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**THE FLINT-CHATTAHOOCHEE-APALACHICOLA
REGION AND ITS ENVIRONMENTS**

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THE FLINT-CHATTAHOOCHEE-APALACHICOLA REGION AND ITS ENVIRONMENTS¹

T. H. HUBBELL,² A. M. LAESSLE,³ AND J. C. DICKINSON, JR.⁴

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INTRODUCTION

The drainage system of the Flint-Chattahoochee-Apalachicola Rivers has long been an area which has attracted the attention of systematists and students of natural history. Forming, at once, highways for and barriers against dispersal for many plants and animals, the area drained is one which has provided much information of interest to zoogeographers. The United States Government, through the Corps of Engineers of the Army, is presently constructing a multi-purpose dam on the Apalachicola River just below the confluence of the Flint and Chattahoochee Rivers. The Jim Woodruff Dam was begun in 1950 and is scheduled for completion in 1956. A lake of approximately 37,500 acres will be created when the water level above the dam is raised to the planned elevation of 78 feet above sea-level. The pool itself will extend up the Flint and Chattahoochee River basins 47 miles and 52 miles respectively. Construction of an additional series of dams above the Jim Woodruff Dam will further

¹Field work done in connection with this report was supported in part by grants from the U. S. National Park Service and the National Science Foundation.

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alter the natural environments affected by impoundment. Through the cooperation of the U. S. National Park Service (in 1953-1954) and the National Science Foundation (1954-1957) funds have been made available to conduct studies of those portions of the area which will be most directly affected. Response to our requests for co-operative efforts in carrying out these field studies has been most gratifying and work is now in progress which will lead to reports on the following special animal groups and specific problems:

Ephemeroptera	Lewis Berner, University of Florida
Orthoptera	T. H. Hubbell, University of Michigan
Formicidae	Paul W. Kanno, University of Michigan
Diptera	George W. Steyskal, Grosse Ile, Michigan
Tipulidae	J. Speed Rogers (deceased) University of Michigan
Aquatic	
Coleoptera	F. N. Young, Indiana University
Thysanoptera	J. D. Hood, Cornell University
Mollusca	W. J. Clench and Ruth Turner, Harvard University
Fish	J. D. Kilby, David K. Caldwell, and Leonard Giovannoli, University of Florida
Odonata	M. J. Westfall, University of Florida
Hemiptera	R. F. Hussey, University of Florida
Reptiles and Amphibians	A. F. Carr, W. J. Riemer, Duke Wilder, Walter A. Auffenberg, University of Florida
Psocidae	E. M. Mockford, University of Florida
Birds	J. C. Dickinson, Jr. and Fred Bartleson, University of Florida
Mammals	Paul G. Pearson, Rutgers University, and Bette A. Starner, University of Florida
Crayfish	H. H. Hobbs, University of Virginia
Ostracoda	H. H. Hobbs, University of Virginia
Plant Communities	A. M. Laessle, University of Florida, and Robert F. Thorne, University of Iowa

Several incidental reports have already appeared as the result of studies made in connection with the general problems of this overall survey of the area. The present report is made in an effort to provide a summary description of the regions most intensively worked, and a preliminary outline of the more important habitats represented therein. It is hoped that this will avoid duplication of effort in the

preparation of the various special reports which will appear subsequently.

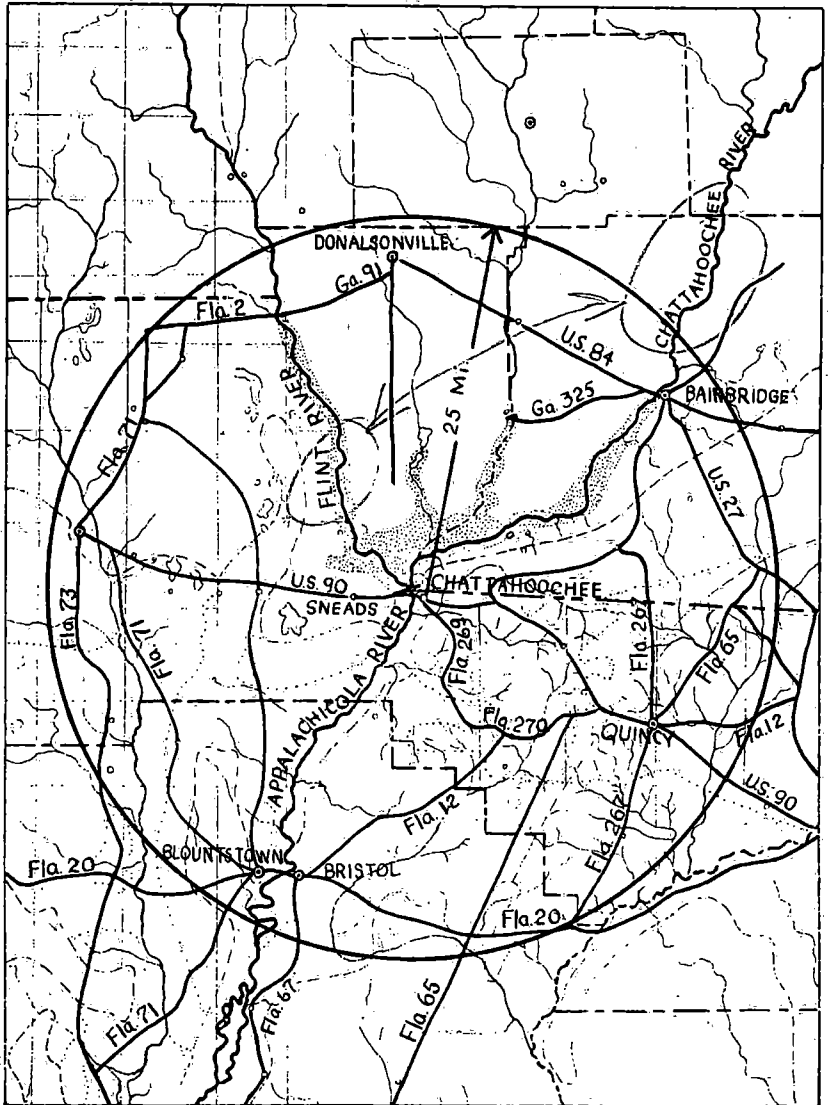
This account is provisional, pending acquisition of more accurate and detailed information about the plant habitats (see below) and more data on the fauna. It is based upon: (1) various published regional descriptions, cited in the bibliography of this report, especially Braun's *Deciduous Forests of Eastern North America* (1950); (2) manuscript notes on the plant habitats of the limestone area of southwestern Georgia, by Robert F. Thorne; (3) field observations and notes by J. S. Rogers and T. H. Hubbell, made at intervals over a period of 25 years; (4) lists of the principal plant species in the numbered field stations set up in 1953, made by A. M. Laessle while visiting the stations with Hubbell; and (5) independent observations by the authors during the years 1953-1955.

Thorne made a detailed field study of the flora and plant associations of southwestern Georgia while working at the Emory University Field Station near Newton, Georgia, in the angle between the Flint and the Chattahoochee rivers. He writes (*in lit.*) that this work was done "with a view to learning as much as possible about the flora of the region to be flooded," and that the manuscript notes mentioned under (2) above are a "rough and oversimplified treatment" based upon a detailed classification and description of the plant habitats in a manuscript that awaits publication. The planned completion of the field work and publication of this paper will furnish students of the biota with a much needed foundation for their ecological studies.

PHYSICAL FEATURES AND NATURAL REGIONS

A circle drawn with a 25-mile radius around the Jim Woodruff Dam as its center (Map I) includes not only all of the bottomland that will be flooded, but also parts of all the natural regions that adjoin or closely approach the impoundment basin. With the town of Chattahoochee near the center, the circle passes not far beyond Donalsonville and Bainbridge in Georgia, and Quincy, Bristol, Blountstown and Marianna in Florida. It includes the southeast corner of Houston County, Alabama, almost all of Seminole and more than half of Decatur County, Georgia, and in Florida most of Gadsden and parts of Liberty, Calhoun and Jackson Counties. The circle is unevenly tri-sected by the Flint and Chattahoochee Rivers and the Apalachicola, product of their confluence.

The area covered by this survey is completely within the "Southeastern Evergreen Forest Region" of Braun (1950).

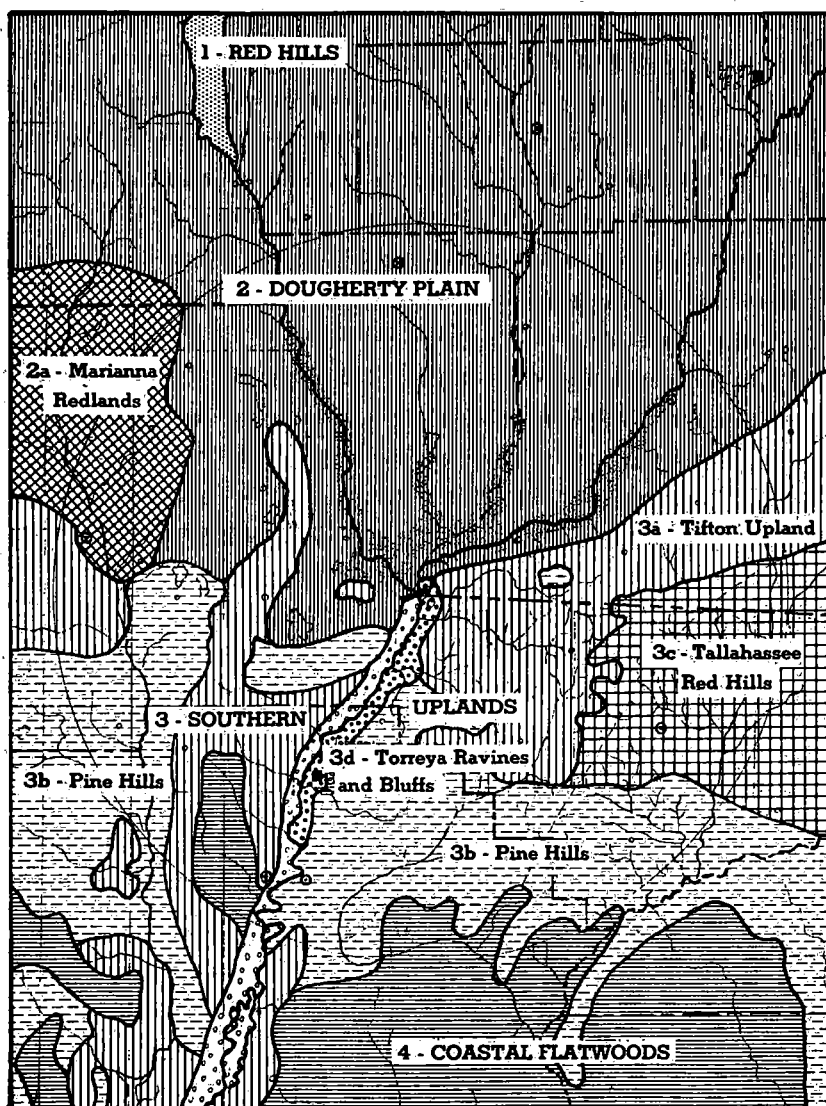


Map I. The Chattahoochee region.

There are no logical natural boundaries which serve our purposes in this general report. The greater part of the field work done in connection with the continuing survey of the fauna has been carried out within the area included in our 25-mile zone. With this in mind we have confined our remarks, for the most part, to this arbitrarily established area.

Within or adjacent to the area thus delimited are parts of four physiographic subdivisions of the Gulf Coastal Plain. They form belts extending from northeast to southwest across central and southern Georgia and parallel to the Gulf Coast in Florida and Alabama. They owe their existence primarily to the kinds of rock which underlie them and the lengths of time during which they have been subjected to erosion, except the outermost, which consists of late Pleistocene marine terraces. The innermost belt is the Fall Line Hills, divisible in southwestern Georgia into the Fall Line Sand Hills along the edge of the Piedmont, and the Red Hills Belt between the Sand Hills and the Dougherty Plain. A narrow projecting portion of this region on the east bank of the Chattahoochee River approaches this territory from the north (Region 1 on Map II). Next coastward comes the Dougherty Plain (Region 2, Map II), a broad lowland stretching from central Georgia into southeastern Alabama and adjacent Florida, formed by solution of a belt of soft porous Eocene and Oligocene limestones. Beyond this is a broad upland belt underlain by relatively insoluble Miocene and Pliocene formations. Extending across all of Georgia and westward in Alabama and Florida, we may call this belt the Southern Uplands (Region 3, Map II), although no name has been given it previously as a whole. In Georgia it confronts the Dougherty Plain with a conspicuous escarpment, which is continued down the east side of the Apalachicola River nearly to Bristol. The subdivisions of this region will be discussed later. Its surface slopes gradually to the south and southeast to join the inner margins of the Coastal Flatwoods (Region 4, Map II) along a boundary which is sometimes distinct, sometimes almost imperceptible.

The four great belts just described are major natural regions, characterized by differences in geology, elevation, topography, soils, drainage, and flora and fauna. Their landscapes are unlike, and in some instances the boundaries between them are clear-cut; they are everywhere distinguished by the local inhabitants, who have names for the different sections with which they are familiar though none for the regions over their full extent. Because of their wide extent, the regions vary and can be subdivided into smaller sections, characterized by predominance of some one feature or a combination of features.



Map II. The natural regions of the Chattahoochee area.

There is always a large subjective element involved in the selection of such minor natural regions and in their delimitation. It is not surprising, therefore, that the various workers who have concerned themselves with this matter differ among themselves as to how many natural regions there are in this area and where their boundaries should be placed. One of the problems that had to be faced is that of deciding what natural regions we could recognize in the field that would be meaningful and useful from the standpoint of the biota. Matching our own field observations against the previous attempts at regional classification by Harper (1906, 1913, 1914), Sellards and Gunter (1914), Cooke (1925, 1939, 1943, 1945), and Thorne (1954), we find a surprisingly large degree of accord, partly concealed by differences in terminology, in fineness of subdivision, and exact position of boundaries. The widest discrepancies are those between the natural regions, whether those of previous students or the ones used in this report, and the distribution of vegetation types shown by Henderson (1939) on his generalized vegetation map of Florida. Even these can be reconciled after a fashion if one is willing to accept, following Henderson, a classification that includes under the single vegetation type, Red Clay Hammock Land, two such different regions as the flat, low-lying Dougherty Plain and the dissected, well drained Tallahassee Red Hills. In other respects we have found Henderson's map useful in helping to locate certain boundaries and in distinguishing the sandy from the clayey parts of the uplands.

The classification and nomenclature which we have adopted differ somewhat from any of those hitherto proposed, although they are conformable with those of Harper, Cooke and Thorne. We have followed Thorne (1949) in distinguishing the Red Hills Belt as a subdivision of the Fall Line Hills that forms a separate natural region. Harper's Marianna Red Lands seems to us scarcely separable from the adjacent West Florida Lime Sink or Cypress Pond Region, and we agree with Cooke (1939) that they should be united; but whereas Cooke called the resulting natural region the Marianna Lowlands, which are plainly no more than the western extension of the Dougherty Plain. We here treat the Marianna Red Lands as a minor subdivision of the last-named region.

The greatest divergence from previous classifications is found in our treatment of the belt of uplands south of the Dougherty Plain. The essential unity of this belt both physiographically and as a biotic environment is evident to one who has studied it as a region, without regard to such artificialities as political boundaries. That part which extends northeastward into Georgia has been called the Tifton Upland

by Cooke and others. Still earlier, when Harper was beginning his series of investigations of the natural regions of the southeastern Coastal Plain, he defined approximately the same unit as the Altamaha Grit Region (1906). In Florida, Harper (1914) distinguished three natural regions in the country eastward from the Apalachicola River: a part of the West Florida Pine Hills, a westernmost lobe of the Middle Florida Hammock Belt, and, almost surrounded by the last named region, the Tallahassee Red Hills. Cooke (1939) united these three into a single upland region stretching from the Apalachicola River to the Central Highlands of peninsular Florida, and called the combined region the Tallahassee Hills. The corresponding uplands west of the Apalachicola, included by Harper in his West Florida Pine Hills, were by Cooke made a distinct region, the Western Highlands. All this seems at first sight quite confusing; but order and simplicity reappear when one thinks of all these variously named upland regions as parts of a single physiographic entity which is here called the Southern Uplands. We distinguish in the Southern Uplands a Georgia part, which is the Tifton Upland, and a southern section parallel to the Gulf Coast, which is the Pine Hills Belt; a rather deeply dissected subdivision to the east of the junction of the Tifton Upland and the Pine Hills Belt is the Tallahassee Red Hills (comprising Harper's region of that name, plus the territory west to around Quincy which Harper included in his Middle Florida Hammock Belt). The *Torreya* Ravines, which cut deeply into the escarpment fronting the Apalachicola River on the east bank, form another subdivision of the Southern Uplands that is biotically distinctive. South of the Southern Uplands is the fourth great physiographic belt, the Coastal Lowlands. These represent late Pleistocene marine terraces, and constitute a natural region which may be called the Coastal Flatwoods, or following Harper (1914), the Apalachicola Flatwoods.

1. *The Red Hills Belt.* This region is the only one of those described which does not extend within 25 miles of the Jim Woodruff Dam. Little of the field work of the present survey has been done in this area, but its proximity together with its biotic peculiarities as described by Thorne (1949) suggest that it may be important in explaining the occurrence in our area of some of the northern types of plants and animals.

Cooke (1925, 1943) did not differentiate this region from the Fall Line Hills, but he did remark that "the dark red soils of the southern part of the Fall Line Hills contrast strongly with the lighter tones

of the [sandy] soils farther north." In his Alabama paper Harper (1913) describes and maps a "Southern Red Hills" belt extending in a broad curve across the southern part of the state, with its southern edge reaching the Chattahoochee River at the Houston-Henry County line. Thorne's more detailed map of the southwestern corner of Georgia (1949:89) shows the Red Hills Belt contiguous with the same region in Alabama along the Chattahoochee River in Clay and Henry Counties, and extending from there northeastward, with a tongue extending down the east side of the Chattahoochee to within a few miles of the Seminole County line (Map II, Region 1).

According to Thorne (1954) the "Eocene Red Hills Belt of the Gulf Coastal Plain in southwestern Georgia lies between the sandy Fall Line Hills to the northwest and the sandy pinelands of the Dougherty Plain to the southeast. It is a level to rolling plateau dissected by deep valleys. The flat-topped divides reach elevations of 400 to 600 or more feet above sea-level and often stand more than 100 feet above the valley floors. The Chattahoochee River, which here forms the boundary between Georgia and Alabama, is bordered in many places by high, steep bluffs, and smaller tributary streams enter it through gorges. The headwater branches of streams tributary to both the Chattahoochee and Flint rivers create a much dissected terrain. The soil for the most part is a reddish sandy-loam or clay-loam probably derived largely from the underlying early Tertiary formations [which according to Cooke (1943) are limestones, clays and sands of the Paleocene Clayton formation and the Lower Eocene Wilcox group]. The steep slopes of the moist ravines and of the bluffs along the Chattahoochee River in this area are forested with rich woods of Piedmont aspect. Mixed with Coastal Plain plants are many species not ordinarily found on the Coastal Plain. These latter plants are more northern or inland in their distribution, being either widespread throughout the eastern forests, or limited largely to the Appalachian Highlands." In these floristic aspects this region strongly resembles the Tallahassee Red Hills and the Torreya Ravines, differing from both in the larger northern element and from the latter in lacking certain of the striking endemics, i.e., *Taxus* and *Torreya*⁵ that characterize that restricted region.

2. *The Dougherty Plain.* This lowland includes the entire area which will be inundated by the Jim Woodruff Dam and hence requires special attention. As delimited by Cooke (1925) it extends

⁵Throughout this report we are following the common and scientific names used by Thorne (1954).

obliquely across Georgia from the Oconee River near Dublin southwest to the corner of the state and westward a shorter distance in Alabama and Florida. To the northwest it is bordered by the Red Hills Belt, on the southeast by the prominent escarpment bounding the Tifton Upland, and on the southwest and west by the Pine Hills Belt in Florida and Alabama. Within the circle of a 25-mile radius from the dam the Dougherty Plain occupies about two-fifths of the total area, including all the land between the Flint and Chattahoochee Rivers, a narrow strip to the east of the Flint, and considerable area west of the Chattahoochee.

The Dougherty Plain is a solution lowland developed on a belt of territory underlain by soluble limestones. Over most of its extent (in this area including in Florida much of Jackson County, in Georgia the southern third of Seminole and all but the northwestern angle of Decatur County) it is floored by the Flint River formation of Upper Oligocene age. This formation is not highly soluble. In its original condition it appears to have consisted chiefly of sandy and pebbly limestone and calcareous dirty sand. The processes of solution and weathering have removed all the lime from the exposed parts of the Flint River formation, leaving white, purple, and variegated clay and reddish or orange sand and gravel. Solution of the limestone was accompanied by silicification, producing chert masses which now lie scattered over the surface in many places or stand partially exposed around the edges of sinks and ponds. Much of the sand and clay which mantle the bedrock in the Dougherty Plain is residual from the Flint River formation, but the grayish surface sands are of Pleistocene marine origin.

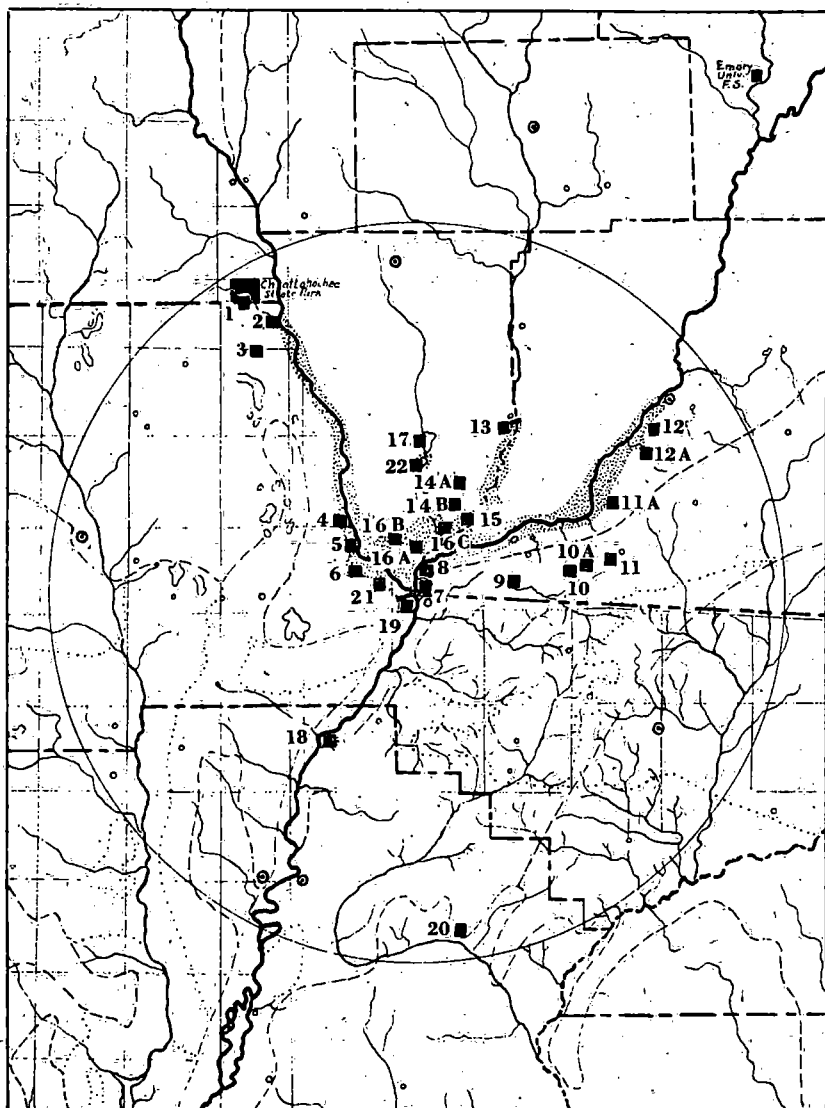
Everywhere underlying the Flint River formation and exposed at the surface in a part of the Dougherty Plain, is the soft, porous, highly soluble Ocala limestone of Upper Eocene age. Its presence is the principal factor responsible for the appearance of this region. It forms the bedrock immediately beneath the superficial mantle in all of Houston County in Alabama, north-central Jackson County in Florida, and northern Seminole and northwesternmost Decatur Counties in Georgia. In Jackson County the similarly soft and soluble Marianna limestone or "chimney rock," of Vicksburg (Middle Oligocene) age, occurs above the Ocala in a limited area around Marianna, overlapped by the Flint River formation.

The more striking topographic and drainage features of the Dougherty Plain are all the result of solution. Solution of the Ocala limestone has not only lowered the surface of the region to a level controlled by the water-table, but has also transformed the upper part of the

rock into a cavernous mass full of cavities and communicating passages, through which flows most of the drainage and into which has slumped much of the disintegrated residue of the Flint River formation. The resulting topography is notably flat, but with many shallow, saucer-shaped depressions of all sizes up to acres in extent. For this reason Harper (1913) called the part of this region present in Alabama the Lime-sink Region, and (1914) the part in Florida the West Florida Lime-sink or Cypress Pond Region. Most of the sinks are nearly circular, rather shallow, flat-bottomed, and have gently sloping sides. Some of them contain water throughout the year, but many are dry except in rainy periods. There are very few small surface streams. Rainwater sinks rapidly into the sandy soil, and finds its way along channels in the porous limestone to issue as beautiful, blue springs along the banks of the larger creeks and rivers. Many of the larger of these springs will be submerged by the impounded waters above the dam.

The portion of the Dougherty Plain which we have considered is part of an embayment that was submerged by the sea in early Pleistocene (Brandywine time) and again in middle Pleistocene (Coharie and Sunderland time). These marine invasions left the surface covered with a veneer of Pleistocene sands, commonly grayish or grayish-yellow in hue, that partially account for the prevailingly sandy soils. In places there are reddish or orange sandy loams, loamy sands, and sandy clays formed from the residual materials of the Flint River formation, and elsewhere black clay loams derived from decay of the underlying limestone, or chocolate-colored sandy loams bordering the Chattahoochee and Apalachicola Rivers on the west. Over much of the triangle between the Flint and the Chattahoochee Rivers the surface soil is yellow or gray sand. As Harper points out, there is enough sand almost everywhere in this region to make plowing easy and to keep the roads from getting muddy.

There are three main levels in this part of the Dougherty Plain, if one counts the narrow river channels as the first and lowest. In times of low water the Chattahoochee and Flint Rivers flow with their surfaces 10 to 15 feet below the level of the flood plain, in narrow, steep-sided trenches with bare slopes and narrow stretches of shore and an occasional sand or mud bank. Above these lies the flood-plain, having an extent about as shown by the stippled areas on Map III. It is floored with recent alluvium, and contains occasional flowing springs, sometimes quite large and sometimes close to the banks of the rivers, as for example those a short distance south of the site of the Recovery ferry. The whole flood plain was originally covered by



a rather dense hardwood forest that graded from mesic hammock through swampy hammock into the black gum and cypress swamps and cypress stands in the springs. Almost the whole of this forest has been removed by bull-dozer and saw; the trees were pushed into heaps and burned; and the ground beneath churned into ridges and mud-holes by the tractor treads (Plate X, upper). Most of this necessary devastation had been accomplished before the work of the survey began, but in some places it was still in progress and in others patches of the flood-plain forest were left for unknown reasons, or because they were beyond reach of the impounded waters. Similar flood-plain forest is still accessible for study below the dam, and upstream beyond the affected reaches of the rivers.

Above the ordinary floodplain, at an elevation of 50 to 60 feet above the normal water-level, there is an extensive terrace known colloquially as the "second bottom." This terrace occupies by far the greater part of the Dougherty Plain in our territory. In places along the west side of the Chattahoochee River the stream has undercut the west bank into the edge of the terrace, which forms a low eastward-facing bluff overlooking the flood-plain across the river. Within the triangle between the Flint and the Chattahoochee Rivers the drop from the second bottom to the flood-plain is usually distinct and sometimes abrupt. In the arm of flood-plain that stretches northwest from the dam site in T. 4 N., R. 7 W., Jackson County, Florida, and which is crossed by the soon-to-be-submerged Chattahoochee River Road (Florida Highway 126), "islands" of second bottom terrace stand in what will be flooded land. On some of these, trees have been left standing, while all around them the flood-plain forest has been removed in a clean sweep. Over most of the area of the "second bottom" the soil is mostly a few inches or feet of grayish or yellowish-gray sand or sandy loam, passing downward into reddish or mottled sandy clay or clayey loam over-laying the limestone. The surface sands are mostly of Pleistocene marine derivation, while the deeper layers are mostly residual from the Flint River formation. In this part of the Dougherty Plain the prevailing topography is irregularly undulating. Steep slopes are uncommon except adjacent to streams, and streams are relatively few since most of the drainage is underground. There are occasional limestone sinks, and several large "blue" limestone springs such as Sealy's Spring on lower Spring Creek, and Blue Springs near Marianna. Ponds of all sizes, from a fraction of an acre to a few square miles, abound. Their average size is perhaps two or three acres; some are nearly circular, some irregular, and some so long and narrow that they resemble creeks. Some are open bodies of water

with marshy shores, like Ray's Lake in Seminole County, Georgia; some are occupied by stands of cypress; and some (according to Harper those with least seasonal fluctuation of water-level) are the type of tree-swamp locally called "bays," with a dense undergrowth of evergreen shrubs and vines, especially the tytys, *Cyrilla racemiflora* and *Cliftonia monophylla*.

Locally the Dougherty Plain shows peculiarities that add to the variety of its environments. Thus Harper describes a strip a few miles wide along the west side of the lower Chattahoochee and the Apalachicola which seems to him almost entitled to rank as a separate natural region. "Much of its soil is a chocolate-colored sandy loam, evidently much above the average. . . in fertility. [In this strip] the ground-water level exhibits some curious irregularities. A few miles south of Sneads . . . can be found places where the water is perpetually seeping out on gentle slopes, characterized by sandy bog vegetation, and then at the bottom of the same slope, perhaps fifty yards away, may often be found a lime-sink with no water in it, showing that the ground-water surface is more irregular than the surface of the ground in such places."

2a. *The Marianna Red Lands.* A somewhat more distinctive area around Marianna was set apart by Harper under the name Marianna Red Lands. It is approximately coincident with the extent of the exposures of the Marianna limestone, already mentioned, and is drained by the headwater tributaries of the Chipola River. There are many outcrops of the Marianna limestone, capped in some places by the Byram limestone. The topography is rolling to distinctly hilly, the hills, at least in part, made up of reddish and orange sand, and sandy clay residual from the Flint River formation and up to at least 40 feet in thickness. According to the 1910 soil survey of the Marianna region the soils are prevailing reddish or brownish clay, loams, sandy loams, and fine sandy loams of the Greenville, Orangeburg and Norfolk series. The vegetation of the rock outcrops and the deciduous forests of the red clay slopes give this area a somewhat different aspect than that of the rest of the lowland; it is here treated as a subdivision of the Dougherty Plain.

A large part of the work on terrestrial animals in the present survey has been concentrated upon the environments of the Dougherty Plain, especially adjacent to the Flint and Chattahoochee rivers and in the intervening territory. Thirteen of the 20 field stations set up in 1953 are in this natural region (Nos. 1-6, 12-17, 19) and extensive sampling has been done here. In previous years Hubbell and, more

particularly, Rogers have done considerable field work in Jackson County, Florida, especially around Marianna, along Blue Spring Creek, and in the cypress-pond country east of Marianna.

3. *The Southern Uplands.* Our reasons have already been given for treating the whole upland belt that borders the Dougherty Plain on the south as a single natural region, of which the Tifton Upland in Georgia (3a) and the Pine Hills Belt in Florida (3b) are geographic sections and the Tallahassee Red Hills (3c) and the Torreya Ravines (3d) are distinguishable subdivisions. The whole belt is upheld by the relatively insoluble and resistant sands and gravels of the Miocene Hawthorn formation, capped in parts of its extent in Florida by the sands, gravels and clays of the Pliocene Citronelle formation.

3a. *The Tifton Upland.* This part of the Southern Uplands is a belt of elevated terrain that extends across Georgia from Burke County on the Savannah River to the southwestern corner of the state and into Florida, where it merges with the Pine Hills Belt. Along most of its extent its inland margin is an escarpment overlooking lower country; in our territory this escarpment overlooks the Dougherty Plain, above which it rises abruptly to a height of 100 to 150 or more feet. The trend of the scarp is from northeast to southwest, drawing closer to the Flint River as it proceeds in that direction until at a point some 10 miles south of Bainbridge the river bends to parallel the escarpment at no great distance from its base. In general the summit of the upland is a nearly level plain sloping gently to the southeast away from the edge of the escarpment. The divide between the Flint-Apalachicola and the Ocklocknee drainages lies along or not far from the rim, and no large tributaries enter the Flint from the east. Maps which show Mosquito Creek as doing so are in error; although the north branch of that stream drains the part of the Tifton Upland just north of the Florida state line and flows westward, it swings south to join the South Branch, and the creek empties into the Apalachicola River a short distance below Chattahoochee. The flat or gently rolling surface of the upland is traversed by shallow to moderately deep valleys—in Decatur County those of the headwaters of Mosquito Creek and of tributaries to the Ocklocknee River. Harper (1906) says of the Tifton Upland in general, "a straight line drawn across the country . . . would cross on an average two or three [or fewer] valleys per mile, each perhaps 20 [to 50] feet lower than the intervening ridges." The flat areas are always part of the upland, not of the valley bottoms. "In the rolling sections every little valley contains a small and often intermittent 'branch,' bordered by more or

less swamp." Sometimes the head of a "branch" is not surrounded by swamp, but by a seepage slope ("dreen") occupied by hydrophytic herbs. There do not appear any of the sandhill belts along the east sides of the creeks such as are features of other parts of the Tifton Upland. There are, however, short stretches of sand-bar and sandy bank along tributaries of Mosquito and Swamp Creeks.

For this natural region, as for the others here discussed, no adequate account of the soils can be given, for lack of published accounts in which the modern soil classification is followed. The upland soils have been almost wholly derived from the sands and clays of the ubiquitous Hawthorn formation, above which a widespread sheet of gray or grayish Pleistocene sand was spread. Today in many parts of the upland a thin sandy surface soil is underlain at shallow depth by red, yellow, or mottled clay subsoil which becomes exposed on hillcrests and valleysides. In other places the surface sands overlie deep sandy subsoil which may be yellow, brownish, reddish, or mottled; such soils are well to excessively drained. In earlier and less critical days, soils of the first sort would probably have been classed as Greenville or Tifton (the subsoil in the latter full of brown iron concretions), and the deep sands of the second type as Norfolk if the subsoil was yellow or brownish, or as Orangeburg if it was red. Today the soils are divided into many soil types belonging to several soil series. However, in his map of Florida vegetation types, Henderson (1939) has performed a service by grouping the upland soils into "clay pine lands" and "rolling sandy pine lands"—a useful distinction and one of practical application in the field. The areas of these soil-vegetation categories shown by Henderson, though highly generalized, conform quite well with our own field observations. Most of the Tifton Upland in Decatur County is of the "clay pine land" type but with areas, mostly too small to map, of the "rolling sandy pine land" type.

Harper (1906) first described the Tifton Upland as a natural region, under the name "Altamaha Grit Region of Georgia." He was at that time attempting to correlate topography and vegetation with geology, and to equate phytogeographic districts with the areal distribution of particular rock formations. He stated that "in Georgia, and especially in the Coastal Plain . . . similar types of topography and vegetation seem almost invariably to indicate similar geological conditions; and for an area of that size and character a phytogeographic classification based on geology seems to be the only logical one." And again, "The most satisfactory system of geographical classification of the vegetation of temperate Eastern North America is one based on geology . . . The Altamaha Grit Region of Georgia is cen-

trally located and otherwise fairly typical of the Coastal Plain, in many respects homogeneous, and in some respects unique. Its boundaries are fairly well defined, and its flora differs perceptibly from that of adjacent regions." With increased knowledge of the geology of the Coastal Plain it was found that the "Altamaha Grit" was an artificial stratigraphic unit made up of lithologically similar parts of formations ranging in age from Oligocene to Pleistocene. The name therefore no longer has any geological standing; but Harper's "Altamaha Grit" did actually correspond in great part to the Miocene Hawthorn, and his "Altamaha Grit Region" to the Tifton Upland. His description remains our fullest and best account of the topography, soils, and vegetation of this natural region as a whole.

According to Harper, the level uplands and upper slopes of this region were originally occupied by a superb open forest of longleaf pine, that was present over more than half the total area, and occurred on both sandy and clay soils. Much of it was carpeted with wire-grass, and the whole region was called by the local inhabitants the "Wire-grass Region." Most of the land has now been cut over, and some of it is under cultivation; but Harper has pointed out that so far as the herbaceous undergrowth of such forests is concerned, clearing has little effect. Although a forest, the pineland is essentially an unshaded region for the trees grow far apart; as Harper says, "from any point an unobstructed view of about a quarter of a mile can usually be had." The undergrowth is made up of plants adapted to endure and to require direct sunlight, and is little affected by removal of the pines, although the resultant increase in the oaks of the original understory somewhat increases the amount of shade and leaf-litter. In exceptionally dry and sandy situations the proportion of oaks to pines was always higher than elsewhere, and such places were known to the inhabitants as "oak-ridges." Although deforestation has proceeded far, examples of the dry upland pine forests are still to be found, and the scrub oak type, dominated by turkey oak (*Quercus laevis*) and upland willow oak (*Q. incana*) has greatly increased in extent. Other environments, associated with streams, poorly drained flats, and ponds, are also present in the Tifton Upland. The various habitats of the region were studied mainly in Decatur County, Georgia.

3b. *The Florida Pine Hills.* This part of the Southern Upland is identical with Harper's (1914) West Florida Pine Hills region, except for unimportant differences in boundaries. It is continuous with the Tifton Upland in Georgia, and in Florida forms a belt extending from east of the Apalachicola River westward beyond the limits of the

state. The part east of the river is the western end of Cooke's (1939) Tallahassee Hills, while that west of the river is his Western Highlands. Geologically this region differs from the Tifton Upland by having a variably thick cover of Citronelle formation above the Hawthorn. An apparent difference between the eastern and western parts is unreal; east of the Apalachicola the Citronelle overlies the Hawthorn; west of the river it overlies the Chipola; but it is only by convention that the line between the two last-named contemporaneous Miocene formations is drawn along the river.

In this belt, as in the Tifton Upland, both clay pineland and sandy pineland occur, but the latter predominates, especially along the coastward margins of the region. The sandy soils would have been classed, under the old system, mostly as belonging to the Norfolk and Orangeburg series. Because of the prevalence of deep, well-drained sands, there are fewer gullies and ravines, and more rolling topography. Stream valleys on the higher parts are generally V-shaped with almost no swamp, but on the lower areas near the coastal flatwoods they may be flattish and savannah-like, with acres of boggy wet pine land. Many of the headwater branches, like some of those of Telogia Creek in Georgia, head in amphitheaters or "steep-heads" formed around springs, or surrounded by seepage slopes. A short distance west of Hosford, Florida (Sta. 20) a considerable expanse of hillside consists entirely of seepage slope, giving rise to a peculiar sort of bog, in many respects different from any encountered elsewhere, and in which some unusual species of Orthoptera and craneflies were found.

In the Florida Pine Hills, as on the Tifton Upland, remnants of the original longleaf pine forest are present, especially along the less accessible ridges between the Torreya Ravines. In the regions of sandy soils large areas, such as that to the east of Bristol, are now occupied by an almost solid stand of scrubby oaks, chiefly turkey oak (*Quercus laevis*), small post oak (*Q. margaretta*), and upland willow oak (*Q. incana*) on what was once pineland. The resulting environment scarcely differs from that of the sand hills in central peninsular Florida, described by Laessle (1942). Today large areas of such land are being cleared of forest by the use of mechanized equipment. In Liberty and Gadsden Counties the trees are being uprooted and pushed into windrows to decay, leaving the sandy soil bare for the planting of improved pastures. Should this venture prove profitable and be continued to its logical conclusion, the scrub oak upland habitat will largely disappear, and with it may be expected to go a number of localized species of Orthoptera and doubtless other animals and plants of equally restricted distribution.

3c. *The Tallahassee Red Hills.* This subdivision of the Southern Uplands is distinguished largely on the basis of its greater surface irregularity and the predominance in it of hardwood forest. Its boundaries are quite indefinite; but in general it is that part of the upland (lying southeast of the Tifton Upland) which has been rather extensively dissected by the Ocklocknee River⁶ and its tributaries. It may be taken as extending from the vicinity of Quincy in Gadsden County eastward past Tallahassee. Harper (1914) included its western part, around Quincy, in his Middle Florida Hammock Belt, which was shown as almost surrounding the Tallahassee Red Hills, the latter being limited to the area immediately about Tallahassee. Cooke (1939) included in his Tallahassee Hills all of the uplands from the Apalachicola River to the peninsular Central Highlands.

The Tallahassee Red Hills have been carved out of the same land mass as that which forms the rest of the Southern Uplands, and largely from the Hawthorn formation. Apparently the Upland Plain which formerly extended far to the eastward remains, largely undissected, in the region east of the Apalachicola River. The greatest elevation of that upland is about 300 feet above the sea; the Tallahassee Red hills in Gadsden County have a general slope eastward and south-eastward from a maximum of about 250 feet elevation in the west to 50 to 100 feet elevation near the Ocklocknee River. The surface is much dissected by stream valleys of all sizes; there are deep ravines in the region around Quincy, while elsewhere the surface may consist largely of gentle slopes and rounded summits; there is little or no level upland, and only narrow flood-plain strips border the larger streams. In the portion of this region with which we are concerned there is little evidence of the work of solution, but a little farther east in Leon County, where much of the Hawthorn has been removed from above the underlying limestone, there are many sinks and several large solution basins occupied by "disappearing lakes" as described by Sellards (1914). The region is so highly diversified in topography, soils, and vegetation, that it is not easy to characterize or delimit. It derives its name "Red Hills," however, from the fact that the subsoils are red or reddish sandy loams and clays over much of the area.

The wooded hillside and rich development of hardwood and pine forests give this region a resemblance to some parts of the Piedmont of Georgia and the Carolinas, and to the Red Hills Belt of Geor-

⁶The name of this river is variously spelled on maps and in geological reports as Ocklockonee, Ochlocknee, Ochlockonee, and as given above.

gia. Beeches and large deciduous oaks form a considerable part of the forest. The upland woods are more mesic than are the "high hammocks" of peninsular Florida, and the lowlands have either rich hardwood swamps or wet, boggy woods. The ravines around Quincy, with their clear, swift, sand-bottomed streams, resemble the Torreya Ravines along the Apalachicola River except in the absence of some of the characteristic endemic plants and animals found in the latter (see below).

The country around Tallahassee to which Harper restricted the region for which we have adopted his name "bears much the same relation to the adjoining hammock belt that the Marianna Red Lands do to the West Florida Cypress Pond Region. . . . Each is similar geologically to the country bordering it on the east, north, and west, but is characterized by richer, redder soils, more hilly topography, a scarcity of long-leaf pine, and other characters . . ." Differences of 100 feet in elevation in less than half a mile are common. Solution has had a hand in producing the topography; there are no through-flowing streams, and ponds and sinks occur in the low grounds. The region seems originally to have been covered with mixed hardwood forests of southern red oak, hickory, and dogwood, along with short-leaf pine (*Pinus echinata*).

3d. *The Torreya Ravines and Bluffs.* On account of its botanical peculiarities this natural region (a subdivision of the Southern Uplands in our classification) has become widely known in spite of its very small extent and geographic unimportance. It is, in fact, merely the steep, west-facing escarpment of the Florida Pine Hills that overlooks the Apalachicola valley between Bristol and Chattahoochee, and is continuous with the escarpment of the Tifton Upland overlooking the Flint River and the Dougherty Plain. In the short section from just north of Chattahoochee to Alum Bluff, a little north of Bristol—a distance of some 13 miles—this escarpment, rising 150 to 200 feet above the river, is carved into a series of bluffs and deep ravines or rich valleys. The bluff and ravine area is narrow and its extent hard to estimate, but although the valleys of the larger streams (Mosquito Creek, Flat Creek, Crooked Creek, and Sweetwater Branch) extend back several miles into the upland, the actual area of ravine and bluff was thought by Harper to be not over 50 square miles. Although physiographically it is no more than the dissected edge of the upland, biotically it may be regarded as a small but distinctive natural region characterized by its peculiar mixture of Coastal Plain and northern plants and animals, and by the presence of a group of remarkable relic species restricted

to the region. Some of its peculiarities were pointed out by Croom as long ago as 1833-1835 and Asa Gray (1875) made the region famous by his paper, "A Pilgrimage to Torreya."

Aspalaga Bluff, in Gadsden County, rises about 175 feet in a distance of a quarter of a mile from the river's edge, and Rock Bluff in Liberty County is only a little less high. Alum Bluff, a short distance above Bristol, is the southernmost of the high bluffs. It has a very steep face about 160 feet high, undercut by the river at its base, and according to Harper is perhaps the most conspicuous topographic feature in all Florida. Between the bluffs are many short, steep-sided ravines and small valleys, which commonly head in amphitheaters or "steep-heads" at the edge of the upland. All the valleys have swift, sand-bottomed streamlets generally rising in springs in the "steep-heads" and fed by seepages from the valley-sides. In the entire stretch from the Georgia line to Alum Bluff there are only the four larger creeks already mentioned. The lower courses of these are bordered by narrow floodplain belts with swampy forest, but their headwaters and tributaries have cut back some miles into the upland.

The characteristics of the biota of this natural region have been described many times, and for this report it will suffice to quote what was said of them by one of the collaborators in the present survey. Rogers (1933), describing the Torreya Ravines primarily as crane-fly habitats, says of them, in part:

Botanically, the cool humid ravines of this very restricted area have long been of great interest as the habitat of two endemic and very disjunct coniferous trees, *Tunion taxifolium* [*Torreya taxifolia*] (Torreya) and *Taxus floridana* (Florida yew). Many other trees of these densely wooded ravines are of interest in that they occur in but a few or no other places in Florida and are only to be found commonly elsewhere much further north. In fact, the general aspect of the flora of these ravines reminds one of regions in the Piedmont, despite the inclusion of a large number of typical Florida plants. Beeches (*Fagus grandifolia*) [*F. g.* var. *caroliniana*] vie with magnolias, spruce pine (*Pinus glabra*) and Torreya as the most abundant trees, and these, with sweet gum, yellow poplar (*Liriodendron tulipifera*), white oak, sugar maple (*Acer floridanum* [*A. Barbatum*]) hornbeam, red bud, holly and needle palm (*Rhaphidophyllum hystrix*) make up the bulk of the more conspicuous vegetation. A heavy leaf mold is present and herbs are scarce, but *Mitchella repens*, *Trillium* sp., *Sanguinaria canadensis*, *Hepatica triloba* [*H. americana*] and *Uvularia* sp. occur here and there on the steep slopes and contribute to the northern aspect of the vegetation. Small sand-bottomed brooks flow along

these ravines and often pass into short swampy reaches where they wander through tangles of standing and fallen vegetation and over deposits of rich organic silt. Near the bottom, springs and seepage areas are common, and wet rotten wood, fungi, mosses and liverworts are abundant. The fauna of these ravines is as surprising and interesting as their flora, for here a number of animals reach their southernmost limits, frequently disjunct from the remainder of their ranges. In the Amphibia, Crustacea, Odonata, Ephemerida and Orthoptera, a number of unexpected northern species or species with distinct northern affinities have been discovered, and among the crane flies more than a dozen species are found that have been taken nowhere else south of the Piedmont region.

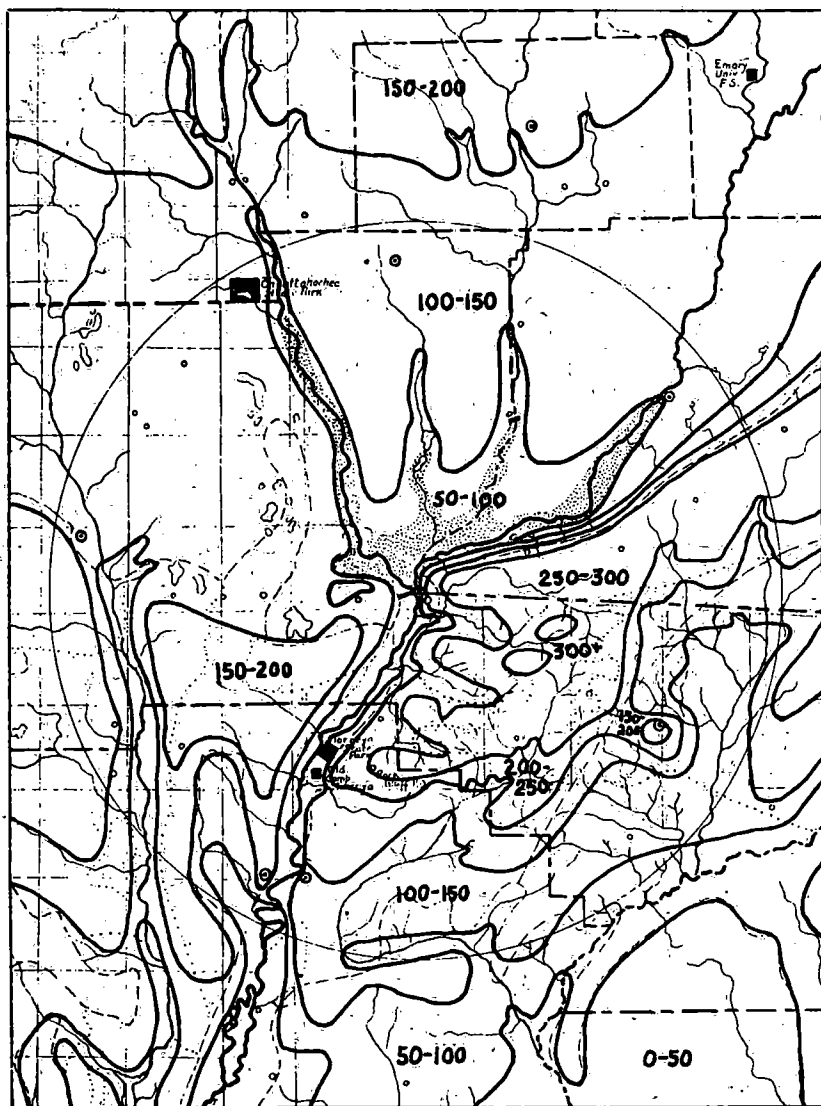
Of the Orthoptera of the ravines some are endemic species, apparently confined to this very small region.

Between 1923 and 1935 Rogers, Hubbell, and several of their associates and students made many visits to the Torreya Ravines. Most of the work was done in and around a very deep, narrow, east-west trending ravine at a point about 3.2 miles west by south from Rock Bluff Post Office, on the old road to Bristol. This ravine parallels Sweetwater Branch at a distance of a mile or less to the north, and has a total length of a little more than a mile from its mouth on the narrow Apalachicola River floodplain to its two-forked head. Within a quarter of a mile of its spring-fed beginnings it is 100 feet deep, with a small permanent stream in its bottom; this stream, however, disappears before reaching the river during dry seasons. The old Bristol road runs for a quarter of a mile along the south rim of the ravine near its head, before bending south to cross Sweetwater Branch about a mile farther on, via an old concrete bridge near the site of the former settlement of Watson. Where the road parallels the ravine it is bordered on the south side by a sandy, brambly pine-studded field, sloping away from the road and the lip of the ravine. Here parties visiting the region used to camp, sometimes for weeks at a time, and the camp-site and adjacent ravine were known to those who worked there as "Camp Torreya." Situated in or near Section 21, T. 2 N., R. 7 W., "Old Camp Torreya" (as it is now called) became an important biological landmark. Unknown by name to the local inhabitants and unmarked on maps or by any monument, it is the type locality of various interesting species of insects and other invertebrates, and the place where much field work has been done on the ravine biota. Some of the species described from this ravine have never been found elsewhere, even in any other part of this restricted region. Compared with the wide, sunny, relatively dry ravines in

Torrey State Park, a few miles to the north, the one at "Old Camp Torrey" is very narrow, deep, and steep-sided, as well as more moist and more densely shaded. It contains a small spring-fed, sand-bottomed brook that is permanent in its upper stretches. The vegetation is more mesic and contains more shade-tolerant plants than that in the larger ravines in the park.

"Old Camp Torrey" ravine was damaged by lumbering in the 1930's, when some of its larger hardwood trees were removed and much incidental devastation done. At that time it was thought to have been irreparably injured, but a visit in 1954 showed that the damage had been less in amount and extent than had been supposed, and that the ravine has made a remarkably complete recovery. Two species of Orthoptera described from it were found again, for the first time in many years; they have never been found in Torrey State Park, in spite of careful search on various occasions.

4. *The Coastal Flatwoods.* The fourth great physiographic region represented is the belt of lowland between the Southern Uplands and the coast, made up of a series of late Pleistocene marine terraces. We have already mentioned the submergence of early and middle Pleistocene that covered much of the upland and formed an embayment that penetrated along the Apalachicola valley far into the Dougherty Plain. Those of late Pleistocene, by contrast, merely lapped against the face of the Southern Uplands and extended into them along sounds and estuaries that are now stream valleys. During each stand of the sea, the waves cut a shallow horizontal notch into the edge of the land, the upper edge of which was at the shore; the terrace of that stage begins with the rather abrupt slope on the face of this notch, and extends seaward in a gentle slope to the edge of the notch with which the next lower terrace begins. Four such marine terraces of late Pleistocene age fringe the Coastal Plain from Virginia to Alabama. From innermost and highest to outermost and lowest these are: Wicomico, 100-70 feet; Penholoway, 70-42 feet; Talbot, 42-25 feet; Pamlico, 25 feet and lower. In regions that have been topographically mapped the individual terraces can often be traced in detail; but where this has not been done, as in our territory, their boundaries are often hard to see in the field. Map IV, accompanying this report, was drawn to show the approximate locations of the 50, 100, 150, 200, 250 and 300 foot contours. It was based on all elevations published for the region, on the map by Sellards and Gunter (1918) showing the generalized 100, 200, and 300 foot contours in the area between the Apalachicola and Ocklocknee Rivers,



Map IV. Approximate location of critical contour lines in the Chattahoochee region.

and on personal observations and drainage indications. Although it is admittedly inaccurate, it does show the general configuration of the land surface, and the fact that only the inner edge of the coastal terraces comes within a 25-mile circle around the dam. Comparison of Maps II and IV will reveal the fairly good agreement between the inner edge of the Coastal Flatwoods as delimited by Harper and Henderson and the inner edge of the Wicomico terrace as indicated by the 100 foot contour.

Harper (1914) described this region as the Apalachicola Flatwoods, and the following characterization is based largely on his account. The surface slopes gently seaward and is essentially flat. There are, however, many shallow stream channels occupied by sluggish rivers and creeks with clear but coffee-colored water, and innumerable shallow ponds and bays. Over wide expanses, where the surface stands a little above normal ground-water level, the soil is Leon sand, a groundwater podzol with grayish sandy surface and a hardpan at depths of 1 to 3 feet. Here the flatwoods, of longleaf or a mixture of longleaf and slash pine, has an undergrowth of wire-grass and gallberry, often mixed with saw palmetto. In the more poorly drained areas there are many half-bog soils, more or less patchy and occurring over smaller or larger areas. One of the most widespread is the Plummer series, including much of what is locally called the "crayfish lands"—wet flatwoods with an undergrowth of wire-grass, pitcher plants and sedges, with *Rhexia* and sundew common, and characteristically dotted with crayfish "chimneys." Depressions are cypress ponds or bays; according to Harper, cypress occurs where the water level fluctuates three or four feet each season, cypress and slash pine where the fluctuation is only about two feet, and bays where the water is not too deep and the fluctuation a foot or less in amount. The bays are occupied by dense growths of trees and shrubs, the latter largely of the two species called "tyty." Along the streams are swampy forests of various kinds and extents.

Little work in the current study has been done in the Coastal Flatwoods. In previous years Rogers and Hubbell sampled the region in a few places, and the survey party of the spring of 1954 made a few collections in it. The insect fauna is probably very similar to that of the flatwoods of peninsular Florida; but a certain amount of endemism may be expected, in the light of what has been found in the crayfishes by Hobbs (1942) and in the water-beetles by Young (1954).

In concluding this brief account of the natural regions represented in the area surrounding the Jim Woodruff Dam, we may emphasize a point that Harper has made. This is that each natural region is

distinguished from the others only by showing a preponderance of certain environmental features, or a special combination of features. Some of these same environments will also occur in the other regions, but less extensively or less typically. Thus flatwoods are characteristic of the Coastal Flatwoods region, but tongues and patches of flatwoods also occur in the lowlands around Marianna, in the Tallahassee Red Hills, and even, in not very typical form, in a few places in the Tifton Upland. In a given region conditions are such that a given micro-environment may be expected to occur frequently, occasionally, or only rarely, if at all.

A CLASSIFICATION OF THE MAJOR HABITATS

Most of the important animal habitats of a region consist either of the plant communities, taken as larger or smaller aggregates, or of special situations created by or associated with such communities. A classification of the animal habitats therefore requires a classification of the plant communities. Any attempt to understand the local occurrence and geographic distribution of the elements of a regional fauna must rest upon thorough knowledge of the region and especially of its vegetation. Of course, no scheme of classification of habitats and no set of categories can be made that will meet the varied needs of students of different animal groups, except perhaps in its broad aspects. There are in the southeastern Coastal Plain, however, such striking contrasts in soils and drainage and such conspicuous differences in the types of vegetation found in different areas that we may recognize certain major habitats which tend to carry the same floras and faunas wherever they occur. They are often sharply delimited from one another in a given territory, and it is usually possible to make a local classification that works well and includes most of the locally-occurring types of environment. It is such a classification that we here attempt to present. The real difficulty with all such classifications comes when we try to extend them over wider areas; changes appear in a given type of environment, and we include more and more deviant phases until we suddenly realize that we are dealing with a very different sort of habitat in western Florida, for example, than the one with which we began in the peninsula, and for which we have been using the same name. In spite of such difficulties, the description and classification of local habitats is necessary and useful for an understanding of local distribution and ecology. It is apparent that this is true for terrestrial animals almost without regard to group. Thus, for animals that live in soil, it is soil type and

moisture relations that are important, and not whether pines or magnolias grow above; but the conditions in the soil in a magnolia hammock are very different from those in a pine flatwoods, and the soil fauna reflects this fact. By contrast, other animals live not in some special situation, but in a whole environment; a squirrel uses the forest, from tree-tops to soil. And for many animals it is not the species composition of the vegetation that is important, but its life form in Raunkier's sense.

In classifying the habitats of the Jim Woodruff Dam area we have encountered a number of difficulties, some of which can be overcome while some cannot. *First*, is the lack of detailed knowledge of the plants and plant communities of the region. *Second*, is our lack of information about the soils of the region. It would seem highly desirable that a competent specialist be obtained to make a reconnaissance of the region and to make detailed studies at selected stations for correlation with plant communities. *Third*, is inadequate knowledge of the distribution and areal extent of the important plant communities of the region. *Fourth*, there is often no sharp break in the vegetation on clays; even when topographic changes are considerable. This is due in part to the great water-holding capacity of such soil. The much freer percolation and movement of ground water in sands results in markedly different water relationships, even when topographic changes are slight, and this is reflected by much sharper vegetational changes, i.e., narrow ecotones. *Fifth*, much of the vegetation has been disturbed by lumbering, grazing, fire, etc., and is in such a state of flux that it is difficult to classify in any of the systems which have been proposed for use in consideration of natural units or typical communities.

A final difficulty in deciding upon a usable and comprehensive classification of the habitats of this region was encountered when we tried to reconcile the descriptions given and the nomenclature used by various previous workers in this and adjacent regions. This difficulty is much like that which we encountered in dealing with the natural regions, and we ended in much the same way, with a feeling that there is a much higher degree of accord than would at first appear. In Table I we give a tentative classification, based in part on Braun's monograph on deciduous forests, Thorne's work in Georgia (Preliminary MS), in part on Harper's studies (1906, 1913, 1914), and in considerable part on our own observations. This table also gives a partial synonymy as we have worked it out, and the degree of agreement of our classification with earlier ones. Following the table the habitats are briefly listed with comments, an assignment to them

of station and field numbers, and an estimate of their area extent by assignment to one of four classes, in each of the four major natural regions.

No attempt is made to describe these habitats in any more than a tentative and general way in this report.

In addition, Braun (1950), breaks down the Evergreen Forest Region of the Eastern Deciduous Forest Formation as follows:

1. Pine and Pine-Oak Forest Communities
 - a. Longleaf Pine Forests
 - b. Pine Flats, Savannahs and Bays (Bogs are treated here)
 - c. Loblolly Pine and Pine-Hardwoods Forests
 - d. Slash Pine Forests
2. Prairies and Associated Forest Communities
3. Swamp Forests of the Uplands (Bogs are treated here)
4. Bottomland Forests
 - a. Swamp Forests (Cypress-tupelo)
 - b. Hardwood Bottoms
 - c. Ridge Bottoms
5. Hardwood Forests of the Uplands and Slopes
 - a. Oak-Hickory Forest
 - b. Mesophytic Mixed Hardwoods
 - c. Beech-Magnolia Forest
 - d. Evergreen Oak Forest

In the brief treatment of these vegetational types which follows, close correspondence to Braun's is found in most of the wooded situations. Such similarities are noted under each habitat.

In the following list the abbreviations are:

Regions: 1—Red Hills Belt; 2—Dougherty Plain; 3—Southern Uplands; 3a—Tifton Upland; 3b—Florida Pine Hills; 3c—Tallahassee Red Hills; 3d—Torreya Ravines and Bluffs; 4—Coastal Flatwoods.

Prevalence: W—widespread; M—moderately extensive; L—localized but general; R—localized, uncommon or unique.

1. DRY PINELAND

Formerly the prevailing habitat type in much of the region, covering most of the areas of better-drained soils with open stands of longleaf pine (*Pinus palustris*) and wire-grass (*Aristida stricta*). Now much restricted by logging, cultivation, and fire. Occurring on sand (a) and on clay (b) soils. 2-L; 3-L or M; 4-L. This is essentially the same as Braun's "Longleaf Pine Forest."

2. DRY OAKLAND

Largely consists of former dry pineland from which the longleaf pine has been removed by logging or burning, permitting the land to become dominated by several species of oaks including southern red oak (*Quercus falcata*), black-jack (*Q. marilandica*), post oak (*Q. stellata*), small post oak (*Q. margaretta*), upland willow oak (*Q. incana*) and turkey oak (*Q. laevis*) with some mockernut (*Carya tomentosa*), dogwood (*Cornus florida*) and persimmon (*Diospyros virginiana*). Occurs on sand (a) and on clay (b) soils. 2-M; 3-W; 4-L. This is close to Braun's "Oak-Hickory Forest."

3. SANDY OAK-BARRENS

Open stretches of white or light-colored sand along parts of the larger streams and especially in the angle between the Chattahoochee and Flint Rivers, supporting a sparse growth of turkey oak (*Quercus laevis*), bluejack or upland willow oak (*Q. incana*), small post oak (*Q. margaretta*) longleaf pine (*Pinus palustris*) and hawthorn (*Crataegus michauxii*). 2-L or R. This is, no doubt, a facies of Braun's "Longleaf Pine Forest."

4. SANDY HAMMOCK

Perhaps the climax type of vegetation in this region on both clay and sandy soil. The trees and shrubs are predominately evergreen and wild flowers are very scarce. Beech (*Fagus grandifolia* var. *caroliniana*), magnolia (*Magnolia grandiflora*), pignut (*Carya glabra*), laurel oak (*Quercus hemisphaerica*), hop hornbeam (*Ostrya virginiana*), spruce pine (*Pinus glabra*), dogwood (*Cornus florida*) and holly (*Ilex opaca*) are the most common trees; wild-olive (*Osmanthus americanus*), horse-sugar or sweet-leaf (*Symplocos tinctoria*) witch-hazel (*Hamamelis virginiana*) are the characteristic shrubs. Its aspect is quite different

TABLE I. HABITAT, VEGETATION TYPE, AND PLANT COMMUNITY EQUIVALENT

This Report	Laessle: Welaka	Harper: C. Fla.	Thorne: SW Ga.	Henderson: Fla.
A. TREE-OR-SHRUB-DOMINATED COMMUNITIES				
I. On well-drained soils				
1. <i>Dry Pineland</i>			Dry Pineland	
a. On sand	Sandhills	High pine land		Rolling sandy pineland
b. On clay				Clay pineland
2. <i>Dry Oakland</i>			Dry Oakland	
a. On sand	Sandhills (part)	High pine (part)		Sandy pineland (part)
b. On clay				Clay pineland (part)
3. <i>Sandy Oak-barrens</i>			Sandy oak-barrens	
4. <i>Sandy Hammock</i>	Mesic hammock	Sandy High Hammock	Sandy Hammock	
a. Open tree canopy				
b. Closed tree canopy				
5. <i>Rich woods (Ravine Forest)</i>			Rich woods	Red clay hammock land
6. <i>Stream Bank Woods and Thickets</i>			Stream banks	
II. On seasonally flooded areas:				
<i>Hydric</i>				
7. <i>Floodplain Forest</i>			River bottoms	
8. <i>Alluvial Swamp</i>	River swamp	Swamps	Alluvial swamp	Swamp
9. <i>Cypress Ponds</i>		Cypress ponds	Cypress ponds	
10. <i>Bayhead (Bay)</i>	Bayhead	Bays		
III. On poorly drained soils:				
<i>Xero-hydric</i>				
11. <i>Pine Flatwoods</i>	Flatwoods	Low pine land	Moist pineland	Flat pine land
a. Long-leaf pine*	Long-leaf pine			
b. Black pine-Fetterbush*	Black pine-Fetterbush			
c. Slash pine	Slash pine			
1. Marginal thicket type	Marginal thicket type			
2. Pitcher-plant type				

TABLE I. (continued)

This Report	Laessle: Welaka	Harper: C. Fla.	Thorne: SW Ga.	Henderson: Fla.
B. HERBACEOUS COMMUNITIES:				
Hydric				
IV. <i>On seasonally flooded areas</i>				
12. <i>Fluctuating pond margins</i>	Grassy pond margins		Grassy limesink ponds	
V. <i>On permanently saturated soil</i>				
13. <i>Bogs</i>	Bogs		Bogs	
VI. <i>In water</i>				
14. <i>Emergent vegetation</i>	Emergent Association			
15. <i>Floating vegetation</i>	Floating Association			
16. <i>Submerged vegetation</i>	Submerged Association			
C. RUDERAL COMMUNITIES:	Areas which have been considerably disturbed by man, except by fire and lumbering			
17. <i>Planted or managed forest</i>				
18. <i>Old fields and pastures</i>	Old fields			
18.A. <i>Lawns and grazed meadows</i>	Lawns			
19. <i>Roads and roadsides</i>	Roads and Roadsides			
19.A. <i>Bull-dozed floodplain areas</i>				
20. <i>Roadside ditches</i>	Ditches			

*None of the flatwoods in the Woodruff Dam area, except the barely touched-upon coastal flatwoods, have the characteristic hardpan that Laessle encountered at Welaka, but have clay sub-soils and while vegetational similarities occur, the communities are by no means alike.

according to whether it occurs in open (a) generally disturbed, or closed (b) stands. 2-M; 3-L; 4-R. This falls within Braun's "Beech-Magnolia Forest," the climax of the region.

5. RICH WOODS OR RAVINE FOREST

In ravines and in bluffs along the Chattahoochee River, the Flint River in southern Decatur County, Georgia, the Apalachicola River in Florida, and in the Tallahassee Red Hills region. The trees and shrubs are predominantly deciduous, and the numerous species of wild flowers bloom mostly in the spring. Some of the more common trees are beech (*Fagus grandifolia* var. *caroliniana*), white oak (*Quercus alba*), sugar maple (*Acer barbatum*), magnolia (*Magnolia grandiflora*), umbrella tree (*Magnolia fraseri*), big-leaf magnolia (*Magnolia macrophylla*), dogwood (*Cornus alternifolia*), arrow-wood (*Viburnum acerifolium*), Carolina allspice (*Calycanthus floridus*), and oak-leaf hydrangea (*Hydrangea quercifolia*).

The deep, steep-sided, moist ravines are characterized by needle-palm (*Rhapidophyllum hystrix*), fetterbush (*Leucothoe axillaris*), hydrangeas (*Hydrangea arborescens* and *H. quercifolia*), climbing hydrangea (*Decumaria barbara*), calico-bush (*Kalmia latifolia*), rhododendron (*Rhododendron minus*), and venus-hair fern (*Adiantum capillus-veneris*). Those in the Torreya Ravines and Bluffs region also have an abundance of torreya (*Torreya taxifolia*) and an occasional Florida yew (*Taxus floridana*). 1-L; 3a-R; 3b-R; 3c-L; 3d-M. This also falls within Braun's "Beech-Magnolia Forest."

6. STREAM BANK THICKETS AND WOODS

The margins of rivers and creeks where not bordered by high banks or low muddy swamp; characterized by a large variety of trees and shrubs. Among the trees are bald-cypress (*Taxodium distichum*), black willow (*Salix nigra*), poplar (*Populus deltoides*), river birch (*Betula nigra*), sycamore (*Platanus occidentalis*), catalpa (*Catalpa bignonioides*), water locust (*Gleditsia aquatica*), water hickory (*Carya aquatica*), ash (*Fraxinus pennsylvanica*), water ash (*Fraxinus caroliniana*), and tupelo gum (*Nyssa aquatica*). Box-elder (*Acer negundo*), silver maple (*Acer saccharinum*) and buckthorn (*Bumelia lycioides*) are according to Thorne, largely limited to the banks of the Chattahoochee River.

We have found no exception to this. 1-L; 2-L; 3-R; 4-R. This is close to Braun's "Hardwood Bottoms."

7. FLOODPLAIN FOREST

Flat, low woods on the river bottomlands, subject to flooding. In addition to many of the Stream Bank species, the following are common; overcup oak (*Quercus lyrata*), basket oak (*Quercus michauxii*), winged elm (*Ulmus alata*), possum-haw (*Ilex decidua*), swamp-privet (*Forestiera acuminata*), water oak (*Quercus nigra*), hackberry (*Celtis laevigata*), and sweet gum (*Liquidambar styraciflua*). This habitat is variable and grades into 3, 4, 6 and 8. 2-W; 3-L; 4-R. This clearly corresponds to Braun's "Hardwood Bottoms."

8. ALLUVIAL SWAMP

Along the rivers and larger creeks; often far back from the banks of the river, there occur stands of river or bald-cypress (*Taxodium distichum*), tupelo gum (*Nyssa aquatica*), water-elm (*Planera aquatica*) and many somewhat less abundant species such as water gum (*Nyssa sylvatica* var. *biflora*), red maple (*Acer rubrum*), swamp-ash (*Fraxinus caroliniana*), willows (*Salix nigra* and *S. caroliniana*). Grades into 7 and 10. 1-R; 2-M; 3-L; 4-M. This is nicely covered by Braun's "Swamp Forest."

9. CYPRESS POND

Permanent or nearly permanent ponds with considerable fluctuation of water-level, surrounded or filled with dense stands of pond-cypress (*Taxodium ascendens*) often with some water gum (*Nyssa sylvatica* var. *biflora*), water elm (*Planera aquatica*), red maple (*Acer rubrum*), and buttonbush (*Cephalanthus occidentalis*). Those in the Dougherty Plain region are more likely to be permanent, and to have open water with floating leaves of *Brasenia*, *Nymphaea*, *Nuphar*, *Nymphoides*, *Potamogeton* and *Cabomba*. Those of the flatwoods are more likely to be semi-permanent, with cypress throughout, often forming "cypress domes." 2-L; 3-R; 4-L or M. This is similar to Braun's "Swamp Forest of the Uplands" but lacks pond pine (*Pinus rigida* ssp. *serotina*) which she considers typical.

10. BAYHEAD OR BAY

Seepage slopes around springs or "branch heads," occupied by a more or less dense growth of predominantly evergreen shrubbery and trees, or similar growths on the slopes around the margins of flatwoods ponds and in depressions in flatwoods. The plant community is composed of species tolerant of saturated acid soils not subject to prolonged flooding. In this region the shrub-thickets generally include much tyty (*Cliftonia monophylla* and *Cyrilla racemiflora*), white bay (*Magnolia virginiana*), wax myrtles (*Myrica cerifera* and *M. inodora*), gall-berry (*Ilex glabra* and *coriacea*), and swamp-bay (*Persea palustris*) with many others. Slash pine (*Pinus elliotii*) is likely to be present as relict scattered trees. This habitat grades into 8, 9, 11 and 13. 3-L; 4-M. Braun considers this a part of the "Swamp Forests of Uplands."

11. PINE FLATWOODS

As Laessle (1942) states, the term flatwoods includes several vegetationally distinct communities that are found on a considerable variety of soil types. All are characterized by occurring on poorly drained flat land, and are normally dominated by pines. The three main types recognized by Laessle in the Welaka area are apparently distinguishable in the Coastal Flatwoods of our region, together with a few others as subdivisions of them. These types are the longleaf pine flatwoods, the black-pine flatwoods, and the slash-pine flatwoods. All grade into one another and into habitats 9 and 10. 2-L or R; 3-R; 4-W.

11a. *Longleaf Pine Flatwoods*: Longleaf pine is the only common tree, forming a usually open stand, with an undergrowth of wiregrass (*Aristida stricta*) and many characteristic herbs, and with a shrub stratum containing saw-palmetto (*Serenoa repens*), usually dwarfed, fetter bush (*Lyonia lucida*), poor-grub (*Xolisma fruticosa*), dwarf live-oak (*Quercus minima*), a blueberry (*Vaccinium myrsinites*), gopher-berry (*Gaylussacia dumosa*), gallberry (*Ilex glabra*), and wicky (*Kalmia hirsuta*). This plant community occurs on Leon fine sand soils, which are extensively developed in the Coastal Flatwoods region of our territory as well as in peninsular Florida. 3-R; 4-M. Braun classifies this and the next community as varieties of Pine Flats under the more inclusive heading of "Pine Flats, Savannahs, and Bays."

[A very different type of situation, also dominated by longleaf pine and flat and poorly drained but with altogether dissimilar soil and ground vegetation, is represented at Sta. 16B]

11b. *Black-pine and Fetterbush Flatwoods*: Occurs on extremely flat areas and is always at a slightly lower level than bordering areas of 11a. Black-pine (*Pinus rigida* ssp. *serotina*) is the characteristic tree but may be very scattered, with large areas dominated by fetterbush (*Lyonia lucida*) which may comprise 90% or more of the shrub vegetation. Herbaceous vegetation is scarce. This type of flatwoods occurs on St. Johns soil, which is present in the Coastal Flatwoods of this region; the habitat is therefore probably represented, but has not been definitely identified or studied in our territory.

11c. *Slash pine Flatwoods*: Normally dominated by slash pine (*Pinus elliottii*), most common on low, poorly drained soils lacking a hard-pan layer, and occurring around flatwoods ponds, in low spots bordered by slightly higher areas occupied by longleaf pine flatwoods, in narrow belts around the edges of bayheads or swamps, or over rather extensive areas of wet soils marked by the presence of pitcher plants or crayfish burrows. In general, Plümmer and Portsmouth soils support slash pine flatwoods, but they are also occupied to some extent by 11a and 11b, and the ecotones between the three are often vague and difficult to determine. The flatwoods dominated by slash pine are quite variable, but can be subdivided into a number of fairly distinct facies that are characterized by the nature of the vegetation that forms the understory. 2-L or R; 3-R; 4-W. This is treated by Braun under the heading of "Slash Pine Forest."

Neither of the following types is recognized by Braun. (See note under Pitcher-plant type, below):

11c-1. *Marginal thicket type*: Has an understory of shrubs such as gallberry (*Ilex glabra*), wax myrtle (*Myrica cerifera*), blackberry (*Rubus* sp.), chokeberry (*Pyrus arbutifolia*), green-brier (*Smilax laurifolia*), and often saw palmetto (*Serenoa repens*). This type is common around the margins of bayheads and around ponds. 3-R; 4-L.

11c-2. *Pitcher-plant type*: In extensive areas in the Coastal flatwoods the water table is almost at the surface, and there are perma-

nently wet areas which support a large number of semi-aquatic plants as well as scattered slash pines. Common among the herbaceous plants of the ground-cover are *Sarracenia leucophylla* and *flava*, *Drosera* spp., *Eriocaulon* spp., *Xyris* spp., *Pinguicula* spp., *Fimbristylis* spp., *Rhynchospora* spp., and many kinds of grasses. The soils of these areas generally belong to the Plummer and Portsmouth groups, and in some of them the ground is literally riddled with crayfish burrows and dotted by crayfish "chimneys." This type of habitat is extensively developed in the Coastal Flatwoods (4-W), but no Stations have been selected in it. An approximation of this community is treated by Braun as "Savannah" under "Pine Flats, Savannahs, and Bays."

12. FLUCTUATING-POND MARGINS

Often a zone of herbage dominated by grasses, sedges, and rushes, with a greater or less expanse of bare, usually sandy soil, occurs around the margins of ponds in which the water-level fluctuates widely. The breadth of the zone is determined by the amount of such fluctuation and the slope of the shore. A great many of the ponds in the Dougherty Plain and the Coastal Flatwoods are bordered by this habitat, as are some of those in the Tifton Upland. Two vegetation zones can usually be distinguished, an inner and an outer. The inner zone is usually dominated by cut-grass, *Leersia hexandra*. Other plants likely to occur in it are maiden-cane (*Panicum hemitomon*), *Sacciolepis striata*, water-pennywort (*Hydrocotyle* spp.), *Centella erecta*, water-hyssop (*Bacopa caroliniana*), *Rhynchospora corniculata* and *R.* spp., *Xyris* spp., and *Juncus* spp. The outer zone is usually a belt of taller vegetation dominated by the broom sedges *Andropogon brachystachys* and *A. virginicus*, as well as *Juncus effusus*, which are not the same in the margins of the flatwoods ponds and those of the limestone lowland. Laessle (1942) considers the fluctuating-pond marginal communities to be fire-and-flood climaxes. 2-L; 3-R; 4-L.

13. Bogs

Thorne says that this habitat is represented in the part of southwestern Georgia that he has studied only by a single large non-alluvial boggy swamp in Early County, south of Hilton. This swamp is dominated by bays (*Magnolia virginiana* and *Persea palustris*), black pine (*Pinus rigida* ssp. *serotina*), swamp maple (*Acer rubrum*), and water gum (*Nyssa sylvatica* var. *biflora*), and is filled with numerous interesting and rare shrubs and other sphagnicolous plants.

Open bogs are often formed when bayheads are severely burned. Intermediate stages between open bogs and bayheads (10) are numerous.

A large example of an open bog has been studied, at a point 1.7 miles west of Hosford in Liberty County, Florida. It has been rather fully described in the account of Sta. 20 (p. 57).

14. EMERGENT VEGETATION

Stands of rooted but emergent herbaceous vegetation in shallow ponds and bordering deeper bodies of still and flowing water; a complex of plant communities which varies from place to place. 2-L; 3-R; 4-L.

15. FLOATING VEGETATION

Water hyacinths (*Eichornia crassipes*) have been observed above the dam and although control measures have been initiated, the hyacinths may develop into a serious problem in the future.

16. SUBMERSED AQUATIC VEGETATION

This vegetation is of two principal types:

1. Submersed aquatics of quiet water, i.e., ponds and lakes, with species of *Utricularia*, *Cabomba caroliniana* and submerged species of spike-rushes such as *Eleocharis vivipara*. (Ex. Lewis Pond, Ray's Lake).

2. Submersed aquatics of springs and spring runs, with such species as *Potamogeton*, *Najas*, *Vallisneria*. (Ex. Sealey's Springs, Shackelford Springs).

17. PLANTED OR MANAGED FOREST

Excellent examples of planted and of managed forests of many sorts on various soils and types of situations are to be found at Southlands Plantation. Some of these rather closely approach natural forests in their composition and environmental conditions; and there is here an opportunity to compare periodically burned with fire-free woodland. Much of the upland area of the plantation is occupied by second-growth pine forest of various ages, in which longleaf, slash and loblolly pines are present naturally or as a result of planting. Other areas on this plantation, much or little affected by forestry practices, are in

sandy hammock, floodplain forest, swamp, and various ruderal communities including old fields and pastures in various stages of succession to forest. Little work has as yet been done here.

18. OLD FIELDS AND PASTURES

Under this heading a wide variety of ruderal plant communities may be grouped, which together occupy much territory in this region but which have been little studied in connection with this survey.

19. LAWNS AND PASTURED MEADOWS

Another ruderal situation of considerable extent but of not much interest to the student of the native fauna.

19. ROADS AND ROADSIDES

Same remarks as under 18. Nearly all stations.

19-A. BULL-DOZED FLOODPLAIN AREAS

At the time the work of the survey began, in June, 1953, this artificial environment covered thousands of acres in the flood-plains of the Flint and the Chattahoochee Rivers. All trees had been removed and the stumps cut down close to the ground; the trees had been pushed into heaps and burned. The ground was cut up by the tractor treads, and there were many small depressions, some with water remaining from the last flood, and some forming parts of spring-runs draining to the river. In the older parts of the clearing much of the bare soil was covered by a low growth of herbage and sprouts from the tree-roots; in newer parts most of the earth was bare.

20. ROADSIDE DITCHES

An aquatic habitat not considered in the work here reported.

C. LIST OF SELECTED STUDY AREAS OR "STATIONS"

A number of study areas or "stations" have been chosen as representative of the principal environments of the Jim Woodruff Dam area. It was thought that they could be intensively studied and fully described, and might serve as standards with which other situations could be compared. Such stations need to be carefully selected in the

light of such considerations as probable permanence, accessibility, and representativeness. Not all those selected in 1953 were well chosen, as the comments on Stations 2, 7 and 11a will demonstrate. A few additions to the list were made in 1954 and 1955, and some habitats, especially those of the flatwoods, are not represented. The location of the stations is shown on accompanying Map III. Each station is briefly characterized below, and its habitats listed by number, according to the scheme of classification in Table I (page 30).

1. *Irwin Mill Creek and Chattahoochee State Park, Houston County, Alabama.* (Plate I, upper) A swift, clear, sand-bottomed stream, dammed within the Park to form a considerable pond with nearly constant water-level. In addition to the strictly aquatic habitats, not here considered, the Park contains examples of habitats 4, 6, 14, 17, 18, and 20, only those italicized being of importance.

The Park has considerable areas of sandy mixed woods (cut-over stage, of 4), sloping down to the stream and pond banks. This forest is composed largely of loblolly pine (*Pinus taeda*), white hickory (*Carya tomentosa*) and smaller numbers of sugar maple (*Acer barbatum*), laurel oak (*Quercus hemisphaerica*), and tulip tree (*Liriodendron tulipifera*). There is an understory of scattered small trees and shrubs, including wild olive (*Osmanthus americanus*), sparkleberry (*Vaccinium arboreum*), red cedar (*Juniperus virginiana*), chickasaw plum (*Prunus angustifolia*), flowering dogwood (*Cornus florida*), fringe-tree (*Chionanthus virginicus*) and reproduction of red buckeye (*Aesculus pavia*) and magnolia (*Magnolia grandiflora*). The ground is carpeted with leaf-litter and pine-straw, and has many decaying logs; there is a scattered herbaceous stratum. Toward the pond margin the woods become moister, and pass into the next habitat.

Along the edges of the stream and the dammed pond (6) red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*) and (*Quercus laurifolia*) form most of the tree growth, and rise from thickets along the water's edge in which silverling (*Baccharis halimifolia*) is abundant, along with wild olive (*Osmanthus americanus*), wax myrtle (*Myrica cerifera*), *Viburnum* sp., witch-hazel (*Hamamelis virginiana*) yellow jessamine (*Gelsemium sempervirens*), and trumpet-vine (*Campsis radicans*). *Houstonia procumbens* and other herbs were also noted here. Towards the ends of the dam there are willow-thickets (*Salix nigra*). Driftwood and silt have lodged on top of the dam and support on its ends dense thickets of *Baccharis* and wild roses (*Rosa palustris*). In the shallow water (14) above and below

the dam are tall stands of *Zizaniopsis mileacea* and a large *Cyperus* sp., pickerel weed (*Pontederia cordata*); water hemlock (*Cicuta curtissii*), golden-club (*Orontium aquaticum*) and other emergents, while in the deeper water are yellow and white water-lilies and other emergent vegetation (14). Where the water runs over the summit of the dam in a thin sheet it is partially filtered through a mass of smart-weed (*Polygonum* sp.) and other low plants. None of the other habitats present at this station have been studied.

2. *Swinging Bridge on Florida Highway 2, T. 7 N., R. 8 W. Sec. 26, Jackson County, Florida*: A station on the flood-plain of the Chattahoochee River, just north of Swinging Bridge. The steep bank here is nearly bare and is exposed at times of normal and low stages of the river. The woods above the river channel north of the bridge fits our classification of stream bank woods (6). At the time it was studied, in June, 1953, evidences of recent flooding to a depth of some feet were clear from the mud-staining of the tree-trunks and the lodged driftwood, in the lower portions of the area.

Roads lead north from the bridge into the woods, which is composed of rather large trees of numerous species, nearly all being deciduous hardwoods. Among the larger and more numerous in the lower area, back about 50 yards from the river, are winged elms (*Ulmus alata*), sycamores (*Platanus occidentalis*), hackberries (*Celtis laevigata*), sweet-gum (*Liquidambar styraciflua*), water-oak (*Quercus nigra*), river birch (*Betula nigra*) and loblolly pine (*Pinus taeda*). On the higher ground above the bank are white oak (*Quercus alba*), and Shumard's oak (*Quercus schumardii*), and a number of surprisingly large silver-bells (*Halesia diptera*), were at first not recognized because they are good-sized trees. The forest is rather open with a scattered understory of tree seedlings, dwarf sumac (*Rhus copallina*) up to 25 feet tall, a few red cedar (*Juniperus virginiana*), French mulberry (*Callicarpa americana*), poison ivy (*Rhus radicans*), grape and woodbine, and patches of big bluestems (*Sabal minor*), the latter in bloom when seen. The higher portions of this station have some elements of Rich Woods (5) but on the whole Floodplain Forest (7) fits the situation better.

Since the above description was made, reconstruction of the bridge was commenced and the area has been greatly modified by construction crews, along the river bank and extending back from it for at least 50 feet. Many of the large trees have been removed and weedy and other herbaceous species have greatly increased.

3. *Dry Pineland on sandy soil, T. 6 N., R. 8 W., Sec. 2 or 11, Jackson County, Florida:* This station is located 1.6 miles south of the intersection of Florida Highway 2 (road to Swinging Bridge) and Florida Highway 126 (Chattahoochee River road), on the west side of the latter. It is an excellent example of this habitat (1-a) as developed on the second bottom in the Dougherty Plain.

This patch of woods is a stand of young longleaf pine (up to 8" d.b.h.), with a scattered understory of blackjack oak (*Quercus marilandica*), southern red oak (*Quercus falcata*), water-oak (*Quercus nigra*), persimmon (*Diospyros virginiana*), and *Crataegus* sp. and with a ground cover largely of wiregrass (*Aristida stricta*) and various typical high pine herbs, along with abundant *Rubus* sp., patches of runner-oak (*Quercus pumila*) and pawpaw (*Asimina angustifolia*), poison ivy in abundance, stinging nettles (*Cnidioscolus stimulosus*) and partridge pea (*Cassia fasciculata*). The undergrowth is very much like that of the sandhills of peninsular Florida, but the assemblage of deciduous tree species is different, not including any *Quercus laevis* or *Q. incana* which generally dominate the understory of the high pine woods on the uplands to the south and east.

4. *Butler's Landing on Chattahoochee River, T. 6 N., R. 7 W., Sec. 28, Jackson County, Florida:* (Plate VII, lower). This station is reached by a road leading east from Butler's crossroads on Florida Highway 126 (Chattahoochee River road) to the bank of the river. Along this road nearly to the river there are fields and pastures (18); at the river bank there are groves of large trees and considerable areas of sandy bank exposed at low stages of the river.

Along the river but above the nearly bare bank, the trees are fairly typical of Stream Bank Woods (6) with sycamore (*Platanus occidentalis*), river birch (*Betula nigra*), sweet gum (*Liquidambar styraciflua*) box-elder (*Acer negundo*), but a little way in from the river the woods are more like Floodplain Forest (7). Here black walnut (*Juglans nigra*), water oak (*Quercus nigra*), winged elm (*Ulmus alata*), persimmon (*Diospyros virginiana*) and some more typically hammock (4) species as pignut (*Carya glabra*), laurel oak (*Quercus hemisphaerica*) and sugar maple (*Acer barbatum*) occur. There are also some chickasaw plum (*Prunus angustifolia*), chinaberry trees (*Melia azedarach*) and loblolly pine (*Pinus taeda*), which support the idea that there is secondary succession involved. Rarely, at extreme high water, even the highest portions of this station are flooded.

5. *Floodplain forest east of Florida Highway 126, on woods road beginning on 126 at a point 4.8 miles north of junction of 126 and U. S. Highway 90, Jackson County, Florida:* This station is reached by a road that leaves Florida Highway 126 near a telephone pole marked M-6-90 and leads down into the floodplain forest from the second bottom. A single brief visit was made to this station in June, 1953. At that time the trees bore a water-mark about 6 feet above the ground, recording the height of the spring flood. It appeared to be an excellent example of the floodplain forest (7). In the lower parts of the bottomlands, the trees are chiefly water oak (*Quercus nigra*), sweet-gum (*Liquidambar styraciflua*), hackberry (*Celtis laevigata*) and winged elm (*Ulmus alata*). The trees are fairly large and form a dense stand with little understory and almost no ground vegetation. Although plans were made to study this station, it was not re-visited. Station 19, located below the dam, was established in 1954 and forms an excellent example of this habitat beyond the reach of the impoundment.

6. *Gravel Lake, in Chattahoochee floodplain on east side of Florida Highway 126, about 3.5 miles north of junction of 126 and U.S. Highway 90, Jackson County, Florida:* (Plate III, lower) This pond of an acre or two in extent was doubtless originally surrounded by floodplain forest, but lies surrounded by old field areas that were cleared long ago. It is bordered on a part of its margin by a belt of water gum and a few cypress, but for the most part is surrounded by a broad, sloping margin of black, mucky soil, in most places trampled by cattle and rooted by hogs, but with a broken herbaceous cover and areas of grass. This margin records the large fluctuations in water level, also indicated by the gums and young cypress. The pond itself has most of the characteristics of a cypress pond (9) except for the scarcity of trees. Its water is clear and brown; there is a marginal growth of emergent grasses and sedges and other herbage, and considerable development of submerged vegetation (16) particularly *Utricularia* sp. Small island-like clumps of water-gum and buttonbush (*Cephalanthus occidentalis*) occur in the pond. Aquatic insects and vertebrates were collected here, but only the pond margins (12) were examined for terrestrial species. This pond is located in T. 4 N., R. 7 W., Section 9; there are others near by on the west side of the road. It is in the area to be submerged and is partially under water now.

7. *Small ravine cutting into bluff that faces the east end of the Jim Woodruff Dam, just north of Florida line and below and to left*

of observation point near Army Engineers' headquarters, in Lot 423, District 21, Decatur County, Georgia: This small, moist ravine, about a mile north of Chattahoochee, is the northernmost point in which *torreya* (*Torreya taxifolia*) was observed in the course of this survey, and the only one of its kind in Georgia. When first visited in the spring of 1954, the bluff near its mouth had been cut back to make room for the road curving down to the east end of the dam from the U. S. Army Engineers' headquarters, but the remainder of the ravine was intact. Where the road ditch is cut into the Tampa limestone in the base of the bluff there are moist rock faces, seepage areas, and patches of mosses and algae. The ravine itself is not over $\frac{1}{4}$ mile long, but resembles a miniature and shallower example of the one at "Old Camp Torreya," in having a small, spring-fed sand-bottomed brook, steep slopes shaded by large trees, and mesic conditions in the bottom, although as a whole it is dryer. The rich ravine woods (5) were made up of loblolly pine (*Pinus taeda*), sweet-gum (*Liquidambar styraciflua*), magnolia (*Magnolia grandiflora*), southern red oak (*Quercus falcata*), cow-oak (*Quercus michauxii*), tulip tree (*Liriodendron tulipifera*), basswood (*Tilia americana* var. *heterophylla*), hickory (*Carya tomentosa*), and sugar maple (*Acer barbatum*), the last two mostly on the upper slopes, which open out more broadly. The really steep-sided, narrow part of the ravine was not over 200 yards in length; the small brook in it flowed to the roadside ditch after two days of heavy rain, but only reached part way to the mouth in dry weather; it is at most about half an inch deep and a foot wide, flowing over orange sandy clay, its course interrupted and overhung by logs, roots, etc. Near the mouth, where it widens slightly, there are dense growths of ferns and herbage, and in the bottom and on the lower slopes the understory trees, shrubs, and ground vegetation include *Carpinus*, *Ostrya*, scattered *Torreya*, oak-leaf hydrangea (*Hydrangea quercifolia*), grape (*Vitis rotundifolia* and *Vitis* sp.) climbing-hydrangea (*Decumaria barbara*), French mulberry (*Callicarpa americana*), woodbine (*Parthenocissus*), etc. The slopes are covered with a heavy layer of leaf-duff over the sandy soil surface; herbage is scattered, becoming dense in the openings. On the south side, the ravine slope goes up into rather dense xeromesic forest, described below; on the north side, into clearing and brush below the observation point at the Engineers' headquarters, which, as seen from across the river, is the highest point on the Tifton escarpment. In the ravine there is some bluestem (*Sabal minor*), but no needle-palm (*Rhapidophyllum hystrix*), and no beech (*Fagus grandifolia* var. *caroliniana*) were seen. Logs and rotting wood were abundant.

The woods on the upper slope of the ravine grade from mesic below to xeromesic above, and from (5) to (4) in our classification. In the upper parts the predominant trees are white oak (*Quercus alba*), hickory (*Carya tomentosa*), loblolly pine (*Pinus taeda*), southern red oak (*Quercus falcata*) *Quercus austrina*, and *Crataegus* sp. There are bare, shaded, leaf-strewn areas under the trees, alternating with sunny openings having a dense undergrowth of *Desmodium* sp., grasses, tree-seedlings, *Gelsemium*, *Ampelopsis arborea*, trailing-beans (*Strophostyles helvola*), goldenrod, *Rubus*-sp., and scattered *Vaccinium* spp. The trees are thinly draped with Spanish moss.

The descriptions given above are of the ravine as it was studied in 1953. When next seen, in the spring of 1954, it had been completely devastated. All the large trees in the lower part had been cut and left as they fell, in a criss-crossed jumble; the entire ravine was open to the sun, and any thought of using it as a study area had to be abandoned. What might have been retained as an added attraction to those visitors to the lake-to-be who are interested in nature, and what was probably the only ravine of its type in Georgia, has thus been destroyed.

8. Red clay hills on bluffs east of the Flint River, 2.0-2.5 miles north of U.S. Highway 90, in Chattahoochee, on unpaved road running (by right fork) past Army Engineers' headquarters opposite east end of dam, in Lot 381 and adjacent, District 21, Decatur County, Georgia: Along the crest of the Tifton escarpment the sandy surface soil has been removed from considerable areas, leaving the sandy clay subsoil exposed. The principal habitats in this station are dry pinelands (1b) and dry oaklands (2b) together with ruderal communities (18, 19).

On the higher land to the east of the road is an open forest of long-leaf pine (*Pinus palustris*) and blackjack oak (*Quercus marilandica*), with some upland willow oak (*Quercus incana*); the largest pines are about 1 foot d.b.h. and the trees rather widely scattered, so that the forest is open and sunny. This area had been burned over some time ago; the soil bare in places (sandy clay or a thin layer of sand over clay), but elsewhere with a rather tall growth of wiregrass and dry herbage, windrows of dead leaves, occasional clumps of oak shoots and scattered persimmon seedlings. There are many partly burned dead branches and logs. On the west side of the road, down the slope toward the edge of the bluff, conditions are not quite so dry and the clay is nearer the surface. Here longleaf pine and upland

willow oak continue to dominate the forest, but there are also some hickories (*Carya tomentosa*) and other species of oak (*Quercus margaretta*, *Q. stellata*, *Q. falcata*) and the trees are somewhat more closely spaced. This part has not been recently burned, and the ground is covered by a heavy growth of wiregrass, mixed with which are bracken ferns, partridge-pea (*Cassia fasciculata*), *Schrankia* sp., clumps of oak shoots, and in the depressions more herbage and much poison ivy. This pineland grades from (1b) into the xeromesic hardwood forest described under Station 7 where the upland passes into the escarpment slopes. In some places, where the longleaf pine has been removed by logging or fire, the oaks that were present in the original forest have replaced the pine, giving rise to dry oakland on clay soil (2b) of which good examples are present in this place. In this station black jack (*Quercus marilandica*), post oak (*Q. stellata*), small post oak (*Q. margaretta*) and southern red oak (*Q. falcata*) are present in about that order of abundance, along with persimmon (*Diospyros virginiana*). The undergrowth in this environment is almost the same as that of the dry pineland (1b) except that the oak-leaf litter tends to shade out the small plants by its accumulations and thus to produce more areas of bare ground. The dry oak forest on clay soils passes into the xeromesic mixed forest of the escarpment slopes just as does the dry pineland.

9. *North Branch of Mosquito Creek, at bridge on Georgia Highway 97, in Lot 268, District 21, Decatur County, Georgia:* (Plate VIII, upper and lower). This creek here flows westward in a broad, shallow valley on the Tifton Upland. The stream is about 10 feet wide and 1 foot deep (at a stage of medium low water) where it flows under the bridge. It is joined just below by a smaller tributary coming in from the northeast parallel to the road. The water in both is clear, brownish, the current swift; the stream is sand-bottomed, and the banks low and sandy to muddy, the sand and mud being of a yellow or orange-yellow color. The whole valley at this point is less than a mile wide and perhaps 50 feet deep; its slopes are clothed with dry pine and oak forest except as they approach the creek, or where they have been cleared. The extent of this station is confined to the immediate vicinity of the creek, above and below the highway bridge. The habitats represented here are sandy hammock (4), stream banks (6), alluvial swamp (8), aquatic communities (14, 16) and ruderal situations (18, 19, 20) which will not be described. We shall take these up in reverse order, beginning with the creek itself.

Aquatic situations and stream banks: Above the bridge the creek spreads into a shallow pool, largely filled with *Juncus repens* (16) and the following emergents (14): *Lycopus virginicus*, *Scirpus rubicosus*, *Hydrolea quadrivalvis*, *Juncus effusus*, *Hydrocotyle* sp., *Ludwigia palustris*?, *Gratiola virginica*, *Polygonum punctatum*, *Xyris* sp., and *Leersia oryzoides*. An aquatic-moss (*Fissindens* sp.), growing on fragments of concrete from a former bridge, was very abundant in the rapids, below the bridge. Along the banks of the stream in the immediate vicinity of the bridge are dense growths of *Juncus coriaceus*. A little farther up and down the stream are thickets of woody stream margin vegetation (6) made up largely of black willow (*Salix nigra*), river birch (*Betula nigra*), a few small bald cypress (*Taxodium distichum*), white bay (*Magnolia virginiana*), silverling (*Baccharis halimifolia*), numerous, water gum (*Nyssa sylvatica* var. *biflora*), fetter bush (*Leucothoe axillaris*), alder (*Alnus serrulata*) and azalea (*Rhododendron canescens*). There are considerable stretches of bare sand-bank and sand-bar along the streams below the bridge.

Alluvial swamp: (8). Bordering the stream above the bridge is an area of low, wet land only a few inches above the level of the creek, and with many undrained depressions, some still containing water from the latest flood. Here the following trees are numerous or dominant: white bay (*Magnolia virginiana*), bald cypress (*Taxodium distichum*), river birch (*Betula nigra*), water ash (*Fraxinus caroliniana*), black willow (*Salix nigra*), water gum (*Nyssa sylvatica* var. *biflora*), red maple (*Acer rubrum*), and swamp bay (*Persea palustris*). The forest is rather open below, with few shrubs and little ground cover except for mats of hedge-hyssop (*Gratiola virginiana*) on some of the sunny wet areas. The ferns *Onoclea sensibilis*, *Woodwardia areolata* (abundant), *Athyrium felix-femina* var. *asplenoides* and *Asplenium platyneuron* are frequent. Most of the ground surface is matted with dead leaves; the soil is wet sandy muck.

Sandy Hammock: (4). This environment, with variations, occupies most of the lower slopes of the stream valley above the swampy floodplain. Above the road bridge a path parallels the right bank of the creek above the swamp, through rather open swampy hammock which is somewhat less well drained and probably more often briefly flooded than the part on the other side of the road to be described in detail. The principal features of note along this path are as follows: (1) the abundance of vines, with *Gelsemium sempervirens* forming much of the ground cover, poison ivy rather common, and climbing hydrangea (*Decumaria barbara*), cross-vine (*Bignonia ca-*

preolata), bamboo-vine (*Smilax laurifolia*), pepper-vine (*Ampelopsis arborea*), climbing hemp-weed (*Mikania scandens*), native wistaria (*Wisteria frutescens*) also present; (2) the numerous large sourwoods, (*Oxydendrum arboreum*) with trunks from 6 inches to a foot in diameter; (3) a meadow-like opening bordering the swamp, filled with a tall grass (*Uniola* sp.), and sedges (*Scirpus* spp.) and bordered by fetter bushes (*Lyonia lucida*), and arrow-woods (*Viburnum obovatum*); (4) sunny openings with dry sandy soil and scant xerophytic ground cover close to the edge of the swamp; and (5) an area near the entrance to the path from the road, where the larger trees are widely scattered and beneath them sebastian-bush (*Sebastiania fruticosa*) forms a low feathery thicket with sand-floored, leaf-carpeted "rooms" containing a little *Rubus* sp. and low herbage. In other respects this area is like that on the opposite side of the highway.

Across from the area just described, on the downstream side, there is little swamp and mostly sandy hammock, especially along the small tributary stream. This flows in a meandering course through the woods, bordered by sandy banks 1 to 3 feet in height and in most places abrupt. There is evidence of flooding in the part of the woods adjacent to the stream, but the water cannot remain long on account of the gradient and the sandy soil soon drains dry. In spite of the high water table, this hammock is as good an example of the Magnolia-Beech climax as was observed during this study.

An old roadway parallel to the present highway runs through the woods on the far side of the tributary creek, leading from an old ford or bridge up a gradual slope to a point where the sandy hammock passes gradually into sandy dry pineland. In the woods along the lower part of this road the following trees are dominant or numerous: magnolia (*Magnolia grandiflora*), American holly (*Ilex opaca*), sweet-gum (*Liquidambar styraciflua*), white oak (*Quercus alba*), beech (*Fagus grandifolia* var. *caroliniana*) and laurel oak (*Quercus hemisphaerica*). This list (with its emphasis on evergreen broad-leaved trees), the sandy soil, and the associated plants named below, are sufficient evidence of the propriety of assigning this community to the sandy hammock habitat (4). Other plants present are: spruce-pine (*Pinus glabra*), tulip tree (*Liriodendron tulipifera*), loblolly pine (*Pinus taeda*), pignut (*Carya glabra*), black gum (*Nyssa sylvatica* var. *sylvatica*), cow-oak (*Quercus michauxii*), wild olive (*Osmanthus americanus*), silverbell (*Halesia caroliniana*), mountain laurel (*Kalmia latifolia*), sweet-leaf (*Symplocos tinctoria*), sparkleberry (*Vaccinium arboreum*), shadbush (*Amelanchier arborea*), large gallberry (*Ilex*

coriacea), fringe tree (*Chionanthus virginicus*), sebastian-bush (*Sebastiania fruticosa*), strawberry bush (*Euonymus americanus*), blue-stem (*Sabal minor*), arrow-woods (*Viburnum* spp.) sumac (*Rhus copallina*), witch-hazel (*Hamamelis virginiana*), fetter bush (*Leucothoe axillaris*), azalea (*Rhododendron canescens*), Hercules club (*Aralia spinosa*), lead plant (*Amorpha fruticosa*), partridge-berry (*Mitchella repens*), dwarf pawpaw (*Asimina parviflora*), catclaw (*Smilax glauca* and *S. spp.*) and the other vines mentioned as occurring in the area across the road. In the sandy road near the main stream there are openings with a considerable development of tall grasses, herbage, and *Rubus* sp.

10. Dry oakland on sandy hill crests and slopes, about 3 miles west-southwest of Faceville, on Georgia Highway 97, Decatur County, Georgia: A community formerly dominated by longleaf pine, but from which the pine has mostly been removed, by logging, leaving the oaks to take over control. (2). The soil is yellowish sand at the surface, has a red clay subsoil, and belongs to the Norfolk-Red Bay soil group. Here the most numerous trees are rather large, widely spaced oaks, with small post oak (*Quercus margaretta*), upland willow oak (*Quercus incana*), turkey oak (*Quercus laevis*) and laurel oak (*Quercus hemisphaerica*) (on lower part of slope) in about that order of abundance. There are a few large persimmons (*Diospyros virginiana*) and many small ones (d.b.h. 8 inches and down). The sandy soil is exposed over perhaps as much as one-third of the total area, and elsewhere covered chiefly with a growth of wiregrasses, *Aristida stricta* and *Sporobolus gracilis*, and with a scattering of typical sandhills herbs, among which are *Sorghastrum secundum*, *Kuhnistera pinnata*, *Berlandiera pumila*, *Euphorbia* sp., *Gnaphalium* sp., *Chrysopsis* sp., *Houstonia procumbens*, *Pteridium aquilinum*, *Elephantopus tomentosus*, *Eupatorium compositifolium*, *Eriogonum tomentosum*, and *Ceanothus microphyllus*. This situation had been burned at not too distant a time.

10a. Small bayhead or bay at foot of slope adjacent to Station 10, 3 miles south-southwest of Faceville, on Georgia Highway 97, Decatur County, Georgia: (Plate IV, upper). This bayhead (10) has been split by the highway. The part on the north side of the road (bordered by Station 10) has been recently burned out, and is now a pond with areas of open water and clumps of shrubs and trees in and near the water, surrounded by a typical fluctuating pond margin zone (12). Standing in the water are black pines (*Pinus rigida* ssp.

serotina) which survived the burn, and clumps of willow (*Salix nigra*), white bay (*Magnolia virginiana*), tytys (*Cliftonia monophylla* and *Cyrilla racemiflora*), feverbush (*Pinckneya pubens*), black alder (*Alnus serrulata*), odorless wax-myrtle (*Myrica inodora*), red chokeberry (*Pyrus arbutifolia*) and gallberry (*Ilex glabra*). In the marginal zone are cat-tails (*Typha* sp.), rushes (*Juncus* sp.), sedges (*Scirpus* sp. probably *rubricosus*), *Hypericum* sp., *Potamogeton diversifolius*, *Dulichium arundinaceum*, *Ludwigia* sp., *Jussiaea* sp., and clumps of *Andropogon* sp. The water is clear and brownish in color. Just outside the bare or sparsely herbage-grown, sandy margins the dry oakland woods begin.

Across the road from this area is an unburned part of the same bayhead (11). It has almost the same tree and shrub composition as the burned section, but by contrast is so densely filled with vegetation as to be almost impenetrable. Twenty to thirty tall black pines (*Pinus rigida* ssp. *serotina*) tower over the swamp thickets at their bases; they are up to 1 foot d.b.h. The bulk of the thicket is made up of *Cliftonia*, *Aronia*, *Alnus*, and white bay; but wild azalea (*Rhododendron canescens*), red maple (*Acer rubrum*), wax myrtle (*Myrica cerifera*), *Smilax laurifolia*, odorless wax-myrtle (*Myrica inodora*) and *M. heterophylla*, salt bush (*Baccharis halimifolia*), arrow-wood (*Viburnum* sp.), elder (*Sambucus canadensis*), fetterbush (*Lyonia lucida*) and poison sumac (*Rhus vernix*) are present. The thicket is characterized by a dense clustering of many small stems of shrubs, with few open spaces among them and almost no ground vegetation. Giant plume-grass (*Erianthus giganteus*) grows along the edge of the swamp where it is cut by the roadside ditch.

11. Flatwoods and swamp on southeast side of Georgia Highway 97, 1.3 miles south-southwest of Faceville, Decatur County, Georgia: Typical flatwoods environments are rare on the Tifton Upland; most of those areas thought at first sight to be flatwoods proved on examination to be one or another variety of dry pineland. This was the best and almost the only flatwoods that we found in the half of the region lying north of Chattahoochee. Here a gentle slope is occupied by dry pineland at the top, passing into a zone of longleaf and slash-pine flatwoods that surrounds a swampy area of small extent.

In the flatwoods zone (11-c-1) the dominant tree is slash pine (*Pinus elliottii*) mixed with some longleaf (*Pinus palustris*); up the slope longleaf becomes more abundant and scattered turkey oaks, blackjack oaks, persimmons and sweet-gums appear. The undergrowth

consists principally of wiregrass and gallberry (*Ilex glabra*) with blueberries (*Vaccinium myrsinites*), bracken fern (*Pteridium aquilinum*), dwarf wax myrtle (*Myrica pusilla*), and patches of oak-runner (*Quercus pumila*). In a belt above the areas of swamp and marsh the gallberry growth is taller and denser, and some yaupon (*Ilex myrtifolia*) and azalea (*Rhododendron canescens*) occur here. The swampy areas, dry much of the time, are occupied by thickets of yaupons surrounded by a zone of tall St. John's wort (*Hypericum galioides* var. *galioides*). In the road ditch and an adjoining area of marsh occur cat-tails (*Typha* sp.), sedges (*Scirpus* spp.), and cut-grass (*Leersia* sp.).

11A. *Southlands Plantation of the Southern Kraft Division, International Paper Company, entrance on west side of Georgia Highway 97, 4.4 miles north of Faceville, Decatur County, Georgia:* When first seen this was thought to include some of the best dry pineland and sandy hammock habitats of the region, but on investigation all the forests on this plantation prove to be planted or under management, and thus to represent our ruderal habitat (17) and various modifications of (1) and (4).

Although members of the survey may find the fire-free forests useful for certain studies, this station is not at all representative of natural conditions and will probably be little studied.

12. *Four Mile Creek, at bridge on Georgia Highway 97, 4 miles south of Bainbridge, Lot 356, District 21, Decatur County, Georgia:* At this point Four Mile Creek is sluggish and small, winding through a shallow valley. It is bordered with typical stream margin trees and shrubs (6) such as bald cypress (*Taxodium distichum*), water gum (*Nyssa sylvatica* var. *biflora*), black willow (*Salix nigra*), blue beech (*Carpinus caroliniana*), sweet gum (*Liquidambar styraciflua*), Virginia willow (*Itea virginica*), buttonbush (*Cephalanthus occidentalis*) and water oak (*Quercus nigra*).

Emergent aquatics (14), predominantly water smartweed (*Polygonum punctatum*) and *Hydrophila lacustris*, cover most of the water beneath and on both sides of the bridge. Beside these dominants there are *Rhynchospora corniculata*, *Leersia oryzoides*, *Echinodorus cordifolius*, *Eleocharis nodulosa*, *Lycopus rubellus*, *Cyperus haspan*, *Paspalum distichum*, *Hydrocotyle* sp., *Spirodela polyrhiza*, *Saururus cernuus* and *Micranthemum umbrosum*.

12A. *Thickets on low ground, east side of Georgia Highway 97, 5.3 miles south of beginning of Georgia 97, in Bainbridge, in Lot 363, District 20, Decatur County, Georgia.* (Plate IV, lower). This place, on the floodplain or perhaps the second bottom of the Flint River, is nearly level, poorly drained, with grayish sandy surface soil, and is occupied by scattered black pines (*Pinus rigida* ssp. *serotina*), an occasional loblolly (*Pinus taeda*), some black gum (*Nyssa sylvatica*) and sweet-gum (*Liquidambar styraciflua*), but most conspicuously by a rather dense and extensive thicket of hawthorn (*Crataegus*) up to about 8 feet in height, with a sprinkling of winged elm (*Ulmus alata*), young laurel oaks (*Quercus haemisphaerica*), wax-myrtle clumps (*Myrica cerifera*), persimmon (*Diospyros virginiana*), and chickasaw plum (*Prunus angustifolia*). This rather striking habitat occupies at least several acres at this point, and similar situations were seen elsewhere. Whether or not it is the result of fire or other disturbance, it does not fit any of our vegetational categories.

13. *Spring Creek at the Georgia Power and Light Company's dam, on Georgia Highway 253, in Lots 30 and 31, District 21, Decatur County, Georgia.* (Plate I, lower) There was formerly some *Potamogeton illinoiensis* and *Chara* (16) above the dam. By October, 1955, the removal of the dam had virtually been completed and the lake was almost gone. Hydrophytic streambank trees such as bald cypress (*Taxodium distichum*) and water locust (*Gleditsia aquatica*) are scattered below the dam (6).

14A. *Dry Oakland, about 2 miles north of Sealey's Spring, in Lot 172, District 21, Seminole County, Georgia* (Plate II, lower). A rather unusual sort of dry oakland, but a type apparently fairly common in the low sandy land just above the floodplain areas in the angle between the Flint and Chattahoochee Rivers, less xeric and with richer vegetation than typical sand hills. This place is located only a little above the cleared flats bordering Spring Creek and just a little north of 14B.

Dry oakland (2a) on sandy soil, the surface layers yellowish gray or gray-brown, considerable humus, dominated by oaks but with a considerable scattering of longleaf pine (*Pinus palustris*), the oaks including upland willow (*Quercus incana*), small post oak (*Q. margaretta*), southern red oak (*Q. falcata*), and turkey oak (*Q. laevis*), in in about that order of abundance, and a few flowering dogwood (*Cornus florida*) and hawthorns (*Crataegus* sp.). The ground-cover chiefly a rather heavy growth of tall wire-grass, bracken fern, yellow

jessamine, with an accumulation of oak leaves and pine-straw, and considerable *Rubus* sp. and poison ivy. There are many decaying pine branches and logs, residue of logging. Other plants noted here include dwarf sumac (*Rhus copallina*), persimmon (*Diospyros virginiana*), blueberries (*Vaccinium* spp.). The ground vegetation varies from a few inches to about 18 inches in height. A quite similar type of situation was also studied in Lot 216, District 21.

14B: Frog Pond and large pond to north, with surrounding dry oakland, in and just above cleared area, Lots 179, 180, and 212, District 21, Seminole County, Georgia: (Plate III, upper) The aquatic and semi-aquatic habitats of two large cypress ponds (9) and adjoining dry oakland (2a) of a type more xeric than that of Station 14A.

The ponds are in the floodplain of Spring Creek, in the area to be flooded, a little closer to Sealey's Spring than site 14A. The floodplain forest by which they were surrounded has all been bull-dozed clean, but the bald cypress and water tupelo have been left standing, apparently on the theory that trees that grow in water will be unaffected by the flooding of the reservoir.

Frog Pond is a rather unusual community in that the co-dominants are pond cypress (*Taxodium ascendens*) and tupelo gum (*Nyssa aquatica*). The alluvial swamps (See Station 19, p. 55) contain bald cypress and water tupelo, while the upland non-alluvial swamps almost invariably have pond cypress and water gum (*Nyssa sylvatica* var. *biflora*) as associates. Buttonbush (*Cephalanthus occidentalis*) and black willow form a scattered woody understory at Frog Pond. The submersed aquatics (16) are fanwort (*Cabomba pulcherrima*), bladderwort (*Utricularia* sp.) and the alga *Chara* sp.

15. Sealey's Spring and adjacent swamp, forest, and clearing, in Lot 235, District 21, Seminole County, Georgia: A large "blue" limestone spring and spring run, bordered by cypress swamp (8), floodplain forest (7), much disturbed, and sandy hammock (4), much disturbed.

In addition to the aquatic habitats, the environments of most interest here are the cypress swamp and considerable areas of sloping shore covered with low grasses and herbs, most similar to the fluctuating pond margin (12) and caused by the same seasonal fluctuation of water level. The low vegetation on these sloping shores consists of carpetgrass, *Hypericum* spp., and (along the water's edge) *Ludwigia*

sp. The alluvial swamp contains, besides river cypress (*Taxodium distichum*), a considerable variety of other trees, water elm (*Planera aquatica*), water gum (*Nyssa sylvatica* var. *biflora*), tupelo gum (*Nyssa aquatica*), red maple (*Acer rubrum*), an ash (*Fraxinus caroliniana*), and a *Crataegus* sp. In the sandy hammock on the sloping banks above the spring (in which the clearing for Sealey's hunting lodge was made) the most evident trees are live oaks (*Quercus virginiana*), large laurel oaks (*Q. hemisphaerica*) and sweet-gums (*Liquidambar styraciflua*).

16A. *Scrubby floodplain forest and thickets, just above cleared area. Lot 35, District 14, Seminole County, Georgia:* (Plate II, upper). Scrubby forest, the larger trees are mostly longleaf and slash pine (*Pinus palustris* and *P. elliotii*), southern red oak (*Quercus falcata*), water oak (*Quercus nigra*), sweet-gum (*Liquidambar styraciflua*), and live oak (*Quercus virginiana*), quite scattered, with an understory thicket occupying most of the space under the taller trees except for occasional room-like openings in it. This thicket composed chiefly of *Viburnum obovatum* with a smaller amount of sparkleberry (*Vaccinium arboreum*) in places, and dwarf sumac (*Rhus copallina*), hawthorn (*Crataegus*, 3 species), *Rubus* sp., etc. In the openings the ground is sparsely covered with wire-grass, *Rubus*, and various herbs. No habitat quite like this has been seen except in the southern tip of the triangle between the rivers, where it covers a large area.

16B. *Grassy longleaf pine flat, Lot 44 or 45, District 14, Seminole County, Georgia:* A level area of many acres, with widely scattered longleaf pines (*Pinus palustris*) and flatwoods-like appearance, but the ground-cover only a very low lawn-like growth of grass, with scattered clumps of runner oak (*Quercus pumila*), and large areas of bare earth; the soil a grayish sandy silt at the surface. There are a few small water-holes shaded by laurel and live oaks, and with surrounding thickets of *Viburnum obovatum* and hawthorn (*Crataegus* sp.) A peculiar type of situation not encountered elsewhere.

16C. *Limestone spring about one-half mile west of Sealey's Spring, District 14, Seminole County, Georgia:* Steep sandy slopes lead down to a partly rock-enclosed "blue spring" that flows into a swamp occupied by an almost pure stand of water-elm (*Planera aquatica*); the dry, sandy slopes around the spring are sandy hammock (4), with big sweet-gums (*Liquidambar styraciflua*), laurel oak (*Quercus hemi-*

sphaerica), and undergrowth of *Viburnum obovatum* that makes the thickets in 16A. At the edge of the spring near the rocky overhang are water-locust (*Gleditsia aquatica*), and on the sandy slope, bluestem (*Sabal minor*), false indigo (*Baptisia* sp.) etc. The ground is carpeted by a fairly thick layer of dry dead leaves.

17. *Ray's Lake and surrounding area, Lots 99 and 102, District 21, Seminole County, Georgia:* (Plate IX, lower). A shallow, sand-bottomed lake with aquatic vegetation zones (14, 16), grassy margins (12) and on the northeast side, bordering slopes with sandy, dry oakland (2a).

This limestone "lake" or pond is estimated to cover about 15 acres. The water is open and clear except for patches of bonnets (*Nuphar orbiculatum*) and water-lilies (*Nymphaea odorata*) and a few grassy islands dominated by maiden cane (*Panicum hemitomon*). When this station was visited May 6, 1955, the water was quite low, exposing a good portion of the white, sandy bottom; much of this was golden-yellow with the bloom of *Utricularia cornuta*, a plant not noticed on a June, 1953, visit. *Bacopa caroliniana* is very abundant in the shallower water along the shore. The sloping sandy shores are typical of those surrounding fluctuating ponds (12) with *Hydrocotyle umbellata*, *Eleocharis acicularis*, *Polygonum punctatum*, *Ptilimnium capillaceum*, *Sagittaria isoetiformis*, *Eupatorium capillifolium*, maiden-cane, hatpins (*Eriocaulon compressum* and *E. septangulare*), cut-grass (*Leersia hexandra*) *Rhynchospora globularis* and *R. corniculata*, in places dark patches of *Juncus effusus*. *Sagittaria latifolia*, *Cabomba pulcherrima*, lotus (*Nelumbo lutea*), pickerel-weed (*Pontederia cordata*) and *Senecio glabellus* were recorded but were in very minor numbers. A few small bald cypress (*Taxodium distichum*), buttonbushes (*Cephalanthus occidentalis*), *Hypericum galioides* var. *galioides* grow at what is near or above highwater.

Most of the bordering land is cleared, but on the northeast side an open forest of scattered oaks and pines occupies the sandy slopes above the "lake." The principal trees are longleaf pine (*Pinus palustris*), laurel oak (*Quercus hemisphaerica*), water oak (*Q. nigra*), blue-jack oak (*Q. incana*) and dogwood (*Cornus florida*), the laurel oaks being the largest of these. The ground is covered by wire-grass (*Aristida stricta*), broom-sedge (*Andropogon virginicus*) and a few other grasses. There are also present ridge blackberry (*Rubus cuneifolius*), some runner oak (*Quercus pumila*), and the herbs dog-tongue (*Eriogonum tomentosum*), *Chrysopsis* sp., rockrose (*Helianthemum caro-*

linianum), batchelor's button (*Polygala nana*), bush-clover (*Lespedeza* sp.) bracken (*Pteridium aquilinum*) and elephant foot (*Elephantopus tomentosus*). The soil is a yellowish-grey sand to a depth of 2 to 4 inches, over a reddish-yellow, clay subsoil. The vegetation resembles that of the sandhills except for the greater variety of trees and lack of turkey oak (*Quercus laevis*). Pocket gopher mounds are present.

18. *Ravines and bluffs in Torreya State Park, west of Rock Bluff Post Office, in Liberty County, Florida:* These ravines are larger, more open, and drier than the one at "Old Camp Torreya" described on pages 20-23 of this report, but are otherwise similar. The habitats represented in the park are chiefly the rich-woods (5) of the ravines and bluffs, and the dry pineland (1) and oakland (2) on the uplands above the ravines. See brief description on page 32.

19. *Heavy river-bottom forest, just below the Jim Woodruff Dam on the west bank of the Apalachicola River, in Jackson County, Florida:* (Plate VI, upper and lower, Plate VII, lower). As one follows the west bank south of the bridge on U. S. 90, a cleared right-of-way is first encountered. Then scattered trees such as black walnut (*Juglans nigra*), chinaberry (*Melia azedarach*) persimmon (*Diospyros virginiana*), hawthorns (*Crataegus* sp.), buckthorn (*Bumelia lycioides*) and a few sycamore (*Platanus occidentalis*) are met with. Much of the ground-cover here is Bermuda grass (*Cynodon dactylon*) but weeds such as *Hyptis mutabilis* and *Cassia occidentalis* are scattered. Obviously this is a disturbed area with elements of (6) and (18).

On the river bank about one hundred yards south of the bridge, the forest canopy is more closed and the flora is much more like that of a mesophytic hammock than that of a swamp. It is quite similar to Station 2 with elements of (5), (6) and (7). This is probably due to the good soil drainage, there being a sharp drop of about 15 feet to the normal river level. Also, this is the highest part of the bottom and shows little evidence of having been flooded. Here the dominant trees are water-oak (*Quercus nigra*), live-oak (*Q. virginiana*), hackberry (*Celtis laevigata*), sweet-gum (*Liquidambar styraciflua*), blue-beech (*Carpinus caroliniana*), magnolia (*Magnolia grandiflora*), american holly (*Ilex opaca*), wafer-ash (*Ptelea trifoliata*) and along the edge of the river bank occur a few large river-birch (*Betula nigra*). Vines are abundant, both in variety and quantity with the high climbing dutchman's pipe (*Aristolochia tomentosa*), leather-flower (*Clematis viorna*), bull-briar (*Smilax bona-nox*), virginia creeper (*Par-*

thenocissus quinquefolia), *Gonolobus suberosus*, pepper vine (*Ampelopsis arborea*), cupseed (*Calycocarpum lyoni*), poison ivy (*Rhus radicans*), *Brunnichia cirrhosa* and a great amount of japanese-climbing-fern (*Lygodium japonicum*). Some of the more obvious elements among the shrubs and herbs are bluestem (*Sabal minor*), french mulberry (*Callicarpa americana*), *Vernonia* sp., and *Panicum* spp. This habitat fits Braun's "Ridge Bottoms" fairly well.

Moving west about 20 yards from crest of the river bank, an almost imperceptible drop in topography is noticed and a dense, almost pure stand of tall, very straight sweet-gums is encountered. As none of these trees is very large in diameter, and because they appear to be of uniform age, it seems likely that they are second growth, possibly coming in after lumbering. Poison-ivy is very abundant, climbing high up the tree trunks. There is no woody understory but a heavy ground cover of wood-grass (*Oplismenus setarius*), false-strawberry (*Duchesnea indica*), chick-weed (*Stellaria media*), and wandering-jew (*Commelina* sp.) nearly hide the ground. A scattering of normal-shield-fern (*Thelypteris normalis*) and black snakeroot (*Sanicula marilandica*) was observed. This is clearly a facies of Floodplain Forest (7).

At the western edge of the sweet-gum stand, there is an obvious drop in elevation, and a band of more hydrophytic species is encountered; with overcup-oak (*Quercus lyrata*), some sycamores, winged-elm (*Ulmus alata*), hackberry, possum-haw (*Ilex decidua*) and laurel-oak among the more abundant. *Justicia lanceolata* is plentiful as the ground cover. This habitat conforms to Braun's "Hardwood Bottoms" and is a wetter example of our Floodplain Forest (7).

Just west of the narrow zone of vegetation described above, the topography, while generally lower, is irregular with washed pockets and bars. Here the trees are scattered with black willow (*Salix nigra*), bald-cypress (*Taxodium distichum*), water-locust (*Gleditsia aquatica*), water-elm (*Planera aquatica*), *Forestiera acuminata* and water-ash (*Fraxinus caroliniana*) being common. Elderberry (*Sambucus canadensis*) and button-bush (*Cephalanthus occidentalis*) are the principal shrubs. Numerous sedges and grasses, smartweed (*Polygonum punctatum*), false-nettle (*Boehmeria cylindrica*), and *Senecio glabellus* are common herbaceous elements. This is clearly a flood washed and eroded facies of Alluvial Swamp (8).

Still further away from the river is a swamp with a nearly pure stand of tupelo gum (*Nyssa aquatica*) and scattered bald cypress (8). Red maple (*Acer rubrum*), overcup oak (*Quercus lyrata*), and water

hickory (*Carya aquatica*) occupy slightly higher ground. Here much of the area is normally covered with shallow stagnant water. Isolated button-bushes and water-elms are the principal shrubs. The ground is nearly bare of vegetation except for scattered smartweeds. This habitat essentially agrees with Braun's "Swamp Forest" (Cypress-tupelo).

20. "Seeping bog," 1.7 miles west of Hosford on Florida Highway 20, in Liberty County, Florida: (Plate V, upper and lower). This ecologically remarkable habitat occupies many acres of wet seepage slope on the west side of the second rise west of Hosford. The slope surrounds a bayhead along a small tributary of Taluga River. The bayhead is cut by the road and extends some distance up into the boggy meadow, nowhere more than 100 feet wide. The bayhead is rather dense along the small trickling brook and is made up of thickets of tyty (*Cliftonia monophylla*), white bay (*Magnolia virginiana*), slash pine (*Pinus elliottii*), odorless wax myrtle (*Myrica inodora*), large-leaved gallberry (*Ilex coriacea*) and swamp-bay (*Persea palustris*), the first two predominating. Scattered shrubs and clumps of some of these species, especially tyty, white bay and wax myrtle, along with a few fever trees (*Pinckneya pubens*) and an occasional small slash pine (*Pinus elliottii*) break the uniformity of the open boggy marsh that surrounds the bayhead on nearly all sides. It is not the woody vegetation, but this herbaceous growth of the open areas, that makes this place distinctive.

Everywhere between and among the clumps and patches of shrubbery are small or large areas covered with a dense stand of wire grass, apparently *Aristida stricta*, about a foot tall. This grass has been sterile even in the early fall. The ground feels spongy underfoot, and water rises around the shoes to a height of an inch or less except when one unexpectedly steps into one of the deeper seepage-drains which ramify through the bog. The bulk of the vegetation is made up of the wire-grass and the rather unusual rush-like featherling (*Pleea tenuifolia*); some of the "grass" is also gold crest (*Lophiola aurea*). Other herbs growing in the openings are abundant *Sphagnum* sp., sundews (*Drosera tracyi* and *D. sp.*), the pitcher-plants (*Sarracenia leucophylla*) abundant, and (*S. flava* and *S. psittacina*), hatpins (*Eriocaulon decangulare* and *E. compressum*) as well as *Syngonanthus flavidus*, colic root (*Aletris aurea*), *Calopogon pulchellus*, orange milkwort (*Polygala lutea*), the club mosses (*Lycopodium carolinianum* and *L. adpressum*), sedges *Carex* spp., *Rhynchospora oligantha*, *R.*

baldwinii and *R. macra* (the last, our only record for this species), *Juncus trigonocarpus* and other spp., and the grasses *Andropogon* sp. and *Panicum sphagnicola* or *lucidum*. There are patches of St. John's worts (*Hypericum galioides* var. *galioides* and *H. microsepalum*), *Gaylussacia mosieri* and the shrub thickets are draped with bamboo vine (*Smilax laurifolia* and *S. walteri*). The surface layers of the soil are a mucky sand. Where the road ditch cuts this habitat there are wet bare sand-flats sloping to the bayhead. The boggy marsh is probably in succession toward typical bayhead. If its existence is the result of fire, it must have been a very intense fire that occurred a long time ago, since it must have made a clean sweep of all woody vegetation, and left few visible traces. This seepage area lies on the border between the Southern Uplands and the Coastal Flatwoods, and no other place like it has been found; there may be similar ones on a smaller scale around many of the bayheads along this border.

21. *Tan Vat Hill, on east side of Florida Highway 126, about 3 miles north of junction of Highway 126 and U. S. Highway 90, Jackson County, Florida: (Plate X, upper and lower).* Tan Vat Hill is an "island" of the Southern Uplands surrounded by the Dougherty Plain. Near the top of this hill, about a large sawdust pile, are dry, cut over, scattered hardwoods with occasional loblolly pines (*Pinus taeda*). Among the more common hardwoods are mockernut (*Carya tomentosa*), black oak (*Quercus velutina*), post oak (*Q. stellata*), white oak (*Q. alba*), southern red oak (*Q. falcata*), sweet-gum (*Liquidambar styraciflua*), persimmon (*Diospyros virginiana*), flowering dogwood (*Cornus florida*), redbud (*Cercis canadensis*), hawthorns (*Crataegus* spp.), chickasaw plum (*Prunus angustifolia*), hop-hornbeam (*Ostrya virginiana*), *Cornus foemina*, sparkleberry (*Vaccinium arboreum*), red buckeye (*Aesculus pavia*), dwarf sumac (*Rhus copallina*) and *Viburnum rufidulum*. Small shrubs and common herbs observed here were New Jersey tea (*Ceanothus americanus*), *Rubus cuneifolius*, *Panicum* spp., *Rhynchosia* spp., *Lespedeza* spp., *Dychoriste oblongifolia*, *Tragia* spp. the milkweeds (*Asclepias tuberosa* and *A. obovata*), *Cracca* sp., *Tetragonotheca helianthioides* and *Schrankia microphylla*. The vine, muscadine (*Vitis rotundifolia*) is common. This portion of the station is close to our Dry Oakland (2) but is somewhat richer both in soil and flora.

As one follows the dirt road northwestward along the northern side of the hill, a moderate but continuous descent is apparent and with this is correlated a gradual change to a denser growth of more

mesophytic plants. Among those more characteristic of this moist woodland (5) are tulip tree (*Liriodendron tulipifera*), basswood (*Tilia americana* var. *heterophylla*), pawpaw (*Asimina parviflora*), lead plant (*Amorpha fruticosa*), sugar maple (*Acer barbatum*), pignut (*Carya glabra*), *Viburnum dentatum*, *Styrax grandifolia*, witch-hazel (*Hamelis virginiana*) and such herbs as *Spigelia marylandica* and *S. gentianoides*, *Trillium sessile*, *Thalictrum revolutum*, *Sanguinaria canadensis*, *Prunella vulgaris* var. *lanceolata*, *Polygala boykinii*, and green dragon (*Arisaema dracontium*). Common vines observed were cross-vine (*Bignonia capreolata*), virginia-creeper (*Parthenocissus quinquefolia*), poison-ivy (*Rhus radicans*), partridge berry (*Mitchella repens*), and *Passiflora lutea*. Some of the species found in the drier woods near the hilltop such as white oak, flowering dogwood, sparkle-berry, loblolly pine and muscadine are also common here. This is a good example of our Richwoods (5) but shows evidence of having been partially lumbered.

After following the road through the woods for about a third of a mile, the area cleared for flooding is encountered (19A). Here sprouts, up to 8 or 10 feet high, have grown up from the stumps of trees and shrubs cut some two years earlier. Many of these sprouts are of basswood, hop-hornbeam, persimmon, dwarf sumac, redbud, sweetgum, pignut, tulip poplar, flowering dogwood, white oak and buckeye mentioned above. Some ruderal and more hydrophytic species such as water gum (*Nyssa*), buttonbush (*Cephalanthus occidentalis*), salt-bush (*Baccharis halimifolia*), water ash (*Fraxinus caroliniana*), dog-fennels (*Eupatorium capillifolium* and *E. compositifolium*), broom-sedges (*Andropogon* spp.) and Bermuda grass (*Cynodon dactylon*) and other ruderal herbs are common. Originally close to our Floodplain Forest (7) it now contains many elements of Old Fields and Pastures (18). The gross structure of these thickets is everywhere much the same, but specific variations occur as reflections of the nature of the previously existing covering forests.

The officials in charge of the area have expressed some concern over the rapidity of the re-establishment of the woody flora. In the spring of 1955 an attempt was made to retard this re-establishment by brief periods of flooding to the 68-foot contour. With extension of the final coffer dams across the river in June, 1955, the water level was raised to the 66-foot level where it is expected to remain until the final flooding to the 78-foot contour upon the completion of the dam.

22. *Lewis's Pond, about 1 mile southwest of Ray's Lake, District 21, Seminole County, Georgia:* This pond is similar to Ray's Lake in many respects but is much smaller and has generally more gently sloping shores which support herbaceous vegetation. It has a much denser, in fact almost solid growth, of bonnets (*Nuphar* sp.) and water-lily (*Nymphaea odorata*) in the central, deeper portions. In shallower water a very dense growth of water shield (*Brasenia schreberi*) and scattered bladderworts (*Utricularia* probably *foliosa*) are evident. The still shallower water and the wet margins are dominated by *Juncus repens*, *Bacopa caroliniana*, *Eleocharis tricostrata*, *E. acicularis* and *E. flavescens*. *Sagittaria isoetiformis* also occurs here (14, 16). A few scattered buttonbushes (*Cephalanthus occidentalis*) were observed. *Triodia ambigua* is present a short distance above normal water level. The land away from the shoreline is clear of all trees for at least 100 yards or more and is covered with herbs similar to those of old fields (18).

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SUMMARY

We have examined the drainage basin of the Flint, Chattahoochee and Apalachicola Rivers in the general vicinity of Chattahoochee, Florida from the standpoint of its physical features and natural regions. A suggested plan for recognition of these natural regions is presented. The major habitats occurring within the area are described, with emphasis being placed upon the plant associations present. Our categories have been compared with those of previous workers who have concerned themselves with this and other areas. Special study areas have been designated as representing typical examples of the major habitats recognized.

LITERATURE CITED

- BRAUN, E. Lucy. 1950. Deciduous Forest of Eastern North America. Blakiston Co., Philadelphia. pp. 1-596, 91 tables, 83 pls., and numerous maps and large folding map.
- COOKE, C. Wythe. 1925. The Coastal Plain. pp. 19-54, in: L. LaForge *et. al.*, Physical Geography of Georgia. Geol. Surv. Georgia, Bull. 42, x + 1-189 pp., 43 pls., 6 figs.
- 1939. Scenery of Florida. Interpreted by a Geologist. Florida Dept. Conserv., Geo. Bull. 17, pp. 1-118, 58 figs.
- 1943 (1944). Geology of the Coastal Plain of Georgia. U. S. Geo. Surv. Bull. 941, pp. 1-121, geol. map.
- 1945. Geology of Florida. Florida Dept. Conserv., Geol. Bull. 29, pp. x + 1-339, 1 pl., 47 figs.
- GRAY, Asa. 1875. A Pilgrimage to Torreya. Amer. Agriculturist, 34:266-267. July, 1875. Reprinted: Scientific Papers of Asa Gray, 1:188-195, 1889.
- HARPER, Roland M. 1906. A phytogeographical sketch of the Altamaha Grit Region of the Coastal Plain of Georgia. Ann. N. Y. Acad. Sci., 17 (1), pp. 1-415. Sept. 1906, fronts. (map), 28 pls., 22 figs.
- 1913. Economic Botany of Alabama. Part I. Geographical Report, including Descriptions of the Natural Divisions of the State, their Forests and Forest Industries, with Quantitative Analyses and Statistical Tables. Geol. Surv. Alabama, Monograph 8, June, 1913, pp. 1-229, fronts. (folding map) and plate, figs. 1-63.
- 1914. Geography and Vegetation of Northern Florida. 6th Ann. Rept. Florida State Geol. Survey, pp. 163-437, 40 figs. (map) pl. figs. 41-90.
- 1915. Vegetation types. pp. 135-188, folding map, and figs. 54-70, in: E. H. Sellards *et. al.*, The Natural Resources of an area in Central Florida, including a part of Marion, Levy, Citrus, and Sumter Counties. 7th Ann. Rept. Florida State Geol. Surv. pp. 117-251, with fig. 53 and folding soil map.
- HENDERSON, J. R. 1939. Generalized vegetation map of Florida. Florida Agr. Exp. Sta., Gainesville, Florida, 9/12/39 (1939). To accompany: The Soils of Florida. Florida Agr. Exp. Sta. Bull. 334, May, 1939, pp. 1-67, 5 figs.

- HOBBS, Horton H. 1942. The crayfishes of Florida. Univ. Florida Publ. Biol. Sci. Ser., 3 (2), pp. vi + 1-179, 24 pls., figs. a-c and 11 maps.
- LAESSLE, Albert M. 1942. The Plant Communities of the Welaka Area, with special reference to correlations between soils and vegetational succession. Univ. Florida Publ. Biol. Sci. Ser. 4 (1), pp. 1-143, 14 pls., 25 figs.
- ROGERS, J. Speed. 1933. The ecological distribution of the Crane-flies of northern Florida. Ecol. Monogr., 3 (1), pp. 1-74, Jan. 1933, 25 figs.
- SELLARDS, E. H. 1914. Some Florida Lakes and Lake Basins. Fla. State Geo. Survey. 6th Annual Report. 115-159.
- SELLARDS, E. H. and H. GUNTER, 1918a. Geology between the Apalachicola and Ocklocknee Rivers in Florida. 10th-11th Ann. Rept. Florida Geol. Surv., pp. 9-56, figs. 1-6, folding map.
- 1918b. Geology between the Choctawhatchee and Apalachicola Rivers in Florida. 10th-11th Ann. Rept. Florida Geol. Survey. pp. 77-102, figs. 7, 8, folding map.
- THORNE, Robert F. 1949. Inland Plants on the Gulf Coastal Plain of Georgia. Castanea: Jour. So. App. Bot. Club, 14, pp. 88-97, with map of the physiographic divisions of southwestern Georgia.
- 1951. Vascular plants previously unreported from Georgia. Castanea: Jour. So. App. Bot. Club, 16, pp. 29-48.
- 1954. The Vascular Plants of Southwestern Georgia. Am. Mid. Nat. Vol. 52, No. 2, pp. 257-327.
- 1947. Principal Habitats in Limestone Area of Southwestern Georgia. An outline for the use of collaborators at the Emory University Field Station, Newton, Georgia. Prepared September 17, 1947. 2 pp., unpublished.
- YOUNG, Frank N. 1954. The Water Beetles of Florida. Univ. Florida Studies, Biol. Sci. Ser., 5 (1): pp. x + 1-238, 31 figs.

PLATE I



Upper: Station 1. Lake created by Dam at Chattahoochee State Park, Alabama. River bank trees and cut-over hammock with loblolly pine showing to the left and center.

Lower: Station 13. Spring Creek immediately below site of former dam. Bald cypress, center and right are the only trees bordering the stream.



Upper: Station 16-A. Dry longleaf pine with runner oak, wire-grass and a great variety of herbs; characteristic of much of the Dougherty Plain.

Lower: Station 14-A. Dry oakland with longleaf pine more obvious in the foreground, the principal oaks being turkey, upland willow and small post oak. Wire grasses dominate the ground cover.



Upper: Station 16-B. (Frog Pond). The larger trees are bald cypress and tupelo. The small flowers of fanwort are visible in the foreground. The water is higher than normal due to effect of the Jim Woodruff Dam impoundment.

Lower: Station 6. (Gravel Lake).



Upper: Station 10-A. Bayhead, showing relic slash and pond pines and the somewhat lower, very dense growth of white bay, tyty and other predominately evergreen shrubs.

Lower: Station 12-A. Hawthorn thicket, just beyond the partially cleared right-of-way on Georgia State Road 97, foreground. Loblolly and slash pines with scattered sweet and black gums tower over the thicket.



Upper: Station 20. An open area in the Hosford Bog. The pitcher plants (*Sarracenia leucophylla* and *S. flava*) are plainly visible among the wire-grass, foreground. Scattered *Cliftonia monophylla* are shown in the central area and to the left. Slash pines and typical bayhead vegetation occupy the lower and wetter area in the background.

Lower: Station 20. Bayhead in the wettest and relatively unburned portion of the Hosford bog. This bayhead is almost completely surrounded by the more or less open bog shown above.



Upper: Station 19. Bald cypress-water tupelo characteristic of the wetter depression of an alluvial swamp. The small trees, forming a very thin understory, are water elms (*Planera aquatica*).

Lower: Station 19. Hardwood bottom composed largely of hackberry (*Cellis laevigata*). Just to the left of this area, at slightly lower level, overcup oaks predominate. To the right a nearly pure stand of sweet gum occurs, as shown in Plate VII, upper.



Upper: Station 19. A nearly pure stand of tall, straight sweetgums with a few sycamores, a facies of the hardwood bottoms.

Lower: Station 4. Mixed hardwood bottom, Butler's Landing. This is a good example of a drier type of bottom, flooded only at extreme high water.



Upper: Station 9. Mosquito Creek below bridge. This sandbottom stream has practically no herbaceous aquatics where it flows through the hammock.

Lower: Station 9. Mosquito Creek Hammock. The larger trees are: left center—beech, right center—magnolia, extreme left—laurel oak, and a small basket oak on extreme right.

Upper: A pond on the Dougherty Plain. The shallow water, lack of vegetation and muddy bottom are characteristic.

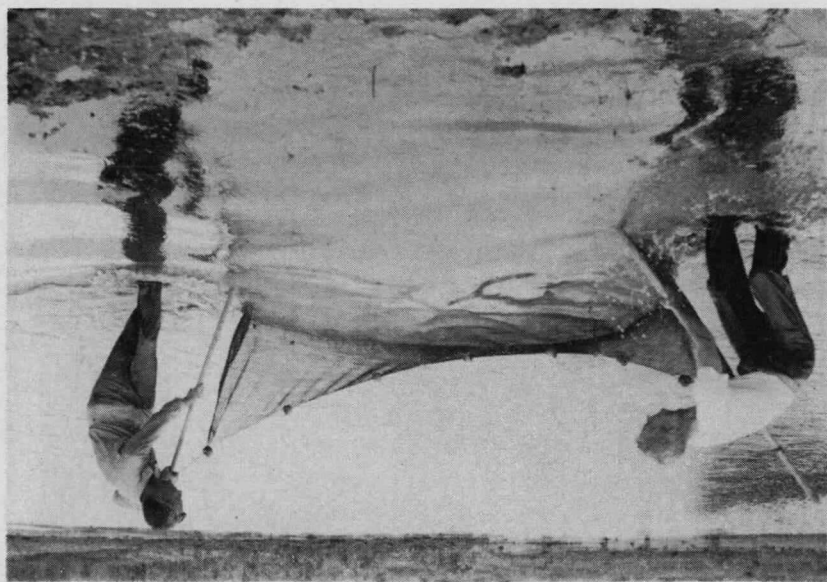
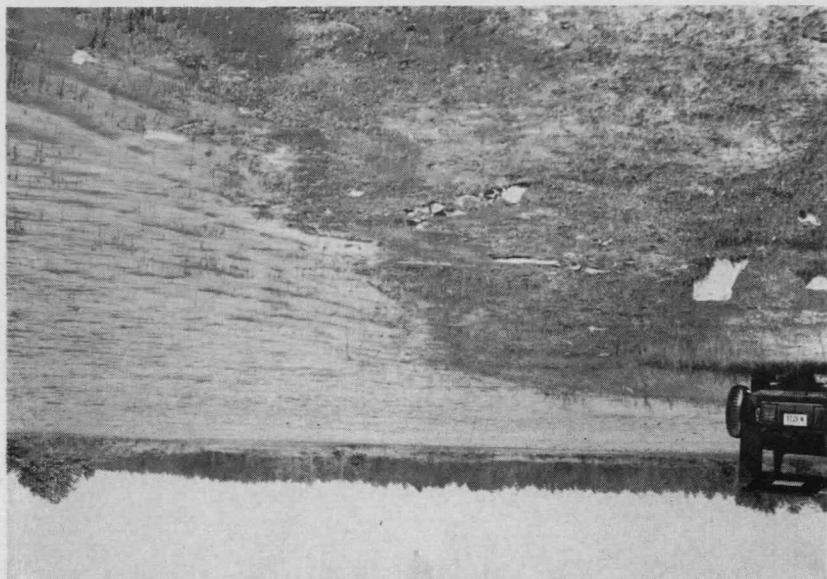


PLATE IX

Lower: Station 17, Ray's Lake at a moderate low water level. Most of the vegetation visible along the shore and in the shallow water is *Bacopa caroliniana*.



Upper: View of cleared area looking northward across the flood plain of the Chattahoochee River from Tan Vat Hill. This photograph was made as the clearing was being completed in 1952.

Lower: Same view in 1955, showing the sprout growth and old-field characteristics of the area.