# Fire promotes downy brome (*Bromus tectorum* L.) seed dispersal


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## The interplay between downy brome invasion and fire

In the western U.S., disturbance caused by fire and the expansion of the invasive annual grass *Bromus tectorum* (downy brome or cheatgrass) are strongly associated. As a winter annual grass, *B. tectorum* responds readily to the increased light and nutrients available following fire. The fine fuels produced as *B. tectorum* senesces then causes a considerable increase in fire frequency, further promoting its development. This has resulted in a dramatic, extensive, and costly decline in the productivity and diversity of western U.S. rangelands. Despite the strong association between *B. tectorum* invasion and fire, the effect of fire on *B. tectorum* dispersal has not been studied (Fig. 1).

We compared dispersal distances of diaspores in recently *burned* areas and in paired, *control* areas. We also quantified the effect of diaspore dimorphism on *B. tectorum* dispersal. The two most common types of diaspores, single seeds and seeds adhered to sterile, unfilled florets, were included. The study took place in sites with pinyon – juniper vegetation, in western Colorado, U.S.

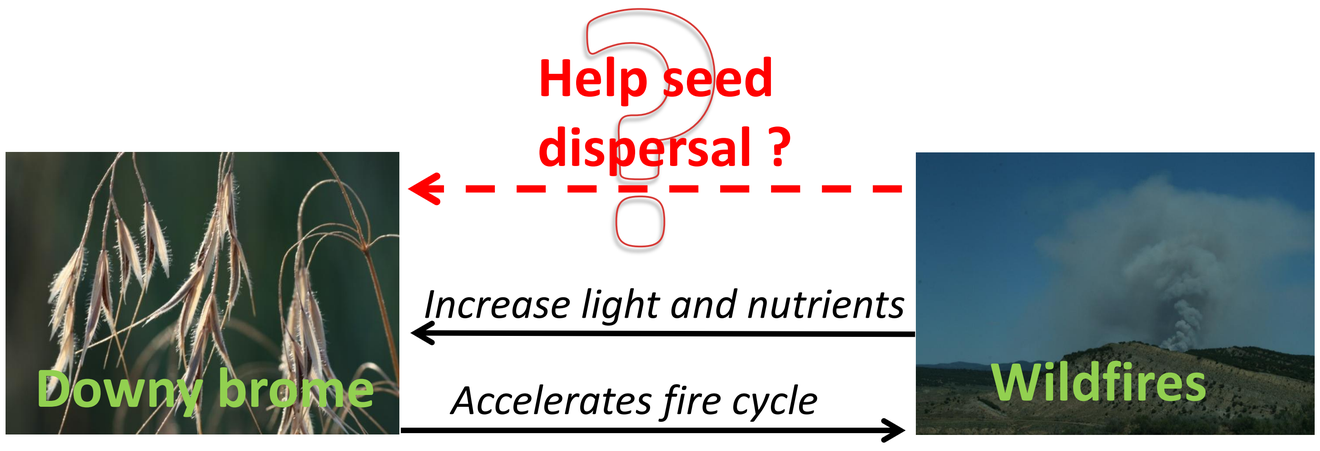


Fig. 1. Our main hypothesis replaced in the « fire – downy brome invasion » context.

## Experimental approach

Twelve groups of 100 diaspores, in which the two main diaspore types were represented in their naturally occurring proportion, were sterilized and coated with fluorescent powder (Fig. 2). In each of three sites, 400 seeds were released in *burned* (2 x 100 seeds) and *control* (2 x 100 seeds) areas (Fig. 2). Two to three days after release, at night, diaspores were tracked and distance to the release point was recorded. A second measurement round, six to seven days after release, was performed in a similar way.

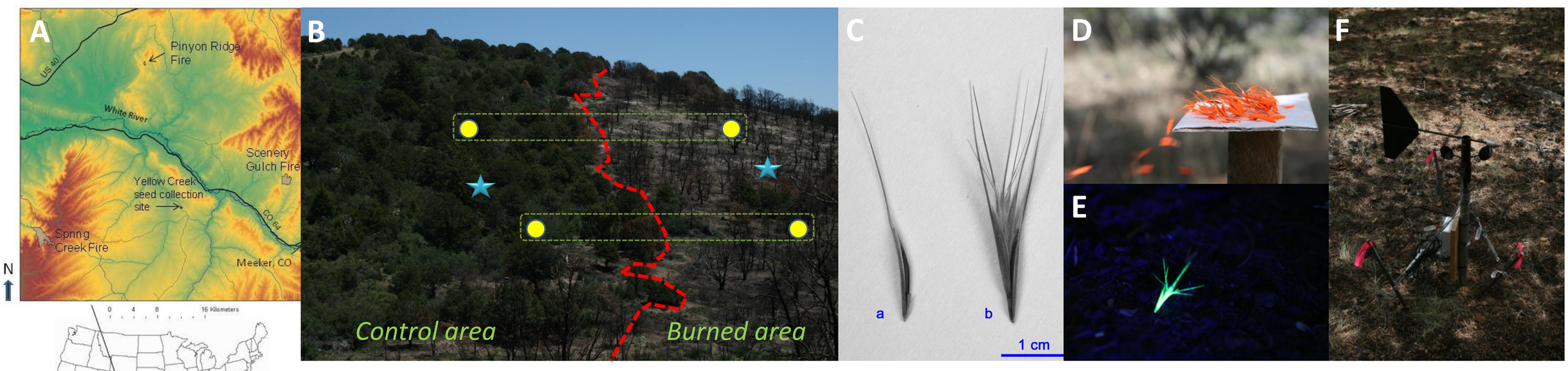


Fig. 2. Illustration of the experimental approach: (A) Location of the three study sites; (B) Experimental design in one site, with yellow dots representing paired release points and blue stars representing wind measurement stations; (C) Illustration of the two diaspore types (a: without sterile florets; b: with sterile florets attached); (D) Release of coated seeds; (E) Coated seed as found at night using a black light; and (F) Wind measurement station.

## Results

Diaspores travelled much further in burned than in unburned areas (Fig. 3), indicating an increase in dispersal distance after fire. The action of fire was notably due to promotion of secondary dispersal, as revealed by the increase in dispersal distance over time. Spread rate (average distance travelled by the 100 released diaspores at a point between two measurements divided by the number of hours between the two measurements) reached 8.18 cm $h^{-1}$ in the most recently burned site. In contrast, in unburned areas, secondary dispersal was almost nonexistent. At the end of the experiment, average and maximum dispersal distances were 5 and 13-fold higher, respectively, in burned areas than in unburned areas. Burned areas in the present study were characterized by lower cover of all types of vegetation (except dead trees) and faster wind speeds and gusts near the ground surface. Both vegetation and wind changes may have accelerated secondary dispersal in burned areas.

The presence of sterile florets attached to seeds promoted dispersal (Fig. 3). Although complex diaspores were heavier, they dispersed further, and this effect was more pronounced in burned areas and with increasing time since release.

Our results indicate that at least one of the mechanisms by which the spread of *B. tectorum* is promoted by fire is through increased seed dispersal distance. Preventing movement of seeds from nearby infestations into burned areas may help avoid the rapid population expansion often observed after fire.

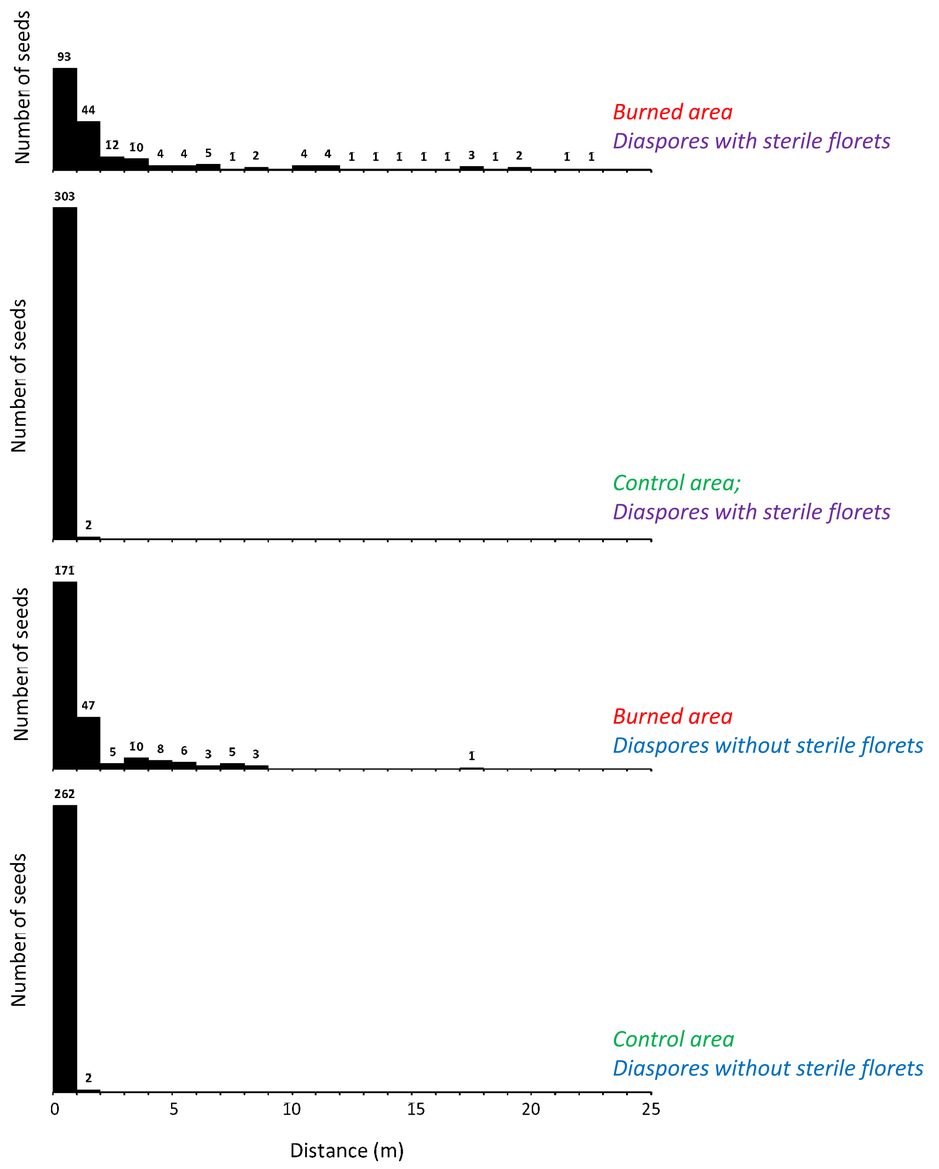


Fig. 3. Distribution of dispersal distances (step: 1 m) after 6-7 days for both diaspore types in burned and unburned areas. Data from the different sites were pooled.

## Take-home messages

- If downy brome increases wildfires fire frequency and intensity, fire in turn accelerates downy brome spread through increased seed dispersal
- Sterile florets attached to diaspores seem to enhance dispersal