United States Department of Agriculture

Angell Allotment

Environmental Assessment

Forest Service Coconino National Forests Flagstaff Ranger District April 2015

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Chapter 1 – Introduction Document Structure

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 No Action Alternative, the Current Management Alternative and the Proposed Action. The document is organized into four parts:

- Chapter 1 - 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.
- Chapter 2 - Alternatives:This section provides a detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on input raised by Forest Service Personnel and the Grazing Permittee. This discussion also includes possible resource protection measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- Chapter 3 - Affected Environment and Environmental Consequences: This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.
- Chapter 4 - Appendices: The appendices provide more detailed information to support the analyses presented in the environmental assessment, including consultation and coordination, and monitoring data.
- Glossary - Provides definitions for technical terminology used in this document

This EA is a summary document containing the relevant conclusions the Responsible Official needs in order to make an informed decision. Supporting documentation (maps, data, detailed specialist reports, etc.) is on file in a project record at the Flagstaff Ranger District in Flagstaff, Arizona or available upon request. This EA includes summarized information based on analyses from specialist reports from each resource. In some situations, the EA presents the information in a slightly different manner than the specialist reports. In these situations, the EA was modified to better serve its purpose as the instrument used to inform the decision-making process. Specialist reports contain important reference sources for more detailed information on affected environment, methodology, and analysis that was not included in this document. The formation of the EA is based on the Council for Environmental Quality's NEPA regulations (Section 1508.9), which identifies an Environmental Assessment as a "concise public document" to include "brief discussions" of the proposal, alternatives, environmental impacts of the alternatives, and a listing of agencies and persons consulted.

Acres discussed in the analysis for the Angell Allotment may differ slightly depending on which resource is being analyzed. In general these acreage differences are less than 0.1 percent of the project area and are a result of rounding errors and slight boundary differences that occur when combining multiple geospatial data layers.

After the preliminary EA is released and comments are received and addressed, a draft decision notice will be released with a Finding of No Significant Impact (FONSI) determination anticipated. This draft decision and FONSI is subject to the predecisional objection process described at 36 CFR 218. Upon completion of that process a final decision notice document would be released and, if grazing is to continue, a new Term Grazing Permit (TGP), valid for 10 years, would be issued to reflect that decision. A new Allotment Management Plan (AMP) would then be developed for the Angell Allotment. The information in the EA will be used to inform the AMP development. The TGP, along with the AMP are the documents which implement the action alternative. Then, every year, Annual Operating Instructions (AOIs) would be developed with the permittee, outlining the specific instructions for livestock grazing and allotment operation for that particular year, based on current and expected forage and range conditions as determined through allotment inspections and monitoring. AOIs may be modified throughout the grazing season based on variables including precipitation, forage growth, and unexpected events such as wildfire.

Purpose and Need for Action

The Angell Allotment is scheduled for an environmental analysis of grazing use on the Coconino National Forest, as required by the Rescissions Act (1995). This analysis is required in order to ensure that livestock grazing is consistent with goals, objectives and the standards and guidelines of the Coconino National Forest Plan (1987 as amended).

The purpose of this project is to authorize livestock grazing in a manner that maintains and/or moves the area toward Forest Plan objectives and desired conditions, including maintaining and/or improving vegetation and soil conditions and trends on the allotment.

There is a need to address possible future issues related to varying climatic conditions such as the possibility of more frequent and higher intensity droughts that may affect soil, water, vegetation and wildlife resources. There is also a need to make available additional water sources to allow for better, more flexible adaptive management and, if necessary, improved livestock management by both the Coconino National Forest and the grazing permittee.

Proposed Action

The Proposed Action has been developed to meet the project's purpose and need. The Proposed Action consists of seven components: authorization, drought management, structural improvements, monitoring, adaptive management, and resource protection measures**.** The proposed action follows current guidance from Forest Service Handbook 2209.13, Chapter 90 (Grazing Permit Administration; Rangeland Management Decision making). Detailed information on the proposed action is in Chapter 2.

Decision Framework

Given the purpose and need, the deciding official reviews the proposed action and the other alternatives in order to make the following decisions:

- Would livestock grazing be reauthorized on all, part, or none of the project area?
- What management prescriptions would be applied to ensure that desired condition objectives are met or that movement occurs towards those objectives in an acceptable time frame?

- What types of associated activities (range improvements) would occur?
- What resource protection measures and monitoring would apply to the project?
- Is a more in-depth analysis (Environmental Impact Statement) needed?

Public Involvement

This proposal has been listed in the quarterly published and online versions of the Schedule of Proposed Actions (SOPA) since February of 2014. As part of the public involvement process, a 30-day comment period on the proposed action and preliminary assessment of effects was initiated with the release of this EA as communicated through a legal notice published in the Arizona Daily Sun on September 27, 2014. Responses were received from 29 individuals and organizations. Comments have been reviewed and a response to comments document is available as part of the project record.

The permittee was kept informed of the project through regular meetings during the analysis period. Permittee input was used to develop several elements of the proposed action alternative and was considered in the analysis.

Issues

An issue is an unresolved conflict related to effects on a physical, biological, social, or economic resource. An issue is not an activity in itself; instead, it is the projected effects of the activity that create the issue. For example, livestock grazing is an activity, but its effects on a resource can form an issue.

Issues were identified from internal and external scoping efforts and are directly or indirectly caused by implementing the proposed action for which a cause and effect relationship has been identified. Some key issues were addressed by incorporating resource protection measures into the proposed action or other alternatives in addition to evaluation under each alternative. Other issues are addressed in this EA through the analysis of potential effects of livestock grazing.

Limited water sources and inadequate distribution of livestock: Limited or decreasing livestock water sources in portions of the Cocrane, Cinder Hill, and South Angell pastures can result in inadequate distribution of livestock in these pastures, which can lead to uneven use of large areas of upland vegetation. Due to climate change there is a possibility that in the future there could be a lack of reliable and well distributed surface water sources in portions of the Cocrane, Cinder Hill, and South Angell pastures, limiting livestock management options and resulting in inadequate distribution of livestock on the allotment.

- This issue was addressed by incorporating into Alternative 3 new range improvements including a new water lot fence, expansion of an existing water lot, addition of new troughs and two newly constructed pipelines connected to a well on private property in order to improve water availability and distribution, which will facilitate improved livestock management and livestock distribution in the Cocrane, Cinder Hills, and South Angell pastures.

Flexibility of livestock management: The current permitted season of use for the Angell Allotment is May 15 through October 31 (2,375 AUMs), because there is no flexibility with the

on or off dates, the operational needs of the permittee are not being met to account for the annual variation in forage quality or quantity.

- To address this issue Alternative 3 includes a change in the permitted season of use to June 1 through November 15 (2,350 AUMs) with the possibility of extending the season of use by allowing livestock to enter the allotment as early as May 15th, if conditions are appropriate, without exceeding the maximum permitted 2,350 AUMs. This provides the necessary management flexibility to match the authorized grazing period with forage quality, forage availability, and operational needs while maintaining and/or improving vegetation and soil conditions and trends on the allotment.

Economic values – Restrictions on livestock grazing or reduction in permitted livestock can cause economic impacts such as lost jobs and labor income.

- This issue is addressed in the EA by including an analysis of economic impacts to the permittee, larger community, and Federal Government from implementation of each alternative considered in detail.

Climate change – a changing climate in the southwest is expected to result in increasing temperatures and more frequent and higher intensity droughts, which may cause impacts to surface water, groundwater, vegetation, and wildlife; which may be exacerbated by livestock grazing.

- This issue is addressed by incorporating additional management flexibility and water infrastructure into Alternative 3 to facilitate improved management and livestock distribution. In addition, the cumulative effects of climate change and livestock grazing to surface and groundwater, wildlife, and vegetation was addressed through proposed action requirements for conservative utilization and addressed with analysis in the Environmental Assessment.

Wildlife - Livestock grazing and associated activities can cause direct and indirect impacts to wildlife by affecting habitat or competing for forage/vegetation needs for species such as prairie dogs, pronghorn, and birds.

- This issue was addressed by including requirements for conservative utilization and, by proposing additional water infrastructure in Alternative 3 which will improve livestock distribution and use on the allotment. The EA also addresses this issue by including analysis of each alternative on each sensitive, Threatened, Endangered, Candidate, management indicator, or migratory bird species.

Cultural Resources – Livestock grazing and structural range improvements can cause impacts to cultural sites.

- This issue is addressed through requirements that all ground disturbing activities first require survey and all sites will be identified for avoidance. There is also language in the proposed action requiring management practices that tend to concentrate livestock, such as placement of salt, construction of fences, etc., to be located away from cultural resources.

Water Quality – Livestock grazing can result in erosion of soils and sediment delivery to nearby waterways affecting watershed function.

- To address potential impacts to watershed function, the proposed action includes requirements for conservative utilization. Also, the EA includes a detailed analysis of potential impacts to watershed function.

Groundwater – Development of range improvements included in the proposed action may result in additional groundwater pumping from a private well, which may result in additional stress on groundwater resources especially if climate change results in a drier climate in the future.

- This issue is addressed by including additional analysis in the EA that discusses effects of use of the private well on groundwater resources.

Background

The Angell Allotment is located on the Flagstaff Ranger District of the Coconino National Forest (sometimes abbreviated as Forest), and is administered and managed by the Flagstaff Ranger District. The allotment boundary begins approximately 3 miles east of the City of Flagstaff and runs east to the Forest boundary. This allotment is located within all or portions of T22N R10E Sections 4-9, 16-21 and 28-33; T21N R10E Sections 4-10 and 13-35; T20N R10E Sections 2-11; T22N R9E Sections 13, 14 and 20-36; T21N R9E Sections 1-5, 9-14 and 24 (Figure 1). Grassland and juniper, which varies from open grassland to dense juniper, dominate the vegetation on the Angell Allotment at elevations ranging from 5,700 feet to 7,000 feet. Ponderosa pine exists in the northwest corner of the allotment and in canyons. There are three canyons running through the allotment: Walnut Canyon, Youngs Canyon and San Francisco Wash. These canyons have diverse vegetation including ponderosa pine; however riparian vegetation is lacking due to naturally limited water availability.

Some of the analysis in this document extends beyond the project area to take into account and disclose the effects of the alternatives to watershed areas outside the allotment, wildlife habitat outside of the allotment that is important to species that occur within the allotment, and surrounding areas that are culturally and economically affected by activities that occur within the allotment. Land ownership within the Angell Allotment includes Forest Service and private land. The Forest Service only has management jurisdiction over Forest Service acreage, the remaining acreage is managed by private land owners. Therefore, while the allotment is approximately 51,700 acres in size, the Forest Service manages about 51,584 acres with the remaining 116 acres managed by private land owners.

Five Management Areas (MAs) occur within the Angell Allotment, Table 8 lists these MAs and the management emphasis for each per the Coconino Forest Plan (1987, as amended).

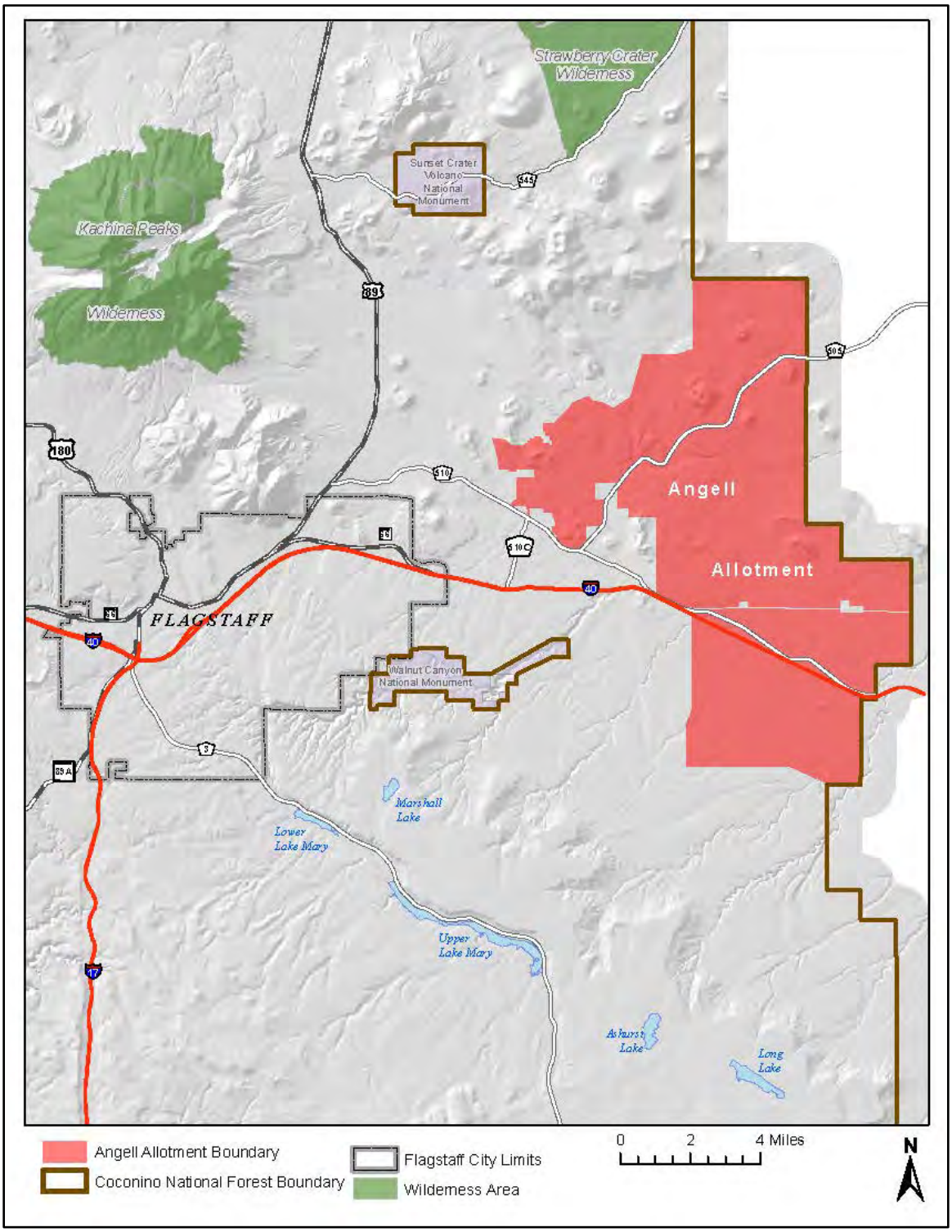

Figure 1: Locator map for the Angell Grazing Allotment

Grazing Management and History

The allotment is divided into 12 main grazing pastures: Cinder Hill, Cocrane, Crisp, Horse, Maroon, O'Neil, Railroad, Rattlesnake, Rio De Flag, South Angell, Turkey Tanks and Winona (see Appendix C, Figure 2 for map of pastures on Angell Allotment, and Table 20 for individual pasture acres). The allotment also contains several small livestock management pastures and water lots that are less than 100 acres in size.

The current season of use is May 15 through October 31. Current permitted livestock numbers are 425 head of cattle (cow/calf pair) or 2,375 Animal Unit Months (AUMs). Seasonal utilization[1] levels (the amount of herbage removed or trampled during the grazing season) are managed at the light to moderate level (21 to 50 percent). Utilization[2] levels, measured at the end of the growing season, are managed at the conservative level (35 percent) for herbaceous and non-riparian woody vegetation.

Current grazing management for Angell Allotment follows a deferred/rest rotation schedule where at least one pasture is rested each season with the South Angell pasture rested every other grazing season. The decision to rest a pasture is based on past use, authorized AUMs, monitoring, and allotment inspections. The number of planned days each pasture is grazed varies in correspondence with its current year authorized AUMs, existing and predicted forage production, and past year's utilization. The actual number of days each pasture is grazed is dependent on authorized AUMs, forage production and grazing intensity.

Livestock grazing has occurred in the area since the late 1870s. Permitting began around 1908, following the establishment of the National Forests. No specific documentation is available regarding the type and number of livestock grazed in the early years on the Angell Allotment. However, the grazing history on the Coconino National Forest indicates that AUMs have decreased over the decades to a fraction of previous levels. For example, head months of cattle, horses and sheep on the Coconino National Forest changed from 539,000 head months in 1910 to 99,028 head months in 2000 (USDA Forest Service 2001).

Actual use on the Angell Allotment over the past fourteen years has been variable from year-to-year. Actual use averaged 76.3 percent of permitted numbers and ranged from 467 to 2,347

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[1] The percentage of forage produced in the current season, to the date of the measurement that has been consumed or trampled by animals. It is a comparison of the amount of herbage left compared with the amount of herbage that has been produced to the date of the measurement. Seasonal utilization is measured at the end of a grazing period. Seasonal utilization differs from utilization because it does not account for subsequent growth of either the ungrazed or grazed plants. May also be referred to as "grazing intensity" or "relative utilization".

[2] The proportion or degree of current year's forage production by weight that is consumed or destroyed by animals (including insects). The term may refer either to a single plant species, a group of species, or the vegetation community as a whole. It is a comparison of the amount of herbage left compared with the amount of herbage produced during the year. Utilization is measured at the end of the growing season when the total annual production can be accounted for and the effects of grazing in the whole management unit can be assessed.

AUMs during the 2000 to 2013 grazing seasons. Annual variations in livestock numbers were the result of different factors including, but not limited to, climatic conditions and operational/economic requirements of the permittee. For example, during periods of drought when monitoring revealed decreased forage production, authorized livestock numbers were decreased either at the beginning of or during the grazing season so that utilization would be limited to conservative levels. Also, in some years actual livestock numbers were below permitted numbers because the permittee did not have the full number of livestock available. This commonly occurs following drought periods when the permittee has reduced livestock numbers for resource protection during the drought and when the drought conditions no longer exist, it usually takes the permittee a number of years to build the herd back up to permitted livestock numbers.

Forest Plan Capacity

Forest-wide standards and guidelines from the Coconino National Forest Plan (1987, as amended) require that livestock "Permitted use and capacity are assigned based on full capacity range only" (page 67). The Forest Plan identifies three Range Capacity Levels; Full Capacity, Potential Capacity, and No Allowable Capacity. Full Capacity is defined as "Lands that are presently stable because vegetative ground cover is holding soil loss to an acceptable level and are, therefore, suited for grazing and can support a livestock operation" (page 260).

Determining factors/measures in the Forest Plan definition of Full Capacity Range are "vegetative ground cover" and "holding soil loss to an acceptable level". Vegetative ground cover is the sum of the basal area of vegetation and litter greater than 0.5" in depth. An acceptable level of soil loss is considered to be achieved when vegetative ground cover is equal to or exceeds tolerable ground cover level defined by the COF Terrestrial Ecosystem Survey (TES) (Miller et.al. 1995).

Utilizing the criteria identified above for determining vegetative ground cover and an acceptable level of soil loss, there are 50,742 acres of Full Capacity Range, as defined by the Coconino National Forest Plan, on the Angell allotment. Based on a more detailed analysis of the allotment, the current Estimated Grazing Capacity for the Angell Allotment assigns grazing capacity to 44,380 acres, 6,362 acres less than the Coconino National Forest Plan Full Capacity acres. This means that the permitted use and capacity for the Angell Allotment are based on an acreage amount well below the amount of acres identified in the Coconino National Forest Plan that could have permitted use and capacity assigned.

Table 31 in Appendix G documents how relevant standards and guidelines from the Forest Plan are addressed in the proposed action.

Grazing Capability

Grazing capability of a land area is dependent upon the interrelationship of the soils, topography, plants and animals. Grazing capability is a qualitative expression of the inherent ability of an ecosystem to support grazing use by various classes of livestock on a sustained yield basis. Grazing capability is expressed as one of four capability classes: Full Capability, Limited Capability, Potential Capability, and No Capability (Region 3 Rangeland Analysis and Management Training Guide; Revised 11/2013; 2.8-2.12B), which are defined as:

Full Capability - Full Capability areas are those which can be used by grazing animals under proper management without long-term damage to the soil resource or plant communities. Typically, this land is stable. Vegetative ground cover is maintaining site productivity and producing a minimum of 100 pounds of dried forage per acre per year. Soil loss as judged by available techniques is within tolerance.

Limited Capability – Limited Capability areas have some natural characteristic(s) that limits the capability of these areas for grazing; however, these characteristics do not totally prevent the area from being utilized by some level of grazing. Common situations of Limited Capability include, but are not limited to, slopes in excess of 40% and areas with inherently unstable soils. The limitations in these areas are naturally occurring and management will not change these limitations. However, with prudent management these areas can provide forage for livestock. When determining grazing capacity in the Limited Capability class, conservative allowable use assignments must be made. Limited Capability is assigned to acres on a by project basis and is determined by resource specialists on the Interdisciplinary Team. In order to be in compliance with the Forest Plan and to help keep permitted AUMs at a conservative level it was decided that all Limited Capability acres in the Angell Allotment would be redesignated No Capability.

Potential Capability - Areas which could be used by grazing animals under proper management, but where soil stability is impaired or range improvements are not adequate under existing conditions to obtain necessary grazing animal distribution. The area is not capable of being fully or adequately utilized by grazing animals. Generally, this land has impaired soil stability, lack of water, lack of access and/or there is insufficient vegetative ground cover to protect the soil, but if treated, developed, or properly managed, could become Full Capability. These areas are different from Limited Capability because management may provide opportunities for change in the grazing capability classification. When determining grazing capacity in the Potential Capability class, conservative allowable use assignments must be made. Rationale for assigned allowable use will be documented.

No Capability - No capability areas are those which cannot be used by animals without long-term damage to the soil resource or plant community, or are barren or unproductive naturally. These areas are not capable of being grazed by domestic livestock under reasonable management goals. Grazing capacity will not be assigned to these areas, even though light livestock use may occur.

The analysis of grazing capability on the Angell Allotment indicates that the major factors in determining and classifying capability are soil condition, slope, and site productivity. Table 1 displays grazing capability classification and acres for the Angell Allotment.

Table 1: Grazing Capability Classification Acres for Angell Allotment

Grazing Capability Classification	Pasture Acres	% of Angell Allotment	Description
Full Capability	41,756	80.9	Sat. Soil Condition and <40% Slope
Potential Capability	2,624	5.1	Impaired Soil Condition and <40% Slope
No Capability	7,204	14.0	Slopes >40%; areas with <100# forage prod./acre; Sat., but Inherently Unstable soil condition <40% slope
Total	51,584	100	

Areas with over 40 percent slope were considered No Capability because the Forest Plan states that, “Slopes exceeding 40 percent where high probability for damage exists,” (replacement page 206-70) and defines “No Capacity” lands as areas including lands over 45 percent slopes. The Full Capability lands would be “producing a minimum of 100 pounds of dried forage per acre per year” per the definition used for this analysis.

Estimated Grazing Capacity for the Angell Allotment

Grazing capacity is a function of grazing capability, forage production, topography, allowable use, and the level of management that may be applied. An equation was used to determine the estimated grazing capacity relative to grazing capability, forage production, topography, and an appropriate allowable use. The following describes these factors and their implications on the calculation of estimated grazing capacity:

1. Grazing Capability: Grazing capability classifications have been determined for the Angell Allotment and are described in the Grazing Capability section of this document.

2. Forage Production: Forage production was stratified by Terrestrial Ecosystem Unit (TEU). Forage production estimates (Forg) from Table 3 of the Terrestrial Ecosystem Survey (TES) (Miller et.al., 1995) were used for the forage production values of these TEUs. Where multiple forage production values were provided in TES for a single TEU, or in the case of TEU groups, the smallest forage production value was used. Forage Maximum (ForgM) figures were not used because they are estimates based on the total annual yield of native forage plants after elimination of non-forage species.

3. Topography: Adjustments in the grazeable land area were made to account for slope (USDA 2013; and Holchek 1988). The following factors were used for topography adjustments on the allotment:

   Class 1 - 0 to 10 percent slope, no reduction in estimated grazing capacity
   Class 2 - 11 to 30 percent slope, 30 percent reduction in estimated grazing capacity

Class 3 - 31 to 40percent slope, 60 percent reduction in estimated grazing capacity
Class 4 - >40 percent slope, 100 percent reduction in estimated grazing capacity

4. Allowable Use: Allowable use was established at 35 percent. This value represents the mid-point of conservative use (31-40% forage utilization) and the combined utilization level of both livestock and wildlife. Allowable use and therefore grazing capacity, were assigned only to the following:
    a. Acres classified as Full Capability and less than 40 percent slope.
    b. Acres classified as Potential Capability and less than 40 percent slope.

5. Only the 12 main grazing pastures were used to determine the estimated grazing capacity. Management pastures (used for gathering, holding, shipping, etc.) less than 200 acres in size and water lots were not included in the calculations.

6. Estimated grazing capacity is expressed in Animal Unit Months (AUMs). An Animal Unit Month is defined as the amount of forage required by an animal unit (mature cow with or without a nursing calf) for one month; approximately 800 pounds of forage per AUM (Manske 1998).

Grazing capacity estimates are conservative because they are based on the average forage production of perennial grasses only. Annual plant species and browse species can make up a large part of cattle diets in a given year. Using the average forage production data based only on perennial grass species, underestimates the total forage available for livestock use. This results in a conservative estimate of the livestock carrying capacity for the allotment.

Some lands designated as “Full Capacity” at the Forest Plan level were assigned “potential capability” or “no capability” within the project level evaluation when their specific attributes were evaluated in detail. This approach results in fewer acres being assigned capacity than what is estimated in the Forest Plan and is more conservative than the programmatic level decision; therefore this estimate of project-level capacity is in compliance with the Forest Plan. See the Rangeland Resources affected environment in chapter 3 for more information on grazing capability.

Project-level estimates of capacity is the total number of livestock and/or wildlife which may be sustained on a management unit, and is defined in the Forest Plan as the maximum level at which 0.5 animals can graze an area without damage to the vegetation or related uses (USDA 1987, pg. 245). Estimated grazing capacity is used to support the proposed permitted numbers.

Based on the factors used in this analysis, the estimated grazing capacity for wildlife and livestock in the Angell Allotment is approximately 8,072 Animal Unit Months (AUMs).

Carrying capacity also included elk use[3] which accounted for approximately 1,444 AUMs. This leaves 6,628 AUMs for livestock, well above the 2,350 AUMs permitted in the proposed action.

[3] Estimated elk use on the Angell Allotment is approximately 1,444 AUMs, with approximately 963 AUMs for pastures north of Interstate 40, and approximately 481 AUMS for pastures south of Interstate 40. Estimated use based

Estimated Livestock Water Consumption

The maximum permitted livestock estimated annual water consumption of approximately 5.14 acre-feet represents less than three tenths of one percent (0.28 %) of the estimated average total annual surface water amount on the Angell Allotment (1,869 acre-feet)(Table 6, Range Specialist Report).

A fraction of annual surface water is impounded in earthen stock ponds on the Angell Allotment for livestock and wildlife consumption. There are 10 earthen stock ponds on the allotment (FRD Records) and the average capacity of earthen stock ponds on the Coconino National Forest is 2.34 acre-feet (R. Steinke, 3/2014). This equates to a water storage capacity of approximately 23.4 acre-feet of water. The water storage capacity on the Angell Allotment represents approximately 1.25 percent of the total estimated surface runoff for the allotment. Additionally, the estimated annual water consumption by the maximum permitted livestock number on the allotment represents approximately 22 percent of the water storage capacity on the allotment.

The primary source of water on the Angell Allotment is a well/water pipeline/storage tank system that feeds over 30 troughs. Therefore the earthen stock ponds are a supplemental water source to the pipeline/storage tank system on the allotment.

For further information on livestock water consumption see the Range Specialist Report.

Existing Conditions

This section summarizes the existing conditions of forest resources within the Angell Allotment that may be affected by the alternatives discussed in this EA. Additional descriptions of the affected environment can be found in Chapter 3 of this document. The information in this section is intended to provide enough background to enhance the reader's comprehension of the alternatives and issues described in Chapters 1 and 2 and is not a complete assessment of these resources.

Climate

Climate on the Angell Allotment is characterized by a bimodal precipitation pattern with about 60 percent of precipitation occurring as frontal systems in the winter from December to March, resulting in widespread gentle rains in the lower elevations and snow in the higher elevations, and about 40 percent occurring as monsoons in the summer from July to September. The summer period is characterized by localized high intensity, short duration thunderstorms.

Climate conditions are a major contributing factor affecting range condition and trend in the southwestern United States. Large year-to-year differences in rainfall and forage production are characteristic of southwestern ranges (Martin and Cable 1974). Climate model projections for the southwest United States predict average temperatures will continue to rise as will the potential for an increase in the frequency of extreme heat events (Crimmins et al. 2007). Regional models have

on estimated elk population numbers provided by Arizona Department of Game and Fish. See Table 20 in Appendix C.

shown temperatures increasing from 2 to 20 degrees on average over the next 50 years (Smith et al 2010 and TACCIMO 2012). Changes in precipitation are less predictable, with some models calling for increases of 5 percent and other models calling for decreases of varying degree from 3 to 40 percent over the next 50 years (Smith et al 2010 and TACCIMO 2012). Other models suggest that an average annual precipitation in the Southwest will likely decrease 6 to 12 percent by 2100 (USDA Forest Service 2012a).

Fire frequency and severity will likely increase if temperatures rise and precipitation decreases (USDA Forest Service 2010).The resulting changes in vegetation cover and soil characteristics can dramatically increase flooding and soil erosion, with severe impacts to downstream infrastructure and aquatic ecosystems (Furniss et al. 2010). Consequently, these extremes may pose additional risk to vegetation and soil productivity from decreased cover that may result in higher risk of accelerated erosion and sediment delivery. Therefore, it may be critical to reduce overall soil disturbance by implementing appropriate resource protection measures including soil and aquatic BMPs.

Changes in climate may affect the vitality and productivity of rangeland plants, and thus the overall conditions of both wildlife habitat and ecosystem conditions (USDA Forest Service 2010). Increased temperatures combined with decreased precipitation would lead to lower plant productivity and cover, which in turn would decrease litter cover. The reduction in plant and litter cover would make the soils more susceptible to wind and water erosion. Drought will likely increase and the increase will likely intensify as temperature increases (USDA Forest Service 2012a). Climate change will likely increase the establishment of invasive plants in the U.S. Forests (USDA Forest Service 2012a). Shifts in forage productivity and the presence of exotic plant species in grasslands will likely affect forage quality and fire frequency (USDA Forest Service 2010).

Timing of moisture can lead to shifts in dominance from warm to cool season plant species or vice-versa (Conley et al 1999). Past changes in species composition have occurred due to changes in the amount and timing of moisture. From the early 1900s to the 1950s, cool season grasses increased with the increase in winter and spring moisture. Since the 1990s, warm season grasses have increased with the decrease in winter moisture and increase in summer moisture (Ruyle 2003). Currently we are observing a shift to warm season species dominance in many areas of northern Arizona as a result of lower winter moisture and higher summer moisture. Therefore, percent vegetative ground cover of warm season grasses has increased and percent vegetative ground cover of cool season grasses has decreased.

Coupled with changing forage conditions, there may be a general scarcity of water for cattle (USDA Forest Service 2010). Water supplies are projected to become increasingly scarce and seasonal as snowmelt occurs earlier in the year. The Colorado River, Rio Grande, and several other southwestern rivers have stream flows that appear to be peaking earlier in the year, suggesting that the spring temperatures in these regions are warmer than in the past, causing snow to melt earlier. Some of the most notable observed effect of climate change occur in the Western United States and include an increase in the size and intensity of forest fires, bark beetle outbreaks killing trees over enormous areas, accelerated tree mortality from drought, and earlier snowmelt and runoff (USDA Forest Service 2012a).

Regional trend and projections of changing climatic conditions for the West include lower precipitation in Arizona with more frequent rain on snow flooding in some areas, decreased soil

productivity, reduced vegetative cover in some areas, and a highly variable climate with exceptionally wet and dry periods (USDA Forest Service 2010). While the exact changes in resource conditions from a changing climate are not known, we anticipate that the range and rate of change is going to increase in the coming decades. Researchers have identified a need to respond to this climate variability and its effects in a planned way by allowing for management flexibility through active adaptive management (Ash et al. 2012).

Rangeland Resources

Range condition and trend are assessed at permanent monitoring locations. Frequency and 1/10 acre ocular macroplot cover methods are used on the Angell Allotment.

Data collected from a total of 18 long term monitoring plots were used in this analysis. One long term monitoring plot, C9-NAN is read annually. Long term monitoring plots are located in key areas, the criteria for which include slopes less than 40 percent and sites representative of livestock grazing (e.g. further than ¼ mile from water). The Angell Allotment permanent monitoring plots are located on 8 of 25 TEUs or TEU groups. These 8 TEUs represent approximately 42,811 acres (85%) of the Angell Allotment.

Since monitoring plots were established prior to the publication of TES, not all TEUs are represented by long term monitoring. While we cannot extrapolate existing condition data to TEUs that do not have monitoring plots, we can determine, based on professional judgment, that conditions observed at long term monitoring plots and inventory plots are characteristic for all TEUs of the Angell Allotment.

Additional information regarding monitoring locations and monitoring summaries can be found in the Range Specialist Report. Complete data and monitoring/inventory forms are located in the project record and at the Flagstaff Ranger District.

Table 2 compares the most recent long term monitoring data with the desired conditions for various range condition attributes. The comparison between existing conditions and desired conditions are organized by the TEU, or TEU grouping, which occur within the Angell Allotment, and are relevant only to TEUs that are associated with long term monitoring plots.

Data were analyzed using an 80 percent confidence interval to determine if observed ground cover values were significantly different from TEU values. If TEU values fell within the confidence limit for the observed values then it was determined that there is no significant difference between TEU and observed values (Ruyle 1997). For example plot C3-RF (TEU 426) had an existing vegetative ground cover value of 3 percent in 2013 with an 80 percent confidence limit of 1-5 percent, TES shows the vegetative ground cover value for TEU 426 to be 5 percent; therefore the existing vegetative ground cover at C3-RF is not significantly different from the value recorded in TES for TEU 426. While data were analyzed using both 80 percent and 95 percent confidence intervals, for this specialist report only confidence limits from the 80 percent confidence interval are used.

Table 2: Comparison of long term monitoring data and Range Desired Conditions by TEU

TEU groupings[1]	**Long Term Monitoring plots by TEU groupings**	Acres of TEU in allotment	Do existing conditions meet desired conditions?[2]			
			Perennial grass canopy cover	Number of Perennial Grass Species	Vegetative Ground Cover[3]	Composition of cool and warm season grasses
426	C3-RF	1,546	Yes	Yes	Yes	No
433	C1-TT	3,700	Yes	No	Yes	No
434, 437	C1-SAN, C2-SAN, C3-SAN	11,672	Yes	Yes	Yes	Yes
436	C6-NAN, C7-NAN, C8-NAN	4,786	Yes	Yes	Yes	Yes
443	C2-TT,	6020	Yes	Yes	Yes	No
444	C1-RF, C2-RF, C1-NAN, C2-NAN, C4-NAN, C5-NAN, C9-NAN[4]	12,386	Yes	Yes	Yes	Yes
512	C5-TT	2,794	Yes	Yes	Yes	No
513	C3-TT	903	Yes	Yes	Yes	No

1) TEU groupings were determined based on similar species composition, species richness, parent material and slope. In some instances, one or two of these criteria were not similar, however the TEUs were grouped due to the strong similarity of the remaining criteria.
2) Desired Conditions are identified in Table 7 in Chapter 1.
3)These desired conditions are based on the TEU-estimated tolerable ground cover which includes vegetative basal area plus litter greater than 1” in thickness, but does not include rock fragments.
4) C9-NAN is read annually.

Perennial grass canopy cover: All 8 TEUs show existing percent canopy cover of perennial grass species meets or exceeds the desired condition.

Number of Perennial Grass Species: All but one TEU show existing numbers of perennial grass species to be within the range for the desired condition. Current data for TEU 433 show one grass species, this is one less than the desired condition. The full complement of species identified during TES surveys of a particular polygon representing a TEU is not expected to be present in all polygons representing that TEU.

Vegetative Ground Cover: Vegetative ground cover for existing conditions is the sum of litter >0.5 inches [4]in depth and vegetation basal area. Desired conditions for vegetative ground cover is vegetative ground cover greater than or equal to tolerable vegetation cover (TOL) found in Table 3 of the TES document for each TEU or TEU group. For TEU groups, the maximum tolerable vegetation cover value was used for the desired condition. Tolerance soil loss rate is the rate of soil loss that can occur while sustaining inherent site productivity. The TOL listed in Table 3 of TES indicates the percentage of vegetative ground cover necessary to meet the tolerance soil loss rate. All TEUs meet the desired condition for vegetative ground cover.

Composition of cool and warm season grasses: Data from the most currently read 10th acre canopy cover plots were used to determine existing species composition and the ratio of cool to warm season grasses. This data was compared to the natural composition determined by TES.

Three out of 8 TEUs currently meet the desired conditions for the ratio of cool to warm season grasses determined in TES. However the absence in the long term monitoring plots of some species listed in TES can be attributed to the natural percent canopy cover determined in TES. Plants listed as trace (T) or present (P) in Table 2 of TES (where T=<0.01 percent canopy cover, and P=present in the area, but not recorded in the plot) have a possibility of not being recorded in the long term monitoring plots due to limited and sporadic occurrences within the area.

Range Trends

Trend data collected in 2001 and 2013 show variations in ground cover and canopy cover over time, these variations are further emphasized by the annual data collected between 2006 and 2013 at the C9-NAN plot. Seven plots show an upward trend for vegetative ground cover. Six plots are showing a downward trend for vegetative ground cover. Five plots show static trends for vegetative ground cover. One plot shows an upward trend for litter cover. Two plots show a downward trend for litter cover. Fifteen plots show static trends for litter cover.

Precipitation strongly influences plant yield, and “even the slightest reductions from normal precipitation can cause severe reductions in plant yield” (Holechek et al. 1989), which when combined with changing temperatures can lead to decreased plant productivity, decreased vegetation cover and decreased litter cover. While livestock grazing can affect vegetation and litter cover, comparing vegetation trend to precipitation trend shows that variations in cover for the plots is likely driven primarily by an overall below average amount of precipitation during this time period (Figures 3 and 4 in Appendix C).

Soil, Watershed and Water Resources

Four of the subwatersheds (i.e. 6th code watersheds) that intersect the allotment boundary are classified as functioning properly and five as functioning at risk (Table 3).

Table 3: Subwatersheds Intersecting the Angell Allotment

[4] Region 3 defines litter as being at least 0.394 inches (1 cm) thick to be considered effective ground cover against both rill and inter-rill erosion (T. Runyon, personal communications, March 30, 2015-document in project record).

Subwatershed (6TH Code HUC) Name	Allotment Area within Subwatershed (acres)	Total Subwatershed Size (acres)		% Subwatershed Within Allotment	Subwatershed Condition
Cinder Basin	4933	39864	41	12.4	Functioning properly
Lower Padre Canyon	6405	22951	82	27.9	Functioning at risk
Lower Rio de Flag	991	35308	90	2.8	Functioning properly
Lower San Francisco Wash	3698	32481	98	11.4	Functioning properly
Middle San Francisco Wash	3718	20977	87	17.7	Functioning properly
Mormon Canyon	89	19252	28	0.5	Functioning at risk
Porcupine Canyon-Walnut Creek	654	16622	18	3.9	Functioning at risk
Upper San Francisco Wash	17189	34398	12	50.0	Functioning at risk
Youngs Canyon	13908	36563	40	38.0	Functioning at risk
Total	**51584**				

The most recent assessment of all subwatersheds in the Coconino National Forest (CNF) was completed in 2010 with the results of this assessment for subwatersheds overlapping the analysis area displayed in Table 3 above. Qualitative watershed condition indicator scores are summarized in Table 4.

Table 4: Watershed Condition Indicator Scores for Subwatersheds Intersecting the Angell Allotment.

Subwatershed Name	Indicators											
	Water Quality	Water Quantity	Aquatic Habitat	Aquatic Biota	Riparian/ Wetland Veg.	Roads and Trails	Soils	Fire Regime or Wildfire	Forest Cover	Rangeland Veg	Terrestrial Invasive Species	Forest Health
Porcupine Canyon-Walnut Canyon	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Good	Fair	Good	Good
Upper San Francisco Wash	Fair	Fair	Fair	Fair	Fair	Poor	Good	Fair	Good	Good	Good	Good
Mormon Canyon	Fair	Good	Fair	Fair	Fair	Fair	Poor	Fair	Good	Fair	Good	Good
Upper Padre Canyon	Fair	Good	Good	Poor	Fair	Fair	Fair	Fair	Good	Fair	Good	Good
Young's Canyon	Fair	Fair	Fair	Fair	Good	Poor	Poor	Fair	Good	Fair	Good	Good
Lower Padre Canyon	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Good	Fair	Fair	Good
Middle San Francisco Wash	Good	Good	Good	Good	Good	Fair	Good	Good	Good	Fair	Good	Good

Subwatershed Name	Indicators											
	Water Quality	Water Quantity	Aquatic Habitat	Aquatic Biota	Riparian/ Wetland Veg.	Roads and Trails	Soils	Fire Regime or Wildfire	Forest Cover	Rangeland Veg	Terrestrial Invasive Species	Forest Health
Lower San Francisco Wash	Good	Good	Good	Good	Good	Good	Good	Good	Good	Fair	Fair	Good
Cinder Basin	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good

Soils

The description of existing conditions of soil resources in the analysis area is based on field visits conducted in 2014 supplemented with information published in the Coconino National Forest (CNF), Terrestrial Ecosystem Survey (TES) (Miller, et. al. 1995) and soil erosion modeling of TEUs identified as satisfactory, but inherently unstable. Soil conditions were assessed at four sites within three TEUs during January 2014 using the soil condition assessment protocol developed by Region 3 of the U.S. Forest Service (FS) (FSH 2509.18-99-1) and Technical Guidance for Soil Quality Monitoring in the Southwest Region (Robbie, 2012). Soil condition ratings (Table 5 below; see Appendix B, Glossary for soil condition definitions) are classified using the R3 Soil Quality Technical Guidance (Forest Service Handbook, R3 Supplement 2509.18-99-1), and based on interpretations of the three primary soil functions:

- Hydrologic function is based on indications of reduced infiltration due to compaction and modification of the surface soil structure.
- Soil stability is generally assessed through visual inspection of the soil surface for evidence of erosion.
- Nutrient cycling is generally assessed through erosion modeling and visual observation of surface litter, composition and distribution of perennial vegetation, presence and distribution of coarse woody material, and root distribution within the surface soil horizons.

The TES was mapped across the landscape at a scale of 1:24,000. Therefore, small patches (<40 acres) are generally not broken out in the TES. The TES is considered reliable for allotment-level evaluations. Soil condition assessment forms are included in the project record. Appendix E contains supplemental information about current soil conditions in the allotment.

Table 5: Soil Condition Classes on less than 40 percent slopes in the Angell Allotment.

Soil Condition Classification	Acres in Angell Allotment	Percentage of Allotment
Satisfactory	48,117	93.3%
Impaired	2,624	5.1%
Unsatisfactory	0	0%
Satisfactory but Inherently Unstable	842	1.6%
Total	51,583	100%

The majority of the allotment is in satisfactory soil condition while about 5 percent of the allotment is in impaired soil condition and about 2 percent is satisfactory but inherently unstable. The most current available data collected in 2014 assesses several TEUs previously classified as in impaired soil condition. Current field data shows fewer areas of impaired soils than had been previously identified by COF soil scientist Rory Steinke as reflected in the COF soils geospatial dataset.

Project specific field data, where different from TES, is considered to supersede TES data. Since TES did not include a soil condition category of “impaired”, CNF soil scientist Rory Steinke re-

classified “satisfactory” soils as “impaired” if field evidence, such as lack of plant community diversity and soil compaction, suggested that soil hydrologic and nutrient cycling functions were less than satisfactory or observed trends in plant communities suggested that soil hydrologic and nutrient cycling functions were at risk if observed trends were to continue.

Soils within the analysis area’s ponderosa pine and pinon-juniper vegetation communities are generally satisfactory owing to high amounts of effective vegetative ground cover (litter and herbaceous plants).

Wetlands, Springs and Riparian Vegetation

The allotment contains no mapped wetlands, riparian areas or springs.

Wildlife and Botanical Resources

The Angell Allotment includes occupied or potential habitat for a large number of wildlife and plant species including one species, the black-footed ferret, that is listed as an endangered species under the Endangered Species Act of 1973 (ESA). Black-footed ferrets are not known to occur on the Angell Allotment, but suitable habitat does occur north of Interstate 40 within the allotment boundaries. Suitable habitat has not been surveyed recently and U.S. Fish and Wildlife Services (USFWS) believe that it may be possible for populations of ferrets to exist in un-surveyed suitable habitat. Releases of captive bred ferrets from the Aubrey Valley population by the USFWS and Arizona Game and Fish Department (AZGFD) occurred in October 2014 on Espee Ranch, a working cattle ranch approximately 30 miles to the northwest of the Angell Allotment.

The Angell Allotment provides suitable habitat for 8 species on the U.S. Forest Service Region 3 sensitive wildlife and plant species list, including four mammals, two birds, and one plant (Table 6). Additionally there is suitable habitat for pronghorn antelope, a species identified as a management indicator species (MIS) in the Forest Plan, and golden eagle which is protected under the Bald and Golden Eagle Protection Act.

Aquatic habitats accessible to livestock on the allotment are limited to earthen stock ponds and do not provide suitable habitat for any of aquatic species of concern.

Five species of noxious or invasive plant species (weeds) have been documented on the Angell Allotment: Scotch thistle, Dalmatian toadflax, bull thistle, diffuse knapweed, and cheatgrass. Many of the documented weed populations are in the Leupp Road right of way which borders Cocrane, Cinder Hill, O’Neill, Rio de Flag and Turkey Tanks pastures. Diffuse knapweed is known to occur in areas with cinder soils such as the Cinder Hills OHV area north of the allotment and could potentially occur in this soil type in those pastures north of Interstate 40.

Table 6: List of Forest Sensitive Species known to occur or have the potential to occur on the Angell Grazing Allotment.

Common Name	Scientific Name	Status Federal/State/Forest Service	Known Populations in Angell Allotment	Potential to Occur in Angell Allotment
Mammals				
Navajo Mogollon vole	*Microtus mogollonensis navaho*	--/S1/Sensitive	No	Yes
Spotted bat	*Euderma maculatum*	--/S2/Sensitive	No	Yes
Western red bat	*Lasiurus blossevillii*	--/S3/Sensitive	No	Yes
Allen's lappet-browed bat	*Idionycteris phyllotis*	--/S2/Sensitive	No	Yes
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*	--/S3/Sensitive	No	Yes
Birds				
Northern goshawk	*Accipiter gentilis*	--/S3/Sensitive	No	Yes
Western burrowing owl	*Athene cunicularia hypugaea*	--/S3/Sensitive	No	Yes
Plants				
Sunset Crater beardtongue	*Penstemon clutei*	--/S2/Sensitive	Yes	Yes

S – Heritage database subnational rating; S1 – subnationally critically imperiled; S2 – subnationally imperiled; S3 – subnationally vulnerable to extirpation or extinction

Further information on the species listed above and information on additional species with documented populations and/or potential habitat within the Angell Allotment can be found in the Biology specialist's report.

Heritage

Archaeological surveys have been performed within the Angell Allotment resulting in the cumulative survey of 14,167 acres, or 27.5 percent of the allotment. Surveys completed across the allotment are not random, but have been strategically applied in areas where land management activities that may affect cultural resources have been proposed or where landscape features result in a high likelihood of historic or prehistoric inhabitance. This amount exceeds the 10 percent inventory considered a baseline for project inventory per the Coconino Forest Plan (1987, as amended). Based on the Coconino National Forest heritage INFRA and Geospatial Data Bases, a total of 1,146 cultural resource sites are documented in the Angell Allotment. Simplified, the sites consist of 16 historic sites, 1,079 prehistoric sites (consisting of 1,078 Northern Sinagua and one Clovis Point discovery), 6 multicomponent sites, and 45 type-unknown or unrecorded sites. Of the sites listed above 38 are listed on the National Register of Historic Places, 1 is a Historic District (Ridge Ruin Archaeological District), 217 are eligible for listing, 6 are not eligible for listing, and 884 are unevaluated. Unevaluated sites are treated as eligible for listing on the National Register of Historic Places until further evaluation is completed. The historic sites in the Angell Allotment, consisting of both Euro-American and Navajo site types, all date from the early 1900's to the present with the exception of the Beale Wagon Road. The Euro-American sites

consist of trash dumps, rock outlines, a rock foundation, and thermal features. The Navajo sites consist of historic brush structures/hogans, a sweat lodge, and a possible corral.

Northern Sinagua sites consist of a myriad of different site types including habitations (field houses, masonry pueblos, rock shelters/cliff dwelling, and pit houses), resource procurement and processing areas, agricultural fields, roasting features, general artifact scatters, rock art sites, sherd scatters, water control features, fortifications, cavates, and ballcourts.

Recreation

Recreation use within the Angell Allotment includes driving for pleasure, wildlife viewing, big game and antler hunting, picnicking, rock climbing and bouldering, firewood gathering, heritage site visitation, dispersed camping, OHV activities, and some off-trail hiking, horseback riding, mountain biking. There are no congressionally designated wilderness areas, wilderness study areas, National Recreation Areas, or inventoried roadless areas in the analysis area.

The Angell Allotment is located within portions of three Game Management Units; 7E, 11M, and 5BN. The local hunting seasons last from about mid-August through December (AZGFD, 2014). Game species within these units include waterfowl, antelope, black bear, elk, Merriam's turkey, mule deer, and mountain lion (waterfowl and mountain line apply to 5BN only).

There are no developed recreation sites or trails located within or adjacent to the Angell Allotment analysis area. Although there are no developed facilities, there is a limited amount of dispersed recreation in the project area.

Turkey Tanks is a fairly concentrated area of recreation use, and consists of an informal 1/4 mile trail to a few permanent water tanks in the basalt canyon. This area is used for wildlife viewing and viewing archeological sites, including cave dwellings, pottery shards, and petroglyphs. The area also offers a well know rock bouldering site and a short rope sport climb. Turkey Tanks is the most heavily used area for recreation in the project area.

The Coconino National Forest administers some Special Use Recreation Permits within the project area. One such permit has been issued to the Flagstaff Flyers for a club permit to operate a Remote Controlled (RC) airstrip. The airstrip is not within any active pastures of the Angell Allotment. It is within a small fenced area used when cattle are being transferred across Leupp Road between Cinder Hill, Rio De Flag, and Turkey Tanks pastures. Other Special Use Recreation Permits consist mainly of non-commercial groups using small areas for overnight camping and certain recreation events generally for a week or less each year.

Desired Conditions

The need for a change in management was identified by comparing specific descriptions of what is desired across the landscape to what currently exists. Desired conditions are the on-the-ground resource conditions management is working towards achieving. The Forest Plan sets forth in detail the direction for managing the land and resources of the forest. The desired conditions for the project are based on Forest Plan objectives, goals, standards and guidelines (1987, as amended). Desired conditions are also derived from agency range management policy, shared interagency resource goals, and direction relevant to wildlife, water quality, and cultural resource laws and regulations.

The Forest Plan includes specific language to manage grazing in order to limit impacts to forest resources including, but not limited to, threatened and endangered species and soil condition. There are multiple factors that may affect resource conditions, and livestock grazing is but one of many activities that occur on the allotment. However, since this analysis is specific to livestock grazing, it discusses the management of livestock in regards to forest resources and how livestock grazing may or may not be used to address resource desired conditions. Other forest uses that affect forest resources are taken into consideration and discussed in the cumulative effects sections of this EA.

The desired conditions in Tables 7 and 8 are primarily based on Forest Plan direction (See Forest Plan Compliance Supplement, Appendix G, for full list of Forest Plan management direction), which incorporates law and regulation and often provides more specific direction for livestock grazing and resource protection.

Table 7: General Desired Conditions for the Angell Grazing Allotment.

Resource	Relevant source	Specific Management Direction or resource goal/objective	Desired Conditions
Upland vegetation and rangeland	Forest Plan, p. 67	"Permitted use and capacities are maintained in balance for the allotments by increasing or decreasing numbers of livestock, by changing the management intensity levels, and by initiating changes in livestock class, season of use, and rotation patterns."	There is a desired condition to maintain or improve vegetative and forage condition over the long-term through monitoring and adaptive management techniques.
	Forest Plan, p. 67	"Do production and utilization surveys at least every 9 to 13 years for capacity determinations."	
	Forest Plan, p. 68	"Manage grazing use to maintain or enhance condition classes of full capacity rangelands."	
Soil Conditions	Forest Plan, p. 23,	"Maintain or, where needed, enhance soil productivity and watershed condition."	There is a desired condition to maintain satisfactory soil conditions and improve impaired soil conditions so that they meet or move towards satisfactory conditions using appropriate range management techniques. Vegetative ground cover meets or exceeds tolerable vegetation cover (as displayed in Table 2), where it is possible to do so, in order to maintain or improve soil
	Forest Plan, p. 68	"Full capacity rangeland in unsatisfactory condition that has potential for improvement is treated through appropriate structural and nonstructural range improvements and pasture stocking rate adjustments as described in the AMP'S"	

Resource	Relevant source	Specific Management Direction or resource goal/objective	Desired Conditions
			productivity.
	Forest Plan, p. 74	"Implement resource improvement projects that are cost-effective and/or are beneficial for maintaining and improving water quality, quantity, and soil productivity."	There is a desired condition to improve resource conditions by implementing activities that improve water quality, quantity, and soil productivity.
Watershed Condition and Water Quality	Forest Plan, p. 71	"Ensure compliance with PL 92-500 'Federal Water Pollution Control Act' and Arizona Water Quality Standards through the implementation of Best Management Practices (BMP) to prevent water quality degradation."	There is a desired condition to improve water quality in those areas that are currently not meeting Arizona state water quality standards.
	Forest Plan, p. 74	"Implement resource improvement projects that are cost-effective and/or are beneficial for maintaining and improving water quality, quantity, and soil productivity."	
Wildlife	Forest Plan, p. 66-1	"Forage use by grazing ungulates will be maintained at or above a condition which assures recovery and continued existence of threatened and endangered species."	There is a desired condition to support the recovery of endangered and threatened species by maintaining or improving vegetative conditions in riparian and upland areas. There is a desired condition to manage forage to increase threatened and endangered species and MIS, where appropriate.
	Forest Plan, p. 65-5	" Implement forest plan forage utilization standards and guidelines to maintain owl prey availability, maintain potential for beneficial fire while inhibiting potential destructive fire, maintain and restore riparian ecosystems, and promote development of owl habitat. Strive to attain good to excellent range conditions."	

Resource	Relevant source	Specific Management Direction or resource goal/objective	Desired Conditions
	Forest Plan, p. 66	"Manage forage to increase threatened and endangered species and management indicator species (MIS)where it is determined appropriate through the IRM and NEPA process."	
	Forest Plan, p. 64-1	"Evaluate potential resource impacts on T&E and sensitive species habitat by projects and activities through a biological assessment (FSM 2670) and conduct appropriate consultation (FSM 2670) when necessary. Provide appropriate protection or enhancement."	
Economic and Social Values	Forest Service Manual 2203.1; 36 CFR 222.2(c)	"Where consistent with other multiple use goals and objectives, there is congressional intent to allow grazing on suitable lands"	There is a desired condition to continue to facilitate livestock grazing on National Forest System lands where livestock grazing is managed to maintain or improve range conditions over the long-term.
	Forest Service Manual 2202.1	"It is Forest Service policy to make forage available to qualified livestock operators from lands suitable for grazing, consistent with land management plans. It is also Forest Service policy to continue contributions to the economic and social well-being of people by providing opportunities for economic diversity and promoting stability for communities that depend on range resources for their livelihood."	There is a desired condition to contribute to the economic and social well-being of communities that depend on range resources.

Resource	Relevant source	Specific Management Direction or resource goal/objective	Desired Conditions
Cultural and Historic Values	Forest Plan, p. 49	"Ground disturbing projects receive cultural resources clearance. This includes projects proposed in areas that have been previously cleared for other projects. Projects, not areas, receive clearance. Projects receive clearance without additional archaeologicalfield work whenever sufficient prior field work has been done to clear the project."	There is a desired condition to avoid all adverse impacts to cultural and historic resources.
	Forest Plan, p. 50	"Cultural resource sites are located and protected from project activities according to direction in FSM 2360..."	
Invasive Species	Forest Plan, p. 23	"Prevent any new noxious or invasive weed species from becoming established, contain or control the spread of known weed species, and eradicate species that are the most invasive and pose the greatest threat to the biological diversity and watershed condition."	There is a desired condition to prevent new invasive species from becoming established and remove invasive species that cause the greatest effect to Forest resources.

Table 8: Desired Conditions for Management Areas (MAs), with acreage and management emphasis, located in Angell Allotment.

Management Area (MA)	Acres in Angell Allotment	**Location in Forest Plan**	Management Emphasis	Desired Conditions
3	9	p. 116	"Emphasize a combination of multiple-uses including a sustained-yield of timber and firewood production, wildlife habitat, livestock grazing, high quality water, and dispersed recreation."	There is a desired condition to generally manage livestock grazing to Level C and D, as identified in the Forest Plan, as amended. There is a desired condition to maintain or improve soil condition and condition of upland vegetation.
7	16,740	p. 148	Emphasize firewood production, watershed condition, wildlife habitat, and livestock grazing. Other resources are managed in harmony with the emphasized resources.	There is a desired condition to generally manage livestock grazing to Level C and D, as identified in the Forest Plan, as amended. There is a desired condition to maintain or improve soil condition and condition of upland vegetation.
8	228	p. 156	Emphasize wildlife habitat, watershed condition, and dispersed recreation.	The area is classified as no capacity range. The area generally is not fenced, so occasional livestock use does occur. There is a desired condition to maintain or improve soil condition and condition of upland vegetation.
10	12,386	p. 162	Emphasize range management, watershed condition, and wildlife habitat. Other resources are managed to improve outputs and quality. Emphasis is on prescribed burning to achieve management	There is a desired condition to generally manage livestock grazing to Level D and E, as identified in the Forest Plan, as amended. There is a desired condition to maintain or improve soil condition and condition of

Management Area (MA)	Acres in Angell Allotment	**Location in Forest Plan**	Management Emphasis	Desired Conditions
			objectives.	upland vegetation.
31[*,#]	MA 3: 405, MA 7: 1,863 MA 10: 11,674 Total: 14,970	MA 31-206-84; MA 3 – 116, MA 7 – 148, MA 10 - 162	MA 31: Maintain cinder ecosystems, un-tracked appearance of cinder cones, and remote recreation opportunities with a high sense of self-exploration. Continue opportunities for firewood cutting and livestock grazing in the pinyon/juniper woodland. Restore natural grasslands. Re-establish or maintain fire and other ecosystem processes in the pinyon/juniper woodland. MA 3: Emphasize a combination of multiple-uses including a sustained-yield of timber and firewood production, wildlife habitat, livestock grazing, high quality water, and dispersed recreation. MA 7: Emphasize firewood production, watershed condition, wildlife habitat, and livestock grazing. Other resources are managed in harmony with the emphasized resources. MA 10: Emphasize range management, watershed condition, and wildlife habitat. Other	MAs 3, 7 and 10: There is a desired condition to generally manage livestock grazing to Level D, as identified in the Forest Plan, as amended. There is a desired condition to maintain or improve soil condition and condition of upland vegetation.

Management Area (MA)	Acres in Angell Allotment	**Location in Forest Plan**	Management Emphasis	Desired Conditions
			resources are managed to improve outputs and quality. Emphasis is on prescribed burning to achieve management objectives.	
33[*,+]	MA 3: 3,526 MA 9: 330 MA 10: 4,084 Total: 7,940	MA 3-116 MA 9 - 158 MA 10-162	MA 3: Emphasize a combination of multiple-uses including a sustained-yield of timber and firewood production, wildlife habitat, livestock grazing, high quality water, and dispersed recreation. MA 9: Emphasize livestock grazing, visual quality, and wildlife habitat. Other resources are managed in harmony with emphasized resources. The smaller mountain meadows in remote areas are managed mostly for wildlife habitat, especially for elk summer range. MA 10: Emphasize	MAs 3, 9 and 10: There is a desired condition to generally manage livestock grazing to Level D, as identified in the Forest Plan, as amended. There is a desired condition to maintain or improve soil condition and condition of upland vegetation.

Management Area (MA)	Acres in Angell Allotment	**Location in Forest Plan**	Management Emphasis	Desired Conditions
			range management, watershed condition, and wildlife habitat. Other resources are managed to improve outputs and quality. Emphasis is on prescribed burning to achieve management objectives.	

*MAs 31 and 33 replace MA 13 under the Flagstaff Lake Mary Ecosystem Analysis (FLEA) amendment to the Forest Plan.
Desired condition for MA 31 does not discuss livestock grazing, therefore the EA uses the desired conditions from MA 3 3 (cover type Ponderosa Pine and mixed conifer, less than 40% slope), MA 7 (cover type Pinyon-Juniper Woodland, Persistent) and MA 10 (cover type Grassland and sparse pinyon-juniper above the rim).
+ Management emphasis and desired condition for MA 33 does not discuss livestock grazing, therefore this EA uses the management emphasis and desired conditions from MA 3 (cover type Ponderosa Pine and mixed conifer, less than 40% slope), MA 9 (cover type Mountain Grassland) and MA 10 (cover type Grassland and sparse pinyon-juniper above the rim).

Desired conditions can also be evaluated by comparing current conditions to potential and natural conditions in the Terrestrial Ecosystem Survey (TES) and considering what conditions could be achievable in a 10 year timeframe. The terrestrial ecosystem units (TEUs) in Table 9 account for approximately 43,811 acres (approximately 85 percent of the proposed allotment size) within the allotment and are those TEUs associated with long term vegetation monitoring locations. Desired conditions are based on a range of species richness, vegetative cover, species composition, and soil conditions. For more detailed description of existing, desired and potential conditions by TEU, see Appendix E.

TEU-specific desired conditions were not developed for those TEUs of which the majority are over 40 percent slope, whose acreages do not meet key area requirements (see Glossary), and where there is no existing condition data which could be compared to potential TEU parameters for the development desired conditions. For these portions of the allotment, only the allotment-wide desired conditions in Table 7 above apply.

Table 9: Desired Conditions for Major TEUs and TEU Groupings associated with monitoring plots in Angell Allotment.

TEU	Description	Grasses	Forbs	Shrubs	Trees	Soil (Vegetative Ground Cover[5] %)
426	Pinyon/Juniper communities located on elevated plains on the northern region of the Angell Allotment with a slope of 0-10%. Typical shrub and tree species includes Apache plume, one-seed juniper and pinyon pine. There are approximately 1,546 acres in this TES units; all acres on slopes with less than 40%.	2-5 species <0.05-3% percent canopy cover cool season species composition 1-40 percent warm season species composition 60-99 percent	3-4 species <0.05-10 percent canopy cover	2-5 species 8-24 percent canopy cover	0-2 species 0-35 percent canopy cover	Vegetative ground cover greater than or equal to 5 percent
433	Pinyon/Juniper communities located on elevated plains of the Angell Allotment with a slope of 0-10%. Typical grass species includes blue gramma, threeawn and black gramma. There are approximately 3,700 acres in this TEU; 3,695 acres on slopes with less than 40% and 6 acres on slopes greater than 40%.	2-10 species 8-15 percent canopy cover Cool season species composition 1-33 percent Warm season species composition 66-99	1-5 species <0.05-1 percent canopy cover	1-5 species <0.05-1 percent canopy cover	1-2 species 20-35 percent canopy cover	Vegetative ground cover greater than or equal to 5 percent

[5] Effective ground cover for existing conditions is the sum of litter >0.5” in depth and vegetation basal area. Effective ground cover for desired conditions is greater than or equal to the tolerable vegetation cover (Tol.) found in Table 3 of TES for each TEU group. Tolerance soil loss rate is the rate of soil loss that can occur while sustaining inherent site productivity. The Tol. value listed in Table 3 of TES indicates the percentage of effective ground cover necessary to meet the tolerance soil loss rate.

TEU	Description	Grasses	Forbs	Shrubs	Trees	Soil (Vegetative Ground Cover[5] %)
		percent				
434, 437	Pinyon/Juniper communities located on elevated plains on the Angell Allotment with a slope of 0-10%. Typical grass species includes blue gramma, sideoats grama and squirrel tail. There are approximately 11,673 acres in these aggregated TES units; all acres on slopes with less than 40%.	3-10 species 30-59 percent canopy cover Cool season species composition 1-33 percent Warm season species composition 66-99 percent	3-7 species .25-1 percent canopy cover	1-5 species 0.5-3 percent canopy cover	1-3 species 1-30 percent canopy cover	Vegetative ground cover greater than or equal to 10 percent
436	Pinyon/Juniper communities located on elevated plains on the Angell Allotment with a slope of 0-10%. Typical grass species includes blue grama, needle and thread and crested wheatgrass. There are approximately 4,786 acres in this TEU; all acres on slopes with less than 40%.	2-10 species 26-42 percent canopy cover Cool season species composition 1-33 percent Warm season species composition 66-99 percent	3-7 species 0.5-2 percent canopy cover	1-5 species 1-5 percent canopy cover	0-2 species 0-<0.5 percent canopy cover	Vegetative ground cover greater than or equal to 15 percent
443	Pinyon/Juniper communities located on elevated plains on the Angell Allotment with a slope of 0-10%. Typical grass species includes blue gramma, sideoats	2-8 species 23-35 percent canopy cover Cool season species	0-2 species 0-1 percent canopy cover	1-3 species <0.5-2 percent canopy	1-2 species 20-30 percent canopy	Vegetative ground cover greater than or equal to 5 percent

TEU	Description	Grasses	Forbs	Shrubs	Trees	Soil (Vegetative Ground Cover[5] %)
	gramma and hairy gramma. There are approximately 6,020 acres in this TEU; all acres on slopes with less than 40%.	composition 1-38 percent Warm season species composition 62-99 percent		cover	cover	
444	Pinyon/Juniper communities located on elevated plains on the Angell Allotment with a slope of 0-10%. Typical grass species includes blue gramma, sideoats gramma and galleta. There are approximately 12,386 acres in this TEU; all acres on slopes with less than 40%.	2-5 species 12-49 percent canopy cover Cool season species composition 1-33 percent Warm season species composition 66-99 percent	1-5 species .5-15 percent canopy cover	0-3 species .5-15 percent canopy cover	0-1 species <0.5-3 percent canopy cover	Vegetative ground cover greater than or equal to 10 percent
512	Ponderosa pine and pinyon/juniper communities located on elevated plains on the Angell Allotment with a slope of 0-10%. Typical grass species includes blue gramma, cane beardgrass and prairie junegrass. There are approximately 2,794 acres in this TEU; all acres on slopes with less than 40%.	1-3 species 7-30 percent canopy cover Cool season species composition 1-33 percent Warm season species composition 66-99 percent	5-8 species 1.5-2 percent canopy cover	2-5 species 1-5 percent canopy cover	0-2 species 3-5 percent canopy cover	Vegetative ground cover greater than or equal to 10 percent percent

TEU	Description	Grasses	Forbs	Shrubs	Trees	Soil (Vegetative Ground Cover[5] %)
513	Ponderosa pine and pinyon/juniper communities located on cone/scarps slopes of plains on the Angell Allotment with a slope of 30%. Typical grass species includes blue gramma, cane beardgrass and prairie junegrass. There are approximately 903 acres in this TEU; 880 acres on slopes with less than 40% and 23 acres on slopes greater than 40%.	2-4 species 6-60 percent canopy cover Cool season species composition 1-40 percent Warm season species composition 60-90 percent	1-3 species 0.1-2 percent canopy cover	2-4 species 1-5 percent canopy cover	1-2 species 0.5-10 percent canopy cover	Vegetative ground cover greater than or equal to 20 percent

Chapter 2 - Alternatives

This chapter describes and compares the alternatives considered for the Angell Allotment project. It includes a description of each of the 3 alternatives considered, including the (1) No Action alternative, (2) Current Management Alternative, and (3) Proposed Action Alternative. 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 (e.g., fence construction) and some of the information is based upon the environmental, social and economic effects of implementing each alternative.

Alternatives Considered in Detail

Alternative 1: No Action

A no action alternative is required by NEPA to be developed as a benchmark against which the agency can evaluate the proposed action. No action in livestock management planning equates to no permitted livestock grazing (FSH 2209.13, Ch. 90). This is because no action would be taken to renew the Term Grazing Permit (TGP). The TGP would be cancelled and livestock grazing would no longer be authorized. Livestock would be removed, existing structural range improvements would not be maintained and no new range improvements would be implemented, including fence and pipeline construction.

Selection of this alternative would not mean that livestock grazing could not be authorized on this allotment sometime in the future. The allotment boundary and pasture fences and all other structural range improvements would remain in place. A separate analysis and coordination with adjacent permittees and other agencies would likely be necessary to determine whether to remove or maintain these improvements.

Alternative 2: Current Management

Alternative 2 includes 5 major components, authorization, drought management strategy, monitoring, adaptive management and resource protection measures.

This section includes technical terminology used in allotment administration and rangeland science. Definitions for these terms can be found in the Glossary in Appendix B.

Summary

Under the current management alternative, livestock grazing would continue on the Angell Allotment with 425 head of cow/calf pairs permitted from May 15 through October 31 equating to 2,375 AUMs. Seasonal utilization levels would be managed at the light to moderate (21 to 50 percent), and utilization levels would be managed at the conservative level (35 percent) for herbaceous vegetation.

The Forest Service and grazing permittee have used forms of adaptive management over the years, including the adjustment of livestock numbers to address resource needs. This alternative would continue to use adaptive management by identifying specific scenarios and the possible management responses.

Annual Operating Instructions (AOIs) would be developed in the early spring for each grazing season, but they could be modified later in the season to respond to environmental changes, ranch management and/or monitoring results. Depending on weather conditions, the grazing periods may vary in length by a few weeks.

The current management alternative would follow current guidance from Forest Service Handbook 2209.13, Chapter 90 (Grazing Permit Administration; Rangeland Management Decision making).

Authorization

Under the Current Management alternative the Coconino National Forest would propose to continue to authorize yearlong livestock grazing for the Angell Allotment under the following terms:

- **Permitted livestock numbers** in the Term Grazing Permit would be a maximum of 425 head of adult cattle from May 15 through October 31, or 2,375 AUMs. This is a conservative AUM limit and is based on existing conditions.
- **Annual authorized livestock numbers** would be based on existing conditions, available water and forage, and predicted forage production for the year. Annual authorized livestock numbers would not exceed permitted numbers and therefore would always be between 0 and 2,375 AUMs. Adjustments to the annual authorized livestock numbers and AUMs (increase or decrease) may occur during the grazing year, based on conditions and/or range inspections.
- **The permitted season of use** would be May 15 through October 31.
- **Grazing Management:** Grazing would occur using a deferred, rest-rotation management system, which would allow for plant growth and recovery. Generally pastures would be grazed only once during the grazing year. However, pasture re-entry may be needed to facilitate livestock movement on the allotment. Pastures would be grazed no more than once per year unless authorized by the Responsible Official when conditions warrant. Pasture re-entry would only be authorized if it has been determined through range inspections that soil, water and vegetation conditions are appropriate, and that utilization guidelines for the pasture would not be exceeded as a result of re-entry.
- **Utilization:** A management guideline of conservative use (35 percent forage utilization as measured at the end of the growing season) would be employed to maintain or improve rangeland vegetation and long term soil productivity. Both allowable use and the woody vegetation utilization guidelines take into account the cumulative browsing effects of wildlife and livestock.
- **Seasonal Utilization:** Seasonal utilization is defined as the amount of herbage removed through grazing or trampling during the growing period. Seasonal utilization would be managed to allow for the physiological needs of plants. For the Angell Allotment, the Forest would manage for light to moderate seasonal utilization (21 to 50 percent) during the grazing season.
- **Pasture Use Periods:** Pasture use periods would be variable based on current conditions.
- **Grazing Periods:** The AOI would state the planned graze period for each pasture for each grazing year. However, the actual grazing period within each pasture would depend on current growing conditions and the need to provide for plant recovery following grazing. The length of the grazing period within each pasture would also be dictated by the allotment-wide allowable use guidelines.

Drought Management Strategy

Allotment management would be adjusted during drought conditions. Following FSH 2209.13, the Grazing Permit Administration Handbook, the 12-Month Standardized Precipitation Index (SPI), combined with site-specific information, would be used to assess soil and vegetation conditions. Using the SPI as a baseline and combining it with site-specific information from allotment inspections and monitoring, a determination for necessary management actions would be made, and adaptive management alternatives would be evaluated.

Region 3 and Coconino National Forest drought management policies identify numerous adaptive management actions for mitigating grazing effects during drought. The following management actions would be used on the Angell Allotment during periods of drought:

- Authorized AUMs (livestock numbers) may need to be reduced. Reductions may be necessary prior to the permitted season of use and/or during the permitted season of use.
- Season of use may need to be shortened. Depending on the severity of the drought and authorized AUMs, a reduced grazing season may be necessary.
- Pasture use periods may need to be shortened. Pastures would not be grazed twice during the same grazing season and this may ultimately result in an early exit from the allotment.
- Pastures may need complete rest from livestock use. How long a pasture, or pastures, would be rested depends on the severity of the drought.
- Utilization and/or seasonal utilization levels may need to be reduced. Depending on the severity of the drought and authorized AUMs, reduced utilization and/or seasonal utilization levels would likely result in shortened pasture use periods and may ultimately result in an early exit from the allotment.
- Lack of livestock water, or poor distribution of livestock water, may result in reduced pasture/allotment use periods.
- Livestock use of planned rested pastures due to drought would not be authorized.

Any adaptive management actions necessary due to drought conditions would be made by the Responsible Official in consultation with the range specialist and the permittee.

All range improvements would follow the site-specific Construction Guidelines. The Forest Service uses plan direction, Forest Service Manual 2200 Chapter 2240 and a number of sources to identify specific guidelines for each project; some of the sources include:

- Sanderson, H. Reed; Quigley, Thomas M.; Swan, Emery E.; Spink, Louis R.1990. Specifications for structural range improvements. Gen. Tech. Rep. PNWGTR-250. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 120 p.
- USDA Forest Service, USDI Bureau of Land Management. 1999. Fences. 210 pp.
- AZGFD. 2011. Wildlife Compatible Fencing. Arizona Game and Fish Department, Phoenix, AZ. 34 pp.

Monitoring

See “Monitoring” section under “Proposed Action Alternative.”

Adaptive Management

See “Adaptive Management” section under “Proposed Action Alternative.”

Resource Protection Measures

See “Resource Protection Measures” section under “Proposed Action,” below.

Alternative 3: Proposed Action

The proposed action includes 6 major components, authorization, drought management strategy, structural range improvements, monitoring, adaptive management and resource protection measures.

Summary

Under the Proposed Action, livestock grazing would continue on Angell Allotment with 425 head of cow/calf pairs permitted from June 1 through November 15 equating to 2,350 AUMs. Seasonal utilization levels would be managed at moderate (21 to 50 percent) in late spring and early summer months when sufficient opportunity exists for plant regrowth. During the late summer and fall, seasonal utilization would be managed at the conservative level (30 to 40 percent) when potential for plant regrowth is limited. Utilization levels would be managed at the conservative level (30 to 40 percent) for herbaceous vegetation.

The Forest Service and grazing permittee have used forms of adaptive management over the years, including the adjustment of livestock numbers to address resource needs. This alternative would continue and expand the use of adaptive management by identifying specific scenarios and the possible management responses.

Annual Operating Instructions (AOIs) would be developed in the early spring for each grazing season, but they could be modified later in the season to respond to environmental changes, ranch management and/or monitoring results. Depending on allotment conditions the grazing periods may vary in length by a few weeks.

The Proposed Action alternative follows current guidance from Forest Service Handbook 2209.13, Chapter 90 (Grazing Permit Administration; Rangeland Management Decision making).

Authorization

The Coconino National Forest proposes to continue to authorize livestock grazing for the Angell Allotment under the following terms:

- **Permitted livestock numbers** in a TGP would be a maximum of 2,350 AUMs which is the equivalent of 425 head of adult cattle for approximately five and a half months. This is a conservative AUM limit and is based on existing conditions.
- **Annual authorized livestock numbers** would be based on existing conditions, available water and forage, and predicted forage production for the year. Annual authorized livestock numbers would not exceed permitted numbers and therefore would always be between 0 and 2,350 AUMs. Adjustments to the annual authorized livestock numbers and AUMs (increase or decrease) may occur during the grazing year, based on conditions verified by range inspections.
- **The permitted season of use** would be June 1 through November 15, however depending on allotment conditions the grazing periods may vary in length allowing livestock to enter the allotment as early as May 15 and/or remain on the allotment until November 31. An extended season of use would only be authorized if it has

been determined through range inspections that soil, water and vegetation conditions are suitable. AUMs will not exceed 2,350 AUMs permitted by the selected alternative.

- **Grazing Management:** Grazing would occur using a deferred or a deferred, rest-rotation management system, which would allow for plant growth and recovery. Having the option to use either the deferred rotation or deferred rest rotation grazing system would allow the Forest to adjust management depending on monitoring and conditions. Generally pastures would be grazed only once during the grazing year. However, pasture re-entry may be needed to facilitate livestock movement on the allotment. Pastures would be grazed no more than once per year unless authorized by the Responsible Official when conditions warrant. Pasture re-entry would only be authorized if it has been determined through range inspections that soil, water and vegetation conditions are appropriate, and that utilization guidelines for the pasture would not be exceeded as a result of re-entry.
- **Utilization:** A management guideline of conservative use (30 to 40 percent forage utilization as measured at the end of the growing season) would be employed to maintain or improve rangeland vegetation and long term soil productivity. Allowable use guidelines take into account the cumulative effects of wildlife and livestock.
- **Seasonal Utilization:** Seasonal utilization is defined as the amount of herbage removed through grazing or trampling during the grazing period. Seasonal utilization would be managed to allow for the physiological needs of plants. For the Angell Allotment, the Forest would manage for moderate seasonal utilization (21 to 50 percent) in late spring and early summer months when sufficient opportunity exists for plant regrowth. During the late summer and fall seasonal utilization would be managed at the conservative level (30 to 40 percent) when the potential for plant regrowth is limited.
- **Pasture Use Periods:** Pasture use periods would be variable based on current conditions.
- **Grazing Periods:** Actual grazing period within each pasture would depend on current growing conditions and the need to provide for plant recovery following grazing. The length of the grazing period within each pasture would also be dictated by the seasonal utilization guidelines.

Drought Management Strategy

Allotment management would be adjusted during drought conditions. Following FSH 2209.13, the Grazing Permit Administration Handbook, the 12-Month Standardized Precipitation Index (SPI), combined with site-specific information, would be used to assess soil and vegetation conditions. Using the SPI as a baseline and combining it with site-specific information from allotment inspections and monitoring, a determination for necessary management actions would be made, and adaptive management alternatives would be evaluated.

Region 3 and Coconino National Forest drought management policies identify numerous adaptive management actions for mitigating grazing effects during drought. The following management actions would be used on the Angell Allotment during periods of drought:

- Authorized AUMs (livestock numbers) may need to be reduced. Reductions may be necessary prior to the permitted season of use and/or during the permitted season of use.
- Season of use may need to be shortened. Depending on the severity of the drought and authorized AUMs, a reduced grazing season may be necessary.
- Pasture use periods may need to be shortened. Pastures would not be grazed twice during the same grazing season and this may ultimately result in an early exit from the allotment.

- Pastures may need complete rest from livestock use. How long a pasture, or pastures, would be rested depends on the severity of the drought.
- Utilization and/or seasonal utilization levels may need to be reduced. Depending on the severity of the drought and the authorized AUMs, reduced utilization and/or seasonal utilization levels would likely result in shortened pasture use periods and may ultimately result in an early exit from the allotment.
- Lack of livestock water, or poor distribution of livestock water, may result in reduced pasture/allotment use periods.
- Livestock use of planned rested pastures due to drought would not be authorized.

Any adaptive management actions necessary due to drought conditions would be made by the Responsible Official in consultation with the range specialist and the permittee.

Structural Range Improvements

Climate change may require land managers and users to be more flexible in the future. It is possible that as climate change continues there will be a need for additional waters on the Angell Allotment to help improve livestock distribution and management on the allotment. Through the construction of pipelines, troughs and water lots, the grazing permittee will be better able to implement adaptive management on the Angell Allotment. Under this alternative the following four groups of structural range improvements would be altered or constructed, all proposed structural range improvements would help improve livestock distribution, allotment management and increase adaptive management options:

1. To allow for range of adaptive management options, improve livestock distribution and allotment management, a new water pipeline and trough would be constructed in the southwestern portion of the Cocrane pasture and the southeastern portion of Cinder Hill pasture. The pipeline would run along the pasture fence between Cocrane pasture and Luepp Road (Appendix C, Figure 5). The new pipeline and trough would create new livestock watering locations for both Cocrane and Cinder Hill pastures. The source for this new pipeline and trough is the existing pipeline in the Cocrane pasture and the initial project plan is to construct the new pipeline as an above ground pipeline.

2. To improve livestock distribution and allotment management, two new water pipelines would be constructed in South Angell pasture with troughs located at the terminal end of the pipelines (Appendix C, Figure 6). The source for these new pipelines is the existing pipeline in the South Angell pasture and the initial project plan is to construct the new pipelines as above ground pipelines.

3. The existing water lot currently servicing Crip and Cinder Hill pastures would be expanded to also service the O'Neil pasture (Appendix C, Figure 7). The expansion of this water lot would allow for better livestock distribution and improved livestock management within the O'Neil pasture by providing an additional water source

4. A water lot would be constructed in the southeast corner of Cinder Hill pasture that would also be accessible from Cocrane pasture (Appendix C, Figure 5). This water lot would be constructed around the trough proposed in #1 above. The construction of this water lot would allow for better livestock distribution and improved livestock management in Cinder Hill and Cocrane pastures.

All structural range improvements are listed in the TGP. New structural range improvements would be added to the TGP as they are constructed. Maintenance responsibility for each structural

range improvement is also listed in the TGP. In general, maintenance responsibility will fall to the holder of the TGP or the permittee. Prior to any construction of proposed structural range improvements National Historic Preservation Act Section 106 compliance would be completed. Project resource protection measures would also be in place, which would include complete avoidance of any archeological sites or features. All range improvements would follow the site-specific Construction Guidelines. The Forest Service uses plan direction, Forest Service Manual 2200 Chapter 2240 and a number of sources to identify specific guidelines for each project; some of the sources include:

- Sanderson, H. Reed; Quigley, Thomas M.; Swan, Emery E.; Spink, Louis R.1990. Specifications for structural range improvements. Gen. Tech. Rep. PNWGTR-250. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 120 p.
- USDA Forest Service, USDI Bureau of Land Management. 1999. Fences. 210 pp.
- AZGFD. 2011. Wildlife Compatible Fencing. Arizona Game and Fish Department, Phoenix, AZ. 34 pp.

Monitoring

Two types of monitoring would be used, implementation and effectiveness monitoring. Implementation monitoring would be conducted on an annual basis and would include: permit compliance livestock actual use data, seasonal utilization evaluations during the grazing season (within key areas), assessments of forage production and ground cover and precipitation monitoring.

Utilization monitoring would occur at the end of the growing season within each of the main grazing pastures. Utilization is defined as the proportion or degree of current year's forage production that is consumed or destroyed by animals (including insects). Utilization is measured at the end of the growing season when the total annual production can be accounted for and the effects of grazing in the whole management unit can be assessed.

Utilization measurements would be taken in key areas which reflect grazing effects within an entire pasture. A minimum of one key area would be established within each main grazing pasture, at existing long-term monitoring sites if possible, to represent overall pasture utilization. Utilization guidelines are not intended as inflexible limits. Utilization measurements can indicate the need for management changes prior to this need being identified through long-term monitoring. Utilization data would not be used alone, but would be used along with reporting of the number of AUMs grazed (actual use), climate and condition/trend data, to determine authorized AUMs and pasture rotations for future years.

Effectiveness monitoring to evaluate the success of management in achieving the desired objectives would occur within key areas on permanent transects at an interval of approximately 10 years. Effectiveness monitoring may also be conducted if data and observations from implementation monitoring indicate a need. Monitoring frequency of vegetation and soil condition and trend would be accomplished collaboratively by Forest Service personnel, permittee, and cooperating agencies as funding, personnel, and time are available. Both qualitative and quantitative monitoring methods would be used in accordance with the Interagency Technical References, Region 3 Rangeland Analysis and Management Training

Guide, and the Region 3 Allotment Analysis Handbook. Soil assessments would also be performed on the allotment in coordination with the soil and range programs.

Adaptive Management

The Current Management alternative includes adaptive management, which provides a menu of management options that may be needed to adjust management decisions and actions to meet desired conditions as determined through monitoring. If monitoring indicates that desired conditions are not being achieved, management would be modified in coordination with the permittee. Adaptive management allows the Forest Service to adjust the following: the timing, intensity, frequency and duration of grazing; the grazing management system, and livestock numbers. If adjustments are needed, they are implemented through the Annual Operating Instructions (AOI), which may be amended throughout the grazing season.

Table 10 below identifies several examples of management evaluation points and management options to describe scenarios when adaptive management would be used as part of implementation. This is not an all-inclusive list.

Table 10: Management Evaluation Points and Adaptive Management Options.

Management Evaluation Point The “If” Statement	Adaptive Management Response Options The “Then” Statement
If existing and predicted forage production falls below average because of climatic conditions,	Authorized livestock numbers may be reduced, the grazing season may be adjusted, pasture use period may be adjusted or any combination of these options.
If available water is below average,	Authorized livestock numbers may be reduced, the grazing season may be adjusted, pasture use period may be adjusted, water hauling for livestock use may be required or any combination of these options.
If grazing utilization is in compliance with the up to 40 percent guideline,	Continue current management system.
If grazing utilization is NOT in compliance with the up to 40 percent guideline,	The strategy for that pasture the following year may be either be to rest it, graze it at lighter intensity, or shorten the use period. The season of use or timing of grazing the next year may be changed The permittee would be required to implement additional strategies to more evenly distribute forage use such as use of salt blocks.

Management Evaluation Point The “If” Statement	Adaptive Management Response Options The “Then” Statement
If seasonal utilization is NOT in compliance with the up to 50 percent guideline,	Livestock might leave that pasture early The strategy for that pasture the following year may be to rest it, graze it at lighter intensity, or shorten the use period. The season of use or timing of grazing the next year may be changed The permittee would be required to distribute livestock use better.
If wildfires and/or prescribed burning occur in pastures.	Based on the severity and extent of the fire and the condition of the vegetation afterwards, resting or deferrment of pastures may be considered.

Resource Protection Measures

The action alternatives are designed to comply with Forest Plan standards and guidelines, as amended. Resource protection measures are design features that would be incorporated into the project to protect soil, water, scenery values, cultural resources, wildlife and aquatic habitat, and rare plants. Mitigation measures and best management practices would be implemented to prevent the introduction and spread of invasive plants, to retain water in earthen stock ponds for wildlife, to protect heritage resources, and to protect public health and safety during project implementation. Specific design features include but are not limited to the following:

- Prevention measures from the State of Arizona Aquatic Invasive Species Management Plan (AZGFD 2011) would be required to avoid spreading aquatic invasive nuisance species and pathogens during tank cleaning activities.
- At least 60 days prior to the start of maintenance of earthen stock tanks, the permittee would be required to contact the District so biological and heritage surveys can be completed, if needed and mitigation measures for the protection of aquatic species including could be implemented.
- Salt or mineral supplement locations should be rotated annually and avoid areas where livestock concentrations could cause excessive vegetation trampling, soil loss or disturbance to sensitive species or habitats. Salt and mineral supplements should not be placed closer than ¼ mile from a water source.
- Management practices which tend to concentrate livestock (and most likely wild ungulates), such as placement of salt or water troughs, will be located away from known cultural resources.
- Any construction of new fences or reconstruction of fences would be done in accordance with specifications developed to facilitate wildlife passage.

- Project work on structural range improvements and/or new construction of structural range improvements would be carried out when when soils are dry enough to support heavy equipment without creating compaction or ruts.
- Use grazing best management practices (BMPs) in keeping with Arizona Administrative Code R18-9-501. Grazing management and mitigation practices which could be considered for these allotments are described in the National Management Measures to Control Nonpoint Source Pollution from Agriculture published by EPA in 2003. This publication can be downloaded at http://www.epa.gov/owow/nps/agmm/index.html.
- Spread of potential and existing noxious or invasive weeds by heavy equipment used in the maintenance or construction of structural range improvements will be prevented by cleaning the heavy equipment before entering the area and by avoiding weed infestations during travel. Noxious or invasive weed populations that may occur in areas of proposed structural improvements will be identified and treated.
- Incorporate the Best Management Practices (BMPs) for noxious or invasive weeds as listed in Appendix B of the 2005 Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds into all management actions.
- Water will be left in troughs when cattle leave the pastures per forest-wide Forest Plan direction.
- All new and existing open storage tanks and drinkers would be fitted with entry and escape ramps for wildlife. These ramps would be built to current Bat Conservation International specifications and installation would be coordinated with both the range and wildlife staff.
- Monitoring/site inspections within the grazing allotment will continue as a part of the day to day activities of forest archaeologists.
- Any ground disturbing range developments or vegetation treatments within the allotment will comply with the existing Region 3 Programmatic agreement with the Arizona State Historic Preservation Officer, dated December 24, 2003, and shall constitute an undertaking for Section 106 compliance.
- Prior to ground disturbing activities, archaeological sites will be identified and marked for avoidance. If previously unrecorded cultural resources are encountered during ground-disturbing activities, all work must cease in the immediate vicinity of the discovery and steps would be taken to secure the site. Work should not resume until the federal agency archaeologist has been notified and have determined an appropriate course of action.

Comparison of Alternatives

Tables 11 and 12 below provides a summary of the proposed actions by alternative and the potential effects of implementing each alternative considered in detail. A more in-depth analysis of potential effects of implementing each alternative is discussed in Chapter 3 of this document. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 11: Comparison of Alternatives.

Action	Alternative 1	Alternative 2	Alternative 3
Permitted Season of Use	N/A	5/15-10/31	6/1-11/15
Permitted numbers	0 AUMs	425 head or 2,375 AUMs	425 head or 2,350 AUMs
Fence – expansion of existing water lot; Crisp, Cinder Hill and O'Neil pastures	0	0	Approximately 0.22 miles/2 acres
Fence – new water lot; Cinder Hill and Cocrane pastures	0	0	Approximately 0.30 miles/3 acres
Water Distribution – pipeline and trough, Cocrane pasture	0	0	Approximately 0.72 miles of pipeline, 1 trough
Water Distribution – 2 Pipelines and 2 troughs, South Angell pasture	0	0	Approximately 3 miles of pipeline, 2 troughs

Table 12: Comparison of Effects by Alternative.

Measure	Alternative 1	Alternative 2	Alternative 3
Vegetation diversity and density	Static or move upwards during favorable climatic conditions, except where overstory limits improvement potential	Static or move upwards during favorable climatic conditions, except where overstory limits improvement potential	Static or move upwards during favorable climatic conditions, except where overstory limits improvement potential
Vegetation production and quality for forage plants	Not expected to be maintained or enhanced over a large portion of the allotment	Maintained or enhanced over a large portion of the allotment	Maintained or enhanced over a large portion of the allotment
Vegetation production and quality for non-forage plants	Stable	Stable	Stable
Water sources available for wildlife	Decreased because of lack of maintenance of waters.	Stable/maintained	Stable/maintained, 1 additional water source in Cocrane pasture, 2 additional water sources in South Angell pasture
Condition of allotment and pasture Fences	Decreased because of lack of maintenance, would likely become an entanglement/impalement hazard for wildlife	Stable/maintained	Stable/maintained, expansion of one water lot fence, construction of one new water lot fence
Biological soil crusts	No effect	Incidental damage	Incidental damge
FS Sensitive Plant species	No effect on FS sensitive plant species	May impact individuals of Sunset Crater Beardtongue but is not likely to result in a trend toward federal listing or loss of viability.	May impact individuals of Sunset Crater Beardtongue but is not likely to result in a trend toward federal listing or loss of viability.

Measure	Alternative 1	Alternative 2	Alternative 3
Invasive weeds control and detection	Lower rates of detection	Control needs similar to current conditions with use of BMPs during construction of improvements Similar rates of detection.	Control needs similar to current conditions with use of BMPs during construction of improvements. Similar rates of detection.
Forest Service Sensitive wildlife species	No impact[6] ; may impact individuals of these species but are not likely to result in a trend toward Federal listing or loss of viability of the species[7]	May impact individuals of these species but are not likely to result in a trend toward Federal listing or loss of viability of the species	May impact individuals of these species but are not likely to result in a trend toward Federal listing or loss of viability of the species
Bald and Golden Eagle Act Compliance	Would not result in take of golden eagles	Would not result in take of golden eagles	Would not result in take of golden eagles
MIS species	No change in pronghorn habitat quantity or quality.	No change in pronghorn habitat quantity or quality.	Improvement in quality of 242 acres of pronghorn habitat.
Migratory Birds	Would not result in unintentional take of individuals and would not lead to a decline in migratory bird populations.	Would potentially result in unintentional take of individuals but would not lead to a decline in migratory bird populations.	Would potentially result in unintentional take of individuals but would not lead to a decline in migratory bird populations.
Threatened and Endangered wildlife species findings (Black-footed Ferret)	No impact	Impacts to ferret prey and their habitats would be minimal.	Impacts to ferret prey and their habitats would be slightly greater than Alternative 2, but would still be minimal.

[6] This includes Navajo Mogollon vole and western burrowing owl.

[7] This includes western red bat, spotted bat, Allen's lappet-browed bat, pale Townsend's big-eared bat and northern goshawk.

Measure	Alternative 1	Alternative 2	Alternative 3
Effects to Scenic Resources	No effect	Minimal short term effects from construction and maintenance of improvements In the long term, existing scenic integrity maintained and moving towards desired landscape character	Minimal short term effects from construction and maintenance of improvements In the long term, existing scenic integrity maintained and moving towards desired landscape character
Effects to Recreation Opportunity Spectrum	No effect	No effect	No effect
Effects to heritage resources	No effect	May effect, not likely to adversly effect due to resource protection mesures	May effect, not likely to adversly effect due to resource protection mesures
Economics - Direct and Indirect Jobs*	0	4.85 jobs	4.85 jobs
Economics - Federal Payments to Counties**	0	$801.56	$793.13
Benefit/Cost Ratio for Forest Service	NA	0.75	0.69
Benefit/Cost Ratio for the Permittee	NA	2.70	2.57
Benefit/Cost Ratio for all partners	NA	1.50	1.00

Chapter 3 - Affected Environment and Environmental Consequences

This section summarizes 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. More detail for these environments as they pertain to specific resource areas is provided in relevant resource area sections below and elaborated upon in the specialist reports located in the project record and available for review by contacting the Flagstaff Ranger District office. This section also presents the scientific and analytical basis for the comparison of alternatives presented in Tables 11 and 12 above.

Acres discussed in the analysis for the Angell Allotment may differ slightly depending on which resource is being analyzed. In general these acreage differences are less than 0.1 percent of the project area and are a result of rounding errors and slight boundary differences that occur when combining multiple geospatial data layers.

Rangeland Resources

Affected Environment

Rangeland condition is evaluated by measuring how well ecosystem processes are functioning on the land. Evidence of properly functioning processes is expressed largely through the vegetative and soil components of each community.

Vegetation Cover Type

Within the Angell Allotment, the Potential Natural Vegetation Types (PNVT) with the largest extents are pinyon-juniper grassland (44,198 acres) and ponderosa pine (4,932 acres). Table 13 below shows the breakdown by acres of the PNVTs on the Angell Allotment.

Table 13: Potential Natural Vegetation Types (PNVT), by acres, in the Angell Allotment.

PNVT	Acres	% of Allotment*
Great Basin Grassland	227	0.44
Montane Subalpine Grassland	329	0.64
Pinyon Juniper Grassland	44198	85.68
Pinyon Juniper Woodland (Persistent)	1869	3.62
Ponderosa Pine	4932	9.56
Total	**51555**	N/A

*Percentages don’t add up as some of the PNVTs overlap.

Environmental Consequences

The following section discloses the direct, indirect and cumulative effects per alternative for vegetation height and canopy cover, vegetation diversity and density, vegetation production and quality and structural range improvements.

Direct and Indirect Effects

Alternative 1: No Action

Vegetation Height and Canopy Cover

Under the No Action Alternative, seasonal reductions in vegetation height and canopy cover resulting from livestock grazing would not occur. Livestock grazing reduces plant height and canopy cover as a result of livestock consumption or trampling; however this is only a temporary reduction because those plants will recover under favorable climatic conditions. Seasonal reductions in plant height and canopy cover would continue in localized areas as a result of wildlife use. Within these localized areas, recovery of plant height and canopy cover is expected under favorable climatic conditions except in areas that are continuously grazed by wildlife.

Vegetation Diversity and Density

Changes in range condition and trend, as measured by changes in vegetation density (number of plants per unit area) and vegetation diversity (number of different plant species present in a given area) may be observed under this alternative. The degree to which those vegetative changes would occur in the absence of livestock grazing has not been well researched, and existing studies report a range of outcomes resulting from the absence of livestock grazing. Courtois, et al (2004) found few differences in species composition, cover, density, and production in comparing 16 long-term livestock exclosures (65 years) with adjacent areas that had been moderately grazed. Loeser, et al (2006) found that cattle removal resulted in little increase in native plant cover and reduced plant species richness relative to the moderate grazing control in an 8 year study in north-central Arizona.

Due to their palatability and early season availability, cool-season plant species would continue to receive a disproportionate share of the grazing by wildlife under this alternative. This could affect the vegetative diversity within portions of the analysis area as cool-season plants are either allowed to recover from the effects of wildlife grazing or they are continually grazed. In the case of continual grazing by wildlife, the eventual result may be a reduction in cool-season species which would reduce plant species diversity (Archer and Smeins 1991; Briske D.D. 1991; Szaro, et al. 1999; Vavra et al. 1994).

Under this alternative, range condition and trend within most of the analysis area is expected to remain static or move upward during periods of favorable climatic conditions. The exception to this would occur in areas where overstory species limit the improvement potential of understory species (Jameson 1967) or in areas that are continuously grazed by wildlife; range condition and trend in these areas would likely remain static or continue to decline during periods of favorable climatic conditions. During periods of unfavorable climatic conditions, range condition and trend is expected to decline at all locations within the analysis area commensurate with the severity and duration of unfavorable climatic conditions. Under this alternative, the ability for improvement in range condition and trend would be most affected by climatic conditions (Sprinkle, et al, 2007).

Vegetation Production and Quality

Changes in vegetation production (amount of plant biomass above ground produced in a given year) and vegetation quality (the nutritional value and palatability of plant biomass) of forage species (herbaceous and woody palatable plant species available for food to herbivores) within the analysis area are expected under this alternative. Holechek (1981) reported that forage production and quality is maintained and enhanced by light to moderate grazing. Patton, et al (2007) found that low to moderate levels of grazing can increase vegetative production over no grazing, but that the level of grazing that maximizes vegetation production depends upon the growing conditions of the current year.

Under this alternative, livestock grazing would not occur and as a result, vegetation production and the quality of forage species would not be maintained or enhanced over a large portion of the analysis area. Changes in vegetation production and quality of non-forage vegetation species is expected to remain unchanged under this alternative. Wildlife would continue to graze within the analysis area and provided the wildlife use continues to be seasonal and transitory, vegetation production and quality of forage species would be maintained in localized areas. If wildlife use within these localized areas were to substantially increase in intensity (such as if the wildlife use became yearlong and continuous, or if these localized areas became the only available foraging areas due to wildfire in adjacent areas) vegetation production and quality would not be maintained as a decrease in vegetation diversity and density would likely occur.

Existing Structural Range Improvements

Operation and maintenance of existing structural range improvements is the responsibility of the grazing permittee. Under this alternative livestock grazing would not occur and there would be no grazing permittee; as a result, operation and maintenance of existing structural range improvements would not occur. This would result in an immediate loss of available water for wildlife since the existing pipeline/drinker system would no longer be operated. Indirect effects due to the lack of improvement maintenance would be realized through a long-term loss of water available for wildlife as stock tanks fill with sediment and as the pipeline/drinker system is no longer operated and degrades. Additionally, as fences degrade due to lack of maintenance, they may become an entanglement/impalement hazard for wildlife (AZGFD, 2011).

Alternative 2: Current Management

Direct and indirect effects for this alternative are the same as the effects identified and discussed for the Proposed Action Alternative with the exception of new structural range improvements which are not proposed in the Current Management Alternative.

Currently, portions of the Cocrane, Cinder Hill, and South Angell pastures are indirectly being affected due to the lack of readily available surface water. Because there is not a reliable and well distributed surface water source in these pastures livestock distribution can be difficult. As a result, there are times when distribution of livestock is inadequate.

Alternative 3: Proposed Action

Vegetation Height and Canopy Cover

Under this alternative, seasonal reductions in herbaceous vegetation height and canopy cover resulting from livestock grazing would occur. Reductions in herbaceous plant height and canopy cover would continue in localized areas as a result of wildlife use. Under favorable climatic conditions the reduction of herbaceous vegetation height and canopy cover is temporary and recovery of plant height and canopy cover is expected within the same growing season except in areas that are continuously grazed by wildlife. Under favorable climatic conditions the management guidelines for grazing periods, frequency of grazing, forage utilization, and grazing intensity are expected to:

- Maintain or improve vegetative canopy cover and vegetative ground cover.
- Maintain soil condition within the areas currently identified as having satisfactory soil condition.
- Improve soil condition within the areas currently identified as having impaired soil condition except in those areas where overstory species limit the improvement potential.

Adaptive management would provide the ability to modify the management guidelines as needed to maintain vegetation height and canopy cover during periods of unfavorable climatic conditions. Annual implementation monitoring would be used, in part, to determine if there is a need to adjust livestock management. During periods of unfavorable climatic conditions the management guidelines for grazing periods, frequency of grazing, forage utilization, and grazing intensity would be modified to accomplish the following:

- Maintain or minimize the reduction of vegetative canopy cover and vegetative ground cover.
- Maintain or minimize the reduction of vegetation necessary for soil stability.

Vegetation Diversity and Density

Livestock grazing can have an effect on plant species composition depending on the timing of grazing. For instance, spring and early summer grazing occurs mainly on cool season species. Once the monsoon season begins, grazing occurs mainly on warm season species. As the weather cools in the fall, use changes back to cool season species. Under this alternative, the grazing use period within a pasture is seasonally rotated so that forage is grazed and rested at different times each year. By alternating the livestock use and rest periods on cool and warm season species, plant species composition could be maintained or improved. Additionally, adaptive management and annual implementation monitoring would provide management options and the necessary resource information to adjust the timing, intensity, frequency and duration of livestock grazing to ensure that vegetation condition is maintained or improved.

Milchunas (2006) reported that spring grazing could be especially detrimental to cool-season grasses in the Arizona pinyon-juniper type. However, excellent vegetation diversity and density can be maintained, "…if proper utilization levels were maintained, but condition could decline during drought." Under this alternative, through effective implementation of the management guidelines, annual implementation monitoring, and adaptive management, range condition and trend (as measured by changes in vegetation diversity and density) is expected to remain static or move upward during periods of favorable climatic conditions, except in areas where overstory species limit the improvement potential of understory species (Jameson, 1967) or in areas that are continuously grazed by wildlife. During periods of unfavorable climatic conditions, range condition and trend is expected to decline at all locations within the analysis area commensurate with the severity and duration of unfavorable climatic conditions. The ability for improvement in range condition and trend would be most affected by climatic conditions (Sprinkle, et al. 2007).

Vegetation Production and Quality

Vegetation production (amount of plant biomass above ground produced in a given year) and vegetation quality (the nutritional value and palatability of plant biomass) of forage species (herbaceous and woody palatable plant species available for food to herbivores) within the analysis area are expected to be maintained under this alternative. There are few studies to base conclusions on the effects of grazing to understory vegetation production of the pinyon-juniper type, yet available evidence suggests that there can be declines or increases in production based on a variety of factors such as historic grazing practices, pinyon-juniper canopy cover, and historic distribution of grazing species such as bison (Milchunas 2006, Milchunas 2013). Long-term monitoring data in conjunction with more site-specific research of livestock grazing in the general area of the Angell Allotment suggests that given average climate conditions forage production and quality will be maintained or slightly improved with conservative grazing levels and flexible livestock management as proposed in this alternative. Similarly, conservative use and adaptive management is expected to limit the effects of grazing during periods of drought, so that vegetation can be resilient and return to increased production and quality when climatic

conditions improve (Vogel 2012). Holechek (1981) reported that forage production and quality is maintained and enhanced by light to moderate grazing. Loeser et al. (2004) showed evidence of increased aboveground productivity in response to defoliation from cattle grazing. Patton, et al (2007) found that low to moderate levels of grazing can increase vegetative production over no grazing, but that the level of grazing that maximizes vegetation production depends upon the growing conditions of the current year.

Under the Proposed Action Alternative, managed livestock grazing would occur and as a result, vegetation production and vegetation quality of forage species would be maintained or improved over a large portion of the analysis area. Changes in vegetation production and quality of non-forage vegetation species is expected to remain unchanged under this alternative.

Wildlife would continue to graze within the analysis area and provided the wildlife use continues to be seasonal and transitory, vegetation production and quality of forage species would be maintained or enhanced in combination with managed livestock grazing. Vegetation production is expected to be average to above average during periods of favorable climatic conditions. During periods of unfavorable climatic conditions, vegetation production is expected to decline, but would maintain resiliency for when climatic conditions improve (Loeser et al. 2007).

Existing Structural Range Improvements

Under this alternative, existing structural range improvements will be maintained and operational. The operation and maintenance of existing structural range improvements would have short-term direct effects to upland vegetation. Plant height and canopy cover would be reduced in the immediate area due to maintenance activities and trampling of vegetation is expected in the immediate area surrounding water sources; however, plant height and canopy cover would recover with favorable climate conditions. Operating and maintaining existing structural improvements will allow for the implementation of managed livestock grazing and provide the necessary infrastructure to control grazing periods, frequency of grazing, grazing intensity, and forage utilization.

Existing allotment and pasture fences will be maintained annually. Maintaining existing fences will reduce the chance of entanglement/impalement for wildlife (AZGFD, 2011). Existing fences may be modified or upgraded to current wildlife specifications described in the current Forest Plan. When existing fences reach the end of their functional lifespan they will be reconstructed to current wildlife specifications.

Existing earthen stock ponds will be maintained and water distribution systems (wells, pipelines, water storage tanks, and troughs) will be maintained and operational. Functional livestock water developments are necessary for managed livestock grazing but also provide important/critical water sources for wildlife.

New Structural Range Improvements

Under this alternative the following structural range improvements would be altered or constructed:

1. To improve livestock distribution and allotment management, a new water pipeline and trough will be constructed in the southwestern portion of the Cocrane pasture and the southeastern portion of Cinder Hill pasture. The pipeline will run along the pasture fence between Cocrane pasture and Luepp Road (Appendix C, Figure 5). The new pipeline and trough will create new livestock watering locations for both Cocrane and Cinder Hill pastures. The source for this new pipeline and trough is the existing pipeline in the

Cocrane pasture and the initial project plan is to construct the new pipeline as an above ground pipeline.

2. To improve livestock distribution and allotment management, two new water pipelines will be constructed in South Angell pasture with troughs located at the terminal end of the pipelines (Appendix C, Figure 6). The source for these new pipelines is the existing pipeline in the South Angell pasture and the initial project plan is to construct the new pipelines as above ground pipelines.

3. The existing water lot currently servicing Crisp and Cinder Hill pastures would be expanded to also service the O'Neil pasture (Appendix C, Figure 7). The expansion of this water lot would allow for better livestock distribution and improved livestock management within the O'Neil pasture by providing an additional water source

4. A water lot would be constructed in the southeast corner of Cinder Hill pasture that would also be accessible from Cocrane pasture (Appendix C, Figure 5). This water lot would be constructed around the trough proposed in #1 above. The construction of this water lot would allow for better livestock distribution and improved livestock management in Cinder Hill and Cocrane pastures.

The proposed water lot fence and pipeline and trough construction would provide additional water for livestock and wildlife and allow for better livestock distribution and improved livestock management. Newly constructed pipeline would connect to an existing water source on private land. Upland plant height ground and ground cover would be improved near existing water facilities.

These activities would have short-term direct effects to upland vegetation. Plant height and canopy cover would be reduced in the immediate area due to fence and pipeline construction activities (approximately 5.5 acres); however, plant height and canopy cover would recover with favorable climate conditions. Plant production would be reduced within the foot print of the troughs, and is not expected to recover during the life of the trough. Placement of the troughs in the South Angell pasture and the Cocrane and Cinder Hill water lot would create an area of common livestock and wildlife congregation which will result in heavy utilization levels within an approximately 100 meter (300 feet) radius around the trough. Plant height and canopy cover would be reduced in the high use area adjacent to the troughs during the time periods when cattle and wildlife have access to the troughs, and during other periods of the year when only wildlife have access to the troughs and water is present. The impact of these high use areas would affect approximately 10.5 acres (less than one-tenth of 1% of the allotment). Within the high use areas that would result from the three new water troughs, plant height and canopy cover would recover with favorable climate conditions except in the areas of high soil compaction immediately around the troughs (approximately 50 foot radius; 0.2 acres per trough).

Cumulative Effects

The past, present, and reasonably foreseeable future activities considered in the cumulative effects analysis for upland vegetation include dispersed recreation, firewood gathering, weed treatments, hunting, roads, off-highway vehicle (OHV) use, wildfires which have occurred within the Angell Allotment boundary since 2000 and wildlife use. The geographical extent of the cumulative effects analysis is confined to the Angell Allotment boundary. The timeframe selected for this analysis is 20 years; 10 years in the past and 10 years in the future (Appendix E).

Common to all Alternatives

Wildlife would continue to graze within the analysis area creating localized impacts. Activities identified above would also continue, creating localized impacts to upland vegetation.

Changes in road management and motor vehicle use through the Travel Management Plan has reduced the amount of off-road travel and is expected to effectively close additional miles of road within the project area over the next decade, resulting in a slight increase in potential forage on the allotment. Reduction in off-road travel in combination with each alternative would cumulatively lessen the impact to the upland vegetation across the Angell Allotment.

Six wildfires have occurred within the boundary of the Angell Allotment since 2000, impacting about 7,300 acres. Impacts to herbaceous cover were favorable due to the high morality of juniper, which increased understory vegetation density and diversity in years following the fires. In general above ground vegetation is removed during and immediately (one to two years) following a wildfire. However, given favorable climatic conditions there can be an increase in vegetation density, diversity, production and canopy cover of herbaceous species (Coultrap et al. 2008).

Vegetation density, diversity, production and canopy cover fluctuate naturally in response to inter-annual and annual climate variability, including timing and amount of precipitation. Periods of favorable climatic conditions can result in increased vegetation density, diversity, production and canopy cover. Periods of unfavorable climatic conditions can result in decreased vegetation density, diversity, production and canopy cover.

Climate change is predicted to result in periods of extreme climatic conditions in both temperature and precipitation. Climate change in the North American southwest is predicted to lead to decreased winter precipitation throughout the current century (Seager and Vecchi 2010). This decline in winter precipitation could lead to a decrease in vegetation dependent on winter precipitation. Although winter precipitation is important for annuals and cool season grasses as well as replenishment of soil moisture, rangeland productivity in the southwest is primarily controlled by summer precipitation delivered by the North American monsoon (McCollum et.al. 2011). The effect of climate change on the North American Monsoon, which accounts for roughly half the precipitation on the Angell Allotment, is uncertain, however; recent research suggests a delay in the onset of the monsoonal activity with no change in total precipitation (Cook and Seager 2013). Based on the inclusion of adaptive management techniques in the action alternatives that would enable adjustment of the timing, intensity, distribution and numbers of livestock; the effect of climate change in the coming decade is not expected to result in a cumulative impact in the abundance of upland vegetation over the long-term, but may affect the availability of this vegetation during the growing season and the species composition of forage resources.

Alternative 1: No Action

Under the No Action Alternative livestock grazing will not be authorized and therefore there will be no cumulative effects to upland vegetation due to livestock grazing.

Alternative 2: Current Management

Under this alternative, adaptive management and annual implementation monitoring would provide the ability to modify livestock management as needed to maintain or improve vegetation conditions under varying climatic conditions. As a result, there would be no cumulative effects from this alternative that would be additive to the potential effects of climate change.

Wildlife would continue to graze within the analysis area and provided the wildlife use is seasonal and transitory, vegetation production and quality of forage species would be maintained or enhanced in combination with managed livestock grazing. If heavy wildlife use occurs continuously throughout the year in combination with managed livestock grazing, vegetation production and quality will not be maintained as a decrease in vegetation diversity and density would likely occur. Vegetation production is expected to be average to above average during periods of favorable climatic conditions. During periods of unfavorable climatic conditions, vegetation production is expected to decline, but maintain resiliency for improvement when conditions change (Loeser et al. 2007).

Treatment of noxious weeds would result in localized, short term reductions in plant height, canopy cover, and vegetation production due to the physical defoliation and crushing of understory vegetation related to mechanical/vehicular weed treatment activities. However, these effects would be temporary and recovery would typically occur in one growing season under favorable climatic conditions. In the long term, weed treatment projects would remove, or control the spread of, noxious weed species which would result in maintaining vegetation density, vegetation diversity, plant height and canopy cover, and vegetation production within the analysis area.

Recreation (camping, hiking, biking, etc.), hunting and firewood gathering all result in reductions in plant height, canopy cover, and vegetation production due to the physical defoliation and crushing of understory vegetation primarily related to the vehicular use associated with these activities. Except in areas that receive continuous recreational and vehicular use, the effects to plant height, canopy cover, and vegetation production would be temporary and recovery would typically occur in one growing season under favorable climatic conditions. There are no indications that current recreation, hunting and firewood gathering would increase in area or magnitude during the 10-years identified for spatial boundaries and thus there are no cumulative impacts expected from these uses with livestock grazing.

Wildfires are always a possibility and any future wildfires in the Angell Allotment would most likely improve herbaceous cover and reduce bare soil by increasing the mortality of overstory species such as juniper that outcompete native perennial plants. Effects from wildfire include removal of herbaceous cover, however these effects would be temporary and depending on the type of wildfire recover would typically occur within one to five growing seasons under favorable climatic conditions.

Off Highway Vehicle (OHV) use results in reductions in plant height, canopy cover, and vegetation production due to the physical defoliation and crushing of understory vegetation. Except in areas that receive continuous OHV use, the effects to plant height, canopy cover, and vegetation production would be temporary and recovery would typically occur in one growing season under favorable climatic conditions. Changes in road and OHV management through the Travel Management Plan will continue to lessen the impact to the upland vegetation within the analysis area through a reduction in the number and mileage of roads open for vehicular use and the elimination of unauthorized off-road vehicle use.

Alternative 3: Proposed Action

Cumulative effects for this alternative are the same as the effects identified and discussed for the Alternative 2, with the exception of new construction of structural range improvements.

The addition of three troughs to the allotment will help alleviate cumulative effects to soil and upland vegetation during drought by allowing for better distribution of wildlife on the allotment.

Soils

Affected Environment

This section describes the potential effects of the alternatives on soil condition. This analysis does not describe individual soil types, but rather focuses on the condition of the soil. This section does not break down the condition of the soil pasture by pasture; it focuses on specific areas with the most substantial problems.

The description of existing conditions of soil resources in the analysis area is based on field visits conducted in 2014 supplemented with information published in the Coconino National Forest (CNF), Terrestrial Ecosystem Survey (TES) (Miller, et. al. 1995) and soil erosion modeling of TEUs identified as satisfactory, but inherently unstable. Soil conditions were assessed at four sites within three TEUs during January 2014 using the soil condition assessment protocol developed by Region 3 of the U.S. Forest Service (FS) (FSH 2509.18-99-1) and Technical Guidance for Soil Quality Monitoring in the Southwest Region (Robbie, 2012). Soil condition assessment forms are included in the project record. A summary of TEU soil conditions is included in Table 14.

Table 14. Soil conditions by TEU within the allotment.

Soil Condition by TEU	Area (acres)	Percentage of Project Area
Impaired, Total	2624.4	5.09%
Satisfactory, Total	48117.4	93.28%
Satisfactory, but inherently unstable, total	842.1	1.63%
Total Area (acres)	51583.8	100.0%

Satisfactory soils were those in which the predicted long-term annual soil loss under TES-surveyed vegetative cover conditions was less than an estimated tolerable soil loss rate assigned to each TEU. Unsatisfactory soils were those in which the predicted long-term annual soil loss rate under surveyed vegetative cover conditions was greater than the tolerable soil loss rate. Unsuited (i.e., satisfactory but inherently unstable) soils were those in which the predicted long-term annual soil loss rate under reference vegetative cover conditions (taken to be natural or potential vegetative cover conditions) exceeded the tolerable soil loss rate, conditions which often occur on slopes exceeding 40 percent.

Pastures located in ponderosa pine vegetation types have satisfactory soil conditions and offer full capability for grazing. Grazing with a conservative allowable use and an adaptive management strategy would maintain this satisfactory soil condition and long-term soil productivity.

Environmental Consequences

Direct and Indirect Effects

Direct/indirect and cumulative effects to soils were analyzed within the allotment. This spatial scale of analysis is used as soils are most likely to be impacted by activities occurring at or in their immediate vicinity. Soil condition assessments, where available, were used for determining current soil condition and the potential effects of the proposed action and its alternatives on soil resources.

Alternative 1: No Action

Under this alternative, livestock grazing would not occur and as a result, there would be no direct or indirect effects from cattle grazing on soils within the portion of the allotment on Forest Service-managed lands.

Alternative 2: Current Management

Grazing, either by livestock or wildlife, has the potential to impact soils primarily through impacts to vegetative cover, since vegetative cover protects the soil from raindrop impact and sheetflow-induced shear stress and through alteration of soil infiltration rates by compaction. The effects of the hoof action of cattle have been reported to be both beneficial to soils by maintaining or increasing above-ground biomass (Loeser 2004); breaking up surface crusts and enhancing seedbed preparation of the soil (Savory 1988, Nash et al. 1999); and detrimental to soils in terms of decreased infiltration and aeration of the soil through hoof compaction (Gifford and Hawkins 1978). These contrasting effects may be representative of the complexity of rangeland ecosystems and explained by differences in grazing intensity. By reducing soil aeration and infiltration, soil compaction can decrease soil productivity and increase runoff exposing the soil to increased shear stress and erosion; however, areas of extensive soil compaction are generally only found in the immediate vicinity of water sources where cattle tend to congregate.

Biological soil crusts, sometimes referred to as cryptogamic crusts or microphytic crusts, are found throughout the world and generally consist of non-vascular plant groups including lichens, mosses, and algae (Belnap, 2001). These crusts have important functions including but not limited to the protection of soils from wind and water erosion, and increasing soil nutrients (Beymer and Klopatek, 1992). Biological crusts are susceptible to trampling whether it be from humans, livestock, or wild ungulates. Cattle grazing has been shown to reduce the total cover and biomass of biotic crusts in various sites in northern Arizona exposed to differing grazing histories (Beymer and Klopatek, 1992). Wind and water erosion in those areas protected by biological soil crusts would likely increase if these crusts were disturbed by livestock trampling.

Pastures are generally grazed only once per year allowing for recovery of vegetation during the current or subsequent growing season and recovery of soil compaction through freeze-thaw and burrowing by organisms. The existing condition of soils on the Angell Allotment suggests that grazing under this management system is not having a negative impact on soil condition. Where impaired soils exist, it has been attributed to either the expansion of juniper trees into inter-canopy spaces or the potential for this expansion to occur based on observations from similar areas.

Alternative 3: Proposed Action

Direct and indirect effects for this alternative are the same as for the Current Management Alternative with the exception of new construction of structural range improvements.

The construction of new pipelines and troughs and expansion and construction of water lots under alternative 3 would not have a negative effect on soils since these improvements would only require minimal soil disturbance. These improvements would likely help to improve soil condition by improving livestock distribution in Crisp, Cinder Hill, O'Neil, Cocrane and South Angell pastures, resulting in more even utilization of vegetation and less congregation of cattle around water sources since there would be more water sources accessible to cattle.

Cumulative Effects

The geographical extent of the cumulative effects analysis is confined to the Angell Allotment boundary. Except in the case of fire, the timeframe selected for this analysis is 20 years; 10 years in the past and 10 years in the future (Appendix E). This analysis uses the time frame of 10 years into the future since this is the length of the term grazing permit. Fires occurring within the allotment boundary over the past 15 years were considered in the cumulative effects analysis to soils because of the longer term effect of fire on the overstory.

Alternative 1: No Action

Under this alternative there would be no cumulative effects since livestock grazing would not be authorized.

Alternative 2: Current Management

Cumulative effects to soils within the allotment boundary are attributable to ground disturbing activities including current livestock management, wildfire, recreational activities and climate change.

Since 2000, there have been six fires that have occurred at least partially within the allotment boundary impacting roughly 7,300 acres. The largest of these, known as the Lizard fire, occurred in 2003 with a fire perimeter of roughly 5,200 acres within the southern portion of the allotment. Soil conditions for TEU 437 was rated as "satisfactory" with an estimated vegetative ground cover of 50 percent after the fire, versus 20 percent as measured during TES surveys (late 80s to early 90s). This increase in herbaceous cover helps to protect the soil from wind and water erosion and improves nutrient cycling that would otherwise be limited where junipers outcompete perennial ground plants for limited soil water and nutrients. Reductions in road traffic on non-designated routes and reductions in off-road travel as the 2011 Travel Management Decision is implemented in over the next decade are predicted to decrease soil erosion.
Recreational activities with potential impacts to soils occurring within the proposed allotment boundary include motorized and non-motorized travel, camping, hunting, and other related activities. In terms of these recreational activities, forest roads are the common thread through which most recreational uses of public lands generally occur. Forest roads have an impact on soils because soils are left unprotected (i.e., vegetation and/or litter is removed) and soils are compacted by recreation and use of these features. The combined effects of compaction and exposure of bare mineral soil in forest roads tend to increase soil erosion by reducing infiltration and exposing the soil to raindrop impact, which detaches and displaces soil particles. Roads are frequently identified as the largest source of sediment delivery to stream courses with the amount of erosion associated with roads a function of rainfall, road condition (e.g., rutted vs. non-rutted), maintenance, road gradient, and traffic type and volume. Partly to address this issue, the Coconino National Forest signed a record of decision (ROD) in September 2011 implementing the 2005 Federal travel management regulations, or Travel Management Rule (TMR). Although changes to road designations may occur within the allotment over the next decade, the improvements to soils from implementation of TMR are likely to have an overall benefit to soils over the next 10 years as off-road motor vehicle use is decreased and non-designated routes are decommissioned.

Long-term improvements to soils from wildfires and travel management efforts are expected to combine with the effects of livestock grazing to result in a slow, but long-term improvement of soils on the allotment over the next 10 years. For example, an increase in perennial grass cover would result in improved cattle distribution throughout pastures affected by wildfire. Exceptions to this include soils that are likely to experience more compaction and decreased productivity in areas within the direct vicinity of water sources, which are expected to receive more concentrated use by wildlife, livestock, and recreation users as climate change results in frequent and more severe droughts within and adjacent to the allotment. Thus there will be a cumulative increase in soil impacts in small concentrated portions of the allotment (<1 percent) adjacent to developed water sources; however, there is likely to be a cumulative improvement in soil conditions in remaining portions of the allotment over the next 10 years.

It is largely through impacts to vegetative cover that climate may affect erosion. Vegetative cover fluctuates naturally in response to inter-annual and longer climate variability. Change in climatic conditions may result in a reduction in vegetative cover leading to increased soil erosion. While these changes may occur during periods of severe or long duration drought, we don't anticipate cumulative effects when combined with livestock grazing because livestock grazing would be adjusted according to the adaptive management framework as well as project design features which are designed to limit any potential impacts from grazing on resources.

Alternative 3: Proposed Action

Cumulative effects for this alternative are the same as the cumulative effects identified and discussed for Alternative 2 with exception of the addition of structural range improvements discussed below.

The construction of new pipelines and troughs and the expansion and construction of water lots under Alternative 3 would result in cumulative effects to soils in the near vicinity of these facilities. Construction of these improvements would, in the short term, require minimal soil disturbance on a small percentage of the allotment (<1 percent). Combined with managed grazing, construction of these improvements would not have a negative cumulative effect on soils.

Watersheds and Water Resources

This section briefly discusses the water quality of the area and how the alternatives may affect the water resource and watershed conditions. This section does not address water quality in earthen stock ponds that were established and are managed for wildlife and livestock management, because state water quality standards do not apply to these water sources.

Affected Environment

Watershed condition and water quality can be affected by changes in vegetation attributes (e.g. species composition, vegetative ground cover), soil condition, climate, and livestock and wildlife activities.

Watersheds and associated stream courses were analyzed at the watershed (6th code) scale for direct/indirect and cumulative effects since activities that may cause environmental consequences to water resources may occur anywhere within the watershed in which these activities occur.

There are no perennial stream courses, wetlands, or springs within the allotment boundary.

Of the nine subwatersheds intersecting the allotment, four were classified as “functioning properly” and five as “functioning at risk”. Qualitative indicator scores of “fair” for water quality, aquatic habitat and biota, and riparian/wetland vegetation for subwatersheds rated as “functioning at risk” do not accurately reflect conditions at the project level since perennial surface flow does not occur within these subwatersheds. The lack of perennial flow means that water quality data, aquatic habitat and associated biota, and riparian/wetland vegetation are generally lacking for these subwaterheds. Because of the lack of perennial surface waters in these subwatersheds, they were given “fair” rather than “good” qualitative indicator scores. These qualitative indicator scores reflect the fact that these semi-arid watersheds are generally not cable of supporting aquatic life and riparian/wetland vegetation rather than the actual condition of these attributes. The ‘fair’ qualitative indicator score for water quality, aquatic habitat and biota, and riparian/wetland vegetation for subwatersheds rated as “functioning at risk” are based on the lack of riparian/wetland vegetation and are not a result of impacts from livestock grazing or other activities occurring in these subwatersheds.

In the subwatersheds classified as “functioning at risk”, “roads and trails” qualitative indicator scores ranged from “fair” to “poor”. This indicator is reflective of the density of roads and trails within a subwatershed and ratings of “fair” and “poor” may indicate that road density is such that the rainfall/runoff response within a subwatershed is altered. These ratings were assigned prior to the implementation of TMR and the open road density on Forest Service lands has subsequently been reduced within the subwatersheds.

The Rio De Flag is the only stream course within the analysis area for which attainment of water quality standards has been assessed. This assessment was conducted in a 3.7 mile reach of the Rio De Flag extending from the outfall of the City of Flagstaff’s Wildcat wastewater treatment plant to the confluence with Wildcat Canyon, downstream of which the stream course is referred to as San Francisco Wash. Roughly ½ mile of this reach is within the allotment boundary whereas the remainder is upstream of the allotment boundary. ADEQ rated this reach as “inconclusive” though no exceedances of state water quality standards were noted during the last sampling period from 11/29/2006 to 3/07/2007 (ADEQ 2012).

Environmental Consequences

This section provides a summary of effects. More detail can be found in the soil and water specialist’s report in the project record. Direct/indirect and cumulative effects to soils are analyzed within the allotment. This spatial scale of analysis is used as soils are most likely to be impacted by activities occurring at or in their immediate vicinity.

Direct and Indirect Effects

Alternative 1: No Action

Under the No Action Alternative, there will be no direct/indirect effects to watershed condition nor will there be any direct/indirect effects to water quality from managed grazing on the Angell Allotment because there would be no authorized livestock grazing.

Alternative 2: Current Management

Indicators of watershed condition that would potentially be influenced by Alternative 2 include rangeland vegetation, soils, and water quality. Under current management, soils are generally protected against accelerated erosion by vegetative ground cover in excess of tolerable vegetative

cover. This suggests that current management is not having a negative impact on rangeland vegetation, soils, water quality, and watershed condition.

Alternative 3: Proposed Action

Direct and indirect effects for this alternative are the same as for the Current Management Alternative with the exception of new construction of structural range improvements.

This alternative would result in improved distribution of livestock throughout the allotment, particularly in Cocrane, Cinder Hill, O'Neil, Crisp and South Angell pastures. This is expected to decrease the amount of soil compaction in these limited areas.

The construction of new pipelines and troughs and expansion and construction of water lots under Alternative 3 would not have a negative impact on watershed condition and water quality since impacts to vegetation and soils would be minimal (<1 percent of the allotment). It is largely through the exposure of bare mineral soil that disturbance has the potential to increase accelerated erosion and affect downstream water quality and watershed condition. Since impacts to vegetation and soils would be very limited and there are resource protection measures to limit loss of vegetation and movement of soils from the disturbance area, it is highly likely any erosion caused from this activity would not reach any downstream perennial water sources and thus would not measurably affect water quality.

The proposed expansion of the existing water system on the Angell Allotment would be sourced by a private well on private property. The private well is classified as "exempt" by the Arizona Department of Water Resources (http://gisweb.azwater.gov), is designated for both stock use and domestic use and is unmetered; therefore there is no way to determine the amount of water pumped from the well. It is estimated that the addition of 3 troughs and 3.72 miles of pipeline coupled with the estimated amount of water consumed by the proposed 425 head of cattle would result in approximately 0.016 acre feet to 0.026 acre feet of water per day (Filley 2005). This would not be considered a significant increase in impacts to groundwater resources because water would be redistributed across the allotment therefore less water would be used in other portions of the allotment, which affect the same groundwater resource.

The Intergovernmental Panel on Climate Change (IPCC) states in their 2007 report that while climate change may affect aquifer recharge, there is not enough information to determine how and to what degree climate change will affect aquifers in the future (Bates et al. 2008).

Cumulative Effects

The geographical extent of the cumulative effects analysis is confined to the 9 subwatersheds which intersect the Angell Allotment. The timeframe selected for this analysis is 20 years; 10 years in the past and 10 years in the future (Appendix E).

Alternative 1: No Action

Under the No Action Alternative, there will be no cumulative effects to watershed water quality from managed grazing on the Angell Allotment because there would be no authorized livestock grazing.

Alternative 2: Current Management

Under this alternative, cumulative effects to watersheds and water quality would occur as a result of current livestock management activities, combined with various forms of recreation, forest restoration/fuels reduction activities, residential and commercial development, and livestock management not associated with the Angell Allotment. Allotments that intersect the same

watersheds as the Angell Allotment include Peaks, Cosnino, Youngs Canyon, Walnut Canyon, Pickett Lake/Padre Canyon, Lake Mary Forage Reserve, and Deep Canyon.

Recreational activities with potential impacts to watershed condition and water quality include motorized and non-motorized travel, camping, hunting, and other related activities. In terms of these recreational activities, forest roads are the common thread through which most recreational uses of the public lands occur. Roads are frequently identified as the largest source of sediment delivery to stream courses with the amount of erosion associated with roads a function of rainfall, road condition (e.g., rutted vs. non-rutted), maintenance, road gradient, and traffic type and volume. The impacts of NFS roads on watershed condition and water quality has been reduced through implementation of the TMR.

Forest restoration/fuels reduction activities including prescribed fire and mechanical thinning of trees cause a short-term disturbance to forest soils (typically less than 5 years) and may locally increase rates of erosion mainly through exposure of bare mineral soil, however; these activities typically don’t degrade water quality at the watershed scale since disturbance is spatially limited and measures are taken to prevent sediment delivery to stream courses including establishing undisturbed filter strips around stream courses and preventing concentrated flow on the temporary network of roads and trails needed to accomplish forest restoration/fuels reduction activities. These activities are expected to have a long-term benefit to watershed condition and water quality by reducing the likelihood of wildfires with severe consequences to watershed function.

Residential and commercial development activities are expected to continue on non-Federal lands within the watersheds intersecting the Angell Allotment. The percent of non-Forest Service land within these watersheds ranges from 2 percent to 88 percent. Those watersheds with a higher percentage of non-Forest Service land would experience greater development which could affect watershed functioning by increasing the amount of impervious cover leading to more frequent and larger but less sustained flows in stream courses. This, in turn, could impact water quality since there would be more energy available for sediment transport in stream channels.

Managed livestock grazing on the Angell Allotment as well as the other allotments in watersheds intersecting the allotment boundary would continue under Alternative 2. The impact of managed grazing on watershed condition and water quality in the affected watersheds is thought to be minimal because vegetative ground cover generally exceeds tolerable vegetative cover such that widespread accelerated erosion is not occurring. As a result, the cumulative impact of livestock grazing is expected to be limited to localized areas within the allotment and would not combine with other activities to result in a measurable cumulative effect to water quality in downstream perennial waters.

Alternative 3: Proposed Action

Cumulative effects for this alternative are the same as the cumulative effects identified and discussed for Alternative 2 with exception of the addition of structural range improvements discussed below.

The construction of new pipelines and troughs and the expansion and construction of water lots under Alternative 3 would result in cumulative effects to watersheds and water quality. Construction of these improvements would, in the short term, only require minimal soil disturbance on a small percentage of the allotment. Combined with managed grazing construction of these improvements would not have a negative cumulative effect on watersheds and water quality.

Once the structural range improvements have been constructed, the addition of these improvements combined with managed grazing will likely decrease the cumulative effects to watersheds and water quality by allowing for improved livestock distribution in Cocrane, Cinder Hill, O'Neil, Crisp and South Angell pastures.

Additional groundwater use from a private well to supply the additional water sources would be minimal and mostly offset from less livestock use of water at other water sources on the allotment. However, this small increase in groundwater use may result in a cumulative impact on the aquifer when more heavily used from municipal and agricultural withdrawals in the case of high severity or long duration drought, which is more likely to occur with climate change. The amount of water to supply these additional water sources would be extremely small compared to the size of the aquifer and other uses affecting this water source, and thus while there would be a cumulative impact of well use it would be of little or no consequence at the scale of the aquifer.

Forest Service Sensitive Plant Species

This section focuses on potential effects to the one Forest Service sensitive plant known to occur on the Angell Allotment, Sunset Crater beardtongue. There are no plants or critical habitat protected under the Endangered Species Act present on the Angell Allotment. More details can be found in the Wildlife and Botany specialist's report in the project record.

Affected Environment

Sunset Crater beardtongue

Sunset Crater beardtongue (*Pentemon clutei*) is a species only known from Coconino County. Classified in the penstemon family, this species is a perennial herb typically growing up to 30-80 centimeters tall. Flowers are pale to pink colored in an upright habit. This species may be fire dependent.

Environmental Consequences

Direct and Indirect Effects

Alternative 1: No Action

Under this alternative, there would be no livestock grazing or construction or maintenance of existing structural improvements in occupied or suitable habitat for the species. No direct or indirect effects from livestock grazing would occur to Sunset Crater beardtongue or its habitats under Alternative 1.

Alternative 2: Current Management

Under Alternative 2, grazing operations would be authorized on the Angell Allotment. Impacts to this species could potentially occur from trampling. A study on the effects of disturbance agents to the species found that this penstemon thrives in disturbed environments such as those that may result from grazing, but are impacted directly through activities such as being run over by OHVs or trampling by wild and domesticated ungulates (Fule et al. 2001). Direct impacts from grazing or trampling would be expected to be minimal as these plants occur in open cinder fields where the grass component is limited and livestock would be not be expected to congregate and would likely avoid due to lack of forage. Additionally, if there are areas where grasses occur near penstemon plants, cattle would preferentially graze on grasses. Livestock would only be expected to move to these forbs under extreme drought conditions. This is unlikely to occur since resource protection measures in extreme drought conditions would be taken to limit the length of grazing

of a pasture in a given grazing season. Also, the use of a rotational grazing management system will be implemented, seasonal utilization levels would be managed at moderate (21 to 50 percent) in late spring and early summer months and at conservative levels (30 to 40 percent) in the late summer and fall and yearly utilization levels would be managed at the conservative level (30 to 40 percent) for herbaceous vegetation. These measures would ensure that grasses would still be available to livestock and result in minimal effects to the populations of Sunset Crater beardtongue on the allotment.

Alternative 3: Proposed Action

Alternative 3 would have the same direct and indirect effects as Alternative 2 as new range improvements are not proposed in occupied or suitable habitat for this species.

Cumulative Effects

The geographical extent of the cumulative effects analysis is confined to the Angell Allotment boundary. The timeframe selected for this analysis is 20 years; 10 years in the past and 10 years in the future (Appendix E). This analysis uses the time frame of 10 years into the future since this is the length of the term grazing permit.

Cumulative effects to Sunset Crater beardtongue and its habitats would result from trampling or browse of plants and habitat fragmentation. Past, present, and reasonably foreseeable future projects that could be sources of trampling and habitat fragmentation include wild ungulate grazing, recreation including dispersed camping, horseback riding, and illegal road and trail creation, OHV use in the Cinder Hills OHV Area, wildfire, fuelwood harvest, spread of invasive plant species, road closures, and climate change.

Wild ungulate grazing on the Angell Allotment would be expected to have similar effects to occupied and suitable habitat for this species as described for livestock. The main difference is livestock grazing is intensively managed, while wild ungulates are not. This could result in trampling or potential browse of the penstemon by wild ungulates. Due to the lack of water and grass cover in areas of suitable habitat, these impacts would be expected to be low and would, potentially, result in a slight cumulative risk of trampling individual plants.

Effects from wildfires and suppression tactics are evident on the allotment and can be expected in the future as a result of the human alteration of the natural fire regime. Effects depend on the time of year, scale of the fire, intensity, severity and associated management or suppression activities and can range from none to improvement or reduction of individuals, populations, and suitable habitat for Sunset Crater beardtongue. While the penstemon may thrive as a result of fire disturbance, activities associated with suppression could result in the destruction or trampling of plants. Best management practices are incorporated into suppression activities as much as possible to conserve plants and suitable habitat but this species has been observed to benefit from fire. Any short-term effects of fire would typically last one to three years but recovery depends on factors such as climate and burn severity.

Recreational activities such as motorized and non-motorized travel, camping, hunting, and fuelwood harvest have the potential to result in trampling of plants and habitat fragmentation. System and user created roads can lead to the crushing of plants and can result in barriers for the plants to germinate and spread. In portions of the nearby 13,700 acre Cinder Hills OHV area where herbaceous vegetation is limited and no documented populations of beardtongue are known to occur, riders can travel cross-country. In areas within the OHV area where this species is known to occur, it is unlikely that all riders stay on identified trails so impacts to some

individuals can be expected and fragmentation of suitable habitat could occur. Outside of the OHV area, motorized use off of designated routes likely occurs, but is expected to decrease over the next decade as a result of signage, education, and enforcement efforts associated with implementation of TMR. These actions are likely to reduce the cumulative impact of crushing individual Sunset Crater beardtongue plants.

Invasive plant species are well-adapted to out-compete native plants leading to decreases in the density of Sunset Crater beardtongue and other native plants in the infested area. As infested areas are treated under the Coconino National Forest noxious weed program, native plants including this species would increase.

Vegetation density, diversity, and cover and available water fluctuate naturally in response to inter-annual and longer periods of climate variability. Periods of favorable climatic conditions can result in increased quality and quantity of suitable habitat conditions for this species, while in periods of unfavorable climatic conditions the reverse can occur. Climate change is predicted to result in periods of extreme climatic conditions in both temperature and precipitation. As described in the Rangeland Resources and Soils sections, climate change in the Southwest is predicted to lead to decreased winter precipitation and delays in the onset of the monsoon. These changes could result in drier conditions and an extension of the fire season resulting in increased areas of beardtongue habitat being impacted by wildfire on the allotment as well as reductions in the quantity of water available for the plant. While these changes may reduce beardtongue populations, they may also increase levels of disturbance that create beneficial conditions for population increase. As a result of conservative utilization guidelines and implementation of adaptive management during drought conditions, it is highly unlikely that there will be cumulative effects with livestock grazing resulting in a decrease of the Sunset Crater beardtongue within the allotment or in surrounding areas.

In general, most of the past, present, and reasonably foreseeable future activities would be expected to result in localized decreases in the number of individuals of Sunset Crater beardtongue and the quality of its habitat on the allotment. Conversely, improvement in habitat and possible an increase in numbers of beardtongue would be expected in those areas where low severity fire occurs, off-road travel is decreased, road densities are reduced through closures, and control of invasive plant species occurs. These ongoing activities would ameliorate the potential cumulative effect of livestock grazing from trampling of beardtongue within the Angell Allotment, and in surrounding areas.

Alternative 1: No Action

Since no livestock grazing or related activities would occur under Alternative 1, there would be no addition to the effects described for past, present and reasonably foreseeable activities and therefore no cumulative effects would occur.

Alternative 2: Current Management

Cumulative effects on Sunset Crater beardtongue, when combined with the potential effects of Alternative 2, could result in impacts to individual plants, but would not affect large groups of plants or the overall population since this species is widely dispersed across suitable habitat on the allotment.

Alternative 3: Proposed Action

Cumulative effects for Alternative 3 would be the same as Alternative 2 as new range improvements are not proposed in occupied or suitable habitat for this species.

Determination

- No effects on Sunset Crater Beardtongue would be expected to occur under Alternative 1.
- Alternative 2 may impact individuals, but would not result in a trend toward federal listing or a loss of viability for Sunset Crater beardtongue.
- Alternative 3 may impact individuals, but would not result in a trend toward federal listing or a loss of viability for Sunset Crater beardtongue.

Invasive Plant Species[8]

Affected Environment

The following noxious or invasive plant species (weeds) have been documented on the Angell Allotment: Scotch thistle (*Onopordum acanthium*), Dalmatian toadflax (*Linaria dalmatica*), bull thistle (*Cirsium vulgare*), diffuse knapweed (*Centaurea diffusa*), and cheatgrass (*Bromus tectorum*). Four of them were addressed in the Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab, and Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona (USDA Forest Service 2005a) and the fifth, cheatgrass, was recently added to the Coconino National Forest's list of invasive plants species of concern. On the Angell Allotment, known populations of most of these species are found along the Leupp Road right of way in the Cocrane, Cinder Hills, O'Neill, Rio De Flag, and Turkey Tanks pastures. Diffuse knapweed is known to occur in areas with cinder soils such as the nearby Cinder Hills OHV area. This soil type can be found in portions of each pasture except South Angell.

Environmental Consequences

Direct and Indirect Effects

Alternative 1: No Action

Under Alternative 1, no grazing would occur and there would be no effects to noxious or invasive weeds from grazing or management activities. There would be no disturbance from the maintenance or construction of range improvements or the potential for expansion or introduction of noxious or invasive weeds as a result of these activities. Without livestock grazing, there would be no participation by the permittee in monitoring for new weed infestation. This could result in a decreased rate of detection of invasive species establishment and spread both within the allotment and from nearby lands (Ditomaso 2000). A decreased rate of detection of invasive species establishment and spread may result in the occurrence of larger weed populations that are difficult to effectively treat and manage.

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[8] The purpose of this analysis is to analyze the effects of alternatives to authorize grazing on the Angell Allotment on invasive species establishment and spread and does not include authorization of any new noxious or invasive weed treatments as part of the management actions to be considered in this decision. The treatment strategies and objectives for noxious or invasive weeds are addressed in the Final Environmental Impact Statement for the Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab and Prescott National Forests. Weed treatments are not specifically proposed for any alternatives in this analysis but may occur in conjunction with actitives in the action alternatives such as where structural improvements are proposed.

Alternative 2: Current Management

The weeds known to occur on or adjacent to the Angell Allotment can result in the reduction of forage quantity and quality. Some studies have found that grazing probably has little effect on the accelerated spread of most exotic plant species at landscape scales in grasslands similar to those on the Angell Allotment, and that few invasive plant species show a direct response to grazing and cessation of grazing (Stohlgren et al. 1999).Weeds can decrease grazing opportunities by invading an area and outcompeting native plant species that provide a large quantity and better quality of forage for livestock. Parks et al. (2005) demonstrated that properly managed grazing results in fewer opportunities for invasive species establishment and spread and usually results in invasive species populations similar to ungrazed areas. Therefore, it is important to employ good grazing practices to limit the risk of the spread of existing weeds and the introduction of new species using the resource protection measures in Chapter 2. These include limiting the length of grazing of a pasture in a given year, the use of a rotational grazing management system, managing seasonal utilization levels at moderate (21 to 50 percent) in late spring and early summer months and at conservative levels (30 to 40 percent) in the late summer and fall and managing yearly utilization levels at conservative levels (30 to 40 percent) for herbaceous vegetation. These measures would help maintain conditions that favor native plants and limit the establishment and spread or invasion of weeds on the Angell Allotment.

Alternative 3: Proposed Action

Alternative 3 is similar to Alternative 2 and would have the same direct and indirect effects as a result of livestock grazing and maintenance of existing range improvements.

Construction of new structural range improvements result in ground disturbance and increase the risk of spreading existing weeds and introducing new species. Prior to the start and after completion of construction and maintenance of structural range improvements, mud, dirt, and plant parts would be removed from all tools, equipment, and vehicles used during these activities to prevent the spread or introduction of invasive plants or noxious weeds. Ground disturbance as a result of these new improvements would be limited in size (~1 acre), so potential effects from the proposed improvements would be expected to be minimal.

Cumulative Effects

The geographical extent of the cumulative effects analysis is confined to the Angell Allotment boundary. The timeframe selected for this cumulative effects analysis is 20 years. This includes 10 years in the past and the 10 year term of the grazing permit that would be issued under Alternatives 2 and 3.

Cumulative effects on weeds would be expected from disturbance that changes vegetative cover and soil conditions. Activities that could cumulatively affect weeds include wild ungulate grazing, recreation including dispersed camping, horseback riding, and illegal road and trail creation, OHV use in the Cinder Hills OHV Area, wildfire, fuelwood harvest, road closures, control of weeds, maintenance of Arizona Power Service (APS) 69 kilovolt (kV) lines and roads on the Forest, and climate change.

Wild ungulate grazing on the Angell Allotment would be expected to have similar effects as described for livestock. The main difference is livestock grazing is managed, while wild ungulates are not. This could result in an increase in the level of disturbance to vegetative cover and soil condition in localized areas across the allotment, and thus result in a cumulative source of invasive weed establishment and spread.

Effects from wildfires and suppression tactics are evident on the allotment and can be expected in the future as a result of the human alteration of the natural fire regime. Effects depend on the time of year, scale of the fire, intensity, severity and associated management or suppression activities and can range from none to reductions in native plant cover and soil conditions. Studies in northern Arizona have found that nonnative species presence increase after fire, but abundance of these species remain low (<10 %) with nonnatives tending to increase with increasing fire severity (because of less competition from native plants) (McGlone and Egan 2009). Best management practices are incorporated into suppression activities as much as possible to reduce impacts to native vegetation and some species benefit from the effects of low intensity fire. Any short-term effects of fire would typically last one to three years, which is when invasive species establishment and spread is greatest, but recovery depends on factors such as climate and burn severity.

Recreational activities such as motorized and non-motorized travel, camping, hunting, and fuelwood harvest have the potential to result in the loss in vegetative cover and impacts to soil conditions. System and user created roads can lead to the crushing of native plants and ground disturbance that favor weeds. New travel management rules were established by the Forest in 2011 that have reduced the densities of open roads on the Forest and created the opportunity for road closures. As they are implemented, effects to native plant cover and soil conditions would be reduced, limiting the suitable habitat for weeds.

Weeds treatments currently occur in portions of the allotment, such as along major roadways and in the Cinder Hills OHV area. As infested areas are treated, the size and number of weed populations would be reduced and native vegetation would be expected to recover.

Routine removal of woody vegetation underneath APS 69 kV lines and the Western Area Power Administration 345 kV transmission lines, and maintenance of any type of road on the allotment has the potential to result in the loss in vegetative cover and impacts to soil conditions. The use of heavy equipment and vehicles along roads and off-road could result in can lead to the crushing of native plants and ground disturbance that favor weeds. BMPs for noxious or invasive weeds as listed in Appendix B of the 2005 Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds are implemented during these activities to limit the introduction and spread of weeds in these areas.

Vegetation density, diversity, and cover and available water fluctuate naturally in response to inter-annual and longer periods of climate variability. Periods of favorable climatic conditions can result in increased growth and spread of weeds, while in periods of unfavorable climatic conditions the reverse can occur. Climate change is predicted to result in periods of extreme climatic conditions in both temperature and precipitation. As described in the Rangeland Resources and Soils sections, climate change in the Southwest is predicted to lead to decreased winter precipitation and delays in the onset of the monsoon. These changes could result in drier conditions and an extension of the fire season resulting in increased areas that currently support native plants to be impacted by wildfire on the allotment. This could result in an increase in the spread of weeds into areas where native plant cover is reduced.

In general, most of the past, present, and reasonably foreseeable future activities would be expected to result in localized increases in suitable habitat for weeds on the allotment. Conversely, suitable habitat for weeds would be expected to decrease in those areas where off-road travel is limited and road densities are reduced through closures.

Alternative 1: No Action

Under this alternative there would be a decrease in potential detection of invasive species within the allotment. Since populations of invasive species remain small and localized, often for long periods, before a sudden explosive range expansion; detection of these species when small is of key importance for limiting the extent of these species (Hobbs and Humphries 1995). Since there are multiple activities and opportunities from cumulative actions that are expected to continue the establishment of invasive species on the allotment and the effects of climate change may result in a competitive advantage for invasive species over native species, this alternative would result in a cumulative increase in the spread of invasive species.

Alternative 2: Current Management

Cumulative effects on weeds, when combined with the potential effects of Alternative 2, could result in an increase in impacts to vegetative cover and soil conditions on the allotment through increased potential for invasive species establishment and a cumulative increase in invasive species spread, which would be mitigated through ongoing detection and invasive species treatments.

Alternative 3: Proposed Action

Cumulative effects for Alternative 3 would be the same as Alternative 2 except for the additional areas of disturbance (~1 acre) as a result of proposed range improvements. Due to the very small increase in effects between the two action alternatives, the potential impacts of livestock grazing and associated activities on weeds under Alternative 3 combined with past, present and reasonably foreseeable future projects on the allotment would be expected to be similar to Alternative 2.

Wildlife

This section presents the analysis of effects for the terrestrial species that have potential habitat within the Angell Allotment and those that have habitat adjacent to the allotment and have the potential be affected by the activities within.

The section also addresses compliance with the Endangered Species Act, Bald and Golden Eagle Protection Act, the Migratory Bird Treaty Act and the requirements of the Forest Plan concerning Management Indicator Species (MIS).

Threatened and Endangered Species

Guidelines from the 2005 Forest Service Southwest Region's "Framework for streamlining informal consultation for livestock grazing activities" were used during the effects analyses and findings of the one species designated as "endangered" in the analysis area (black-footed ferret). Similar guidelines have not been developed for those species that are currently "proposed" for listing under the Endangered Species Act (ESA).

Black-footed Ferret

Black-footed ferrets (*Mustela nigripes*) were listed as endangered by the Fish and Wildlife Service in 1967. Historically, the black-footed ferret range was nearly identical to the range of 3 prairie dog species throughout the western United States. In Arizona, the Gunnison prairie dog (*C. gunnisoni*) occurs on the Coconino National Forest. Black-footed ferrets depend on prairie dogs as prey and utilize prairie dog burrows for dens.

Affected Environment

There are no documented occurrences of ferrets on the Angell Allotment, but suitable ferret habitat does exist. A total of 2,230 acres of prairie dog colonies occur in close enough proximity to each other to meet the criteria for potential black-footed ferret habitat. These exist in the sections north of I-40 in Railroad, Rattlesnake, and Rio de Flag pastures.

Direct and Indirect Effects

Alternative 1: No Action

Under this alternative, there would be no livestock grazing or construction or maintenance of existing structural improvements in ferret habitat. No direct or indirect effects from livestock grazing would occur to ferrets or their habitats under Alternative 1.

Alternative 2: Current Management

Although prairie dog complexes exist in the Angell Allotment meeting the definition of ferret habitat, no ferrets have been documented on the Coconino National Forest. No direct effects would be expected as there are no ferrets on the allotment. Potential indirect effects to ferrets on the allotment would include collapsing of burrows from cattle, competition for and reduction of forage for prey (prairie dogs), compaction of soil, and reduction of cover (increasing predation risk). These potential effects would be managed by limiting the length of grazing of a pasture in a given year, using a rotational grazing management system, managing seasonal utilization levels at moderate levels (21 to 50 percent) in late spring and early summer months and at conservative levels (30 to 40 percent) in the late summer and fall and managing annual utilization levels at the conservative level (30 to 40 percent) for herbaceous vegetation. This level of management would maintain sufficient herbaceous forage and hiding cover for ferret prey.

Maintenance of existing structural improvements such as fences, water lots, troughs, and pipelines could result in short term disturbances to ferret prey. The presence of humans and the noise associated with maintenance activities could lead to avoidance of the area by prey species where these actions occur. Vegetative cover in the immediate area of improvements could be reduced, but these areas would be expected to recover within a year or two with favorable climatic conditions. These disturbances would be of a short duration and would be expected to have minimal impacts to ferret prey or their habitat (Seglund et al. 2005).

Based on this information, potential direct and indirect impacts from livestock grazing and related activities on black-footed ferrets under Alternative 2 would be discountable.

Alternative 3: Proposed Action

Alternative 3 is similar to Alternative 2 and would have the same direct and indirect effects as a result of livestock grazing and maintenance of existing range improvements.

Additionally, the construction of new structural range improvements under Alternative 3 could result in similar short term effects to ferret prey and habitat as described for maintenance of improvements. These new improvements would increase the number of disturbed areas on the allotment, but only slightly more (~1 acre) than Alternative 2. These water developments would improve livestock distribution across pastures and resulting in long-term beneficial impact to ferret habitat through improvement of forage resources and cover for prey in grazed areas. The potential beneficial effects of such long-term habitat improvement would be expected to be greater than the potential negative effects from noise disturbance and temporary loss of vegetative

cover. As a result, the potential beneficial impacts of Alternative 3 would be expected to be slightly greater than those for Alternative 2.

Cumulative Effects

The geographical extent of the cumulative effects analysis for black-footed ferret is confined to the Angell Allotment. The timeframe selected for this cumulative effects analysis is 20 years. This includes 10 years in the past and the 10 year term of the grazing permit that would be issued under Alternatives 2 and 3.

Cumulative effects to black-footed ferret habitat and their prey would result from disturbance of prey and changes in vegetative cover and soil conditions that affect foraging habitat through changes in food resources and hiding cover for prey. Past, present, and reasonably foreseeable future projects that could be sources of noise disturbance of prey include recreationists such as hikers, bikers, horseback riders, hunters, and OHV users, fuelwood harvests, and maintenance of Arizona Power Service (APS) 69 kilovolt (kV) lines and Western Area Power Administration 345kV transmission lines and roads on the Forest.

Activities that could cumulatively affect ferret foraging habitats include wild ungulate grazing, recreation including dispersed camping and illegal road and trail creation, OHV use, wildfire, fuelwood harvest, spread of invasive plant species, road closures, maintenance of APS 69 kV lines, maintenance of Western Area Power Administration 345kV transmission lines and climate change.

Wild ungulate grazing in foraging habitats on the Angell Allotment would be expected to have similar effects to ferret habitat and their prey as described for livestock. The main difference is livestock grazing is managed, while wild ungulates are not. This could result in decreases in vegetative cover in grassland habitat on the allotment and in quality and quantity of hiding cover and food resources for prey species.

Effects from wildfires and suppression tactics are evident on the allotment and can be expected in the future as a result of the human alteration of the natural fire regime. Effects depend on the time of year, scale of the fire, intensity, severity and associated management or suppression activities and can range from none to improvement or reduction of ferret and prey habitat. Best management practices are incorporated into suppression activities as much as possible to conserve ferret habitat and its components. Short-term effects of fire to herbaceous cover typically last one to 3 years but recovery depends on factors such as climate and burn severity.

Recreational activities such as motorized and non-motorized travel, camping, hunting, and fuelwood harvest have the potential to affect vegetative cover and soil condition. System and user created roads remove vegetation and litter and compact soils (see Soil and Watershed Report for more detail). New travel management rules were established by the Forest in 2011 that have reduced the densities of open roads on the Forest and created the opportunity for road closures. As they are implemented, effects to ferret habitat and prey would be reduced by reducing disturbance, fragmentation by roads, and increased plan cover.

Invasive plant species are well-adapted to out-compete native plants. This can lead to a decrease in density and diversity of native plant species which are food resources for prey. This can result a decrease in prey availability for ferrets. As infested areas are treated and native plants are restored, the effect to ferret habitat and their prey would be reduced.

Routine removal of woody vegetation underneath APS 69 kV lines and the 345kV transmission live corridor on the allotment has the potential to affect vegetative cover and soil conditions. The use of heavy equipment and vehicles off-road could result in the compaction of soil and collapsing of burrows in localized areas on the allotment decreasing the amount of ferret and prey habitat. Herbaceous vegetation would be expected to improve with the removal of woody vegetation due to the increase in availability of space, sunlight, nutrients, and water.

Components of ferret habitats such as vegetation density, diversity, and cover and available water fluctuate naturally in response to inter-annual and longer periods of climate variability. Periods of favorable climatic conditions can result in increased quality and quantity of wildlife habitats including herbaceous cover, plant growth, fruit and seed production, and water in stock tanks, while in periods of unfavorable climatic conditions the reverse can occur. Climate change is predicted to result in periods of extreme climatic conditions in both temperature and precipitation. As described in the Rangeland Resources and Soils sections, climate change in the Southwest is predicted to lead to decreased winter precipitation and delays in the onset of the monsoon. These changes could result in drier conditions and an extension of the fire season resulting in increased areas of ferret habitat being impacted by wildfire on the allotment as well as reductions in the quantity of water available for prey.

In general, most of the past, present, and reasonably foreseeable future activities would be expected to result in localized decreases in the quality and quantity of ferret foraging habitat on the allotment or short-term noise disturbance. Conversely, improvement in foraging habitat would be expected in those areas where off-road travel is limited, road densities are reduced through closures, and control of invasive plant species occurs.

Alternative 1: No Action

Since no livestock grazing or related activities would occur under Alternative 1, there would be no addition to the effects described for past, present and reasonably foreseeable activities and therefore no cumulative effects would occur.

Alternative 2: Current Management

Cumulative effects for Alternative 2 would not result in losses in vegetative cover or decreases in diversity, density, production, or quality of herbaceous vegetation at the scale of the allotment over the length of the term grazing permit. Should there be high severity or long duration drought affecting vegetative cover in one or more pastures, livestock grazing would be adjusted through the adaptive management framework to limit the cumulative impact of these activities. Habitat conditions for ferret and their prey would be expected to remain stable. Therefore, the potential impacts of livestock grazing and associated activities under Alternative 2 combined with past, present and reasonably foreseeable future projects on the allotment would not result in any additional effects to ferret habitats and their prey.

Alternative 3: Proposed Action

Cumulative effects for Alternative 3 would be the same as Alternative 2 except for the additional areas of disturbance (~1 acre) as a result of proposed range improvements. Due to the very small increase in effects between the two action alternatives, the potential impacts of livestock grazing and associated activities under Alternative 3 combined with past, present and reasonably foreseeable future projects on the allotment would be expected to be similar to Alternative 2 and not result in any additional effects to ferret habitats and their prey.

Determinations

No livestock grazing or related activities would occur under Alternative 1, so the proposed project would have no impact on black-footed ferrets.

As proposed under Alternative 2, livestock grazing and associated activities could have negative effects on black-footed ferrets. Potential negative effects on burrows and reductions in habitat quality for prey would be minimized through timing of grazing and other management strategies. As a result, impacts to ferret prey and their habitats under Alternative 2 would be expected to be minimal.

Under Alternative 3, proposed range improvements could have potential negative impacts to black-footed ferret through decreased habitat quality for ferrets and their prey. Since these potential effects would be short-term and localized, impacts to black-footed ferrets under Alternative 3 would be slightly greater than for Alternative 2 but would be expected to be minimal.

Sensitive Species

Sensitive species are defined as "…those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by: a) significant current or predicted downward trends in population numbers or density, or b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5(19))." The U.S. Forest Service Region 3 sensitive species list (9/18/2013) was reviewed and a list of species was created for this project based on known occurrences or, in the absence of survey data, the presence of suitable habitat. This assessment considers, as appropriate for the species and area, factors that may affect the current trend for the species' population. Additionally, this assessment will display findings under the various management alternatives considered for the project (FSM 2621.2).

Sensitive Mammal

Navajo Mogollon Vole

Navajo Mogollon voles (*Macrotus mogollonensis navaho*) are associated with meadows and other wet areas above the Mogollon Rim in proximity to ponderosa pine or other coniferous forests. They also occur in forested areas where tree densities are low and herbaceous cover is high. Voles depend on grasses and herbaceous vegetation for food and cover. Vole densities are greatest in ungrazed areas or areas further from forest edges (Chambers and Lesh 2005). A study of Mogollon voles on the Coconino and Kaibab national forest explained that grazing by livestock or native herbivores may reduce abundance of voles when large quantities of plants or plant tissues are removed and excessive use and associated damage limits production of food plants for the vole (Yarborough and Chambers 2007). This study only found excessive grazing in one area with potential vole habitat, which was located outside of the allotment boundary (Yarborough and Chambers 2007).

Affected Environment

There are no documented occurrences of Navajo Mogollon voles on the allotment. Potential habitat for voles on may be found in the areas with ponderosa pine in the northwest portion of the allotment.

Environmental Consequences

Direct and Indirect Effects

Alternative 1: No Action

Under this alternative there would be no livestock grazing operations on vole habitat, and no structural improvements constructed or maintained. There would be no direct or indirect effects to voles or their habitat on the Angell Allotment under Alternative 1.

Alternative 2: Current Management

Alternative 2 would have potential effects on voles from concentrations of livestock in areas with high herbaceous ground cover such as those areas adjacent to ponderosa pine forest. These potential impacts include trampling of individuals and vegetation, ground compaction, and collapsing of burrows and runways. Grazing by livestock can possibly result in a competition for forage, as well as result in a loss of hiding cover for voles which could increase predation. These potential direct and indirect effects would be reduced and minimized by limiting the length of grazing of a pasture in a given year, using a rotational grazing management system, managing seasonal utilization levels at moderate levels (21 to 50 percent) in late spring and early summer months and at conservative levels (30 to 40 percent) in the late summer and fall and managing annual utilization levels at the conservative level (30 to 40 percent) for herbaceous vegetation. This level of management would maintain sufficient herbaceous forage and hiding cover for voles. Based on this information, potential direct and indirect impacts from livestock grazing on Navajo Mogollon voles would be expected to be discountable.

Maintenance of existing structural improvements such as fences, water lots, troughs, and pipelines could result in short term disturbances to voles. The presence of humans and the noise associated with maintenance activities could lead to avoidance of the area by voles where these actions occur. Vegetative cover in the immediate area of improvements could be reduced, but these areas would be expected to recover within a year or two with favorable climatic conditions. These disturbances would be of a short duration and would be expected to have minimal impacts to voles or their habitat.

Alternative 3: Proposed Action

Alternative 3 is similar to Alternative 2 and would have the same direct and indirect effects as a result of livestock grazing and maintenance of existing range improvements.

Additionally, the construction of new structural range improvements under Alternative 3 could result in similar short term effects to ferret prey and habitat as described for maintenance of improvements. These new improvements would increase the number of disturbed areas on the allotment, but only slightly more (~1 acre) than Alternative 2. These developments would improve livestock distribution across pastures and resulting in long-term beneficial impact to vole habitat through improvement of forage resources and cover in grazed areas. The potential beneficial effects of such long-term habitat improvement would be expected to be greater than the potential negative effects from noise disturbance and temporary loss of vegetative cover. As a result, the potential beneficial impacts of Alternative 3 would be expected to be slightly greater than those for Alternative 2.

Cumulative Effects

The geographical extent of the cumulative effects analysis is confined to the Angell Allotment. The timeframe selected for this cumulative effects analysis is 20 years. This includes 10 years in

the past and the 10 year term of the grazing permit that would be issued under Alternatives 2 and 3.

Cumulative effects to Navajo Mogollon voles would result from noise disturbance of voles and changes in vegetative cover and soil conditions that affect habitat through changes in food resources and hiding cover. Past, present, and reasonably foreseeable future projects that could be sources of noise disturbance of voles include recreationists such as hikers, bikers, horseback riders, hunters, OHV users, maintenance of APS 69 kV lines and roads and fuelwood harvests.

Activities that could cumulatively affect vole habitats include wild ungulate grazing, recreation including dispersed camping and illegal road and trail creation, OHV use, wildfire, fuelwood harvest, spread of invasive plant species, road closures, maintenance of APS 69 kV lines and the 345kV transmission lines and climate change.

As described in detail for ferrets and their habitats, most of the past, present, and reasonably foreseeable future activities would be expected to result in localized decreases in the quality and quantity of vole habitat on the allotment or short-term noise disturbance impacts. For example, decreased precipitation as a result of climate change, wild ungulate grazing, recreation, and wildfire could result in reductions in herbaceous cover. Operation of motorized vehicles for recreation or chainsaws for fuel wood harvest could result in voles temporarily avoiding an area. Conversely, improvement in foraging habitat would be expected in those areas where off-road travel is limited, road densities are reduced through closures, and control of invasive plant species occurs resulting in improved native herbaceous cover.

Alternative 1: No Action

Since no livestock grazing or related activities would occur under Alternative 1, there would be no addition to the effects described for past, present and reasonably foreseeable activities and therefore no cumulative effects would occur.

Alternative 2: Current Management

Cumulative effects for Alternative 2 would not result in losses in vegetative cover or decreases in diversity, density, production, or quality of herbaceous vegetation at the scale of the allotment over the length of the term grazing permit. Should there be high severity or long duration drought affecting vegetative cover in one or more pastures, livestock grazing would be adjusted through the adaptive management framework to limit the cumulative impact of these activities. Habitat conditions for voles would be expected to remain stable. Therefore, the potential impacts of livestock grazing and associated activities under Alternative 2 combined with past, present and reasonably foreseeable future projects on the allotment would not result in any additional effects to voles and their habitats.

Alternative 3: Proposed Action

Despite the small increase in habitat quality for voles as a result of new range improvements, the potential impacts of livestock grazing and associated activities under Alternative 3 combined with past, present and reasonably foreseeable future projects on the allotment would be expected to be similar to Alternative 2 and would not result in any additional effects to voles and their habitats.

Determinations

- Alternative 1 would result in no impact to Navajo Mogollon voles.

- Alternative 2 may impact individual Navajo Mogollon voles but are not likely to result in a trend toward federal listing or a loss of viability of the species.
- Alternative 3 may impact individual Navajo Mogollon voles but are not likely to result in a trend toward federal listing or a loss of viability of the species.

Sensitive Bats

There are four Forest Service sensitive bat species that have suitable habitat within the Angell Allotment: western red, spotted, Allen's lappet-browed, and pale Townsend's big-eared.

Affected Environment

There are no documented occurrences of any of these bats on the Angell Allotment. No known or suitable roosting sites for western red bats or Pale Townsend's big-eared bat are located on the Angell Allotment as there is a lack of broad-leafed trees and caves, mines, or abandoned buildings. Suitable roosting habitat for Allen's lappet-browed bat exists in the large snags in the ponderosa pine stands in the northwest portion of the allotment and for Allen's lappet-browed and spotted bats in the cracks and crevices of the walls of Walnut and Youngs canyons and San Francisco Wash. For all four species suitable habitat for foraging and drinking can be found at earthen stock ponds and troughs on the allotment as well as areas with high herbaceous ground cover.

Environmental Consequences

Direct and Indirect Effects

Alternative 1: No Action

Under this alternative there would be no livestock grazing operations in suitable bat habitat or no structural improvements constructed or maintained. Operation and maintenance of existing structural range improvements would not occur under Alternative 1. Decreases in availability of water at earthen stock ponds and drinker/pipeline systems for foraging and drinking would occur over time as no maintenance of these water sources would occur under this alternative reducing prey habitat and drinking water for the species. Additionally, the risk of drowning in drinkers would increase for bats since maintenance of wildlife escape ramps would not occur. The potential loss of water and risk of drowning from lack of maintenance could result in direct and indirect effects to individual bats and their foraging habitats on the Angell Allotment under Alternative 1.

Alternative 2: Current Management

No impacts to roost sites of Allen's lappet-browed or spotted bats would be expected to occur from grazing or related operations as roost sites are inaccessible to livestock. Concentrations of livestock in suitable foraging habitat such as areas of high herbaceous ground cover could potentially result in a reduction in the quality of foraging habitat for prey such as moths for the four species of bats through trampling of vegetation and compaction of soil. Water quality of stock tanks could potentially be impacted by grazing and result in effects to invertebrate prey. These potential effects to vegetation and water quality would be managed by limiting the length of grazing of a pasture in a given year, using a rotational grazing management system, managing seasonal utilization levels at moderate levels (21 to 50 percent) in late spring and early summer months and at conservative levels (30 to 40 percent) in the late summer and fall and managing annual utilization levels at the conservative level (30 to 40 percent) for herbaceous vegetation. Based on this information, potential direct and indirect impacts from livestock grazing on the four species of bats would be expected to be discountable.

Beneficial impacts would be expected from maintenance of existing structural improvements. Maintenance would improve or maintain available waters on the allotment, which provide drinking water and foraging areas for bats. Risk of drowning in drinkers would be reduced as escape ramps would be installed and maintained.

Alternative 3: Proposed Action

Alternative 3 is similar to Alternative 2 and would have the same direct and indirect effects as a result of livestock grazing and maintenance of existing range improvements.

Additionally, the construction of new structural range improvements under Alternative 3 could result in impacts to bat foraging habitat. Some of the new improvements would increase the number of disturbed areas on the allotment, but only slightly more (~1 acre) than Alternative 2. Loss of vegetative cover would be expected to have minimal impact on prey populations or habitats. Construction of new water sources would provide additional foraging habitat and drinking sources for bats. These improvements would improve livestock distribution across pastures and resulting in long-term beneficial impact to bat foraging habitat through improvement of herbaceous cover. As a result, the potential beneficial impacts of Alternative 3 would be expected to be slightly greater than those for Alternative 2.

Cumulative Effects

The geographical extent of the cumulative effects analysis is confined to the Angell Allotment. The timeframe selected for this cumulative effects analysis is 20 years. This includes 10 years in the past and the 10 year term of the grazing permit that would be issued under Alternatives 2 and 3.

Cumulative effects on Forest Service sensitive bats would be expected from changes in vegetative cover and soil conditions that alter water availability for drinking and foraging and effect prey habitat and prey availability in areas of high herbaceous cover on the allotment. Activities that could cumulatively affect bat habitats include wild ungulate grazing, recreation including dispersed camping and illegal road and trail creation, OHV use, wildfire, fuelwood harvest, spread of invasive plant species, road closures, maintenance of APS 69 kV and the 345kV power and transmission lines and climate change.

As described in detail for ferrets and their habitats, most of the past, present, and reasonably foreseeable future activities would be expected to result in localized decreases in the quality and quantity of bat foraging habitat on the allotment. For example, climate change could result in a decrease or complete lack in the availability of water in all or some portions of the allotment as a result of changes in precipitation and native herbaceous cover can be impacted by wild ungulate grazing, recreation and wildfire. Conversely, improvement in foraging habitat would be expected in those areas where off-road travel is limited, road densities are reduced through closures, and control of invasive plant species occurs resulting in improvement in native herbaceous cover and water quality.

Alternative 1: No Action

Since no livestock grazing or related activities would occur under Alternative 1, there would be no addition to the effects on vegetative cover or diversity, density, production, or quality of herbaceous vegetation described for past, present and reasonably foreseeable activities and therefore no cumulative effects would occur related to vegetation. The effects of climate change on water availability could have an additive effect to the loss of water from a lack of maintenance

of earthen stock tanks and drinker/pipeline water systems, but would be limited to those individual bats that forage on the allotment.

Alternative 2: Current Management

Cumulative effects for Alternative 2 would not result in losses in vegetative cover or decreases in diversity, density, production, or quality of herbaceous vegetation at the scale of the allotment over the length of the term grazing permit. Should there be high severity or long duration drought affecting vegetative cover in one or more pastures, livestock grazing would be adjusted through the adaptive management framework to limit the cumulative impact of these activities. Habitat conditions for bats would be expected to remain stable. Therefore, the potential impacts of livestock grazing and associated activities under Alternative 2 combined with past, present and reasonably foreseeable future projects on the allotment would not result in any additional effects to bats and their habitats.

Alternative 3: Proposed Action

Despite the small increase in quality of foraging habitat for bats in pastures including in Cocrane, Cinder Hill, O'Neil, Crisp and South Angell as a result of new range improvements, the potential impacts of livestock grazing and associated activities under Alternative 3 combined with past, present and reasonably foreseeable future projects on the allotment would be expected to be similar to Alternative 2 and would not result in any additional effects to bats and their habitats.

Determination

Spotted Bat

- Alternative 1 may impact individual spotted bats, but are not likely to result in a trend toward Federal listing or loss of viability of the species.
- Alternative 2 may impact individual spotted bats, but are not likely to result in a trend toward Federal listing or loss of viability of the species.
- Alternative 3 may impact individual spotted bats, but are not likely to result in a trend toward Federal listing or loss of viability of the species.

Western Red Bat

- Alternative 1 may impact individual western red bats, but are not likely to result in a trend toward Federal listing or loss of viability of the species.
- Alternative 2 may impact individual western red bats, but are not likely to result in a trend toward Federal listing or loss of viability of the species.
- Alternative 3 may impact individual western red bats, but are not likely to result in a trend toward Federal listing or loss of viability of the species.

Allen's Lappet-browed Bat

- Alternative 1 may impact individual Allen's lappet-browed bats, but are not likely to result in a trend toward Federal listing or loss of viability of the species.
- Alternative 2 may impact individual Allen's lappet-browed bats, but would not result in a trend toward Federal listing or a loss of viability for the species.
- Alternative 3 may impact individual Allen's lappet-browed bats, but would not result in a trend toward Federal listing or a loss of viability for the species.

Pale Townsend's Big-eared bat

- Alternative 1 may impact individual pale Townsend's big-eared bats, but are not likely to result in a trend toward Federal listing or loss of viability of the species.

- Alternative 2 may impact individual pale Townsend's big-eared bats, but would not result in a trend toward Federal listing or a loss of viability of the species.
- Alternative 3 may impact individual pale Townsend's big-eared bats, but would not result in a trend toward Federal listing or a loss of viability of the species.

Sensitive Birds

Northern Goshawk

Affected Environment

There are currently no identified post fledgling family areas (PFAs) on the Angell Allotment. Approximately 4,932 acres of ponderosa pine forest in the northwestern portion of the allotment provide suitable nesting and foraging habitat for goshawks. Suitable foraging habitat is also present in areas with high herbaceous cover and near earthen stock tanks.

Environmental Consequences

Direct and Indirect Effects

Alternative 1: No Action

No livestock grazing or associated activities would occur on the Angell Allotment if this alternative was implemented, so no direct or indirect effects would be expected to occur to northern goshawks. Decreases in availability of water at earthen stock ponds and drinker/pipeline systems for goshawk prey would occur over time as no maintenance of these water sources would occur under this alternative.

Alternative 2: Current Management

Livestock grazing would occur on the allotment during the goshawk breeding season (March 1st – August 31st). The presence of humans and noise associated with livestock management activities could potentially result in temporary or permanent nest abandonment. Currently there are no known nesting goshawks on the allotment, so no effects to breeding birds would be expected from livestock grazing and related activities. Concentration of livestock in suitable goshawk foraging areas such as areas with high herbaceous ground cover could result in trampling of vegetation and compaction of soil, reducing foraging and hiding cover for goshawk prey species and potentially reducing water quality in earthen stock tanks for prey species. These potential effects to vegetation and water quality would be managed by limiting the length of grazing of a pasture in a given year, using a rotational grazing management system, managing seasonal utilization levels at moderate levels (21 to 50 percent) in late spring and early summer months and at conservative levels (30 to 40 percent) in the late summer and fall and managing annual utilization levels at the conservative level (30 to 40 percent) for herbaceous vegetation. Based on this information, potential direct and indirect impacts from livestock grazing on northern goshawks and suitable foraging habitats are expected to be minimal.

Maintenance of range improvements could have both negative and positive effects for northern goshawks. Negative effects may occur as a result of noise and habitat disturbance for prey through maintenance of fences, pipelines, and troughs. This could cause prey to temporarily avoid these areas and reduce foraging habitat quality through reduced herbaceous cover. Such disturbances would be expected to be localized across the allotment at any given time and of short duration. The herbaceous community would be expected to recover under favorable climactic conditions in one or two years. Positive effects would be expected to occur from maintenance of earthen stock tanks and troughs, which provide water resources for prey species.

Alternative 3: Proposed Action

Alternative 3 is similar to Alternative 2 and would have the same direct and indirect effects as a result of livestock grazing and maintenance of existing range improvements.

Additionally, the construction of new structural range improvements under Alternative 3 could result in impacts to goshawk foraging habitat. Some of the new improvements would increase the number of disturbed areas on the allotment, but only slightly more (~1 acre) than Alternative 2. Loss of vegetative cover would be expected to have minimal impact on prey populations or habitats. Construction of new water sources would benefit goshawk prey. These improvements would improve livestock distribution across pastures and resulting in long-term beneficial impact to prey habitat through improvement of herbaceous cover. As a result, the potential beneficial impacts of Alternative 3 would be expected to be slightly greater than those for Alternative 2.

Cumulative Effects

The geographical extent of the cumulative effects analysis is the Angell Allotment and a 0.5 mile buffer due to their larger home ranges. The timeframe selected for this cumulative effects analysis is 20 years. This includes 10 years in the past and the 10 year term of the grazing permit that would be issued under Alternatives 2 and 3.

Cumulative effects to northern goshawk habitat and their prey would result from disturbance of prey and changes in vegetative cover and soil conditions that affect foraging habitat through changes in food resources and hiding cover for prey. Past, present, and reasonably foreseeable future projects that could be sources of noise disturbance of prey include recreationists such as hikers, bikers, horseback riders, hunters, and OHV users, maintenance of APS 69 kV and 345kV transmission lines, maintenance of roads, and fuelwood harvests.

Activities that could cumulatively affect goshawk foraging habitats include wild ungulate grazing, recreation including dispersed camping and illegal road and trail creation, OHV use, wildfire, fuelwood harvest, spread of invasive plant species, road closures, maintenance of APS 69 kV and 345 kV transmission lines and climate change. The geographical extent of the cumulative effects boundary for northern goshawks does not include any past, present, or reasonably foreseeable forest restoration projects such as tree/brush removal or prescribed burning.

As described in detail for ferrets and their habitats, most of the past, present, and reasonably foreseeable future activities would be expected to result in localized decreases in the quality of goshawk foraging habitat on the allotment. For example, climate change could result in a decrease in the availability of water as a result of changes in precipitation and native herbaceous cover can be impacted by wild ungulate grazing, recreation and wildfire. Conversely, improvement in foraging habitat would be expected in those areas where off-road travel is limited, road densities are reduced through closures, and control of invasive plant species occurs resulting in improvement in native herbaceous cover and water quality.

Alternative 1: No Action

Since no livestock grazing or related activities would occur under Alternative 1, there would be no addition to the effects on vegetative cover or diversity, density, production, or quality of herbaceous vegetation described for past, present and reasonably foreseeable activities and therefore no cumulative effects would occur related to vegetation. The effects of climate change on water availability for goshawk prey could have an additive effect to the loss of water from a

lack of maintenance of earthen stock tanks and drinker/pipeline water systems, but would be limited to those individual goshawks that forage on the allotment.

Alternative 2: Current Management

Cumulative effects for Alternative 2 would not result in losses in vegetative cover or decreases in diversity, density, production, or quality of herbaceous vegetation at the scale of the allotment over the length of the term grazing permit. Should there be high severity or long duration drought affecting vegetative cover in one or more pastures, livestock grazing would be adjusted through the adaptive management framework to limit the cumulative impact of these activities. Habitat conditions for goshawks would be expected to remain stable. Therefore, the potential impacts of livestock grazing and associated activities under Alternative 2 combined with past, present and reasonably foreseeable future projects on the allotment would not result in any additional effects to goshawks and their habitats.

Alternative 3: Proposed Action

Despite the small increase in quality of foraging habitat for goshawks as a result of new range improvements, the potential impacts of livestock grazing and associated activities under Alternative 3 combined with past, present and reasonably foreseeable future projects on the allotment would be expected to be similar to Alternative 2 and would not result in any additional effects to goshawks and their habitats.

Determination

- Alternative 1 may impact individual northern goshawks but are not likely to result in a trend toward Federal listing or a loss of species viability.
- Alternative 2 may impact individual northern goshawks but are not likely to result in a trend toward Federal listing or a loss of species viability.
- Alternative 3 may impact individual northern goshawks but are not likely to result in a trend toward Federal listing or a loss of species viability.

Western Burrowing Owl

Burrowing owls are found in flat, open, low-stature grasslands, sparsely vegetated desert scrub, and edges of human disturbed land. These owls take over burrows of prairie dogs ground squirrels, and other fossorial rodents and dens of coyote, fox and badger. They also readily use artificially created burrows.

Affected Environment

There are no known locations of burrowing owls on the Angell Allotment, but no formal surveys have occurred in the project area. Suitable burrow habitat does exist in the grassland habitats on the allotment that could be used during the breeding season, migration and/or winter. This includes 2230 acres of both occupied and vacant prairie dog colonies north of I-40 in Railroad, Rattlesnake, and Rio de Flag pastures as well as dens created by foxes and coyotes and abandoned pocket gopher tunnels in grasslands on the allotment. Suitable foraging habitat exists in many of the pastures on the allotment in open areas outside the ponderosa pine stands.

Environmental Consequences

Direct and Indirect Effects

Alternative 1: No Action

Under this alternative, there would be no livestock grazing or construction or maintenance of existing structural improvements in burrowing owl habitat. No direct or indirect effects from livestock grazing would occur to burrowing owls or their habitats under Alternative 1.

Alternative 2: Current Management

Alternative 2 would have potential effects on owls from concentrations of livestock in areas in areas with high herbaceous ground cover such as those areas adjacent to ponderosa pine forest. These potential impacts include trampling of individuals and vegetation, ground compaction, and collapsing of burrows and runways. These impacts would be managed by limiting the length of grazing of a pasture in a given year, using a rotational grazing management system, managing seasonal utilization levels at moderate levels (21 to 50 percent) in late spring and early summer months and at conservative levels (30 to 40 percent) in the late summer and fall and managing annual utilization levels at the conservative level (30 to 40 percent) for herbaceous vegetation. This level of management would maintain sufficient herbaceous forage and hiding cover for owl prey.

Maintenance of existing structural improvements such as fences, water lots, troughs, and pipelines could result in short term disturbances to owls and their prey. The presence of humans and the noise associated with maintenance activities could lead to avoidance of the area by owls and prey species where these actions occur. Vegetative cover in the immediate area of improvements could be reduced, but these areas would be expected to recover within a year or two with favorable climatic conditions. These disturbances would be of a short duration and would be expected to have minimal impacts to owls, their habitats or their prey.

Based on this information, potential direct and indirect impacts from livestock grazing and related activities on burrowing owls and their habitats under Alternative 2 would be discountable.

Alternative 3: Proposed Action

Alternative 3 is similar to Alternative 2 and would have the same direct and indirect effects as a result of livestock grazing and maintenance of existing range improvements.

Additionally, the construction of new structural range improvements under Alternative 3 could result in similar short term effects to burrowing owls, their prey and habitat as described for maintenance of improvements. These new improvements would increase the number of disturbed areas on the allotment, but only slightly more (~1 acre) than Alternative 2. These water developments would improve livestock distribution across pastures and resulting in long-term beneficial impact to owl habitat through improvement of forage resources and cover for prey in grazed areas. The potential beneficial effects of such long-term habitat improvement would be expected to be greater than the potential negative effects from noise disturbance and temporary loss of vegetative cover. As a result, the potential beneficial impacts of Alternative 3 would be expected to be slightly greater than those for Alternative 2.

Cumulative Effects

The geographical extent of the cumulative effects analysis is confined to the Angell Allotment. The timeframe selected for this cumulative effects analysis is 20 years. This includes 10 years in

the past and the 10 year term of the grazing permit that would be issued under Alternatives 2 and 3.

Cumulative effects to western burrowing owls, their prey and habitats would result from disturbance of owls and prey and changes in vegetative cover and soil conditions that affect foraging habitat through changes in food resources and hiding cover for prey. Past, present, and reasonably foreseeable future projects that could be sources of noise disturbance of prey include recreationists such as hikers, bikers, horseback riders, hunters, and OHV users, maintenance of APS 69 kV and 345 kV power and transmission lines, maintenance of roads and fuelwood harvests.

Activities that could cumulatively affect owl foraging habitats include wild ungulate grazing, recreation including dispersed camping and illegal road and trail creation, OHV use, wildfire, fuelwood harvest, spread of invasive plant species, road closures, maintenance of APS 69 kV and 345 kV power and transmission lines and climate change.

As described in detail for ferrets and their habitats, most of the past, present, and reasonably foreseeable future activities would be expected to result in localized decreases in the quality of owl foraging habitat on the allotment or short-term noise disturbance impacts. For example, climate change could result in a decrease in the availability of water as a result of changes in precipitation and native herbaceous cover can be impacted by wild ungulate grazing, recreation and wildfire. Operation of motorized vehicles for recreation or chainsaws for fuel wood harvest could result in owls and their prey temporarily avoiding an area. Conversely, improvement in foraging habitat would be expected in those areas where off-road travel is limited, road densities are reduced through closures, and control of invasive plant species occurs resulting in improvement in native herbaceous cover and water quality.

Alternative 1: No Action

Since no livestock grazing or related activities would occur under Alternative 1, there would be no addition to the effects described for past, present and reasonably foreseeable activities and therefore no cumulative effects would occur.

Alternative 2: Current Management

Cumulative effects for Alternative 2 would not result in losses in vegetative cover, decreases in diversity, density, production, or quality of herbaceous vegetation at the scale of the allotment over the length of the term grazing permit. Should there be high severity or long duration drought affecting vegetative cover in one or more pastures, livestock grazing would be adjusted through the adaptive management framework to limit the cumulative impact of these activities. Cumulative effects of livestock grazing with recreation, OHV use, fuelwood harvest is expected to not change from current conditions with regard to noise effects. Habitat conditions for owls would be expected to remain stable. Therefore, the potential impacts of livestock grazing and associated activities under Alternative 2 combined with past, present and reasonably foreseeable future projects on the allotment would not result in any additional effects to burrowing owls and their habitats.

Alternative 3: Proposed Action

Despite the small increase in quality of foraging habitat for burrowing owls and short-term noise disturbance for owls and their prey as a result of new range improvements, the potential impacts of livestock grazing and associated activities under Alternative 3 combined with past, present and

reasonably foreseeable future projects on the allotment would be expected to be similar to Alternative 2 and would not result in any additional effects to burrowing owls and their habitats.

Determination

- Alternative 1 would have no impact on western burrowing owls.
- Alternative 2 may impact individual western burrowing owls, but would not result in a trend toward Federal listing, or a loss of viability of the species.
- Alternative 3 may impact individual western burrowing owls, but would not result in a trend toward Federal listing, or a loss of viability of the species.

Bald and Golden Eagle Protection Act Compliance

Affected Environment

Golden eagles are known to occur on the Coconino National Forest. Although no occupied nest sites are known on the Angell Allotment, one historic nest is known from San Francisco Wash. Suitable nesting habitat does exist adjacent to the allotment on rock ledges or cliff faces in Padre and Walnut canyons and San Francisco Wash. The grasslands on the allotment support jackrabbits, a preferred prey species for golden eagles and provide suitable foraging habitat within a reasonable distance of potential nest locations near the allotment.

Bald eagles will not be evaluated in this document due to the lack of large snags for nesting and dense stands of trees for winter roosts, and lakes or streams for foraging on the Angell Allotment.

Environmental Consequences

Direct and Indirect Effects

Alternative 1: No Action

Under this alternative, there would be no livestock grazing or construction or maintenance of existing structural improvements in suitable golden eagle nesting habitat. No direct or indirect effects from livestock grazing would occur to nesting golden eagles under Alternative 1.

Alternative 2: Current Management

Under Alternative 2, livestock grazing would be authorized on the Angell Allotment. While there are no currently occupied nests on the allotment, suitable nesting locations exist on cliffs and ledges in Padre and Walnut canyons and in San Francisco Wash. Human disturbance associated with livestock management could potentially affect nesting golden eagles. These potential effects would be minimal as resource protection measures such as limiting the length of grazing of a pasture in a given year and using a rotational grazing management system would limit the amount of time livestock would spend during the breeding seasons near suitable nest locations.

Maintenance of existing structures such as fences, troughs, and pipelines (portions of Rattlesnake, Rio De Flag, and Turkey Tanks pastures near San Francisco Wash) could result in human disturbance of nesting golden eagles where they occur near suitable nesting sites. Such disturbances would be expected to be localized and of a short duration and would not involve use of equipment louder than a vehicle or chainsaw. Based on this information, potential direct and indirect effects to nesting golden eagles from livestock grazing and related activities would be expected to be discountable under Alternative 2.

Alternative 3: Proposed Action

Alternative 3 is similar to Alternative 2 and would have the same direct and indirect effects as a result of livestock grazing and maintenance of existing range improvements. Since new structural range improvements proposed under Alternative 3 would be constructed more than 0.5 mile from any suitable nesting locations, no additional effects to nesting golden eagles would be expected. As a result, the impacts of Alternative 3 would be expected to be similar to those for Alternative 2.

Cumulative Effects

The geographical extent of the cumulative effects analysis is confined to the Angell Allotment and a 0.5 mile buffer due to their larger home ranges. The timeframe selected for this cumulative effects analysis is 20 years. This includes 10 years in the past and the 10 year term of the grazing permit that would be issued under Alternatives 2 and 3.

Cumulative effects to nesting golden eagles would result from those activities that result in human disturbance. Past, present, and reasonably foreseeable future projects that could be sources of noise disturbance include recreationists such as hikers, bikers, rock climbers, horseback riders, hunters, and dispersed camping, OHV users, wildfire, maintenance of APS 69 kV and 345 kV power and transmission lines, maintenance of roads, and fuelwood harvest.

As described in detail for ferrets and their habitats, most of the past, present, and reasonably foreseeable future activities would be expected to result in short-term noise disturbance impacts. Operation of motorized vehicles for recreation or chainsaws for wildfire suppression and fuelwood harvest could result in disturbance of nesting golden eagles. Also short-term disturbance could result from the presence of humans that are hiking, biking, hunting, camping, or rock climbing near nesting golden eagles.

Alternative 1: No Action

Since no livestock grazing or related activities would occur under Alternative 1, there would be no addition to the effects described for past, present and reasonably foreseeable activities and therefore no cumulative effects would occur.

Alternative 2: Current Management

Cumulative effects for Alternative 2 would be low in frequency and transitive in nature, and not result in long-term impacts to nesting golden eagles. Therefore, the potential impacts of livestock grazing and associated activities under Alternative 2 combined with past, present and reasonably foreseeable future projects on the allotment would not result in any additional effects to nesting golden eagles.

Alternative 3: Proposed Action

The potential impacts of livestock grazing and associated activities under Alternative 3 combined with past, present and reasonably foreseeable future projects on the allotment would be the same to Alternative 2 since none of the improvements and changes in livestock distribution would be near golden eagles and their habitats.

Determinations

- Alternative 1 would not result in take of golden eagles as defined in the Bald and Golden Eagle Protection Act.

- Alternative 2 would not result in take of golden eagles as defined in the Bald and Golden Eagle Protection Act.
- Alternative 3 would not result in take of golden eagles as defined in the Bald and Golden Eagle Protection Act.

Management Indicator Species (MIS)

A Forest-wide assessment entitled "Management Indicator Species Status Report for the Coconino National Forest, Version 2" (Forest MIS report) summarizes current knowledge of population and habitat trends for species identified as management indicator species (MIS) for the Coconino National Forest (USDA Forest Service 2013a).

To evaluate the potential effects of a project on MIS, only those species that have representative habitat identified in the project area that will be affected by the proposed action have to be addressed.

Due to lack of habitat such as riparian areas, mixed conifer or spruce fir and aspen stands MIS species were not analyzed in this section. Livestock grazing will have no effect on the seral stages or number of snags in pinyon-juniper or ponderosa pine ecosystems so MIS associated with seral stages or snags within these ecosystems were not analyzed. Since the proposed action could potentially affect grasslands on the allotment, one MIS was analyzed, pronghorn antelope.

See Appendix D Table 23 for a list of MIS found on the Coconino National Forest and associated Indicator Habitats, Table 24 for a list of MIS and associated Management Areas (MAs) located on the Angell Allotment, and Table 25 for the effects to habitat quality for MIS by alternative. For further explanation of MIS see the Biology specialist's report.

Pronghorn Antelope

Pronghorn are grassland and opening dependent species. Pronghorn avoid dense understory conditions, preferring habitats that provide expansive vistas with uncluttered views (Brown and Ockenfels 2007). Their diet consists of forbs, grasses and shrubs and varies seasonally depending on availability, palatability and succulence and is generally higher in forbs and shrubs compared to other ungulates. Pronghorn choose fawning areas within approximately ½ mile of water due to increased nutritional and water needs during pregnancy and lactation.

Pronghorn are shy and do not respond well to disturbance (Neff 1986). Adults have been known to leave fawns when disturbed by humans. Fences can be complete or partial barriers to pronghorn depending on location (near waters, migration routes, roads, and railroads), size of area fenced, and design (hog wire, number of strands, bottom wire height, etc.; Neff 1986, Lee et al. 1998). Pronghorn have learned to negotiate certain fences by crawling underneath, but if the bottom wires of fences are too low, by virtue of design or buildup of vegetation or snow, pronghorn mobility can be impeded.

Affected Environment

Based on PNVT, there are 556 acres of grassland habitat on the Angell Allotment for which pronghorn are an MIS: 227 acres of Great Basin grasslands and 329 acres of montane subalpine grasslands. This represents less than 0.01 percent of Great Basin grassland type and approximately 0.01 percent of montane subalpine grassland type on the Forest. These acres are scattered across portions of Crisp, Horse, O'Neill, Railroad, Rattlesnake, Turkey Tanks, and Winona pastures, all of which are located in Game Management Unit (GMU) 7. The pronghorn

herd closest to these pastures ranges north of Flagstaff between Interstate 40 and Highway 89 with the most favorable habitats located north around Wupatki National Monument and east along the Navajo Reservation Boundary (Ockenfels et al. 1996). The quality of pronghorn habitat on the majority of the allotment (approximately 95 percent) is classified as low to poor because of the lack of tall, open grasslands on flat terrain (slopes less than 10 percent) preferred by pronghorn; fragmentation and barriers created by roads including Interstate 40 and Townsend-Winona Road; and proximity to development. No detections of radio-collared pronghorn were made on the allotment during previous telemetry work conducted in GMU 7 (Ockenfels et al. 1996). Based on this information, it is assumed that use of the grassland habitats on the allotment by pronghorn is limited to foraging and travel corridors.

Habitat Trend

Forest-wide grasslands trends are based on analyses of the amount of departure of vegetation and soil condition from reference condition of the three grassland types on the Forest using potential natural vegetation types and range monitoring and assessment data. In the Forest MIS report, the forest-wide trend for grasslands is determined to be stable to declining (USDA Forest Service 2013).

Population Trend

The main data source for the Forest's pronghorn population trend in the Forest MIS report is derived from Arizona Game and Fish Department fixed winged aerial surveys and hunt data for Game Management Units (GMU) 5A, 5B, 6A, 6B, and 7. The two best indicators for pronghorn population trend are 1) the number of pronghorn observed and 2) the number of fawns per 100 does observed. The population trend for pronghorn appears to be relatively stable, with fawn-to-doe ratios increasing somewhat over approximately the last 10 years (USDA Forest Service 2013). Pronghorn population indicators have fluctuated since the late 1980's, with fawn-to-doe ratios showing greater fluctuation than number of pronghorn observed per hour. Low fawn recruitment is a concern because of its influence on long-term productivity on a population and its ability to maintain itself. A number of factors have been identified that affect pronghorn populations including severe weather, amount and timing of precipitation, habitat fragmentation, diet overlap with other grazers, reductions in fawn hiding cover, woody vegetation encroachment, predation, and nutritional concerns (Neff 1986, Ockenfels et al. 1996a).

Environmental Consequences

Direct and Indirect Effects

Alternative 1: No Action

Under Alternative 1, there would be no livestock grazing or construction of new or maintenance of existing structural improvements in grassland habitat. Since there would be no competition with livestock for spring forage nor would there be reductions in the herbaceous cover from grazing or trampling, the quality of forage for pronghorn would be expected to remain stable or potentially improve during periods of favorable climatic conditions. Conversely, operation and maintenance of existing structural range improvements would not occur under Alternative 1. This would result in an immediate loss of available water for wildlife since the existing pipeline/drinker system would no longer be operated and a long-term loss of water as stock tanks fill with sediment and the pipeline/drinker system degrades. Additionally, as fences degrade due to lack of maintenance, they may become an entanglement/impalement hazard for pronghorn. Since the amount of habitat on the allotment is so small and the quality of this habitat is already

considered very poor due to issues such as terrain and existing barriers, these potential effects would not result in a change in the quantity or quality of pronghorn habitat on the allotment.

Alternative 2: Current Management

Under Alternative 2, there would be no effects to the quantity of Great Basin or montane subalpine grasslands on the allotment since grazing and related activities would not result in the conversion of one habitat type to another. The quality of Great Basin and montane subalpine grasslands may be impacted through potential competition for forage. Diet overlap between cattle and antelope is usually minimal, but competition for early spring forage may occur (Lee et al. 1998). Under Alternative 2, livestock grazing on the allotment can begin as early as May 15th so, depending on the timing of the emergence of herbaceous vegetation, some competition for spring forage could occur. Potential effects of competition would be managed by limiting the length of grazing of a pasture in a given year, using a rotational grazing management system, managing seasonal utilization levels at moderate levels (21 to 50 percent) in late spring and early summer months and at conservative levels (30 to 40 percent) in the late summer and fall and managing annual utilization levels at the conservative level (30 to 40 percent) for herbaceous vegetation. This level of management would maintain sufficient herbaceous forage for pronghorn and meets the management guidelines for livestock grazing in the Arizona Statewide Pronghorn Management Plan (AZGFD 2011a). As a result, grazing would have a minimal impact to the quality of grassland habitats and would contribute to maintaining the viability of pronghorn populations on the Forest.

Maintenance of existing structural improvements such as fences and drinker/pipelines would have short duration effects on this species and its foraging habitats. Disturbance created by the presence of humans and the noise of construction activities could lead to temporary avoidance of areas where activities occur in suitable pronghorn habitats, specifically in Crisp and O'Neill pastures. Reductions in vegetative cover in the immediate area of improvements would be anticipated with recovery expected to occur in one to two years with favorable climatic conditions. These potential effects would occur at localized areas across grasslands in any given year and would be of short duration. Water would be available for pronghorn as the pipeline/drinker system would be operated and maintained and sediments would be removed from earthen stock tanks as needed. Fences would be maintained reducing the risk of pronghorn becoming entangled or impaled on fences. Where necessary, fences would be reconstructed over time to meet wildlife specifications, reducing the number of barriers that exist to pronghorn movements on the landscape. Based on this information, potential impacts from existing structural improvements on pronghorn and quality of grassland habitats on the allotment would be expected to be minimal.

Alternative 3: Proposed Action

As described for Alternative 2, no change in the quantity of Great Basin or montane subalpine grasslands habitats would be expected under Alternative 3. Similarly potential effects from livestock grazing to the quality of Great Basin and montane subalpine grasslands under this alternative would result from competition for forage. Under this alternative, livestock grazing on the allotment would typically not begin until June 1st. Since this is two weeks later than Alternative 2, potential competition for early spring forage between livestock and pronghorn would be expected to be reduced under Alternative 3. These potential effects would be managed by limiting the length of grazing of a pasture in a given year, using a rotational grazing management system, managing seasonal utilization levels at moderate levels (21 to 50 percent) in late spring and early summer months and at conservative levels (30 to 40 percent) in the late

summer and fall and managing annual utilization levels at the conservative level (30 to 40 percent) for herbaceous vegetation. This level of management would maintain sufficient herbaceous forage for pronghorn and be expected to have a similar impact to the quality of grassland habitats and maintaining the viability of pronghorn populations on the Forest as Alternative 2.

Potential impacts from maintenance of existing structural improvements would be similar to those expected under Alternative 2 but there would be additional effects from proposed improvements. Impacts to pronghorn and habitat quality from proposed improvements would be both positive and negative. As described for maintenance of improvements, disturbance created by the presence of humans and the noise of new improvements could lead to temporary avoidance of areas where activities occur as well as short-term reductions in vegetative cover (~ 1 acre). The expansion of the water lot servicing Crisp and Cinder Hill pastures to include the O'Neil pasture would improve the quality of 242 acres of grassland habitat in the O'Neil pasture for pronghorn through improvement of livestock distribution and management in the pasture through the addition of a water source. As a result, new improvements constructed under Alternative 3 would be expected to have a small increase (0.002 percent) in the quality of grassland habitat for pronghorn on the allotment.

Cumulative Effects

The geographical extent of the cumulative effects analysis is Great Basin and subalpine grassland habitats on the Coconino NF. Most of these acres are located on Anderson Mesa and the northern boundary of the Forest. The timeframe selected for this cumulative effects analysis is 20 years. This includes 10 years in the past and the 10 year term of the grazing permit that would be issued under Alternatives 2 and 3.

Cumulative effects to pronghorn and its habitats would result from disturbance of pronghorn and changes in vegetative cover and soil conditions that affect habitat through changes in food resources and hiding cover for fawns. Past, present, and reasonably foreseeable future projects that could be sources of noise disturbance include recreationists such as hikers, bikers, horseback riders, hunters, and OHV users, fuelwood harvests and maintenance projects such as along roads and utility corridors

Activities that could cumulatively affect grassland habitats include wild ungulate grazing, recreation including dispersed camping and illegal road and trail creation, OHV use, wildfire, fuelwood harvest, spread of invasive plant species, road closures, maintenance activities such as along roads and utility corridors, grassland restoration projects on Anderson Mesa, fence modifications projects and climate change.

As described in detail for ferrets and their habitats, most of the past, present, and reasonably foreseeable future activities would be expected to result in localized decreases in the quality of pronghorn habitat on the allotment or short-term noise disturbance impacts. For example, climate change could result in a decrease in the availability of water as a result of changes in precipitation and native herbaceous cover can be impacted by wild ungulate grazing, recreation and wildfire. Operation of motorized vehicles, chainsaws, and other equipment for recreation, fuel-wood harvest, wildfires, restoration projects and maintenance activities could result in pronghorn temporarily avoiding an area. Conversely, improvement in habitat quality would be expected in those areas where off-road travel is limited, road densities are reduced through closures, and control of invasive plant species occurs resulting in improvement in native herbaceous cover.

Grassland restoration efforts on Anderson Mesa, including on the Bar T Bar and Anderson Springs allotments, around Slate Mountain and within the Marshall Fuel Reduction and Forest Restoration project area have improved the quality of grassland habitats for pronghorn through removal of woody vegetation and prescribed fire. Activities that have occurred in recent years have led to increases in the amount of open grassland habitat, reductions in competition for herbaceous vegetation with juniper and pine, and improvement of native herbaceous cover. Such efforts are expected to continue in the future in these areas as well as in those areas within the boundary of Phase One of the Four Forest Restoration Initiative.

Fence modifications to reduce or eliminate barriers to pronghorn movement have improved access to grassland habitats across the Forest. Over the past several years, Arizona Game and Fish Department in conjunction with the Forest, Arizona Department of Transportation, and other partners have relocated fences and implemented modifications such as installing goatbars and installing smooth wire and raising the height of bottom wires along segments of Highways 180 and 89. Goatbars are modifications to the lower wire of a fence, using PFC pipe that makes it easier for pronghorn to go underneath. Such modifications have eliminated major barriers to movement of pronghorn across grassland habitats on the northern portion of the Forest and more projects along these two highways are expected to occurring in the next couple of years. Additionally, regular fence modification and maintenance of allotment and pasture fences is conducted by grazing permittees, the Forest, AGFD, and volunteer groups. During these efforts, fences are modified to meet Forest Plan wildlife-friendly guidelines through replacement of barbed wire with smooth on the bottom wire, raising of this wire to 18 inches, and installation of goat bars in areas where travel corridors for pronghorn and other wildlife. For example, in a 2001 cooperative effort with AGFD in GMUs 5A and 5B, approximately 200 miles of fences were monitored and about 60 miles of fence were improved through the installation of goatbars (USDA Forest Service 2013).

Alternative 1: No Action

Since no livestock grazing or related activities would occur under Alternative 1, there would be no addition to the effects on vegetative cover or diversity, density, production, or quality of herbaceous vegetation described for past, present and reasonably foreseeable activities and therefore no cumulative effects would occur related to vegetation. The effects of climate change on water availability could have an additive effect to the loss of water from a lack of maintenance of earthen stock tanks and drinker/pipeline water systems. Since the amount of pronghorn habitat on the allotment is so small and the quality of this habitat is already considered very poor due to issues such as terrain and existing barriers, the additive effects would not result in a change in the quantity or quality of pronghorn habitat on the allotment.

Alternative 2: Current Management

Cumulative effects for Alternative 2 would not result in long-term losses in forage quality or vegetation at the scale of the allotment over the length of the term grazing permit. Should there be high severity or long duration drought affecting vegetative cover in one or more pastures, livestock grazing would be adjusted through the adaptive management framework to limit the cumulative impact of these activities. Cumulative effects of livestock grazing with recreation, OHV use, fuelwood harvest is expected to not change from current conditions with regard to noise effects. Therefore, the potential impacts of livestock grazing and associated activities under Alternative 2 combined with past, present and reasonably foreseeable future projects on the allotment would not result in any additional effects to the quality or quantity of pronghorn habitat.

Alternative 3: Proposed Action

Cumulative effects for Alternative 3 would not result in long-term losses in forage quality or vegetation at the scale of the allotment over the length of the term grazing permit. Should there be high severity or long duration drought affecting vegetative cover in one or more pastures, livestock grazing would be adjusted through the adaptive management framework to limit the cumulative impact of these activities. Cumulative effects of livestock grazing with recreation, OHV use, fuelwood harvest is expected to not change from current conditions with regard to noise effects. Despite the small increase in quality of pronghorn habitat as a result of new range improvements, the potential impacts of livestock grazing and associated activities under Alternative 3 combined with past, present and reasonably foreseeable future projects on the allotment would not result in any additional effects to the quality or quantity of pronghorn habitat.

Determinations

- Alternative 1 would result in no change in habitat quantity or quality for pronghorn antelope. This would not alter forest-wide habitat and population trends.
- Alternative 2 would result in no change in habitat quantity or quality for pronghorn antelope. This would not alter forest-wide habitat and population trends.
- Alternative 3 would result in no change in habitat quantity, but a small increase (approximately 0.002 percent) in habitat quality for pronghorn antelope. This increase would be too small to alter forest-wide habitat and population trends.

Migratory Birds

In addition to the species already analyzed in this document, migratory birds as identified by Arizona Partners in Flight as Priority Bird Species (PIF) and U.S. Fish and Wildlife Service Birds of Conservation Concern (BCC) are analyzed that occur in the project area. Nineteen species that occur in ponderosa pine, grasslands, and pinyon-juniper habitats will be analyzed for this project. Migratory birds previously discussed (northern goshawk, golden eagle, and western burrowing owl) were excluded.

Affected Environment

Important Bird Areas (IBAs) are identified by the Audubon Society and are sites that provide important habitat for birds as well as provide opportunity to engage the public in conserving priority habitats for migratory and other species. No IBAs exist within the Angell Allotment. The closest IBA is the Anderson Mesa IBA is located approximately 3 miles directly south and west of the allotment.

See Table 26 in Appendix D for a list of migratory bird species and habitat preference.

Environmental Consequences

Direct and Indirect Effects

Alternative 1: No Action

Under this alternative there would be no livestock grazing operations in suitable bat habitat or no structural improvements constructed or maintained. Operation and maintenance of existing structural range improvements would not occur under Alternative 1. Decreases in availability of water at earthen stock ponds and drinker/pipeline systems for foraging and drinking would occur over time as no maintenance of these water sources would occur under this alternative reducing prey habitat and drinking water for migratory birds. Additionally, the risk of drowning in drinkers

would increase for birds since maintenance of wildlife escape ramps would not occur. The potential loss of water and risk of drowning from lack of maintenance could result in direct and indirect effects to individual migratory birds and their foraging habitats on the Angell Allotment under Alternative 1.

Alternative 2: Current Management

Livestock grazing and maintenance of existing range improvements would be authorized under Alternative 2. Noise disturbance to foraging and nesting birds may occur from management actions by the permittee such as herding, fence maintenance, and trough/pipeline work.

Grazing can reduce the amount of forage available and herbaceous ground cover for many species of migratory birds. This includes both seeds for forage, the insects that use the herbaceous cover, and both hiding cover and nesting cover. Potential effects to vegetation would be managed by limiting the length of grazing of a pasture in a given year, using a rotational grazing management system, managing seasonal utilization levels at moderate levels (21 to 50 percent) in late spring and early summer months and at conservative levels (30 to 40 percent) in the late summer and fall and managing annual utilization levels at the conservative level (30 to 40 percent) for herbaceous vegetation. This would help maintain vegetation at sufficient levels to continue to provide for the various needs described above.

Impacts to nesting birds from grazing may occur to those species that are ground nesters such as Virginia's warbler. Trampling of nests or vegetation for nesting cover could result in unintentional take of individual migratory birds. These impacts are expected to be minimized by management actions such as limiting the length of grazing of a pasture in a given year, using rotational grazing management system, managing grazing intensity at conservative to moderate levels, and forage utilization at conservative levels.

Alternative 3: Proposed Action

Alternative 3 is similar to Alternative 2 and would have the same direct and indirect effects as a result of livestock grazing and maintenance of existing range improvements.

Under Alternative 3, new construction of pipelines, troughs, and fences for water lots would increase this disturbance slightly over the disturbance levels in Alternative 2 for a short period of time (<1 year). These actions would ultimately provide more waters for migratory birds to utilize, and would be a positive affect to birds and their habitat through the length of the 10-year grazing permit. The disturbance from these actions would be temporary and localized in effect, and would be expected to be minimal and that species would resume normal activities in these areas quickly.

Cumulative Effects

The geographical extent of the cumulative effects analysis for migratory birds is confined to the Angell Allotment. The timeframe selected for this cumulative effects analysis is 20 years. This includes 10 years in the past and the 10 year term of the grazing permit that would be issued under Alternatives 2 and 3.

Cumulative effects to migratory birds and their habitats would result from disturbance of migratory birds and their prey and changes in vegetative cover and soil conditions that affect foraging and ground nesting habitat through changes in food resources and hiding cover in herbaceous cover. Past, present, and reasonably foreseeable future projects that could be sources

of noise disturbance include recreationists such as hikers, bikers, horseback riders, hunters, and OHV users, maintenance of roads and utility corridors and fuelwood harvests.

Activities that could cumulatively affect migratory birds foraging and ground nesting habitats include wild ungulate grazing, recreation including dispersed camping and illegal road and trail creation, OHV use, wildfire, fuelwood harvest, spread of invasive plant species, road closures, maintenance of vegetation in 69kV and 345kV power and transmission line corridors, and climate change.

As described in detail for ferrets and their habitats, most of the past, present, and reasonably foreseeable future activities would be expected to result in localized decreases in the quality of migratory foraging and ground nesting habitat in grasslands and other areas with herbaceous ground cover or short-term noise disturbance impacts. For example, native herbaceous cover can be impacted by wild ungulate grazing, recreation, wildfire, and climate change. Operation of motorized vehicles for recreation or chainsaws for fuel wood harvest could result in migratory birds and their prey temporarily avoiding an area. Conversely, improvement in foraging habitat would be expected in those areas where off-road travel is limited, road densities are reduced through closures, and control of invasive plant species occurs resulting in improvement in native herbaceous cover.

Alternative 1: No Action

Since no livestock grazing or related activities would occur under Alternative 1, there would be no addition to the effects on vegetative cover or diversity, density, production, or quality of herbaceous vegetation described for past, present and reasonably foreseeable activities and therefore no cumulative effects would occur related to vegetation. The effects of climate change on water availability could have an additive effect to the loss of water from a lack of maintenance of earthen stock tanks and drinker/pipeline water systems, but would be limited to those individual migratory birds that forage on the allotment.

Alternative 2: Current Management

Cumulative effects for Alternative 2 would not result in long-term losses in vegetative cover, decreases in diversity, density, production, or quality of herbaceous vegetation at the scale of the allotment over the length of the term grazing permit. Should there be high severity or long duration drought affecting vegetative cover in one or more pastures, livestock grazing would be adjusted through the adaptive management framework to limit the cumulative impact of these activities. Cumulative effects of livestock grazing with recreation, OHV use, fuelwood harvest is expected to not change from current conditions with regard to noise effects. Habitat conditions for migratory birds would be expected to remain stable. Therefore, the potential impacts of livestock grazing and associated activities under Alternative 2 combined with past, present and reasonably foreseeable future projects on the allotment would not result in any additional effects to migratory birds and their habitats.

Alternative 3: Proposed Action

Despite the small increase in quality of foraging and ground nesting habitat for migratory birds and short-term noise disturbance for migratory birds and their prey as a result of new range improvements, the potential impacts of livestock grazing and associated activities under Alternative 3 combined with past, present and reasonably foreseeable future projects on the allotment would be expected to be similar to Alternative 2 and would not result in any additional effects to migratory birds and their habitats.

Determinations

- Alternative 1 would not result in unintentional take of individuals and would not lead to a decline in migratory bird populations.
- Alternative 2 would potentially result in unintentional take of individuals but would not lead to a decline in migratory bird populations.
- Alternative 3 would potentially result in unintentional take of individuals but would not lead to a decline in migratory bird populations.

Recreation

Affected Environment

Recreation use within the Angell Allotment includes driving for pleasure, wildlife viewing, big game and antler hunting, picnicking, rock climbing and bouldering, firewood gathering, heritage site visitation, target shooting, dispersed camping, OHV activities, some off-trail hiking, horseback riding, and mountain biking.

The Coconino National Forest manages for a multitude of recreational experiences by designating areas according to the recreation opportunity spectrum. The recreation opportunity spectrum addresses the appropriateness, frequency and duration of human sounds and sights within the forest by considering the probability or prevalence of human sounds and sights in discretely defined settings. Recreation opportunity spectrum classifications are based on the magnitude and nature of this human influence. The recreation opportunity spectrum divides the Forest into the following setting classes: primitive, semi-primitive nonmotorized; semi-primitive motorized; roaded natural; rural; and urban areas.

The Recreation Opportunity Spectrum classes in the Angell Allotment Area consist of about 43 percent of Roaded Natural (RN), 56 percent of Semi-Primitive Motorized (SMP), and a small amount (less than 1 percent) of Semi-Primitive Non-Mototorized (SPNM).

Environmental Consequences

Direct and Indirect Effects

Alternative 1: No Action

The no action alternative would have minimal direct effect on recreation resources and activities within the analysis area. Most recreationalists participating in various recreational activities such as rock climbing, hiking, biking, horseback riding, driving, other recreational activities and hunting would not likely notice a difference if cattle were no longer in the Angell Allotment.

There would be an indirect effect in that livestock fences would no longer be maintained and likely fall in disrepair. This could result in visual impacts in some areas of the allotment.

The no action alternative would have no effect on the current ROS classification within the project area as it would result in no or very little change in the probability or prevalence of human sounds and sights in each recreation setting.

Alternative 2: Current Management

Conflicts between recreation users and livestock grazing are generally related to personal perspectives, access, and scenic values. Forest visitors to the Angell Allotment may vary widely

in their reaction to seeing cattle on the National Forest. Reactions depend on viewer's personal values, opinions, and whether they are accustomed to seeing cattle. Visitors travelling through the allotment may stop to take pictures of cattle because to them this is a pleasant pastoral scene. Conversely some wildlands advocates who dislike any kind of "unnatural" structures or animals on landscapes may feel that cattle disrupt their perception of National Forests as truly wild places.

To campers, picnickers, and rock climbers who like to recreate in the same place in which cattle may congregate, the presence or leavings of cattle in those areas may detract from their experience or even cause them to move to different sites. Trail and motorized recreationalists may be disrupted by features of cattle, such as fences, while traveling in an area and may be inconvenient for them and result in fences being cut or damaged or gates left open.

The Alternative 2 would not change livestock management currently experienced by recreation users on the allotment and thus have no or minimal direct effect on recreation resources and activities within the analysis area. The Current Management Alternative would have no effect on the current ROS classification within the project area as it would result in no or very little change in the probability or prevalence of human sounds and sights in each recreation setting.

Alternative 3: Proposed Action

The direct and indirect effects for the Proposed Action Alternative would be the same to the recreation resources as the Current Management Alternative. The inclusion of additional structural range improvements is inconsequential to recreational activities within that portion of the analysis area. None of the range improvements are occurring in Semi-Primitive Non-Motorized areas where the prevalence of human sounds and sights is expected to be minimal.

Cumulative Effects

The geographical extent of the cumulative effects analysis is confined to the Angell Allotment. The timeframe selected for this cumulative effects analysis is 20 years. This includes 10 years in the past and the 10 year term of the grazing permit that would be issued under Alternatives 2 and 3.

Alternative 1: No Action

Since there would be minimal direct and indirect effects from Alternative 1, there would be no cumulative effects to recreation. Since there would be no direct and indirect effects, there would be no cumulative effect to the ROS classification.

Alternative 2: Current Management

Effects of livestock grazing to the recreation uses and settings within the Angell Allotment would be minimal to visitors and would not limit recreation opportunities and therefore there would not result in cumulative effects. Since there would be no direct or indirect effects, there would be no cumulative effect to the ROS system.

Alternative 3: Proposed Action

Cumulative effects for Alternative 3 would be the same as for Alternative 2.

Heritage Resources

Affected Environment

There has been approximately 27.5 percent of the Angell Allotment surveyed for cultural resources. This amount exceeds the 10 percent inventory baseline for project inventory as per the Coconino Forest Plan (1987, as amended). Per the Coconino National Forest heritage geodatabase, a total of 1,145 cultural resource sites are documented in the Angell Allotment (more details available in the Heritage Resources Specialist Report). Simplified, the sites consist of 16 historic and 1,077 prehistoric sites (1,078 Northern Sinagua and one Clovis Point discovery, 6 multicomponent sites) and 45 type-unknown or unrecorded sites. These sites qualify as 'historic properties' per the National Historic Preservation Act. Surveys completed across the allotment are not random, but have been strategically applied in areas where land management activities that may affect cultural resources have been proposed or where landscape features result in a high likelihood of historic or prehistoric inhabitance.

Guidelines have been developed in consultation with the Region 3 and the Arizona and New Mexico Historic Preservation Offices serve to standardize NHPA requirements for Allotment Management Plans (US Forest Service 2007).

In accordance with these guidelines, archaeologists on the Flagstaff Ranger District assessed potential effects to sites in the Angell Allotment as a result of cattle grazing. To accomplish a more holistic understanding about how cattle affect archaeological resources in the Angell Allotment the Coconino National Forest conducted field research, completed GIS modeling to determine a sampling strategy for site monitoring/condition assessments, created a new Condition Assessment Form to better document the effects of livestock on cultural sites, and contracted an archaeological firm, Logan Simpson Design (LSD) Inc, to perform independent site monitoring at 39 cultural resources within the Angell Allotment. This site-monitoring endeavor not only sought to assess effects of cattle grazing activities to archaeological sites, but to also provide appropriate measures to mitigate any such effects.

LSD archaeologists conducted site visits to each of the sampled archaeological sites between 9/17/13 and 9/20/13, in order to evaluate the condition and integrity of each site based on criteria determined in conjunction with Coconino National Forest archaeologists. Of the 39 archaeological sites chosen for evaluation, 3 sites (02-3585, 02-3609, and 02-3618/NA21162) could not be relocated by LSD personnel, for listing in the National Register.

The remaining 36 visited sites were determined to have sustained no adverse effects caused by cattle grazing activities. Cattle hoof prints and dung was present at 24 sites. Cattle (or other ungulate) bedding was observed at 19 of the sites. All cattle bedding areas were observed to be superficial and have not resulted in any lost data or impacts resulting in loss of site integrity. No damage to archaeological features or artifacts could be attributed to cattle.

Archaeological site assessment within the Angell Allotment demonstrates that cattle grazing has not resulted in adverse effects to cultural resource sites. The Arizona State Historic Preservation Office concurred with this determination of no adverse effect, in correspondence dated 5/5/2014. The Hopi Tribe also concurred with this determination of no adverse effect in correspondence dated 5/7/2014.

While the study showed no evidence of livestock grazing resulting in adverse effects to cultural resource sites, it is assumed that range practices that aggregate a large number of cattle within

archaeological sites may affect site integrity. This would include various activities associated with rangeland management, such as salt placement and the placement of water sources. Provided these high aggregation locations are not within cultural resource sites, the effects are unlikely to be adverse.

In summary, the results of the archaeological site assessment reveal that cattle graze through archaeological sites, and may bed under trees at site locations, however grazing within the Angell Allotment has not resulted in adverse effects to cultural resource sites. Monitoring should be conducted throughout the allotment when conducting other inventories, as a part of day to day field work (US Forest Service 2007).

Any additional ground disturbing range improvements or treatments proposed within the Angell

Grazing Allotment will comply with the existing Region 3 Programmatic Agreement with the

Arizona State Historic Preservation Officer, dated December 24, 2003, and shall constitute an additional undertaking for Section 106 compliance outside of this Allotment Management Plan Report. This would include all structural improvements as proposed in alternative 3.

See the Angell Allotment Heritage Specialist Report for further information regarding the study mentioned in this section.

Environmental Consequences

Direct and Indirect Effects: Common to All Alternatives

There would be no adverse effect to heritage resources under all alternatives. Removing grazing from the allotment per the No Action Alternative would result in no effect to heritage resources. Reauthorization of grazing under Alternatives 2 and 3 would result in no adverse effect to cultural resource sites. Grazing activities should be benign to cultural resource sites and not adversely affect their national register status. While there is no documentation of livestock damage to sites eligible for listing in the National Register of Historic Places based on study of livestock in the allotment, in areas where visible damage from livestock has occurred in rock shelters, historic building and prehistoric sites with standing architecture, adaptive management strategies such as fencing or other forms of exclosures will be used.

Archaeological sites generally consist of a surface artifact assemblage, and subsurface artifact and feature deposits. The surface expression represents a horizon of material that is used by archaeologists to readily interpret general information about a site, and provide clues to a site's ability to yield information through its subsurface deposits. Due to processes such as wind, rain, snow, erosion, sedimentation, animal burrowing, ungulate grazing, and human modification, surface artifact assemblages are generally lacking in primary context and artifact integrity can be compromised by these processes.

Experimental studies of the effects of cattle trampling show that surface artifacts may be vertically and horizontally displaced, as well as modified or damaged by cattle trampling (Benito-Calvo et al. 2011; Cinnamon 1986; Erin et al. 2010; Estes et al. 2013; Jennings 2011; Douglass and Wandsnider 2012). The intensity of these effects are related to the duration and intensity of trampling, as well as varying substrates (Benito-Calvo et al. 2011; Cinnamon 1986; Erin et al. 2010; Estes et al. 2013; Jennings 2011; Douglass and Wandsnider 2012).

It is therefore reasonable to assume that cattle trampling does not improve surface artifact assemblage integrity. However, given that surface assemblages are known to be disturbed by a multitude of processes over hundreds or thousands of years, surface disturbance by cattle grazing may be negligible.

In contrast, subsurface archaeological deposits, embedded to their surrounding soil matrix, generally have retained integrity and have a greater potential for yielding information about an archaeological site. If an archaeological site is situated in an area of erosion, the site will eventually be destroyed by erosion; if a site is in an area of deposition, the site will be buried; if erosion and deposition are negligible, the site will remain at the surface (Waters 1992). Most sites in the Angell Allotment appear to be buried or partially buried by soil/sediment deposition. As such, archaeological site integrity is dependent on the soil matrix that holds archaeological deposits together. While buried, archeological deposits and the potential data they hold remain relatively intact. The loss of soil due to erosion can expose in situ site deposits, resulting in a diminishment of site integrity and the loss of data.

As vegetative cover protects the soil from forces of erosion, such as rain and sheet-flow stress (see Soils section), it can be implied that maintaining vegetation cover within archaeological sites protects subsurface archaeological site integrity. Inversely, the loss of ground cover by livestock grazing could result in erosion and negative effects to archaeological sites.

As previously mentioned in the Existing Conditions section, current conditions within the analysis area's ponderosa pine and pinon-juniper vegetation communities are generally satisfactory owing to high amounts of effective vegetative ground cover (litter and herbaceous plants).

Under alternatives 2 and 3, managed livestock grazing would continue to occur. Based on soils analysis from previous sections, vegetation production and vegetation quality of forage species would be maintained or improved over a large portion of the analysis area. Changes in vegetation production and quality of non-forage vegetation species is expected to remain unchanged under the preferred alternative.

Provided the ground cover conditions remain the same or improve, we can expect that subsurface archaeological deposits will not be affected by the proposed alternatives.

Accordingly, the authorization of seasonal grazing for 425 cattle, from June 1st through November 15th, across the 51,701 acre Angell Allotment will not have significant effects to cultural resources.

Alternative 3: Proposed Action

All structural range improvements will comply with the existing Region 3 Programmatic agreement with the Arizona State Historic Preservation Officer, dated December 24, 2003, and shall constitute an additional undertaking for Section 106 compliance outside of this allotment Management Plan Report. Any improvements shall meet no effect or no adverse effect standards in consultation with the Arizona State Historic Preservation Office.

Cumulative Effects

Accordingly, the authorization of seasonal grazing for 425 cattle, from June 1st through November 15th, across the 51,701 acre Angell Allotment will not have significant effects to cultural resources.

Economics

Affected Environment

Livestock grazing contributes to the livelihood of the Angell Allotment permittee as well as to the economy of local communities. The Angell Allotment is located in Coconino County and is currently permitted 425 head of adult cattle with a season of use from May 15 through October 31. The nearest community to the allotment is Flagstaff, Arizona. This community has a large and fairly diverse economy with livestock grazing associated revenues making up a very small portion of the economy. Individual allotments provide incremental contributions to local economies; a change to one allotment may result in no impacts to the local economy, but changes in several allotments would most likely result in an impact to the area economy.

Coconino County receives revenue in several ways: county sales taxes, state-shared sales taxes, highway user revenues (gasoline taxes), property taxes, and National Forest fees. The greatest revenues come from the county and state-shared sales taxes. National Forest fees, which include payments from timber harvesting, mining, recreational uses, and cattle grazing, are an important part of county revenues, but provide only a fraction of available funds (EPS-HDT, 2013b). Coconino County also receives National Forest fees from uses on the Apache-Sitgreaves, Kaibab, and Prescott National Forests. National Forest fees are used primarily for highway maintenance and public schools in Coconino County. The Angell Allotment permittee directly contributes revenues to Coconino County through property taxes.

Environmental Consequences

Direct and Indirect Effects

Estimates of direct and indirect jobs and payments to Coconino County from Federal receipts provide a relative comparison of economic effects that could occur due to changes in livestock grazing.

Table 15 estimates the effects expected on these indicators in Coconino County from implementing the No Action alternative, the Current Management Action and the Proposed Action alternative on the Angell Allotment.

Table 15: Estimated Economic Effects for Coconino County.

Economic Effects	No Action Alternative	Current Management Alternative	Proposed Action Alternative
Direct and Indirect Jobs*	0	4.85	4.85
Federal Payments to Counties**	0	$801.56	$793.13

*Approximately 1.14 jobs per 100 cattle

**The amount shown under the Current Management alternative and the Proposed Action alternative is based on 25 percent of the Angell Allotment grazing fees paid to Coconino County at the 2013 grazing fee rate of $1.35/HM and at the maximum permitted Head Months of 2,375 and 2,350 respectively. Not shown in this amount are the taxes that county collects on range structural improvements. These taxes are based on a percentage of the assessed values of those improvements and the materials purchased for the construction of these improvments.

Quantifiable factors such as economic costs and outputs, along with projected head months (HM) or animal unit months (AUM) have been used to help describe the economic effects of grazing on the Angell Allotment. These projections from the Quick-Silver model[9] are best used as an indicator of change to compare alternatives rather than a precise measurement.

The investment analysis anticipates the rate of return for the projected expenditures by the permittee and Forest Service on the Angell Allotment over a 10 year period. Table 16 displays that the Current Management Alternative has the highest benefit cost ratio, followed by the Proposed Action Alternative; the No Action Alternative provides a zero value benefit cost ratio.

[9] Quick-Silver is a program developed and supported by the Forest Service for economic analysis of long-term, on-the-ground resource management projects (Ecosystem Management Coordination Home, 2015).

Table 16: Investment Analysis.

Investment Analysis	Alternative 1 - No Action Alternative	Alternative 2 - Current Management Alternative	Alternative 3 - Proposed Action Alternative
Forest Service			
Present Value of Benefits [1]	$0.00	$26,006	$25,732
Present Value of Costs [2]	$0.00	-$62,342	-$109,100
Present Net Value [3]	$0.00	-$36,336	-$83,368
Benefit/Cost Ratio [4]	NA	0.42	0.24
Permittee			
Present Value of Benefits [1]	$0.00	$226,730	$224,343
Present Value of Costs [2]	$0.00	-$106,405	-$141,346
Present Net Value [3]	$0.00	$120,325	$82,997
Benefit/Cost Ratio [4]	NA	2.13	1.59
All Partners			
Present Value of Benefits [1]	$0.00	$252,736	$250,075
Present Value of Costs [2]	$0.00	-$168,747	-$250,446
Present Net Value [3]	$0.00	$83,989	$371
Benefit/Cost Ratio [4]	NA	1.50	1.00

Note: All figures have been rounded to the nearest dollar.

[1]*Present value of benefits* represents the income generated from grazing on the Angell Allotment by the permittee, along with the present value of the grazing fees collected by the Forest Service.

[2] *Present value of costs* represents the cost of range improvement maintenance, range improvement construction, and range inspections (Permittee), along with the costs of permit administration, range inspections, range monitoring, materials for new range improvements, and limited construction of range imporvements (Forest Service).

[3] *Present net value* represents present value of benefits minus present value of costs.

[4] *Benefit/cost ratio* represents the present value of benefits divided by the present value of costs

Gross revenue estimates are created by estimating the amount of calves produced each year for each alternative. Table 17 represents a comparison of the No Action Alternative, the Current Management Alternative and the Proposed Action Alternative for Estimated Gross Annual Revenue.

Table 17: Estimated Gross Annual Revenue.

Value	No Action Alternative	Current Management Alternative	Proposed Action Alternative
Estimated Gross Annual Revenue	$0.00	$239,541	$239,541

These factors will vary annually, but serve as a point of comparison. No complete projections were made of the permittee's actual costs, the ability to cover costs, or any supplemental income that may be available.

Alternative 1: No Action

Under the No Action alternative, the allotment would not be grazed and the permit for grazing cattle on this allotment would be cancelled. The permittee would lose future potential revenue derived from the sale of cattle that would have been produced on the Angell Allotment.

The No Action alternative would result in the loss of annual Federal payments to Coconino County for livestock grazing on the Angell Allotment. This loss, by itself, is not substantial; however, the county would also lose revenues from taxes on structural improvements and the state would lose tax revenues based on the permittee's use of Federal lands. Under this alternative, all jobs directly associated with livestock grazing on the Angell Allotment would be eliminated. Some of the jobs indirectly associated with livestock grazing on the Angell Allotment may also be eliminated; however, most indirect jobs would likely be maintained because the need for ranching supplies and services would continue to be filled by other area ranches and individuals/businesses from the surrounding communities. Since livestock grazing does not limit recreational uses or other permitted activities on National Forest System (NFS) lands, it is not anticipated that the local economies would be enhanced due to increased recreational use or an increase in other permitted activities once livestock are removed.

Alternative 2: Current Management

The Current Management Alternative would help maintain current jobs within the surrounding communities and revenues to Coconino County. If changes are made in the use of the Angell Allotment in the future, contributions to state, county and local economies from fees, taxes and jobs associated with cattle grazing on this allotment would change accordingly.

Alternative 3: Proposed Action

Alternative 3 would have similar effects as Alternative 2 at the state, county and regional scale. Alternative 3 would result in the additional cost of approximately $32,945 as a result of fence, above ground pipeline and trough construction. This cost would be to both the Forest Service ($26,883) and the permittee ($6,062).

Cumulative Effects-Common to All Alternatives

Changing the economic contribution of the Angell Allotment and associated Forest Service federal land payments from the regional economy would be insignificant in terms of cumulative effects. This is because the agricultural sector makes up less than 1percent of the economy in Coconino County (EPS-HDT, 2013a and c).

Environmental Justice

Executive Order 12898 directs federal agencies to consider Environmental Justice under NEPA. Environmental Justice requires evaluating whether a proposed action would have a disproportionately high and adverse human health or environmental effect on minority and/or low-income populations or Indian tribes, and consideration of that effect when making a decision.

Affected Environment

In Coconino County, minority groups present in a percentage greater than the Arizona state percentage are American Indian and Alaska Native persons and persons claiming two or more races. In Coconino County, the poverty level is higher than the state percentage, indicating a low-income population (US Census Bureau 2013).

Environmental Consequences

There would be no effect related to Environmental Justice under all alternatives. Although minority and low-income populations are present, none of the alternatives would result in adverse, disproportionate effects to those groups. There is no data to suggest current ranch operations, and employment at the ranch is uniquely depended upon by any minority or low-income populations. Therefore, there would be no adverse, disproportionate effects to minority and/or low-income populations under any of the alternatives.

Relationship of Short-Term Uses and Long-Term Productivity (all resources)

NEPA requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Continuing livestock grazing, using the principles of conservative utilization and adaptive management to respond to changing conditions would allow for the long-term productivity of the land.

If livestock grazing is removed from the allotment, it would result in the long-term productivity of the upland vegetation on the allotment similar to the proposed action.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

There are no irreversible commitments of resources associated with this process as livestock grazing under the No Action Alternative, Current Management Alternative or Proposed Action Alternative would not result in the loss of resources that cannot be regained. The irretrievable commitment of resources in this case is the temporary removal of vegetation and localized

compaction that inevitably occurs with the continuation of grazing activities. Continuation of grazing is expected to continue to result in compacted soils and thus limited soil productivity where livestock and wildlife congregate around water sources.

Relevant Disclosures

The Coconino Forest Plan is undergoing revision. When the revised plan is complete, it might contain rangeland management requirements that differ from the current plan. If the proposed action is approved, adaptive management or future planning through the NEPA process would allow the Forest Service to make adjustments to ensure compliance with the new plan. The website for the Coconino National Forest Plan Revision is:
http://www.fs.fed.us/r3/coconino/plan-revision.shtml

Protection and management of heritage resource on NFS land is mandated by the National Historic Preservation Act, 1966 as amended (NHPA), 36 CFR 800, and Forest Service Manual 2360, American Indian Religious Freedom Act, Archaeological Resource Protection Act and the National Environmental Policy Act (NEPA).

In addition Southwest Region has developed alternative procedures, per 36 CFR 800.14, in the form of the Region 3 First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities. An appendix to this Agreement, *APPENDIX H STANDARD CONSULTATION PROTOCOL FOR RANGELAND MANAGEMENT* establishes standard procedures for NHPA compliance for Rangeland Management related undertakings.

Any future improvements and ground-disturbing management practices will be contingent upon completion of the identification and protection of historic properties and compliance with applicable provisions of NHPA. This will include acceptance of the inventory report by the Forest Archaeologist or other FS archaeologist with delegated responsibilities and appropriate SHPO and tribal consultation.

Chapter 4 – 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. Other groups and individuals who were sent the Draft Environmental Assessment but who did not provide comments or feedback can be found in the project record.

Interdisciplinary Team Members:

Specialists Contributing to the EA

Mandy Roesch – Rangeland Resources

Tom Runyon – Soil and Water, Wetlands, Springs and Riparian Resources

Loren LeSuer, Julia Camp – Wildlife and Fish, Botany and Invasive Plant Species

Patrick McGervy – Recreation and Wilderness

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Federal and State Officials and Agencies

US Fish and Wildlife Service

Arizona Department of Game and Fish

Arizona Department of Environmental Quality

Tribes

Hopi Tribe

Navajo Nation

Yavapai-Apache Nation

Pueblo of Zuni

Others

James Turrell, Walking Cane Ranch (Permittee)

Jennifer and Stuart Anderson, Walking Cane Ranch (Ranch Managers)

Appendix A – References

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Appendix B - Glossary

A

Actual Use: The actual number of livestock that grazed a pasture during the grazing season and actual period of use for each pasture.

Adaptive Management: A formal, systematic, and rigorous approach to learning from the outcomes of management actions, accommodating change, and improving management (FSH 2209.13 CH 90). Management is designed to provide sufficient flexibility to adapt management to changing circumstances. If monitoring indicated that desired conditions are not being achieved, management will be modified in cooperation with the permittee.

Allotment Management Plan (AMP): A document that specifies the actions to be taken on individual allotments to manage and protect the rangeland resources and reach the stated set of objectives. A long-term operating plan which is the implementing document for the decision made through the National Environmental Policy Act process and promotes progress toward desired future conditions.

Annual Operating Instructions (AOI): A set of instructions cooperatively developed by the Forest Service and grazing permittee on an annual basis that outlines the allotment and livestock management for the grazing season.

Animal Unit (AU): A standardized measure of animals for agricultural purposes. The standard measure for an AU is a 1000 pound beef cow that requires 26 pounds of forage/day. Based on this standard, AUs can be calculated for other animals. For example, a 700 pound steer would be 0.80 AUs.

Animal Unit Month (AUM): The amount of oven-dry forage (forage demand) required by one animal unit for a standardized period of 30 animal-unit-days. The term AUM is commonly used in three ways: (a) stocking rate, as in “X acres per AUM”; (b) forage allocations, as in “X AUMs in allotment A”; (c) utilization, as in “X AUMs utilized in Unit B”.

Authorized Use: The number of livestock and season of use authorized for the permittee by the responsible official for the current grazing season.

B

Basal Cover: The area of ground surface occupied by the basal portion of the plants.

Best Management Practices (BMPs): A combination of practices that are the most effective and practical means of achieving resource protection objectives (primarily water quality protection) during resource management activities.

Biomass: The total mass of living organisms within a particular environment.

Browse: (1) The part of shrubs, half shrubs, woody vines, and trees available for animal consumption; or (2) to search for or consume browse.

Browse Plant or Browse Species: a shrub, half shrub, woody vine, or tree capable of producing shoot, twig, and leaf growth suitable for animal consumption.

C

Canopy Cover: The area of ground covered by the vertical projection of the outermost perimeter of the natural spread of foliage of plants. Small openings within the canopy are included. It may exceed 100 percent.

Capability: Grazing capability of a land area is dependent upon the interrelationship of the soils, plants, and animals. Grazing capacity is a function of capability, proper use by livestock, and the level of management that may be applied. Capability is used to further quantify areas defined as "Full Capacity" in the Coconino National Forest Plan, as amended. Only those acres defined as "Full Capacity" in the Forest Plan were assigned a capability class. Capability classifications are made based on the following three capability classes:

- *Full Capability* - Full Capability areas are those which can be used by grazing animals under proper management without long-term damage to the soil resource or plant communities. Typically, this land is stable. Vegetative ground cover is maintaining site productivity and producing a minimum of 100 pounds of dried forage per acre per year. Soil loss as judged by available techniques is within tolerance.
- *Potential Capability* - : Areas which could be used by grazing animals under proper management but where soil stability is impaired, or range improvements are not adequate under existing conditions to obtain necessary grazing animal distribution. The area is not capable of being fully or adequately utilized by grazing animals. Generally, this land has impaired soil stability, lack of water, steep terrain, lack of access and/or there is insufficient vegetative ground cover to protect the soil, but if treated, developed, or properly managed, could become Full Capability. When determining grazing capacity in the Potential Capability class, conservative allowable use assignments must be made. Rationale for assigned allowable use will be documented.
- *Limited Capability* – Limited Capability areas have some natural characteristic(s) that limits the capability of these areas for grazing; however, these characteristics do not totally prevent the area from being utilized by some level of grazing. Common situations of Limited Capability include, but are not limited to, slopes in excess of 40 percent and areas with inherently unstable soils. The limitations in these areas are naturally occurring and management will not change these limitations. However, with prudent management these areas can provide forage for livestock. When determining grazing capacity in the Limited Capability class, conservative allowable use assignments must be made. Limited Capability is assigned to acres on a by project basis and is determined by resource specialists on the Interdisciplinary Team. In order to be in compliance with the Forest Plan and to help keep permitted AUMs at a conservative level it was decided that all Limited Capability acres in the Angell Allotment would be redesignated No Capability.
- *No Capability* - No capability areas are those which cannot be used by animals without long-term damage to the soil resource or plant community, or are barren or unproductive naturally. These areas are not capable of being grazed by domestic livestock under reasonable management goals. Grazing capacity will not be assigned to these areas, even though light livestock use may occur.

Capacity: The average number of livestock and/or wildlife which may be sustained on a management unit compatible with management objectives for the unit. In addition to site characteristics, it is a function of management goals and management intensity. Capacity is based on lands identified as "Full Capacity" in the Coconino National Forest Plan, as amended and was further quantified and reduced based on capability class categorization.

Condition: As evaluated and ranked by the Forest Service, is a subjective expression of the status or health of the vegetation and soil relative to their combined potential to produce a sound and stable biotic community. Soundness and stability are evaluated relative to a standard that encompasses the composition, density, and vigor of the vegetation and the physical characteristics of the soil.

Corral: A range improvement that generally is made of logs, boards or pipe, and is used to hold, load, or unload livestock.

Critical Habitat: That portion of a wild animal's habitat that is critical for the continued survival of the species ("Critical" is a formal designation under the Endangered Species Act).

Cumulative Effects: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR § 1508.7).

D

Decision Notice: A decision document prepared for an environmental assessment that documents the decision by the Responsible Official and explains the rationale for the decision.

Deferment: The delay of grazing to achieve a specific management objective. A strategy aimed at providing time for plant reproduction, establishment of new plants, restoration of plant vigor, a return to environmental conditions appropriate for grazing, or the accumulation of forage for later use.

Deferred Rotation Management: A grazing system that provides for a systematic rotation of the deferment among pastures to provide for plant reproduction, establishment of new plants, or restoration of plant vigor.

Developed Recreation: Recreation areas that require facilities that result in concentrated use of an area. Examples are campgrounds and ski areas. Facilities might include roads, parking lots, picnic tables, toilets, water systems, ski lifts, and buildings.

Direct Effects: The effects caused by the action and occur at the same time and place (40 CFR§ 1508.8).

Dispersed Recreation: Recreation use that occurs outside of developed sites and requires few, if any, improvements other than roads and trails. Representative activities are hiking, backpacking, driving for pleasure, viewing scenery, snowmobiling, cross-country skiing, hunting, off-road vehicle use, and berry picking.

E

Environmental Assessment (EA): A concise document that briefly provides sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement or a Finding of No Significant Impact.

Environmental Justice: refers to an equitable spatial distribution of burdens and benefits to groups such as racial minorities, and/or residents of economically disadvantaged areas.

Ephemeral Channels: Watercourses that only flow for hours or days after a rainfall

F

Finding of No Significant Impact (FONSI): A document briefly presenting the reasons why an action will not have a significant effect on the environment and for which an environmental impact statement will not be prepared (40 CFR 1508.13).

Forage: All non woody plants (grass, grass-like plants, and forbs) and portions of woody plants (browse) available to domestic livestock and wildlife for food. Only a portion of a plant is available for forage if the plant is to remain healthy.

Forage Production: The weight of forage produced within a designated period of time on a given area. Production may be expressed as green, air dry, or oven dry weight. The term may also be modified as to the time of production such as annual, current year, or seasonal forage production.

G

Grasslands: Lands where the vegetation is dominated by grasses, grass-like plants, and/or forbs. Non-forest land is classified as grassland when herbaceous vegetation provides at least 80 percent of the canopy cover excluding trees.

Grazing Period: The length of time allowed in a grazing pasture or unit, usually displayed in number of days. Also referred to as season of use.

Ground Cover: The cover of plants, litter, rocks, and gravel on a site.

H

Head Month (HM): One month's use and occupancy of range by one weaned or adult animal cow, bull, steer, heifer, horse, burro, mule or five sheep or goats.

Hydrologic Unit Code (HUC): A system of codes used to identify all of the drainage basins in the United States in an arrangement from largest to smallest. A drainage basin is an area or region of land that catches precipitation that falls within that area, and funnels it to a particular creek, stream, river or other watercourse until it drains into an ocean. See the following website for a more extensive explanation: http://water.usgs.gov/GIS/huc.html

I

Impaired Soil Condition: Indicators may signify a reduction in soil quality. The ability of the soil to function properly has been reduced and/or there exists an increased vulnerability to degradation. An Impaired category indicates a need to investigate the ecosystem to determine the cause and degree of decline. Changes in land management practices or other preventive measures may be appropriate.

Important Bird Area (IBA): an internationally recognized place on the landscape that provides exceptionally valuable or essential habitat for one or more species of birds, including breeding, wintering or migratory habitat.

Indirect Effects: Effects caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR § 1508.8).

Inherently Unstable Soil - These soils have natural erosion exceeding tolerable limits. Based on the Universal Soil Loss Equation (USLE) these soils are eroding faster than they are renewing themselves but are functioning properly and normally. These soils have no capability for grazing.

Interdisciplinary Team (IDT): A group of individuals with skills from different disciplines.

Intermittent Stream: Streams which normally cease flowing for weeks or months every year.

Invasive Species: A species not native to the ecosystem being considered and whose introduction causes or is likely to cause environmental, economic or human harm.

Issue: A subject, question, or unresolved conflict of widespread public discussion or interest regarding management of National Forest System lands.

K

Key Area: A portion of rangeland selected because of its location, grazing or browsing value, or use. It serves as a monitoring and evaluation point for range condition, trend, or degree of grazing use. Properly selected key areas reflect the overall acceptability of current grazing management over the rangeland. A key area guides the general management of the entire area of which it is a part.

M

Macroinvertebrate: Animals without backbones that are larger than ½ millimeter, are generally visible to the naked eye, and require a watered environment to persist and/or complete their life cycle. Includes animals such as crayfish, clams, and snails.

Management Area (MA): As defined in the Coconino National Forest Plan, an area that has common direction throughout and that differs from neighboring areas. The entire forest is divided into management areas where common standards and guidelines apply.

Management Indicator Species (MIS): Any species, group of species, or species habitat element selected to focus management attention for the purpose of resource production, population recovery, maintenance of population viability, or ecosystem diversity (FSM 2605).

Maximum Numbers: The maximum number of livestock that could reasonably be permitted while making the best use of available capacity.

Mitigation Measures: Actions that are taken to lessen the severity of effects of other actions.

Montane: Pertaining to mountains. A montane meadow is a mountain meadow or a high elevation meadow.

N

Nonpoint source (NPS) pollution: Unlike pollution from industrial and sewage treatment plants, NPS comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water.

Natural Resource Information System - NRIS: A U.S. Forest Service system that provides information and support for a variety of database, data collection and analysis products. See www.fs.fed.us/emc/nris/products/index.shtml.

P

Frequency Method (Condition and Trend Monitoring): A monitoring method consisting of observing quadrats along transects, with quadrats systematically located at specified intervals along each transect. This method measures the frequency of species, herbaceous perennial basal cover and general cover categories including litter (Interagency Technical Reference).

Perennial Stream: A stream or river that has continuous flow in parts of its bed year round.

Permittee: An individual who has been granted a Federal permit to graze livestock for a specific period of time on a range allotment.

Prescribed Fire: Fires set under conditions specified in an approved plan to consume fuels, control unwanted vegetation, stimulate growth of desired vegetation, and change successional stages to meet range, wildlife, recreation, wilderness, watershed, or timber management objectives.

Proper Functioning Condition (PFC): A methodology for assessing the physical functioning of riparian and wetland areas. The term PFC is used to describe both the assessment process, and a defined, on-the-ground condition of a riparian-wetland area. In either case, PFC defines a minimum or starting point. The PFC assessment provides a consistent approach for assessing the physical functioning of riparian-wetland areas through consideration of hydrology, vegetation, and soil/landform attributes. The PFC assessment synthesizes information that is foundational to determining the overall health of a riparian-wetland area. The on-the-ground condition termed PFC refers to *how well* the physical processes are functioning. PFC is a state of resiliency that will allow a riparian wetland system to hold together during a 25- to 30-year flow event, sustaining that system's ability to produce values related to both physical and biological attributes.

An area is in PFC when adequate vegetation, landform, or large woody debris is present to:

- Dissipate stream energy associated with high flows
- Filter sediment and capture bed load
- Aid floodplain development
- Improve floodwater retention and groundwater recharge
- Stabilize streambanks

Protected Activity Center (PAC): A breeding area for a pair of Mexican spotted owls. They are a minimum of 600 acres as mandated by the U.S. Fish and Wildlife Service.

Potential Natural Vegetation Type: The plant community that would become established if all successional sequences were completed without human interference under present environmental and floristic conditions, including those created by humans.

Prehistoric: Refers to the span of time before recorded history.

R

Range Allotment: A designated area of land available for livestock grazing. Usually a grazing permit is issued designating a specified number and kind of livestock to be grazed according to direction found in an allotment management plan. It is the basic land unit used in the management of livestock on NFS lands, and associated lands administered by the Forest Service.

Rangeland (Range): All land producing, or capable of producing, native forage for grazing and browsing animals, and lands that have been revegetated naturally or artificially to provide a forage cover that is managed like native vegetation. It includes all grasslands, forblands, shrublands, and those forested lands which can – continually or periodically, naturally or through management – support an understory of herbaceous or shrubby vegetation that provides forage for grazing or browsing animals.

Responsible Official: Forest Service officer with the authority to make a decision on a NEPA project. Usually a District Ranger or Forest Supervisor.

Rest: To leave an area of grazing land ungrazed for a specific time, such as a year, a growing season, or a specified period required within a particular management practice.

Rest- Rotation Management: A grazing management scheme in which rest periods for individual pastures, paddocks or grazing units, generally for the full growing season, are incorporated in a grazing rotation.

Re-vegetation: Re-establishing and developing plant cover. This may take place naturally through the reproductive processes of existing vegetation or artificially by planting.

Riparian Area: Riparian ecosystems are distinguished by the presence of free water within the common rooting depth of native perennial plants during at least a portion of the growing season. Riparian ecosystems are normally associated with seeps, springs, streams, marshes, ponds, or lakes. The potential vegetation of these areas commonly includes a mixture of water and land ecosystems.

Recreation Opportunity Spectrum (ROS): A land classification system that categorizes National Forest land into six classes, each class being defined by its setting and by the probable recreation experiences and activities it affords. The six classes in the spectrum are: primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban/

S

Satisfactory Soil Condition: Soil function is being sustained and soil is functioning properly and normally. The ability of the soil to maintain resource values and sustain outputs is high. These soils have full capability and full grazing capacity.

Seasonal Utilization: The percentage of forage produced in the current season, to the date of the measurement that has been consumed or trampled by animals. It is a comparison of the amount of herbage left compared with the amount of herbage that has been produced to the date of the measurement. Seasonal utilization is measured at the end of a grazing period. Seasonal utilization differs from utilization because it does not account for subsequent growth of either the ungrazed or grazed plants. May also be referred to as “seasonal utilization” or “relative utilization”.

Seasonal Utilization Level: Description for seasonal utilization levels as determined at the date

of measurement (FSH, R3-2209.13-2007-1).

Table 18. Seasonal utilization levels by percent of vegetation consumed.

Seasonal Utilization level	Percent of vegetation consumed at the date of measurement
Non-use to Light	0-30 percent
Conservative	30-40 percent
Moderate	41-50 percent
Heavy	51-60 percent
Severe	61+ percent

Sediment: Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice, and has come to rest on the earth's surface either above or below sea level.

Sensitive Species: Plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density, or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (FSM 2670.5(19)).

Seral stage – An intermediate stage in an ecosystem that is advancing towards its climax community. Usually more than one seral stage evolves until climax conditions are reached.

Stock Tank: A man-made earthen tank for providing water for livestock and wildlife.

Structural Improvement (Range and Wildlife): Any type of range or wildlife improvement that is human-made such as fences, water developments, corrals, and waterfowl islands.

Suitability: "The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices." (36 CFR 219.3)

T

Term Grazing Permit (TGP): Authorization for livestock grazing on NFS Lands for a specified number of livestock, grazing season, location, and duration of time.

Terrestrial Ecosystem Unit (TEU) Survey: The TEU survey, or Terrestrial Ecosystem Survey (TES), is the result of the systematic analysis, mapping, classification and interpretation of terrestrial ecosystems also known as ecological types delineated and numbered in ecological units. It is the only seamless mapping of vegetation and soils available across the Forest. TEU boundaries and classifications were determined using a sample of field visited, validated and correlated sites that were interpolated using a Regional and National protocol. The data for the Coconino National Forest was compiled in 1991.

Threatened and Endangered Species: Species identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act, as amended.

- *Threatened Species* - Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
- *Endangered Species* - Any species that is in danger of extinction throughout all or a significant portion of its range.
- *Proposed Species* - Any species of fish, wildlife, or plant that is proposed in the Federal Register to be listed under Section 4 of the Endangered Species Act (50 CFR 402.02).

Trend: The direction of change in resource value ratings or attributes as observed over time. Apparent trend is an interpretation of trend based on observations and professional judgment at a single point in time. Measured trend is quantitative changes in vegetative or soil conditions over time, which can be measured in terms of plant communities or resource value ratings.

Turbidity (or haze): The cloudiness or haziness of a fluid caused by suspended solids that are generally invisible to the naked eye.

U

Understory: The trees and other woody species growing under a more or less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

Unsatisfactory Soil Condition: Degradation of vital soil functions result in the inability of the soil to maintain resource values, sustain outputs or recover from impacts. Unsatisfactory soils are candidates for improved management practices or restoration designed to recover soil functions. These soils have potential capability but currently do not provide much forage.

Utilization: The proportion or degree of current year's forage production by weight that is consumed or destroyed by animals (including insects). The term may refer either to a single plant species, a group of species, of the vegetation community as a whole. It is a comparison of the amount of herbage left compared with the amount of herbage produced during the year. Utilization is measured at the end of the growing season when the total annual production can be accounted for and the effects of grazing in the whole management unit can be assessed.

Utilization Guidelines: Guidelines developed for utilization that are intended to indicate a level of use or desired conditions to be achieved over a period of years. See Table 18 above for utilization levels and respective percent vegetation consumed. In this case utilization levels pertain to percent vegetation consumed at the end of the growing period.

V

Vegetative ground Cover: The sum of perennial vegetation (basal are) and litter (dead and down plant material 0.5 inch or deeper on the soil surface). This is expressed as a percent.

Vegetation production: Amount of plant biomass above ground produced in a given year.

Vegetation quality: The nutritional value and palatability of plant biomass.

W

Water lot: A range improvement usually constructed of fencing materials that enclose a watering structure that is used to provide water for livestock or to close the water off to livestock.

Watershed: An entire area that contributes water to a drainage or stream.

Watershed Condition Framework: A method for classifying watershed condition based on the following 12 indicators: water quality, water quantity, aquatic habitat, aquatic biota, riparian wetland vegetation, roads and trails, soils, fire regime, forest cover, rangeland vegetation, terrestrial invasive species and forest health,

Wetlands: Areas with shallow standing water or seasonal to yearlong saturated soils including bogs, marshes, and wet meadows. The United States Army Corps of Engineers has jurisdiction over wetlands. According to the 1987 USACE Wetlands Delineation Manual, wetlands must have the following three attributes to be considered wetlands: (1) hydric soils, (2) hydrophytic vegetation, and (3) evidence of frequent inundation.

Wildfire: Any wildland fire that requires a suppression action. This includes all fires not meeting the requirements of a prescribed fire.

Appendix C – Supplement Information for Rangeland Resources

Table 19. List of pastures in Angell Allotment.

Pasture Name	Acres
8	60
9	23
11	13
Cinder Hill	3211
Cocrane	2755
Crisp	1250
Horse	972
Maroon	3967
O'Neil	4630
Railroad	5530
Rattlesnake	8358
Rio De Flag	4563
South Angell	10468
Turkey Tanks	1718
Winona	4183
Total	**51701**

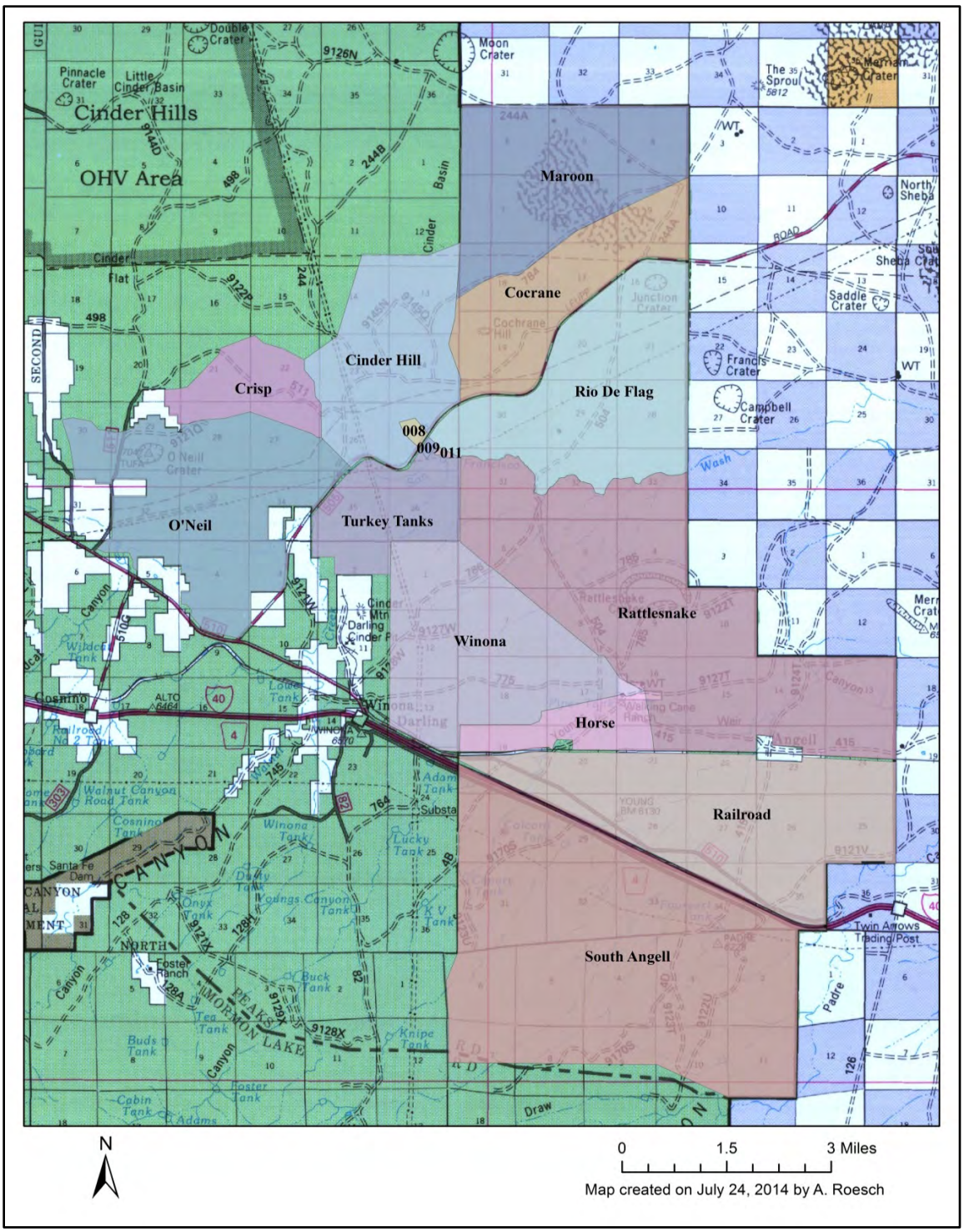


Figure 2. Map of pastures on Angell Allotment

Figures 3 and 4 below compare precipitation data to ground cover data at the annually read long term monitoring plot on the Angell Allotment. The figures illustrate that in general increased precipitation results in increased basal vegetation cover and decreased bare ground. Precipitation for 2007 and 2013 was 8in and 15.5in respectively while basal vegetation cover ranged from 18

percent to 29 percent and bare ground ranged from 12 percent to 2 percent during the same time period.

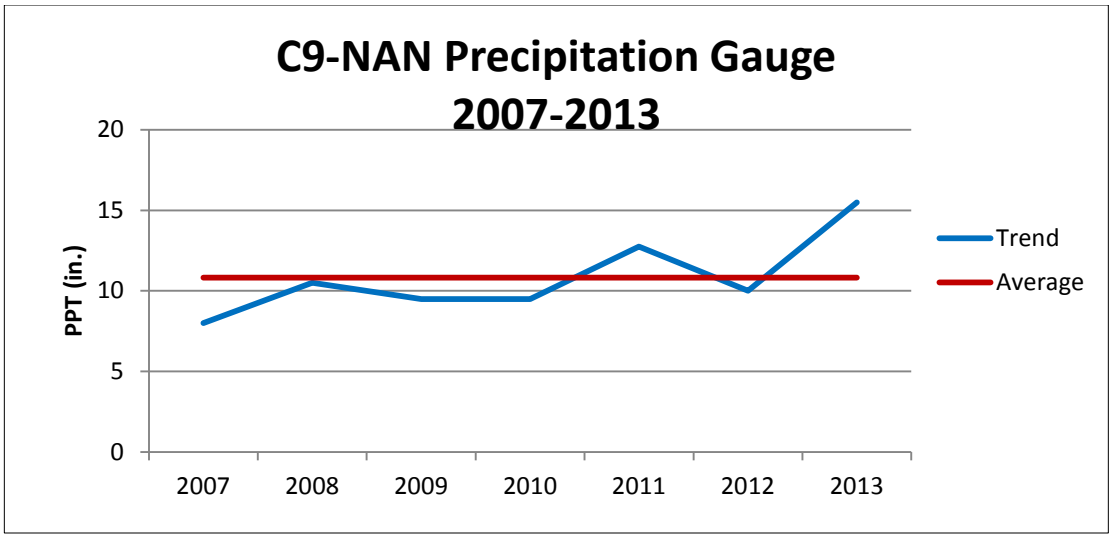


Figure 3: Long Term Monitoring Plot C9-NAN; 6 Year Precipitation Trend; 6 year average = 10.82 inches/year. Blue line represents precipitation trend; Red line represents average precipitation/year

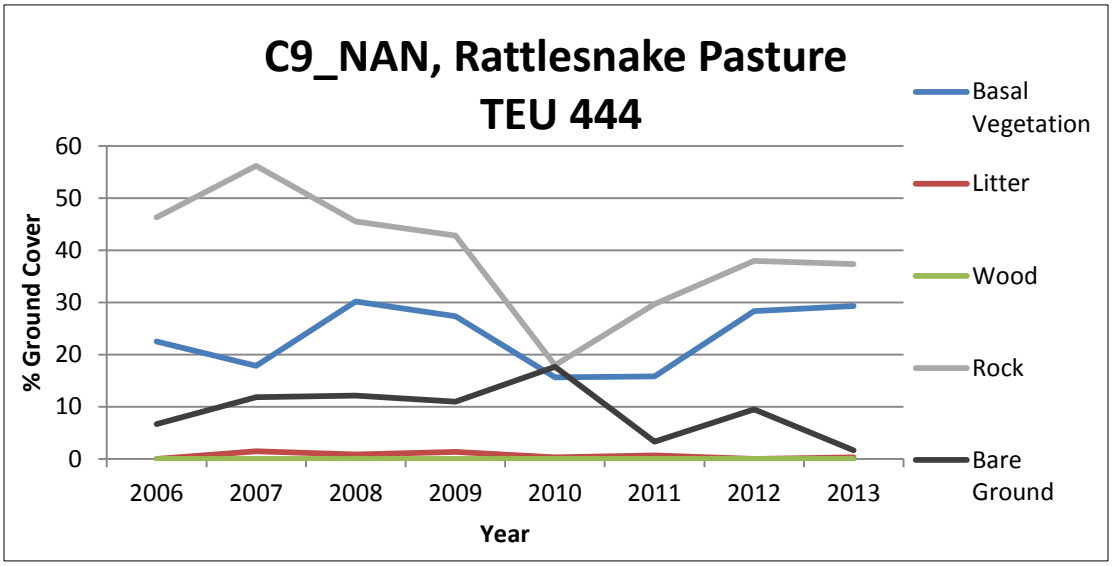


Figure 4. Eight year ground cover trend data for annually read monitoring Plot C9_NAN. Rock variations in years 2009 to 2011 are likely due to user error.

Forage Production

Forage production estimates (Forg) from Table 3 of the Terrestrial Ecosystem Survey (TES) of the Coconino National Forest (1995) were used for the forage production values of these TEUs. Where multiple forage production values were provided in TES for a single TEU, or in the case of TEU groups, the smallest forage production value was used.

Table 20: Angell Forage Production Data.

TEU	Forage Production (lbs/acre)
14	25
15	25
41	1600
426	25
427	25
433	75
434, 437	125
435	125
436	900
441	100
443	400
444	700
450	125
455	100
473	175
491	100
506	175
510	25
511	25
512	150
513	150
558	50
560	105
561	25
566	1700

Table 21: Estimated Livestock and Elk Use (AUMs) Based on Potential Livestock Use Dates for Angell Allotment.

Period of Livestock Use[1]	Livestock Use at Maximum Permitted Numbers (AUMs)	Estimated Elk Use for Game Unit 7E[2,4] (AUMs)	Estimated Elk Use for Game Unit 5B[3,4] (AUMs)	Total Livestock and Estimated Elk Summer Use (AUMs)	Estimated Capacity at 35% Use (AUMs)	Estimated Capacity Not Used by Livestock or Elk (AUMs)
6/1 to 11/15	2,350	963	481	3,794	8,072	+ 4,278

1) Periods of livestock use reflect a range of use periods that are likely to occur on the Angell Allotment.
2) Estimated Elk Use assumes that (a) the herd size is an average of 200 elk within the allotment boundary (source: personal communication with M. Padila 2014) (b) one elk has an animal unit equivalent of 0.6 (source: USDA National Range Handbook) (c) Period of elk use is assumed to average April 1 to November 30 (244 days).
3) Estimated Elk Use assumes that (a) the herd size is an average of 100 elk within the allotment boundary (source: personal communication with C. Adams 2014) (b) one elk has an animal unit equivalent of 0.6 (source: USDA National Range Handbook) (c) Period of elk use is assumed to average April 1 to November 30 (244 days).
4) Deer, antelope and other wildlife are not considered here because they have little dietary overlap with livestock and are expected to have a negligible effect on forage levels.

Figures 5 through 7 show proposed structural range improvements under the Proposed Action alternative. All locations, distances and sizes of proposed improvements are approximate.

Figure 5: Proposed pipeline, trough and water lot with access from Cocrane and Cinder Hill pastures

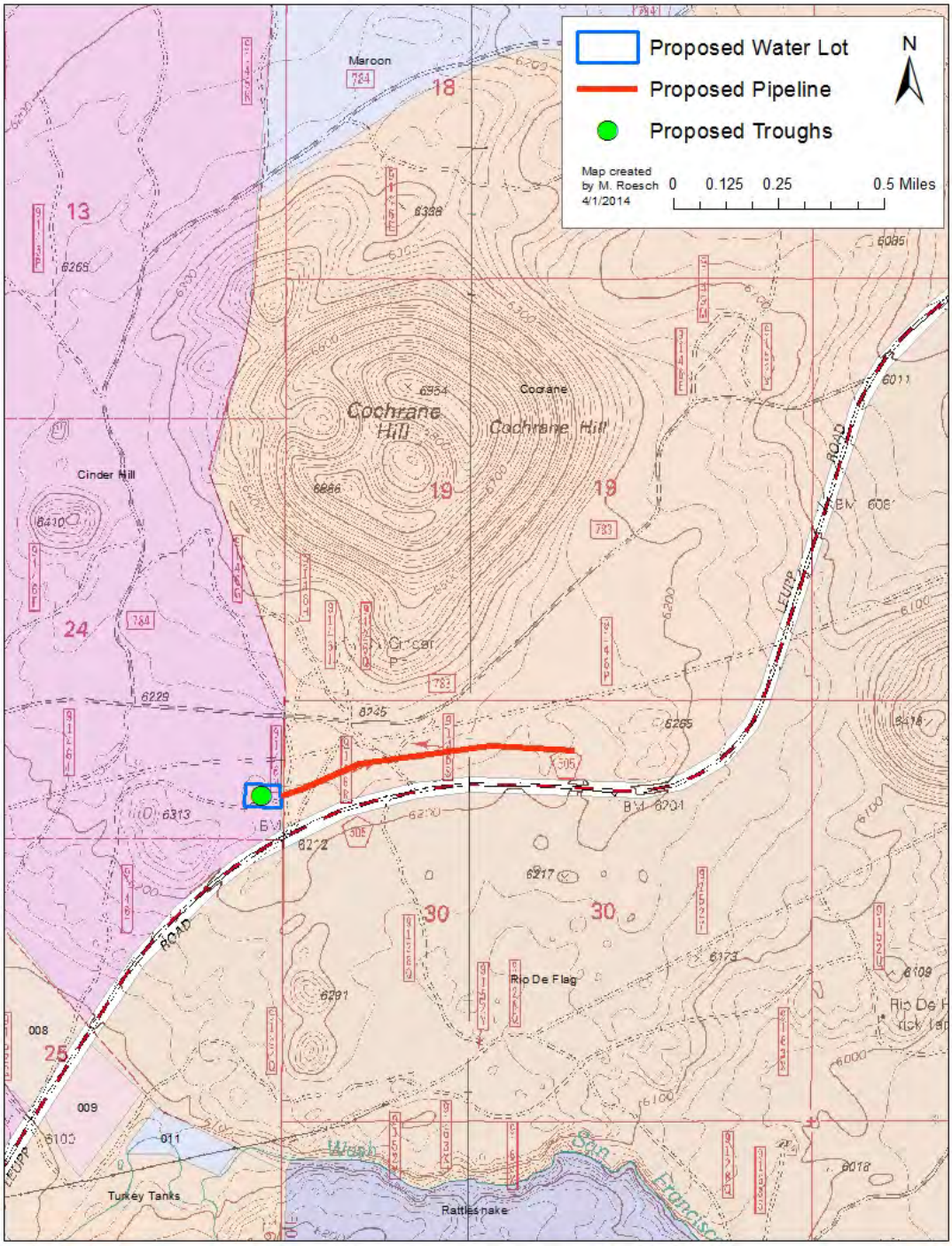


Figure 6: Proposed pipelines and troughs in South Angell pasture

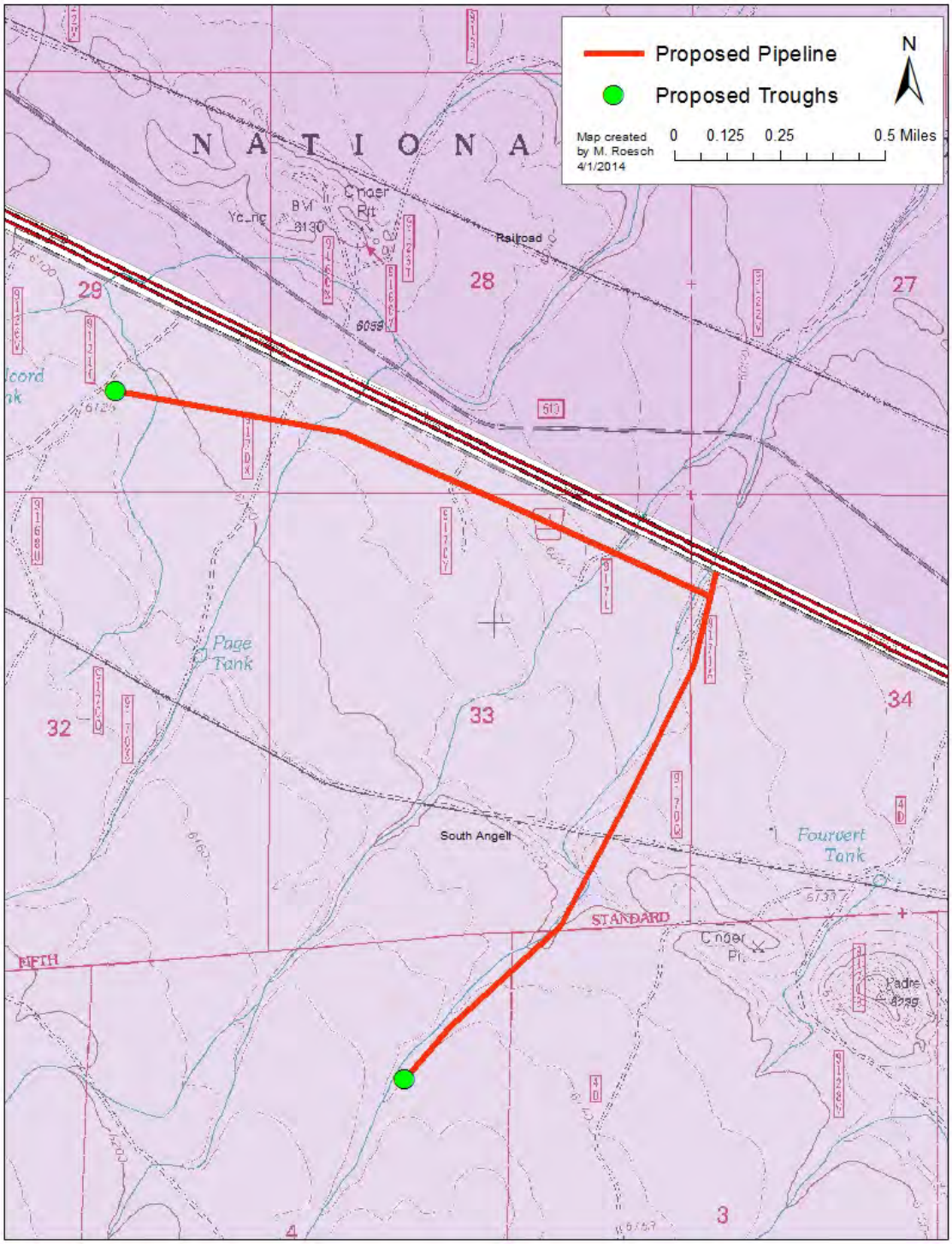
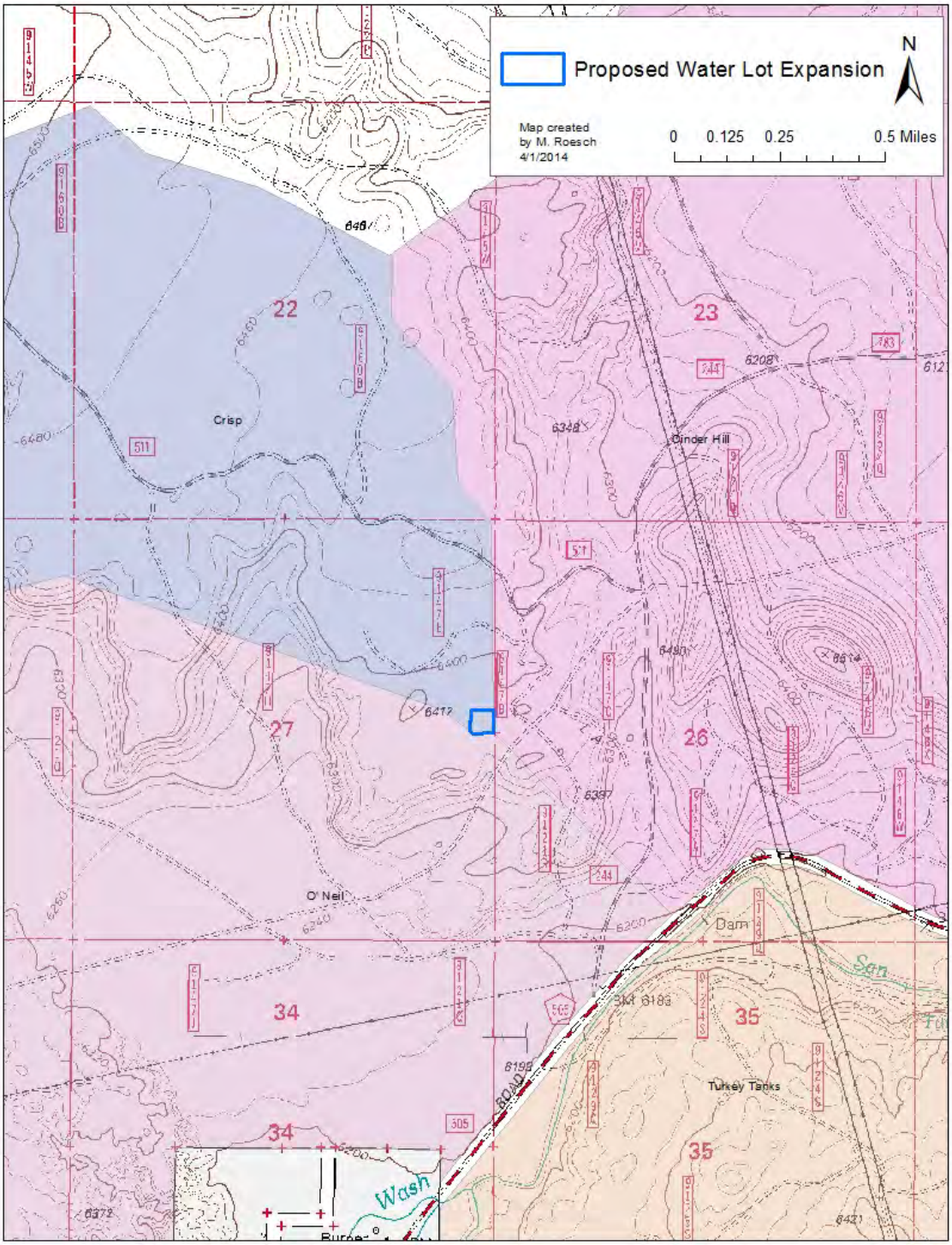


Figure 7: Proposed water lot expansion in Crisp pasture with access from Cinder Hill and O'Neil pastures



Appendix D – Supplement Information for Wildlife Species

Table 22. Management Indicator Species (MIS) found on the Coconino National Forest, and associated Indicator Habitats.

Species	
Abert's Squirrel	Early seral ponderosa pine
Goshawk	Late seral ponderosa pine
Pygmy Nuthatch	Late seral ponderosa pine
Turkey	Late seral ponderosa pine
Elk	Early seral pinyon-juniper, ponderosa pine, mixed conifer, and spruce-fir
Hairy Woodpecker	Snag component of ponderosa pine, mixed conifer, and spruce-fir
Mexican Spotted Owl	Late seral mixed conifer and spruce-fir
Red Squirrel	Late seral mixed conifer and spruce-fir
Red-naped (Yellow-bellied) Sapsucker	Late seral and snag component of aspen
Mule Deer	Early seral aspen and pinyon-juniper
Juniper (Plain) Titmouse	Late seral and snag component of pinyon-juniper
Pronghorn Antelope	Early and late seral grasslands
Lincoln's Sparrow	Late seral, high elevation riparian (≥7000')
Lucy's Warbler	Late seral, low elevation riparian (<7000')
Yellow-breasted Chat	Late seral, low elevation riparian (<7000)
Macroinvertebrates	Late seral, high and low elevation riparian
Cinnamon Teal	Wetlands/aquatic

Table 23: MIS and associated Management Areas (MAs) located on the Angell Allotment.

Management Area (MA 2007)	Management Indicator Species	Acres within Project Area	Acres of Associated PNVTs in Project Area
MA-3: Ponderosa pine and mixed conifer, less than 40 percent slopes	Mexican spotted owl, red squirrel, Abert's squirrel, elk, northern goshawk, pygmy nuthatch, turkey, and hairy woodpecker	9	Ponderosa Pine – 4,932
MA-7: Pinyon Juniper on lesser than 40% slope	Juniper (plain) titmouse, mule deer, elk	16,543	Pinyon Juniper Grassland – 44,198 Pinyon Juniper Woodland (Persistent) – 1,869 Total – 46,067
MA-8: Pinyon Juniper on greater than 40% slope	Juniper (plain) titmouse, mule deer, elk	215	Pinyon Juniper Woodland (Persistent) – 1,869
MA-10: Grassland and sparse pinyon-juniper above the rim	Pronghorn	11,904	Great Basin Grassland – 227 Montane Subalpine Grassland – 329 Total - 556
MA-31: Craters	Juniper (plain) titmouse, mule deer, elk	14,970	N/A
MA-33: Doney	Juniper (plain) titmouse, muledeer, elk, Abert's squirrel, northern goshawk, pygmy nuthatch, turkey, hairy woodpecker.	7,940	N/A

Table 24. Effects to Habitat Quality for each MIS by Alternative

MIS Species	Forest-wide Habitat	Effects to Habitat Quality (acres / percent change)		
		Alternative 1	Alternative 2	Alternative 3
Pronghorn Antelope	116,342	0	0	+242 / +0.002

Table 25 Migratory Birds in Angell Allotment, as identified through Partners in Flight and US Fish and Wildlife Service Birds of Conservation Concern.

Species	USFWS Bird of Conservation Concern	Arizona Partners in Flight Priority Species	Habitat Preference[1]	Acres of Habitat in Project Area
Olive-sided Flycatcher		X	Mixed conifer, ponderosa pine	4,932
Virginia's Warbler	X		Mixed conifer, ponderosa pine, high-elevation riparian	4,932
Cordilleran Flycatcher		X	Ponderosa pine, mixed conifer	4932
Olive Warbler	X		Ponderosa pine	4,932
Greater Pewee	X		Ponderosa pine	4,932
Grace's Warbler	X		Ponderosa pine	4,932
Lewis' Woodpecker	X		Ponderosa pine	4,932
Flammulated Owl	X		Ponderosa pine	4,932
Purple Martin		X	Ponderosa pine	4,932
Swainson's Hawk	X	X	High elevation grasslands	44,754
Grasshopper Sparrow (*ammolegus*)	X	X	High elevation grasslands and wetlands	44,754
Ferruginous Hawk	X	X	High elevation grasslands	44,754
Pinyon Jay	X	X	Pinyon-juniper	1,869
Gray Vireo	X	X	Pinyon-juniper	1,869
Gray Flycatcher		X	Pinyon-juniper	1,869
Black-throated Gray Warbler	X	X	Pinyon-juniper	1,869
Juniper Titmouse		X	Pinyon-juniper	1,869
Loggerhead Shrike	X		Pinyon-juniper, chaparral, desert scrub, grasslands	1,869
Lawrence's Goldfinch	X		Riparian, desert scrub, grasslands	44,754

Notes
[1]For PIF priority species, habitat preference from Latta, Bearmore and Corman 1999; otherwise, from Corman and Wise-Gervais, 2005).
Acres calculated using Potential Natural Vegetation Type models

Appendix E – Supplement Information for Soil Conditions

Soil condition attributes in Table 26 display the variability of these attributes that, in part, influence soil condition.

Table 26 Range of Soil Condition Attributes not included in Desired Conditions by TEU groupings.

TEU Groupings	Potential Soil Condition Attributes
14	Bare soil 20 percent Rock 75 percent Basal Vegetation 5 percent Effective Litter (>.5") 10 percent
15	Bare Soil 20 percent Rock 75 percent Basal Vegetation 5 percent Effective Litter (>0.5") 10 percent
41	Bare soil 40-45 percent Rock 0-10 percent Basal vegetation 30 percent Effective litter (>0.5") 55 percent
427	Bare soil 5 percent Rock 75 percent Basal vegetation 5 percent Effective litter (>0.5") 25 percent
435	Bare soil 10 percent Rock 55 percent Basal vegetation 15 percent Effective litter (>0.5") 35 percent
441	Bare Soil 5 percent Rock 75 percent Basal Vegetation 10 percent Effective Litter (>0.5") 20 percent
450	Bare soil 5 percent Rock 70-75 percent Basal vegetation 10 percent Effective litter (>0.5") 40-70 percent
455	Bare soil 5-10 percent Rock 65 percent Basal vegetation 5-10 percent Effective litter (>0.5") 25-40 percent
473	Bare soil 15 percent Rock 50 percent Basal vegetation 15 percent Effective litter (>0.5") 55 percent

TEU Groupings	Potential Soil Condition Attributes
491	Bare soil 20-25 percent Rock 15-20 percent Basal vegetation 10-15 percent Effective litter (>0.5") 55-65 percent
506	Bare soil 10 percent Rock 55 percent Basal vegetation 15 percent Effective litter (>0.5") 65 percent
510	Bare soil 10 percent Rock 75 percent Basal vegetation 10 percent Effective litter (>0.5") 50 percent
511	Bare soil 10 percent Rock 75 percent Basal vegetation 10 percent Effective litter (>0.5") 50 percent
558	Bare soil 10 percent Rock 55 percent Basal vegetation 10 percent Effective litter (>0.5") 60 percent
560	Bare soil 5 percent Rock 45 percent Basal vegetation 10 percent Effective litter (>0.5") 70 percent
561	Bare soil 10 percent Rock 75 percent Basal vegetation 10 percent Effective litter (>0.5") 60 percent
566	Bare soil 5 percent Rock 70 percent Basal vegetation 20 percent Effective litter (>0.5") 40 percent

Table 27 displays how many acres in satisfactory, impaired and satisfactory but inherently unstable soil condition occur in each TEU.

Table 27. Soil Condition Class by TEU in the Angell Allotment.

Terrestrial Ecosystem Unit	Soil Condition Class	Acres
14	Satisfactory	478
14	Satisfactory, Inherently Unstable	1
15	Satisfactory	14
15	Satisfactory, Inherently Unstable	23
41	Impaired	227

Terrestrial Ecosystem Unit	Soil Condition Class	Acres
426	Satisfactory	1546
426	Satisfactory, Inherently Unstable	0.5
427	Satisfactory	212
427	Satisfactory, Inherently Unstable	105
433	Satisfactory	3695
433	Satisfactory, Inherently Unstable	5
434, 437	Satisfactory	9361
434, 437	Impaired	2310
435	Satisfactory	255
435	Satisfatory, Inherently Unstable	197
436	Satisfactory	4786
441	Satisfactory	3292
441	Satisfactory, Inherently Unstable	414
443	Satisfactory	6016
443	Satisfactory, Inherently Unstable	4
444	Satisfactory	12385
444	Satisfactory, Inherently Unstable	1
450	Satisfactory	217
450	Satisfactory, Inherently Unstable	60
455	Satisfactory, Inherently Unstable	5
473	Satisfactory	622
491	Satisfactory	601
506	Satisfactory	70
510	Satisfactory	274
511	Satisfactory	2
512	Satisfactory	2792
512	Satisfactory, Inherently Unstable	1
513	Satisfactory	881
513	Satisfactory, Inherently Unstable	22
558	Satisfactory	61

Terrestrial Ecosystem Unit	Soil Condition Class	Acres
560	Satisfactory	230
561	Satisfactory	79
561	Satisfactory, Inherently Unstable	2
566	Satisfactory	242
566	Impaired	86

Table 28 displays the acres of each TEU grouping within the allotment, what portion is found on slopes greater than 40% (which are often inherently unstable) and whether Frequency monitoring or tenth-acre inventories have been recorded within the TEU within the Angell Allotment. This table does not show the results of soil assessments and other monitoring conducted on the allotment (See the Soil and Water Specialist Report for more details).

Table 28: Acres of TEU groupings within the Angell Allotment in Grazed Pastures.

TEU (TEU Group)	Acres <40% Slope	Acres > 40% Slope	Total Acres	% of Allotment Acres	% of Graze Acres	Number of Monitoring Plots	Acres with Existing Condition Data	Acres <40% Slope with Existing Condition Data
14	478	1	479	0.9	0	0	0	0
15	14	24	37	0.07	0	0	0	0
41	227	0	227	0.4	0.5	0	0	0
426	1,546	0	1,546	3	0	1	1,546	1,546
427	212	105	317	0.6	0	0	0	0
433	3,695	5	3,700	7	0	1	3,700	3,695
434,437	11,673	0	11,673	23	26	3	11,673	11.673
435	255	197	452	0.9	0.6	0	0	0
436	4,786	0	4,786	9	11	3	4,786	4,786
441	3,293	414	3,707	7	7	0	0	0
443	6,017	4	6,021	12	14	1	6,021	6,017
444	12,386	1	12,387	24	28	7	12,387	12,386
450	218	60	277	0.5	0.5	0	0	0
455	0	5	5	0.01	0	0	0	0
473	622	0	622	1	1	0	0	0
491	601	0	601	1	1	0	0	0
506	70	0	70	0.1	0.2	0	0	0
510	275	0	275	0.5	0	0	0	0
511	2	0	2	0.003	0	0	0	0
512	2,793	1	2,794	5	6	1	2,794	2,793

TEU (TEU Group)	Acres <40% Slope	Acres > 40% Slope	Total Acres	% of Allotment Acres	% of Graze Acres	Number of Monitoring Plots	Acres with Existing Condition Data	Acres <40% Slope with Existing Condition Data
513	881	23	903	2	2	1	903	881
558	61	0	61	0.1	0	0	0	0
560	230	0	230	0.4	0.5	0	0	0
561	79	2	81	0.2	0	0	0	0
566	329	0	329	0.6	0.7	0	0	0
Total	**50,743**	**842**	**51,582**	**99**	**99**	**18**	**43,810**	**32,115**

Appendix F – Activities Considered in Cumulative Effects Analysis

Not all activities in Table 29 are relevant to each resource's cumulative effects analysis. Projects and their expected outcomes may have been discussed generally or grouped in the effects analysis.

Table 29. Summary of Past, Present and Reasonably Foreseeable Activities for the Angell Allotment EA.

Project	Description and Relevant Effects	Effects Timeframe
Grazing by wild ungulates	Grazing by elk, deer, and antelope occurs throughout the project area. Arizona Game and Fish (AZGFD) estimated that the elk herd size within the allotment is an average of 200 elk in Angell Allotment north of Interstate 40 (source: personal communications with M. Padila 2014) and 100 elk in the Angell Allotment south of Interstate 40 (source: personal communication with C. Adams 2014). A number of efforts have been made on the forest to support antelope movement on and in the area surrounding the allotment. Hunting is the main control on the population of wild ungulates in the allotment and occurs at levels that meet AZGFD objectives for population management.	Present, Reasonably foreseeable
Stock tank invasive aquatic species management	Establish clearance for treatments of non-invasive aquatic species in stock tanks to prevent non-native invasive fish and other aquatic species from being reintroduced to downstream habitat with Threatened, Endangered and Sensitive fish.	Present, Reasonably foreseeable
Invasive Weeds Management on the Coconino, Kaibab and Prescott National Forests	This decision was signed in 2005 and allows the use of herbicides on forest lands, therefore providing a management tool not previously available to forest managers. The document and its provisions were incorporated into the Coconino National Forest Plan by Amendment 20 of the Plan and is presently being implemented across all 3 forests.	Present, Reasonably foreseeable
Maintenace of powerlines	There are several 69 kV and 345 kV powerlines are within the allotment boundaires. The right of way for these lines will continue to be maintained per national standards for vegetation clearance and approved by appropriate NEPA analysis. These include a 300-foot wide corridor that may include veg maintenance with potential additional tree	Present, Reasonably foreseeable

Project	Description and Relevant Effects	Effects Timeframe
	removal 60 feet on either side of the ROW.	
Maintenance of 345kV Power and transmission lines	The Western Area Power Administration 345 kV transmission lines go right through the allotment and should be mentioned here as well.	
Coconino NF Travel Management	As a result of the Travel Management decision in October 2011, public cross-country vehicle travel is no longer allowed, except in designated areas. This reduces the expansion of bare soil from motorized vehicles and nearly eliminates direct impacts of legal off-road motorized vehicles travel. Limited administrative and access for permitted uses such as livestock grazing are the extent of permitted off-road travel.	Present, Reasonably foreseeable
Maintenance of Forest Roads in and around the Angell Allotment	Routine maintenance of roads for administrative and public use would continue throughout the cumulative effects area according to Forest Service policy.	Present, Reasonable foreseeable
Climate change	Global climate change is expected to be a source of widespread disturbances. Higher temperatures will occur and precipitation cycles will be modified from current patterns over large areas. The warmer climate conditions may affect ecosystems by altering biotic and abiotic factors and increase the extent and severity of disturbances for some species (Bradley et al 2010, Hellmann et al 2008, Middleton 2006). Larger and more frequent fires are expected (Marlon et al. 2009). Climate may favor the spread of invasive exotic grasses into arid lands where the native vegetation is too sparse to carry a fire. When these areas burn, they typically convert to non-native monocultures and the native vegetation is lost (USDA Forest Service 2010).	Reasonable foreseeable

Project	Description and Relevant Effects	Effects Timeframe
Wildfire	Six wildfires have occurred within the boundary of the Angell Allotment since 2000 effecting almost 7,300 acres in the allotment. It is possible that wildfires will occur in the allotment again. Wildfire typically has beneficial effects to the ecosystem by removing overstory spcecies such as juniper and allowing for an increase in herbaceous cover and reduced bare soil. Effects of wildfire are temporary and depnding on they type of wildfire, recovery typcially takes one to five years under favorable climatic conditions.	Reasonable foreseeable

Appendix G – Forest Plan Compliance

Included in this Forest Plan consistency check are only those Standards and Guidelines applicable to project-level related activities. All other Forest-wide and Management Area Standards and Guidelines and associated amendments not included here were either determined to provide direction at a larger scale, beyond the scope of this project or not applicable to the project location and activities.

Table 30: Angell Allotment Range EA Forest Plan Consistency Check.

Page	Forest Plan Direction	Project Consistency with Forest Plan
Forest-Wide Cultural Resources		
52-3	Consult with Native Americans when projects and activities are planned in sites or areas of known religious or cultural importance.	The Dine', Fort McDowell Yavapai, Havasupai, Hopi, Hualapai, Navajo, Acoma, Zuni, San Carlos Apache, San Juan Southern Paiute, Tonto Apache, White Mountain Apache, Yavapai-Apache, and Yavapai-Prescott were contacted regarding this project through correspondence dated February 6, 2014. The Hopi Tribe responded with a letter of interest, dated February 19, 2014, requesting that copies of the cultural assessment report and the draft environmental assessment. The cultural assessment report was forwarded to the Hopi Tribe on April 1, 2014. The Hopi Tribe responded with a letter dated April 7, 2014 stating “we concur that a determination of no adverse effect is appropriate for this undertaking.” The letter also supported ARPA assessment of site 02-2512 and the obliteration of now closed roads that lead to three sites, as described in the attached report. No other tribal concerns have been received.

Page	Forest Plan Direction	Project Consistency with Forest Plan
52-3	The Forest complies with the National Historic Preservation Act (NHPA) in decisions involving interactions between cultural and other resources. Cultural resources are managed in coordination with the State Historic Preservation Plan (SHPO). Until evaluated, the minimal level of management for all sites is avoidance and protection.	A cultural resources clearance report was completed for this project. The project was determined to have "No Adverse Effect" on cultural resources. SHPO concurrence for this proposal is dated May 5, 2014. Any additional ground disturbing range developments or treatments proposed within the Angell Grazing Allotment will comply with the existing Region 3 Programmatic agreement with the Arizona State Historic Preservation Officer, dated December 24, 2003, and shall constitute an additional undertaking for Section 106 compliance outside of this allotment Management Plan Report. By avoiding archeological sites during construction and in areas of concentrated use there should be no future direct effects to cultural resources. Following Regional Guidance, ground-disturbing activities that are planned to occur within the first 2 years of the Decision will be surveyed first and clearance reports completed as part of this NEPA analysis. If any improvements are implemented as part of adaptive management, they will be surveyed and clearance reports will be written prior to implementation.
52-4	Consultation with the SHPO, and if necessary, the Advisory Council on Historic Preservation (ACHP), before project implementation. Significant, or potentially significant, inventoried sites are managed to achieve a "No Effect" determination, in consultation with the SHPO and ACHP (36 CFR800).	SHPO was consulted and concurred with the "No Adverse Effect" determination. Both 'No Effect' and 'No Adverse Effect' determinations of effect result in no adverse effects to heritage resources.

Page	Forest Plan Direction	Project Consistency with Forest Plan
53	Monitoring during and after project implementation is done to document site protection and condition.	The District will periodically monitor known archaeological sites to ensure they have been avoided, and such inspections will be reported in writing to the Forest Archeologist. Should any additional prehistoric or historic archaeological sites be encountered during the course of this project, they are to be avoided and immediately reported to a District or Forest Archaeologist. If any of these new discoveries are rock shelters, they will be closely monitored and if cattle are using these sites for shelter and impacting the fragile nature of the site, the shelter should be excluded from future grazing.
Wildlife and Fish Operations and Maintenance		
64	Habitat management for Federally listed species will take precedence over unlisted species. Habitat management for endangered species will take precedence over threatened species. Habitat management for sensitive species will take precedence over non-sensitive species. Follow approved recovery plans.	A Biological Assessment has been prepared analyzing the potential effects to T&E species in the project area. A detailed analysis of effects to FS sensitive species and other wildlife can be found in the Wildlife Specialist Report. The T&E species with suitable habitat in the project area does not have a recovery plan.
64	Inventory and evaluate wildlife and fish habitat. Use the best available knowledge, resource data and technical expertise to identify habitat objectives and prepare implementation schedules for key habitats.	Habitat evaluations for the appropriate T&S, FS sensitive, MIS, and MBTA species have been determined based on the best available data including survey data and habitat modeling. The potential effects of each alternative have been analyzed and is found in the Wildlife Specialist Report.
64	The riparian standards apply to areas meeting the riparian definition even though the sites may not have been large enough to be mapped as a discrete unit.	No areas meeting the riparian definition were identified in the project area.

Page	Forest Plan Direction	Project Consistency with Forest Plan
64	On identified big game winter ranges, treatments are designed to enhance the specified wildlife species. These areas are managed primarily for the welfare of the wildlife species using the area. Where forage is identified as a limiting factor for big game populations, seek opportunities to make available additional forage and implement where determined appropriate through analysis with the IRM and NEPA process.	This project area does not contain identified big game winter range. No vegetation treatments to enhance big game winter ranges are proposed. Forage is not identified as a limiting factor in the project area. Livestock grazing at proposed levels would not significantly reduce existing herbaceous ground cover.
T&E Operations and Maintenance		
64-1	Evaluate potential resource impacts on T&E and sensitive species habitat by projects and activities through a biological assessment (FSM 2670) and conduct appropriate consultation (FSM 2670) when necessary. Provide appropriate protection or enhancement.	A Biological Assessment has been prepared for T&E species with suitable habitat in the project area and the Wildlife Specialist's Report contains an analysis of potential effects to FS sensitive species and other wildlife.
64-1	Habitat locations for listed plant and animal species remain confidential to prevent unnecessary disturbances or theft.	Locations of suitable habitat for T&E species have not been disclosed in readily accessible public documents.
Mexican Spotted Owl		

Page	Forest Plan Direction	Project Consistency with Forest Plan
65-5	Domestic Livestock Grazing: Implement forest plan forage utilization standards and guidelines to maintain owl prey availability, maintain potential for beneficial fire while inhibiting potential destructive fire, maintain and restore riparian ecosystems, and promote development of owl habitat. Strive to attain good to excellent range conditions.	There are no Mexican spotted owls, suitable habitat or designated critical habitat in the project area.
Northern Goshawk Habitat		
65-7	Survey the management analysis area prior to habitat modifying activities including a 1/2 mile beyond the boundary.	This project does not propose to modify goshawk habitat.
65-7	Manage the ground surface layer to maintain satisfactory soil conditions i.e. to minimize soil compaction; and to maintain hydrologic and nutrient cycles.	The project proposes conservative to moderate seasonal and annual utilization levels. Grazing at these levels would not significantly reduce herbaceous ground cover, thus providing for prey species.
T&E Plant Habitat Maintenance		
65-12	Give priority to maintaining structures for threatened and endangered species.	Maintenance of existing improvements and construction of new improvements would have no effect on T&E species.
65-12	Determine whether structural improvements are needed. Maintain structural improvements in operable condition or replace. Protect occupied *Cimicifuga arizonica* habitat. Restrict ground disturbing activities within the habitat and provide shade needed for perpetuation of the species. Fence and/or relocate trails where necessary to protect occupied habitat.	There are no T&E plants or habitat in the project area.

Page	Forest Plan Direction	Project Consistency with Forest Plan
Wildlife and Fish Habitat Maintenance		
65-12	Determine the need for structural improvements and maintain those needed in operable condition or replace.	The action alternatives would allow for maintenance and construction of improvements such as drinker/pipeline systems, earthen stock tanks, and fences that would maintain existing water sources and provide new one for wildlife and would allow for building of new fences and modifying of existing fences during routine fence maintenance to wildlife passage standards
Wildlife and Fish Coop. with State, Federal Agencies, and Other Groups		

Page	Forest Plan Direction	Project Consistency with Forest Plan
65-12	Consult and cooperate with Arizona Game and Fish Department (AGFD) to at least achieve habitat management goals and objectives specified in the Arizona Wildlife and Fisheries Comprehensive Plans and strategic plans. Work with AGFD to fully consider opportunities for increasing habitat capacity above the objectives specified in the Comprehensive Plans and strategic plans. Where habitat capacity can reasonably be increased above the objectives specified in the Comprehensive Plan without adversely affecting other resources and uses, work with AGFD to fully consider these opportunities. Implement where determined appropriate through the environmental analysis process. Cooperate with the Fish and Wildlife Service and other agencies and organizations as the need arises. Cooperate with AGFD in evaluating proposals for reintroducing extirpated species into suitable habitat and on fish stocking and public access for fishing. Cooperate with the AGFD to prevent and/or remove unapproved introduced species.	Arizona Game and Fish Department and US Fish and Wildlife Service have been informed of and have participated in the development of the proposed action for this project.
Nonstructural Wildlife Habitat Improvement		

Page	Forest Plan Direction	Project Consistency with Forest Plan
66	Manage forage to increase threatened and endangered species and management indicator species where it is determined appropriate through the IRM and NEPA process.	Forage will be managed at conservative to moderate seasonal and annual utilization levels, which will benefit T&E species and management indicator species.
T&E Nonstructural Wildlife Habitat Improvement		
66	Improve T&E and sensitive species habitat. Improvement projects give priority to recovery of T&E species. Conform to approved recovery plans.	Effects to T&E habitat and FS sensitive species have been evaluated in the Biological Assessment and Wildlife Specialist's Report. Federally listed species were given priority over all other wildlife. The one T&E species in the project area does not have a recovery plan.
66	Develop wildlife waters where needed in accordance with approved plans and fence where necessary to protect wildlife values.	The project proposed additional waters that will be benefit wildlife. No need to protect wildlife values with fencing were identified.
Range Resource Planning and Inventory		
66-1	Forage use by grazing ungulates will be maintained at or above a condition which assures recovery and continued existence of threatened and endangered species.	A management guideline of conservative use (up to 40% forage utilization as measured at the end of the growing season) will be employed to maintain or improve rangeland vegetation and long term soil productivity.

Page	Forest Plan Direction	Project Consistency with Forest Plan
66-1	Identify key ungulate forage monitoring areas. These key areas will normally be 1/4 to 1 mile from water, located on productive soils on level to intermediate slopes, and be readily accessible for grazing. Size of the key forage monitoring areas could be 20 to 500 acres. Within key forage monitoring areas, select appropriate key species to monitor average allowable use.	Implementation monitoring will be conducted on an annual basis and will include: permit compliance, livestock actual use data, grazing intensity, utilization, assessments of forage production and ground cover, precipitation, and allotment inspections. Effectiveness monitoring will occur within key areas on permanent transects at an interval of 10 years or less. Effectiveness monitoring will include forage production and vegetation condition and trend. See Range Specialist Report.
66-1	In consultation with US Fish and Wildlife Service, develop site-specific forage use levels. In the event that site-specific information is not available, average key species forage utilization in key forage monitoring areas by domestic livestock and wildlife should not exceed levels in the following table during the forage growing season.	Based on an effects analysis of the proposed utilization levels, it was determined that species composition and residual biomass will be sufficient to support wildlife.
66-1-2	Guidelines for allowable use for specific allotment(s) management or for grazing strategies will vary on a site-specific basis.	Under Alternatives 2 and 3, monitoring of existing plots for range condition and trend will help determine the effectiveness of grazing management in the project area.
66-2	Range Administration--Receive applications for grazing permits, issue and validate permits, and prepare annual permittee plans as per FSM 2230.	A new Term Grazing Permit will be issued and a new Allotment Management Plan will be written once a Decision Notice for this EA has been signed. Preparing Annual Operating Instructions will be completed annually for this project.

Page	Forest Plan Direction	Project Consistency with Forest Plan
66-2	Manage allotment at the C through D level of Management Intensity in existing allotment management plans (AMP). Where appropriate economically and environmentally, implement E Level (MIH 1309.11).	This project will be managed at the Management Intensity C and D Levels as described in the Forest Plan.
67	Permittees are responsible for maintenance of structural improvements as defined in the AMP or the annual operating plan. Maintenance of improvements continues until replacements are built, then the permittee is responsible for maintaining the replacement.	Improvements have been maintained on this allotment in the past and the new AMP will follow this maintenance protocol.
67	Some State, private, and non-Forest Service lands within the Forest may be excluded from grazing; some lands are grazed under private agreement, and/or waived to the Forest Service for management. (FSM 2230)	Inholdings contained within the Angell Allotment area are not managed by the Forest Service.
67	Range cooperation with agencies and groups is encouraged. Coordinate range activities with outside, local, State and Federal agencies, and groups.	This will be done and documented, as the need arises, during the term of the authorized grazing permit.
67	Do production and utilization surveys at least every 9 to 13 years for capacity determinations.	The most recent forage production survey was completed on the Angell Allotment in 2006 and the next survey is scheduled to occur after 2015.

Page	Forest Plan Direction	Project Consistency with Forest Plan
67	Permitted use and capacities are maintained in balance for the allotment by increasing or decreasing numbers of livestock, by changing the management intensity levels, and by initiating changes in livestock class, season of use, and rotation patterns.	Permitted use on the allotment has been shown to be well below estimated capacity to allow for both livestock grazing and wildlife management goals in the face of variable climate conditions. Continued balance of permitted use and capacity will be accomplished through adaptive management.
67	Conduct annual allotment inspections to Regional standards as set in FSH 2209.21.	Inspections will be completed annually and to regional standards, as discussed in the proposed action - Chapter 2 Alternatives.
67	Revise and update AMPs at least every 10 years to the Regional standards in FSH 2209.21. Management systems are designed to provide multiple-use management. The integrated resource management (IRM) approach is used during the environmental analysis of AMPs. The scoping portion of IRM will include an interdisciplinary analysis with input from potentially affected and interested parties. Issues that are significant and need to be included in further analysis will be identified. As a minimum the following areas will be considered to determine whether they contain significant issues: range condition, riparian condition, watershed condition, economic feasibility, practicality of implementation, wildlife habitat, recreation opportunity spectrum, timber management, and resource access and travel management.	These IRM guidelines are met through the interdisciplinary NEPA process. This project will establish a new AMP when the EA and Decision and Finding of No Significant Impact are issued.

Page	Forest Plan Direction	Project Consistency with Forest Plan
67	Permitted use and capacity are assigned based on full capacity range only.	The proposed capacity and permitted use is based on allotment specific carrying capacity analyses. Only full capacity range, as determined by the Forest Plan (p. 67), is considered in the allotment specific capacity analysis.
68	Manage grazing use to maintain or enhance condition classes of full capacity rangelands.	Proposed grazing strategies are designed to maintain or improve the condition class in this project.
68	Full capacity rangeland in unsatisfactory condition that has potential for improvement is treated through appropriate structural and nonstructural range improvements and pasture stocking rate adjustments as described in the AMPs.	There are no acres defined as unsatisfactory condition on the Angell Allotment.
68	Inventory transitory range resulting from timber harvest and firewood cutting during the allotment planning process, and assign capacity where appropriate.	Capacity is analyzed and determined through the NEPA process and addressed in this EA.
68	Place cattleguards where problem gates exist.	No new cattleguards are proposed in this project because no problem gates are known at this time. Existing cattleguards will be maintained.
68	Water lots are left open to wildlife for free access except when controlling livestock distribution through water accessibility and when soil moisture conditions adversely affect fence stability.	All water lots service drinkers fed by a pipeline and well system originating on private land, therefore this direction is not applicable to water lots on this allotment.
68	During summer months, leave water in livestock troughs for wildlife use after domestic animals have been removed from the grazing unit. In winter months in key wildlife winter ranges, provide water where freezing will not damage facilities. Bubblers are used to prevent freezing.	All troughs are fed by a pipeline and well system originating on private land, therefore this direction is not applicable to troughs on this allotment.

Page	Forest Plan Direction	Project Consistency with Forest Plan
68	Salt is used to help achieve proper livestock grazing distribution. Permanent salt is not placed within 1/4 of a mile of the edge of any riparian area or tree plantation. Temporary salting may be approved if it will help to achieve a specific management objective for enhancement of riparian areas.	This has been addressed in the Final EA, Chapter 2 - Alternatives, under Resource Protection Measures. This direction is also incorporated into the Allotment Management Plan and the Annual Operating Instructions.
68	No livestock trailing is allowed except within a permittee's own grazing allotment(s). Exceptions require Forest Supervisor approval and are based on documented results of an environmental analysis.	Trailing has been addressed in the Final EA and the Range Specialist Report.
Reconstruction of Range Structural Improvements		
68	Analyze range structural improvements to determine whether they are needed during the preparation of the AMPs. Reconstruct only those improvements that are needed. Remove improvements no longer needed and restore the area as appropriate, e.g., old fence is picked up and removed, discontinued fences are completely removed, and ineffective stock tanks returned to production following transfer of water rights.	In addition to maintaining current range structures, this project would add approximately 0.22 mile of new barbwire fence to expand a water lot accessible by Crisp, Cinder Hill and O'Neil pastures; approximately 0.3 mile of new barbwire fence creating a new water lot accessible by the Cinder Hill and Cocrane pastures. Construction of 0.72 mile of new water pipeline will be constructed on the Cocrane pasture, and 2 new pipelines will be constructed on the South Angell pasture totaling about 3 mile. Three new troughs will be placed on the allotment.

Page	Forest Plan Direction	Project Consistency with Forest Plan
68-A	Reconstruct range structural improvements to appropriate construction standards or better according to FSM 2244, and FSH 2209.22. Maintain range structural improvements in operable condition according to FSM 2244, FSH 2209.22, and FSM 2320.	This direction is addressed this EA, Chapter 2, Structural Range Improvements. It will also be addressed in the Allotment Management Plan and the Annual Operating Instructions.
68-A	Inventory earthen tanks having current water rights that are not contributing to management because of poor location, inefficient placement, or in closed allotment and not needed by wildlife, during the first decade. Exchange the old sites for new sites with similar capacity and transfer the water rights. The old tanks are filled in, reshaped, and returned to production.	No permanent closure or removal of tanks is proposed, therefore, there are no effects of the actions on any existing claims or water rights.
69	On open storage tanks and drinkers provide entry and escape ramps for wildlife.	This is addressed in the Final EA, Chapter 2, Resource Protection Measures; and in the Range Specialist Report and the Wildlife Specialist Report.
69	When existing allotment boundary, Forest boundary, and water lot fences need to be reconstructed or new fences are built, they shall consist of four wires, with the top wire being at least 38 inches but no more than 42 inches above the ground. The bottom wire will be smooth twisted and at least 18 inches above the ground. Highway right-of-way fences will meet highway fence standards.	Construction of new proposed fences will be completed to these standards. As other fences are reconstructed over time, they will also be completed to these standards.

Page	Forest Plan Direction	Project Consistency with Forest Plan
69	Interior fences in an allotment are generally three wire fences with the bottom wire smooth and conform to the above height restrictions.	Reconstruction of fences will be completed to these standards. Not all current fences meet this standard, but we are currently working on modifying these fences to the 18” smooth bottom wire standard over time.
69	Install antelope passes, let-down fences, electric fences, or elk jumps wherever necessary to improve wildlife travel ways.	New fences will include these features as appropriate.
	Range Structural Improvement	
69	Improve livestock handling and water facilities for optimum production while maintaining cost-effective management systems and techniques. Construct structural range improvements necessary to implement and maintain range resource management level identified for the Management Area. Comply with construction standards set in FSM 2240, 2320, and FSH 2209.22.	This project would add approximately 0.22 mile of new barbwire fence to expand a water lot accessible by Crisp, Cinder Hill and O'Neil pastures; approximately 0.3 mile of new barbwire fence creating a new water lot accessible by the Cinder Hill and Cocrane pastures. Construction of 0.72 mile of new water pipeline will be constructed on the Cocrane pasture, and 2 new pipelines will be constructed on the South Angell pasture totaling about 3 mile. Three new troughs will be placed on the allotment.
69	Evaluate proposed earthen stock tank sites for location, adequacy, soil suitability, efficient use of the water resource, and legal requirements. Design structures built in drainages to meet appropriate flood occurrence intervals. Assure that on new stock tanks appropriate documents for construction and water rights application are filed in a timely manner and according to State law.	No new stock tanks are proposed.

Page	Forest Plan Direction	Project Consistency with Forest Plan
Range Forage Improvement		
69	Establish woody riparian vegetation as defined in FSH 2509.23 in wet meadows and other riparian areas. Control livestock grazing through management and/or fencing to establish vegetation and eliminate overuse.	There are no riparian areas located in the Angell Allotment.
69	Manage all seeding projects to avoid concentrating livestock use in riparian and other sensitive areas.	No areas are proposed for re-seeding.
Noxious and Invasive Weeds		
69	Incorporate measures to control invasive weeds into project planning, implementation, and monitoring.	An Invasive Plant Species Specialist Report was completed for the project and mitigations specific to Range Management were included.

Page	Forest Plan Direction	Project Consistency with Forest Plan
69	Use the Appendix B “Design Features, Best Management Practices, Required Protection Measures, and Mitigation Measures” in the “Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests within Coconino, Gila, Mojave, and Yavapai Counties, Arizona” (2004) for specific mitigation measures. Deviance from Appendix B does not trigger the need for a Forest Plan Amendment, however Required Protection Measures from Section 7 consultation (Endangered Species Act) must be followed. If as a result of environmental analysis, Best Management Practices or Mitigation Measures are modified, document the reason(s) in a NEPA decision.	Noxious weed mitigation measures specific to Range Management (pp. B-12 to B-14) are incorporated into the design of the proposed action and alternatives. Usually livestock coming onto the Forest from neighboring state and private land are not fed as they come on the forest, however if they are, the AOI will direct the permittee to not feed cattle weedy hay one week before they enter this allotment. The Forest Service and permittee will coordinate monitoring and treatment of noxious weeds, with responsibilities identified in the AOI. All tools, equipment, and vehicles used in maintenance and construction of improvements will be cleaned of soil and plant parts before the start and after the completion of activities.
Soil, Water and Air		
71	Ensure compliance with PL 92-500 "Federal Water Pollution Control Act" and Arizona Water Quality Standards through the implementation of Best Management Practices (BMP) to prevent water quality degradation.	BMPs have been adopted from Chapter 22 of Forest Service Handbook (FSH) 2509.22 also referred to as the "Soil and Water Conservation Practices Handbook" and will be implemented in this project.

Page	Forest Plan Direction	Project Consistency with Forest Plan
72	Plan projects, parts of projects, and/or management practices for soil and water resources improvement where watershed condition is unsatisfactory. Incorporate plans for soil and water improvements into project planning for other resources.	Mitigation measures and Best Management Practices (BMPs) will help protect soil and water quality on this allotment. See Chapter 2-Mitigation Measures and Resource Protection Measures in the Final EA.
Water Resource Monitoring		
73	Evaluate the need to monitor water quality from areas disturbed by management and use activities. Conduct monitoring where needed to assure compliance with the Arizona State Water Quality Standards and P.L. 92-500.	The Arizona Department of Environmental Quality (ADEQ) generally monitors the water quality of perennial surface bodies owing to the unpredictable nature of flow in intermittent and ephemeral stream systems. ADEQ does not monitor water quality in the intermittent or ephemeral drainages associated with the allotment.
73	Conduct water quality monitoring of primary contact recreation sites to standards of FSM 2540 and Arizona Water Quality Standards for full body contact waters (swimming and wading). Conduct monitoring as necessary to assure compliance with standards for aquatic life and wildlife where known problems are occurring.	There are no primary contact recreation (water) sites located within the project area and there are no known water quality problems on this allotment.
73	Evaluate watershed condition for its effect on suspended sediment.	Soils within the allotment are generally characterized by ground cover sufficient to prevent soil loss from exceeding tolerable levels. Although ADEQ does not monitor water quality within the allotment, suspended sediment within intermittent or ephemeral drainages is not expected to exceed levels that may occur in the absence of livestock grazing.
Water Uses Management		

Page	Forest Plan Direction	Project Consistency with Forest Plan
74	Evaluate current and proposed water uses to promote efficient use of Forest Water resources.	Existing stock tanks available for livestock on the allotment meet current cattle distribution needs. Future water uses will be evaluated as needed during the term of the authorized grazing permit.
Water Resource Improvement		
74	Maintain current satisfactory watershed conditions and improve any unsatisfactory conditions to satisfactory by 2020.	The proposed action would not likely affect overall watershed conditions as indicators of watershed condition are either unaffected by the proposed action (e.g., the proposed action includes no change to road status so indicator 6, roads and trails, would remain unchanged), the area affected by the proposed action represents a small portion of the total watershed (e.g., allotment occurs in less than 3% of Rio De Flag subwatershed), or the allotment lacks indicator attributes (e.g., riparian areas and aquatic habitat not present in or directly downstream of the allotment).

Page	Forest Plan Direction	Project Consistency with Forest Plan
74	Implement resource improvement projects that are cost-effective and/or are beneficial for maintaining and improving water quality, quantity, and soil productivity. Priority is given to vegetative versus structural measures. On those areas where grazing occurs, projects are only done where there is an approved AMP. Treated areas are protected by grazing management, fencing, and/or other methods, until recovery is satisfactory. On those areas where grazing occurs, management will be evaluated and modified if necessary to be consistent with the objectives of the improvement project. In project planning, evaluate the need for planting nonpalatable herbaceous and woody vegetation to discourage concentration of elk and livestock.	These measures are outside the scope of this project. However, as the need to improve water quality, quantity, or soil productivity arises in the allotment, adjustments may be made in the Annual Operating Instructions to address concerns specific to livestock grazing. Adaptive management is part of this project. Adaptive management provides a menu of management options that may be needed to adjust management decisions and actions to meet desired conditions as determined through monitoring.
Terrestrial Ecosystem Survey		

Page	Forest Plan Direction	Project Consistency with Forest Plan
75	Conduct an on-site soils investigation for soil disturbing projects which require site specific, precise, highly detailed soil information which is beyond the scope of what is provided in a Level 3 TES., such as terrestrial ecosystem information concerning inclusions and other miscellaneous areas which is important for site specific projects. Site specific projects would include but are not limited to site preparation, campgrounds, trails, and pit tanks.	No soil disturbing projects that require site specific, precise, highly detailed soil information are proposed.
Ponderosa Pine and Mixed Conifer, Less Than 40 Percent Slopes - Management Area 3		
Range Resource Planning and Inventory		
120	Grazing Allotment will generally be managed to Level C and D.	Angell Allotment will be managed at Level C and D Intensity.

Page	Forest Plan Direction	Project Consistency with Forest Plan
120	This MA is open to grazing. There are 623,222 acres of full capacity lands. Of these total acres, 46,740 acres are in less than satisfactory condition. Less than satisfactory range conditions are improved through completion of the development program contained in AMPs.	There are no "less than satisfactory" range conditions in MA3 on the allotment.
Range Forage Improvement Maintenance		
120	Evaluate forage improvements and maintain forage improvement acres in satisfactory or better condition. Attain a balanced composition of cool and warm season forage species.	There are no forage improvement acres on this allotment.
120	Where open meadows in the pine/mixed conifer type are to be maintained, eliminate invading overstory vegetation, stabilize gullies to raise the water table, scarify the soil, and seed with appropriate grass and forage species. Control livestock grazing through management and/or fencing to establish the revegetation.	There are no plans for forage improvement treatments in Angell Allotment.

Page	Forest Plan Direction	Project Consistency with Forest Plan
Piñon-Juniper Woodland,< 40% Slopes -Management Area 7		
Wildlife Structural Improvements		
149	Provide water where needed on key wildlife winter ranges. Use bubblers or other means to prevent freezing, where needed.	There are no key wildlife winter ranges identified in the project area, but earthen stock tanks do provide water to wildlife in winter.
Range Resource Planning and Inventory		
150	Grazing Allotment will generally be managed at Level C or D. Full capacity lands are assigned a grazing capacity. There are 227,601 acres of full capacity lands, of which 29,702 acres are in less than satisfactory condition. Less than satisfactory range conditions will be improved through completion of the range development program outlined in the AMP.	For this project, management will be at the Management Intensity C or D Level. Alternative 2 and 3 are designed to maintain and/or improve all range conditions except where trees are limiting this improvement. There are no "less than satisfactory" conditions in MA 7 on the allotment.
Range Forage Improvement Maintenance		
150	Evaluate and determine the need to maintain forage improvement acres in satisfactory or better condition.	There are no forage improvement acres on this allotment.
Pinon Juniper Woodlands, >40% Slope -Management Area 8		
Wildlife Structural Improvements		
157	During winter months in key wildlife winter ranges provide water where needed using bubblers to prevent freezing.	There are no key wildlife winter ranges identified in the project area, but earthen stock tanks do provide water to wildlife in winter.

Page	Forest Plan Direction	Project Consistency with Forest Plan
Range Planning and Inventory		
157	The area is classified as no capacity range. The area generally is not fenced, so occasional livestock use does occur.	MA 8 is not fenced on the Angell Allotment. Due to terrain limitations livestock use would rarely occur in this MA.
Mountain Grassland -Management Area 9		
Structural Wildlife Habitat Improvements		
159	Evaluate need and, where necessary, construct fences to protect key meadows from grazing.	No meadows were identified on the allotment.
Range Resource Planning and Inventory		
160	Grazing allotments are generally managed at the D level. Full capacity are lands assigned a grazing capacity. There are 8,824 acres of full capacity land; of this total, 947 acres are in less than satisfactory condition. Less than satisfactory range conditions will be improved through completion of the development program in the respective AMPs.	This allotment will be managed at the C and D level. There are no "less than satisfactory" acres on the allotment.
Range Forage Improvement		
160	Control livestock grazing by management and/or fencing to allow adequate regeneration of grasses and forbs	This direction is addressed in Chapter 2 of this EA: through implementation monitoring and adaptive management, adjustments to livestock management will be made to allow for adequate regeneration of grasses and forbs.

Page	Forest Plan Direction	Project Consistency with Forest Plan
160	Increase forage production by attaining a balanced composition of cool and warm season forage species.	This direction is addressed in Chapter 2 of this EA: through implementation monitoring and adaptive management, adjustments to livestock management will be made to help attain a composition of cool and warm season forage species appropriate for TEUs in MA 9. However the composition of cool and warm season forage species is dependent on precipitation and climate change.
Water Resource Planning		
160	Manage mountain grasslands to achieve 90 percent of potential ground cover to prevent accelerated surface erosion and gully formation. Areas that presently do not meet these standards are scarified and seeded to bring ground cover to the desired level by the second decade. Restricting livestock may be necessary until revegetation	There are no areas in MA 9 identified for treatment
Grassland and Sparse Piñon-Juniper Above the Rim -Management Area 10		
Structural Wildlife Habitat Improvements		
164	During winter months in key wildlife winter ranges, provide water where possible, using bubblers or other methods to prevent freezing where needed.	There are no key wildlife winter ranges identified in the project area, but earthen stock tanks do provide water to wildlife in winter.
Range Resource Planning and Inventory		

Page	Forest Plan Direction	Project Consistency with Forest Plan
164	Manage grazing allotment generally at Levels D and E. Full capacity lands are assigned a grazing capacity. There are 123,435 acres of full capacity land; of these, 24,278 acres are in unsatisfactory range condition. Unsatisfactory range conditions will be improved through completion of the range development program in AMPs.	For this project, the Management Intensity will be at level C and D. Alternatives 2 and 3 are designed to maintain and/or improve all range conditions except where trees are limiting this improvement. There are no unsatisfactory acres in the allotment.
Range Forage Improvement Maintenance		
164	Maintain a seral grassland state on pinyon-juniper lands where type conversions have occurred in the past, with the exception that corridors of cover for wildlife habitat, determined through environmental analysis, may be allowed to develop through regrowth of pinyon-juniper. Initiate a retreatment schedule of approximately 25 years.	No maintenance treatments (such as thinning) on pinyon-juniper lands were analyzed in this EA. Thus, all of the alternatives would be in compliance with this element of the Forest Plan.
Craters Management Area -Management Area 31		
Cultural and Historical		

Page	Forest Plan Direction	Project Consistency with Forest Plan
206-85	Continue active monitoring of cultural and historical sites to impacts from recreation, cattle grazing, firewood cutting, and other human uses. Changes in management can occur in response to demonstrated (through monitoring) negative impacts to archaeological resources.	Concurrent to the Region 3 Programmatic Agreement, Appendix H, grazing allotments cover most of any given forest, and site inspections/monitoring of effects from grazing will be conducted as a part of day-to-day activities of a forest archaeologist. As they arise, opportunities to minimize effects of grazing to cultural resource sites should be taken. Incidents of damage to historic properties will be documented and appropriate protection measures, as outlined in Appendix H, shall be implemented. In an addition to the standards described in the Programmatic Agreement Appendix H, the CNF has implemented three monitoring plots across the allotment in an effort to continue to understand grazing effects on cultural resources.