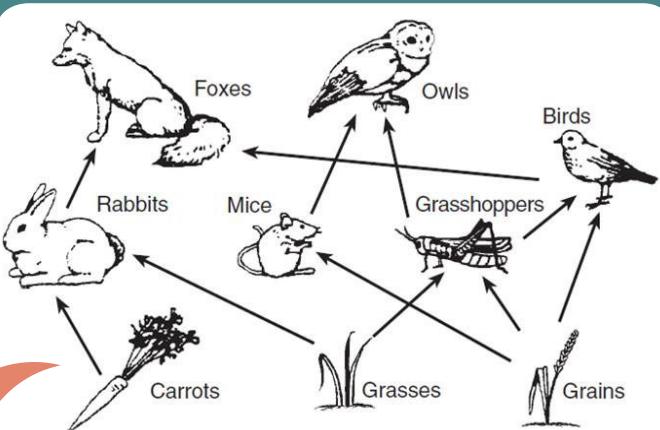




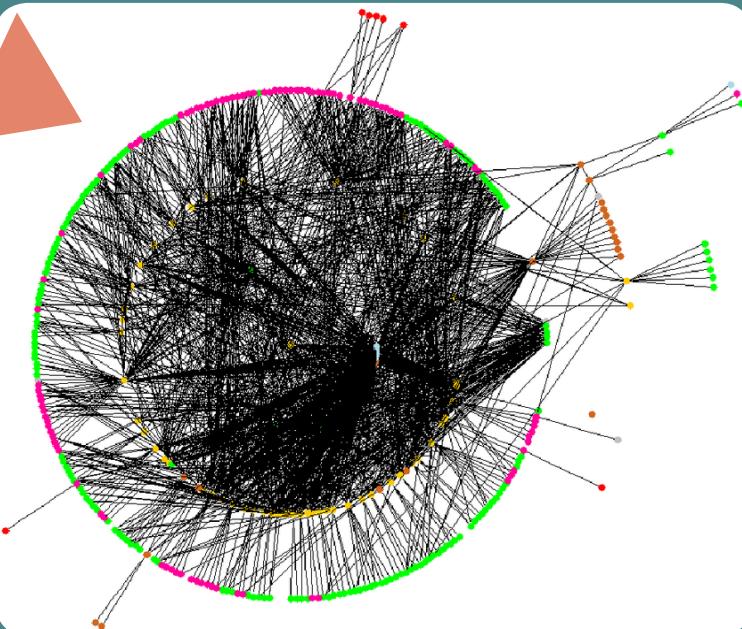
The Complexity of Forest Science and Management

One of the most challenging things to communicate about natural resources science and management are the layers of ecological, social, economic, and political complexity at work in forest science and forest management. We can't be sure how every management action (or inaction) will affect this incredibly complex system. That's why scientific monitoring and adaptive management frameworks are so important. They allow us to evaluate the impact we're having on an ecosystem and move forward with more detailed, specific, and locally relevant information.

Ecosystem Complexity



We all remember the images of food webs from our middle school science textbooks. It can be helpful to think about ecosystem interactions like this—all the different parts of an ecosystem feed into and support one another in different ways.



The reality is infinitely more complex. For example, here is a food web for 58 grasshopper species in Wyoming's rangeland. This web represents interactions between grasshoppers, birds, spiders, parasites, non-living food sources like plants and fungus, and even cannibalism among the grasshoppers themselves... and this food web only focuses on grasshoppers.

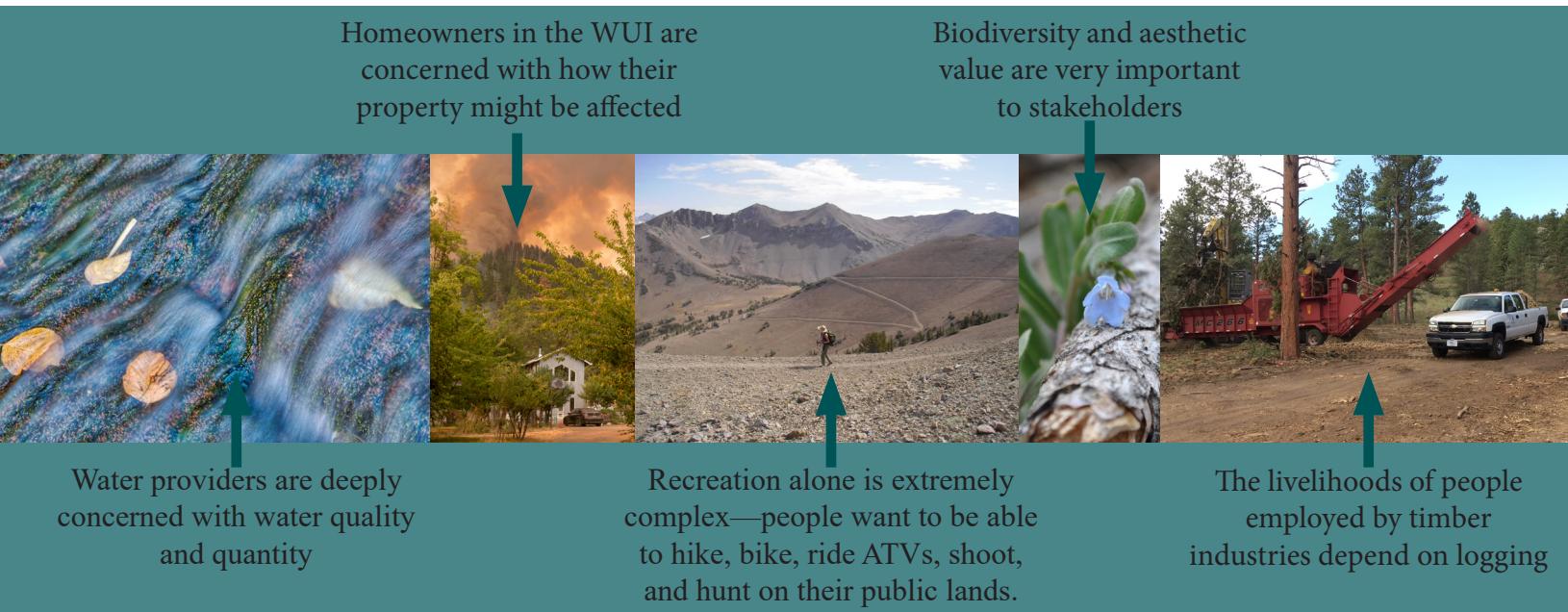
Lockwood, Dale & Lockwood, Jeffrey. (2019). Grasshopper Population Ecology: Catastrophe, Criticality, and Critique. *Ecology and Society*; Vol. 13, No. 1 (2008).

Imagine such a complex web created for every animal, plant, insect, fungus, and soil microbe, and every service they provide or require from another organism, and you might begin to approximate a visual of the complexity of an entire ecosystem.

Even that visual wouldn't capture the importance that processes like fire, hydrology, and climate patterns have on the system as a whole.

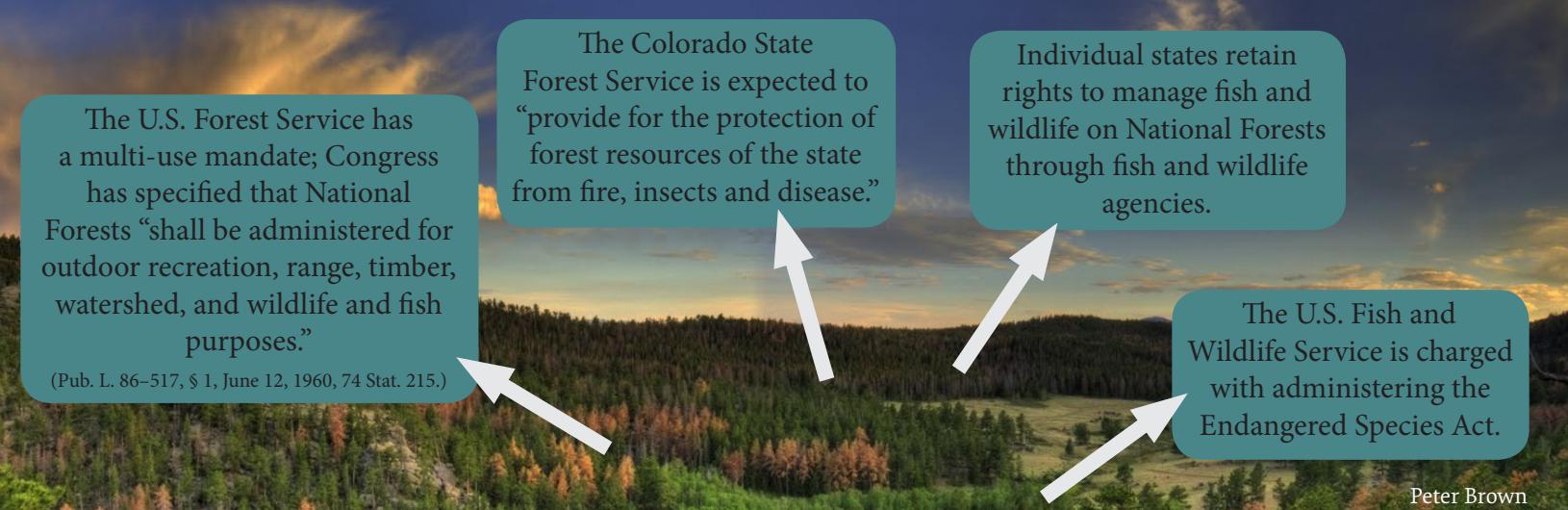
Social Complexity

So many people have a vested interest in the natural resources of Colorado's Front Range, and different groups bring their own visions and values for what constitutes an ideal stewardship strategy.



Policy-Based Complexity

Agencies responsible for managing Colorado's lands have multiple mandates. Each of these agencies is also internally responsible for following their own internal protocols and procedures. This can make taking collaborative management action complicated. Agencies may even have to balance internal priorities for a single action.



Economic Complexity

On Colorado's Front Range, it can be very difficult to recoup costs for restoration treatments because there are not many readily available markets for small-diameter timber. This economic reality may curtail restoration even when it is ecologically necessary, has public social buy-in, and accords with agency policies.

Climate Change Creates Uncertainty

Climate change makes all of these factors even more complex. We don't know yet how changing fire and precipitation regimes will impact forests on the Front Range; that's part of what makes science such a valuable tool at this particular moment. Science-based adaptive management processes will help us respond to challenging questions in the future.