Research Project Ideas for Harvard Forest REUs

1 Effects of Urbanization on Tree Growth and Climate Sensitivity

1.1 Question: How does urbanization affect tree growth rates and growth sensitivity to temperature and other climatic factors?

1.2 Approach:

Focal species: Choose 5-10 tree species that occur at both Harvard Forest and Bussey Brook Meadows and other unmanaged urban forests around Arnold Arboretum. These species could include: *Betula allegheniensis, Betula papyrfera, Fagus grandifolia, Quercus alba, Quercus rubra, Pinus strobus, Populus deltoides, Tsuga canadensis.* Add nonnative tree species, too?

Field work at Harvard Forest: Core trees. Could collect additional data, such as soil nitrogen and other soil characteristics.

Lab work (could be at Harvard Forest or Arnold Arboretum): Mount, sand, and analyze cores. Gather climate data from Harvard Forest. Correlate growth to climate data (temperature precipitation) and compare growth rates and climate sensitivity to those of trees at/near Arnold Arboretum (many have already been collected, but some additional cores may need to be collected in Boston, depending on the focal species selected).

References: Need to add a few relevant ones, like O'Brian et al 2012.

2 Functional trait diversity over agricultural intensification gradient

2.1 Question: what level of agricultural intensity is sustainable for the New England landscape?

2.2 Approach:

3 Tree functional traits across climate gradients

3.1 Question: Do populations of trees exhibit adaptive variation in functional traits across a climate gradient?

Woody plants rely on ability to persist across wide variations in climate to germinate, survive, and reproduce. Ability to maintain performance across a range of environments is hypothesized to be especially useful for early successional and invasive species, whereas dominant

late successional species are assumed to have narrower functional trait range. However, testing this and related question remains a challenge at the scale of forest ecosystems.

3.2 Approach:

We will sample leaf and stem morphological and physiological characteristics for up to 40 species of woody plants at Harvard Forest. For key species, we will sample populations across the climate ranges of these species, ranging from Connecticut to northern New Hampshire. Specific wood density, leaf toughness, specific leaf area, leaf nitrogen and phosphrous concentrations, and other traits will be compiled. Analysis of functional traits at the population and community level will test how dominance and trait varaibility range with climate.