

**2008**  
**CENTRAL COAST CATTLEMEN'S**  
**GRAZING LANDS NON-POINT SOURCE APPROACH**

**STATEMENT OF PURPOSE**

As a result of increased surface water quality monitoring, certain water bodies on the Central Coast have been deemed impaired for a variety of constituents. Some constituents such as pathogens or sediment have been assumed to be associated with cattle grazing activities. Subsequently, in 2006 The Central Coast Regional Water Quality Control Board (RWQCB) began dialog with the Central Coast Cattlemen regarding their impacts to water quality while simultaneously conducting an active assessment of the potential for water quality impacts due to grazing and livestock operations.

In response to discussions with RWQCB, and as the Central Coast Cattlemen take seriously their land stewardship mission; this document was created as a basis for the application of appropriate grazing management measures for California's Central Coast region rangelands with respect to protecting or enhancing the region's water quality. The primary goals of these measures are to:

1. Maintain and or enhance the quality of the region's water resources, stressing prevention rather than costly fixes and monitoring.
2. Stress voluntary participation through education, technical assistance, incentives and emphasize the benefits of such an approach.
3. Reduce conflicting and duplicative regulatory authorities, fees and permit requirements in order to encourage implementation of management measures that will produce net water quality and other environmental gains.
4. Focus implementation and monitoring at the ranch and/or watershed level.
5. Balance legal requirements with the need for site-specific flexibility and economic feasibility for rangeland managers.
6. Identify gaps in information that may prove critical for taking a science based and economically sustainable approach to protecting water resources, particularly with respect to pathogenic loading.

**BACKGROUND**

**Project Area**

There are about 57 million acres of primary rangeland (i.e. suitable for grazing) in the State of California<sup>1</sup>. About 34 million are actually grazed by cattle or sheep.

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<sup>1</sup> The Changing California, Forest and Range 2003 Assessment, State of California, The Resource Agency, California Department of Forestry and Fire Protection, Fire and Resource Assessment Program (FRAP), Assessment Summary, October, 2003. <http://www.frap.cdf.ca.gov/assessment> 2003

These lands may be either public or private. The public sector represents about 57% of the total grazing acres while the most productive grazing lands are in the private sector. Annual grasslands, coastal prairies and hardwood woodlands comprise the most important and productive rangeland in the state.

In 2003, there were about 7,244,000 acres of forest and rangeland on the Central Coast composed of conifer forest, conifer woodland, hardwood forest, hardwood woodland, shrub, and grassland. Approximately 4,786,000 acres or 66% of rangeland acres were privately owned. About 2,104,000 acres of all Central Coast rangeland are in shrub; but only about 500,000 of that is in private land. In Region 3, about 4,000,000 acres of private land were either in hardwood woodland or grasslands. In terms of public rangeland; 23%, 4%, and 6% of the total rangeland acres were respectively owned by the US Forest Service, BLM and other miscellaneous public entities. For the purposes of this report, "grazing lands" will connote grazing acres composed of hardwood woodlands and grasslands. Other rangeland types mostly tend to be held in public ownership.

It should be noted that major changes have occurred in land ownership through land conversions from rangeland to other uses in the past few years throughout the region. For example, in Santa Barbara County, the number of cattle operations declined by 40 percent in five years (2002-2007). Grazing lands declined by 18,385 acres in 20 years with about 8,000 acres being converted to other agricultural uses and 10,000 acres being removed from the agricultural land base. In some areas, land conversions have been more pronounced. (See Appendix C: 3, 4 & 5)

Historically, California Cattlemen have been proactive in regards to land stewardship. In late 1989, California's Range Management Advisory Committee (RMAC) to the State Board of Forestry, composed of livestock industry and public members, identified water quality as a priority issue. This resulted in the development of a statewide Rangeland Water Quality Management Plan and the 15 hour Rangeland Water Quality Planning Short Course (Short Course) which was jointly conceived and delivered by the University of California Cooperative Extension (UCCE) and USDA Natural Resources Conservation Service (NRCS). The Central Coast Cattlemen actively participated in these endeavors with 392 ranchers attending the Short Course between 1997 and 2007. This represented 278 ranches with about 900,000 acres. Of the operations that attended the Short Course, about 81% of the acres were covered by a Ranch Water Quality Plan. (See Appendix C: 6)

There is a direct and documented correlation between education and implementation of management practices. According to UC Davis who maintained Short Course statistics, more than two-thirds of the 800 ranchers (representing more than 1.5 million acres) who took the Rangeland Water Quality Short Course between 1997 and 2004 have implemented "best management practices" that addressed potential pollution sources that they identified in their water quality plans. (See Appendix C: 7)

## **Regulation**

In November of 2006, the Central Coast Regional Water Quality Control Board (RWQCB) decided to continue their evaluations of regulations and requirements for grazing and livestock operations. Specifically, their goal was to determine the degree to which this land use might be contributing to any water quality impacts associated with coliform bacteria (coliform bacteria are not pathogenic and do not cause contamination, but E.coli or salmonellae do) contamination of food crops. In June of 2007, RWQCB staff wrote that they planned to “continue to evaluate impacts from grazing, rangeland and livestock operations in the Central Coast Region and to “make a decision to pursue (or not to pursue) region-wide regulations for grazing and livestock operations”. To that end, the RWQCB staff solicited the input of the region’s grazing industry leaders, and in August, 2007, members representing the affected Central Coast Counties Cattleman’s Associations began to work together in an effort to proactively inform staff regarding conditions of, benefits to, and grazing management practices employed to protect Central Coast water quality and grazing lands.

In August, 2008, RWQCB formalized their regulatory policy relative to grazing lands by stating that “*a region-wide approach is not necessary at this time*”...Staff evaluated data and “found that water quality in streams with tributaries and runoff draining mostly from grazed lands did not always carry fecal indicator bacteria concentrations above the water quality standard. Furthermore, the concentrations of fecal indicator bacteria in grazed areas were often lower than concentrations in streams with tributaries and runoff draining urbanized or irrigated agricultural lands. Staff further determined that additional data [is needed] to better assess pollutant loading and other impacts from grazing and livestock operations. The data used in this evaluation was limited because monitoring stations were not deliberately located to directly assess the potential impacts of grazing activities. Consequently, [RWQCB] staff is expanding the monitoring and assessment capabilities and partnering with dischargers and other organizations to evaluate these and other key parameters that indicate watershed impacts of various land uses, including grazing. RWQCB will regulate on a watershed basis in impaired waterbodies that are scheduled for TMDL programs such as in the Lower Salinas River Watershed in Monterey County, San Benito River Watershed in San Benito County and the Lower Santa Maria River Watershed in Santa Barbara County. Owners and operators of grazing and livestock operations in impaired waterbodies will be required to develop non-point source implementation plans for their operations, implement management practices, and report their implementation practices and monitoring results to RWQCB.

### **Benefits of Grazing**

Grazing animals occur naturally as integral members of rangeland ecosystems or communities, and have shaped - and been shaped by - the ecology of California’s Central Coast. Throughout time and in response to geological and climatic changes, the distribution and type of both plant and animal species have continually shifted. Domesticated livestock, along with native grazing species, have been a part of that ecosystem for the last few hundred years along the Central Coast. In fact, based on historical accounts, the current distribution and concentration of domestic grazing

animals are at low levels when compared with levels prior to the Gold Rush. Indeed, the absence of grazers in many parts of the Central Coast region has had negative impacts on watersheds that scientists are just beginning to explore and understand. Grazing, once banished from a number of publicly owned grasslands in the later half of the 20<sup>th</sup> Century, is now being encouraged to return and the perceptions once held about the negative impacts of grazing are shifting in its favor. However, returning grazing to these grasslands is often proving difficult for its removal has resulted the removal or neglect of the infrastructure that supported the grazing. (See *Appendix C: 8*)

Recently, there has been broad recognition of the many benefits that grazing Provides. This is apparent through the unprecedented efforts of a wide range of stakeholders, environmentalists, conservationists, ranchers and government agencies, who have joined together to form the California Rangeland Conservation Coalition. This group recognizes the critical role of economically viable and sustainable grazing in the maintenance and protection of California's water resources, its critical wildlife habitat and native plant communities, and the reduction of the intensity of wild land fires, all while preserving working landscapes and views as a public benefit. In addition, the grazing of rangelands contributes property tax revenue, creates economic value and plays an important part in the overall supply of food and fiber.

While the awareness of the importance of grazing in California has dramatically increased over the last several years, much of the current literature available with respect to appropriate grazing management measures is supported by scientific studies conducted in geographic areas with geological, climatic and riparian conditions dissimilar to those of the Central Coast. Although, it is true there are some in the Central Coast. It is critical that sound science be used when shaping policy and regulation with respect to local water quality. An attempt has been made to compile pertinent science and to tailor these measures to conditions that are unique to the Central Coast. (See *Appendix C: 9*)

***The Benefits of Grazing Abstracts may be found in Appendix B.***

## **GRAZING MANAGEMENT MEASURES FOR THE CENTRAL COAST**

### **Riparian Habitats**

The focus of The Grazing Management Measures is the protection and enhancement of water quality and riparian habitat. Riparian habitat conditions may be beneficially influenced by properly managing livestock use of riparian areas, especially during periods of streambank instability and regrowth of riparian vegetation. In the Central Coast region, most grazing activity occurs on rangelands that are in the upper reaches of larger watersheds or small coastal watersheds and where topography can be steep. Rangeland watercourses are often steep in gradient, frequently seasonal and compositionally variable in terms of riparian vegetation depending on underlying geology, topography, aspect and microclimate. A number of management tools can be successfully utilized to help manage livestock

use of riparian habitats and to minimize impacts to or enhance habitat conditions for riparian species. (See Appendix C: 10)

### **Measures for managing livestock use of riparian habitats:**

1. The installation of alternative drinking sources, where feasible, can be extremely effective for minimizing the use of sensitive riparian habitat. If given a choice, livestock will tend to avoid the effort required to traverse into gullies, ravines or canyons to find water. The development of springs and seeps by excavating or cleaning and providing for additional impoundment and troughs can help minimize livestock use of streams. Active stock ponds have been found to provide high quality habitat for California red-legged frogs and grazing around pond margins has been found to be beneficial in maintaining habitat. Pond development and targeted grazing can be an effective tool for managing for specific habitat conditions.
2. Salt and mineral supplements may be placed in locations and at distances adequate to protect riparian habitat. Livestock are attracted to salt and mineral supplements and will tend to congregate in the vicinity, making them a useful management tool to help distribute cattle away from riparian areas and to places within pastures that they may not otherwise utilize. (See Appendix C: 11)
3. While fencing can sometimes be effective for dispersing livestock from sensitive riparian habitats, steep terrain and heavy riparian vegetation, including brush and trees combine to make fencing impractical for some areas in Central Coast rangelands. Fencing in this setting can be extremely difficult and expensive to construct and maintain compared to the more practical use of fencing in pasture settings. (See Appendix C: 12 & 13)
4. If adequate shade is unavailable away from riparian habitat, additional shade, including artificial shelters may be placed so they help to protect sensitive areas from overuse.
5. If supplemental feeding is utilized during the fall and winter months, feeding can occur away from riparian habitats to reduce the deposition of fecal material near water bodies as well as protect riparian vegetation and minimize the potential for increased sedimentation.
6. Consideration should be given to the placement and/or maintenance of ranch road and trail access points at stream crossings in order to minimize stream channel and riparian disturbance. Some stream or ranch road crossings may need to be hardened. (See Appendix C: 14)

### **Healthy Plant Communities**

The timing of grazing and planning for the recovery of grazed plants is critical to the health of rangeland plant communities. Well planned grazing helps invigorate grazed plant communities, build soil, minimize soil erosion and compaction and optimize water infiltration and quality. While guidelines recommended by the University of California Cooperative Extension and/or the Natural Resource Conservation Service can help approximate stocking rates, ultimately, site specific

and seasonal conditions dictate the proper timing of grazing, as well as stocking rates conducive to achieving appropriate forage utilization. Interpretation of these conditions requires knowledgeable management. (See *Appendix C: 15 & 16*)

Forage growth and production vary greatly from season to season on the Central Coast rangelands, as well as according to location. Peak forage availability and quality may extend from late winter through late summer. Forage is composed primarily of annuals, which sprout with the onset of the first significant rains. Forage production is slow during the colder periods and the shorter days of winter and increases during the warmer and longer days of spring. Ripening occurs and nutrition peaks as soil moisture is exhausted by the beginning of May or June. The nutritional level of dry upland forage drops throughout the fall and early winter. A number of measures can be utilized to ensure appropriate stocking rates and to promote healthy plant communities.

**Measures for maintaining healthy plant communities:**

1. Foraging behavior and forage intake varies according to the type of livestock being grazed. Sheep and goats have greater intake rates when measured as a percentage of live weight than do cattle, and tend to be more selective of the plants they graze, utilizing a higher percentage of browse. Appropriate species selection and stocking rates must be assessed. Cattle have become the livestock of choice for best utilizing the grazing conditions found on Central Coast rangeland. (See *Appendix C: 17, 18, 19 & 20*)
2. Livestock class, health and condition impacts forage intake. Pregnancy and lactation can significantly increase demand, as can the additional expenditure of energy exerted in obtaining water during the dry season and the energy expended to combat the chill and wet of winter months. Stocking rate should be adjusted to accommodate these factors.
3. Livestock distribution impacts forage production and availability. The choice and effective management of grazing systems can maximize forage production and encourage stable plant communities. On the Central Coast, continuous, season long grazing is typically utilized on larger ranches. This method, practical for Central Coast rangeland conditions, requires far less fencing and fewer water sources. Continuous grazing can lead to underutilization of forage in some areas and over-utilization in others, and may reduce the overall stocking levels that could be achieved through the application of planned grazing which alternately employs more intensive grazing with rest periods. When utilizing a continuous grazing system, herding can be effectively utilized to reduce grazing pressure in specific areas. Planned grazing can be effective at maximizing forage production and utilization, but requires additional management and, sometimes, labor. (See *Appendix C: 21 & 22*)
4. Wildlife forage utilization must be accounted for when assessing stocking rates. In some areas, wildlife may consume a significant amount of forage. Excessive rooting of wild pigs can severely impact riparian vegetation and forage growth and can increase the aggressive establishment of non-native weed species. Hunting pressure, where it can be appropriately applied, can be extremely effective at moving pigs away from sensitive areas. Hunting can also be used to

help generate ranch income and can potentially offset the costs associated with forage loss. Ground squirrels and gophers can also significantly impact forage availability and quality. Encouraging a healthy population of natural predators (raptors, bob cats, coyotes and herons) can be effective in managing these populations. (See Appendix C: 23)

5. Non-native, invasive weeds and brush can reduce forage production and lower forage quality. Well-managed rangelands present fewer weed problems, and grazing at appropriate stocking rates is effective for managing invasive weeds. Grazing by livestock can be effectively employed to reduce dangerous fuel levels on rangelands.
6. Prescribed burning, while a potential tool for managing vegetation, is site specific, because there are local impacts on air and water quality, wildlife and human populations, and liability and regulatory issues that need to be considered. (See Appendix C: 24)

### **Nutrient Input and Pathogen Loading**

Manure from livestock has been utilized throughout history as the principal source of fertility for agricultural soils, forage and food crops. It provides important nutrient inputs utilized by microbes that in turn cycle mineral and organic compounds essential for healthy plant growth. The use of manure-based fertilizers on crop fields has increased throughout the Central Coast as more and more acres are dedicated to organic food production. However, over use by livestock and wildlife of rangelands has the potential to impact water quality negatively if excessive amounts of organic sediments and bacterial contaminants enter aquatic systems. The issue of food crop contamination from pathogenic bacteria has focused attention on how proper grazing management measures can be utilized to minimize the risk of crop contamination. In the Central Coast, rangeland and associated grazing management in close proximity with irrigated croplands may create the potential for pathogenic contamination. Ongoing scientific studies are beginning to yield much needed information about the initial sources of pathogenic contamination of food crops. Genetic source testing shows that there are many sources of bacterial contamination, including pets, wildlife, human, livestock and avian populations. Initial results from studies also indicate that the transport of pathogenic bacteria from managed rangelands depends on a number of factors, including presence of wildlife, vegetative buffers, runoff patterns and soil saturation levels. Managing for maximum filter capacity of rangelands can minimize transport of manure and/or organic sediments onto adjacent cropland and into streams. (See Appendix C: 25 & 26)

### **Measures for managing nutrients and potential pathogenic contamination from livestock:**

1. Time of use, relative to season, vegetation growth, crop production patterns and weather, can be very effective and of minimal cost in preventing pathogen movement onto crops.
2. Communication between farmers and livestock managers can be effective to this end as well.
3. Keeping livestock from loafing and over utilizing areas immediately adjacent to

cropland can effectively reduce the deposition of manure, help minimize soil compaction and maintain healthy plant communities in order to maintain infiltration and filtering capacity. If supplemental feeding is utilized during the fall and winter months, feeding should occur away from sensitive areas in order to reduce the deposition of excessive fecal material, soil compaction and loss of vegetative cover/filtering capacity.

4. The installation of alternative drinking sources, where feasible, can be extremely effective for minimizing livestock use of sensitive areas and streams. The development of springs and seeps away from sensitive crops and providing for additional impoundment and troughs can help minimize livestock use and thus reduce the risk of pathogenic contamination.
5. Salt and mineral supplements should be placed in locations and at distances adequate to protect sensitive areas. *(See Appendix C: 27)*
6. Use of sensitive habitat by wildlife, particularly wild pigs, should be monitored. During the dry season, pigs like to wallow in streams and wet areas and may be drawn from rangelands into irrigated crop land on a seasonal basis, depending on water availability and foraging opportunities. Hunting pressure or trapping may be effective at moving pigs away from sensitive areas or where there is concern about their access directly into cropland. *(See Appendix C: 28)*
7. While expensive and impractical in many Central Coast rangeland settings, the use of fencing may be an appropriate alternative for excluding livestock from areas directly adjacent to sensitive crops, and to create buffers between areas of particular concern and livestock. Alternatively, the appropriate selection of crops less sensitive to pathogenic contamination in those areas impacted by wildlife or adjacent land uses can also minimize risk. *(See Appendix C: 29)*
8. Pens or small pastures used to confine livestock that are in close proximity to sensitive crops, particularly those used during periods when there is significant hydrologic activity, should be located in areas where they have drainage that provides adequate filtering capacity to protect sensitive areas.
9. Application of inorganic fertilizers on rangeland is not commonly practiced throughout the Central Coast. However, if fertilizers are applied, timing of applications and consideration given to runoff patterns should dictate appropriate use.

### **Erosion and Sediment Input**

A number of factors can impact the erosion and associated sedimentation rates on rangeland. The coastal ranges of the region are experiencing extremely rapid geologic uplifting, associated with rapid hydrologic down cutting. This accounts for the Central Coast region's steep terrain and naturally high "background" sedimentation rates for upland streams. Sometimes other factors such as annual stream flow dynamics can play a bigger role than grazing in some intermittent streams. Soil compaction and over grazing can lead to decreased infiltration, increased runoff and bank instability and can lead to erosion and unnatural levels of sedimentation. Conversely, well-managed, economically sustainable rangelands can provide critical protection to watersheds by allowing a relatively low impact, ecologically natural activity to exist in a region where an increasing amount of rangeland conversion is taking place. Subdivision and rural residential development,

coupled with conversion of grazed rangelands to vineyards, poorly managed “ranchettes”, or under managed recreational use has exposed uplands to increasing amounts of disturbance. While ranchers are unable to control sediment inputs from conditions and areas outside their control, there are a number of practical management measures that can help enhance water quality by minimizing unnatural levels of sediment input. Poorly managed roads have been found to be the worst contributors to sediment from rangelands. (See Appendix C: 30)

**Measures for managing erosion and sediment input:**

1. Over-use by livestock of unstable slopes or areas prone to gullying, and riparian areas during periods when soils are heavily saturated can lead to erosion and stream bank instability. Measures employed to manage livestock use of riparian habitats, maintain or enhance healthy plant communities, and to manage nutrient inputs that can be effectively employed to minimize erosion potential.
2. Livestock kept in fenced pens, or small, restricted pastures for extended periods of time, particularly, when located on slopes, leads to loss of vegetation, soil compaction and erosion. This practice, often seen in association with “ranchettes” or rural residential use, should be avoided. When it is essential to keep livestock in pens or smaller pastures, they should be located with consideration to minimize erosion and sediment delivery. (See Appendix C: 31)
3. Supplemental feeding during the wet season results in heavy use by livestock feeding and loafing in higher concentrations. Such feeding should be conducted in areas that will avoid erosion and sediment delivery. (See Appendix C: 32)
4. Wild land fire poses not only the risk of forage and livestock loss, but can also significantly increase soil erosion and sedimentation. Grazing by livestock can be an effective tool to help reduce fire hazard by reducing the quantity of small “flashy” fuels that can dramatically influence the rate of fire spread. The risk of fire ignition can increase where dry rangelands are adjacent to highways, rural developments and recreational properties. Additional factors impacting fire hazard include the type and level of fuel loading, topography and weather conditions. In areas that are particularly at risk, firebreaks may be a useful tool to help manage the spread of fire. However, dozing or disking fire breaks on steep ground can also pose a risk of exposing soils to high intensity rains which could result in rilling or gullying. The potential of erosion from exposed firebreaks may be mitigated by the strategic placement of fire breaks and by adding water bars to disperse runoff where appropriate. Rangeland managers must assess and weigh the risk and hazard posed by fire, depending on site-specific conditions. (See Appendix C: 33)
5. Roads and livestock trails are necessary tools for providing for proper forage utilization, access to water and for rangeland maintenance. Cattle, if given a choice, prefer to traverse slopes at a low, easy gradient. This natural pattern of travel results in reducing the velocity of water transport down slope and helps minimize the risk of erosion. When soils become saturated during winter months, hooves leave traveled areas “pock marked”, which can help slow water transport and allow for increased infiltration, even on relatively compacted trails or roads. Fences, heavy brush or trees and breaks in terrain such as gullies and ravines can present barriers that alter, inhibit or adversely change livestock travel

patterns. Trails and roads used by livestock should be managed and maintained with an eye toward allowing for easy gradients by removing barriers to natural travel patterns where possible. *(See Appendix C: 34 & 35)*

6. Minimizing the width of roadbeds, use of outsloped road surfaces and the installation of frequent rolling dips and/or water bars are measures that can be effective for reducing road surface erosion. The use of ranch roads during saturated conditions should be avoided where possible. Light tracking, wide tired vehicles (such as quad runners) can be particularly useful for winter ranch maintenance. Ranch roads should be visually inspected to ensure adequate drainage during the wet season. Proper culvert maintenance and cleaning is needed.
7. Ranch roads can also provide critical access to rangelands for fire fighting equipment and crews during summer months. Roads should be assessed for their suitability for providing critical dry season access. Suitable roads should be visually inspected and maintained to allow for timely emergency access. Periodic communication with local Cal Fire station crews to update them on the availability of suitable access routes can prove useful in the event of a local wild fire emergency.
8. Excessive rooting and wallowing of wild pigs, particularly on steep topography during the wet season, can elevate the potential for surface erosion. Pig rooting should be assessed and hunting pressure applied accordingly if this is considered a viable option.
9. In some areas, trespass, particularly by bicycles and motorcycles, has become increasingly prevalent. Unmanaged recreational use, particularly during the wet season, can negatively impact vegetative cover on rangelands and can destroy road drainage structures, which may lead to rilling and erosion. Dry season trespass can increase the risk of fire ignition. Trespassing and recreational use should be managed to avoid the potential for negatively impacting erosion rates. *(See Appendix C: 36)*

## **Approaches to Effectively Monitoring Grazing Management Measures**

Approaches to monitoring the implementation and effectiveness of management measures should be science based, practical for providing for timely corrective action or effective adaptive management, and they must be cost effective. Grazing is typically a low revenue generating activity and ranching expenses must be minimized if grazing on privately owned rangelands throughout the Central Coast Region is to continue. Monitoring of management measures can best be accomplished through a practical and voluntary approach that allows ranchers, who have consistent and long term site specific knowledge of and access to private rangelands, to assess the effectiveness of their own management measures and to adapt them as necessary. Building a science based awareness of conditions beneficial for water quality is best accomplished through effective communication and education. *(See Appendix C: 37)*

### **Monitoring of riparian habitats:**

1. Visual monitoring is the most practical and cost effective approach to monitoring of riparian habitats. Seasonal visual monitoring, particularly during periods of soil saturation and after high intensity rainfall, should assess whether

riparian vegetation is sufficient to protect sensitive habitat and stream bank stability. Road crossings at streams should be visually inspected to assure that crossings are functioning properly and that there are no unnaturally elevated levels of sediment entering streams. *(See Appendix C: 38)*

2. Photo monitoring is effective for monitoring and documenting change over time of particularly sensitive riparian areas. "On the ground" photo points can be used to assess annual change in small, site-specific locations. Larger scale "watershed level" changes in riparian vegetation can be assessed over a longer periods of time by utilizing wider landscape or aerial photography. This approach has become more practical as aerial photo coverage has become increasingly available and is more frequently updated. *(See Appendix C: 39)*
3. Document off site uses or unplanned disturbances, if known, that could impact the potential for impacting riparian habitats such as flood, drought, or encroachment by invasive weed species. *(See Appendix C: 40)*

#### **Monitoring for healthy plant communities:**

1. Visual monitoring is the most practical and cost effective approach to monitoring plant health and diversity. Seasonal visual monitoring, particularly during late spring or early summer can be useful in tracking the condition of rangeland plant communities. Visual monitoring of rangeland conditions should be documented in writing so that over time, comparisons and trends in forage quality and quantity, establishment of invasive weed species, and encroachment of brush or woody species can be assessed and appropriately addressed.
2. Photo monitoring may be effective for monitoring and documenting general change in vegetation patterns over time. *(See Appendix C: 41)*
3. Photo points can be used to assess annual change in smaller, site-specific locations. Larger scale "watershed level" changes in large woody vegetation can be assessed over longer periods of time by utilizing wider landscape or aerial photography. This approach has become more practical as aerial photo coverage has become increasingly available and is more frequently updated. *(See Appendix C: 42)*
4. Note off site uses or unplanned disturbances that have the potential for impacting healthy plant communities, such as drought, fire or invasive pests. *(See Appendix C: 43)*
5. The Central Coast Rangeland Coalition is working with a group of ranchers, researchers, conservationists and government agency staff to develop a monitoring system that is acceptable to ranchers and acceptable by scientists. *(See Appendix C: 44, 45, 46, 47 & 48)*

#### **Monitoring of nutrient inputs and pathogenic contamination from livestock:**

1. The effective monitoring for nutrient inputs and contamination from livestock is best done in conjunction with university level research projects. Relatively new scientific research has led to the ability to trace the source of bacterial contamination, but is extremely specialized and expensive. The ability to trace sources of bacterial contamination is proving critical in the ongoing efforts associated with ensuring that irrigated food crops are safe, especially since multiple uses and sources of potential bacterial contamination exist throughout the Central Coast Region. This type of monitoring effort and the resources needed to accomplish it is best focused and directed at impaired water bodies at

- a watershed wide scale. (See Appendix C: 49)
2. Visual monitoring of stream crossings and riparian areas can be useful in helping assess the potential for excessive nutrient loading from livestock or wildlife. Adaptive management can be utilized to help minimize use and the potential for excessive loading.
  3. Note that off-site uses or unplanned disturbances that could impact the potential for nutrient loading or bacterial contamination, such as rural residential development or excessive wild pig use of riparian areas.

### **Monitoring of erosion and sediment input:**

1. Visual monitoring is the most practical and cost effective approach for monitoring and minimizing erosion and sediment input. Ranch roads should be visually monitored during periods of soil saturation and high intensity rainfall to ensure proper drainage and road performance. This also allows for the immediate action needed to mitigate any potential problems. Road associated problems and the necessary action required to correct them should be documented as part of an effective and proactive road maintenance program. (See Appendix C: 50)
2. Photo monitoring can be effective for documenting areas of special concern with respect to sediment delivery, such as active landslides, gullies or stream banks experiencing accelerated rates of erosion. Changes over time and actions taken to help protect sensitive areas or mitigate problems can be assessed. (See Appendix C: 51)
3. Note off site uses or unplanned disturbances, if known, that could impact the potential for increased erosion or sediment input such as fires, landslides, or excessive trespassing. (See Appendix C: 52 & 53)

### **FUTURE TACTICS & ACTIONS**

Central Coast Cattlemen will promulgate water quality protection environmental stewardship and rangeland sustainability with the following tactics and actions:

#### **Tactics #1: Education and Outreach**

The Central Coast Cattlemen feel strongly that education is the cornerstone to improvement of grazing land management relative to water quality protection. They support updating the Rangeland Water Quality Planning Short Course in order to continue outreach and education of grazing water quality protection measures to on the Central Coast. During these courses rangeland owners and managers learn about non-point source pollution and develop a water quality plan for their property. The goals for the Rangeland Water Quality Planning Short Course were stated in 1995 and remain unchanged:

- Acquire, organize, and synthesize available and newly emerging information.
- Disseminate information through rancher education.
- Develop demonstrations.
- Deliver educational programs to expanded audiences - landowners, state and county agencies, resource professionals, conservation organizations and general public.

**Action:**

- Unfortunately, UCCE's water quality and natural resource positions on the Central Coast are currently vacant; and therefore, the Cattlemen must utilize Central Coast and California non-profits to supplement outreach and education functions normally offered by University of California Cooperative Extension (UCCE). For example, The Central Coast Agricultural Water Quality Coalition is currently planning a merger with the Southern San Luis Obispo and Santa Barbara Counties Agricultural Water Quality Coalition to form one Water Quality Coalition on the Central Coast. This newly aligned Coalition will be in a position to procure funding and to provide staffing necessary to execute this tactic. The Coalition will be able to coordinate with the University of California Davis, Central Coast Cattlemen and RWQCB in order to prioritize watersheds, procure funding and provide outreach and education. Other non-profits that could assist are the California Rangeland Conservation Coalition and the Central Coast Rangeland Coalition. (See *Appendix C: 54*)
- Continue to interface with County UCCE directors, University of California, Davis, and Agricultural Commissioners to ensure livestock advisors remain a priority as new funding becomes available, staff leave, or retire. However the pending state budget crisis will likely constitute a hiring freeze for UCCE. (See *Appendix C: 55*)

**Tactic #2: Water Quality Plans**

Promote development of new Rangeland Water Quality Plans where none exist or improve plans that were created previously. While over 900,000 acres on the Central Coast have been addressed through Rangeland Water Quality Short Course, there is still much room for improvement. However, the level of outreach and the technical assistance needed to address this entire region would be a daunting undertaking. Therefore, the Central Coast Cattlemen support RWQCB's strategy to prioritize the most impaired watersheds and concentrate efforts on improving management practices through education and planning in those watersheds. The success of this watershed-based approach is demonstrated through Water Quality Planning Short Course efforts in the Pajaro River. There are about 324,949 acres in Santa Clara and San Benito Counties' portion of the Pajaro River and 296,207 acres belong to ranches that have sent one or more persons through the Short Course. These account for about 91% of the total acres in the upper reaches of the Pajaro River. (See *Appendix C: 56 & 57*)

**Action:**

- Utilize the Rangeland Water Quality Planning Short Course curriculum to provide attendees with a framework for finalizing ranch-specific Management Plans that are specific and confidential for each ranch.
- Utilize outreach and education partners such as the Central Coast Agricultural Water Quality Coalition to coordinate with UCCE, RWQCB,

NRCS, RCDs, Farm Bureaus and other entities to provide the Short Courses for ranchers in priority watersheds and to encourage completion of Ranch Water Quality Management plans through this activity.

- NRCS on-site training and technical assistance.
- Educational programs such as “Livestock and Land” which has been successfully used in the past in the coastal counties and should be available as soon as funding issues are resolved.

### **Tactic #3: Implementation of Management Practices**

The rancher is in the best position to determine which practices are relevant to ensuring environmental protection for his particular operation. Implementation of management measures can best be accomplished through a practical and voluntary approach that allows ranchers, who have generational and long- term site-specific knowledge to assess the effectiveness of their own management measures and to adapt them as necessary. (See *Appendix C: 58*)

This tactic will endorse the use of the management measures as a guide for proper range management but will not prescribe specific practices. Practices should be practical. Providing for timely corrective action or effective adaptive management, and most importantly, they must be cost effective.

#### **Action:**

- In some cases, education is sufficient and a rancher is able to implement practices based on what he has learned through educational venues. This supposition is supported by the fact that, in California, more than two-thirds of the 800 ranchers (representing more than 1.5 million acres) who attended the Short Courses between 1997 and 2004 have implemented "best management practices" that address potential pollution sources that were identified in water quality plans. (See *Appendix C: 59*)
- Other ranchers may need individual assistance with Rangeland Water Quality Plans. In that case, Central Coast Cattlemen will rely on local technical service providers such as NRCS or the local Resource Conservation Districts or nonprofits to provide that assistance.
- NRCS Ranch and Conservation Planning.

### **Tactic #4: Research**

- The Central Coast Cattlemen strongly endorse continued research so that policy and regulatory decisions are and will continue to be based on a sound scientific foundation. A science base approach is best accomplished through quantifiable activities such as management practice effectiveness measurements and research. Ongoing and future research efforts are implemented by the following researchers:

***Dr. Rob Atwill, UC Davis, Western Institute for Food Safety and Security***

Is participating in “the Lettuce Project” by working with a diverse group of agencies, including USDA’s Ag Research Service, the California Department of Health and

Human Services, and the University of California to determine routes of E. coli transmission. He hopes to influence the process with continued research and the evaluation of the entire working landscape not just a specific incident. Of note, results from the ARS lab show that feral pigs consistently carry E. coli while waterfowl have tested negative.

Is working on research to compare the movement of pathogens within a working landscape, comparing both the shedding and movement of E. coli from cattle and wildlife. He has been working with the livestock and produce industry to identify private lands to conduct his research in Monterey County and San Benito County. He hopes to have a total of 20 sites and to include 8 produce sites. UCCE and California's Wildlife Services will be working on the ground to both collect samples and trap animals. The California Department of Fish and Game has also expressed an interest in participating to measure the contributions of feral pigs and deer. DFG hopes to remove deer from the list as they are already concerned about dwindling deer populations in the region and, if implicated, could lead to further reductions in the deer population. Human feces is currently not on the list to be tested. The study will focus on livestock and wildlife, but common knowledge and the report released last year by Human and Health Services confirms humans and unsanitary practices can contribute to O157:H7 contamination. Dr. Atwill stated the human factor has yet to be discussed with research team members, public agencies, and the public at large and further discussions will be required to include human waste in future studies.

***Trevor Suslow, UC Davis,***

Recently concluded a research project and is in the process of writing the report measuring the decay of E. coli over time. The research team sprayed a produce field with concentrations, exceeding what could possibly be shed by cattle, and found that the E. coli only survived for roughly two weeks. His evidence may narrow the range of conditions under which pathogens may transfer old feces to the produce fields during early rains before harvest and that runoff occurring in the spring would have little threat to harvest in the fall. Dr. Atwill understands the importance of this research to our industry and will follow up with Dr. Suslow and identify the timeline for the release of his report and our industry's overall interest.

***Dr. Ken Tate, UC Davis***

Provided evidence that buffer strips (recommended as a practice) in the Rangeland Water Quality Management Plan can be effective in reducing the pathogen movement across pastureland if properly implemented. The buffer strip study is ongoing at the Brown's Valley research center in the Sierra Nevada foothills.

**Action:**

- Ensure that County Cattlemen's Association memberships are well-informed regarding on-going research and how this may be translated and used to improve management practices.
- Distribute research that thoroughly demonstrates that the current BMPs identified under the Rangeland Water Quality Management Plan are effective.
- Assist researchers as much as possible to find research locations and

- cooperating ranchers
- Provide researchers with practical feedback regarding research needs and/or data interpretation.
- Additionally, monitor efforts of Central Coast Rangeland Coalition as it develops the use of rangeland indicators to assist growers with making wise management decisions. This organization will continue to research and promote methods of self- assessment and environmental monitoring in order to promote viable and sustainable range management throughout the Central Coast.
- Encourage coordination of NRCS/RCD range field trials with UCCE and other researchers for maximum benefit for research and also for the ranching community.

#### **Tactic #5: Source Testing**

Often, impairments of water quality result from exceedances of pollutants associated with ranching operations; and therefore, regulatory agency staff assumes that grazing is directly responsible. Source testing exercises in the Watsonville Slough and in the Morro Bay area demonstrated that other sources also contributed to pathogen loads. The pathogenic source data in this case are somewhat controversial; nevertheless, they identify several land uses in the watershed that contribute to exceedances. In the case of TMDL programs in priority watersheds, The Central Coast Cattlemen are concerned that regulatory staff will make pathogen load allocations on the basis of misinformed assumptions about the relative contributions of different land uses to the problem. The Cattlemen support the use of watershed-specific source testing to establish the contributions of all sources and to guide TMDL load allocations on the basis of fact rather than presumption. This, especially because source types (ranching, recreation, residential, etc.) may all vary considerably in their contributions on the basis of site-specific circumstances and management.

The results of water quality testing done on an individual Ranch will vary greatly with specific locations and seasonality. For example, examination of GIS data for a 1100 acre ranch in Monterey County shows that there could be over 30 locations which could meet the definition of "Waters of California." Most of these are minor creeks and drainage swales and have only trivial flows of less than 1 cubic feet per second and only during a rain event. Other locations may have significant flows of more than 500 cfs/during seasonal rains. The extent of pollutants in a small, localized, drainage swale or creek would be higher than in a larger flow area where dilution from large watersheds has taken place. Testing methods should be developed that emphasize sites that are in a confluence of local drainages. Sites should be selected where the testing results can be shown to have a realistic effect on water quality of influential bodies of water or watersheds. Additionally, order to evaluate results and maintain consistency in data, the timing of samples to both seasonality and rain events must be standardized.

#### **Action:**

- This is a secondary tactic in that it should occur after Tactics #1 through #4 have been fully implemented. Given current science, it is reasonable to believe that consistent and complete implementation of the above tactics will reduce pathogen and sediment loading to a minimal amount and sources related to grazing will be minimal.

## CONCLUSION

Properly managed, privately-owned rangelands on the Central Coast provide many cultural, economic, and environmental benefits to the region. Not least of these is the provision of good quality water. Ranching is a self-sustaining and integral part of the region's present ecosystem management, where livestock have been grazed since the late 1700's.

There exists a body of evidence from university research to show that livestock grazing, when managed according to some basic principles, can produce quality habitats for native plants and animals, clean water, stable cycling of nutrients, carbon and water, and economic revenues for rural coastal communities. Should grazing cease to be an economically viable activity, the benefits associated with that historical use may well also be lost. California's cattle grazing industry is at a crossroads for a variety of reasons; increased cost of production and the generally challenging economic climate, decreased availability of public lands for grazing, urban encroachment, and cumulative regulatory burden. Effects of climate change; continued land use conversions; land exclusion for preservation of rare and declining habitats, and efforts to protect scattered communities from wildfire will all have long-term and largely unpredictable impacts on commercial ranching operations.

As watershed uses become more diverse, the number of individuals or groups participating in public decision-making processes increases. Many new stakeholders lack the education and experience needed to manage complex landscapes, and come with divergent opinions and viewpoints which take time to resolve. Community outreach and education as part of a process of defining, then resolving, water quality impairments is a good approach to addressing the potential impacts that come with diverse uses. Education can best be accomplished where programs can be sustainably funded. Mitigation projects should be undertaken through community watershed groups at watershed or sub-watershed scales. Enforcement, when required, will be most effective when the RWQCB has established and well-informed community networks to interact with, and a good basis of data to work from. (See *Appendix C: 60* )

The majority of grazing throughout the Central Coast occurs on privately owned rangelands. Grazing policies on public lands are typically not made at the local level and rangeland managers have limited opportunity to provide input. However, if and when possible, affected rangeland managers should participate with public agencies in order to help influence grazing policy. (See *Appendix C: 61 & 62*)

Several watersheds in the Central Coast region are listed, under Clean Water Act

303(d), for sediment and pathogens (including fecal coliforms). Each listed watershed possesses unique topography, geology, hydrology and vegetation types. Listed impairments must be assessed in ways that best suit the unique characteristics of each watershed, and solutions must be equitably applied to all uses and non-point source impacts within the watershed. All affected individuals within each impaired watershed, including affected rangeland managers, must work together to formulate those solutions.

Maintaining proper watershed functions and healthy aquatic habitats are primary goals of the CCRWQCB. Achieving those goals will require a full partnership with land managers and stakeholders to ensure that sources are accurately identified and appropriate corrective actions are taken. The RWQCB must also continue to identify and acknowledge shortcomings in both data and management information and, recognizing that, facilitate the continuation of research leading to better and more economically sustainable methods for protecting water quality.

Ranchers are proud of their heritage and their stewardship of rangelands and most ranchers embrace proactive management practices. Ranchers, to date, have widely participated in voluntary programs such as conservation planning and implementation with NRCS and RCDs, as well as attending the Rangeland Water Quality Short Courses. The Central Coast Cattlemen will continue to encourage all ranchers to implement management measures that will produce net water quality gains, and ongoing efforts by the RWQCB should continue to emphasize water quality education, provide technical assistance and create incentives that emphasize the benefits of managing towards healthy rangeland watersheds. It is incumbent upon the RWQCB to correct known water quality issues and to strongly encourage those individuals who fail to utilize good grazing practices to adopt more appropriate management measures. *(See Appendix C: 63)*

The economic viability of grazing is threatened by increasing operational costs and markets that do not adequately cover those costs. In order to protect the economic viability of grazing and the many benefits sustainable grazing brings to rangeland watersheds, it is imperative that prevention rather than costly fixes be stressed. The RWQCB must find a balance between legal requirements with the need for site specific flexibility and economic feasibility. It is critical that additional monitoring fees, permit requirements and/or regulatory creep be avoided. *(See Appendix C: 64 & 65)*

*Note: The Benefits of Grazing will be updated over time and constantly enlarged and improved.*

## **Appendix A.**

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## Appendix B. Benefits of Cattle Grazing

### Long-term Grazing Study in Spring-fed Wetlands Reveals

**Management Tradeoffs.** *Allen-Diaz, Barbara; Jackson, Randall D.; Bartolome, James W.; Tate, Kenneth W.; Oates, Lawrence G. California Agriculture, Vol. 58, July-September, 2004.*

ABSTRACT- Spring-fed wetlands perform many important functions with oakwoodland landscapes, and livestock grazing modifies these functions. We used 10-year (long-term) and 3-year (paired-plot) experiments to better understand grazing management effects. We studied spring ecosystem responses in plant composition, diversity and cover; channel morphology; water quality; aquatic insects; and greenhouse gases. Lightly and moderately grazed wetlands exhibited lower insect family richness than ungrazed springs. Plant cover was maintained for the first seven years of grazing, and plant diversity was not significantly affected. At the same time, removal of grazing decreased emissions of the greenhouse gas methane, and increased nitrate levels in spring waters. The results reveal important management tradeoffs relevant to key response variables. In general, light cattle grazing at springs appears to be desirable from an eco-system function perspective.

### Efficacy of Natural Grassland Buffers for Removal of

***Cryptosporidium parvum* in Rangeland Runoff.** *Atwill, Edward, R.; Tate, Kenneth W.; Pereira Maria das Gracas Cabral; Bartolome, James; Nader, Glenn. Journal of Food Protection, Vol. 69, January, 2006: pp 177-184.*

ABSTRACT - Our goal for this project was to estimate the retention efficiency of natural grassland buffers for *Cryptosporidium parvum*. Three sets of 16 plots (2.0 by 3.0 m) were established at 5, 20, and 35% slopes. Within each set of 16 plots, residual dry vegetation matter treatments of 225, 560, and 900 kg/ha were implemented, along with a noncut control averaging 4,500 kg/ha. Buffer width treatments were implemented by placing cattle fecal material containing known loads of *C. parvum* 0.1, 1.1, or 2.1 m up-slope of the runoff collector. Grassland buffers of 1.1 and 2.1 m generated 3.2- to 8.8-log and 3.6- to 8.8-log retention of *C. parvum*, respectively, across the range of residual dry vegetation matter, land slope, rainfall, and runoff conditions examined during this project. Buffers with an increased percent land slope exhibited improved the retention efficiencies, whereas buffers experiencing larger maximum annual runoff events exhibited reduced retention efficiencies. Water-quality data from the 0.1-m-wide buffer plots (effectively no buffer) demonstrated that the majority of *C. parvum* oocysts (98 to 99.999%) were retained in the fecal matrix for the duration of the storm season, irrespective of the presence of a vegetated buffer. In conclusion, these results support the assertion that grassland buffers are an effective method for reducing animal agricultural inputs

of waterborne *C. parvum* into drinking and irrigation water supplies.

**Transport of *Cryptosporidium parvum* Oocysts through Vegetated Buffer Strips and Estimated Filtration Efficiency.** *Atwill, Edward R.;*

*Hou,*

*Lingling; Karle, Betsy M.; Harter, Thomas; Tate, Ken; and Dahlgren, Randy. Applied and Environmental Microbiology, November, 2002: pp 5517-5527.*

ABSTRACT – Vegetated buffer strips were evaluated for their ability to remove waterborne *Cryptosporidium parvum* from surface and shallow subsurface flow during simulated rainfall rates of 15 or 40 mm/h for 4 h. Log for spiked *C. parvum* oocysts ranged from 1.0 to 3.1 per m of vegetated buffer, with buffers set at 5 to 20% slope., 85 to 99% fescue cover, soil textures of either silty clay (19:47:34 sandsilt-clay) , loam (45:37:18), or sandy loam (70:25:5), and bulk densities of between 0.6 to 1.7g/cm. Vegetated buffers constructed with sandy loam or higher soil bulk densities were less effective at removing waterborne *C. parvum* (1- to 2-log reductions compared to buffers constructed with silty clay or loam or at lower bulk densities (2- to 3- log reductions). The effect of slope on filtration efficiency was conditional on soil texture and soil bulk density. Based on these results, a vegetated buffer strip comprised of similar soils at a slope of <20% and a length of >3 m should function to remove 99% of *C. parvum* from agricultural run-off generated during events involving mild to moderate precipitation.

**California Native Grasslands: A Historical Perspective, A Guide for Developing Realistic Restoration Objectives.** *Barry, Sheila; Larson,*

*Stephanie; George, Melvin. Grasslands, Winter, 2006.*

ABSTRACT- California's grasslands cover approximately 25% of the state, either in open grassland, oak woodland, or savanna. Although they are largely dominated by nonnative annual species, they provide essential hydrologic functions (capture, storage, and safe release of water), important for wildlife habitats (Giusti et al. 1996) and repositories of native flora diversity. Around 90% of species listed in the Inventory of Rare and Endangered Species in California (Skinner and Pavlik 1994) inhabit California's grassland ecosystems. In addition to their important ecological values, California's grasslands provide forage for range livestock, a leading agricultural commodity in the state. Despite its value for native biological diversity and range livestock, California grassland habitat is increasingly reduced in acreage and quality not only because of conversion to cropland and residential and urban development, but also because of invasion by woody species and continued nonnative species invasion. Invasion by woody and nonnative species often occurs on conservation lands, which have been protected from grazing and other disturbances.

**Effects of Livestock Grazing, Tree Thinning and Prescribed Fire on Herbaceous Vegetation Composition and Forage Production in a Ponderosa Pine Forest.** *Bartolome, James; Forero, Larry; Lile, David;*

*Huntsinger, Lynn. Presentation, Society of Range Management Annual Meeting, 2007.*

ABSTRACT- The USFS Pacific South West Experiment Station established large scale well-replicated forest thinning, fire and grazing treatments on the Black's Mountain Experimental Forest in northeastern California, a ponderosa pine, Idaho fescue range site. In 1997 four 100 ha plots were thinned to provide either a high structural diversity or a low structural diversity, and either grazed or not grazed by cattle. Each of the four plots was divided into two subplots that were either treated with prescribed fire or left unburned. The objectives of this study were to monitor long term understory plant community trends, and to quantify the effects of grazing in the presence of forest thinning and prescribed fire treatments. Areas with vegetation preferred by livestock were defined within each treatment plot (and subplot on the basis of the frequency of herbaceous forage). Transects were established and evaluate mid-season each year from 2002 through 2005 for species frequency, foliar cover, and herbaceous production. Actual grazing use was initially estimated by the landscape appearance method at the end of the grazing season and later with utilization cages. Vegetation within plots exhibited little change year to year; however, significant differences in understory herbaceous and shrub species occurred as a function of the applied treatments. Understory species composition responded significantly to the treatment interactions of grazing and thinning, grazing and fire, and thinning and fire, but productivity did not. Significant grazing impacts appear primarily to be a result of an interaction with fire and thinning in this range site.

**Lizard Abundance in Managed Central California Grasslands.** *Bell, Douglas A.; Riensche, Dave. Cal-Pac Society for Range Management Symposium -Grazing for Biological Conservation, June 23, 2006.*

ABSTRACT- In sum, research demonstrated that western fence lizard and western skink abundance tends to be higher in managed, grazed grasslands than in ungrazed grasslands at the sites included in this study. This research has significant management implications for the East Bay Regional Park District, as it will help managers to shape vegetation management strategies aimed at maintaining grassland communities in the East Bay Area. This will become increasingly important for maintaining overall biodiversity in the East Bay Area as the region continues to grow in human population. District managers also place a high premium on obtaining results from research conducted in local environments in order to help shape policy on these lands. In particular, long-term monitoring of populations and communities combined with multidisciplinary studies are needed to better understand and manage special status species in a variety of habitats including grasslands.

**Managing Change – Grazing on Western Riparian Areas.** *Chaney, Ed; Elmore, Wayne; Platts, Bill. Nonpoint Source News Notes, United States Environmental Protection Agency.*

ABSTRACT - EPA's Denver-based office (Region 8) has produced this new, attractive, informative, instructive report: *Managing Change – Livestock Grazing on Western Riparian Areas*. The report is meant for the use of ranchers and others concerned with the conservation and wise use of western range lands. Its publication is particularly apt at this time when a new administration seeks to introduce new approaches to the preservation, restoration, and environmentally sound use of these lands. As the report says: "This document is written for the most important people in the growing national effort to enhance water quality on western rangeland watersheds; the men and women who move the livestock." In 1990, EPA published the original *Livestock Grazing on Western Riparian Areas*, providing a broad view of the functions and values of western riparian areas and causes and effects of degraded riparian areas and water quality. The current report is a sequel and companion piece to its predecessor. The report indicates: "Together [the reports] are designed to foster broader understanding of how improved grazing management on western riparian areas can enhance water quality and overall productivity of rangeland watersheds.

**Stubble Height as a Tool for Management of Riparian Areas.** *Clary, Warren P.; and Leininger, Wayne C. Journal of Range Management, November, 2000. Vol. 54: pp 562-573.*

ABSTRACT- Stubble height, a measure of the herbaceous vegetation remaining after grazing, has been widely used in recent years to gage the impacts of grazing use in riparian areas. Stubble height is a short-term management guide that should only be applied to help attain long-term ecological objectives; it should not be thought of as a long-term management objective. Maintaining a minimum stubble height helps preserve forage plant vigor, retain sufficient forage to reduce cattle browsing of willows (*Salix* spp.), stabilize sediments, indirectly limit stream-bank trampling, maintain cattle gains, and provide an easily communicated management criterion. Based on limited specific research of riparian system response and on knowledge of the characteristics of how cattle graze, a 10-cm residual stubble height is recommended by the authors as a starting point for improved riparian grazing management. Monitoring should then be conducted to determine if an adjustment is needed. In some situations, 7 cm or even less stubble height may provide for adequate riparian ecosystem function, particularly when stream-banks are dry and stable or possibly at high elevations where vegetation is naturally of low stature. In other situations, 15–20 cm of stubble height may be required to reduce browsing of willows or limit trampling impact to vulnerable stream-banks. The recommended criterion would apply to streamside and nearby meadow sites with hydrophilic or potentially hydrophilic vegetation, but not directly to dry meadows or even to all wet meadows. Stubble height may have little application where the stream-banks are stabilized by coarse substrates, or the channels are deeply incised. The effects of residual stubble height in riparian functions have received limited direct experimental examination. Consequently, much of the information in this review was derived from studies indirectly related to the questions raised and, to some extent, from observations of experienced professionals. The authors have identified areas of scientific investigation needed to improve our understanding of the effects of stubble height on riparian function and grazing management.

**Watershed Research Examines Rangeland Management Effects on Water Quality.** *Dahlgren, Randy A.; Tate, Kenneth W.; Lewis, David J.; Atwill, Edward R.; Harper, John M.; Allen-Diaz, Barbara H. California Agriculture, Volume 55, November – December, 2001.*

ABSTRACT – Oak and annual grass-dominated rangelands in California occupy 7.4 million acres, often occurring at the state’s urban wildland and agricultural interface. Rapidly changing land uses in these ecosystems have watershed-scale impacts that are the subject of intense debate among policy-makers, environmentalists and landowners. Watershed research conducted at the UC Hopland Research and Extension Center (HREC) between the 1950s and 1980s provided valuable information for predicting the effects of watershed management activities – such as converting oak and chaparral to grasslands – on water quantity and quality, slope stability and erosion. The research illustrated that conversion from woodland to grassland significantly impacts the hydrology and sediment dynamics of watershed, suggesting that land-use changes such as vineyards and urban expansion must be evaluated carefully. Preliminary data from a new series of watershed studies initiated at HREC in 1998 indicate that livestock grazing does not significantly increase nutrient and sediment levels in stream water, but that current fecal coliform standards may be exceeded during storm events.

**Endangered Amphibian Research within Grazed Grasslands.** *DiDonato, Joseph. Cal-Pac Society for Range Management Symposium – Grazing for Biological Conservation – June 23, 2006.*

ABSTRACT- Livestock grazing is an effective tool for maintaining open grasslands and oak savannah communities. There appears to be a strong association between these grazed communities, burrowing rodents, and the presence of tiger salamanders. Furthermore, compaction and reduction of vegetation by livestock has been documented to increase the ponding duration of vernal pools and seasonal ponds. The creation of stockponds has created highly suitable reproductive habitat for tiger salamanders. On District lands tiger salamanders breed exclusively in seasonal and perennial stockponds. The district supports over 500 adult Red legged frogs, and the vast majority of water bodies that support Red-legged frogs also provide water for livestock. These stockponds provide highly suitable habitat that has augmented the Red legged frog population in the East Bay. In summary, Red-legged frogs are certainly compatible with range management utilizing livestock as a tool. Amphibians evolved with disturbances associated with large herbivores and such animals continue to play an important role in these ecosystems. Furthermore, the USFWS recent ESA 4d rule exempts routine grazing practices as part of the endangered species act. It was also stressed that private lands highly complement public lands in long-term species management.

**The Checkerspot Mystery: An Ecological Whodunit.** *Eilperin, Juliet, Washington Post Staff Writer, Monday, May 22, 2006.*

ABSTRACT- For one week a year, the vibrantly colored bay checkerspot butterfly number crashed in the early 1900s as Silicon Valley’s high-tech boom spurred a

wave of development. The species, with its brilliant orange-and-red-flecked wings, first crashed between Palo Alto and San Francisco in the 1980s prompting federal officials to list it as threatened with extinction. Then in the early '90s its numbers dropped on the southern edge of San Jose, around the suburban subdivisions that abut Coyote Ridge. Stuart Weiss figured out that the butterfly's woes stemmed from a combination of pollution from the freeway below and, surprisingly, a cutback on local cattle grazing. "The grazed side is great butterfly habitat, the ungrazed side is lousy," Weiss said. "You end grazing in the areas and it's bye-bye butterflies."

**Grazing Management of Upland and Pond Habitat of Two Threatened Amphibians in California Grassland.** *Ford, Lawrence; Van Hoorn, Pete. Presentation, Society of Range Management Annual Meeting, 2007.*

ABSTRACT- The California red-legged frog (*Rana draytonii*) and California tiger salamander (*Ambystoma californiense*) are listed by the U.S. Fish and Wildlife Service as threatened in the East Bay Area, California. Both amphibians typically occur on grazed rangelands, and use ponds built for livestock watering. They are largely dependent upon favorable grazing practices, including pond maintenance and the management of vegetation at the edges of ponds and streams and in the adjacent uplands. Scientifically sound guidelines for pond habitat restoration and conservation are emerging, but have been unavailable for grazing management of upland habitat. This paper summarizes the process of determining such guidelines, and preliminary results to achieve restoration and conservation objectives. The guidelines were based on the best available animal ecology and rangeland management science related to these amphibians and grazing management experience in the region. The guidelines were synthesized through a review of the scientific literature, interviews of experts, and an expert workgroup defining habitat parameters, grazing management effects, and the range of desirable outcomes in habitat zones. The guidelines will be used as a model by the Alameda County Resource Conservation District and the USDA Natural Resource Conservation Service to create, enhance, and protect habitat for the amphibians in a new program of assistance and incentives for voluntary conservation on private and public lands.

**Association of Vegetation Composition and Canopy Structure with Songbirds in California Valley Grasslands.** *Gennet, Sasha; Hammond, Michele; Bartolome, James. Cal-Pac Society for Range Management Symposium – Grazing for Biological Conservation June 23, 2006.*

ABSTRACT- there is no indication from this analysis that ongoing livestock grazing in East Bay Regional Park District Grasslands is negatively impacting songbird populations. Also, songbird populations had variable associations with measurements of structure and species composition, suggesting that a mosaic of landscapes is preferable for maintaining these species.

**Managing Exotic Species and Conserving Declining Species.** *Germano, David J., Rathbun, Galen, Saslaw, Lawrence. Cal-Pac Society for Range Management Symposium – Grazing for Biological Conservation – June 23, 2006.*

ABSTRACT- Most small vertebrates that are protected in the San Joaquin Valley benefit and are not harmed by livestock grazing. Furthermore, although a species may persist during grassy years without livestock grazing, populations may be vulnerable to extinction on small-sized habitats surrounded by agriculture; areas typical of reserves in the valley established to protect these very species.

**Cattle Grazing Impacts on California Coastal Prairie and Associated Wildflowers over a Broad Geographic Range.** *Hayes, Grey F.; Holl, Karen D. Cal-Pac Society for Range Management Symposium – Grazing for Biological Conservation, June 23, 2006.*

ABSTRACT- Several meaningful conclusions can be drawn from this study. First, grazing increases native annual forb diversity and abundance in California coastal prairies. This may be due to decreased vegetation height and litter depth. Grasses show mixed responses to grazing. Exotic forb abundance increases with grazing. Finally, native perennial forb abundance decreases with grazing; this is probably due to native coastal scrub incursion. Some land management recommendations resulting from this study are that grazing should be considered as a management tool in mesic grasslands, and that disturbance regimes should be varied across the landscape.

**Role of soils in Watershed Function.** *Herrick, Jeffrey, Presentation, Society of Range Management Annual Meeting, 2007.*

ABSTRACT- Soils play five important roles in watershed function: they (1) serve as the substrate for plant growth and (2) store water. Together with vegetation and topography, they (3) control vertical (infiltration) and (4) horizontal (runoff) water movement, and (5) soil erosion. Critical soil properties for watershed hydrology include texture, depth and structure. In the absence of accelerated erosion, managers have little control over texture and depth, but they can affect structure both directly (through management of disturbances) and indirectly (through management of vegetation). Management has different effects on different soils. For example, vehicle compaction of dry soil has virtually no effect on some soils, but can increase infiltration over 50 percent on others. Soil-vegetation interactions are extremely important in determining the ultimate effect on watershed function. Soils affect the amount of water available to plants by controlling infiltration rate, soil water holding capacity and hydraulic conductivity. Plants (and plant litter) intercept precipitation and protect the soil from the energy raindrop impact that can break soil aggregate bonds and create a sedimentation crust that impedes infiltration. In the long-term, plants and associated soil biota generate stable soil structure, which increases both soil water infiltration and water holding capacity. The spatial location of the soils within watersheds is also important. We will present examples of how soils and vegetation interact to affect rangeland watershed function at different spatial and temporal scales.

**Ranching as A Conservation Strategy: Can Old Ranchers Save the New West?** *Huntsinger, Lynn; Brunson, Mark. Rangeland Ecology & Management, Vol. 61, March, 2008.*

ABSTRACT- Ranchers and ranching have of late been proffered as providers of ecosystem services, protectors of open space, and the bearers of a unique western heritage. The concept of working landscapes has gained much currency. Yet at the same time, we hear that ranchers are an aging population who are land rich and cash poor, and that the purchase or maintenance of a ranch as an economic enterprise is becoming less and less feasible. What do studies of rancher demographics, attitudes, values, and innovation tell us about the potential for ranchers and ranching to fulfill the conservation vision? Does the length of tenure influence whether ranches will continue to provide these benefits to society? We will synthesize findings from studies conducted in several states in the western U.S., demonstrating how an understanding of the social aspects of range management can be useful in developing strategies to ensure the long-term sustainability of the rangeland ecosystems.

### **Ecosystem Services and Rangelands – Traditions and Transitions.**

*Jeffrey, Fehmi. Presentation. Society of Range Management Annual Meeting, 2007.*

ABSTRACT- Ecosystem services are the benefits we receive from the natural world and rangelands have always been an important provider of ecosystem services. As described in the Millennium Ecosystem Assessment, ecosystem services fall into four main categories: provisioning, regulating, cultural, and supporting services. Historically, provisioning services (e.g. food, fuel, and fiber) were seen as the primary resource derived from rangelands and regulating services, (e.g. prevention of erosion), were secondary. However, once we begin to value and attempt to conserve the other benefits provided by rangelands, we must begin to assess the tradeoffs between potential uses of services. In a simplified rangeland system, one can assess the direct interactions and tradeoffs between water quality (a regulating service) and livestock grazing (a provisioning service) as well as begin quantification of the supporting services. Adding fire to the system changes the relative tradeoff between water and grazing along with a change in the other services that can be supported. Conserving or recognizing the supporting services (e.g. pollinators of diversity) will continue to be a challenge into the future. As urbanization preferentially targets more fertile lands, rangelands increase in their importance for supplying ecosystem services. This recognition requires: understanding the connections between the elements in the rangeland system, accurately projecting the impacts or outcomes of management choices, knowing if specific outcomes are good or bad, and finally advocating management for the best long-term benefits and against the destructive short term uses.

**Biodiversity across a Rural Land-Use Gradient.** *Maestas, Jeremy D.; Knight, Richard L.; Gilgert, Wendell C. Conservation Biology, Pages 1425-1434, Volume 17, No. 5, October 2003.*

ABSTRACT- Private lands in the American West are undergoing a land-use conversion from agriculture to exurban development, although little is known about the ecological consequences of this change. Some nongovernmental organizations are working with ranchers to keep their lands out of development and in ranching, ostensibly because they believe biodiversity is better protected on ranches than on

exurban developments. However, there are several assumptions underlying this approach that have not been tested. To better inform conservation efforts, we compared avian, mesopredator, and plant communities across the gradient of intensifying human uses from nature reserves or cattle ranches to exurban developments. Biological surveys were conducted on different land uses. Ranches had plant communities with higher native species richness and lower non-native species richness and cover than did the other types of land use. Ranches are important for protecting biodiversity and suggest that future conservation efforts may require less reliance on reserves and a greater focus on private lands.

**Grass-Shrub Riparian Buffer Removal of Sediment, Phosphorus, and Nitrogen from Simulated Runoff.** *Mankin, Kyle R.; Ngandu, Daniel M.; Barden, Charles J.; Hutchinson, Stacy L.; and Geyer, Wayne A. Presentation, USDA-CSREES 2007 National Water Quality Conference.*

ABSTRACT- Riparian buffer forests and vegetative filter strips are highly recommended for improving surface water quality, but grass-shrub riparian buffer systems (RBS's) are less well studied. The objective of this study was to assess the influence of buffer width and vegetation type on key processes and overall reductions of total suspended solids (TSS), phosphorus (P), and nitrogen (N) from simulated runoff passed through established (7-year old) RBS's. Nine 1-m RBS plots, with three replicates of three vegetation types (all natural selection grasses, two-segment buffer with native grasses and plum shrub, and two-segment buffer with natural selection grasses and plum shrub) and widths ranging from 8.3 to 16.1 m, received simulated runoff having 4,433 mg/l TSS from onsite soil, 1.6 mg/l total P, and 20mg/l total N. Flow-weighted samples were collected by using Runoff Sampling System (ROSS) units. The buffers were very efficient in removal of sediments, N, and P, with removal efficiencies strongly linked to infiltration. Mass and concentration reductions averaged 99.7% and 97.9% for TSS removal, >90% of total P, and 92.1% and >90% of total N removal. Vegetation type induced significant differences in removal of TSS, total P, and total N. These results demonstrate that adequately designed and implemented grass-shrub buffers with widths of only 8m provide for water quality improvement, particularly if adequate infiltration is achieved.

**Vernal Pools are at Home on the Range.** *Marty Jaymee. National Wetlands Newsletter, Volume 26, July – August, 2004.*

ABSTRACT- Vernal Pools are among the rarest of California's scarce but ecologically vital wetland resources. Although conventional wisdom suggests that preserving these areas requires leaving them untouched, new research indicates that nearby cattle grazing actually may benefit the fragile wetlands.

**Grazing Effects on Biodiversity and Ecosystem Function in California Vernal Pool Grasslands.** *Marty, J. Conservation Biology, 2005 Vol. 19: pp.1626-1632.*

ABSTRACT- This study has several implications for management and restoration of vernal pool grasslands. First, if a site is grazed and demonstrates high diversity,

then it should be left grazed unless there is a compelling, scientifically-based reason to change the management regime. Furthermore, if changes are made to the grazing regime the change should be monitored utilizing a control so that changes can be effectively observed and attributed to the grazing treatment rather than changes that may be simply due to climatic variability. Grazing too little should be considered as a threat to these systems as well as overgrazing. Finally, the removal of grazing may negatively impact vernal pool hydrology and species requiring longer periods of pool inundation.

### **Sediment Movement and Filtration in a Riparian Meadow Following Cattle Use.**

*McEldowney, R.R; Flenniken, M; Frasier, G.W.; Trlica, M.J.; Leininger, W.C. Journal of Range Management, 2002, Vol. 55: pp. 367-373 .*

ABSTRACT- Improper livestock grazing practices in western U.S. riparian areas may reduce the nutrient and pollutant removal function of riparian communities, resulting in degradation of surface water quality. Short duration-high intensity cattle use in 3×10 m plots was evaluated in a mountain riparian meadow in northern Colorado to quantify livestock effects on sediment movement and filtration under simulated rainfall (100 mm hour<sup>-1</sup>) plus overland flow (25 mm hour<sup>-1</sup>) conditions. Four treatments: 1) control, 2) mowed to 10 cm stubble height, 3) trampled by cattle, and 4) cattle grazed plus trampled (grazed) were evaluated. Sixty kg of sediment was introduced to overland flow in each plot. Sediment movement was evaluated using sediment traps positioned in microchannels and on vegetation islands at 5 distances downslope from the upper end of the plots and by sediment front advancement. Most sediment deposition occurred within the first meter downslope from application. About 90% of the applied sediment was filtered from runoff within 10 m in the control and mowed treatments, while approximately 84 and 77% of the applied sediment was trapped in the trampled and grazed treatment plots, respectively. The primary variables that influenced sediment filtration were stem density and surface random roughness. Stem density was the most influential variable that affected sediment filtration. Cattle grazing reduced the stem density by 40%. Monitoring of stem density should aid land managers in regulating cattle use of riparian communities and facilitate the protection of surface water quality from sediment in overland flow.

### **Managed Grazing and Seeding Shelters Enhance Oak**

**Regeneration on Rangelands.** *McCreary, Douglas D.; George, Melvin. California Agriculture, October- December, 2005, Vol. 59: pp 217-222.*

ABSTRACT- Livestock grazing remains a common practice on California's hardwood rangelands. This can create problems for oak regeneration because grazing has been identified as one of the factors limiting the establishment of certain oak species. Previous research, as well as recent studies at the UC Sierra Foothill Research and Extension Center, suggests that cattle will damage both planted and/or naturally occurring oaks, but damage varies by season with less during the winter when deciduous oaks do not have leaves. Damage is also influenced by the density and distribution of cattle stocking. Oaks taller than 6.5 feet seem relatively resistant to cattle damage in lightly to moderately grazed pastures, but smaller

seedlings need protection.

**Planned Herbivory in the Management of Wildfire Fuels.** *Nader, Glenn; Henkin, Zalmen,; Smith, Ed; Ingram, Roger; and Narvaez, Nelmy. Presentation, Society for Range Management Annual Meeting, 2007.*

ABSTRACT – Modification of wildfire fuels is an important issue. Knowledge of using grazing animals for fuel management is necessary to direct the timing and intensity of grazing to reach fuel management objectives similar to other methods. Grazing is most effective at treating smaller diameter live fuels that can greatly impact the rate of spread of a fire along with the flame height.

**Prescribed Herbivory for Fire Fuels Management.** *Pittroff, Wolfgang, Narvaez, Nelmy, Ingram, Roger, Barry, Sheila, Nader, Glenn, Doran, Morgan. Cal-Pac Society for Range Management Symposium – Grazing for Biological Conservation, June 23, 2006.*

ABSTRACT- Conclusions of the research indicate that economically sustainable use of prescribed herbivory is feasible in:

- Maintenance grazing of fuel breaks with mixed goat-sheep flocks without charging a fee for the service, provided there are appropriate market opportunities for meat goats and lambs
- High impact browsing where prescribed burns are not possible as high cost service due to supplementation needs
- Specialized impact browsing on timber plantations at a medium to high cost to allow timber companies forgoing herbicide use in meeting environmental standards for specific markets.
- Follow-up grazing on burned areas for a maximum of two to three years at low cost.
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**Grazing Handbook, A guide for Resource Managers in Coastal California.** *Sotoyome Resource Conservation District.*

ABSTRACT - The handbook is for public agency personnel and private landowners who may be interested in exploring the use of livestock grazing to further their resource management goals. It has been prepared for smaller agencies and private landowning organizations that do not have grazing specialists on staff. We hope that the information contained in this handbook will broaden the understanding of the potential applications of livestock grazing in various grassland vegetation types and will help guide decision-making about grazing programs. The handbook addresses grazing management of three important rangeland types within the Sotoyome Resource Conservation District (SRCD). These include coastal grasslands, vernal pool grasslands, and riparian areas. However, most of the information in the handbook is widely applicable to similar areas elsewhere in the coastal central California and beyond.

**Public Grazing Program Goals, Policies, and Consequences in an**

**Urbanizing Landscape.** *Sulak, Adriana; Huntsinger, Lynn; Barry, Sheila. Presentation, Society for Range Management, 2007.*

ABSTRACT- Throughout the Western US, publicly owned and privately owned rangelands are inextricably linked through proximity, public land management goals, and private livestock operation needs. This is of particular importance in Alameda and Contra Costa counties of the San Francisco Bay Area where there are 23 different public entities using domestic livestock for vegetation management on their properties. These include all levels of government: city, county, state, and federal. The rangeland of the two counties is about 27% public. The three agencies with the largest grazing programs are connected to at least 17.5% of the private rangelands of the two counties through the privately owned and leased land of their grazing tenants. This public-private relationship is mediated by public grazing program goals and strategies and, due to significant development pressure on local rangelands, public agency policies will likely define the future ranching operations of the area as well as the ecological integrity of public lands and private open space. This presentation will describe the 23 leasing agencies, their grazing program goals and policies, and the implications for the future of the local ranching industry. These lessons are applicable all over the West where public holdings of rangelands have increased over the past 20 years and private ranching operations are under severe pressure to sell for more intensive land uses. We will share what we see as the implications for open space and ranch land conservation in these counties and others like them.

**Macroinvertebrate Analysis Indicates Significant Improvement of Meadow Stream Health due to Livestock Distribution Efforts.** *Tate, Kenneth; Becchetii, Theresa; Battaglia, Charles; McDougald, Neil; Lile, David; George, Holly; Lancaster, Donald. Presentation, Society for Range Management, 2007.*

ABSTRACT- The objective of this study was to quantify relationships between grazing management and macroinvertebrate assemblages in mountain meadow associated stream reaches in California. Fifty-eight low gradient meadow stream reaches in the Sierra Nevada and Southern Cascades were enrolled in this cross-sectional survey during 2003 and 2004. The meadows and stream reaches enrolled in this study are contained within large pastures and allotments, typical of mountain grazing lands in California. Mean pasture/allotment size was 18,000 ac, with a median of 3,000 ac. Macroinvertebrate sample collection commenced in early June at low elevation sites (3000 to 5000 ft) and ended in late August at high elevation sites (7,500 to 9,000 ft). Substrate size class (cobble, gravel, fines), percent available solar radiation reaching stream water surface, and embeddedness of streambed substrates were measured along each macroinvertebrate sampling transect. Grazing metrics were determined by survey of the grazing manager at each site. Negative binomial regression was used to test for relationships between grazing practices, stream characteristics, and stream macroinvertebrate indices. We were able to statistically correlate ( $P < 0.10$ ) livestock distribution effort (days) with 11 macroinvertebrate indices. The act of implementing a distribution practice (yes v. no) was not significantly correlated to any macroinvertebrate indices. Positive

correlations were found between livestock distribution effort and all sensitive (intolerant of pollution or habitat degradation) macroinvertebrate indices, while negative correlations were found for all insensitive (tolerant of pollution or habitat degradation) indices. These results provide strong evidence that active, consistent implementation of common livestock distribution tools is associated with increased riparian health.

**Significant Escherichia coli Attenuation by Vegetative Buffers on Annual Grasslands.** *Tate Kenneth W.; Atwill Edward R.; Bartolome James W.; Nader Glenn. Journal of Environmental Quality, 2006, Vol. 35: pp. 795-805.*

ABSTRACT - A study was conducted to estimate the retention efficiency of vegetative buffers for Escherichia coli deposited on grasslands in cattle fecal deposits and subject to natural rainfall-runoff conditions. The study was conducted on annual grasslands in California's northern Sierra Nevada foothills, a region with a distinct wet-dry season Mediterranean climate. We used 48, 2.0- by 3.0-m runoff plots to examine the efficacy of 0.1-, 1.1-, and 2.1-m buffers at three land slopes (5, 20, and 35%) and four dry vegetation matter levels (225, 560, 900, and 4500 kg/ha) across 27 rainfall-runoff events during two rainfall seasons. Buffer width treatments were implemented by placement of cattle fecal material containing known loads of E. coli 0.1, 1.1, or 2.1 m upslope of the plot runoff collector. Mean total runoff to total rainfall ratio per plot ranged from 0.014:1 to 0.019:1 and reflected the high infiltration capacity of these soils. Approximately 94.8 to 99.995% of total E. coli load applied to each plot appears to be either retained in the fecal pat and/or attenuated within 0.1 m downslope of the fecal pat, irrespective of the presence of a wider vegetated buffer. Relative to a 0.1-m buffer, we found 0.3 to 3.1 log<sub>10</sub> reduction in E. coli discharge per additional meter of vegetative buffer across the range of residual dry vegetation matter levels, land slope, and rainfall and runoff conditions experienced during this project. Buffer efficiency was significantly reduced as runoff increased. These results support the assertion that grassland buffers are an effective method for reducing animal agricultural inputs of waterborne E. coli into surface waters.

**Impact of Environmental Factors on Fish Distribution Assessed in Rangeland Streams.** *Thompson, Lisa; Rorero, Larry; Sado Yukako; Tate, Kenneth W. California Agriculture, Vol. 60, October – December, 2006.*

ABSTRACT- Fish pools were sampled on tributaries of Cow Creek in the northern Sacramento Valley, and related fish distribution and habitat use to environmental factors across the 2003 agricultural growing season. This rangeland watershed experiences extensive livestock use and many landowners divert stream water for pasture irrigation. The goal was to provide landowners and managers with current baseline information about the conditions in which fish were found. The results provide a basis for the development and comparison of irrigation best management practices that may improve conditions for native fish in rangeland streams.

## **Effects of Management on Soil Carbon Pools in California**

**Rangeland Ecosystems.** *Silver, W.L.; Ryals, R.; Lewis, D.J.; Creque, J.; Wacker, M.; Larson, S. American Geophysical Union, Fall Meeting, 2008.*

ABSTRACT - Rangeland ecosystems managed for livestock production represent the largest land-use footprint globally, covering more than one-quarter of the world's land surface (Asner et al. 2004). In California, rangelands cover an estimated 17 million hectares or approximately 40% of the land area (FRAP 2003). These ecosystems have considerable potential to sequester carbon (C) in soil and offset greenhouse gas emissions through changes in land management practices. Climate policies and C markets may provide incentives for rangeland managers to pursue strategies that optimize soil C storage, yet we lack a thorough understanding of the effects of management on soil C pools in rangelands over time and space. We sampled soil C pools on rangelands in a 260 km<sup>2</sup> region of Marin and Sonoma counties to determine if patterns in soil C storage exist with management. Replicate soil samples were collected from 35 fields that spanned the dominant soil orders, plant communities, and management practices in the region while controlling for slope and bioclimatic zone (n = 1050). Management practices included organic amendments, intensive (dairy) and extensive (other) grazing practices, and subsoiling. Soil C pools ranged from approximately 50 to 140 Mg C ha<sup>-1</sup> to 1 m depth, with a mean of 99 ± 22 (sd) Mg C ha<sup>-1</sup>. Differences among sites were due primarily to C concentrations, which exhibited a much larger coefficient of variation than bulk density at all depths. There were no statistically significant differences among the dominant soil orders. Subsoiling appeared to significantly increase soil C content in the top 50 cm, even though subsoiling had only occurred for the first time the previous Nov. Organic amendments also appeared to greatly increase soil C pools, and was the dominant factor that distinguished soil C pools in intensive and extensive land uses. Our results indicate that management has the potential to significantly increase soil C pools. Future research will determine the location of sequestered C within the soil matrix and its turnover time.

**Livestock Can Help Rangelands Recover from Fires.** *Perry, Ann, ARS, USDA. ARS News Service, September 30, 2009.*

ABSTRACT: A 14-year study by Agricultural Research Service (ARS) scientists in Oregon found that rangelands that have been grazed by cattle recover from fires more effectively than rangelands that have been protected from livestock. These surprising findings could impact management strategies for native plant communities where ecological dynamics are shifting because of climate change, invasive weeds and other challenges. Much of the rangeland in the western United States is threatened by the spread of cheatgrass and medusahead, invasive non-native annual grasses that fuel wildfires and readily infest landscapes, especially after fires. These rangelands historically were burned by wildfires every 50 to 100 years, but over the past century these fires have been suppressed by humans. This suppression allowed some dead plant litter to accumulate, but when cattle were introduced to the region, their grazing helped keep litter accumulation in check. Rangeland scientists Kirk Davies and Jon Bates and research leader Tony Svejcar, who work in the ARS Range and Meadow Forage Management Research Unit at the

Eastern Oregon Agricultural Research Center in Burns, Ore., carried out studies comparing how native plants on grazed and ungrazed sagebrush rangelands recovered from fires. All the sites had similar vegetation profiles and were virtually free of cheatgrass. In the grazed areas, cattle consumed around 40 percent of the available forage, which removed much of the potential litter. The ungrazed sites, where livestock had been excluded since 1936, had almost twice as much litter as the grazed sites. The scientists conducted a controlled burn on all the sites in 1993, and then measured vegetation cover, vegetation density and biomass production in 2005, 2006 and 2007. They found cheatgrass had infested a large portion of the ungrazed sites, leaving these areas even more vulnerable to future fires. However, cheatgrass did not become problematic on the sites that had been grazed. On these sites, native bunchgrass cover was almost twice as dense as bunchgrass cover on the ungrazed sites. The team concluded that the litter in the ungrazed sites fueled hotter fires that killed off much of the perennial vegetation, which allowed quick-growing invasive annuals to become established. Results from this study were published in the September 2009 issue of *Ecological Applications*. This study supports the USDA research priority of responding to global climate change.

**APPENDIX C:  
COMMENTS FROM PEER REVIEW**

Response/Comment	Approach
1 <i>“Thank you for the opportunity to review the “Central Coast Cattlemen’s Grazing lands Non-Point source Approach” document. XXXX and I read the document and we felt you did a great job putting this together!”</i>	General comment
2 <i>“I found the document very well-written. I particularly liked the lit’ review. I think in this day and age, most resource agencies recognize the benefits of proper well-managed grazing. There are still individual employees of those agencies, and the general public that need to be continually reminded, though. Most of our conflicts today seem to revolve around what constitutes well-managed grazing, and how do we get those ranchers who are not using best management practices to adopt them.”</i>	General comment
3 There are a couple of trends I see that work against well-managed rangelands. You may want to mention these on page two where you discuss major changes. Over the last 100 years, the average size of a ranch has decreased, and for various other reasons, many ranches are no longer capable of generating enough income to support a family. As a result, many ranchers have outside employment. Most of the best management practices not only take money, but time, and labor. With outside employment, ranchers have less time and labor to devote to managing their rangelands.	General comment
4 Another trend is that more and more of our rangelands are operated under lease agreements. An increasing number of ranches sold in SBCO are being sold to non-ag buyers, people who do not have an ag background. They made their money, or are making their money, in some other industry, and are purchasing a ranch for other benefits. They will typically lease out the grazing to a rancher. Generally, and this isn't always the case, these rangelands are not as well-managed as "owner/operator" rangelands. The incentive to invest time and money to improve the rangeland isn't as great on a place you lease versus a place you own. In most cases, the rancher/lessee is willing, but the lessor does not understand the benefits, and is unwilling to participate/share in the cost/labor. For this reason, we always tried to encourage owners to attend the range water quality workshops with their lessees.	General comment
5 Do you know if the 10,000 acres removed was specifically from rezoning to allow for housing, development, etc?	We feel the answer to this question does not strengthen this document
6 Not that I think it ought to be included here, but do the cattlemen have a sense of what proportion of all the cattle ranches on the central coast this number represents? Down the road, that could become important, and it should be something for them to be thinking about beforehand. Having conducted these short courses in the northern Sacramento Valley, and assisted producers in completing their Ranch Water Quality Plans, I know that in many cases these don’t always reflect the level of active water quality management that actually gets to the ground. I know that the fact that some number of plans have been submitted covering X numbers of acres is used to assert that good water quality protection is being exerted in the area, but that assertion might be revealed to be an exaggeration if investigated very closely. The ranch water quality plans are definitely a step in the right direction, but in many areas (and perhaps the central coast is a positive exception to this) ranch owners and managers lack the financial resources, technical skill, and/or motivation to follow through (and keep following through) on them. Most plans for ranches I am familiar with, though not all, soon began gathering dust in drawers and on shelves.	This comment has merit but warrants more investigation  Note: Ranch Water Quality Plans have been done on a voluntary basis – no government taxpayer funding has been used.
7 This is also arguably a case of moderate overstatement, which might be revealed as such by closer public scrutiny (of the sort that TMDLs and other public water quality management processes sometimes invite). The UCCE analysis does not indicate how much of each ranch’s water quality burden was relieved by these practices, and so the assertion of the magnitude of the result is suspect. I don’t doubt that some ranches made significant gains on problems that they had, but this study did not address that aspect. That a great many of them had largely curtailed excess sediment losses is certainly possible, but open to question. You might also want to cite the source of this information (Larson et al., 2005. Evaluation of California’s rangeland water quality education program. Rangeland Ecology and Management. 58:514-522.)	This comment has merit but warrants more investigation
8 Comment – Fourth sentence: “Indeed, the absence of grazers in many parts of the Central Coast region has had impacts on watersheds that scientists are just beginning to explore and understand.” – <i>Like what?</i>	Answers to this question can be found in the Benefits of Grazing section

9	I have just a few general comments. The most important practice a rancher can have in a Mediterranean climate is flexibility. Ranchers have to be able to adjust their herd size in a timely manner in response to the huge variability in rainfall, timing of rainfall, and annual forage production we experience on the Central Coast. Stocker operations provide the most flexibility. Cow-calf operations provide the least. Some combination of the two would be ideal. In poor forage years, many ranchers are reluctant to sell off part of their cow herd, and if they provide supplemental feed, it is usually too little too late. I think it needs to be stressed that a rancher's stocking rate isn't something that is established and left alone. It requires constant attention and adjustment, especially due to our unique highly variable climate. Some method of flexibility has to be built into the operation	This comment has merit and the need for flexibility is generally stated throughout the document
10	Add additional sentence after the word species in this paragraph – “If riparian vegetation is degraded, then streams may warm up much faster than they would without shade, so stream shading is an important attribute to look at.”	This comment has merit but warrants more investigation
11	Sometimes, but these tend to be weak attractants, not usually sufficient to keep livestock away from water sources (Ganskopp, 2001. Manipulating cattle distribution with salt and water in large arid-land pastures. Applied Animal Behavior Science.). Water and supplemental feed are much stronger and more consistent attractants (Tate et al., 2003. Spatial and temporal patterns of cattle feces deposition on rangelands. J. Range Management 56:432-348.).	This comment has merit but warrants more investigation  Note: This statement does not take into account time and costs associated with supplementing cattle with hay or grain.
12	In response to first sentence “.....impractical for use in Central Coast Rangelands...” - <i>In some places, certainly, but seems hardly enough to justify a suggestion that fencing here is generally impractical. A good deal of the state, especially in the many mountainous regions, is fenced through more difficult terrain and inhospitable climates than is found on most of the central coast.</i>	This comment has merit but warrants more investigation
13	Maybe this is too nit-picky...but “dispersing” makes it sound like there is an attempt to get rid of or scatter the livestock, when I think the goal might sound better if the fencing were to be used as a management tool that assists with providing alternate directions for the livestock to move across and or through a specified ecosystem...  See USDA Website for Directional Fencing <a href="http://www.ars.usda.gov/reasearch/publications/publications.htm?SEQ_NO_115=173367">http://www.ars.usda.gov/reasearch/publications/publications.htm?SEQ_NO_115=173367</a>	This comment has merit but warrants more investigation
14	I would agree that fencing out riparian areas is in many cases impossible for the reasons you state. My office seldom recommends it. However, what we found is often a fencing scheme can be designed to create a riparian pasture, which can then be managed as part of a rotational grazing system. In other words, you're not fencing out the stream, but you are creating a pasture that includes the stream, and managing/grazing it to preserve and enhance the riparian values.	This comment has merit but does not need to be added into the document
15	Add to end of third sentence – <u>(due to the variability in CA and especially in the Central Coast, it takes a minimum of 8 years to determine what the average production, hence the average carrying capacity is. This makes proper stocking rates very difficult to achieve. From research around CA and in the Central coast, a paper has been submitted but cannot share until we hear if it is accepted)</u>	This comment has merit but does not need to be added into the document
16	In response to “Well planned grazing helps invigorate grazed plant communities” - **What follows in this comment is just my nit-picking at the broad sweep of the assertion about the effects of “well-planned” grazing (which is followed in the next sentence by a considerably more nuanced statement aiming to escape being trapped by broad grazing management prescriptions).** It should at least be borne in mind that grazing never invigorates “whole” communities, unless the community is defined as that which has come to persist after an extended period of adaptation to a particular grazing regime – which may be different from other possible communities at the location (including what existed prior to the most ‘recent’ re-introduction of the grazers). Grazing will usually stimulate some members of plant communities and suppress others. Sometimes the stimulated plant species are widely considered desirable, sometimes not. Doubtless there are many native rangeland plant species on the central coast for which grazing, at least grazing at any commercially viable frequency or intensity would not be especially ‘invigorating’. I do not think this statement needs to be removed, but it wouldn’t hurt to soften it to something like, “Properly managed	This comment has merit but does not need to be added into the document

	grazing can be a means for maintaining the health and function of many grassland and brushland habitats on the central coast.”	
17	Add as last sentence - <i>But there is some indication that multi-species (cows and goats) can improve the plant communities more than just single species grazing.</i>	We feel this sentence does not strengthen this document
18	In response to first half of second sentence - <i>Primarily just because they are physically smaller animals. Intake varies with ‘metabolic size’ – e.g. mice eat a greater proportion of their body weight than elephants. But, interesting as a fact, what does it matter here? What is critical is determining realistic carrying capacities for the plant communities on the landscape, and understanding how those carrying capacities vary in response to climate and management. The type or size of animal is much less important than the numbers of them, frequency and duration of grazing – all in relation to the productivity of the plant communities in the management area at any points in time.</i>	The comment does not support the purpose of this document – not a document for specific species
19	In response to last half of second sentence “utilizing a higher percentage of browse” - <i>At least the goats do. Any off these three species (cattle, goats, sheep) can consume a major portion of their diet in browse, but goats tend to be more naturally designed for it. In places where they are relatively common, sheep prefer grasses and forbs, and cattle will take any or all of the three vegetation types but their foraging efficiency is highest with stuff they can get big mouthfuls of (which of the three plant types, is most often grass).</i>	We agree with this comment, keeping in mind this document is a general grazing document
20	In reference to third sentence regarding horses - <i>Have a reference for that? According to the National Research Council’s “Nutrient Requirements of Horses”, the standard reference for equine nutrition, the dry matter forage intake for horses does not exceed 2% of body weight under most circumstances (5<sup>th</sup> revised edition, 1989; Table 5-4, p. 48.). Most adult cattle consume 2%-2.5% of their live weight in forage dry matter at maintenance.</i>	We removed the reference to horses from this document
21	Second sentence comment – “The choice and effective management of grazing systems ( <i>lots of controversy on this. See the October 2009 issue of Rangelands, which is devoted to discussing different grazing systems and how they do or do not effect plant communities.</i> ) can maximize forage production and encourage stable plant communities.”	This comment has merit but does not need to be added into the document
22	Next to last sentence – “When utilizing a continuous grazing system, herding can be effectively utilized to reduce grazing pressure in specific areas. <i>Also, the ability to turn on or turn off various water troughs)</i>	This comment has merit but does not need to be added into the document
23	In response to third sentence - Although I know some ranchers who swear that pig rooting increases acorn germination, so far the research literature indicates their effects are at best benign (Bartolome, J.W., B. Allen-Diaz, P. van Hoorn, J. Robbins. 2000. Feral Pigs and Oak Woodland Vegetation. Integrated Hardwood Rangeland Management Program. Fact Sheet 103. University of California. <a href="http://danr.ucop.edu/ihrmp/oak103.htm">http://danr.ucop.edu/ihrmp/oak103.htm</a> .) or damaging, as you suggest (Sweitzer, Rick A.; Van Vuren, Dirk H. 2002. Rooting and foraging effects of wild pigs on tree regeneration and acorn survival in California's oak woodland ecosystems. Proceedings of the fifth symposium on oak woodlands: oaks in California's changing landscape. 2001 October 22-25; San Diego, CA. <a href="http://www.treearch.fs.fed.us/pubs/26124">http://www.treearch.fs.fed.us/pubs/26124</a> .)	We agree with this comment, but feel it does not need to be added into the document
24	<i>The most important management measure that can be done for annual grasslands is by leaving proper Residual Dry Matter (RDM) just prior to the onset of the rainy season. Too much RDM, as well as too little RDM can change the annual grassland plant communities and production. Too little RDM also leads to excessive erosion and sedimentation. It is difficult to determine the exact proper levels of RDM, but there are guidelines to help. (California Guidelines for Residual Dry Matter (RDM) Management on Coastal And Foothill Annual Rangelands. Bartolome et. al. ANR Pub 8092.</i>	We believe RDM measurements are not an absolute indicator for range health. RDM's are a management tool, not an absolute measure
25	Amend the last sentence to read – “ <i>The most critical management goal for minimizing the transport of bacterial contaminants is to manage grazing activities so as to maintain as much vegetative cover as possible (you can leave too much, as well as not enough). This in turn helps maximize the filter capacity of rangelands and can minimize transport of manure and/or organic sediments onto adjacent cropland and into streams.</i> ”	Sentence was amended to reflect this comment
26	In response to last two sentences – “ <i>This is an excellent argument for cessation of grazing. You cannot ‘maximize’ vegetation cover through defoliation. Maybe better to say that managers need to understand what minimum levels of plant cover are necessary to maintain adequate filtration of contaminants under the</i>	Sentence was amended to reflect this comment

	<u>variety of conditions found on central coast rangelands, and agree to not exceed those levels of herbivory, especially in critical areas.</u>	
27	<u>As before, this is likely to be ineffective in many, if not most, cases. If it is shade, water, or forage attracting livestock to these areas, the best solution is to provide better and more consistent sources of same in less sensitive areas. Salt/mineral will not ordinarily alter their use habits significantly.</u>	This comment has merit but does not need to be added into the document
28	In response to last sentence - <u>Possibly so. But it will likely have to be sustained indefinitely, or until the population has been extirpated or (only where suitable alternatives are available) shifts to other areas.</u>	This comment has merit but does not need to be added into the document
29	In response to last sentence - Yes, although finding crops less vulnerable to this contamination that have similar market value may be difficult.	This comment has merit but does not need to be added into the document
30	Amend to read beginning with sentence four - Soil compaction <u>from inappropriately high numbers of livestock on fine-textured soils, especially during wet periods,</u> can <u>produce accelerated</u> erosion and sedimentation <u>rates, and reduce infiltration. Managed appropriately,</u> rangelands <u>used for grazing in large open space tracts</u> can <u>allow</u> watersheds <u>to function better than they can when broken into</u> subdivision and rural residential (“ <u>ranchette</u> ”) developments, vineyards, or <u>intensive</u> recreational uses. Ranchers <u>have</u> a number of practical management measures <u>available to them</u> that can help <u>protect</u> water quality by minimizing sediment inputs.  How would the local vineyard operators respond to this? Is there any actual evidence that vineyards presently <u>do not</u> , or, more to the point, <u>can not</u> implement similar degrees of water quality protections?	This comment does not support the purpose of the document – we do not want to target rural “ranchettes” without proper data
31	Amend paragraph to read – <u>“Keeping livestock in pens or small pastures, often result in bare ground, as these stocking levels frequently exceed what the land can produce. When animals are maintained this way for years, over repeated wet and dry cycles, soil can become compacted and erosion may accelerate. This practice, often associated with “ranchettes” or rural residential use, should be avoided. When it is essential to keep livestock in pens or smaller pastures, these should be located where sediments transported out of them by wind or runoff can be recaptured in adjacent “buffer” areas.”</u>	This comment supports the existing language with no further edits needed
32	Change last sentence to read – <u>“Such feeding should be conducted in areas less prone to soil compaction and erosion, and where sediment would be unlikely to be transported to sensitive waterways.”</u>	This comment supports the existing language with no further edits needed
33	Change paragraph to read – <u>“Wildland fire can significantly increase soil erosion and sedimentation in upland areas. Grazing by livestock can help minimize fire hazard by reducing the quantity of fine fuels (dry grass residues) available to ignite and spread fires. Ignition is a particular risk along highways, rural developments and near recreational properties. In particularly at-risk areas, firebreaks are often used to help contain the spread of fire. However, dozing or disking operations on steep ground can also greatly increase the likelihood and magnitude of erosion. This may be mitigated somewhat by the strategic placement of fire breaks and by adding water bars to disperse runoff where appropriate, but limiting fine-fuels through grazing is often a more cost-effective strategy, one which can be used together with fuel breaks to maximize effect while minimizing costs of constructing and maintaining fire containment structures. Rangeland managers must assess and weigh the risk and hazard posed by fire on the basis of site conditions.”</u>	This comment supports the existing language with no further edits needed
34	When soils become saturated during winter months, hooves leave traveled areas “pock marked”, which can help slow water transport and allow for increased infiltration, even on relatively compacted trails or roads <u>(this may only be true in some circumstances. But in other circumstances infiltration is actually decreased, and water in hoof marks may simply just evaporate and not infiltrate.</u>	This comment does not support the purpose of the document
35	Change paragraph to read – <u>“Roads and livestock trails are necessary tools for providing for proper forage utilization, access to water and for rangeland maintenance. Cattle, if given a choice, prefer to traverse slopes at a low, easy gradient. This natural pattern of travel reduces the velocity of water transport down slope and helps minimize the risk of erosion. When soils become saturated during winter months, hooves leave traveled areas “pock marked”, which can help slow water transport and allow for increased</u>	This comment supports the existing language with no further edits needed

	<p><u>infiltration, even on relatively compacted trails or roads. Fences, heavy brush or trees and breaks in terrain such as gullies and ravines can present barriers that alter, inhibit or adversely change livestock travel patterns. Trails and roads used by livestock should be managed and maintained with an eye toward allowing for easy gradients by removing barriers to natural travel patterns where possible.</u></p> <p>To an extent. At the same time, infiltration is reduced on many trails because of compaction. This may offset any ‘benefit’ of the shallow slopes. A few relatively low-gradient trails aren’t likely to be a problem, though. More of a concern will be pastures where livestock have been allowed to create high concentrations of trails, or trails cut through especially steep and erodible terrain. Ranch managers need to identify these areas and attempt to redesign the fences and other infrastructure to counteract this (much as you captured in the last sentence).</p> <p>Citation for this? I realize this is an opinion that is popular in some circles, but I think the evidence that this is a common result is lacking. At present, I find this assertion rather dubious, at best, and open to challenge. I’ll allow that the assertion is not without some qualified experimental support (J. R. Russell, K. Betteridge, D. A. Costall and A. D. MacKay. 2001. Cattle treading effects on sediment loss and water infiltration. J. Range Management. 54:2, pp. 184-190.), but these authors demonstrated that, where vegetation was grazed very short (2 cm), high densities of hoof prints merely minimized the sediment losses created by the animal-induced soil compaction produced in creating them. Grazed paddocks still had poorer infiltration than non-grazed paddocks. See also Castellano, M.J. and T.J. Valone. 2007. Livestock, soil compaction and water infiltration rate: Evaluating a potential desertification recovery mechanism. J. Arid Environment. 71:1, pp. 97-108.</p>	
36	<p>Amend second sentence to read – <u>“This kind of unmanaged recreational use, particularly during the wet season, can expose soils and make them unstable. It can also destroy road drainage structures, which may lead to rilling and erosion.”</u></p>	This comment has merit but does not need to be added into the document
37	<p>Amend paragraph to read – <u>“Efforts to monitor the effectiveness of management measures should be science-based, provide for timely corrective action, and they must be cost effective. Ranching produces limited revenues, and cost-control is an important component of economic viability. If grazing on privately owned rangelands throughout the Central Coast Region is to continue, the costs of monitoring efforts must be minimized. Monitoring of management measures can best be accomplished through a practical and voluntary approach that allows ranchers to assess their management effectiveness and to adjust them as monitoring indicates. Effective communication and education will be critical in carrying this out. The University of California Cooperative Extension has published a number of guidelines for monitoring rangeland water quality which can readily be adapted for use on central coast ranches.”</u></p>	This comment has merit but does not need to be added into the document
38	<p>Amend paragraph to read – <u>“Visual appraisal is the most practical and inexpensive approach to monitoring riparian and aquatic habitats. Visual observations, particularly during periods of soil saturation and after heavy rainfall events, can assess the integrity of riparian vegetation and stream bank stability. Road crossings at streams should be visually inspected to assure that they are functioning properly and that they are not sources of sediment to the waterway.”</u></p>	This comment supports the existing language with no further edits needed
39	<p>Amend paragraph to read – <u>“Photography can be used for documenting changes in vegetation structure and bank condition over time. Ground photos can be used to assess changes in specific locations. Landscape-scale alterations in vegetation cover and structure (relative proportions of trees, shrubs, and herbaceous plants) can be assessed using aerial photography, such as the NAIP imagery product which is provided for free to the public by the USDA and updated approximately every 5 years.”</u></p>	This comment supports the existing language with no further edits needed
40	<p>Amend paragraph to read – <u>“Impacts on riparian systems produced by flood events, drought, or known alterations in the channel which have occurred upstream of the property should be thoroughly documented.”</u></p>	This comment supports the existing language with no further edits needed
41	<p>Amend paragraph to read – <u>“Photography can be used for documenting changes in vegetation structure over time. Ground photos can be used to assess changes in specific locations, while landscape-scale alterations in vegetation cover and structure can be assessed using aerial photography, such as the NAIP imagery product which is provided for free to the public by the USDA and updated approximately every 5 years.”</u></p>	We are uncomfortable with the indiscriminate use of this tool

42	Delete paragraph	Did not delete
43	Amend paragraph to read – <u>“Site alterations resulting from drought, fire or invasive weeds should be documented.”</u>	This comment supports the existing language with no further edits needed
44	“Positive Points” project chaired by George Work be referenced - “The Ranching Sustainability Self-Assessment Project”	This comment has merit but does not need to be added into the document
45	“Guidelines for Residual Dry Matter on Coastal & Foothill Rangelands in California” by James Bartolome be referenced	We believe RDM measurements are not an absolute indicator for range health. RDM’s are a management tool, not an absolute measure
46	Delete the words “a group of”	Did not delete
47	I did not see any mention in the document regarding monitoring residual dry matter (RDM). Maintaining adequate levels of RDM will maximize infiltration, and minimize runoff and erosion. It is a very simple and inexpensive tool ranchers can use to help determine whether or not their rangelands are properly stocked. There are even photo scorecards available that ranchers can use as a visual comparison.	We believe RDM measurements are not an absolute indicator for range health. RDM’s are a management tool, not an absolute measure
48	A group of ranchers, with the help of Cooperative Extension have developed “A Ranching Sustainability Self Assessment Project”	This comment has merit but does not need to be added into the document
49	<u>Very doubtful that university research projects will be available to offer funding for such work in the immediacy of a contamination event (and this will be reduced to damage control and assignment of blame – not where the CCC would want to position itself). Better to work with RWQCB and leverage outside funding to perform some baseline analyses of priority areas (this might be done in coordination with a research institution), but then begin the work of developing funding sources that could assist in periodic monitoring of critical areas over time, in an attempt to catch and address problems before they become crises. Proactive, not reactive.</u>	General comment
50	In response to first sentence - <u>“No. Visual examination is fine for determining whether ‘significant’ erosion coupled with sediment transport to waterways is occurring, but ultimately the RWQCB will be forced to drill down to the magnitude of sediment transport that is produced by various sources. This will require more than ocular or photographic reconnaissance. David Lewis’ method is one that could be used for this.”</u> Lewis, D.J., K.W. Tate, and J.M. Harper. 2000. Sediment delivery monitoring: A water quality tool for California Rangeland watersheds. University of California Division of Agriculture and Natural Resources Publication 8014. Davis, California.	This comment has merit but warrants more investigation
51	Amend first sentence to read – <u>“Photographs can be used to document areas of special concern with respect to sediment delivery, such as active landslides, gullies or stream banks experiencing accelerated rates of erosion.”</u>	This comment has merit but does not need to be added into the document
52	Measure the dimensions of streamside slumps	This comment has merit but warrants more investigation
53	Amend paragraph to read – <u>“Fires, landslides, or trespass recreational use that may have altered erosion and sediment transport should be fully documented.”</u>	This comment has merit but does not need to be added into the document

54	Should be noted that the RWQPSC was conceived as a coordinated partnership between UCCE and USDA-NRCS. At present, UCCE is short-staffed (although Royce Larson could do it, or maybe Sheila Barry could be wrangled a little south of her territory) and has a minimal budget. NRCS does not have as critical a budget shortfall at present, but its programmatic attentions are presently elsewhere. Were this effort to translate into an accelerated level of conservation planning and work on central coast ranches through NRCS programs, this might possibly be changed. There are also a few folks around who have experience delivering the RWQPSC, or are at least technically capable of it, including myself at Cal Poly, and Larry Ford, who could also play some role in this. I am looking for opportunities to get my range mgt students in the field getting experience doing these kinds of assessments and developing conservation plans and management recommendations. This is one potential vehicle for that.	General comment
55	And the Coastal Ranches Conservancy. How about CNGA and/or UCSB's Carla D'Antonio?	This comment has merit but warrants more investigation
56	In response to "improve plans" in first sentence – <i>"Not only 'improve', but help those that have been completed on paper get fully implemented on the ground. I'd wager there are at least a few, if not many, that are not fully finished."</i>	This comment has merit but warrants more investigation
57	In response to "sent one or more persons through the Short Course" in next to last sentence – <i>"Nice factoid, but attending the short course is not the issue, not is having written a ranch water quality plan. What matters is what changed on the ground as a result. That, I doubt there is much evidence of."</i>	This comment has merit but warrants more investigation
58	In reference to the first sentence – <i>"The better ranch managers, in my opinion, unquestionably have a grasp of relevant information that no-one else does, however they are not therefore unequivocally in the 'best' position to judge on their own which practices are most appropriate. As to whether they have the financial, technical, and material resources to implement certain practices, most certainly yes, they alone will know, but most of them will still need interaction with others with more extensive expertise in sediment, nutrient, and vegetation management to help them choose the most effective practices and modify them according to their specific capabilities and needs, and the particular circumstances of the problem(s) they are trying to address."</i>	This comment does not support the purpose of the document
59	In reference to "implemented 'best management practices' that address potential pollution sources that were identified in water quality plans" – <i>"What percentage of identified water quality impairments on these ranches were resolved, and to what degree of success (completely resolved, 60%, 20%)?"</i>	This comment has merit but warrants more investigation
60	In reference to first sentence - true, but some work has been done, R. Larsen, L. Althouse, D. Meade and M. Battany. 2008. Nutrient and Sediment Transport From a New Vineyard in an Oak Woodland. Sixth Symposium on Oak Woodlands: California's Oaks: Today's Challenges, Tomorrows Opportunities, October 9-12, 2006. Rohnert vicinity of Cuesta Ridge Vineyard, San Luis Obispo County, where drainages carry water from chaparral, oak woodland, and a new vineyard. Three drainages were instrumented with gauges above and below the vineyard for stage height, and turbidity to assess the effectiveness of water quality protection measures at the Cuesta Ridge Vineyard. Water samples were taken during storm events and analyzed for pH, EC, nitrogen, phosphorus, and sediment concentrations. Erratic flow conditions may have made it difficult to identify differences above and below the vineyard. Water quality was good at all sites and data collected serves as baseline information for future study. Landform, geology, soil type, proximity to wetlands, and land use practices in the surrounding areas should be investigated to consider possible relationships with turbidity and nutrient concentrations.	This comment has merit but warrants more investigation
61	Amend paragraph to read – <i>"The majority of grazing in the Central Coast occurs on rangelands that are privately owned. Grazing policies developed for public lands are not made at the local level and rangeland managers have limited opportunity to provide input. However, if and when possible, affected rangeland managers should participate with public agencies in order to help influence grazing policy."</i>	This comment supports the existing language with no further edits needed
62	I don't think this is usually true for the federal agencies. Those policies are open to public input, and they have historically been strongly influenced by the ranching community. As for state and county-level policies, the statements here may well be true (certainly as regards Fish & Game, I know this to often be the case). I would recommend deleting this paragraph, but I presume that it was offered by one or more who feel strongly about it.	General comment
63	Amend paragraph to read – <i>"Ranchers are proud of their heritage and their stewardship of rangelands. Many ranching families endorse the philosophy of proactive management. Ranchers, to date, have widely participated in voluntary programs such as the Rangeland Water Quality Short Courses. The Central Coast Cattlemen will continue to encourage all members of the ranching community to implement measures that"</i>	This comment supports the existing language with no further edits needed

	<i>will result in water quality improvements consistent with CCRWQCB targets. Ongoing efforts by the CCRWQCB should continue to emphasize water quality education, provide technical assistance and create incentives that emphasize the benefits of managing towards healthy rangeland watersheds. The Central Coast Cattlemen recognize that it is the CCRWQCB's responsibility to find remedies for known water quality issues. As a partner in that process, the CCC will strongly encourage members of the ranching community who fail to utilize good grazing practices to adopt more appropriate management measures, recognizing that otherwise regulatory methods may be required."</i>	
64	Amend paragraph to read – <i>"It is the position of the Central Coast Cattlemen that it is imperative that prevention rather than costly fixes be emphasized. The CCRWQCB will have greater success in achieving its goals by balancing legal requirements with legitimate needs for site-specific flexibility and economic feasibility. To accomplish these things, additional monitoring fees, permit requirements and/or regulatory creep should be avoided as much as possible."</i>	This comment supports the existing language with no further edits needed
65	In reference to last sentence, "permit requirements" – amend to include "duplicative permit requirements for other agencies..."	Did not edit