Judith Dyess, Rangeland Management Staff May 11, 2004
USDA Forest Service
Southwestern Region
333 Broadway, SE
Albuquerque, NM 87102

**RE: Regionwide Drought Policy and Guidelines**
**Via E-mail: jdyess@fs.fed.us**

Dear Ms Dyess:

We are resubmitting these comments, as a number of groups have signed on to them since last week. They have not changed substantially. Again, we would like to thank you and the Regional Forester for soliciting comments in preparation of formulating a region wide drought policy for the management of grazing allotments on National Forests. These comments are on behalf of the groups and individuals signed below representing close to 15,000 citizen members who use these areas for recreation and wildlife viewing, and who are greatly concerned about the health of watersheds, wildlife habitat and other natural resources in the area.

## *DROUGHT PERSISTENCE AND SEVERITY*

As noted in Harv Forsgren's 4/9/04 letter, "drought is an inevitable occurrence in the southwestern United States." Research on the regional drought effects from the Intergovernmental Panel on Climate Change not only concurs, it shows that increased temperatures are "very likely" (up to 5 degrees on average in the Southwest) and that drought is likely to intensify, partly due to an increased amplitude of El Nino events (Watson 2001). Further, researchers have high confidence that climate change will lead to the loss of high alpine ecosystems in North America (Watson, p128) and that "Snowmelt-dominated watersheds in western North America will experience earlier spring flows (high confidence), reductions in summer flows (medium confidence); and reduce lake levels" (Watson, p235).

Much of the Southwestern United States has been facing drought conditions since 1996, of a severity that has not been witnessed in decades. Throughout New Mexico and Arizona, precipitation levels have been exceptionally low, with potentially devastating consequences for native vegetation and wildlife. We regard the lack of a regionwide drought policy, particularly given the increased susceptibility of the land to human abuse during drier times (Thomas 1997), as a significant oversight. Given the severe nature of the drought over the last decade, and the fact that the effects of this drought will be exacerbated by many human activities—particularly livestock grazing permitted by the Forest Service—we are concerned that the Southwestern Region has no systematic policy in place for addressing inevitable drought situations.

It is imperative to remember that drought is no new phenomenon in the arid southwest, and the Forest should be aware of the devastating consequences that grazing and drought in combination may have on the land. As we indicate below, in the drought of 1891-1893, during which livestock grazing continued without restraint, much of the Southwest became so stressed that a threshold was reached from which watersheds, riparian areas, vegetation, and wildlife have not recovered to this day. While grazing management is somewhat better that in the late 19th century, failure to quickly respond to drought conditions, or to restart grazing on areas that have not fully recovered, can still have severe impacts that have already altered southwestern ecosystems.

## *DEGRADATION OF SOUTHWESTERN GRASSLANDS AND FORESTS*

Globally, livestock over-grazing and over-stocking is the foremost cause of desertification and land degradation (Le Houérou 1996). In the American Southwest, large-scale desertification has taken place, wherein grasslands dominated by perennial grasses are transformed into desert scrub, dominated by brush and annual forbs and grasses (e.g., Bahre 1995; Whitford 1997; de Soyza et al. 1998). Drought itself triggers or accelerates the impacts of land misuse (Le Houérou 1996). Because of these plant community changes, desert grasslands may be the most endangered landscape type in North America (Whitford 1997).[1] Consider Bahre's (1995: 230-231) description of the changes that have occurred in the Southwest's desert grasslands:

> In the 1850s and 1860s…the grasslands were open and largely free of brush. Grass was plentiful, the streams and rivers dissecting the grasslands were in parts unchanneled and lined with galleria forests and marshes…, wildfires were common, and antelope (*Antilocapra Americana*), prairie dog (*Cynomys ludovicianus*), and Mexican wolf (*Canis lupus baileyi*) were abundant. Today, the landscape is different. The native grasses have declined, and in many areas nonnative species have replaced them; wildfires are rare; erosion is commonplace; and several grassland predators and herbivores have been eliminated. Probably the two most dramatic changes in the grasslands are the extensive increases in woody shrubs and trees and the landscape fragmentation resulting from localized urban and rural settlements.

Bahre (1995) and Bock and Bock (2000) emphasize the importance of the 1891-1893 drought, combined with peak stocking rates of cattle and sheep, in accelerating the degradation of Southwestern grasslands. State Bock and Bock (2000: 6), "This one event marked the time when the prehistoric high plains of southern Arizona were lost forever from our view." Other authors (e.g., Frederickson et al. 1998), reference livestock ranching during drought years in 1886, 1891-1894, and 1901-1904 which left rangelands severely overgrazed in parts of New Mexico.

---

[1]Authors writing for the U.S. Geological Survey provide a more qualified description of the desert grasslands' imperilment, stating they may be one of the rarest ecosystems in the southwest (Muldavin et al. 1998).

There are several processes by which livestock grazing has degraded Southwestern grasslands. First, livestock grazing causes brush encroachment and consequent desertification of southwestern grasslands (Walker et al. 1981; Brown and Archer 1987; Bahre 1995; McPherson 1995; Le Houérou 1996; Weltzin et al. 1997; Frederickson et al. 1998; Valone and Kelt 1999; Kerley and Whitford 2000; Drewa and Havstad 2001; Pidgeon et al. 2001; Whitford et al. 2001).[2] Arid and semi-arid lands which are kept free from human and livestock impacts usually do not experience desertification. Some 73% of desertified lands in the U.S. have been desertified due to over-stocking of livestock (Le Houérou 1996).

Second, livestock grazing diminishes fine fuels and facilitates the spread of some noxious weeds, which disrupts southwestern fire ecology. U.S. southwestern desert grasslands were once characterized by frequent fires (every 7-10 years) that typically ignited in late June-early July, just prior to the summer rainy season from July-September (Drewa and Havstad 2001). With reduced fine fuels due to livestock grazing, fire's role in maintaining grasslands by reducing brush has consequently been compromised (Bahre 1991; 1995; McPherson 1995; Muldavin et al. 1998; Valone and Kelt 1999; Bock and Bock 2000; Drewa and Havstad 2001). Furthermore, once honey mesquite (Prosopis glandulosa) stands are established, fire is seldom effective in killing the roots and reducing local distributions of this shrub (Drewa and Havstad 2001).

Livestock grazing has been implicated in the spread of noxious weeds (Fleischner 1994; Muldavin et al. 1998; Belsky and Gelbard 2000; LeJeune and Seastedt 2001). In the 1930s, Lehmann (Eragrostis lehmanniana) and Boer lovegrass (E. curvula var. conferta) was introduced in the southwest for cattle forage. These grasses now dominate some southwestern sites and displace native grasses, particularly in areas degraded by livestock or in times of drought (Bahre 1995; Parmenter and Van Devender 1995; Frederickson et al. 1998; Bock and Bock 2000).[3]

Third, livestock grazing and management impacts wildlife species, which play fundamental roles in maintaining grasslands and riparian ecosystems. Livestock ranching impacts a variety of rodents, which are the dominant mammals in many desert grasslands (Parmenter and Van Devender 1995) and often play keystone roles in the ecosystems where they exist (e.g., Whitford 1997; Kotliar et al. 1999; Sherrod 1999; Kotliar 2000; Miller et al. 2000; Sherrod and Seastedt 2001). The extirpation of black-tailed prairie dogs from much of the American Southwest has been implicated in the spread of mesquite, as the absence of prairie dogs has taken away an important natural control of shrub encroachment (Weltzin et al. 1997), thereby compounding the process of desertification discussed above. Gunnison's prairie dogs (C. gunnisoni) have also

---

[2]Frederickson et al. (1998: 198) note the effects of Don Juan de Onate's expedition up the Camino Real in 1598. They write, "Along the trail cattle ate mesquite (*Prosopis glandulosa*) beans and left a trail of seed-filled dung. The Camino Real would later become readily visible from a distance, marked by dense stands of mesquite that lined the road." These authors similarly note the establishment of dense mesquite stands around old indigenous campsites, where people fed mesquite to their horses.

[3]However, Lehmann lovegrass has even spread on ungrazed areas (Bahre 1995; Bock and Bock 2000; Angell and McClaran 2001).

suffered substantial acreage and population reductions and are estimated to currently occupy only 236,000 acres (Knowles 2001). This prairie dog species is also considered keystone (Bangert and Slobodchikoff 2000).

As part of their keystone role (Kotliar et al. 1999; Kotliar 2000; Miller et al. 2000), prairie dogs increase water filtration on soils within their colonies, and there is increased soil moisture content due to prairie dog colonization (Day and Detling 1994). One author (Outwater 1996) also asserts that prairie dogs' burrows act as megapores, channeling precipitation to the water table. Day and Detling (1994) also note the role of prairie dog burrows to facilitate water infiltration to greater depths. These combined functions may therefore provide a defense for the prairie dog ecosystem against drought. Continued livestock grazing, particularly in times of drought, and its association with continued brush encroachment, may inhibit the potential for prairie dogs to be restored and/or recover in some parts of their range. Consequently, prairie dogs' hydrological function and provision of refugia for associated wildlife through their burrow systems will be compromised if livestock grazing is not addressed through a Regionwide Drought Policy.

Livestock grazing degrades riparian areas (e.g., Fleischner 1994; Muldavin et al. 1998; Belsky et al. 1999; Bock and Bock 2000), thereby impacting riparian flora and fauna and, in particular, beavers (Castor canadensis). Riparian areas are incredibly valuable for southwestern wildlife – they represent less than 1% of the region's area, yet 75-80% of vertebrates in the region depend on these areas for food, water, cover, and migration routes (Fleischner 1994; Muldavin et al. 1998). The primary method by which livestock cause this damage is through destruction of riparian soils and vegetation, which leads to the erosion of streambanks, which leads to lowering of the water table, conversion of stable, gently-flowing perennial streams to ephemeral streams characterized by flash flooding, and transformation of ephemeral streams to dry washes (Muldavin et al. 1998; Bock and Bock 2000).

Willows (Salix spp.) are important streamside vegetation and are associated with beavers (Olson and Hubert 1994). Livestock damage to willows and hydrological disruption may render habitat unsuitable to beaver dam- and lodge building and foraging behavior (Olson and Hubert 1994). Beaver play an important role in creating and maintaining riparian areas (Muldavin et al. 1998) and are described as a keystone species that creates habitat for native flora and fauna by modifying local hydrology, stream geomorphology, and habitat conditions.[4] Among the consequences of beaver activities are: the creation and expansion of wetlands, elevated water tables in riparian areas, enhanced forage and cover for wildlife, improved watershed stability, reduction in high flows and downstream flooding, more constant summer flows, the retention of sediment and organic matter, increased aquatic invertebrate production, and increased total aquatic productivity. In particular, an elevated water table in areas adjacent to ponds and canals enhances riparian plant growth and stabilizes banks (Olson and Hubert 1994). All of these beaver-induced effects on riparian areas are vital for sustaining wildlife in times of drought.

[4]See Southwestern Willow Flycatcher Recovery Plan. Draft of April 2001. Appendix K.

In addition, beaver may play a role in counteracting non-native salt-cedar (Tamarix spp.), which is increasingly imperiling southwestern riparian areas. Salt-cedar can out-compete native cottonwoods and willows (Muldavin et al. 1998) and is particularly hardy in times of drought (Stevens 2002). Beaver can reduce salt cedar or tamarisk through their felling and flooding activities (Glausiusz 1996). Conversely, livestock don't tend to eat salt cedar, but do graze on cottonwood and willow saplings and thus provide a competitive advantage to salt cedar (Muldavin et al. 1998). Livestock grazing may therefore prevent, or erode, the capacity for beavers to offer themselves, other wildlife, and native vegetation a hedge against drought.

Another keystone species, the kangaroo rat (Dipodomys spp.), may be locally extirpated when desert grassland is converted to shrubland. Whitford (1997) found that the banner-tailed kangaroo rat (D. spectabilis), which may be a keystone species in desert grasslands, is absent in most mesquite coppice dune sites and creosote shrublands. Another study (Heske and Campbell 1991) indicated a significantly higher number of kangaroo rats (D. merriami and D. ordii) on areas ungrazed by livestock. With desertification and livestock grazing, there is a consequent loss of this species' nest mounds, which produce patches rich in water and nutrients; its harvesting of flowering tillers of perennial grasses, which shapes the seed bank; fertilization and aeration of the soil through digging and defecating activities; and the collateral protection provided for a variety of vertebrate and invertebrate species through its burrow system (Parmenter and Van Devender 1995; Whitford 1997). The banner-tailed kangaroo rats' creation of areas rich in water and refugia for wildlife is particularly important in times of drought and livestock grazing's impact on kangaroo rats is therefore of particular significance.

Another keystone species is the pocket gopher (Family Geomyidae) (Sherrod 1999; Sherrod and Seastedt 2001). There are several different pocket gopher species in the southwestern U.S., including the desert pocket gopher (Geomys arenarius), plains pocket gopher (G. bursarius), Mexican pocket gopher (Pappogeomys castanops), and Valley pocket gopher (Thomomys bottae) (Parmenter and Van Devender 1995). One study concluded "the activities of pocket gophers cascade through the trophic web" (Huntly and Inouye 1988: 792). Pocket gophers play important roles in soil formation and movement (Armstrong 1987; Huntly and Inouye 1988; CDOW 2000) and consequent plant diversity (Huntly and Inouye 1988); as a prey base for avian, mammalian, and reptilian predators (CDOW 2000); and their burrows provide habitat for other species (Vaughan 1961; Chase et al. 1982; CDOW 2000). Like other rodents, pocket gophers' digging activities aerate the soil and increase their ability to absorb precipitation (Muldavin et al. 1998). Where livestock grazing or management (e.g., in the form of pocket gopher lethal control) reduces pocket gopher population and distribution, pocket gophers' assistance in water conservation and refugia for wildlife will be compromised.

Although it has not been described as a keystone species, the soaptree yucca (Yucca elata) plays an important role in desert grasslands. It provides nesting sites, perches, and forage areas for grassland birds such as the cactus wren (Campylorhynchus brunneicapillus), Scott's oriole (Icterus parisorum) (Naranjo and Raitt 1993) and northern

aplomado falcon (Falco femoralis septentrionalis) (Young et al. 2001), and its degradation by cattle can result in local reductions in insect and bird diversity (Kerley et al. 1992; Whitford et al. 1995). Cattle quickly eat the yucca's flowering stalks and flowers and will push over trunks of tall yuccas to eat the flowers (Whitford et al. 1995). Livestock impacts on yucca may be exacerbated during times of drought.

Overall, the reduction of perennial plant cover, simplification of the vegetation structure, and transition to shrubland caused by livestock grazing results in:

- reduction in soil organic content with decreased litter;
- increased fragility and vulnerability of soils;
- soil compaction, lower permeability, and lower water storage;
- soil surface crusting, leading to increased runoff;
- lowered biological activity in microflora and fauna;
- water logging, increased salinity, and encrusting salinity resulting from increased runoff;
- increased evaporation with reduced shading of soil surface; and
- higher wind speeds at soil surface, with consequently higher rates of evapo-transpiration and increased aridity (Le Houérou 1996).

All of these processes exacerbate the impacts of drought in the grasslands in the American Southwest. Moreover, there is a greater likelihood of irreversibility with drier environments with more shallow soils (Le Houérou 1996) and many researchers have indicated that the transformation of U.S. southwestern grasslands to desert scrub may, indeed, be irreversible (Bahre 1995; Muldavin et al. 1998; Bock and Bock 2000; Pidgeon et al. 2001). This is due to shrubs being able to conduct water from lower depths than grasses, thus providing them with the ability to achieve dominance over grasses (Burgess 1995; Hutchinson 1996; Gibbens and Lenz 2001).[5] In addition, there is increased infiltration beneath shrubs, with lower temperatures and more soil biota. In contrast, barren areas between shrubs experience greater runoff and erosion, higher temperatures and lowered soil nutrients (Hutchinson 1996).

Shrubland therefore perpetuates the dominance of shrubs over grasses and impedes restoration to a grassland state (Heske and Campbell 1991; Whitford et al. 2001). Shrub densities continue to increase in the southwest (Muldavin et al. 1998; Gibbens and Lenz 2001). However, shrubs such as creosotebush have a more difficult time becoming established in ungrazed grassland with substantial perennial grass cover (Whitford et al. 2001). Consequently, there is an urgent need for a Regionwide Drought Policy that meaningfully considers the potential for livestock grazing to compound the impacts of drought on native flora, fauna, and natural processes on all Forest Service

[5]Gibbens and Lenz (2001) provide an exhaustive description of the root systems of desert plants. In creosotebush (Larrea tridentata) dominated areas, creosotebush root systems extended as much as five (5) meters below the soil surface and extend laterally several meters. This can be contrasted with perennial grasses such as tobosa (Pleuraphis mutica) or black grama (Bouteloua eripoda) in the same areas, whose roots extended less than 0.5 meters below the soil surface and laterally less than one (1) meter.

lands. In addition, such a policy must adequately protect desert grasslands that have not yet been transformed to desert scrub (Pidgeon et al. 2001).

As indicated above, livestock grazing alters fire ecology in the southwest, and this extends to forested areas. Fire suppression due to decreased fine fuels allows the development of dense sapling understories, many of which may be fire-resistant species such as white fir and Douglas fir. Consequently, there are artificially high forest densities that may be more prone, especially in times of drought, to catastrophic wildfires. In addition, these two tree species are preferred hosts for spruce budworms and are therefore associated with increasingly intense budworm outbreaks. Livestock grazing also leads to desertification in the understory within pinyon-juniper woodlands by decreasing perennial grasses and increasing invasive shrubs in these areas (Muldavin et al. 1998).

## *CURRENT DROUGHT POLICY*

According to information received from the Regional Office and from all eleven Forests in the Region, the Forest Service's means of dealing with the current drought have been inconsistent at best, and in many cases woefully inadequate. Only two out of the eleven Forests even have drought policies in place, and the Regional Office itself has no standing policy that would provide a systematic method for planning for and addressing drought situations.

In the absence of a formal drought policy based on objective scientific recommendations, the agency has no means of ensuring that the health of soils, watersheds, riparian areas, threatened and endangered species, and fire ecology are protected in cases of extreme climatic conditions. In light of the fact that drought can have severe long-term effects on soil productivity, vegetative vigor, wildlife, and sensitive riparian systems, such a policy is needed to provide a systematic, coordinated, and scientifically valid means of ensuring that sensitive Forest resources are protected in times of drought. At a regional and forest level, the failure of the Southwestern Region of the Forest Service to have such a policy in place equates to a failure to provide necessary protections to these critical forest resources.

According to the information provided by the Forests and the Region, the agency has largely dealt with the drought by means of letters sent to livestock grazing permittees warning them that changes in management or numbers of their livestock may be necessary. Individual forests have sent various letters to permittees, and have had widely disparate means of addressing the drought on the ground. Thus, while the Tonto National Forest has a drought policy and has been very proactive and has kept a large number of allotments in total nonuse over the past year, other Forests have implemented very few changes in livestock management. This is not because a more severe drought situation exists on the Tonto than throughout the Region, but is simply due to the lack of a consistent drought policy throughout the Region. Similarly, letters to livestock permittees have followed no consistent pattern, and are clearly based not on any coherent policy, but simply on the impulses of individual Forest officers.

***DROUGHT POLICY ON THE TONTO NATIONAL FORESTS***

The proactive measures taken on the ground by the Tonto National Forest this season, which will afford at least some relief to the already overstressed wildlife, soils, vegetation, and riparian areas of the Forest, are due in part to the fact that the Tonto is the one Forest in the Region that has a relatively comprehensive, scientifically sound drought policy. This policy clearly articulates consistent, systematic methods for evaluating and responding to drought conditions throughout the Forest. The policy sets forth a methodology for defining drought that utilizes the Standard Precipitation Index (SPI), which is an objective standard based on measurements of data. Such a methodology allows for a consistent means of addressing drought conditions through scientific analysis, and allows the agency to make important decisions about protecting resources in times of severe stress in an objective manner. All forests throughout the region should be using the SPI, as well as other objective tools such as the Palmer Drought Index, to provide sound scientific bases for management decisions regarding drought. Perhaps not coincidentally, the Tonto national forest has more allotments in "non-use" than any other forest in the Region, with over half of the allotments currently off-limits to livestock.

The Tonto National Forest's drought policy is also of note in that it provides clear, conservative direction as to when livestock may be returned to the land after periods of drought. The policy provides that:

> Drought periods shall end when the SPI for the last 12 months becomes positive. Even though precipitation has returned to normal, rangeland plants normally need more time to recover. The Team shall establish standards for re-stocking allotments that will ensure the protection of rangelands until proper recovery is complete. Generally, after normal precipitation resumes, re-stocking shall not occur until after a minimum of one growing season of rest. In cases of prolonged or severe drought, two or more seasons of rest may be required prior to re-stocking. (Tonto National Forest Rangeland Drought Policy at 4.)

As should be the case throughout the Region, the Tonto is acknowledging the severe stress that drought represents to vegetation, soils, and wildlife, and is erring on the side of caution when determining at what point one can defensibly add to this stress the additional impact of livestock grazing. This use of the Precautionary Principle should be the basis for the entire Region's approach to drought management, and for a comprehensive Regionwide drought policy.

In contrast to the Tonto National Forest's Drought Policy, which provides a scientific basis for addressing drought that errs on the side of resource protection, the majority of the Forests in the Region have responded to the drought in a way that leaves much to be desired. While Forests are all too ready to close their doors to recreational users, the attitude toward grazing permittees appears to be one of accommodation at all

costs. Nine of the eleven forests have sent some form of letter to livestock grazing permittees informing them of the need to be prepared for changes due to the drought. These letters, instead of providing clear instructions to permittees on measures that must be taken in order to protect resources, more often adopt the tone of appealing to permittees for their consideration and help, as if responding to the drought in some way should be voluntary. While periods of drought are times when unequivocal direction to Forest users is most needed in order to protect resources from lasting damage, the Forest is instead abdicating its responsibility to steward the land in favor of catering to a narrow special interest. A letter sent to permittees by the Springerville Ranger District of the Apache-Sitgreaves National Forest contains the statement,

> It is likely that wet meadows and riparian areas along the bottom of creeks will receive heavy utilization because these areas may be the only watering sources. Letter, John A. MacIvor to Permittee, April 24, 2002.

Rather than taking decisive action to prevent long-term damage to precious riparian resources upon which so many wildlife species depend, the Forest is assuming that damage will occur because it refuses to insist that permittees observe the limits of the land.

This type of response to the drought crisis on the part of Forests is inexcusable and tremendously dangerous. Leaving drought decisions up to permittees is inherently dangerous because few permittees have the skills or resources to annually quantify forage production in terms of drought projections. Inaccurate calculations, coupled with the permittee's reluctance to reduce livestock numbers, inevitably lead to range degradation.

It is inexcusable that cattle should be allowed to remain on the Forests, inflicting extensive and likely irreversible damage to Forest resources, while taxpayers are barred from camping and hiking in the very lands we collectively own. Streams, rivers, elk, deer, bears, coyotes, native vegetation, and recreational Forest users should not all be expected to suffer while the Forest Service bends over backwards to ensure that grazing permittees can conduct business as usual. Those Forest users whose activities most exacerbate the effects of drought—the soil drying, loss of forage, and degradation of riparian areas that are consequences of cattle grazing even in the wettest of years—should be expected to relinquish their Forest privileges first.

## *THE NEED FOR A REGIONWIDE DROUGHT POLICY*

In your letter you ask us to consider whether a regional consistent policy is needed. Given the information we have presented, we find the need for a regional drought policy is clear, as drought is a certainty in the American Southwest. Indeed, drought normally recurs in all arid lands. However, humans are typified by their short memories, tending to believe that favorable weather is "normal" (Le Houérou 1996). As Bock and Bock (2000: 26) quote from a rancher neighbor during a wet summer, "You know, I've lived in this country for twenty-five years, and this is about the first typical summer

we've had." The tendency to stock rangelands at carrying capacities determined in wetter years results in severe overgrazing effects during drought (Muldavin et al. 1998) and this can be redressed in an adequate Regionwide Drought Policy.

While it is encouraging to note that some Forests such as the Tonto are taking such a proactive stance, in the absence of a systematic drought policy we have no assurance that the beneficial effects of this stance will be long-lasting or of any substance. In *Drought: An Agency and Interagency Perspective,* Harv Forsgren, Regional Forester, captures the issue: "Drought is exacerbating grazing impacts by concentrating wildlife and domestic animals onto small portions of the landscape such as riparian areas that provide the most nutritious forage." Based on the evidence we have presented on the potential for livestock grazing to exacerbate the impacts of drought on native flora, fauna, and natural processes, the Forest Service should adopt a Regionwide Drought Policy which will minimize these negative impacts. Sensible application of the Precautionary Principle now is certainly preferable to permanent watershed and riparian degradation, the destruction of native plant communities in favor of exotics, and the possible extinction of numerous species as a result of the devastating consequences of continued livestock grazing in a time of such scarcity.

Some may ask why drought can't be addressed on a forest-by-forest or allotment-by-allotment basis. While a regional policy can and should have some variability, so that it could be adjusted by various forests for various ecosystems, drought is clearly a regional issue and therefore deserves a region-wide response by the Regional 3 office. For each individual forest to engage in developing such a policy would be a waste of time and resources. Only the regional office has the resources to bring together the expertise to develop minimum standards and procedures that can be implemented throughout the region, and to formulate a set of adjustments that can be used to adapt those standards for various forests and ecosystems.

Further, without a regional policy, the agency cannot consistent in its treatment of permittees. Only measurable and specific criteria that make clear when management changes are needed and a clear set of specified responses to those criteria can provide forest district managers – who are directly responsible for the forest recourses – with the tools that they need to treat permittees consistently in respond to drought.

## ***POLICY SPECIFIC***

The regional policy should use conservative, scientific methodology for determining responsive measures such as stocking rates, season of use, removals of cows from Forest lands, and length of time to require rest before restocking. Specifically, the policy should use the Palmer Drought Index and/or the Standard Precipitation Index to determine those areas that are afflicted with drought. If strictly enforced, the Tonto National Forest policy provided an acceptable minimum standard:

> When the SPI for a particular Arizona Climate Division (as defined by NOAA) is at a value of –0.70 or less (larger negative number) for a specific time period (usually 9 to 12 months as determined by the Forest Drought Team), that area of the Forest shall be considered to be in a drought. An SPI value of -0.70 indicates that precipitation is approximately 50% of the long-term average amount.

However, in areas that are experiencing more severe drought, adjustments might need to be made sooner than the 9-12 month period described.

In addition to climatic measurements, the guidelines need to provide measurable standards for forage growth. As Dr. Kris Havstad notes, "drought resulting in a reduction in production is the rule not the exception in the arid Southwest, and the resulting reduction in annual yield is substantial." Without available forage, grazing impacts quickly magnify, soils are exposed and livestock use on – and damage to – riparian areas increases. An absolute minimum to consider might be no stocking until new growth on key perennial grasses is at least at a level that will prevent resource damages. In addition the standard should include a minimum for available forage (in pounds per acre) before stocking occurs. It is important to note that these conditions may delay or prevent stocking in localized areas even when the drought conditions are not reached by the indices. The drought policy must also include an allotment level evaluation by forest hydrologists as to whether drought conditions are at the point where livestock water guzzlers and various holding tanks are contributing to the dewatering of springs and creeks in the area.

***PROMPT ACTION***

As the Regional Forester has noted, a major issue in developing a drought policy is, "How information is effectively communicated to prompt action." Perhaps the most important element of a regional policy is that various measurable standards are keyed to specific actions, i.e. stocking reductions or removal, and that these actions be set to occur within a limited timeframe. In this area, even the Tonto's existing drought policy is inadequate and could lead to disastrous results. It provides for three weeks to evaluate allotments, an undetermined timeframe for the District Ranger to respond, and up to 30 days before livestock are reduced or removed. Thus, the policy allows for seven weeks or more of utilization after drought conditions are declared. The regional policy needs to allow the Drought Team to begin evaluations before Index targets are reached, if meteorological predictions give them reason to assume that they will be reached. It must also specify a response time by the District Rangers and in circumstances of more severe drought, give them the authority to order reductions or removal of livestock within 1-2 weeks of notifying the permittee.

***RESTOCKING INDICATORS***

As we have seen in the past, all too often the Forest is willing to consider a rainfall or two as an adequate basis for returning livestock to the ground after a prolonged period of drought. A scientifically sound drought policy would give the agency and other concerned citizens some basis for trusting that livestock are only being returned to the land when soil, vegetation, watershed, imperiled and sensitive species habitat, and riparian conditions have recovered sufficiently from the drought to allow for livestock grazing without causing significant long-term damage.

Harv Forsgren, Regional Forester also notes the need for, "Quantifiable indicators of drought "recovery" at those same scales." Considering variations in microclimates, drought recovery needs to be examined on an allotment-by-allotment basis after general conditions have shown regional drought recovery. For drought recovery to be declared for an allotment, not only should the indices show that moisture has returned over one or more years, each allotment needs to show that there is sufficient forage available to prevent damage to soils and watersheds, and that key species are consistently showing renewed vigor (measuring at least 6-7). Recovery of annuals should not be considered sufficient grounds at restock allotments. In areas where utilization standards are measured in leaf-length (for instance, 4" in Mexican Spotted Owl protected areas), growth should be at an absolute minimum double that before any restocking is done.

We must also keep in mind that the current drought has been severe. Anderson notes:

> Even if precipitation returns to normal, we will need 5 to 20 inches of *extra* precipitation to end the drought. We may be living with this for years! The 12-month period ending in August 2002 was the driest in recorded history throughout the Southwest. Climatic reconstructions from tree-rings near Flagstaff, AZ, indicate the period from 1996-2002 may have been the driest period in the last *1400* years.

Even if precipitation returns to normal or above normal levels, many allotments may take more than one or two years to recover. For other allotments, the drought may make it clear that conditions are such that ANY livestock grazing is likely to maintain poor soils and vegetative conditions so that the allotment will never meet forest plan standards. In such cases allotments should be closed to further grazing.

***DROUGHT POLICY AND THREATENED AND ENDANGERED SPECIES***

As noted previously, grazing can affect various species and their habitats, and drought can exacerbate those effects:

> As water in Arizona becomes even more scarce and competition for that water increases, drought will continue to hamper efforts to recover

> threatened and endangered species, avoid the future listing of species, and manage our refuges. Long-term planning is needed to better manage our water resources, reduce the spread of both plant and animal non-native species, and restore watersheds so these species can better survive the next drought cycle. (Smith 2003)

Given the high number of endangered species throughout the region, it is important the drought policy make special consideration for TES and their habitat. Allotment or pastures with TES or habitat need to be the first evaluated and criteria used in evaluating acceptable grazing levels needs to be more protective of these areas.

***CONCLUSION***

Once again, we thank you for requesting our thoughts on regional drought for managing grazing. Considering the persistence of the drought, we hope that a scientifically based policy will be quickly developed and implemented. Please keep us informed for future developments on this issue.

Respectfully submitted,

Billy Stern
Forest Guardians
Santa Fe, NM

Kat A. Hummell
Animal Protection of New Mexico
Albuquerque, NM

Daniel R. Patterson
Center for Biological Diversity
Tucson, Arizona

Joanie Berde
Carson Forest Watch
Penasco, NM

Jim Powers
Prescott National Forest Friends
Prescott, AZ

Tim Lengerich
P.O. Box 111
Ajo, AZ 85321

Michael Sauber
Gila Watch
Silver City, NM

Bob Witzeman
Maricopa Audubon Society
Phoenix, AZ

Liz Wise
White Mountain Conservation League
Pinetop, AZ

REFERENCES AND BIBLIOGRAPHY

Anderson, Jesse, Jill Rundall, and Neil Cobb, "Is the Southwest in an Unprecedented Drought?" Merriam-Powell Center for Environmental Research: http://friendsofflagstaff.org/pdfs/drought_facts.pdf

Angell, Deborah L. and Mitchel P. McClaran. 2001. "Long-term influences of livestock management and a non-native grass on grass dynamics in the Desert Grassland." Journal of Arid Environments 49:507-520.

Armstrong, David M. 1987. Rocky Mountain Mammals. Colorado Associated University Press. Pp. 107-109.

Bangert, R.K. and C.N. Slobodchikoff. 2000. "The Gunnison's prairie dog structures a high desert grassland landscape as a keystone engineer." Journal of Arid Environments 46:357-369.

Bahre, Conrad J. 1991. Legacy of Change: Historic Human Impact on Vegetation in the Arizona Borderlands. Tucson, AZ: University of Arizona Press.

Bahre, Conrad J. 1995. "Human impacts on the grasslands of southeastern Arizona." The Desert Grassland. Eds. Mitchel P. McClaran and Thomas R. Van Devender. Tucson: University of Arizona Press. Pp. 230-264.

Belsky, A. Joy and Jonathan L. Gelbard. 2000. "Livestock grazing and weed invasions in the arid west." Published by the Oregon Natural Desert Association.

Belsky, A. Joy, A. Matzke, and S. Uselman. 1999. "Survey of livestock influences on stream and riparian ecosystems in the western United States." Journal of Soil and Water Conservation, First Quarter 1999: 419-431.

Bock, Carl E., and Jane H. Bock. 2000. The View From Bald Hill: Thirty Years in an Arizona Grassland. Berkeley, CA: University of California Press.

Burgess, Tony L. 1995. The Desert Grassland. Eds. Mitchel P. McClaran and Thomas R. Van Devender. Tucson: University of Arizona Press. Pp. 31-67.

Chase, Janis D., Walter E. Howard, and James T. Roseberry. 1982. "Pocket Gophers." In Wild Mammals of North America. Johns Hopkins University Press. Pp. 239-255.

Clark, Elizabeth and Neil Cobb (Report Compilers), 2003 Southwest Drought Summit Summary Report, Northern Arizona University, October 3, 2003: http://www.mpcer.nau.edu/megadrought/drought_summit_report/index.htm

Colorado Division of Wildlife (CDOW). 2000. Covers ranking record for Thomomys talpoides macrotis. Report printed June 22, 2000.

Day, T.A., and J.K. Detling. 1994. "Water Relations of Agropyron smithii and Bouteloua gracilis and Community Evapotranspiration Following Long-term Grazing by Prairie Dogs." American Midland Naturalist 132:381-92.

de Soyza, Amrita G., Walter G. Whitford, Jeffrey E. Herrick, Justin W. Van Zee, and Kris M. Havstad. 1998. "Early warning indicators of desertification: examples of tests in the Chihuahuan Desert." Journal of Arid Environments 39: 101-112.

Drewa, Paul B. and Kris M. Havstad. 2001. "Effects of fire, grazing, and the presence of shrubs on Chihuahuan desert grasslands." Journal of Arid Environments 48:429-443.

Eakin, Hallie and Diana Liverman (The University of Arizona), "Drought and Ranching in Arizona: A Case of Vulnerability" (This is a preliminary report): http://geochange.er.usgs.gov/sw/impacts/society/ranching/

Forsgren, Harv (Regional Forester, Southwestern Region, U.S. Forest Service), "Drought: An Agency and Interagency Perspective:" http://www.mpcer.nau.edu/megadrought/drought_summit_report/source_files/Agency/2%20Forsgren%20Drought%20%20Presentation1.htm

Frederickson, Ed, Kris M. Havstad, Rick Estell, and Paul Hyder. 1998. "Perspectives on desertification: south-western United States." Journal of Arid Environments 39: 191-207.

Gibbens, Robert P. and James M. Lenz. 2001. "Root systems of some Chihuahuan Desert plants." Journal of Arid Environments 49: 221-263.

Glausiusz, Josie. 1996. "Trees of Salt." Discover March 1996. Pp. 30-32.

Hassol, Susan Joy and Randy Udall, "A Change of Climate," Issues in Science and Technology, Spring 2003.

Havstad, Dr. Kris, Supervisory Scientist, Jornada Experimental Range), "Drought: A Scientific Perspective: http://www.quiviracoalition.org/documents/08-00_drought_science.html."

Heske, Edward J. and Mariel Campbell. 1991. "Effects of an 11-year livestock exclosure on rodent and ant numbers in the Chihuahuan Desert, southeastern Arizona." The Southwestern Naturalist 36(1):89-93.

Huntly, Nancy and Richard Inouye. 1988. "Pocket gophers in ecosystems: patterns and mechanisms." BioScience 38(11):786-793.

Hutchinson, Charles F. 1996. "The Sahelian desertification debate: a view from the American south-west." Journal of Arid Environments 33: 519-524.

Kerley, Graham I.H. and Walter G. Whitford. 2000. "Impact of grazing and desertification in the Chihuahuan Desert: plant communities, granivores and granivory." American Midland Naturalist 144:78-91.

Kerley, Graham I.H., F. Tiver, and Walter G. Whitford. 1992. "Herbivory of clonal populations: cattle browsing affects reproduction and population structure of *Yucca elata*." Oecologia 93:112-117.

Knowles, Craig. 2001. "Status of the white-tailed and Gunnison's prairie dog." Prepared for Environmental Defense and National Wildlife Federation, December 5, 2001.

Kotliar, Natasha B. 2000. "Application of the new keystone-species concept to prairie dogs: how well does it work?" Conservation Biology 14(6): 1715-1721.

Kotliar, Natasha B., Bruce W. Baker, April D. Whicker, Glenn Plumb. 1999. "A critical review of assumptions about the prairie dog as a keystone species." Environmental Management 24 (2): 177-192.

Le Houérou, Henry N. 1996. "Climate change, drought and desertification." Journal of Arid Environments 34: 133-185.

LeJeune, Katherine D. and Timothy R. Seastedt. 2001. "Centaurea species: the forb that won the West." Conservation Biology 15(6): 1568-1574.

McPherson, Guy R. 1995. "The role of fire in the desert grasslands." The Desert Grassland. Eds. Mitchel P. McClaran and Thomas R. Van Devender. Tucson: University of Arizona Press. Pp. 130-151.

Merideth, Robert, "A Primer on Climatic Variability and Change in the Southwest, Udall Center for Studies in Public Policy and Institute for the Study of the Earth, U. of Arizona, March 2001.

Miller, Brian, Rich Reading, John Hoogland, Tim Clark, Gerardo Ceballos, Rurik List, Steve Forrest, Lou Hanebury, Patricia Manzano-Fischer, Jesus Pacheco, and Dan Uresk. 2000. "The role of prairie dogs as a keystone species: response to Stapp." Conservation Biology 14(1):318-321.

Muldavin, Esteban H., Steven P. Platania, James N. Stuart, Greg H. Farley, Patricia Melhop, and Jayne Belnap. 1998. "Southwest." In Mac, M.J., P.A. Opler, C.E. Puckett Haecker, and P.D. Doran. Status and trends of the nation's biological resources. 2 vols. U.S. Department of Interior, U.S. Geological Survey, Reston, VA. Pp. 543-592.

Naranjo, Luis G. and Ralph J. Raitt. 1993. "Breeding bird distribution in Chihuahuan Desert habitats." The Southwestern Naturalist 38(1):43-51.

NOAA, "Special climate summary 96/2: Drought in the Southern Plains and the Southwest," June 1996: http://climchange.cr.usgs.gov/info/sw/publicl.html

Olson, Rich and Wayne A. Hubert. 1994. "Beaver: water resources and riparian habitat manager." University of Wyoming. 48 pp.

Outwater, Alice B. 1996. Water: A Natural History. New York, NY: BasicBooks.

Parmenter, Robert R., and Thomas R. Van Devender. 1995. "Diversity, spatial variability, and functional roles of vertebrates in the desert grassland." The Desert Grassland. Eds. Mitchel P. McClaran and Thomas R. Van Devender. Tucson: University of Arizona Press. Pp. 196-229.

Pidgeon, A.M., N.E. Mathews, R. Benoit, and E.V. Nordheim. 2001. "Response of avian communities to historic habitat change in the Northern Chihuahuan Desert." Conservation Biology 15(6):1772-1288.

Sherrod, Susan K. 1999. "A multiscale analysis of the northern pocket gopher (Thomomys talpoides) in the alpine, Niwot Ridge, CO." Ph.D. dissertation, University of Colorado. 142 pp.

Sherrod, Susan K., and Timothy R. Seastedt. 2001. "Effects of the northern pocket gopher (Thomomys talpoides) on alpine soil characteristics, Niwot Ridge, CO." Biogeochemistry 55: 195-218.

Smith, Brenda (Assistant Field Supervisor, Flagstaff Ecological Services Sub-Office), "Perspectives on Drought Impacts on Diverse Southwest Ecosystems," U.S. Fish and Wildlife Service, May 2003: http://www.mpcer.nau.edu/megadrought/drought_summit_report/source_files/Agency/6%20USFW_Smith_Summary.htm

Stevens, Dr. Larry E. 2002. "Exotic tamarisk on the Colorado Plateau." Online at http://www.cpluhna.nau.edu/Biota/tamarisk.htm, visited site 12 June 2002.

Thomas, David S.G. 1997. "Science and the desertification debate." Journal of Arid Environments 37: 599-608.

U.S. Dept. or Agriculture, Forest Service Southwestern Region 3, "Drought Management Briefing Paper," April 29, 2003

U.S. Geological Survey, "Soil Hydrology and Drought in Arid Ecosystems:" http://climchange.cr.usgs.gov/info/sw/interact/soil_hydro.html

Valone, Thomas J. and Douglas A. Kelt. 1999. "Fire and grazing in a shrub-invaded arid grassland community: independent or interactive ecological effects?" Journal of Arid Environments 42: 15-28.

van Riper III, Charles, Mark K. Sogge, and David W. Willey, "Potential Impacts of Global Climate Change on Bird Communities of the Southwest," Biological Resources Division, U.S. Geological Survey:
http://geochange.er.usgs.gov/sw/impacts/biology/birds/

Vaughan, Terry A. 1961. "Vertebrates inhabiting pocket gopher burrows in Colorado." Journal of Mammalogy 42(2):171-174.

Watson, Robert T (ed, the World Bank)), Climate Change 2001: Synthesis Report, Contributions of Working Groups I, II and III to the4 Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, 2001

Weltzin, J.F., S. Archer, and R.K. Heitschmidt. 1997. "Small-Mammal Regulation of Vegetation Structure in a Temperate Savanna." Ecology 78(3):751-763.

Whitford, Walter G. 1997. "Desertification and animal biodiversity in the desert grasslands of North America." Journal of Arid Environments 37: 709-720.

Whitford, Walter G., Gregory S. Forbes, and Graham I. Kerley. 1995. "Diversity, spatial variability, and functional roles of invertebrates in desert grassland ecosystems." The Desert Grassland. Eds. Mitchel P. McClaran and Thomas R. Van Devender. Tucson: University of Arizona Press. Pp. 152-195.

Whitford, Walter G., Ronald Nielson, and Amrita de Soyza. 2001. "Establishment and effects of establishment of creosotebush, *Larrea tridentata*, on a Chihuahuan Desert watershed." Journal of Arid Environments 47:1-10.

Wilkinson, Todd, "West Faces a Sixth Year of Epic Drought," *The Christian Science Monitor,* April 27, 2004: http://www.csmonitor.com/2004/0427/p03s01-usec.html

Young, Kendal E., Quinn H. Hodgson, Dawn M. Browning, Julie L. Lanser, Bruce C. Thompson, Raul Valdez. 2001. "Determination of habitat suitability for aplomado falcons on public lands in southern New Mexico." Report submitted to U.S. Bureau of Land Management, U.S. Army. May 16, 2001.

Zimmerman, G. Thomas and L.F. Neuenschwander. 1984. "Livestock Grazing Influences on Community Structure, Fire Intensity and Fire Frequency in the Douglas-fir/ Ninebark Habitat Type." Journal of Range Management 37(2): 104-110.