Assessing how effects of browsing by white-tailed deer on tree regeneration vary by species and seedling size across the northeastern USA

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NSRC
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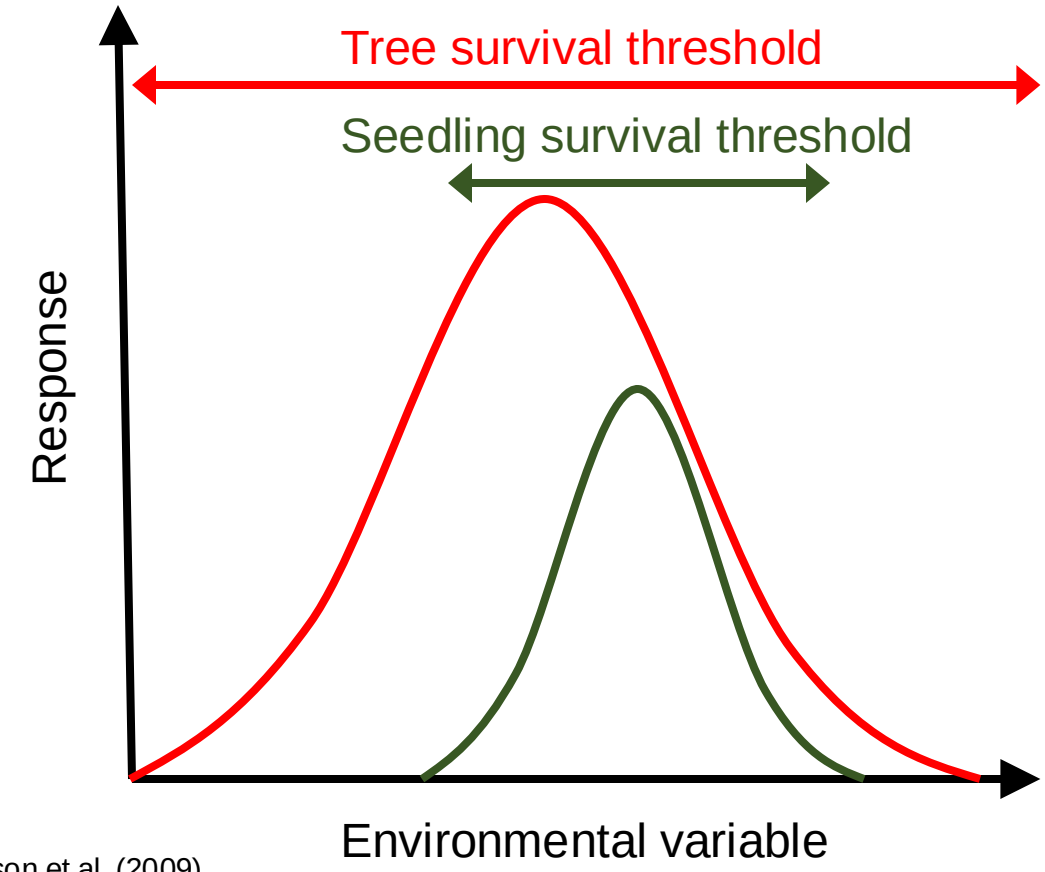
Regeneration and global change

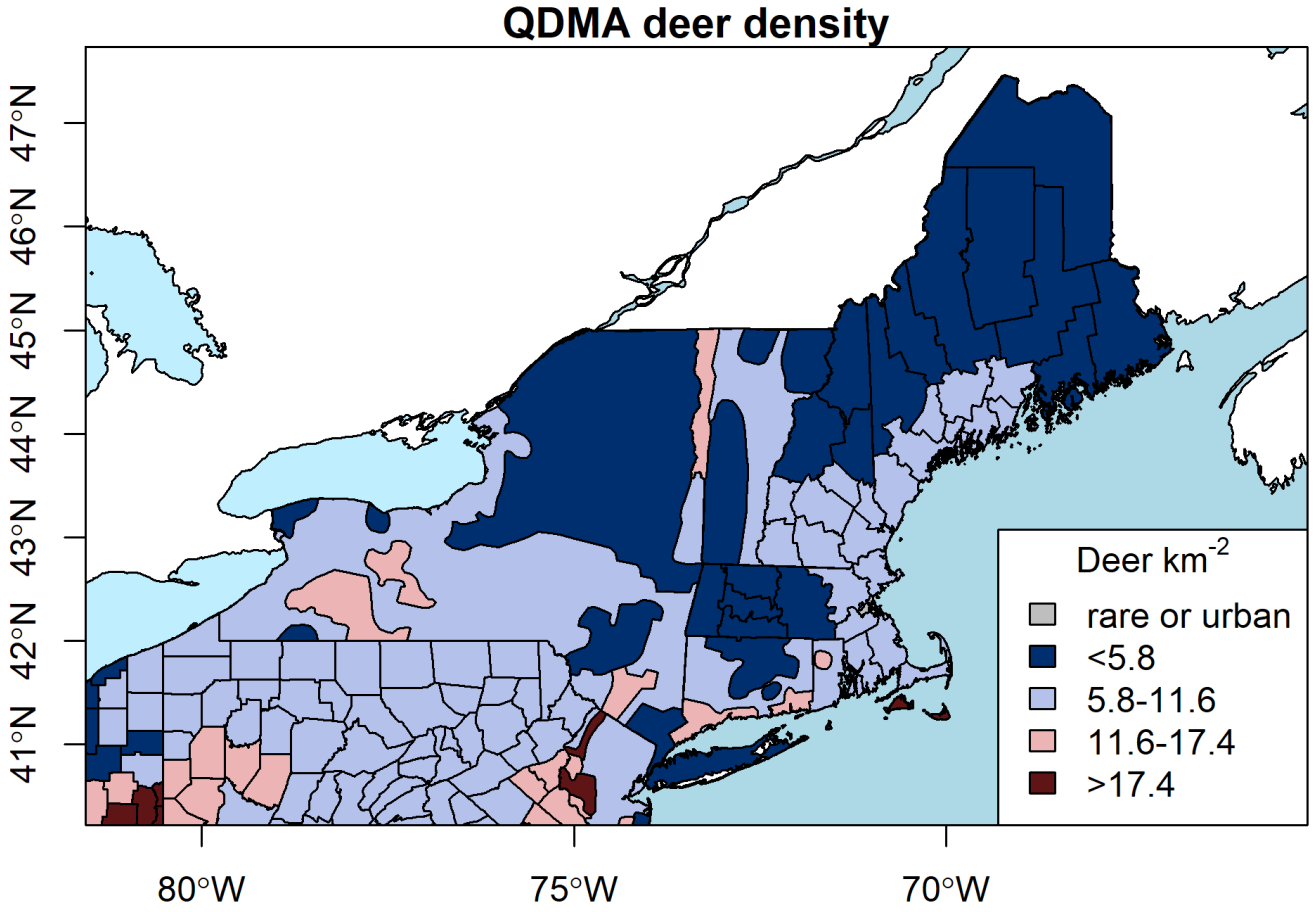
- Seedlings more sensitive than trees to stressors
- Major concerns:
  - Invasive species
  - Climate change
  - **Herbivory**
- Interest in managing for regeneration
  - Need to identify bottlenecks in growth/survival



Adapted from Jackson et al. (2009)

Deer and tree regeneration

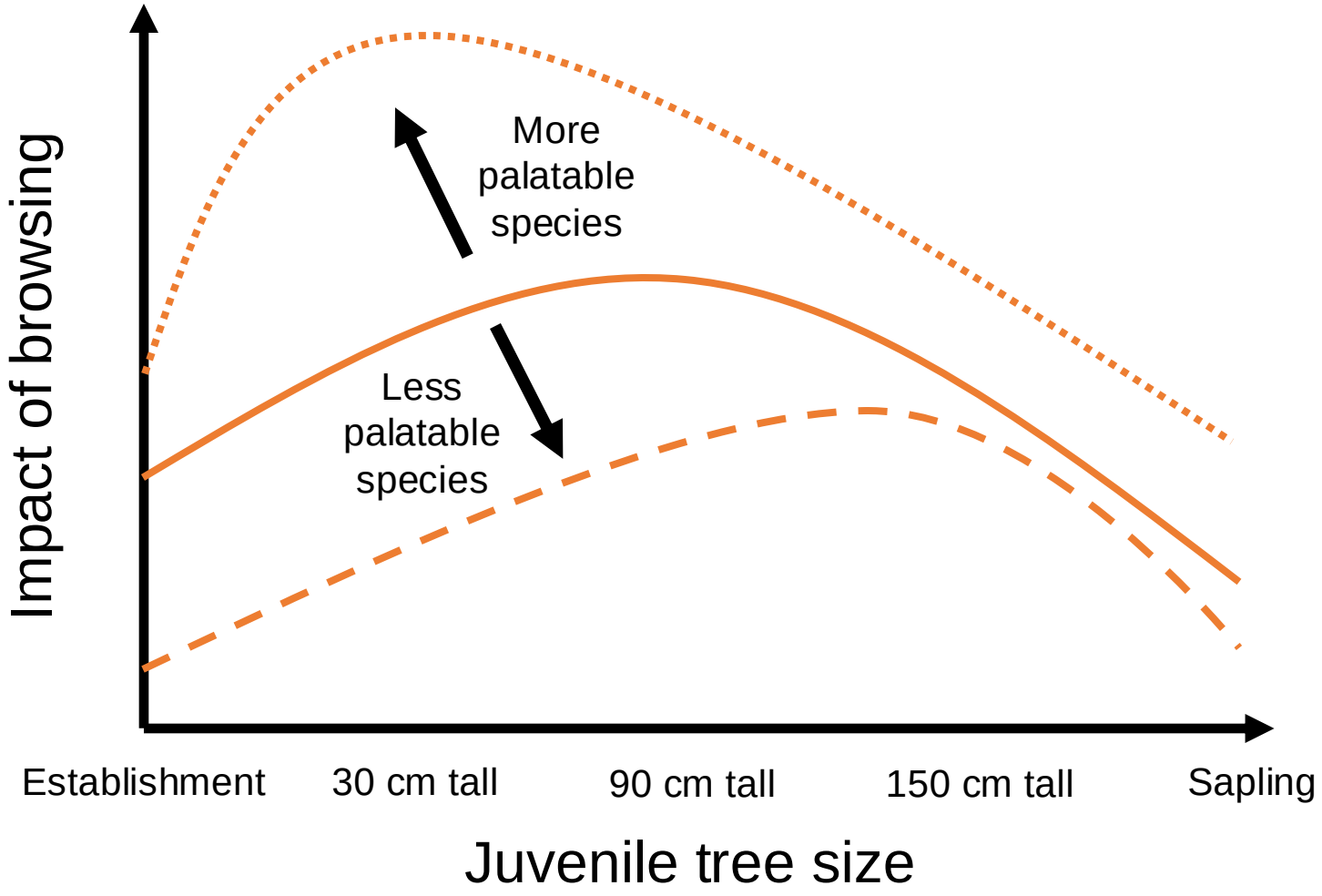
- Challenging to measure at regional scales
  - Need for proxies such as harvest records
- Deer browsing limits overall seedling abundance (Russell et al. 2017, Miller et al. 2019, Vickers et al. 2019)



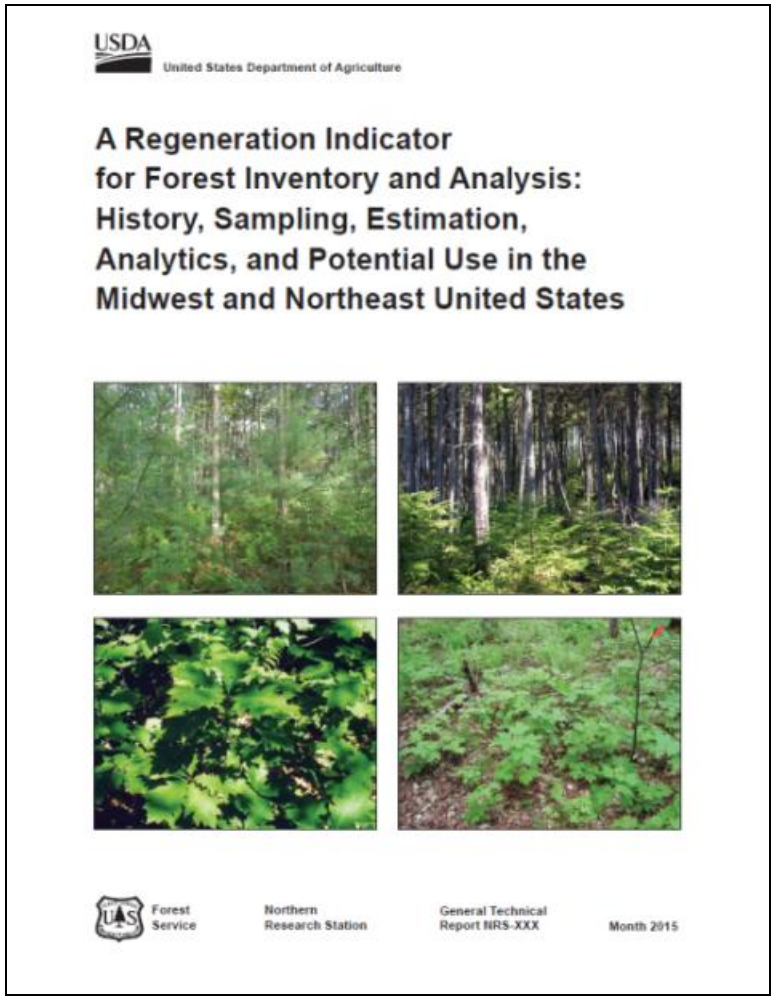
Data from Walters et al. (2016)

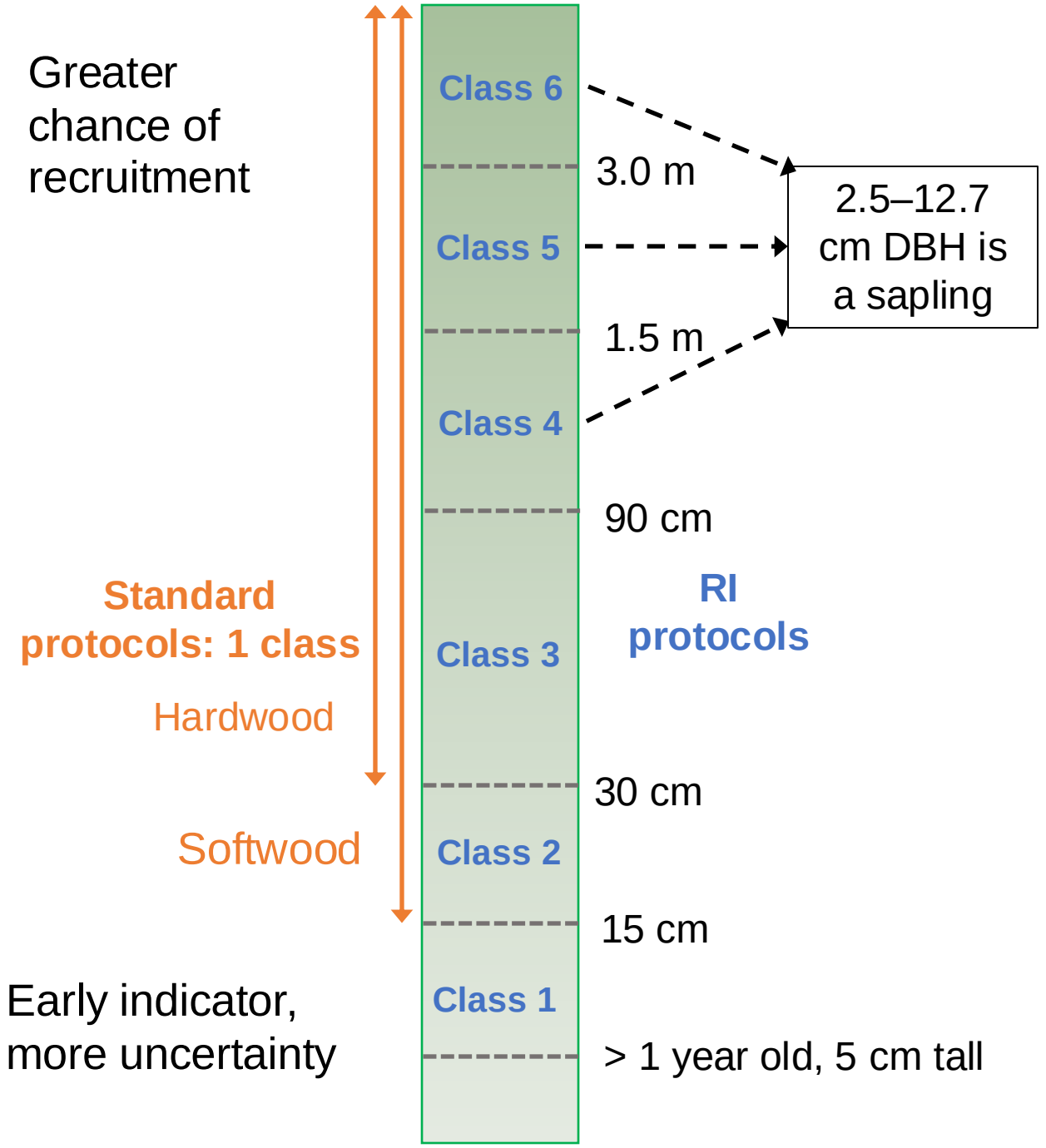
Seedling size

- Influences on growth and survival vary by seedling size
- Demographic inertia
  - Confounds efforts to characterize browse impacts
  - Solution: isolate effects on particular size classes

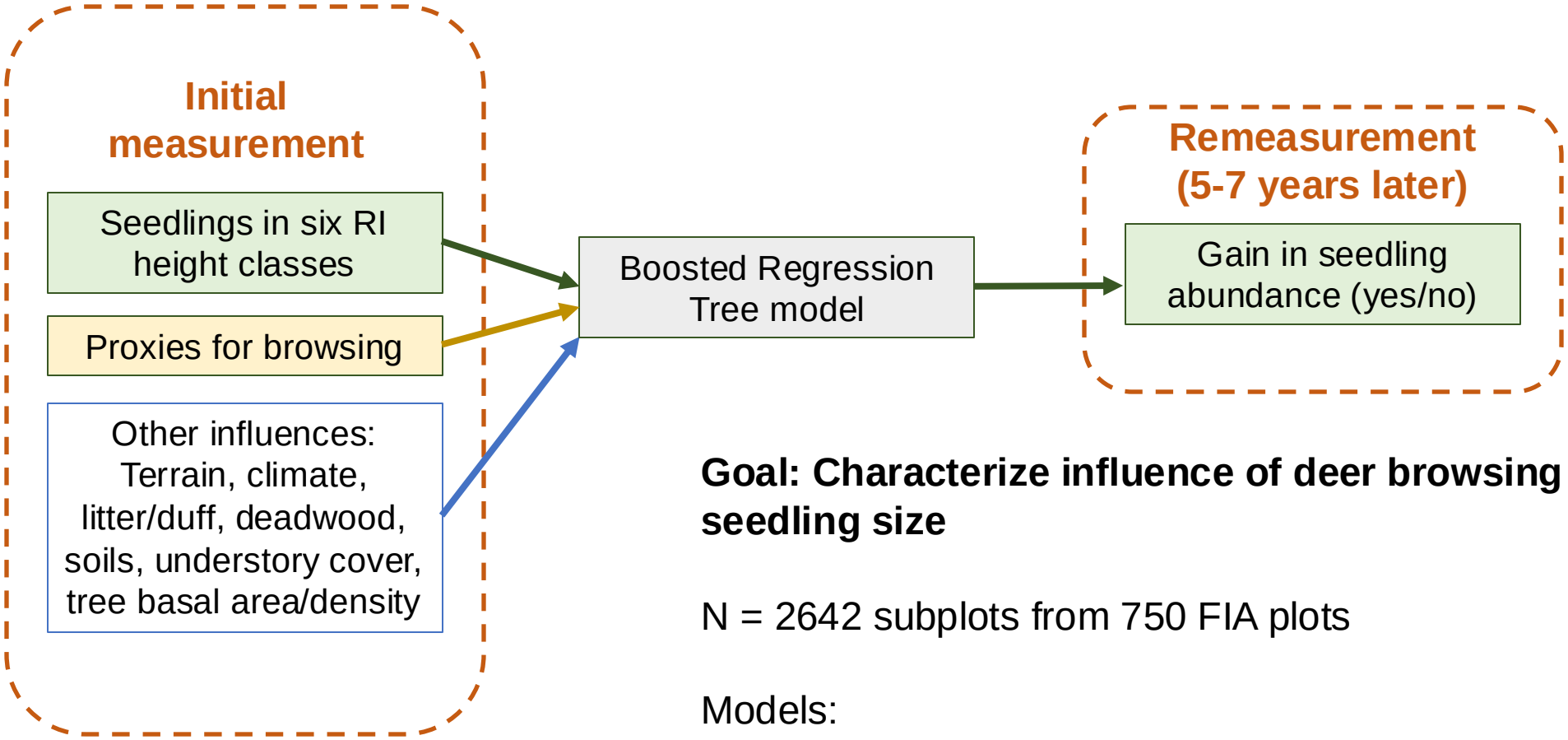


FIA's Regeneration Indicator





Predicting seedling gain



Goal: Characterize influence of deer browsing by seedling size

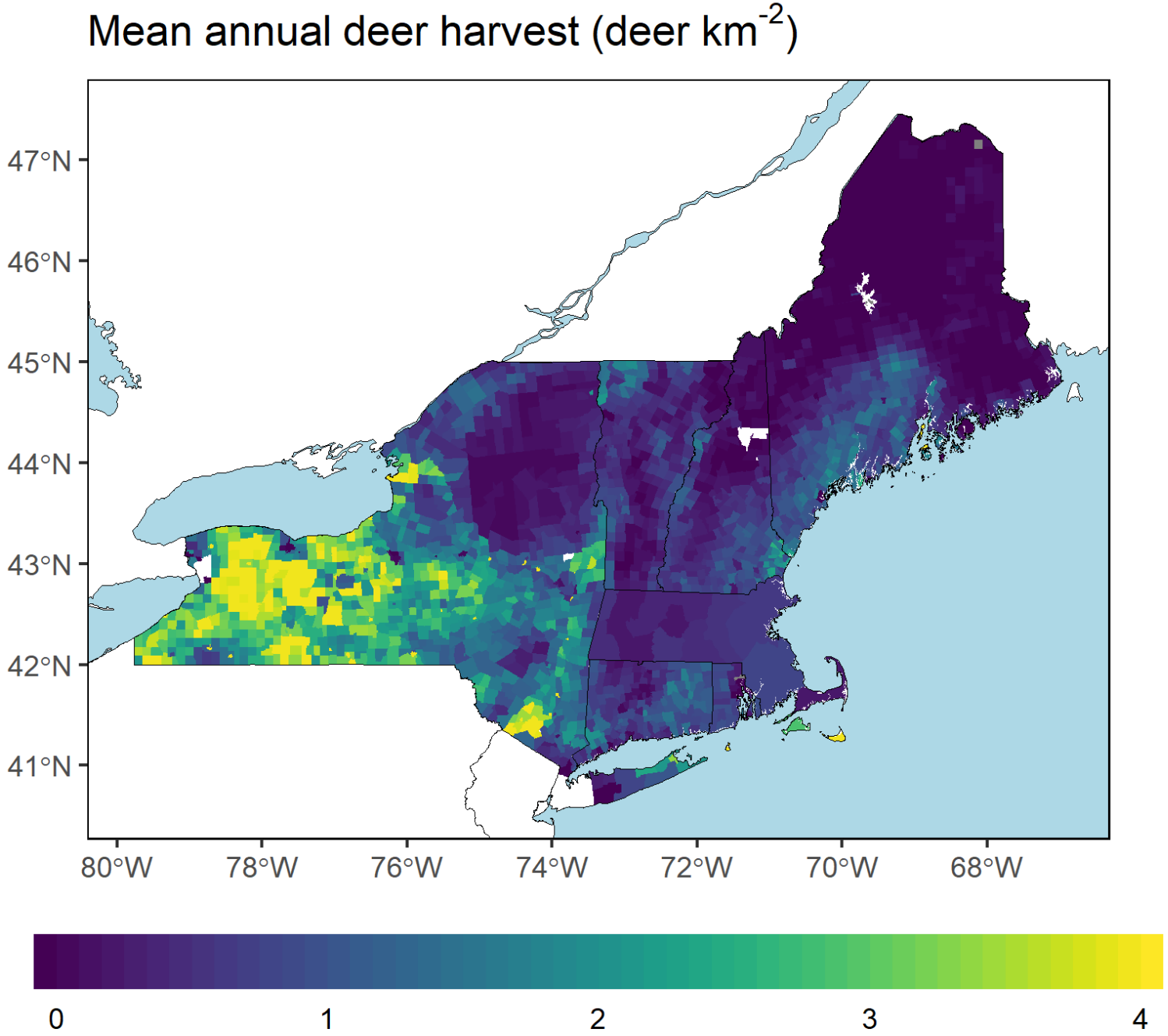
N = 2642 subplots from 750 FIA plots

Models:

- Low–moderate palatability species
- Highly palatable species
- Individual species (9 common species)

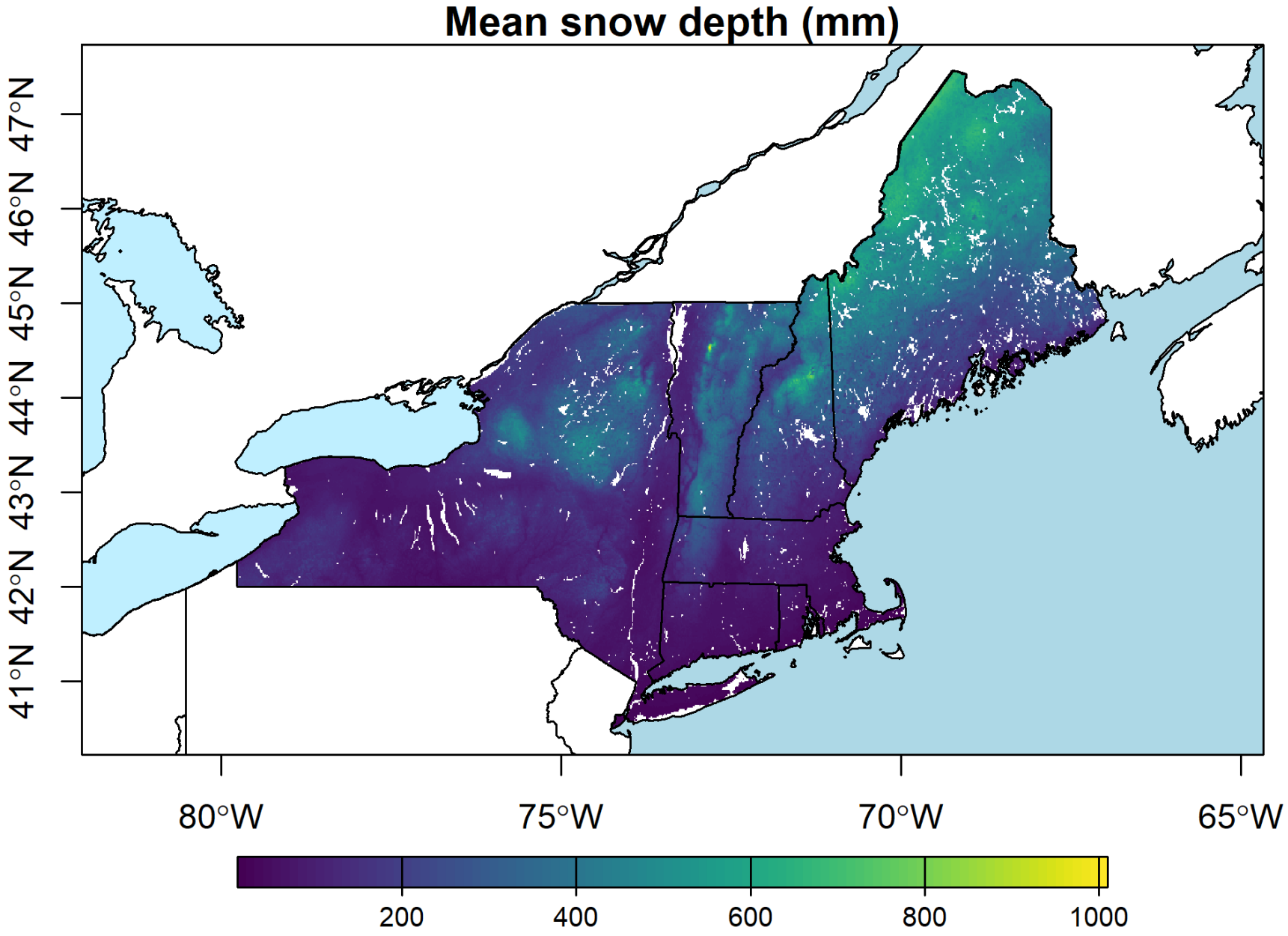
Deer harvest

- Town-level data available for most of Northeast



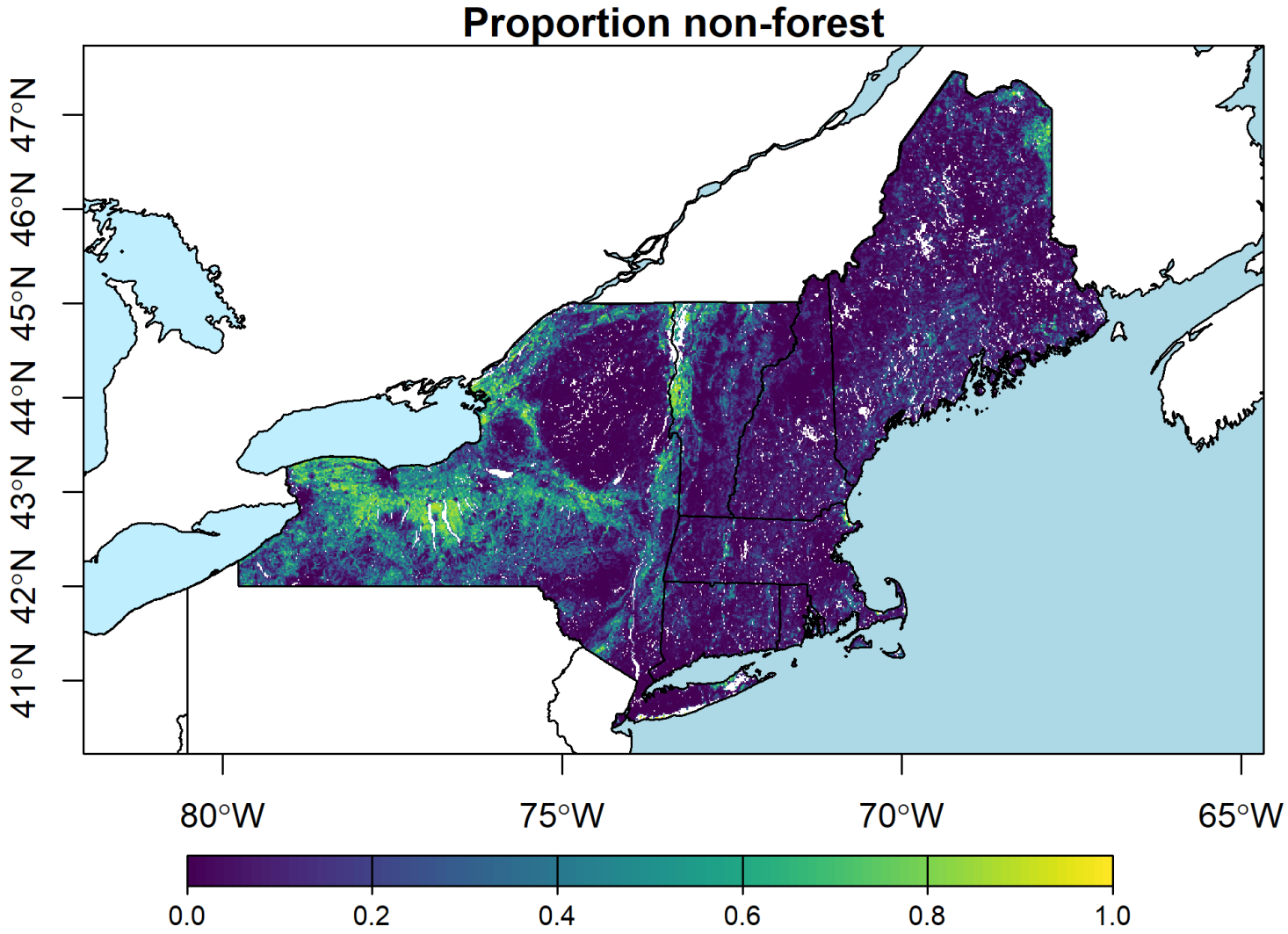
Snow

- Dec. to March snow depth
- Deep snowpack limits deer populations



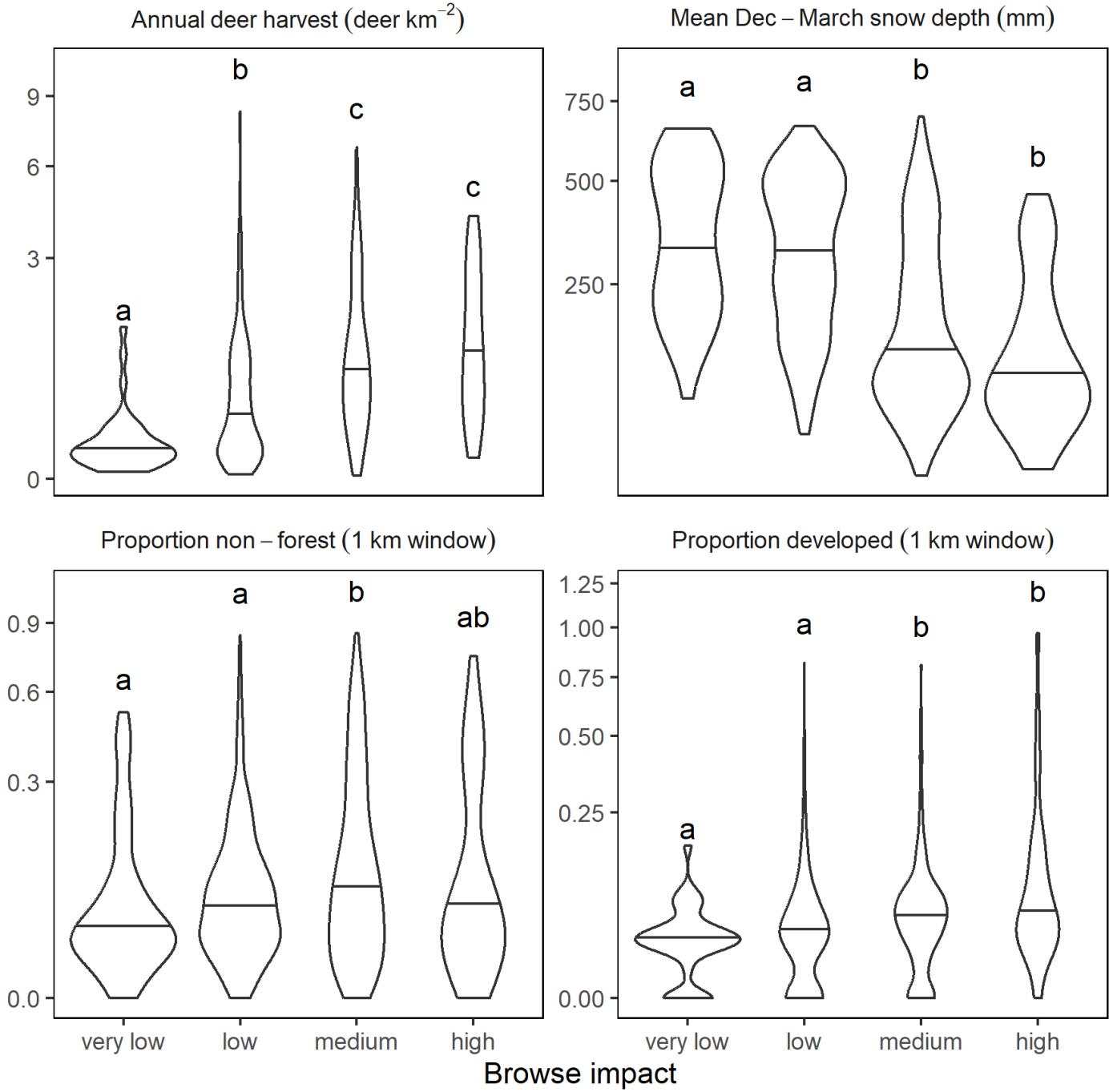
Proportion of non-forest

- More non-forest vegetation within ~1-2 km means better deer habitat and higher browsing pressure (Lesser et al. 2019)
- Also considered developed land



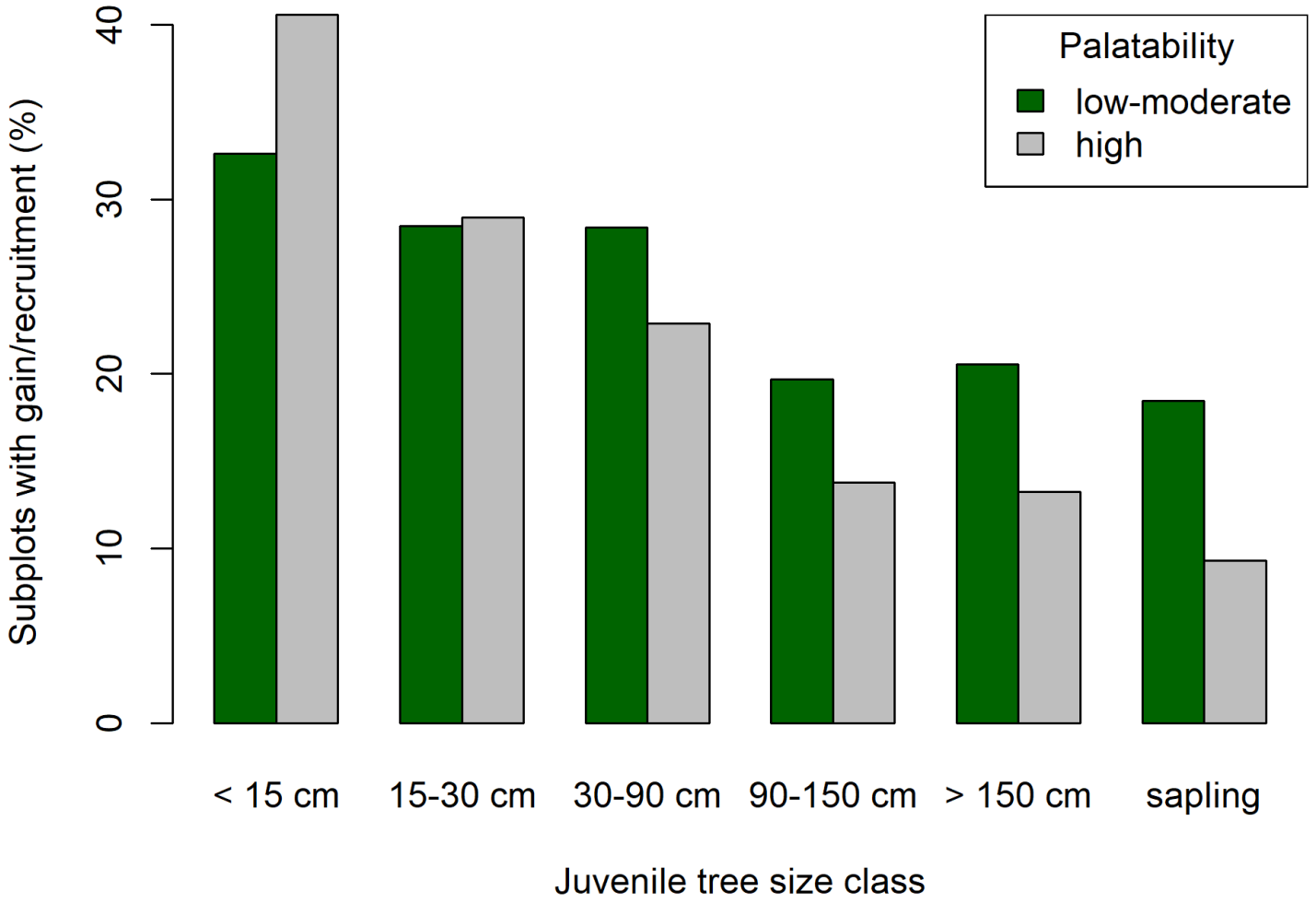
Browse impact scores

- Browse proxies correspond with browse impact assessed in the field
  - Deer harvest = most effective proxy



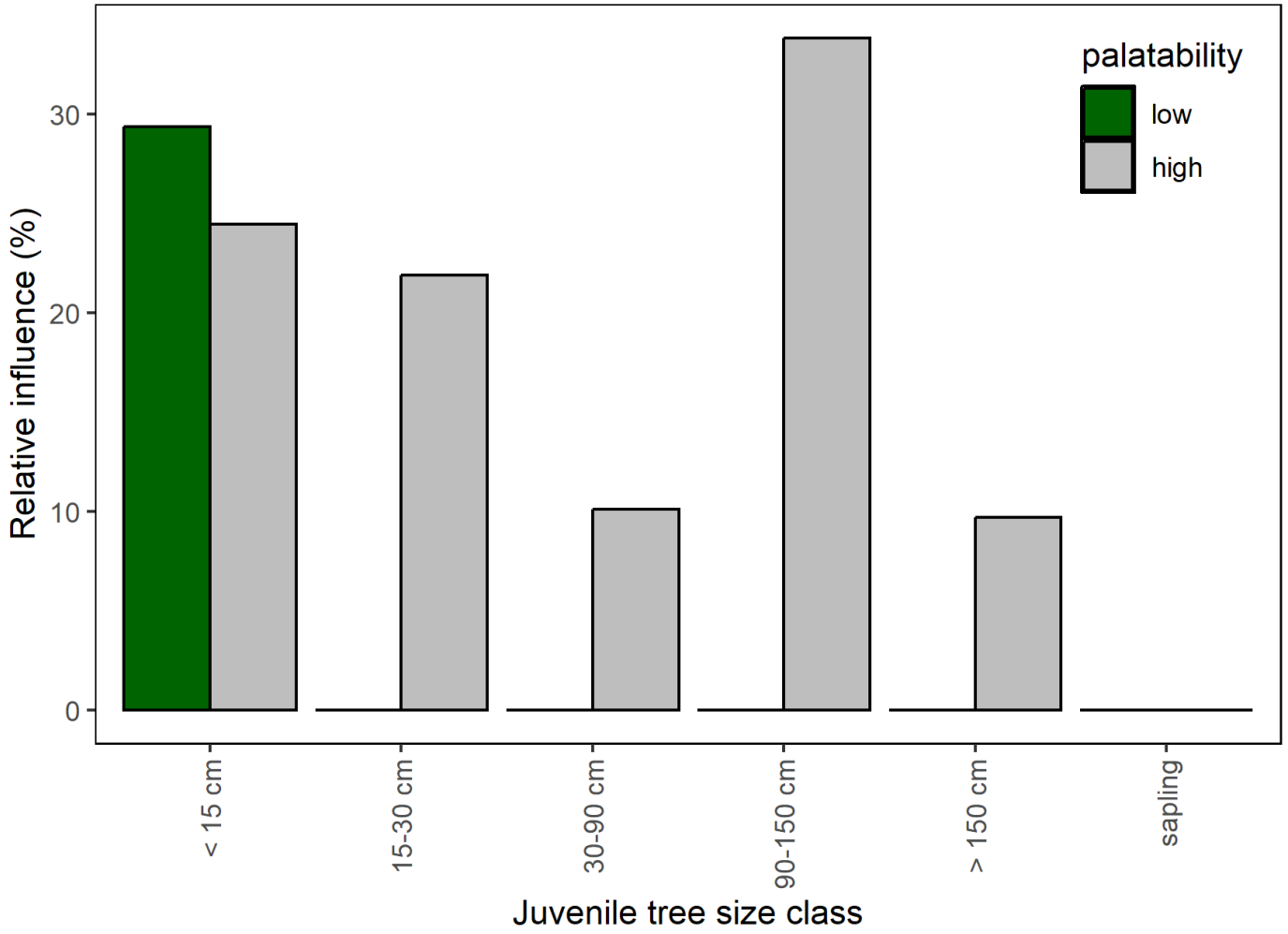
Seedling gain and palatability

- Similar for small-sized seedlings
- Differences for larger seedlings
  - Twofold difference in sapling recruitment



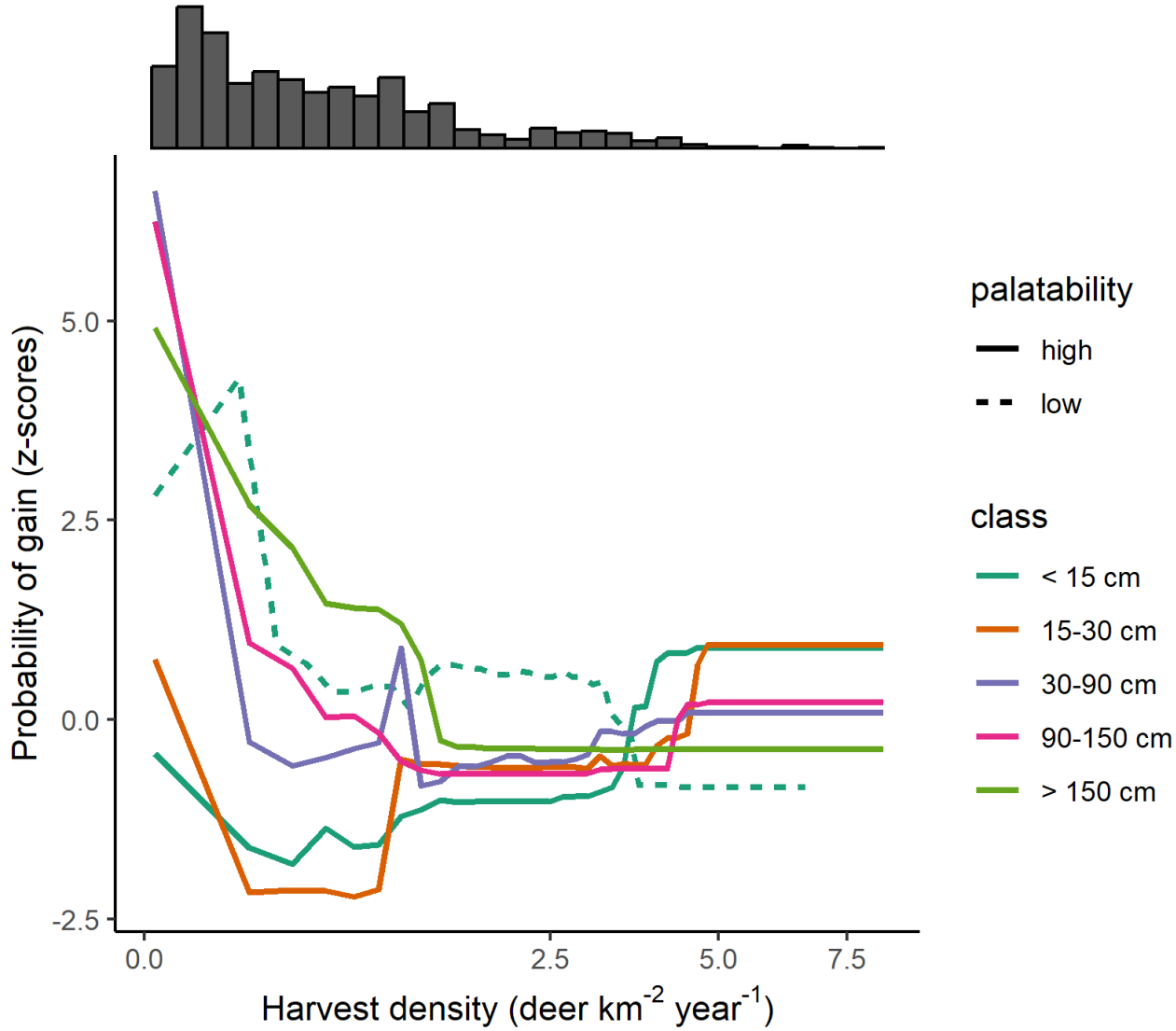
Influence of browsing proxies

- For less palatable species, browsing influenced the smallest seedlings only
- For highly palatable species, influenced all seedling size classes
  - Peak at 90-150 cm tall



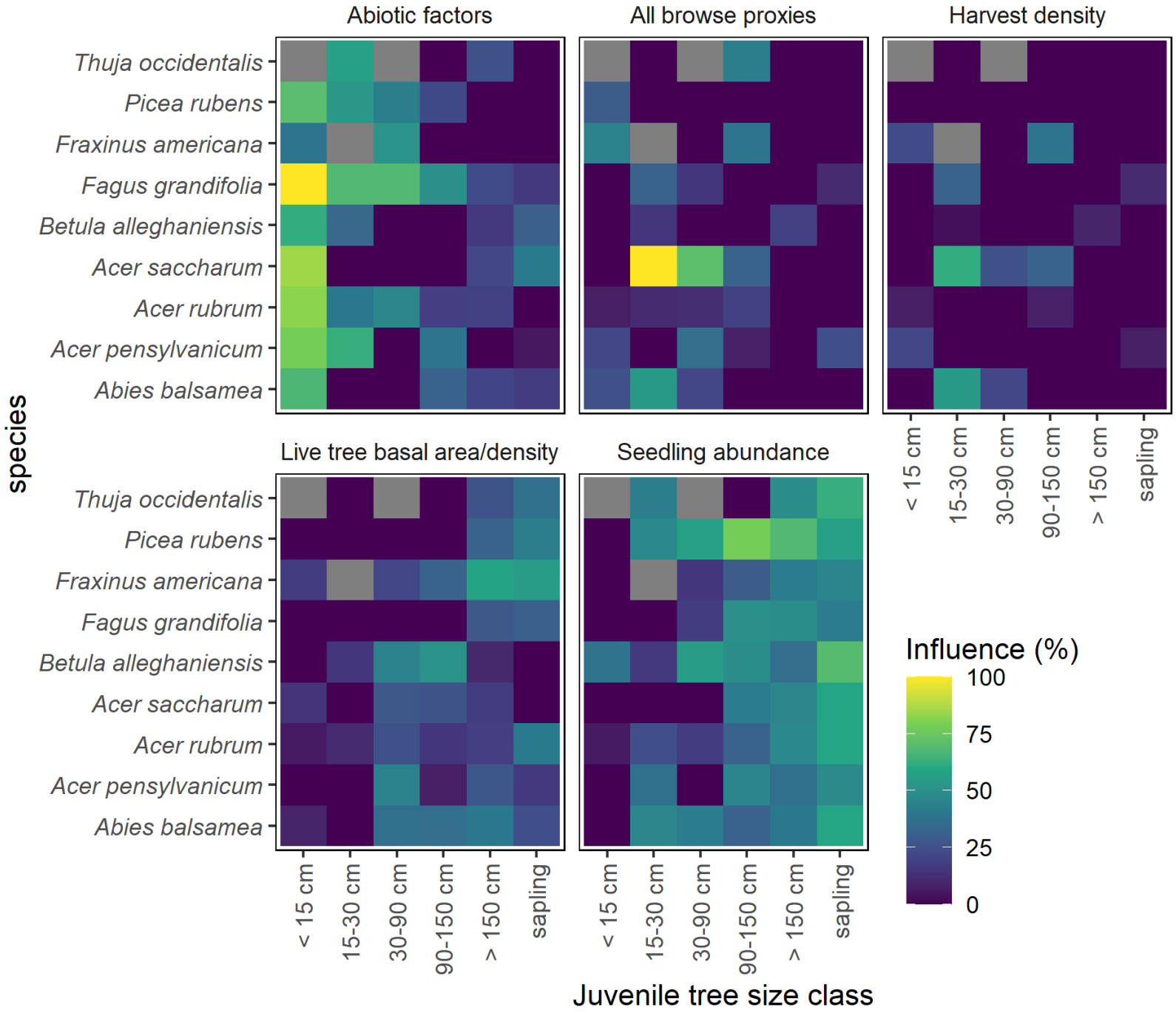
Harvest density and seedling gain

- Highly palatable species:
  - Negative effect on seedling classes >30 cm tall
- Less palatable species
  - Effect on smallest seedlings only



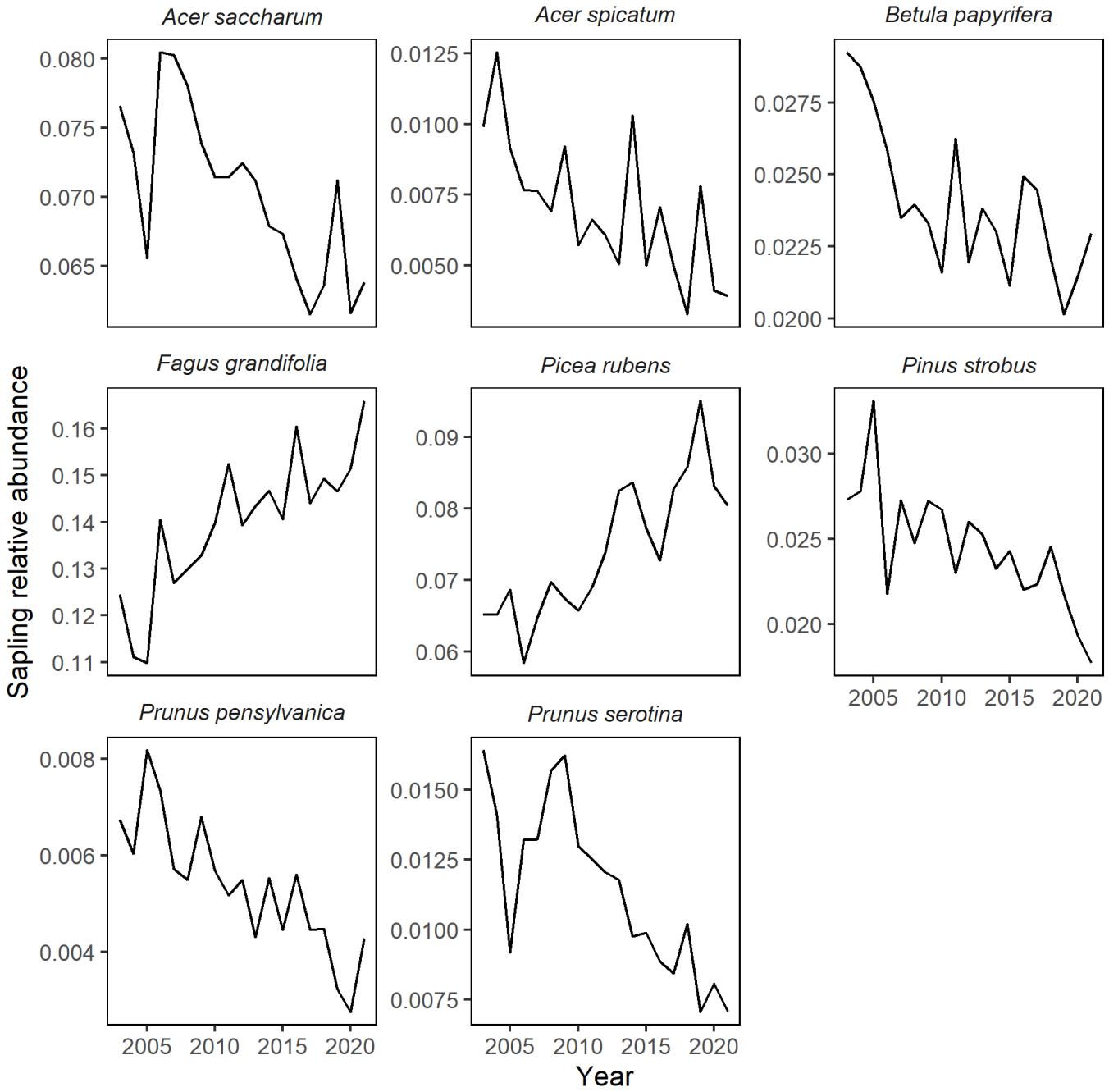
Species-level

- Influence of browsing varies by size among species
- Sugar maple stands out: strong negative effects in multiple size classes



Stepping back...

- Significant trends in relative sapling abundance across the Northeast
  - Decrease in sugar maple abundance, increase in beech and red spruce



Conclusions

- Examining seedling gain by size class helps pinpoint browsing effects on regeneration
- Abiotic factors determine seedling establishment/early survival, and light availability determines sapling recruitment
  - In between, browsing negatively influences regeneration of highly palatable species, with some species (e.g., sugar maple) affected more than others
- Can use improved regeneration assessments to guide management
  - Interaction between browsing and other global change threats

Thank you!

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