Invasive weeds and nitrogen deposition suppress ephemeral post-fire plant diversity

INVASIVE WEED &
RESTORATION ECOLOGY LAB

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How can we conserve and restore California's plant communities in the face of environmental change?

Multiple drivers of environmental change both *necessitate* and *complicate* ecological restoration

Nitrogen deposition

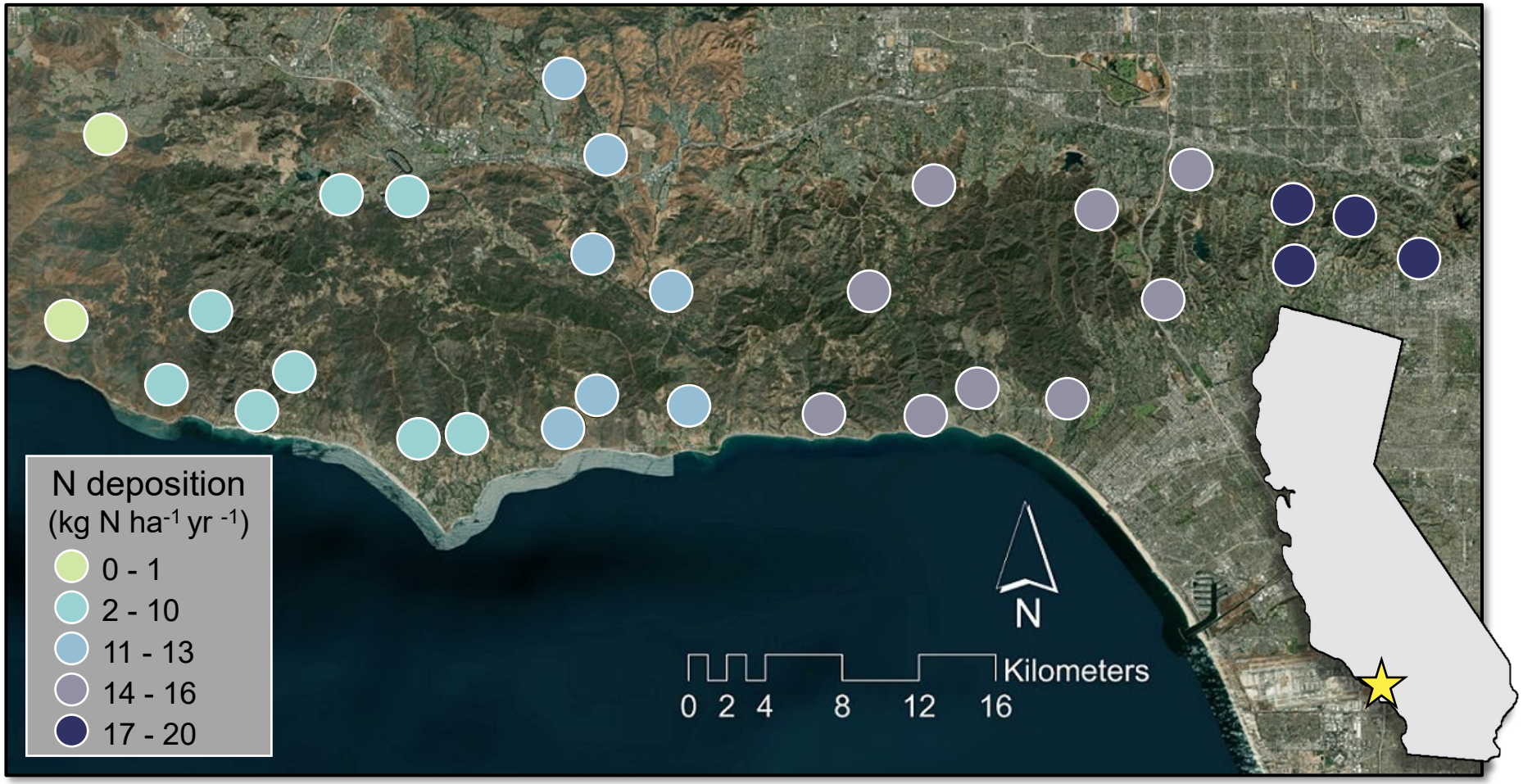
Extreme drought

Nonnative plant invasion

Altered fire regimes

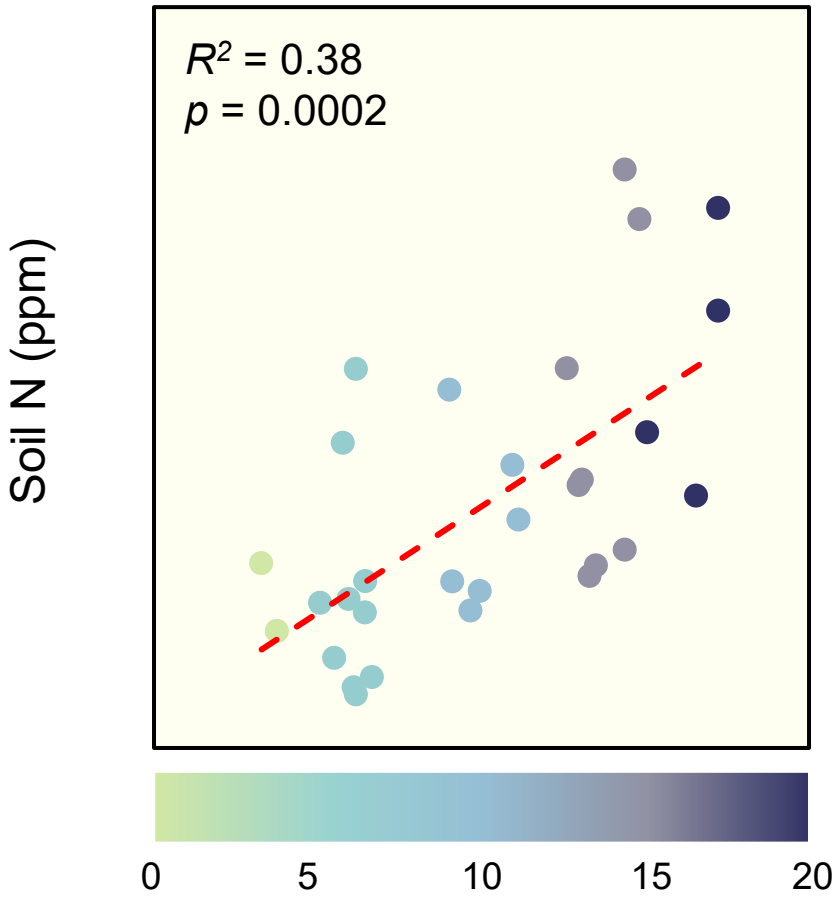

Coastal Sage Scrub
Scott Gibson

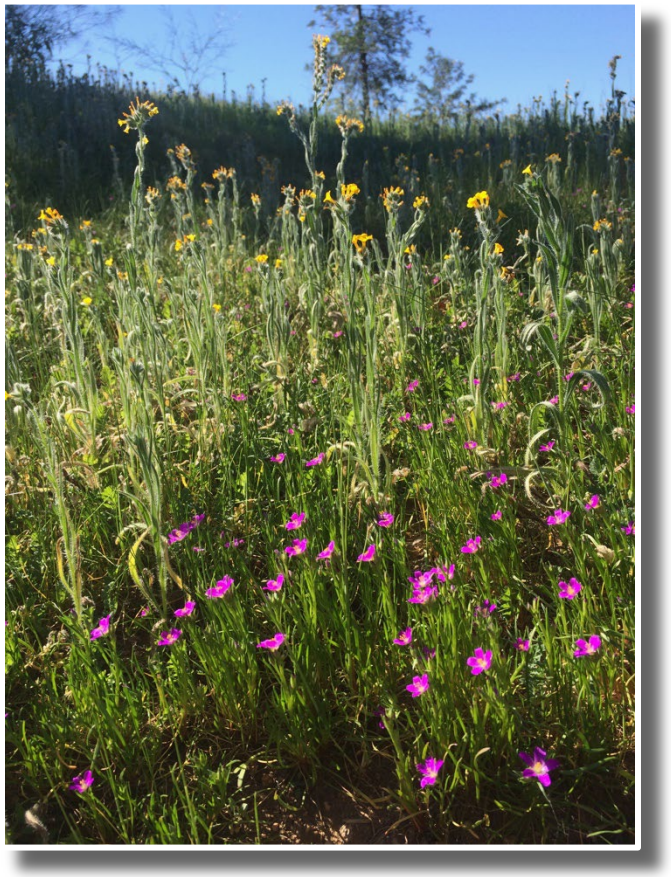
Ecological impacts of anthropogenic nitrogen deposition in the world's largest urban national park

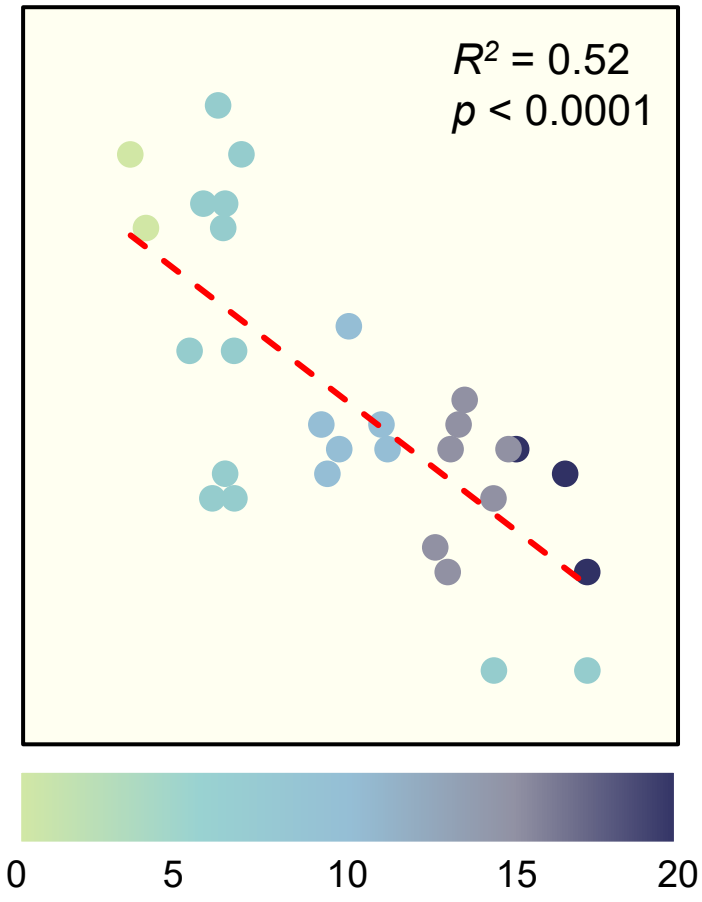


Valliere et al. 2020. *Ecosphere*

Atmospheric N pollution causes a dramatic increase in soil N availability and declines in native forbs

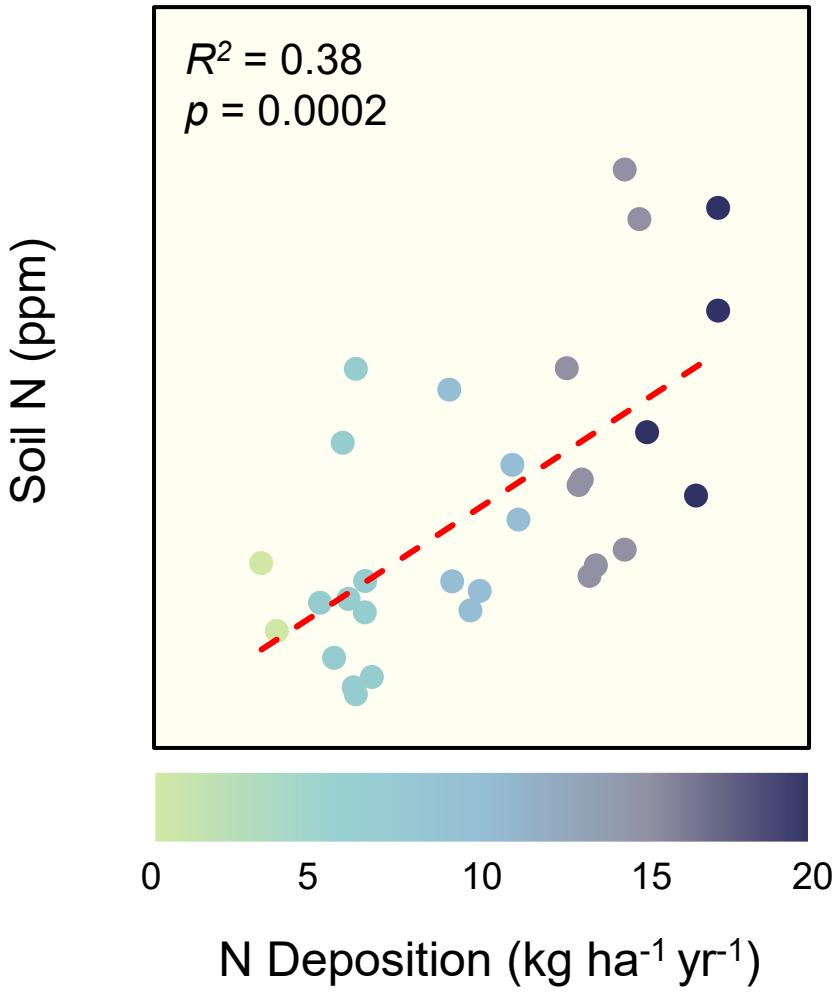


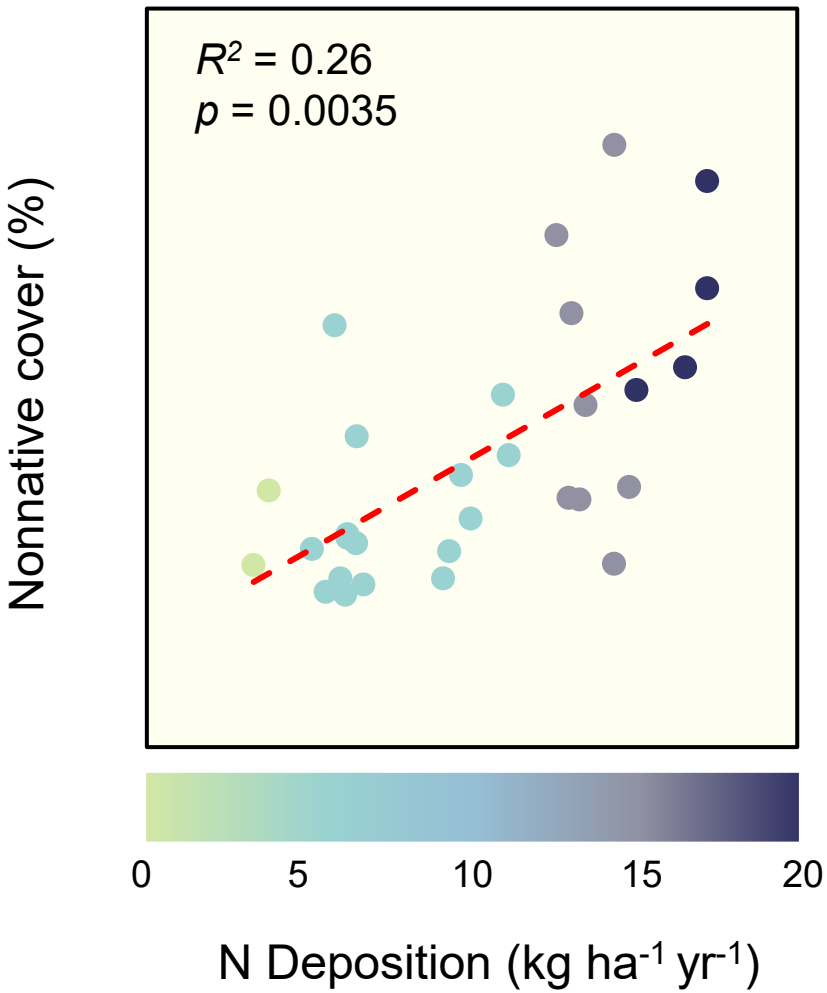




Valliere et al. 2020. *Ecosphere*

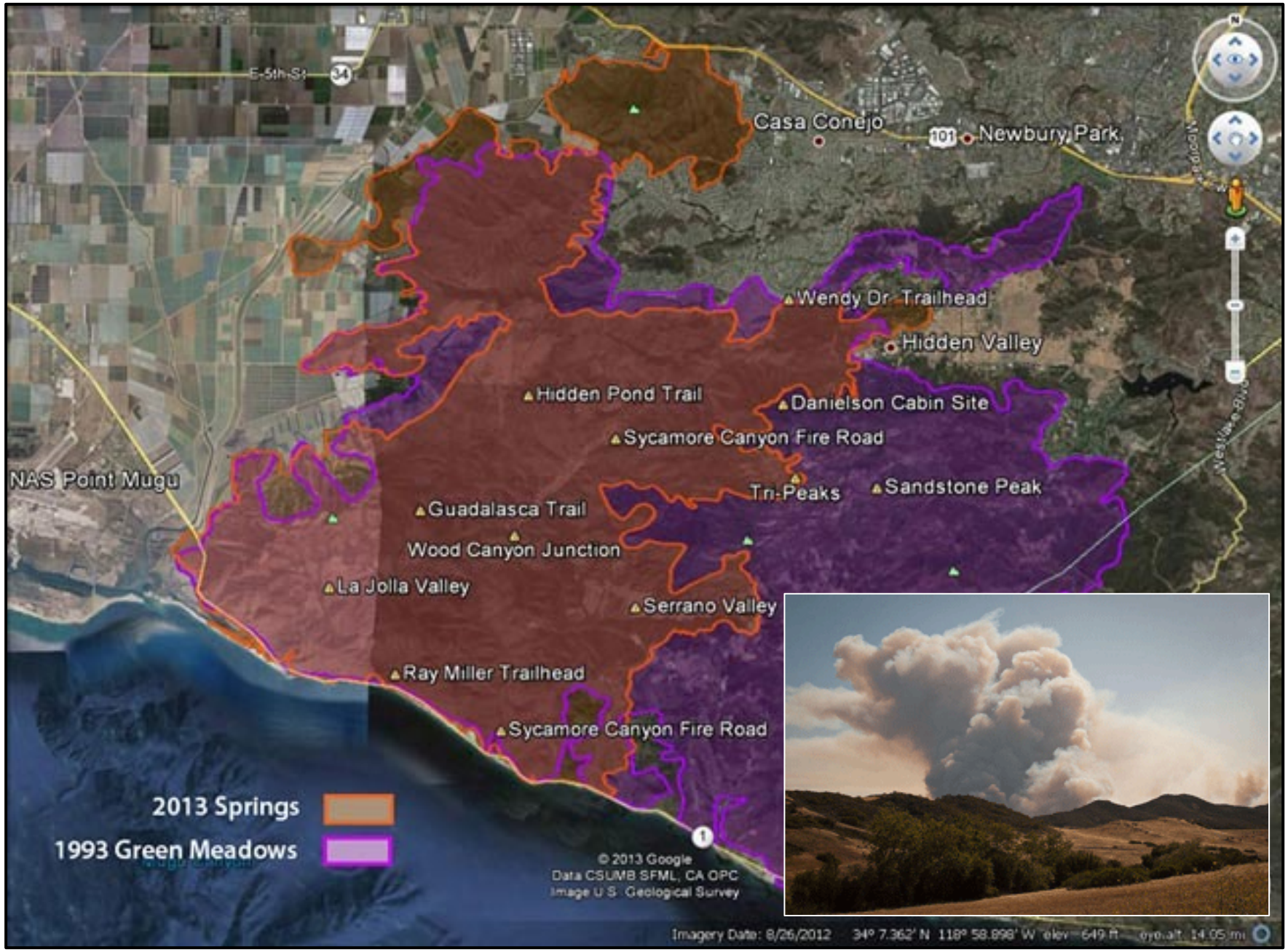
Nitrogen deposition favors weeds over native forbs





Valliere et al. 2020. *Ecosphere*

Springs Fire 2013



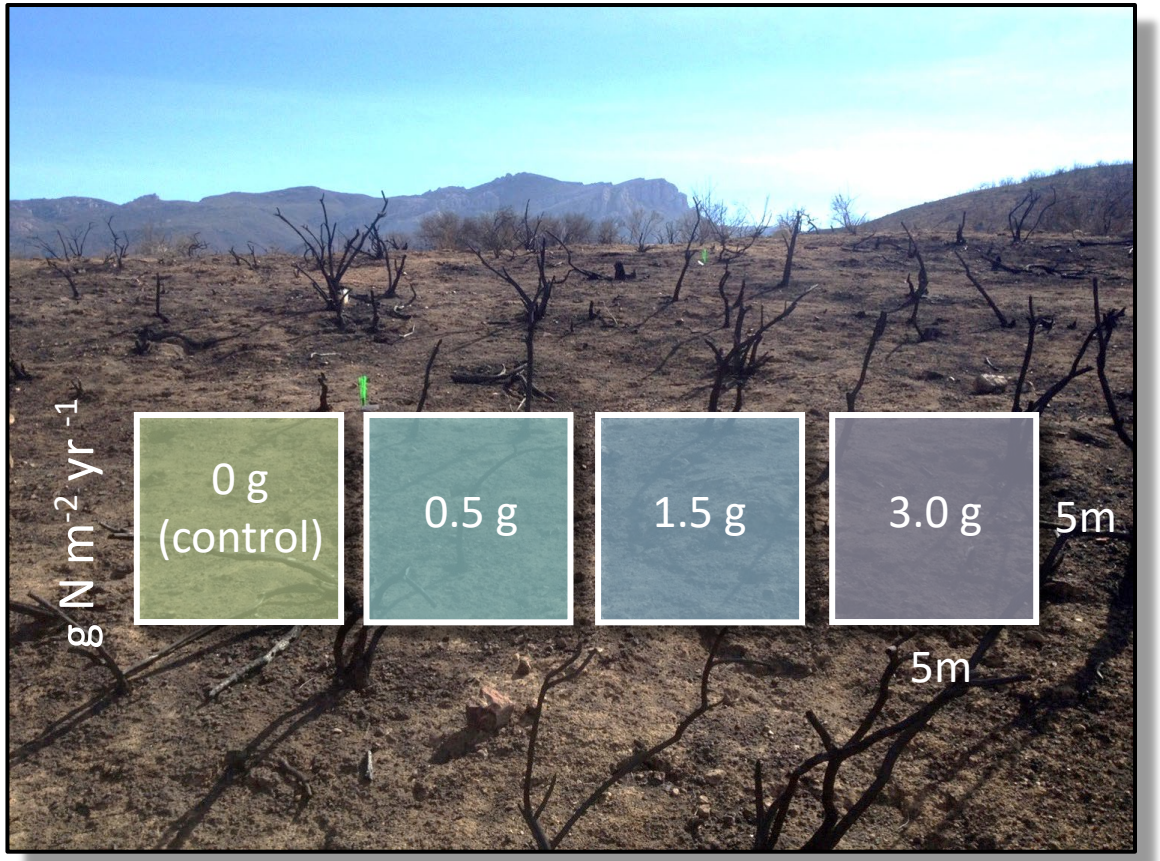
How do nitrogen deposition and invasion history influence passive restoration of coastal sage scrub?

Audubon CALIFORNIA

Valliere et al. 2024. *Global Change Biology*

NATIONAL PARK SERVICE

How do nitrogen deposition and invasion history influence passive restoration of coastal sage scrub?



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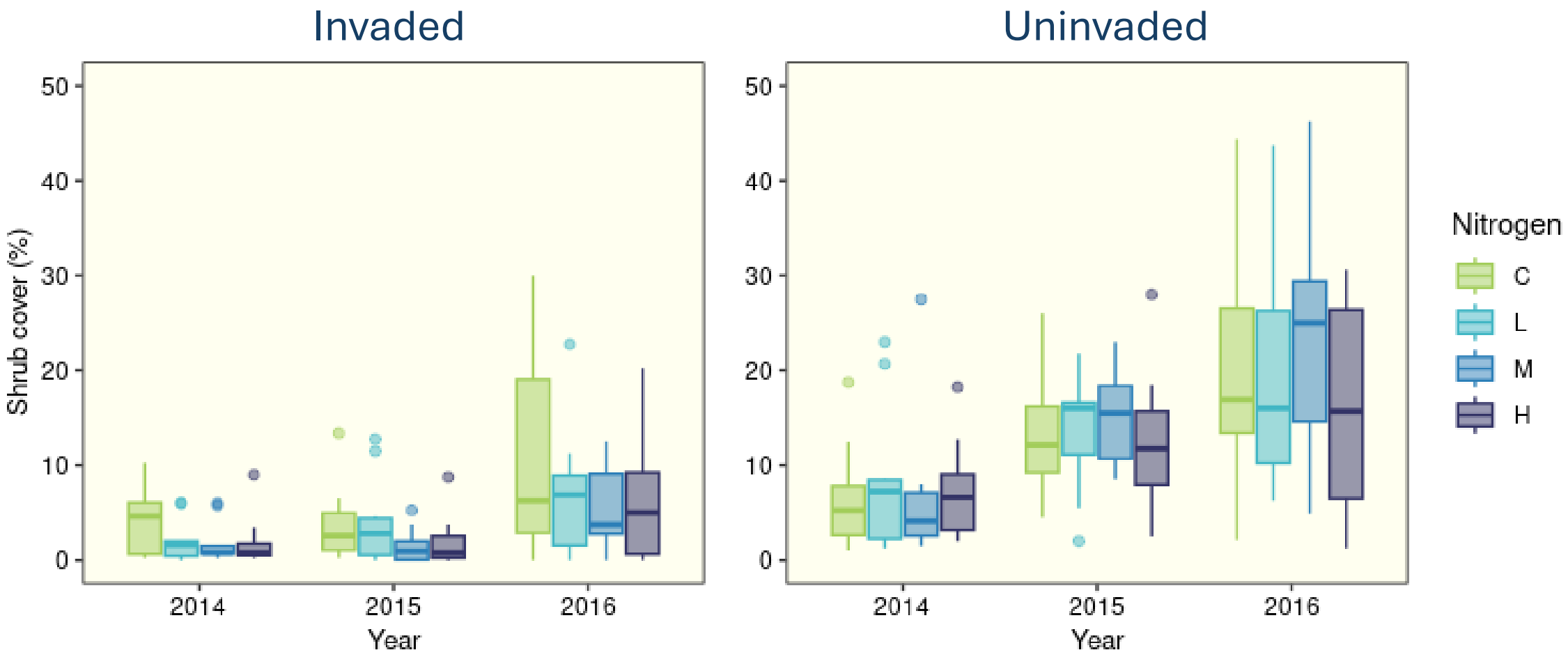
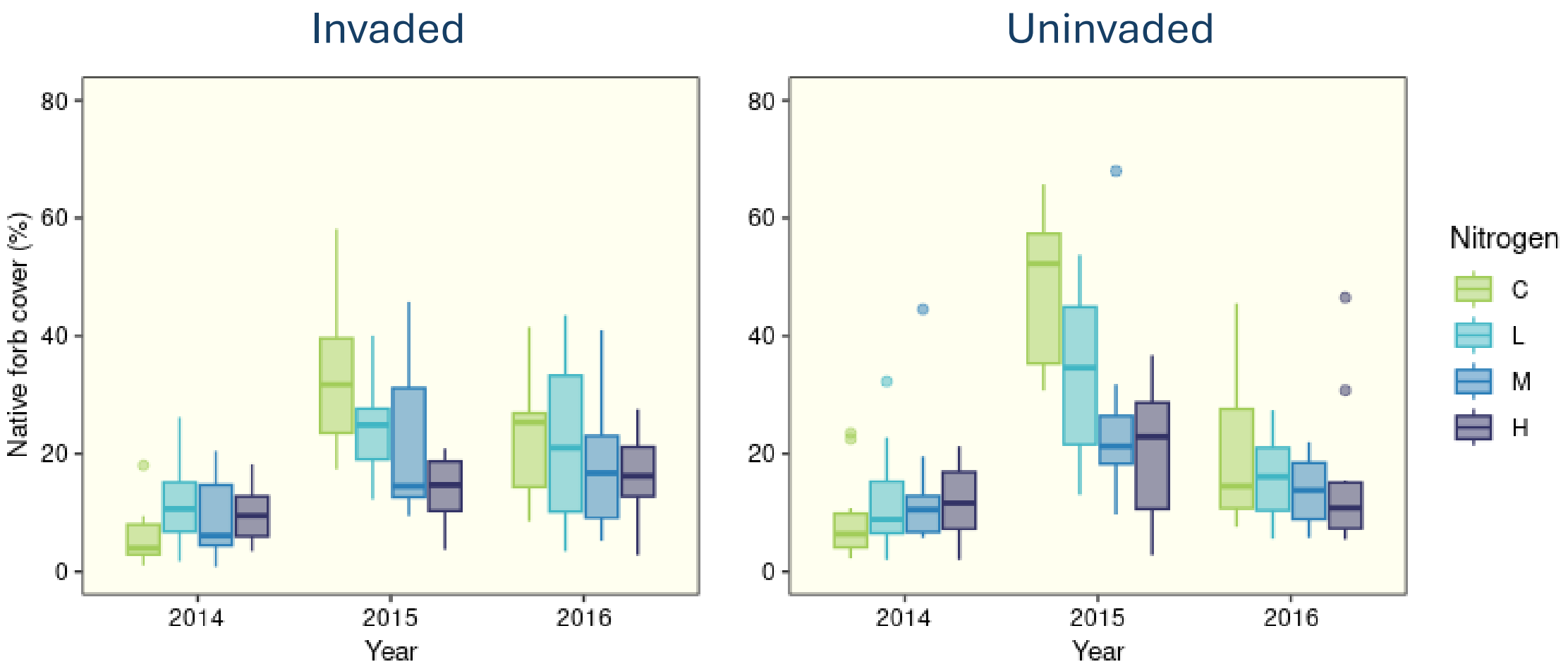
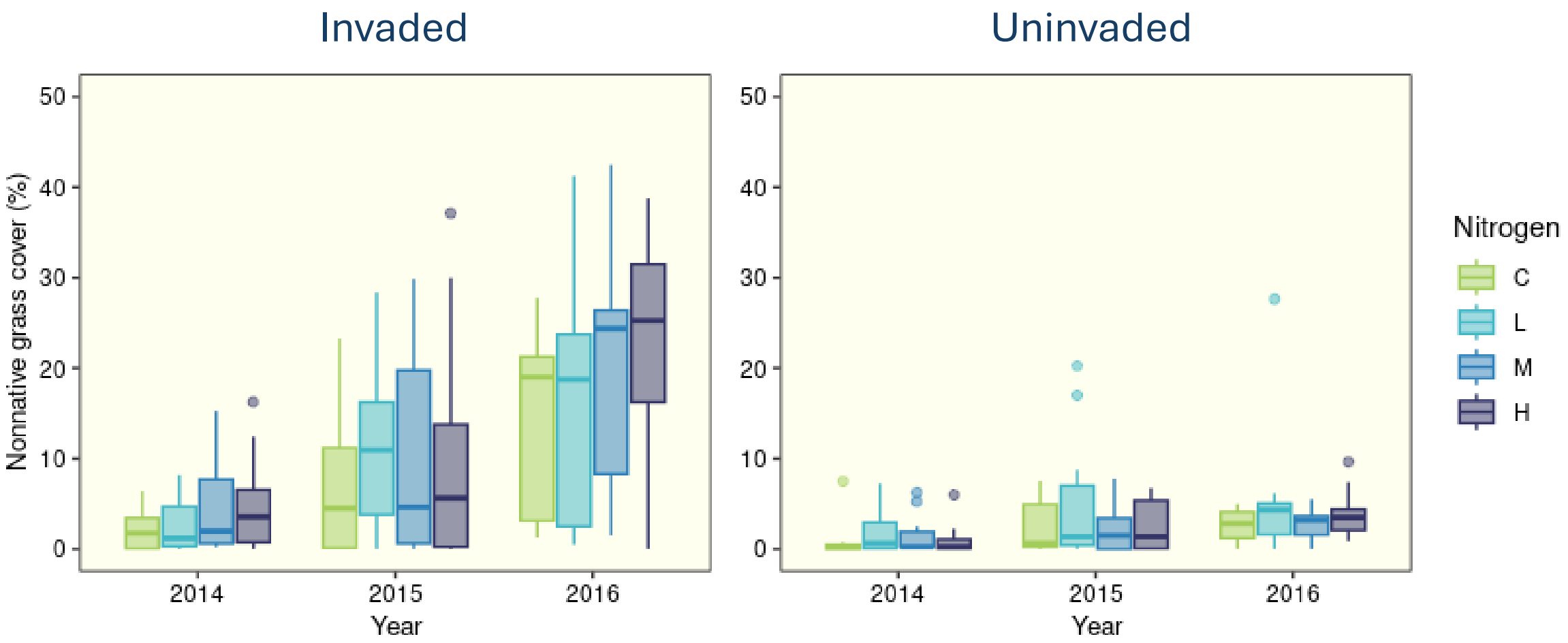
Post-fire shrub recovery was greater in previously uninvaded CSS stands, with minimal impacts of N addition



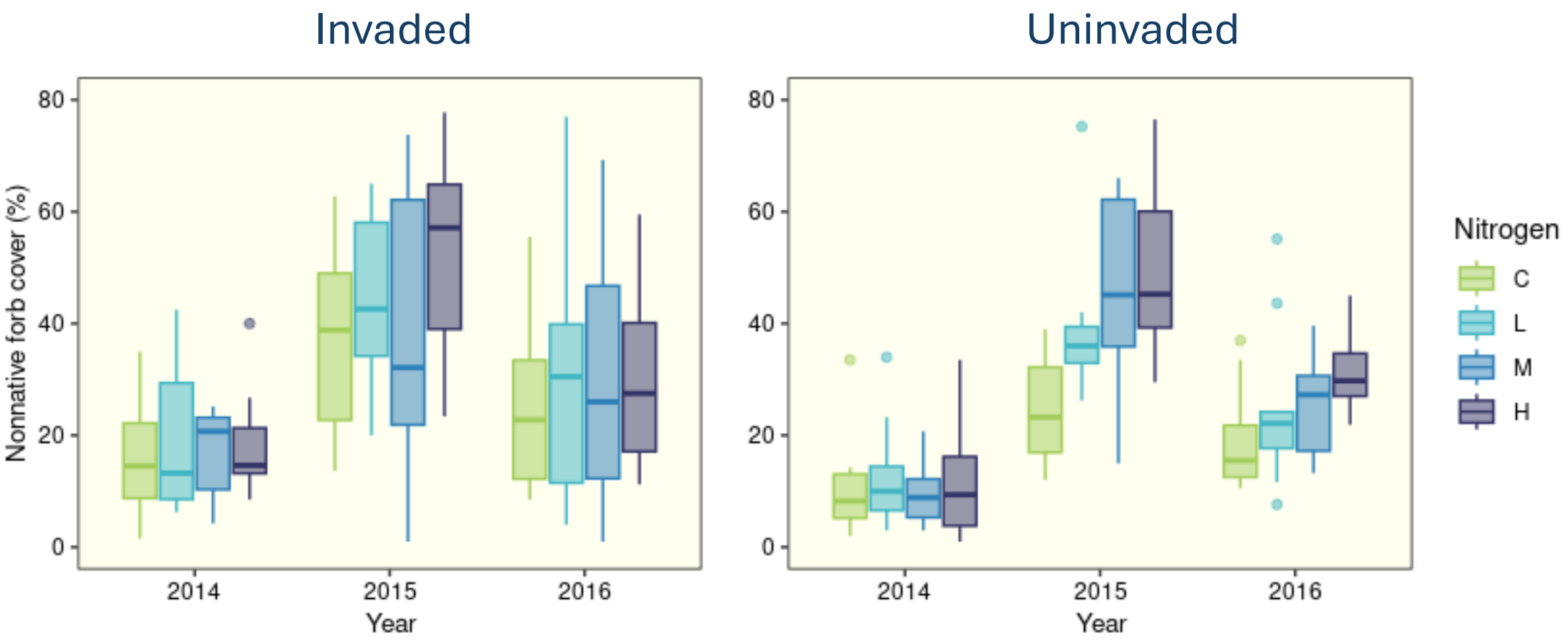
Nitrogen addition suppressed native forb cover in the 2nd year post-fire when rainfall was greatest



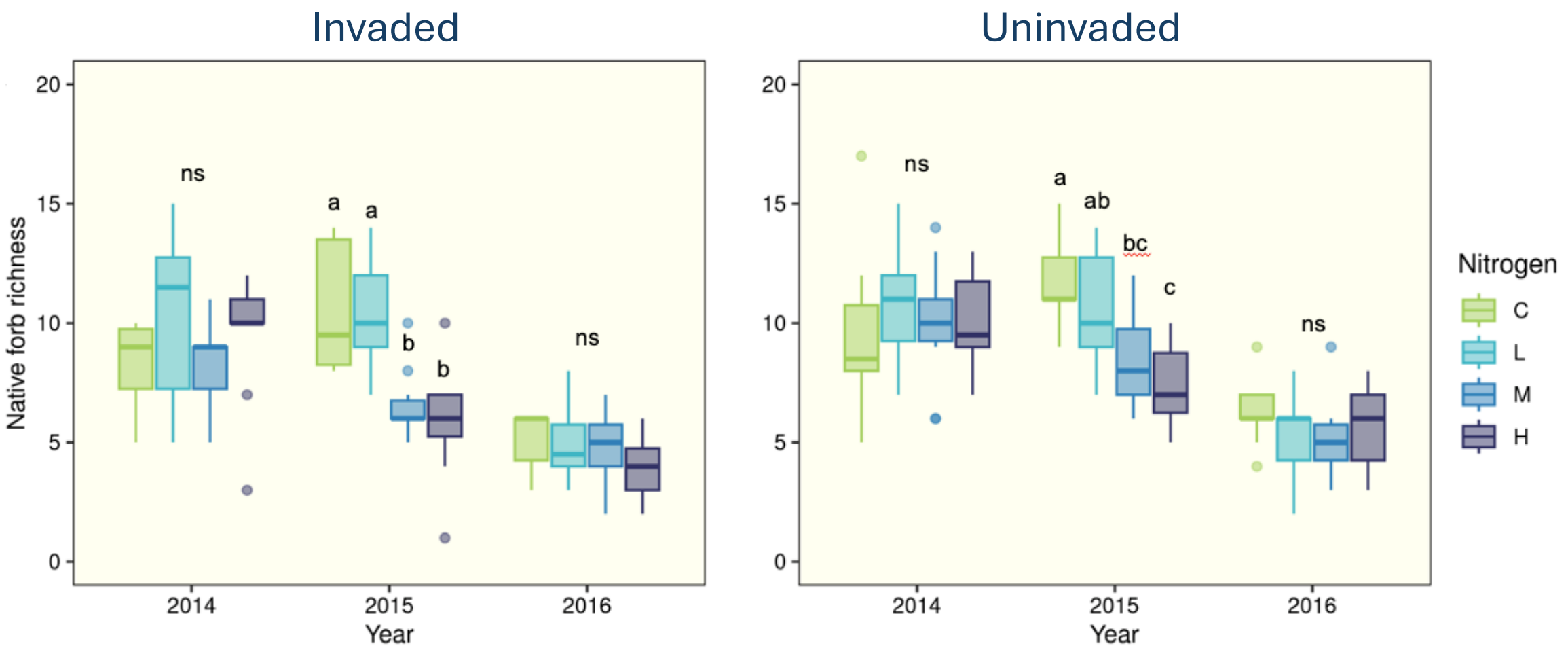
Nonnative grasses more abundant in previously invaded shrublands especially under high N



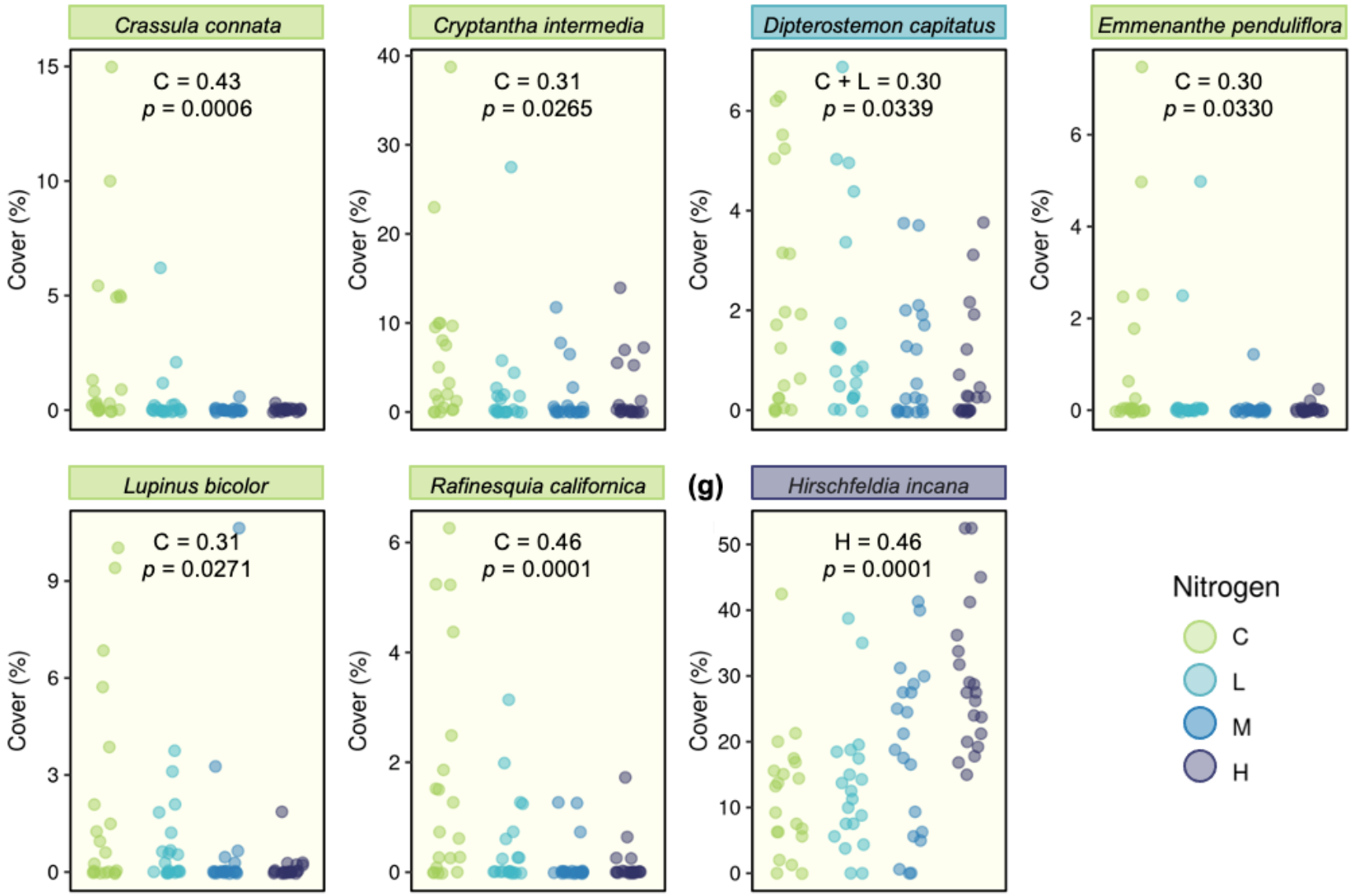
Nonnative forbs more abundant under high N regardless of invasion history



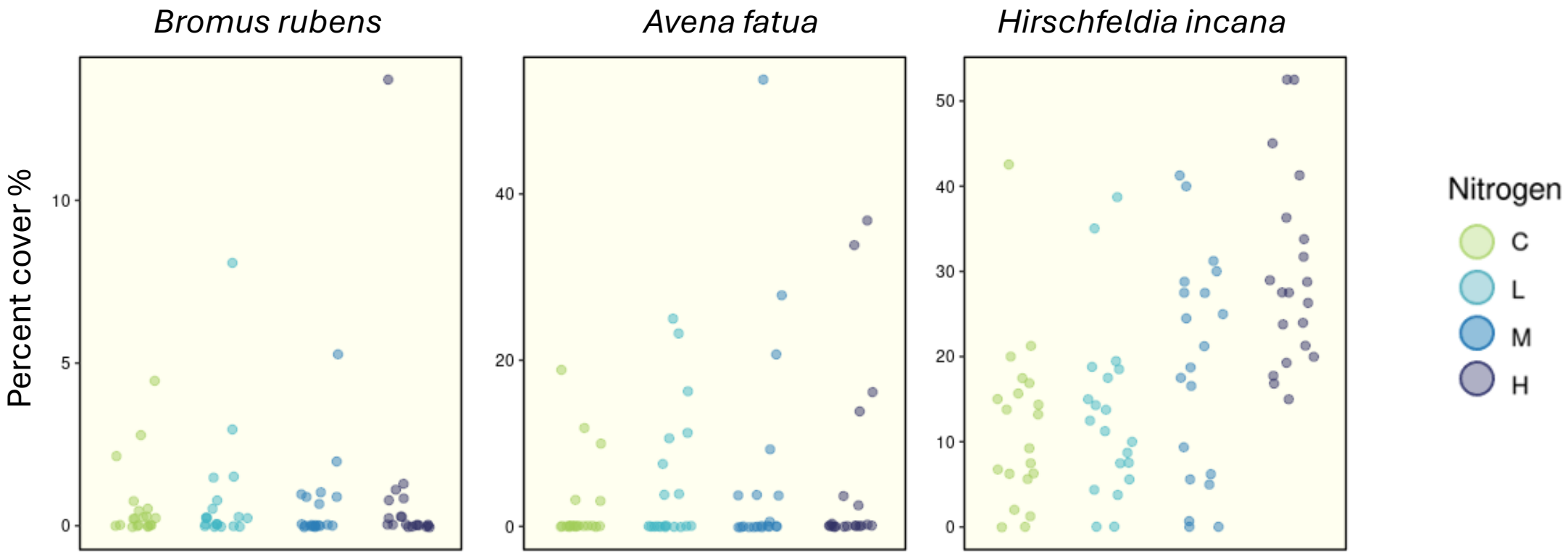
Nitrogen addition reduced native forb richness in the 2nd post-fire, especially in previously invaded CSS



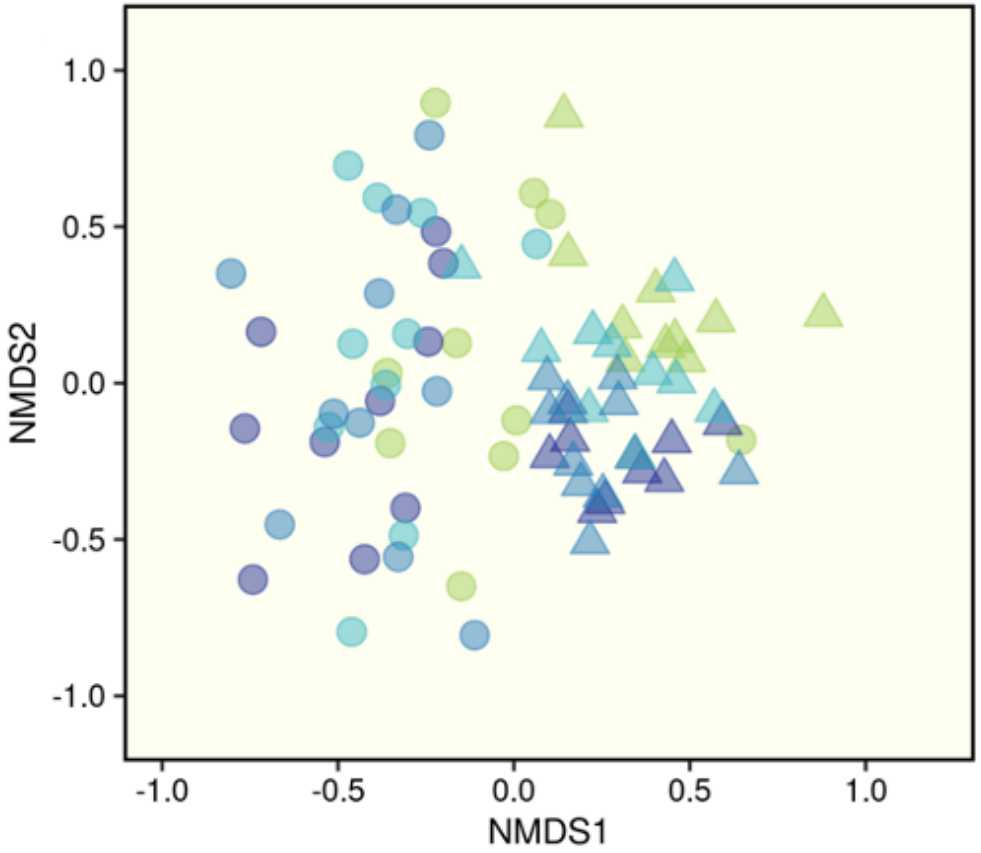
Nitrogen addition suppresses native forb species

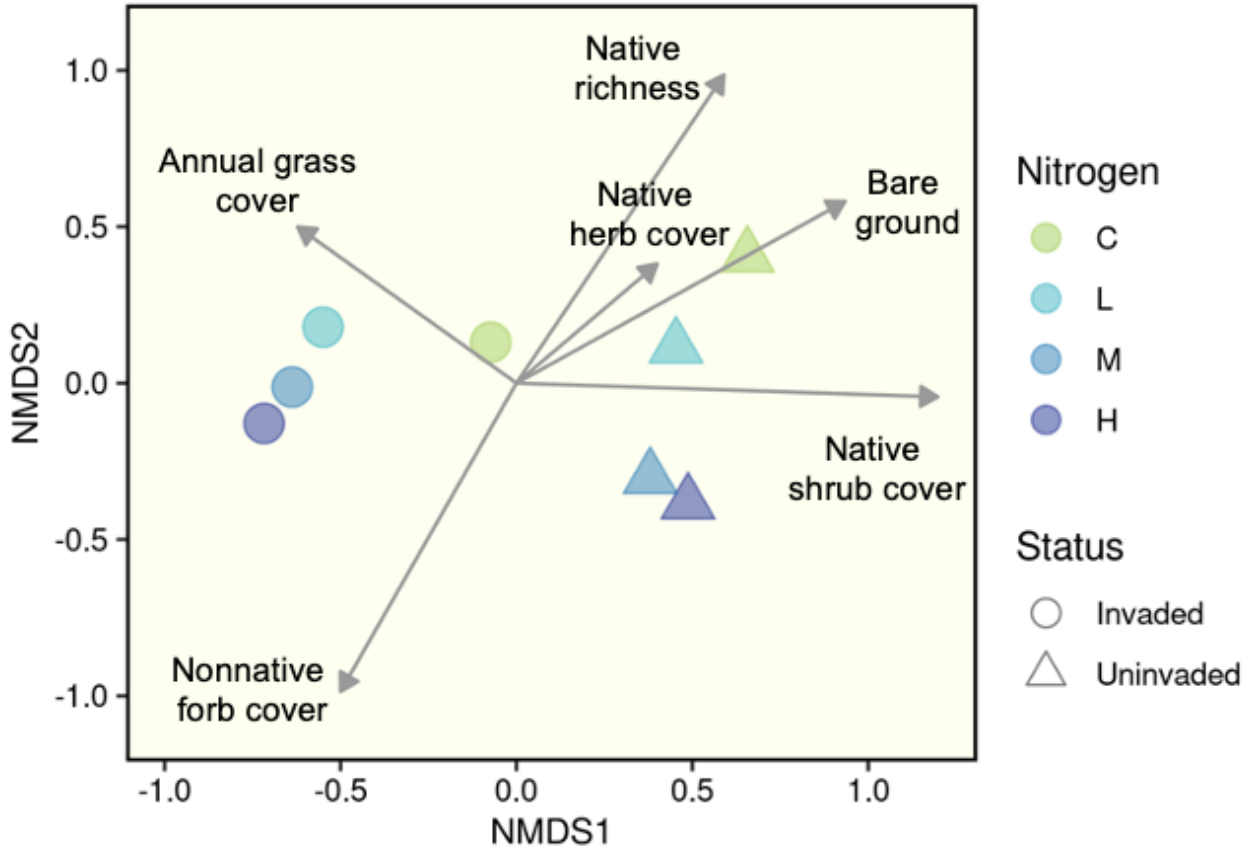


Two invasive annual grasses and one invasive mustard were strongly associated with elevated N



Nitrogen addition and invasion history shape post-fire plant community composition





Nitrogen deposition + invasive weeds threaten ephemeral post-fire plant diversity

- In coastal sage scrub, diversity in highest in the first years after fire when native forbs emerge
- Elevated nitrogen and a history of annual grass invasion suppress fire-following bloom events due to competitive exclusion
- If these fleeting species fail to flower and reproduce, the native seedbank will not be replenished
- This will ultimately deplete this cryptic pool of biodiversity

Nitrogen deposition + invasive weeds threaten ephemeral post-fire plant diversity

- Preventing conversion of native shrublands to invasive annual grasslands is critical
- Minimize weed spread during fire-fighting activity
- Post-fire weed management may be essential for protecting native forbs
- Reintroducing fire-following species may be required in areas where native seedbank has been depleted

Questions?

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