Livestock Grazing and the Sonoran Desert Conservation Plan

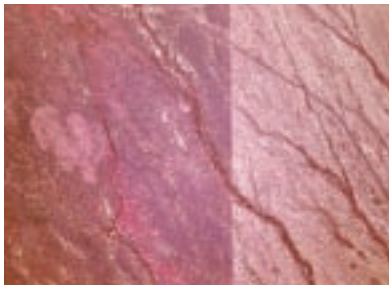
A Conservation Perspective

presented by the
Coalition for Sonoran Desert Protection

May 2001

Cover Photos

Fenceline 100 meters west of the northern entry to Buenos Aires National Wildlife Refuge. Refuge on left, Palo Alto Ranch on right. (Martin Taylor 2001)



Infrared aerial photo of northern boundary of the Buenos Aires National Wildlife Refuge, courtesy of refuge. The Palo Alto ranch abuts the boundary on the right. Infrared imaging shows reduced vegetation and soil moisture on ranch side. (1995)

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May 17, 2001

Honorable Pima County Board of Supervisors
Mr. Chuck Huckelberry, County Administrator
130 West Congress, 10th Floor
Tucson, AZ 85701

Re: New Coalition report, *Livestock Grazing and the Sonoran Desert Conservation Plan: A Conservation Perspective*

Honorable Boardmembers and Mr. Huckelberry:

The 41-member group Coalition for Sonoran Desert Protection wishes to convey to you our deepest gratitude for your leadership and vision towards balancing natural and cultural resource conservation with urban growth as you prepare the Sonoran Desert Conservation Plan.

We are pleased to present you with the following report, *Livestock Grazing and the Sonoran Desert Conservation Plan: A Conservation Perspective*, in an effort to foster dialogue over conservation management of the reserve system to be established under the Plan.

Ranch conservation is a legitimate means to protect open space and the Coalition supports the County in its efforts to achieve this goal. The Coalition is concerned, however, over information in County Plan reports which appears to over-emphasize the importance of ranching in conservation of native Pima County ecosystems and vulnerable species, while under-emphasizing the negative effects of livestock grazing.

The Coalition's grazing report contains three primary sections. First, the report reviews the best available scientific information regarding the effects of livestock grazing on natural resources ranging from riparian areas to living soil to vulnerable species. This review shows that grazing results in significant harm to these resources.

The report then critiques biological and economic information, as well as ranch conservation recommendations presented in various County ranch documents prepared for the Plan. Conclusions and recommendations in the County ranch documents may ultimately reduce effective natural resource and vulnerable species conservation under the Plan, according to the Coalition report.

Last, the report presents fifteen recommendations for reconciling ranch and natural resource conservation under the Plan. Here the report recommends, among others, adaptive grazing management for portions of the Plan reserve, purchase of development rights

to build the preserve, tax law changes to favor conservation and grassbanking. Setting aside a portion of the Plan reserve system to be free of all harmful land use practices, including livestock grazing, is perhaps the most important step the County can take to achieve the Plan's ecosystem and vulnerable species conservation goals.

We hope you find helpful the information and recommendations contained in the Coalition's report, and we appreciate your consideration. We look forward to discussing this issue with you and other stakeholders, and working with you to advance the vision of the Sonoran Desert Conservation Plan.

Sincerely,

Carolyn Campbell
Executive Director

Rich Genser
Conservation Chair

Livestock Grazing and the Sonoran Desert Conservation Plan

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Introduction

Pima County's Sonoran Desert Conservation Plan is a far-sighted planning effort launched by the Board of Supervisors in October 1998 and officially adopted in March 1999. The Plan is intended to serve as a guide for balancing urban growth with conservation of natural and cultural resources. The Plan will also be prepared as an Endangered Species Act "Habitat Conservation Plan" application for the "take" of the Cactus ferruginous pygmy-owl and other federally listed species.

The Coalition for Sonoran Desert Protection supports the County's effort to create the best possible Sonoran Desert Conservation Plan ("SDCP" or "Plan"), and remains committed to assisting the County toward that goal. However, the Coalition is concerned with the September 2000 draft preliminary Plan's ranch conservation element and related reports because these reflect a significant over-reliance on ranching as a primary conservation tool.

Most of the peer-reviewed scientific literature available does not support conservation benefits of livestock grazing. The draft preliminary Plan, for example, emphasizes the use of ranch land as a boundary for urban growth. Ranches may well provide valuable open space. But where livestock grazing contributes to degradation of native ecological conditions and imperilment of species, other means of urban growth control must be utilized, and grazing must be eliminated from the most ecologically sensitive areas.

The Coalition acknowledges and encourages the efforts of ranchers to reduce negative effects of livestock grazing and to restore extirpated wildlife. But these cases are exceptions. The compatibility of livestock grazing with conservation of native Sonoran desert ecological conditions and vulnerable species remains unproven.

As a Habitat Conservation Plan, the final version of the Plan must provide for the survival and recovery of listed species according to Endangered Species Act standards. To the extent conserving ranch land and conserving imperiled species conflict, conservation of imperiled species must take precedence.

The Coalition is concerned by the County's inclusion of the ranch conservation element in the draft preliminary Plan without giving equal weight to a significant body of scientific evidence questioning the conservation utility of livestock grazing. The County should not invest a disproportionate amount of finite resources in ranch conservation as a means to ensure ecosystem conservation when its ability to succeed is unlikely.

The Coalition offers the following report in a constructive attempt to help the County make reasonable and appropriate Sonoran Desert Conservation Plan decisions. We summarize the findings of

the best available scientific literature and economic role of livestock grazing, and make recommendations based on those findings.

If the final Sonoran Desert Conservation Plan is to successfully conserve Pima County's native ecosystems, wildlife, plants and vulnerable species, it must use sound science to address the negative effects of livestock grazing on these resources.

> **"Ecologists generally agree that drier lands are most at risk of losing biological diversity to livestock grazing ... The more arid the climate, the more likely and more severe are the ecological impacts of grazing by introduced ungulates."**
>
> **— Debra Donahue, 1999, *The Western Range Revisited***

Arid regions of the Southwest, such as Pima County, are particularly fragile and susceptible to damage from livestock grazing. As University of Wyoming Law Professor Debra L. Donahue writes in her 1999 book *The Western Range Revisited*: "Ecologists generally agree that drier lands are most at risk of losing biological diversity to livestock grazing … The more arid the climate, the more likely and more severe are the ecological impacts of grazing by introduced ungulates" (Donahue 1999).

Thomas Fleischner, a conservation biologist at Prescott College, has studied the effects of livestock grazing in the arid West. He found that cattle often have "significant" negative impacts on riparian and upland areas in the arid West (1994).

According to Fleischner, the riparian, or stream-side, areas "are incredibly critical habitat for thousands of species – one of the richest biological resources in the region." More than 75 percent of the vertebrate species in the arid West are dependent on riparian areas. While cattle's impact on upland areas is not as immediately obvious or devastating as on riparian areas, "recovery is much slower in the uplands" due to the lack of water.

Curtis E. Flather of the U.S. Forest Service's Rocky Mountain Range and Experiment Station in Fort Collins, Colo., led a team that reviewed U.S. Fish and Wildlife Service data and other scientific reports on imperiled species nationally (Flather et al. 1994, 1998). The team found that livestock grazing contributes to the endangerment of species in general, and in the Southwest is an "important" contributing factor to species endangerment. The study found twelve "hot spots" for species endangerment across the country. Three of these hot spots intersect in the Southwest, two of them in Arizona and one including Pima County. According to the report, grazing is the number one factor endangering species in the Arizona Basin.

The Plan's ranch conservation element can still serve as a tool for preserving open space. The County certainly deserves praise for recognizing the enormous impact that urban sprawl can have on our desert landscape. However, use of ranch conservation as a tool for open space preservation must be largely separated from conservation of the most ecologically sensitive areas and imperiled species. Certain types of wildlife and vegetation management can be compatible with livestock grazing. But where grazing is a cause of habitat degradation or species endangerment, it is antithetical to the purpose and legal requirements of the Plan and the Endangered Species Act.

For this reason, it is the Coalition's position that the County should establish a core and corridor reserve, inclusive of the Plan's new or expanded mountain parks, natural reserves and riparian conservation areas, and that this reserve should be entirely free from grazing and other harmful land uses.

With this, the Coalition presents the following analysis of livestock grazing issues in Pima County, a review of County ranch conservation reports and recommendations to reconcile livestock grazing and ranch conservation with conservation of native Sonoran desert region ecosystems, wildlife, plants and vulnerable species.

I. The Best Available Science: Livestock grazing harms Western ecosystems and wildlife

> **"Probably no single land use has had greater effect on the vegetation of southeastern Arizona or has led to more changes in the landscape than livestock grazing range management programs. Undoubtedly, grazing since the 1870s has led to soil erosion, destruction of those plants most palatable to livestock, changes in regional fire ecology, the spread of both native and alien plants, and changes in the age structure of evergreen woodlands and riparian forests."**
>
> — C.J. Bahre, 1991, *A Legacy of Change: Historic Human Impact on Vegetation of the Arizona Borderlands*

Livestock used in commercial production – cattle and sheep in the West, primarily – are not native to what is now the United States. Cattle originated in wetter climates of Asia where rainfall and humidity is much greater than the arid West in general, and the Sonoran desert region in particular. As a result, their impact is very damaging to Western ecosystems, and plants and animals.

In particular, cattle congregate near water, primarily the streams and rivers so valuable to the welfare of native species in the arid West. Due to the damming and diverting of surface water and the draw down of groundwater that has occurred in this region, surface water sources have become scarce and thus more heavily congested with thirsty livestock. The development of stock tanks generally has been at the further expense of natural waterways from which ranchers often draw water for their tanks. Tanks themselves typically are scenes of intensive habitat destruction.

Grazing and riparian areas

Livestock, particularly cattle, have a dramatic impact on fragile arid lands riparian areas, trampling down stream banks, snapping tree seedlings and denuding the vegetation by devouring grasses, seedling trees and other leafy green plants. Riparian vegetation provides the bulk of forage for livestock, which only reluctantly move far from water (Holechek et al.1998). A 1994 U.S. Bureau of Land Management report estimated that livestock had "damaged" 80 percent of the West's riparian areas. Livestock remove protective vegetation, trample streambanks, and defecate near streams, degrading water quality. Streambank erosion increases, stream channels widen or deepen and streams lose their ability to absorb retain and steadily release water (U.S. Bureau of Land Management 1994).

Healthy streams in the Southwest usually have a narrow, deep channel. Sediment-capturing grasses, cottonwood gallery forests, and dense willow and box elder under-stories stabilize the stream banks. This "riparian" habitat dissipates high stream-flow energy that otherwise can be destructive, and provides the water, food, shade, nesting sites or cover for about 80 percent of all wildlife in Arizona and New Mexico (Ohmart and Anderson 1982, Ohmart 1996, Chaney et al. 1990).

Joy Belsky and others (1999) reviewed more than 120 published scientific studies on the effects of grazing on riparian areas and found:

- Reduced herbaceous cover, biomass, productivity and native species diversity (14 studies).
- Reduced diversity and abundance of native reptiles and amphibians (four studies).
- Wider stream channels, less stable banks, higher peak water flows (16 studies).
- Reduced soil fertility, water infiltration and resistance to erosion (12 studies).
- Higher water temperature and lower dissolved oxygen (five studies).
- Reduced tree and shrub cover and biomass (eight studies).
- Shift from cold-water fish and aquatic invertebrates to warm-water species (eight studies).
- Higher water loads of sediments, nutrients and pathogens (10 studies).
- Lower water tables (two studies).
- Shift from riparian bird species to upland-generalist species (six studies).

> **"Livestock remove protective vegetation, trample streambanks, and defecate near streams, degrading water quality. Streambank erosion increases, stream channels widen or deepen and streams lose their ability to absorb retain and steadily release water."**
>
> **— U.S. Bureau of Land Management, *Rangeland Reform 1994 Environmental Impact Statement***

The extensive literature search of the Belsky report authors did not find a single peer-reviewed empirical report showing a positive impact of grazing on riparian areas. Similarly, Ohmart's 1996 study concluded that, "…there is not a single grazing management approach that has produced consistent improvements of degraded riparian-wetland areas."

Other scientists have reached similar conclusions. Two separate studies found that tree seed and sapling survival rates were reduced up to threefold in southeastern Arizona grazed riparian areas compared to those without livestock (Glinski 1977, Szaro 1983). Also in southeastern Arizona, an ornithological study found negative grazing impacts on 17 of 43 neo-tropical migratory bird species (Bock et al. 1992).

Riparian areas can recover from grazing damage if livestock are removed. For example, trout recovered significantly in Pacific Northwest streams closed to livestock (Bowers et al. 1979), and riparian canopy-dependent bird species increased 20-fold along the San Pedro River in southeast Arizona after cattle were removed in 1986 (Krueper 1993).

Grazing and watersheds

Impacts of livestock on stream and water conditions go well beyond just immediate impacts to riparian areas. Impacts across an entire watershed affect stream and water quality. Conversely, damages to riparian areas can extend out to an entire watershed.

Even at modest levels, grazing in upland areas of a watershed is known to produce greater soil erosion. This effect is greatest when the grazing occurs during a rainy season (Smiens 1975). The phenomenon has three basic components. First, grazing reduces plant cover that intercepts raindrops and binds the soil, and in low desert areas destroys microbiological soil crusts that stabilize soil surfaces (Beymer and Klopatek 1992, Brotherson et al. 1983, Brotherson and Rushforth 1983). Second, vegetation that impedes overland flow of rainfall runoff in intact watersheds is lost to grazing (Sharp et al.

1964). Third, grazing livestock compact the soil and reduce infiltration (Gifford and Hawkins 1976), so instead of rainfall soaking down toward the aquifer it flows faster and in greater volume over land (Arnold 1950, Johnson 1956; reviewed by Belsky et al. 1999, Jones 2000). Eroding soil and trampled debris throughout the watershed end up in streams as increased sediment load. Various grazing management strategies have not been found to reduce such watershed degradation (Gifford and Hawkins 1976, B

Natural cryptobiotic soil crusts inhibit exotic-plant germination, but grazing livestock break up these crusts (Kaltenecker and Wicklow-Howard 1999, Eckert et al. 1986, Mack 1989, Rosentreter 1994). P. M. Schiffman found in 1997 that grazing left bare ground, facilitating weed invasions. Schiffman also found that livestock feed containing seeds of exotic weeds and other plants led to their introduction to grazed areas. Numerous studies have found higher concentrations of exotic plants in grazed areas than on comparable un-grazed lands throughout the West (Daubenmire 1975, Stromberg and Griffen 1996, Robertson and Kennedy 1954, Goodwin et al. 1999, Rickard 1995). In addition, studies have found that livestock tend to avoid eating some of the exotic weeds, giving them another advantage over more palatable native plants (Lacey 1987, Olson et al. 1997).

Areas around stock tanks are a particular problem with regard to exotic-plant invasions. Since livestock congregate around water sources, nitrogen from livestock waste is concentrated around stock tanks, and around them soil is compacted and cryptobiotic crusts are broken up. This leaves considerable amounts of defoliated, bare soil (Andrew 1988). As a result, these areas are especially prone to proliferation of exotics (Rickard 1995, Nash et al. 1999).

In Pima County, studies have found prickly pear cacti and creosote bushes displacing ocotillo plants and columnar cacti, such as saguaros, due to direct livestock trampling or because grazers eat shade-providing "nurse plants" (Blydenstein et al. 1957, Abouhaidar 1992, Pierson and Turner 1998). J. E. Bowers (1997) found a similar phenomenon occurring in the Grand Canyon area.

Grazing and forests

Several native bunch grasses chemically inhibit pine seedlings (Jameson 1968, Rietveld 1975), and other native grasses have competitive advantages over woody species and weedy annuals (Rummell 1951, Belsky and Blumenthal 1997). Grazing on native grasses thus has allowed higher-altitude grasslands to be taken over by pinyon, juniper and other conifer species (Martin and Turner 1977, Arnold et al. 1964, Swetnam et al. 1999).

Grazing has removed the principal fuel of pre-historic and early historic native grass fires. This and aggressive grass fire suppression have led to a new fire regime that contributes to the loss of grasslands and replacement with chaparral and woody thickets (Hill 1917, Leopold 1924, Madany and West 1983, Arnold 1950, Covington 1992).

Direct grass losses to grazing, and related losses of natural periodic grass fires that also inhibit conifer seedling survival, have allowed thickets of spindly Ponderosa pines to encroach into previously open forest-savannahs dominated by large pines with lush native-grass under-stories. Such pine thickets of spindly trees are highly susceptible to insect and mistletoe attacks. Low-intensity ground fires of pre-historic times now rage through these unhealthy pine thickets. The resulting conflagrations can be devastating – fires flare up into the canopies of the trees, killing whole stands instead of burning only the native grasses on the forest floors (Belsky and Blumenthal 1997).

Grazing and wildlife

The effects of rangeland livestock production on wildlife include direct competition for forage, disease transfer, degradation of natural ecosystems, range developments such as fencing and direct persecution of wildlife by ranchers or federal agencies on behalf of ranchers. It has been estimated that

present numbers of native big game species have been reduced to 15-20% of pre-Columbian numbers by the combination of these factors (Wagner 1978).

In natural ecosystems, predators are atop the food chain and serve as essential checks on herbivores. Without this predation, herbivores can devastate vegetation communities. Historically the livestock industry extirpated wolves, jaguars, grizzly bears, beavers and Merriam's elk from the Southwest (Wagner 1978). The livestock industry continues to kill large numbers of species of forage competitors and predators of livestock (Wagner 1978).

U.S. Wildlife Services, formerly known as "Animal Damage Control," traps, shoots or poisons vast numbers of coyotes, bobcats, wolves, mountain lions and prairie dogs to benefit the livestock industry. The agency killed 85,751 of these animals in 1997 alone (U.S. Wildlife Services 1997).

Ecologists have identified prairie dogs as "keystone" herbivores in Western grasslands, as well as in the prairies to the east. Prairie dogs once provided food and shelter for 170 species, including Black-footed ferrets (now endangered), hawks, burrowing owls, mice and snakes. The livestock industry and some federal agencies still regard prairie dogs as pests that compete with livestock for forage, and they have exterminated 98% of the prairie-dog populations that were known in 1919, which in turn, were probably only a small fraction of the original extent of all populations (Baskin 1997).

> **"In addition to grazing per se, the industry of livestock production entails a number of indirect costs to native biodiversity. Livestock compete with native herbivores for forage ('usurpation') and often consume the most nutritive species ('highgrading'). Fencing, which is a fundamental livestock management tool, creates obstacles for many native wildlife species, such as the pronghorn."**
>
> **—Thomas Fleischner, 1994,** ***Ecological Costs of Livestock Grazing in Western North America***

The Allison Jones review (2000) of 54 studies of arid grasslands in the West found rodent species' diversity averaged 22 percent lower in grazed areas than in comparable areas without grazing.

In Sonoita Valley southeast of Tucson, animals that need grass cover, such as the Bunchgrass lizard, are lost or reduced in grazed areas compared to similar areas without grazing (Bock et al. 1990). Nineteen species of ground-foraging, seed-eating birds were 2.7 times more abundant in an area without grazing (Bock and Bock 1999). Reduced abundance and diversity of small reptiles, mammals and birds has a "bottom-up" impact on predators dependent upon them, such as endangered Mexican spotted owls and Cactus ferruginous pygmy owls (U.S. Fish and Wildlife Service 1995, U.S. Fish and Wildlife Service 1999).

Coyotes killed en masse from helicopter. Photo by ex-Animal Damage Control staffer.

Livestock may also repel wildlife. Elk and mule deer avoid cattle and the areas they have grazed, even if the livestock were in "moderate

stocking" numbers (Loft et al. 1991, McClaran 1991, McIntosh and Krausman 1981, Wallace and Krausman 1987).

Even in the absence of grazing livestock, fencing and water developments can have negative impacts on wildlife. Open water tanks may harbor "source populations for … non-native fish" that are swept during heavy rainstorms into streams. These exotic fish either eat imperiled native fish or out-compete them for scarce food supplies (U.S. Fish and Wildlife Service 1999). Water tanks can cause drownings of wildlife and by attracting predators may reduce the relatively predator-free space formerly enjoyed by many desert dwellers (Craig and Powers 1975, Buttery and Shields 1975, Sherrets 1989). Although "wildlife-friendly" fencing is now commonly installed, the vast majority of fencing is older, and routinely entraps and causes deaths of raptors, bighorn sheep and pronghorns (Van Dyke et al. 1983, Wagner, 1978, Wyoming Game and Fish Dept. 1973, Knight et al. 1980, Fitzner, 1975, Anderson, 1977, Avery et al. 1978).

Grazing and disease

Grazing livestock also introduce new diseases to wildlife and humans, and exacerbate occurrences of other diseases. Pronghorn antelope and bighorn sheep were found to suffer increased mortality in sheep- and goat-grazed rangelands (Yoakum 1975, Goodson 1982).

Infected cattle introduced brucellosis to elk and bison in the West (Meagher and Meyer 1994). Cattle, particularly calves, also carry the human gastrointestinal parasite Cryptosporidium parvum, which is common in streams around which cattle congregate and not easily killed by ordinary water-purification methods (Atwill 1998).

Grazing and vulnerable species

The negative impacts of grazing on vulnerable species are numerous and severe. Table 1 (please see page 12) lists endangered species found to be harmed by grazing according to various agencies. Flather and others (1994, 1998) synthesized data on 667 threatened and endangered species for the years 1976 to 1994. Their research identified grazing as a factor in the imperilment of 15 of the 27 species then listed as threatened or endangered in the Southwest. Looking at U.S. data on a county-by-county basis, the Flather study identified Pima County as an imperiled species "hotspot," primarily for animals, and found cattle grazing to be the number one factor for species endangerment in the Arizona Basin.

The U.S. Fish and Wildlife Service recognizes the negative impacts of grazing on federally listed species with habitat in Pima County. The agency's 1997 Biological Opinion on the Bureau of Land Management's Livestock Grazing Program in Southeastern Arizona, including eastern Pima County, made these statements about grazing:

- Pima pineapple cactus – "Adverse effects of grazing include trampling by livestock; habitat loss and degradation associated with construction of range improvements; vegetation manipulations such as chaining, prescribed fire, seeding with non-native plants and imprinting; and … erosion, changes in vegetation communities, hydrology and microhabitats in uplands where the species occurs." – Page 74.

- Huachuca water umbel – "Livestock grazing can affect the umbel through trampling and changes in stream hydrology and loss of stream-bank stability." – Page 98.

- Gila topminnow – "Direct effects [of livestock grazing] include trampling of and ingestion of fish eggs and larvae by cattle." ... "Effects of cattle grazing on watersheds include alterations of vegetation communities, increased soil erosion and runoff, decreased infiltration rates, damage to cryptobiotic crusts, and increased soil compaction… Degradation of watersheds can cause down-cutting [of stream banks], loss of perennial flow, loss of riparian vegetation, increased sedimentation, and higher peak flows in steams and rivers." – Pages137-138.

- Southwestern willow flycatcher – "The overuse of riparian areas by livestock has been a major factor in degradation and decline of willow flycatcher habitat. Grazing in the riparian area during the growing season of willows and cottonwoods often precludes their regeneration. These trees, particularly willows, are favored by this species… When cattle grazing is reduced or eliminated, willow flycatcher numbers can rebound. Direct destruction of nests, eggs, and nestlings by foraging cattle has been documented. Trampling of banks and reduction in riparian vegetation due to grazing can cause changes in channel morphology and stability that can further adversely affect riparian plant communities… Livestock tend to concentrate in riparian areas for forage, water and shade, due to the aridity of the surrounding uplands… [There is] a tendency to cause degradation of riparian areas regardless of the stocking rate." – Page 197

- Cactus ferruginous pygmy owl – "… the loss of riparian habitat to a variety of uses, including livestock grazing, is considered one of the causes contributing to the decline of the pygmy-owl… Damage to riparian areas from grazing … can be long lasting and potentially irreversible. … unregulated livestock grazing has been implicated as one of the primary causes of decadent age structures of trees, where stands have large old trees, but few saplings or small trees… reduced seedling establishment can result from browsing, trampling of seeds, and reduction of a stabilizing herbaceous cover. Soil compaction associated with grazing can reduce the growth rate of existing trees by decreasing water percolation and the abundance of mycorrhizae and other critical soil components." – Page 225.

The Fish and Wildlife Service also produced a Biological Opinion in 1999 on the Coronado National Forest's grazing program. It had the following to say about the impacts of forest grazing on listed species:

- Lesser long-nosed bat – "The Lesser long-nosed bat consumes nectar and pollen of paniculate agave flowers and the nectar, pollen and fruit produced by a variety of columnar cacti (saguaro)." – Page 123. "Agaves are moncarpic, flowering only once and then dying. Livestock … feed on young agave stalks, which precludes the plant from flowering … Saguaros are dependent on nurse plants to provide cover during their sensitive seedling stage. Livestock grazing may affect the density and distribution of nurse plants, increasing the mortality of saguaro seedlings." – Page 125.

- American peregrine falcon – "Livestock grazing may negatively affect peregrine falcons if the existing mosaic of vegetation attributes (e.g. plant structure and species composition) are simplified across the landscape. This could … reduce the prey base … riparian areas may be used disproportionately…" – Page 176.

- Cactus ferruginous pygmy owl – "Direct effects of livestock grazing include removal of vegetative cover and trampling of grass and brush. Indirect or delayed effects of grazing include altered forage

composition, reduced vigor of plants and accelerated soil erosion resulting in a reduction of land productivity." – Page 193.

- Mexican spotted owl – "Grazing can alter a plant community through direct alteration such as plant removal by consumption or trampling, and indirectly through the loss of seed source or through damaging the soil. Moderate to heavy grazing can reduce plant diversity, cover, biomass, vigor, and regeneration ability… If these changes occur in or near areas used by spotted owls, then grazing can influence the owl." – Page 218. "Mexican spotted owls consume a variety of prey … but commonly eat small- and medium-sized rodents…" – Page 214. "The abundance of small mammals in grazed versus ungrazed areas has been documented … with the mean abundance of small mammals per census about 50 percent higher on plots from which livestock were excluded." – Pages 219-220.

- Jaguar – "It is well known that livestock grazing can alter vegetation. Changes in vegetation type or structure could affect cover for jaguars. In addition, changes in vegetation may modify the population dynamics of jaguar prey species such as deer and javelina." – Pages 360-361.

- Northern aplomado falcon – "… habitat alteration was the primary reason the aplomado falcon was extirpated in Arizona. High levels of livestock grazing in the 1880s, with losses of riparian and grassland habitats, changed the falcon's preferred habitats…" – Page 365.

- Masked bobwhite quail – "Impacts to Masked bobwhite associated with grazing activities primarily results from habitat modification and lack of grass- and forb-species diversity. Heavy grazing reduces herbaceous vegetation, plant species abundance, shrub structure and cover, aids invasion by woody plants and exotic species, causes soil loss on vulnerable soils, and contributes to fire influence in desert grasslands… Current understanding is the species can exist only under light to no grazing." – Page 368.

- Southwestern willow flycatcher – "Livestock grazing can cause degradation of all riparian habitat components… Livestock overgrazing is a leading cause of deterioration and loss of Southwestern willow flycatcher habitat… Livestock use of riparian areas not presently excluded is a concern to the Service." – Page 372.

Studies conducted for the County also identify grazing as having negative impacts on 48 out of the 50 vulnerable species (please see Table 1) recognized in various Sonoran Desert Conservation Plan reports as deserving habitat protection.

Table 1 Pima County endangered, threatened and vulnerable species harmed by livestock grazing, according to various agencies

Species	Status	Effects of ranching	Notes
Mexican gray wolf	E	"[I]ts reputation as a livestock killer led to concerted eradication efforts" [1]	Historically widespread, "unconfirmed reports of individuals in southern AZ" [2] "Extirpated" [3]
Jaguar	E	"Decline of the species was concurrent with predator control... associated with... the cattle industry" [4]	Historically widespread, "confirmed sightings ... south central AZ (confirmed with photographs)" [2] "Extreme edge of species range" [3]

Species	Status	Effects of ranching	Notes
Ocelot	E	"Predator control operations contributed to extirpation" [4]	Historically widespread, "sightings in southern AZ (unconfirmed)" [2] "Does not occur" [3]
Jaguarundi	E	"Predator control operations contributed to extirpation." [4]	Historically widespread, "sightings in southern AZ (unconfirmed)" [2] "Does not occur" [3]
Sonoran pronghorn	E	Adverse impacts from water developments, fences, livestock competition, reduction of cover for fawns by livestock.[5]	Low desert scrub and creosote flats [5] "Naturally headed toward extinction" [3]
Arizona shrew	V	Adverse impacts [6]	Riparian dependent, springs above 5000 ft [2,6] No records from Pima County, but no survey [3]
Merriam's mouse	V	Adverse impacts [6]	Riparian dependent [6] Mesquite bosque, numbers have plummeted in Pima County [2]
Lesser long-nosed bat	E,V	Adverse impacts [6] Likely to adversely affect [7] Depends on nectar of flowers of agaves and saguaros which are eaten by livestock [7, 8]	Desert scrub with agave and columnar cacti [2] Day roosts in caves and mines [2]
Allen's big-eared bat	V	Adverse impacts [6]	Caves and mines [6]
California leaf-nosed bat	V	Adverse impacts [6]	Scrubland dependent [6] Poorly known [3]
Mexican long-tongued bat	V	Adverse impacts [6] May affect [7,8]	Riparian/grassland dependent [2,6] Only in Colossal Cave [3]
Pale Townsend's big-eared bat	V	Adverse impacts [6]	Caves and mines [6]
Western yellow bat	V	Adverse impacts [6]	Little is known, needs palms [2]
Western red bat	V	Adverse impacts [6]	Riparian dependent [6]
Cactus ferruginous pygmy-owl	E,V	Grazing reduces saguaro population, degrades riparian areas. Adverse impacts [6] May affect [8]	Nests in saguaros or big trees, hunts in washes and riparian habitat [2,6] Critical habitat designated 1999 in Altar Valley, Tortolita Fan, Tucson Mtns, San Pedro River
Mexican spotted owl	T	Grazing reduces rodent prey abundance [4]	Santa Catalinas, Santa Ritas. Nests in old growth, hunts grassland rodents [2] Only on USFS or NPS land [3]
American Peregrine falcon	E	Watershed and riparian degradation [2]	Nests in cliffs, hunts in grasslands, riparian areas [2]
Bald eagle	T	Riparian habitat degradation [2]	Nests in cliffs, large trees near streams [2]
Swainson's hawk	V	Adverse impacts [6]	Grassland dependent [6]

continued on next page

Species	Status	Effects of ranching	Notes
Burrowing owl	V	Adverse impacts [6]	Grassland/ scrubland dependent [6]
Southwestern willow flycatcher	E,V	Adverse impacts [6] May affect [7,8]	Migratory, riparian obligate breeder April-September [2] Critical habitat on the San Pedro River
Masked bobwhite	E	Grazing reduces cover. May affect [7]	Dense native grassland/ savannah [2] "only on Buenos Aires NWR" [3]
Western yellow-billed cuckoo	PE	Adverse impacts [6]	Riparian dependent [2,6]
Rufous-winged sparrow	V	Adverse impacts [6]	Grassland/ scrubland dependent [6]
Abert's towhee	V	Adverse impacts [6]	Riparian dependent, range mostly in Pima County [2,6]
Bell's vireo	V	Adverse impacts [6]	Santa Rita grasslands dependent [2]
Mexican garter snake	V	Adverse impacts [6]	Riparian dependent [6] Gone from Colorado River area near Yuma [2]
Desert box turtle	V	Adverse impacts [6]	Grassland dependent [6] Empire Cienega RCA, Buenos Aires NWR [2]
Giant spotted whiptail	V	Adverse impacts [6]	Scrubland dependent [6]
Ground snake	V	Adverse impacts [6]	Grassland/scrubland dependent [6]
Organ Pipe shovel-nosed snake	V	Adverse impacts [6]	Grassland/ scrubland dependent [6]
Tucson shovel-nosed snake	V	Adverse impacts [6]	Low elevation grassland/ scrubland dependent [6] Last record in 1981 [2]
Chiricahua leopard frog	PT,V	Adverse impacts [6]	Aquatic/riparian dependent [6]
Lowland leopard frog	V	Adverse impacts [6]	AZ Game and Fish protected [2] Aquatic/riparian dependent [6]
Desert pupfish	E	Adverse impacts [6] May affect [8]	Warm water springs, cienegas, small streams [2] Once in Santa Cruz R but now "no natural populations" [3]
Gila topminnow	E,V	Adverse impacts [6] May affect [8]	Pools, springs, cienegas, small streams [2]
Loach minnow	T	May affect [8]	Unoccupied critical habitat, San Pedro River

Species	Status	Effects of ranching	Notes
Gila chub	C,V	Adverse impacts [6]	Aquatic dependent [6] Rare in streams and springs
Desert sucker	V	Adverse impacts [6]	Aquatic dependent [6] Once in Santa Cruz R [2] "Not known from Pima County" [3]
Longfin dace	V	Adverse impacts [6]	Aquatic dependent [6]
Sonora sucker	V	Adverse impacts [6]	Aquatic dependent [6] "Extirpated" [3]
Talus snails (13 species)	V	Adverse impacts [6]	Talus slopes in grassland/ scrubland [6]
Huachuca water umbel	E,V	Adverse impacts [6] May affect [7,8]	Aquatic dependent in cienegas, small streams [2,6] San Pedro River, Cienega Creek, formerly Santa Cruz River [2]
Kearney's blue star	E,V	May affect [8]	West face of Baboquivari Mtns [2] Only on Tohono O'Odham land [3]
Nichol's Turk's head cactus	E,V	May affect [8]	Sonoran desert scrub, limestone mountains [2]
Pima pineapple cactus	E,V	Adverse impacts [2,6] May affect [7,8]	Grassland/scrubland dependent [6] Sonoran desert scrub and Santa Rita grasslands [2]
Acuña cactus	V	Adverse impacts [6]	Grassland/scrubland dependent [6] Sonoran desert scrub, gravel ridges [2]
Tumamoc globeberry	V	Adverse impacts [6]	Scrubland on bajadas [2,6]
Gentry indigo bush	V	Adverse impacts [6]	"Extirpated" [3]
Needle-spined pineapple cactus	V	Adverse impacts [6]	Grassland/scrubland dependent [6]

KEY

E – endangered, **PE** – proposed endangered, **T** – threatened, **PT** – proposed threatened, **C** – candidate,
V – vulnerable in Sonoran Desert Conservation Plan

[1] US Fish and Wildlife Service 1998.

[2] Pima County 1999b.

[3] Originally recommended in Pima County 1999b, but recommended for removal from Plan's list in Pima County 2000a.

[4] US Forest Service 1998.

[5] US Fish and Wildlife Service 1994.

[6] Pima County 2000b.

[7] US Fish and Wildlife Service 1999.

[8] US Fish and Wildlife Service 1997.

II. Sonoran Desert Conservation Plan Ranch Conservation Reports: A critical review

Since beginning Sonoran Desert conservation planning in 1998, the County and its Ranch Conservation Team have released three reports in support of the Plan's ranch conservation element. The last report, Our Common Ground; Ranch Lands in Pima County (Pima County 2000c) summarized the earlier reports and concludes that Pima County must " ... encourage and retain viable ranches," and that ranching has " ... served to protect our natural open space."

The Coalition has always supported the concept of ranch conservation as a means to protect open space, but is concerned with information in the reports which appears to over-emphasize the role and importance of ranching in conservation of native ecosystems, wildlife and plants, while under-emphasizing the negative effects of livestock grazing.

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It may be true that ranch conservation would contribute to delineation of an urban boundary as suggested in the County reports. But it is also true that cattle grazing causes significant harm to arid lands ecosystems, as discussed above. Efforts to conserve environmentally sensitive lands and vulnerable species under the Sonoran Desert Conservation Plan could be significantly compromised absent elimination and reduction of grazing in key areas.

Open space, in the sense of land without dense housing or commercial developments, and land with healthy ecological conditions for native wildlife and plants are not always the same. The final Plan must ultimately distinguish clearly between the two. Whether or not the preservation of ranches retains the "integrity" of open space (draft preliminary Plan at page 9, Pima County 2000e) is subject to significant debate. Integrity means being undiminished – in sound, unimpaired or perfect condition. Open space does not necessarily have to retain much ecological integrity for recreational purposes. Ballfields and urban parks, for example, are biologically impoverished but are still valuable as open space. But native ecological conditions must be maintained if conservation of native ecosystems and vulnerable species is the goal.

Conclusions and recommendations presented in the County ranch conservation reports may ultimately reduce effective reserve and vulnerable species conservation under the Plan. Biological science

> **"Conclusions and recommendations presented in the County ranch conservation reports may ultimately reduce effective reserve and vulnerable species conservation under the Plan."**

and economic information behind the draft preliminary Plan's ranch conservation element is primarily embodied in one report; Preserving Ranch Lands in Pima County ("Preserving Ranch Lands report") (Pima County 2000d). Information presented in this document is reviewed below.

Biological science and the County's ranch conservation reports

The view of the ecological effects of cattle grazing contained in the County's Preserving Ranch Lands report is generally unsupported by the preponderance of scientific evidence.

For example, while the report acknowledges that grazing has in fact been destructive to wildlife habitat, the report alleges that this is only the result of "uncontrolled grazing during periods of drought between 1880 and 1934." Since the end of that destructive period, habitat conditions "have generally improved" and in some cases are "significantly enhanced" (Preserving Ranch Lands report at page 1).

The Preserving Ranch Lands report also contends that, "The ecological sustainability of ranching is demonstrated by well-managed ranches and by scientific research" (report at page 1). It adds, "The position that current livestock grazing practices are uniformly negative in their impacts on ecosystems is a narrow and unsubstantiated view" (report at page 3). The Coalition agrees that unilateral positions are unscientific and unproductive, but the same holds for the position that grazing is uniformly beneficial in arid land environments.

Ranch report definitions lacking

Nowhere in the Preserving Ranch Lands report is the pivotal term "sustainability" defined. "Sustainability" can relate to economics, for example, when it addresses the number of cattle that can be kept on a commercial ranch or grazing allotment indefinitely while maintaining necessary forage production. Or "sustainability" can relate to ecological conditions when it addresses the number of cattle which can graze an area without significantly impairing ecosystem function or recovery of imperiled species. There is a significant difference between these two possible definitions, but the Preserving Ranch Lands report never makes clear what definition is used to arrive at its conclusions.

The report also blames loss and degradation of wildlife habitat in the Sonoran desert on "overgrazing," but does not define the term. The report does not indicate at what livestock volume, under what conditions, or at what level of impact grazing becomes overgrazing. The report does not specify whether overgrazing ended in 1934, or whether it remains a common occurrence in Pima County. Without definition, the terms grazing and overgrazing are indistinguishable.

Ranch report science falls short

The Preserving Ranch Lands report relies upon questionable citations for many of its assertions. For example, it cites Brown and McDonald (1995, report at page 3) to refute the findings of Fleischner (1994) that current grazing practices have deleterious effects on native Western plants and

animals. According to Brown and McDonald, Fleischner's was a "dangerously one-sided presentation of data and opinions." But Brown and McDonald cited only two studies purporting to show that habitat values declined after grazing ceased, while Fleischner reviewed dozens of academic publications to reach his conclusions.

The Preserving Ranch Lands report cites McClaren and Sundt (1992) to contend that favorable habitat for an endangered orchid "may require grazing" (report at page 6). But McClaren and Sundt present no before and after comparison of grazing's effects, and even state that the design of their study "prohibits conclusions on the effects of grazing."

The report cites Gordon (2000) to cast doubt on the findings of Bock et al. (1984) that two sparrow species were more abundant in ungrazed areas than in comparable grazed areas (report at page 3). But as the report acknowledges, Gordon only found the opposite to be true in one of three study years, and Gordon's report is not included in the bibliography.

In support of the contention that "proper grazing of livestock is sustainable on the great majority of rangeland," the Preserving Ranch Lands report cites Pieper (1994) (report at page 4). But the report fails to recognize that Pieper's article only addresses the effects of grazing on range conditions and does not address its effects on native Western ecological conditions or imperiled species. It might be plausible that grazing livestock at one animal per 10,000 acres, for example, is unlikely to result in significant damage to wildlife habitat; it is by no means clear that grazing livestock at levels required for economically viable ranching can, under any circumstances, be harmless to arid Western ecosystems and native wildlife and plants.

"Common ground" overstated

There are many references in both the draft preliminary Sonoran Desert Conservation Plan and supporting ranch reports about "common ground" and using retained ranch lands as a means to preserve "natural open space" (draft preliminary Plan at page 10). The Preserving Ranch Lands report also asserts that, "Grazing as a land use may have preserved these [endangered species] habitats" (report at page 4).

Ranching may serve to protect open space, but nearly all reliable scientific evidence contradicts the assertion that grazing protects native Western ecosystems, wildlife and plants, as discussed above. The fact that these resources would suffer more from urbanization does not therefore mean grazing and associated open space protection is unilaterally beneficial.

Many grazed lands have potential for recovery as habitat, but they are not "natural open space." Degradation of grazed lands, particularly in arid and desert environments, is often so severe that recovery processes might extend well beyond our lifetimes, or may be irreversible without active intervention (Fleischner 1994, Donahue 2000).

"Ranching may in fact serve to protect open space, but nearly all reliable scientific evidence contradicts the assertion that grazing protects native Western ecosystems, wildlife and plants ... The fact that these resources would suffer more from urbanization does not therefore mean grazing and associated open space protection is unilaterally beneficial."

Livestock grazing is not a natural ecological process

In a similar vein, the Preserving Ranch Lands report contends that, "Grazing is a natural ecological process" (report at page 5). Yet there exists no scientific evidence to support this claim with respect to Pima County's Sonoran desert region. This area has supported no herds of large grazing ungulates for at least 10,000 years before livestock were introduced from the Old World (Mack and Thompson 1982). Grass species native to areas east of the Rocky Mountains are generally adapted to grazing of large herding animals such as Bison while grasses in the Southwest are not (Mack and Thompson 1982).

Proponents of livestock grazing cite evidence that grazing is beneficial to plants. But grazing does not benefit plants in an absolute sense. Grazing does give a competitive advantage to species that are grazing-adapted. In the southwest such species are usually exotic grasses with adaptations such as ground-level buds, primarily asexual reproduction and synthesis of toxic or unpalatable compounds. Native Arizona grasses have none of these characteristics and have retreated in favor of species that are more tolerant of grazing such as exotic grasses, thorny shrubs like catclaw, acacia and mesquite and exotic weeds such as thistles and tumbleweed (Mack and Thompson 1982).

Before livestock were imported, Pronghorn antelope, elk, deer, rabbits and rodents were dominant herbivores in the Sonoran desert and associated mountain ranges. These animals are browsers of many plants, not simply grazers of grasses. For example, pronghorn antelope generally browse forbs but depend on tall grass for cover to hide from predators (USFWS 1994). Predators such as wolves, mountain lions, jaguars, bears and coyotes were a key part of the pre-livestock local ecology in limiting the numbers of grazers and browsers, as noted earlier.

The Preserving Ranch Lands report cites McNaughton (1986, 1993) to support its argument that grazing can benefit Southwest grasslands (report at page 5). But a review of McNaughton's documents show his work focused on African grasses and grazers – species and plants which occupy a vastly different ecological setting than those in Arizona. The authors also cite Martin (1970) to argue that some shrubs and grasses might have adapted to the grazing of large extinct herbivores of the Pleistocene Epoch. This might be true – but that epoch, as noted above, ended roughly 10,000 years ago. Since then Southwestern ecosystems have evolved in the absence of large grazers.

> "Thirteen different controlled experiments failed to support claims of improvement in range and soil conditions under schemes of short-duration grazing known as 'holistic resource management.'"

Range management and arid Western ecosystems

The Preserving Ranch Lands report does acknowledge that there can be "negative impacts of grazing," but contends that "adjusting stocking rates, improving grazing distribution and changing season of use can mitigate" those impacts (report at page 5). The report supplies no evidence that an economically viable grazing scheme will have no significant negative impact on arid Western ecosystems, and native wildlife and plants. Instead, the report cites papers dated before 1920 and an unpublished document that could not be reviewed.

The report returns to this theme where it states, "The solution lies in controlling the timing, frequency and intensity of grazing pressure" (report at page 15). This view is disputed by Holechek et al. (1999, 2000), who reviewed all available experimental evidence and concluded:

- Thirteen different controlled experiments failed to support claims of improvement in range and soil conditions under schemes of short-duration grazing known as "holistic resource management."

- Livestock rotating schemes did not differ from season-long grazing in their effects on range conditions at the same net utilization levels.

- Even "light" grazing (average of 32 percent of the forage used) failed to allow any range recovery in 25 percent of the cases studied.

Grazing utilization levels in Pima County often exceed those found by the Holechek et al. reviews to allow range recovery. Grazing levels in Pima County are as high as 50 percent of forage utilized on Coronado National Forest grazing allotments (U.S. Forest Service 1996); as high as 60 percent on Bureau of Land Management lands (U.S. Fish and Wildlife Service 1997), and are left largely to the leaseholder's judgment on state land. The Holechek et al. reviews found that the only significant mitigating effects on range conditions resulted from lower overall utilization levels. It is important to note that these reviews considered only the effect of grazing on range conditions and did not address effects on ecological conditions, wildlife and plants.

The Preserving Ranch Lands report portrayal of the "model" Anvil Ranch in Pima County (report pages 20-22) also addresses range conditions and not ecosystem or wildlife and plant condition. The report claims improvements in Anvil ranch range and soil conditions after adoption of a program of prescribed burns and livestock rotation in 1985. It presents no evidence showing improvement in ecological conditions.

Alleged improvements in Anvil's range and soil conditions are based on 1975 baseline data compared with "a recent range survey." The team cites a class of University of Arizona professor Phil Ogden for the 1975 survey data and Meyer-Robinett (2000) for the recent survey data; but neither report is listed in the Preserving Ranch Lands report bibliography. These sets of data (Table III-4.1, report at page 22), perhaps collected using different methods, cannot be meaningfully compared. And the data are compared neither with data from comparable un-grazed areas nor with equivalent data from these areas from before the new management regime was instituted. Absent these comparisons, Anvil range and soil condition changes could have been the result of weather conditions or other factors instead of the new management regime.

The Preserving Ranch Lands report also maintains that, "if grazing [in riparian areas] is brief or excluded during the growing season, however, vegetation quickly recovers and stream conditions improve" (report at page 15). As discussed above, however, this contention is not supported by the best available scientific data.

The practice of winter-only grazing in riparian areas to limit obvious negative impacts has become fairly common. But there is no evidence that it results in any beneficial effects beyond what would accrue from reducing average livestock presence. Although deciduous trees are dormant in winter, some grasses and spring annuals continue growing and are subject to livestock trampling and foraging damage. According to Ohmart (1996), "[T]here is

> **"[T]here is not a single grazing management approach that has produced consistent improvements of degraded riparian-wetland areas."**
>
> **— R.D. Ohmart, 1996, *Historical and Present Impacts of Livestock Grazing on Fish and Wildlife Resources in Western Riparian Habitats***

not a single grazing management approach that has produced consistent improvements of degraded riparian-wetland areas." The U.S. Fish and Wildlife Service studied the practice of winter-only grazing in Redrock Canyon and concluded that, "Winter grazing on … portions of the Redrock stream channel does not appear to have achieved the results predicted" for recovery of the stream channel to proper functioning condition (U.S. Fish and Wildlife Service 1999).

According to the report, more than a century of grazing has caused vegetative shifts that might be irreversible (report at pages 5-6). This should be no valid argument for more of the same harmful management, but rather for changes in land use management and remedial action.

Typical stock tank environs. (Lynn Jacobs)

Stock tanks and riparian habitat

The Preserving Ranch Lands report claims the many artificial stock tanks scattered across the Sonoran desert landscape in Pima County can serve as "replacements" for lost natural riparian areas. Stock tanks "have come to provide habitat to several species of rare native toads and frogs, driven from their original habitats by non-native predators" (report at page 16). Stock tanks do provide important habitat for some imperiled amphibians, but many of these have been displaced to stock tanks because grazing has so degraded native riparian areas and human activities dried their streams – often to fill the stock tanks (Belsky et al. 1999). Artificial tanks, located for convenience of ranch operations, are poor substitutes for native riparian ecological conditions.

Negative evidence lacking

The County's ranch conservation report fails to refute some of the most important work to date on grazing in the Southwest. For example, the team neglects the findings of Flather et al. (1994, 1998), which identified grazing as the most significant cause of species endangerment in this region. Also ignored is the work of the Bocks (Bock and Webb 1994, Bock and Bock 1991, 1999, Bock et al. 1990, 1992) over the last two decades documenting the effects of livestock exclusion on the Appleton-Whittel research ranch near Sonoita; the work of Belsky and Ohmart (Belsky 1986, Belsky et al 1999, Belsky and Blumenthal 1997, Ohmart 1994, 1996) and the work of Allison Jones (2000).

Rapid recovery observed in riparian areas after exclusion of livestock shows that it is current grazing practices and not just a legacy of historical practices that maintain habitat degradation (e.g. Krueper 1996). Bureau of Land Management photographs of the San Pedro River, located southeast of Tucson, before and after livestock were removed, are a strong example of this phenomenon.

Economics and the County's ranch conservation reports

The Preserving Ranch Lands report notes the declining economic viability of ranching as a business in southern Arizona, stating that over the last four decades ranches here "have performed rather poorly when viewed as businesses" (report at page 23). But when it analyzes why ranches remain in

San Pedro River at Hereford Bridge, 1984

San Pedro River at Hereford Bridge in 1997, eleven years after removal of livestock grazing

Redrock Canyon outside cattle exclosure (2000)

Redrock Canyon inside cattle exclosure established in 1992 (2000)

business despite their economic difficulties, and the attraction of subdividing instead, (report at page 24) the report does not list state and federal subsidies as a factor.

> **"The U.S. General Accounting Office found that the Bureau of Land Management's grazing program in the Southwest, including Pima County, was running at an annual loss of $1.3 million and predicted that putting an end to the program would not significantly disrupt local economies."**

The U.S. General Accounting Office (1991b) found that the Bureau of Land Management's grazing program in the Southwest, including Pima County, was running at an annual loss of $1.3 million and predicted that putting an end to the program would not significantly disrupt local economies. The report instead found that the economic value of the lands could well be greater if they were managed for recreational and aesthetic benefits.

Livestock are grazed on 94 percent of Arizona's state land and on 90.5 percent of federal Forest Service and Bureau of Land Management lands in Pima County (Pima County 1999a), for returns to the treasuries of far less than what market grazing rates would collect. Grazing leases on state land generate just 26 cents an acre a year for the school trust fund (Arizona State Land Department 1998). These lease rates are set far below average market rates (Table 2) despite a constitutional mandate that the state derive the highest possible income from these lands for the public-school beneficiaries of the trust fund.

Table 2 Fees charged for forage on private, state and federal lands

Forage Supply	Means of Determination	Monthly Fee per Animal-Unit, 2000	% Increase Since Base Years 1964-68
Private non-irrigated range in 11 Western states	Market	$11.90	226%
Arizona State Land Department lands	Political	$1.95	105%
Bureau of Land Management or Forest Service lands	Political	$1.35	9.6%

Source: *Arizona Agricultural Statistics* (Arizona Agricultural Statistics Service 1999)

The Arizona ranching industry enjoys a host of other direct and indirect taxpayer subsidies. The Coalition has found the following Arizona ranch subsidies (see also Wolff 1999):

- Exemption from higher commercial taxes for agricultural businesses (Arizona Revised Statute § 42-5069);
- Exemption of livestock from taxation as personal property (A.R.S. § 42-15053);
- State motor-vehicle registration 70% subsidy (A.R.S. § 28-5857);
- State 75% tax credit for water conservation projects (A.R.S. § 43-1172 and § 43-1084);
- State sales-tax exemptions for feed and feed supplements (A.R.S. § 1301.01);
- State tax exemptions for businesses at rodeos (Arizona tax code sections 42-5069, 42-5073, and 42-5074);
- Diversion of public funds to buy and operate publicly owned ranches (The city of Tucson bought and operates the A-7, formerly Bellota, Ranch northeast of the Rincon Mountains, on very generous terms. Cattle operations continue at a net loss, at the expense of taxpayers, while the A-7 public lands' grazing leases have been turned over to ranchers in the San Pedro valley for a "grass bank."

State Heritage Fund money was used to buy the White Mountain Hereford Ranch and the San Rafael Ranch, but they are operated as private ranches and not as public parks or preserves);
- State grants for water developments on ranch land;
- State support for "beef councils;"
- Federal drought relief and emergency feed programs;
- Federal and Arizona Game and Fish predator control services. (The bulk of the $756,126 in federal money spent in Arizona in 1997 went toward killing wildlife for the livestock industry. Among the victims that year were 1,528 coyotes, 54 beavers, 43 mountain lions, and 15 black bears. The federal Wildlife Services agency even kills wildlife in designated wilderness areas [Arizona Daily Star, Feb. 5, 1999], a clear violation of the 1964 federal Wilderness Act);
- U.S. Department of Agriculture beef buybacks, other price supports, and export-promotion programs; and
- The Land Grant College system, publicly funded research on range science and for agricultural-extension services.

Tax benefits for livestock production

In 1998, the Arizona Farm Bureau estimated its farming and ranching members enjoyed an average annual tax-breaks windfall of $76,960 each as a result of Farm Bureau lobbying efforts to retain and expand favorable subsidies in the form of state fee and tax formulas.

In Arizona, livestock were taxed as property at an 8 percent rate until 1994, when the Legislature exempted them from such taxation. Legislators retained the property tax on ranchers' private lands, but kept them at an "agricultural" rate much lower than that applied to commercial property, and even lower still than the rate at which vacant land in Arizona is taxed.

To cite an example, from a search of Pima County records we have estimated that one Pima County ranch operation paid just $2,897 in property taxes for 1998 on 1,972 acres in 17 parcels, including two "owner-occupied" residences and one rental residence, resulting in a net annual tax of $1.40 an acre. The owner of the same vacant acreage would pay at a rate more than 10 times the rancher's rate and the owner of that volume of residential land would pay at a rate well beyond six times the rancher's rate at current tax assessment ratios.

A subsidy for a "typical" ranch

The Preserving Ranch Lands report presents data in a balance sheet of a "typical" 300-head cattle-ranch operation (report at page 25) showing the scale of just the below-market-fees subsidy. Grazing fees are shown as a one-year expense at $1,985, or just 2 percent of total costs. One can compare that figure with the $13,407 listed for purchases of a year's worth of imported feed. This typical ranch spends 6.75 times more for supplements than it does for its cattle's primary diet of range forage.

The report does state that below-market grazing fees for public land forage are taxpayer subsidies for ranching (report at page 26). But the report attempts to downplay these subsidies. The report cites a private grazing market rate of "around $9" per animal unit month (report at page 26) when the official Arizona Agricultural Statistics estimate is $11.90 (see Table 2). This understatement of $2.90 per animal unit month exceeds the entire federal fee of $1.35 per animal unit month and the average state fee of $1.95 per animal unit month.

Other subsidies

According to the Preserving Ranch Lands Report, "private grazing land is more productive" than public federal or state school trust land (report at page 26). No evidence is presented to support this claim that forage on private lands is so much more valuable to livestock than forage on public lands as to justify a fee six times or even nearly nine times higher for private-land grazing.

"(T)he rancher pays for expensive improvements" on public lands, according to the Preserving Ranch Lands report (report at page 26). But the rancher retains ownership of these improvements on state land. The federal government pays for and owns these improvements on federal land. In theory, grazing fees are supposed to cover the costs of federal improvements and land management. They fall far short of that, however, as can be seen in the discrepancy between private market fees and those of the federal government. The federal-taxpayer subsidy of fee benefits alone for grazing nationwide was $108 million in 1999 (*San Jose Mercury News*, Nov. 7, 1999).

After understating the grazing subsidy, and considering just the fee issue but not the vast array of subsidies discussed above, the Preserving Ranch Lands report concludes that subsidies to livestock operators are justified by "open-space subsidies" that ranchers provide to the public (report at page 27).

This analysis assumes a rancher must obtain all future income from the presumed capital gains of subdividing and/or developing the smaller private base property. It assumes this is equivalent to replacing the entire ranch operation, the majority of which (10 times to 25 times in listed scenarios) relies on public-land forage. It ignores the reality that many, if not most, Western ranchers today derive income from means other than ranching. In Pima County, 54% of farm operators (including all crop and animal producers) do not list farming as their principal occupation (U.S. Department of Agriculture 1997). Also, the report fails to address tax penalties paid for capital gains accrued from private-land sales for subdivision.

Control of public lands

Beyond taxpayer subsidies, the livestock industry controls much of the public land in the West and Pima County for its own use. The Arizona Agricultural Statistics Annual Report of 1999 showed that cattle grazed on 1.73 million acres of rangeland, 87 percent of that public land, in Pima County in 1997 (Table 3).

Table 3 Land subject to livestock grazing in Pima County

Owner/Manager	Acres total [1]	Acres in ranches [2]	% of land in ranching
Private	690,000	226,019	33%
State	867,000	814,717	94%
Bureau of Land Management	363,000	369,588 [3]	100%
Forest Service	390,000	317,679	81.5%
Total	2,310,000	1,728,003	75%

Sources: [1] *Ranching in Pima County*, Table 1 (Pima County 1999a), [2] Arizona Agricultural Statistics, 1999. [3] Pima County data does not agree with Arizona Agricultural Statistics data. (National Parks and other public or tribal land are not included.)

Decline of range production

Despite its control of public land and subsidies, ranching in Pima County is a relatively minor, and shrinking economic activity. Cash receipts for Pima County livestock in 1998 were just 1.3 percent of all farm receipts that year in Arizona (Arizona Agricultural Statistics Service 1999).

Cattle production in Pima County declined 23 percent in the five years between 1992 and 1997 according to the U.S. Department of Agriculture Census of Agriculture (1997). The census lumps ranches and farms together, but it still is revealing. In 1997, 63.5 percent of Pima County farms and ranches reported a net loss despite an average of $19,590 each in direct government payments, according to the census. It also showed that 63.5 percent of operations reporting a loss in 1997 was up from 58.6 percent five years earlier.

The census also showed the ranching industry to be a minor Pima County employer. County farms and ranches together employed just 1,185 laborers in1997, a figure down 6 percent from 1992. Generously assuming 25 percent of these workers were cowboys on ranches would mean only 296 were employed in ranching. Multiplying 296 by the standard 1.9 to account for indirect jobs related to the industry yields a 1997 County ranching-related workforce of just 563. The total County workforce in 1997 was 266,388, so less than 0.2 percent of it was related directly or indirectly to the ranching industry.

III. Critique of draft preliminary Sonoran Desert Conservation Plan Proposals for Ranch Conservation

The County's September 2000 draft preliminary Sonoran Desert Conservation Plan sets forth six ranch conservation recommendations based on conclusions in the Preserving Ranch Lands and other County ranch reports (report at page 10). The Coalition reviews these six proposals below.

COUNTY RANCH CONSERVATION RECOMMENDATION #1

"Establish a program that provides certainty for long-term state, BLM and Forest Service leases."

The County should not establish a program to provide certainty for Bureau of Land Management or Forest Service grazing leases as these are at low risk for disposal for development. A greater likelihood of disposal for development illustrates the need for a different approach for state land.

As a general rule, the final Sonoran Desert Conservation Plan should not encourage any presumption of private entitlements to public land grazing leases. The County's recommendation as it is now written does not address long-standing abuses in operation and structures of public-land grazing leases. Public land belongs to all the citizen-taxpayers of each jurisdiction, and should be managed for maximum benefit to public owners.

> **"...the final Sonoran Desert Conservation Plan should not encourage any presumption of private entitlements to public lands grazing leases."**

Federal grazing permits are not leases in the standard commercial sense, and they are not entitlements (Federal Lands Legal Consortium v. U.S.A., U.S. Tenth Circuit Court of Appeals No. 98-2211). The law is clear that grazing livestock on federal land is a privilege revocable at any time by the permitting agency. Federal agencies commonly order reductions in livestock numbers on their grazing allotments, usually to lessen damage to range, watersheds and habitat for imperiled species. Federal agencies have often undermined land management laws with decisions implying these permits are entitlements.

Some federal public land agency rules are disincentives to conservation. For example, even if a conservation organization buys a private base ranch property and applies for "voluntary non-use" of associated federal grazing allotments, the agencies can and do reassign the allotments to other ranchers.

For these reasons, and because there is a low risk of federal land disposal for development, the County should not establish a program of certainty for federal land grazing leases. A greater risk of disposal points to the need for different treatment of state land.

The Department classifies the majority of the more than 9 million acres of state land under only two categories – livestock grazing or commercial. For any other "use," including conservation, the Department charges leaseholders, such as the Buenos Aires National Wildlife Refuge, at a much higher commercial leasing rate. This is a powerful disincentive for conservation. The Arizona State Land Department also allows grazing leaseholders to take "non-use" status while simultaneously prohibiting deliberate conservation of state land. An estimated 7 percent of the state land has non-use status and another 7 percent has partial-use status (Tim Hogan, pers. comm., November 16, 2000).

In contrast to management of the majority of state land, the Arizona Preserve Initiative does allow a "conservation" classification for lease or purchase of certain state land around metropolitan areas. The initiative allows governments and other organizations to petition for a conservation classification, and to subsequently lease or purchase these lands. This classification could be expanded to other state land with passage of a planned 2002 state land conservation initiative.

Significant state land holdings around the perimeter of the Tucson metropolitan area are or will soon be reclassified from grazing to commercial and leased or sold for development. These areas are shown on a map titled "Disposable Lands for BLM and State of Arizona" in the County's Our Common Ground: Ranch Lands in Pima County report (Pima County 2000c, between pages 132 and 133).

For these reasons, the County could pursue a program to provide certainty to ranchers on state lands at risk for lease or sale for development. But this certainty program should be carefully crafted for maximum conservation benefit. Please see Coalition recommendations below.

COUNTY RANCH CONSERVATION RECOMMENDATION #2

"Establish a fairly constructed purchase of development rights program for Pima County."

The County should pursue a purchase of development rights program with rigorous conservation conditions.

> **"Purchase of development rights programs and resulting conservation easements can be a reasonable and ecologically sound alternative for limiting urban development of private ranches while simultaneously discontinuing or reducing the harmful effects of grazing."**

Purchase of development rights programs and resulting conservation easements can be a reasonable and ecologically sound alternative for limiting urban development of private ranches while simultaneously discontinuing or reducing the harmful effects of grazing. For example, conservation easements could be purchased by the County with development impact fees, or granted by private property ranchers as mitigation for development of land outside of the core and corridor reserve. The County should also pursue state funding for a purchase of development rights program.

A purchase of development rights program, however, should not become another ranching subsidy and should include appropriate safeguards to ensure that the expenditure of public funds results in commensurate public benefit. Under no circumstances should the County use taxpayer funds to continue harmful grazing practices. Please see Coalition recommendations below.

COUNTY RANCH CONSERVATION RECOMMENDATION #3

"Establish a means to compensate ranchers for a decrease in their investment purchase value of grazing leases at a certain stocking rate should the animal unit numbers be decreased by an agency."

The County should not pursue this recommendation. This recommendation again assumes that ranchers hold some level of entitlement to public land leases. This is clearly not the case as discussed above. Reductions in available forage by public agencies are usually intended to conserve a particular resource or protect native species. Reductions in grazing animal numbers or areas available for grazing should not be compensated by taxpayers because the public should not be obligated to pay for sound public land management.

COUNTY RANCH CONSERVATION RECOMMENDATION #4

"Effect changes in the property tax laws [to] allow a 'conservation classification ...'"

This recommendation has substantial merit, but only if "conservation" is defined to exclude livestock grazing in the core and corridor reserve, and if changes in property tax laws also include raising tax rates for other private ranch land.

Ranchers now pay very low agricultural property tax rates. The County can provide a significant conservation incentive by assessing property taxes at a lower tax rate under a true "conservation classification" for ranchers who discontinue livestock grazing in the core and corridor reserve, and discontinue grazing or reduce livestock numbers in buffer areas.

"The County can provide a significant conservation incentive by assessing property taxes at a lower tax rate under a true 'conservation classification' for ranchers who discontinue livestock grazing in the core and corridor reserve ..."

COUNTY RANCH CONSERVATION RECOMMENDATION #5

"Ask the Legislature to build flexibility into the state statute that mandates 40 head of livestock as a minimum requirement for agricultural lands tax status, especially in drought years or after fire events."

The County should not pursue this recommendation. The County should not seek more flexibility in the law that already permits substantial tax abuses.

State law already allows counties to approve "non-conforming property" for the agricultural tax classification if it does not meet the minimum statutory requirements (A.R.S. § 42-5069). This has led to the tax-evasion scheme commonly referred to as "rent-a-cow." In Pima County, Vistoso Partners LLC in 1997 owned 2,675 acres of land in Oro Valley that was zoned and planned for residential and commercial development. The company put a few head of cattle on the land, even while houses were under construction, and the County assessed the land for 1997 at a value of $5.75 an acre. If the assessment had been at residential rates, the land value would have been $2,000 to $25,000 an acre. Vistoso Partners paid a 1997 property tax for the land of $670, instead of at least $142,000 and possibly as much as $1.77 million (*Arizona Daily Star*, July 25, 1997).

COUNTY RANCH CONSERVATION RECOMMENDATION #6

"Establish a 'grass banks' program which would allow ranchers to 'rest' pastures more frequently or perhaps after prescribed burns ..."

This recommendation has merit, but only if grassbanks are established under stringent conservation conditions, and are not utilized to relieve poor grazing practices. Please see Coalition recommendations below.

The County's description of grassbanking reveals an unfamiliarity with the complexity of grassbank management and suggests the possibility that grassbanking may be used as a band aid for poor livestock management. The County's brief portrayal also overlooks greater conservation opportunities of responsible grassbanking.

Grassbanking is a relatively new livestock management practice. The first grassbank, established on the private 500 square mile Gray Ranch in southwestern New Mexico, was intended to provide alternative pasture for neighboring ranchers who rested degraded areas for rehabilitation with fire, removal of woody species and other treatments. Significantly, the Gray Ranch grassbank included the creation of conservation easements over participating ranchers' private land in exchange for use of the grassbank, thus reducing the possibility of future subdivision. In the first five years of the Gray Ranch grassbank over 60,000 acres were permanently protected from development in the form of conservation easements.

The County has repeatedly acknowledged that conservation easements will play an important role under the Sonoran Desert Conservation Plan. Yet the County's grassbank ranch conservation recommendation makes no mention of conservation easements – an essential element of the original Gray Ranch grassbank.

Grassbanking has the potential to assist in ecosystem recovery by providing opportunities for rest from grazing and the return of fire. Grassbanking can also contribute to creation of the core and corridor reserve through establishment of conservation easements.

There is a significant risk, however, that grassbanks will be used as a band aid for poor livestock management. The term is commonly misused to refer simply to a grazing allotment in "non-use" status. In such cases, ranchers with allotments damaged by grazing might be permitted to move livestock to a "non-use" allotment with better forage. There is no evidence that this shell game actually discourages abusive grazing practices or results in conservation of imperiled species. Indeed, this scheme is much more likely to reward poor land management because it provides a safety net for ranchers who damage their own private land or public land allotments. Without basic precautions, the County should not spend precious resources to establish grassbanks when scarce resources would be better utilized to purchase and remove damaging land uses from the core and corridor reserve.

IV. Conclusions

Livestock grazing is a major conservation issue in Pima County that should undergo unbiased analysis and careful management under the Sonoran Desert Conservation Plan. Yet the draft preliminary Plan and related ranching reports have overstated the positive effects of grazing while downplaying negative effects on Southwestern ecosystems, wildlife, plants and vulnerable species.

Overemphasis on grazing as a tool for protection of all or even most reserve land will greatly reduce the ability of the Plan to accomplish stated conservation goals. The draft preliminary Plan and ranching reports seem to unilaterally equate ranching with ecosystem, wildlife and plant conservation. Conservation of native Sonoran desert region ecological conditions under the Plan cannot be accomplished without removal of grazing from a defined core and corridor reserve, and reduction or removal of livestock from buffer areas.

This is not to say that "open space" preserve areas where grazing will continue are inappropriate under the Plan. On the contrary, ranch conservation to maintain working ranches, delineate an urban boundary and maintain open space may be an appropriate Plan element. But such "ranch conservation areas," or "open-space preserves," should not be unilaterally lumped into the same category as a core and corridor reserve or even buffers.

"... ranch conservation to maintain working ranches, delineate an urban boundary and maintain open space may be an appropriate Plan element. But such "ranch conservation areas," or "open-space preserves," should not be unilaterally lumped into the same category as a core and corridor reserve or even buffers."

It is the Coalition's position that a core and corridor reserve should be entirely free from grazing and other harmful land uses, as reflected in many of our recommendations below. The same is true for any other new or expanded mountain parks, natural reserves and riparian conservation areas established under the final Plan. Outside of these areas, the County should work with all stakeholders to implement an adaptive grazing management program to ensure conservation of environmentally sensitive resources.

V. Recommendations

The Coalition for Sonoran Desert Protection offers the following recommendations to reconcile conservation of native ecosystems, wildlife and plants with ranch conservation. The biological and economic analysis presented in the draft preliminary Sonoran Desert Conservation Plan and related ranch reports is not sufficient to justify the heavy reliance on ranching as a conservation tool. The Coalition's scientific and policy review of ranching has led us to the following recommendations.

Adoption by the County of these recommendations would constitute a significant commitment to the County's natural integrity and a great service to its citizens. The preservation and restoration of the County's valuable and precious resources – its environmentally sensitive land, plants and animals – is a legacy its current leadership should honor and protect.

- **Establish a core and corridor reserve free of livestock grazing –** The final Sonoran Desert Conservation Plan should include a mapped, hard-line core and corridor reserve that will be managed solely for conservation of native ecosystems, wildlife, plants and vulnerable species. This core and corridor reserve should be free from all harmful land uses including livestock grazing. The Plan should also include mapped buffer areas around the core and corridor reserve.

"The final Sonoran Desert Conservation Plan should include a mapped, hard-line core and corridor reserve that will be managed solely for conservation of native ecosystems, wildlife, plants and vulnerable species."

- **Establish an adaptive grazing management program for areas outside the core and corridor reserve –** The County should work with biologists, ranchers, land managers and environmentalists to implement an adaptive grazing management program for buffer areas and other land outside of the core and corridor reserve to ensure conservation of environmentally sensitive resources. The program should include protections for particular environmentally sensitive resources and rigorous monitoring of the effects of various management techniques.

- **Pursue conservation classification and lease or purchase of Arizona Preserve Initiative state land –** The County should seek to secure state land under the Arizona Preserve Initiative located within the Sonoran Desert Conservation Plan reserve, with emphasis on the core and corridor reserve. Grazing should be discontinued on land located within the core and corridor reserve, and discontinued or reduced in buffer and other adjacent areas on land acquired through the Arizona Preserve Initiative process. Failing this, the County should act to limit zoning densities on state land leased or sold for development. Action by the County to increase zoning densities outside of the core and corridor reserve and buffer areas may reduce Arizona State Land Department opposition to conservation inside these areas.

- **Implement land use regulation to protect ranch land –** The Comprehensive Plan, and all available zoning and building restrictions should be vigorously utilized by the County to limit subdivision and development of ranch land.

- **Pursue retirement of grazing in the core and corridor reserve –** The County should work with the Forest Service, Bureau of Land Management, Arizona State Lands Department, private land ranchers and others to permanently retire grazing on land in the defined core and corridor reserve, and to implement protective adaptive grazing management in buffer and other areas.

> **"To the extent conserving ranch land and conserving imperiled species conflict, conservation of imperiled species must take precedence."**

- **Achieve Endangered Species Act conservation standards –** As a Habitat Conservation Plan, the final version of the Plan must provide for "conservation," or survival and recovery of listed species according to Endangered Species Act standards. To the extent conserving ranch land and conserving vulnerable species conflict, conservation of vulnerable species must take precedence.

- **Do not establish a program of certainty for federal land grazing allotments –** The County should not establish any program to provide certainty for Forest Service or Bureau of Land Management grazing allotments.

- **Establish a program of certainty for state land grazing allotments –** The County could establish a carefully crafted program to provide certainty to ranchers on some state land now at risk for development. This program should only apply inside the boundaries of Arizona Preserve Initiative if first the County is unsuccessful in securing these lands through petition for conservation classification and subsequent lease or purchase. Grazing should still only occur outside the core and corridor reserve under this program. The program should also only apply where the state land department agrees to maintain the grazing classification for the life of the certainty program's conservation contract, and the County should not enter into any certainty agreement to establish a long-term grazing lease prior to voter consideration of the planned 2002 state land conservation initiative.

- **Pursue a purchase of development rights program –** The County should pursue a purchase of development rights program with rigorous conservation conditions. A purchase of development rights program should result in establishment of contractual conservation easements. These conservation easements should contain explicit language that grazing will be discontinued in the core and corridor reserve, and discontinued or reduced in buffer and other areas. Development rights should not be purchased where there will be no contractual reductions in the number of grazing animals.

- **Do not establish a means to compensate ranchers for decreases in value of grazing leases based on certain stocking rates –** The County should not establish a means to compensate ranchers for animal number or grazing area reductions on federal land.

- **Pursue establishment of new property tax law conservation classification –** The County should pursue establishment of a new property tax law conservation classification, but only if "conservation" is defined to exclude livestock grazing in the core and corridor reserve, and if changes in property tax laws also include raising tax rates for other private ranch land. Livestock operators who reject

contractual agreements to eliminate or reduce grazing in the core and corridor reserve or buffer area should be taxed at a higher rate, perhaps using a special conservation tax levy. Revenues from this should be used to purchase development rights for reserve areas.

- **Do not pursue increased flexibility in state law for agricultural lands tax status –** The County should not seek a way for property owners to evade fair taxation by grazing livestock while they are drafting plans and raising capital for development projects.

- **Establish grassbanks under certain stringent conditions –** The County could consider establishing grassbanks, but only if they are established outside of the core and corridor reserve, are not established on currently ungrazed public land, and are not utilized to relieve poor grazing practices. A Plan grassbank program should require conservation easements prohibiting subdivision on participants' private land, and rigorous soil, vegetation and wildlife monitoring to ensure rested areas do not revert to previous degraded conditions with the return of livestock. Rigorous monitoring is also necessary to ensure maintenance of the grassbank.

- **Establish other incentives for removal of livestock in the core and corridor reserve –** Incentives such as property tax reductions could be established by the County but only for ranches where grazing will be discontinued in the core and corridor reserve, or discontinued or reduced in buffer or other adjacent areas.

- **Establish new revenue sources to secure the core and corridor reserve –** The County should establish new development impact fees, earmark general revenues, seek voter approval of new bonds or taxes, pursue legislation to secure state funds or levy taxes for outright purchase or purchase of development rights on private land within the core and corridor reserve and buffer areas. Land in the core and corridor reserve protected as mitigation for development should be permanently retired from grazing or development.

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