Swimming upstream and having fun

Richard J. King, *CNGA Board Member*

Background

My comments focus on what I've learned about California Mediterranean annual grasslands in California, although they seem applicable throughout the coastal, mountain, and Great Basin climate zones in which I've also been working. And I see no reason why they wouldn't apply in central and southern California, since I tend to focus on learning principles and trends.

I began focusing on grassland management and ecology in my first professional job out of Humboldt State University as a Range Conservationist with USDA-NRCS (formerly the Soil Conservation Service) in Flagstaff, Arizona in 1975. While in Flagstaff, I pursued a graduate degree and focused on wildland ecology. My passion was to understand how nature works so that land management could be improved. My thesis investigated and compared grazed and relict rangeland sites in the blackbrush formation at the Hualapai Indian Reservation and Grand Canyon National Park, which included various shrub, mixed grass shrub, and grassland sites.

I returned to California in 1982 as a range specialist in Red Bluff, assisting NRCS offices from Livermore north. In 1990, my family moved to Petaluma where I grew up, and we have managed 40 acres of grassland since 1991, 30 acres of which had been dryland farmed for several generations by my family to produce oat hay. The California range profession I joined in 1982 believed that the introduced Eurasian annuals outcompete California's native perennial grasses and forbs, and efforts to bring perennials back had failed. In more recent years, some believe substantial portions of our annual grasslands may never have been perennial grasslands or may have had only small patches of perennials.

Here is what I'm learning by observing my own grasslands and grasslands throughout northern California, whether I'm enjoying the plants, the earthworms, a white-tailed kite, or a pocket gopher:

Restoration and reality

The number of introduced species in our grasslands, in all forms of life—not just plants—is enormous. It will never be possible to restore native grasslands to anything more than a semblance of what may have been because so many species have become naturalized and embedded in the fabric of grassland life. I prefer to view the idea of grassland restoration as managing toward grasslands still rich in native species without presuming the goal of restoration can be anything more than that. Change, including extinction, is a law of nature for individual species and communities of life.

Competition

The only serious competition I find between annuals and perennials is for sunlight. At the perennial seedling stage, annuals typically grow far more rapidly. If you spread the annual canopy after it gets about 6–8 inches tall or more, you will see the lower portion of their stems and leaves are yellow because of inadequate sunlight. Most native perennial grass seedlings grow slower and are subject to being shaded by the annuals, killing seedling perennials. Studies in 1944 by R.M. Love at UC Davis found that early spring grazing increased the survival of needlegrass and Hardinggrass seedlings.

The other enemy of successful perennial seedling growth from shading is excessive litter from the previous growing season, whether standing or lying down and very thick. Seedlings need sunlight for photosynthesis. Even our exotic annual seedlings suffer from excessive thatch. And full-grown perennial grasses and forbs can be shaded to death from old thatch. Grasslands didn't evolve without herding animals that graze or trample old growth.

Some perennial grasses can live a very long time. Even a low rate of successful perennial seedling establishment will win the successional war with annuals in the long term. In the fall, perennials are often seen greening up before annuals have even germinated. Perennials have a head start on annuals once the seedling survives the

A vernal pool on the outskirts of Redding *Richard King*

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first summer. They only need to successfully develop three to five leaves to survive the summer drought. Having worked in Arizona for 8 years, I learned that 6 months without rain is definitely not a drought that is likely to prevent perennial grasses from successful seedling establishment.

Research shows annuals extract soil moisture much more completely than perennials, making it difficult for other species, such as perennial grasses, to successfully develop a root system through that dry zone. I don't doubt the research. I doubt the interpretation that perennials (or oak seedlings) are prevented from successfully establishing due to competition for water when we average a 4–6 month growing season and only need a tiny plant with three to five leaves to develop adventitious roots that can survive the summer drought. I have seen young perennials successfully invading into well managed annual grassland—both in very productive annual grassland and in sites with low productivity.

I'm not saying competition for moisture between annuals and perennials isn't occurring. I'm saying it is overrated as a reason why perennials aren't more successfully reproducing and spreading within our annual grasslands.

Invasives

We think of invasive species as problems. Yellow starthistle invaded loamy soils on the 30 acres where I built my house in 1991 and then stopped the continuous family hay farming. Tarweed increased greatly on the clay soils. (I can't call tarweed invasive because it is a native species.) My wife and kids hated walking out through the pastures. After 6–8 years my wife asked me why the starthistle wasn't as bad. It had dramatically diminished to relatively small and less dense patches. It disappeared in many places. Why? Same story with the tarweed. Why?

On the 10 acres that had not been dryland hay—just annual grassland for the most part—very few starthistle plants have existed since 1991, yet I manage all 40 acres with the same planned livestock grazing. Why didn't yellow starthistle invade that 10 acres too? Same story with the tarweed. Why didn't tarweed invade/increase in that 10 acres?

Medusahead has been steadily spreading on the old cropland with more patches developing and slowly enlarging over the years. Why? Some of the patches have shifted from a thick monoculture thatch to a patch with much more species diversity over time. Why?

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On the 10 acres managed as pasture for many decades, very few patches of medusahead have developed. And they are rich in species diversity compared to the old cropland patches. Why?

Many fenceline contrasts, roadside contrasts, and patchiness of invasives in northern California suggest to me that invasiveness is relative. On my own property, I'm convinced the invasiveness is far less or is nonexistent on the sites with higher soil biodiversity. I'm seeing similar evidence everywhere: invasives are not always invasive, yet we hate them with a passion and spend inordinate amounts of time and money trying to battle them. But are they a causal problem of the "competition" we think we are seeing with other vegetation, or are invasives simply the effect of soil biodiversity loss due to the past or current management of land? I think the latter is very often the case. Too many areas have not been invaded despite the invasive seed raining down on it every year. We have done a very poor job seeing that reality and seeking to understand why invasives are often not at all invasive.

Biodiversity

This is the least understood and appreciated foundation of our California grasslands; it is also true for our grassland restoration efforts. While we tend to focus our attention on nonnative invasions, the competition with natives, and keeping adequate residual dry matter on our annual grasslands grazed by livestock, the real issue we have largely ignored is biodiversity. There is far more to biodiversity than our remnant native plants and animals that we seek to protect or restore. Why do I say that?

There are more species of life in a shovelful of garden soil than aboveground in the Amazon forest—one of the most biologically diverse parts of earth. The diversity of life in soil is also as complex as the biodiversity found in the world's great coral reefs. Most soil microbes and life have not even been named or identified, let alone do we understand the complexity of their interrelationships. The complexity of life in that underworld is simply mind-boggling, and research has barely begun to explore the world beneath our feet.

Klamathweed (St. Johnswort) is an example of the importance of understanding the role of species complexity and relationships in grasslands. It invaded and devastated grasslands in much of northern California until scientists introduced a tiny beetle that disrupts the amount of healthy seed produced. Klamathweed dramatically declined and is still present but no longer threatens grassland biodiversity. The incredible ripple effect through grassland environments infested with the weed occurred by increasing biodiversity by adding only a single new species—a tiny species of beetle.

The solution to the weed invasion was adding biodiversity, not killing Klamathweed. But that is an aboveground example. What about biodiversity in the soil?

I see the similar ripple effects on my own property where invasives like yellow

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starthistle and medusahead may persist in some areas in small amounts, but monocultures of them have dissipated over time while soil organic matter (i.e., carbon sequestration) and biodiversity is improving on my family's former cropland. It beg's the question: "Are such invasives problems or merely symptoms of the loss of soil biodiversity?"

I believe there is great evidence that our soil organic matter and soil biodiversity in much of California's annual grassland was variously depleted long ago when attempts at farming occurred. Abandoned farming has been followed by what I would call conventional annual grassland grazing management, where the management focus is only on leaving adequate residual dry matter—the mantra of the California range profession.

A small relict area on my property has road cuts on two sides of it, creating an island. It may well be an area that was never farmed. It is excessively drained yet very rich in native perennial forb and native perennial grass species as well as typical nonnative annuals. The grazed side of the boundary fence is rich in native species diversity; the roadside that hasn't been grazed or disturbed for many decades has fewer native species and is dominated by only one native perennial species.

In the vicinity of the relict area, some native perennials have spread more quickly than others. Some are not moving outward at all. I cannot help but think the reason may be that soil biodiversity, the level of succession of life in the unfarmed soil, may explain much of what I have observed. Given the loss of soil organic matter and the soil biodiversity dependent on it in the surrounding dryland farmlands, I have no idea how quickly (or slowly) successional changes below or above ground might occur as perennials variously spread (native) or invade (nonnative) well-managed annual grassland. The complexity is far too great to do more than wonder, monitor great detail for the long-term, or invite research.

Are invasives increasing and rare species threatened because biodiversity continues to decline in California grasslands? I don't know, but I think it is a fair question. We know so little about how to monitor biodiversity in a practical way. Perhaps measuring soil organic matter is the single most practical monitoring tool available for grassland managers who want to know if they are building soil life over time.

Management

Grasslands evolved with herding animals subject to predation in California. The grazing animals did not evolve separately from their predators, grasses, soil life, or any species in the web of grassland life. Grasslands evolved with the interrelationships and interdependence of herding animals and their predators. Grasslands require the grazing and herding effects to remain healthy, diverse, and productive. As a range specialist for 35 years, what have I learned about how we manage plants and grazing animals in our grasslands?

(I think fire is an overrated restoration or management tool where grassland fires are predominantly human artifacts rather than lightning in our Mediterranean climate grasslands.)

Humans have changed the equation. Overgrazing of individual native perennial plants (and annuals) is predominant in our California grasslands where livestock are present in pastures for long periods during the growing season. From the plant's point of view, overgrazing occurs when the plant is stressed by the imbalance of its solar collector and the energy demands of its rootmass, and regrowth is grazed again before the plant has fully recovered its vigor. The negative effects on rootmass, soil structure, productivity, soil carbon sequestration, reproduction, and biodiversity above and below ground are all negative and are cumulatively additive as the number of overgrazed plants in a field increases. Invasive species can become more invasive unless they too are overgrazed.

Overgrazing can be remedied by providing adequate plant recovery periods instead of grazing regrowth too soon. I've learned that words like overgrazing, intensive grazing, rotational grazing, and severe grazing mean very different things to different people, including those in the range profession. I've learned to always ask: "What do you mean by that?"

Native perennial grasses and native perennial forbs are variously "invading" my grazed annual grassland, as are nonnative perennials. The evidence of succession toward perennials occurring in

Cattle happy to remove excessive shading from seedling perennials *Richard King*

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annual grasslands is neither unique to my property nor rare, despite the entrenched belief that it is neither practical nor possible. Evidence is everywhere. I've seen native needlegrass invading medusahead rangeland west of Corning. I've seen native blue wildrye move beyond the confines of a blue oak understory and invade the open prairie. I've seen native California oatgrass invading my annual grassland. And I've seen countless other places where native or nonnative perennials are increasing when managed purposefully or accidentally to benefit plant vigor. I rather enjoy referring to native perennials as "invading" our annual grasslands, since the paradigm (i.e., strongly held belief) is that it can't and doesn't happen, and I've learned the facts are otherwise.

Management is everything. Shifts in succession that I've encountered seem always related to past and present management of grasslands. I've learned many principles that apply to grassland management. Minimize overgrazing by providing adequate plant recovery periods after plants are bitten, minimize excessive thatch accumulation by knowing where the environment is on the brittleness scale (i.e., effectiveness of biological decay vs. oxidation), always manage for good livestock performance, and always manage for financially sound enterprises. Always manage ecosystem processes—don't focus on parts. The faces of nature can be simply viewed from four perspectives as the nutrient cycle, water cycle, solar energy flow, and community of life dynamics—none of them exist in isolation or can be managed separately. Only the "whole" can be managed successfully, which includes the people and finances involved.

Learning for Tomorrow

All California grasslands are managed the way they are because of decisions by people. Whether a decision is to act or not to act, even being indecisive is a decision made by people. I know of no grasslands that aren't managed by people who make decisions about what to do with them or on them. Decisions are founded in endless permutations of our beliefs, experience, research, advice from others, and best guesses.

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The most powerful tool I've learned to improve grassland management (or any other environment) is the Holistic Management® framework for decision-making, which differs dramatically from how we tend to make decisions. In this novel framework, decisions are always made toward a three-part goal that is driven by the values of the decision-makers, what they must produce to have and enjoy those values, what the future environment must be like ASAP to produce those things and enjoy those values, and, finally, what the greater community must be like ASAP because few on this planet can stay successful and in isolation from others.

Developing such a goal first requires outlining who the key decision-makers are, what they manage, and what resources they have access to that might be of help in their management decisions. Then, any proposed action or plan can be tested in relationship to the holisticgoal by using seven testing guidelines to ensure the decision is ecologically, socially, and financially sound—much like a pilot uses a checklist before taking off to avoid having a wreck.

Not only does this framework include focusing decisions on enhancing and protecting our life support system (i.e., mother nature) in order to enjoy what we most value, specific planning processes outline how to develop sound grazing plans, financial plans, land plans, policies, and basic biological monitoring. Its not that any of this other than the grazing planning is really new and different; it's the synthesis of addressing land, people, and money issues simultaneously that is unique. I use this framework because it is purposefully kept simple and clear. Like most, I needed a bit of training to shift my paradigms and use this framework. This decision-making process requires some humility because any decision that affects our incredibly complex environment is assumed to be wrong so that close attention and monitoring occurs to immediately change course, if needed.

The grazing planning process is quite different because I'm not aware of any other step-by-step grazing planning process that begins by asking: "What is the plant recovery period necessary to fully restore a severely bitten plant's vigor and root mass?" Sadly, our conventional focus on residual dry matter as the standard for planning grazing on California annual grasslands does nothing to encourage sound grazing planning from the plant's point of view.

Holistic planned grazing strives to minimize overgrazing of plants and prevent excessive accumulation of thatch in environments where biological decay of dead material is not adequately occurring—all in a way that works well for the manager and the pocketbook.

I've practiced using this new holistic grazing planning process on my own property for 18 years and am still learning how to improve and accelerate my skills at managing nature's patterns, pulses, and processes in California's grasslands. I've learned prescriptions don't work but sound planning processes do. Teaching these principles and processes to others interested in more effectively setting goals and developing plans to manage their land and livelihood has been just plain fun. CNGA has offered workshops in holistic grazing planning that will benefit California's grasslands and grassland managers.

Probably the biggest thing I've learned is that there are no experts—we are all learning together—and that can be fun!