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The absence of an *Andropogon* stage in old-field succession at the Hutcheson Memorial Forest

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PICKETT, S. T. A. (Dept. Biol. Sci., Rutgers Univ., P.O. Box 1059, Piscataway, NJ 08854). The absence of an *Andropogon* stage in old-field succession at the Hutcheson Memorial Forest. Bull. Torrey Bot. Club 110: 533-535. 1983.—Studies of old-field succession in the eastern U.S., and especially on the Piedmont, have found *Andropogon scoparius* and *A. virginicus* to be important and often dominant components of old-field vegetation. *Andropogon scoparius* has, in the past, dominated most old fields between 15 and 60 years old in the vicinity of the Hutcheson Memorial Forest (HMF). However, a study of succession on permanent plots begun in 1958 shows that no field at HMF has been dominated by this species within the 26 years of observation. As an example, data on cover of dominant species, defined as those attaining at least 5% mean cover in any year, are presented for one field abandoned in 1960. The failure of *A. scoparius* to become important in these fields documents an important aspect of succession in the fields at HMF, and exemplifies the multiplicity of pathways that old-field succession may take.

Key words: *Andropogon*; Hutcheson Memorial Forest; old-field; succession

General patterns of succession on abandoned farm land in the eastern United States are well known. For example, Oosting (1942) described sequential stages on sites of known age on the North Carolina Piedmont and provided the paradigm for subsequent old-field study. Such studies have great value in understanding vegetation dynamics in general terms. To achieve this generality, the data are averaged over replicate fields. Furthermore, to complete the studies within reasonable time, it is assumed that fields abandoned at different times, but otherwise similar in history and environment, adequately represent the trends that would occur at a given site. Taking these assumptions as fact, some ecologists deduce the age of a field from its vegetation.

Site-specific environmental characteristics, vagaries of dispersal, and variation in weather, among other factors, are all likely to generate differences between different fields or fields abandoned at different times. The multiplicity of mechanisms of succession (Horn 1976, Connell and Slatyer 1977), coupled with the individuality of species characteristics (Gleason 1917), argue against finding deterministic, highly repeatable patterns of succession. The likelihood that succession in a particular field will correspond closely to the general pattern described for a region is, therefore, quite low. The failure of *Andropogon scoparius*, a major dominant found by Bard (1952) in Piedmont old-fields, to appear in any significant amount at Hutcheson Memorial Forest (HMF) illustrates this sort of unpredictability.

Old-field succession at Hutcheson Memorial Forest. A successional study at the Hutcheson Memorial Forest (HMF) on the Piedmont in East Millstone, New Jersey, was begun in 1958 by Drs. Murray and Helen Buell, and Dr. John Small. Starting in 1958, two fields were abandoned every other year until 1966, when ten fields had been abandoned. The coverage of all species in 48 permanent, 1×2 m plots has been recorded at end of July or beginning of August each growing season since 1958. Methods are described more fuly elsewhere (Pickett 1982).

Andropogon spp. are widespread dominant species in early old-field succession in much of the eastern United States. In some cases they attain dominance in 3 or 4 yr old-fields (Oosting 1942, Bazzaz 1968).

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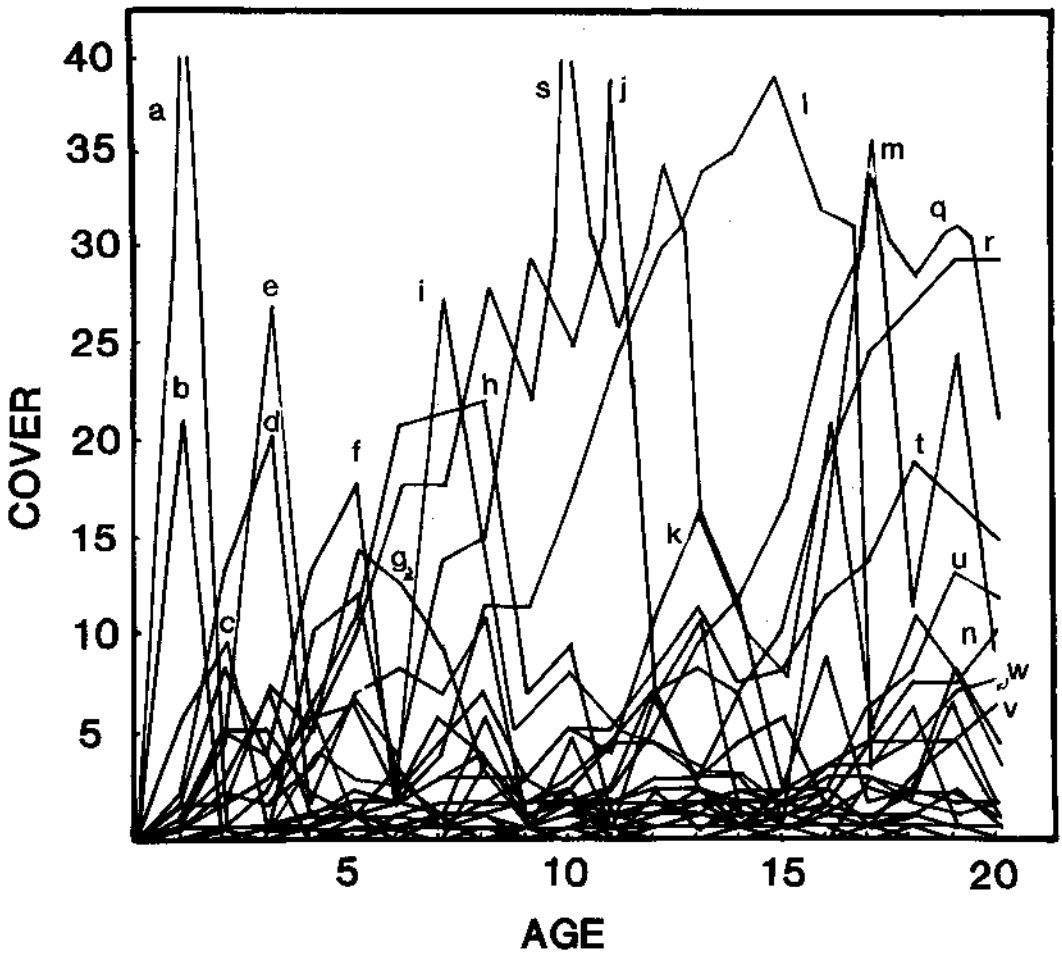

Fig. 1. Changes in the mean cover over time of each of the thirty, most dominant taxa in Field D-3. Mean cover of each species in 48 plots in each year are plotted against the 20 years since abandonment after plowing in spring 1960. The field had been cropped in soybeans and sorghum. Species with prominent peaks are as follows: a) *Ambrosia artemisiifolia*, b) *Digitaria sanguinalis*, c) *Barbarea vulgaris*, d) *Plantago lanceolata*, e) *Erigeron annuus*, f) *Daucus carota*, g) *Rumex acetosella*, h) *Chrysanthemum leucanthemum*, i) *Aster ericoides-A. pilosus* complex, j) *Trifolium pratense*, k) *Convolvulus sepium*, l) *Poa pratensis*, m) *P. compressa*, n) *Rosa multiflora*, q) *Lonicera japonica*, r) *Rhus glabra*, s) *Hieracium pratense*, t) *Acer negundo*, u) *Solidago juncea*, v) *Juniperus virginiana*, w) *Rhus radicans*. The remaining dominant species are not labelled on the figure for the sake of clarity: *Mollugo verticillata*, *Erigeron canadensis*, *Plantago rugellii*, *Oxalis stricta*, *Hieracium florentinum*, *Lepidium campestre*, *Agrostis alba*, *Acer rubrum*, and *Solidago graminifolia*. Original data appear in Pickett 1982.

In fact, Oosting (1942) characterizes 3 yr old-fields on the North Carolina Piedmont as the "broomsedge (*A. virginicus*) stage." In New Jersey *A. scoparius* is an important species in open habitats on Barrier Islands (Martin 1959), the Pine Barrens (Stevens 1940), on sedimentary rock in the Highlands Province (McDonough and Buell 1956), in the NJ Piedmont (Frye 1978) and in the Ridge and Valley Province (Niering 1953). Bard (1952) found *A. scoparius* to be common by 5 yr and dominant by 15 yr and to continue to increase in importance through 60 yr in most Piedmont old-fields.

While instructors and researchers have expected to find *A. scoparius* as a dominant in HMF fields 5 or more yr old, in no field at HMF is *A. scoparius* dominant. In fact, the species is quite rare at HMF, and during the yearly vegetation sampling in the old-fields, encountering a clump or two in or near a plot is occasion for comment. In the data for 20 yr of succession in one field, which can serve as an example

for the present discussion, the species does not appear among the roster of species which exceed 5% mean cover (Fig. 1). Indeed, the species is entirely absent between yr 1–4, and it appears in only one plot from yr 5 to yr 11, and occasionally with low cover in another plot after yr 11.

There are several possible reasons for the absence of *A. scoparius* in this field. First, *A. scoparius* may not disperse readily into the site. The ca. 20-ha oldgrowth HMF lies to the windward of the oldfields. The Village of East Millstone is also to the west, and there is no abandoned farmland in the vicinity of HMF. Keever (1950) noted that a congener, *A. virginicus*, in spite of its small, plumed fruits, is not likely to disperse readily beyond about 2 m from the seed parent. The seeds of *A. scoparius* are heavier and less "feathery" than *A. virginicus* according to Stevens (1940), so their dispersal may be even more restricted.

A second hypothesis for the failure of *A. scoparius* to dominate older fields at HMF is the recent expansion of potential competitors. Bard's (1952) study was conducted in 1949 and 1950. Since then, the introduced species *Rosa multiflora* (Stiles 1982), and *Lonicera japonica* have become prominent at HMF. In some HMF fields *Rosa* has recently exceeded 15% cover (Stiles 1982) while it reached a mean of only 4.7% in 1949–50. *Lonicera japonica*, averaged about 4% cover in 1949–59, but averaged about 20% in one field in 1980, after having reached a peak of 34% several years earlier (Fig. 1). Neither hypothesis has been tested. Whatever the reason, the absence of *Andropogon scoparius* as a dominant at HMF illustrates the variability of vegetation dynamics.

Literature Cited

BARD, G. E. 1952. Secondary succession on the Piedmont of New Jersey. Ecol. Monogr. 22:195–216.

BAZZAZ, F. A. 1968. Succession in abandoned fields in the Shawnee Hills, southern Illinois. Ecology 49:924–936.

CONNELL, J. H. AND R. O. SLATYER. 1977. Mechanisms of succession in natural communities and their role in community stability and organization. Am. Nat. 111:1119–1114.

FRYE, R. J., II. 1978. Structural dynamics of early oldfield succession on the New Jersey Piedmont: A comparative approach. Ph.D. Thesis, Rutgers Univ., New Brunswick.

GLEASON, H. A. 1917. The structure and development of the plant association. Bull. Torrey Bot. Club 43:463–481.

HORN, H. S. 1976. Succession, p. 187–204. *In:* R. M. May [ed], Theoretical ecology: principles and applications. Saunders, Philadelphia.

KEEVER, C. 1950. Causes of succession on old fields of the Piedmont, North Carolina. Ecol. Mongr. 20:229–250.

MARTIN, W. E. 1959. The vegetation of Island Beach State Park, New Jersey. Ecol. Mongr. 29:1–46.

MCDONOUGH, W. T. AND M. F. BUELL. 1956. The vegetation of Voorhees State Park, New Jersey. Am. Midl. Nat. 56:473–490.

NIERING, W. A. 1953. The past and present vegetation of High Point State Park, New Jersey. Ecol. Monogr. 23:127–148.

OOSTING, H. J. 1942. An ecological analysis of the plant communities of Piedmont, North Carolina. Am. Midl. Nat. 28:1–126.

PICKETT, S. T. A. 1982. Population patterns through twenty years of oldfield succession. Vegetatio 49:45–59.

STEVENS, T. D. 1940. Forest succession on upland soils in the New Jersey Pine Barrens. Ph.D. Thesis, Yale Univ., New Haven.

STILES, E. W. 1982. Expansions of mockingbird and multiflora rose in the northeastern United States and Canada. Am. Birds 36:358–364.