

Characterizing the abundance of pitch pine (*Pinus rigida*) regeneration in relation to ericaceous understory abundance in the Long Island Central Pine Barrens

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Abstract

The Long Island Central Pine Barrens is a globally rare and historically fire-dominated ecosystem impacted by human development and affected by a variety of stressors such as climate change and invasive species. Pitch pine can serve as an indicator of ecological integrity as it is one of the dominant native tree species. Pitch pine recruitment is already at risk due to deer herbivory, closing canopies, and a lack of suitable seedbed as a result of infrequent fires. Previous studies have also presented evidence that ericaceous species can inhibit conifer regeneration. Therefore, we wanted to understand whether this variable is also impacting pitch pine seedlings in the Central Pine Barrens. To do this, our team sampled twenty-four forest plots in “oak-pine” and “pine-oak” forests following the Forest Health Monitoring Protocols for the Long Island Central Pine Barrens from the Foundation for Ecological Research in the Northeast. Based on a review of research done by Mallik et al. (2003), we expected to see a negative correlation between the abundance of ericaceous shrubs and pitch pine seedlings in both forest types. We correlated those frequencies to pitch pine seedling abundance using linear regression and sample T-tests. Our study found a significantly positive correlation between ericaceous understory plants and pitch pine seedlings in Oak-pine forests, and a weakly negative (but insignificant) correlation in Pine-oak plots. As further studies look to understand the variables impacting pitch pine recruitment, it may be important to look at how ericaceous shrubs may play a role.

Introduction

Much of the Central Pine Barrens (CPB) ecosystem has been ecologically degraded as a result of a lack of fire-mediated disturbance. The CPB is also facing climate change related stressors such as an influx of pests and diseases that are causing mortality of pitch pines and oaks (*Quercus coccinea*, *Q. velutina*). Along with the increased mortality of canopy trees, we also observed a lack of recruitment in pitch pine seedlings.

Pitch pines are an early successional tree species that provide:

- Habitat to various bird and animal species
- Water filtration
- Carbon fixation

In order to successfully germinate and become established, pitch pine seedlings ideally require:

- Fire mediated disturbances to open cones and release seeds
- Bare mineral soil
- Open canopies
- Little competition



Highbush blueberry
(*Vaccinium corymbosum*)



Pitch pine seedling
(*Pinus rigida*)



Teaberry
(*Gaultheria procumbens*)

Ericaceae growth strategies include:

- Clonal growth
- Ericoid mycorrhizal symbionts
- Allelopathic effects through leaf litter high in phenolic compounds that inhibit the germination and elongation of pine seedlings

Expected results:

- A negative correlation between pitch pine seedling and sapling abundance compared to ericaceous understory abundance

Methods

- **Study area:** twenty-four 16x25 meter plots in the Central Pine Barrens oak-pine and pine oak forests.
 - **Abundance of understory vegetation:** randomly sampled 200 points per plot using a point intercept method along 10 twenty-five meter tapes, at 20 points per tape, one meter apart
 - **Seedling abundance:** sampled four 2x25m belt transects for each plot
- **Statistical analyses:** Pearson’s correlation coefficient and paired t-test to evaluate statistical significance between ericaceous species and associated pitch pines.

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Results

- There were typically more seedlings than saplings in the forest plots.
- Our expected results of a negative correlation between pine seedling abundance and ericaceous shrub abundance was not supported by our data. Contrary, our findings show:
 - Oak-pine forest:** pitch pine seedlings were positively correlated ($R^2=0.237$) with ericaceous shrubs ($p=0.009$)
 - Pine-oak forest:** pitch pine seedlings were negatively correlated ($R^2= 0.089$) with ericaceous shrubs, but not statistically significant

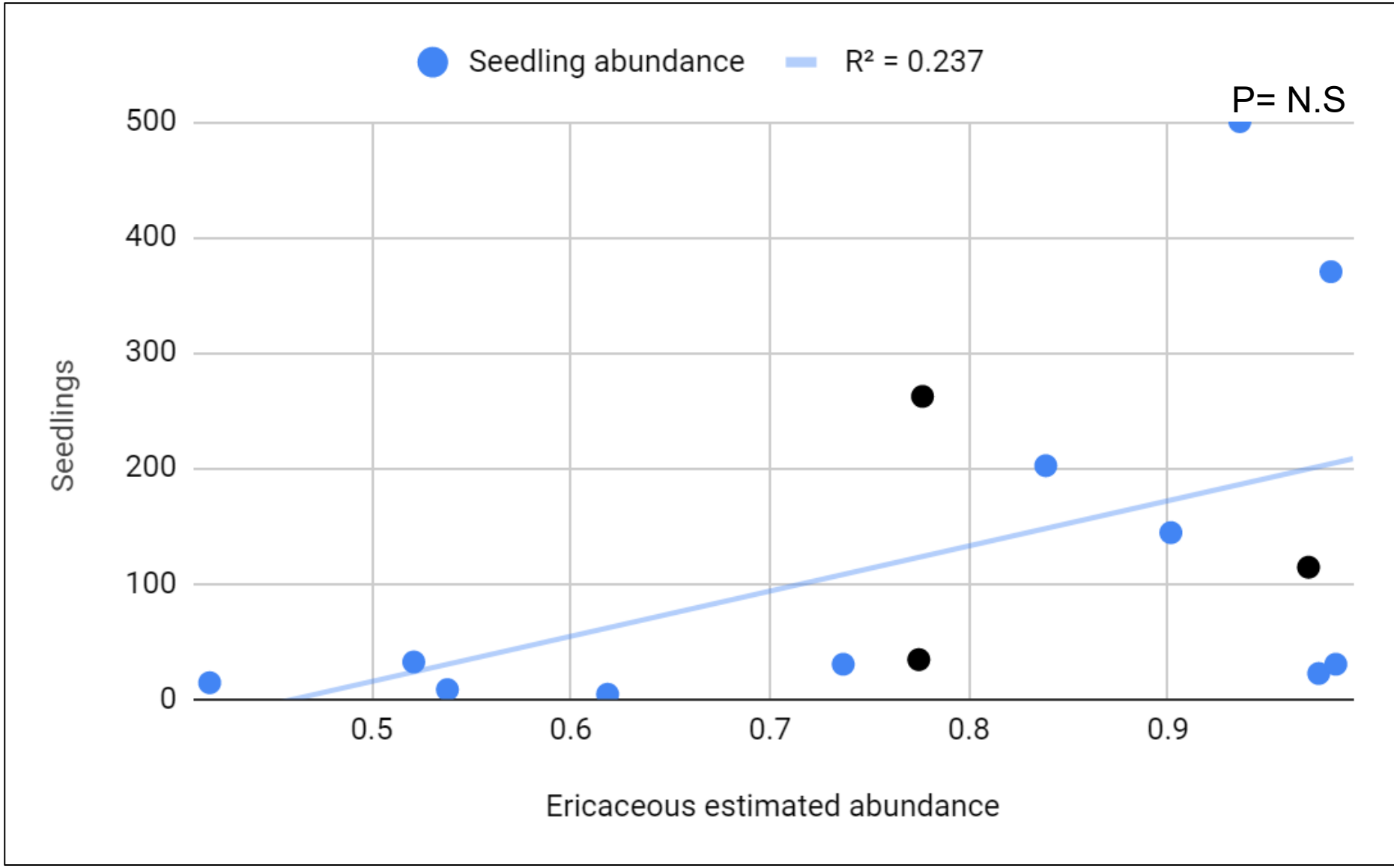


Figure 1. Ericaceous spp. & *Pinus rigida* seedlings in oak-pine forests. Black dots represent plots that have recently experienced fire.

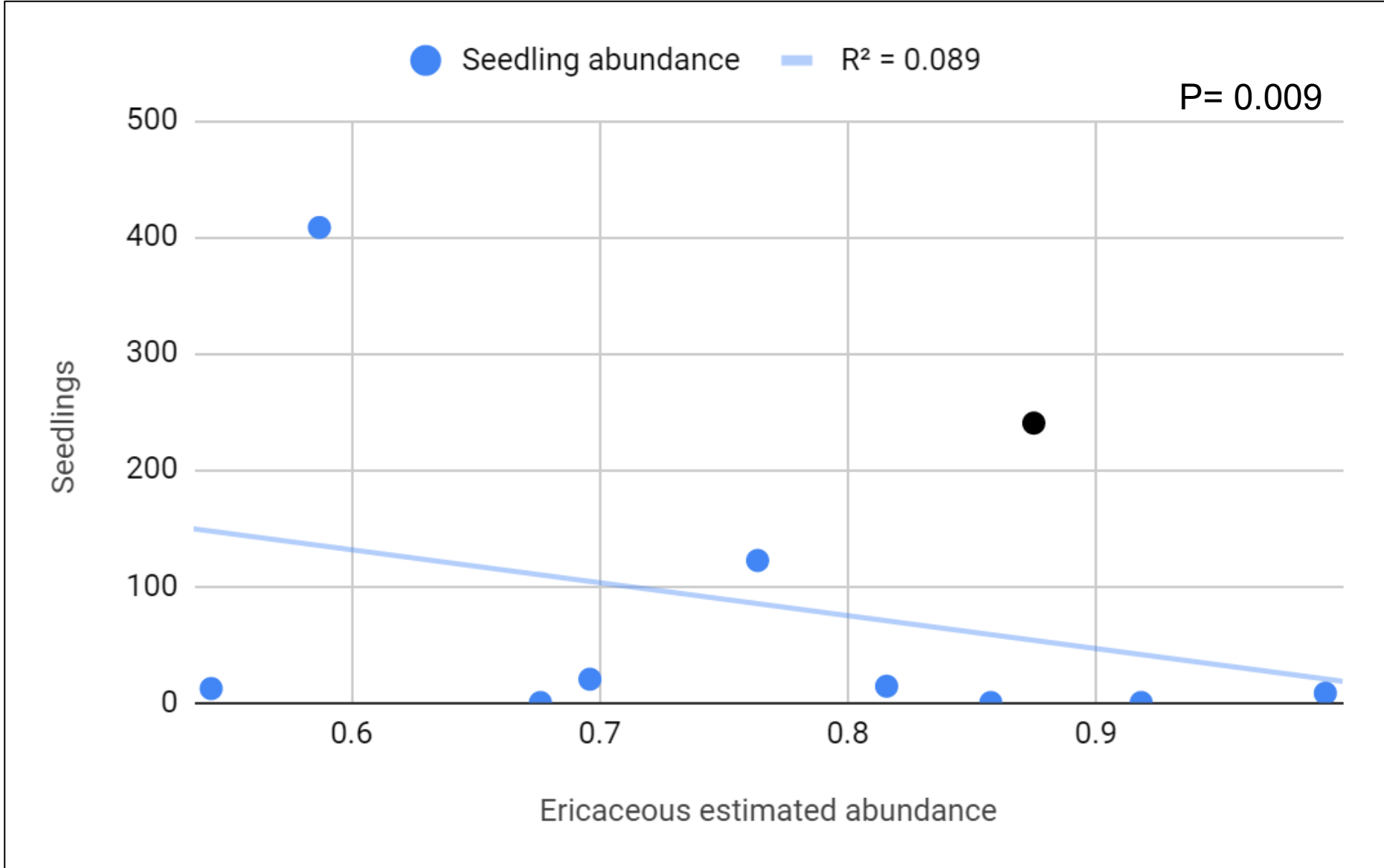


Figure 2. Ericaceous spp. & *Pinus rigida* seedlings in pine-oak forests. Black dots represent plots that have recently experienced fire.

Discussion

The unexpected positive correlation between ericaceous shrubs and pine seedlings may be due to:

- Allelopathic phenol interactions having more of an impact on seedling elongation (i.e., to larger size classes) than seedling establishment and early survival
- Shrubs providing protection to pine seedlings from deer herbivory, or creating suitable shaded and moist germination microsites

Limitations/Experimental problems

- Small sample size
- Presence of burned plots
- Unknown plant/mycorrhizal interactions
- Deer herbivory and other unknown stressors



Line transect in an oak-pine forest

Recommendations & Areas of Future Research

- Future studies should attempt to look at recruitment of saplings
- We recommend future surveys using a larger sample size and all six forest types to strengthen results.

Ericaceous plants have their place in a *balanced* ecosystem since they provide valuable ecosystem services such as pollinator rewards, berries for humans and animals, and wildlife habitat. However, an unbalanced ecosystem, i.e., increased ericaceous and decreased pitch pine regeneration can lead to structural and biological diversity loss.