North Central RISCC

Regional Invasive Species & Climate Change Network

Management Challenge

The Invasive Grass-Fire Cycle in the North Central U.S.

Summary: States in the North Central (NC) region have already been invaded by grass species capable of altering fire regimes and creating self-perpetuating 'grass-fire cycles'. Under climate change, these grasses may interact with drought and fire to burn more and exclude native species. Managers can plan for these interactions and create collaborative communities to address these complex challenges.

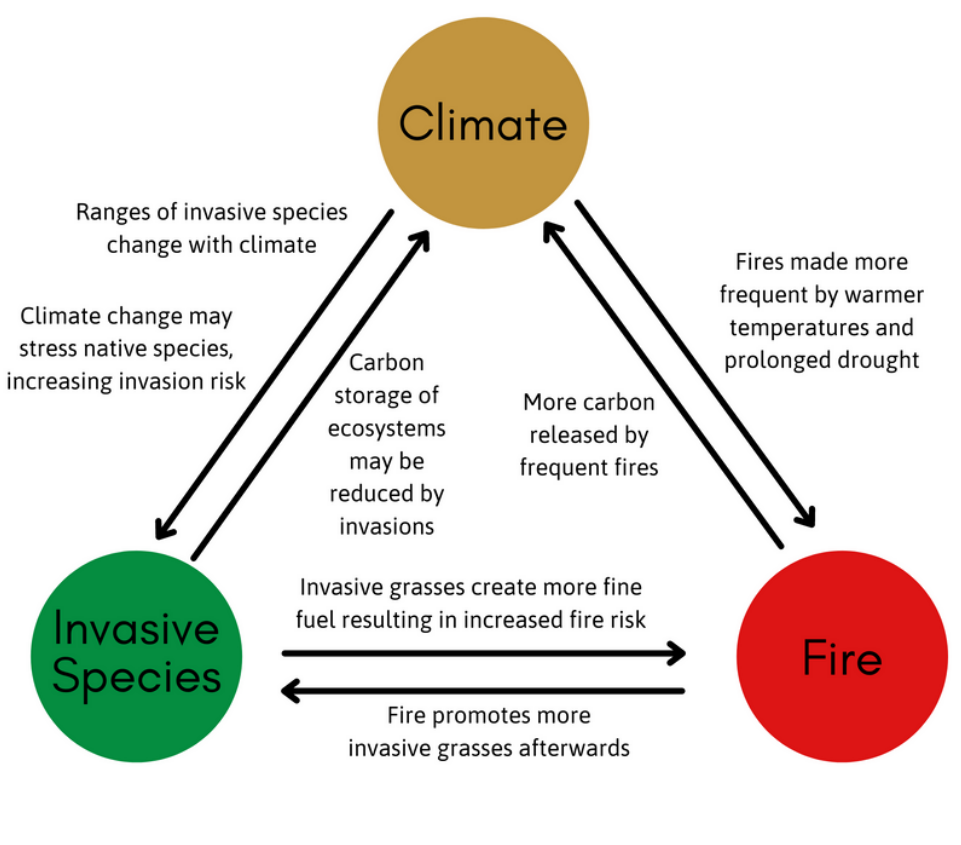
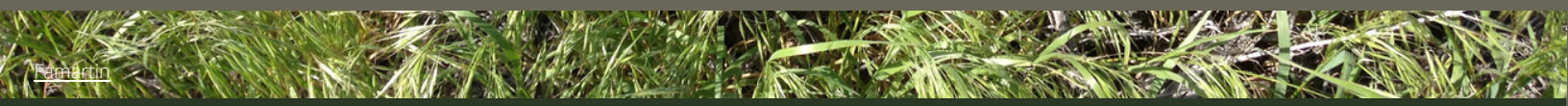


Figure 1: Interactions between climate, fire, and invasive species.

There are several well known grass species including cheatgrass (*Bromus tectorum*) and medusahead (*Taeniatherum caput-medusae*; listed as a noxious weed in multiple NC states), that have the potential to create what is known as a 'grass-fire cycle' -- where abundant fine fuels from invasive grasses lead to more frequent burns, after which the same grasses are able to outcompete native plants, grow back quickly, and perpetuate the cycle. The result is the elimination of key native species (e.g., sagebrush) and significant alteration of ecosystem structure and function.

Given that climate change is in itself leading to more and larger fires in areas like the western U.S., this three-faceted interaction (Figure 1) is both complex and concerning.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The grass-fire cycle is perhaps best studied in sagebrush ecosystems of the arid western U.S., where cheatgrass has been an incredibly successful invader and has led to reduced carbon storage and species diversity. Cheatgrass threatens native sagebrush habitat in the NC states (Figure 2) and can create a near-monoculture (Figure 3). In addition to sagebrush and other shrubland ecosystems, invasive grasses can create grass-fire cycles in forested areas as well. Some forests are unaccustomed to frequent and/or severe fires and here grasses may invade early successional communities, forest gaps and edges, and at the borders with other vegetation classes. Invasive grasses that establish post-fire can deplete soil moisture early in the growing season, limiting regeneration of native shrubs and trees.


Coconino National Forest

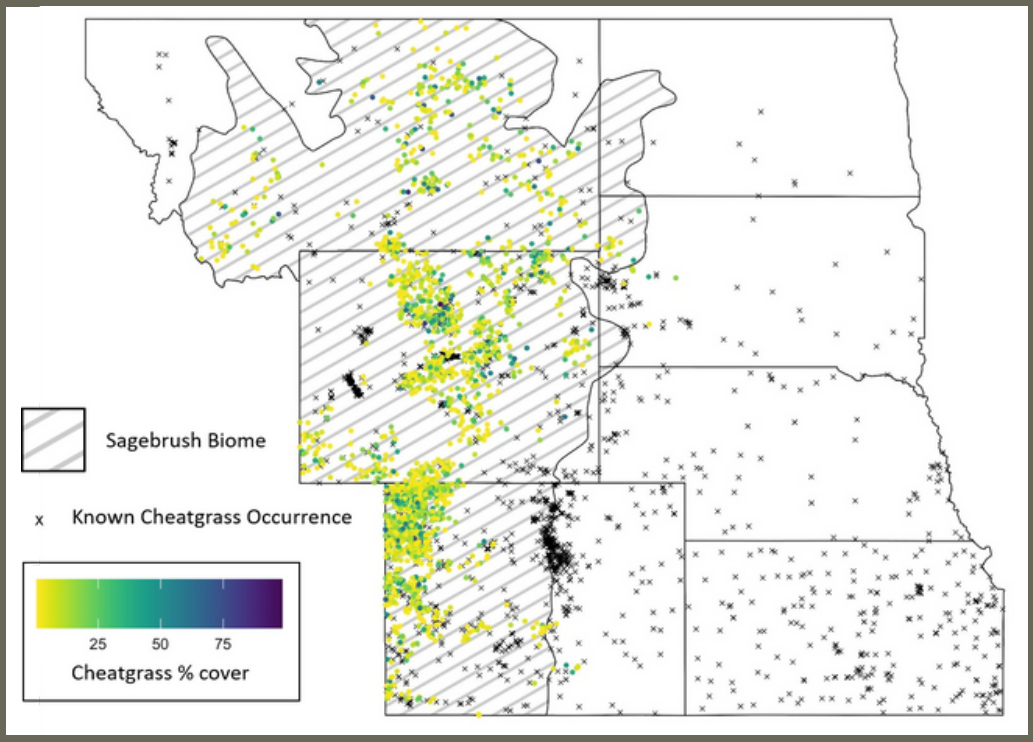

Figure 2 (left): Landsat-derived sagebrush habitat (hatched polygon; Jeffries and Finn 2019) and cheatgrass occurrence in the North Central U.S. Colored dots show cheatgrass abundance (% cover) at known locations from BLM AIM data, and x point locations show known cheatgrass occurrences from GBIF data.

Unlike the more arid areas to the west, invasion of annual grasses in the Great Plains may not perpetuate a grass-fire cycle where grasses are already dominant; here fire may have either neutral or negative effects on invasive grasses.

Sagebrush **Invaded Sagebrush** **Cheatgrass**

Figure 3 (above): Transition from Wyoming big sagebrush (*Artemisia tridentata* subsp. *wyomingensis*) to cheatgrass. Some subspecies of *Artemisia tridentata* like Wyoming big sagebrush have limited regeneration post-fire as cheatgrass depletes soil moisture.

Community Needs

- ***Plan for invasive grasses, fire, and climate change to interact***. This feedback loop has been observed in shrubland and forest ecosystems.
- ***Proactively create cross-community connections.*** Ensure that you work with others in complementary areas - climate adaptation, invasive species, fire management, and emergency response to address this complex problem.
- ***Most research is about post-fire recovery rather than prevention.*** We need more information about invasive grass fuel loads and moisture and fire risk to help direct management actions and prevent costly fires.
- ***Use species projections and other tools to help predict range shifts and fuel abundance.*** Some of these include EDDMapS, INHABIT, Grass-Cast, and Fuelcast.

Earth Lab

North Central Climate Adaptation Science Center

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