Center for Biological Diversity

Protecting and restoring natural ecosystems and imperiled species through science, education, policy, and environmental law.

Cattle grazing and the loss of biodiversity in the East Bay

The negative impacts of cattle grazing on the habitat of native species in the East Bay area are readily acknowledged by the agencies and organizations most knowledgeable about these species. Federal wildlife agencies have identified cattle grazing as a factor leading to the listing under the Endangered Species Act ("ESA") of multiple species that occur on or have been extirpated from East Bay rangelands. These species include but are not limited to the California red-legged frog, steelhead trout, Alameda whipsnake, and listed species of butterflies, as well as numerous special-status East Bay plants. As early as 1979, the California Department of Parks and Recreation ("CDPR") identified cattle grazing as harmful to the ecology of Mt. Diablo (CDPR 1989). The CDPR thoroughly examined the negative environmental impacts of cattle grazing in a 1989 Environmental Impact Report, when commercial grazing was eliminated from Mt. Diablo State Park (CDPR 1989).

A number of public agencies permit and facilitate commercial livestock grazing on public park and watershed land in the East Bay. These include the East Bay Regional Park District ("EBRPD"), which grazes over 57,000 of the 93,000 acres it manages; the San Francisco Public Utilities Commission ("SFPUC"), which grazes over 20,000 of the 40,000 acres of San Francisco Water Department watershed land it manages in the Alameda Creek watershed; the East Bay Municipal Utility District ("EBMUD"), which grazes 21,000 of its 28,000 acres; and the Contra Costa Water District ("CCWD"). Although this report and public attention have been focused on grazing practices on EBRPD land, the issues raised apply equally to over-grazing on SFPUC, EBMUD, and CCWD land.

The Center for Biological Diversity ("CBD") has provided extensive documentation and scientific research papers to EBRPD as part of a review of their grazing management. These included a reference list of over 150 scientific, peer-reviewed research papers and articles detailing the detrimental environmental impacts of livestock grazing in the western U. S., and a 13 page summary of livestock grazing impacts on soil, stream, wildlife, and ecosystem function from peer-reviewed, scientific studies, with references. Also included was a comprehensive Survey of Livestock Influences on Stream and Riparian Ecosystems in the Western United States (Belsky et al. 1999), a survey of over 140 peer-reviewed studies on the biological and physical effects of livestock on western rivers, streams, and riparian areas. Belsky et al. (1999) conducted a systematic literature review which specifically searched for peer-reviewed experimental studies showing the positive environmental impacts of grazing, but none could be found. The EBRPD has been unable to produce a single peer-reviewed scientific study demonstrating any positive environmental impacts from cattle grazing in the East Bay, despite repeated requests during their grazing review process. An analysis of the biased and fraudulent "public review" of the EBRPD grazing program has been published by the Friends of Sycamore Valley (Schneider 2002).

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Belsky et al. (1999) found that studies overwhelming show that livestock grazing negatively affects water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife. Cattle grazing in general has severely degraded all aspects of creek function, processes and ecology. These impacts obviously have significant cumulative negative effects for special-status species dependent on aquatic and riparian habitat. The general impacts of cattle grazing (extensive documentation and references can be found in Belsky et al. 1999) can be summarized as follows:

- Water quality

Cattle grazing increases nutrient concentrations and bacteria and protozoa levels. Sediment load and turbidity are increased, as well as water temperature. Dissolved oxygen levels often decline.

- Stream channel morphology

Channel width increases, and water depth decreases with cattle grazing. Gravels in the channel bed tend to be lost in the erosional environment and fine sediments increased in the depositional environment. Streambank stability is reduced, streambank undercuts are reduced in quality and quantity, and pools decrease in number and quality.

- Hydrology (stream flow patterns)

With cattle grazing, overland flow from runoff increases, and peak flow and flood water velocity also increase. Summer and late-season flows decrease, and the water table is lowered.

- Riparian zone soils

Grazing increases erosion, the amount of bare ground, and soil compaction. Infiltration of water decreases. Litter layer decreases and soil fertility declines.

- Instream vegetation

Algae growth increases with grazing, but higher plants (submerged and emergent) often decline in abundance.

- Streambank vegetation

Herbaceous cover, biomass, productivity, and native plant diversity decline due to grazing. Overhanging vegetation and tree and shrub biomass and cover decline. Plant species composition is altered and plant structure (horizontal and vertical) is simplified. Plant age structure becomes even-aged and plant succession is impeded.

Cattle also grazing causes upland soil compaction, erosion, and sedimentation (Trimble and Mendel 1995) causing water to drain overland instead of infiltrating into the ground. An unnatural and rapid flow of water into creeks results (similar to problems experienced by developments such as subdivisions that create impervious surfaces), further eroding soil surfaces. Within the creeks a greater volume of water flows at a faster rate of speed. If the riparian vegetation is absent or fragmented, as is the case in much of the over-grazed East Bay rangelands, this expanded and accelerated flow erodes the creek banks, causing unstable creek banks and landslides. Erosion, gullying, and sedimentation of creeks is magnified when cattle have access to stream channels, where they destroy stream banks through trampling and eating of stream side vegetation. Schultz and Leininger (1990) documented significant differences in riparian

vegetation between grazed areas and exclosures. Because riparian communities are the most diverse habitats in East Bay ecosystems, the riparian impacts of cattle grazing have resulted in the most severe loss of natural biodiversity, particularly for invertebrates, amphibians, and birds.

Loss of habitat for native amphibians and reptiles

Habitat alteration by livestock grazing (due to trampling, water quality impacts, and impacts to riparian vegetation) is documented to be an important factor in the decline of red-legged frogs (*Rana aurora draytonii*) in California (Jennings et al. 1992; Jennings and Hayes 1994; USFWS 1996, 2000). Livestock grazing is known to decrease the suitability of riparian and aquatic habitat in general (Behnke and Raleigh 1978; Buckhouse et al. 1981; Kauffman et al. 1983; Kauffman and Krueger 1984; Bryant 1985; Marlow and Pogacnik 1985; Siekert et al. 1985) and negatively impacts habitat for herpetofauna (Jones 1979, 1988; Szaro et al. 1985; Jennings and Hayes 1994; USFWS 2000).

Sedimentation of creeks due to the erosional impacts of grazing mentioned above and trampling of undercut streambanks eliminates the deep pools and other cover habitat needed by frogs. Eggs can be smothered by sedimentation, and deep pools necessary for escape cover are filled in. For red-legged frogs, the loss of undercut banks and reduced water levels is particularly critical because refuge plunge pool habitat is reduced or eliminated. Grazing results in a decline in the structural richness of the vegetative community, with a loss of thermal cover and protection from predators. Vegetation is a crucial component of the frog's habitat. Emergent vegetation, upon which the frogs deposit their egg masses can be trampled and eaten. Loss of stream side vegetation due to cattle grazing can reduce habitat for insects and small mammals (USFWS 2000), which are important dietary components for aquatic species (Cordone and Kelley 1961), including the red-legged frog.

Grazing increases aridity and can raise water temperatures to levels lethal to early life stages of the red-legged frog. Livestock grazing can also cause nutrient loading problems due to urination and defecation in areas where cattle are concentrated near the water (Doran et al. 1981). Cattle can crush and disturb egg masses, larvae, and metamorphosing frogs and also can draw down water levels when drinking from small water bodies, leaving amphibian egg masses desiccated or subject to disease such as fungal infections (USFWS 2000). Frogs require rodent burrows for estivation, which are often trampled by cattle. Over-grazing exacerbates the threat of bullfrog expansion (a major introduced predator decimating red-legged frog populations) by creating dramatic changes in riparian and wetland habitat conducive to the spread of bullfrogs (USFWS 1996).

In the East Bay, red-legged frog habitat at the state Corral Hollow Ecological Preserve has been documented to be severely degraded by abusive grazing practices (Jennings et al. 1992), as has frog habitat at EBRPD's Sycamore Valley Regional Park in Danville (CBD 1999, 2000). Conversely, exclusion of cattle grazing on EBMUD lands in Contra Costa County was documented to have resulted in reestablishment of suitable habitat and expansion of red-legged frog populations (Dunne 1995).

Loss of amphibians, reptiles, and other mesofauna (small animals) that require downed woody material is a significant impact from cattle grazing. There is a substantial lack of downed woody material on grazed areas within East Bay rangelands. What little downed wood there is tends to be kicked and trampled by cattle so that the decomposition process fails to create the habitat necessary for salamanders, snakes and other ground dwelling creatures. In addition, there are also many other indirect negative impacts on these species resulting from cattle grazing and the cattle industry in general. For example,

grazing has resulted in the elimination of ground squirrel colonies. Tiger salamanders, western toads, and many other creatures require ground squirrel burrows for summer estivation or other habitat.

Cattle grazing is known to destroy or degrade habitat for several other sensitive East Bay amphibians and reptiles, including the threatened Alameda whipsnake and the giant garter snake, and candidate species for federal listing such as the foothill yellow-legged frog, California tiger salamander, and the California horned and legless lizards (Jennings and Hayes 1994; USFWS 1997).

Livestock grazing that significantly reduces or eliminates shrubs and grass cover (over-grazing) can be detrimental to the Alameda whipsnake (*Masticophis lateralis euryxanthus*). The species avoids such open areas because of the increased danger from predators and the lack of prey (McGinnis 1992). Soil disturbance from grazing may replace native vegetation with non-native plants, potentially degrading the habitat and reducing the prey base for the whipsnake. Inappropriate grazing practices are cited as a specific threat to the Sunol-Cedar Mountain sub-population of the snake (within Sunol and Ohlone parks) by the USFWS (USFWS 1997).

The California horned lizard (*Phrynosoma coronatum frontale*) utilizes small mammal burrows or burrows into loose soils under surface objects during extended periods of inactivity or hibernation (Zeiner et al. 1988). Soil compaction and trampling of rodent burrows by cattle can degrade habitat for this species.

Livestock grazing threatens at least four populations of the listed giant garter snake (*Thamnophis gigas*) (USFWS 1993). Studies on other garter snake species have established a negative cause and effect relationship between livestock grazing and snake population demographics (Szaro et al. 1989). Garter snakes require dense vegetative cover in proximity to waterside foraging and basking habitats in which to seek refuge from predators and other forms of disturbance. Livestock grazing along the edges of water sources degrades habitat quality by reducing vegetative cover (USFWS 1993).

Damage to vernal pool habitats

Intensive livestock grazing can destroy the natural vernal pool habitat of the California tiger salamander (*Ambystoma californiense*) and ESA listed species of vernal pool shrimp. Over-grazing is detrimental to vernal pool habitats due to trampling and increased siltation, and high livestock densities may actually cause changes in pool water chemistry and water quality (USFWS 1994). Intensive grazing alters natural hydrological patterns by extensively terracing hillsides, compacting the soil, and stripping the vegetative cover. Soil disturbance in naturally occurring vernal pools, in particular the puncturing or altering of caliche hardpan, could increase percolation rates and shorten the duration of pool life enough so that California tiger salamanders could no longer metamorphose successfully in those pools (Jennings and Hayes 1994a). Cattle can drink large quantities of water, sometimes causing temporary pools to dry faster than they otherwise would and possibly causing breeding pools to dry too quickly for salamanders to be able to metamorphose (USFWS 2000b).

California tiger salamanders have been found to be either absent or found in low numbers in portions of pools that were heavily trampled by cattle (USFWS 2000b). Continued trampling of a pond's edge by cattle can increase the surface area of a pond and may increase water temperature and speed up the rate of evaporation and thus reduce the amount of time the pond contains enough water. (USFWS 2000b). The decrease in leaf litter and woody debris in heavily grazed areas also reduces habitat for the

salamander, as does trampling of rodent burrows required for estivation. Over-grazing in vernal pool habitats was a factor in the ESA listing (USFWS 1994) of the Conservancy fairy shrimp (*Branchinecta conservatio*), longhorn fairy shrimp (*Branchinecta longiantenna*), vernal pool tadpole shrimp (*Lepidurus packardi*); and vernal pool fairy shrimp (*Branchinecta lynchi*).

Choked-out trout

The negative impacts of cattle grazing on steelhead trout and other salmonids are particularly severe and well documented (CDFG 1996; Knapp and Matthews 1996; NMFS 1997, 2000). Livestock grazing within stream riparian corridors can harm riparian ecosystems and stream channels (Platts 1991; Armour et al. 1994). Grazing may alter natural riparian and channel processes and cause upland and streambank erosion, channel sedimentation and widening, increased stream temperatures, decreases water quality, and changes in the water table (Elmore and Beschta 1987; Platts 1991). Platts (1991) reviewed 19 scientific studies of grazing impacts on salmonids, of which 15 reported either decreased fish abundance with livestock grazing or an increase in fish abundance with cessation of grazing.

The increased sediment load in the creeks due to grazing impacts eliminates spawning habitat by burying the larger size gravel needed for redd (nest) building, suffocating eggs, and filling spaces in the gravels. This reduces habitat for aquatic invertebrates, thereby reducing food for juvenile salmonids. Both sedimentation and actual trampling can damage spawning beds. Grazing impacts such as greater water turbidity, increased siltation, higher bacterial counts, lower summer flows, and low dissolved oxygen in the water column and intra-gravel environment reduce fish survival. Streambank damage and filled-in pools due to sedimentation decreases the hiding cover for steelhead.

Loss of riparian vegetation, expanded and accelerated flows, and loss of creek banks due to cattle grazing causes streams to become shallower and wider, raising water temperatures. Increasing stream temperatures can be lethal to salmonids. Higher water temperatures increase salmonid mortality (by breaking down physiological regulation of vital processes such as respiration and circulation), and negatively affect fish spawning, rearing, and passage. Loss of riparian vegetation has also reduced the amount of large woody debris that is deposited in streams, a key factor in creating pools for young fish and otherwise maintaining suitable salmonid habitat. Removal or exclusion of cattle from riparian areas has been documented to improve salmonid habitat and salmonid populations.

Armour et al. (1994) conservatively estimated that livestock grazing has degraded 50% of all riparian ecosystems on federal rangelands in the western U. S., and this assessment could easily be applied to the public rangelands in the East Bay. Habitat for the federally threatened steelhead trout throughout the East Bay has been severely degraded by cattle grazing at the accepted stocking levels. One example is the well-documented damage to steelhead habitat on EBRPD and SFPUC land in the Sunol allotment in Alameda Creek (Moyle 1993; Bookman-Edmonston 1995, 1995C, 1995D; Murphy and Sidhom 1996). The allotment has large areas of bank erosion, riparian vegetation damage, and sediment deposition, as well as abundance of organic nutrients leading to algal blooms and lowered oxygen levels.

Goodbye butterflies

Cattle grazing is documented to have negative impacts on habitat for rare butterflies, and is a threat to Bay Area endangered and threatened butterflies. For example, the Bay checkerspot butterfly (*Euphydryas editha bayensis*) is threatened by over-grazing of the serpentine grasslands in which its host

plants grow (White 1986; USFWS 1987, 1998; Biosystems 1994). According to USFWS, years of intensive livestock grazing constitutes one of the "assaults on its habitat" that has contributed to its decline (USFWS 1987).

The Bay checkerspot requires *Plantago erecta* and *Castilleja exserta* (native wildflowers) as host plants. Over-grazing and the resultant soil erosion (plus loss of the soil seed bank and the mycorrhizal layer) has reduced or extirpated these species from much of the East Bay. Cattle both eat these host plants and create disturbed soil conditions which favor invasive species that eliminate the native wildflowers (Murphy and Weiss 1988). Over-grazing by livestock has been implicated in extinctions of several colonies of this butterfly (USFWS 1987). Bay checkerspots have been documented to have been crushed by cattle (Elam, et al. 1998), and research has shown that a substantial fraction of eggs, larvae and pupae could be lost to crushing in areas that are heavily grazed (White 1986).

Cattle grazing is also partially responsible for the decline for several other threatened species of butterflies in the East Bay, including the callippe silverspot, Myrtle's silverspot, and Lange's metalmark butterflies (USFWS 1997a, 1997d; Biosystems 1994).

Wildflowers or weeds?

The natural ecosystems of the East Bay have undergone massive change since European settlement, and livestock grazing has been one of the major causes of that change. Pre-settlement native perennial (persisting throughout the year) grasslands were composed primarily of deep rooted perennial bunch grasses and wildflowers (particularly species in the Lily family), with annual grasses and wildflowers, and mosses and lichens growing in between the perennials. This grassland community evolved with fire and native ungulate browsers such as elk, deer, and antelope. It should be noted that cattle grazing does not mimic the browsing patterns of those native ungulates. The native grassland community of California was considered one of the most diverse, beautiful, and productive grassland ecosystems in the world.

The introduction of cattle into the perennial grasslands of California resulted in the introduction of many species of annual non-native invasive weeds such as black mustard, various thistles such as star thistle, and filaree. Non-native plant seeds were introduced to the Bay area from the hooves and hides of cattle, from cattle feed, and in a myriad of other related ways. Introduced cattle ate and trampled native perennial bunch grasses and wildflowers, allowing the non-native species to replace the native grassland community. Today, instead of a perennial grassland that protects the soil surface, our grasslands are composed of annual weeds that die in the summer and leave the soil bare. When the fall rains come, the unprotected soil surface erodes away into the creeks. This has destroyed the soil seedbank (native grass and wildflower seeds present in healthy soil) and resulted in habitat fragmentation.

Over-grazing by cattle also results in a disturbed soil surface that provides the preferable habitat for continued non-native annual weed growth. The role of cattle grazing in spreading weeds is thoroughly discussed in Livestock Grazing and Weed Invasions in the Arid West (Belsky and Gelbard 2000), a summary of 189 peer-reviewed studies on livestock grazing's contribution to weed introductions. Invasive exotic weeds have eliminated numerous sensitive plant species in California and the East Bay.

Over-grazing by cattle has directly or indirectly led to the decline of sensitive plant species in the East Bay, and has been a factor in listing many plants as threatened, endangered, or sensitive species. For example, the Mt. Diablo fairy lantern (*Calochortus pulchellus*) and Oakland star-tulip (*C. umbellatus*)

are rare perennial lilies threatened by cattle grazing (CNPS 1994). These species are known to persist only in lands that are ungrazed, infrequently grazed, or otherwise undisturbed by management activities (Dunne 2000). Many of these traits are also common to other special status species habitats, particularly the Diablo sunflower and the bent-flowered fiddleneck - these native species are not present in most watershed areas that are grazed (Dunne 2000). Grazing is partially responsible for extirpation of some populations of large-flowered fiddleneck (*Amsinckia grandiflora*). The introduction of cattle into the Livermore area is thought to have degraded the native grasslands that once existed there which supported this species (USFWS 1985). The range and population numbers of the soft bird's-beak and palmate-bracted bird's-beak have been reduced by intensive livestock grazing (USFWS 1986, 1997b). Other listed Bay Area plants threatened by cattle grazing include the Most beautiful jewelflower, Presidio clarkia, pallid manzanita, and Contra Costa goldfields (CDFG 1992; USFWS 1995, 1997c, 1998b, 1998c).

Because the federally threatened Santa Cruz tarplant *(Holocarpha macradenia*) is a species that requires disturbance and remaining populations are threatened by proliferation of invasive weeds, pro-grazing advocates have latched onto this species as poster child for the benefits of livestock grazing. The tarplant evolved with disturbance from fire and native grazers, not cattle, and has responded best to burning, mowing, and scraping treatments to mimic natural disturbance (USFWS 1998d, 2000a). There is some evidence that carefully managed grazing can benefit tarplant populations by keeping non-native weeds from crowding out the species. Unfortunately, neither the EBRPD nor EBMUD practice carefully managed grazing on lands where the tarplant occurs - they permit un-managed commercial grazing. In fact, according to USFWS, heavy grazing is most likely responsible for the recent decline of four of the remaining populations (out of 20 known), including a population on EBRPD land in Wildcat Canyon over-grazed by cattle (USFWS 1998d, 2000a). The best known population of the tarplant in the East Bay was on EBMUD land at Pinole Vista before it was grazed, and there is a large population in Sobrante Regional Park that has never been grazed (J. Dunne, EBMUD, pers. comm.2001).

Where have all the oaks gone?

It is widely acknowledged and study results show that grazing is a factor in the failure of several species of California oaks to reproduce and recruit new members (CDPR 1989; Keator 1998; COF 2001). Cattle directly destroy young oak trees by trampling them and eating them. Historically, oaks have been cut down for many reasons, including by ranchers to try to get more forage production. Loss of these oaks translates into loss of biodiversity (over 300 species of vertebrates and 5000 invertebrates directly or indirectly require oaks). Numerous East Bay Regional Parks with heavy cattle grazing have large areas which exhibit poor or no oak regeneration.

Impacts of grazing on other native species

Grazing has been shown to reduce songbird diversity, in particular, at Point Reyes in Marin (Holmes 2000). Cattle grazing is also a threat to local migratory habitat for the Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), a riparian dependent species. Sunol Regional Park is one of the few areas in California where it may still be present. According to CDFG, the major threat to the species is loss and degradation of its riparian habitat, including adverse impacts from water projects and livestock grazing (CDFG 1992).

Tule elk (which occur in the Sunol area) are negatively affected by cattle grazing, due to competition with cattle for preferred forage and browse, the possibility of disease spread by livestock, and the effects of fences on their mobility. Numerous studies have documented that elk will leave an area where cattle are introduced and prefer those areas ungrazed by cattle (Wagner 1978). A study by Jon Skovlin (1968) found that elk use was significantly lower on ranges co-habited by cattle than in those where cattle use was restricted. Cattle serve as vector to spread disease and parasites, both native and exotic, to wild animals. Cattle have been documented to pass numerous diseases to wildlife, such as brucellosis, circling disease, encephalitis, tuberculosis, pneumonia, and bluetongue. Wyoming Game and Fish Department officials believe that widespread ranching that forces elk to concentrate in localized areas is the main reason the number of elk calves born in that state has declined in recent years (Jacobs 1991).

References

Armour, C. L., D. A. Duff, and W. Elmore. 1994. The effects of livestock grazing on western riparian and stream ecosystems. Fisheries 19(9): 9-12.

Behnke, R. J., and R. F. Raleigh. 1978. Grazing in the riparian zone: Impact and management perspectives. Pp. 184-189 *In* R. D. Johnson and J. F. McCormick (technical coordinators), Strategies for protection and management of floodplain wetlands and other riparian ecosystems. U. S. Department of Agriculture, Forest Service General Technical Report WO-12.

Belsky, A. J., A. Matzke, and S. Uselman. 1999. Survey of livestock influences on stream and riparian ecosystems in the Western United States. Journal of Soil and Water Conservation 54(1): 419-431.

Belsky, A. J., and J. L. Gelbard. 2000. Livestock grazing and weed invasions in the arid west. Oregon Natural Desert Association, Bend, Oregon.

Biosystems Books. 1994. Bay Checkerspot Butterfly and Lange's Metalmark Butterfly. *In* Life on the Edge.

Bookman-Edmonston Engineering, Inc. 1995. Alameda Creek Water Resources Study. Prepared for San Francisco Water Department.

Bookman-Edmonston Engineering, Inc. 1995C. Appendix C. Alameda Creek Riparian Vegetation Baseline Assessment, Technical Report May 1993. Prepared for San Francisco Water Department.

Bookman-Edmonston Engineering, Inc. 1995D. Appendix D. Alameda Creek Re-vegetation/Restoration Report February 1993. Prepared for San Francisco Water Department.

Bryant, L. D. 1985. Livestock management in the riparian ecosystem. Pp. 285-289 *In* R. R. Johnson, C. D. Ziebell, D. R. Patton, P. F. Folliott, and R. H. Hamre (technical coordinators), Riparian ecosystems and their management: Reconciling conflicting uses. U. S. Department of Agriculture, Forest Service, General Technical Report RM-120.

Buckhouse, J. C., J. Skvolin, and R. Knight. 1981. Streambank erosion and ungulate grazing relationships. Journal of Range Management 34(4): 339-340.

California Department of Fish and Game (CDFG). 1992. Presidio clarkia. In Annual Report on the Status of California State Listed Threatened and Endangered Animals and Plants.

California Department of Fish and Game (CDFG). 1996. Steelhead Restoration and Management Plan for California.

California Department of Parks and Recreation (CDPR). 1989. Long-term vegetational responses documented in grazed and ungrazed sites at Mt. Diablo State Park. Information Paper III.

California Native Plant Society (CNPS). 1994. Inventory of Rare and Endangered Vascular Plants of California. Sacramento, CA.

California Oak Foundation (COF). 2001. Letter to EBRPD Grazing Review Task Force.

Center for Biological Diversity (CBD). 1999 and 2000. Letters and photos of 11/3/99, 11/16/99, 1/4/00, and 4/4/00 documenting cattle damage in Sycamore Creek.

Cordone, A. J., and D. W. Kelley. 1961. The influence of inorganic sediment on the aquatic life of streams. California Fish and Game 47(2): 189-228.

DiDonato, J. 1998. Threatened and endangered species. Provided by Wildlife Department, EBRPD, 9/9/98.

Doran, J. W., J. S. Schepers, and N. P. Swanson. 1981. Chemical and bacteriological quality of pasture runoff. Journal of Soil and Water Conservation 1981: 166-171.

Dunne, J. 1995. Simas Valley lowland aquatic habitat protection: Report on the expansion of red-legged frogs in Simas Valley, 1992-1995. East Bay Municipal Utility District Report, Orinda, California.

Dunne, J. 2000. The Status of the Mt. Diablo Fairy Lantern (*Calochortus pulchellus*) and Oakland Star-tulip (*C. umbellatus*) on or adjacent to the EBMUD East Bay Watershed. Draft. EBMUD Fisheries and Wildlife Division, January 2000.

East Bay Regional Park District (EBRPD). 1996. EBRPD 1996 aquatic inventory data. Provided by Fisheries Department, EBRPD.

Elam, D. R. et al. 1998. Draft Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area. U. S. Fish and Wildlife Service, Pacific Region.

Elmore, W., and R. L. Beschta. 1987. Riparian responses to grazing practices. Pages 442-457 *In* R. J. Naiman, editor. Watershed management. Springer-Verlag, New York.

Freemire, J. 2000. EBRPD Naturalist, Sunol Wilderness, pers. comm., 2000.

Friends of Sycamore Valley (FSV). 2002. An assault on biodiversity in the name of wildlands and habitat preservation. The truth about the EBRPD Grazing Task Force review & the impacts of cattle grazing in East Bay Regional Parks.

Hayes, M. P. and M. R. Jennings 1988. Habitat Correlates of the Distribution of the California red-legged frog (*Rana aurora draytonii*) and the foothill yellow-legged frog (*Rana boylii*): Implications for management. Pp. 144-158 In: R. C. Szaro et al. (Technical coordinators), Proceedings of the Symposium on the Management of Amphibians, Reptiles and Small Mammals in North America. U. S. D. A., Forest Service, General Technical Report RM-166.

Holmes, A. 2000. Grazing impacts. Point Reyes Bird Observatory.

Jacobs, L. 1991. Waste of the West: Public Lands Ranching.

Jennings, M. R., M. P. Hayes, and D. Holland. 1992. Petition to list the California red-legged frog. Submitted to U. S. Fish and Wildlife Service January, 1992.

Jennings, M. R. and M. P. Hayes. 1994. California red-legged frog. *In* Amphibian and reptile species of special concern in California. California Department of Fish and Game, Rancho Cordova, California. pp. 74-78.

Jennings, M. R. and M. P. Hayes. 1994a. California tiger salamander. *In* Amphibian and reptile species of special concern in California. California Department of Fish and Game, Rancho Cordova, California.

Jones, K. B. 1979. Effects of overgrazing on the lizards of five upper and lower Sonoran habitat types. Cal-Neva Wildlife Transactions 1979: 88-101.

Jones, K. B. 1988. Comparison of herpetofaunas of a natural and altered riparian ecosystem. Pp. 222-227 *In* R. C. Szaro, K. E. Severson, and D. R. Patton (technical coordinators), Proceedings of the symposium of the management of amphibians, reptiles, and small mammals in North America. U.S. Department of Agriculture, Forest Service, General Technical Report RM-166.

Kauffman, J. B., W. C. Krueger, and M. Varva. 1983. Impacts of cattle on streambanks in northeastern Oregon. . Journal of Range Management 36(6): 683-685.

Kauffman, J. B., and W. C. Krueger. 1984. Livestock impacts on riparian ecosystems and stream side management implications: A review. Journal of Range Management 37(5): 430-437.

Knapp, R. and Matthews. 1996. Livestock Grazing, Golden Trout, and Streams in the Golden Trout Wilderness, California: Impacts and Management Implications.

Marlow, C. B., and T. M. Pogacnik. 1985. Time of grazing and cattle-induced damage to streambanks. Pp. 279-284 *In* R. R. Johnson, C. D. Ziebell, D. R. Patton, P. F. Folliott, and R. H. Hamre (technical coordinators), Riparian ecosystems and their management: Reconciling conflicting uses. U. S. Department of Agriculture, Forest Service, General Technical Report RM-120.

McGinnis, S. M. 1992. Habitat Requirements, Distribution, and Current Status of the Alameda Whipsnake, *Masticophis lateralis euryxanthus*. Report prepared for the U. S. Fish and Wildlife Service, Sacramento, California.

Moyle, P. B. 1993. Letter to Joshua Milstein, City and County of San Francisco, dated March 25, 1993. From SFPUC files.

Murphy, K. and N. Sidhom 1996. Alameda Creek, Alameda County Stream Inventory Report. California Department of Fish and Game, Region 3.

National Marine Fisheries Service (NMFS). 1997. Final Rule Listing Central California coast Steelhead Trout as a Threatened Species under the Endangered Species Act. Federal Register, 62 Fed. Reg. 43937.

National Marine Fisheries Service (NMFS). 2000. A Citizen's Guide to the 4(d) Rule for Threatened Salmon and Steelhead on the West Coast.

Platts, W. S. 1991. Livestock grazing. Pages 389-423 *In* W. R. Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society, Special Publication 19, Bethesda, Maryland.

Schneider, G. 2002. An assault on biodiversity in the name of wildlands and habitat preservation. The truth about the EBRPD Grazing Task Force review and the impacts of cattle grazing in East Bay regional parks. Friends of Sycamore Valley.

Schultz, T. T., and W. C. Leininger. 1990. Differences in riparian vegetation structure between grazed areas and exclosures. Journal of Range Management 43: 295-299.

Siekert, R. E., Q. D. Skinner, M. A. Smith, J. L. Dodd, and J. D. Rogers. 1985. Channel response of an ephemeral stream in Wyoming to selected grazing treatments. Pp. 276-278 *In* R. R. Johnson, C. D. Ziebell, D. R. Patton, P. F. Folliott, and R. H. Hamre (technical coordinators), Riparian ecosystems and their management: Reconciling conflicting uses. U. S. Department of Agriculture, Forest Service, General Technical Report RM-120.

Skovlin, J. M. et al. 1968. The Influence of Cattle Management on Deer and Elk. Transactions of the 33rd North American Wildlife Conference, pp. 169-181.

Szaro, R. C., S. C. Belfit, J. K. Aitkin, and J. N. Rinne. 1985. Impact of grazing on a riparian garter snake. Pp. 359-363 *In* R. R. Johnson, C. D. Ziebell, D. R. Patton, P. F. Folliott, and R. H. Hamre (technical coordinators), Riparian ecosystems and their management: Reconciling conflicting uses. U. S. Department of Agriculture, Forest Service, General Technical Report RM-120.

Trimble, S. W., and A. C. Mendel. 1995. The cow as a geomorphic agent, a critical review. Geomorphology 13: 233-253.

U. S. Fish and Wildlife Service (USFWS). 1985. Endangered and Threatened Wildlife and Plants; Determination That Amsinckia Grandiflora is an Endangered Species and Designation of Critical Habitat. 50 CFR Part 17, Federal Register, May 8, 1985.

U. S. Fish and Wildlife Service (USFWS). 1986. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Cordylanthus palmatus (Palmate-Bracted Bird's-Beak). 50 CFR Part 17, Federal Register, July 1, 1986

U. S. Fish and Wildlife Service (USFWS). 1987. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Bay Checkerspot Butterfly (Euphydryas editha bayensis). 50 CFR Part 17, Federal Register, September 18, 1987.

U. S. Fish and Wildlife Service (USFWS). 1993. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Giant Garter Snake. 50 CFR Part 17, Federal Register, October 20, 1993.

U. S. Fish and Wildlife Service (USFWS). 1994. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Conservancy Fairy Shrimp, Longhorn Fairy Shrimp, and the

Vernal Pool Tadpole Shrimp; and Threatened Status for the Vernal Pool Fairy Shrimp. 50 CFR Part 17, Federal Register, September 19, 1994.

U. S. Fish and Wildlife Service (USFWS). 1995. Final Rule listing the Presidio clarkia as an endangered species.

U. S. Fish and Wildlife Service (USFWS). 1996. Final Rule listing the California red-legged frog as a threatened species. Federal Register, 63 Fed. Reg. 54938.

U. S. Fish and Wildlife Service (USFWS). 1997. Final Rule listing the Alameda whipsnake as a threatened species. Federal Register, 62 Fed. Reg. 64306, May 23, 1996.

U. S. Fish and Wildlife Service (USFWS). 1997a. Final Rule listing the callippe silverspot butterfly as an endangered species. Federal Register, 62 Fed. Reg. 64306.

U. S. Fish and Wildlife Service (USFWS). 1997b. Final Rule listing the soft bird's-beak as an endangered species.

U. S. Fish and Wildlife Service (USFWS). 1997c. Final Rule listing the Contra Costa goldfields as an endangered species.

U. S. Fish and Wildlife Service (USFWS). 1997d. Draft Recovery Plan for Seven Coastal Plants and the Myrtle's Silverspot Butterfly. USFWS Region 1, Portland, Oregon.

U. S. Fish and Wildlife Service (USFWS). 1998. Bay Checkerspot Butterfly. In Draft Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area.

U. S. Fish and Wildlife Service (USFWS). 1998b. Most beautiful jewelflower. In Draft Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area.

U. S. Fish and Wildlife Service (USFWS). 1998c. Final Rule listing the pallid manzanita as a threatened species.

U. S. Fish and Wildlife Service (USFWS). 1998d. Proposed Rule listing the Santa Cruz tarplant as a threatened species. March 20, 1998 (63 FR 15142).

U. S. Fish and Wildlife Service (USFWS). 2000. Draft recovery plan for the California red-legged frog (*Rana aurora draytonii*). Region 1 U. S. Fish and Wildlife Service, Portland, Oregon.

U. S. Fish and Wildlife Service (USFWS). 2000a. Final Rule listing the Santa Cruz tarplant as a threatened species. March 20, 2000 (65 FR 14898).

U. S. Fish and Wildlife Service (USFWS). 2000b. Final Rule to list the Santa Barbara County Distinct Population of the California tiger salamander as Endangered. Federal Register, Vol. 65, Page 57242, September 21, 2000.

Wagner, F. H. 1978. Livestock Grazing and the Livestock Grazing Industry. In Wildlife in America, pp. 121-145. H. P. Brokaw, Editor. Council on Environmental Quality, Washington, D. C.

White, R. R. 1986. Pupal Mortality in the Bay Checkerspot Butterfly. Journal of Research in the Lepidoptera 25: 52-62.

Zeiner, D. C. et al. 1988. California's Wildlife. Volume I. Amphibians and Reptiles. California Statewide Wildlife Habitat Relationships System, California Department of Fish and Game, Sacramento, California.