Metrics of Wildlife Community Resilience

Overview: One goal of management is to support the health and resilience of habitats, and biodiversity can be important for enhancing both. However, evaluating resilience alone or links between biodiversity, health and resilience can prove difficult. Therefore, we are developing metrics to quantify and evaluate wildlife community health and resilience.

Health: communities that are supportive of a variety of ecological processes.

Resilience: the ability of a community to maintain integrity/character after a disturbance.

Biodiversity: the variety of life, in all forms. This includes the variety of species, interactions between species, and communities.

Why care about biodiversity?

The world's forests harbor **the vast majority of terrestrial species** (FAO 2020), therefore they are an important source of biodiversity worldwide.

Species provide **critical ecosystem services**, including pollination, seed dispersal, and pest and disease control.

Sierra Nevada forests are home to **charismatic species**, including mountain lions, fishers, martins, spotted owls, and goshawks.

Healthy forests provide ample opportunities for bird watching, hunting, fishing, and other activities.

Globally we're in a biodiversity loss crisis, therefore it is important to have integrative tools that better equip us to evaluate and support healthy and resilient communities.

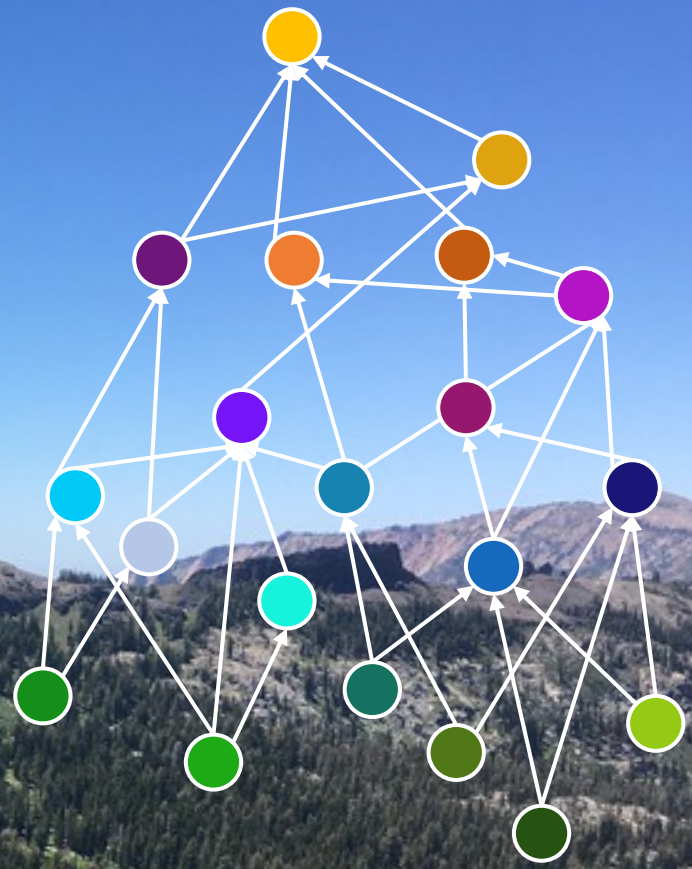
Food and Agriculture Organization of the United Nations (2020) State of the World's Forests

The solution: **Food webs**, are a valuable way to represent the complexity of trophic interactions within a local wildlife community and simultaneously evaluate health and resilience using different **metrics**. For example:

Functional diversity describes the variety of functions present in a wildlife community. Communities with higher functional diversity may support a higher diversity of ecosystem functions that in turn support **ecosystem health**.

Redundancy describes how species perform similar functions within a wildlife community. Communities with higher functional redundancy are predicted to be **more resilient** to species loss.

Guild richness describes how many different functional groups are present in a wildlife community. This is one way to describe **biodiversity** and **health** present in a community.

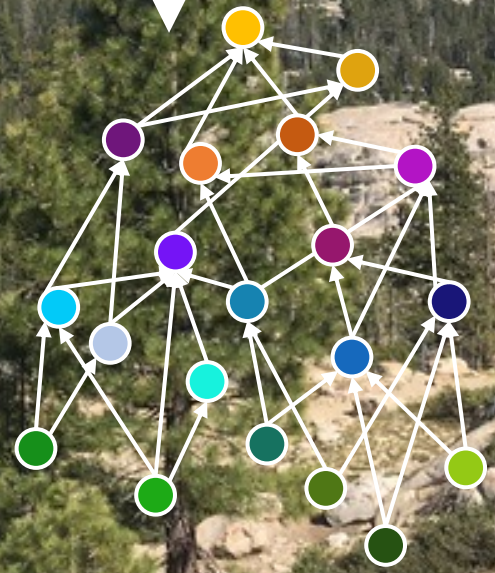


How do we do it?

We leverage a metanetwork approach, where species (small circles) are placed into functional groups (large circles) based on common predators, prey, body size, habits, and habitat. We then use this set of relationships represented by the **global metanetwork** and a series of **habitat filters** to simulate **wildlife community food webs** for forest types (i.e., red fir forest, Sierran mixed conifer, etc.) in the central Sierra.

Global metanetwork

Habitat filters



Wildlife community food web

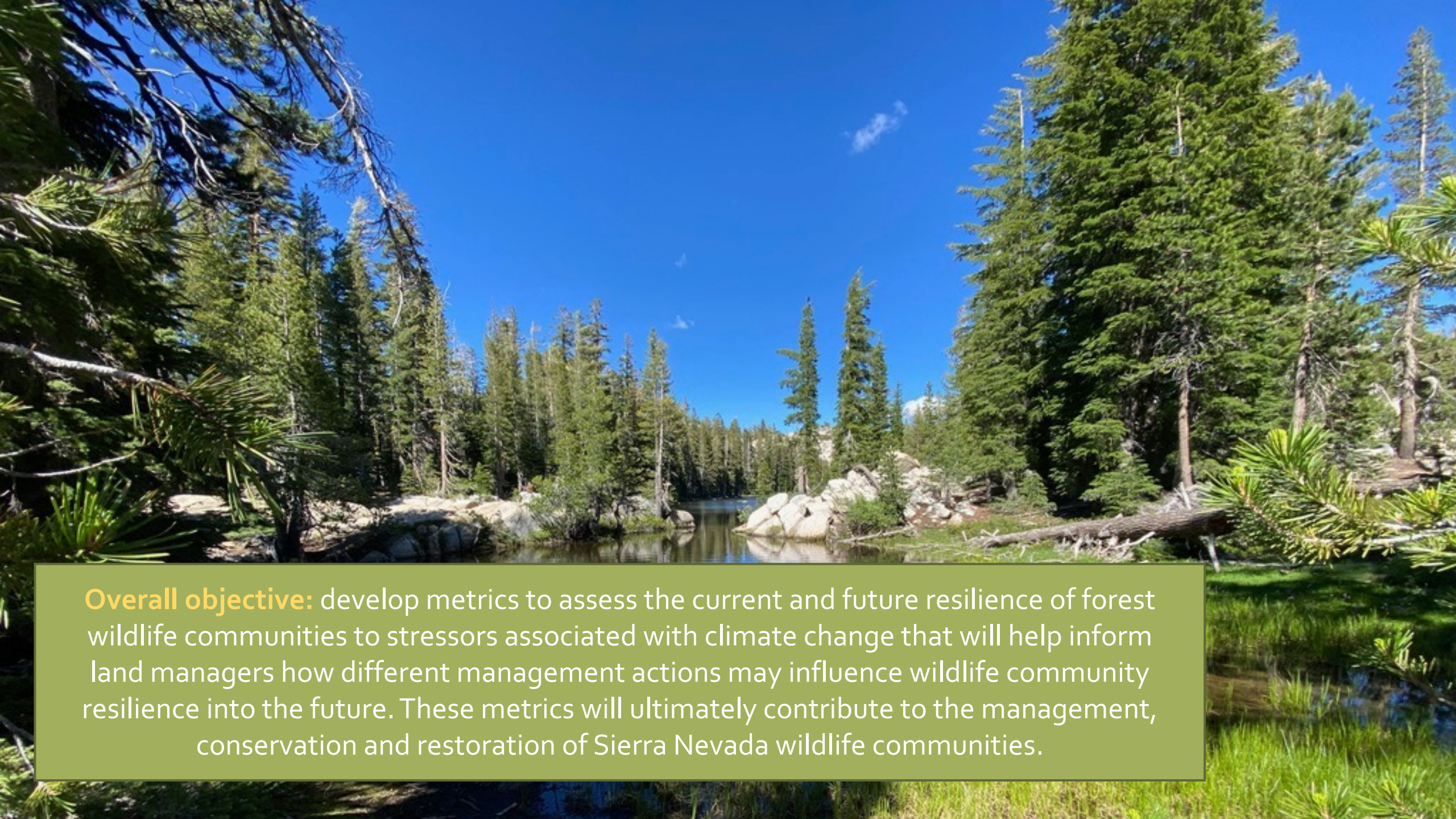
Images: Phylopic and Gabriela Palomo-Munoz.

What can food web metrics tell us about wildlife communities?

Evaluating food web metrics for wildlife communities across different forest types allows us to evaluate current conditions and predict how wildlife communities may respond to different stressors associated with environmental change. For example:

Maximum chain length, describes the number of links between a consumer species and a primary producer. Wildlife communities with long chain lengths, have top predators. These top predators can be more susceptible to anthropogenic change, and their loss may have cascading impacts on the rest of the community.

Generalist species, wildlife communities with more generalist species (more omnivores) may be more able to recover after a disturbance more quickly compared to wildlife communities with more specialist species.



Overall objective: develop metrics to assess the current and future resilience of forest wildlife communities to stressors associated with climate change that will help inform land managers how different management actions may influence wildlife community resilience into the future. These metrics will ultimately contribute to the management, conservation and restoration of Sierra Nevada wildlife communities.

Metrics of Wildlife Community Resilience Team:

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Questions for you:

- How would wildlife community resilience metrics be useful in your work and/or study system?
- What would make them more useful to you? (e.g., specific scenario examples)
- Any comments, questions, or suggestions?

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