

Supporting Information

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SI Text

Experimental Design. We conducted this study at the Savannah River Site (SRS), a National Environmental Research Park, near Aiken, South Carolina (33.20°N, 81.40°W). During the winter of 1999–2000, six 50-ha experimental landscapes were created by harvesting and burning mature *Pinus taeda* (loblolly pine) and *Pinus palustris* (longleaf pine) plantation forest. Each landscape consisted of five open habitats (patches) within a matrix of pine forest: a central 100 × 100-m patch and four peripheral patches (Fig. 2). One peripheral patch was connected by a 150 × 25-m corridor, and the remaining three were isolated by 150 m of pine forest and were either unconnected low-edge or unconnected high-edge patches. Unconnected low-edge patches were 100 × 137.5-m and had the area of the corridor added to the side furthest from the central patch. Unconnected high-edge patches were 100 × 100 m, with 75 × 25-m dead-end corridors (wings) projecting from the two sides parallel to the close side of the central patch. Further information about our experimental landscapes can be found in Tewksbury *et al.* (1).

After creation, the experimental landscapes have been managed by the U.S. Department of Agriculture Forest Service–Savannah River for open longleaf pine savanna, the presettlement dominant vegetation type for uplands in this region. Within each patch during spring 2004, all hardwoods and *Pinus taeda* >2.5 cm diameter were cut within each patch, allowed to dry, and burned with a controlled understory fire. These management actions retard hardwoods, favor *Pinus palustris* recruitment, and promote savanna understory vegetation. In spring 2007, all landscapes were burned with a third controlled understory fire.

Plant Censuses. We censused all vascular plant species occurring in each patch between May 15 and July 15, 2001–2003 and 2005–2007. Patches were not surveyed in 2004 because of prescribed fires.

Species Trait Coding. We coded all plant species for dispersal mode by searching regional flora and guides (2, 3), conducting primary literature searches (ISI Web of Science, Biological Abstracts), and consulting plant databases [Kew Royal Botanical Garden's Seed Information Database (<http://www.kew.org/data/sid>), U.S. Department of Agriculture Plants Database, NatureServe Explorer, The Illinois Plant Network]. Dispersal modes not found by these methods (≈25% of species) were deduced by seed morphology or congener comparison. Here, we consider species categorized as strictly bird-dispersed (supporting fleshy fruits ingested and passed by birds and not known to be consumed by mammals), wind-dispersed (supporting structures to enable wind transport), or unassisted (no external structures). We followed nomenclature from Radford *et al.* (2), except for the genera *Chamaecrista*, *Dichantheium*, and *Panicum*, which followed Weakley (3).

Wind Data. Wind data were collected by using 61-m tall towers positioned over mature pine forest at four locations within SRS (Fig. 2A). Towers were 100–800 m from clearings. At each tower, wind speed and direction data were continuously recorded and stored as 15-min averages. Data were used to create four variables to describe the wind profile: the number of observations from a particular direction (i.e., the number of times the wind was blowing from a particular direction), the average wind speed from a particular direction, the variance in

wind speed from a particular direction, and the average variation in wind direction over each 15-min measurement interval (i.e., how rapidly wind is changing direction). We used data from 0500 on January 1, 2000 through 0400 on September 30, 2007 in our analyses. The majority of wind-dispersed species in our experimental landscapes disperse at the end of the summer growing season. We included wind data from the previous year, including this peak dispersal season, to predict plant species richness during the growing season of the subsequent year.

For each patch within each experimental landscape, we determined the two perpendicular degree directions that describe the orientation of the patch within the landscape. We created 45-degree bins that extended across these two perpendicular directions (Fig. 2B). Each observation for the four separate wind measures were summed for each patch if it was within the 45-degree bins associated with that patch, i.e., only wind observations striking each patch within 22.5° of perpendicular were used to assess the importance of wind for plant species richness within a given patch. Wind observations were summed for 1 year before the year the plant data were collected, so wind events from the previous year were used to predict any given year's plant community composition. We refer to the measure described above as wind incidence.

Data Analysis. To examine differences in species richness as a function of connectivity and edge effects, we used mixed-model repeated-measures ANCOVA, conducting a separate analysis for each dispersal mode (bird-dispersed, wind-dispersed, unassisted). Our model treats patch type (connected, unconnected low edge, unconnected high edge) and year of sampling as a fixed effect, and variation caused by experimental blocks (i.e., each landscape; Fig. 2) as a random effect. Because of its importance in determining local plant species richness in this system, we used the natural log of soil moisture as a covariate (see ref. 5). We model observations taken in different years as repeated measures on the same subject (i.e., the patch), using a spatial power covariance structure as recommended by Littell *et al.* (6). This covariance structure accommodates unequal time periods between sampling events, which is necessary because of missing data for 2004. Degrees of freedom were adjusted by using the Kenward-Rogers method.

To evaluate changes in species richness as a function of time, we used each ANCOVA model to estimate the mean difference in species richness caused by connectivity effects (connected minus unconnected high-edge patches) or edge effects (unconnected high-edge minus unconnected low-edge patches). Trends in these mean values were evaluated by using these mean values as individual observations in a separate ANCOVA, with year as a covariate and the patch comparison (connected vs. unconnected high edge or unconnected high edge vs. unconnected low edge) as a fixed effect. As with our full-data repeated-measures analysis, we use a spatial power covariance structure to accommodate temporal similarity among measures taken in subsequent years. This approach has the advantage of allowing us to directly test for differences among slopes as a function of the patch comparison of interest and is appropriate because preliminary regression analyses suggested that the form of the relationship (i.e., linear vs. quadratic) was the same within all patch comparisons (although there was a trend of a quadratic relationship between time and the difference in richness between connected and unconnected patches). To visualize these data, we plot them as

simple scatterplots and use linear regression to illustrate trends (Fig. 4).

For wind-dispersed species, we subsequently incorporated wind data into the ANCOVA model. Because we had no *a priori* expectations, we used a model-comparison approach to select which portion of the wind profile and which of the four wind variables above to use in the ANCOVA. We split the wind profile into five different sets based on wind speed observations that were: (i) <10th percentile of wind speed, (ii) 25–75th percentiles of wind speed, (iii) <50th percentile of wind speed, (iv) >50th percentile of wind speed, and (v) >90th percentile of wind speed.

From each of these datasets, we calculated each of the four wind variables. We evaluated the fit for each by using linear regression on mean values of wind-dispersed species richness from each experimental unit in each year (i.e., six experimental units over 6 years, for 36 total observations). We used Akaike's Information Criterion (AIC; ref. 4) to compare models, using model-selection criteria described in Burnham and Anderson (4) to select the portion of the wind profile and the wind variable that best explained the richness of wind-dispersed seed species. Our final model included the number of wind observations that were below the 50th percentile of wind speeds.

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