Workshop 2_Nonlinear Models

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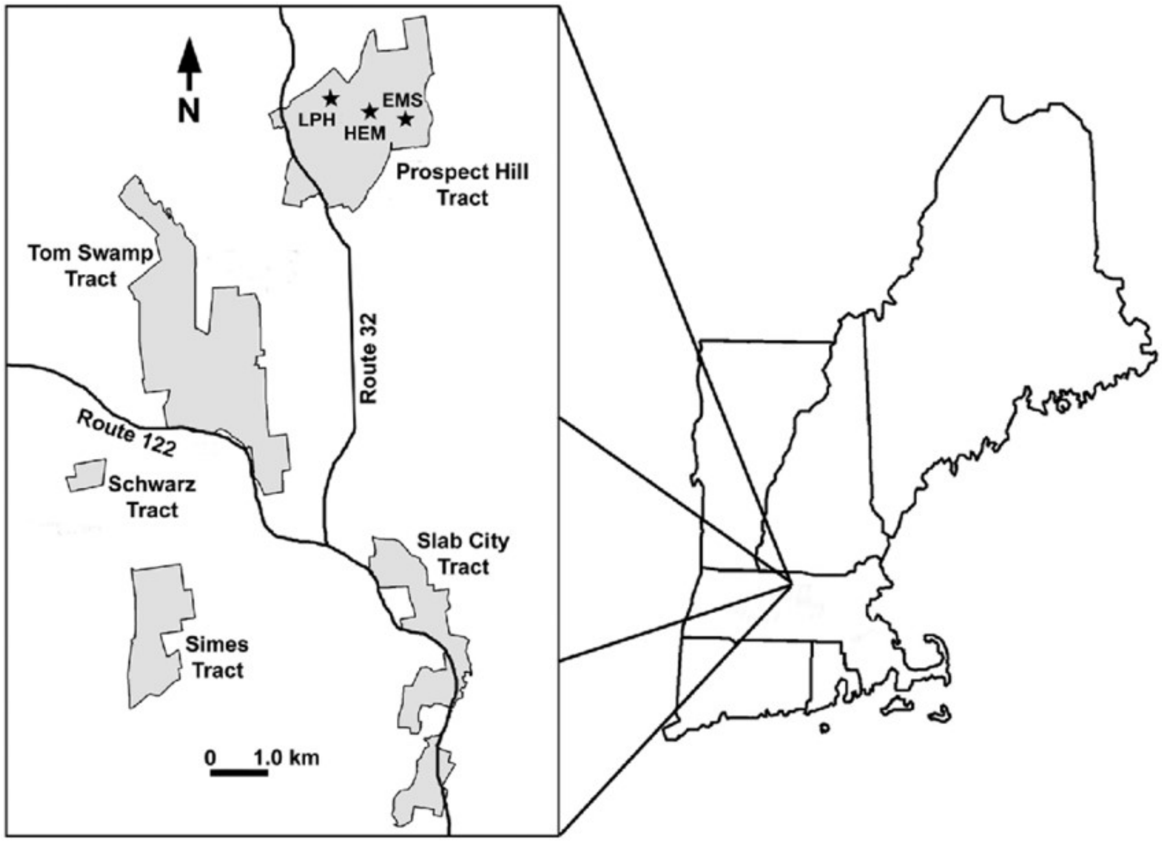
Objectives

The primary objectives of this analysis is to fit monthly light response curves for Harvard forest to understand annual patterns ecosystem photosynthetic potential and respiration rates in temperate mixed forests.

Methods

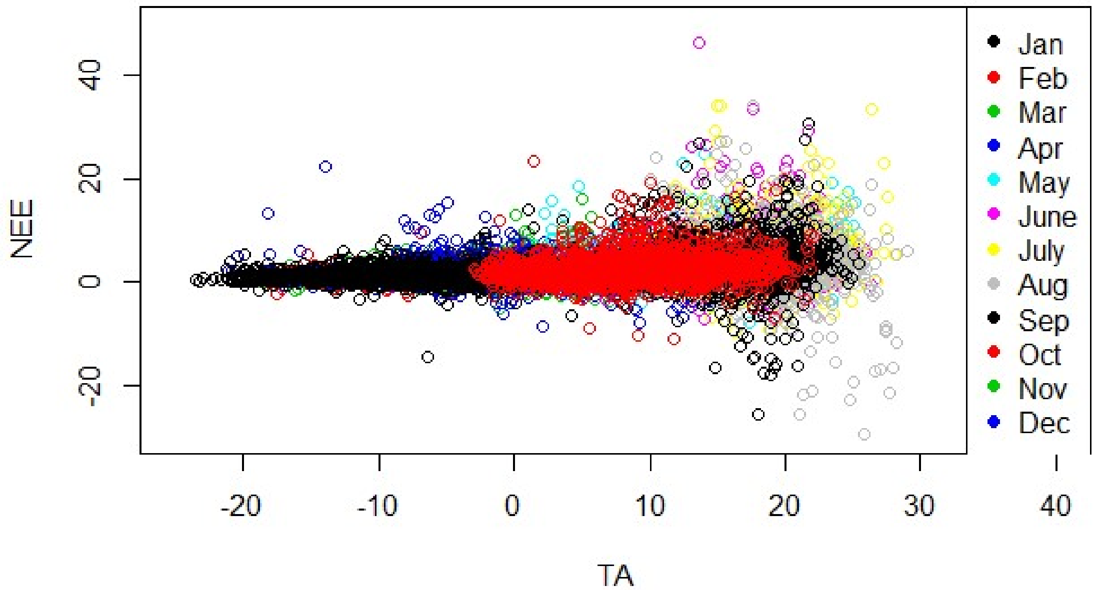
Site Information (include a map of the harvard forest site)

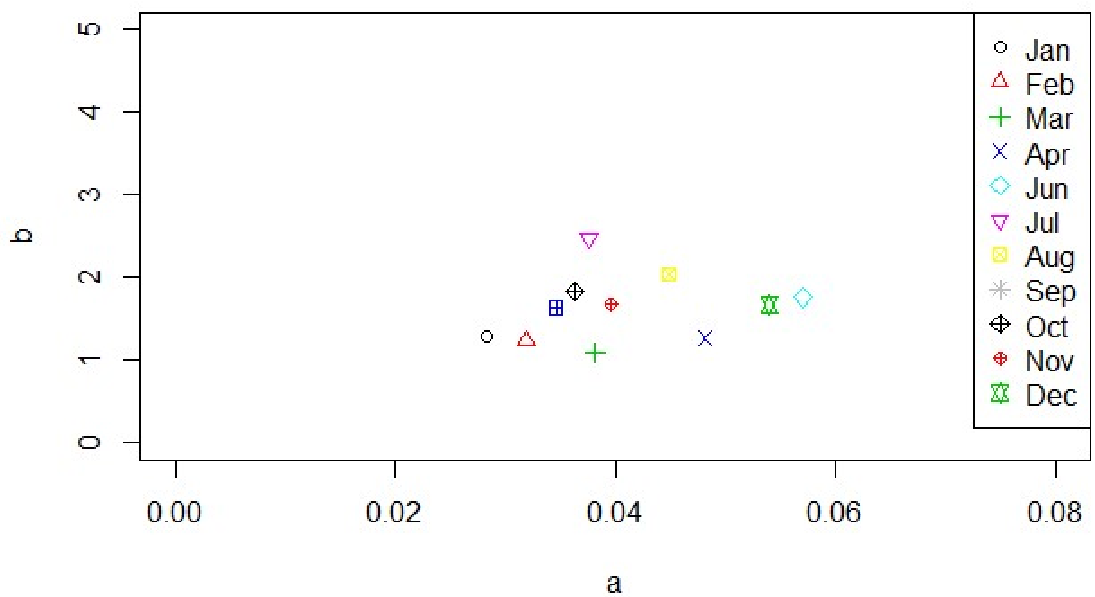
The Harvard Forest is a primarily deciduous forest that is located in northern Massachusetts, USA (Figure 1). The tree species composition is dominated by hardwoods (oaks and maples). The forest is managed by Harvard University, and since 1988 has been funded as a Long Term Ecological Research (LTER) Site to investigate the ecosystem.



Photosynthetic Potential

The photosynthetic potential of an ecosystem can be estimated using a light-response curve with the Michaelis-Menten Approach. This relatoinship compares net photosynthesis with irradiance to show how photosysnthesis will change if the environment is light-limited, or light-saturated. ## Ecosystem Respiration The net photosynthesis within an ecosystem can be estimated using the Arrhenius Approach. For this exercise, we use the Arrhenius approach to estimate potential changes in NEE according to temperature. Using the equation Reco = R0*exp^(b*Tair), we relate how changes in starting values of coefficents within the equation (R0 and b) affect the final outcome. # Results (at least 1 plot and one table) Throughout the year, the NEE changes according to temperautre. At lower temperatures, there is less variance in the NEE measurements than at higher temperatures (Fig. 2). The relationship between a and b does not seem to have a trend throughout the year, other than a increasing during warmer months and is less during colder months (mostly; Fig. 3). This trend is also seen in table 1.





MONTH	a	b	a.pvalue	b.pvalue	a.est	b.est	a.se
1	1.28	0.03	0	0.00	1.28	0.03	0.04
2	1.24	0.03	0	0.00	1.23	0.03	0.03

MONTH	a	b	a.pvalue	b.pvalue	a.est	b.est	a.se
3	1.10	0.04	0	0.00	1.10	0.04	0.03
4	1.27	0.05	0	0.00	1.27	0.05	0.06
5	1.76	0.06	0	0.00	1.76	0.06	0.12
6	2.40	0.04	0	0.00	2.45	0.04	0.32
7	2.01	0.05	0	0.00	2.11	0.04	0.41
8	4.80	-0.01	0	0.11	4.73	-0.01	0.85
9	1.82	0.04	0	0.00	1.82	0.04	0.20
10	1.68	0.04	0	0.00	1.69	0.04	0.10
11	1.67	0.05	0	0.00	1.68	0.05	0.06
12	1.64	0.03	0	0.00	1.64	0.04	0.05

Discussion (1 paragrapgh)

Throughout the year, the mean NEE of the Harvard Forest remains relatively constant. The NEE is more variable during warm months, a result that is potentially caused by long photoperiods during that summer that could cause the ecosystem to be carbon-limited. Light-limited times of the year will not show as much variance, because shifts in light attentuation over time are relatively constant (on a monthly scale), compared to carbon fluctuations in an ecosystem, which can be rapid and less predictable.