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# Environmental Assessment

## Anita, Cameron, and Moqui Allotment Management Plan Revisions

Tusayan Ranger District, Kaibab National Forest  
Coconino County, Arizona

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## SUMMARY

The Kaibab National Forest proposes to revise the management plans for the Anita, Cameron, and Moqui Range Allotments. The project area is located adjacent to and south of the Grand Canyon National Park on the Tusayan Ranger District, Kaibab National Forest. This action is proposed, because there is a need to improve cool season grass density, enhance the browse component in the pinyon/juniper and grass-shrub ecosystems, and balance the permitted numbers with existing production. The Forest Service is required by the 1995 Rescissions Act to undertake full public disclosure of the environmental impacts of livestock activities.

### Anita/Cameron

The proposed action for the Anita/Cameron Allotments would provide for the continuation of the ranching operation and authorize a range of numbers going from of 600 adult livestock per year to a high of 1,310 head per year. The approved season of use would be summer with a rest-rotation grazing strategy employed. The allowable use standard is set at 35 percent in the grassland zones and 20 percent in the uplands. Improvement in the browse habitat and grass frequency is projected under this action. The high deferment success, rest projected, elimination of livestock grazing in the winter rangeland, and low allowable use will promote improved conditions in the grassland, savanna, and ponderosa pine ecosystems. Net profits to the permittee will be positive under the range of numbers disclosed for Alternative 1.

In addition to the proposed action, the Forest Service also evaluated the following alternatives for the Anita/Cameron Allotments:

No-Action or Alternative 2: This alternative would cancel the term permit and all livestock would be removed from the allotment. The total rest provided, at least on the short term, would provide for the optimum conditions for the expansion and reproduction of native plants and we expect to see the highest improvement in range, watershed, and wildlife habitat conditions under this action.

Current Action or Alternative 3: This alternative would maintain current management, which is approximately 385 adult livestock for a yearlong season of use. A deferred rotation strategy would be employed. The allowable use is set at 55 percent on browse and 40 percent on grasses. The light stocking and resulting low actual utilization rates would improve range, watershed, and wildlife resources though the yearlong season of use will hamper browse regeneration. The minimum level water hauling and maintenance work results in this action displaying the second highest profit margin to the permittee. It is unlikely that this alternative could be sustained since the structures on both allotments need significant work and at some point the ability to manage livestock would be seriously hampered.

Alternative 4: This action would permit livestock use on a temporary basis when water availability and forage production is optimum. The shifting of costs to the public sector or another entity from the permittee, the reduction in costs for hauling water and livestock all contribute to this alternative having the highest profit margin for the

operator. Conversely, the highest costs for the Agency are found under this action since we absorb the maintenance responsibility. Another change is the stability of term grazing privileges as compared to a temporary permitting process to an individual rancher. We believe this would be lowered, though looking at this situation from a forest-wide perspective, having areas where other permittees can go and maintain their herd when they are in nonuse status could actually bring higher stability to the grazing program. As with all alternatives improvements in range, watershed, and wildlife resource conditions are projected and we believe this action will result in the second highest rate of improvement.

## Moqui

The proposed action for the Moqui Allotment would maintain the current class of livestock (yearlings), season of use (summer), and rotation strategy (deferred). A range of authorized numbers going from 50 percent of current term numbers (280 yearlings) to 100 percent (560 yearlings) would be evaluated. Adjustments in livestock season of use, utilization levels, and rotation strategy would occur based on monitoring of utilization and changes in range conditions. Additional connected actions include reducing livestock allowable use standard to 30 percent in key areas and 20 percent allowable targeted to the full capacity lands found in the upland landscape positions.

In addition to the proposed action, the Forest Service also evaluated the following alternatives for the Moqui Allotment:

No-Action or Alternative 2: This alternative would cancel the term permit and all livestock would be removed from the allotment. The total rest provided would provide for the optimum conditions for the expansion and reproduction of native plants and we expect to see the highest improvement in range, watershed, and wildlife habitat conditions under this action.

Current Action or Alternative 3: This alternative would maintain current management, which is approximately 560 yearling livestock for 5 ½ months during the summer months. A deferred rotation strategy would be maintained with allowable use set at 30 percent in the key grassland zones and 20 percent within the full capacity upland sites. Light stocking and predicted moderate to low actual utilization rates would improve range, watershed, and wildlife resources.

## Adaptive Management

Adaptive management is included in the proposed actions for both Anita/Cameron and Moqui Allotments and could include the following adjustments if monitoring indicates desired conditions are not being met:

1. Authorized livestock numbers would be adjusted annually, if needed, to meet existing capacities of the allotments. This variation would normally be between the previously identified minimum and maximum number for the Anita/Cameron and Moqui Allotments. Under extreme drought conditions, authorized livestock numbers could drop below the minimum.
2. The on and off dates could be modified within the allotments. Later livestock entry dates and earlier livestock removal dates on the allotments would occur in

order to promote the growth and reproduction of desired herbaceous plants. Changes in on/off dates would be required if utilization levels on primary forage grasses exceed allowable levels, the frequency of these plants drops, or suitable progress toward desired vegetation conditions does not occur.

Based upon the effects of the alternatives, the responsible official will decide.

Whether the proposed actions for these allotment management plan revisions will proceed as proposed, be modified by another action alternative, or result in no livestock grazing. If livestock grazing does continue the District Ranger will also determine:

1. The required best management practices (BMP's) or mitigation measures and monitoring that will occur.
2. Whether the decision is consistent with the Kaibab Forest Plan or requires a Forest Plan amendment.

# INTRODUCTION

## Document Structure

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The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into five sections:

- *Introduction:* The section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Comparison of Alternatives, including the Proposed Action:* This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public, other agencies or internally. This discussion also includes best management practices and possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Affected Environment and Environmental Consequences:* This segment summarizes information on the physical, biological, social and economic environments and discloses the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area and where appropriate consolidates the discussion of impacts, and highlights the relationship between local short-term uses of the environment and the maintenance as well as enhancement of long-term productivity. Within each section, the affected environment is described first, followed by the effects common between alternatives and those impacts specific to an alternative. The No Action Alternative provides the baseline for evaluation and comparison with other actions considered in this analysis.
- *Agencies and Persons Consulted:* This part provides a list of preparers and agencies consulted during the development of the environmental assessment.
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Supervisors Office, Kaibab National Forest in Williams, Arizona.

## Background

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The Anita, Cameron, and Moqui Range Allotments are located on the Tusayan Ranger District, Kaibab National Forest and total approximately 260,415 acres or roughly 80 percent of the land area associated with the District (refer to attached map).

The Anita and Cameron Allotments currently authorize grazing for a term number of 666 and 1200 yearlings, yearlong. Conversion from the yearling classification to adult livestock is 465 head and 840 head, respectively. If both allotments are considered as one unit this equals 1,305 head for the yearlong season of use. The Moqui Allotment allows a maximum 560 yearlings for 5 1/2 months during the summer. Grazing on the Anita/Cameron Allotments was under permit to the same permittee for 40 years until recently, when a new applicant acquired the base property and another permit was issued. The Moqui Allotment has been under permit to the Babbitt Ranches since 1910.

Documented range condition monitoring was initiated on these allotments beginning in the 1950's with subsequent inventory work continuing through 2004. During that time the long-term range monitoring plots have been read on a consistent basis with the last plot readings occurring in the mid to late 1990's. Additional monitoring measurements, in the form of pace transects, has also been collected during this same time period and are continuing to the present.

Until recently, resource inventories note poor range, watershed, and wildlife resource conditions, especially on the Cameron Allotment. Studies invariably tied these conditions to an imbalance between the amounts of forage produced in any given year to what was authorized on the term permit. Beginning in the 1970's and continuing well into the 1980's a series of analysis were undertaken, on both the Anita/Cameron Allotments, that concluded changes in management were needed, though, few were implemented.

## Existing and Desired Conditions

Prior to the development of the proposed action, an analysis team completed an assessment of the existing range, wildlife, and watershed resource conditions. The desired conditions were developed from a review of the goals and objectives for Kaibab Forest Plan Management Areas 8, 9, and 10, which are located in the project area, and the applicable standards and guidelines from the Forest Plan. Existing and desired resource conditions have been identified for six terrestrial ecosystems; 1) fourwing saltbush/western wheatgrass/pinyon pine, 2) big sagebrush/blue grama/pinyon pine, 3) pinyon pine/juniper, 4) ponderosa pine/pinyon pine/Gambel oak/big sagebrush, 5) Kentucky bluegrass/western wheatgrass/ponderosa pine, and 6) ponderosa pine/Gambel oak. The existing and desired conditions for each of these ecosystems are:

### **1. Fourwing saltbush/western wheatgrass/pinyon pine ecosystem (full capacity rangelands):**

**Current Conditions:** This ecosystem is located in the southern portion of the project area and includes both alluvial bottomlands and upland sites. Terrestrial ecosystem (TES) map units representing this ecosystem include units 3, 255, 591, and 677 (USDA-Forest Service, Region 3, 1991). Current soil erosion rate is below the tolerance level and the watershed condition is considered satisfactory. Areas where these TES units are mapped are considered fully capable of being grazed and an allowable use standard adopted (Project Record, USDA Kaibab

National Forest, 2004). Dominant plants include blue grama, western wheatgrass, fleabane species, and squirreltail. Browse plants, including fourwing saltbush and winterfat occur, though their overall frequency is considered low and is generally less than five percent. Past high use by livestock and current use by wildlife has resulted in many browse plants displaying poor growth form. The range resource value ranking is considered poor, (Project Record, USDA Kaibab National Forest, 2004) though the trend is upward. This ecosystem is regarded as important winter range for the Kaibab National Forest Plan Management Indicator Species elk and antelope. The low frequencies of browse plants limit this ecosystem in its overall carrying capacity for these big game species during the winter months.

**Desired Conditions:** These communities are dominated by grass plants with forbs and shrub species represented in higher densities than presently found. Western wheatgrass, Indian ricegrass, needle and thread, and junegrass are the dominant grasses with a strong subdominant representation of blue grama. Other plants are found in higher densities; include spike muhly, squirreltail, and side-oats grama, asters, globemallow, spurge, buckwheat species, fourwing saltbush, and winterfat. Rabbitbrush, snakeweed, and pingue are absent to minimally present. Frequency of desirable grasses, forbs, and shrubs are approximately 60 percent, 20 percent, and 20 percent, respectively. Minimal pinyon and juniper woodland encroachment is found in this ecosystem. Watershed conditions are maintained in the satisfactory category.

Big game wildlife winter range carrying capacities are improved by increasing the frequency of browse plants. The distributions of mid- to late-seral conditions are improved across the project area.

## **2. Big sagebrush/blue grama/pinyon pine ecosystem (full capacity rangelands):**

**Current Conditions:** Like the fourwing saltbush type, this ecosystem occurs at the lower elevations and is also found in both alluvial bottomlands and upland sites. Slope gradients range from 0 to 15 percent. Terrestrial ecosystem map units representing this ecosystem include units 23, 634, 672, 682, and 683 (USDA-Forest Service, Region 3, 1991). Current soil erosion is below the tolerance with the watershed condition considered impaired. The impaired classification results from the high dominance of big sagebrush that limits nutrient cycling. Typically, once big sagebrush achieves over 30 percent of the frequency it effectively ties up most of the available nitrogen and limits regeneration of native grasses. At these high concentrations it also withdraws most of the available water, further limiting the ability of other plants to compete with it. Areas where these TES units are mapped are considered fully capable of being grazed and an allowable use standard adopted (Project Record, USDA Kaibab National Forest, 2004). Dominant plants include blue grama, western wheatgrass, fleabane species, squirreltail, big sagebrush, and crested wheatgrass. The range resource value ranking and soil stability are both classed as poor (USDA Forest Service, Region



3, 1997), with the trend considered stable to downward. The downward classification results from the continual expansion of big sagebrush due to fire absence, which results in a decline in grass plants and a corresponding drop in range condition. This ecosystem is good winter range for the Kaibab National Forest Plan Management Indicator Species mule deer. It is not considered high quality habitat for either elk or antelope since big sagebrush is not a large component of their diet.

**Desired Conditions:** These communities shift from an ecosystem dominated by big sagebrush to an area where at least 50 percent of the species frequency is comprised of native grasses. Forbs and desirable browse plants are also represented in higher densities. Western wheatgrass, Indian ricegrass, and junegrass are the dominant grasses with a strong subdominant representation of blue grama. Other plants that are found in higher densities include spike muhly, mutton bluegrass, and side-oats grama, asters, globemallow, spurge, buckwheat species, fourwing saltbush, and winterfat. Rabbitbrush, snakeweed, and pingue are absent to minimally present. Frequency of desirable grasses, forbs, and shrubs is approximately 50 percent, 15 percent, and 15 percent, respectively. The remaining 20 percent is comprised of big sagebrush. Minimal pinyon juniper woodland encroachment occurs within this ecosystem. Watershed conditions move from the impaired category to satisfactory over 50 percent of the area where these units are found.

Wildlife winter range carrying capacities improve through increases in browse plants. The distributions of mid- to late-seral conditions are improved across the project area.

### **3. Pinyon pine/juniper ecosystem (full capacity rangelands)**

**Current conditions:** This ecosystem is forested with both pinyon pine and juniper species. Juniper is dominant at the lower elevations and pinyon pine is prevalent in the higher elevations. Gambel oak is also found, though this is confined to the transition zone between the woodland and ponderosa pine ecosystem. Terrestrial ecosystem map units representing this ecosystem include units 263, 495, 586, 592, and 599 (USDA-Forest Service, Region 3, 1991). Current soil erosion is below the tolerance with watershed condition considered satisfactory. Areas where these units are mapped are considered fully capable of being grazed and an allowable use standard adopted (Project Record, USDA Kaibab National Forest, 2004). Dominant plants include blue grama, fleabane species, mutton bluegrass, and pinyon pine. The range resource value ranking is classed as poor (USDA Forest Service, Region 3, 1997) with static trend. Soil stability is considered fair, also with static trend. This ecosystem is fair winter range for the Kaibab National Forest Management Indicator species elk and mule deer, though it is considered poor for antelope due to dominance of pinyon pine and juniper. It is, however, considered excellent hiding cover and good thermal cover.

**Desired Conditions:** These TES units are maintained in the full capacity rangeland designation and have increased frequency of cool season grasses and overall carrying capacity. The existing pinyon pine and juniper stand density decreases from 40 to 60 trees per acre to less than 10 trees per acre. Mutton bluegrass, western wheatgrass, and junegrass are dominant with a strong subdominant representation of blue grama. Other plants that are found in higher densities include side-oats grama, and cliffrose. Rabbitbrush, snakeweed, and pingue are absent to minimally present. Frequency of desirable grasses, forbs, and shrubs is approximately 60 percent, 20 percent, and 20 percent, respectively. The overstory dominance of woodland trees suppresses gains in range related resource values. Watershed conditions are maintained in satisfactory condition.

Big game wildlife winter range carrying capacities improve, though increases in browse plants are hampered by the existing pinyon pine and juniper overstory. Manage between 35 and 50 percent of the area that displays a dominance of woodland trees. Corridors are provided for pronghorn antelope to move from winter to summer areas. Also, adequate shrub height is maintained in antelope fawning areas to provide security cover. The distribution of mid- to late-seral conditions is improved across the project area.

#### **4. Pinyon pine/juniper ecosystem (potential capacity rangelands)**

**Current conditions:** This ecosystem is also forested with pinyon pine and juniper species, though the density of trees is higher than the full capacity rangelands. The potential capacity designation applies to areas where forage production is less than 100 pounds per acre. Areas classed as potential capacity will respond with carrying capacity increases if the pinyon/juniper overstory is removed. Terrestrial ecosystem map units representing this ecosystem include units 257, 260, 272, 273, 277, 281 and 287 (USDA-Forest Service, Region 3, 1991). However, with respect to both 277 and 287 there are full capacity rangelands intermixed within the potential capacity (Project Record, USDA Kaibab National Forest, 2004). We estimated that the value of FC designation for units 277 and 287 is 40 and 30 percent, respectively (USDA Forest Service, Region 3, 1991). Current soil erosion is at or below the tolerance with watershed condition considered impaired. This designation is the result of the high tree canopy, which not only limits the ability of the soil to cycle nutrients but also reduces the amount of available moisture to grasses and forbs. Available soil nutrients are absorbed by the trees and are essentially tied up in the overstory. Compounding this problem is the ability of the tree species to out-compete herbaceous vegetation for soil moisture. Both conditions contribute to the impaired condition classification. Areas where these TES units are mapped do not have an allowable use standard adopted and are not considered in the overall range capacity of the allotments. Dominant plants include blue grama, big sagebrush, fleabane species, and pinyon pine. The range resource and soil stability values are classed as poor (USDA Forest Service, Region 3, 1997) with static trend. This ecosystem is regarded as poor winter range for the Kaibab National Forest Management Indicator species elk and mule

deer and antelope, though it is considered excellent big game hiding cover and good thermal cover.

**Desired Conditions:** The existing pinyon pine and juniper stand density decreases from 50 to 75 trees per acre to less than 10 trees per acre. A pinyon/juniper – savanna ecosystem is restored with corresponding improved forage conditions for elk, antelope, and domestic livestock. Within mule deer habitat small openings ranging from 5 to 25 acres in size occur in the pinyon pine and juniper overstory that improve wildlife edge habitat and increase browse production. Mutton bluegrass, western wheatgrass, and junegrass are dominant grass species with a strong subdominant representation of blue grama. Other plants that are found in higher densities include side-oats grama and cliffrose. Rabbitbrush, snakeweed, and pingue are absent to minimally present. Frequency of desirable native grasses, forbs, and shrubs is approximately 60 percent, 20 percent, and 20 percent, respectively. Watershed conditions improve from the impaired category to satisfactory on 60 percent of the area.

Big game wildlife winter range carrying capacities improve, though increases in browse plants are hampered by the existing pinyon pine and juniper overstory. Manage between 35 and 50 percent of the area that displays a dominance of woodland trees. Corridors are provided for pronghorn antelope to move from winter to summer areas. Also, adequate shrub height is maintained in antelope fawning areas to provide security cover. The distribution of mid- to late-seral conditions is improved across the project area.

##### **5. Pinyon pine/juniper ecosystem (no capacity rangelands)**

**Current conditions:** This ecosystem unit is either dominated by shallow soils or is located on steep to very steep slopes, including those associated with the Coconino Rim. The potential for increases in understory plants is limited and the steep slopes preclude management treatments, except for possibly prescribed burning. Terrestrial ecosystem map units representing this ecosystem include units 172, 250, 251, 252, 261, 274, 295, 296, 476, 496, and 681 (USDA-Forest Service, Region 3, 1991). Current soil erosion is below tolerance levels on units 172, 250 and 681. The remaining TES units currently exceed the erosion tolerance level. For the most part the TES units above tolerance are not considered unsatisfactory since they are inherently unstable and the current soil erosion rates do not result from any management activities. Dominant plants include blue grama, squirreltail, and pinyon pine. The range resource and soil stability ranking is classed as poor (USDA Forest Service, Region 3, 1997) with static trend. This ecosystem is regarded as fair winter range for elk and mule deer though it is considered poor for antelope. It is considered excellent hiding cover and good thermal cover.

**Desired Conditions:** Steep slopes, shallow soils, and the inherently unstable nature of sites where this unit is found limit treatment or management options that

would improve current conditions. The desired condition would be to maintain current conditions and limit access on these slopes by motorized vehicles. Where practical decrease stand densities from the current 50 to 100 stems per acres to 15 to 25 stems per acre to reduce the potential for wildfire.

Big game wildlife carrying capacities and cover are maintained at current levels.

#### **6. Ponderosa pine/pinyon pine/Gambel oak/big sagebrush ecosystem (full capacity rangelands)**

**Current conditions:** This ecosystem is forested with varying concentration of ponderosa pine, pinyon pine, juniper species, and Gambel oak. Terrestrial ecosystem map units representing this ecosystem include units 275, 282, 283, 284, and 297 (USDA-Forest Service, Region 3, 1991). Current soil erosion is below the tolerance level and watershed condition is considered satisfactory. Areas where these units are mapped are considered fully capable of being grazed and an allowable use standard adopted. Dominant plants include blue grama, big sagebrush, mutton bluegrass, and junegrass. The range resource value ranking is classed as poor (USDA Forest Service, Region 3, 1996) with static trend. The soil stability rating is fair with a static trend. This ecosystem is regarded as good summer habitat for the Kaibab National Forest Management Indicator species elk, turkey, Abert squirrel, and mule deer. It is considered excellent big game hiding cover and good thermal cover.

**Desired Conditions:** These TES units are maintained in the full capacity rangeland designation and increase both the frequency of cool season grasses and overall carrying capacity. The existing mix of ponderosa pine, pinyon pine and juniper stand density decreases from 100 to 125 trees per acre to less than 40 trees per acre. Mutton bluegrass, western wheatgrass, mountain muhly and junegrass are dominant, with some representation of blue grama. The blue grama is generally less than 20 percent of the grass species composition. Rabbitbrush, snakeweed, and pingue are absent to minimally present. Frequency of desirable native grasses, forbs, and shrubs is approximately 60 percent, 20 percent, and 20 percent, respectively. Watershed conditions are maintained in satisfactory condition.

Manage this habitat where 10 to 20 percent of the ecosystem is considered a primary foraging zone (grassland). Big game wildlife summer range carrying capacities improve on 20 percent of this ecosystem. A minimum of 15 percent will be tied to late seral with the remainder evenly split between early and mid-seral. Two to four snags per acre are present with five to seven tons of downed woody material found on the sites. Browse species, especially cliffrose, are promoted where the potential for increases are predicted.

#### **7. Ponderosa pine/Gambel oak ecosystem (full capacity rangelands)**

Current conditions: This ecosystem is forested with ponderosa pine and Gambel oak. Pinyon pine and the juniper species occur in trace amounts. Terrestrial ecosystem map units representing this ecosystem include units 265, 266, 290, 291, 293 and 297 (USDA-Forest Service, Region 3, 1991). Current soil erosion is below the tolerance levels and watershed condition is considered satisfactory. Areas where these units are mapped are considered fully capable of being grazed and an allowable use standard adopted (Project Record, USDA Kaibab National Forest). Dominant native grasses include blue grama, squirreltail, mutton bluegrass, and western wheatgrass. The range resource value ranking is classed as fair (USDA Forest Service, Region 3, 1996) with static or upward trend. Soil stability is rated fair, with an upward trend. This ecosystem is considered good summer habitat for the Kaibab National Forest Management Indicator species elk, turkey, Abert squirrel, and mule deer. It provides good big game hiding and thermal cover.

Desired Conditions: These TES units are maintained in the full capacity rangeland designation and both the frequency of cool season grasses and overall carrying capacity increase. The existing density of ponderosa pine trees that are less than 16 inches in diameter decreases from the current level of 125 to 200 trees per acre to less than 20 trees per acre. Mutton bluegrass, western wheatgrass, mountain muhly and junegrass are the dominant native grasses, with representation of blue grama. The blue grama is generally less than 20 percent of the composition. Rabbitbrush, snakeweed, and pingue are absent to minimally present. Frequency of desirable grasses, forbs, and shrubs is approximately 60 percent, 20 percent, and 20 percent, respectively. Watershed conditions are maintained in satisfactory condition.

Manage this habitat where 10 to 20 percent of the ecosystem is considered a primary foraging zone (grassland). Big game wildlife summer range carrying capacities improve on 20 percent of this ecosystem. A minimum of 15 percent will be tied to late seral with the remainder evenly split between early and mid-seral. Two to four snags per acre are present with five to seven tons of downed woody material found on the sites. Browse species, especially cliffrose, are promoted where the potential for increases are expected.

#### **8. Kentucky bluegrass/western wheatgrass/ponderosa pine ecosystem (full capacity rangelands)**

Current conditions: This ecosystem includes the small linear grasslands found in and association with the ponderosa pine type. Terrestrial ecosystem map units representing this ecosystem include units 9 and 11 (USDA-Forest Service, Region 3, 1991). Current soil erosion is below the tolerance and watershed condition is considered satisfactory. Areas where these units are mapped are considered fully capable of being grazed and an allowable use standard adopted (Project Record, USDA Kaibab National Forest, 2004). Dominant native grasses include blue grama, squirreltail, mutton bluegrass, and western wheatgrass. The range

resource value ranking and soil stability is classed as fair (USDA Forest Service, Region 3, 1997) with an upward trend. This ecosystem is regarded as good summer foraging habitat for the Kaibab National Forest Management Indicator Species elk, turkey, and antelope. It is considered fair habitat for deer. It has limited hiding and thermal value since dense tree cover is generally less than 10 percent of the area where this unit is mapped, though, in some areas this does increase to the point where these grasslands have filled in with ponderosa pine due to fire absence.

Desired Conditions: TES units in this ecosystem are maintained as full capacity rangeland. Stocking of ponderosa pine greater than 14 inches DBH does not exceed 10 trees per acre. Ponderosa pine regeneration is limited. The frequency of cool season grasses and overall carrying capacity are increased. Mutton bluegrass, western wheatgrass, mountain muhly and junegrass are dominant native grasses, with representation of blue grama. The blue grama generally is less than 20 percent of the composition. Rabbitbrush, snakeweed, and pingue are absent to minimally present. Frequency of desirable native grasses, forbs, and shrubs is approximately 70 percent, 20 percent, and 10 percent, respectively. Watershed conditions are maintained in satisfactory condition.

Manage this habitat where 90 to 100 percent of the ecosystem is considered a primary foraging zone (grassland). Big game wildlife summer range carrying capacities improve on 50 percent of this ecosystem. The distribution of mid- to late-seral conditions is improved across the project area.

## **Purpose and Need for Action**

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The purpose of this initiative is to 1) improve related range, watershed, and wildlife resource conditions found in the project area, 2) make forage available to qualified livestock operators on lands suitable for grazing consistent with the Forest Plan, 3) contribute to the economic diversity and social well being of people by providing opportunities for economic diversity and by promoting stability for communities that depend on range resources for their livelihood (FSM 2202.1), 4) meet the goals and objectives of the Kaibab National Forest Plan, as amended, and the associated Environmental Impact Statement and Record of Decision, and lastly 5) meet the 1995 Rescissions Act and undertake full public disclosure of the environmental impacts of livestock activity. This action is needed because range resource and browse conditions in the winter rangelands are not meeting desired conditions. This action responds to the goals and objectives outlined in the Kaibab Forest Plan, and helps move the project area towards preferred conditions as described in that Plan (USDA Kaibab National Forest 1988 and USDA Regional Office, R3, 1996). Also, prior to the development of the proposed action an analysis identified existing and desired resource conditions for the allotment and also identified specific actions needed to move the area to higher diversity levels (Project Record, USDA Forest Service, 2004).

## Proposed Action

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### Anita and Cameron Allotment

The action proposed by the Forest Service to meet the purpose and need for the Anita and Cameron Allotments is to combine them into a single grazing unit to improve efficiency of the ranching operation and reduce the amount of time livestock are allowed to graze in a pasture. A term grazing permit would be issued that allows from 3600 to 7860 animal unit months annually (600 head to 1,310 head of livestock) for a six month summer grazing period. The level of stocking within that range of livestock numbers in any given year would be depend on annual forage production in full capacity rangelands and the resulting utilization levels that occur. Specific connected actions include the following:

1. Implement a rest-rotation grazing strategy where 20 percent of the ponderosa pine/Gambel oak and 20 percent of the pinyon pine/juniper or shrub grassland ecosystems are excluded from grazing each year in order to promote regeneration of grass species, thereby improving the overall carrying capacity of the project area and improving watershed conditions. This would also promote desirable levels of litter for improved watershed conditions.
2. Adjust the season of use from yearlong to summer seasonal with the use period being approximately May 1 to October 31 in any given year in order to increase browse plants in the winter rangelands and improve the frequency of cool season grasses. These approximate dates could vary based on monitoring of range readiness conditions and forage utilization levels.
3. Change the class of livestock from yearlings to cow/calf to improve the economics of the ranching operation.
4. Reconstruct 21.5 miles of forest boundary fence adjacent to the Navajo Nation.
5. To promote native forage plants, improve watershed conditions and provide improved habitat for wildlife, utilization standards would be reduced to 35 percent in the key areas (grassland or shrub/grasslands at least ¼ mile from dependable water sources). A 20 percent allowable use value would be assigned to the full capacity lands found in the uplands outside of the alluvial bottomlands.

### Moqui Allotment

The proposed action for the Moqui Allotment would maintain the current class of livestock (yearlings), season of use (summer), and rotation strategy (deferred). A range of authorized numbers going from 50 percent of current term numbers (280 yearlings) to 100 percent (560 yearlings) would be evaluated. Adjustments in livestock season of use, utilization levels, and rotation strategy would occur based on monitoring of utilization and changes in range conditions. Additional connected actions include reducing livestock allowable use standard to 30 percent in key areas and 20 percent allowable targeted to the full capacity lands found in the upland landscape positions.

### **Adaptive Management**

Adaptive management is included in the proposed actions for both Anita/Cameron and Moqui Allotments and could include the following adjustments if monitoring indicates desired conditions are not being met:

3. Authorized livestock numbers would be adjusted annually, if needed, to meet existing capacities of the allotments. This variation would normally be between the previously identified minimum and maximum number for the Anita/Cameron and Moqui Allotments. Under extreme drought conditions, authorized livestock numbers could drop below the minimum.
4. The on and off dates could be modified within the allotments. Later livestock entry dates and earlier livestock removal dates on the allotments would occur in order to promote the growth and reproduction of desired herbaceous plants. Changes in on/off dates would be required if utilization levels on primary forage grasses exceed allowable levels, the frequency of these plants drops, or suitable progress toward desired vegetation conditions does not occur.

### **Decision Framework**

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Given the purpose and need, the District Ranger, Tusayan Ranger District, will review the proposed actions for the Anita/Cameron and Moqui Allotments and the other alternatives developed to make the following decisions:

Whether the proposed actions for these allotment management plan revisions will proceed as proposed, be modified by another action alternative, or result in no livestock grazing. If livestock grazing does continue the District Ranger will also determine:

1. The required best management practices (BMP's) or mitigation measures and monitoring that will occur.
2. Whether the decision is consistent with the Kaibab Forest Plan or requires a Forest Plan amendment.

### **Public Involvement**

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This analysis was listed in the Schedule of Proposed Actions in March 2004. The proposal was submitted for comment to the public and other agencies in May 2004. As part of the public involvement process a press release was issued detailing the proposal and requesting comments back from the public. The grazing permittees were consulted with prior to the development of the proposed action and issues documented. In July 2004 a summary of the environmental assessment was mailed to members of the public and other agencies for a 30-day notice and comment period. We received five comment letters from the public. A summary of the initial scoping effort and other supporting information concerning this proposal is found in the project record.

The interdisciplinary team developed a list of issues based on the scoping and 30-day review period and the comments received from the public, other agencies, and internal sources. The District Ranger approved the final list of issues and alternatives to address those comments.



## Issues

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The interdisciplinary team under the guidance of the District Ranger separated the issues into two groups: significant and non-significant issues. Significant issues are defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations require this delineation in Sec. 1501.7, "...identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)..." A list of non-significant issues and reasons regarding their categorization as non-significant is found in the project record.

All letters received during the scoping process were processed and placed into one of the following categories:

- Resolved by forest plan use designation.
- Addressed through implementation of forest plan standards and guidelines as well as best management practices.
- Addressed through implementation of project-specific best management practices.
- Addressed during the analysis conducted by the interdisciplinary team.
- Addressed through special location of activities during alternative design.
- Used to drive or influence an alternative.
- Beyond the scope of the project.
- Addressed through existing law, regulation, and policy.

This analysis indicated that most of the comments identified were either outside the scope of the proposed action, would be a component of the analysis itself, or were addressed by law, regulation, or policy.

The interdisciplinary team identified two topics raised during scoping as significant issues and include:

Issue #1: Some individuals are concerned about the impacts of the proposed grazing strategy, season of use, and stocking rate on vegetation conditions, wildlife habitat, and soil and watershed resources. Indicators to disclose the impacts between alternatives include:

1. Change in acres from potential capacity to full capacity rangelands.
2. Defoliation success for cool and warm season grass species.
3. Deviation in stocking rates between alternatives.
4. Changes in overall carrying capacity expressed in animal unit months.
5. Acres of improved range conditions at 1, 5 and 10-year marks.
6. Changes in forage/cover ratios between alternatives.
7. Acres of improved low/height cover.

8. Acres of improved habitat for management indicator and other wildlife species of concern.
9. Population changes in Management Indicator Species (MIS) by alternative.
10. Variation in soil resource conditions between alternatives.

Issue #2: Some respondents are concerned about the effect of the proposal on sustaining lifestyles for local ranchers and maintaining economic viability. Indices developed to assess an alternatives effect regarding this issue and compare the alternatives are:

1. Number and class of livestock permitted by alternative.
2. Total gross revenue by alternative estimated for the ranching operation.
3. Estimated costs associated with operation excluding grazing fees.
4. Projected grazing fees by alternative.
5. Costs associated with maintenance of livestock facilities and new construction.
6. Trucking costs associated with movement onto and off the allotments by alternative.
7. Water hauling costs by alternative.
8. Net revenue to permittee by alternative.
9. Net to gross profit ratio.
10. Leasing costs associated with livestock operations.
11. Number of jobs created by alternative.
12. Costs to the government associated with administration of the permit.

## **ALTERNATIVES, INCLUDING THE PROPOSED ACTION**

This chapter describes and compares the alternatives considered for the management plan revision for the Anita, Cameron, and Moqui Allotments. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (i.e., variation of livestock numbers that would be approved) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (i.e., changes in range resource value rankings or wildlife habitat conditions).

## Alternatives

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### Alternative 1

#### ***Proposed Action for the Anita and Cameron Allotments***

Alternative 1 for the Anita/Cameron Allotments includes combining both allotments into a single grazing unit, and a change in season of use from yearlong to summer seasonal (May 1 to October 31). The class of livestock would be modified from the current yearling classification to cow/calf and a rest rotation grazing strategy implemented. Authorized livestock numbers would range from a low of 600 head to a high of 1,310 head for the six-month season of use. This represents a reduction in animal units months over the current permit of 50 percent at the high level of stocking (1310 head) and 80 percent at the low end (600 head). Additional components of Alternative 1 include the reconstruction of 21.5 miles of forest boundary fence adjacent to the Navajo Nation and reducing the utilization standard to 35 percent in the key areas (grassland or shrub/grasslands at least ¼ mile from dependable water sources). A 20 percent allowable use value would be assigned to the full capacity lands found in the uplands outside of the alluvial bottomlands.

This alternative is intended to improve the economics of the ranching operation by changing the class of livestock to cow/calf and improving efficiency by combining both allotments into a single unit for the proposed livestock allocation. Reductions of the stocking rate from 50 to 80 percent would reduce the actual utilization on native plants and promote range and watershed values. Shifting the season of use from yearlong to summer seasonal would eliminate the potential for wildlife/livestock dietary overlap in the winter rangeland thereby improving those resources.

#### ***Proposed Action Moqui Allotment***

Alternative 1 for the Moqui Allotment would maintain the current class of livestock (yearlings), season of use (summer), and rotation strategy (deferred). A range of authorized numbers ranging from 50 percent of current term numbers (280 yearlings) to 100 percent (560 yearlings) would be evaluated annually. The allowable use standard would be reduced to 30 percent in key areas and 20 percent assigned to the full capacity lands found in the upland landscape positions.

The range in authorized numbers is designed to account for the variations in actual forage production in any given year and responds to the issue concerning resource conditions.

#### ***Adaptive Management***

Adaptive management is included in the proposed actions for Anita/Cameron and Moqui Allotments and could include the following adjustments if monitoring indicates desired conditions are not being met:

1. Authorized livestock numbers would be adjusted annually to meet existing capacities of the allotments. This variation would normally be between the previously identified minimum and maximum number for the Anita/Cameron and

Moqui Allotments. Under extreme drought conditions, authorized livestock numbers could drop below the minimum.

2. The on and off dates could be modified within the allotments. Later livestock entry dates and earlier livestock removal dates on the allotments would occur in order to promote the growth and reproduction of desired herbaceous plants. Changes in on/off dates would be required if utilization levels on primary forage grasses exceed allowable levels, the frequency of these plants drops, or suitable progress toward desired vegetation conditions does not occur

## **Alternative 2**

### ***No Action for the Anita, Cameron, and Moqui Allotments***

This alternative is required by regulation (Code of Federal Regulations 1502.8) and would eliminate grazing by domestic livestock on the Anita, Cameron, and Moqui allotments. This action also responds to the issue related to grazing impacts and improved vegetation conditions, habitat quality, and soil resources.

## **Alternative 3**

### ***Current Management for the Anita/Cameron Allotments***

This alternative maintains the grazing activities undertaken by the permittee over the last 10-years. It would authorize a yearlong season of use though the class of livestock and numbers would vary considerably. Yearlings, cow/calf pairs, or both would be authorized with approved numbers ranging between 10 to 40 percent of the current term permitted numbers. Livestock classes would be combined into one herd and moved between pastures within either allotment. A deferred rotation grazing strategy would be employed with an allowable use standard of 40 percent for grass species and 55 percent for browse plants. This alternative addresses the sustaining the ranching lifestyle issue by maintaining the yearlong season of use and also addresses the issue regarding resource impacts by authorizing low levels of livestock numbers or none at all during years of poor livestock water.

### ***Current Management for the Moqui Allotment***

Alternative 3 would approve seasonal grazing from approximately May 7 to October 21 in any given year with 560 head approved under a deferred rotation grazing strategy. The class of livestock would be yearlings with an allowable use standard set at 40 percent of the current years growth being authorized. This alternative responds to the issue of ranching sustainability and economic viability.

## **Alternative 4**

This Alternative applies to only the Anita/Cameron Allotments and was designed to address the significant issues related to improvement in vegetation and watershed values and enhancement of wildlife habitat, while still maintaining the ranching operation. In order to provide for increased flexibility in the Forest-grazing program, these allotments would be used on a temporary basis when forage and water conditions are adequate. No term grazing permits would be issued and only temporary grazing allowed. This

alternative was designed to reduce the amount of water hauling to the greatest degree possible. Specific connected actions include:

- 1) Variable numbers and season of use not to exceed 7,860 animal unit months or 1,310 adult livestock for 6 months. Though the lower elevation rangeland is targeted for increased emphasis by eliminating winter use by domestic livestock to improve the browse density, winter grazing could be authorized if resource inspections note increased vigor and reproduction of browse species and when conflicts with native wildlife would not occur.
- 2) Reconstruct 21.5 miles of allotment boundary adjacent to the Navajo Nation.
- 3) To promote grass plants, improve watershed conditions and provide improved habitat for wildlife, utilization standards would be reduced to 35 in the key areas (grassland or shrub/grasslands at least ¼ mile from dependable water sources). A 20 percent allowable use value would be assigned to the full capacity lands found in the uplands outside of the alluvial bottomlands.

The use of these allotments on an intermittent basis, when forage and water are adequate, would provide flexibility in the Forest-wide grazing program when permittees are in nonuse status. We would have an area that livestock use could be authorized and the permittee could maintain their herd. We believe it would also benefit wildlife, range, and watershed resources by allowing use only under conditions when distribution would be optimum and utilization rates at or below the allowable.

### **Alternatives considered and dropped from detailed study (Anita and Cameron Allotments)**

Alternative 5 would authorize the current term permitted number, yearlong, under a deferred grazing strategy for the Anita and Cameron allotments. The current authorized number for the Anita and Cameron units is 666 and 1200 yearlings, respectively. Converted to adult livestock the Anita allotment would be permitted 465 head and the Cameron allotment would be authorized for 845 head. This alternative was not carried forward for study since it exceeds the livestock capacity of the allotments by at least 50 percent and would lead to utilization levels above the allowable. This action would not meet the purpose and need and if implemented and would cause unacceptable resource impacts to the project area.

Alternative 6 would change the season of use to summer, implement a rest-rotation grazing strategy and change the class of livestock to sheep. This alternative could pose a disease threat to desert bighorn sheep in the Grand Canyon National Park and therefore was dropped from further consideration.

## **Best Management Practices (Mitigation) Common to Alternatives 1, 3, and 4**

Best management practices were selected to ease some of the potential direct and indirect impacts the various alternatives may cause. These practices will be applied to any of the action alternatives.

The Soil and Water Conservation Practices Handbook (USDA Forest Service, Region 3, 1991) was developed in concert between the USDA Forest Service, Southwestern Region and both Departments of Environmental Quality from Arizona and New Mexico. It is a formalized agreement with the specific purpose to respond to the objectives defined by Congress in the Federal Water Pollution Control Act, as amended. The main objective of this law is to restore and maintain the chemical, physical, and biological integrity of the Nation's water.

Basically, the Forest Service has agreed to ensure that all project work contain site-specific best management practices (BMP's) developed through the National Environmental Policy Act process. The Forest Service has also agreed to implement a BMP monitoring strategy that includes implementation monitoring to ensure application of BMP's as specified in the project as well as effectiveness monitoring to determine if the BMP met stated objectives.

A Best Management Practice is defined as a practice or a combination of practices, that is determined by the State after problem assessment, to be the most effective and practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to the level compatible with water quality goals (FSH 2209.22).

The following list of BMP's has been developed for the Anita, Cameron, and Moqui project to minimize nonpoint pollution from grazing activities. All the BMP's are considered standard procedure and do not constitute deviation from normal range management planning or implementation process. The BMP's identified for this project are also listed in the Soil and Water Conservation Handbook (2509.22). Application of the BMP's will ensure compliance with the requirements of the Federal Water Pollution Control Act.

22.1: Range Analysis, Allotment Management Planning, Grazing Permit System, and Annual Letter of Instruction – The objective of this BMP is to manage rangelands through the NEPA process and insure they are meeting forestland management plan objectives. The interdisciplinary team will disclose impacts on range capability, overall capacity, and changes in range resource conditions, and other resource values through the NEPA process. Following this analysis the Forest Service, in cooperation with the grazing permittee, will prepare a written allotment management plan that will authorize livestock grazing as stipulated. This document includes measures to protect other resource values, such as water quality and coordinate livestock grazing with other resource uses. Specific methods for controlling when, where, amount of utilization, and numbers of livestock to be grazed are covered in this plan. Also included are needed range structures, monitoring methods, and implementation schedule. An annual letter of

instruction will be prepared, reviewed, and revised as needed to reflect direction in the allotment management plan. The District Ranger is responsible for all analysis work and approves management plans as well as issuing grazing permits.

22.11: Controlling Livestock Numbers and Season of Use -- The objective of this BMP is to safeguard water and soil resources under sustained forage production and manage utilization by livestock to maintain healthy ecosystems for all resource objectives. Periodic field inspections are made to identify needed adjustments in season of use and livestock numbers. This includes, but is not limited to: 1) range readiness to assure the soil is not too wet and sufficient growth has occurred, 2) forage utilization measurements, and 3) assessment of rangeland to verify soil and vegetative trends. The District Ranger administers allotments and provisions are carried out by the grazing permittee as permit requirements.

22.12: Controlling Livestock Distribution -- The objective of this BMP is to manage for sustained forage production and utilization by livestock while protecting soil and water resources. Techniques that may be used to achieve proper distribution and more equal utilization rates on the full capacity rangelands include: 1) construction of fences and implementation of seasonal or pasture system, 2) water development in areas that receive little or no use, 3) herding to shift livestock locations, 4) using salt or supplement feed as tools to gain proper distribution, 5) range improvements, prescribed burning, trail construction or seeding, and 6) prevention of intensive livestock grazing or concentrated livestock use on soils that are saturated.

22.13: Rangeland Improvements -- The objective of this BMP is to improve, maintain or restore range resources, including soil and water through the use of rangeland improvements. This includes building fences to control movement, developing watering sites to distribute utilization, and providing facilities so the permittee can move or remove livestock from the allotment. The permittee is involved as a cooperator in rangeland improvements and may actually complete the work under Forest Service direction. Range improvement needs are identified in the range allotments planning process and are scheduled for implementation in the allotment plan.

22.14: Determining Grazing Capability of Lands - The objective of this BMP is to maintain or improve soil stability, productivity and water quality by grazing lands within its capability. This practice is administrative and preventative control. The interdisciplinary team has conducted an analysis and determined those lands fully capable of being grazed. Soil condition classes have also been determined based on the relationship of current, natural, and tolerance soil losses values as identified in the TES Survey for the Kaibab National Forest. Only lands with soils in stable condition are considered as full capacity range. Grazing capability ratings are then used in conjunction with other grazing considerations to determine the actual grazing capability of an area.

## Monitoring

Timing of implementation monitoring will be during project execution. Effectiveness monitoring will occur at year 10 after project implementation.

The following areas will be included as part of the monitoring program for BMP's:

- 1) Actual and Allowable Utilization – At specific locations, as identified in the allotment management plan and annual operating instructions, actual utilization will be assessed annually to assure grazing is within standards. Key areas will be identified and assessed for achievement of utilization standards. If the weighted average of actual utilization is at or below the assigned standard, use will be considered within the standard for that pasture or the allotment as a whole during that grazing season.
- 2) Permittees ability to make timely pasture moves and undertake the appropriate level of salting and herding – The permittee will be required to remove all livestock to the next assigned pasture within 5 days after the move is initiated. Salting will be completed in accordance with direction found in the annual letter of instruction. When actual utilization approaches the allowable in the key areas the permittee will be instructed to herd livestock into zones that are underutilized or be removed from the pasture. Once all the authorized pastures have been used for that grazing year, livestock will be removed from the allotment.
- 3) Range Facilities. – The permittee will be required to maintain all improvements as listed in the permit. The Forest Service, in cooperation with the permittee, will determine a schedule of needed maintenance prior to livestock using the allotments. For new construction or reconstruction the Forest Service will normally cost-share with the grazing permittee as funds allow.
- 4) Changes in Range Resource Value Ratings – At year 10 the permanent range monitoring clusters will be read and assessed as to meeting or not meeting objectives related to range condition and trend. Those objectives are identified in the allotment management plan and corresponding NEPA documentation.

## Comparison of Alternatives

This section provides a comparative summary of the effects of implementing each alternative. Information in Table 1 and 2 summarizes the different levels of effects or outputs for each of the alternatives. More information on the alternative's effects is provided under "Environmental Consequences", which follow this chapter.

Table 1: Summary of Effects – Anita/Cameron Allotments

Criteria	Existing Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Authorized Livestock (Adult Livestock)	1,310 (15,720 AUMS)	600 to 1,310 (3,600 to 7,860 AUMS)	-0-	385 (4,620 AUMS)	Variable not to exceed 800 (4,800 AUMS)
Season of Use	Yearlong	Summer Seasonal	NA	Yearlong	Summer or Winter Seasonal
Improved Range Resource Acres	95,275	128,145 to 112,540	136,185	124,505	128,145
Acres of Lowered Soil Erosion	95,275	112,890	112,890	112,890	112,890



Criteria	Existing Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Acres of Improved Browse	16,125	21,545	21,545	-0-	21,545
Acres of Improved Low/Height Cover	95,275	128,145 to 112,540	136,185	124,505	128,145
Percent of Forage Production Available to Wildlife	65	92 to 80 percent	100	88	88
Gross Revenue	NA	\$230,000 to \$390,000	-0-	\$147,500	\$350,000
Total Costs	NA	\$176,820 to \$326,785	-0-	\$68,680	\$101,130
Net	NA	\$53,180 to \$63,215	-0-	\$78,825	\$200,870
Forest Service Administration Costs	NA	\$65,000	-0-	\$65,000	\$65,000
Forest Service Maintenance Costs	-0-	-0-	-0-	-0-	\$46,800
Reconstruction of Boundary Fence	NA	\$210,000	-0-	\$210,000	\$210,000

Improvements in range, watershed, and wildlife resources are predicted for all alternatives. The scheduled rest periods, deferment schedules, and utilization standards will improve these resources from current levels, estimated at 95,275 acres, to a range going from 112,540 acres under Alternative 1 (high level of approved numbers) to 136,185 acres recorded for Alternative 2. This improvement will mark itself as increased grass and forb density, higher ground cover percentages, and increased low/height cover. These higher resource conditions will be found mostly in the grassland and savanna ecosystems, though we predict that the ponderosa pine ecosystems, 0 to 15 percent slopes, will also improve.

The browse habitat associated with Strata's 1, 2, and 3 are also projected to expand though we feel this will only occur in Alternatives 1, 2, and 4. Continued winter grazing associated with Alternative 3 will hamper improvements. The percent of annual forage production used by livestock ranges from 8 to 20 percent with the remaining amounts available for use by wildlife and watershed protection (Alternatives 1, 3, and 4).

The permittee should experience a positive cash flow, with the highest estimated for Alternative 4 and the lowest found at the minimum level of approved numbers tied to with Alternative 1. This situation is the result of Alternative 4 using the allotments only under conditions when water and forage are optimum. This reduces costs associated with water hauling and provides for increased profits. The shifting of the maintenance requirements to the Forest Service or cooperator under this action also improves the profit margin to the permittee. Costs associated with the administration of permits are 65,000 per year. Alternative 4 would result in the highest costs to the Agency. Approximately, 21 miles of forest boundary will be constructed which should reduce the incidence of livestock gaining access to the Cameron Allotment from the Navajo Nation.

The Moqui Allotment will also see improvements in range, watershed, and wildlife resources. This predicted impact is the result of the adequate deferment schedules and the low allowable utilization standards prescribed. This will improve range, wildlife and watershed resource conditions from current levels, estimated at 11,920 acres, to a range going from 18,440 acres under Alternative 3 to 20,615 acres recorded for Alternative 2. This improvement will be increased grass and forb density, higher ground cover percentages, and increased low/height cover. These higher resource conditions, like the Anita/Cameron, will be found mostly in the grassland and savanna ecosystems though the ponderosa pine ecosystems will also improve.

Table 2: Comparison of Alternatives – Moqui Allotment

Criteria	Existing Conditions	Alternative 1	Alternative 2	Alternative 3
Authorized Livestock (Adult Livestock)	560 (2,155 AUMS)	280 to 560 (1,080 to 2,155 AUMS)	-0-	560 (2,155 AUMS)
Season of Use	Summer Seasonal	Summer Seasonal	NA	Summer Seasonal
Improved Range Resource Acres	11,920	19,745 to 18,440	20,615	18,440
Acres of Lowered Soil Erosion	11,920	17,885	17,885	17,885
Acres of Improved Low/Height Cover	11,920	19,745 to 18,440	20,615	18,440
Percent of Forage Production Available to Wildlife	78	90 to 77	100	77
Costs to Purchase Replacement Heifers	\$448,000	\$208,000 to \$448,000	-0-	\$448,000
Total Costs	\$97,075	\$43,245 to \$97,075	-0-	\$97,075
Net Savings to the Permittee	\$350,930	\$163,020 to \$350,930	-0-	\$350,930
Forest Service Administration Costs	NA	\$15,000	-0-	\$15,000
Forest Service Maintenance Costs	-0-	-0-	-0-	-0-

The percent of annual forage production available to wildlife ranges from 90 percent for the low level of approved numbers under Alternative 1 to 23 percent found in Alternative 3. Implementation of adaptive management under Alternatives 1 and 3 will entail the modification of either the grazing season or term numbers to achieve allowable use standards.

The permittee should experience a net savings by using the Moqui Allotment versus outright purchase of the replacement heifers ranging from a low of \$163,020 to a high of \$350,930. Cost of administration of permits under alternative 1 and 3 is \$15,000 per year. No significant range reconstruction efforts are planned.

## AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in Table 1.

### Watersheds Resource Conditions

#### Affected Environment

##### *Physical Setting*

The Anita, Cameron, and Moqui Allotments are located south of the Grand Canyon National Park. State and private lands bound it on the west and southern boundaries and the Navajo Nation lies adjacent to the Cameron Allotment on the east.

The entire project area falls within the Coconino Plateau, which is considered a part of the Grand Canyon Section – Colorado Physiographic Province. The USDA Kaibab National Forest report (1979) noted that landforms are gently sloping with some steep slopes occurring along the Coconino Rim, which transects the entire Cameron Allotment. Elevations vary from 5,900 feet to 7,500 feet.

The major geologic influence on soil development found in the project area is Permian Kaibab Limestone (Barr 1972). Barr (1972) also noted that although the Kaibab Formation is the uppermost rock there were at least 10,000 feet of younger material deposited above the Kaibab, which were subsequently eroded off during the Kaibab uplift and other erosion cycles. Red Butte, which is located in the Anita Allotment, was protected from these erosion cycles by a hard cap of lava and represents one of the few areas where this material can be observed.

The climate is considered semi-arid with an average annual precipitation ranging from 9 to 17 inches (USDA Kaibab National Forest 1979). Hendricks (1985) reported that a unique feature of Arizona is the two periods of precipitation: one season from December through March and the other during July, August and September. Storms associated with the winter precipitation are derived in the Pacific Ocean and take the form of large-scale, mid-latitude cyclonic systems, which normally cover a fairly large area of the entire State including the project area. In contrast, the summer rains are brief, sometimes-intense systems resulting from warm moist air originating in the tropics and cooling off as the system moves up the elevation gradient and approaches the Coconino Plateau. These systems rarely cover more than a few square miles.

##### *Hydrology*

There are two main watersheds in the project area, the Little Colorado and the Colorado River. There are several primary factors that influence the hydrology of the area, which includes the semi-arid climate and highly permeable soils found in the alluvial bottoms.

There are no perennial streams or wetlands in the project area. Flow events are classified as ephemeral (USDA Kaibab National Forest 1990). The lack of springs and wetland features is the results from the tilt of the underlying groundwater basin, which begins in Southern Utah and flows southerly towards the Grand Canyon. The canyon intersects the ground water basin producing numerous springs on the north side of the Colorado River. There are no springs within the project area, which is located south of the Colorado River. Another factor is the coarse soil textures, which contribute to a high percolation rate and limits the potential for overland flow, especially in the pinyon pine, sagebrush, and saltbush terrestrial ecosystems (USDA Forest Service, Region 3, 1991).

Water quality sampling on the forest generally supports the conclusion that the waters appear healthy, with good temperature regimes, adequate oxygen levels, fair total dissolved solids, reasonable pH, and acceptable nitrogen levels as well as low fecal coliform counts (USDA Kaibab National Forest 1993). Of the 18 sampling sites Forest-wide one occurs in the project area, Russell Tank. This site is not only the largest impoundment found on the District (44 acre-feet) but it is also the only designated fishery. The protected uses include cold water fishery, full-body contact, fish consumption, and agricultural and livestock watering. As with most of the sites sampled Russell Tank meets all water quality standards. When water conditions are favorable the Arizona Game and Fish stocks this tank with trout. This tank is currently dry.

### **Soils**

The influences of parent material, climate, slope, and vegetation have resulted in 46 unique terrestrial ecosystem survey (TES) map units within the project area (USDA Forest Service, Region 3, 1991). TES map units typically that are associated with the pinyon/juniper, sagebrush, and fourwing saltbush ecosystems in the upland sites, which are outside of drainage bottoms, generally have high calcium carbonate contents, shallow to moderately deep soil depths (10 to 40 inches of soil material), and contain a high degree of rock fragments on the soil surface and in the profile. Soils in the ponderosa pine ecosystem tend to have more clay content, which contribute to greater runoff potentials and an inherently higher productivity potential. Like those units found in the pinyon-juniper woodlands the rock fragment content is considerably higher on the upland sites in contrast to the alluvial bottoms where loam textures and deep soils are prevalent. Where grassland ecosystems predominate the soils are deep to very deep, medium to fine textured, and are found relatively free of rock fragments.

The ecosystems found in the project area are found in Table 3. Almost 90 percent of the three allotments are either dominated by an overstory of sagebrush, ponderosa pine, pinyon/juniper trees or a combination of all three.

Table 3: Terrestrial Ecosystems Inventoried on the Anita, Cameron and Moqui Allotments.

Stratum	TES Units	Terrestrial Ecosystem	Percent of Total Area
1, 2, 3	3, 255, 591, 677	Fourwing saltbush	10
4, 5	23, 634, 672, 682, 683	Big Sagebrush	5
6	599	Blue grama	Less than 1 percent
7, 8, 8A, 9, 11	172, 250, 251, 252, 257, 260, 261, 263, 272, 273, 274, 277, 281, 287, 295, 296, 476, 495, 496, 586, 681	Pinyon -- Juniper	50
13, 14	275, 276, 282, 283, 284, 297	Ponderosa pine/Pinyon pine/Juniper	20
12, 14	9, 11	Kentucky bluegrass	1
10, 16	265, 266, 290, 291, 293, 294, 681	Ponderosa pine/Gambel oak	14

Grasslands make up 16 percent of the project area and this condition explains, to some degree, the problems associated with utilization levels found when grazing occurred. Livestock tended to concentrate in these zones, since there was better forage conditions and actual use exceeded the allowable. Even though there was additional capacity found in the uplands, this was not used because the permittee did not herd their livestock into these zones (USDA Forest Service, Project Record, 2004). Capacity losses resulting from expansion of the woody plants and corresponding declines in grasses and forbs are not known, however, it is thought that the largest reductions probably occurred within the deeper soils found in the pinyon/juniper and ponderosa pine/Gambel oak ecosystems. Both ecosystems are rather extensive in the project area (65 percent) and historically were found with far less tree densities than currently found (USDA Kaibab National Forest 2003). The productive potential for these soils is much higher than what is currently found (USDA Forest Service, Region 3, 1991).

### **Soil Resource Conditions**

The quality of water and soil productivity is related to many factors including soil depth, nutrient status, water holding capacities, and climate. The density and composition of existing vegetation and the influence this has on current ground cover conditions and ultimately soil erosion rates is one of the primary factors influencing soil productivity. The closer the effective ground cover is to the site potential, as disclosed in the TES survey, the greater the ability of the soil to retain nutrients and cycle them through the ecosystem and contribute to higher site productivity. Reaching the site potential or at least moving towards it also lowers the potential for losses in soil productivity from erosion and eventually results in low sedimentation rates into drainage systems and the

ability of water originating on the forest to meet water quality standards. If an area provides sufficient ground cover to maintain soil loss values below the tolerance, declines in soil productivity are not predicted to occur.

The soil quality of an ecosystem is reflected in the soil condition categories (USDA Forest Service, Washington Office, 1991), which include the following:

- 1) Satisfactory – Indicators signify that soil quality is being maintained and the soil is functioning properly. The ability of the soil to maintain resource values, sustain outputs and recover from impacts is high.
- 2) Impaired – Indicators indicate a reduction in soil quality. The ability of the soil to function properly has been reduced and/or there exists an increased vulnerability to irreversible degradation. An impaired category signals that there is a need to investigate the ecosystem further to determine the cause and degree of decline in soil functions. Changes in management practices or other preventative actions may be appropriate.
- 3) Unsatisfactory – Indicators show that degradation of soil quality has occurred. Losses of vital soil functions result in the inability of the soil to maintain resource values or sustain outputs and recover from impacts. Soils rated in this category are candidates for improved management practices or restoration designed to recover soil functions.

Each stratum (combination of similar soils within a terrestrial ecosystem) within the Anita, Cameron, and Moqui Allotments was assessed based on the predicted soil erosion rates from the TES survey and other information (USDA Forest Service, Region 3, 1991 and USDA Kaibab National Forest, Project Record, 2004). These ratings reflect soil disturbance resulting from management practices and activities in relation to maintenance of long-term soil productivity. Activities that cause physical compaction of the soil or the losses of desirable understory plants can and do affect soil functions over a period of time.

### **Anita and Cameron Allotments**

Soil erosion and resource conditions for the Anita and Cameron Allotments are displayed in Table 4 and 5 below. The acres considered satisfactory total 67,739 acres and 49,427 acres for the Anita and Cameron Allotments, respectively. The area classified in the impaired category for these same allotments total 35,961 acres and 40,847 acres. The area classified as unsatisfactory rating total 1,369 acres on the Anita, whereas on the Cameron Allotment it has 18,219 acres.

Table 4: Soil Erosion and Resource Conditions – Anita Allotment

Strata Number	TES Units	Acres	Capability	Pot <sup>1</sup>	Tol <sup>2</sup>	Cur <sup>3</sup>	Nat <sup>4</sup>	Soil Resource Condition
1	3	3,817	FC	1.7	3.0	.5	.1	Satisfactory
2	255, 591	17	FC	.9	2.0	.5	.1	Satisfactory
3	677	3,906	FC	3.0	2.0	.9	.1	Satisfactory
4	23	1,292	FC	5.0	3.0	2.9	1.2	Impaired
5	634, 672, 682, 683	1,231	FC	2.3	2.4	1.0	.2	Impaired
6	599	255	FC	.9	3.0	.7	.1	Satisfactory
7	263, 495, 586	4,554	FC	2.0	2.2	1.3	.6	Impaired
8	257, 260, 272, 273, 281,	15,297	PC	3.0	2.0	.7	.2	Impaired
8A	277, 287	13,587	FC/PC	2.8	3.0	1.1	.3	Impaired
9	172, 250, 251, 261, 295,	4,964	NC	3.1	2.0	1.6	.4	Satisfactory
10	681	37	NC	38.5	3.0	1.2	.9	Satisfactory
11	252, 274, 296, 476, 496	895	NC	8.9	3.0	4.0	.9	Unsatisfactory
12	11	237	FC	4.0	3.0	.9	.2	Satisfactory
13	275, 282, 283, 284, 297	29,465	FC	1.8	3.0	.4	.5	Satisfactory
14	276	701	NC	29.8	2.0	4.2	.7	Unsatisfactory
15	9	934	FC	5.0	3.0	.7	.1	Satisfactory
16	265, 266, 290, 291, 293, 294	24,107	FC	6.1	2.5	.9	.2	Satisfactory

This large variability in unsatisfactory acres between the Anita and Cameron Allotments is the result of a high percent of shallow soils found on moderately steep slopes (15 to 40 percent) and the steep to very steep (40 to 80 percent) associated with the Coconino Rim. The Coconino Rim, which traverses the entire allotment east to west, is probably an old fault line that through a process of uplifting in concert with solution weathering and water erosion has resulted in a massive scarp slope. The site potential with these shallow soils may preclude large increases in effective ground covers and lower soil erosion rates. These are very limited soils and improvements are thought to be remote.

The impaired classification is associated with those strata that have had large increases in woody plants including ponderosa pine, pinyon-juniper, or sagebrush. Past high

<sup>1</sup> Maximum amount of soil erosion with all overstory and ground cover removed.

<sup>2</sup> Rate of soil erosion, that once exceeded, eventually will cause impairment of land productivity.

<sup>3</sup> Existing soil erosion based on average ground cover values recorded during survey.

<sup>4</sup> Natural rate of erosion based on maximum effective ground covers.

utilization levels, since the introduction of livestock 100 years ago, and associated loss of fine fuels combined with fire absence has promoted the ideal environment for the expansion of these plants via plant succession due to lack of disturbance. The former grasslands and savannah types have become dominated by the larger woody plants and have effectively out competed the native grasses and forbs for water, nutrients, and sunlight. Strata's 4, and 5 reflect a type conversion from grasslands to sagebrush whereas Strata's 7, 8, and 8A are representative woodland encroachment into savanna ecosystems within the Anita Allotment.

The Cameron Allotment has experienced this same progression of grasslands being converted to a woodier ecosystem, though, some differences are found between the units. Unlike the Anita Allotment, the Cameron has made some ground cover gains as well as improved diversity levels of grass species in the woodland zone. Strata 8B represents this situation and is found on approximately 6,170 acres of the allotment.

Table 5: Soil Erosion and Resource Conditions – Cameron Allotment

Strata Number	TES Units	Acres	Capability	Pot	Tol	Cur	Nat	Soil Resource Condition
1	3	783	FC	1.7	3.0	.5	.1	Satisfactory
2	255, 591	11,509	FC	1.7	2.0	.8	.2	Satisfactory
3	677	1,514	FC	3.0	2.0	.9	.1	Satisfactory
4	23	2,944	FC	5.0	3.0	2.9	1.2	Impaired
5	634, 672, 682, 683	7,158	FC	2.9	2.2	1.5	.2	Impaired
6	599	-0-	NA	NA	NA	NA	NA	NA
7	263, 495, 586	5493	FC	2.3	2.0	1.5	.7	Impaired
8	260, 273, 281,	14,122	PC	3.5	2.1	.7	.3	Impaired
8A	277, 287	3,895	FC	2.1	2.0	.8	.3	Impaired
8A	277, 287	7,235	PC	2.1	2.0	.8	.3	Impaired
8B	257, 272	6,173	FC	3.8	3.0	1.7	.3	Satisfactory
9	172, 250, 251, 261, 295,	12,747	NC	8.0	2.0	4.0	.9	Unsatisfactory
10	681	1,766	NC	38.5	3.0	1.2	.9	Satisfactory



Strata Number	TES Units	Acres	Capability	Pot	Tol	Cur	Nat	Soil Resource Condition
11	252, 274, 296, 476, 496	2,491	NC	12.7	2.8	7.2	2.4	Unsatisfactory
12	11	624	FC	4.0	3.0	.9	.2	Satisfactory
13	282, 284, 297	2,751	FC	15.4	3.0	2.8	.3	Satisfactory
13A	275, 283	17,748	FC	1.9	3.0	.5	.1	Satisfactory
14	276	988	NC	29.8	2.0	4.2	.7	Unsatisfactory
15	9	231	FC	5.0	3.0	.7	.1	Satisfactory
16	265, 266, 290, 291, 293, 294	1,993	PC	44.6	2.6	3.2	1.4	Unsatisfactory
17	290	6,328	FC	1.9	3.0	.4	.1	Satisfactory

Most of the woodland habitat has experienced at least some, and in some areas a high percentage of canopy closure, by the pinyon-juniper trees and sagebrush over the last 100 years. The influence of dominating woody plants is a reduction in grasses and forbs that has impaired the ability of these soils to effectively cycle nutrients through the ecosystem. The high density of fine roots associated with grasses, and the situation where many of these roots die off every year, provides for a higher potential of the soil to increase organic matter and form sites for soil nutrients to bind to. Over a period of time these organic matter inputs result in the development of a darkened surface horizon and ultimately higher fertility levels. In contrast, those ecosystems where woody plants predominate or have invaded into former grasslands, woody plants reduce the potential for organic matter inputs since these plants do not have the fibrous root systems. In most cases, these soils are classed as potential capacity lands though existing soil erosion is below the tolerance. Within the Cameron Allotment Strata's 4 and 5 represent the expansion of sagebrush to levels high enough that most grasses are eliminated and Strata's 7, 8, and 8A exhibit high densities of pinyon/juniper trees.

Overall, when all strata and classification are considered the weighted tolerance soil loss for the Anita Allotment is 2.6 tons per acre per year with an existing of .8 tons per acre per year, which is well below the tolerance. The Cameron Allotment tolerance soil loss is 2.4 tons per acre per year with an existing soil loss estimated at 1.5 tons per acre per year. The variability between the two allotments, as mentioned before, is that the Cameron Allotment has higher amount of steep to very steep shallow soils whereas the Anita Allotment has more gentle terrain.

**Moqui Allotment**

Existing conditions related to watershed variables for the Moqui Allotment is displayed in Table 6.

Table 6: Soil Erosion and Resource Conditions – Moqui Allotment

Strata Number	TES Units	Acres	Capability	Pot	Tol	Cur	Nat	Soil Resource Condition
1	3	1,901	FC	1.7	3.0	.5	.1	Satisfactory
2	255, 591	769	FC	1.7	2.0	.8	.2	Satisfactory
3	677	5,473	FC	3.0	2.0	.9	.1	Satisfactory
4	23	836	FC	5.0	3.0	2.9	1.2	Impaired
5	634, 672, 682, 683	807	FC	2.6	2.4	1.4	.1	Satisfactory
6	599	-0-	FC	NA	NA	NA	NA	NA
7	263, 495, 586	-0-	FC	NA	NA	NA	NA	NA
8	260, 273, 281,	4,404	PC	3.1	2.0	.6	.2	Impaired
8A	277, 287	10,540	FC	1.8	2.0	.5	.2	Impaired
8A	277, 287	19,578	PC	1.8	2.0	.5	.2	Impaired
8B	257, 272	2,471	FC	1.7	2.0	.4	.2	Satisfactory
9	172, 250, 251, 261, 295	1,007	NC	2.7	2.0	4.4	.9	Unsatisfactory
10	681	-0-	NC	NA	NA	NA	NA	NA
11	252, 274, 296, 476, 496	-0-	NC	NA	NA	NA	NA	NA
12	11	217	FC	4.0	3.0	.9	.2	Satisfactory
13	282, 284, 297	118	FC	24.4	3.0	4.2	.5	Unsatisfactory
13A	275, 283	6,557	FC	1.8	3.0	.4	.1	Satisfactory
14	276	210	NC	29.8	2.0	4.2	.7	Unsatisfactory
15	9	60	FC	5.0	3.0	.7	.1	Satisfactory

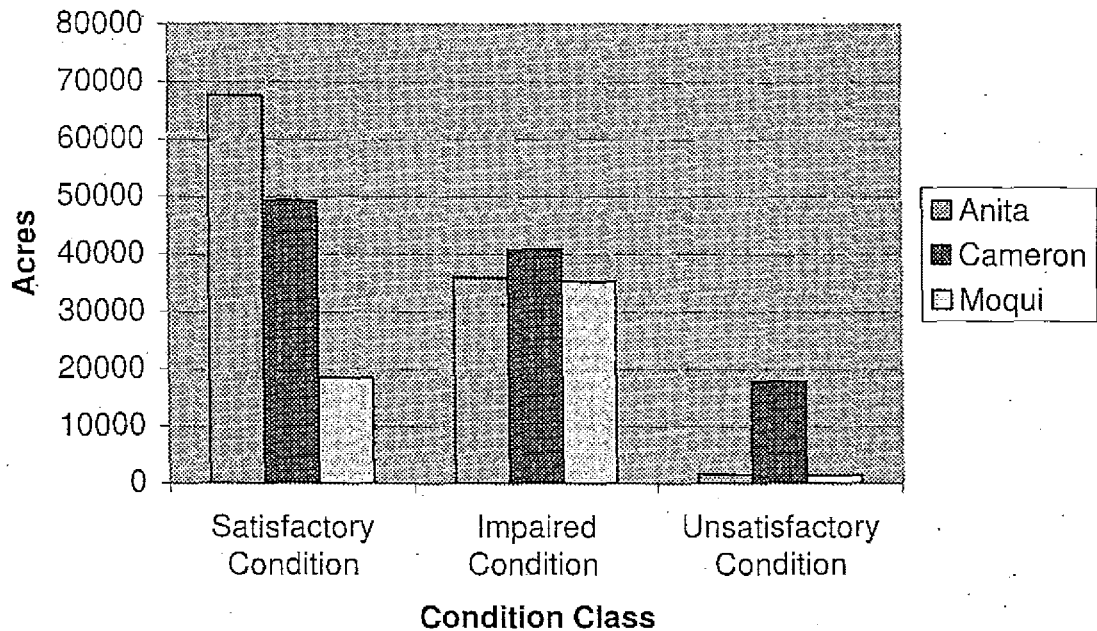
Strata Number	TES Units	Acres	Capability	Pot	Tol	Cur	Nat	Soil Resource Condition
16	265, 266, 290, 291, 293, 294	34	PC	38.1	3.0	4.4	.9	Unsatisfactory
17	290	283	FC	1.9	3.0	.4	.1	Satisfactory

The Moqui has no area with greater than 40 percent slope and only 880 acres are classed between 15 to 40 percent. The tolerance soil loss when all strata are considered is 2.2 tons per acre per year with a current soil loss estimated at .8 tons per acre per year. The relatively high acreage classed as "impaired" is because most of the allotment is either shallow to very shallow over bedrock or represented with extensive pinyon/juniper stands and in some cases both. The moderately deep soils will respond to overstory removal and represent approximately 10,540 acres of the allotment. Under existing conditions the potential to see significant gains resulting from changes in grazing management is thought to be limited unless the moderately deep soils have the woodland overstory removed.

The Anita Allotment has the highest amount of satisfactory soil condition at 65 percent of the unit (Figure-1). Satisfactory soil conditions range from a high of 45 percent to 35 percent surveyed for the Cameron and Moqui Allotments. The impaired category is similar between all three allotments and averages approximately 35,000 acres. The unsatisfactory condition generally occurs on soils over 40 percent although there are several TES units at 15 to 40 percent that have been inventoried with soil loss above tolerance tied to declines in effective ground cover.

Figure 1 below shows contrast and compares the soil resource conditions between the three allotments.

**Figure 1: Existing Soil Resource Conditions - Anita, Cameron, and Moqui Allotments**



Current erosion rates have dropped since the TES survey was published in 1991. A review of the documentation collected for this analysis indicates that ground cover percentages have increased from 10 to 30 percent on the fully capable lands (USDA Forest Service, Project Record, 2004). This increase is mainly the result of the low livestock stocking levels and high degree of rest afforded the Anita and Cameron Allotments over the past 15 years.

## ENVIRONMENTAL CONSEQUENCES

### *Direct and Indirect Effects on Watershed Resources*

#### **Anita and Cameron Allotments**

##### *Effects Common to All Alternatives*

Watershed impacts are disclosed for the Anita and Cameron Allotments in Table 7. We predict that soil erosion will decline by .2 tons per acre per year to .8 tons per acre per year within those TES units with the potential for improved ground cover conditions. Though variation in numbers authorized ranges from zero under Alternative 2 (no-action) to a high of 1310 under Alternative 1 (proposed action) the rest periods and high deferment success in the action alternatives will provide for expansion of native plants and ultimately increases in ground cover and a reduction in overall erosion rates. Adaptive management will promote the maintenance of utilization levels below the

allowable and the appropriate season of use. This will contribute to improvements in ground cover conditions over current levels and promote the continual decline in erosion rates within the allotments.

Table 7: Variation in Soil Erosion for all Alternatives - Anita and Cameron Allotments.

Strata Number	Acres	TES Units	Current Erosion Tons/Ac/Year	Predicted Erosion Tons/Ac/Year	Change
1	4,600	3	.5	.3	-.2
2	11,526	255,591	.8	.4	-.4
3	5,420	677	.9	.5	-.4
6	255	599	.7	.4	-.2
8B	6,673	257, 272	1.7	1.0	-.7
12	861	11	.9	.5	-.4
13	2,751	282, 284, 297	2.8	2.0	-.8
13A	47,213	275, 283	.5	.3	-.2
15	1,165	9	.7	.4	-.3
16	15,057	265, 266, 291, 293, 294	3.2	2.6	-.6
17	17,371	290	.4	.2	-.2

The highest potential for lower soil erosion rates is found in Strata's 8B, 13, and 16 within the Anita Allotment. Improvement in range related variables and ground cover conditions have been noted on the Cameron Allotment within these stratum and we suspect this will begin occurring in the Anita unit as well.

We project that an estimated 112,890 acres could see reductions in current soil erosion rates that will result in less siltation into ephemeral drainage channels, reduced maintenance costs associated with tank work, and surface water continuing to meet state water quality standards.

As native grasses and forbs increase in those ecosystems where the potential is highest we anticipate that this will contribute to improved soil structure, and with the higher inputs of organic matter we should see increased infiltration and improved moisture-holding capacities within the soils. Over a period of time this will reduce the runoff

potential in these watershed and lessen the probability of damaging peak flows. The increased nutrient cycling will provide growth and regeneration of native plants.

Soil resource conditions will continue to improve within the Anita/Cameron Allotments as effective ground covers continue to increase over the next 10-years. We believe the greatest potential is in the grasslands and ponderosa pine ecosystems. The moderately deep and deep soils in combination with generally adequate precipitation will provide optimum conditions of the regeneration of native plants. Maintaining the adequate deferment schedule and rest, if called for, and utilization standards in line with the growth requirements of the plants should push ground covers higher throughout these two allotments.

## Moqui Allotment

### *Effects Common to All Alternatives*

Projected impacts on soil resource and erosion for the Moqui Allotment are found in Table 8. Like the Anita and Cameron units the potential for improvement is restricted to those TES units that are moderately deep-to-deep over bedrock, are found within the more favorable precipitation zones or receive additional runoff because of their landscape position (alluvial bottomlands), and are relatively free of rock in the profile. Unlike Anita/Cameron, the Moqui Allotment is limited in the overall response we predict. Over 30,000 acres is mapped either 277 or 287, which has a strong representation of a shallow soil component. This result in approximately 17,885 acres that we believe has the potential for lower soil erosion rates and improved soil resource conditions.

Table 8: Variation in Soil Erosion for all Alternatives - Moqui Allotment.

Strata Number	Acres	TES Units	Current Erosion Tons/Ac/Year	Predicted Erosion Tons/Ac/Year	Change
1	1,901	3	.5	.3	-.2
2	769	255,591	.8	.4	-.4
3	5,473	677	.9	.5	-.4
8B	2,471	257, 272	.4	.2	-.2
12	217	11	.9	.5	-.4
13	118	282, 284, 297	4.2	3.0	-1.2
13A	6,557	275, 283	.4	.3	-.1
15	60	9	.7	.4	-.3

Strata Number	Acres	TES Units	Current Erosion Tons/Ac/Year	Predicted Erosion Tons/Ac/Year	Change
16	34	265, 266, 291, 293, 294	4.4	3.0	-1.4
17	283	,290	.4	.2	-.2

Soil resource conditions will improve from unsatisfactory to satisfactory on 175 acres (Strata's 13 and 16). We foresee a potential for reductions in soil erosion on 17,883 acres. The net change in soil erosion ranges from a minus .1 tons per acre per year to a high of minus 1.4 tons per acre per year. We believe the remaining strata, which are not shown in this table (numbers 4, 5, 8, 8A, 9, 10, 11, and 14), will maintain current soil erosion rates since these units are quit limited in there ability to respond to management changes. The higher existing erosion on both Strata's 13 and 16 is due primarily to the moderately steep slopes that they are found on, which results in inherently higher erosion rates. We anticipate that the low stocking levels, at least at the low and mid-level of approved numbers of Alternative 1, will provide for generally low actual utilization, and improved regeneration of native plants. This will contribute to higher effective ground covers and a lowering of erosion rates that eventually will expand the area of improved soil resource conditions.

### ***Cumulative Impacts on Watershed Related Variables – Anita, Cameron, and Moqui Allotments***

Cumulatively, when direct and indirect impacts of past, present, and reasonably foreseeable actions are considered we anticipate continual improvement in watershed related resource conditions over the next 10 years.

Table 8A: Past, Present, and Reasonably Foreseeable Actions that will Influence Watershed Conditions.

Activity	Past (Acres)	Present (Acres)	Reasonably Foreseeable (Acres)
Grassland Restoration	1,435	1,185	5,500
Fuelwood	880	-0-	-0-
Vegetation Treatment	20,790	-0-	-0-
Fuels Reduction	14,100	17,600	13,350
Noxious Weed Control	-0-	-0-	2,000

The present and reasonably foreseeable actions will improve watershed conditions on an additional 39,635 acres over the next 10 years (please refer to Table 13 in the wildlife section). This will take the form of higher densities of grass and forb plants and we predict species like western wheatgrass, Junegrass, mutton bluegrass, and the forbs like yarrow, redroot buckwheat, globemallow will expand in their densities. Ground covers will increase in these treated zones and further reduce existing soil erosion in these areas. The higher frequency of grasses, and their fibrous root systems, will improve organic matter contents and eventually improve soil surface structure and overall ability of the soil to accept and hold onto moisture.

The implementation of noxious weed control efforts within the project area will also promote watershed conditions by preventing the expansion of these species and reaching treatment objectives over the next 10 years. These plants pose a serious threat to watershed conditions since they often times form monocultures and reduce native plants to very low levels. This results in increased soil erosion and sedimentation and eventually losses in soil fertility. We predict that over the next 10 years roughly 2,000 acres will be treated and control objectives met for all species.

Another reasonably foreseeable action that should result in improved watershed conditions is the implementation of a decision related to cross-country use of motorized vehicles. The intent of this proposal is to disclose the impacts on the Kaibab, Coconino, Prescott, Tonto, and Apache-Sitgreaves National Forests on reduction in the ability to travel cross-country in vehicles. If implemented, this would reduce the potential of ATV's to cause compaction and lower the infiltration rate.

## **Federally Listed, Sensitive, Management Indicator, Migratory Bird, Game, and Other Wildlife Species of Concern**

### **Affected Environment**

The rangeland environment within the Anita, Cameron, and Moqui allotments includes habitat for many wildlife species found in the ponderosa pine, ponderosa pine-Gambel oak, ponderosa pine-savannah, pinyon pine-juniper, and juniper-savannah forest types. There are also pockets of sagebrush found along drainage bottoms and other grassland and shrublands areas scattered across the three allotments. Inventoried wetlands, perennial streams, or riparian zones are not found within the allotments. There are 107 water sources, which include 91 impoundments, 4 trick-tanks, and 12 water storage tanks. Notable among these are Camp 36, Twin, Skinner, Red Horse, Mundersbach, McRae, Russell, and Hull tanks. There are also two ephemeral lakes within the allotments, Lockett and Twin lakes. None of the tanks or ephemeral lakes support aquatic vegetation, within or around their perimeters, owing to the arid environment, lack of stable water levels, drought conditions, and low runoff potentials. The sporadic nature of runoff, and high evaporation limits the ability of these earthen stocktanks to maintain static water levels. This reduces the potential to produce emergent aquatic vegetation.



For some wildlife species addressed, habitat does not exist within the allotments and/or their range does not overlap with the allotments (see Appendix B for species and rationale). Other species that predominantly use trees, snags, bushes, dense forests, rocks, and/or cliffs for nesting and feeding may incur very minor effects through potential indirect effects to food items (e.g., insects). These minor effects would not result in impacts to habitat or population trends and therefore, no significant impacts would occur to these species (see Appendix B for species and rationale). These species will not be discussed further in this document. Those that are going to be analyzed further are provided in Table 9.

Table 9: Species Analyzed within the Management Plan Revision for the Anita, Cameron, and Moqui Allotments.

Species	Status	Habitat
Chihuahua Savannah Sparrow	Sensitive	Grassland
Navajo Mountain Mexican vole	Sensitive	Grassland
Northern goshawk	Sensitive, MIS	Grassland
Pronghorn antelope	MIS	Grassland
Rocky Mountain elk	MIS	Grassland, Ponderosa Pine
Turkey	MIS	Grassland
Burrowing owl	Birds of Conservation Concern (BCC)	Grassland
Chestnut-collared longspur	BCC	Grassland
Ferruginous hawk	BCC	Grassland
Golden eagle	BCC	Grassland
Northern harrier	BCC	Grassland
Prairie falcon	BCC	Grassland
Swainson's hawk	BCC	Grassland
Gunnison's prairie dog	Species of local concern	Grassland
Eastern cottontail	Game species	Shrubland
Mojave giant skipper	Sensitive	Shrubland - <i>Agave</i>
Mule deer	MIS	Shrubland/Grassland - Browse
Bendire's thrasher	BCC	Shrubland - Sagebrush
Sage sparrow	BCC	Shrubland - Sagebrush
Tusayan flame flower	Plant species of local concern	Woodland
Disturbed rabbitbrush	Plant species of local concern	Woodland and Grasslands

Approximately 2,400 acres of land is designated as part of the Grand Canyon National Game Preserve, which was established in 1906, and is found within the Cameron Allotment only. This represents less than one percent of the entire project area, which is encompassed by the Game Preserve. The Game Preserve was designated and set aside by President Theodore Roosevelt for the protection of game animals and recognition as a breeding place therefore. The Grand Canyon National Game Preserve Act, titled *An Act for the Protection of Wild Animals in the Grand Canyon Forest Reserve*, protects game species. Other legislation that has come out since this Act, such as the Endangered Species Act and Golden and Bald Eagle Protection Act, protect federally listed and eagle species, respectively. All legislation is considered in planning projects. Game species within the preserve include mule deer, Rocky Mountain elk, turkey, pronghorn antelope,

eastern cottontail, tassel-eared squirrel, mourning dove, band-tailed pigeons, and various ducks and geese. Tassel-eared squirrels, mourning doves, band-tailed pigeons, and various ducks and geese would not be affected by any of the alternatives (see Appendix B for rationale). The mule deer, Rocky Mountain elk, turkey, and pronghorn antelope are analyzed as Management Indicator Species (MIS). The eastern cottontail is addressed separately as a Game Species below.

There are six ecosystems found within the project area that provide habitat for wildlife species. These include the following:

### ***Pinyon – Juniper Woodland***

The most prevalent terrestrial ecosystem is the pinyon pine-juniper woodland, which comprises 50 percent of the project area or approximately 130,000 acres. The most frequent understory plant is blue grama with subdominant species including squirreltail, mutton bluegrass, and big sagebrush. The most frequent overstory plants are various juniper species, with pinyon pine as subdominant.

This ecosystem is highly variable in its ability to provide forage for the key ungulate species like elk, mule deer, and pronghorn antelope. Generally, it produces less than 100 pounds of grass per acre and does not have a large diversity of forbs. The browse component is localized, and where found, is of low density and vigor with many of the plants being suppressed by the overstory (USDA Forest Service, Project Record, 2004). Though it may not provide the forage levels required for a large number of animals, it does provide both excellent hiding and thermal cover.

Roughly 90 percent of this ecosystem is considered large trees with the remaining 10 percent classed as medium trees, pole size, or seedlings. The Stand Density Index (SDI) is a measurement that reflects competition between trees and stand sustainability.

Normally, an SDI of 60 percent will have 85 percent shade reaching the ground whereas an SDI of 30 percent will have 50 percent shade reaching the ground. The SDI percent calculated for the woodland zone is approximately 40 percent, which means that the shade reaching the ground is roughly 60 percent. This situation has led to the low average annual forage production and limited browse availability within this ecosystem. Currently, these stands average between 50 and 75 trees per acre.

Opportunities exist for browse release, however, current use levels by native wildlife are at or slightly above the allowable of 50 percent, which means if browse habitat manipulation does occur, improvements in conditions may not manifest themselves until the use levels are reduced. Dietary overlap between livestock and wildlife are not anticipated since these ecosystems have low forage production and are not typically used by domestic livestock.

Two plant species of concern are found in association with this ecosystem, disturbed rabbitbrush and Tusayan flame flower. Disturbed rabbitbrush is normally found on moderately deep and deep soils and forms small isolated colonies interspersed throughout the entire pinyon/juniper type. It has also been observed in the fourwing saltbush ecosystem, and as demonstrated in the woodland zone, it normally is found in rather

small colonies. It is considered excellent browse for native wildlife and domestic livestock.

Tusayan flame flower is found in open mountain meadows with shallow to very shallow soil depths (from less than 10 inches to 20 inches) and fine textures. It has also been inventoried on medium textured soils along canyons and shallow soils associated with the pinyon/juniper ecosystem. The areas it is normally found in are classified as no-capability for livestock grazing and due to the low existing production livestock typically do not use areas these plants are found in.

### ***Current and Historic Grassland and Shrubland Habitats (Fourwing Saltbush and Big Sagebrush)***

Approximately 16 percent, or 41,000 acres, of the project area is mapped as either an existing grassland or former grassland that has been invaded by sagebrush or ponderosa pine. At the lower elevations the fourwing saltbush ecosystem is found with the dominant forage species being blue grama, western wheatgrass, fleabane species, and squirreltail. Browse plants, including fourwing saltbush and winterfat occur, though their overall frequency is considered low and is generally less than five percent. Past grazing pressure during the winter months and current wildlife use has limited the browse species from expanding. It is estimated that the fourwing and winterfat could constitute 15 to 20 percent of the frequency in the future (Personnel Communication, Paul Webber, 2004).

The big sagebrush habitat type occurs along narrow linear drainage bottoms found throughout the woodland zone. This habitat comprises approximately 5,700 acres of the project area. The big sagebrush habitat type generally has low levels of grasses and forbs. Where the frequency of sagebrush is below 10 percent the dominant understory plants include blue grama, western wheatgrass, fleabane species, squirreltail, three-awns, big sagebrush, and crested wheatgrass. The lack of fire has enabled the sagebrush to expand to levels where the carrying capacity for ungulates has been reduced considerably below its potential (USDA Forest Service, Region 3 1991).

Grasslands associated with the ponderosa pine ecosystems are found on 2,300 acres with the dominant understory plants comprised of blue grama, Kentucky bluegrass, squirreltail, mutton bluegrass, and western wheatgrass. Ponderosa pine has encroached to the point that in many areas it has converted to more of a treed ecosystem. This vegetation association is considered a key foraging zone for elk, turkey, and pronghorn antelope.

Fitzhugh (1978) conducted a browse survey within the Cameron Allotment in 1978 and concluded that food plants (fourwing saltbush and winterfat) were being heavily used on 93 percent of the allotment. He further stated that 99 percent of the area was considered low with respects to the density of browse plants and that species composition and density were changing, with preferred food species being reduced and unpalatable species becoming more common. Large, decadent plants were noticeable in many areas of the allotment. In some areas it was also clear that overuse is contributing to the demise of the more palatable shrubs. Over most of the allotments, there is inadequate browse reproduction especially with cliffrose.

This ecosystem has become less represented across the landscape with the expansion of sagebrush, ponderosa pine, and pinyon-juniper (USDA Kaibab National Forest 2003). The amount the former carrying capacity has been affected is unknown but the exclusion of fire and expansion of the woody species could possibly have reduced it by as much as 50 percent.

### ***Ponderosa Pine/Gambel Oak and Ponderosa Pine/Pinyon Pine/Juniper***

The ponderosa pine/Gambel oak and ponderosa pine/pinyon pine/juniper occurs on 34 percent of the area or 88,400 acres. Almost 50 percent of the total capacity produced in the project area is associated with the ponderosa pine type. Suitable habitat for all five management indicator species, including elk, mule deer, antelope, goshawk, and turkey, is found in these ecosystems. Most of the habitat provides adequate forage for consumption by wildlife with the two ecosystems considered both good hiding and thermal cover. Dominant plants include blue grama, mountain muhly, squirreltail, mutton bluegrass, western wheatgrass, big sagebrush, buckwheat species, and lupine.

An estimated 65 percent of this ecosystem is considered pole size trees, 10 percent large trees, with the remaining 25 percent classed as medium trees or seedlings. The SDI percent calculated for this zone is approximately 25 percent, which means that the shade reaching the ground is roughly 40 percent. This could explain the increased frequency of understory plants in the ponderosa pine zone and improved range conditions found there (USDA Forest Service, Project Record, 2004), as compared to the woodland type. The potential for improvement was much higher in this ecosystem, as compared to the woodland zone, and the low levels of livestock grazing and rest over the past 15 years has precipitated a general improvement in trend, grass diversity, and overall carrying capacities.

The following analysis focuses on wildlife species of concern that may be affected by livestock grazing. These include wildlife species that use grasslands, savannahs, and ponderosa pine where the potential for increased grass diversity is the highest and conversely poor livestock management can cause declines in habitat conditions. In addition, our analysis will also focus on the browse species found within these grasslands or savannahs and zones where agave plants could be impacted as well as grass density around water sources.

### ***A. Species that Use Grassland/Savannah/Ponderosa Pine with Good Grass Development***

Range improvement has been recorded on all three allotments by 31,260, 64,020, and 11,920 acres recorded for the Anita, Cameron, and Moqui allotments, respectively (see Tables 16, 17, and 18). This improvement is linked with higher densities of grass cover for wildlife species that use grasslands, savannahs, or ponderosa pine terrestrial ecosystems. The enhancement that has occurred includes increased frequency of cool season grasses, productivity, and understory plant density (USDA Forest Service, Project Record, 2004).

### *Federally Listed Species*

No federally listed species will be affected by any of the alternatives (see Appendix B for species and rationale).

### *Sensitive Species - Chihuahua savannah sparrow, Navajo Mountain Mexican vole, northern goshawk*

Chihuahua savannah sparrow may occur in large grassland areas during the winter on the allotments. This species forages for insects, spiders, and seeds, particularly grass seeds, on the ground in grasslands (Ehrlich et al. 1988). Winter forage availability for this species on the three allotments has been in increasing trend.

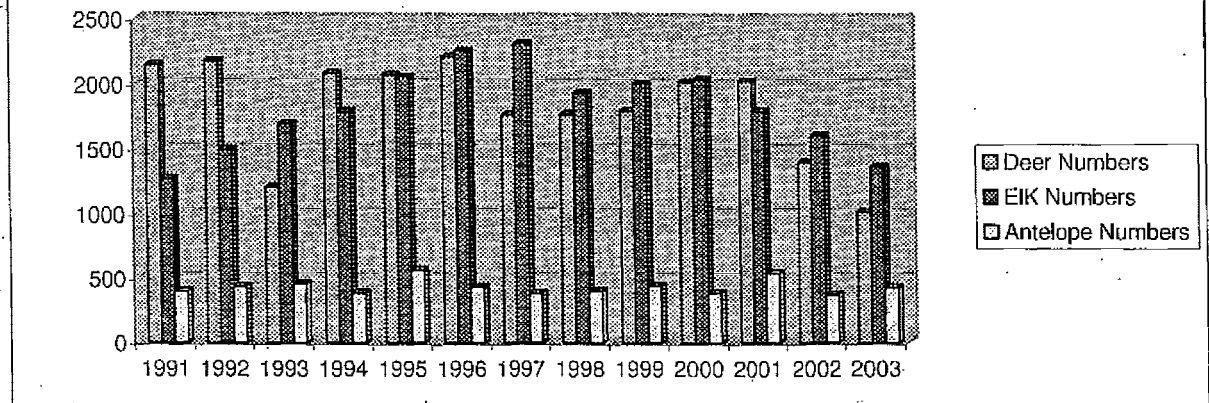
Navajo Mountain Mexican voles prefer ponderosa pine or pinyon-juniper savannah with dense carpets of herbaceous or woody shrub cover. Dense grassy and woody shrub areas may occur along the drainages and Coconino Rim on the allotments. Voles typically eat green shoots, leaves, stems, seeds, herbaceous vegetation, and grasses.

Northern goshawks have seven delineated nest areas and 2,813 acres of post-fledging family areas (PFA) within the allotments. The project area provides foraging habitat and in forest situations they spend much of their time in areas with large, tall trees, though they also use grassy openings, especially during the winter. Use of openings is often related to the availability of prey in these locations and the most important within these areas is the eastern cottontail.

The eastern cottontail prefers well-developed grass and shrub cover for food, nesting, and shelter. The eastern cottontail is analyzed under the Game Species section. Trends in shrub cover, including big sagebrush and rabbitbrush, have increased and are due to absence of fire coupled with past grazing, which reduced the fine fuels that carried fire.

### *Management Indicator Species (MIS) – Northern goshawk, pronghorn antelope, Rocky Mountain elk, turkey*

Figure 2: Population Numbers for MIS Deer, Elk and Turkey.



The MIS concept was developed for use in land-management planning and was based on the idea that monitoring population trends of selected species could allow assessment of the effects of habitat management on communities that include those species. The assumptions inherent in this approach include the following: a) the status of MIS will be reflected in the impacts of management activities at the Forest and the project level; b) changes in MIS populations can be assessed and tracked through time; and c) the changes are representative of overall ecosystem conditions. The selection of MIS, as described in the Federal Code of Regulations (36 CFR 219.19), may include the following: threatened or endangered plant and animal species identified on State and Federal lists; species with special habitat needs that may be significantly influenced by planned management programs; species commonly hunted, fished, or trapped; non-game species of special interest; or other plant or animal species that may reflect management activities. This analysis addresses MIS listed for Ecosystem Management Areas 8, 9, and 10, which encompass the allotments. For information on the status of MIS and their associated habitat at the Forest-level, see the *Management Indicator Species for the Kaibab National Forest*, December 2002.

Northern goshawks were selected as MIS to represent the late-seral ponderosa pine habitat within the Forest. Population trends on the Forest appear to be stable, with possible increases on the North Kaibab Ranger District (*Management Indicator Species for the Kaibab National Forest*; December 2002). Surveys conducted in the project area identified four territories in 1990 with young produced 7 out of the last 13 years (Project Record, USDA Kaibab National Forest, 2004). The amount of fledglings produced range from 8 in 1993 to none observed in either 1997 and 2003. The northern goshawk is discussed in the Sensitive Species section above and will not be addressed further in this section.

Pronghorn antelope were selected as an MIS to represent species using grassland habitat within the Forest. Pronghorn use meadows, grasslands, and flats as summer range on the allotments, and likely for fawning and nursing. Pronghorn fawns have been observed north of Forest Road 2719 on the Cameron Allotment, suggesting that they are also likely

to fawn in the 2,400-acre area designated as part of the Grand Canyon Game Preserve. There is also likely winter range along the southern portions of the allotments. Pronghorn also use other grassy areas and savannahs on the allotments during seasonal and daily movements among grasslands and waters.

Grass and shrub vegetation height is an important attribute of pronghorn habitat, especially during fawning and nursing. Vegetation should be high enough to provide fawns hiding cover from predators, but low enough to allow for good sighting distances, so that pronghorn can scan for, and detect, predators. Based on work by Schuetze and Miller (1992) in central Arizona, pronghorn exhibit the following habitat preferences for fawning and nursing: 1) they prefer herbaceous vegetation (the grass and forb component) that is approximately 10-15 inches high on average, 2) they avoid areas with herbaceous vegetation that is approximately  $\leq 5$  inches in average height, and 3) they prefer areas without woody vegetation (shrubs and cacti). Grass cover on the three allotments has been increasing.

Proper nutrition of wild ungulates can have important influences on reproduction, and offspring survival and growth (Cook et al. 1996, Keech et al. 2000, Cook et al. 2001). In addition, susceptibility to predation and disease can be increased by malnutrition (Spalinger 2000). Pronghorn antelope maintain their necessary nutrition levels by eating primarily high-nutrition forbs, as well as shrubs, especially during the winter (Yoakum and O'Gara 2000). Total grass consumption by pronghorn increases during spring and fall 'green-ups', but remains a small proportion (around 10%) of annual diets (Yoakum and O'Gara 2000). Aside from the known presence of forbs and shrubs on the allotments the nutritional condition of pronghorns on the allotments is uncertain. Some forbs known to be eaten by pronghorn antelope, including buckwheat and sagebrush have increased on all three allotments.

Barbed-wire livestock fences can impede movement, or injure or kill pronghorn if they are not constructed properly. Pronghorn typically pass under fences, and therefore a minimum lower strand height of 16-18 inches is necessary (Ockenfels et al. 1994), as well as a smooth bottom wire to reduce the potential for snagging and injury. In total, there are approximately 516 miles of fences within the allotments. Some interior Forest Service fences on the allotments have four strands with the bottom wire barbed, while others have smooth bottom wires. During 2002-2003, the southern perimeter fences on the allotments (approximately 38 total miles) were inventoried and modified to facilitate pronghorn movement. Modifications included inserting sleeves of polyvinyl chloride (PVC) conduit on the bottom and top barbed wires and raising the height of the bottom wire to 18-20 inches at locations where pronghorn passage was evident. Informal monitoring has shown that pronghorn are still using the modified crossings. In summary, pronghorn seasonal and daily movement abilities were decreased through the past century with the construction of fences, but recent trends have been to minimize the impacts of fence impediments by using design features or modifications that promote passage. The Arizona Game and Fish Department (AGFD) has been monitoring population trends of this species on Game Management Unit 9, which encompasses the allotments. Since 1991 populations have remained fairly stable ranging from 450 animals to just below

500. Pronghorn population trends increased into the mid-1990s and have been decreasing slightly since, with apparent annual variation.

The Rocky mountain elk was selected to represent the early-seral stage of the ponderosa pine and mixed conifer habitats within the Forest, though this species often prefers savannah and grassland environments. Ponderosa pine is common across the allotments and provides summer range for this species. Some areas are dense with small and medium-diameter trees, leading to low levels of elk forage and browse, but good elk-calving cover, while others are more open, providing good elk forage. Ponderosa pine also exists along drainages. This habitat is more open and provides good elk forage and browse, with less elk-calving cover. Elk calves have been observed on the northern portion of the Cameron Allotment, suggesting elk calving also occurs within the Grand Canyon Game Preserve. There is no mixed conifer within the allotments. Pinyon-juniper forests along the southern portions of the allotments and in Upper Basin on the Cameron Allotment provide winter range for this species.

Owing to high levels of dietary overlap between elk and cattle (53% and 97% between summer cattle, and spring and fall elk, respectively on the Coconino National Forest; Miller and Brock 1992), the current range condition and trends for cattle likely reflect those for elk. Grassland condition trends on the three allotments have been upward, while browse conditions have at best remained static and in most cases declined, largely owing to heavy use by elk.

The AGFD has been monitoring population trends of this species in Game Management Unit 9. Population trends increased into the mid- to late-1990s (Figure 2) and have decreased slightly in more recent years. The peak year was recorded in 1997 when roughly 2,300 animals were classified and the low 1991 when 1,200 animals were found. This large ungulate has spread across the entire district since its introduction in 1913 to northern Arizona, after the extirpation of Merriam's elk in the late 1890s (Lee 1986).

Turkeys were selected to represent species using the late-seral ponderosa pine habitat within the Forest. Turkey habitat is found primarily in the drainages of the allotments, but can also be found throughout the ponderosa pine and Gambel oak forest type. Nesting often occurs in dense cover in drainages near waters. Within the Grand Canyon Game Preserve, turkeys are likely to nest along the Coconino Rim and in tributary drainages of the Coconino Wash. They will also utilize edge habitat between openings and forest stands for foraging. Insects, oak mast, and seed heads from grasses and forbs are important food items. Grass around water sources provides important cover and food sources (e.g., grasshoppers and seed heads) for poults. The abundance of seed heads from grasses on the Anita, Cameron, and Moqui allotments have been increasing, owing to improvements in range condition and associated grass productivity on all three allotments. Grass cover around waters is largely non-existent, owing to the arid environment, drought conditions, and associated heavy use by wild and domestic ungulates on these allotments. The AGFD has been tracking population trends of this species on the District though the numbers they have received are from evaluation of



hunter observations and not designated survey routes. Turkey population trends within Unit 9 have remained stable with substantial annual variation.

*Migratory Bird Species of Concern – burrowing owl, chestnut-collared longspur, ferruginous hawk, golden eagle, northern harrier, prairie falcon, Swainson's hawk*

Chestnut-collared longspurs and northern harriers may occur on the allotments only during winter or migration, while the ferruginous hawk, golden eagle, northern harrier, prairie falcon, and Swainson's hawk may occur on the allotments year-round, including during breeding.

Burrowing owls and chestnut-collared longspurs prefer grasslands with less vegetative cover, and vegetative heights < 2 and < 8-12 inches, respectively (NatureServe 2004). With the increased density and frequency of grass within the project area, habitat quality has likely been decreasing for these species on the allotments.

Ferruginous hawks have mixed grass-cover preferences. This species hunts in open, short-stature grasslands, but nests on the ground in areas with substantial grass cover (Saab et al. 1995). Owing to the loss of grasslands with tree expansion, hunting habitat quality for this species has likely been decreasing on the allotments, while nesting habitat quality has likely been increasing. However, we believe with the increased density and diversity of grass plants that population of prey species for these hawks are probably higher.

Northern harriers generally prefer hunting habitats that promote adequate prey base, such as early successional, dense grass ecosystems (NatureServe 2004). Owing to the improved density and composition of grass species, hunting habitat quality for this species has likely increased on the allotments though the amount of area this species would forage within has probably been reduced with tree expansion.

Golden eagles forage primarily in open grasslands, though the primary prey of this species in this area is the black-tailed jackrabbit, which is more abundant in shrublands where this species also forages (Saab et al. 1995). The nearest recorded golden eagle nest was within the Anita Allotment boundary, putting all three allotments within potential eagle foraging areas. Some of the open grasslands have been encroached by trees, leading to reduced availability of foraging habitat for this species, but increased availability of black-tailed jackrabbit prey on both allotments. Grass cover, which may positively influence prey abundance, has increased on the allotments.

Prairie falcons are strongly dependent on populations of their primary prey, ground squirrels. Ground squirrels uniformly prefer early successional, short-stature, dense grasses (NatureServe 2004). Owing to grass cover changes, hunting habitat quality for this species has likely been increasing on the allotments.

Swainson's hawks prefer open, short-stature grassland with scattered trees for hunting and nesting (Latta et al. 1999). They prey on mammals, especially young ground squirrels and pocket gophers, as well as insects. The presence of grass cover is important

to most of their prey species and the improved grass diversity has likely increased the hunting habitat quality for this species.

### *Species of Local Concern – Gunnison's Prairie Dog*

Gunnison's prairie dogs prefer open grasslands and short shrub/grassland, with low vegetation (Boddicker 1983) and little grass cover. Prairie dogs occur along the southern portion of the District and the allotments. Grass cover has been increasing on the allotments, suggesting that habitat quality for this species has decreased.

### *Game Species – Eastern Cottontail*

The eastern cottontail prefers well-developed grass and shrub cover for food, nesting, and shelter. Most eastern cottontail nests are located in grass cover, dense brush, and downed logs. Breeding sites for eastern cottontail are likely to occur throughout the Grand Canyon Game Preserve. Grass cover on the three allotments has been increasing. Sagebrush cover has increased in the past within the grasslands, owing to fire exclusion and heavy historic grazing.

## **B. Species that Use Browse within Grasslands or Savannahs**

### *Management Indicator Species (MIS) – Mule deer, Rocky Mountain elk, pronghorn antelope*

Mule deer were selected as an MIS to represent species using the early and late-seral stage of the aspen and pinyon pine-juniper habitats. There is no aspen habitat within the allotments. Pinyon pine-juniper woodlands occur throughout the project area. The early stage of the ponderosa pine is also an important habitat for this species for browse, fawning, and thermal and hiding cover. Deer are primarily browsers on shrubby plants such as cliffrose, winterfat, and fourwing saltbush. Browse within grasslands on the allotments has declined in density and vigor, owing to heavy grazing by elk and livestock, lack of fire, and tree encroachment. Cliffrose is currently limited in most areas on the allotments by the overstory encroachment by juniper and pinyon pine trees, and not by livestock grazing (personal communication, Dave Brewer, Kaibab National Forest Range Conservationist). Deer may be found on portions of the allotments year round. Mule deer fawning is likely to occur within the Grand Canyon Game Preserve in areas with tree fawning cover. Annual population status of this species is monitored by the AGFD within Game Management Unit 9 (Figure 2). Mule deer populations have declined from just over 2,000 individuals in 1999 to 1,000 animals today. We believe this decline, especially since 2001, is drought related and the population currently is considered stable, though trends are declining in units surrounding Unit 9.

Rocky Mountain elk and pronghorn antelope also use browse species within grasslands and savannahs as discussed in the Grassland Section above.

## **C. Species That Use Agave**

### *Sensitive Species - Mojave giant skipper*

The Mojave giant skipper has some chance of occurring on the allotments based upon limited available information. This species is known to occur in Coconino County. The Mojave giant skipper uses open pine woodland canyons and desert with its host, *Agave utahensis*, which occurs on rocky ridges and gravelly areas on the allotments, especially along the southern portions. The current condition of *Agave* habitat within the allotments is unknown, though if livestock affect the reproductive capabilities and/or availability of *Agave* (see Environmental Consequences Section), then the condition of *Agave* habitat is likely stable to slightly increasing.

#### **D. Species That Use Grasses Around Waters**

##### *Management Indicator Species (MIS) – Turkey*

Grass around water sources provides an important cover attribute for turkey poults. Grass cover around waters on the allotments is limited, owing to the arid environment, drought conditions, and associated concentrated use of waters by wild and domestic ungulates on these allotments. The AGFD has been tracking population trends of this species on the District. Turkey population trends within Unit 9 have remained stable with substantial annual variation.

## **ENVIRONMENTAL CONSEQUENCES**

### **Direct and Indirect Effects**

Anticipated impacts on wildlife species are disclosed in Tables 10 and generally all alternatives will promote improved conditions.

Table 10: Effects on Grass and Browse Habitat on the Anita and Cameron Allotments.

Unit of Measure	Alternative 1			Alternative 2	Alternative 3	Alternative 4
Permitted Number (Adult Livestock)	600	800	1310	-0-	385	800
Season of Use	Seasonal - Summer			NA	Yearlong	Seasonal Summer
Scheduled Rest	35 percent			100 percent	5 percent	65 percent
Forage/Cover Ratio	13/87			13/87	13/87	13/87
Acres of Improved Low/Height Cover	128,145 to 112,540			136,185	124,505	128,145
Percent of Total Annual Forage Production Available to Wildlife	92	88	80	100	88	88

Unit of Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Acres of Improved Browse Habitat	29,690	29,690	-0-	29,690

### ***A. Species That Use Grassland/Savannah/Ponderosa Pine With Good Grass Development***

#### **Anita and Cameron Allotments**

Two key effects are addressed: 1) effects of changes in forage or grass cover on grassland and savannah species, and 2) effects of changes to the extent of fencing on the American pronghorn antelope. None of the alternatives would affect the presence or abundance of nutritional forbs and shrubs for the pronghorn antelope because, a) there is relatively low level of dietary overlap between cattle and pronghorn (<30% in 9 of 10 studies; Yoakum and O'Gara 1990), and b) heavy grazing is not projected to occur under any of the alternatives. There could be some losses of forbs and grasses as the woodland trees expand out into grasslands or the stands get denser though this will be offset as the frequency of both grasses and forbs in the sites where the potential exists (Yoakum and O'Gara 1990).

Habitat and population trends from the two key effects are discussed at species-specific levels. Population viability would not be affected for any species under any of the alternatives.

All alternatives would increase forage and grass cover within grasslands and shrublands on all three allotments for the following species or their prey: Chihuahua savannah sparrow, Navajo Mountain Mexican vole, northern goshawk, pronghorn antelope, Rocky Mountain elk, turkey, ferruginous hawk, golden eagle, northern harrier, prairie falcon, Swainson's hawk, and eastern cottontail. These increases in forage and grass cover would occur for the following reasons: Alternative 2, there would be no livestock grazing of the allotments; Alternative 4, livestock grazing would be authorized only when forage and water is optimum which would mean good distribution and overall light use; Alternative 1, reduced livestock numbers and shifting from yearlong grazing to summer; and Alternative 3, though yearlong use is authorized the projected numbers would result in very light use and continued improvement in both the diversity of plants and their density. These actions would result in increases in habitat trends for these species within the project area. Increases in forage and grass cover and habitat trends would range from a high, for the Anita and Cameron units, of 136,185 acres in Alternative 2 to a low of 112,540 acres projected for Alternative 1 (high end of approved numbers). The current condition for both allotments is estimated at approximately 95,000 acres of improved range conditions. Increased forage and grass cover would improve foraging success and survival of individuals of these species within the allotments. Herbaceous vegetation height, which is likely correlated with grass cover, is particularly important for pronghorn antelope fawning and is also an important determinant of the presence of the Navajo Mountain Mexican vole.

All alternatives would have the opposite effects on the burrowing owl, chestnut-collared longspur, and Gunnison's prairie dog because of the preference for habitat with less grass cover. These alternatives would result in continued decreases in habitat trends. Increases in forage and grass cover and decreases in habitat trends on the allotments would occur from most to least in the following order: Alternative 2, Alternative 1 (low and mid-level of approved numbers) and Alternative 4, and lastly Alternative 3.

Population trends of the Navajo Mountain Mexican vole, Rocky Mountain elk, turkey, burrowing owl, Gunnison's prairie dog, ferruginous hawk, golden eagle, prairie falcon, Swainson's hawk, and eastern cottontail are likely correlated with habitat trends. Under all four alternatives, population trends of the Navajo Mountain Mexican vole, Rocky Mountain elk, turkey, ferruginous hawk, golden eagle, prairie falcon, Swainson's hawk, and eastern cottontail are predicted to increase with the highest correlated to Alternative 2 and the lowest projected for Alternative 3. Slight changes in population trends are attributed to changes in grass cover and associated improved survival, reproductive success, and displacement to other areas. Because the Arizona Game and Fish Department manages populations of the Rocky Mountain elk and turkey, population effects to these species would be less apparent. In addition, because of the large foraging zones needed for the ferruginous hawk, golden eagle, prairie falcon, and Swainson's hawk, population effects to these species would be less apparent. The Forest-level population trends identified for the Rocky Mountain elk and turkey would be increased within the project area under all alternatives.

Alternatives 1, 3, and 4 would result in improvements to pronghorn antelope movement from reconstruction of 21.5 miles of fence that borders the Cameron Allotment and Navajo Nation. Alternative 1 and 4 would also improve pronghorn antelope movement from the removal of fences, as pastures are merged with the combining of the Anita and Cameron Allotments. The amount of miles this involves, however, is unknown. Daily and seasonal movement capabilities of the pronghorn antelope would improve, with the highest predicted for Alternative 1 and the lowest Alternative 2. Slight impediment of daily and seasonal movement may result in effects to survival or reproductive success of individual pronghorn antelope though we feel this would be small. Combining the influences of improved habitat conditions with the anticipated removal of fences we anticipate population trends would likely increase the most to least in the following order: Alternative 4 and Alternative 1, Alternative 2, and Alternative 3. The situation where neither Alternative 2 nor 3 removes unneeded fences is the reason why Alternatives 1 and 4 are projected to improve antelope conditions to a higher level. However, the Forest-level population trends identified for pronghorn antelope would be increased under all actions.

No other species would incur changes in population trends under the alternatives. Chihuahuan savannah sparrow, northern harrier, and chestnut-collared longspur population trends are not likely to be affected because these three species may only be found on the allotments during the winter. Population trends of the northern goshawk are also not

likely to be affected because grasslands and grassland prey species constitute a minor portion of the vegetation types and prey base.

## **B. Species that Use Browse within Grasslands or Savannahs**

One key effect is addressed: 1) effects of changes in browse within grasslands or savannahs for the mule deer, Rocky Mountain elk, and pronghorn antelope. Habitat and population trends from this key effect are discussed at species-specific levels. Population viability would not be affected for any species under any of the alternatives as analyzed below.

Browse, including winterfat, fourwing saltbush, and black sagebrush, is most affected by cattle grazing during winter months, when grasses are covered by snow. Because Alternatives 1, 2, and 4 would eliminate or restrict greatly the ability to graze in the winter months, this in combination with the lowered stocking levels, would increase browse within grasslands or savannahs on 26,690 acres for the mule deer, Rocky Mountain elk, and pronghorn antelope. Continued heavy foraging on browse by elk will limit any expansion, but influences by livestock would be eliminated. Increases in browse and habitat trends for these species would occur from most to least in the following order: Alternative 2, Alternative 4 and Alternative 1, and lastly Alternative 3. Browse under Alternative 3 would remain the same or slightly decrease because there would still be winter use permitted.

Population trends of the mule deer are likely correlated with changes in browse densities in the grasslands or savannahs, and other habitat changes (overstory removal). We predict that population trends for this species on the Anita and Cameron allotments would improve under Alternatives 1, 2, and 4, with increases being from most to least in the following order: Alternative 2, Alternative 4, and Alternative 1. We anticipate that Alternative 1 (low and mid-level of approved numbers) would actually be equal to Alternative 4 in improved acres of both browse and low/height cover. Population trends under Alternative 3 on these two allotments would remain the same or slightly decrease. This stable to slight decrease in population trend for the mule deer would not affect population viability for this species because mule deer population trends in the project area are considered stable. Overall the population trends have been stable since 1982, when the mule deer population estimate (1,000) was twice the minimum viable population estimate for the mule deer on the District (500; MIS Report, Kaibab National Forest 2002), and we predict that any decreases in population trends would be very slight, if at all. Forest-level population trends identified under the Affected Environment Section for the mule deer would be increased slightly in the project area under Alternatives 1, 2, and 4 and would remain stable or decrease very slightly under Alternative 3.

Rocky Mountain elk population trends would be the same as discussed in the Grasslands Section, with increases from most to least in the following order: Alternative 2, Alternative 4 and Alternative 1, and Alternative 3 (possibly stable). Again, the Forest-level population trends identified under the Affected Environment for the Rocky Mountain elk would be increased slightly in the allotments under all alternatives.

Combining this effect on browse with the habitat and population effects for pronghorn antelope population trends would likely increase the most to least in the following order:

Alternative 1 and 4, Alternative 2, and Alternative 3. Again, the Forest-level population trends identified under the Affected Environment for the pronghorn antelope would be increased slightly within the allotments under all alternatives.

### **C. Species that Use Agave**

Cattle may forage on young, reproductive *Agave* stalks, which could preclude these plants from flowering. Flowering occurs between May-July for *A. utahensis*, which includes the period during which cattle would be on the allotments under the grazing alternatives. Because *Agave* are semelparous or monocarpic, flowering only once and then dying, seemingly subtle effects from livestock foraging on flowers could have large impacts to *Agave* reproduction and availability. Because all the alternatives considered on the Anita and Cameron allotments would result in reduced livestock use levels, these alternatives could slightly increase *Agave* reproduction and availability and *Agave* habitat for the Mojave giant skipper. Continued potential foraging on *Agave* by elk and deer could lessen benefits, though, overall we predict an increases in habitat trends for these species. Increases in *Agave* reproduction and availability and habitat trends for the Mojave giant skipper on these two allotments could occur from most to least in the following order: Alternative 2, Alternative 4 and Alternative 1, and Alternative 3.

Population trends of the Mojave giant skipper are likely to be correlated with habitat trends. Population trends of this species on the Anita and Cameron allotments could increase slightly under Alternatives 1, 2, and 4, with increases being from most to least in the following order: Alternative 2, Alternative 4, and Alternative 1. Population trends under Alternative 3 on these two allotments could remain the same or slightly decrease.

### **D. Species that Use Grasses Around Waters**

Livestock and wild grazing ungulates forage on, and trample grasses around waters. All actions, except for possibly Alternative 3, would result in reduced livestock use levels as compared to permitted and this could increase grass density around waters for turkey poults and improve survivability. The arid environment poses an upper limit to grass growth though we still foresee that Alternatives 1, 2, and 4 could increase habitat trends for the turkey. Increases in grass around waters and habitat trends for the turkey could occur from highest to lowest as follows: Alternative 2, Alternatives 4 and 1, and Alternative 3. Grasses around waters under Alternative 3 are anticipated to remain stable or decrease slightly because of the yearlong season of use, though the light stocking levels may alleviate this problem. The projected increases in grasses around waters should improve foraging success or survival of turkeys.

Turkey population trends would be the same as discussed in the Grasslands Section, with increases from most to least in the following order: Alternative 2, Alternatives 1 and 4, and Alternative 3 (possibly stable). Forest-level population trends identified under the Affected Environment for the turkey would be increased slightly in the project area under all alternatives.

## **Moqui Allotment**

Projected changes in wildlife variables are found in Tables 11 and generally all alternatives will promote improved conditions.

Table 11: Quantified Effects on Grass and Browse on the Moqui Allotment

Unit of Measure	Alternative 1			Alternative 2	Alternative 3
Permitted Number (Yearlings)	280	460	560	-0-	560
Season of Use	Seasonal - Summer			NA	Seasonal Summer
Scheduled Rest	-0-			100 percent	-0-
Forage/Cover Ratio	13/87			13/87	13/87
Acres of Improved Low/Height Cover	19,745			20,615	18,440
Percent of Total Annual Forage Production Available to Wildlife	89	81	77	100	77

#### ***A. Species That Use Grassland/Savannah/Ponderosa Pine With Good Grass Development***

We anticipate the same general increases in habitat conditions for MIS and other species as disclosed for Anita/Cameron Allotments for this habitat type. Acres of improved low/height cover will increase from the current 11,917 acres to 20,615 acres for Alternative 2 and 18,440 acres projected for Alternative 3. The range in total forage produced and what is required for the permitted numbers ranges from 23 percent under Alternative 1 (high level of approved numbers) and Alternative 3 to zero within Alternative 2. We foresee this range will provide for generally low levels of actual utilization and provide for the growth and expansion of native plants. This will make available improved cover for wildlife, especially antelope, and increase the suitability of their habitat.

The burrowing owl, chestnut-collared longspur, and Gunnison's prairie dog because of the preference for habitat with less grass cover would have declines in their surroundings. Increases in forage and grass cover and decreases in habitat trends on the allotments would occur from most to least in the following order: Alternative 2, Alternative 1 (mid and low level of approved numbers), and Alternative 3. Increased forage and grass cover would decrease foraging success or survival of individuals of these species.



### **B. Species that Use Browse within Grasslands or Savannahs**

On the Moqui Allotment, winter restrictions on livestock grazing already exist, so changes under the alternatives would occur from changes in cattle stocking numbers. Slight increases in browse in grasslands and savannahs, and habitat trends for the mule deer, Rocky Mountain elk, and pronghorn antelope would be greatest under Alternative 2, but would also occur under Alternative 1. Browse under Alternative 3 would remain the same as current conditions because there is no change in management. Slight increases in browse under Alternatives 1 and 2 may improve foraging success or survival of individuals of these species within the project area.

We anticipate a slight increase in population trends for mule deer also and we suspect it would be greatest under Alternative 2, though we also foresee improvement within Alternative 1. Population trends for mule deer under Alternative 3 would remain static. Slight changes in population levels are attributed to changes in browse quality and availability and the influence this would have on improved survival and reproductive success.

### **C. Species that Use Agave**

On the Moqui Allotment, differences in cattle stocking numbers under the alternatives may influence *Agave* reproduction and availability. Slight increases in *Agave* reproduction and availability and habitat trends for the Mojave giant skipper could be greatest under Alternative 2 and the lowest projected for Alternative 3. This anticipated effect is the result of no livestock grazing associated with Alternative 2 and no-change in management called for within Alternative 3. Slight increases in *Agave* habitat under Alternatives 1 and 2, resulting from no or light stocking, would improve the reproductive success and survival of *Agave* plants and result in increases in foraging areas for the Mojave giant skipper.

On the Moqui Allotment, slight increases in population trends of the Mojave giant skipper could be greatest under Alternative 2, though we predict improvement under Alternative 1 also. Population levels for this species under Alternative 3 would remain the same as current since management changes are not called for.

### **D. Species that Use Grasses Around Waters**

On the Moqui Allotment, differences in cattle stocking numbers under the alternatives may influence grass cover around waters. Slight increases in grass cover around waters and habitat trends for turkey poult could be greatest under Alternative 2, but also Alternative 1. Grasses around waters under Alternative 3 could remain the same as the existing condition on the Moqui Allotment because there would be no change in management. Slight increases in grasses around waters under Alternatives 1 and 2 would improve foraging success or survival of individuals of this species.

### **Summary of Direct and Indirect Effects**

Effects of the alternatives on grass and browse are summarized for the Anita/Cameron and Moqui allotments in Tables 10 and 11, respectively. The interpretations of those effects on key habitat features are summarized for the Anita/Cameron in Table 12 and the

Moqui unit in Table 13. The effects of the alternatives on habitat and population trends of species analyzed are summarized for the Anita/Cameron and Moqui allotments in Appendix C.

Table 12: Summary of Effects on Key Habitat Features by Alternatives for the Anita and Cameron Allotments

Key Habitat Feature	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Forage and Grass Cover	Slight increase	Slight increase	Slight increase	Slight increase
Extent of Fences	Substantial improvement (removal of about 100 miles of fence; reconstruction of 21.5 miles of pronghorn-friendly fence)	No change	Slight improvement (reconstruction of 21.5 miles of wildlife-friendly fence)	Substantial improvement (removal of about 100 miles of fence; reconstruction of 21.5 miles of pronghorn-friendly fence)
Browse within Grasslands	Slight increase	Slight increase	No change or slight decrease	Slight increase
<i>Agave</i>	Possible Slight increase	Possible Slight increase	No change or possible slight decrease	Possible Slight increase
Grass Around Waters	Possible Slight increase	Possible Slight increase	No change or possible slight decrease	Possible Slight increase

Typically, the overall impact of the proposed alternatives is a slight improvement in habitat conditions for all species found within the allotments. The exception to that is within the Anita/Cameron where either Alternative 1 or 4 will improve dramatically the migration corridors for pronghorn antelope as unneeded fences are removed.

Table 13: Summary of Effects on Key Habitat Features by Alternatives for the Moqui Allotment

Key Habitat Feature	Alternative 1	Alternative 2	Alternative 3
Forage and Grass Cover	Slight increase	Slight increase	No change
Extent of Fences	No change	No change	No change
Browse within Grasslands	Slight increase	Slight increase	No change
<i>Agave</i>	Possible Slight increase	Possible Slight increase	No change

Key Habitat Feature	Alternative 1	Alternative 2	Alternative 3
Grass Around Waters	Possible Slight increase	Possible Slight increase	No change

We predict that overall there should be a positive impact or no change on native wildlife species with implementation of any alternative. Slight decreases may occur on the Anita/Cameron Allotments under Alternative 3 for agave plants with the continued winter use and turkey survival related to grazing around stocktanks.

### ***Cumulative Impacts of Wildlife Related Variables – Anita, Cameron, and Moqui Allotments***

Cumulative effects include past, present, and reasonably foreseeable future activities that are likely to occur. The geographical extent of analysis includes the Red Horse Wash, Heather Wash, Lower and Upper Cedar Washes, Lee Canyon-Lower Little Colorado River, and Miller Wash watersheds. This analysis area incorporates a landscape scale, as well as the home ranges of all of the far-ranging ungulates and birds analyzed and those of shorter-ranging species during their use of the allotments. Past (past 20 years), present, and future activities and projects within the analysis area are listed in Table 1.

Table 13. Past, Present, and Reasonably Foreseeable Activities and Projects in the Cumulative Effects Analysis Area.

Activity	Project Name	Timeframe	Acres
Livestock Grazing	Rain Tank Allotment	Past; vacant for past ~5 years	63,632
Grassland Improvement – Tree Removal	No Name	Past	505
Grassland Improvement – Tree Removal	Harbison	Past	429
Grassland Improvement – Tree Removal	Nameless	Current	540
Grassland Improvement – Big Sagebrush Mowing	O'Connell	Past	500
Grassland Improvement – Big Sagebrush Mowing	Brush Tank	Current	500
Grassland Improvement – Big Sagebrush Mowing	Sage Tank	Current	145
Fuelwood Sale	Moqui	Past	30

Activity	Project Name	Timeframe	Acres
Fuelwood Sale	Harbison	Past	550
Fuelwood Sale	Huff	Past	300
Vegetation Treatment	Hammer	Past	7417
Vegetation Treatment	Gallo	Past	11,056
Vegetation Treatment	Upper Ten-X	Past	2315
Fuel Reduction	Java	Past	540
Wildland Use Fire	Cameron	Present	4,500
Fuel Reduction	Skousen	Foreseeable	2,000
Fuel Reduction	Russell	Foreseeable	1,000
Fuel Reduction	Reed	Foreseeable	1,000
Fuel Reduction	Tusayan West	Past	1,100
Fuel Reduction	X-B	Past	3,400
Fuel Reduction	Moqui	Past	80
Fuel Reduction	Rain Tank	Past	500
Fuel Reduction	Scott	Past	2,500
Fuel Reduction	Lone Tree	Past	1500
Fuel Reduction	Camp 36	Past	4480
Fuel Reduction	Topeka	Present	1,800
Fuel Reduction	Ten X	Present	2,600
Fuel Reduction	Redhorse/Mudersbach	Past	8700
Fuel Reduction	Boggy Tank	Foreseeable	1848
Fuel Reduction	Camp 36	Foreseeable	3,000
Broadcast Burn	Redhorse	Foreseeable	2,000
Broadcast Burn	Scott	Foreseeable	2,500
Antelope Fence Modification	Antelope Fence Modification	Past	33 miles

Activity	Project Name	Timeframe	Acres
Fence Removal	McRae Tank Fence Removal	Past	3 miles
Antelope Fence Modification	Antelope Fence Modification	Foreseeable	5 miles
Livestock Fence Construction	Anita/Cameron/Moqui Allotments	Past	16 miles
Stocktank Reconstruction	Anita/Cameron/Moqui Allotments	Past	19 tanks

Four key direct and indirect effects were identified in this analysis: 1) effects of changes in forage or grass cover on grassland and savannah species, 2) effects of changes to the extent of fencing on the American pronghorn antelope, 3) effects of changes in browse (winterfat, fourwing saltbush, and black sagebrush) and shrub cover for the mule deer, Bendire's thrasher, sage sparrow, and eastern cottontail, and 4) effects on *Agave* for the Mojave giant skipper.

Other livestock grazing, grassland improvement, fuelwood sale, and fuel reduction projects listed in Table 13 have resulted in a positive trend in the abundance of forage and grass cover. We foresee that implementation of any of the alternatives would result in the cumulative effect of maintaining or accelerating improving trend in forage and grass cover characteristics for the Chihuahua savannah sparrow, Navajo Mountain Mexican vole, northern goshawk, Rocky Mountain elk, turkey, ferruginous hawk, golden eagle, northern harrier, prairie falcon, Swainson's hawk, and eastern cottontail on all three allotments. The degree of positive change in this improving trend would be from most to least for the Anita/Cameron units in the following order: Alternative 2, Alternative 4 and the low and mid-level of approved numbers for Alternative 1, and lastly Alternative 3. These cumulative effects would result in the associated maintenance or improvement of the ability of these species to survive and forage and reproduce successfully. With respects to the Moqui Allotment we anticipate the Alternative 2 will have the greatest improvement in grassland cover with Alternative 1 being the next, and lastly Alternative 3.

We suspect that all alternatives considered for the three allotments would contribute to the cumulative effect of maintaining or contributing to the current decreasing trend in these habitat characteristics for the burrowing owl, chestnut-collared longspur, and Gunnison's prairie dog on all three allotments. The degree of negative change in this decreasing trend would be from most to least for the Anita/Cameron Allotments in the following order: Alternative 2, Alternative 4 and Alternative 1 (low and mid-level of approved numbers, and Alternative 3. These cumulative effects would result in the related maintenance or decreases of the ability of these species to survive and forage and reproduce successfully.

Grassland improvements resulting from such activities as fuelwood sales, fuels reduction, and antelope fence modification projects have resulted in a positive trend in the

movement of pronghorn antelope within the analysis area over the past 20 years. Livestock fence construction projects lessen the rate of improvement, but do not reverse the trend, owing to the small length of fence created, compared to that modified or removed to facilitate pronghorn movement, and the use of smooth bottom wires in the fence construction projects. Therefore, under all of the alternatives we would have a cumulative effect of improving trend and continued increases in facilitation of pronghorn movement through the area. The degree of positive change in this improving trend would be from most to least for the Anita/Cameron as follows: Alternative 1 and 4, Alternative 3, and lastly Alternative 2.

Three grassland improvement projects (O'Connell, Brush Tank, and Sage Tank) and one fuels reduction project (Java) have affected browse and shrub cover. These activities resulted in reduced abundance of big sagebrush in the project areas and no changes to browse or other shrub species. These project-related reductions in big sagebrush are countered and superceded by increasing abundance of big sagebrush and other shrubs in grasslands across the district. Other browse species, including winterfat, fourwing saltbush, and black sagebrush are in decreasing trend because of heavy use by elk, deer, and past livestock grazing. Therefore, effect number 3 under all of the alternatives would have a cumulative effect of offsetting or reducing the rate of decline of this trend in browse and shrub cover. Reversal of the declining trend would not be expected without reductions in the numbers of elk within the allotments. The degree of positive change to this declining trend in browse and shrub cover would be from most to least in the following order: Alternative 2 (offset to slightly declining), Alternative 4 (offset to slightly declining; Anita and Cameron allotments only), Alternative 1 (declining at a slightly reduced rate of decline), and Alternative 3 (declining trend maintained).

Past livestock grazing on the Rain Tank Allotment may have reduced availability of *Agave* habitat in the analysis area, however this would have been countered by the absence of livestock on this Allotment over the past eight years, and so recent trends in *Agave* habitat availability have likely been stable to slightly increasing. Foraging of *Agave* by elk and deer may limit potential benefits from reduced livestock grazing. Therefore, the trend in *Agave* habitat availability for the Mojave giant skipper within the analysis area is likely stable to slightly increasing. As a result, effect number 4 under all of the alternatives would have a cumulative effect of maintaining or increasing the stable to slightly increasing trend in *Agave* habitat availability. The degree of positive change to this stable to slightly increasing trend in *Agave* habitat availability would be from most to least in the following order: Alternative 2 (improvements), Alternative 4 (improvements; Anita and Cameron allotments only), Alternative 1 (slight improvements), and lastly Alternative 3 (maintained).

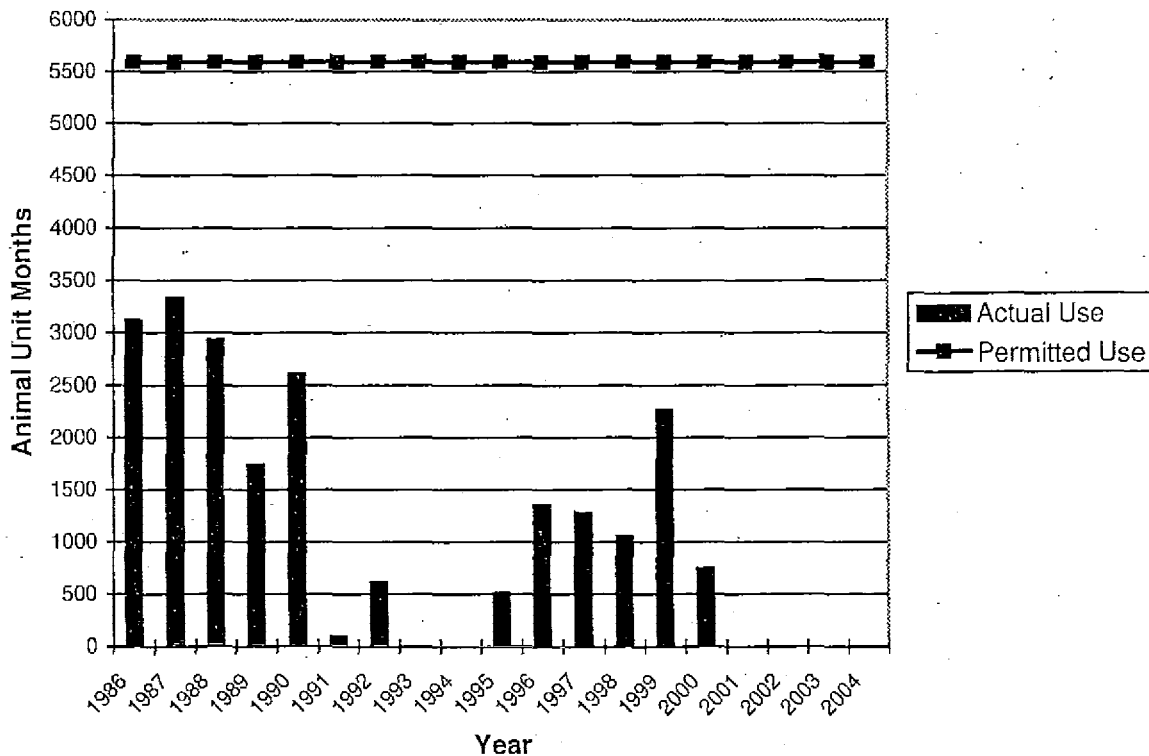
## **Range Management, Stocking Levels, Range Capability and Capacity, and Variation in Rangeland Health**

### **Affected Environment**

## ANITA ALLOTMENT

Currently, the term permit for the Anita Allotment authorizes 666 yearlings (based on an entry weight of 375 to 425 pounds) with a yearlong season of use. The permit allows for substituting mature cattle for yearling cattle at a conversion rate of 0.7 mature cattle to 1 yearling. This conversion would equate to 465 adult livestock. Since 1986, the permit has been administered in a flexible manner with regards to the class of livestock and season of use. The permittee has also been approved for significant periods of non-use for either personal convenience or resource protection. An analysis of the actual use records from 1986 to 2004 indicates that when the allotment was stocked, it was usually with a combination of yearling cattle and adults. The analysis further revealed that a yearlong season of use only occurred only in 4 of the past 19 years (1987, 1988, 1990 and 1999) and that in 6 of the past 19 years the allotment was not stocked. Actual use averaged 1,670 animal unit months (the amount of forage one cow with a calf consumes in one month which is approximately 900 lbs/air dry) per year or approximately 30 percent of what could be permitted. The highest level of livestock use occurred in 1987 when the actual use was recorded at 3,340 AUM's or 60 percent of permitted. Figure 3 shows actual use on the Anita Allotment from 1986 to 2004.

Figure 3: Anita Allotment Actual Use from 1988 to 2004.



Since 1985 the following range structures have been completed on the allotment: construction of approximately 2.5 miles of pasture division fence in South pasture, resulting in South pasture and Lower Anita pasture; construction of approximately 4.5 miles of pasture division fence in Skinner pasture, resulting in East and West Skinner pastures; reconstruction of approximately 7.0 miles of allotment/forest boundary fence;

reconstruction with bentonite lining of 8 stock tanks; and the reconstruction of one water catchment. Nearly all of these projects were completed in the late 1980's and early 1990's with the exception of approximately 5.0 miles of Forest boundary fence reconstruction through volunteers and contracts completed in 2003. No structural range improvements have been undertaken by the permittee since 1993 and most existing improvements have received little, if any, maintenance in the past 5 years. Rangeland related vegetation enhancement projects include prescribed burning and more recently, mechanical treatments. Approximately 1,000 acres of sagebrush encroached grasslands have been burned to improve herbaceous diversity, quantity and quality. In addition, 150 acres of sagebrush encroached grassland will be mechanically treated with a large mower attached to a small skid steer tractor in July/August, 2004.

The Anita Allotment is divided into nine main grazing pastures and three smaller holding pastures. The main grazing pastures are; Headquarters, Tusayan, East Skinner, West Skinner, Dillman, Red Butte, Upper Anita, Lower Anita and South. The grazing management strategy employed on this allotment is a one herd, yearlong, deferred rotation system. The objectives are to use each pasture every year and to provide every pasture with either spring or summer growing season deferment. Use within each pasture is limited to the established allowable utilization level. The three smaller holding pastures, Anita, Bentley, and Old Airport, are typically used for gathering, working and shipping livestock for short periods of time and are therefore not considered in the pasture rotation schedule. However, livestock use within these holding pastures is seasonally deferred each year to ensure either spring or summer growing season rest.

Livestock water has historically been a problem on the Anita allotment. Existing stock tanks are unreliable and poorly distributed and as a result, hauling water to portable water tanks and troughs is a common practice. Water hauling by the permittee has been a necessity in every year that the allotment has been stocked since 1985 with water being purchased and transported to the allotment from Tusayan and/or Valle. In some instances, water hauling to portable water tanks and troughs has been required as a management strategy to improve livestock distribution within the pasture. However, there have also been numerous occurrences where livestock use of a pasture was dependent upon water hauls.

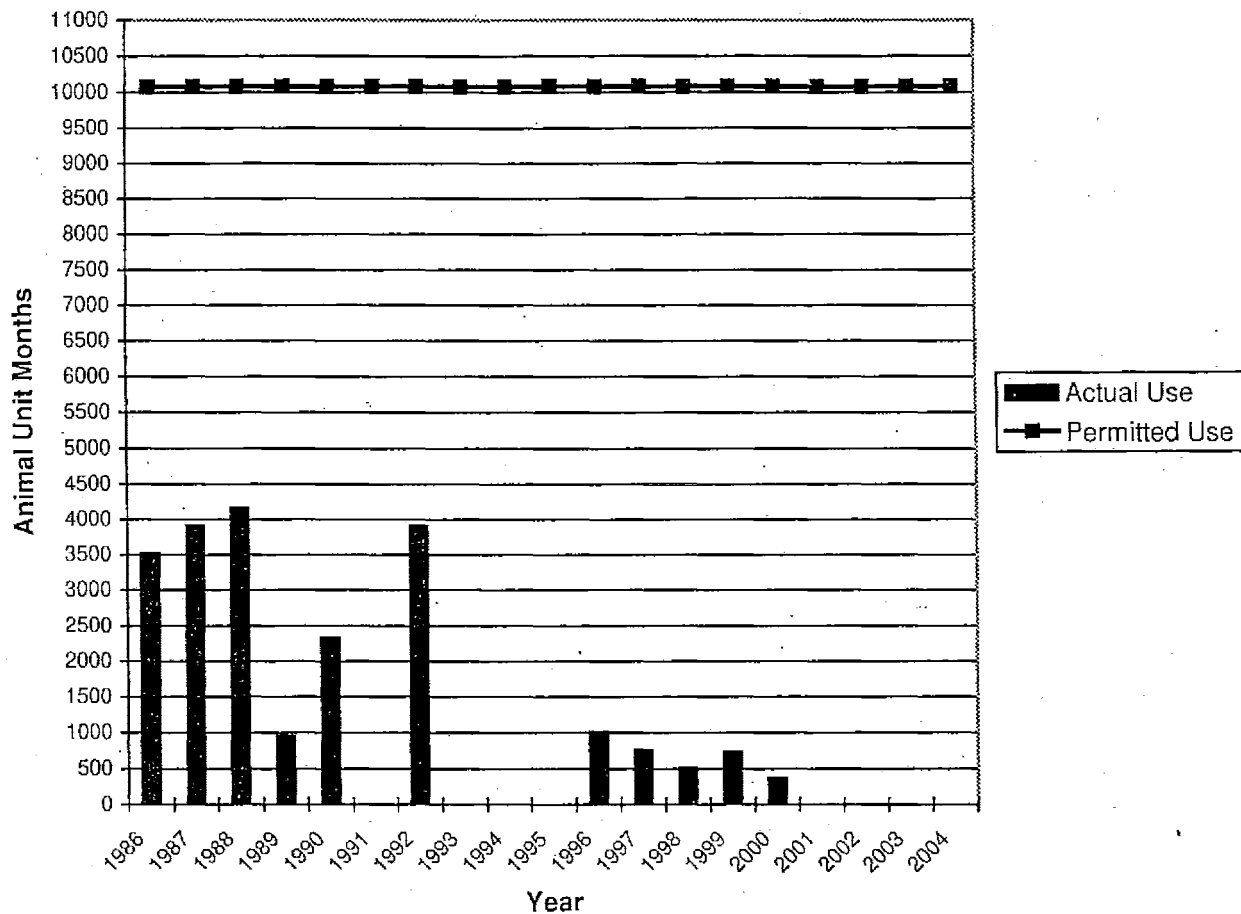
### **CAMERON ALLOTMENT**

The term permit for the Cameron Allotment authorizes 1,200 yearlings (based on an entry weight of 400 pounds) for a yearlong season of use. The current permit allows for substituting mature cattle for yearling cattle, which at the .70 conversion ratio results in 840 adult livestock. However, records indicate that a conversion ratio of 0.67 mature cattle to 1 yearling has been used in the past and using that ratio results in 800 adult livestock. Like the Anita Allotment, this permit has seen variable classes of livestock, season of use, and approved numbers significantly below what the term permit allows since 1986. Actual use records from 1986 to 2004 indicate it was usually stocked with yearling cattle, though adult livestock were also allowed. Yearlong use has not occurred in the past 19 years and that for 8 years out of the past 19 years the allotment has not been stocked at all. Part of the problem with using this allotment is the poor condition of the



eastern boundary fence adjacent to the Navajo Nation. Once cattle are turned out it is extremely difficult, if not impossible, to keep them within the designated allotment boundary. Actual use averaged 2,023 AUM's per year (20 percent of permitted) for the 11 of the past 19 years. The highest level of stocking occurred in 1988 with an actual use of 4,167 AUM's (41 percent of permitted). Figure-4 shows actual use on the Cameron Allotment from 1986 to 2004.

Figure 4: Cameron Allotment Actual Use—1986 to 2004



Since 1984 the following structural range improvements have been completed on the allotment 1) construction of approximately 4.25 miles of pasture division fence in Basin pasture, resulting in East and West Basin pastures, 2) construction of approximately 3.75 miles of pasture division fence in Willows pasture, resulting in East and West Willows pastures, 3) reconstruction of approximately 2.0 miles of allotment boundary fence, 4) reconstruction and bentonite lining of 4 stock tanks, and 5) the construction of one water catchment. All these projects were completed in the mid to late 1980's. No facilities have been completed by the permittee since 1989 and maintenance has been limited. Rangeland related vegetation enhancement projects that have been implemented since 1984 include approximately 1,500 acres of prescribed burning in sagebrush to improve diversity of native plants.

The Cameron Allotment is divided into thirteen main grazing pastures and three smaller holding pastures. The main grazing pastures are; Bucklar, Strip, Cabin, Muggs Castle, Willows West, Willows East, Willows Headquarters, Trash Dam, Basin West, Basin East, Basin Headquarters, Deer and Navajo. The grazing management strategy employed on this allotment is a one herd, yearlong, rest-rotation system. The objectives are to provide complete rest from livestock grazing in two to three pastures each year and to provide either spring or summer growing season deferment on the other pastures. Use within each pasture is limited to the established allowable utilization level. The three smaller holding pastures, Bucklar Holding, Willow Camp, and Basin Holding, are typically used for gathering, working and shipping livestock for short periods of time and are therefore not considered in the pasture rotation schedule. However, livestock use within these holding pastures is seasonally deferred each year to ensure either spring or summer growing season rest.

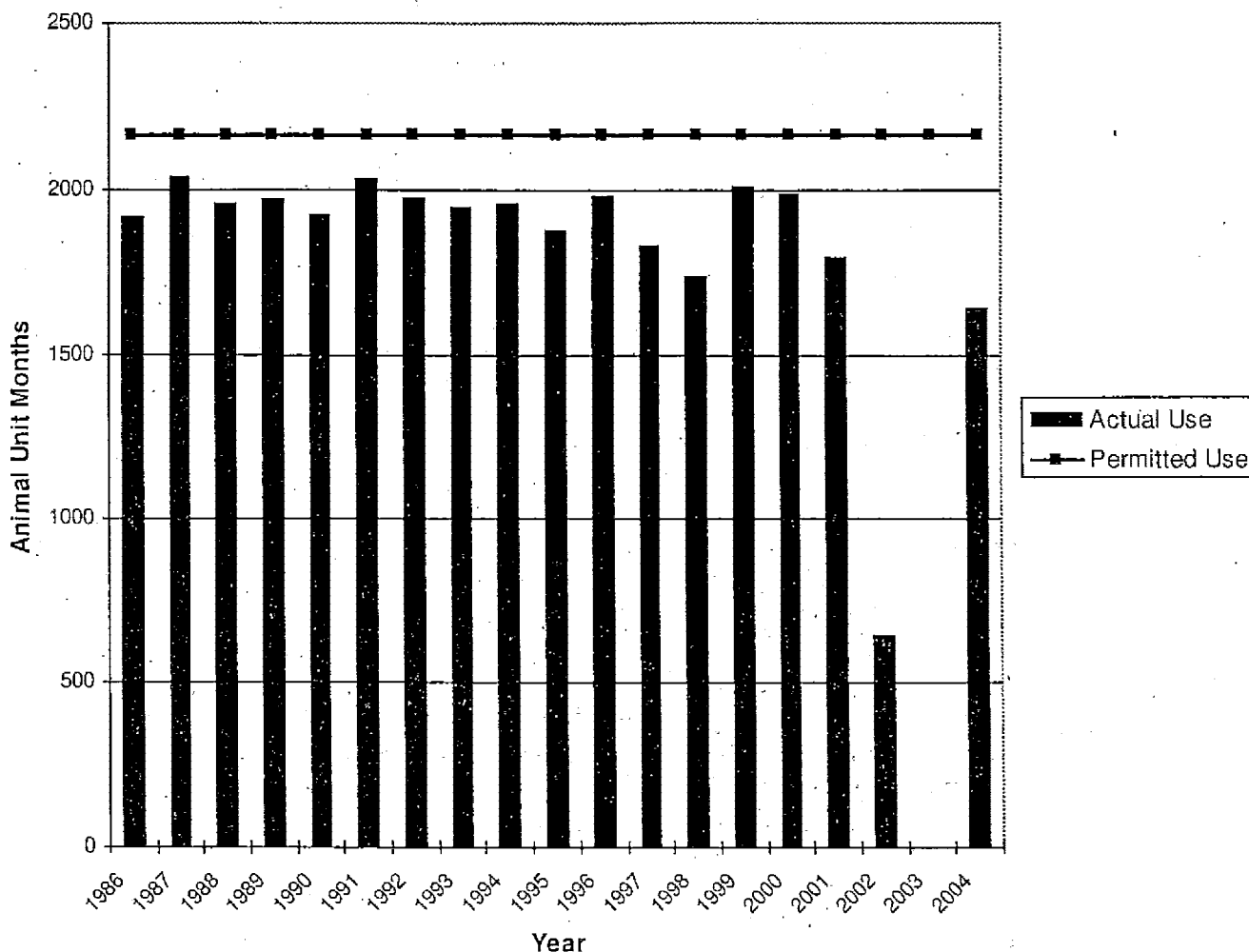
Livestock water is also a problem on this allotment with unreliable and poorly distributed sources contributing to a significant amount of the permittees time and costs associated with hauling water to portable water tanks/trough.

The Cameron allotment has a long history of trespass cattle, sheep and horses from the Navajo Nation. Records indicate that most trespass occurs during the winter and spring months and is mainly occurring in pastures adjacent to the Navajo Nation. Trespass livestock numbers average approximately 10 to 20 head per incident but numbers as high as "three bands of sheep" (no numbers reported), 50 head of cattle, and 27 horses have been documented. On several occasions, the Annual Operating Instructions and planned pasture rotations have had to be modified as a result of the forage utilization levels resulting from the trespass livestock.

### **MOQUI ALLOTMENT**

The term permit for the Moqui Allotment authorizes 560 yearlings with a season of use from May 7 to October 21. Actual use from 1986 to 2004 indicates that 2003 was the only year that the allotment was not stocked and that livestock were removed early in 2002 due to drought conditions. Actual use averaged 1,917 AUM's per year (90 percent of permitted) for 17 of the past 19 years that the allotment was used. The highest level occurred in 1987 with actual use projected at 2,040 AUM's (94 percent of permitted). Figure-5 shows actual use on the Moqui Allotment from 1986 to 2004.

Figure 5: Moqui Allotment Livestock Actual Use – 1986 to 2004



Since 1989 the following work has been completed, 1) reconstruction of approximately 4.0 miles of allotment boundary fence 2) construction of one water catchment and two water haul storage tanks and troughs, and 3) the replacement and reconstruction of 6 water troughs at existing water catchments. Most structural improvements are in fair to good condition and receive annual maintenance. Vegetation enhancement projects have occurred since 1989 and include approximately 1,000 acres of grassland restoration. Approximately 550 acres of additional grassland restoration work will be completed by October 2004.

The Moqui Allotment is divided into three main grazing pastures and two smaller holding traps. The main grazing pastures include Corbett, Harbison and Peterson. The grazing management strategy employed on these pastures is a one herd, next-best pasture, and deferred rotation grazing system. The objectives are to provide either spring or summer growing season deferment for two of the three pastures every year and both spring and summer deferment once in three years for the third pasture. Use within each pasture is limited to the established allowable utilization level. The two smaller holding pastures,

Harbison Trap and Dillman Trap, are typically used for gathering, working and shipping livestock for short periods of time and are therefore not considered in the pasture rotation schedule. However, livestock use within these holding pastures is seasonally deferred each year to ensure either spring or summer growing season rest.

Though water for livestock is limited, as with all allotments on the District, this allotment has improved water availability by constructing an extensive water delivery system. Water is supplied to the Harbison storage tank by a pipeline from Cedar Ranch, which is located on the permittees private land approximately 23 miles south of the allotment. This pipeline also supplies water to the much smaller "No Name" storage tank and drinker in the Harbison pasture. Compared to other allotments on the District, the need for water hauling is less demanding on the Moqui. However, in most years, the permittee will still need to remove water from the Harbison storage tank and truck to other storage facilities on the allotment.

While not as serious a problem as the Cameron Allotment experiences, the Moqui also has a history of trespass cattle, sheep and horses. Records indicate that most trespass occurs during the winter and spring months with livestock entering from the Cameron allotment through open gates or damaged fences.

### ***Range Capability and Capacity for the Anita, Cameron and Moqui Allotments***

There has been a long history of questions regarding the realistic livestock capacities of for the Anita and Cameron Allotments whereas the Moqui Allotment has generally been considered appropriately stocked. Analyses of range capabilities, condition and trend or livestock capacities have been undertaken on 13 separate occasions for the three allotments (USDA-Tusayan Ranger District 1954, 1955, 1956, 1962, 1965, 1966, 1968, 1981, 1983a, 1983b, 1985, 2000, 2004). Table 14 summarizes the results of the capacity evaluations conducted within the project area.

Table 14: Variation in Estimated Capacities and Capabilities between Analysis Periods.

Allotment	Analysis/Study Year	Estimated Livestock Capacity Animal Unit Months (AUMs)	Range Capability (Full Capacity Acres)
Anita <sup>1</sup>	1983	3,120	80,144
Anita <sup>2</sup>	2000	3,270	61,740
Anita <sup>3</sup>	2004	4,180	74,570
Cameron <sup>4</sup>	1981	1,808	22,499
Cameron <sup>2</sup>	2000	3,844	70,545
Cameron <sup>3</sup>	2004	3,780	69,144
Moqui <sup>5</sup>	1968	3,080	54,463
Moqui <sup>6</sup>	1985	3,335	54,460
Moqui <sup>3</sup>	2004	1,775	30,066

1. USDA-Tusayan Ranger District, 1983

2. USDA-Tusayan Ranger District, 2001
3. USDA-Tusayan Ranger District, 2004
4. USDA-Tusayan Ranger District, 1981
5. USDA-Tusayan Ranger District, 1968
6. USDA-Tusayan Ranger District, 1985

The most recent analysis of the allotments indicate that there are approximately 22,455 animal unit months (AUMs) of forage produced per year on the Anita allotment, roughly 22,170 AUMs of forage created within the Cameron allotment, and an estimated 9,605 AUMs of forage created on the Moqui allotment. The estimated livestock capacity, once allowable use criteria is applied, for the Anita, Cameron, and Moqui Allotments is estimated at 4,180 AUMs, 3,780 AUMs, and 1,755 AUMs, respectively (USDA Tusayan Ranger District, Project Record, 2004). Livestock capacities are calculated using such factors as 1) full capacity acres (range capability), 2) annual forage production on full capacity acres, 3) livestock forage requirements, and 4) allowable use factors. Table 15 summarizes the results of the 2004 livestock capacity analyses that have been conducted on the Anita, Cameron, and Moqui allotments relative to the permitted. In all cases, except for the Anita Allotment, the estimated capacity is based on the recorded amounts found in the TES survey, clippings, or ocular estimates.

Table 15: Estimated Livestock Capacity for the Anita, Cameron, and Moqui Allotments.

Allotment	Total Annual Forage Production (AUMs)	Full Capacity Acres	Estimated Capacity (AUMs)	Stocking Rate (AC/AUM)	Current Permitted AUMs	Stocking Rate (AC/AUM)
Anita	22,455	74,570	4,180	17.8	5,595	13.3
Cameron	22,170	69,144	3,780	18.3	10,080	6.9
Moqui	9,605	30,066	1,755	17.1	2,165	13.9

The Anita Allotment currently permits approximately 5,595 AUMs of livestock use, which represents approximately 25 percent of the total annual forage production whereas the Cameron approves 10,040 AUMs or roughly 45 percent of the total annual forage production. Within the Moqui Allotment the permitted numbers equates to 2,165 AUMs or 23 percent of the estimated annual forage production.

Though the estimated capacities, as disclosed in Table 15, range from one analysis period to another this is to be expected considering the analysis methodologies. Except for the Anita Allotment, and several pastures on the Cameron Allotment, formalized production/utilization surveys were not completed. To correct for this we identified specific TES units and used estimate production values from TES or field inventories to estimate a livestock capacity. The 2000 and 2004 study for the Cameron Allotment were virtually the same between survey periods with a 30 percent increase projected for the Anita and a 45 percent decline estimated for Moqui. Though the sharp decline in

capacity on Moqui is not known, there is no doubt the Cameron Allotment is over-obligated.

### ***Rangeland Health for the Anita, Cameron and Moqui Allotments***

Rangeland health is evaluated and ranked by using measurements of range condition and trend. Range condition is defined as "...the present state of vegetation of a range site in relation to the climax (natural potential) plant community for that site..." It is an expression of the relative degree to which the kinds, proportions, and amounts of plants in a plant community resemble that of a climax plant community for the site (USDA Rangeland Analysis and Management Training Guide, 1997). The terms used to describe range condition are excellent, good, fair, poor and very poor. One of the limitations of this methodology is that it is a range resource value ranking, and as such has limited value in facilitating the identification of a high, moderate or low seral condition classes since its focus is on understory plants and those plants preferred by livestock. This is especially true in ecosystems where the potential natural vegetation is tree species like ponderosa pine or pinyon pine. In areas where the community tends to evolve into a treed overstory the number of understory plants will be restricted resulting from competition from the overstory for light, moisture, and nutrients. Since this is a value ranking to the kinds of plants livestock impact, ecosystems that are dominated by woody plants can and will reduce the potential to produce grass species, regardless if livestock are grazed or not. What this means for the project area is this, major improvements in range conditions resulting from changes in livestock management will occur only on those lands that have the potential for it, and that includes basically the grasslands and shrub/grasslands that comprise approximately 40,000 acres or less than 15 percent of the allotments. This is especially prevalent for the woodland communities where the high density of pinyon-juniper trees essentially ties up most of the available soil nutrients and water.

Range trend expresses the direction of change in range condition, in response to livestock management practices and other environmental factors. Terms used to define range trend are upward (↑), static (⇒), or downward (↓). As previously mentioned, it is important to understand that the methods used to evaluate range condition and trend are generally considered a process for determining these variables relative to the lands ability, or value, for grazing livestock and do not provide information on ecological status (USDA Rangeland Analysis and Management Training Guide, 1997). However, the fact that these data points represent a 50-year record, and are also sensitive to changes in management, do make them valuable in assessing variables tied to range health, watershed conditions, and habitat features related to wildlife species.

The Parker Three Step method was adopted by the Forest Service in Region 3 to determine range condition and trend and was also employed within the project area. From about 1955 to 1965, 18 clusters were established on the Anita allotment, 15 clusters were established on the Cameron allotment, and 17 clusters were established on the Moqui allotment. It is not feasible to have sufficient numbers of Parker Three Step clusters on each allotment to provide the necessary data for an allotment scale assessment of range condition and trend. As a result, other methods such as paced transects are used

to provide additional information for determining range condition and trend on allotments.

For this analysis of rangeland health for the Anita, Cameron, and Moqui Allotments a total of 11, 14, and 10 clusters were used, respectively. In addition, over 100 paced transects were collected. This information was placed into a database and an analysis completed that yielded average range score, effective ground cover, soil stability score, and the mean frequency of dominant plants tied to a terrestrial ecosystem map unit basis or combination thereof (USDA Kaibab National Forest, Project Record, 2004). The most recent information was then compared to the last inventory period and three categories established, which included:

1. Acres of improved range condition.
2. Acres of stable range condition.
3. Acres in declining range condition.

As displayed in the following table the Anita Allotment has dropped from over 30 percent being in declining condition to less than one percent today. Conversely, the amount of area considered in improved range condition has jumped from 22 percent in 1966 to approximately 30 percent today (USDA Kaibab National Forest, Project Record, 2004).

Table 16: Anita Allotment

Range Condition Class And Trend	1966 Range Analysis		2004 Range Analysis	
	Acres	Percent	Acres	Percent
Acres of improved range condition.	22,607	22	31,257	30
Acres of stable range condition.	47,934	47	72,808	70
Acres in declining range condition and trend.	32,448	31	1,251	Less than 1

By far the largest increase in acres is reflected of the maintained condition class and is reflective of the high predominance of dense pinyon-juniper overstory or ponderosa pine. Of the 11,690 acres typed as either grassland or shrub/grassland 45 percent is considered improved, 10 percent in declining, and the remaining 45 percent stable. The declining condition is found in Strata 5, which includes TES units 634, 672, 682, and 683 and is tied to the expansion of the sagebrush species that has lowered the overall condition class.

The Cameron Allotment has always been identified with resource problems with the last studies completed in 1983. An internal memo documenting an inspection noted that "the major problem areas are overstocking and depletion of the range, competition between wildlife and cattle on the major browse species, deterioration of watershed and soil conditions, inadequate water supply or lack of water, and unauthorized livestock use from the Navajo Indian Reservation" (USDA Kaibab National Forest, Project Record, 2004). Its hard to imagine a series of conditions that would limit the ability of an allotment to provide adequate forage to either domestic livestock much less wildlife but as far back as 1948 it was observed "through actual use, general range conditions, inadequate water facilities, and the concentration of livestock in local areas, it had been determined this range would not support more than 600 cattle yearlong". The term permit, at that time, was issued for 800 adult livestock and even though this imbalance has been noted for almost 60 years, actions to bring the permitted number in balance with the livestock capacity has never been completed, though numerous attempts were made.

Since 1983 there has been a complete reversal of the area considered in declining range resource conditions. The estimated 64,000 acres considered in declining condition in the 1983 study has shifted to improved category. In most cases there has been a gain of at least one condition class (e.g., poor to fair) and in some cases two (e.g., very poor to fair) over the last 20 years. A total of 41,990 acres was classified in fair (II) whereas the former study identified only 1,735 acres.

Table 17: Cameron Allotment

Range Condition Class And Trend	1983 Range Analysis		2004 Range Analysis	
	Acres	Percent	Acres	Percent
Acres of improved range condition.	472	Less than 1	64,018	60
Acres of stable range condition.	38,723	38	44,085	40
Acres in declining range condition and trend.	64,018	62	0	0

Cool-season grasses, which were virtually non-existent prior to the 1990's, are slowly starting to be found in the composition. This includes western wheatgrass, Indian ricegrass, mutton bluegrass, and squirreltail. It appears, through the analysis of the pace transects, that the ponderosa pine ecosystem has moved from a poor (⇒) to fair (II) since 1983. As a matter of fact, most of the acres tied to the fair condition class are found in this ecosystem.

The Moqui Allotment, at least based on the clusters does not appear to have improved to the degree like the Cameron or Anita. Of the 10 clusters surveyed 1 is considered in



upward trend, 6 classed as static trend, and the remaining 3 in downward trend. However, recent data collected in 2004 and visual observations indicate that except for a few spots it seems that this allotment is experiencing some influx of new plants, mostly in the form of cool-season grass grasses. This invariably would precipitate a general shift to more of an upward trend line. As Table 18 indicates, when all the data is considered, it appears this allotment has made some gains over the last assessment period.

Table 18: Moqui Allotment

Range Condition Class And Trend	1968 Range Analysis		2004 Range Analysis	
	Acres	Percent	Acres	Percent
Acres of improved range condition and trend.	6,311	10	11,917	20
Acres of stable range condition.	48,213	90	43,485	80
Acres in declining range condition and trend.	159	Less than 1	0	0

Overall, when the entire project area is considered there has been strong shift to more upward trend classifications and higher range resource conditions. This has manifested itself in improved diversity of grass plants and higher ground cover percentages. Though possible declines in overall ungulate capacity are predicted, since grassland restoration or prescribed burning has not been undertaken to the degree to make significant gains, were the potential existed, higher diversity of plants has been noted (USDA Kaibab National Forest, Project Record, 2004).

The reason for these improved conditions, especially when the last 10 years of drought are considered, relates to the light stocking levels and significant amounts of rest provided in the pastures found in the Anita and Cameron Allotments. Apparently, the precipitation amounts we received and the low stocking levels in combination with the rest and deferment schedules provided the optimal growing conditions for the cool-season plants and they responded with increases in their density. This was also noted on the Moqui Allotment though the long-term data points were more variable.

## ENVIRONMENTAL CONSEQUENCES

### *Direct and Indirect Effects on Rangeland Health*

#### **Anita and Cameron Allotments**

The evaluation criteria found in Table 19, and interpretations of those changes, have been used to disclose impacts on range related variables.

Table 19: Effects of Implementation of Alternatives – Anita and Cameron Allotments

Unit of Measure	Existing Condition	Alternative 1			Alternative 2	Alternative 3	Alternative 4
Authorized Livestock	1,265	600	800	1310	-0-	385	800
Season of Use	Yearlong	Summer Seasonal			NA	Yearlong	Summer Seasonal
Percent Rest	NA	35			100	5	85
Deferment Success Warm Species Cool species	NA	70			100	90	85
	NA	90			100	80	95
Stocking Rate	9.5	35.9	26.9	16.2	NA	27.9	26.9
Full Capacity Acres	143,714	129,344			129,344	129,344	129,344
Improved Range Resources (Acres)	95,275	128,145 to 112,540			136,185	124,505	128,145
Acres of Improved Browse	16,126	21,546			21,546	-0-	21,546
Total Forage Production (AUMS)	44,625	40,165			40,165	40,165	40,165
Authorized AUMS	15,180	3,600	4,800	7,960	NA	4,620	4,800
Percent of Annual Forage Production used by Livestock	35	8	12	20	-0-	12	12

### *Effects Common to All Alternatives*

All alternatives, including no-action, would result in improved management on both warm and cool-season grasses. The deferment success, which is a measure of the ability of an alternative to meet the growth requirements of the plants, ranges from 80 percent for Alternative 3 to a high of 100 percent found in Alternative 2. The full capacity acres will decline over the next 10 years resulting from the expansion of ponderosa pine, woodland trees and sagebrush into grasslands or shrub/grasslands. Declines would also occur in stands of ponderosa pine or pinyon pine-juniper as the tree canopy cover increases causing a loss of understory plants through the shading effect and the build-up of litter on the forest floor. This eventually will result in a loss of capacity, which is estimated at approximately 4,000 AUMS.

*Effects Common to Alternative 1 (low and mid-level of approved numbers), Alternative 3, and Alternative 4*

Stocking levels are considered very light under all these actions and vary from 35.9 to 26.9 acres per AUM. The authorized livestock numbers would range from 385 head, yearlong, to 800 head during the summer grazing period. The average number of AUMS tied to the permitted numbers is approximately 4,500 with the allotments producing in a typical year 40,165 AUMS. At these levels we suspect that actual utilization will be below the allowable in the uplands and in the key grasslands communities as well. The average utilization, based on the total amount of capacity produced divided into the amount needed for the term numbers, is calculated at 10 percent. At these stocking levels and anticipated utilization we predict that range resource will improve over current from 17,000 acres in Alternative 1 to 41,000 acres for Alternative 2.

Adaptive management is a component of all action alternatives (Alternatives 1, 3, and 4). If utilization rates are exceeded the approved numbers, season of use or both will be modified the next grazing season to correct the problem.

#### *Effects Common to Alternative 1, Alternative 2, and Alternative 4*

These actions would result in 21,546 acres of improved browse habitat. Most of this increase will occur in Strata's 1, 2, and 3 (TES units 3, 255, 591, and 677), which have the potential for increased densities of fourwing saltbush and winterfat. Current frequencies of both species are below 5 percent and it is speculated that these plants could increase to 20 or 25 percent under improved management. Though the elimination of winter grazing is projected to improve the density of these browse plants this could be hampered by the wildlife use. Inspections have noted that current utilization by elk exceeds the standard of 50 percent.

#### Alternative 1

This action would approve a range of livestock numbers, for the summer grazing period, from 600 to 1,310 livestock. A rest-rotation grazing strategy would be used and we estimate that 35 percent of the pasture would be totally excluded from livestock activities during the 10-year cycle. We anticipate the high deferment success for both warm and cool season growing plants in combination with the rest periods will promote the expansion of areas considered in improved range resources from the current level of 95,275 to a high of 128,00 acres (low and mid-level of approved numbers). Changes that we foresee include not only improved browse conditions but also continued increases in the cool season grasses. This includes such species as Indian ricegrass, needle and thread, Junegrass, western wheatgrass, and mutton bluegrass. All of these plants generally note higher diversity levels and provide important protein sources during the spring months.

#### *Alternative 2*

This alternative would cancel the term-permit and exclude livestock from the project area. The amount of rest and deferment on native plants is 100 percent, though some native wildlife use would occur. The high deferment and rest scheduled would increase the amount of acres considered improved to 136,185. Though this action represents the

highest increase in the improved category we suspect that the nutrimental value of the plants will diminish.

### *Alternative 3*

This action would maintain current management that has averaged 385 adult livestock for a yearlong season of use. The light stocking levels would mean low actual utilization except on the browse plants found in the winter range associated with TES units 3, 255, 591, and 677. Increases in carrying capacities resulting from higher densities of browse plants would not occur under this alternative though we predict that improved range conditions would happen on 124,505 acres. This enhancement would be found mostly in the ponderosa pine though grass plants should continue to improve in the winter rangelands as well. The combined use of both elk and domestic livestock during the winter period will hamper browse recovery.

### *Alternative 4*

Alternative 4 would use the Anita and Cameron Allotments when forage and water are optimum under a temporary basis. When grazed, up to 800 adult livestock under a rest-rotation grazing program would be approved. The high rest periods, which is the result of these allotments only being used when water and forage are optimum in conjunction with the high deferment schedules for native plants would increase the amount of improved range resources from the current 95,275 acres to 124,344 acres.

## **Moqui Allotment**

### *Effects Common to All Alternatives*

Approximately 10 percent or 3,000 acres of the full capacity designated lands would have the expansion of woody plants into the grassland and savanna ecosystems or higher overstory densities that would shift these lands into a potential capacity classification. Approximately 9,520 AUMS will be produced under these actions, which is a slight drop over current conditions, which is reflective of the 3,000 acres of full capable lands shifting to potential capacity. This will be offset by the improved production and diversity of plants in other full capacity lands. We estimate that between 180 and 240 AUMS will result from implementation of any of these alternatives.

Table 20: Effects of Implementation of Alternatives – Moqui Allotment

Unit of Measure	Existing Condition	Alternative 1			Alternative 2	Alternative 3
Authorized Livestock	560	280	460	560	-0-	560
Season of Use	Summer Seasonal	Summer Seasonal			NA	Summer Seasonal

Unit of Measure	Existing Condition	Alternative 1			Alternative 2	Alternative 3
Percent Rest	-0-	-0-			100	-0-
Deferment Success						
Warm Species	40	40			100	40
Cool species	60	60			100	60
Stocking Rate	13.9	25.1	15.3	12.5	NA	12.5
Full Capacity Acres	30,066	27,066			27,066	27,066
Improved Range Resources (Acres)	11,920	19,745			20,615	18,440
Total Forage Production (AUMS)	9,605	9,520			9,520	9,520
Authorized AUMS	2,160	1,080	1,770	2,160	NA	2,160
Percent of Annual Forage Production used by Livestock	22	11	19	23	-0-	23

### *Effects Common to Alternatives 1 and 3*

These actions would continue a deferred-rotation grazing program. There would be no rest prescribed and the deferment success on warm and cool-season growing plants is 40 and 60 percent, respectively. Acres of improved range condition would increase from 11,920 acres to 19,745 acres under Alternative 1 and 18,440 acres scheduled for Alternative 3. We predict that this anticipated improvement will occur, and it is directly correlated to our projection that utilization in the key areas and uplands will remain at or below the 30 and 20 percent maximum. We suspect that warm season plants like winterfat, blue gram, sidecoats grama, mountain muhly, and spike muhly will benefit the most under this rotation strategy though cool-season species are also predicted to improve.

Adaptive management is a component of both alternatives. If utilization rates are exceeded the approved numbers, season of use or both will be modified the next grazing season to correct the problem.

### *Effects Common to Alternatives 1 (high level of approved numbers) and 3*

Under these actions 560 head would be approved for 5 ½ months during the summer grazing period. We predict that the stocking rates would be approximately 12.5 acres per AUM and that 23 percent of the total AUMS produced would be needed to adequately cover the term number. Though these values are considered a moderate level of stocking,

given the existing resource conditions, we suspect that utilization levels in the key areas will be maintained at or below the allowable of 30 percent. However, under drought conditions this number will not be sustained.

*Alternative 1 (low and moderate level of approved numbers)*

This action would permit between 260 and 460 yearlings for the 5 ½ month summer grazing period. Stocking levels would be light and are estimated at 25.1 and 15.3 acres per AUM. Utilization levels in the key areas and upland sites are projected to be at, or below, the allowable use standard that is set at 30 and 20 percent.

***Cumulative Impacts of Range Related Variables – Anita, Cameron, and Moqui Allotments***

Cumulatively, when direct and indirect impacts of past, present, and reasonably foreseeable actions are considered we anticipate continual improvement in range related resource conditions over the next 10 years. Table 21 discloses those past, present, and reasonably foreseeable activities.

Table 21: Past, Present, and Reasonably Foreseeable Actions that will Influence Range Related Variables.

Activity	Past (Acres)	Present (Acres)	Reasonably Foreseeable (Acres)
Grassland Restoration	1,435	1,185	5,500
Fuelwood	880	-0-	-0-
Vegetation Treatment	20,790	-0-	-0-
Fuels Reduction	25,600	4,400	1,850
Noxious Weed Control	-0-	-0-	2,000

The present and reasonably foreseeable actions will improve range conditions on an estimated 14,935 acres over the next 10 years. This will take the form of higher densities of grass and forb plants and we predict species like western wheatgrass, Junegrass, mutton bluegrass, and the forbs like yarrow, redroot buckwheat, globemallow will expand in their densities. Overall capacity should increase and we estimate that 2,490 AUMS will be produced if present and reasonably foreseeable activities occur.

The implementation of noxious weed control efforts within the project area should contain, control, or eradicate at least five species of plants including leafy spurge, Dalmatian toadflax, bull thistle, and several knapweed species. We predict that over the next 10 years roughly 2,000 will be treated and control objectives met for all species.

Another reasonably foreseeable action that should result in improved range conditions and help in the prevention in the spread of weeds is the implementation of a decision related to cross-country use of motorized vehicles. The intent of this proposal is to disclose the impacts on the Kaibab, Coconino, Prescott, Tonto, and Apache-Sitgreaves National Forests on reduction in the ability to travel cross-country in vehicles. If implemented, this would reduce the potential of ATV's to trample plants and pick up and spread noxious weed seeds.

## Social and Economic Considerations

### Affected Environment

#### **ANITA, CAMERON, AND MOQUI ALLOTMENTS**

Putt (1991) noted that the grazing of sheep was occurring around the Red Butte and within the vicinity of Tusayan with operators expanding those herds in the mid 1890's. He noted that these herds were given a real catalyst for expansion once the railroad was completed between Williams, AZ and the South Rim of the Grand Canyon in 1901. Putt (1991) also stated that sheep generally replaced cattle during the 1890's since they could withstand the limited amounts of grass and poor water conditions that resulted from a severe drought during that period.

Exactly when the sheep industry lost favor and a conversion to generally cattle operations occurred in the project area is unclear but it appears to be prior to the 1930's (USDA Forest Service 1965, 1966, and 1968). The Anita Allotment had a permit issued in 1925 for 1,233 cattle, yearlong. The permitted area included the Grand Canyon National Park, which was fenced in 1934, however, livestock were still grazed until 1940. The records are clear that the permit was for a 1,000 head since 1946 but doesn't mention if they were yearlings or adult cattle. By 1955 a change of class of livestock was approved to yearlings with a shortened season of use. It seems this unit has remained as a yearling allotment since the 1950's with the current approved number being 666 head.

The Cameron allotment records indicate it was also a cattle allotment prior to 1937 though changing allotment boundaries and permittees show a rather wide fluctuation of permitted numbers until 1942. In that year the Willows country transferred to a new permit holder, at which time, the final sheep permit was retired within the project area. It appears after this wavier the current configuration of the allotment was set and by 1946 the name was changed to the Cameron Allotment. A report completed by the Tusayan Ranger District (1983) noted that starting in 1942 the authorized number was 800 adult livestock though numerous temporary increases were approved well into the 1960's. The 800 head, yearlong, permit remained in effect until the 1980's when it was changed to 1200 yearlings.

Since the mid-1980's, when new allotment management plans were executed for both allotments, a considerable amount of non-use has been taken. Though the exact reasons why the permittee began taking so much nonuse is unknown we suspect at that point the high costs associated with maintenance of improvements and hauling water made the use of those allotments, at least by this permittee, a marginal proposition.

The Moqui Allotment has been considered part of the Babbitt Ranches since 1910 and the records indicated that it has run yearlings since 1945. The number authorized stayed fairly constant at 800 head for a 5 1/2 month season of use during the summer with the approved number being modified in 1988 to 560 head.

In contrast to the Anita and Cameron units this allotment has generally been stocked within 90 percent of term numbers since 1988, except for the years 2002 and 2003 when the effects of the drought were the most severe. Normally, the permittee uses this allotment for heifers, which they then use as replacements for their older culled cows.

Federal rangelands are critical to the economic viability of the industry in the 11 western states (USDI Bureau of Land Management and USDA Forest Service 1994). USDI Bureau of Land Management and USDA Forest Service (1994) also noted that an estimated 21,000 federal permits have been issued in the western states, which represents roughly 22 percent of all livestock producers in the region. Locally, within the project area and the forest as a whole this value is probably higher since almost all the producers on the Kaibab National Forest are dependent strictly on the forage produced on federal lands to support their livestock operation.

The USDA Coconino National Forest (2003) noted that social concerns for livestock grazing are related to the public perception of the appropriate use of public lands, the customs and traditions found in an area, and the community of ranching in relation to those forest uses. They found, based on comments from local residents and forest visitors, that many people thought that livestock on the forest was typical of the western lifestyle and problems associated with ranching were not voiced. On the other hand, to those that felt that livestock were an unnatural intrusion on the landscape, there was almost universal agreement that cattle disrupt their perception of the forest as a wild place. Some people object to livestock grazing on purely environmental concerns noting damage to riparian areas, watershed or wildlife habitat, that has been caused by poorly managed livestock activities. Suffice to say there is a wide range of opinions on whether livestock are an appropriate or inappropriate use of public lands.

Coconino County as well as the entire State of Arizona has experienced an incredible rate of growth between 1990 and 2002 (Arizona Department of Commerce 2002). Over this 12-year period population levels went from 95,590 to 125,420 or an increase of roughly 30 percent. This trend is expected to continue as the population ages and people retire and move into Coconino County for its scenic qualities and climate.

The Arizona Department of Commerce (2002) also noted that the principle industries include retail trade, public administration, and service industries with manufacturing, agriculture, and mining making up less than 10 percent of the jobs in the employment sector. The Grand Canyon Trust (1996) claimed that there has been a shift over the past 30 years from a commodity-based industry that depends on the extraction of timber, water, energy and mineral wealth for job creation to one that is amenity based.



There can be no doubt that the influences of livestock grazing on the economic vitality of Coconino County are not what it once was. However, the fact that the permits are acquired and held for 20 to 30 years or more indicates that individuals find the lifestyle appealing and that some economic gain is forthcoming. Though this gain may be small or none in years when drought or poor prices predominate, they hold onto their permits and do not sell out during poor economic conditions. Furthermore, additional benefits may be acquired by allowing grazing to occur on the forest. In some cases the forest permits are tied to grazing on State and private lands off-forest. Elimination of the forest permits would push these permittees to possibly selling off their private lands for development, contributing to further declines in wildlife habitat.

## ENVIRONMENTAL CONSEQUENCES

### *Direct and Indirect Effects on Social and Economic Considerations*

Economic impacts were analyzed, though the numbers derived should be considered a relative index of economic profitability and not hard and fast values. First, there are a variety of assumptions underlying the calculation of these indices. As an example, the value gained by the sale of a calf is set at \$500.00 for all alternatives. Second, since this is a relative index, benefits and costs are not discounted to analyze them at a common reference point nor is inflation accounted for. These projections then, while considered realistic, serve only as indicators of relative change rather than measures of actual change.

Important economic considerations like debt load, interest rates, and depreciation are not considered and are outside the control of the Agency. However, it is recognized that these factors are probably one of the key variables in making a livestock operation profitable.

Table 23 and 24 display the results of the analysis with the following assumptions applying to the key measures:

1. Gross Revenue -- For the Anita and Cameron allotments this is based on the estimated calf crop multiplied by \$500.00/calf. For the Moqui allotment, this is based on the purchase price of replacement heifers (\$800.00/heifer).
2. Water Haul Costs -- For Anita and Cameron allotments, this charge is based on a standard cost of reclaimed water of \$1.50 per thousand gallons and an average 75 mile roundtrip distance for Cameron and an average 50 mile roundtrip distance for Anita. It also assumes a maximum load of 6,500 gallons and \$3.00 per mile to operate the truck. Since the Moqui allotment hauls water from the Harbison storage tank located on the allotment, water haul costs are reflected in Operational costs.
3. Grazing Fees -- This value is set at \$1.35 per head month.

4. Operational Costs – This rate represents the costs associated with labor, trucks, housing, per diem, veterinarian charges, and is set at \$15.00 per head per month.
5. Maintenance Costs – This value represents costs associated with reconstruction and new construction. With respects to the Anita/Cameron the use of the entire east side is tied to the heavy maintenance work scheduled for the boundary fence between the Forest and the Navajo Nation. In addition, numerous tanks need to be cleaned out, sealed and old fences removed. This value is set at \$46,800 per year or 15 percent of gross profitability. It is expected this value will drop by year 3. For the Moqui allotment, this value is set at 10% of gross profitability.
6. Livestock Hauling Costs – This rate is based on the authorized number divided by 50 (number of adult livestock per load), 300-mile round-trip completed twice a year, and a \$3.00 per mile charge for equipment.
7. Leasing Costs – Since Alternatives 1 and 4 call for a change from yearlong to summer seasonal it is assumed the permittee will have to lease winter rangeland. This charge is set at \$10.00 per head per month.
8. Net to Gross Profit Ratio – This value is a measure of an alternatives ability to maximize profits to the operator. The higher the ratio the less costs associated with the action and the higher the profit margin.
9. Number of Jobs Created – This number is based on the number of adult livestock permitted divided by 300 (number of adult livestock that will support one full-time job).
10. Forest Service Administrative Costs – This value is set at \$.30 cents per acre. This rate includes not only the monitoring of each pasture but range analysis studies and capacity evaluations, if needed.
11. Forest Service or Partnership Costs to Maintain Improvements – Alternative 4 calls for the use of the Anita/Cameron Allotments on an intermittent basis when forage and especially water conditions are adequate to support the livestock operation. Since this use would be authorized under a more temporary permitting system all heavy maintenance, new construction and reconstruction would shift from the permit holder to the Forest Service or partner.
12. Cost to Reconstruct Boundary Fence – Under all action alternatives this fence will be reconstructed. It is estimated the 21 miles will cost an estimated \$210,000.

## **Anita and Cameron Allotments**

### *Effects Common to Alternatives 1, 3, and 4*

These alternatives would maintain the ranching lifestyle and authorize a range of approved livestock from 385 head in Alternative 3 to 1,310 head for the upper end of

Alternative 1. Grazing fees range between \$4,860, at the low end of approved numbers for Alternative 1, to a high of \$10,611 under that same action. Even though Alternative 3 has considerably less numbers the fact that the livestock are approved for yearlong use pushes the fee higher. Like grazing fees, the number of jobs varies from a low of 1.3 calculated for Alternative 3 to a high of 4.4 found at the high end of approved numbers of Alternative 1. Forest Service administration costs are set at \$65,000 per year and would not vary even though numbers of livestock do.

Table 22: Social and Economic Impacts for the Anita and Cameron Allotments.

Unit of Measure	Alternative 1			Alternative 2	Alternative 3	Alternative 4
Livestock Permitted	600	800	1,310	-0-	385	800
Livestock Activity Permitted	Yes			No	Yes	Yes
Gross Revenue	230,000	275,000	390,000	-0-	147,500	350,000
Water Haul Costs	13,560	18,275	28,775	-0-	8,790	8,250
Grazing Fees	4,860	6,480	10,611	-0-	6,237	6,480
Operational Costs	54,000	72,000	117,000	-0-	34,650	72,000
Maintenance Costs	46,800 <sup>5</sup>	46,800	46,800	-0-	11,800	-0-
Livestock Hauling Costs	21,600	27,000	45,000	-0-	7,200	14,400
Leasing Costs	36,000	48,000	78,600	-0-	-0-	48,000
Net to Permittee	53,180	56,440	63,214	-0-	78,823	200,870
Net to Gross Profit Ratio	.23	.20	.16	-0-	.53	.57
Number of Jobs Created	2.0	2.7	4.4	-0-	1.3	2.7
Forest Service Costs to Administer to 100 Percent of Standard	65,000	65,000	65,000	-0-	65,000	65,000
Forest Service or Partnership Costs to Maintain Improvements	-0-			-0-	-0-	46,800
Cost to Reconstruct Boundary Fence	210,000			-0-	210,000	210,000

<sup>5</sup> This value is expected to fall after year 3 to an average of 20,000 per year and the high initial costs are associated with heavy maintenance work on 21 miles of the eastern boundary fence and tank reconstruction.

### *Effects Common to Alternatives 1 and 3*

Overall net profit to the permittee is similar between these two alternatives and ranges from a low of \$53,180 for the minimum number of livestock found in Alternative 1 to a high of \$78,823 for Alternative 3. As mentioned, the low costs of water hauling and dollars tied to maintenance results in Alternative 3 having the second highest profit margin to the permittee. However, we suspect that this alternative cannot be sustained since it is likely that the low costs associated with maintenance will eventually mean many of the improvements will not meet standards and maintaining the proper rest and deferment schedules will not occur.

### *Effects Common to Alternatives 3 and 4*

Water haul costs and net to gross profit ratios are virtually the same between these two alternatives. In both cases the use of the allotments when generally forage and water are adequate reduces the costs associated water hauling. The shifting of heavy maintenance costs from the permittee to the public or another entity in the private sector under Alternative 4 makes it, at least in profits to the permittee, the best calculated.

### *Alternative 1*

This action would result in net profits to the permittee ranging from \$53,180 to \$63,214 with the average net to gross profit ratio calculated at .20. The high costs associated with maintenance (at least for the first 3 years until all the improvement are up to standards), water and livestock hauling, and the operation of the ranch results in this action having the lowest profit margin to the permittee.

### *Alternative 2*

Alternative 2 would cancel the permit and eliminate livestock grazing from the project area. Costs and revenues derived from the livestock operation would drop to zero. Costs associated with administration of the permit and grazing fee revenues would also be eliminated.

### *Alternatives 3*

This action would authorize grazing on a yearlong basis with the average number run projected at 385 adult livestock. We foresee this action as generating the second highest profit margin for the permittee since the costs to run the operation are considerably less than Alternative 1. Since yearlong use would still be approved the need to lease lands during the winter are not necessary.

### *Alternatives 4*

Alternative 4 would provide for the highest profits to the permittee and is calculated at \$200,870 per year when grazing is approved. The high degree of rest and deferment will provide for excellent forage conditions and a high plan of nutrition for the livestock, which will invariably lead to high conception rates and calf weights when the animals are sold. The reduced costs associated with hauling water and livestock, and the elimination

of heavy maintenance costs leads this action, from a profit margin standpoint, to the highest calculated. However, the expenditures to the Agency are also the highest since we will eventually absorb all the maintenance costs, which are estimated at \$46,800 per year for the first 3 years.

## Moqui Allotment

### Effects Common to Alternatives 1 and 3

Alternatives 1 and 3 would maintain the ranching operation. Livestock hauling and leasing costs would drop to zero and the number of jobs created range from .60 to 1.3. We anticipate that administrative costs to the government between these alternatives would be \$15,000 per year. The high net to gross profit ratio is the result of this allotment currently having improvements maintained to standards and the situation were water, livestock, or leasing costs are nonexistent or very low. These minimal costs associated with these activities will create a favorable profit margin to the permittee with the net to gross profit ratio calculated at .78.

Table 23: Social and Economic Impacts for the Moqui Allotment.

Unit of Measure	Alternative 1			Alternative 2	Alternative 3
Livestock Permitted	260	460	560	-0-	560
Livestock Activity Permitted	Yes			No	Yes
Cost to Purchase Replacement Heifers	208,000	368,000	448,000	-0-	448,000
Water Haul Costs	800	1,590	1,915	-0-	1,915
Grazing Fees	1,930	3,415	4,158	-0-	4,158
Operational Costs	21,450	37,950	46,200	-0-	46,200
Maintenance Costs	20,800	36,800	44,800	-0-	44,800
Livestock Hauling Costs	-0-			-0-	-0-
Leasing Costs	-0-			-0-	-0-
Savings to Permittee by using Moqui Allotment instead of Outright Purchase of Yearlings	163,020	288,240	350,930	-0-	350,930
Net to Gross Profit Ratio	.78			-0-	.78
Number of Jobs Created	.6	1.1	1.3	-0-	1.3

Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Forest Service Costs to Administer to 100 Percent of Standard	15,000	-0-	15,000

### *Effects Common to Alternatives 1 (high level of approved numbers) and 3*

Alternative 1 (high level of approved numbers) or 3 would permit 560 yearlings and we estimate that total savings to the permittee would be \$350,930. We anticipate that grazing fees, operational costs, heavy maintenance or reconstruction costs, would be approximately \$4,158, \$46,200, and \$44,800, respectively.

### *Alternative 1 (low and mid-level of approved numbers)*

We calculate that the cost to purchase replacement heifers ranges from \$208,000 to \$368,000. The net savings to the permittee, correspondingly, varies as the higher numbers are approved and is estimated at \$163,020 to \$288,240. Operational costs also follow this same trend line and we estimate that it will range from \$21,450 to \$36,800 per year.

### *Alternative 2*

Alternative 2 would cancel the permit and eliminate livestock grazing from the project area. Costs and revenues derived from the livestock operation would drop to zero. Costs associated with administration of the permit and grazing fee revenues would also be eliminated.

### **Cumulative Impacts on Social and Economic Considerations**

There are no cumulative impacts predicted under social and economic considerations.

## **Heritage Resources**

### **Affected Environment**

#### **ANITA, CAMERON, AND MOQUI ALLOTMENTS**

Approximately 34 percent (70,000 out of 263,000 acres) of the project area has been previously surveyed for heritage resources, primarily for timber sale, range and roads projects. Archaeologists have located over 1341 heritage resource sites that include hogans, sweat lodges, historic mining camps and quarries, logging railroads, masonry outlines, pithouses, rock art sites, and numerous lithic scatters.

The earliest evidence of human occupation is represented by Paleoindian to Archaic projectile points, dating between approximately 10,000 BC to AD 1. These people were primarily hunter-gatherers, relying on a variety of wild resources. Very little evidence remains of these nomadic people. Some of the numerous lithic scatters may be associated with these occupations, however many of these sites lack diagnostic projectile

points and little can be said about their cultural affiliation. The transition between the Archaic and Cohonina periods is poorly understood in this area. Few sites from this time have been identified on the south Kaibab.

Within the project area, site density is greatest between AD 700-1150 and is primarily affiliated with the Cohonina culture. The Cohonina were a semi-sedentary population who likely relied on a mixed subsistence of cultigens and wild resources. Based on site density, the peak in occupation occurred during the early Medicine Valley Phase, AD 900-1050. In the Upper Basin, located within the Cameron Allotment, there is evidence of cultural mixing between the Cohonina and Anasazi peoples, as evidenced by mixed ceramic assemblages.

There is evidence of Protohistoric activity in the project area after the Cohonina abandoned their territory around AD 1150. It is likely that ancestors of Hualapais and Havasupais traversed the area, hunting, gathering, and trading. Archaeological materials documenting Protohistoric use of the area include roasting pits, lithic materials, and ceramic trade wares.

Navajo use of the area likely began around AD 1880. The area was utilized for pinyon nut and fire wood collection, as well as for sheep grazing. The material remains from Navajo use include hogans, sweat lodges, brush shelters, and sheep pens.

Historic Anglo use of the project area includes the railroad spur line constructed from Williams, Arizona to the Grand Canyon National Park in 1906. High stumps located along the route indicate areas that were cut in the early 1900's as ties were needed for the laying of track through the area. Remnants of the Saginaw Manistee logging railroad, ca 1930, and associated logging camps, are also found within the project area. Remains of the Red Butte Airfield, ca 1927, can also be found in the Anita allotment. Hull Cabin, which is located in the Cameron Allotment, is listed on the National Register of Historic Places and is an old sheep camp that was used as a District Ranger Office and line camp since the 1890's. Portions of the old stage line that originated in Flagstaff and went to the Grand Canyon can be found on both the Cameron and Moqui Allotments. Isolated scattered trash in this area may be associated with cross-country auto travelers from this time period.

## ENVIRONMENTAL CONSEQUENCES

### *Direct and Indirect Effects on Heritage Resources on the Anita/Cameron Allotments*

With respect to grazing, cave/rock shelters are important sources of stratified and well-preserved cultural deposits that are vulnerable to livestock traffic disturbance. Rock art sites may be vulnerable to impacts from livestock, as cattle may abrade rock art. Although these sites are present within the allotment areas, the dispersed nature of grazing reduces the likelihood of adverse impacts.

The four proposed alternatives are 1) Proposed Action (50 to 80 percent reduction); 2) No Action (termination of grazing on the allotments); 3) Current management (385 adult

livestock, yearlong, roughly a 60 percent reduction); 4) Temporary permitting (up to 800 head for the summer grazing period which represent about a 70 percent reduction over current permitted numbers). Any of these alternatives will have no adverse effect on Heritage Resources. Current survey work has found no significant damage from livestock grazing on heritage resources within the Anita/Cameron units at the present permitted number (approximately 1,310 adult livestock yearlong), which equates to a stocking level of approximately 8 acres per AUM (animal unit month). We foresee no adverse impacts when stocking levels go to approximately 20 acres per AUM. Livestock grazing generally has no adverse effect when grazing use and animal traffic is dispersed.

Improvements associated with the proposed action include 21.5 miles of fence construction between the Tusayan District and the Navajo Nation and cleaning and maintenance of existing tanks. Prior to implementation of any of these projects a heritage clearance report will have to be completed, which will meet the requirements for the National Historic Preservation Act of 1966 Section 106 consultation process. All future project developments proposed for management of the allotment will be subject to Section 106 consultation prior to implementation.

Hull Cabin will not be impacted under any alternative since it is fenced out from the allotment and livestock use will not occur.

#### ***Direct and Indirect Effects on Heritage Resources on the Moqui Allotment***

As with Anita/Cameron Allotments, cave/rock shelters are important sources of stratified and well-preserved cultural deposits that are vulnerable to livestock traffic disturbance. Rock art sites may be vulnerable to impacts from livestock, as cattle may abrade rock art. Although these sites are present within the allotment areas, the dispersed nature of grazing reduces the likelihood of adverse impacts.

The three proposed alternatives are: 1) Proposed Action (280 to 560 yearlings for 5 ½ months during the summer); 2) No Action (termination of grazing on the allotment); 3) Current management (560 yearlings for 5 ½ months during the summer). Any of these alternatives will have no adverse effect on Heritage Resources. Current survey work has found no significant damage from livestock grazing on heritage resources within the Moqui allotment at the present permitted number (approximately 560 yearlings), which equates to a stocking level of approximately 14.2 acres per AUM. We foresee no adverse impacts when stocking levels range from 27.8 acres per AUM to the current 14.2 acres per AUM. Livestock grazing generally has no adverse effect when grazing use and animal traffic is dispersed.

Improvements associated with the proposed action include cleaning and maintenance of existing tanks, fences and other range structures. Prior to implementation of any of these projects a heritage clearance report will have to be completed, which will meet the requirements for the National Historic Preservation Act of 1966 Section 106 consultation process. All future project developments proposed for management of the allotment will be subject to Section 106 consultation prior to implementation.



## ***Cumulative Impacts on Heritage Resources***

Reasonably foreseeable actions have the potential to impact heritage resources. Over the next 10 years approximately 13,935 acres of either prescribed burning or thinning will be completed within the 3 allotments. However, prior to implementation of any of these projects a heritage clearance report will have to be completed, which will meet the requirements for the National Historic Preservation Act of 1966 Section 106 consultation process. We predict that reasonably foreseeable actions will have no adverse impacts on heritage resources.

## **CONSULTATION AND COORDINATION**

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

### ***ID TEAM MEMBERS:***

Dave Brewer, IDT Leader, Range and Watershed Program Manager, Supervisors Office  
Gary Hase, Jr., IDT Member, Range Conservationist, Williams Ranger District  
Bonnie Nielson, Wildlife Biologist, Williams Ranger District  
Chuck Nelson, IDT Member, Wildlife Biologist, Williams Ranger District

### ***CONSULTANT***

Calla McNamee, Archeologist, Williams Ranger District

### ***FEDERAL, STATE, AND LOCAL AGENCIES:***

Grand Canyon National Park  
Coconino National Forest  
Coconino NRCN Natural Resource Districts  
Arizona Game and Fish Department  
Arizona Department of Environmental Quality  
Department of Public Safety  
Coconino County Sheriff's Department

### ***TRIBES:***

Navajo Nation

### ***OTHERS:***

Doug Wells	Pat Lauzon	Dave Brown	Jackie Brown
Brian Ciesielski	Brian Nowicki	Jeff Burgers	Tom Depaolo
Brad Fuqua	Martha Seely	Anita McFarlane	Robert Evans
Eric Gueissaz	Andy Taranto	Donald Cox	Pete Shearer
Bob Lacivita	Gery Booth	Bill Hadden	Kali Kalche
John Ruter	Greg Gibbons	Gary Booth	John Tatham
John Talberth	Don Keil	Chip Ernst	Kirsten Stade

Dianna Vansanford	Lars Ortegren	Arizona Antelope Foundation
Bryan Bird	Brian Segee	Bob Button
Sharon Galbreath	Chris Thurston	Chris and Habin Robin
Chris Harbin	The Wildlife Society	

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## Appendix B

Species that would not have habitat or population trends affected by any of the alternatives.

Common Name	Scientific Name	Status	Rationale
Amphibians			
Northern Leopard Frog	<i>Rana pipiens</i>	Sensitive	Not likely to occur within allotments - Surveys have been done on the Williams Ranger District since 1990, with only one known recent occurrence in the far southern portion of the Williams Ranger District. Found in fresh-water ponds or streams that typically hold water year-round and have aquatic vegetation. A few tanks on the allotments hold water year-round, though they are depauperate of aquatic vegetation and likely unsuitable for this species.
Birds			
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	Sensitive; FWS Bird of Conservation Concern (BCC)	No impacts to habitat or population trends - nests on cliffs that would incur little to no use by livestock; forages on a variety of bird species, including doves, pigeons, shorebirds, waterfowl, and passerines, that use a variety of habitats, many of which would incur little to no use by livestock grazing

Common Name	Scientific Name	Status	Rationale
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Threatened	No effect - breeding range does not overlap; no management activities (beyond livestock presence) within 0.25 miles of a bald eagle winter roost during any time of occupation by bald eagles; winter roost site habitat would not be affected by livestock grazing; little seasonal overlap of livestock grazing and winter occupation by bald eagles; opportunistic nature of bald eagle foraging and winter perching
Band-Tailed Pigeon	<i>Patagioenas fasciata</i>	Game Species	No impacts to habitat or population trends – species occurs in closed- or open-canopy mature to old-growth forest that would not be affected by livestock grazing
Bendire's Thrasher	<i>Toxostoma bendirei</i>	FWS BCC	No impacts to habitat or population trends – occurs in sagebrush and scattered junipers that would not be affected by livestock grazing
Black Swift	<i>Cypseloides niger</i>	FWS BCC	No impacts to habitat or population trends – forages over forests and open areas and breeds in cliffs near waterfalls that do not occur within or near the allotments
Black-Throated Gray Warbler	<i>Dendroica nigrescens</i>	FWS BCC; AZ Partners in Flight Priority Bird Species of pinyon-juniper habitat	No impacts to habitat or population trends – uses pinyon pines and junipers that would not be affected by livestock grazing
California Condor	<i>Gymnogyps californianus</i>	Endangered, Experimental/Nonessential (Northern Arizona)	No likely impacts – this experimental population occurs within the Vermillion Cliffs, Paria Plateau, and areas surrounding the Grand Canyon. Only one report of one condor exists on the Tusayan Ranger District, in an area outside of the allotments. No potential breeding sites occur within the District or allotments.



Common Name	Scientific Name	Status	Rationale
Cordilleran Flycatcher	<i>Empidonax occidentalis</i>	AZ Partners in Flight Priority Bird Species of pine habitat	No impacts to habitat or population trends – uses pine or aspen forests with substantial canopy cover that would not be affected by livestock grazing
Crissal Thrasher	<i>Toxostoma crissale</i>	FWS BCC	No potential habitat – occurs in chaparral habitat
Flammulated Owl	<i>Otus flammeolus</i>	FWS BCC	No impacts to habitat or population trends – uses mature montane forest, usually with an open canopy with yellow pine, brush, and saplings and often on ridges and upper slopes that would not be affected by livestock grazing
Gunnison Sage Grouse	<i>Centrocercus minimus</i>	Candidate; Sensitive; FWS BCC	Range does not overlap – now restricted to western Colorado and eastern Utah
Grace's Warbler	<i>Dendroica graciae</i>	FWS BCC	No impacts to habitat or population trends – uses ponderosa pine and Gambel oak trees that would not be affected by livestock grazing
Gray Flycatcher	<i>Empidonax wrightii</i>	AZ Partners in Flight Priority Bird Species of pinyon-juniper habitat	No impacts to habitat or population trends – ponderosa pine, pinyon pine, and juniper trees that would not be affected by livestock grazing
Gray Vireo	<i>Vireo vicinior</i>	FWS BCC; AZ Partners in Flight Priority Bird Species of pinyon-juniper habitat	No impacts to habitat or population trends – uses shrubby vegetation and junipers that would not be affected by livestock grazing
Hairy Woodpecker	<i>Picoides villosus</i>	MIS of snag habitat in ponderosa pine, mixed conifer, and spruce fir	No impacts to habitat or population trends – uses snags in ponderosa pine, mixed conifer, and spruce fir forests that would not be affected by livestock grazing
Juniper Titmouse	<i>Baeolophus griseus</i>	MIS of late-seral pinyon-juniper woodlands and the snag component within pinyon-juniper habitat; AZ Partners in Flight Priority Bird Species of pinyon-juniper habitat	No impacts to habitat or population trends – uses tall, moderately dense junipers that would not be affected by livestock grazing

Common Name	Scientific Name	Status	Rationale
Lewis' Woodpecker	<i>Melanerpes lewis</i>	FWS BCC	No impacts to habitat or population trends – uses old growth ponderosa pine, Gambel oak, or pinyon-pine trees or snags that would not be affected by livestock grazing
Lincoln's Sparrow	<i>Melospiza lincolnii</i>	MIS of late-seral, high-elevation riparian habitat	No potential habitat – occurs in thickets within montane, wet meadows or riparian habitats
Lucy's Warbler	<i>Vermivora luciae</i>	MIS of late seral, low elevation (<7,000 feet) riparian habitat	No potential habitat – occurs in riparian cottonwood and willow habitat in mountain foothills and desert riparian mesquite
Marbled Godwit	<i>Limosa fedoa</i>	FWS BCC	No impacts to habitat or population trends – transient in flooded plains or open shallow water along shorelines.
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	Threatened	No potential habitat - no, protected, restricted, or proposed critical habitat exists within or near the allotments.
Mountain Plover	<i>Charadrius montanus</i>	FWS Bird of Conservation Concern	Breeding and wintering ranges do not overlap – breeding range borders eastern AZ; winter range includes southern AZ
Mourning Dove	<i>Zenaida macroura</i>	Game Species	No impacts to habitat or population trends – species shows unresponsive or mixed response to livestock grazing (Bock et al. 1992)
Olive-Sided Flycatcher	<i>Contopus borealis</i>	AZ Partners in Flight Priority Bird Species of mixed conifer and pine habitats	No impacts to habitat or population trends – uses high-elevation ponderosa pine trees that would not be affected by livestock grazing
Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	FWS BCC; AZ Partners in Flight Priority Bird Species of pinyon-juniper habitat	No impacts to habitat or population trends – uses pinyon pines, junipers, ponderosa pines, and oak trees that would not be affected by livestock grazing
Purple Martin	<i>Progne subis Linnaeus</i>	AZ Partners in Flight Priority Bird Species of pine habitat	No impacts to habitat or population trends – uses snags that would not be affected by livestock grazing

Common Name	Scientific Name	Status	Rationale
Pygmy Nuthatch	<i>Sitta pygmaea</i>	MIS of late seral ponderosa pine	No impacts to habitat or population trends – uses late seral ponderosa pine snags that would not be affected by livestock grazing
Sage Sparrow	<i>Amphispiza belli</i>	FWS BCC	No impacts to habitat or population trends – occurs in tall-stature sagebrush habitat that would not be affected by livestock grazing
Short-Eared Owl	<i>Asio flammeus</i>	FWS BCC	No potential habitat - occurs in fresh or saltwater marshes, bogs, dunes, or tundra
Snowy Plover	<i>Charadrius alexandrinus</i>	FWS BCC	No impacts to habitat or population trends - does not breed or winter within allotments; possible transient on lakes and ponds
Solitary Sandpiper	<i>Tringa solitaria</i>	FWS BCC	Breeding and wintering ranges do not overlap – does not breed or winter within Arizona
Sprague's Pipit	<i>Anthus spragueii</i>	FWS BCC	Breeding and wintering ranges do not overlap – does not breed in Arizona; winters in southern Arizona
Various Ducks and Geese -- Ringed-Necked Duck, Bufflehead, Mallard, Northern Pintail, Common Merganser, American Coot, Canada Goose	various	Game Species	No impacts within the Game Preserve -- there are no tanks or ephemeral lakes within the 2,400 acres of Game Preserve on the Cameron Allotment
Virginia's Warbler	<i>Vermivora virginiae</i>	FWS BCC	No impacts to habitat or population trends – uses ponderosa pine, Gambel oak, pinyon pine, and juniper trees that would not be affected by livestock grazing
Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>	FWS BCC	No impacts to habitat or population trends – uses aspen or ponderosa pine trees that would not be affected by livestock grazing
Wilson's Phalarope	<i>Phalaropus tricolor</i>	FWS BCC	No impacts to habitat or population trends – does not breed or winter within allotments; possible transient on lakes and ponds.
Yellow-Billed Cuckoo	<i>Coccyzus americanus</i>	Candidate, Warranted but Precluded; Sensitive; FWS BCC	No potential habitat – occurs in large blocks of riparian woodlands (cottonwood, willow, or tamarisk)

Common Name	Scientific Name	Status	Rationale
Yellow Breasted Chat	<i>Icteria virens</i>	MIS of late seral, low elevation (<7,000 feet) riparian habitat	No potential habitat – occurs in riparian associated dense shrubby habitat
Yuma Rufous-Crowned Sparrow	<i>Aimophila ruficeps rupicola</i>	Sensitive	No impacts to habitat or population trends – uses pinyon pine and juniper trees that would not be affected by livestock grazing
Fish			
Apache (Arizona) Trout	<i>Oncorhynchus apache</i>	Threatened	Range does not overlap and no potential habitat – restricted to perennial streams of upper Salt, Blue, and Little Colorado drainages and introduced to North Canyon and Grant Creek
Little Colorado Spinedace	<i>Lepidomeda vittata</i>	Threatened	Range does not overlap and no potential habitat – occurs in north-flowing tributaries of the Little Colorado River with slow to moderate water currents
Spikedace	<i>Meda fulgida</i>	Threatened, Critical Habitat	No potential habitat – occurs in moderate to large perennial streams with moderate to swift water velocities. No effects to Critical Habitat Complex 1 (Verde River) owing to the large distance (approximately 80 miles) of the Complex to the allotments.
Invertebrates			
A Tiger Beetle	<i>Amblycheila picolomini</i>	Sensitive	No impacts to habitat or population trends – not known to occur within the allotments; uses bare rock, talus, and scree that would not be affected by livestock grazing
A Tiger Beetle	<i>Amblycheila schwarzi</i>	Sensitive	No impacts to habitat or population trends – not known to occur within the allotments; uses rocky sand crevices, bare rock, talus, and scree that would not be affected by livestock grazing
A Tiger Beetle	<i>Cicindela hirticollis corpuscular</i>	Sensitive	No potential habitat – occurs along sandy banks of river terraces

Common Name	Scientific Name	Status	Rationale
A Tiger Beetle	<i>Cicindela purpurea cimarrona</i>	Sensitive	No impacts to habitat or population trends likely – not known to occur within the allotments; family uses open, sunny situations, especially dry paths, fields; and sandy areas; potential balance in positive (e.g., promoting open situations and dry paths) and negative effects (e.g., trampling of larval burrows) to individuals
Antioch Potter Wasp	<i>Microdynerus arenicolus</i>	Sensitive	No impacts to habitat or population trends – not known to occur within the allotments; subfamily uses burrows, cavities in twigs or logs, or abandoned nests of other wasps that are not likely to be affected by livestock grazing
Aquatic Macroinvertebrates	Several species – <i>Mayflies,</i> <i>Stoneflies,</i> <i>Caddisflies</i>	MIS of late seral riparian habitats	No impacts to habitat or population trends – represented habitat of healthy, aerated streams does not exist within the allotments; individuals may occur along-side tanks.
Arizona Giant Sand Treader Cricket	<i>Dalmanella arizonensis</i>	Sensitive	Not likely to occur on allotments – only two records exist from Apache County in high desert plateau
Arizona Snaketail	<i>Ophiogomphus arizonicus</i>	Sensitive	No potential habitat – occurs along the sides of perennial streams
Early Elfin Butterfly	<i>Incisalia (Callophrys) fotis</i>	Sensitive	No impacts to habitat or population trends – the host of this species, cliffrose, is limited by the abundance of encroaching trees and not livestock grazing
Freeman's Agave Borer	<i>Agathymus baueri freemani</i>	Sensitive	No potential habitat and host range does not overlap – occurs in south central Arizona canyons with its host plant, <i>Agave chrysantha</i>
Maricopa Tiger Beetle	<i>Cicindela oregona maricopa</i>	Sensitive	No potential habitat – occurs along sandy stream banks or sand bars
Mountain Silverspot Butterfly	<i>Speyeria Nokomis nitocris</i>	Sensitive	No potential habitat – occurs in open seepage areas, which do not exist within the allotments

Common Name	Scientific Name	Status	Rationale
Navajo Jerusalem Cricket	<i>Stenopelmatus navajo</i>	Sensitive	No impacts to habitat or population trends -- not known to occur within the allotment; occurs on hillsides under rocks that are not likely to be affected by livestock grazing
Obsolete Viceroy Butterfly	<i>Limenitis archippus obsoleta</i>	Sensitive	No potential habitat -- occurs in riparian canyons and desert arroyos
Spotted Skipperling	<i>Piruna polingii</i>	Sensitive	No potential habitat -- occurs in moist meadows in coniferous and mixed woodlands; which do not occur on the allotments
Mammals			
Allen's Lappet-Browed Bat	<i>Idionycteris phyllotis</i>	Local Concern	No impacts to habitat or population trends -- uses ponderosa pine snags and trees that would not be affected by livestock grazing
Cactus Mouse	<i>Peromyscus eremicus papagensis</i>	Sensitive	No impacts to habitat or population trends -- occurs on bare rock/talus/scree substrates in oak woodland that would incur little use by livestock
Desert Bighorn Sheep	<i>Ovis canadensis mexicana</i>	Sensitive	No impacts to habitat or population trends -- occurs within the Grand Canyon area and the southern portion of the state. The allotments would not be used by domestic sheep under any of the alternatives, so there would be no potential for spread of disease from domestic to wild sheep
Spotted Bat	<i>Euderma maculatum</i>	Local Concern	No impacts to habitat or population trends -- roosts in caves and rock crevices near water that do not occur within the allotments; forages in open ponderosa pine forest that is not likely to be affected by the alternatives
Tassel Eared (Abert's) Squirrel	<i>Sciurus aberti</i>	Game Species; not an MIS of Ecosystem Management Areas 8, 9, or 10	No impacts to habitat or population trends -- uses early seral ponderosa pine forest that would not be affected by livestock grazing

Common Name	Scientific Name	Status	Rationale
Townsend's Big-Eared Bat	<i>Corynorhinus townsendii townsendii</i>	Local Concern	No impacts to habitat or population trends -- roosts in coniferous forests and tree cavities that would not be affected by livestock grazing
Western Red Bat	<i>Lasiurus blossevillii</i>	Local Concern	No potential habitat - occurs in riparian habitat with cottonwoods, oaks, and sycamores
Wupatki Arizona Pocket Mouse	<i>Perognathus amplus cineris</i>	Sensitive	No potential habitat -- occurs in desert scrub habitats
Reptiles			
Arizona Night Lizard	<i>Xantusia vigilis arizonae</i>	Sensitive	No potential habitat -- occurs in granite outcrops
Snails			
Brown Springsnail	<i>Pyrgulopsis sola</i>	Sensitive	Range not likely to overlap -- found in the Lower Verde Watershed in Yavapai County; the <i>Pyrgulopsis</i> genus tends to be highly endemic
Cumming's Mountainsnail	<i>Oreohelix yavapai cummingsi</i>	Sensitive	Range not likely to overlap -- most records from New Mexico, northeast of Santa Fe; very rare in Arizona
Desert Springsnail	<i>Pyrgulopsis deserta</i>	Sensitive	Range not likely to overlap -- found in the Upper and Lower Virgin River watersheds in Mohave County, Arizona and Washington County, Utah; the <i>Pyrgulopsis</i> genus tends to be highly endemic
Fossil Springsnail	<i>Pyrgulopsis simplex</i>	Sensitive	Range not likely to overlap -- found in the Lower Verde Watershed in Yavapai and Gila counties; the <i>Pyrgulopsis</i> genus tends to be highly endemic
Grand Wash Springsnail	<i>Pyrgulopsis bacchus</i>	Sensitive	Range not likely to overlap -- found in the Grand Wash Watershed, Mohave County; the <i>Pyrgulopsis</i> genus tends to be highly endemic
Kingman Springsnail	<i>Pyrgulopsis conica</i>	Sensitive	Range not likely to overlap -- found in the Havasu-Mohave Lakes and Sacramento Wash watersheds in Mohave County; the <i>Pyrgulopsis</i> genus tends to be highly endemic

Common Name	Scientific Name	Status	Rationale
Montezuma Well Springsnail	<i>Pyrgulopsis montezumensis</i>	Sensitive	No potential habitat and range not likely to overlap -- occurs in perennial springs and spring brooks; benthic; found in the Upper Verde Watershed in Yavapai County; the <i>Pyrgulopsis</i> genus tends to be highly endemic
Niobrara Ambersnail	<i>Oxyloma haydeni</i>	Sensitive	No potential habitat -- occurs in perennial riverside springs with wetland vegetation
Verde Rim Springsnail	<i>Pyrgulopsis glandulosa</i>	Sensitive	Range not likely to overlap -- found in the Agua Fria Watershed in Yavapai County; the <i>Pyrgulopsis</i> genus tends to be highly endemic



## Appendix C

### Summary of Habitat and Population Trends for Wildlife Species for Anita, Cameron, and Moqui Allotments.

#### Anita and Cameron Allotments

Species	Alt. 1 Hab.	Alt. 1 Pop.	Alt. 2 Hab.	Alt. 2 Pop.	Alt. 3 Hab.	Alt. 3 Pop.	Alt. 4 Hab.	Alt. 4 Pop.
Chihuahua Savannah Sparrow	Slight increase	No change	Slight increase	No change	No change or slight increase	No change	Slight increase	No change
Navajo Mountain Mexican vole	Slight increase	Slight increase	Slight increase	Slight increase	No change or slight increase	No change or slight increase	Slight increase	Slight increase
Northern goshawk	Slight increase	No change	Slight increase	No change	No change or slight increase	No change	Slight increase	No change
Pronghorn antelope	Slight increase	Slight increase	Slight increase	Slight increase	Slight increase	Slight increase	Slight increase	Slight increase
Rocky Mountain elk	Slight increase	Slight increase	Slight increase	Slight increase	No change or slight increase	No change or slight increase	Slight increase	Slight increase
Turkey	Slight increase	Slight increase	Slight increase	Slight increase	No change or slight increase	No change or slight increase	Slight increase	Slight increase
Burrowing owl	Slight decrease	Slight decrease	Slight decrease	Slight decrease	No change or slight decrease	No change or slight decrease	Slight decrease	Slight decrease
Chestnut- collared longspur	Slight decrease	No change	Slight decrease	No change	No change or slight decrease	No change	Slight decrease	No change
Ferruginous hawk	Slight increase	Slight increase	Slight increase	Slight increase	No change or slight increase	No change or slight increase	Slight increase	Slight increase
Golden eagle	Slight increase	Slight increase	Slight increase	Slight increase	No change or slight increase	No change or slight increase	Slight increase	Slight increase
Northern harrier	Slight increase	No change	Slight increase	No change	No change or slight increase	No change	Slight increase	No change

Species	Alt. 1 Hab.	Alt. 1 Pop.	Alt. 2 Hab.	Alt. 2 Pop.	Alt. 3 Hab.	Alt. 3 Pop.	Alt. 4 Hab.	Alt. 4 Pop.
Prairie falcon	Slight increase	Slight increase	Slight increase	Slight increase	No change or slight increase	No change or slight increase	Slight increase	Slight increase
Swainson's hawk	Slight increase	Slight increase	Slight increase	Slight increase	No change or slight increase	No change or slight increase	Slight increase	Slight increase
Gunnison's prairie dog	Slight decrease	Slight decrease	Slight decrease	Slight decrease	No change or slight decrease	No change or slight decrease	Slight decrease	Slight decrease
Eastern cottontail	Slight increase	Slight increase	Slight increase	Slight increase	No change or slight increase	No change or slight increase	Slight increase	Slight increase
Mojave giant skipper	Possible Slight increase	Possible Slight increase	Possible Slight increase	Possible Slight increase	No change or possible slight decrease	No change or possible slight decrease	Possible Slight increase	Possible Slight increase
Mule deer	Slight increase	Slight increase	Slight increase	Slight increase	No change or slight decrease	No change or slight decrease	Slight increase	Slight increase

### Moqui Allotment

Species	Alt. 1 Hab.	Alt. 1 Pop.	Alt. 2 Hab.	Alt. 2 Pop.	Alt. 3 Hab.	Alt. 3 Pop.
Chihuahua Savannah Sparrow	Slight increase	No change	Slight increase	No change	No change	No change
Navajo Mountain Mexican vole	Slight increase	Slight increase	Slight increase	Slight increase	No change	No change
Northern goshawk	Slight increase	No change	Slight increase	No change	No change	No change
Pronghorn antelope	Slight increase	Slight increase	Slight increase	Slight increase	No change	No change
Rocky Mountain elk	Slight increase	Slight increase	Slight increase	Slight increase	No change	No change
Turkey	Slight increase	Slight increase	Slight increase	Slight increase	No change	No change
Burrowing owl	Slight decrease	Slight decrease	Slight decrease	Slight decrease	No change	No change
Chestnut-collared longspur	Slight decrease	No change	Slight decrease	No change	No change	No change
Ferruginous hawk	Slight increase	Slight increase	Slight increase	Slight increase	No change	No change
Golden eagle	Slight increase	Slight increase	Slight increase	Slight increase	No change	No change

Species	Alt. 1 Hab.	Alt. 1 Pop.	Alt. 2 Hab.	Alt. 2 Pop.	Alt. 3 Hab.	Alt. 3 Pop.
Northern harrier	Slight increase	No change	Slight increase	No change	No change	No change
Prairie falcon	Slight increase	Slight increase	Slight increase	Slight increase	No change	No change
Swainson's hawk	Slight increase	Slight increase	Slight increase	Slight increase	No change	No change
Gunnison's prairie dog	Slight decrease	Slight decrease	Slight decrease	Slight decrease	No change	No change
Eastern cottontail	Slight increase	Slight increase	Slight increase	Slight increase	No change	No change
Mojave giant skipper	Possible Slight increase	Possible Slight increase	Possible Slight increase	Possible Slight increase	No change	No change
Mule deer	Slight increase	Slight increase	Slight increase	Slight increase	No change	No change

## Appendix D

### Summary of Cluster Readings and Final Range Conditions Rankings for Terrestrial Ecosystems Inventoried within the Anita, Cameron and Moqui Allotments.

#### Anita Allotment – Cluster Readings

Allotment Name	Cluster Number	Strata ID	TES Unit	Capability	Range Typing
Anita	1	15	9	FC	1/6 - Bogr, Agsm, CHRY P ↓ 9 P ⇒ FC
	2				Cluster established in 1954, however, by next analysis period in 1963 it appears it had been destroyed.
	3				Cluster established in 1954 and reread in 1963, however, it was not surveyed in 1996.
	4				Cluster established in 1954, however, by next analysis period in 1963 it appears it had been destroyed.
	5	12	11	FC	1/4 - Agsm, Artr, Bogr P ⇒ 3 F ⇒ FC
	6	4	23	FC	4/1 - Bogr, Agsm, Artr P ⇒ 23 P ⇒ FC
	7	5	672	FC	4/1 - Artr, Agcr, Bogr P ↑ 672 F ⇒ FC
	8				Cluster established in 1963, however, by next analysis period in 1996 it appears it had been destroyed.
	9	1	3	FC	1 - Bogr, Agsm, CHRY P ⇒ 3 P ⇒ FC
	10	1	3	FC	1 - Bogr, Agsm, CHRY P ⇒ 3 P ⇒ FC
	11	1	3	FC	1 - Bogr, CHRY, Muto P ⇒ 3 P ⇒ FC
	12	15	9	FC	1/6 - Bogr, Agsm, GUTI P ⇒ 9 VP ⇒ FC
	13				Cluster established in 1963 though it was not surveyed in 1996.
	14				Cluster established in 1963 though it was not surveyed in 1996.
	15	8A	287	PC/FC	9 - Bogr, GUTI, CHRY P ⇒ 287 P ⇒ PC/FC

	16				Cluster established in 1963 though it was not surveyed in 1996.
	17	4	23	FC	4/1 - Agsm, Bogr, Artr P ⇒ 23 VP ⇒ FC
	18	3	677	FC	1 - Bogr, Sihy, Eula P ⇒ 677 P ⇒ FC

**Cameron Allotment – Cluster Readings**

Allotment Name	Cluster Number	Strata ID	TES Unit	Capability	Range Typing
Cameron	1	5	682	FC	4/1 – Bogr, Spcr, GUTI P ⇒ 682 VP ↓ FC
	2	5	682	FC	4/1 – Bogr, Artr, SENE P ⇒ 682 VP ↓ FC
	3				Cluster established in 1956 and read in 1962, 1976, and 1983, however, notes indicate it was destroyed prior to the 1996 survey.
	4	15	9	FC	1/6 - Bogr, Agsm, CHRY P ⇒ 9 P ⇒ FC
	5	5	683	FC	4/1 – Artr, Bogr, Gusa VP ⇒ 683 VP ⇒ FC
	6	2	255	FC	1 – Bogr, Sihy, Orhy P ↓ 255 P ⇒ FC
	7	1	3	FC	1 - Bogr, Agsm, CHRY P ↓ 3 P ↓ FC
	8	2	255	FC	Cluster established in 1956 and read in 1962, 1976, 1983 and 1996. After 1962 an exclosure was built that placed 2 ½ transects inside the plot and 50 points within the grazed zone. In the 1996 reading only T1 (50 points in exclosure 50 point outside) and T3 were inventoried. T2 was not surveyed.
	9	5	683	FC	4/1 – CHRY, Orhy, Sihy P ↑ 683 VP ⇒ FC
	10	17	290	FC	6 - Bogr, SENE, Agsm P ⇒ 290 F ⇒ FC
	11	8A	287	PC/FC	9 - Bogr, Come, JUNI P ⇒ 287 P ⇒ PC/FC
	12	17	290	FC	6 - Sihy, ERIG, Pofe P ↓ 290 G ↑ FC
	13	12	11	FC	1/4 – Pofe, Bogr, Agsm F ↑ 11 P ↑ FC
	14	5	683	FC	4/1 – Arno, Arfr, Gusa P ⇒ 683 P ⇒ FC

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	15	5	683	FC	4/1 - Artr, Agcr, Bogr P ⇒ 683 P ⇒ FC
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**Moqui Allotment – Cluster Readings**

Allotment Name	Cluster Number	Strata ID	TES Unit	Capability	Range Typing
Moqui	1	3	677	FC	1 – Bogr, GUTI, CHRY P ⇒ 677 P ↓ FC
	2				Established in 1955 and read in 1966 though it was not inventoried in either 1986 or 1995.
	3	3	677	FC	1 – Agcr, Bogr, GUTI P ⇒ 682 P ↓ FC
	4	4	23	FC	1/4 – Bogr, Agsm, Pipo P ↑ 23 P ⇒ FC
	5	1	3	FC	1 – Bogr, GUTI, CHRY P ⇒ 3 P ↓ FC
	6	15	9	FC	1/6 – Bogr, CHRY, Agsm P ↓ 9 P ↓ FC
	7	5	682	FC	4/1 – Artr, Bogr, GUTI VP ⇒ 682 P ⇒ FC
	8	4	23	FC	1/4 – Bogr, ARTE, Sihy P ↓ 23 P ↓ FC
	9	8A	287	PC/FC	Surveyed in 1986 though not in 1995
	10	1	3	FC	1 – Bogr, GUTI, Sihy P ⇒ 3 P ⇒ FC
	11				Established in 1958 and reread in 1968. This plot was not sampled in either 1986 or 1995.
	12	3	677	FC	Surveyed in 1986 though not in 1995
	13				Established in 1960 and reread in 1967. This plot was not sampled in either 1986 or 1995.
	14	1	3	FC	Surveyed in 1986 though not in 1995
	15	1	3	FC	1 – Bogr, CHRY, GUTI P ⇒ 3 F ⇒ FC
	16				Established in 1960 and reread in 1967. This plot was not sampled in either 1986 or 1995.
	17	5	682	FC	4/1 – Arno, Bogr, Agcr VP ↓ 682 P ↓ FC



**Anita Allotment – Final Range Typing**

Strata Number	Location	TES Units	Capability Class	Range Typing	Acres
1	Bottomlands	3	FC	1 - Bogr, Agsm, ERIG, Sihy P $\uparrow$ 3 P $\Rightarrow$ FC	3,817
2	Uplands	255, 591	FC	1 - Bogr, Orhy, Gusa, Sihy F $\uparrow$ 255, 591 P $\Rightarrow$ FC	17
3	Uplands	677	FC	1 - Bogr, ERIG, Sihy P $\Rightarrow$ 677 P $\Rightarrow$ FC	3,906
4	Bottomlands	23	FC	1/4 - Bogr, Agsm, ERIG, Artr P $\Rightarrow$ 23 P $\Rightarrow$ FC	1,292
5	Uplands	634, 672, 682, 683	FC	4/1 - Artr, Bogr, Agcr, Agsm P $\downarrow$ 634, 672, 682, 683 P $\Rightarrow$ FC	1,231
6 <sup>6</sup>	Uplands	599	FC	1 - Bogr, Agsm, ERIG F $\uparrow$ 599 P $\Rightarrow$ FC	255
7	Uplands	263, 495, 586	FC	9 - Bogr, ERIG, Pofe, Pied P $\Rightarrow$ 263, 495, 586 F $\Rightarrow$ FC	4,554
8	Uplands	257, 260, 272, 273, 281,	PC	9 - Bogr, Artr, ERIG, Pied P $\Rightarrow$ 257, 260, 272 P $\Rightarrow$ PC	15,297
8A	Uplands	277, <sup>7</sup> 287 <sup>8</sup>	PC/FC	9 - Bogr, Artr, ERIG, Pied P $\Rightarrow$ 277, 287 P $\Rightarrow$ PC/FC	13,587
9	Uplands to Moderately Steep Slopes	172, 250, 251, 261, 295,	NC	9 - Bogr, Sihy, Pied P $\Rightarrow$ 172, 250, 251 P $\Rightarrow$ NC	4,964
10	Steep to Very Steep Slopes	681 <sup>9</sup>	NC	6-Pipo 681 NC	37
11	Steep to Very Steep Slopes	252, 274, 296, 476, 496 <sup>10</sup>	NC	9-Pied 252, 274 NC	895
12	Bottomlands	11 <sup>11</sup>	FC	1/4 -Bogr, Agsm, Artr P $\Rightarrow$ 11 P $\Rightarrow$ FC	237
13	Uplands	275, 282, 283, 284, 297	FC	6 - Bogr, Artr, Pofe, Kocr P $\Rightarrow$ 275, 282, 283 F $\uparrow$ FC	29,465
14	Moderately Steep Slopes	276	NC	6 - Bogr, Pofe, Gusa F $\Rightarrow$ 276 F $\Rightarrow$ NC	701
15	Bottomlands	9	FC	1/6 - Agsm, Bogr, Sihy F $\uparrow$ 9 F $\uparrow$ FC	934
16	Uplands	265, 266, 290, 291, 293, 294	FC	6 - Bogr, Agsm, Artr P $\Rightarrow$ 265, 266, 290 F $\uparrow$ FC	24,107
Total Acres =					105,296

<sup>6</sup> Used to be delineation number 7a<sup>7</sup> Used to be considered NC it is now considered PC intermixed with 40 percent FC<sup>8</sup> Still considered predominately PC though 30 percent considered FC<sup>9</sup> Formally in Strata 11<sup>10</sup> Formally Strata 10<sup>11</sup> Formally considered part of Strata 15

**Cameron Allotment – Final Range Typing**

Strata Number	Location	TES Units	Capability Class	Range Typing	Acres
1	Bottomlands	3	FC	1 - Bogr, Agsm, ERIG, Sihy P $\uparrow$ 3 P $\Rightarrow$ FC	783
2	Uplands	255, 591	FC	1 - Bogr, Orhy, Gusa, Sihy F $\uparrow$ 255, 591 P $\Rightarrow$ FC	11,509
3	Uplands	677	FC	1 - Bogr, ERIG, Sihy P $\Rightarrow$ 677 P $\Rightarrow$ FC	1,514
4	Bottomlands	23	FC	1/4 - Bogr, Agsm, ERIG, Artr P $\Rightarrow$ 23 P $\Rightarrow$ FC	2,944
5	Uplands	634, 672, 682, 683	FC	4/1 - Artr, Bogr, Agcr, Agsm P $\Rightarrow$ 634, 672, 682, 683 P $\Rightarrow$ FC	7,158
6 <sup>12</sup>	Uplands	599	FC	1/9 - Bogr, Agsm, ERIG F $\uparrow$ 599 P $\Rightarrow$ FC	0
7	Uplands	263, 495, 586	FC	9 - Bogr, ERIG, Pofe, Pied P $\Rightarrow$ 263, 495, 586 F $\Rightarrow$ FC	5,493
8	Uplands	260, 273, 281,	PC	9 - Bogr, Artr, ERIG, Pied P $\Rightarrow$ 257, 260, 272 P $\Rightarrow$ PC	14,132
8A	Uplands	277, <sup>13</sup> 287 <sup>14</sup>	PC/FC	9 - Bogr, Artr, ERIG, Pied P $\Rightarrow$ 277, 287 P $\Rightarrow$ PC/FC	11,130
8B	Uplands	257, 272 <sup>15</sup>	Pied	9 - Bogr, Pofe, Artr F $\uparrow$ 257, 272 F $\uparrow$ FC	6,173
9	Uplands to Moderately Steep Slopes	172, 250, 251, 261, 295,	NC	9 - Bogr, Sihy, Pied P $\Rightarrow$ 172, 250, 251 P $\Rightarrow$ NC	12,747
10	Steep to Very Steep Slopes	681 <sup>16</sup>	NC	6-Pipo 681 NC	1,766
11	Steep to Very Steep Slopes	252, 274, 296, 476, 496 <sup>17</sup>	NC	9-Pied 252, 274 NC	2,491
12	Bottomlands	11 <sup>18</sup>	FC	1/4 -Bogr, Agsm, Artr P $\Rightarrow$ 11 P $\Rightarrow$ FC	624
13	Uplands	282, 284, 297	FC	6 - Bogr, Artr, Pofe, Kocr P $\Rightarrow$ 275, 282, 283 F $\uparrow$ FC	2,751
13A	Uplands	275, 283 <sup>19</sup>	Pipo/Pied	6 - Bogr, Pofe, Gusa F $\uparrow$ 275, 283 F $\uparrow$ FC	17,748
14	Moderately Steep Slopes	276	NC	6 - Bogr, Pofe, Gusa F $\Rightarrow$ 276 F $\Rightarrow$ NC	988
15	Bottomlands	9	FC	1/6 - Agsm, Bogr, Sihy F $\uparrow$ 9 F $\uparrow$ FC	231

<sup>12</sup> Used to be delineation number 7a<sup>13</sup> Used to be considered NC it is now considered PC intermixed with 40 percent FC<sup>14</sup> Still considered predominately PC though 30 percent considered FC<sup>15</sup> These 2 TES units were considered part of strata 8 within the Anita Allotment<sup>16</sup> Formally in Strata 11<sup>17</sup> Formally Strata 10<sup>18</sup> Formally considered part of Strata 15<sup>19</sup> Considered part of Strata 13 within Anita Allotment

16	Uplands	265, 266, 291, 293, 294	FC	6 - Bogr, Agsm, Artr P ⇒ 265, 266, 290 F ↑ FC	1,993
17	Uplands	290 <sup>20</sup>	FC	6 - Bogr, Pofe, Sihy F ↑ 290 F ↑ FC	6,328
Total Acres =					108,503

<sup>20</sup> Part of Strata 16 within Anita Allotment

**Moqui Allotment – Final Range Typing**

Strata Number	Location	TES Units	Capability Class	Range Typing	Acres
1	Bottomlands	3	FC	1 - Bogr, Agsm, ERIG, Sihy P $\Rightarrow$ 3 P $\Rightarrow$ FC	1,901
2	Uplands	255, 591	FC	1 - Bogr, Orhy, Gusa, Sihy F $\Rightarrow$ 255, 591 P $\Rightarrow$ FC	769
3	Uplands	677	FC	1 - Bogr, ERIG, Sihy P $\Rightarrow$ 677 P $\Rightarrow$ FC	5,473
4	Bottomlands	23	FC	4/1 - Bogr, Agsm, ERIG, Artr P $\Rightarrow$ 23 P $\Rightarrow$ FC	836
5	Uplands	634, 672, 682, 683	FC	4/1 - Artr, Bogr, Agcr, Agsm P $\Rightarrow$ 634, 672, 682, 683 P $\Rightarrow$ FC	807
6 <sup>21</sup>	Uplands	599	FC	1/9 - Bogr, Agsm, ERIG F $\Rightarrow$ 599 P $\Rightarrow$ FC	0
7	Uplands	263, 495, 586	FC	9 - Bogr, ERIG, Pofe, Pied P $\Rightarrow$ 263, 495, 586 F $\Rightarrow$ FC	0
8	Uplands	260, 273, 281,	PC	9 - Bogr, Artr, ERIG, Pied P $\Rightarrow$ 257, 260, 272 P $\Rightarrow$ PC	4,404
8A	Uplands	277, <sup>22</sup> 287 <sup>23</sup>	PC/FC	9 - Bogr, Artr, ERIG, Pied P $\Rightarrow$ 277, 287 P $\Rightarrow$ PC/FC	30,118
8B	Uplands	257, 272 <sup>24</sup>	Pied	9 - Bogr, Pofe, Artr F $\Rightarrow$ 257, 272 F $\Rightarrow$ FC	2,471
9	Uplands to Moderately Steep Slopes	172, 250, 251, 261, 295,	NC	9 - Bogr, Sihy, Pied P $\Rightarrow$ 172, 250, 251 P $\Rightarrow$ NC	985
10	Steep to Very Steep Slopes	681 <sup>25</sup>	NC	6-Pipo 681 NC	0
11	Steep to Very Steep Slopes	252, 274, 296, 476, 496 <sup>26</sup>	NC	9-Pied 252, 274 NC	0
12	Bottomlands	11 <sup>27</sup>	FC	1/4 - Bogr, Agsm, Artr P $\Rightarrow$ 11 P $\Rightarrow$ FC	217
13	Uplands	282, 284, 297	FC	6 - Bogr, Artr, Pofe, Kocr P $\Rightarrow$ 275, 282, 283 F $\Rightarrow$ FC	118
13A	Uplands	275, 283 <sup>28</sup>	Pipo/Pied	6 - Bogr, Pofe, Gusa F $\Rightarrow$ 275, 283 F $\Rightarrow$ FC	6,557
14	Moderately Steep Slopes	276	NC	6 - Bogr, Pofe, Gusa F $\Rightarrow$ 276 F $\Rightarrow$ NC	210
15	Bottomlands	9	FC	1/6 - Agsm, Bogr, Sihy F $\Rightarrow$ 9 F $\Rightarrow$ FC	60
16	Uplands	265, 266,	FC	6 - Bogr, Agsm, Artr P $\Rightarrow$	34

<sup>21</sup> Used to be delineation number 7a<sup>22</sup> Used to be considered NC it is now considered PC intermixed with 40 percent FC<sup>23</sup> Still considered predominately PC though 30 percent considered FC<sup>24</sup> These 2 TES units were considered part of strata 8 within the Anita Allotment<sup>25</sup> Formally in Strata 11<sup>26</sup> Formally Strata 10<sup>27</sup> Formally considered part of Strata 15<sup>28</sup> Considered part of Strata 13 within Anita Allotment

		291, 293, 294		265, 266, 290 F ↑ FC	
17	Uplands	290 <sup>29</sup>	FC	6 – Bogr, Pofe, Sihy F ↑ 290 F ↑ FC	283
				Total Acres =	55,243

<sup>29</sup> Part of Strata 16 within Anita Allotment