Chapter 3. Environmental Consequences

This section summarizes the physical, biological, social, and economic environments of the affected analysis area and the potential changes to those environments due to implementation of the alternatives. This section also presents the scientific and analytical basis for the comparison of alternatives presented in Chapter 2.

To comply with NEPA requirements of analytic and concise environmental documents (40 CFR 1502.2), the resources identified as potentially affected by the proposed action or as a special concern are described. [5] Environmental components that do not exist within the ecosystem boundaries such as wilderness areas and wilderness study areas, are not discussed in detail.

The environmental consequences or effects are changes from present baseline conditions. Some of the environmental effects are confined to wild horse activity within the Jicarilla Wild Horse Territory. Others are cumulative with environmental effects from other past, present and reasonably foreseeable actions and cover an area beyond the JWHT.

Soil and Watershed

The District is located on the northeastern-most part of the San Juan Basin, which is characterized by an asymmetrical layering of sedimentary rocks. Many of the soils on the JWHT are deep and well drained, formed from alluvial or residual materials derived from sandstone, siltstone, and shale. The dominant types of erosion occurring on the District are wind erosion and water erosion. There is little evidence of mass wasting, except along a few steep canyon walls with intermittent surface water flows. Streambank erosion is widespread because most of the waterways are actively downcutting.

The type and quality of vegetation cover have crucial impacts on erosion rates, soil productivity, and soil condition, all of which contribute to watershed health. Activities that damage vegetation and increase the amount of bare soil in a watershed such as road construction, well pad and pipeline construction, and grazing accelerate natural soil erosion. [226] Heavy grazing by horses, cattle, deer, and elk on newly reseeded oil and gas pipelines and locations often cause the reseeding to fail.

For the purpose of determining the existing condition of the soil resource for this area analysis, an evaluation of soil condition for each Terrestrial Ecosystem Survey (TES) map unit was made. This evaluation utilized existing information contained in the interpretive tables for the map unit and other pertinent sources of information as found in the Carson National Forest 1987 TES publication. [16] The TES map units within the allotment were evaluated by comparing the soil loss rates as predicted by the Universal Soil Loss Equation (USLE) model. The relationship of current soil loss to soil loss tolerance was used as an indication of soil condition.

Soil condition is also determined by evaluating surface soil properties. This is the critical area where plant and animal organic matter accumulate, begin to decompose and eventually become incorporated into soil. It is also the zone of maximum biological activity and nutrient release. The physical condition of this zone plays a significant role in soil stability, nutrient cycling, water infiltration and energy flows. The presence and distribution of the surface soil horizon is critically important to vegetative productivity. Two classes of soil condition are recognized:

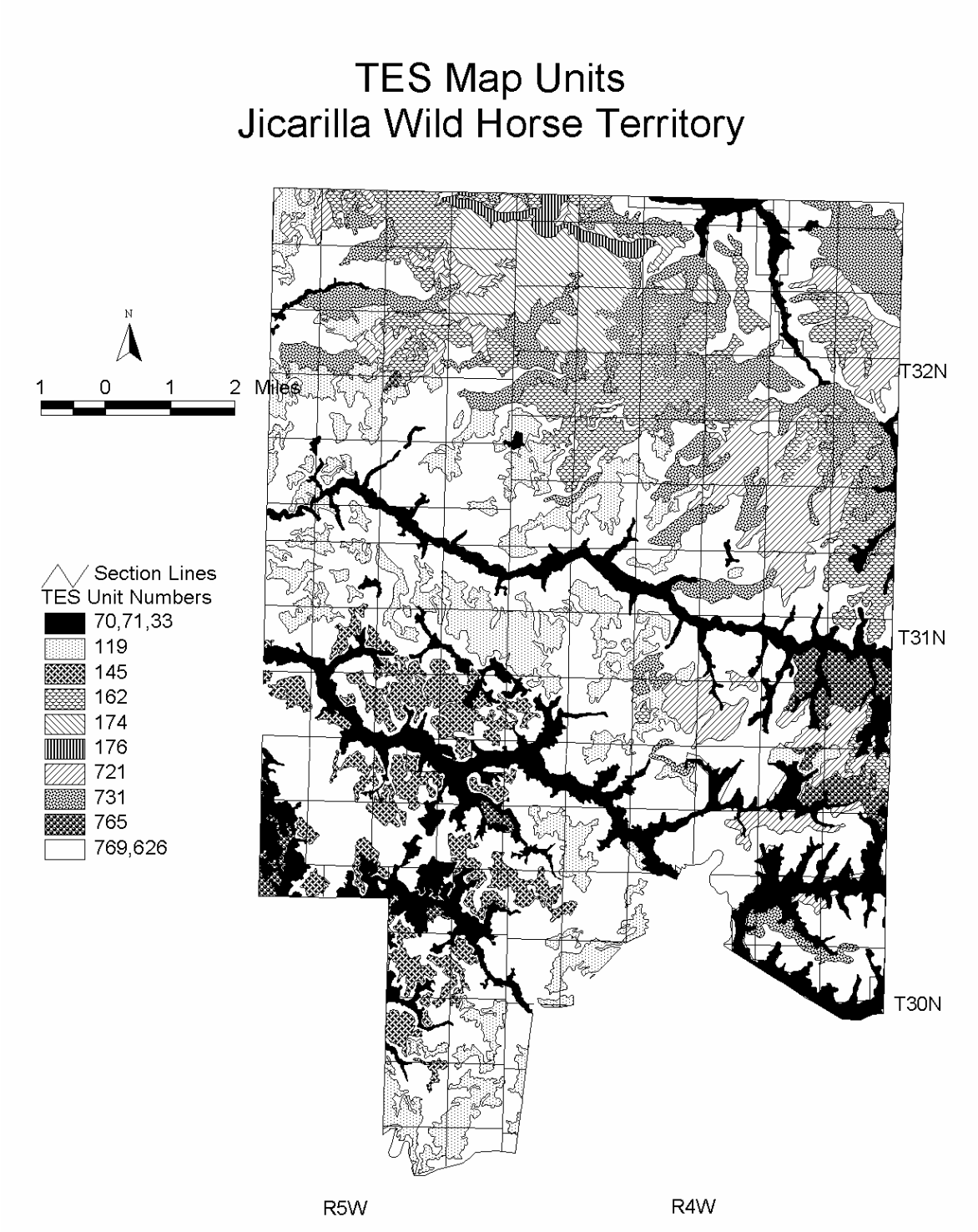

Figure 3. Terrestrial Ecosystem Survey Units Within the Jicarilla Wild Horse Territory

Satisfactory - Indicators signify that soil function is being sustained and soil is functioning properly and normally. The ability of soil to maintain resource values and sustain outputs is high. It is desirable for current soil loss to be below the tolerance levels established for each soil map unit. The soil loss tolerance, a reference condition established in the TES, is the maximum rate of soil loss from sheet and rill erosion that can occur while sustaining inherent soil productivity. Soils within the tolerance are considered in satisfactory condition.

Unsatisfactory - Indicators signify that loss of soil function has occurred. Degradation of vital soil functions result in the inability of soil to maintain resource values, sustain outputs, and recover from impacts. Soils rated in the unsatisfactory category are candidates for improved management practices or restoration designed to recover soil functions. If the current soil loss is above the tolerance levels established for each soil map unit then the soils are considered to be in unsatisfactory condition.

It is desirable for current soil loss to be below the tolerance levels established for each soil map unit. The soil loss tolerance, a reference condition established in the TES, is the maximum rate of soil loss from sheet and rill erosion that can occur while sustaining inherent soil productivity. Concentrated surface water flows often result in gully erosion, a process that causes erosion at a much faster rate than sheet and rill erosion and the primary cause of the unsatisfactory condition ratings for portions of some watersheds.

Parker 3 step transect methodology was used to evaluate soil stability within 3 TES units where historical range/soil transects were located. [39] Transects with fair soil stability with stable trends are considered satisfactory.

Soil Conditions

Soil conditions for TES units 119, 145, 162, 174, and 765 with the potential for moderate or slight erosion appear to be reasonably stable with unsatisfactory soil conditions estimated at 2 percent of the unit acreage. Those acres in unsatisfactory condition are generally related to oil and gas roads, pipelines, and well locations or portions of the unit that are adjacent to areas of heavy grazing use by horses, cattle or elk

Table 3. Terrestrial Ecosystem Survey Map Unit Information

TES Unit	Acres	Percent	% Slope	Potential Erosion Hazard	Topography	Estimated Acres of Unsatisfactory Soil Conditions	% of the Unit in Unsatisfactory Condition
70 71	7,514	10	0-15	severe	valley plains 6900-7500 ft.	3,757	50
119	7,888	11	0-15	moderate	elevated plains 7200 ft.	158	2
145	3,119	4	0-15	moderate	elevated plains 6900-7500 ft.	62	2
162	5,842	8	0-15	slight	plains 7500 ft.	120	2
174	2,970	4	0-15	moderate	plains 7900 ft.	60	2
176	477	0	40-80	severe	hills and scarps 7900 ft.	48	10

TES Unit	Acres	Percent	% Slope	Potential Erosion Hazard	Topography	Estimated Acres of Unsatisfactory Soil Conditions	% of the Unit in Unsatisfactory Condition
721	5220	7	0-40	severe	plains, hills and scarps 7500-8500 ft.	261	5
731	7,000	9	15-80	severe	scarps and hills 7500 ft.	700	10
765	1,284	2	0-40	moderate	plains and hills 7200 ft.	26	2
769 626	33,078	45	15-80 mostly >40%	severe-unclassified	hills and scarps 6900-7900 ft.	estimated ~3301	10
Total	74,392	100				8493	

Estimates for unsatisfactory condition acreages were estimated based on TES information, field inspections, GIS mapping, and professional knowledge of the JWHT. [16, 48, 147, 158]

TES map units 176, 731 and 769/626 make up 40,555 acres within the JWHT (54% of the JWHT) and are associated with slopes generally 40 percent or greater. The potential erosion hazard on these units is considered severe due to steep slopes. In 1987 when the TES was completed, current erosion for TES map units 176, 731, and 769/626 was estimated to be less than the tolerance, the maximum level of soil loss that can occur while sustaining site productivity. Herbaceous vegetation is generally limited on these sites, while woody vegetation along with rock or cobbles make up the majority of ground cover. Overall, TES units 176, 731 and 769/626 do not appear to have unsatisfactory soil conditions except along the toe of slopes adjacent to valley bottoms such as Bancos, Cabresto, and Carracas canyons, where grazing use primarily from horses and cattle has reduced plant cover and where runoff is concentrated from higher slopes. Also contributing to unsatisfactory conditions are roads constructed for gas development, gas well locations, and pipelines. Acres in unsatisfactory soil condition have not been mapped, but are estimated to be 10 percent of TES units 176, 731 and 769/626.

TES unit 721 (5,220 acres) falls in the potentially severe erosion hazard category because of soil type and slope. This unit is primarily located on the Carracas Canyon allotment. Soils in this unit appear to be relatively stable. Soil condition information was collected on one site within map unit 721 that exhibited a satisfactory soil condition rating. In 1987 (when the TES was completed) current erosion for TES unit 721 was estimated to be less than the tolerance level. [16] Acres in unsatisfactory condition are generally related to portions of the unit that are adjacent to areas of heavy grazing use by horses or roads constructed for gas development, pipelines, and well locations. It is estimated that 5 percent of the TES unit is in unsatisfactory condition.

TES map unit 70/71 (7,514 acres) also falls into the potentially severe erosion hazard, because of the soil type and it's susceptibility to gullying. Map unit 70/71 is the primary soil type that is grazed throughout the JWHT. Consequently the majority of range/soil transect information is gathered within this unit. Soil condition was evaluated on 6 sites within TES map unit 70/71 using Parker 3 step methodology. [39] Transect information is presented in Table 4. Those transects located in Cabresto Canyon were rated at poor or very poor soil stability. Only one transect

was located in Bancos Canyon, and it was also rated in poor soil stability. Other transects in Mule, Buzzard, and Lynch Ranch areas had fair soil stability. Poor soil stability is considered unsatisfactory soil condition.

In August 2003, a soil and watershed inspection indicated that the Lion, Cabrero, and Cabresto canyon areas were in unsatisfactory soil condition. [158] Extensive sheet, rill, and gully erosion are very common throughout this unit. Range inspection notes from 1998 specify that there were serious concerns about soil conditions in the Cabresto/Bancos Canyon area and that rill and wind erosion were active and needed to be addressed. [42] During drought conditions in 2002 a broad scale watershed assessment was prepared for the Jicarilla Ranger District. [226] The assessment states that, “there is little or no grass and forb cover under current conditions in Bancos and Carracas watersheds, due to the drought and grazing pressure by the high population of wild horses, in addition to cattle and elk.” There were 12 head of cattle permitted on the JWHT in 2002. Map unit 70/71 in Bancos Canyon is essentially roadless, with only one crossing, however the area has very serious erosion impacts throughout the canyon bottom (see Figure 5). Current unsatisfactory soil conditions have not been mapped throughout the JWHT, however it is estimated that 50 percent, or roughly 3,757 acres of TES unit 70/71, is in unsatisfactory condition.

Table 4. Soil Stability by TES Unit From Fall 2003 Range/Soil Transect Data [16, 260a]

Allotment	Location	TES Unit	Soil Stability/Trend	Site
Bancos	Lynch Ranch	70/71	fair/stable	reseeded 1973 sagebrush
Bancos	Mule Canyon	70/71	fair/stable	reseeded 1973 sagebrush
Bancos	Buzzard Park	70/71	fair/stable	piñon-juniper, ponderosa pine
Bancos	Cabresto Canyon	70/71	very poor/down	reseeded 1973 sagebrush
Cabresto	Cabresto Canyon	70/71	very poor/down	sagebrush, canyon bottom
Cabresto	Bancos Canyon	70/71	poor/down	piñon-juniper, sage
Carracas	Lower Carracas Canyon	721	fair/down	piñon-juniper, ponderosa pine
Carracas	Upper Carracas Canyon	174	fair/stable	ponderosa pine/meadow

The total acreage of unsatisfactory soil conditions on the JWHT is estimated to be 8,493 acres. Unsatisfactory soil conditions are scattered throughout the JWHT and are attributed primarily to gas development activities, grazing by wild horses, cattle grazing and some use by elk, all combined with long-term drought. Of greatest concern is map unit 70/71 where half the unit is in unsatisfactory condition.

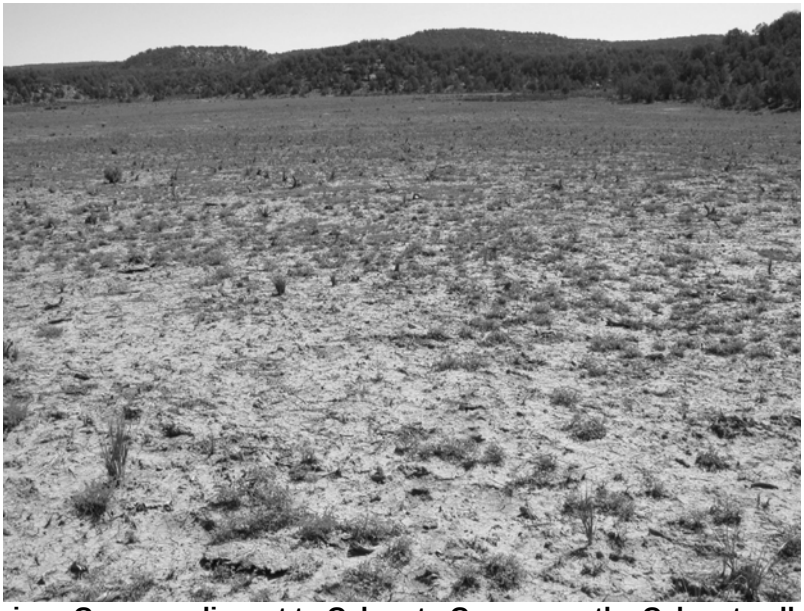

Figure 4. American Canyon adjacent to Cabresto Canyon on the Cabresto allotment taken in the fall of 2003. TES map unit 70/71, key grazing area ½ mile from water. Drought combined with heavy grazing use has left this previously reseeded flat with little protection from erosion. Herbaceous cover is primarily made up of annuals with some western wheatgrass and blue grama.

Figure 5. The Cabresto Allotment in Bancos Canyon taken in fall of 2003. Severe rill and gully erosion at the toe of the slope between TES map units 70/71 and 769. Erosion of this nature is common in Bancos Canyon.

The watershed assessment completed for the Jicarilla Ranger District in 2003 states:

If wild horse populations were managed according to the current management plan, reductions of up to 130 horses would be necessary. An environmental assessment for a new management plan is currently under development by District resource specialists and may propose new optimum numbers for the herd based on forage production and utilization. Due to the importance of grasses and forbs to the soil productivity and erosion control in the Wild Horse Territory, predominantly within the Carracas and Bancos watersheds, and the damage sustained to this vegetation by the aggressive grazing by these wild horses, it is clear that some reduction in herd size is essential to improve watershed condition. [226]

Dr. Jerry Holechek discusses erosion protection in his textbook *Range Management-Principles and Practices*. He states:

The best protection against erosion is to establish and maintain a good vegetative cover. Livestock affect watershed properties by removal of plant cover and through the physical action of their hooves. Reduction in the plant cover can increase the impact of raindrops, decrease soil organic matter and soil aggregates, and increase soil crusts. The primary effect of hoof action is compaction of the soil surface. Removal of cover and soil compaction reduce water infiltration rates, increase runoff, and increase erosion. [36]

Watershed Conditions

The following information is primarily taken from the 2003 Watershed Assessment for the Jicarilla Ranger District. [226]

Bancos, Carracas, and La Jara watersheds are all part of the Upper San Juan 4th-level hydrologic unit (14080101) or sub-basin. Bancos watershed, which drains into the San Juan River below Navajo Lake, is the only watershed with most of its area (55 percent) on National Forest System lands. National forest is located in the middle to upper part of the watershed. Only 25 percent of the Carracas watershed, which outlets into Navajo Lake, is on the Carson National Forest. The Jicarilla Ranger District in the Carracas watershed is in the middle of the delineated area. La Jara watershed runs into the San Juan River downstream from the Bancos watershed. In the La Jara watershed, the Jicarilla Ranger District (28% of total area) is also located in the center of the area. [226] Table 5 shows the 5th code watersheds and acreages within the JWHT.

Table 5. 5th Code Watersheds in the Jicarilla Wild Horse Territory

Watershed	Total Watershed Acres	Acres Within JWHT	Percent Watershed
Bancos	107,986	53,451	50
Carracas	51,940	13,193	25
La Jara	185,112	7,748	4

Riparian

Riparian habitat represents less than 30 acres of the JWHT. This habitat is found scattered in isolated tracts generally less than 1 acre in Bancos, Cabresto, Eul and Carracas canyons with the majority located in Bancos canyon. A mix of coyote willow, Gooding's willow, peachleaf willow, and Freemont cottonwood are found in some of these areas. Other vegetation associated with this habitat includes sedges, rushes, blue grama, rubber rabbitbrush, big sagebrush, squirreltail, and dropseed species. These are all ephemeral streams and riparian vegetation is limited to small areas primarily in subirrigated canyon bottoms or where a seep or a constructed sump is present.

Water Quality

The Bancos, Carracas and La Jara watersheds are located in the Upper San Juan Subbasin. The Upper San Juan is currently identified on the 2002 – 2004 State of New Mexico §303(d) List for Assessed River/Stream Reaches Requiring Total Maximum Daily Loads (TMDL'S) as a water quality limited water body (Assessment Unit ID NM-2406_00). The designated uses impaired are warmwater and coldwater fisheries. Probable cause of impairment is mercury in fish tissue, and the magnitude is listed as Moderate. Probable sources of impairment are listed as Atmospheric Deposition and other Unknown Sources. Because the Bancos, Carracas and La Jara watersheds drain into Navajo reservoir, sediment has not been identified as a probable cause of water quality impairment

> *The lack of quality vegetative cover and the acreage of surface disturbance, combined with a predominance of naturally erodable soils and relatively high peak flows generated by storm water runoff combine to cause accelerated erosion throughout the District.* [226]

> *Current sheet and rill erosion can be attributed to the lack of ground cover due to sparse vegetation, especially native grasses and forbs that hold soil in place during rainfall and runoff events. Lack of ground cover and sparse vegetation has been attributed to bare ground from construction activities for gas development, which removes 2 to 3 acres of native vegetation for well pads, in addition to road construction and pipeline installation. The past few years of drought, combined with overgrazing by wild horses in addition to forage utilization by cattle and elk,*

have severely damaged the understory vegetation that provides protection from erosion and filters sedimentation from surface water runoff before reaching the stream system. [226]

Comparison of Alternatives

Past, Present, and Reasonably Foreseeable Activities

The past, present and reasonably foreseeable activities that will be used to analyze the cumulative effects on vegetation are: Livestock and wildlife grazing and activities associated with natural gas development (roads, pipelines and well pads).

Alternative A

Even with favorable weather conditions, range conditions would rapidly decline as the wild horse population continues to climb. Acres of unsatisfactory soil conditions in TES map unit 70/71 would continue to increase. It is expected that within the next 5 years all 7,514 acres of TES map unit 70/71 would be in unsatisfactory soil condition. Unsatisfactory soil conditions in TES map units 176, 731, and 769/626 would likely double to 8,000 acres in the same time frame as heavy grazing use climbs up slope, while the valley bottoms continue to decline in productivity. Soil loss from gullying, rilling and overland flow would persist, reducing long-term productivity of the soil and limiting the future potential for site stability recovery. Reseeding on gas related pipeline and well locations within the JWHT would continue to fail also -- increasing the acres in unsatisfactory condition. Decline of watershed conditions would persist relative to degrading soil conditions.

Cumulative Effects

Effects described above include the cumulative effects of livestock and wildlife along with the impacts of horses on soils, specifically ground cover. Effects of natural gas development and production would reduce the effective ground cover since revegetation efforts on the JWHT would be seriously hampered (see also Gas Development section).

Alternative B

Alternative B would decrease grazing use to 30 percent available forage, providing flexibility for managing wild horse and livestock numbers and improving soil conditions. Increases in vegetation biomass retained on site and returned nutrients to the soil would help stabilize current erosion rates, particularly on TES units 70/71, 176, 731, and 769/626. Reseeding success on gas related pipeline and well locations would dramatically improve with decreased grazing pressure, also reducing acres in unsatisfactory condition. Overall unsatisfactory soil conditions associated with grazing would be expected to improve to satisfactory over 10 percent of the acres within the next 10-year period. Watershed conditions would show signs of recovery with improvement in soil conditions. It is likely that some areas in unsatisfactory condition would not respond to decreased grazing pressure. In these areas, reseeding coupled with restricted grazing use may be necessary to increase herbaceous ground cover to achieve satisfactory conditions.

Cumulative Effects

Effects described above include the cumulative effects of livestock and wildlife along with the impacts of horses on soils, specifically ground cover. Both wild horses and natural gas development and production would have cumulative effects on soils through reductions in ground cover and soil productivity. Natural gas related activities would tend to have more extensive effects than wild horses.

Alternative C

Like Alternative B, Alternative C would decrease grazing use to 30 percent of available forage. Flexibility in the management of wild horse and livestock numbers would result in an improvement of soil conditions. Increases in vegetation biomass retained on site and returned nutrients to the soil would help stabilize current erosion rates, particularly on TES units 70/71, 176, 731, and 769/626. Reseeding success on gas related pipeline and well locations would dramatically improve with decreased grazing pressure, also reducing acres in unsatisfactory condition. Overall unsatisfactory soil conditions associated with grazing would be expected to improve to satisfactory over 10 percent of the acres within the next 10-year period. Watershed conditions would show signs of recovery with improvement in soil conditions. It is likely that some areas in unsatisfactory soil conditions would not respond to decreased grazing pressure. In these areas, reseeding coupled with restricted grazing use may be necessary to increase herbaceous ground cover to achieve satisfactory conditions.

Cumulative Effects

Effects described above include the cumulative effects of livestock and wildlife along with the impacts of horses on soils, specifically ground cover. Both wild horses and natural gas development and production would have cumulative effects on soils through reductions in ground cover and soil productivity. Natural gas related activities would tend to have more extensive effects than wild horses.

Alternative D

Alternative D would decrease grazing use to 30 percent of available forage during non-drought years and would incorporate some flexibility in managing wild horse and livestock numbers, thus improving soil conditions. During drought periods, it is expected that grazing use would climb well above the 30 percent use level, thus slowing improvement in soil conditions. During periods of extended drought, soil conditions would not improve and could potentially decline. Depending on drought conditions, upgrading soil conditions to satisfactory could be as much as 5 percent or as little as zero over the next 10-year period. Watershed conditions would show signs of recovery with improvement in soil conditions. It is likely that some areas in unsatisfactory soil conditions would not respond to decreased grazing pressure. In these areas, reseeding coupled with restricted grazing use may be necessary to increase herbaceous ground cover to achieve satisfactory conditions.

Cumulative Effects

Effects described above include the cumulative effects of livestock and wildlife along with the impacts of horses on soils, specifically ground cover. Both wild horses and natural gas development and production would have cumulative effects on soils through reductions in ground cover and soil productivity. Natural gas related activities would tend to have more extensive effects than wild horses.