Data from: Successional shifts in tree demographic strategies in wet and dry Neotropical forests.

This dataset summarizes demographic rates, abundances and basal area across succession of ~800 (sub) tropical tree species to explore generalities in demographic trade-offs and successional shifts in demographic strategies across four Neotropical forests that cover a large rainfall gradient. We used repeated forest inventory data from chronosequences in two wet (Costa Rica, Panama) and two dry forests (Yucatan, Oaxaca, both Mexico) to quantify demographic rates of ~800 tree species. For each forest, we explored the main demographic trade-offs and assigned tree species to five demographic groups by performing a weighted Principal Component Analysis (PCA) that accounts for differences in sample size. We aggregated the basal area and abundance across demographic groups to identify successional shifts in demographic strategies over the entire successional gradient from very young (<5 years) to old-growth forests. This dataset provides raw and transformed demographic rates, their weights in the weighted PCA, assignments to demographic groups, and forest inventory data at the species level, as well as the code for performing the weighted PCA.

Description of the data and file structure

Explanation of columns in Demographic_rates.txt (missing values are denoted by NA):

- sp: species acronym
- genus: genus
- species: species
- family: family
- site: site
- growth1.orig: mean growth of individuals assigned to canopy layer 1; mm/y for wet sites, cm^2/y in the dry sites
- growth2.orig: mean growth of individuals assigned to canopy layer 2; mm/y for wet sites, cm^2/y in the dry sites
- growth3.orig: mean growth of individuals assigned to canopy layer 3; mm/y for wet sites, cm^2/y in the dry sites
- growth4.orig: mean growth of individuals assigned to canopy layer 4; mm/y for wet sites
- survival1.orig: annual survival rates of individuals in canopy layer 1
- survival2.orig: annual survival rates of individuals in canopy layer 2
- survival3.orig: annual survival rates of individuals in canopy layer 3
- survival4.orig: annual survival rates of individuals in canopy layer 4
- recruitment.orig: number of recruits per year and m^2 of basal area of individuals in old-growth forest
- growth1.trans: transformed growth rate in canopy layer 1 for PCA analysis (missing values were replaced by median of other species, a small constant was added to all values to make values positive, ln transformed)
- growth2.trans: transformed growth rate in canopy layer 2 for PCA analysis (missing values were replaced by median of other species, a small constant was added to all values to make values positive, ln transformed)
- growth3.trans: transformed growth rate in canopy layer 3 for PCA analysis (missing values were replaced by median of other species, a small constant was added to all values to make values positive, ln transformed)

- growth4.trans: transformed growth rate in canopy layer 4 for PCA analysis (missing values were replaced by median of other species, a small constant was added to all values to make values positive, ln transformed)
- survival1.trans: transformed survival rates in canopy layer 1 for PCA analysis (missing values were replaced by median of other species, survival = 1 was replaced by values close to 1 0.997-0.999, transformation into lifespan 1/(1-survival), ln transformed)
- survival2.trans: transformed survival rates in canopy layer 2 for PCA analysis (missing values were replaced by median of other species, survival = 1 was replaced by values close to 1 0.997-0.999, transformation into lifespan 1/(1-survival), ln transformed)
- survival3.trans: transformed survival rates in canopy layer 3 for PCA analysis (missing values were replaced by median of other species, survival = 1 was replaced by values close to 1 0.997-0.999, transformation into lifespan 1/(1-survival), ln transformed)
- survival4.trans: transformed survival rates in canopy layer 4 for PCA analysis (missing values were replaced by median of other species, survival = 1 was replaced by values close to 1 0.997-0.999, transformation into lifespan 1/(1-survival), ln transformed)
- recruitment.trans: transformed annual recruitment rate per year and m^2 of basal area in old-growth forest (missing values were replaced by median of other species, ln transformed)
- growth1.weight: weight of demographic rate in weighted PCA based on the sample size
- growth2.weight: weight of demographic rate in weighted PCA based on the sample size
- growth3.weight: weight of demographic rate in weighted PCA based on the sample size
- growth4.weight: weight of demographic rate in weighted PCA based on the sample size
- survival1.weight: weight of demographic rate in weighted PCA based on the sample size
- survival2.weight: weight of demographic rate in weighted PCA based on the sample size
- survival3.weight: weight of demographic rate in weighted PCA based on the sample size
- survival4.weight: weight of demographic rate in weighted PCA based on the sample size
- recruitment.weight: weight of demographic rate in weighted PCA based on the sample size
- group.4: classification of species into demographic groups including demographic rates in 4 canopy layers (1: Fast, 2: Slow, 3: LLP (Long-lived pioneer), 4: SLB (Short-lived breeder), 5: Intermediate)
- X1.4: Species coordinate on first dimension of weighted PCA including demographic rates in 4 canopy layers
- X2.4: Species coordinate on second dimension of weighted PCA including demographic rates in 4 canopy layers
- group.3: classification of species into demographic groups including demographic rates in 3 canopy layers (1: Fast, 2: Slow, 3: LLP (Long-lived pioneer), 4: SLB (Short-lived breeder), 5: Intermediate)

- X1.3: Species coordinate on first dimension of weighted PCA including demographic rates in 4 canopy layers
- X2.3: Species coordinate on second dimension of weighted PCA including demographic rates in 4 canopy layers
- BA.10 - BA.120: basal area >1 cm dbh (m^2/ha) in 10-year age classes; 1-10, 11-20, 21-30 years, etc.
- BA.OG - BA.30: basal area >1 cm dbh (m^2/ha) in old-growth forest for repeated inventories, e.g. OG10 is 10-years after first measurement, except for Yucatan where OG10 is 5 years after first measurement
- N.10 - N.120: stem number >5 cm dbh (/ha) in 10-year age classes; 1-10, 11-20, 21-30 years, etc.
- N.OG - N.30: stem number >5 cm dbh (/ha) in old-growth forest for repeated inventories, e.g. OG10 is 10-years after first measurement, except for Yucatan where OG10 is 5 years after first measurement
- abun: abundance = number of individuals included in the estimation of demographic rates

Note, in Costa Rica, demographic rates include individuals from 'Carbono' plots (see Table S1 in Ruger et al. 2023), but forest inventory data in old-growth forest exclude 'Carbono' plots because there, the dbh threshold was 10 cm, which biases the results towards taller-statured species. Additionally, many trees were measured at much higher heights than 1.3 m. This resulted in four species that had estimates of demographic rates, but no forest inventory data.

Sharing/Access information

Code/Software

The file 'weightedPCA.R' contains an implementation in R of the weighted principal component analysis described in Delchambre, L. 2014. Weighted principal component analysis: a weighted covariance eigendecomposition approach. Mon. Not. R. Astron. Soc. 446(2), 3545-3555.

It needs demographic rates of multiple tree species and their weights as input, e.g. those in the file 'Demographic_rates.txt'.