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PLANT PHENOLOGY IN THE LOWER RIO GRANDE VALLEY, TEXAS

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ABSTRACT.—Native plant growth and reproduction in the lower Rio Grande Valley of Texas were keyed to rainfall and soil moisture for most species during 1985 and 1986. The three most active growth and reproductive periods were February, late May to June, and late September through November; there were significant differences between years. The majority species dropped ripened seeds in mid- to late summer, although several species produced flowers and fruit throughout the year. *Key words:* plant phenology; lower Rio Grande Valley, Texas.

Plant phenology in the subtropical lower Rio Grande Valley of south Texas is more complex than that in temperate regions. Multiple periods of growth and reproduction have been observed in many species but little has been documented. Knowledge of plant phenology aids studies in botany, entomology, and wildlife and is valuable in landscaping and plant community restoration. General flowering and fruiting periods are listed in plant texts such as Correll and Johnston (1970), Vines (1960), and Lonard et al. (1990), but multiple cycles during the year are not listed.

The objective of this study was to record plant phenology for several native species over a two-year period. Woody species that are commonly planted as ornamentals or in plant community restoration efforts by the U. S. Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department were emphasized.

METHODS

Forty-four plants of 19 species were observed for flowering, fruiting, and leaf growth and drop weekly from May 1985 to January 1987 at the Santa Ana National Wildlife Refuge (NWR) (C Trail) (Table 1). In addition, notes on plant phenology were made by several employees of the USFWS and by visitors on these 19 and other plant species. Observations were limited to tracts of native brush throughout the lower Rio Grande Valley and the Santa Ana NWR parking lot. Ideker (1985, 1987) recorded observations made in October 1985, November and December 1986, and January 1987 in the newsletter of the Native Plant Project of the Lower Rio Grande Valley. Nomenclature for woody plants and vines follows Lonard et al. (1990) and is from Correll and Johnston (1970) for other species. Rainfall was recorded at the Santa Ana NWR headquarters site (Fig. 1).

RESULTS

Winter

Mexican ash (*Fraxinus berlandieriana*), honey mesquite (*Prosopis glandulosa*), Texas sugarberry (*Celtis laevigata*), lotebush (*Ziziphus obtusifolia*), and cedar elm (*Ulmus crassifolia*) were among the few woody species that lost most or all of their leaves in mid-December.

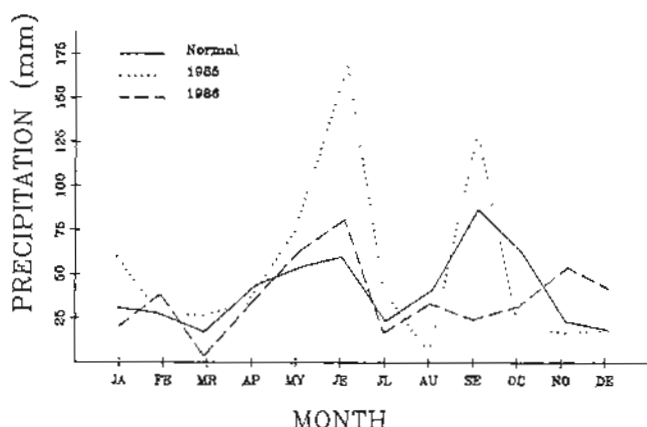


FIGURE 1. Precipitation in 1985 and 1986 at the Santa Ana National Wildlife Refuge, Texas.

among annuals and low perennials was triggered by rains in late May and early June.

Summer

Texas sabal palms (*Sabal texana*) bloomed and began producing fruit in June. Retama, Texas ebony, tepeguaje, anacahuita, catchweed bedstraw, tropical sage, mist-flower, and pigeon-berry continued flowering. By late June the fruit of Texas huisache, retama, Texas prickly pear, anacua, brasil, coyotillo, lotebush, and coral bean were mature. Snailseed also produced fruit.

Fruits of spring flowers ripened for many species in July and August. These included Texas sugarberry, guayacan, granjeno, chilipiquin, tepeguaje, Texas ebony, Wright's acacia, colima, blackbrush, cenizo, honey mesquite, Texas persimmon, elbow bush, brasil, black mimosa, Texas paloverde, snake-eyes (*Phaulothamnus spinescens*), and desert yaupon (*Schaefferia cuneifolia*). These months were relatively dry except for occasional afternoon thundershowers, and many plants wilted or dropped leaves under the intense heat (high temperatures usually more than 35°C). Plants such as retama, Texas ebony, tropical sage, pigeon-berry, and honey mesquite continued to flower with sufficient soil moisture. Tenaza (*Pithecellobium pallens*) was one of the few plants with peak flowering in August.

Autumn

The autumn rains arrived in mid-September in 1985 and initiated vigorous plant growth and flowering in the latter part of that month and in October. Retama, manzanita, white bush, chilipiquin, chapotillo, Berlandier wolfberry (*Lycium berlandieri*), Texas ebony, tropical sage, pigeon-berry, cenizo, black mimosa, Texas lantana, Texas kidneywood (*Eysenhardtia texana*), Texas paloverde, tenaza, la coma, tepeguaje, mist-

flower, and anacahuita November. Cedar elm October.

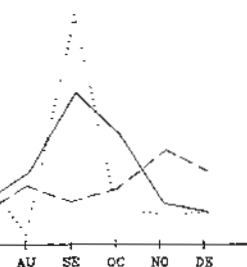
In November of 1985 soapberry (*Sapindus dr*) and tasajillo (*Opuntia lept*) developed fruits. Some continued to hold pods in winter.

Rains did not arrive until flowering and growth observed in 1985. August was inactive growth for most

Plant growth and reproduction for most species; these were late November and the first and reproductive period September through November. Warm weather plants had been partly or completely in moisture stress. Species that had completed a complete reproductive cycle, except during the summer, when temperatures were not relatively high, did not bloom once in spring or June.

Rainfall was highly variable, resulting in yearly and seasonal reproduction. Growth was limited by autumn droughts of 1986. Fruits such as Texas persimmon and fruit that year. The cedar elm of the previous year. Plant growth in the Valley grew vigorously with rains. Rainfall in the west was 100 mm less than in the east for the same species showing little fruit year-round when it was ornamental), but reproduction in autumn in its native dry upland.

Winter severity also varied. The study period were relatively



Ana National Wildlife Refuge, Texas.

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flower, and anacahuita flowered. This flowering period continued into November. Cedar elm fruits dropped in late September and early October.

In November of 1985, species such as Texas persimmon, western soapberry (*Sapindus drummondii*), retama, brasil, Texas prickly pear, tasajillo (*Opuntia leptocaulis*), and urvillea-vine (*Urvillea ulmaceae*) developed fruits. Some legumes, such as Texas ebony and huisachillo, continued to hold pods with mature seeds through the autumn and early winter.

Rains did not arrive until late November in 1986 (Fig. 1). Some flowering and growth occurred at that time, but not of the intensity observed in 1985. August through mid-November was a period of inactive growth for most species in 1986.

DISCUSSION

Plant growth and reproduction were keyed to rainfall and soil moisture for most species; these were, however, reduced by cool weather between late November and the first of February. The three most active growth and reproductive periods were February, late May-June, and late September through November. Cycles varied considerably with species. Warm weather plants had two or more growing seasons. Some species were partly or completely deciduous in hot, dry period in response to moisture stress. Species such as tropical sage and pigeon-berry went through a complete reproduction cycle each time there was sufficient soil moisture, except during cold periods (perhaps less than 7°C, but actual temperatures were not recorded). Other species, such as Texas huisache, bloomed once in spring (late January to March) and seeds ripened by June.

Rainfall was highly variable from year to year and between areas, resulting in yearly and spatial differences in plant growth and reproduction. Growth was minimal during the five-month spring and autumn droughts of 1986. Many species, especially those producing fleshy fruits such as Texas persimmon, brasil, and Texas sugarberry, had little fruit that year. The cedar elm seed crop was also much reduced from that of the previous year. Plants in the eastern part of the lower Rio Grande Valley grew vigorously and produced abundant fruit after heavy fall rains. Rainfall in the western part of the valley, however, was 75 to 200 mm less than in the eastern areas during that period, resulting in the same species showing little activity. Anacahuita produced flowers and fruits year-round when it received sufficient water (as when used as an ornamental), but reproduction was limited to spring, early summer, and autumn in its native dry upland sites.

Winter severity also varies from year to year. The two winters in the study period were relatively mild with temperatures staying above

freezing the entire winter of 1986-87. Many plants such as tepeguaje, tropical sage, anacahuita, and pigeon-berry continued growth and reproduction through the winter. Severe winters do occur once every 10 to 20 years, as in 1983-84, and several species were damaged by that severe freeze (Lonard and Judd, 1985).

Soil moisture appears to be the key to plant growth and should be carefully monitored in revegetation efforts. Plants such as tropical sage and pigeon-berry may provide a good index to soil moisture, and planting should perhaps be avoided when those species are not flowering or producing new vegetative growth. Most species drop ripened seeds in mid- to late summer in anticipation of autumnal rains. Many species, especially legumes, have hard seed coats and require weathering action to soften the coats before water can be absorbed. This protects the seed from germinating too early as a result of short-term summer thunderstorms.

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A RECORD OF *BOOTHERIUM BOMBIFRONS* (BOVIDAE)

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ABSTRACT.—A third cranial (= *Symbos cavifrons*, Gidleya) is illustrated. This specimen was from the Pleistocene of Commerce, Hunt County, pre-Wisconsinan in age. Remains of *Mammuthus* and *Bison* *bombifrons*, which incorporates *Bootherium bombifrons*, are also present.

The musk ox group (*Bootherium* (Harlan), 1822) appeared near the end of the Pleistocene and disappeared during the middle Wisconsinan. *Praeovibos* and *Ovibos* *Bootherium* evidently occupied the most widely distributed southern boundary of its range. The only genus of musk ox is *Bootherium*. As used in this paper, *Bootherium* (*Symbos* (Leidy, 1852) and *Bootherium* of which have been placed in *Bootherium* *bombifrons* by McDonald and

To date, only two records of *Bootherium* in Texas have been documented (Lonard and Judd, 1985). We describe and figure a new specimen (ET 5301) is now in the collection of the Natural Sciences at East Texas State

PREVIOUS RECORDS

Two records of *Bootherium* have been reported from Texas. The first was collected from a sand dune near the Bridge, in Brazos County and became the holotype of *Bootherium* *bombifrons* by Ray (1966) to *Bootherium* *bombifrons*. The second was from the University of Texas, Balcones