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Rocky Mountain Gambel Oak-Mixed Montane Shrubland

BpS Model/Description Version: Aug. 2020

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Vegetation Type

Shrubland

Map Zones

27, 33

Geographic Range

Colorado Plateau and Southern Rocky Mountains. Gambel oak shrubland occurs primarily in Colorado, New Mexico, Utah, Arizona, and southeastern Wyoming. In the Southwest, Gambel oak is also present in low- to mid-elevation ponderosa pine forests. In southern Colorado and farther north, long-lived Gambel oak clones can form dominant to monotypic overstories (Simonin 2000). This system also occurs west of Denver (south of I-70) along the Front Range, down into New Mexico, and eastward in canyonlands adjacent to shortgrass prairie.

Biophysical Site Description

In Colorado, Gambel oak shrubland occurs between 2,000m and 2,900m (6,600-9,570ft) on all aspects in this biophysical setting (BpS). At higher elevations, it is more predominant on southern exposures. Gambel oak is typically a riparian species in the Black and Sacramento mountain ranges of New Mexico.

Vegetation Description

Gambel oak occurs as the dominant species, ranging from dense thickets to clumps associated with serviceberry or sagebrush. Gambel oak shrubland generally has a well-developed understory comprised of snowberry, elk sedge, needlegrass, *Poa secunda*, yarrow, lupine, and goldenrod.

RONE is not common in Colorado; it occurs in the southern area of map zone (MZ) 27 and MZ33. At one southern Colorado site, there is mountain mahogany and mountain muhly listed as associated species in a rare community.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
QUGA	<i>Quercus gambelii</i>	Gambel oak
AMUT	<i>Amelanchier utahensis</i>	Utah serviceberry
CAGE	<i>Carex geophila</i>	White mountain sedge
ACHNA	<i>Achnatherum</i>	Needlegrass
RONE	<i>Robinia neomexicana</i>	New Mexico locust
PRVI	<i>Prunus virginiana</i>	Chokecherry

SYMPH	<i>Symphoricarpos</i>	Snowberry
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Species names are from the NRCS PLANTS database. Check species codes at <http://plants.usda.gov>.

Disturbance Description

The primary disturbance mechanism is fire resulting in top-kill and rare mortality. Gambel oak respond to fire with vigorous sprouting from the root crown. Larger forms may survive low-intensity surface fire. Scant research, however, has been done on the fire regime in the Southwest; Floyd et al. (2000) describe only a crown fire regime, not mixed- or low-severity surface fire regimes. There is scant if any evidence of mixed-severity and low-severity regimes in the Southwest (John Vankat, pers. comm.).

Fire in Gambel oak stands may promote a brief grass-forb stage depending upon fire intensity and frequency (Crane 1982). In most situations, Gambel oak resprout vigorously the first growing season following fire. If successive fires occur at this stage, Gambel oak stands may be reduced to a grass-forb stage. (This, however, has been questioned because there is scant evidence of this type conversion for the Southwest [John Vankat, pers. comm.]) As sprouts continue to grow, natural thinning occurs, adding dead stems to the fuel. Fire occurring at this stage also sends Gambel oak stands back to a seral grass-forb stage. In absence of fire, sprouts form young poles. Fires are stand replacement, either creating openings within stands for colonization by resprouts or recycling back completely to a grass-forb stage. In the absence of fire, Gambel oak stands reach maturity in 60-80yrs. Fire response in mature stands is similar to that in young poles (Crane 1982; Simonin 2000).

Floyd et al. (2000) found that the turnover time (years required to burn an area equal to the entire shrubland zone) was 100yrs under the “natural” fire regime of the mid to late 19th century. Fire occurrence was reduced substantially during the first half of the 20th century, but the current fire regime (since about 1950) appears to be similar to that of the 19th century, despite fire suppression.

Because the study by Floyd et al. (2000) was conducted in southwestern Colorado, it was thought it might represent a different fire regime than eastern Colorado/northeastern New Mexico. Other modelers felt the mean fire return interval (MFRI) should be similar to that of mountain mahogany in MZ27 and MZ33, which has an MFRI of 45yrs. Those modelers felt the fire regime is driven by the same factors that drive adjacent PIPO and grassland systems. MZ25 modeled a 39-yr interval, with 50yrs replacement and 175yrs mixed.

Gambel oak in Mesa Verde, Colorado, however, apparently recruit new stems more or less continuously, in a manner similar to many shrub species in southern California chaparral. However, despite the continual mortality and recruitment of stems in these populations, a prominent cohort of similar-age stems is produced via sprouting after fires intense enough to kill all the aboveground vegetation. This post-fire cohort persists and can be detected for as long as 150yrs after the fire, even though younger age classes also are present (Floyd et al. 2000).

Floyd et al. (2000) found two photos from the 1930s depicting a stand-replacement crown fire that occurred at some unspecified time prior to Park establishment in 1906--a scene similar to that after recent fires in a woodland zone. These photos indicate that severe crown fires occurred in the 19th century and they are not an anomaly of the late 20th century. It appears, therefore,

that Mesa Verde has long been characterized by a crown fire regime dominated by infrequent but large, high-severity fires-- more similar to boreal and some high-elevation forest ecosystems than to many other low-elevation forests and woodlands in the American Southwest (Floyd et al. 2000).

Fire usually stimulates sprouting of Gambel oak after top-kill (Brown 1958), increasing density of previously open stands and merging scattered stands into continuous thickets. Gambel oak regeneration after fire is usually vigorous. Sprouts may be observed within 10 post-fire days (Brown 1958; Simonin 2000).

Extended drought could also contribute to the structure and composition of this system, although specific effects are not noted here. Floyd et al. (2000) indicated that climate has had an impact on the fire regime.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	50	100		
Moderate (Mixed)				
Low (Surface)				
All Fires	50	100		

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

Scale ranges from tens to thousands of acres.

Adjacency or Identification Concerns

This type should function somewhat similarly to mountain mahogany systems in MZ27. This Gambel oak system is more mesic than the mountain mahogany systems, however. Canopy cover is higher in this system than in mountain mahogany.

This BpS is characterized by >80% Gambel oak. This type merges with mountain shrub systems at lower elevations and intermingles with the deciduous woodland systems at higher elevations and/or northern exposures.

Gambel oak shrubland also intergrades with pinyon-juniper at lower elevations and ponderosa pine forest at higher elevations in the Southwest and in southern Colorado or throughout the Front Range of Colorado.

Exotics are not found much in this BpS in the Southwest, and oak resprouting prevents exotics from becoming abundant after fire.

This BpS might be seen as unchanged on the landscape today in terms of departure or lack of departure. Floyd et al. (2000) indicated that this system is within its HRV, at least in Mesa Verde. However, in some areas it could be experiencing issues similar to that for mountain mahogany, with tree invasion.

Description

Post-replacement sprouts to approximately 2ft high. Dense resprouting with high number of stems per acre. Abundant grass and forb cover.

Maximum Tree Size Class

None

Class B	38	Mid Development 1 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUGA	Quercus gambelii	Gambel oak	Upper

Description

Three to 6ft tall to 3in in DBH. Stem mortality due to competition, with slight decrease in understory species due to shading. Grass and forbs declining.

Maximum Tree Size Class

None

Class C	55	Late Development 1 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUGA	Quercus gambelii	Gambel oak	Upper
CAGA3	Carex garberi	Elk sedge	Middle

Description

The late development stages are combined into one stage. Greater than 6ft tall and >3in in DBH. Small stands <30m with open canopy and usually scattered throughout a grassland or shrub type (Brown 1958), as well as nearly continuous canopy cover, 2ha+, with only occasional openings (Brown 1958). This effort models Gambel oak as a climax species.

Some ponderosa pine can also come into this stage. Some feel that ponderosa pine is present in this stage (Sprock, pers. comm.).

Maximum Tree Size Class

None

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
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Early1:ALL	0	Mid1:CLS	4
Mid1:CLS	5	Late1:CLS	30
Late1:CLS	31	Late1:CLS	999

Probabilistic Transitions

Disturbance Type	Disturbance occurs In	Moves vegetation to	Disturbance Probability	Return Interval (yrs)	Reset Age to New Class Start Age After Disturbance?	Years Since Last Disturbance
Replacement Fire	Early1:ALL	Early1:ALL	0.0222	45	Yes	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.02	50	Yes	0
Replacement Fire	Late1:CLS	Early1:ALL	0.02	50	Yes	0

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