USDA Forest Service, Rocky Mountain Research Station
Grassland, Shrubland and Desert Ecosystems Research Program
Boise, ID

Rush skeletonweed (*Chondrilla juncea* L.) in the northern Great Basin

Distribution

Rush skeletonweed (*Chondrilla juncea*: Asteraceae) is an herbaceous perennial composite forb of the chicory tribe (Figure 1). Eurasian and Mediterranean in origin, it has been introduced in the United States, Chile, Australia, and New Zealand (Figure 2). The species was first noted in the western U.S. near Spokane, WA in 1938, and now occurs on more than 2.5 million ha in California and the Pacific Northwest (Figure 3). Infestations have recently been discovered in northern Nevada. It is designated a noxious weed in 7 states (AZ, CO, ID, MT, NV, OR, WA).

Figure 1. Rush skeletonweed flowers and seed (upper left), rush skeletonweed invading abandoned farmland (middle), and rosette (lower right).

Spread

Physical disturbances such as logging, overgrazing, farming, and road construction have expanded the range of rush skeletonweed. Wildfires have accelerated its spread in Idaho and across the Snake River Plain where it was first discovered near Banks in 1960. This invasive grows well on recently burned areas, amidst exotic annuals, and on abandoned farmland. It has also entered undisturbed native shrublands, including big sagebrush and antelope bitterbrush communities. Plants there establish on localized disturbances such as gopher mounds or around badger holes. Land managers struggle against this plant that is adapted to many soil types at elevations from 225-1900 m, exploits deep soil moisture during extended periods of drought, and forms extensive and persistant colonies. These factors may allow it to spread southward across the Great Basin.

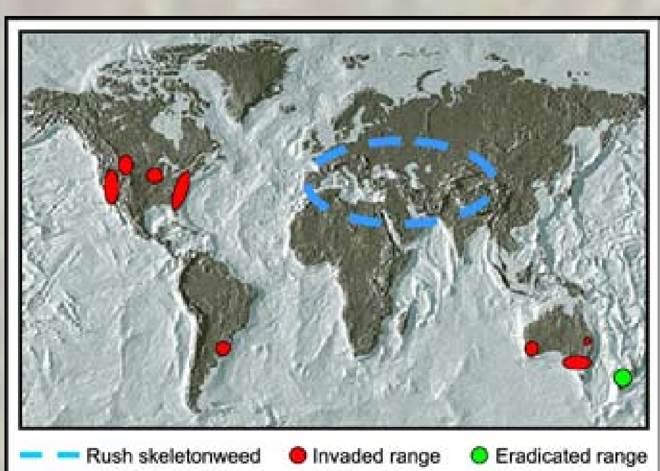

Figure 2. Native range of rush skeletonweed, invaded range, and eradicated range.

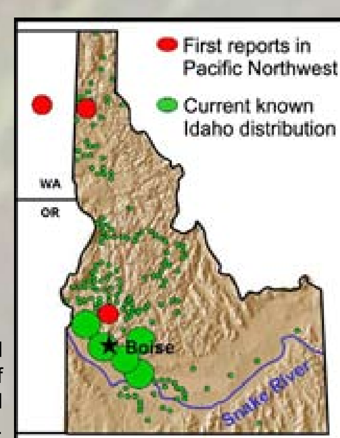

Figure 3. Initial invasion and spread of rush skeletonweed within Idaho.

Plant Description and Life Cycle

Mature plants consist of multi-branched, nearly leafless stems 1 m or more in height with taproots growing to depths of 2.5 m. Stems die back in fall. Spread occurs vegetatively and from seed (Figure 4). New basal rosettes emerge from root sprouts in fall, but many do not survive through winter. Spring growth and emergence of additional rosettes occurs when temperatures are above freezing. Established plants begin to bolt in May, with rosettes drying by early to mid summer. Flowers and tiny apomictic seed, up to 20,000 per mature plant, are produced from mid summer until first frosts. Seeds mature in 9-15 days and wind disperses them over long distances. They also attach to animals, vehicles and other vectors. Germination occurs in fall or spring over a wide temperature range (6-30 °C) with adequate soil moisture. Fall precipitation followed by dry or cold periods may lead to germination and subsequent loss of seedlings. More seed may be available for spring germination following a dry fall and winter. Seedling establishment is thus episodic, and few seed carry over beyond the first year in soil seed banks.

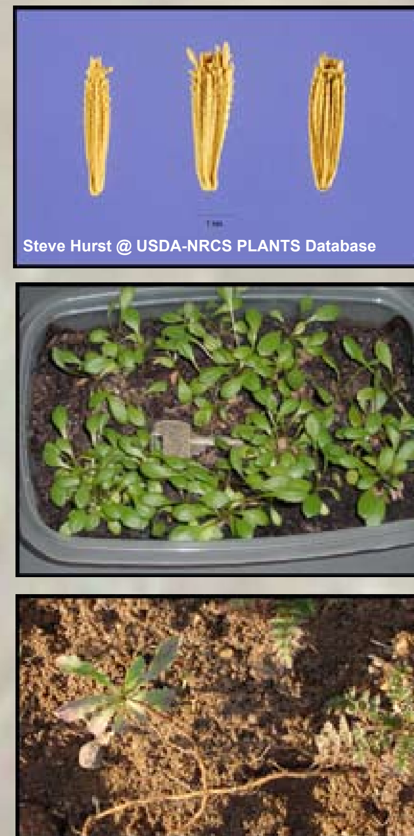

Figure 4. Rush skeletonweed seeds (upper), seedlings (middle), and root sprouts (lower).

Recruitment and Response to Fire

Rocky Mountain Research Station (RMRS Boise) and University of Wyoming researchers examined the recovery and spread of rush skeletonweed following wildfires at 10 locations on the Snake River Plain. They observed burned and unburned plot pairs located in degraded big sagebrush and antelope bitterbrush communities dominated by cheatgrass and other exotic annuals for 2 years. Rosettes developing from root sprouts were more numerous on burned than on unburned plots during the first year post-fire (Figure 5). Herbivory by small mammals and insects during the second year negated these differences. Laboratory studies showed decreased emergence from unburned compared to recently burned or sterilized field soils when equal numbers of seeds were added. This difference may have resulted from the activity of soil microorganisms. Field emergence from seed was extremely low except during a wet spring preceded by a dry fall when twice as many seedlings emerged on burned compared to unburned plots. This research indicates rush skeletonweed density increases primarily through vegetative reproduction and that spread can be enhanced by wildfires. Establishment from seed is episodic, but provides for dispersal, with increasing fire frequency and size expanding the areas of disturbance available for new invasions.

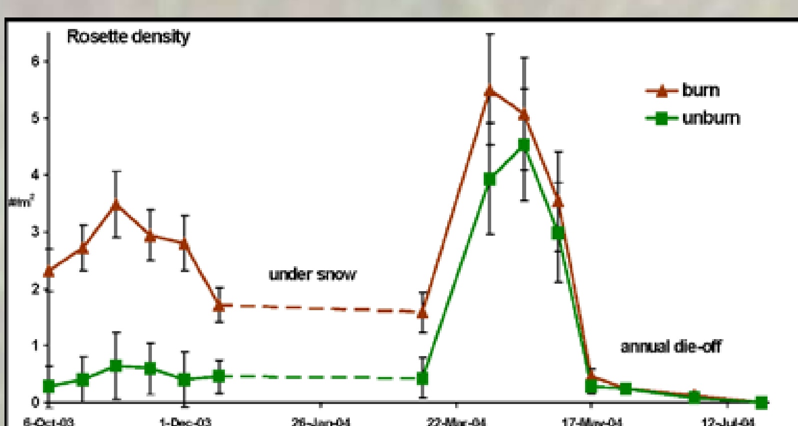

Figure 5. Rosette recruitment was greater on burned than on unburned plots during the post-burn year.

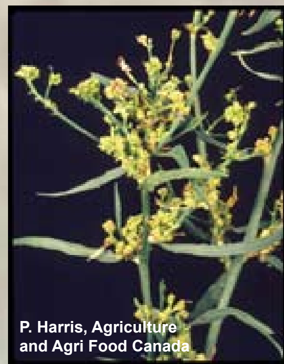

Figure 6. Biocontrol agents: gall midge (upper left), rust (lower left), and gall mite (right).

Control Efforts

Control efforts are best focused on rosettes of mature plants. Herbicides such as picloram, clopyralid, aminopyralid, and clopyralid/dicamba combinations are effective only when applied while rosettes are present in spring or fall, as the coarse stems present in summer take up little herbicide. Repeated applications over a period of several years are required for complete control. Efforts to remove aboveground portions of adult plants by mowing, burning, or other means reduce photosynthetic material and seed production, but will also induce root sprouting and increase stand density over time if not combined with herbicide treatments.

Several biological control agents used successfully in Australia were later introduced in the United States. These include a rust (*Puccinia chondrillina*), a gall mite (*Aceria chondrillae*), and a gall midge (*Cystiphora schmidti*) (Figure 6). A root-feeding moth (*Bradyrrhoa gilveolella*) was released in 2002. Biocontrol effectiveness differs, depending on the rush skeletonweed biotype, climatic differences between their place of origin and place of introduction, and native parasites and predators that attack the introduced organisms. Although the available biological control agents reduce plant vigor and seed set, infected plants are generally not killed. RMRS Bozeman researchers and their cooperators are working to identify more effective biocontrol organisms.

Interesting Facts

- There are 30 species of *Chondrilla* worldwide.
- The first U.S. collection was made near Washington, DC in 1872.
- At least three forms or biotypes of rush skeletonweed occur in the U.S.; genetic research is ongoing to determine their geographic origins. The forms differ in morphological and physiological characteristics such as size, leaf width and root growth potential.
- Because the species is apomictic (seed is produced without fertilization), biotypes may be maintained almost indefinitely.
- Apomictic seed production also occurs in the closely related genus *Taraxacum* (family Asteraceae), which contains the common dandelion.
- In its native habitat, rush skeletonweed is primarily a species of disturbed sandy sites such as roadsides and river valleys, but it may invade waste areas if the soil is well drained.
- The dispersal unit is the fruit or achene. These are small and possess a pappus (tuft of fine bristles) that facilitates wind dispersal and a rough pericarp or fruit coat with small teeth that readily attaches to animals and other vectors.
- Shoots developing from severed rush skeletonweed roots can reach the soil surface from depths of 1.5 m.
- Root segments as small as 2.5 cm in length can produce new plants.
- New plants will continue to emerge from severed roots after hand-pulling. Successful hand-pulling would require removal of plant growth 3-6 times per year for up to 10 years.
- Annual applications of clopyralid, picloram, 2,4-D amine, and dicamba are required over a period of several years to achieve control. Herbicides are most effective when applied to plants infected with biological control agents.

Other Management Considerations

Limiting seed transport vectors (quarantining livestock prior to moving them, cleaning vehicle undercarriages) is an important proactive means of reducing rush skeletonweed spread and protecting native vegetation. However, additional infestations can be expected due to the high level of human activity near cities, long-distance seed dispersal, and extensive disturbances resulting from natural events and human activities (e.g. wildfires, livestock grazing, road construction) (Figure 7). Destroying small satellite infestations at and beyond the expansion front is essential for reducing the rate of spread. Once populations are established, sustained and integrated control, including combinations of biocontrols, herbivory, herbicides and seedings with competitive species, becomes essential.

Figure 7. Wildfire in big sagebrush and cheatgrass (upper) and researcher examining post-fire population dynamics of rush skeletonweed (lower).

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