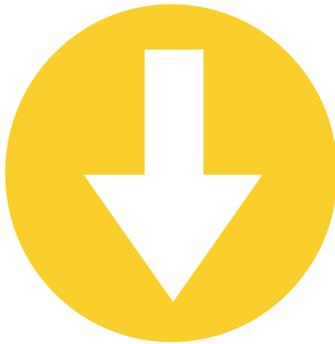


GRASSLANDS



Condition: Caution
Trend: Declining
Confidence: Low



WHY IS THIS RESOURCE INCLUDED?

Grasslands ecosystems are dominated by both perennial and annual herbaceous plants, with little to no trees or shrubs. Dominant native grassland species in the One Tam area of focus include purple needlegrass (*Stipa pulchra*), blue wild rye (*Elymus glaucus*), clovers (*Trifolium spp.*), California oatgrass (*Danthonia californica*), and red and blue fescue (*Festuca rubra and idahoensis*), among others. Dominant non-native species include wild oats (*Avena barbata*), perennial rye grass (*Festuca perennis*), Harding grass (*Phalaris aquatica*), and tall fescue (*Festuca arundinacea*).

California native grasslands are among the most endangered ecosystems in the country occupying less than 1% of their historic extent. Perennial grasslands provide ample carbon storage below ground in extensive root systems and some species of native grasses can live for hundreds of years. Grasslands are the old-growth at our feet and a rich part of Marin's natural heritage and contemporary ecology.

Nearly 90% of California's rare species listed in the Inventory of Rare and Endangered Species in California occur within California grassland settings in addition to 30% of the threatened and endangered wildlife species (over 40% of terrestrial animals). American badgers and grassland-nesting birds rely on large patches of grassland for reproduction and forage. Large, connected patches are necessary in order to maintain gene flow among grassland species and to minimize edge effects. Many grassland-dependent bird and mammal species are declining elsewhere in the region but their status on Mt. Tam is unknown.

OVERALL CONDITION

About 10% of the open spaces in the One Tam area of focus are grasslands, which include native species-dominated perennial grasslands, non-native annual grasslands, non-native perennial grasslands, serpentine grasslands, and seasonally wet meadows. Non-native plants are ubiquitous, primary components of most grasslands throughout Mt. Tam and the state. The Manual of California Vegetation defines a "native" grassland as one with as little as 10% relative cover of native species.

DESIRED CONDITIONS

The desired condition for grasslands is persistence of large, intact, and native-rich blocks of this vegetation type, which is needed to support grassland-dependent plant and wildlife species that are sensitive to edge effects and fragmentation. Because grassland habitats have decreased dramatically in extent over the last 100 years, both statewide and on Mt. Tam, preservation or expansion of grassland acreage is desirable. Good examples of this vegetation type can be found on Pine Mountain, in scattered patches along Highway 1, and adjacent to Bootjack Creek below Mountain Theatre.

STRESSORS

Non-native, Invasive Species: At nearly all grassland sites, non-native species make up the majority of the plant cover—a situation unheard of and likely intolerable in any other vegetation type found on Mt. Tam. Non-native, invasive plant species have resulted and continue to result in the loss of native species diversity, changes in nutrient cycling and hydrology, and shifts in invertebrate abundances.

Woody Species Encroachment/Succession: In the absence of fire, grazing, or other landscape-scale disturbance, grasslands in northern coastal California rapidly transition into scrublands (primarily coyote brush [*Baccharis pilularis*]), woodlands, and/or forest. This process is arrested on south-facing slopes and where soils are thin, seasonally saturated, or nutrient poor.

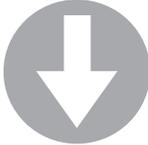
Climate Change: The potential effects of climate change, including frequent drought conditions and increased climatic water deficit, may detrimentally affect Mt. Tam's grasslands. Models disagree on whether grasslands may decrease or increase in future climate scenarios. Within the One Tam area of focus, nearly all grasses—both by number of species and by area covered—are “cool-season,” or C₃ grasses. The few (native and non-native) species of “warm-season,” or C₄ grasses, are wetland species and their increased ability to take advantage of higher temperatures and CO₂ levels may be tempered by concomitantly lower water availability.

Lack of Disturbance: California's grasslands evolved with episodic disturbances from both anthropogenic and natural fire, and grazing by antelope, tule elk, and black-tailed deer. The loss of these sources of disturbance has resulted in the loss of native species productivity, diversity, and the loss of grasslands themselves as they convert to woody-dominated communities. Higher fuel loads also increase fire severity, which has unknown impacts in these ecosystems.

Atmospheric Nitrogen Deposition: Air pollution contains reactive nitrogen compounds like NO_x, ammonia, and nitric acid that deposit on surfaces and act as nitrogen fertilizer. Impacts of N-deposition are well documented across California, and include increased annual grass and weed growth in grasslands. Grasslands on Mt. Tam are exposed to N-deposition from <2 lbs-N ac-1 year-1 to ~10 lbs-N ac-1 year-1, which exceed the critical load needed to promote exotic annual grass growth beyond background rates. Increased annual grass biomass leads to accumulation of thatch and losses of native biodiversity.

METRICS AND GOALS

Metric	Condition Goal(s)	Status
Metric 1 Total acres	Reversal of woody encroachment into remnant grassland patches	
Metric 2 Patch size	Maintain core areas of grasslands over 30 acres in size	

Metric 3 Community composition and native species richness	Not yet set	
Metric 4 Percent cover native grasses	Maintain 50% of existing grasslands with 15% or greater relative cover of native grasses	

INFORMATION GAPS

Time Series Measurements of Grassland Extent: While grassland patches cannot be mapped remotely within the National Vegetation Classification System with the same level of accuracy as forest and scrub habitats, the delineation of grasslands as a general life form is straightforward and beneficial for the understanding of wildlife habitat quality, fire dynamics, and successional processes. Historic aerial photos are available for the entire One Tam area of focus and would allow for the change-over-time assessment of total acres and patch size that has been completed for MMWD lands.

Comprehensive Grassland Composition Data from a Permanent Plot Network: The spatial and temporal variability in the grassland types distributed across the One Tam area of focus cannot be adequately described or monitored from the sorts of sampling exercises completed to date. However, the protocols described in the 2013 NPS grassland study would generate the appropriate data needed to understand and respond to changes in grassland composition over time, if plots were established and monitored in a coordinated manner throughout all jurisdictions.