

# Conservation Grazing Part 1

## Introduction to Conservation Grazing for Western Washington Prairies



### Introduction

Conservation grazing is an approach that endeavors to use grazing for conservation outcomes. It has been variously defined as “livestock grazing that delivers multiple benefits for wildlife and people now and into the future,” and “...the use of livestock where the primary objective is to manage the site for wildlife, whether it be grassland, woodland, wetland or scrub,” among other descriptions (Tallowin 2021, Payne 2020). This approach is part of a transition from a utilitarian focus on production of livestock and forage to an ecosystem management focus (Fuhlendorf et al. 2012; Havstad et al. 2007, Freece et al. 2014). While natural resource conservation elements have been common in grazing management plans for decades, they need to be better supported by practical and detailed guidelines, such as through Extension bulletins, detailed planning tools, and trainings grounded in grassland and restoration ecology.

To begin to address these gaps, this Extension series aims to:

1. Introduce grassland ecology and the conservation grazing approach,
2. Compile available scientific concepts and principles to build shared understandings of grassland ecology and restoration on grazing lands, and
3. Illustrate these principles through practical examples.

A common problem when considering use of grazing animals for conservation is the conflicting perspectives and priorities held by livestock producers, conservation ecologists, and the regulatory community. While a popular refrain among proponents of grazing animals for sustainable grassland management is “*it’s not the cow, it’s the how*”, some remain unconvinced.

For these unconvinced, concealed within the refrain above is the possibility that grazing can be applied as an ecological process, and that just as with fire grazing applied well can generate ecological niches and thereby wildlife habitat (Figure 1).



Figure 1. It might not look like much, but these are dried camas (*Camassia quamash*) seedheads in a pasture managed by Tracking Y Ranch, Thurston County, WA. The ranch operator defers spring and some summer grazing when they find spotty areas of Camas. This allows the species to develop seed pods and mature fully. The livestock producer then grazes these patches in the fall, the cattle consume the hard seeds, and disperse them through their manure around the properties that they are managing for increased ecological condition and native prairie species. Further, this short stubble height in the fall leads to new Camas plants not having to fight through tall forage for sunlight as they start growing in the spring. (Photo and caption credit: Jake Yancey, Tracking Y Ranch)

To lay out this approach, this series aims to increase knowledge of ecological principles in grassland management and use specific management examples for how grazing has been and can be applied as an ecological process for biodiversity conservation and enhancement. The target audiences are the regulatory community, grass-based livestock producers, conservation land managers, private landowners, and others.

A little background is first provided on grasslands locally and globally, their geographic extent, ecological, cultural and social importance, and trends in loss of this critical biome. Readers interested solely in the introduction to conservation grazing can skip down to that section. Bulletins two through four in this series present management and planning tools for implementing this approach.

## **Grasslands Globally and in Western Washington**

Grassland ecosystems cover approximately 26% (8.6 billion ac) of the global land surface (Squires et al. 2018). With savannas, shrubland, semi-forested rangeland, arid and tundra habitats included, these ecosystems cover approximately 40% of the terrestrial land surface. Grass-dominated ecosystems are dispersed across a variety of elevations, topographies, and latitudes, and develop due to conditions that limit closed tree cover. These limits include environmental factors such as precipitation (or lack of), soil type, disturbances such as wildfire or herbivory, cold temperatures, and cultural maintenance through burning, and removal of shrubs and trees (Figure 2).



Figure 2. Cattle grazing on glacial outwash prairie in Western Washington (Nisqually silt-loam soil). This landscape would quickly develop into closed canopy Douglas Fir (*Pseudotsuga menziesii*) in the absence of disturbance.

Grasslands have been typified as natural, semi-natural, or improved (Squires and Feng 2018), though these bounds are often hard to maintain. Natural, or primary, grasslands are predominantly maintained by low rainfall or cold temperatures though often in combination with herbivory and fire. For example, fossil records indicate that expansion of grasses (species in the family Poaceae) apparently coincided with increased aridity and retreat of forests during the Oligocene (34-23 million years ago; Gibson 2009). Such was the case in North America during this time, when uplift of the Rocky Mountains reduced rainfall on the plains (Great Plains) east of the emergent continental divide. Other regions of these so-called natural grasslands include Australia, the Arctic, Antarctic and alpine tundra (from “treeless plains” in Finnish), pampas of Argentina, African savanna, and steppe regions of Russia, Mongolia, and China, among others.

In the Mesolithic to Neolithic transition (4,300 to 3,700 years ago) it becomes more difficult to separate human activity such as burning and extensive grazing management from climatic maintenance of grassland ecosystems (Figure 3). Additionally, referring to human-influenced grasslands as “semi-natural” suggests the role of indigenous populations are artificial or unnatural. This is problematic in prairies that have been managed by tribes for so long it is difficult to isolate the role of people on endemic speciation and unique ecosystems that resulted.



Figure 3. Prairie-oak grassland in south Puget Sound. Landscapes throughout western Washington were thought to have been natural grasslands as long ago as 40,000 years ago, during a cooler and drier climatic regime. More recently, at least for the last several thousand years these grasslands have been managed by indigenous populations as a form of eco-agriculture through burning and harvesting (Photo credit Ecostudies Institute)

Semi-natural, or secondary, grasslands are loosely defined as lacking one or more of the natural disturbances or climatic limitations that maintain herbaceous dominance (Gibson 2009). These grasslands are associated with human activity in which succession to tree canopy closure is or has been restricted, typically through the use of fire (Figure 4), but also potentially in combination with moisture-limiting edaphic (soil) conditions.

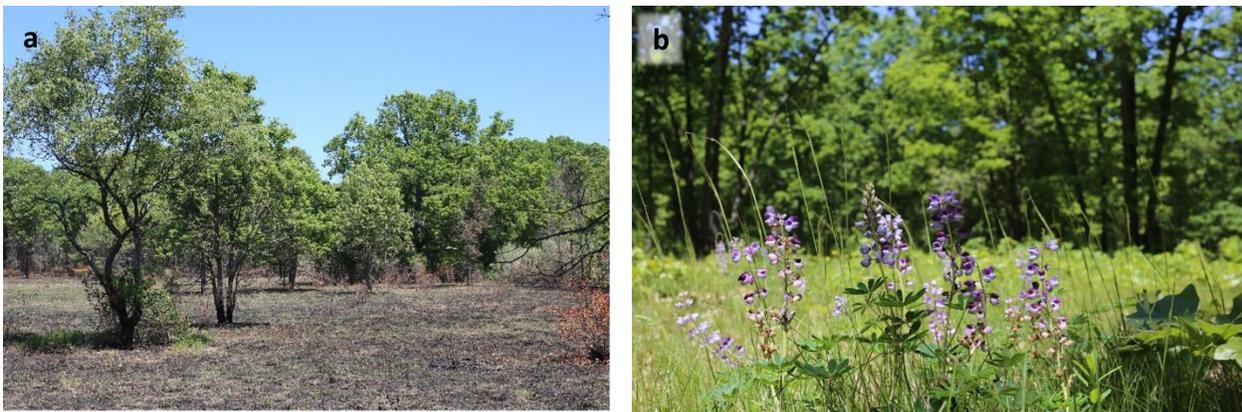


Figure 4. Burning at the Allegan State Game Area (a) outside Allegan, MI to maintain oak-savanna habitat. Among other objectives, land management aims to maintain habitat patches for the Federally Endangered Karner blue butterfly (*Lycaeides melissa samuelis*). (b) Wild lupine (*Lupinus perennis*) is the only host plant for the species.

Grass and forb-dominated prairie ecosystems of western Washington are a type of semi-natural or secondary grassland, though with qualifications. Maintenance of these ecosystems for habitat and natural function in addition to mere forage production distinguishes a ‘semi-natural’ from a ‘secondary’ classification. So-called improved grasslands are those managed with high-producing non-native livestock forages that are the result of breeding programs, such as perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*). These grasslands are often but not always managed with increased fertility and irrigation inputs.

As noted, in the Puget lowlands the picture is complicated by climatic shifts before and after glacial expansion and contraction. Fossil pollen samples dominated by grass family (Poaceae) and *Artemisia* species suggest a cold steppe-like climate between 40 and 14 thousand years before present (Ashworth and Nelson 2014). As a result, what likely became grasslands maintained by indigenous populations were at one time so-called natural grasslands maintained by a colder and drier environment.

## Geographic Extent of Grasslands in Western Washington (map?)

Terminology for grasslands is diverse and not often applied uniformly. What we know as the prairie ecosystems of western Washington, in technical terms would be described as semi-natural grasslands (Figure 5). Prairie is a French word (prairie) derived from the Latin *pratium* (meadow) and its popularization in North America is likely linked to early exploration by French-Canadian missionaries and fur traders (Creamer 2012). Other terms used to describe biodiverse grasslands in the context of conservation grazing, especially in Europe, are “high value grasslands” and “species rich grasslands”, though there are others. Gibson (2009) provides a succinct compilation of grassland terminology and notes that many terms are based on traditional uses, such as hay meadow, pasture, forage, and rangeland. For this publication series we follow local convention, using the terms prairie and grassland interchangeably.



Figure 5. A stand of Douglas aster (*Symphyotrichum subspicatum*) in a south Puget Sound prairie. Due to fewer sod-forming grasses native to the region prior to European settlement, it is thought that western Washington grasslands may have been more dominated by forbs rather than species in the Poaceae, or grass family. Though approximate percentages are not well known. (Photo credit: Ecostreams Institute)

However they are described, grass and forb-dominated ecosystems have been roughly mapped in western Washington based on the geographic distribution of prairie and grassland soils in the region as described by the Natural Resource Conservation Service (Noland and Carver 2011). These soils extend in patches from the Columbia River in the south near Camas, WA to the tip of Orcas Island (San Juan Islands) in the north, with a patch of prairie-soils in eastern Whatcom County. They include Carstairs, Doty, Ebey, Mossyrock, Nisqually, Orcas, Spanaway, Tacoma, and Washougal soil series, among others, totaling approximately 47 soil series (Noland and Carver 2011). The three primary prairie regions in Western Washington are the islands of San Juan and Island Counties, areas of Pierce and Thurston Counties in South Puget Sound including substantial areas in Lewis County, and southern Clark County near Camas (Figure 6).



Figure 6. Characteristic Puget prairie with thick cover of Common camas (*Camassia quamash*) and hemmed by Gary Oak (*Quercus garryana*) outside of Tenino, WA. Note the oak and prairie are not well-integrated here in a savanna. The cattle pictured are fenced in a deferment pasture (difficult to see in photo) for forb bloom and seed set.

Historic extent of western Washington prairies is estimated at approximately 150 to 180 thousand acres, of which only 2,990 acres (or 3 percent) of “intact prairies” remain (Crawford and Hall 1997, WDFW 2024). The lower historic estimates from Crawford and Hall, now dated, were based on distribution of only a subset of those gravelly, well-drained soils noted above. As a result, the actual historic extent may have been much greater. Sites with these soils are also those most likely to have supported oak-savanna grasslands.

### **Native Ungulates in Grasslands: A Model for Livestock-Based Grazing Disturbance?**

In many grasslands worldwide, native ungulates (wildlife that can digest cellulose-rich grass) have played a significant role in shaping these ecosystems in tandem with climatic and human influences. All three are types of disturbance that maintain native grass and forb dominated landscapes. Similar to climatic conditions and human management (such as use of fire), grazing by native ungulates has historically provided the critical and periodic disturbance that many grasslands require to fend off encroachment by trees and shrubs. While not directly comparable to wild ungulates, a need for periodic disturbance highlights the ecological niche that livestock (native grazer analogues) occupy when rotated, stocked, and managed thoughtfully.

There is very little known about the role native ungulates have played in the formation and maintenance of prairies in western Washington. Research from other regions have correlated an increase in grassland plant species richness with herbivory by native migratory ungulates, including bison, elk, and deer. These findings describe native ungulates as facilitating ecosystem services in grasslands, especially in moist grasslands (Frank 2005). Yet impacts are not always the same under varying conditions. In one study, moisture gradients were an important factor in determining whether grazing by large herbivores had a positive or negative impact on plant biodiversity, with greater risk of biodiversity loss in arid grasslands and greater benefit in wet grasslands (Gao & Carmel, 2020). This is relevant to western Washington’s wet climate.

And while bison were not present historically in western Washington, their ecological role and impacts elsewhere may provide insights on how best to manage grazing cattle as an analogue. Reintroduction of bison in other regions has shaped/maintained and enhanced biodiversity in grassland ecosystems, and increased bird, mammal, arthropod, and plant diversity (Moran, 2014; Boyce, Shamon & McShea, 2022). Conservation grazing that relies upon domestic livestock may need to emulate the grazing behavior of large native herbivores, and considerable research is underway investigating how to create historical patch-mosaic disturbance patterns caused by these ungulates.

## Ecological, Cultural, and Social Importance of Grasslands

Globally and locally, grasslands support human livelihood and ecological function on a massive scale (Figure 7). Grasslands have supported food for human populations world-wide for millennia, generating a diversity of native first foods and, more recently, supporting the majority of agricultural operations. Grasslands currently constitute 70 percent of total global agricultural land area, sustaining two billion people (25 percent of the world population; Robinson et al. 2019). Ecologically, grasslands play an important role in global climate regulation, exhibit greater plant diversity on small spatial scales than any other ecosystem in the world (e.g. number of species per 100 ft<sup>2</sup> patch; Habel et al. 2013), and provide many ecosystem services in terms of pollinator resources (and resources for their predators) and water regulation (Bengtsson et al. 2019; Figure 9).

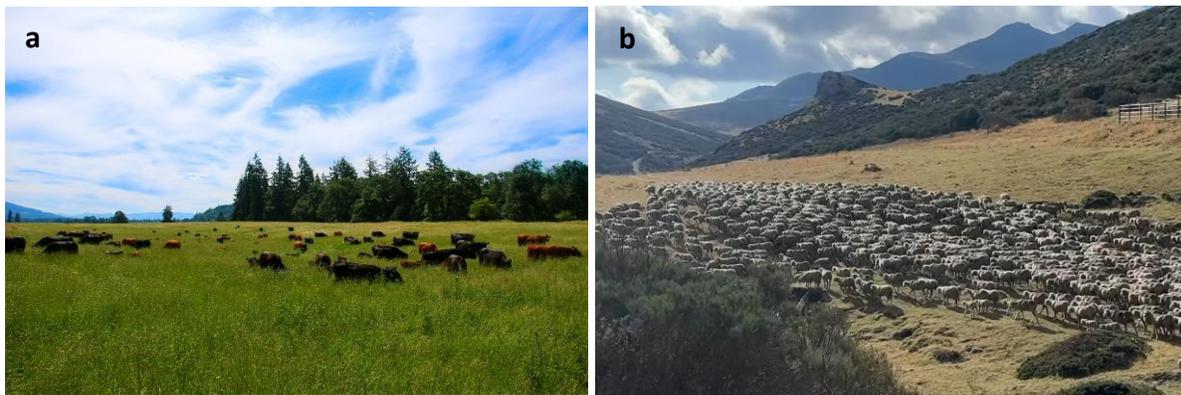


Figure 7. (a) Cattle grazing at Colvin ranch in Western Washington, a grass-based livestock operation that has supported the family and provided beef to the community since the mid-1800s. (b) Grass and range-based livestock support roughly 2 billion people around the world, including shepherds and their families managing these 1,400 Merino sheep making an annual journey from the Palentine Mountain region in Spain to oak-grassland pastures in the lowlands.

Prairies have been stewarded for thousands of years by Native peoples in western Washington using fire and traditional harvesting to generate food, medicines, basketry materials, and other textiles (Hamman 2021). These important cultural practices are still recognized and utilized by tribes to manage prairies throughout the region, including in south Puget Sound the Nisqually, Chehalis, Cowlitz, Puyallup, Squaxin and more (Figure 8). Loss of traditional ecological management due to displacement of indigenous peoples and practices led to shrub and tree encroachment, loss of native species displaced by invasive forages, contraction of total area, and nutrient enrichment from agricultural intensification (Figure 9).

Today, grasslands still provide most of the land for livestock grazing operations and more intensive row-crop agriculture in the region. Also, western Washington prairies provide recreational and educational opportunities such as birdwatching, hiking/trail running, horseback riding, botanizing, and educational experiences for upcoming livestock producers (Figure 10).



Figure 8. (a) Camas plants harvested by members of the Chehalis Tribe. The pictured digging tools combine traditional and more modern elements. (b) Camas bulbs. The remaining and historic western Washington prairies are the ancestral lands of several tribes in south Puget Sound, including the Chehalis, Cowlitz, Nisqually, and Squaxin. Close connection of local tribes to the prairies is illustrated, for example, by the name 'Nisqually' which was derived from "Squalli-absch", meaning 'people of the grass'.



Figure 9. A restored prairie on a former dairy site in South Puget Sound completed by the Center for Natural Lands Management. This site was non-native forage prior to renovation using chemical controls followed by heavy native seeding for several years. The site is highly biodiverse and produces substantial plant biomass due to its history as a dairy. The high levels of fertility are unusual compared to typical nutrient-limited, gravelly-sandy glacial soils supporting upland prairie in this area.



Figure 10. Grasslands provide important employment and educational opportunities for next generation livestock producers, such as attendees at this Southwest Washington Grazing Association fencing field day.

## Loss of Grassland and Grassland Species Globally and Locally

Grasslands and associated grassland species have experienced dramatic declines worldwide over the past 50 years (Peterken 2013, Mahony 2022, NABCI 2022) (Figure 11). This includes a 60% (360 million ac) loss of North American grassland, 90% loss of northern European semi-natural grassland, 106 million acre loss of Eurasian steppe to cropland, and 60-80% degradation of South American grassland (Bengtsson et al 2019).

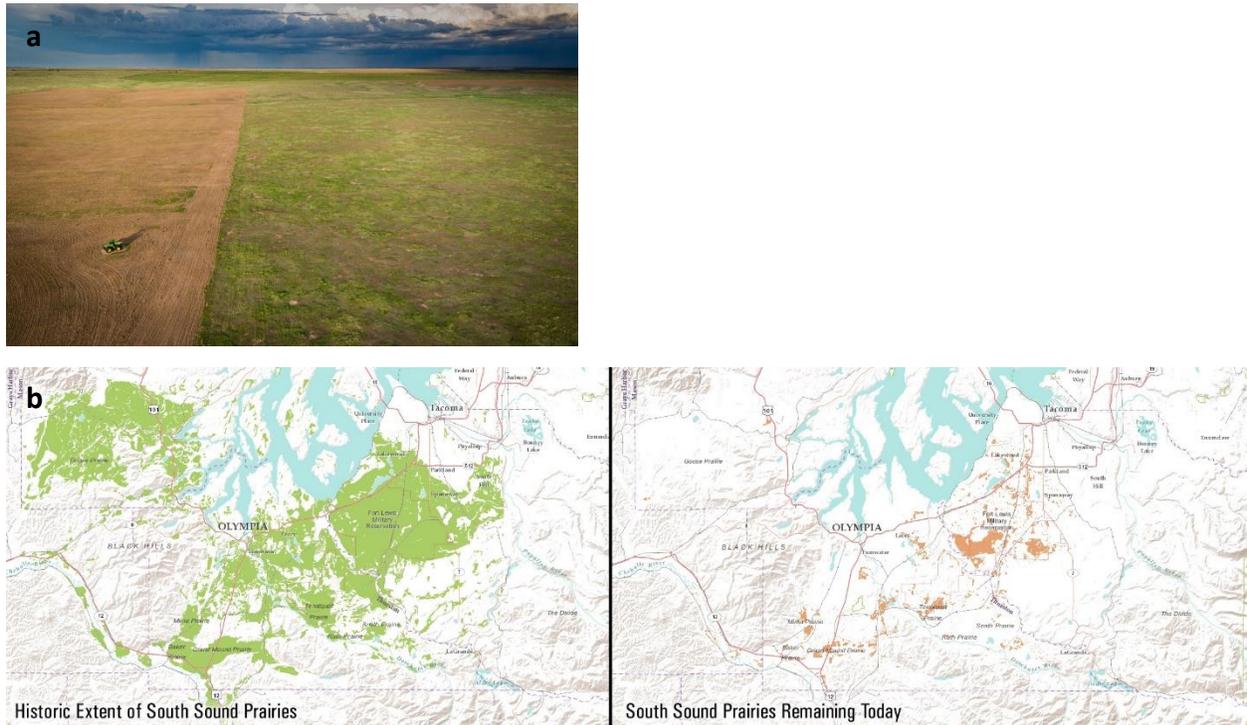


Figure 11. (a) Grasslands in the North American Great Plains contracted by 2.1 million acres according to the World Wildlife Fund “2020 Plowprint Report” (Photo credit World Wildlife Fund). (b) Illustration of the historical and current extent of prairie remaining in the Puget Sound region of Western Washington (Photo credit: US Fish and Wildlife Service).

Grassland species losses and extinctions can be illustrated by the decline of grassland birds. In North America, the overall abundance of birds (in total numbers) declined by 29% since 1970, amounting to the loss of approximately 3 billion birds. Across biomes, grassland species exhibit the greatest losses, with 74% of species overall in decline for a total estimated loss of 700 million breeding individuals across 31 species (Rosenberg et al. 2019). Decline in extent of global grasslands diminishes opportunities to sustain rural livelihoods, meet food and fiber needs from these perennial-based agroecosystems, and sustain grassland biodiversity and ecological function generally.

This same pattern rings true in western Washington: over 90% of the region’s grasslands have been lost due to conversion to cropland or urban uses or invasion by shrublands or forest due to fire exclusion, significantly impacting grassland habitat, birds, and other wildlife (Figure 12). Most of the grasslands that do remain are ecologically compromised by invasive species and non-supportive land uses. The substantial contraction of this habitat has resulted in their being listed as a priority habitat by the State of Washington (WDFW 2023).



Figure 12. Streak horned larks are emblematic of bird species heavily impacted by grassland loss, in particular large tracts of 100 or more acres. Horned larks are ground-nesting birds, and prefer sites that are 100 to 300 or more acres. Preferred habitat are bare, sparsely vegetated ground and they are found in agricultural fields, airports, seasonally dry wetlands, and remnant prairies. Habitat loss and fragmentation are critical issues for this species especially in western Washington.

In western Washington, grassland species losses are illustrated by the listing of several federally threatened or endangered species in 2013-2014, including the Taylor's checkerspot butterfly (*Euphydryas editha taylori*), Mazama pocket gopher (*Thomomys mazama*), Oregon Vesper Sparrow (*Pooecetes gramineus*) (Figure 13), Streaked Horned Lark (*Eremophila alpestris strigata*) (Figure 14), and Oregon spotted frog (*Rana pretiosa*). These species all require certain aspects of open, diverse grassland, oak savanna or wetlands adjacent to prairie.



Figure 13. Oregon Vesper Sparrow (Photo Credit Marissa Gibson, Ecostudies Institute)



Figure 14. Pair of Competing Streaked Horned Larks (Photo Credit Marissa Gibson, Ecostudies Institute)

## What is Conservation Grazing?

In the context of increasing land-use conflict between habitat and food production, conservation grazing has emerged as an approach to integrate ecosystem management with livestock production (Figure 15). While the approach is somewhat loosely defined, we refer to conservation grazing as the application of grazing as an ecological process to generate ecosystems goods and services.

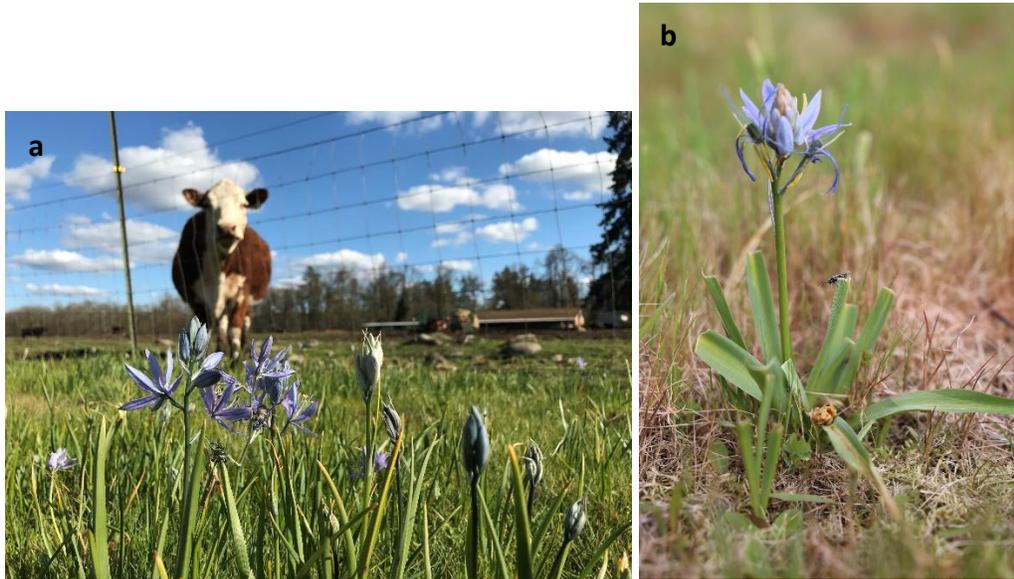


Figure 15. These pastures on working ranches are being managed for native prairie plants and wildlife, including common camas (*Camassia quamash*). Picture 'a' shows a deferment period when grazing is withheld to allow this forb to flower and set seed. (b) Pictures shows camas recovering after an early spring graze followed by a deferment period to flower. Note the bloom growing past grazed leaves, indicating cattle were removed just in time. Camas is a culturally significant food source for indigenous tribes in the region. The end of a rest period in late May can be timed either for flowering (for pollinators) or formation of seed pods (b) to rejuvenate the soil seed bank.

### **Conservation Grazing as a Broadening of Priorities**

Theoretically, conservation grazing is connected to a rethinking of the role of grazing in grassland ecosystems. As noted, scientific literature describes the transition from a utilitarian and resource-use approach to grazing management focused on forage and livestock products to an ecosystem management approach as a paradigm shift (Fuhelendorf et al. 2012). For example, the environmental results of grazing for ecosystem management include not only food and fiber for humans, but also carbon sequestration (climate regulation), pollination services, water infiltration and storage, wildlife habitat, and more (Goodwin et al. 2023).

To get a sense of the breadth of language used in this reexamination of the role of grazing livestock in a broader ecological sense, we include some descriptions of this shift in Sidebar 1.

#### **Sidebar 1. Some Descriptions of the Shift from a Utilitarian Approach to Grazing Management to an Ecosystem Management Approach**

Transition from livestock-centered management to biodiversity-centered management (Freese et al. 2014)

Embrace of "...an expanded view of rangelands as complex ecosystems that support multiple land use objectives and provide a full suite of ecosystem services including biodiversity (Fuhlendorf et al. 2012, Havstad et al. 2007; Figure 16)

Response to new demands from society for a wider range of goods and services from grazing lands (Svjecar and Havstad 2009)

Opportunity to promote pastoral communities and economies for production of livestock products as well as to conserve biodiversity in collaboration with ecologists and conservation biologists (Havstad et al. 2007)

Opportunity to develop “lucrative markets” (Havstad et al. 2007) and supportive regulatory conditions (Westoby et al. 1989) that “free managers to intervene positively” and flexibly to enhance ecological services on managed grasslands.

Expansion of the focus of grazing management from forage production to include or even prioritize ecological and amenity goals such as improving water quality, conserving endangered species, and creating open space (Havstad et al. 2007).



Figure 16. Western Washington grasslands provide numerous benefits to human and non-human populations. These include water infiltration and storage, carbon storage, wildlife habitat, pollinator resources, culturally-significant foods such as Camas bulbs, and where grazed, livestock products. South Puget Sound prairies support an estimated 48 butterfly species (Dunn and Fleckenstein n.d.).

### ***What a Conservation Grazing Approach Can Contribute (pictures needed)***

Importantly, conservation grazing is not a recipe or a grazing plan, nor is it necessarily novel as a concept. Conservation in many forms has been a component of grazing plan development for many years. Terminology aside, what we believe is needed and what conservation grazing (or whatever terms we choose for elevating environmental results) can provide is:

1. Increased focus on functional connections between grazing science and practice, and grassland ecology principles, such as heightened lay knowledge of the links between grazing, vegetation structure, and habitat (Figure 17)
2. Repositioning of grazing as an ecological process rather than a vegetation management tool, with resulting impacts on habitat patterns on the landscape (i.e. non-substitutability of grazing or fire with mowing or herbicide spraying, discussed in bulletin 2)

3. Persistent re-evaluation of grazing and range science best management practices, with a focus on developing and testing practices to optimize forage and habitat niches, among other environmental results
4. A conservation-focused framework around which to organize grazing planning tools and trainings. For example, worksheets, prompts and technical support to understand priority habitat, select practices for target vegetation structure, and design grazing plans to produce environmental results. Support tools should be equal in detail to and as ubiquitous as forage-animal balance worksheets.
5. A rapidly expanding global catalogue of examples to get inspired by, and to inform habitat stewardship and maintenance using grazing animals.



Figure 17. Illustration of the core links in conservation grazing between grazing, vegetation structure, and habitat. Here rotational grazing provides low stature vegetation in a seasonally inundated wetland. This provides superb habitat for the endangered Oregon Spotted Frog. Absence of grazing eliminates open surface water preferred by the frogs, and that aids egg development in the spring. Continuous grazing may disturb habitat, break down vernal pool structure, and create deeper mires through concentrated impact that are not used by frogs or warm insufficiently.

### ***A Framework for Understanding Conservation Grazing***

Practically speaking, conservation grazing can be organized hierarchically from the general approach to relevant ecological knowledge or concepts, areas of management decisions that producers have control over on their farms and ranches, and finally specific practices within these management decision areas (Figure 18). We organize our ideas about conservation grazing this way due to the greatly increasing number of examples of conservation grazing worldwide. Grouping them by management areas that producers and land managers have control over can help categorize our options and thereby help the development of grazing plans.

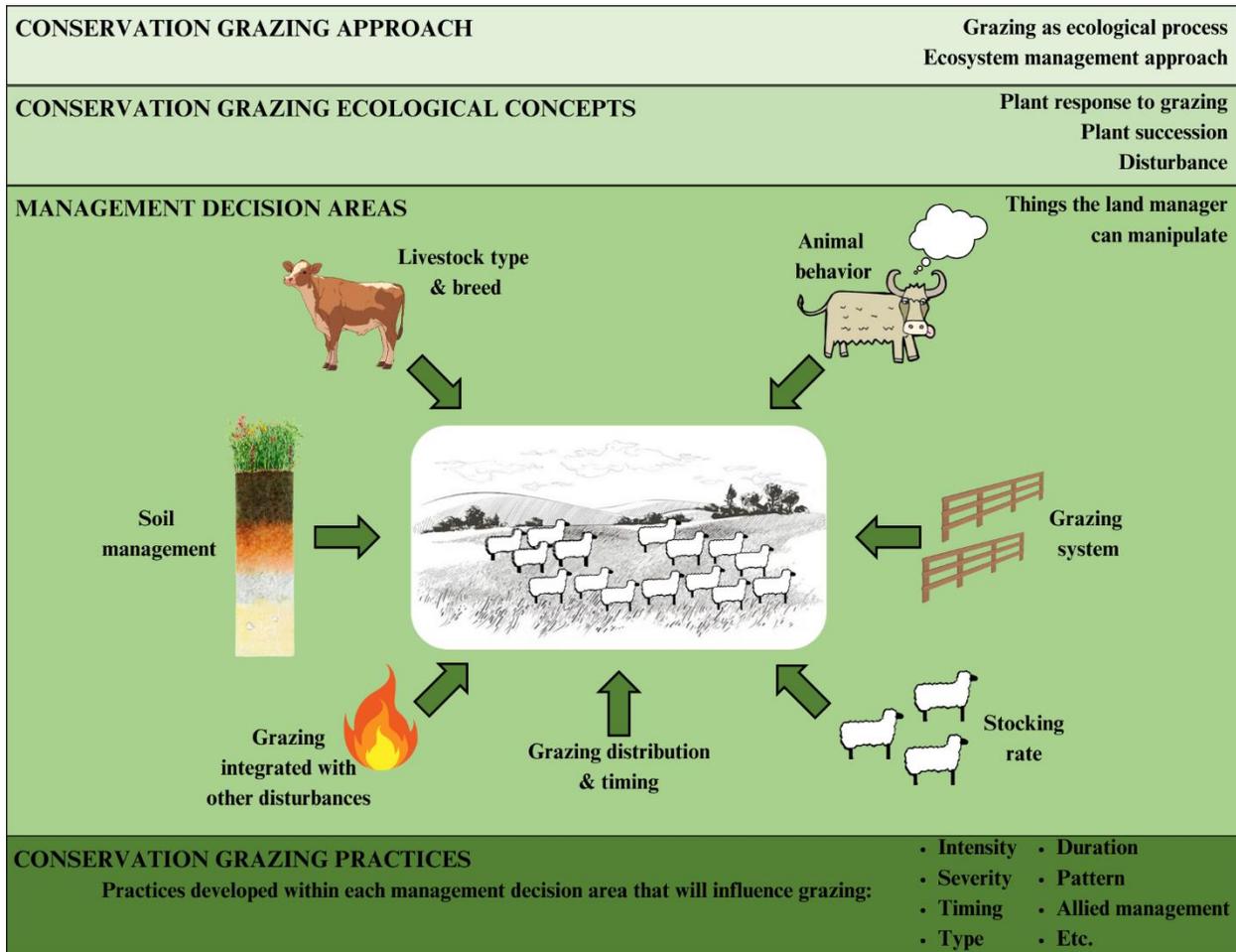


Figure 18. Decision-Making Categories for Managing Grazing Operations

Selection of conservation grazing management practices within management decision areas provides opportunities to steer the effect of grazing on landscapes and habitat niches. These categories are discussed in greater detail and illustrated with examples in the following fact sheets in this series, but they can be initially defined as following:

**Livestock Type and Breed Selection:** Deliberate selection of the grazing animal (type and breed) to match grazing behavior to achieve desired modification of vegetation on the landscape.

**Animal behavior:** the use and gradual modification of grazing behavior itself (within livestock type or breed) to influence forage utilization to optimize vegetation use, habitat outputs, or other outcomes.

**Grazing Systems:** Physical systems such as fencing, the use of paddocks, and sequences of herd movements in space and time to direct herbivory. These include continuous grazing, rest-rotation grazing, deferment grazing, and management-intensive grazing (Reece et al. 2008).

**Stocking Rate:** the number of animals grazing a given land area for a specific period of time. Stocking rate can be used to create habitat niches by determining how much forage is used, the stature of remaining vegetation, and to generate variable or homogenous vegetation structure across the landscape.

**Grazing Distribution and Timing:** the distribution of grazing disturbance on the landscape, most simply imagined as a range from even use of vegetation to uneven use. Grazing management has traditionally focused on evenly using available forage to optimize quality, while conservation grazing may target even use or deliberate uneven use depending on whether homogeneity or heterogeneity are the desired habitat outcomes. Generating disturbance gradients often creates multiple types of functional habitat.

**Integrated Disturbance Regimes:** combinations of two or more disturbances that may be ecologically independent or linked. Ecologically linked disturbances such as grazing and fire together result in ecological patterns necessary for wildlife. A goal may be to create the full range of disturbance intensities for wildlife that prefer habitat that is undisturbed or highly disturbed. Other disturbances include mowing, tree removal, digging to harvest plants, soil loss (erosion), drought, reseeding, and tillage, among others.

**Soil Management:** management of soil physical properties, fertility, and biology to support development of complex soil ecological relationships critical to recruitment and retention of biodiverse floral communities.

## **Why Conservation Grazing?**

In both western Washington and globally, biodiversity conservation and food production are often in conflict. Global population is projected to grow by 2 billion people (36%) over the next 60 years, peaking at approximately 10.8 billion in the 2080s. Considering a local example in Thurston County, Washington, the human population is expected to grow by 100,000 people (25%) over the next 15 years.

This rapid population growth is straining wildlife populations. With increased human-induced species extinction rates, pushing us into a sixth mass extinction (Ceballos et al. 2015), it is projected that global protected areas are inadequate to conserve biodiversity in the face of human-induced losses (Williams et al. 2022). At the same time, farmland yield must increase to address escalating global food demand, but on-farm habitat must simultaneously improve (Phalan et al. 2014). While debate continues about land-sharing (farming + habitat) versus land sparing (intensify food production to spare habitat elsewhere), it increasingly looks like on-farm habitat conservation can help yields and increase biodiversity with its many benefits (Renard and Tilman 2021) (Figure 19).

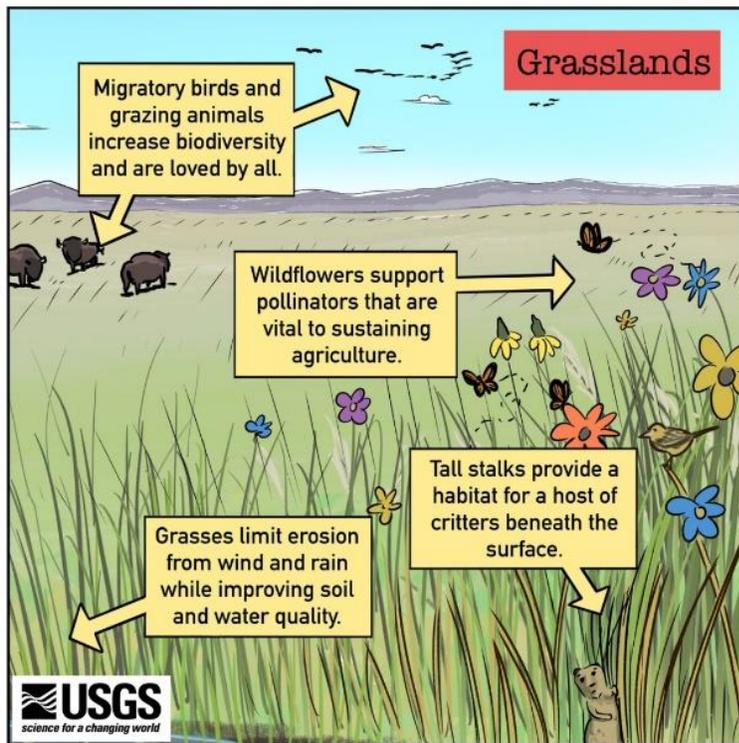


Figure 19. Agricultural landscapes are increasingly being looked to for ecosystem services such as providing habitat for migratory birds, supporting wildflowers for pollinators, habitat for mammals and conservation of water and soil resources, among other goods and services. The US Fish and Wildlife “Partners Program” provides information about collaborations between private landowners and conservation workers. (Photo credit US Geological Service)

## How to Develop Conservation Grazing Plans

### *Augment Existing Grazing Planning Processes*

The conservation grazing approach we describe in this series can support and build upon existing guidance and templates for writing grazing plans, including the Natural Resources Conservation Service (NRCS) Guide 528 Prescribed Grazing, the NRCS 9-Step Planning Process (NRCS n.d.), and the ATTRA Grazing Plan Manual and Workbook (ATTRA 2017).

This Extension series does not replace but rather augments these resources by providing:

- A framework connecting 1) grassland ecology concepts to 2) areas of management decisions and 3) illustrative practices,
- A catalogue of these example conservation grazing practices in action, and
- A conservation grazing plan template, including planning prompts and worksheets to augment existing grazing planning tools

Table 1 roughly follows NRCS Guide 528 and the NRCS 9-Step planning process to illustrate conservation elements that should receive heightened attention in a grazing planning process focused on conservation.

Table 1. Established Grazing Plan Elements and Areas for Additional Focus in Conservation Grazing Planning

<b>Grazing Plan Element</b>	<b>Existing Planning Process</b>	<b>Additional Conservation Elements or Increased Focus</b>	<b>Notes</b>
Goals and Objectives	Landowner goals Pasture goals Livestock goals Conservation/habitat goals Financial performance goals Marketing goals	Specific habitat niches Specific species occupancy Homogenous, heterogeneous, or mixed vegetation structure Seasonality of bloom Other ecosystem services	<i>Taking a holistic view here is critical. Conservation elements are not a box to check, but one of the primary objectives of applying grazing for habitat goals.</i>
Resource Inventory	Existing resource conditions and concerns Ecological site or forage suitability group Opportunities to enhance resource conditions Location and condition of structural improvements such as fences, water developments, etc., including seasonal availability and quality of watering sites	Potential wildlife re-introduction site Soil conditions considering floral species recovery potential Wildlife inventory, use of site Nearby habitat reserves: island-corridor potential	<i>Networking will be key here. Get to know what wildlife initiatives are active nearby, to help guide what to look for. The US Fish and Wildlife Partners Program is a great entry point.</i>
Forage Inventory	Expected forage quality, quantity, and species in each management unit(s)	Native species present Non-native species of habitat value Species on nearby parcels for range potential expansion Species on similar parcels for potential range expansion	
Forage-Animal Balance	Ensures forage produced or available meets forage demand of livestock and/or wildlife	Variable stocking rates considered based on target vegetation structure and habitat objectives	
Grazing Plan Developed	Identifies periods of grazing and/or browsing, deferment, rest, and/or other treatment activities for each management unit that accommodates the flexibility needed for adaptive management decisions as supported by the contingency plan and monitoring plan in order to meet goals and objectives.	Each management decision area is considered (Figure 1) in relation to habitat and other ecological and amenity goals at the site Conservation grazing practices within management areas are drawn from the examples in bulletins 2 and 3 in this series,	<i>Reading about, researching, and selecting specific practices in each management area is where the bulk of the work will take place. Focus here to understand the options available to you as a rancher</i>

		additional toolkit resources available online, and elsewhere	<i>or conservation land manager</i>
Contingency Plan	Details potential problems (i.e., drought, flooding, and insects) and serves as a guide for adaptive management decisions in grazing prescription adjustments in order to mitigate resource and economic effects.	Consider conservation-focused issues such as available native seed or plugs, land to defer grazing during bloom periods, complex succession dynamics, opportunistic moments to shift plant community composition to desired ecological states and avoid degradation to undesired states	
Evaluate the Plan	Assess whether the grazing strategy is resulting in a movement toward meeting goals and objectives. Short-term and long-term monitoring may be needed to determine outcomes and support timely adaptive management decisions. Identify the key areas, key plants, or other monitoring indicators that the manager should evaluate in making grazing management decisions.	Potential collaboration with working lands conservation partners for field expertise, attend monitoring trainings, identify habitat indicators, heighten focus on and commit to species recovery and other appropriate ecological indicators	

## ***Broaden Perspectives and Priorities***

For a conservation grazing approach to work, land managers need to understand several things.

First, basic principles of grazing management are critical. These include goal setting, forage response to grazing, evaluating forage quality, and balancing forage availability with herd requirements and stocking rates, among others (Reece et al. 2008). Beyond these, land managers need to explore and understand:

- The context of their local environment: what species and habitat assemblages need stewardship and support?
- What benefits can their specific land provide in addition to forage and livestock production?
- What synergies can be found that support your operation while benefitting other conservation priorities in your area, such as reducing invasive species (Figure 20)?



Figure 20. Sheep working at the margin of secondary grassland and forest edge. The grazing prevents encroachment from an invasive species, Himalayan Blackberry (*Rubus armeniacus*) while maintaining an open pasture-meadow in this wet maritime environment.

Land management priorities can then be chosen that support the farmer and the specific site while being responsive to the context and needs of the regional biological community.

Next, land managers should be introduced to a wide variety of grazing and land management tools (such as we attempt in this series), including how their application can be altered to produce a variety of outcomes. Subsequent publications in this series explore specific grazing techniques in detail and highlight their application in various conservation settings. Additional grassland management tools such as prescribed fire and seeding need to be made available and accessible to private land managers. Localized education, demonstration and support for their usage will help to achieve regional and site-specific priorities.

Finally, the land manager will need the freedom to apply, experiment with, and explore the application of these tools towards their priorities on their land (Table 2). Site and microsite variation are the rule not the exception and no publication can tell you what precisely will happen on your site if you apply a given practice. Large year-to-year variation also supports experimentation by managers with long land tenure and the commitment to a given locale. In this way, the land manager becomes the resource expert for their parcel. Technical service providers can introduce tools to the practitioner and provide constraints around application, but the farmer or conservation land manager becomes the active conservationist through empowerment and education. Government can incentive various priority outcomes just as the market will incentive

other priorities, and the farmer remains the final arbiter of which land values they prioritize. A farmer that knows their local biological community and is financially supported to prioritize it becomes the greatest ally of conservation.

Table 2. Land priorities that can be incorporated into a grazing plan\*

<b>Livestock</b>	<b>Soil</b>	<b>Plants</b>	<b>Wildlife</b>	<b>Climate</b>
Forage production	Improved soil structure	Plant diversity	Bird nesting habitat	Drought resilience
Forage diversification	Reduced soil compaction	Rare plant populations	Pollinator resources	Water quality
Livestock health	Increased soil biological activity	Native species introductions	Habitat for imperiled animals	Water conservation
Livestock growth		Foraging and wildcrafting resources		Carbon sequestration
		Tree establishment		Reduction of chemical usage
		Crop integration		

\*While they have been grouped for ease of reading, individual priorities are most often beneficial across multiple categories. Every grazer will choose some subset of these priorities and will likely add priorities of their own.

Conservation grazing, as presented here, supports the re-broadening of priorities to restore the beauty of agricultural land and rural life and livelihoods. By explicitly weighting non-production priorities the land manager can justify exploring practices and outcomes that may be a wash on the bottom line but increase those qualities of the land they specifically value. Some of these priorities may pay unexpected dividends to the bottom line through improved livestock, land or farmer health.

### ***Adapt Established Practices to Elevate Ecosystem Diversity and Functionality***

This Extension series describes concepts, management areas, and practices that can be used to implement a conservation approach to grazing. These practices and resulting conservation grazing plans are based on well-established grazing principles; however, they will also be based on sound ecological adaptations of these principles that can contrast strikingly with accepted best management practices for pasture and rangeland management (see Sidebar 2). The reason for this is that creation of ecosystem diversity and functionality (i.e. habitat niches on the landscape, pollination resources, etc.) is being prioritized at least as much as forage production.

#### **Sidebar 2. An Ecosystem Management Paradigm for Grazing Management**

The ecosystem management paradigm, in the context of range or grassland management, aims to re-integrate grazing into landscape-scale ecological processes with the goal of restoring habitat functionality. With re-establishment of ecological processes as the long-term goal, it follows that specific grazing management practices will be guided by different objectives than have long structured and guided range sciences.

For example, heterogeneity in vegetation structure (for example, tall vegetation adjacent to short vegetation at the within- and between-pasture scales) may be more important to some wildlife than even utilization of forage (Figure ZZ), even while overuse of sensitive habitat (riparian areas, wetlands, other) still needs to be restricted to prevent excessively variable utilization.

Similarly, some rare species (plants and wildlife) require heavy disturbance while others require minimal disturbance. Stocking rates can be set deliberately and variably across landscapes to generate disturbance gradients. In some cases it may be impossible to manage to the needs of individual species and more practical to create disturbance gradients that generate contrasting niches for plants and wildlife (Figure 21).

Finally, there are few one-size-fits-all recommendations. While heterogeneity is appropriate for some applications and often suitable for generalist species (Figure UU), others homogenous sites and either heavily or lightly-grazed grasslands are critical for specialist grassland species. This is the case for Streaked Horned Lark (*Eremophila alpestris strigata*) in the Pacific Northwest and Great Bustard (*Otis tarda*) in Europe, both of which prefer large tracts of open landscapes unbroken by hedges, tree lines, or other structural variation (Batary et al. 2011; WDFW n.d.).

Fact sheets #2 and #3 provide numerous examples. These illustrate how a distinct shift in thinking about how grazing principles are applied in practice is needed to achieve outcomes (i.e. habitat and species conservation) that go beyond forage and livestock production.



Figure 21. California quail (*Callipepla californica*) prefer edge habitat in heterogenous landscapes, seeking out habitat at the margins of shrubby, tall vegetation and short-statured, rather intensively utilized vegetation. Females will lay eggs in thick vegetation a few feet from closely grazed or mown pasture. Family groups of adults and newly fledged juveniles can be observed foraging in low-cropped vegetation that is close to the cover of tall, unmown grass. Photo A shows a nest in 4-ft tall vegetation that is several feet from the edge of a mown field. Adults keep watch on the nesting site (Photo B) while alternately foraging in shorter grass.

### ***Socio-Economic and Cultural Considerations***

Finally, in developing practices and recommendations in this emerging field, it is important to be take a multi-disciplinary perspective. Much of the content in this series is informed by science and experience-based concepts and practices, yet the success of their application will depend on cultural and socio-economic conditions in specific places. For example, private land managers are rational actors and business decisions must support economic viability. Currently, many conservation objectives work at cross-purpose with current market signals and, as a result, financial incentive mechanisms are necessary to successfully advance conservation on private

lands. This is important not merely for the success of conservation, but also for the business success of private landowners, who are critically important partners in this work (Figures 22 and 23). As one landowner we know has said, “If you pay us to grow grass, we’ll grow grass. If you pay us to grow butterflies, we’ll grow butterflies.”



Figure 22. Kevin Jensen with Riverbend Ranch in Tenino, WA balances conservation and grazing on a daily basis. The ranch has participated in research to evaluate native prairie restoration techniques, and numerous cost-share funded conservation projects to enhance riparian habitat, and cross-fence to integrate deferment periods for native wildflower blooms and improved forage management.



Figure 23. Jennifer Colvin (gray shirt and visor) leads a group of farmers, conservation workers, and technical service providers on a tour at Colvin Ranch. The ranch was put in a conservation easement by Jennifer’s parents, Katherine and Fred. The easement prevented the ranch from being sold and developed, and supports management compatible with prairie habitat, including use of deferment periods for native blooms. The ranch is a sea of Camas blooms in the spring and supports healthy populations of the endangered Mazama Pocket Gopher.

Similarly, many grasslands are owned or managed by indigenous, farming, and otherwise deeply rooted multi-generational families. Based on past experiences of these populations, “conservation” or “grazing” can be associated with land displacement, loss of cultural values, lost access, costly regulatory burden, and uncompensated policy changes. Conservation and food

production have not always been allies or compatible, but with appropriate cultural approaches and knowledge, policy, financial incentives, and market structure, they can both be achieved on the same land base. This is an important merger at a time of rapid development and dwindling land available for either priority.

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