Relevant Literature Notes

Recruitment Failure Outline

* Nuisance species have a profound impact on regional ecosystems
* There is a documented overabundance of white-tailed deer (*Odocoileus virginianus*) (*Publication referenced in McGravey et al. 2013*) which can be attributed to human influence (*Publication referenced in McGravey et al 2013*)
* White-tailed deer consume seedlings and saplings, negatively impacting seedling and sapling survival, density and growth (*Publications referenced in McGravey et al. 2013*, *Holm et al. 2013*)
* This can lead to decreased understory diversity, decreased canopy diversity and species richness and decreased abundance of dominant species in a typical forest (in this case Quercus spp.) (*Holm et al. 2013*)
* Define or contextualize non-endemic plants (Look for a reference)
  + Working definition: Plants that were not historically present in an area, region or ecosystem or were found at different abundances or densities
* Deer selectively browse on palatable species, and some non-endemic species, including pawpaw, are considered non-palatable by deer (*McGravey et al. 2013*) This can create dense stands of non-endemic species (*Knauer et al. 2023*)
* Non-endemic species may be able to utilize niche space in a forest faster or more efficiently (Reference - considered common knowledge?)
* As a result, they may be able to out compete endemic species
* These nuisance species can contribute to recruitment failure
  + Consider defining and contextualizing recruitment failure a little more here
  + The effects of these recruitment failure on species composition and forest structure are often not apparent for decades (*McGravey et al. 2013* - potentially move to regeneration debt paragraph).

Recruitment Failure Literature

McGarvey et al. 2013

* Chronic over-browsing by white tailed deer can influence the life history of forests
* Deer browsing had the greatest effect on seedling establishment
* Browsing has an effect with smaller stems and saplings, but less of an effect on larger stems
* The effects of deer browsing might not be apparent in species composition and forest canopy for decades
* An increase in white deer over the past 50 years, which can be attributed to human influence
* Deer browsing reduces seedling survival rates and densities
* Deer selectively browse on palatable species
* Some non-endemic species, including pawpaw, are considered to be unpalatable to deer
* Seedling height and small-sapling abundance were most effected

Knauer et al. 2023

* Heavy browsing by deer reduces palatable species, which can create ideal conditions for dense stands of unpalatable native, non-native and browse-resistant stands to form
* Removing deer for long periods of time (8-20 years) does not lead to increased species diversity (in the understory?); the understory remains depauperate (poorly or imperfectly developed)
  + Once browsing has reduced species to low levels of abundance, it can take decades for them to recover
* Browsing can lead to species being extirpated or be sparsely distributed locally or regionally
* Many forest understories, especially in urban-fringe forests, and infested with non-endemic plants

Holm et al. 2013

* In a model predicting the effects of deer browsing on forest composition in 200 years, deer browsing decreased understory diversity, decreased species richness and decreased the abundance of Quercus spp. (a dominant species in this forest type)
* Gap disturbances exacerbated these impacts (could tie into paragraph on non-endemic pests and pathogens and tree mortality)
* Deer browsing can reduce survival and growth of several woody species and change the dominance rank of species at the sapling stage
* Impacts of browsing are likely to be greater in areas with high gap disturbance
* Deer herbivory on saplings reduced tree diversity in the understory

White-tailed deer (*Odocoileus virginianus*) represent an endemic nuisance species prevalent in eastern deciduous forests. Their populations have substantially increased in the past 50 years (McShea et al. 1997), due in large part to human influence/which can be attributed to changes in social norms and management decisions. (Found in McGarvey et al. 2013 – Brown et al. 2000, Côté et al. 2004, Rooney 2001). White-tailed deer preferentially browse on woody herbaceous species in their earliest life stages (McGarvey et al. 2013), with overabundant herbivory negatively impacting seedling and sapling survival, growth and density (Found in McGarvey et al. 2013 – Dzieciolowski 1980, Gill and Beardall 2001, Healy 1997, Konig 1976, Putman et al. 1989). Models predict that chronic overabundance will reduce understory diversity and decrease the abundance of traditionally dominant species (Holm et al. 2013).

Due to climate change and human activity, many non-endemic plant species are being introduced or increasing in abundance in forest ecosystems (Reference). Deer find many of these species, including pawpaw (*Asimina triloba*), to be unpalatable (Found in McGarvey 2013 – Asnani 2006), and do not consume them at the same rates relative to their native counterparts (Reference), enabling them to form dense stands in forest understories (Found in Knauer et al. 2023 – Horsley and Marquis 1983; Stromayer and Warren 1997; Royo and Carson 2006). This lack of browsing pressure, coupled with characteristics such as fast growth rate and greater adaptability to conditions caused by climate change, allow nuisance plant species to outcompete other species in the understory (Reference). The interaction of these phenomena on the landscape contributes to a recruitment failure in forests, [where individuals from certain tree species do not enter the mature population] (Do we need to define recruitment failure, or is that considered common knowledge? If so, reference). The extent of consequences derived from recruitment failure on species composition and forest structure are often not apparent for years (McGarvey et al. 2013)

*Read this source for pawpaw life history traits*

Intensive Selective Deer Browsing Favors Success of *Asminia trloba* (Paw paw) a Native Tree Species

*Cut-out sentences*

White-tailed deer preferentially browse on woody herbaceous species in their earliest life stages (Reference), with overabundant herbivory negatively impacting seedling and sapling survival, growth and density (Reference). Long-term/chronic overabundance could contribute to decreased understory diversity and fewer individuals from traditionally dominant species (Reference)./ Models predict that chronic overabundance will reduce understory diversity and decrease the abundance of traditionally dominant species (Reference)./Models of mid-Atlantic mesic forests predict that chronic overabundance of white-tailed deer will reduce future understory diversity and decrease the abundance of traditionally dominant species (Reference).