



Keeping Landscapes Working

A Newsletter for Managers of Bay Area Rangelands

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A newsletter provided by UC Cooperative Extension Natural Resources Program in the San Francisco Bay Area. This newsletter provides information to managers of both public and private rangelands. RANGELAND, which is land characterized by natural vegetation i.e., grass, forbs and shrubs and managed as a natural ecosystem, is the predominate source of OPEN SPACE in the San Francisco Bay Area.

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Learning from New Zealand's Challenges to be "Clean and Green."

My recent 8-month sabbatical in New Zealand afforded me the opportunity to learn from researchers, conservationist, and livestock producers who are focused on New Zealand's efforts to protect their environment while growing their capacity to produce food. The challenges and opportunities they are facing in terms of livestock production and grassland management are not unlike the ones facing California's livestock producers and rangeland managers. Protecting water quality, sequestering carbon, controlling invasive species, and providing habitat for native species are top issues on both lists.

This issue of *Keeping Landscapes Working* includes an article on the impact of a new water quality regulation on farm sustainability around Lake Taupo, New Zealand (see pg. 6). These results are compared to the impact of a new TMDL (Total Maximum Daily Load for fecal-coliform) facing livestock producers in Northern California. A future edition of my newsletter will look at grazing public parklands in New Zealand including public outreach efforts and conflicts with native peoples.

On another note, progress continues on habitat conservation planning efforts in both Alameda and Santa Clara counties. Both efforts recognize livestock grazing as a tool for habitat management. This recognition is supported by recent updates to United States Fish and Wildlife Service endangered species listing information (see Current Findings, pg. 2). Although this recognition is important to continue livestock grazing programs on conservation lands, keeping landscapes working for sustainable conservation will not only require the recognition of the value of grazing but also rancher stewardship. Unlike other tools, "livestock grazing" doesn't come in a box and can't be stored in a shed. New research findings on the value of rancher stewardship will be presented in a future issue of this newsletter.

Current Findings on Grazing Impacts of California's Special Status Species

The United States Fish and Wildlife Service (Service) periodically reviews and revises listed species information including conducting five-year reviews. These reviews include new research findings and impacts of recovery efforts. The following is a summary of updates on grazing impacts to listed species occurring on rangelands. Interestingly, in every case where grazing was originally considered a threat it has been found that managed grazing may be beneficial. In addition, for several species, managed livestock grazing has been determined to be essential to prevent further loss or decline in the species. The five year reviews can be accessed online at <https://ecos.fws.gov/doc>.

These findings as reported by the Service overwhelmingly point to the need to sustain grazing regimes and rancher stewardship for the successful conservation of special status species occurring on California's rangelands.

San Joaquin kit fox (*Vulpes macrotis mutica*)

In the five-year review for San Joaquin kit fox (USFWS 2010), the Service stated that additional threats to kit fox habitat had been identified. These threats include changes to vegetation structure due to non-native species and altered grazing regimes. Kit fox are vulnerable to coyotes in dense vegetation. Optimal habitat is considered to have low vegetation structure, common patches of bare ground and abundant prey. It has been demonstrated that a reduction or cessation of grazing on sites where precipitation and soil conditions allow the growth of dense vegetation results in conditions unsuitable for kit fox. Grazing by cattle has been identified as the most plausible and economical strategy for landscape-scale management of kit fox habitat (Constable et al. 2009).

Constable, Julie L., B.L. Cypher, S.E. Phillips, P.A. Kelly. 2009. Conservation Of San Joaquin Kit Foxes In Western Merced County, California. Prepared for the US Bureau of Reclamation. May 13, 2009. 48 pp.
United States Fish and Wildlife Service. 2010. San Joaquin Kit Fox- 5-year Review: Summary and Evaluation. Sacramento, CA: United States Fish and Wildlife Service. February 16, 2010. 121 pp.

Large-flowered fiddleneck (*Amsinckia grandiflora*)

When Large-flowered fiddleneck was listed, it was thought that grazing may have been responsible, in part, for the extirpation of some populations. In the five-year review, (USFWS 2009) it was recognized that a combination of either the change in the intensity of grazing (possibly a decline in cattle grazing) or the change from cattle grazing to sheep grazing may have extirpated the natural population located at Carnegie Canyon. No plants were seen at this site in 2003.

United States Fish and Wildlife Service. 2009. *Amsinckia grandiflora* (Large-flowered fiddleneck) 5-Year Review: Summary and Evaluation Sacramento, CA: United States Fish and Wildlife Service. January, 2009. 18 pp.

California red-legged frog (*Rana draytonii*)

Although overgrazing was recognized as a threat to the CA Red-legged Frog; findings since the listing have concluded that managed livestock grazing at low to moderate levels has a neutral or beneficial effect on frog habitat. Managed livestock grazing around ponds can maintain a mix of open water habitat and emergent vegetation. In some cases, without managed grazing, stock ponds would quickly fill with emergent vegetation resulting in habitat loss. In some locations fencing which had excluded livestock from ponds is being removed to improve habitat for red-legged frogs (USFWS 2006).

United States Fish and Wildlife Service. 2006. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the California Red-Legged Frog, and Special Rule Exemption Associated With Final Listing for Existing Routine Ranching Activities; Final Rule. April 13, 2006. 71 FR 19244 19346.

California tiger salamander
(*Ambystoma californiense*)



Managed livestock grazing by cattle, horse and sheep is thought to be compatible with the successful use of rangelands by the California tiger salamander. It has been recognized that grazing can maintain a low vegetation structure which makes areas more suitable for California ground squirrels whose burrows are essential to California tiger salamanders. The Service (2004) has recognized that the long-term effect of ranching is either neutral or beneficial, as long as burrowing rodents are not completely eradicated. It is likely that CTS would have been extirpated from many areas if stock ponds had not been built and maintained for livestock production. Less vegetation may also facilitate the movement of California tiger salamanders from upland areas to breeding ponds (USFWS 2003). In addition, sustainable grazing around natural ephemeral pools may also benefit the California tiger salamander by extending the inundation period so amphibian larvae can complete their life cycle (USFWS 2004)

U.S. Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; Listing of the central California distinct population segment of the California tiger salamander; proposed rule. Federal Register 68:28648

United States Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the California Tiger Salamander; and Special Rule Exemption for Existing Routine Ranching Activities; Final Rule. April 4, 2004. 69 FR 47212 47248

Bay checkerspot butterfly (*Euphydryas editha bayensis*)

Overgrazing has previously been identified as a threat to the butterfly; however, based on current findings, the Service (2009) states that lack of grazing or undergrazing is a more common threat. Grazing reduces standing biomass of non-native vegetation which uncontrolled crowds out forbs including those essential to the Bay checkerspot butterfly. Since maintaining an appropriate grazing regime is essential to the butterfly's habitat, the Service has also recognized that protecting habitat from development alone is not sufficient. For example, State and County parks are considered "protected" (i.e., not subject to development), but without appropriate grazing regimes, the butterfly has disappeared from historical areas within "protected lands."

United States Fish and Wildlife Service. 2009. Bay checkerspot butterfly (*Euphydryas editha bayensis*) 5-Year Review: Summary and Evaluation. August 2009. 42 pp.

Palmate-bracted bird's beak (*Cordylanthus palmatus* = *Chloropyron palmatum*)

At the time of listing in 1986, cattle grazing was identified as a major factor in the decline of bird's beak. In the five-year review the Service recognized that cattle grazing may be beneficial although it may also have harmful effects. Grazing can enhance habitat for palmate-bracted bird's-beak through the removal of invasive non-native plants. Unmanaged grazing can negatively impact habitat through physical destruction (e.g., soil compaction or wallowing in seasonal ponds. Many areas occupied by palmate-bracted bird's-beak have been grazed by cattle over the years with mixed results. At Springtown Alkali Sink (Livermore, California) an end to intensive cattle grazing in the 1980s allowed the native alkali sacaton (*Sporobolus airoides*), pickleweed (*Salicornia subterminalis*), and iodine bush (*Allenrolfea occidentalis*) to recover. This

action also promoted the partial recovery of the palmate-bracted bird's-beak. However, without grazing weed cover increased significantly and palmate-bracted bird's-beak numbers have been declining over time. These results suggest that the short-term results may differ from long-term results of grazing. In its five-year review, the Service (2009) concluded that controlled and properly managed, grazing may be helpful for management of palmate-bracted bird's-beak.

United States Fish and Wildlife Service. 2009. Palmate-bracted bird's-beak (*Cordylanthus palmatus* = *Chloropyron palmatum*) 5-Year Review: Summary and Evaluation. June 2009. 53 pp.



Palmate bracted bird's beak
Cordylanthus palmatus=
Chloropyron palmatum

Blunt-nose leopard lizard (*Gambelia sila*)

Although overgrazing was previously indicated as a threat to the blunt-nosed leopard lizard, current findings as reported by the Service in its five-year review (2010) suggest that the cessation of grazing is likely to be even more detrimental. Long-term studies of blunt-nosed leopard lizard population trends on the Elkhorn Plain and Pixley NWR have shown dramatic declines in numbers following consecutive wet years and dense vegetation growth. Annual grazing studies in the Lokern area from 1997 to 2005 have demonstrated the benefits of livestock grazing in reducing exotic grasses and increasing blunt-nosed leopard lizard numbers. Decisions to severely restrict or eliminate livestock grazing from conservation lands may negatively affect blunt-nosed leopard lizards. Fire as an alternative vegetation management tool has also been studied in recent years. It was found to be less effective than grazing at controlling annual vegetation because the positive effects lasted less than one year.

United States Fish and Wildlife Service. 2010. Blunt-nosed leopard lizard (*Gambelia sila*) 5-Year Review: Summary and Evaluation. February 2010. 78pp.

Calistoga popcorn flower (*Plagiobothrys strictus* *Calistoga allocarya* or *Calistoga* Popcorn Flower) and Napa bluegrass (*Poa napensis*)

In the Service's recent five-year review (2010) it was stated that the consistent pattern of heavy growth of nonnative grasses when not controlled by grazing or other management can 'smother' native plants, resulting in the subsequent crowding out, outcompeting, or overshadowing of native annuals.

United States Fish and Wildlife Service. 2010. *Plagiobothrys strictus* (*Calistoga allocarya*) and *Poa napensis* (Napa bluegrass) 5-Year Review: Summary and Evaluation. February 2010. 22 pp.

Fresno kangaroo rat (*Dipodomys nitratoides exilis*)

Although studies in the 1970s, identified grazing as a threat to Fresno kangaroo rats, recent studies with giant kangaroo rats (*Dipodomys ingens*) suggest that both overgrazing and complete lack of grazing are detrimental for populations of kangaroo rats (USFWS 2010). Sites which develop thatch from nonnative grasses not only impede the activities of the kangaroo rats and but also competitively exclude the native forbs that are the preferred food source for the kangaroo rats. When grazing was removed by CA Department of Fish and Game from the Alkali Sink Ecological Reserve and the Kerman Ecological population numbers of Fresno kangaroo rats began to decline. Heavy thatch buildup was observed at the Kerman Ecological Reserve as recently as 2008. California Fish and Game is currently working on a contract to begin grazing in the Kerman Ecological Reserve. They are also contracting with California Department of Forestry and Fire Protection to conduct a prescription burn in the Alkali Sink Ecological Reserve to reduce vegetation cover and thatch buildup and thereby benefit San Joaquin kit fox and Fresno kangaroo rat.

United States Fish and Wildlife Service. 2010. Fresno Kangaroo Rat (*Dipodomys nitratoides exilis*) 5-Year Review: Summary and Evaluation. February 2010, 22pp.

Giant kangaroo rat (*Dipodomys ingens*)

Although earlier studies reported the negative effects of overgrazing on habitat quality through competition for food between the cattle and the giant kangaroo rat and the potential collapse of burrows by livestock, more recent long-term grazing studies included in the five-year review have reported declines in the number of kangaroo rats (including the giant kangaroo rat) on ungrazed plots relative to grazed plots during wet years (USFWS 2010). The actual cause of decline in kangaroo rats during wet years is unknown, but a possible factor is dense grass growth, which inhibits foraging; increases the risk of predation by providing cover for hunting animals; and increases soil moisture which may lead to fatal respiratory problems, or the infestation of kangaroo rat seed caches with toxic molds. Livestock grazing can control the dense growth of nonnative grasses that threaten giant kangaroo rats during wet years. The Service (2010) concludes that while overgrazing may disturb individual giant kangaroo rat precincts, the cessation of grazing may lead to a significant decline in giant kangaroo rat numbers particularly during wet years.

United States Fish and Wildlife Service. 2010. Giant kangaroo rat (*Dipodomys ingens*) 5-Year Review: Summary and Evaluation. February 2010. 47pp.

San Bruno Elfin butterfly (*Callophrys mossii bayensis*) and Mission Blue butterfly (*Icaricia icarioides missionensis*)

The five-year review (USFWS 2010) recognizes that coastal scrub succession continues unchecked and without a comprehensive grazing and/or controlled burning program, habitat for these two butterflies will continue to slowly decline on San Bruno Mountain. It has been documented that in the absence of grazing and fire, coastal prairie grassland habitats are being lost to shrub and tree encroachment. The recovery plan (USFWS 1987) included livestock grazing as a threat to the survival of the mission blue butterfly due to encouraging the growth of weedy annuals and other exotic plants in the grasslands and reducing the amount of chaparral; however, current studies as reported in the review have shown that managed grazing may increase the density of native plants that support butterfly populations. A stewardship grazing plan was developed for San Bruno Mountain in 2002. Due in part to lack of funding the plan has not been implemented. The Service recognizes that preventing the continued loss of habitat will require sustainable funding sources and/or manpower and/or the reintroduction of San Bruno Elfin butterfly.

United States Fish and Wildlife Service. 2010. (*Callophrys mossii bayensis*) and Mission Blue Butterfly (*Icaricia icarioides missionensis*) 5-Year Review: Summary and Evaluation grazing and/or fire into the system. February 2010. 39pp

Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*)

The review (USFWS 2010) recognizes that while there are some monitoring studies underway the biology of the subspecies and keys to effective habitat management essentially remain poorly known. Livestock grazing has been identified as a potential habitat management tool to reduce thatch.

United States Fish and Wildlife Service. 2010. Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*) 5-Year Review: Summary and Evaluation. February 2010. 98 pp.

Water Quality Regulations on Grazed Lands in California and New Zealand: Implications for producers, communities and watersheds

By Sheila Barry, Warren King, Lynn Huntsinger, Stephanie Larson, Michael Lennox

The potential impact of livestock grazing on water quality is a concern wherever grazing takes place near surface or ground water. New Zealand and California are no exceptions. In New Zealand, more intensive grazing and an increase in the number of cattle over sheep has led to growing concerns about water quality. Some New Zealand lakes are losing their clarity due to increasing levels of nutrients. The nutrient, nitrogen, is leaching through pumice soils to groundwater which recharges lakes. Cattle urine, especially from female cows, which tend to stand in one place while urinating, is considered the primary source of rising nitrogen levels in ground water. A market-based strategy that caps nitrogen leaching from livestock in the Lake Taupo watershed is the first attempt in New Zealand to regulate livestock production intensity and protect water quality. In California, growing concerns about drinking water quality and fisheries have resulted in similar scrutiny of the relationship between livestock grazing and water quality. In the Tomales Bay watershed in northern California pathogens in runoff from grazing lands have been blamed for limiting harvest days of the commercial shellfish industry. A regulatory approach that requires assessment of on-farm water quality impacts and implementation of best management practices is being used to minimize pathogen pollution from livestock grazing. A survey of producers and regulators in the two watersheds: Lake Taupo,

New Zealand and Tomales Bay, California was conducted to evaluate the success of the regulations and identify unintended consequences for producers, communities and watersheds.

Regulations can significantly impact agricultural sustainability, economically and socially. The marginal returns for most livestock enterprises may not cover the cost of compliance and producers are not always able to pass these costs on to consumers. Furthermore, regulations may impact sustainability by affecting the producer's "quality of life." Quality of life objectives including family values and independent lifestyle are often primary drivers for livestock producer decision-making in both the US and New Zealand.



**Pasture being sprayed out to plant trees.
Lake Taupo, New Zealand.**

Policy makers may assume that increasing regulations improves environmental outcomes, but the unintended consequences of regulations have been found in many cases to have counterproductive results. If regulations impact ranch sustainability, the results may include a shift away from ranching, non-compliance, and other undesirable actions including removing or

concealing the resource to be regulated. For example in the US, protection of certain wildlife species under the Endangered Species Act has led, in some instances, to “shoot, shovel, and shut up.” Similarly in New Zealand, regulations protecting wetlands has led, in some instances, to “dig, drain, and deny.”

Although negative actions might occur on a ranch-by-ranch basis, change on an individual ranch or the loss of a ranch can have broader regional implications. Fragmentation of land use, loss of agricultural infrastructure, change in land values, and change in community structure are potential outcomes from decisions made by individual producers.

Study areas. The watersheds of Lake Taupo, New Zealand and Tomales Bay, California are quite different in size, soil type, vegetation, and water

quality impairments (Table 1), but both have international importance, share a similar primary land use, and have long history of water quality protection efforts (Table 2). Tomales Bay is located in western Marin County, California. Lake Taupo is located in the center of New Zealand’s North Island.

Water quality regulations discussed in this study are the result of actions by regional water regulatory authorities in both watersheds (Table 2). In both cases the regulations were developed after several years of consultations, public input, and in the case of Lake Taupo watershed, court action. Although the regulations in both watersheds identified an acceptable level of a contaminant, they differ significantly in how the regulation is enforced including producer requirements to comply.

	Lake Taupo	Tomales Bay
	fresh water lake, 386 miles ²	narrow ocean estuary, 17 miles ²
Depth avg	360 ft	< 23 ft
Watershed size	2167 miles ²	361 miles ²
Soil type	Free-draining pumice formed from volcanic rock and lava with the eruption of Lake Taupo volcano 1700 to 1800 years ago.	Western shore derived from granite very permeable, yet highly erosive. Eastern shore soils formed from uplifted ancient seafloor, also very erodible.
Vegetation	Native forest 45% Commercial pine forest 24% Grazed pasture 19% - (51,000 ac.) Bare/tussock land 11% Urban 1%	Forest 41% Grazed grass/oak woodland 49% - (26,400 ac.) Cultivated agriculture 2% Coastal scrub/marsh/beach 7% Urban 1%
Water quality issue(s)	Nitrogen leaching causing excessive algal and plankton growth.	Pathogens impacting recreational use and shellfish. Excessive mercury, nutrients and sediments.

Table 1. Watershed characteristics for Lake Taupo, New Zealand and Tomales Bay, California

Lake Taupo nitrogen cap and trade. In 2001 Environment Waikato (EW), the regional council that manages water and soil resources in the Waikato region, New Zealand where Lake Taupo is situated, began to meet with livestock producers to discuss a nitrogen cap. In 2005, after 4 years of consultations, the council announced a strategy to

cap and reduce by 20% nitrogen loads (releases) from manageable sources (pastoral lands) in the watershed. Under the strategy, EW grants “resource consent to farm” for 25 years after setting a cap on nitrogen leaching stated as the Nitrogen Discharge Allowance for each property. The allowance for each ranch is derived from the

nutrient- budget model, Overseer[®] www.overseer.org.nz and is based on the ranch's highest nitrogen discharge level during the benchmark years of 2001-2005. Compliance for producers means not exceeding benchmarked nitrogen leaching levels, or the cap, each year.

The nitrogen cap and trade strategy also created a public fund and charitable trust, the Lake Taupo Protection Trust, to permanently remove 20% of the manageable nitrogen from pasture lands by 2018. The public fund provides the Trust, approx.

\$61 million to implement the 20% reduction goal in the watershed. The Trust has the flexibility to either purchase pastoral land fee-title or purchase nitrogen discharge allowance credits to achieve its goal. Rules were established so that land owners can also trade nitrogen credits with each other. Non-livestock properties with relatively low amounts of leached nitrogen, such as golf courses, commercial forests, and undeveloped land, are not required to obtain a resource consent to continue their land use activities

	Lake Taupo	Tomales Bay
Importance	Internationally known for its deep clear water and trout fishery.	Wetland of International Importance as designated by US Fish and Wildlife Service. Commercial shellfish and fish industries.
Watershed population	16 small towns, population 28,000; 2.9 million visitors/year	11 small towns, population 11,000; 2.5 million visitors/ year
Land Uses	Grazing of beef cattle, sheep, deer; 4 dairy farms, commercial forestry lands, ranchettes and undeveloped open space. 92 farms > 200 acres	Grazing of beef cattle and sheep; 10 dairy farms, 33 equestrian facilities, ranchettes, and undeveloped open space (some with grazing). 151 farms > 50 acres
Water Quality Protection efforts	Efforts to control sediment began 34 years ago. Streams and highly erodible areas were excluded from grazing and some riparian areas were planted.	Efforts to control sediment began 50 years ago. Efforts focused on head cut and gully repair, sediment traps (stock ponds), some riparian fencing and plantings, and better grazing management.
Water regulatory agency	Regional Council (elected)- Environment Waikato (EW)	Regional Board (appointed)- San Francisco Bay Region(RWQCB)

Table 2. Watershed similarities for Lake Taupo, New Zealand and Tomales Bay, California, USA.

Tomales Bay Pathogen Total Maximum Daily Load (TMDL) regulation. After ten years of efforts focused on requesting livestock producers to voluntarily reduce pathogens, sediments and nutrients from runoff to Tomales Bay, the Regional Water Quality Control Board adopted a regulatory strategy to reduce pathogen sources in 2005. The strategy, known as the Tomales Bay Pathogen TMDL, moved away from singling-out

livestock producers and includes regulations targeting six potential sources of pathogens: ranch runoff, urban runoff, boat discharge, septic tanks, open space lands, and waste water treatment facilities. The TMDL regulation establishes a density-based acceptable fecal-coliform level for the bay and its tributaries and describes a plan for compliance monitoring to assess if requirements are successfully reached.

Landowners with grazing lands of 50 acres or more were required to submit a Notice of Intent to comply with the water quality regulations by January 31, 2009. They also had to complete a Ranch Water Quality Plan by November 15, 2009. The grazing land plan must identify problem areas in regards to erosion, runoff, and manure management, and state a plan of action and implementation schedule. Compliance with the TMDL regulation is based on submission of the Letter of Intent, Annual Certifications and evidence of actions that reduce potential pathogen inputs into the tributaries and bay. The total program implementation cost for livestock operations is estimated to range between \$9 and \$20 million, to be shared by approximately 150 producers. This estimate includes the cost of implementing animal waste control and grazing management measures, and costs associated with technical assistance and evaluation.

Survey Approach

Key participants in each watershed’s regulatory process including producers, water quality

regulators, and consultants were interviewed (n=13 Lake Taupo watershed (out of 92); n =11 Tomales Bay watershed (out of 151)). Interviewees were asked about motivations for livestock production, the influence of water quality regulations on ranch goals and practices, and attitudes regarding water quality regulations and their potential results. Producers interviewed represented a diversity of ranch size, type, and attitudes towards regulations.

Results

Average livestock property size in the Lake Taupo watershed is larger and stocking rates on New Zealand pastures are 5 to 10 times higher than on Tomales Bay ranches (Table 3). New Zealand’s climate in the Lake Taupo watershed provides for year-around forage production on non-irrigated pastures. In contrast, the long summer drought, typical of California’s Mediterranean climate supports predominantly annual forage grasses with a 6 to 7 month growing season.

	Lake Taupo (n=13)	Tomales Bay (n=11)
Average property size	2250 acres (Range 375 to 8650 acres)	950 acres (Range 300 to 2700 acres)
Typical stocking rate	1 to 1.25 AU ¹ /acre	8 to 12 acres per AU
Average length of landownership	17 years (Range 2 to 28 years)	65 years (Range 13 to 148 years)

Table 3. Interviewee demographics by watershed. ¹Animal Units (AU) are the equivalent of one mature cow.

Lake Taupo and Tomales Bay livestock producers are similar in several ways. They rated the desire to feel close to nature, work with animals, and work with family and/or friends as very important reasons for raising livestock. For most producers in both watersheds, livestock production is an important part of their heritage. This heritage includes a history of caring for livestock and the land. All producers in both watersheds engage in some level of land stewardship beyond livestock production, e.g. planting trees, protecting or enhancing wildlife, and controlling invasive species on their property. Long-term landowners in each watershed (ownership > 25 years) felt like their property represented their “life’s work” or “legacy.” This attitude is more prevalent in the Tomales Bay watershed (9 versus 2 landowners

rating “my ranch is my legacy” as a very important reason to raise livestock). Land ownership in the Tomales Bay watershed, in most cases, spans at least two generations (Table 3). In contrast, land ownership the Lake Taupo watershed is relatively new with most of the pastoral lands developed by Central Government agencies just 35-50 years ago. The soils couldn’t support pasture growth until a cobalt deficiency was recognized and addressed.

Interviewees in both watersheds overwhelmingly agree that livestock production is an important land use and strongly agree that it can be done in ways that protect water quality in their watershed. Several interviewees offered examples of their commitment to the environment:

Ranchers don't want to pollute. (CA)
No farmer wakes up and says, "Today I'm going to pollute". (NZ)
We don't want to do anything that will knowingly degrade the land. (CA)
As ranchers we learn to be kind to the land. (CA)
Farmers in the Lake Taupo catchment are progressive; we already fenced-off all our riparian streams and planted riparian areas. (NZ)

Interviewees' opinion in both watersheds was divided on whether the particular regulation they are facing is necessary and whether it will be effective or if additional regulations will be needed in their watershed. Their comments in regards to their respective regulation highlighted their concerns regarding the science informing the regulation in each watershed. In particular, seven interviewees in the Tomales Bay watershed questioned whether pathogen sources had been accurately identified, for example:

I don't want to be blamed for what the birds do. Even if you remove all the cattle from the watershed there will still be fecal coliform.
We have been requesting DNA testing to identify the sources.

Three interviewees in the Tomales Bay watershed thought there should be a better understanding of the fate and transport of pathogens from grazing livestock in the watershed and their connection with human disease, for example:

Will pathogens remain viable downstream? My ranch is 6 miles upstream from the bay.
Where is the record of harm from bacteria from ranches?

Similarly, in the Lake Taupo watershed there were questions from four interviewees about the fate of nitrogen leaching from their property relative to proximity to the lake. These interviewees also questioned whether the primary sources of N in the lake had been accurately identified, for example:

Have you seen how far my property is from the lake? What's the impact of feral pigs?
What about the pine tree pollen, geese and fish that have direct contact with lake?

What about gorse on the undeveloped lands leaching nitrogen?
I don't think they are targeting the problem. What about pollution from towns especially those right on the lake



Huka Falls, crystal clear water flowing from Lake Taupo

Two interviewees questioned if the lake's watershed really matches the groundwater basin.

The catchment boundary is defined in some places by a road, how could this represent what's going on underground?
What happens when high numbers of livestock are moved just across the catchment boundary?

Differences. Interviewees in the Lake Taupo watershed generally agreed that landowners should be directly compensated for loss of use as a result of regulations. In contrast, most interviewees (10 out of 11) in the Tomales Bay watershed were not sure or did not agree that compensation was necessary, especially if there was good science behind the regulation. Two interviewees in the Tomales Bay watershed remarked that they feared compensation would be a way for government to take control of more land. The Tomales Bay watershed includes a large National Park which was created from the government acquisition of private farm lands starting in 1962. The local government agreed to the formation of the Park with the condition that grazing would continue in order to support the infrastructure for a viable dairy industry. Grazing has continued in a park "pastoral zone," but relations between the park and remaining livestock enterprises—now on long-term leases-- have not

always been smooth. In addition, private land conservation efforts and land use planning in this area is relatively active. As a result, some landowners believe that fully private livestock enterprises are disappearing, and that there is an implicit government plan to take over more of the area.

Despite these concerns, 45 landowners (n= 125) in the Tomales Bay watershed have either sold or donated a conservation easement to a local agricultural land trust (Marin Agricultural Land Trust or MALT). The conservation easement precludes future development on the property but provides for the continuation of the livestock production in perpetuity. The funds to purchase the easements on these extremely valuable lands have largely come from state government and a private charitable foundation. MALT is dedicated to the long-term sustainability of family farms and farm land in the region not only through easements but also through education and outreach to public officials and the community as indicated by these statements on their website (www.malt.org):

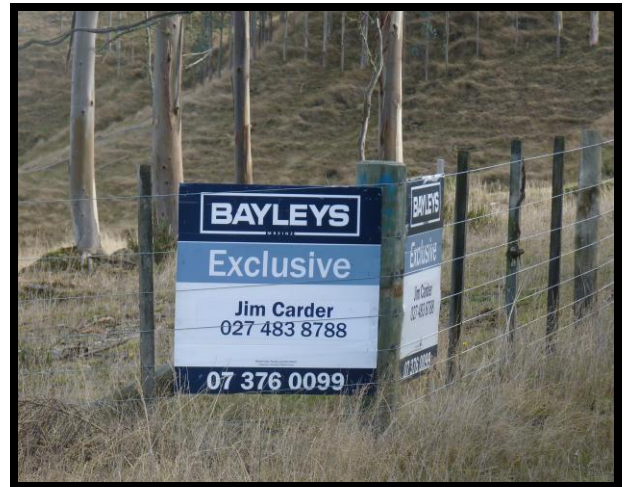
If you value this land and Marin's rural heritage, if you share our belief that the preservation of family farms and agricultural lands for local food production, open space, and wildlife habitat benefits all of us, you can play a vital role in safeguarding these resources. The producers survive and thrive only if we support them.

In contrast, community recognition of the value of farming beyond food production in the Lake Taupo watershed is poorly developed. The recent visioning process in the Taupo District in 2009 only mentioned farming as a primary source of nitrogen leaching and an industry which the community should look beyond for future economic growth. The mandate for the Lake Taupo Protection Trust (LTPT) is solely focused on reducing manageable nitrogen flowing to the lake largely by retiring land to lower nitrogen uses (LTPT 2009) such as forestry. At least three producers raised concerns about the conversion of the landscape to forest.

How much N leaching will result from all the tree plantings?

Do tourist visiting Lake Taupo really want to just see rows and rows of pine trees all around them?

There will be less control of non-native wildlife like feral pigs under the pine trees without the daily presence of the farmer.



Lake Taupo, New Zealand farm land for sale

Regulation impacts on ranch goals and practices.

Water quality regulations have had different effects in the two watersheds. The nitrogen cap and trade regulation in the Lake Taupo watershed has impacted both ranch goals and practices. Production goals that may provide more economic return but do not increase the property's nitrogen leaching, including increasing production per animal, reducing cost, and seeking value-added market opportunities have become more important to most Lake Taupo interviewees. However, at this point most interviewees are unsure of how changing practices to accomplish these goals will affect their nitrogen leaching, kg/ha as calculated by the Overseer[®] model, so little action has taken progress towards these goals. Actual change in production practices to date as a result of the nitrogen cap and trade regulation is limited to change in the land and livestock base among interviewees in the Lake Taupo watershed.

Based on interviewees' comments the change in land base does not appear to be limited to just interviewees in the watershed.

Four of my neighbors have sold their properties to the Lake Taupo Protection Trust.

I can think of 11 farms that have changed ownership since the announcement of the nitrogen cap strategy in 2001. I think 80% of these properties were sold as a

result of concerns about the farm's future value related to the nitrogen cap.

In addition, Landcorp, the company that owns and manages agricultural properties for the New Zealand Central Government put all eight of their properties up for sale as a result of perceived loss of value due to the N cap. Such changes in ownership have led to ownership consolidation, because other than the LTPT there are only a couple of buyers. These buyers stated that they saw opportunities from discounted farm prices and some certainty from future water quality regulations. In addition, these new buyers have either bought nitrogen from other properties in the watershed or redistributed nitrogen discharge allowances on their property to better utilize their best soils for pasture and seeking other income opportunities through forestry on less productive lands. Most producers interviewed believe that the net effect of these changes in land ownership has been to concentrate the allocated nitrogen on fewer acres and increase the number of dairy cows in the watershed.

The nitrogen cap, which was based on nitrogen leaching (kg/ha) measured during a farm's best year between 2001 and 2005 has left some producers feeling insecure about their farm's future. Although producers were not specifically asked about their nitrogen cap level, three producers stated that they had low nitrogen leaching caps (<14 kg/ha), as a result of their past conservative management. These producers felt as if future land value had been taken from them, and were also concerned about the resulting lack of management flexibility reducing their ability to deal with market and weather conditions. In contrast, 4 producers with higher nitrogen leaching caps (>17 kg/ha) felt that they could continue comfortably farming for the next five years or so, but were concerned about their farm's future sustainability. Most producers interviewed saw little opportunity to sell nitrogen discharge credits, for example:

Our farm isn't big enough to buy or sell nitrogen. I've already done everything I could do, that makes sense, (to lower my nitrogen leaching).

I can't even increase my cow numbers to decrease sheep numbers and reduce my workload under my current NDA (Nitrogen Discharge Allowance).

Most interviews noted that other than selling nitrogen discharge credits there was no incentives in the *nitrogen cap and trade* strategy to lower nitrogen leaching on their property (Table 4).

In contrast, production goals have not apparently been impacted at all by the TMDL strategy in the Tomales Bay watershed, according to interviewees. In addition, there have been few changes in land or livestock base as a result of the Tomales Bay TMDL strategy. No one interviewed in the Tomales Bay watershed had bought or sold land or changed their class of livestock in the past decade. Since the announcement of the TMDL two dairy farms have gone out of business. One dairy farm converted to beef and another sub-divided, but their demise was not a result of water quality regulations according to an industry expert. In the Tomales Bay watershed, the most significant changes to production practices have occurred because of requirements placed on dairy farms as a result of California state laws, according to interviewees. Dairy farms in the watershed were noted as all having complied with the new wastewater management regulations called for in the TMDL implementation plan by developing storage capacity for wastewater and applying it correctly to their lands.

On the other hand, there have been some changes in conservation goals across all ranches in the watershed that interviewees attributed to the water quality regulations. Several producers mentioned greater awareness of erosion and manure sites, and the need to do something to mitigate them. Some had applied for cost-share funding through the local RCD or USDA NRCS as a result of the TMDL strategy. Cost-share funding provides technical support and partial funding to implement new practices including fencing, water developments, erosion control, and improved grazing management. Several remarked that they had already put these practices in place or they had already considered these practices but were

motivated by the TMDL strategy to make them a higher priority.

The regulations forced my hand to improve facilities, which has benefited my farm in the end.

The TMDL provided motivation, but it wasn't the sole reason I put these conservation practices in place.

We use our conservation efforts to market our ranch products.

I didn't do anything I wasn't going to do anyway.

The TMDL provided motivation for change.

Although the producers felt that the regulation was imposed upon them, most didn't feel that the TMDL strategy impacted their finances or quality of life (Table 44). They recognized they were able to develop their own ranch water quality plan, self-identify water quality problems on their property, and chose appropriate solutions and a timeline for implementation.

Some of the differences in regards to quality of life impacts as a result of the regulations (Table 4)

were attributed to the process leading to the regulations. In the Lake Taupo watershed, most of the interviewees (9 out of 13) participated in the process. Some were heavily involved in the consultations. Although the producers formed an association, Taupo Lake Care, individual producers within the group remained very engaged and took on a great deal of personal stress. Individual producers, who were not as involved in process but have ended up with a low Nitrogen discharge allowance, also indicated they had a high level of stress. In contrast, individual producers in the Tomales Bay watershed (3 out of 11) were less involved in the process leading to the regulation. They relied heavily on their trade associations and local Resource Conservation District to provide input into the process. Although some felt "hassled" by being over-regulated and mentioned feeling stressed during the process, this was not a common feeling and no one interviewed noted stress as an outcome of the Tomales Bay TMDL strategy.

	Lake Taupo	Tomales Bay
Economic*	Loss of flexibility (12) Loss of future value (10)	None (7) Infrastructure Cost (5)
Environmental	None (12)	Better on-farm water quality (5) None (7)
Quality of life on farm	Stress (9) None (3)	None (10) Feeling hassled (2)
Quality of life within their community*	Lack of cohesiveness (12) Distrust (2)	None (10) Improved environment (2)

Table 4 Regulatory impacts on aspects of farm sustainability by number of responses

***More than one response permitted if not "none"**

Importance of producer motivations. Tomales Bay producers have received technical assistance and opportunities for cost-share funding to construct new farm infrastructure and/or adapt new management strategies. This cost-share funding has been shown to be successful in New Zealand as well. Environment Waikato's Clean Stream Fund, which provides cost share for riparian-fencing, has been an effective program in improving farm runoff water quality. Although

cost-share funding might be classified as an economic incentive, projects typically require a substantial investment from the producer. This investment provides a sense of ownership and personal action, supporting the "desire to care for the environment" that producers mentioned in their interviews. Because of the substantial investment by the producer in cost-share projects, the projects must also be compatible with production and quality of life goals. This allows

producers to “select” cost-share practices that will work for them and avoids feelings of being forced to change. Researchers have found that “when people are forced to change, even innovative individuals resist the innovation.” This finding may also explain why Tomales Bay producers often stated that the TMDL didn’t cause them to do anything that they would not have done anyway. This type of statement is often interpreted to mean that the producers would have undertaken a project with or without funding, but we urge caution. It is more likely that the meaning is that the project fit in with the producer’s goals.

Meeting water quality objectives. The Lake Taupo nitrogen cap and trade strategy was not meant to encourage individual producers throughout the watershed to reduce their nitrogen leaching. Instead, the goal was to change land use within the watershed to achieve a 20% reduction in nitrogen leaching from farms and to prevent further intensification within the watershed. The nitrogen cap and trade strategy will undoubtedly be successful at achieving this purpose because public funds have been provided to purchase land or nitrogen credits in order to achieve this reduction and all land, including farms, will be capped. In contrast, although Tomales Bay producers are legally obligated to address water quality issues on their properties, there are no guarantees that the fecal coliform levels in the tributaries and bay will be reduced and that targets will be met. However, the efforts of Tomales Bay producers could possibly lead to greater reduction of contaminants than that required by the regulation. This possibility may be an important distinction because in both cases targets were based on the regulators and associated scientists’ “best guesses.” Reaching desired water quality outcomes may require future reductions of nitrogen and contaminants beyond the initial targets.

Unintended consequences. While the mechanism in the Lake Taupo strategy that allows for nitrogen allocation trading among producers provides flexibility for some farms, it adds little value or opportunities for farms that already are at low levels of nitrogen leaching. Because they will have less flexibility, the “greenest” farms in terms of

nitrogen leaching may require more oversight and technical assistance as they strive to remain viable. Thus, this method could have undesirable consequences in terms of favoring fewer, larger and more intensive farms in the watershed, farms that have the capital to purchase nitrogen credits. It may also lead to concentrating the allocated contaminant load, leaching nitrogen across fewer hectares.

Some researchers in New Zealand have suggested that future research should focus on finding market-based means to divert livestock producers from high leaching livestock to “environmental friendly non farming” activities. However, it should be considered that although alternative land uses may be lower in nitrogen leaching, they may not only be less desirable from a community perspective, but also fail to recognize the non-profit motivations of livestock producers.



A new crop of Monterey Pines around Lake Taupo, New Zealand

Animal husbandry is one of the things producers enjoy. Finding ways for livestock to be raised in low-leaching systems in the watershed may have more desirable and far-reaching results across pastoral New Zealand. Additional technical assistance, based in the idea of sustaining production, could bridge the current gap in producer understanding of the nitrogen cap and trade and how to deal with it, which is leading some producers to see opportunity while others find despair (Table 4).

Conclusion

Although livestock producers in the US and New Zealand need financial returns to remain viable,

the importance of lifestyle and environment to owner-operators should not be overlooked in developing regulations. Most producers demonstrate a desire to care for their land, and they recognize that the long-term health of their soil and protection of water quality is essential to the future well-being of their farm. Effective regulations and incentives should support

producers in their desire to care for the land. This support should go beyond economic incentives and include education, cost-share for trying new production systems, public recognition of good stewardship, and provision of preferential tax rates if their farmland is maintained in extensive production form.



Cows grazing swedes (a turnip-like plant grown for livestock fodder)
Lake Taupo watershed, New Zealand

Upcoming Events

- **April 17, 3:00 PM to April 18, 4:00 PM. Cal-Pac Society for Range Management Spring Meeting and Tour at Tejon Ranch.** Conservation Partnerships for Working Landscapes- An Introduction to the Tejon Ranch and the Tejon Conservancy Project. Space is limited. For more information and registration go to: casrm.rangelands.org.
- **April 21, 8:30-4:30. Central Coast Rangelands Coalition Spring 2011 Meeting just south of San Jose.** Improving Cooperation between Public Lands Agencies and Ranchers. Attend this day-long event to learn how conservation-oriented public lands agencies work with ranchers to meet their goals. ****No registration fee, but ADVANCE REGISTRATION IS VERY HIGHLY RECOMMENDED**** due to the security measures of our hosts. To request registration link contact sbarry@ucdavis.edu.
- **May 17-18. UC Blue Oak Ranch Reserve Oak Woodland Conservation Workgroup in San Jose, CA** Details to be announced. Request more information from sbarry@ucdavis.edu



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