest to the east. Introduced Rocky Mountain elk contribute to grazing pressures that affect wildlife in similar ways to livestock. Elk reduce biomass that provides cover and food for small mammals. Reduced small mammal populations then affect reproductive success of other species, including Mexican spotted owls and northern goshawks. These large ungulates also remove riparian vegetation, break down stream banks, and increase siltation in streams, all of which degrade riparian habitats for wildlife. Paired exclosures that exclude livestock or elk and livestock demonstrate that recovery of streams and wet meadows would be severely limited if livestock are removed and elk populations remain high. Dispersed recreation also impacts riparian function.

Game and Non-game Wildlife

On the allotment, much of the riparian habitat is found in steep canyons that are not accessible to livestock. Alternatives would allow livestock access to 0% (Alternative A), 36% (Alternatives E and G) to 66% (Alternative B) of the riparian habitats on the allotment, or 24% to 55% of the riparian habitats in the watershed (Table 25). These riparian habitats are located in shallow drainages, or where shallow side draws enter the canyons. In these areas, livestock have the potential to remove riparian vegetation, compact soils, and break down streambanks. Utilization standards include wildlife use and along with pasture rotations are designed to minimize these impacts.

Alternatives for the Buck Springs allotment vary with one alternative removing all livestock grazing from the allotment, two alternatives resting most of the southern pastures with shallow drainages, and one alternative that grazes the entire allotment. About 45% to 76% of the riparian habitats are unavailable to livestock in the watershed, though elk have access to nearly 90%. Small problem areas with high utilization are expected, though impacts to accessible habitats would be minimized through adherence to utilization standards.

Alternatives for the Buck Springs Allotment would allow livestock access to zero to 178 acres of the 412 acres of wet meadows on the allotment. Alternative B would continue impacts to 178 acres of meadows while protecting 234 acres (57% of allotment meadows, 59% of watershed meadows, Table 27), while all other alternatives would provide protection from livestock for 368 acres or more of the meadows (89% of the allotment, 74% of the watershed, Table 24).

Elk and recreation vehicles cause similar impacts to riparian habitats and wet meadows. Elk have access to nearly 90% of riparian areas in the watershed, and are excluded from a very small proportion of wet meadows (about 150 of 1160 acres within the watershed). Access by recreation vehicles is limited to riparian areas in shallow drainages, though many of the wet meadows may be impacted. Heavy impacts to riparian habitats are expected to be negligible and cumulative impacts to populations of common game and non-game wildlife would be within acceptable levels. Wet meadows, on the other hand, may continue to receive substantial impacts due to these cumulative effects. Improvements in soil and vegetative conditions would be severely limited as long as the elk population remains static. These impacts cannot be quantified. At current elk populations and recreation levels, the cumulative effects on reduction of biomass, compaction of soils, and degradation of stream banks would likely remain high despite the reduction or removal of livestock grazing. The cumulative impacts of all activities in wet meadows would continue for all alternatives, including the elimination of all livestock from the allotment. The Arizona Game and Fish Department is currently working to reduce the elk population in Wildlife Unit 5A, while the East Clear Creek Watershed Improvement Project has proposed eliminating recreation vehicles from a number of wet meadows. These measures would reduce the cumulative effects of these activities.

Habitat Components

Livestock grazing and management have no effect on snags or old-growth, so there would be no cumulative effects on these habitat components. Pre-commercial thins would reduce wildlife cover, however, with heavy regeneration of ponderosa pine on the allotment, the proposed thinning (0.2% to 2.0 % of the allotment) would not adversely affect wildlife that rely on cover. A more detailed discussion of the past, current, and future actions affecting the understory trees is located in the discussion of overstory vegetation.

Management Indicator Species

The discussion of cumulative effects to understory vegetation details the acres of biomass removal affected by livestock grazing in the watershed. Approximately 41% to 69% of the watershed would be affected by biomass removal, which may potentially affect turkeys. Recent surveys indicate that turkey populations are increasing in Wildlife Management Unit 5A, indicating that the cumulative effects of livestock grazing on 69% of the watershed is not adversely affecting the species.

Livestock browsing on aspen has contributed to long-term declines in aspen habitats in the allotment. Elk browsing also contributes to the lack of aspen regeneration. A century of fire suppression has resulted in increases in the conifer overstory that crowds out the mature aspen and suppresses regeneration. The elimination of livestock grazing would not reduce the cumulative impacts. These actions have long-term consequences for aspen habitat and cumulatively affect the red-naped sapsuckers, mule deer, and other species that depend on the habitat. Other projects propose actions that would eliminate browsing on aspen sprouts and reduce the conifer overstory in small pockets of habitat (Maple Draw Project, U-bar Timber Sale, Crackerbox Timber Sale). Past projects have established about 40 of these small pockets within the watershed. These projects allow for small areas of aspen regeneration, favoring future populations of sapsuckers, mule deer and others.

Competition occurs between livestock and wild ungulates, deer and elk. Depending on the chosen alternative, livestock grazing would occur on 41% to 69% of the watershed (Table 20), however, livestock occur on no more than 15% of the watershed at any one time. Adequate areas exist without livestock to provide areas free from competition for deer and elk.

Livestock grazing would occur on about 36% to 66% of the riparian habitats within the allotment, depending on alternative (Table 27). Some changes in macroinvertebrate populations may occur in these areas, however, 34% to 64% of riparian areas with macroinvertebrates would not be affected by livestock. Elk grazing or browsing would continue in most riparian areas within the watershed, continuing to affect macroinvertebrates. Efforts by the Arizona Game and Fish Department may reduce those cumulative effects.

Threatened, Endangered, Proposed and Sensitive Species

Livestock grazing currently occurs within all Mexican spotted owl PACs on the allotment, and in most PACs within the watershed. These actions result in the reduction of grass and forb biomass and loss of cover for prey species, especially in small meadows within the PACs. Several alternatives (A, D, E, F, G, and K) would decrease the amount of grazing in individual PACs, while Alternatives A, E, F, and G reduce the number of PACs with livestock grazing. Elk grazing also reduces grass and forb biomass and loss of cover for prey species, and would continue to occur within all PACs. Utilization standards, pasture rotations, and monitoring of key areas take into account these other impacts and ensure that adequate biomass and forage is available for sufficient prey populations. Recent changes in management of the Clear Creek and Limestone Allotments have reduced grazing pressure on PACs on the eastern boundary of the allotment. Current planning efforts on the Bar T Bar Allotment would result in reduced pressures on the northern boundary. Cumulative impacts for Alternatives B and C would remain high, while Alternatives A, D, E, F, G, and K would reduce cumulative impacts.

Livestock cannot access potential habitat for the southwestern willow flycatcher within the watershed. Improvements in adherence to utilization standards, and changes in pasture rotations throughout the watershed are resulting in fewer indirect impacts to potential habitat through siltation and high peak flows. Timber sales, other grazing allotments within the watershed, wildfires, and roads may accelerate water movement through the system. Changes in watershed conditions through projects such as the East Clear Creek Watershed Improvement Project, the Victorine Fuels Project, and the Blue Ridge Urban Interface Project would improve the water retention of the soils and slow water movement through the system. Overall, cumulative effects to potential flycatcher habitat are not a concern for any of the alternatives.

Livestock grazing occurs in most goshawk PFAs within the allotment, resulting in the reduction of grass and forb biomass and loss of cover for some prey species. Alternative B maintains current levels of grazing and alternatives B, C, D, and K graze six of eight PFAs. Other alternatives graze zero to four PFAs, reducing the acreage grazed in several alternatives. Elk grazing contributes additional reductions in biomass and cover. Utilization measurements include wildlife use and utilization standards, along with pasture rotations and monitoring of key areas, would ensure adequate food and cover for prey species, keeping cumulative effects to acceptable levels.

Historical records indicate that the Chiricahua leopard frog was once found on the Buck Springs Range Allotment. Past livestock grazing may have contributed to its probable extirpation from the watershed. Under alternatives for the Buck Springs Allotment, livestock would have access to 0 to 95 miles of riparian habitats, as well as to most earthen stock tanks. It is unlikely that these potential habitats would be re-colonized without human intervention. Alternatives A, D, E, F, G, and K reduce the amount of grazing on many of the riparian areas and the use of dirt tanks. Alternatives C, D, E, and F fence portions of dirt tanks to improve potential habitats. Elk contribute extensively to cumulative impacts to potential habitat. Since the frog is most likely absent from the

allotment, there are no cumulative impacts to the species, however, Alternatives B and K continue grazing on 66% and 57% of riparian habitats and have no measures to improve potential habitat. Alternatives B and K therefore may have adverse cumulative effects to potential habitat. Alternative K may show improvements, depending on the success of herding as a method to keep livestock out of riparian drainages. Alternatives C, D, and F would allow access to over 50% of the riparian drainages on the allotment, but propose to improve potential habitat conditions in six to ten stock tanks. Alternatives E and G reduce the amount of riparian habitat grazed to 36%, with additional measures to improve potential habitat. Additional projects under the East Clear Creek Watershed Health Project would improve potential habitat. All of these improvements would remain impacted by elk grazing, so cumulative impacts would remain high.

The Mogollon thistle exists entirely within the allotment, which is the area of consideration for cumulative effects. Additional projects that have the potential to directly impact the plants through removal or trampling include dispersed recreation and elk grazing. The plants show tolerance for moderate grazing, and the known locations do not fall within attractive sites for dispersed camping. Therefore, cumulative effects are not considered to be adverse.

Priority Migratory Birds

The cumulative effects of livestock browsing and elk browsing on maple and aspen regeneration, along with unknown factors, has resulted in the extirpation of the MacGillvray's warbler along the Mogollon Rim within the watershed (Martin, 2002 unpublished data). Red-faced warblers and other species are also in decline. The continued loss of maple regeneration in areas without livestock, demonstrate that this trend would not reverse with the exclusion of livestock alone. There are no differences in the cumulative effects by alternative. The District is currently implementing and planning actions to promote maple and aspen regeneration (Maple Draw Project, U-bar Timber Sale, Crackerbox Timber Sale) and to exclude livestock from patches of habitat within the watershed. Only this type of active management can reverse the trend in maple and aspen regeneration.

AQUATIC RESOURCES

[#70]

Impacts to the aquatic resources of the East Clear Creek (ECC) watershed are numerous and are caused by hydrologic disturbances (dams, roads, grazing) and the presence of non-native species (trout, crayfish, elk, livestock). This analysis addresses livestock impacts to the allotment's riparian conditions and how those conditions affect fish habitat. The Little Colorado spinedace has been listed as a threatened species under the Endangered Species Act since 1987. Given its apparent heightened sensitivity to degraded conditions and legal status, the spinedace is considered a barometer for the health of the ecosystem and is used in this discussion to represent the fish group as a whole.

Much research has looked at the effects of livestock grazing on the health of riparian areas and fish populations. However, the large majority of these studies have lacked statistically sound data. Nonetheless, numerous cases of improper livestock grazing on riparian areas have illustrated detrimental effects on riparian vegetation and aquatic ecosystem conditions (Rinne 1999).

Improper livestock and elk grazing can cause detrimental effects to watersheds, streambanks, and riparian vegetation by changing, reducing, or eliminating the vegetation, which has the effect of eliminating riparian areas through channel widening, channel aggradation, or lowering of the water table. Reduction in riparian/streamside vegetation by grazing can change or alter channel substrate and stream channel morphology, cause an increase in water temperature, increase frequency and severity of flooding, and indirectly reduce the amount of perennial surface flow. All of these factors have the potential to reduce or eliminate aquatic habitat complexity (Cain et al. 1997, Platts 1991).

A functional riparian area provides adequate vegetation to lessen the energy of peak and flood flows, trap and hold sediments, augment stream flow through bank storage and timed delivery of water, maintain cooler water temperatures by shading and from base flow discharge, and sustain a higher water quality. Streamside vegetation provides habitats for a diverse assortment of terrestrial wildlife, including insects that contribute to the food base for fish. A well-developed and functioning riparian area and flood plain can enhance fish survival by providing spawning and nursery areas (Platts 1991).

Alternative A: No Grazing

Rest from livestock grazing over a 10-year period would present the most favorable alternative for the riparian and aquatic resources. This alternative would eliminate all direct and indirect effects from livestock use of the riparian areas within the ECC sub-watersheds. The absence of livestock would eliminate all possible chances for uncontrolled livestock presence within riparian or stream course areas. Livestock would not contribute to degradation of riparian systems or headwater meadows, unsatisfactory soil conditions, or non-functioning riparian systems. Habitat for Little Colorado spinedace would likely improve over time, as streambanks stabilize, effective ground cover increases, wetted area perimeters increase, and forage utilization decreases. All improvements would be limited by impacts due to elk grazing.

Alternative B: Current Management

Current fencing and a deferred grazing strategy provide a certain level of protection to specific areas of known and historic spinedace habitat. However, this level of management is neither intensive nor extensive enough to adequately provide for improved and sustained aquatic habitat conditions. Livestock have access to sensitive drainage areas along the south end of the allotment, to portions of Leonard Canyon, and to a small area in East Clear Creek, all of which are priority areas for improving habitat for Little Colorado spinedace. Livestock access to headwater drainages would result in

impacts to riparian vegetation, stream channels, and the water supply. Livestock would contribute to both direct and indirect impacts to the ECC watershed.

Currently, livestock graze in Houston Draw and General Springs Canyon, directly impacting potential Little Colorado spinedace habitat. Current management would continue to degrade riparian conditions, and the two sites could be withdrawn from consideration for future spinedace stocking sites. Aspen Springs provides water for the Houston Draw riparian zone and would continue to be impacted by livestock in the South Pinchot and Aspen Horse Pastures. Livestock access to a historic spinedace site in Miller Canyon would also result in direct impacts to potential spinedace habitat.

Livestock have potential access to Leonard Canyon in the Dines Pasture and the Knolls Pasture, to Buck Springs Canyon in the Knolls Pasture, and to Yeager Canyon in the Forest Service Pasture. These drainages contain unoccupied, suitable spinedace habitat, and/or occupied spinedace habitat, and are considered critical to the restoration of spinedace populations. The southwest corner of the McCarty Pasture has recently been fenced to exclude livestock from a reach of ECC and historic spinedace pool habitat. The remaining portion of the McCarty Pasture and an unfenced portion of ECC would be grazed by livestock, resulting in direct adverse impacts to recovering streambanks and channel conditions upstream from the Blue Ridge Reservoir.

Pasture moves would cross eleven major drainages contributing to a deteriorated riparian condition. The move between North Battleground and McCarty Pastures is of particular concern. Both direct and indirect impacts to the stream channels could occur at these and/or other crossings depending on trail location and stream channel confinement and substrate.

Livestock grazing along the southern tier of pastures would allow access to several headwater drainages and meadows, contributing to the continued degradation of riparian/wetland areas. Present conditions would continue the poor water yield, affecting riparian systems throughout the watershed. Habitat for the Little Colorado spinedace would continue to degrade.

Alternative C: Proposed Action

This alternative continues the deferred rotation grazing strategy, while proposing moderate levels of range improvements designed to protect occupied and suitable spinedace habitat, and allow for improvements to large headwater meadows.

A livestock enclosure fence is proposed along a one and one-quarter mile length of upper Houston Draw (south of the Aspen Horse Pasture) to protect the headwater meadow. Use of the Horse Pasture and livestock access to Houston Draw in the North Pinchot Pasture would restrict improved riparian/water yield conditions to solely within the livestock enclosure. Aspen Springs and Houston Draw downstream of the livestock enclosure would continue to be impacted. Houston Draw is being considered as a future spinedace recovery site.

Four proposed fences would prevent livestock access to drainages containing unoccupied, suitable spinedace habitat, and/or occupied spinedace habitat. These fences are: 1) adjacent to Leonard Canyon in the Dines Pasture, 2) adjacent to Leonard Canyon in the Knolls Pasture, 3) north of Buck Springs Canyon, and 4) along Yeager Canyon in the Forest Service Pasture. These fences are critical to protecting spinedace habitat from livestock impacts.

Two additional spinedace locations are susceptible to direct impacts from livestock. These sites include the potential habitat below the supplemental spinedace stocking sites within General Springs Canyon and a historic spinedace site in Miller Canyon.

The northeast portion of the McCarty Pasture would be grazed by livestock, subjecting the unfenced portion of ECC to uncontrolled livestock access and direct adverse impacts to recovering streambanks and channel conditions upstream from the Blue Ridge Reservoir.

Pasture moves would cross eleven major drainages contributing to degraded riparian conditions. The move between North Battleground and McCarty Pastures is of particular concern. Both direct and indirect impacts to the stream channels could occur at these, and/or other crossings depending on trail location and stream channel confinement and substrate.

Six major headwater meadows in southern pastures would be fenced to exclude livestock, though elk would still have access and contribute to impacts. Livestock would be able to access a few headwater drainages and small meadows, contributing to the continued degradation of some riparian/wetland areas. These conditions would continue the poor water yield currently supplied by these drainages. According to the East Clear Creek Roads Analysis, two of the meadows have roads that are impacting the meadows (9714E and 9737Y, respectively). Portions of these roads will be closed from access by cattle fences under this analysis.

Alternative D: Herding and Alternative K: Modified Herding

The herding alternative provides protection of the most critical areas in headwater meadows and riparian drainages through fencing and other improvements. Additional protection is provided through herding of livestock away from other drainages and small meadows. This alternative has the potential to provide the most protection and improvements in sensitive habitats, but involves an uncertain level of risk for failure. Herding is an intensive method of controlling livestock through hands-on methods using riders and dogs. Any lapse in effectiveness, due to absence of the herder, loss of dogs, dense stands of mixed conifers, or a type of livestock that does not lend itself to being herded, has the potential to negatively impact riparian conditions made over years of effective protection.

If herding would be abandoned permanently or temporarily, the fall-back position would restrict livestock to the northern tier of pastures, where steep canyons more effectively limit livestock access to riparian drainages. Headwater meadows and drainages would be protected by resting sensitive southern pastures.

A livestock enclosure fence is proposed along a one and one-quarter mile length of Houston Draw south of the Aspen Horse Pasture, to protect the headwater meadow. The portion of Houston Draw north of the Horse Pasture within the North Pinchot Pasture would be protected through herding. Use of the Horse Pasture, will not be used under this alternative by cattle grazing and will remove the cattle stressor on the riparian habitat within the Horse Pasture in Houston Draw. The permittee will still be allowed to use the corrals for horses, but the horses will not have access to the streamcourse. An enclosure around Aspen Springs, within the Horse Pasture would maintain an additional, reliable perennial water source for the Houston Draw riparian zone, identified as a future spinedace recovery stream course.

Four other fences would prevent livestock access to drainages containing unoccupied, suitable spinedace habitat, and/or occupied spinedace habitat. These fences are: 1) adjacent to Leonard Canyon in the Dines Pasture, 2) adjacent to Leonard Canyon in the Knolls Pasture, 3) north of Buck Springs Canyon, and 4) along Yeager Canyon in the Forest Service Pasture. These fences are critical to protecting spinedace habitat from livestock impacts.

Two additional spinedace locations would be susceptible to direct impacts from livestock including the potential habitat below the supplemental stocking sites within General Springs Canyon; and a historic site in Miller Canyon. Herding would limit livestock access to these areas.

Livestock would graze the McCarty Pasture, with herding used to control livestock access away from the unfenced portion of ECC. Herding may promote additional stream channel and riparian improvements, and eliminate direct adverse impacts to recovering streambanks and channel conditions upstream from the Blue Ridge Reservoir.

Pasture moves would cross eleven major drainages contributing to deteriorated riparian conditions. The move between North Battleground and McCarty Pastures is of particular concern. Both direct and indirect impacts to the stream channels could occur at these, and/or other, crossings depending on trail location and stream channel confinement and substrate.

Four major headwater meadows in southern pastures would be fenced to exclude livestock, with drift fences limiting access to two additional meadows. Livestock may be able to access a few headwater drainages and small meadows. Herding has the potential to limit livestock access to all headwater drainages, but is contingent on herding being used effectively. Elk would still have access and contribute to impacts.

Alternative E: Northern Pasture Emphasis

Alternative E provides the most protection for headwater meadows and drainages by taking several of the southern pastures out of the grazing landbase (as does Alternative G). Steep canyons and topography restrict livestock access to sensitive riparian drainages while grazing northern pastures. Additional protective measures are afforded through fences along critical drainages and around meadows.

Livestock exclosure fences are proposed along a one and one-quarter mile length of Houston Draw, south of the Aspen Horse Pasture and around Houston Draw north of the Aspen Horse pasture. These exclosures are necessary for protection of this headwater meadow and drainage system. An elk exclosure around Aspen Springs, would maintain a perennial water source for the Houston Draw riparian zone, identified as a future spinedace recovery stream course. Converting the pasture to a riparian pasture (this will remove the pasture from the cattle grazing rotation) and creating a new horse pasture in the south part of North Pinchot pasture would greatly increase the potential for riparian improvements. The permittee will still be allowed to use the corrals for horses, but the horses will not have access to the streamcourse.

Four other fences are proposed that would prevent livestock access to drainages containing unoccupied, suitable spinedace habitat, and/or occupied spinedace habitat. These fences are: 1) adjacent to Leonard Canyon in the Dines Pasture, 2) adjacent to Leonard Canyon in the Knolls Pasture, 3) north of Buck Springs Canyon, and 4) along Yeager Canyon in the Forest Service Pasture. These fences are critical to protecting spinedace habitat from livestock impacts.

Two additional spinedace locations are susceptible to direct impacts from livestock. These sites include the future, potential habitat below the supplemental stocking site within General Springs Canyon and a historic spinedace site in Miller Canyon.

Livestock use in the McCarty Pasture would be restricted to the area south and east of ECC by a proposed fence. The fence would provide the protection needed to maintain and promote additional stream channel and riparian improvements upstream from the Blue Ridge Reservoir.

Livestock would cross eight of eleven drainages, contributing to deteriorating riparian conditions. The move between North Battleground and McCarty Pastures is of particular concern. Both direct and indirect impacts to the stream channels could occur at these, and/or other, crossings depending on trail location and stream channel confinement and substrate.

The McClintock Pasture, one-half of the South Pinchot Pasture, and the southern two-thirds of the Knolls Pasture would be excluded from livestock grazing. These pastures include critical headwater meadows that affect riparian conditions throughout the system. The elimination of livestock from these pastures may result in improvements in functional conditions of the drainages. Unfortunately, eliminating livestock grazing only

reduces the cumulative impacts to the headwater meadows and riparian drainages. Livestock grazing in the northern pastures would likely cause elk to spend more time grazing the southern pastures.

According to the East Clear Creek Roads Analysis, one meadow has roads that are impacting the meadows (9714E). A portion of this road will be closed from access by a cattle fence under this analysis.

Alternative F: Rest-Rotation

Alternative F uses all pastures with the exception of the southern 2/3 of the Knolls Pasture. The allotment is split into an east management unit and a west management unit. Each unit is grazed every other year. Substantial range improvements protect sensitive drainages and headwater meadows.

Two livestock enclosure fences are proposed along upper Houston Draw south of the Horse Pasture and in Houston Draw north of the Horse Pasture. Use of the Aspen Horse Pasture would fragment the benefits achieved towards improved riparian/water yield conditions and continue to impact a potential spinedace recovery stream course.

Four other fences are proposed that would prevent livestock access to drainages containing unoccupied, suitable spinedace habitat, and/or occupied spinedace habitat. These fences are: 1) adjacent to Leonard Canyon in the Dines Pasture, 2) adjacent to Leonard Canyon in the Knolls Pasture, 3) north of Buck Springs Canyon, and 4) along Yeager Canyon in the Forest Service Pasture. These fences are critical to protecting spinedace habitat from livestock impacts.

Two additional spinedace locations are susceptible to direct impacts from livestock. These sites include the future, potential habitat below the supplemental stocking sites within General Springs Canyon and a historic spinedace site in Miller Canyon.

Livestock use in McCarty Pasture would be restricted to the area south and east of ECC by a proposed fence, which would provide the protection needed to maintain and promote additional stream channel and riparian improvements upstream from the Blue Ridge Reservoir.

Pasture moves would cross eleven major drainages, though crossings would only be affected every other year. The movement of livestock through these drainages would contribute to deteriorating riparian conditions. The move between North Battleground and McCarty Pastures is of particular concern. Both direct and indirect impacts to the stream channels could occur at these, and/or other, crossings depending on trail location and stream channel confinement and substrate.

According to the East Clear Creek Roads Analysis, one meadow has a road that is impacting the meadows (9714E). A portion of this road will be closed from access by a cattle fence under this analysis.

This alternative protects most headwater drainages in the southern pastures, with all major meadows fenced to exclude livestock. Livestock may access a few small headwater drainages. Eliminating livestock grazing in these drainages only reduces the cumulative impacts to the headwater meadows and riparian drainages, as elk grazing would continue to cause impacts.

Alternative G: Northern Pastures with Rest-Rotation

Of the action alternatives, Alternative G provides the most protection for headwater meadows and drainages. Headwater protection is afforded by eliminating the influences of livestock grazing on the southeastern portion of the allotment. The deeply incised, steep-walled canyons that define the boundaries of most northern pastures limit livestock access to sensitive riparian drainages. However, livestock would still have some access to those drainages (i.e. Upper Yeager Canyon) where steepness of slope is not great enough to preclude access. Additional protective measures are afforded through fences along critical drainages, and around meadows and spring source areas. Each pasture would be rested one year in two, allowing for additional recovery of accessible riparian drainages which would mitigate some of the impacts of grazing.

The McClintock Pasture, southern half of the South Pinchot Pasture, and the southern four-fifths of the Knolls Pasture would be excluded from livestock grazing. These pastures include critical headwater meadows that affect riparian conditions throughout a large portion of the East Clear Creek (ECC) Watershed. The elimination of livestock from these pastures may result in improvements in functional conditions of the drainages. Unfortunately, eliminating livestock grazing only reduces the cumulative impacts to the headwater meadows and riparian drainages. Livestock grazing in the northern pastures would likely cause elk to spend more time grazing the southern pastures.

Livestock exclosure fences are proposed along a one and one-quarter mile length of Houston Draw, south of the Aspen Horse Pasture and around Houston Draw, north of the Aspen Horse Pasture. These exclosures are necessary to protect this headwater meadow and drainage system. Conversion of the Aspen Horse Pasture to a riparian pasture (this will remove the pasture from the cattle grazing rotation) and creating a new horse pasture in the south part of North Pinchot pasture would greatly increase the potential for riparian improvements. The permittee will still be allowed to use the corrals for horses, but the horses will not have access to the streamcourse.

Proposed elk exclosures around Aspen Springs and Pinchot Springs, within the Horse Pasture, would help to maintain a perennial water source for the Houston Draw riparian zone. Houston Draw is identified in the *East Clear Creek Watershed Recovery Strategy for the Little Colorado Spinedace* (USDA 1999a) as a recovery stream for the spinedace. Eliminating the use of the Aspen Horse Pasture (by cattle/horses) would provide improved conditions along Houston Draw.

Four other fences are proposed that would prevent livestock access to drainages containing unoccupied, suitable spinedace habitat, and/or occupied spinedace habitat. These fences are: 1) adjacent to Leonard Canyon in the Dines Pasture, 2) adjacent to Leonard Canyon in the Knolls Pasture, 3) north of Buck Springs Canyon, and 4) along Yeager Canyon in the Forest Service Pasture. These fences are critical to protecting spinedace habitat from livestock impacts. According to the East Clear Creek Roads Analysis, one meadow has roads that are impacting the meadows (9714E). This roads will be closed from access by a cattle fence under this analysis.

Two additional spinedace locations are susceptible to direct impacts from livestock. These sites include the future, potential habitat below the supplemental stocking site within General Springs Canyon and a historic spinedace site in Miller Canyon. General Springs Canyon is identified in the *East Clear Creek Watershed Recovery Strategy for the Little Colorado Spinedace* (USDA 1999) as a recovery stream for the spinedace. These areas would be rested one year in two, allowing for some potential recovery of riparian systems.

Livestock use in the McCarty Pasture would be restricted to the area south and east of ECC by a proposed fence. The fence would provide the protection needed to maintain and promote additional stream channel and riparian improvements upstream of the Blue Ridge Reservoir. This segment of ECC is designated critical habitat for the Little Colorado spinedace.

Livestock movement between pastures could necessitate the need to cross eight of eleven drainages. Crossing these drainages has the potential of contributing to the less than desirable riparian conditions. The move between North Battleground and McCarty Pastures would be of particular concern. Both direct and indirect impacts to the stream channels could occur at these crossings. Severity of impacts would depend on trail location, stream channel substrate, and drainage confinement. These crossings would potentially be used every other year, allowing for some recovery from impacts.

Summary of Effects

Aquatic resources are affected by actions that degrade soil conditions or riparian and stream functions, or change hydrologic conditions. Alternative A protects aquatic resources by removing one impacter from the ecosystem, livestock. Soils conditions and riparian and stream functions would improve over time, though the degree of improvements would be limited by the amount of continued elk grazing. Of the action alternatives, E and G provide protection for headwater meadows and riparian systems through the removal of several pastures from grazing and additional fencing that excludes livestock grazing. These protections would result in improvements in soil conditions (for currently unsatisfactory soils) and riparian stream functions (some are currently rated as functional-at-risk, and non-functional). Alternative G increases the potential for improvement through resting half of the pastures every year in comparison to Alternatives B, C, D, E, and K. Elk grazing on the rested pastures would limit this strategy. Table 28 summarizes the potential for improvement in soil conditions through

the protection of headwater meadows, and the potential for improvement in stream function through the protection of riparian drainages.

Cumulative Effects

The East Clear Creek watershed is the area of consideration for cumulative effect to aquatic resources. While the effects from some of the past, present, and reasonably foreseeable future actions are long lasting (greater than 10 years); others are expected to be short-term (less than 10 years). Livestock grazing and management affects aquatic resources by changing, reducing, or eliminating vegetation; and by breaking down stream banks and changing stream morphology. These factors affect aquatic habitat complexity (Cain et al. 1997, Platts 1991). The cumulative effects for aquatic resources are very similar to those for riparian conditions.

Table 28. Summary of effects to aquatic resource measures.

MEASURE	Alt. A	Alt. B	Alt. C	Alt. D and K	Alt. E	Alt. F	Alt. G
Headwater Meadows Protected (acres) (improve habitat)	412	234	394	368	412	394	412
Headwater Meadows Accessible (acres) (potential impacts)	0	178	18	44	0	18	0
Riparian Drainages Excluded (miles) (improve habitat)	144	48	62	62	93	70	93
Access to Riparian Drainages (miles) (potential impacts)	0	95	8	82	51	74 every other year	51 every other year
Access to Critical Habitat (miles) (potential impacts)	0	4	4	4	0	0	0
Likely Improvement to Functional at Risk Streams (miles)	34	4	7	9 or more	21	9 or more	21 or more
Likely Improvement to Nonfunctional Streams (miles)	14	3	7	7 or more	12	12 or more	12 or more

Past, present, and reasonably foreseeable future actions considered for this cumulative effects analysis includes: all past (since 1992), present, and future timber harvesting , tree thinning, dispersed recreation, prescribed burns, other range allotment activities within the watershed, Victorine Urban Interface project, and the East Clear Creek Watershed Improvement Project. These projects are listed in Tables 15, 16, 17, and 18.

Cumulative Effects to Riparian Drainages and Meadows

Other grazing allotments within the watershed contribute to the removal of riparian vegetation. Table 25 shows the miles of riparian streams in the East Clear Creek Watershed that are accessible to livestock, by alternative for the Buck Springs Allotment. If livestock were removed from the Buck springs allotment (Alternative A), livestock would have the potential to impact 71 miles of riparian drainages within the watershed, in comparison to 165 miles of riparian drainages if the Current Management Alternative (B) were implemented. This is out of a total of 299 miles of riparian drainages in the watershed.

Elk grazing also results in the removal of streamside vegetation. Elk may access almost all riparian sites within the watershed. A few small elk exclosures protect about 2 miles of riparian sites from elk grazing. The effects of elk grazing on the removal of riparian vegetation are not quantifiable, and would vary by the number of elk in the watershed.

Livestock contribute impacts to headwater meadows, as do elk and recreationists. There are currently 1160 acres of meadows within the watershed. Livestock currently have access to 178 out of 412 acres within the Buck Springs Allotment., and about 478 of 1160 acres of headwaters meadows in the watershed. Under the “no grazing” alternative (A), livestock would have access to 0 acres on the allotment, and 300 acres within the watershed (Tables 23 and 25).

Cumulative Effects to Soils, Vegetation, and Water Quality

The elimination of livestock grazing under Alternative A would remove the possibility of cumulative effects to past, present, and reasonably foreseeable future actions within the watershed. The absence of the effects that livestock grazing contributes to the watershed would eliminate the incremental amount of disturbance imposed upon the soil, vegetation, and water conditions associated with East Clear Creek and its tributaries. Reduction in the number of ungulate grazers within the watershed would intuitively equate to a reduction of effects to the riparian vegetation and to the stability of the banks lining the stream channels. This reduction of effects would be expected to result in an incremental reduction in the amount of sediment delivered to the stream channels. A reduction in sedimentation in and around the gravel and cobble stream channel substrates would aid in maintaining aquatic habitats suitable for fish spawning and for fish food production (macroinvertebrates and algae).

Under Alternative A, all 412 acres of headwater meadows on the allotment, and 860 of the 1160 acres of meadows in the watershed, would be protected from grazing by livestock. In addition, all 144 miles of riparian stream courses on the allotment and 228 miles of the 299 miles within the watershed would be protected from grazing by livestock. The Buck Springs Range allotment would not contribute to cumulative effects.

Changes in livestock management have illustrated the resiliency and responsiveness of riparian ecosystems when given a chance to recover. One such example that exemplifies

riparian restoration is that produced by Phil Knight on his Date Creek Ranch in west-central Arizona. Years of “winter-use only” and “growing season rest” from livestock use were the key to Mr. Knight’s success in restoring the riparian and aquatic habitats of Date Creek. In contrast, livestock can only graze the Buck Springs Allotment during the growing season. During years with measurable snowfall, the allotment sustains a significant amount of uncontrolled grazing by elk from late March through early November, which essentially overlaps with the time livestock graze the allotment. Otherwise, during drought years, where lack of a winter snow pack does not restrict grazing, elk graze the allotment year-round. The circumstances surrounding the grazing of the Buck Springs Allotment limits riparian and aquatic habitat restoration to a handful of relatively small elk exclosures.

The continuation of livestock grazing as proposed under Alternatives B through K, would be expected to add cumulatively to the effects put upon the watershed by the identified past, present, and reasonably foreseeable future actions.

Livestock access and use of the headwater meadows and riparian stream courses under Alternatives B through K would continue to alter riparian vegetation and compact the soils of specific areas, causing reduced water infiltration into the soil and increased runoff. Trails created and used by livestock, to access the headwater meadows and riparian drainages, capture and redirect surface water runoff causing erosion, an increase in peak flows, reduced ground water retention, and sediment delivery to the allotment’s stream courses. Livestock trampling of stream banks loosen soil that becomes increasingly susceptible to erosion and subsequent deposition into stream channels. Sediment deposited in the stream channels fill in the spaces between the various gravel and cobble channel substrates; and in affect reduces or eliminates fish spawning habitat, and the habitat required to sustain a vital component of the aquatic insects found in lotic (flowing water) aquatic environments.

Alternative B would present potential for cumulative impacts on 178 (43%) of the allotment’s 412 acres of headwater meadows, and 95 (66%) of the allotment’s 144 miles of riparian stream courses that remain accessible to livestock use. Alternatives E and G would exclude livestock impacts from 100% (412 acres) of the headwater meadows and 65 % (93 miles) of riparian drainages. Tables 23 and 24 illustrate the overall potential for livestock impacts to headwater meadows and riparian drainages in the East Clear Creek watershed.

Other actions which contribute similar effects to drainages and stream channels include recreation use, roads, timber harvesting, tree thinning, and prescribed burns and wildfires. Recreationists sometimes trample streambanks and remove streamside vegetation, and use recreation vehicles in streambeds. These actions remove vegetation, break down stream banks, and add sediment to streams. The past construction of roads within the watershed, and the continued effects of these roads, result in increased water runoff into streams, which increases peak flows, increased erosion, and increased sediment transport into stream channels.

Wildfire can devastate aquatic systems by removing vegetation in the uplands, creating an inordinate amount of sediment and ash flow into drainages, producing high peak flows that scour out riparian vegetation, and altering stream channel morphology. Current planning efforts include the Victorine Fuels Project and the East Clear Creek Watershed Improvement Project. Both of these projects would contribute to restoring a more natural fire regime to the allotment, which would reduce the threat of stand replacing wildfires. The East Clear Creek Watershed Improvement Project also proposes to improve watershed conditions through stabilizing stream crossings, minimizing recreation impacts, and rehabilitating heavily eroded drainages. These projects would reduce the overall cumulative impacts to aquatic resources.

RECREATION

[#77]

Cattle grazing and associated facilities and activities have a long history in the southwest U.S. and on the Colorado plateau which includes the Buck Springs Allotment area. Past visitors to the area have expected to see cattle and cowboys and many people still think of them as an elemental part of the southwest landscape. Studies of people's perceptions of cattle operations on public lands show that perceptions range from generally negative when cattle are associated with apparently degraded range or forest conditions, to generally positive when working cowboys and lots of green grass are present (Wallace 1996).

Fencing can affect recreation use patterns. The vision statement developed for the East Clear Creek management area described the recreation setting as the following:

“This landscape furnishes the backdrop for a wide array of recreational activities in all seasons. In general the recreationist feels free and untrammled rather than regulated and confined, and can seek out differing levels of isolation. Opportunities exist for a variety of social encounters, ranging from complete solitude to large gatherings. Recreation opportunities exist for people with a variety of abilities.”

Fencing tends to limit access, especially motorized and horse back access. If placed in close proximity to areas where people want to go, fencing can frustrate the public's access expectations. The topography of the Buck Springs Allotment area is such that the tops of the ridges such as Dane Ridge have the most desirable areas for dispersed camping and for access in general. Alternatives which create more fencing on the ridges, especially where the ridges occur alongside major roads, will have the most limiting effect on dispersed camping, one of the most popular and fastest growing activities in the area.

Fencing can also help create opportunities for “remoteness and solitude”, attributes considered highly desirable for increasing numbers of people escaping desert urban areas. Fencing can help create areas where more primitive attributes prevail, when applied strategically in conjunction with topography that limits motorized access.

Fences that exclude livestock from meadows also restrict recreation access to those areas. In most cases, these exclosures would limit vehicle access, but allow the public to carry their camping gear into the meadows and camp. Much of the public prefer to camp alongside their vehicles. Another portion of the East Clear Creek Vision states:

“In general, the landscape is not permanently inhabited by people or dominated by human built structures. In general, the landscape presents a wildland appearance in contrast to an urban or suburban appearance. Human structures are designed to blend into the landscape.”

Fences, especially fences that exclude meadows from livestock and vehicles, and spring enclosures (sucker-rod fences) are unnatural and add human-made structures to the landscape. As the miles of fence on the allotment accumulate, they become more dominant on the landscape. At the same time, improvements in soil and vegetative conditions in excluded meadows and springs would improve the natural conditions of the visual landscape. Alternative F proposes the most fences, followed by Alternatives C, E, D, and G. Alternative A would remove much of the fencing, while Alternatives E and G would eliminate fencing in some southern pastures. The number of additional structures (corrals, waterlots, drylots) follow this same pattern, with the exception that Alternative D would construct the most.

Alternatives C, D, and K propose pre-commercial thinning on 1500 and 1000 acres, while Alternatives E, F, and G propose 200 acres. Such treatments would eliminate doghair thickets of small, suppressed trees and provide a more park-like appearance to the forest on those acres. Most forest visitors tend to prefer the park-like appearance. In the short-term, accumulations of slash would detract from the forest view.

All campgrounds within the allotment are fenced to limit livestock access. Dispersed sites are open to livestock, and many campers do not like having livestock wander through or near their camps or cow-pies in their camps. Alternative A (No Grazing) would alleviate all conflicts between livestock management and recreationists, and would result in the removal of fences as they deteriorate and become hazards.

Comparison of Effects by Alternative

Access

Alternative F restricts cross-country access to a significant extent along many of the more significant ridge tops in the planning area. It is the most restrictive of all the alternatives. Alternatives C and E both restrict access to a significant extent along the north third of Battleground Ridge, while Alternatives D and K restrict access parallel to SR 87 in the north west portion of the planning area. Alternative G has the least amount of new fencing. None of the alternatives strategically promote exclusion of motorized access to the extent that opportunities for solitude or natural quiet would increase significantly. No alternative would result in a change to any ROS class designation.

Alternative C proposes 1.6 miles of road closures (portions of roads 9713G, 9714E, 9737R, and 9737Y), Alternatives D, G, and K propose 1.2 miles of road closures (portions of roads 9713G, 9714E, and 9737R) and Alternatives E and G proposes 0.2 miles of road closure (portion of 9713G) vis-à-vis pasture fencing that will close off roads. Alternative A and B propose no road closures, and as such, minimize the effects to access. The East Clear Creek Roads Analysis [#133] did not note any impacts to necessary access on any of the proposed roads. Necessary access is described as roads that access major recreation sites, private land, or administrative site access.

Scenic Quality

Alternative F has the greatest negative effect on scenic quality resulting from additional fencing and structures, followed in order of effect by Alternatives C, D, K, E, G, B, and A (least negative effect from fencing and structures). All of the action alternatives except B (existing condition) have structures (dry lots, water lots, or corrals) proposed within the Retention VQO zone along FR 300 where it will be difficult or impossible to meet the VQO standard.

Alternatives A, E, and G do the most to protect meadows from livestock grazing since most are in pastures that would not be grazed. However, they do nothing to protect the meadows from recreation vehicles. Alternatives C and F both do the most to rehabilitate and protect existing meadows (6 meadows each) from the effects of both cattle grazing and vehicle access via fencing, followed by Alternatives D and K (4 meadows fenced). Alternative B would have the greatest negative effect on the major meadows since both grazing and vehicular access would continue.

Alternative C thins the most acres of small trees (1500 acres), which would result in both an increase in short term scenic impacts and in long-term improvement to scenic quality. Alternatives D and K (1000 acres) would have positive effects similar to Alternative C but at a reduced scale. The other action alternatives (E, F, G) have minor thinning components (200 acres) followed by Alternatives A and B with no thinning and therefore no scenic impacts or benefits from this activity.

Table 29 compares the effects to scenic quality for the visibility of fencing and structures, scenic quality for meadow protection, scenic quality for tree thinning, and access, compared to the present situation.

Table 29: Summary of effects on recreation values.

	ALT. A	ALT. B	ALT. C	ALT. D/K	ALT. E	ALT. F	ALT. G
Scenic Quality: Fences, Structures	Positive	Current condition	Moderate Negative	Moderate Negative	Slightly Negative	Highly Negative	Slightly Negative
Scenic Quality: Meadows	Moderate Positive	Current Condition	Highly Positive	Slightly Positive	Moderate Positive	Highly Positive	Moderate Positive
Scenic Quality: Tree Thinning	Current Condition	Current Condition	Positive	Positive	Minimal Positive	Minimal Positive	Minimal Positive
Access (ROS)	Positive	Current Condition	Moderate Reduction	Some reduction	Some Reduction	Moderate Reduction	Slight Reduction

Cumulative Effects

Access

Livestock management affects recreation through impacts to access and scenic quality. The boundary for cumulative impacts is the allotment. The time-frame is the 10-year period of the allotment management plan.

Access for recreation vehicles would be affected on zero to 1.6 miles of the roads on the allotment. These changes would not affect primary recreation sites, administration sites, or private land. Other projects which have affected access in the recent past, or plan changes in the future include the East Clear Creek Watershed Health project which relocate one road to move it out of a meadow, and would install a pole fence along meadows on a second road. These actions would add to fences around meadows proposed in the Buck Springs Range Allotment project and would restrict off-road vehicular access to meadows. The East Clear Creek Project also plans two area closures to vehicles (Dines Tank and Dane Springs) which would restrict access to about 5 acres. The Apache-Sitgreaves National Forest closed portions of FR 91 and FR 40. Cumulatively, these projects affect access to less than 1% of the allotment.

Fences, waterlots, drylots, and corrals proposed by the project would alter the visual quality of the area by adding human-made structures. This action would add zero to 33 miles of fence to the existing 90 miles of fence, and up to four corrals, 12 waterlots, and 6 drylots. The East Clear Creek Watershed Health Project plans pole fences along FR 321C at meadow sections, which would add human-made structures to the landscape. No other projects propose human-made structures. If the maximum miles of new fence, corrals, waterlots, and drylots are built under this action, it would add substantially to the change in visual quality of allotment area. A mid-range alternative such as Alternative G would add about 13 miles of fence, and up to two corrals, three waterlots, and two drylots, which would alter the visual aesthetics in small local areas but the allotment as a whole would not be visually impacted.

CULTURAL RESOURCES

[#80]

The 28 previously recorded sites are considered potentially eligible for the National Register and are considered eligible for purposes for this project. They shall be protected until testing or additional information is available that would allow a formal determination of eligibility to be made.

Livestock grazing has occurred in the Southwest since European contact, and has been a permitted activity on the Forest since its inception in 1906. In addition, wild ungulates have ranged free, potentially in substantial numbers, throughout time; effects to cultural resources have occurred as a result of this situation and are considered *status quo*, or the existing situation. Management of livestock under any of the alternatives, including the No Grazing, would result in no effect, as it continues this *status quo*.

Cumulative Effects

Since this project would have no effects to Cultural Resources, there are no cumulative effects to add to any other past, present, and future actions.

SOCIAL CONCERNS AND ECONOMIC INFLUENCES

[#108]

Economic Influences

Under Alternatives B, C, D, E, F, G, and K, livestock grazing use would continue on the allotment, with corresponding economic contributions to the community and the County (Table 30). The Ranch manager and workers would continue to gain economically, as would businesses in the surrounding area that cater to the Ranch's needs and the needs of the families associated with the Ranch. Coconino County would also continue to gain economically, in the form of payments from the Federal government in lieu of taxes.

Table 30. Direct and indirect jobs and payments in lieu of taxes generated by each management alternative.

	ALT. B (746)	ALT. B (447)	ALT. C	ALT. D ALT. K	ALT. E	ALT. F W 1/2	ALT. G W 1/2
Direct and Indirect jobs¹	8.5	5.1	7.6	8.9	6.0	4.6	4.5
Payment to County²	\$1,292	\$774	\$1,159	\$1,351	\$920	\$705	\$681

¹ 1.14 jobs/100 head (R3 estimate; 1995)

² Payment in lieu of taxes; 25% of 2003 grazing fees

Under Alternative A, livestock would not use the allotment, and there would be a loss in the number of direct jobs and contributions to the County associated with this operation. A loss in the number of indirect jobs is also likely, but may not be as substantial as presented here, as long as other ranches and private individuals continue to support the businesses that supply the same needs. Recreation visitors to the Ranger District are increasing in numbers on an annual basis. This would temper the effects to local businesses due to an end in grazing on this allotment.

Investment Analysis

Quantifiable factors, such as economic costs and outputs, projected head months (HM), and animal unit months (AUM) were used to describe some of the economic effects of livestock grazing use on the Buck Springs Range Allotment. A model called *Quick-Silver* was used to calculate the estimated economic cost and benefits of each alternative

(USDA 1999c). The investment analysis anticipates the rate of return for the projected expenditures by the permittees and the Forest Service for management of the Buck Springs allotment. Measures used to conduct an investment analysis include: present value of benefits, present value of costs, present net value and the benefit/cost ratio. These values are displayed in Tables 31 and 32, below.

Non-monetary benefits or costs are not calculated from this analysis. Non-market values are discussed in a narrative following the investment analysis. The estimates in this analysis are based on a variety of quantitative assumptions, including actual current market values and the estimation of livestock numbers, both of which will likely change over time. Therefore, the projections presented in Tables 31 and 32 serve as indicators of change for comparing alternatives, rather than an exact measure of value. A description of the transactions, units of measure, and cost of units used for the analysis is located in the project record. All transactions are discounted over time with a 4% discount rate.

Economic Values

Tables 31 and 32 display economic values calculated by the *QuickSilver Program*. The first column labeled Alternative B displays the economics of the current permitted numbers. Since it is extremely unlikely that these numbers would be allowed under the current management strategy (due to a likely jeopardy determination for a threatened species), the following discussions use the numbers currently allowed (second column of the table) for comparing alternatives.

The following are definitions of fields in Tables 31 and 32:

The *Benefit/Cost Ratio* represents the value of benefits divided by the value of costs.

The *Present Net Value* represents the value of benefits minus the value of costs for a period of 10 years.

The *Present Value of Benefits* represent the present value of grazing on the allotment over the next 10 years for the permittee (Table 31), and the present value of the grazing fees over the next 10 years for the Forest Service (Table 32). The Forest Service recognizes the value of grazing to the permittee as the value of AUMs while the value that the Forest Service receives from the allotment is the amount of grazing fees collected.

The *Present Value of Costs* represents the present costs of the operation of the allotment, including maintenance and range improvements for the permittee over the next 10 years (Table 31). This value for the Forest Service includes costs for administration of the allotment, range inspections, monitoring, archeological and biological clearances, and their share of the costs for range improvements for the next 10 years (Table 32).

The public has expressed interest in the costs of improvements to the federal government, and thus to the taxpayers. Table 33 shows these costs for new fencing, cattle-guards, corrals, drylot, and waterlots. The Forest Service usually pays a higher proportion of the costs for cattleguards, and corrals, while the permittee generally pays a higher proportion of the costs for fences. In Alternatives C, D, F, and K, the Forest Service shares these costs of all improvements with the permittee. In Alternatives E and G, the permittee assumes all of the costs for many of the fences, while the Forest Service shares in the costs of fences required for a minimal rotation and for other improvements.

Table 31. Analysis of the economic costs and benefits for the permittee by alternative for the 10-year period.

RANCH ¹	AL T.A	ALT. B (746) ²	ALT. B (447) ²	ALT. C	ALT. D	ALT. E	ALT. F	ALT. G	ALT. K
B/C Ratio	NA	1.94	1.28	1.19	1.33	0.89	0.65	1.17	1.36
Present Net Value (\$)	NA	170,798	46,843	50,391	90,599	-32,244	-96,124	21,927	97,363
Present Value Benefits (\$)	NA	352,994	211,559	316,605	368,919	251,440	180,962	153,234	368,918
Present Value Cost (\$)	NA	-182,196	-164,716	-266,213	-278,320	-283,684	-277,085	-131,307	-271,555

Table 32. Analysis of the economic costs and benefits for the US Forest Service by alternative for the 10-year period.

USFS ³	ALT.A	ALT. B (746) ²	ALT. B (447) ²	ALT. C	ALT. D	ALT. E	ALT. F	ALT. G	ALT.K
B/C Ratio	0.00	0.16	0.09	0.09	0.13	0.14	0.07	0.13	0.13
Present Net Value (\$)	-100,495	-235,161	-252,630	-403,945	-310,029	-195,551	-288,323	-126,907	-301,095
Present Value Benefits (\$)	0	43,592	26,123	39,105	45,596	31,042	22,326	18,871	45,596
(\$ Present Value Cost	-100,495	-278,754	-278,754	-443,051	-355,625	-226,594	-310,649	-145,779	-346,691

¹ The Ranch provides for a varying share of the cost of structural range improvements on the allotment.

² The economics for Alternative B were run with full permitted numbers and with current allowable numbers, to show the economics of both scenarios. The numbers in parentheses () indicate that one was run using 746 cow/calf pairs, while the second was run using 447 cow/calf pairs.

³ The Forest Service provides a proportionate share of the cost of the structural range improvements on the allotment by alternative. They may use allocated funds, cost share funds, or grants, to pay for non-structural vegetation treatments, and soil, watershed, and wildlife habitat improvements such as prescribed burning, precommercial thinning, or construction of wildlife exclosures.

Table 33: Costs Of Range Improvements By Alternative for the Permittee and the US Forest Service.

ALTERNATIVES								
	A	B	C	D	E	F	G	K
Permittee	\$0	\$0	\$80,500	\$87,750	\$121,100	\$134,700	\$87,350	\$80,500
USFS	\$0	\$0	\$304,900	\$210,100	\$67,300	\$157,600	\$26,450	\$200,150

Benefit/Cost Ratio and Improvement Costs

The benefit/cost ratio (B/C) represents the total discounted benefits of the project divided by the total discounted costs. The comparison of the B/C ratio for all the grazing alternatives can be a helpful tool in decision making. The B/C ratios for grazing alternatives for the Ranch range from 0.65 to 1.36 (1.94 for Alternative B with full numbers). A B/C ratio of 1.00 indicates that the benefits are about equal to the cost. B/C ratios exceed 1.00 in Alternatives B, C, D, G and K, and are less than 1.00 in Alternatives E and F. However, costs for improvements are based on contract costs used by the Forest Service. The costs to the permittee are likely to be less than those projected, which would result in a more positive B/C for the permittee.

The B/C ratios for the Forest Service for the grazing alternatives vary from 0.07 to 0.14 (0.16 for Alternative B with full numbers), with costs out-weighing the economic benefits approximately 10 to 1.

Alternative A: No Grazing

Under this no graze alternative, no economic benefits would be generated for either the Ranch or the Forest Service. The permittee would incur expenses while realizing no income from the allotment. No investment in structural improvements or daily management would be made by the permittee. Adjacent permittees would incur a higher annual cost of maintaining boundary fences. The government would incur a loss of investment in existing improvements, as they deteriorate due to lack of maintenance, and would lose the income from grazing fees. However, the need for Forest Service range administration of this allotment would be minimal, including the lack of future investments in range improvements over the 10-year term of this document. Forest Service costs would remain fairly high and include watershed, range and wildlife monitoring, removal of downed fences, and wiring open gates.

Neither the permittee nor the Forest Service would incur costs for improvements under this alternative.

Alternative B: No Action, Current Management

As discussed above, the economic model Quick-silver was run for both the current numbers on the permit, and for the numbers currently allowed under consultation with the US Fish and Wildlife Service. This discussion is based on the numbers currently allowed rather than the numbers on the permit. If this alternative were selected, the Ranch would receive a positive B/C ratio 1.28. The only costs to the ranch would be those associated with current management requirements, such as maintaining existing structures and paying grazing fees. This alternative, however, is extremely variable with a high degree of uncertainty on a year-to-year basis, and the costs may be highly underestimated. The economic analysis is based on some very gross assumptions about the numbers of livestock, pastures to be used, and the lack of needed improvements. Annual consultations with the US Fish and Wildlife Service would set numbers and pastures and would likely require additional improvements on a yearly basis.

This alternative would require the least investment from the permittee in terms of construction and maintenance of range improvements and in daily management of the allotment. Existing improvements would continue to deteriorate in unused pastures due to lack of maintenance, causing a loss of the initial government investment. The permittee is concerned over the uncertainty of allowable numbers on an annual basis, making it difficult to plan ahead for acquisition of livestock. The possibility that livestock would have to be removed from the allotment before the end of the grazing season would create additional uncertainty for the permittee. The Ranch would receive benefits from the value of AUMs, with a B/C ratio of 1.28.

The Forest Service costs would be associated with the current level of administration and monitoring required to allow livestock use on the allotment. On-the-ground Forest Service administration costs would be very high. The Forest Service would receive benefits from the grazing fees paid by the permittee. The B/C ratio (0.09) is higher than Alternatives A, and F, the same as C and lower than D, E, G, and K.

Neither the permittee nor the Forest Service would incur costs for improvements under this alternative.

Alternative C: Proposed Action

In this alternative, the Ranch would receive a relatively high economic gain. The B/C ratio for the Ranch is less than B, D and K and greater than A, E, F, and G, a result of a moderate level of expenditures on range improvements while being permitted with 90% of the current number of livestock.

This alternative would result in the second to lowest B/C ratio (0.09) for the Forest Service, only Alternative A and Alternative F are lower, due in part to the large number of new improvements, moderately high miles of new fence construction, and greatest number of acres of pre-commercial thinning.

The costs to the permittee for range improvements would be approximately one-third of the costs to the US Forest Service.

Alternative D: Herding

If the herding alternative were chosen, benefits would exceed costs for the Ranch, with a B/C ratio of 1.33. This B/C ratio is exceeded by Alternative K. There is some uncertainty involved in the implementation of this alternative, if the permittee is unable to effectively herd for a period of time, livestock would be restricted to fewer pastures, possibly resulting in reduced numbers or early removal from the allotment.

Costs for the Forest Service would far exceed benefits with a B/C ratio of 0.13. Comparatively, the B/C ratio lies in the middle, being greater than Alternatives B, C, and F, equal to Alternatives G, and K, and less than Alternative E.

The costs to the permittee for range improvements are far less than the costs for improvements to the US Forest Service, and slightly more equitable than Alternative C.

Alternative E: Northern Pasture Emphasis

Implementation of the northern pastures alternative would result in the second lowest B/C ratio (0.89) for the Ranch and would have the highest B/C ratio (0.14) for the Forest Service. Since this alternative would only utilize the northern pastures, the miles of new fence construction, the number of improvements, and the acres of pre-commercial thinning would be lower than Alternatives C and D for both the Ranch and the Forest Service. Aside from the no graze Alternative, this alternative would have the second lowest cost for the Forest Service.

More of the costs for range improvements are transferred to the permittee in this alternative. The permittee would pay nearly twice the amount that the US Forest Service would pay for improvements.

Alternative F: Rest-Rotation

Under the rest rotation alternative, the B/C ratio would be the lowest of all Alternatives for the Ranch (0.65) and would be the lowest of all the Alternatives for the Forest Service (0.07). Benefits for both parties would be lower than any of the other action Alternatives B, C, D, E, F, and K. Costs would be the highest of any alternative for the Ranch and mid-range for the Forest Service, resulting in a poor economic return for both parties.

Due to the proportionate costs of the different improvements, and the high amount of fencing in this alternative, costs are fairly equitable for the Forest Service and the permittee. The permittee would incur the highest costs for this alternative, while Forest Service costs would be mid-range of the alternatives.

Alternative G: Northern Pastures, Rest-Rotation

Under this alternative, the Ranch has a higher B/C ratio (1.17) than Alternatives E and F, though lower than Alternatives B, C, D, and K. The B/C ratio for the Forest Service (0.13) is exceeded only by Alternative E.

More of the costs for range improvements are transferred to the permittee in this alternative. The permittee would pay nearly three times the amount that the US Forest Service would pay for improvements. Costs for the Forest Service are the lowest of all alternative, except A and B. Costs for the permittee are greater than alternatives A, B, C, and K, and less than alternatives D, E, and F.

Alternative K: Modified Herding

This alternative is identical in all effects to Alternative D, with the exception of the economic analysis. It shows the highest B/C ratio (1.36) for the Ranch. The B/C ratio for the Forest Service is 0.13, and is mid range of the alternatives, exceeded by Alternative E and similar to Alternatives D and G. This alternative differs economically from Alternative D by replacing 2.1 miles of permanent fence with temporary fence, resulting in lower costs.

The Forest Service costs for improvements would be about two and a half times the costs to the permittee. There would be no range improvement costs under Alternative A and B, while Alternatives C and K show the lowest costs for the permittee for actual improvements.

Summary of Economic Influences

Using the B/C ratio as the indicator of economic influence, the alternative with the highest B/C ratio for the Ranch is Alternative K, followed in descending order by Alternatives D, B, C, G, E, and F, respectively. Alternatives E and F are the only alternatives with a B/C ratio less than 1.00 for the Ranch.

The Forest Service would get no economic benefit from Alternative A, however, costs would be the lowest of all alternatives. The highest B/C ratio would be Alternative E, followed by Alternative D, G, and K (tied), then Alternatives B and C (tied). with Alternative F having the lowest B/C. There would be no range improvements for Alternative A and B, with Alternative G showing the lowest costs for actual improvements.

Non-Market Benefits

Social concerns for livestock grazing are related to public perception of the appropriate use of public lands, customs and traditions of the area and the community, and ranching life-style in relation to forest resources. Based on comments from local residents and forest visitors, there is a wide variation in reactions to cattle on the Forest. To the visitor

traveling along the highways or backroads, cattle may be thought of as picturesque and typical of the “western life-style”. But to someone who dislikes any kind of “un-natural” structures or animal on the landscape, the presence of cattle disrupts their perception of the Forest as a wild place. Some people object to livestock grazing of western public lands based on ecological concerns, such as damage to riparian areas, watersheds and wildlife habitat, which can be caused by poorly managed livestock use. However, to those whose economic and social well-being is tied to the land, and to ranching in particular, livestock use is perceived as part of everyday life. Based on responses to the Proposed Action for the Buck Springs Range Allotment, there appears to be overall public acceptance of livestock grazing as long as the animals are controlled, impacts to all resources are considered and monitored, and sensitive areas (especially riparian areas) are protected from unwanted impacts [#30]. Thus, a majority of the non-market benefits that will be discussed are tied to improved soil and watershed conditions.

The value of the federal public lands is both vast and incalculable. While it is frequently possible to quantify public and private revenues associated with specific public land resources, activities, and programs, this information rarely paints a complete picture of resource valuation. Of particular concern is the observation that many qualities of the public lands are valued in ways that are not explicitly economic, thus impeding efforts to quantify all resource values using a singular, monetary valuation criterion. Additionally, many types of values with an economic component defy easy measurement. This can be particularly troublesome for resource goods and services that are not directly associated with human consumption or use, and for those which are not amenable to market transactions due to their public good orientation, their intergenerational nature, or to related qualities promoting market failures. There is no evidence that the presence of, or the lack of cattle, affects the opportunities for dispersed recreation and recreation use is increasing in the area [#30].

The following narrative discusses the non-market benefits resulting from the implementation of the different alternatives. Non-market benefits are either consumptive or non-consumptive. Consumptive benefits are those things that require something physical be removed from the site or have the potential to physically affect the site. Non-consumptive benefits are those in which nothing physical is removed from the site and there is no potential to physically affect the site.

Improved soil and water conditions through improved livestock management or through removal of livestock are both consumptive and non-consumptive in nature. Consumptive benefits include an increase in water flow and a longer duration of flow. This benefit would primarily aid downstream users of the water (Winslow and tribal users), as well as anglers (primarily downstream of the dam).

Non-consumptive benefits of improved soil and watershed conditions are tied to recreation benefits. Improved flow and duration of flow would allow recreationists an increased opportunity to visit sites with water. Also, with improved riparian conditions comes an increase in biodiversity. Examples of non-consumptive benefits of improved

riparian conditions include recreational camping, sightseeing, bird watching, hiking, and wildlife viewing.

Improved soil stability and productivity benefits result when the existing soil remains in place or conditions are created so as to enhance either on-site soil creation or retention of soil deposited from off-site. This leads to improved soil productivity, which in turn would lead to increasing vegetative biomass and species diversity.\

Other non-market benefits include ceremonial and medicinal benefits from improved soil and watershed conditions, and in particular improvements in native plant biodiversity, and educational opportunities. Consumptive ceremonial and medicinal benefits include the gathering of ceremonial and medicinal items. Opportunities for this activity would be expected to increase as riparian habitat improves. Non-consumptive uses include the passing on of ceremonial and medicinal knowledge to younger generations. Educational non-consumptive benefits include research opportunities and improving the level of awareness about the function of properly functioning watersheds, soils, and riparian areas.

Alternative A has the best chance to improve these non-market benefits because it would provide the greatest improvement to the riparian areas and soil and watershed conditions. The absence of livestock would also offer 70,000+ acres for those who may be opposed to recreating in areas with cattle. Of the action alternatives, Alternative G would have the greatest chance to improve non-market benefits related to soil and watersheds. Alternative G and E allow for about 27,000 acres of cattle free recreation. Alternatives C, D, E, and F are similar in their opportunities to improve soil and watershed non-market benefits, while Alternative B would improve non-market opportunities the least.

WILD AND SCENIC RIVERS

[#71]

This document evaluates the potential for effects to the outstanding resource values that were identified for the three creeks identified in the *Preliminary Analysis of Eligibility and Classification for Wind, Scenic, and Recreation River Designation*. This discussion is not a further analysis of eligibility, which will be conducted during revision of the Coconino National Forest Plan. This project recognizes the ORVs outlined in the document and would protect them.

Section 7(b) of the Wild and Scenic Rivers (W&SR) Act of 1968 provides a specific standard for review of developments near a congressionally authorized “study river”. Section 7(b) specifies:

Developments below or above a potential wild, scenic or recreational river may occur as long as the project “will not invade the area or diminish the scenic, recreational, and fish and wildlife values present in the potential wild, scenic or recreational river area on the date of designation of a river for study as provided in Section 5 of this Act.”

In regards to the Buck Springs Allotment, existing livestock control fencing and topographic relief along East Clear Creek, Leonard Canyon, and Barbershop Canyon prevent virtually all livestock use of these drainages. With a few exceptions, existing fences have been constructed along canyon rims and benches, out of sight from the deeply incised drainage bottoms. Existing fences cross Leonard Canyon at two places within a mile below Knoll Lake, and at four places within the vicinity of Dines Tank. Depending on alternative, additional fencing would exclude livestock access to remaining portions of Leonard Canyon. These proposed fences would be constructed along locations that are out of sight of the drainage bottom.

Livestock may inevitably get past control fencing and/or overcome the physical barriers protecting entry into the three potential Wild and Scenic River drainages. Herd movement between McClintock and South Pinchot and/or North McClintock, and between North McClintock and North Pinchot would require crossing Barbershop Canyon. Any livestock use of the potential Wild and Scenic River drainages would be evident through bank and vegetation trampling, forage utilization, and defecation. This would be particularly true of those areas used as livestock crossings between pastures.

None of the proposed structural improvements would invade or diminish the “outstandingly remarkable values” identified for East Clear Creek, Leonard Canyon, and Barbershop Canyon. However, unauthorized livestock use could pose a slight diminishing effect on the fisheries habitat values identified for Leonard or Barbershop Canyons. Evidence of livestock use could degrade the scenic value of Barbershop Canyon and the recreational experience sought in Leonard Canyon. These impacts would be very local at very small sites in the drainages and would not affect potential inclusion of the creeks as Wild and Scenic Rivers.

INVENTORIED ROADLESS AREAS

Livestock management would not affect roadless areas. There is no new road building proposed and the project would not affect the roadless character.

MEMORANDUM OF UNDERSTANDING FOR RECOVERY OF THE EAST CLEAR CREEK WATERSHED

In the fall of 2000, the Arizona Game and Fish Department, US Fish and Wildlife Service, Apache-Sitgreaves National Forest and the Coconino National Forest signed a general memorandum of understanding that specified using the *East Clear Creek Watershed Recovery Strategy for the Little Colorado Spinedace and Other Riparian Species* (Watershed Recovery Strategy) as the guiding document for the management of the East Clear Creek Watershed. This project and others (East Clear Creek Watershed Health Project, Victorine Fuels Project) propose actions to work towards watershed health and the recovery of the Little Colorado spinedace.