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Halogeton glomeratus

Index of Species Information
SPECIES: Halogeton glomeratus

Introductory
SPECIES: Halogeton glomeratus

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ABBREVIATION :
HALGLO

SYNONYMS :
NO-ENTRY

SCS PLANT CODE :
HAGL

COMMON NAMES :
halogeton
barilla
Aral barilla

TAXONOMY :
The currently accepted name of halogeton is Halogeton glomeratus (M. Bieb.) C. A. Meyer; it is a member of the goosefoot family (Chenopodiaceae). One author relegates halogeton to synonymy with the European species, Halogeton sativus (L.) Moq. [98]. However, most authors recognize halogeton as a separate and distinct species [30,31,46,49,71,104]. There are no subspecies, varieties, or forms.

LIFE FORM :
Forb

FEDERAL LEGAL STATUS :
See OTHER STATUS

OTHER STATUS :
Halogeton is a noxious weed in the Pacific Northwest and Intermountain

states, and California, Hawaii, and New Mexico [102].

DISTRIBUTION AND OCCURRENCE
SPECIES: Halogeton glomeratus

GENERAL DISTRIBUTION :
Halogeton is an introduced species from southeastern Russia and northwestern China [49,55,98]. In the United States, halogeton is found in the Rocky Mountain and Great Basin regions and in two disjunct infestations in Nebraska [30,31,46,71,77,104].

ECOSYSTEMS :
FRES29 Sagebrush
FRES30 Desert shrub
FRES33 Southwestern shrubsteppe
FRES40 Desert grasslands

STATES :
CA CO ID MT NE NV NM OR UT WY

BLM PHYSIOGRAPHIC REGIONS :
5 Columbia Plateau
6 Upper Basin and Range
7 Lower Basin and Range
8 Northern Rocky Mountains
9 Middle Rocky Mountains
10 Wyoming Basin
11 Southern Rocky Mountains
12 Colorado Plateau
14 Great Plains
16 Upper Missouri Basin and Broken Lands

KUCHLER PLANT ASSOCIATIONS :
K038 Great Basin sagebrush
K040 Saltbush - greasewood
K055 Sagebrush steppe
K056 Wheatgrass - needlegrass shrubsteppe
K057 Galleta - three-awn shrubsteppe

SAF COVER TYPES :
238 Western juniper
239 Pinyon - juniper

SRM (RANGELAND) COVER TYPES :
NO-ENTRY

HABITAT TYPES AND PLANT COMMUNITIES :
Halogeton is typical in disturbed sites in salt-desert shrubland and

surrounding big sagebrush (Artemisia tridentata) steppe types, and in transition zones from shadscale (Atriplex confertifolia) to big sagebrush [9,24,103]. Where halogeton is the dominant forb, shadscale is the dominant shrub in the salt-desert shrubland; halogeton may also occur in various associations with other shrubs, such as winterfat (Ceratoides lanata), bud sagebrush (Artemisia spinescens), greasewood (Sarcobatus baileyi), and spiney hopsage (Atriplex spinosa) [12,13,14]. Infrequently, halogeton is a dominant understory forb in western juniper (Juniperus osteosperma) communities. Halogeton occurs as a dominant or codominant with other annuals, such as cheatgrass (Bromus tectorum) and tansymustards (Descurainia pinnata and D. sofia).

Publications that list halogeton as a dominant forb in habitat types in Nevada are:

Vegetation and soils of the Crane Springs watershed [12],
Vegetation and soils of the Cow Creek watershed [13],
Vegetation and soils of the Duckwater watershed [14].

MANAGEMENT CONSIDERATIONS
SPECIES: Halogeton glomeratus

IMPORTANCE TO LIVESTOCK AND WILDLIFE :
Halogeton is high in oxalates and is a serious health threat to grazing animals, especially sheep [25,49,55,104,107]. A sheep will be killed by 12 to 18 ounces [0.3-0.5 kg] of halogeton [23]. Symptoms of halogeton poisoning have been described [70,102]. There is no treatment once an animal is poisoned [99].

The amount of soluble oxalates in halogeton varies by season, locality, and part of plant eaten [55]. As a halophyte, halogeton makes excessive amounts of oxalic acid in response to excessive uptake of sodium ions [41]. While halogeton is growing, oxalates are highly concentrated; 17 to 30 percent of dry plant weight is soluble oxalates [25,55]. Sheep can safely consume halogeton after the soluble oxalate concentrations are reduced through leaf loss or leaching by rain or snow [23,55,109]. Additionally, calcium-fortified pellets have been recommended as supplements to sheep feeding in halogeton range, to compensate for the calcium precipitation from the blood by oxalates [23,25,103]. Van Dyne [103] recommends against using halogeton as forage [103]. However, other studies indicate that halogeton is useable when it is mixed in small amounts with other forage [70,96]. Krueger and Sharp [57] reported that sheep can adapt to halogeton if it is fed to them in gradually increasing amounts. Adapted sheep can detoxify 75 percent more oxalate than nonadapted sheep [57].

PALATABILITY :
Palatability is extremely low, and halogeton is seldom eaten by livestock [24,99]. The palatability of halogeton is listed as poor for ungulates in Montana, Utah, and Wyoming [28]. In Utah and Wyoming, halogeton palatability is fair for small mammals, good for game and nongame birds,

and poor for waterfowl [28].

NUTRITIONAL VALUE :
NO-ENTRY

COVER VALUE :
Halogeton provides poor environmental protection for ungulates, game birds, and waterfowl in Utah and Wyoming [28]. In these states, it provides fair protection for small mammals and nongame birds [28].

VALUE FOR REHABILITATION OF DISTURBED SITES :
Halogeton is a noxious weed that must be prevented from establishing on denuded or disturbed soils in the semiarid shrublands of the western United States. Halogeton makes an area less favorable for revegetation with other species; it is difficult to establish desirable plants where halogeton occurs [59]. At mine reclamation sites, several studies have measured changes in halogeton establishment or abundance over many years [2,7,68,75]. One study examined leachate from three levels of halogeton mulch. They found significant soil alteration: increases in pH, exchangeable sodium, potassium, magnesium, electrical conductivity, and decreases in water percolation [25,33]. High salts inhibit micro-organisms aiding nitrification, which depresses plant growth [33]. Halogeton does not form mycorrhizae and does well in mine spoils with diluted or eliminated vesicular-arbuscular mycorrhize [1,2,7]. Goodman [42] added nitrogen to enhance native plant production, and halogeton biomass doubled compared to unfertilized controls.

OTHER USES AND VALUES :
NO-ENTRY

OTHER MANAGEMENT CONSIDERATIONS :
Halogeton readily invades and dominates rangeland depleted by persistent and continuous overgrazing [25,53,54,57,93]. Heavy sheep losses from halogeton poisoning have occurred since 1940 on ranges in Idaho, Nevada, and Utah [4,15,66,89,91,95]. The rapid spread of halogeton from 1935 through the 1940s, coupled with extensive livestock poisonings, resulted in the Federal Halogeton Control Act [63].

The best defense against halogeton is a vigorous stand of perennial range plants and variations in grazing patterns [4,15,47,77,101]. Moderate range use only after the growing season is the wisest halogeton strategy [54,105]. Efforts must be taken to prevent vegetation destruction by rodents and rabbits, road construction, surface mining, or the use of off-road vehicles [15].

Three methods are used to control halogeton [24].

(1) Cultural control: Introduced perennials, such as immigrant kochia (Kochia prostrata), were planted with successful decrease in halogeton cover [67,94]. Crested wheatgrass (Agropyron cristatum and A. desertorum) was seeded extensively in depleted winter rangeland to slow halogeton growth [65,111,113 but see 64,76]. Crested wheatgrass does not suffer from halogeton competition, but from the saline-alkaline site conditions where it occurs [20]. Some hybrids (for example, A. desertorum cv. Hycrest) can tolerate saline conditions. Asay and Johnson [3] found that a heavy halogeton infestation was essentially elimated by year 2 after seeding with Hycrest.

(2) Biological control: A stem-boring moth (Coleophora porthenica) from Pakistan was released for halogeton control [77]. However, it failed to establish. The search for a biological control agent continues in Soviet central Asia [77]. A case-bearing moth (Coleophora atriplecivora) has been found on halogeton [69]. It is not currently known what effect it has on halogeton; however, Moore and Stevens [69] found that the case-bearing moth reduced seed production and foliage in fourwing saltbush (Atriplex canescens).

Altered grazing practices can slow halogeton spread. Studies showed that high intensity grazing in early spring (March and April) increased halogeton cover significantly in Utah [106]. Heavy spring grazing causes rapid rangeland deterioration [60]. Halogeton was reported to decrease in Nevada under early (mid-April to mid-June) grazing at moderate intensity [85].

(3) Chemical control: Halogeton is susceptible in the preflowering stage to 2,4-D at 2 pounds active ingredients per acre (2.2 kg ai/ha) [25,37,80]. Approximately 17 percent of the plants survive this rate [101]. Higher 2,4-D rates of six pounds active ingredient per acre (6.7 kg ai/ha) are recommended to kill all halogeton; however, native plants are severely impacted [23]. The application of 2,4-D must be repeated annually for 6 to 10 years after the final halogeton seed crop [99].

Herbicide control is too expensive to be used on low-production ranges on which halogeton occurs [77,78]. Widespread herbicide control of halogeton was stopped because land managers did not have desirable forage to replace halogeton, especially on saline-alkaline soils [21,66,101].

BOTANICAL AND ECOLOGICAL CHARACTERISTICS
SPECIES: Halogeton glomeratus

GENERAL BOTANICAL CHARACTERISTICS :
Halogeton is an exotic succulent annual forb [42,104]. It has a generalized type of root system; the taproot can penetrate as deep as 20 inches (51 cm), with a radial spread of 18 inches (46 cm) [32]. Many main stems branch from the base of the plant and are low spreading before becoming erect [107]. Halogeton can be a few inches high in dense stands to 2 feet [61 cm] high in widely spaced stands [103,107]. Leaves are small, fleshy, and spine tipped [26,49]. Flowers are inconspicuous in leaf axils and produce winged black and wingless brown seeds [26,101].

RAUNKIAER LIFE FORM :
Therophyte

REGENERATION PROCESSES :
Halogeton can produce 75 seeds per inch (35 seeds per cm) of stem, which is 200 to 400 pounds of seeds per acre (222-449 kg/ha) [25]. It produces two types of seeds which are important to its spread and persistence. The production of brown seed is controlled by long photoperiods; black seeds are produced during short photoperiods [114].

Black seeds have no dormancy and are viable for 1 year [24,88,114]. Late germinating and maturing plants only make black seeds [25,114]. Brown seeds have a dormancy and can survive buried for up to 10 years [4,24,25,108]. This allows halogeton to survive during extended drought periods. Brown seeds readily germinated under moist conditions after a 3-month cold (35 degrees Fahrenheit [5.4 deg C]) treatment [24,88].

Halogeton has many agents of dissemination. Halogeton seeds have a high degree of viability after passing through the digestive tracts of sheep and rabbits [24]. Animals are capable of spreading large amounts of seed great distances; seeds pass with the feces [23,37,63,99]. Halogeton seeds are rapidly spread along roads by road equipment, especially road graders [24]. Local spread of halogeton is primarily by the wind [37,99]. Halogeton will break off at ground level when dry and tumble with the wind, scattering mature seeds [109]. Whirlwinds or dust-devils will transport dry stems with seeds up to 2 miles (3.2 km) [24]. Western harvester ants collect seeds [39]. Brown seeds recovered from anthills gave 5 to 20 percent germination [24].

SITE CHARACTERISTICS :
Halogeton is adapted to alkaline soils and semiarid environments [47,107]. Halogeton is found from 2,526 to 7,218 feet (770-2,200 m) in elevation throughout its range [19,38,43,44]. It occurs on soils that are heavy clays, clay loams, sandy loams, and loamy sands [5,20,27,50]. Although halogeton can occur on many soil types, the sites usually are saline [63]. Halogeton does best in soils where sodium chloride levels are 5,800 p/m; increased salt does not increase the water requirements of halogeton [25]. Soils may or may not have a prominent hardpan; carbonates accumulate near the soil surface [16]. Soils are light colored because little humus is present [50,97]. The soil pH ranges from 8.0 to 9.0 [27,52]. Typically, there are large fluctuations in daily temperatures [61]. Mean annual temperature is 42 degrees Fahrenheit (5.5 deg C). The abundance of halogeton depends upon year to year precipitation, so outbreaks may sporadically appear [4,6,103]. Annual precipitation at most halogeton sites is from 5 to 13 inches (127-330 mm) [21,50]. Approximately, 60 to 70 percent of precipitation occurs as snow [21,50].

Halogeton has invaded open or disturbed ground such as dry lakebeds and rodent workings [4,99]. Halogeton infests domestic stock trails, overgrazed rangeland, and livestock congregation areas [46,49,71,82,86]. Halogeton invaded the disturbed areas left after dryland farms, townsites, and mining camps were abandoned in the 1930's [25,33,52,56, 109]. Halogeton occurs in railroad rights-of-way, along road shoulders, airstrips, and gravel pits [61,67,107].

Associated species, in addition to those previously mentioned (see Habitat Types), are clasping pepperweed (Lepidium perfoliatum), povertyweed (Iva axillaris), and bur buttercup (Ranunculus testiculatus) [38,87]. Common grass associates are Indian ricegrass (Oryzopsis hymenoides) and bottlebrush squirreltail (Elymus elymoides) [44]. Halogeton occurs with Gardner saltbush (Atriplex gardneri) in Colorado and Wyoming [5].

SUCCESSIONAL STATUS :
Obligate Initial Community Species

Halogeton is a ruderal species that readily invades disturbed, saline-alkaline ground where other species offer no or little competition [37,47,74,77,105,107]. Halogeton does not establish in vigorous competing vegetation because it does not grow a large shoot or

root system early in the growing season [32].

In the alkaline valley soils where halogeton occurs, shadscale vegetation is considered an edaphic climax [115]. Human use leads to permanent changes in the flora of disturbed arid environments [56]. After 70 years of grazing on some sites in the Great Basin, halogeton was dominant on moderately disturbed areas with cheatgrass and shadscale [56]. Halogeton may permanently change soil surfaces via salt pumping which impedes moisture infiltration and enhances evaporation [88,105]. In a comparison of plots on areas that were grazed or protected for 15 years, Branson [17] observed that no succession occurred or that it occurred very slowly.

Cleared big sagebrush areas follow a succession pattern that currently climaxes in cheatgrass. Nelson and others [72] state that the succession through introduced annuals to a cheatgrass climax is maintained by fire. The order of appearance of vegetation changes are Russian thistle (Salsola kali), tumblemustard (Sisymbrium altissimum), pinnate tansymustard (Descurainia pinnata), and cheatgrass [112,116]. Young and others [116] added halogeton to this sequence as an initial invader. Halogeton is also a part of another seral continuum that climaxes with medusahead (Taeniatherum caput-medusae) [116].

SEASONAL DEVELOPMENT :
Depending upon moisture, halogeton seedlings establish from February through August, with a peak in April [24,99,101]. Halogeton builds its root system during the cool weather, and topgrows during warmer weather [54]. Seedlings begin rapid vegetative growth in May [24,109]. Growth can continue through June; the best halogeton development occurs when soil temperatures are between 60 and 80 degrees Fahrenheit (15-27 deg C) [32]. In Utah, halogeton biomass was 4.1 pounds per acre (4.7 kg/ha) over 5 years [6]. Near the first part of July, the plants cease vegetative growth and begin reproductive growth [24]. Plants flower during July and August. Seeds begin to mature late August to early September and are mature in October [24,25,96]. The frosts in October and November will kill any plants not yet dried [51]. The majority of black seeds are dropped by early November; however, brown seeds persist and may remain on the plant until January or February [24]. Black seeds may germinate after mid-December under favorable conditions [24]. Halogeton is a winter annual in the broad sense; plants may germinate in the fall, winter, or spring, depending upon soil moisture [92]. Two authors [96,103] state that halogeton is a warm-season plant; however, since vegetative growth usually ceases at the end of June and seedling establishment occurs predominantly in April, Parker [74] considers it a cool-season plant.

FIRE ECOLOGY
SPECIES: Halogeton glomeratus

FIRE ECOLOGY OR ADAPTATIONS :
After halogeton dries, it does not readily decompose, which increases fuel loads [24]. Dried halogeton is capable of spreading fire; flaming, wind-thrown plants may enter unburned areas. Halogeton can tumble across burned areas, spreading seed [109].

POSTFIRE REGENERATION STRATEGY :
   Initial-offsite colonizer (off-site, initial community)
   Secondary colonizer - off-site seed

FIRE EFFECTS
SPECIES: Halogeton glomeratus

IMMEDIATE FIRE EFFECT ON PLANT :
Immediate effects of fire on halogeton were not found in the literature. Halogeton is probably killed by fire; any seeds remaining on the plants would also be killed. Seeds present in the soil before fire are probably destroyed. Halogeton seeds are killed at 158 degrees Fahrenheit (70 deg C), which is considerabley lower than soil surface temperatures that may occur in sagebrush fires [90]. Mack [63], however, reported that halogeton seed survives summer fires in steppe communities.

DISCUSSION AND QUALIFICATION OF FIRE EFFECT :
NO-ENTRY

PLANT RESPONSE TO FIRE :
Halogeton seeds are probably transported from off-site into burned areas within 1 or 2 years postfire [43]. Two years after a fall burn in central Idaho where perennial plants were not damaged, halogeton appeared [36]. One year following an Idaho burn that destroyed all aboveground vegetation, halogeton increased in abundance, and by postfire year 2, it had significantly increased in biomass [45]. Halogeton increased in frequency each year for 3 years postfire in another study [90].

DISCUSSION AND QUALIFICATION OF PLANT RESPONSE :
NO-ENTRY

FIRE MANAGEMENT CONSIDERATIONS :
Prescribed burning will not control halogeton. It colonizes from off-site, readily invading bare or disturbed soils.

REFERENCES
SPECIES: Halogeton glomeratus

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