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Moisture Variation in Selected Pocosin Shrubs of Eastern North Carolina

by
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and
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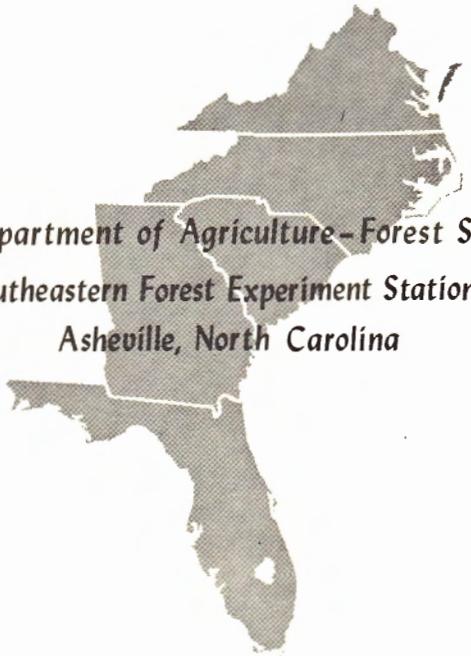

U.S. Department of Agriculture–Forest Service
Southeastern Forest Experiment Station
Asheville, North Carolina

ACKNOWLEDGMENT

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by

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INTRODUCTION

In an earlier report (Blackmarr and Flanner 1968) we discussed the seasonal variation in moisture content of six shrub species found in pocosins[1] of the eastern North Carolina organic soils area. The report compared moisture content of foliage and stem tissue with the average moisture content of the whole plant. The data covered only one annual growth cycle.

This report contains further documentation of seasonal moisture trends over a 2-year period. It also compares observations made in widely separated locations along the North Carolina coastline. The species included are the same as in the earlier report: gallberry (Ilex glabra (L.) Gray), swamp cyrilla (Cyrilla racemiflora L.), redbay (Persea borbonia (L.) Spreng.), switch cane (Arundinaria tecta (Walt.) Muhl.), fetterbush (Lyonia lucida (Lam.) K. Koch), and honeycup (Zenobia pulverulenta (Bartr.) Pollard). These plants are an important part of the total fuel complex of forest lands in the organic soils area because they become a severe fire hazard during low points in their annual moisture cycle. Their peculiar branching habit enhances their flammability by forming a dense, relatively homogeneous mixture of finely divided fuel particles suspended just above the litter surface.

[1] Pocosins are poorly drained organic soil deposits which are often slightly higher in elevation near their center than they are around their perimeter. Hence, the term "pocosin," an Indian name meaning swamp on a hill, is used.

METHODS

Seasonal variation in moisture content of six species of shrubs native to the eastern North Carolina organic soils area was observed throughout two successive annual growth cycles (March 1964 through December 1965). Samples of each species were collected from three areas along the North Carolina coastline (fig. 1). We separated the sampling areas to observe any possible effects of geographic location on the timing of the annual growth cycles. In all three sampling areas, each species was sampled on two to four different plots located within 25 miles of each other. We chose the plot locations to represent a cross section of typical habitat conditions. We did not make detailed analyses of soils to determine the drainage class, but simply observed local habitat conditions, such as soil profile, relief, floristic structure, etc., prior to establishing each plot. Most plots were on organic soils, but a few were on mineral soils.

Old foliage, new foliage, and stem tissue were sampled separately at weekly intervals between noon and 4 p.m. throughout the 22-month period. Sampling was less frequent during the winter, when moisture content fluctuated very little. The method of sampling on each plot has been described by Blackmarr and Flanner (1968). Moisture content was determined by ovendrying for 24 hours at 100° to 105° C.

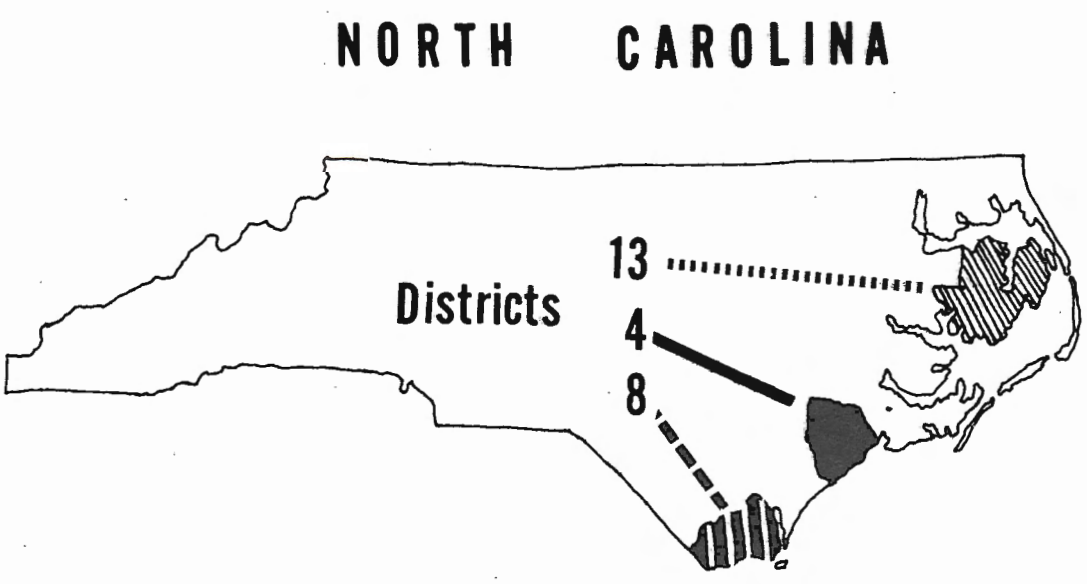

Figure 1.--Three areas where moisture content samples of gallberry, fetterbush, redbay, swamp cyrilla, honeycup, and switch cane were collected.

RESULTS AND DISCUSSION

The annual cycle of moisture variation exhibited a characteristic pattern in each species (appendix A and B). The pattern was relatively consistent over both annual growth cycles of this study and agrees closely with Wendel and Storey's (1962) earlier study of four of the same species. Figure 2 illustrates the consistency between 1964 and 1965 moisture cycles in the evergreen species and the deciduous species. Year-to-year consistency in moisture cycles has been observed in other wildland shrubs. For example, Van Wagner (1967) found that seasonal trends in foliar moisture of some Canadian conifers and hardwoods had a characteristic pattern that was closely duplicated over three successive years, and Reifsnyder (1961) found a consistent pattern of moisture variation in mountain-laurel over two annual growth cycles. Differences in precipitation between the 2 years had little effect on the pattern of seasonal moisture variation. Although we made no attempt to relate moisture variation to weather conditions, it appears that the pattern of seasonal moisture content variation may be little affected by year-to-year differences in precipitation.

There are characteristics which are typical of the evergreen species and others which are typical of the deciduous species. The evergreens (gallberry, fetterbush, and redbay) usually had a lower moisture content than the deciduous species (swamp cyrilla, honeycup, and switch cane) at any given time of the year. This should make the evergreen species more flammable than the deciduous species if other properties affecting flammability were the same.

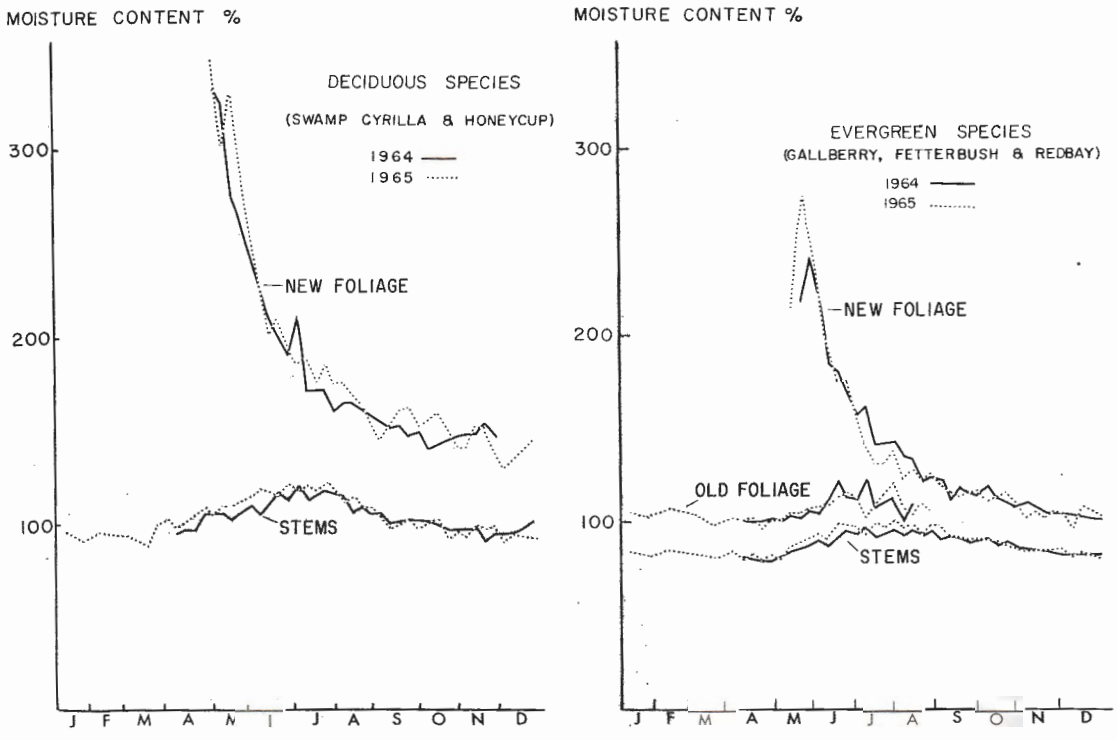

Figure 2.--Annual moisture content cycles in selected evergreen and deciduous pocosin shrubs during 1964 and 1965.

The initiation and development of new foliage in the spring occurred first on the sample area located farthest south (figs. 3 and 4). The development of new tissue on the shrubs in the northernmost district, District 13, lagged about 2 to 3 weeks behind that in the southernmost district, District 8. These differences in seasonal growth patterns reflect the influence of climatic variation due to differences in latitude. Factors other than latitude may modify seasonal moisture content cycles since resumption of new spring growth is influenced by air temperature as well as solar radiation (Meyer, Anderson, and Bohning 1960). For example, factors which affect seasonal cycles of air temperature, such as proximity to the seacoast, also may influence the initiation of new growth of pocosin shrubs as did north-south location.

We observed that new spring growth in District 13 does not always lag behind new spring growth of plants in District 4. This could be because the sample plots in District 4 were located about 35 to 40 miles inland from the coast, whereas those in District 8 and 13 were only about 10 to 15 miles inland. Our observations are supported by climatic maps for the east coast of North Carolina (U.S. Department of Commerce, Environmental Science Services Administration 1964) which show District 4 in a zone with lower minimum daily temperatures in the spring. The average date of the last killing frost is also later in the spring in District 4 than it is in the other districts.

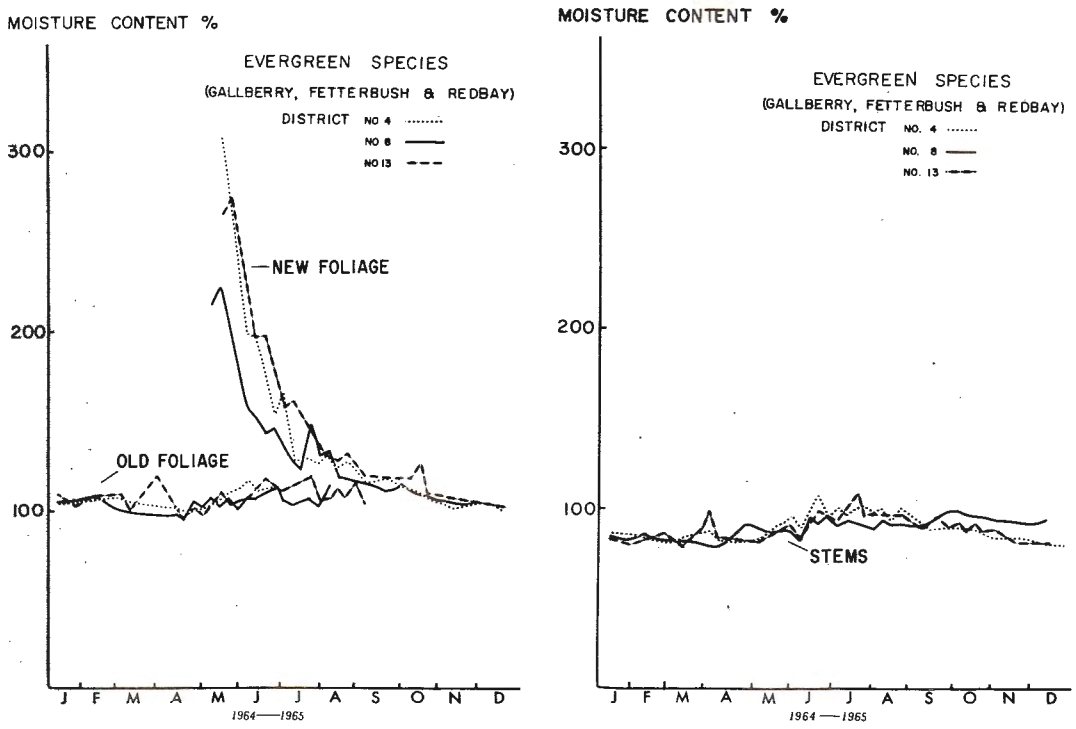

Figure 3.--Annual moisture content cycles in selected evergreen pocosin shrubs at three different locations in eastern North Carolina.

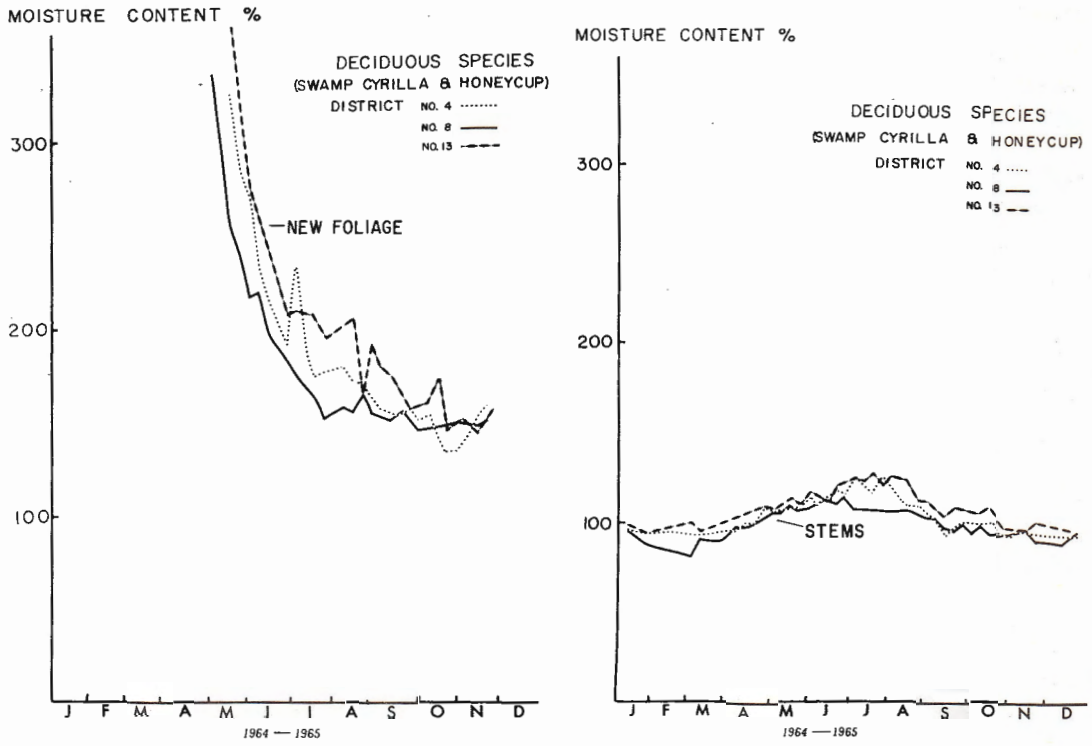

Figure 4.--Annual moisture content cycles in selected deciduous pocosin shrubs at three different locations in eastern North Carolina.

Rapid development of new foliage of all species began, both years, during the fourth week in April through the month of May. This agrees with Wendel and Storey's (1962) findings, and suggests this period as the most likely time when moisture content of pocosin shrubs in eastern North Carolina begins its rapid increase. These data support our earlier conclusion (Blackmarr and Flanner 1968) that bud break and the rapid buildup of moisture in the whole plant begin at about the same time.

March through April, and October through November are two periods when high intensity fires are most frequent. Fires are usually more intense and more difficult to control during the spring fire season than they are during the fall fire season. One reason is that weather conditions favoring high intensity fires are more frequent in the spring. There are characteristics of the moisture regime of pocosin shrubs, however, which also would encourage higher intensity fires in the spring. For example, moisture content of the evergreen foliage and of both evergreen and deciduous stems reaches a minimum just prior to the resumption of new growth in the spring. The moisture content of stems is also higher in the fall than during the spring. Furthermore, green foliage has a higher moisture content than stems, and it makes up a higher proportion of the whole plant in the fall. All of this produces a higher average plant moisture content in the fall than in the spring. The differences between spring and fall in both the amount and the distribution of water in these shrubs should make them more flammable in the spring if the influence of moisture only is considered.

The occurrence of a spring minimum moisture content has been observed in other evergreen plants and may be a characteristic of many of these species. Van Wagner (1967), Johnson (1966), and Jameson (1966) observed this in the foliage of some coniferous species. Reifsnyder (1961) also found it in mountain-laurel foliage.

This report documents seasonal cycles of moisture content variation in pocosin shrubs. However, additional research that relates specific plant moisture contents to actual fire behavior is still needed. We could gain further insight by studying fuel moisture variation during the two most critical periods, March-April and October-November. Specific plant moisture contents could possibly be related to visible phenological characteristics of the plants. A visible indicator of current moisture levels could then be used in conjunction with flammability ratings, based on fuel moisture content, to monitor fuel flammability and predict fire behavior and difficulty of control in the pocosins of North Carolina.

SUMMARY AND CONCLUSIONS

Seasonal variation in the moisture content of six species of pocosin shrubs was observed over two growing seasons at three locations along the coast of eastern North Carolina. The species were gallberry, fetterbush, redbay, swamp cyrilla, honeycup, and switch cane. Moisture content cycles in new foliage, old foliage (evergreen species only), and stems were observed.

Most species exhibited a rapid buildup of moisture content as new growth resumed in the spring. Moisture content declined rapidly during the first few weeks of growth, then tapered off gradually toward the end of the growing season. Each species had a characteristic pattern of moisture content variation that was relatively consistent over two growing seasons.

The moisture content of most species reached a minimum level in the spring, just prior to the initiation of new growth. This was most obvious in the foliage of the evergreen shrubs.

Evergreen shrubs usually had lower moisture contents than deciduous shrubs at any given time of the year.

Growth initiation in the spring was apparently influenced by the north-south location and nearness to the seacoast. Plants located at the northern extreme or further inland began new spring growth as much as 3 weeks later than those in the south or near the coast.

The date of new growth initiation in the spring was not consistent from one year to the next. In most species, however, new growth usually began before the third week in May, and could start as early as the fourth week in April.

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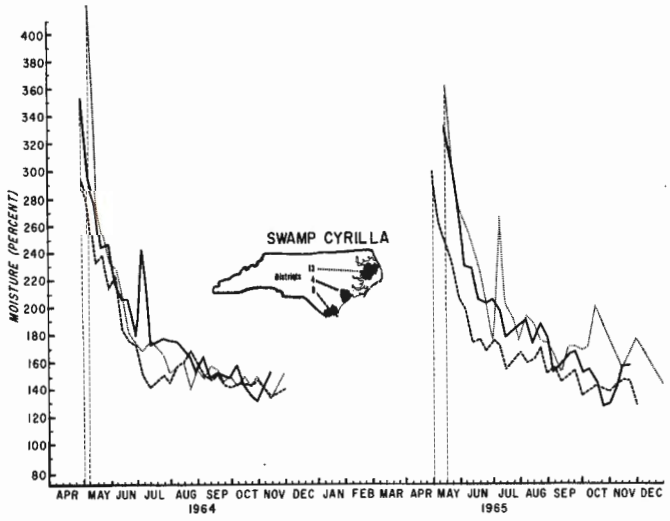
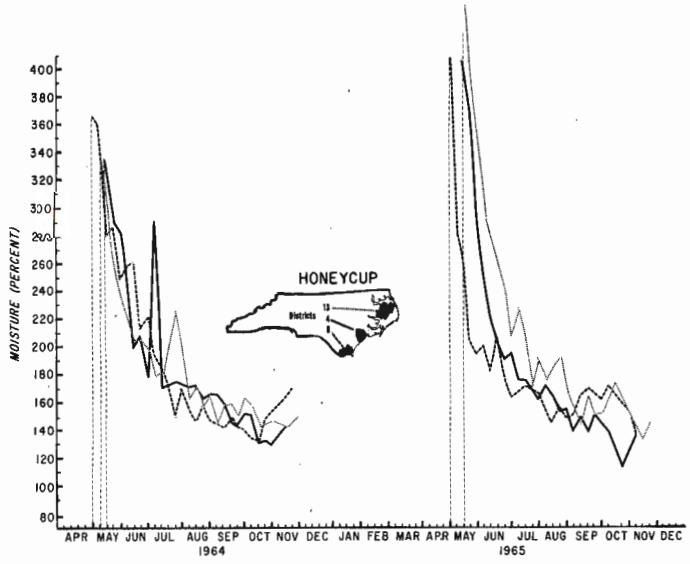
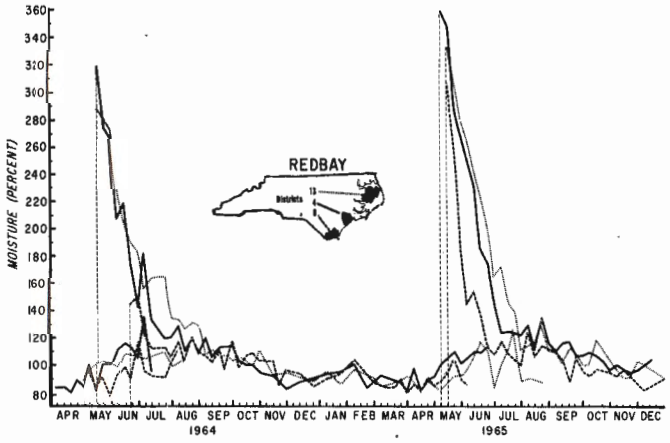
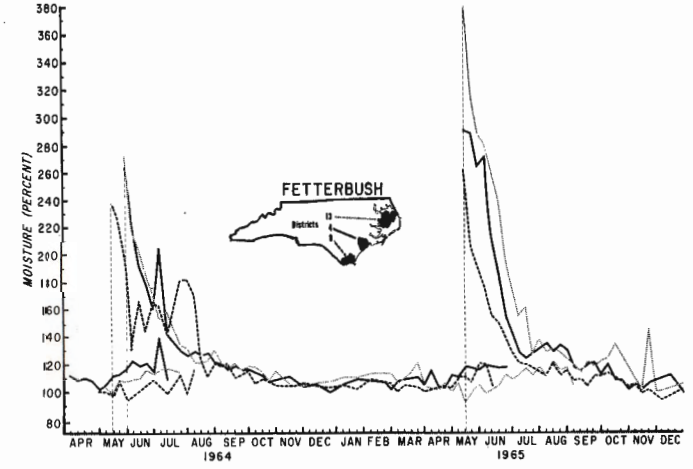
APPENDIX A

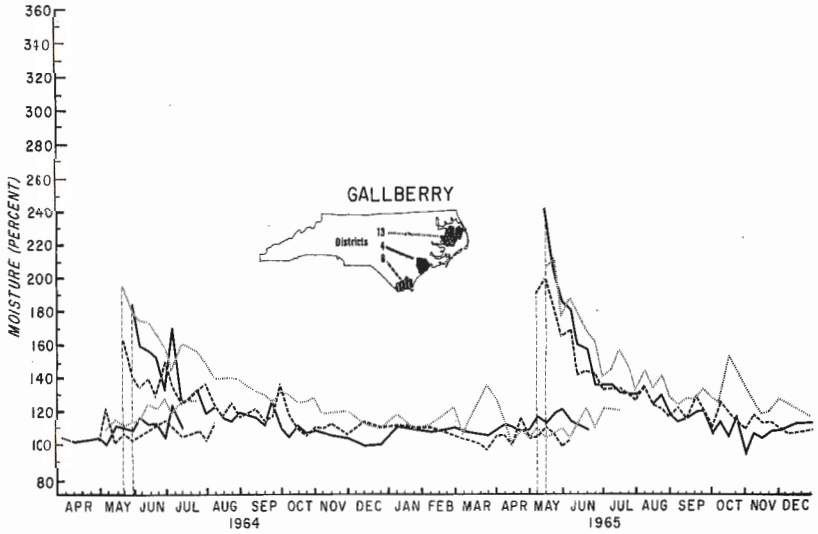
Seasonal variation in moisture content of the foliage of swamp cyrilla, honeycup, redbay, fetterbush, gallberry, and switch cane plants of the eastern North Carolina organic soils area.










GALLBERRY
MOISTURE (PERCENT)
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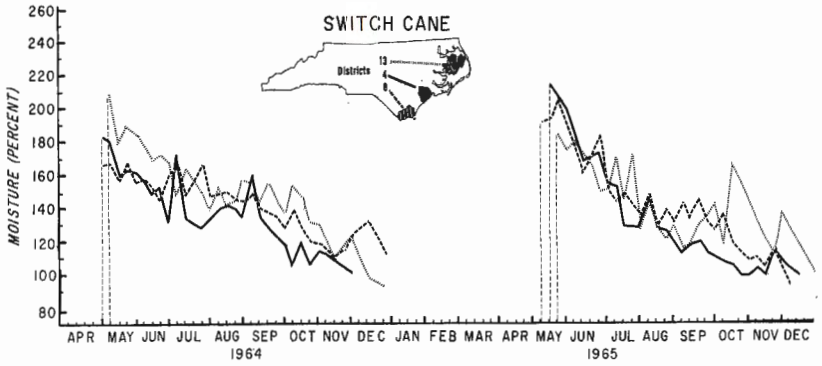
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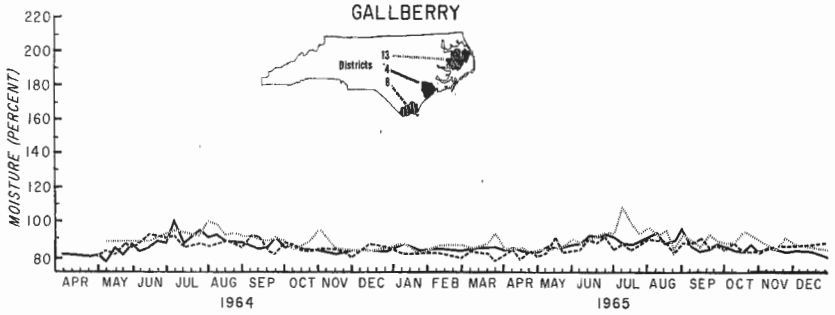
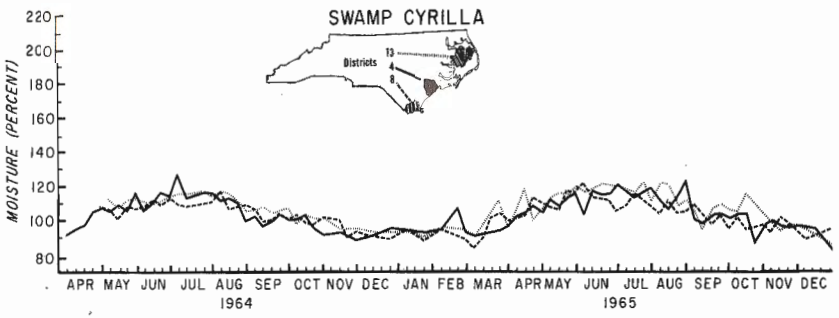
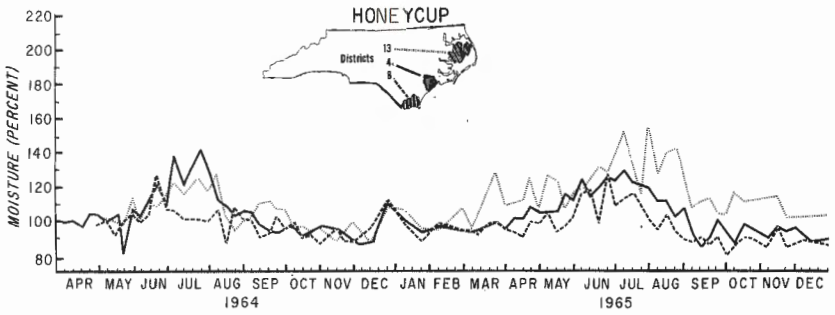
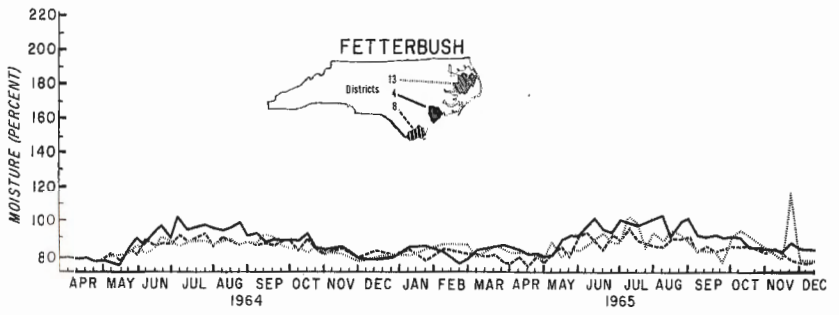
APPENDIX B

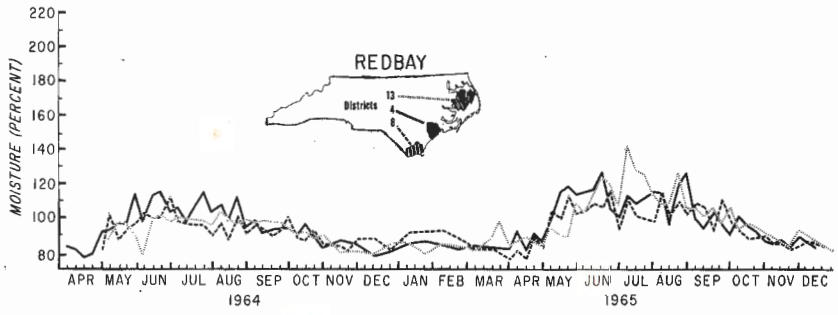
Seasonal variation in moisture content of the stems of gallberry, swamp cyrilla, honeycup, fetterbush, redbay, and switch cane plants of the eastern North Carolina organic soils area.

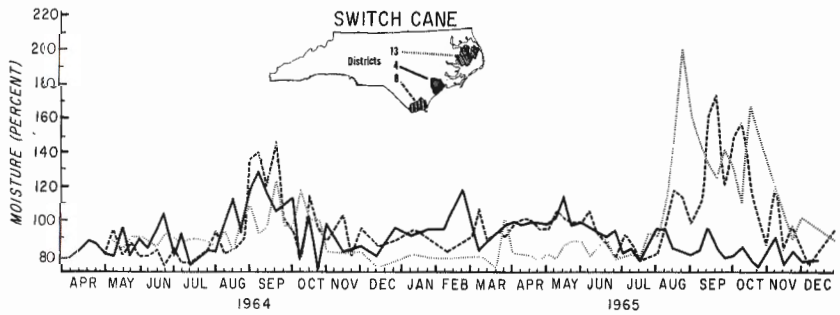












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1974. Moisture variation in selected pocosin shrubs of eastern North Carolina. USDA For. Serv. Res. Pap. SE-124, 10 p. Southeast. For. Exp. Stn., Asheville, N.C.

Seasonal moisture content cycles in selected understory shrubs of eastern North Carolina pocosins were observed over two successive growing seasons. Each species had a characteristic pattern of moisture variation which was closely duplicated over two annual growth cycles. North-south location of the sample area and proximity to the seacoast were related to the timing of the annual moisture content cycles. Moisture content was lowest in most species during the spring, just before the appearance of new growth.

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