

Research Notes cont.

In small, coldwater streams in the inland West, the primary invasive fish species is the brook trout *Salvelinus fontinalis*, which is native to eastern North America. Brook trout were widely stocked in streams in this region beginning in the late 1800s. Historically, these streams contained various subspecies of cutthroat trout *Oncorhynchus clarkii*, but cutthroat trout are now absent from much of this area. For example, in central Montana, where westslope cutthroat trout *O. c. lewisi* were first identified by Lewis and Clark, this subspecies occupies perhaps 5% of its historical range, primarily in small streams above fish barriers. It has been replaced in large rivers by rainbow trout *O. mykiss* (which was stocked from Pacific coastal waters) and brown trout

Salmo trutta (which originates from Europe), and in small streams by brook trout. In western Montana and Idaho, however, westslope cutthroat trout are much more widespread; they appear to occupy over 50% of their historical range. Although brook trout are present in some waters, they are thought to be much more limited in their distribution. “Thought” is intentional here: little sampling of headwater streams has been done.

In 2008, researchers from Missoula, Montana, began an extensive survey of western Montana and northern Idaho streams to document the distribution of all species of fish and amphibians on Forest Service lands. We sampled using intensive, single-pass electrofishing in over 1,000 reaches of nearly 400 streams. Many of these reaches were in the extreme headwaters of over 200 streams. These sites were located near the

upstreammost extent of the distribution of fish, locations that are generally regarded to have pristine habitats that lack exotic species.

Preliminary results suggest a disturbing pattern. Westslope cutthroat trout seem much less widely distributed than was assumed during a recent (2005) assessment of their range. Moreover, brook trout are present in about half of the small streams in western Montana and northern Idaho, and in about a quarter of all headwaters sites. In streams containing both species, brook trout usually (and often dramatically) outnumber westslope cutthroat trout. In a substantial number of streams, as in central Montana, brook trout have completely replaced westslope cutthroat trout. This study will yield many insights into the impacts of exotic brook trout on native fish of the region.

Treating Downy Brome with Herbicide and Seeding With Native Shrubs

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Downy brome or cheatgrass (*Bromus tectorum* L.) is one of the most invasive and widespread exotic plants in North America. Downy brome can reduce soil nutrient availability, alter native plant community composition, and increase fire frequencies. The effectiveness of Plateau® imazapic herbicide in reducing downy brome cover has been variable, and there is uncertainty about the impacts of imazapic on native species. Researchers from Flagstaff, Arizona, recently published

an article in *Invasive Plant Science and Management* that investigated if treatments of imazapic and/or seeding with native shrubs were effective in rehabilitating shrublands highly invaded by downy brome on the Kaibab National Forest in northern Arizona. Researchers also determined the effects of imazapic on different growth stages of both downy brome and three native shrub species in the greenhouse.

A one-time application of imazapic combined with seeding shrubs was only slightly effective in rehabilitating areas with high downy brome and thatch cover, and resulted in short-term impacts to nontarget species. In the field, seeding shrubs did not significantly increase shrub density, although imazapic herbicide reduced downy brome cover and nontarget forb cover by 20-25% and altered plant community composition the first

year post-treatment. Imazapic was lethal to downy brome at all growth stages in the greenhouse and reduced shrub germination by 50 to 80%, but older shrub seedlings were more tolerant of the herbicide. These results highlight the need to treat downy brome infestations before they become too large. Removing thatch before treating with imazapic, although likely lethal to the native shrubs in this study, could increase the effectiveness of imazapic. Because imazapic can alter native plant communities, managers should consider the unintended consequences of this herbicide and the consideration of other strategies for downy brome control, such as seeding native plant barriers and using herbicides that selectively reduce downy brome seed viability. For more information, see Owen and others (2011), listed in the Recent Publications section on page 8.



Imazapic herbicide application to downy brome-invaded shrubland. The herbicide was mixed with an inert blue dye for visibility.



Greenhouse experiment showing downy brome that was treated with the herbicide, imazapic (left), and water as a control (right).