Salsola tragus, Salsola kali, Salsola iberica, Salsola australis
Russian Thistle, Tumbleweed

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History

Figure 1. Young Russian thistle. Source: Texas A&M AgriLife Extension, College Station, TX, Available from: Texas A&M AgriLife Extension, http://essmextension.tamu.edu/plants/plant/russian-thistle-tumbleweed/ (accessed August 2014).

Russian thistle, an exotic weed originally from Russia, is present throughout most of North America, most often found in arid and/or disturbed habitats. Belonging to the *Amaranthaceae* family, Russian thistle, though once thought to be a single species, is denoted by numerous Latin names due to the number of species found around the world. In North America, Russian thistle is largely known as *Salsola tragus* and *Salsola kali*, the former more widespread in arid, inland regions of the continent while the latter is focused to coastal regions. It was first introduced to the United States in 1873 when flaxseed that had been brought to and planted in South Dakota was found to be contaminated by Russian thistle seeds. From there the weed quickly spread and established itself. In 1894 Lyster Dewey emphatically noted the quick spread of the weed, particularly in comparison to Canada thistle, a weed that had not spread as quickly though it had been present in North America for one hundred years. By 1892, Russian thistle made its first appearance in Colorado; merely two years later, a third of the state reported the presence of the weed. Historic management varied depending on the stage in which the thistle was to be treated. Several authors suggested pulling the weed when young prior to seeding and others recommended burning the plant—a method that is now discouraged due to Russian thistle's ability to easily establish itself and out compete other plants in disturbed areas. In Colorado, Russian thistle is not listed as a noxious weed.[1]

Rocky Mountain National Park (ROMO) made no concerted efforts to combat Russian thistle until 2003, when management of the weed was limited to 1.59% of the Exotics Crew's time. While 1.2 acres were treated in 2003, the Exotics Crew treated 12.47 acres in 2013. ROMO has most commonly manually controlled Russian thistle, though a combination of applying sugar and mowing have been utilized to control the weed in experimental plots.[2]

Biological Concerns

Figure 2. Russian thistle, after breaking at the stem and spreading its seeds as tumbleweed. Source: Bruce Coleman, National Geographic Society. Available from National Geographic: http://environment.nationalgeographic.com/environment/photos/desert-plant/ (accessed August 2014).

Russian thistle, also known as tumbleweed when dry, presents a biological concern due to its ability to spread quickly and easily establish in arid conditions, rangelands, and disturbed areas. When the weed matures and the stem separates from the root—becoming the easily recognizable tumbleweed—the plant "tumbles" across the landscape, blown by the wind and allowing its seeds to fall as it tumbles. As Stallings et al determined in their 1995 study of Russian thistle seed dispersal, the distribution of the plant's seeds is greatly increased by the tumbling, as opposed to when the thistle is held stationary. The number of seeds distributed by Russian thistle ranges from 57,000 to 250,000, with the tumbleweed often traveling several miles. Russian thistle is also a major competitor for water, particularly in the arid regions in which it thrives and is most often found.

While Russian thistle does not effectively compete in the presence of numerous plants, its success in cropland, arid, and disturbed areas easily prevents other plants from establishing themselves. In particular, Russian thistle greatly reduces wheat crop yields, making it economically detrimental as well. Additionally, Russian thistle is a major fire hazard due to its abilities to ignite and spread quickly. Dried tumbleweeds collect along fences and buildings and across the landscape, which allows for the swift ignition of fire. Furthermore, the tumbling weeds quickly spread fire across the landscape, and make the management of fires significantly more difficult. And, while the weed can serve as a forage food for cattle and sheep during the early stages of its growth, it also contains toxic levels of nitrates. However, when soil salinity increases, nitrate levels decrease and forage quality improves.[3]

Management Strategies

Effective management and elimination of Russian thistle is best achieved through the adoption of a variety of strategies, depending on the time of treatment. In the early stages of the plant's life, several authors recommend pulling the weed. If the plant is pulled while seeding, the plant must be bagged in order to prevent seed dispersal, as seeds are viable for up to one year. Mowing Russian thistle is also a viable option if performed prior to seeding, as Russian thistle is capable of producing seeds that grow below the mowed level. Targeting the plant at a young age is also recommended when applying herbicides, so as to prevent seed emergence. Recently, however, researchers have noted the plant's resistance to certain herbicides, as the thistle has developed an acetolactate synthase which served to inhibit the effects of herbicides. Despite this, the herbicides 2,4-D, dicamba, and glyphosate have been found to be effective methods of Russian thistle control.[4]

Researchers have also suggested several biological control methods, none of which have been implemented at ROMO, probably because little research has been done on the species. In 2005, Colorado Parks & Wildlife noted two potential moth species that could serve to manage Russian thistle: *Coleophora klimeschiella* and *Coleophora parthenica*. A 1978 study by Hawkes and Mayfield determined that *C. klimeschiella* did not target other plants, but the moth also did not wholly eliminate the thistle. Other studies recommend the use of a rust fungus, *Uromyces salsolae*, or a mite, *Aceria salsolae*. According to both studies, these methods did not impact non-target species, and thus may serve as useful controls for Russian thistle. Other biological control methods such as the weevil *Lixus salsolae*, have been found to attack surrounding vegetation.[5]

ROMO has largely relied upon manual control methods of Russian thistle through hand pulling and digging, although occasionally the plant will be mechanically treated through mowing. The Exotic Crew's treatment of acreage infested with Russian thistle has been comparatively small compared to other exotics in the park, though a thorough survey of the weed's presence in the park has not been conducted.

Recommendations

Given the relatively little time devoted to management of Russian thistle at ROMO, the author recommends a thorough survey of its presence in the park to determine suitable methods of eradication. With the knowledge of Russian thistle locations in the park, the weed may be targeted with manual, mechanical, and/or chemical control at an early stage of the plant's growth. Manual removal is recommended due to the higher cost of chemical control and given that the plant is not rhizomatous. Sites may then be revisited later in the season to determine the efficacy of the manual control, after which pulling and bagging the remaining plants will prove effective. The most important element of Russian thistle control will be to pull the plant before it breaks off its stem and tumbles, further infesting and spreading in the park.

Endnotes

[1] Hugh J. Beckie and Ardath Francis, "The Biology of Canadian Weeds. 65. *Salsola tragus* L. (updated)," *Canadian Journal of Plant Science* 89, no. 4 (2009): 776; Lyster Hoxie Dewey, *The Russian Thistle: Its History as a Weed in the United States, with an Account of the Means Available for its Eradication* (Washington DC: US Department of Agriculture, Division of Botany, 1894), 12; Lyster Hoxie Dewey, "Distribution of the Russian Thistle in North America," *Botanical Gazette* 20, no. 11 (1895): 501; George P. Clinton, *The Russian Thistle and Some Plants that are Mistaken for it* (Urbana: University of Illinois Agricultural Experiment Station, 1895), 91; Clinton, *The Russian Thistle*, 99; Lyster Hoxie Dewey, *The Russian Thistle and Other Troublesome Weeds in the Wheat Region of Minnesota and North and South Dakota* (Washington DC: US Department of Agriculture, 1893), 8.

[2] Julie Knudson, Matt Ounsworth, Michael Prowatzke, Jamie Dahlkemper, Jim Bromberg, and Brian Kolokowsky, "Rocky Mountain National Park Exotics Year-End Reports," Rocky Mountain National Park: Division of Resource Stewardship, 2000-2013.

[3] Institute for the Study of Invasive Species, "*Salsola tragus*: Russian Thistle," accessed August 4, 2014, http://www.tsusinvasives.org/database/russian-thistle.html; George P. Stallings, Donald C. Thill, Carol A. Mallory-Smith, and Lawrence W. Lass, "Plant Movement and Seed Dispersal of Russian Thistle (*Salsola iberica*)," *Weed Science* 43, no. 1 (1995): 63; Janet L. Howard, "*Salsola kali*: Index of Species Information," (Fire Effects Information System: US Department of Agriculture, 2014), http://www.fs.fed.us/database/feis/; Institute for the Study of Invasive Species, http://www.tsusinvasives.org/database/russian-thistle.html; Edith Bach Allen, "Water and Nutrient Competition Between *Salsola Kali* and Two Native Grass Species (*Agropyron smithii* and *Bouteloua gracilis*)," *Ecology* 63, no. 3 (1982): 732; Edith Bach Allen, "Germination and Competition of *Salsola kali* with Native C_3 and C_4 Species Under Three Temperature Regimes," *Bulletin of the Torrey Botanical Club* 109, no. 1 (1982): 39; Frank L. Young, "Effect of Russian Thistle (*Salsola iberica*) Interference on Spring Wheat (*Triticum aestivum*)," *Weed Science* 36, no. 5 (1988): 594; The Great Basin and Invasive Weeds, "Russian Thistle: *Salsola tragus* (*Salsola iberica, Salsola kali*)," accessed August 4, 2014, http://www.usu.edu/weeds/plant_species/weedspecies/russianthis.html; S. Bokan, K. Crumbaker, and G. Beck, "Identification and Management of Kochia and Russian Thistle," last modified December 12, 2012, http://www.ext.colostate.edu/pubs/natres/06314.html; James L. Fowler, James H. Hageman, Kenneth J. Moore, Margaret Suzukida, Hamid Assadian, and Mario Valenzuela, "Salinity Effects on Forage Quality of Russian Thistle," *Journal of Range Management* 45, no. 6 (1992): 559.

[4] Bokan et al, "Identification and Management of Kochia and Russian Thistle," http://www.ext.colostate.edu/pubs/natres/06314.html; Colorado State Parks, "Best Management Practices Weed Profile: Russian Thistle," last modified April 1, 2005, http://cpw.state.co.us/Documents/ResourceStewardship/RussianThistle.pdf; Institute for the Study of Invasive Species, http://www.tsusinvasives.org/database/russian-thistle.html; Beckie and Francis, "The Biology of Canadian Weeds, 783.

[5] Colorado State Parks, "Best Management Practices Weed Profile, Russian Thistle," http://cpw.state.co.us/Documents/ResourceStewardship/RussianThistle.pdf; R.B. Hawkes and A. Mayfield, "*Coleophora klimeschiella*, Biological Control Agent for Russian Thistle: Host Specificity Testing," *Environmental Entomology* 7, no. 2 (1978): 257; S. Hasan, R. Sobhian, and F. Hérard, "Biology, Impact, and Preliminary Host-Specificity Testing of the Rust Fungus, *Uromyces salsolae*, a Potential Biological Control Agent for *Salsola kali* in the USA," *Biocontrol Science and Technology* 11, no. 6 (2001): 677; Lincoln Smith, Massimo Cristofaro, Enrico de Lillo, Rosita Monfreda, and Alessanda Paolini, "Field Assessment of Host Plant Specificity and Potential Effectiveness of a Prospective Biological Control Agent, *Aceria salsolae*, of Russian Thistle, *Salsola tragus*," *Biological Control* 48 (2009): 237; R. Sobhian, B. Fumanal, and M. Pitcairn, "Observations on the Host Specificity and Biology of *Lixus salsolae* (Col., Curculionidae), a Potential Biological Control Agent of Russian Thistle, *Salsola tragus* (*Chenopodiaceae*) in North America," *Journal of Applied Entomology* 127 (2003): 322.