ATTACHMENT 4

HYDROLOGY AND HABITAT EVALUATION FIFTY-ONE SELECTED COLONIES OF PONDBERRY IN DELTA NATIONAL FOREST, MISSISSIPPI

HYDROLOGY and HABITAT EVALUATION OF FIFTY-ONE SELECTED COLONIES OF PONDBERRY in DELTA NATIONAL FOREST, MS

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Order No. 1448-43910-1-M007A

For

US FISH & WILDLIFE SERVICE
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INTRODUCTION

Pondberry (*Lindera melissifolia*) is one of three North American spicebushes of *Lindera*, a genus of about 100 species predominantly in east Asia (van der Werff 1997). Because of its scarcity and the occurrence of a pubescent form of the common spicebush, *Lindera benzoin*, confusion has marked the botanical correspondence, reports, collections, and manuals over the past two centuries. That the genus--at least in North America—is not well understood is highlighted by the fact that a new species, *Lindera subcoriacea*, was named as recently as 1983 (Wofford 1983). Others (Gordon, personal communication) believe cryptic species are yet to be found within the southeastern US assemblage of spicebushes.

The geographic range of pondberry is currently documented from the Coastal Plain of the South Atlantic, the Gulf Coast, and the Mississippi Embayment (U.S. Fish and Wildlife Service 1993). Populations are generally disjunct in a narrow curving band stretching from southeast Missouri and adjacent Arkansas to the Delta in west-central Mississippi; then southern Georgia to southeast North Carolina. Colonies have not been relocated in Louisiana, Alabama, and Florida since early nineteenth century collections were made in these States.

OBJECTIVES

The U.S. Fish and Wildlife Service contracted Gulf Coast Biological Surveys, Inc. [no relation to Gulf South Resource Corporation (GSRC)] in April 2001 to examine selected sites of pondberry in Delta National Forest, Mississippi and to determine if these colonies were located in ponded depressions mostly influenced by rainwater accumulation or on alluvial ridges mostly influenced by over-bank flooding. This report documents these findings.

METHODS

Materials provided to the contractor were USGS topographic maps with GSRC colony locations plotted and numbered; a list of Universal Transverse Mercator (UTM) coordinates for each colony; Compartment maps for Delta National Forest; a copy of "Final Survey Report: Reevaluation of Pondberry in Mississippi" (Gulf South Research Corporation 2000); and a copy of the pondberry Recovery Plan (U.S. Fish and Wildlife Service 1993).

Procedures were to locate the colony or the area designated by red flagging and a numbered stake; to note wetness characteristics, groundcover, overstory, and colony condition; and to provide photo documentation. Sites were located by choosing the "best route" based on topography and by using a Garmin 75 GPS unit to locate the coordinates. Forest Service staff at Rolling Fork generously provided suggestions on access to certain colonies.

Field work was conducted during eight days in April 2001 (4/3-4/5; 4/10-4/13; 4/18).

RESULTS

Before presenting a synoptic discussion for each colony, three errors in mapping were found. Colonies 45 (Easting 714125/ Northing 3620368) and 46 (Easting 714127/ Northing 3620356) are incorrectly mapped and no pondberry plants could be found at these coordinates. The correct locations where flagging and stakes were found should be approximately 1,200 meters northwest of the mapped points on the Lucre quadrangle. Approximate UTM coordinates are Colony 45: easting 713167/ northing 3621183; Colony 46: easting 713169/ northing 3621165. In searching for these two sites, an additional colony of 50 stems was found at easting 713153/ northing 3621022.

The error for Site 54 appears to be a typographic entry one. As provided, the NAD 27 UTM coordinates (easting 716257/ northing 3630607) fall within Yazoo County in the middle of Pan Handle Brake (Holly Bluff USGS quadrangle). The correct location should be easting 706257/ northing 3630607 on the Red Rock USGS quadrangle. UTM coordinates obtained with the Garmin 75 unit were 706256/3630607; 706260/3630617.

The Bayland topographic map does not show a numbered Site 23 although the yellow triangle point that marks the locations was plotted. The colony was flagged and staked.

At almost all sites the number of stems counted during this survey were less than the number of stems counted by Gulf South Research Corporation. In certain instances the flagged area where pondberry plants were concentrated was smaller than GSRC's original plot census. The discrepancy in colony census numbers probably should not be taken as a decline in colony size although all colonies showed die-back.

The photo record is found at the end of this report.

As evidence for depressional ponding the following criteria were used:

- Presence of standing water with no defined exit channel
- Presence of obligate aquatic vegetation when canopy is open
- Absence of obligate wetland herbaceous groundcover when canopy is closed
- Local depressional topography
- Accumulation of partly decomposed, stratified leaves with silty veneer

As evidence for overbank flooding these criteria were used:

- Absence of standing water
- Development of diverse groundcover
- Topographic rises with respect to nearly swales
- Presence of loose detrital accumulation
- Presence of species typical of alluvial, well-drained environments

In the following brief descriptions, the scientific name of the genus is generally used. Common names have been chosen from the lists included in the Gulf South Research Corporation (2000) report.

Acer negundo	Box elder
Acer rubrum	Red maple
Ampelopsis arborea	Pepper vine
Arundinaria gigantea	Cane
Berchemia scandens	Rattan
Brunnichia ovata *[=B. cirrhosa]*	Lady's ear drops
Campsis radicans	Trumpet creeper
Carex cherokeensis	Cherokee sedge
Carya aquatica	Water hickory
Celtis laevigata	Sugar berry
Cornus drummondii	Swamp dogwood
Crataegus sp.	Hawthorn
Diospyros virginiana	Persimmon
Forestiera acuminata	Swamp privet
Fraxinus pennsylvanica	Green ash
Galium sp.	Bedstraw
Liquidambar styraciflua	Sweetgum
Matelea sp.	Climbing milkweed
Parthenocissus quinquefolia	Virginia creeper
Phytolacca americana	Pokeweed
Planera aquatica	Planer tree
Platanus occidentalis	Sycamore
Populus heterophylla	Cottonwood
Quercus lyrata	Overcup oak
Quercus nigra	Water oak
Quercus pagoda	Cherrybark oak
Quercus phellos	Willow oak
Quercus similis	Swamp post oak
Quercus texana *[=Q. nuttallii]*	Nuttall oak
Rubus sp.	Blackberry
Sabal minor	Sabal palm
Sanicula sp.	Snakeroot
Sassafras albidum	Sassafras
Smilax sp.	Green briar
Taxodium distichum	Cypress
Tovara virginiana	Jumpseed
Toxicodendron radicans	Poison ivy
Ulmus americana	American elm
Viola sp.	Violet
Vitis rotundifolia	Muscadine

Summary of Field Observations, Holly Bluff USGS quadrangle. Colonies 1-21 are located on a ridge and swale complex locally known as Fifteen Mile Bend.

GSRC 01—Edge of woodlands in view of field to north. Slight ridge with overstory of *Liquidambar*, *Celtis*, and *Ulmus*; understory with some *Sabal* and *Toxicodendron*. No silt on leaves nor indication of depressional water retention . Recorded as 1 clump of 2 stems by GSRC. Not found during this survey but possibly overlooked.

GSRC 02—Colony with 22 stems (tallest 1.5 meters). Slight slope to the east with overstory of *Liquidambar*, *Quercus phellos*; vines are *Berchemia*, *Ampelopsis*, *Brunnichia*; no *Parthenocissus* or *Toxicodendron*. Scant ground cover and no indication of ponding.

GSRC 03—Colony of 42 stems. Ridge with slight slope to the northwest. Overstory of *Liquidambar*. Moderate groundcover of herbs and vines including *Sanicula*, *Smilax*, *Vitis*, *Rubus*, *Brunnichia*, and *Parthenocissus*. No indication of ponding.

GSRC 04—Colony of 60 stems up to 2 meters tall. Slight opening in canopy with overstory of *Liquidambar*, *Quercus nigra*. Heavy groundcover and colony overrun by *Vitis*. No indication of ponding.

GSRC 05—Colony of 3 stems in small vine overrun opening beneath *Liquidambar* and *Quercus nigra*. Moderate groundcover. Ca. 10 meters from the edge of a dry depression to the west.

GSRC 06—Colony of 4 stems. Overstory is *Liquidambar* and *Quercus nigra*. Heavy groundcover of *Parthenocissus*, *Toxicodendron*, and *Vitis* with no indication of depressional ponding.

GSRC 07—Colony of 9 stems on dry ridge, draining eastward. Overstory is *Liquidambar* and *Quercus phellos*. Heavy groundcover of *Parthenocissus*, *Toxicodendron*, *Rubus*, and *Vitis*. No indication of depressional ponding.

GSRC 08—Five stems in weak colony. Site is dry, sloping east. Overstory of *Liquidambar* and *Quercus phellos*. One pondberry partly covered by *Cornus*; fair groundcover with no evidence of ponding.

GSRC 09—Colony of 35+ stems with tip-over tree fallen across colony. Overstory of *Quercus phellos* and *Liquidambar*. Very heavy vine cover. Tallest pondberry plants are 1 meter. No depressional ponding.

GSRC 10—Colony of 4 plants on dry ridge. Overstory is *Liquidambar*. Moderate groundcover including *Parthenocissus* and *Toxicodendron*. No ponding.

GSRC 11—Colony of 29 stems up to 1.5 meters tall on *Liquidambar* ridge, slightly open with old logs present. Moderate groundcover. No evidence of ponding.

GSRC 12—Colony of 21 stems. Dry ridge with overstory of *Liquidambar* and heavy vine groundcover. Site flagged but could not find stake. No ponding.

GSRC 13—One stem observed; however, top of tree is broken out and may be on top of colony. Heavy ground cover on ridge with *Liquidambar* overstory. No ponding.

GSRC 14—Fifteen stems on dry ridge that slopes to the west. Two-meter deep (and mostly dry) ditch east-west along edge of woods and ca. 8-10 meters from site Overstory is *Liquidambar, Celtis, Carya, Fraxinus*; moderate vine groundcover. No ponding. A second area flagged without post is located between GSRC 14 and GSRC 9. This colony was photographed as "GSRC 14A" (see photos at end of text).

GSRC 15—Colony of 50+ stems. Overstory is *Quercus phellos* and *Liquidambar*. Pondberry plants are small and groundcover is scant. Slough with water is visible to the east but site is clearly on berm or ridge. No depressional ponding.

GSRC 16—Colony of 25 stems up to 1 meter tall. Site slopes west to shallow depression but not considered within the area that would be modified by rainwater retention, in other words, on berm. Overstory is *Liquidambar* and *Quercus phellos*. Moderate groundcover.

GSRC 17—Colony of 75 stems mostly in one clump and 1 meter tall or a little over; numerous single stems over 20 m^2 area. A terrace colony that slopes west and not to slough that contains water to the east. Overstory is *Liquidambar*; heavy groundcover.

GSRC 18—Colony of ca. 100 stems up to 1.2 meters tall on back flank of Big Sunflower River levee. Site slopes north and ultimately drains toward the northwest. Overstory is *Liquidambar*. Groundcover moderate to heavy with *Berchemia* and *Smilax*. The common invasive, *Phytolacca*, also here. No ponding.

GSRC 19—About 15 stems positionally similar to preceding on crest and north slope of levee. Overstory opening in *Liquidambar* canopy. Badly overgrown with vines (*Vitis*); also has *Sassafras* and *Phytolacca*. Not a ponded depression.

GSRC 20—Colony of 60 stems of small plants less than ½ meter tall. Flat rise southeast of beaver impounded area. Overstory of *Liquidambar* and *Quercus phellos*. Fair ground covering of vines. Not a ponded depression.

GSRC 21—Colony of 37 stems. Overstory of *Quercus phellos* and *Liquidambar*. Moderate groundcover of vines. Colony is on very slight rise near the edge of a shallow depression, dry at this time. Condition of leaves and groundcover do not indicate prolonged if any rainwater ponding.

Summary of Field Observations, Bayland USGS quadrangle. Colonies 22-43 are located generally in the northeast corner of Delta National Forest, vicinity of Sweetgum Research Natural Area. In addition to the mixed overstory of *Liquidambar, Ulmus, Acer, Celtis,* and *Quercus* on uplands and occasional *Taxodium* in sloughs, most of the area is characterized by an abundance of *Sabal* palms in the understory.

GSRC 22—Colony of 12 stems. Hardwood flat. Overstory of *Liquidambar*; understory with scattered *Sabal* and groundcover moderate (*Toxicodendron, Ampelopsis, Smilax, Parthenocissus*). No evidence of ponding.

GSRC 23—Three stems with overstory of *Liquidambar*. Very slight depression; however, groundcover well developed including *Carex, Brunnichia, Viola, Parthenocissus, Matelea, Toxicodendron,* and seedlings of *Ulmus*. Minimal ponding.

GSRC 24-- Seven stems with overstory of *Liquidambar*. Groundcover is well developed in small canopy opening with *Toxicodendron, Brunnichia, Campsis,* scattered *Sabal* and numerous seedlings of *Celtis*. Area is flat with minimal ponding, if any.

GSRC 25—Two stems beneath *Liquidambar* canopy. *Sabal* scattered; groundcover moderately well developed, mostly *Toxicodendron*. Very slight depression, dry at this time.

GSRC 26—Colony of 73 stems crest of flatwoods dropping off to depression or drainage ditch (?) to the south. Overstory of *Liquidambar* and *Quercus nigra*. Very heavy herb and vine groundcover in opening (*Toxicodendron, Vitis, Parthenocissus, Carex,* occasionally dense *Sabal,* and numerous sprouts of *Diospyros*).

GSRC 27—Colony of 12 stems. Mixed overstory of *Liquidambar, Platanus, Populus, Quercus phellos, Q. nigra. Sabal* abundant; scant vine groundcover. No indication of ponding.

GSRC 28—Colony of 16 stems. Overstory *Liquidambar, Quercus phellos, Q. nigra.* Heavy groundcover of *Parthenocissus, Rubus, Vitis, Acer negundo,* with *Sabal* nearby. Site slopes north about 50 meters to a small drain. Ponding unlikely.

GSRC 29—More than 200 stems, 2-5 dm tall. Overstory *Liquidambar, Celtis, Ulmus, Quercus phellos*. Understory with scattered *Sabal*. Diverse herbaceous groundcover. Site is flat and dry with no evidence of ponding.

GSRC 30—More than 100 stems to 1.5 meters tall. Overstory of *Ulmus* and *Celtis* with a few scattered *Sabal* in understory. Groundcover of herbs and vines diverse. Site is flat with occasional small depressions and minimal ponding.

GSRC 31—Colony of 150+ stems to 1 meter tall. Overstory of *Quercus texana, Acer rubrum, A. negundo, Celtis*. Slight opening with small *Sabal* and abundant small *Smilax,*

Rubus, and *Brunnichia*; also *Carex* and *Tovara*. Site is low, dry at this time with minimal ponding.

GSRC 31A—Seven stems. Overstory of *Liquidambar*, *Quercus phellos*. Abundant understory of *Sabal*. Sparse groundcover beneath *Sabal*. Slight opening and dry with no evidence of ponding.

GSRC 32—Six stems. Overstory of *Liquidambar*. Near edge of shrub thicket of old clearcut. Sparse vine groundcover of *Berchemia*, *Campsis*, *Smilax*, *Parthenocissus* and few *Sabal* sprouts. Area generally consists of low hardwood flats; site has imperceptibly slope to north into cutover forest. Doubtful if water covers site during growing season.

GSRC 33—Colony of 27 stems with severe die-back (at least 50%). Overstory of *Liquidambar*. Moderate groundcover of *Parthenosissus* and *Campsis* with seedlings of *Diospyros*, *Smilax*, and scattered *Sabal*. No evidence of ponding; probably drains to the north.

GSRC 34—Colony of 11 stems, mostly less than 1 meter tall. Overstory of *Liquidambar*, *Acer rubrum*, and *Quercus similis*. Understory and shrub plants include *Cornus* and *Celtis* with groundcover of *Parthenocissus*, *Smilax*, and *Campsis*. Plot has a small (2 m^2) depression with ca. 1 cm of water; otherwise, minimal ponding.

GSRC 35—Colony of 24 stems. Overstory of *Liquidambar* on slight rise. Heavy groundcover of vines and low shrubs (*Smilax*, *Toxicodendron*, *Parthenocissus*, *Berchemia*). Site drains toward clearcut swale to the northwest. Minimal ponding.

GSRC 36-38—Original GSRC plots cover more than 6,000 sq. ft. Area generally comprised of *Liquidambar* overstory and dense understory/groundcover mostly dominated by *Sabal* with abundant vines and herbs in *Sabal* openings. Part of this site contains hundreds if not thousands of pondberry plants and is part of a research area of Schiff and Duvall. Not subject to ponding.

GSRC 39-43—These five plots are located around the margin of one of two woodland natural ponds, characterized by overstory of *Liquidambar*, *Quercus texana*, *Q. pagoda*, *Q. lyrata*, *Diospyros*, and other hardwoods. Standing water is present and groundcover is totally lacking. Deeper parts of the ponds have a few large *Taxodium* but these together with *Planera* and *Forestiera* subcanopy trees are in water too deep for pondberry colonization. Numbers of pondberry plants vary from plot to plot with only a few emergent stems (GSRC 39-41) to hundreds of plants (GSRC 42-43). In addition, pondberry colonies are found on non-ponded sites southwest of GSRC 39-43 and at these locations groundcover is well developed.

Summary of Field Observations, Lucre, Red Rock, and Valley Park USGS quadrangles.

GSRC 44—Colony of 25 plants in disturbed woodlands, a short distance west of large field. Overstory of *Liquidambar*, *Fraxinus*, and *Quercus texana*. Groundcover absent. Site is damp, possibly a slight depression.

GSRC 45—More than 200 stems in dense cluster, many approaching 2 meters tall. These are the tallest pondberries observed. Overstory of *Liquidambar*. Large log across colony. Pondberry plants form the groundcover, but a cane brake (*Arundinaria*) was noted about 20 meters east of plot. No evidence of ponding.

GSRC 46—Colony of 91 stems to 1 meter tall. Overstory is *Liquidambar* with only a fair but floristically diverse groundcover (*Smilax*, *Toxicodendron*, *Galium*, *Viola*, *Sanicula*, and seedlings of *Fraxinus* and *Ulmus*). Site is flat, dry, and not subject to ponding, possibly due to field drainage to the north and east of this site and GSRC 45.

(Not included here GSRC 47-52)

GSRC 53—Colony of ca. 40 stems in opening beneath dead tree. Overstory *Quercus texana* and *Acer rubrum*. Abundant vines of *Berchemia*, *Vitis*, *Toxicodendron* and scant herbaceous groundcover. Plot is on a slight rise that drains west and southwest to a slough. Site is near south-southwest of a wildlife food plot and is within Sunflower Greentree Reservoir. Prior to impoundment, colony doubtfully ponded.

GSRC 54—Colony of 150 stems, west of FS Rd. 703, and south of overgrown clearcut. Overstory included *Quercus texana* and *Celtis* with a tall shrub component of *Crataegus* and saplings of *Ulmus*. Scant groundcover. Although this site is located on a very localized rise, the nearby forest is pockmarked by shallow puddles. Occasional standing water is expected.

GSRC 55—Colony of 10 stems beneath of cluster of ten overstory trees, surrounded on east, south, and west by overgrown clearcut and just south of gas line right-of-way. Overstory consists of *Liquidambar*, *Quercus pagoda*, and *Celtis*. *Sabal* is present in the understory but less frequent here than to the north of the gas line. Vines abundant; groundcover herbs scant. Ponding not expected.

GSRC 56—An excellent colony of 300 stems, many to 1-1.3 meters tall. Overstory of *Quercus texana*, *Q. similis*, *Carya*, and *Fraxinus*. Few seedlings of *Celtis*. Plot has cypress knees from an old growth tree several meters northeast of plot. Groundcover absent. Woods are pockmarked with shallow depressions, most with some standing water. Although this site is located on a slight rise, temporary ponding likely occurs.

Summary of Field Observations Regarding Ponding.

- 5 Sites with ponded water, mostly > 20 cm: GSRC 39-43
- 2 Sites with occasional standing surface water, mostly < 5 cm: GSRC 54, 56
- 9 Sites with rarely standing surface water: GSRC 23-25, 30-31, 32, 34-35, 44
- 35 Sites not ponded: GSRC 1-22, 26-29, 31A, 33, 36-38, 45-46, 53, 55

DISCUSSION

Pondberry, across its range from southeast Missouri to southeast North Carolina appears as relict populations of clonal colonies, invariably subject to dieback caused by a scientifically verified pathogen. Vigor of colonies does not seem to correlate to site edaphic conditions but appears to be inversely related to the severity of wilt. The factor responsible for stem dieback is not geographically limited to the range of pondberry since plants grown 100-200 km beyond the known range continue to show symptoms of wilt beginning at about 5 years from germination (Leonard 1995).

Single-seeded pondberry fruits are glossy red and persist well into autumn. They are not believed to be toxic, nor have they been identified as preferred forage foods of wildlife. The fleshy covering has been shown by experiment not to delay seed germination. (Leonard 1995). Fruits mature in late July-August and remain on the plants until November. Neither fruits nor seeds float. In a North Carolina study, seeds planted during the first week of September began to germinate the following April and May (Leonard 1995). The evidence suggests that seeds are dispersed during the winter months. Additional study is needed to show cold tolerance of the seed embryo.

An examination of the known colonies of pondberry indicates the species does not behave as an invasive, does not colonize ditches, beaver ponds, clearcuts, windthrow openings, dredged material, or other areas of freshly disturbed soil. Once established, however, the plants apparently do benefit from increased light by canopy mortality or forest tip-overs. Moreover, in woodlands where colonies do exist and where presumed "suitable habitat" occurs, seedlings of suspected new colonies were not observed.

Soil characteristics may be of lesser importance than hydrology to pondberry survival. At the eastern end of its range, pondberry is found sporadically around subsidence (or perhaps dunal) ponds that occur on deep sand longleaf pine ridges, frequently adjacent to rivers. These habitats typically may undergo prolonged drought and the pondberry plants are often located near or just above the high water zone in these depressions. In southwest Georgia—and possibly adjacent Alabama and Florida—the colonies are found in pineland ponds associated with karst topography but not where limestone outcrops in the walls of sinkholes. Because the majority of the known Eastern sites are located in

ponded areas, botanists have neglected ridge and swale topography of the larger river systems as potential pondberry locations.

In view of the lengthy range of pondberry distribution, the Mississippi colonies occupy what appears to be an anomalous habitat. Godt and Hamrick (1996) examined populations and found surprisingly little genetic variation in pondberry suggesting that although the habitats are different the species is relatively uniform throughout its range.

With a history of hydrologic manipulation in the Delta that dates from virtually the beginning of regional row crop agriculture, the problem of reconstructing water regimes of pondberry is difficult. Originally, prolonged winter flooding may have protected viable seeds. It will be interesting to see what happens in greentree reservoirs that flood seed-producing colonies.

As water table and flooding periodicity is reduced, sites become increasingly favorable for more plant species. In this case, improving biodiversity may work adversely toward survival of pondberry in the Delta. Drier habitat conditions could

- Stress shallowly rooted pondberry plants
- Increase severity of wilt/dieback
- Reduce or eliminate dispersal of seeds
- Reduce survival of seeds during the winter
- Intensify plant competition from native species
- Favor site exploitation by invasives

Considering where colonies occur, it is doubtful if pondberry has fire tolerance.

CONCLUSIONS

Fifty-one Delta National Forest pondberry sites were examined during April 2001. At a minimum 70 percent are not depressional wetland colonies. Five colonies (10 percent) are clearly related to ponded depressions. The remaining 20 percent probably have shallow standing water due to rainfall at irregular intervals but the frequency and duration of surface water are not sufficient to create pond conditions.

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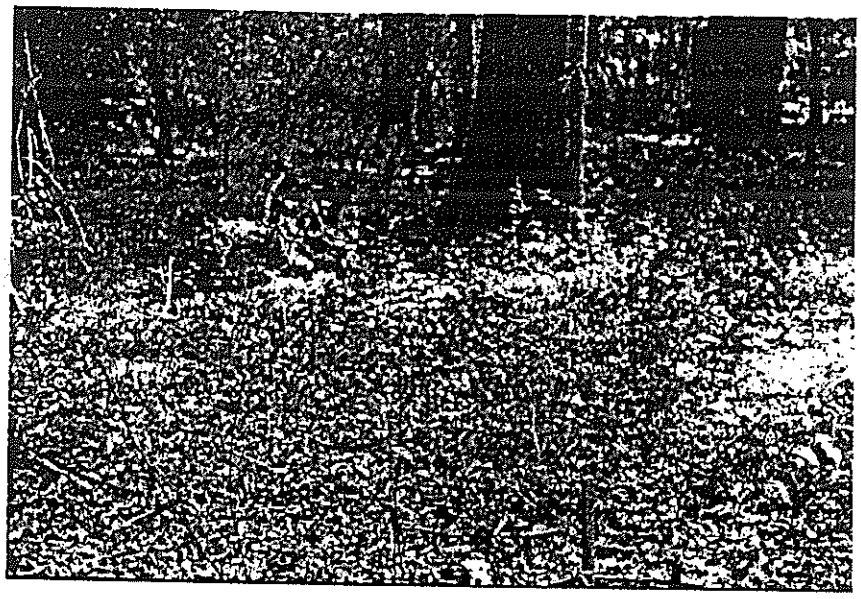
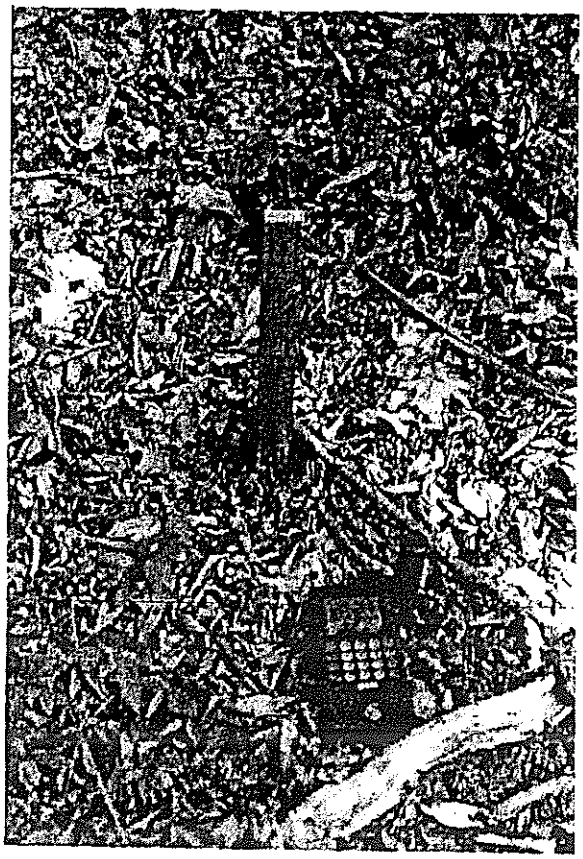
APPENDIX

GSRC 1

GSRC 2





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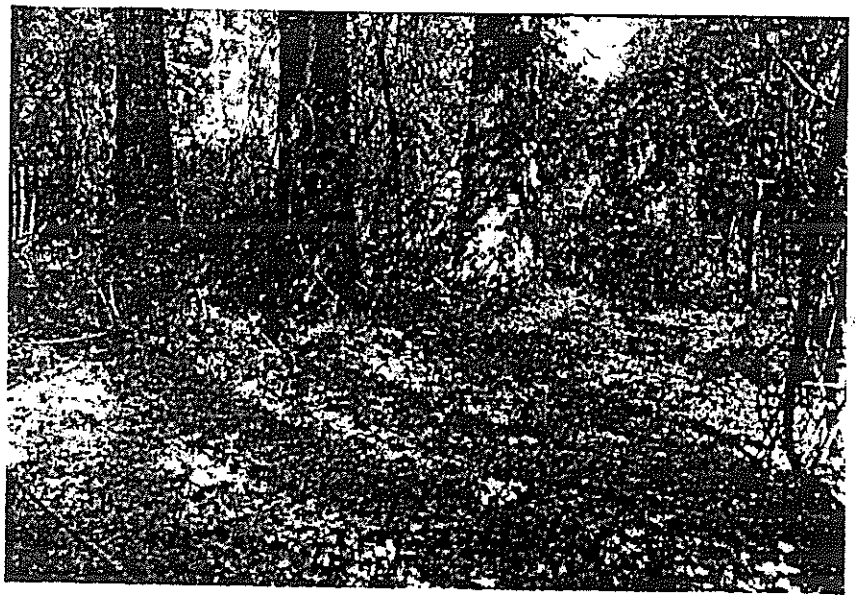

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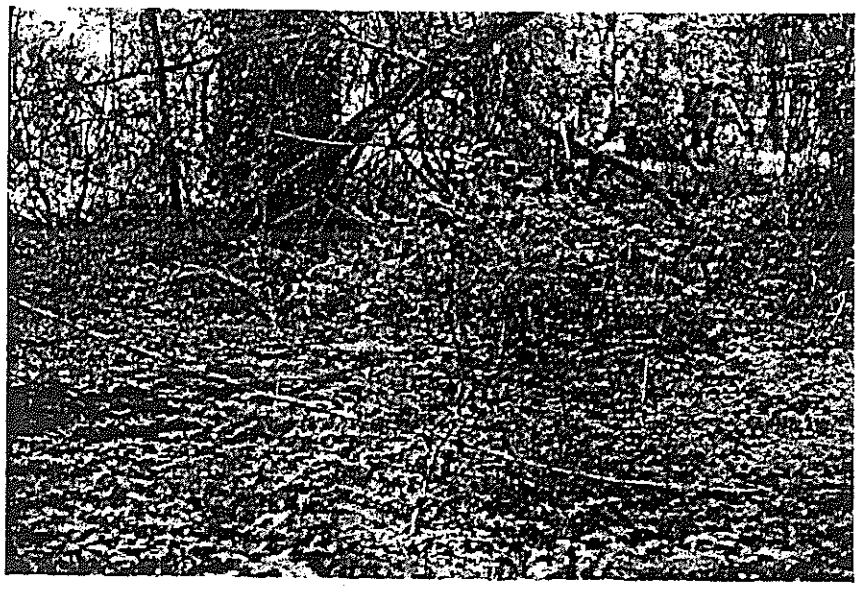

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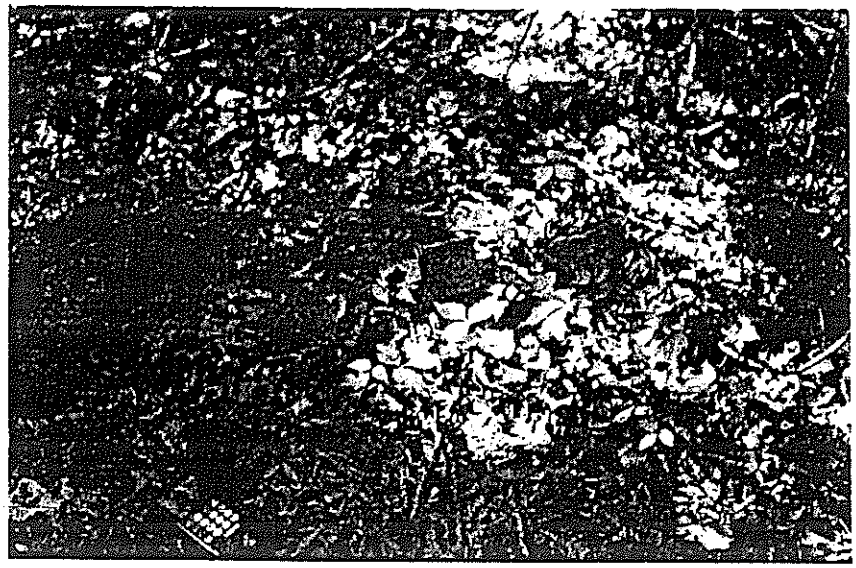

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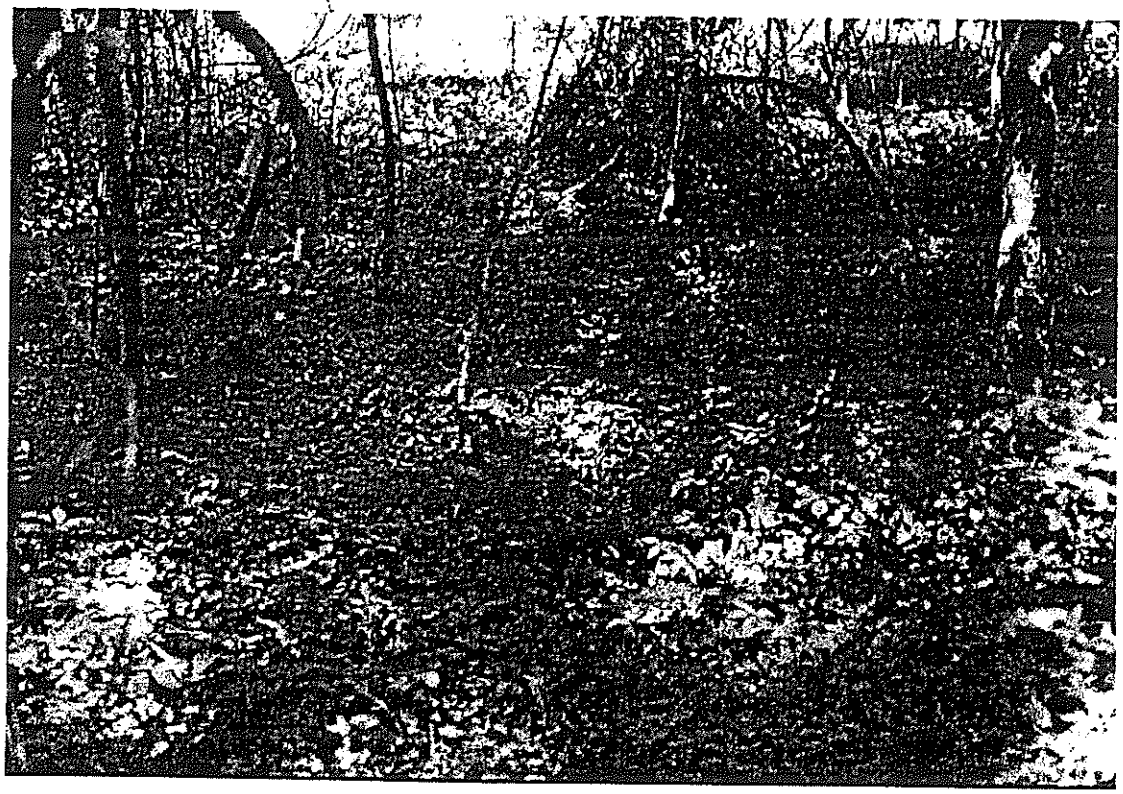

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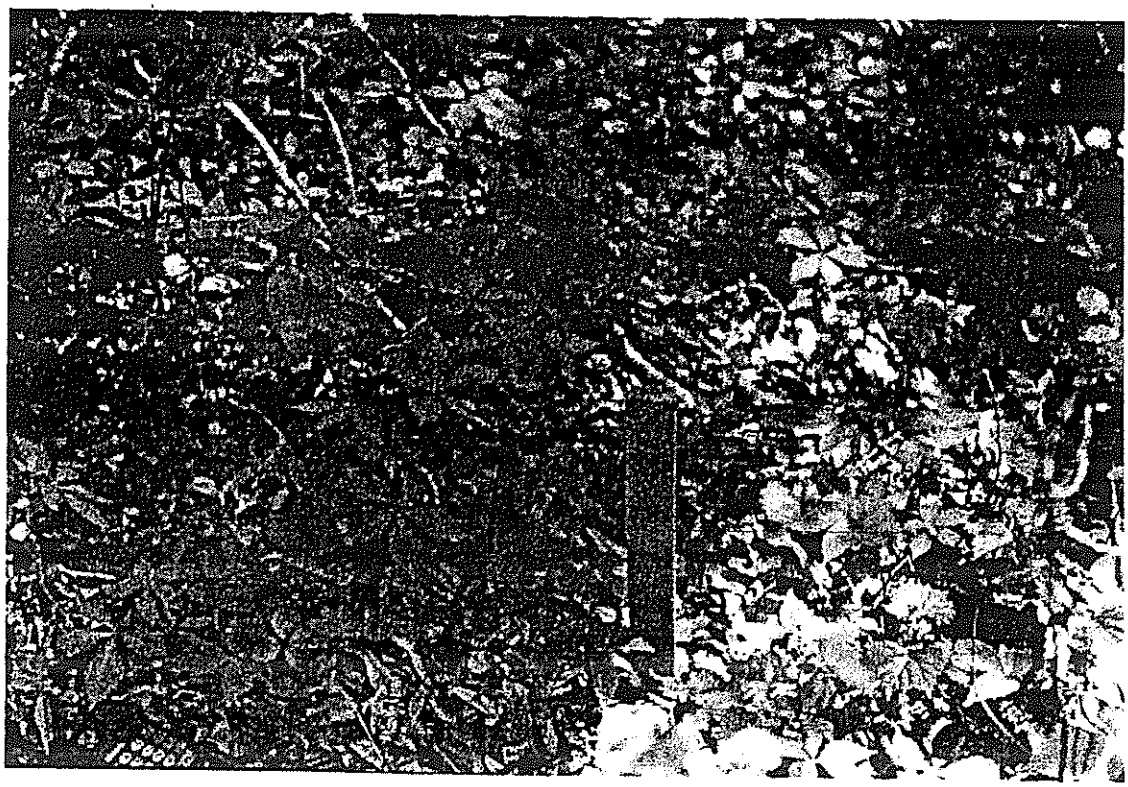

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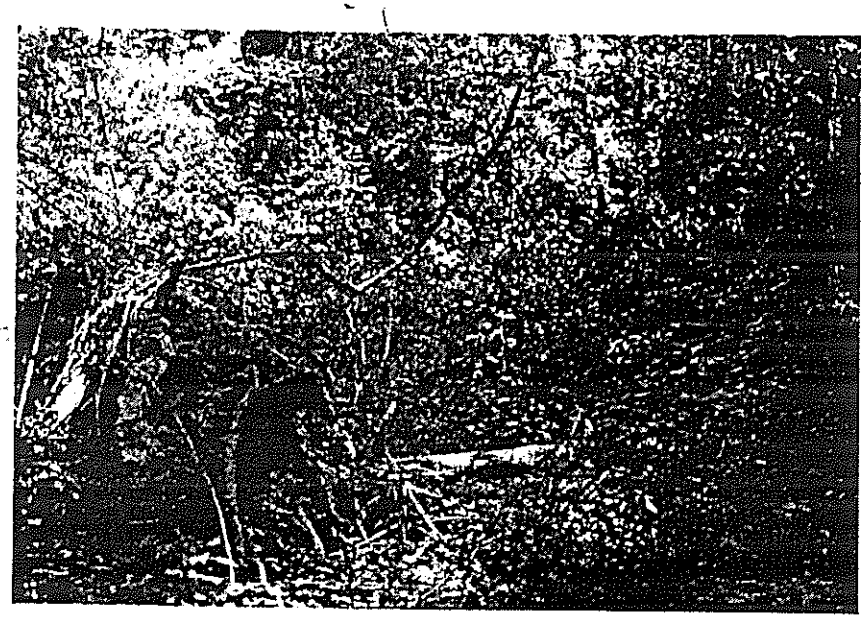

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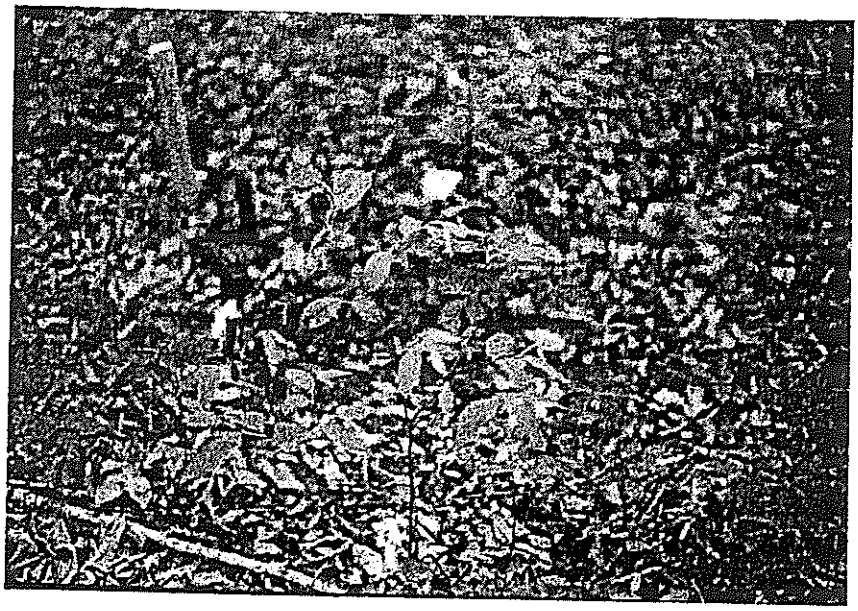
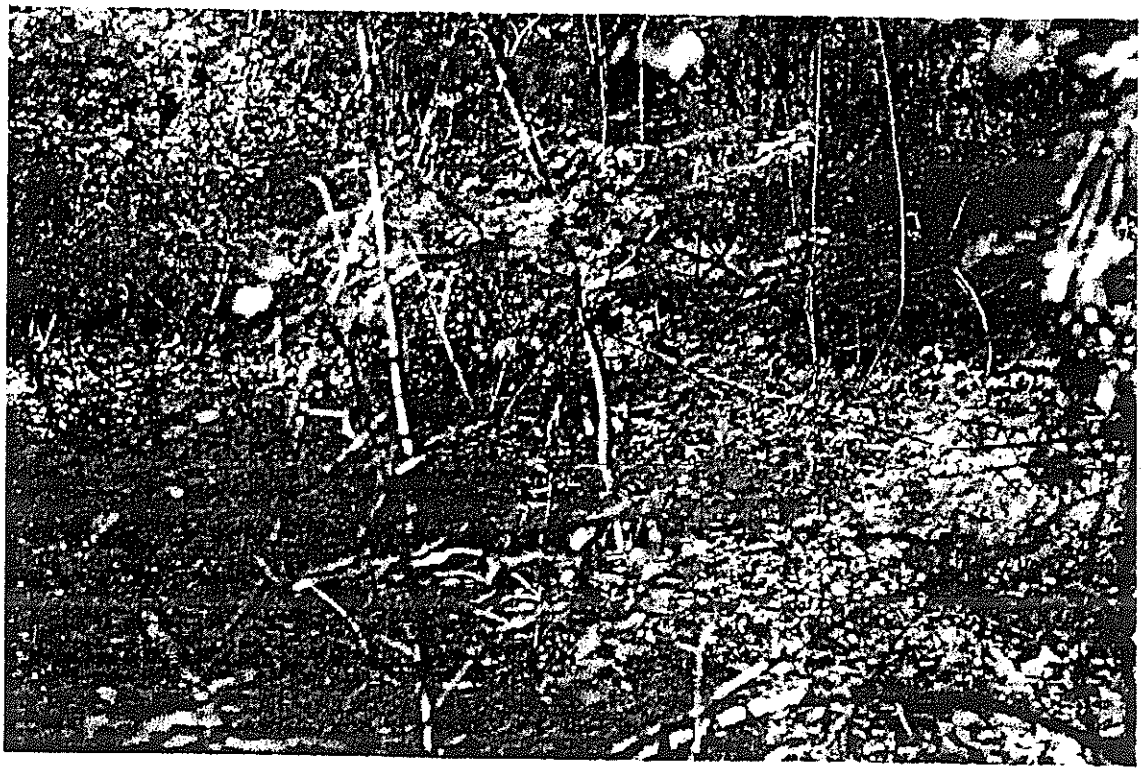


GSRC 11

GSRC 12

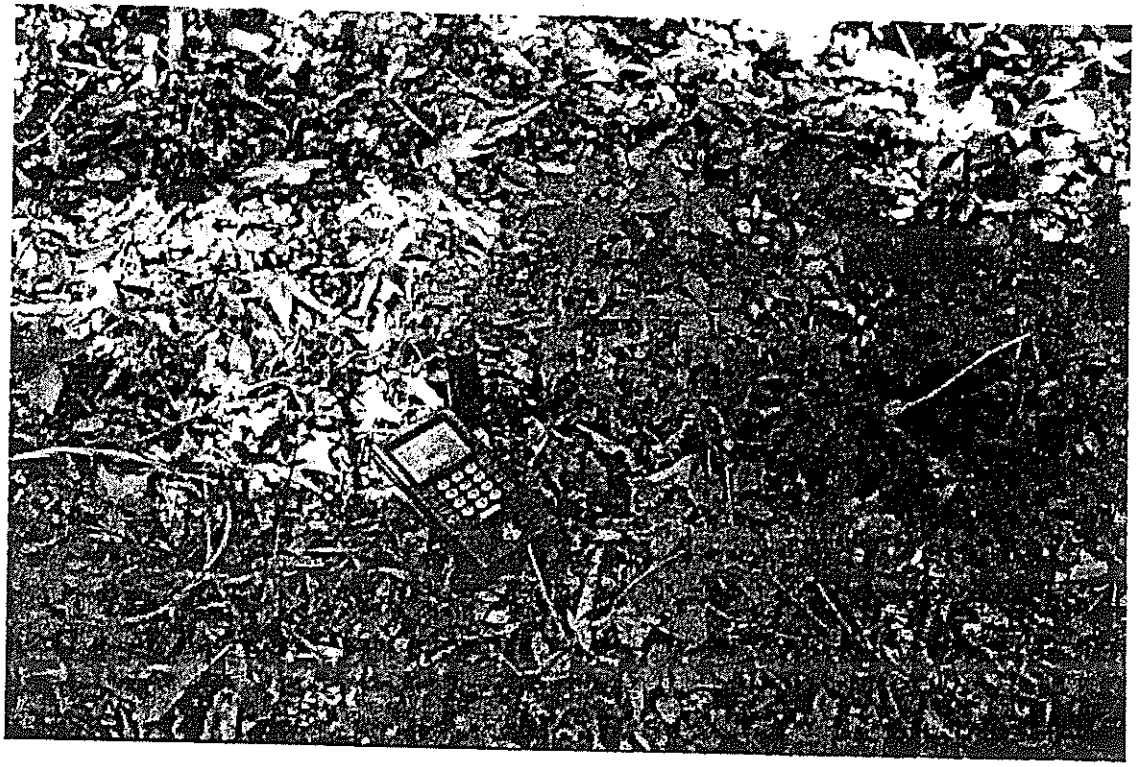
GSRC 13

GSRC 14 & 14A

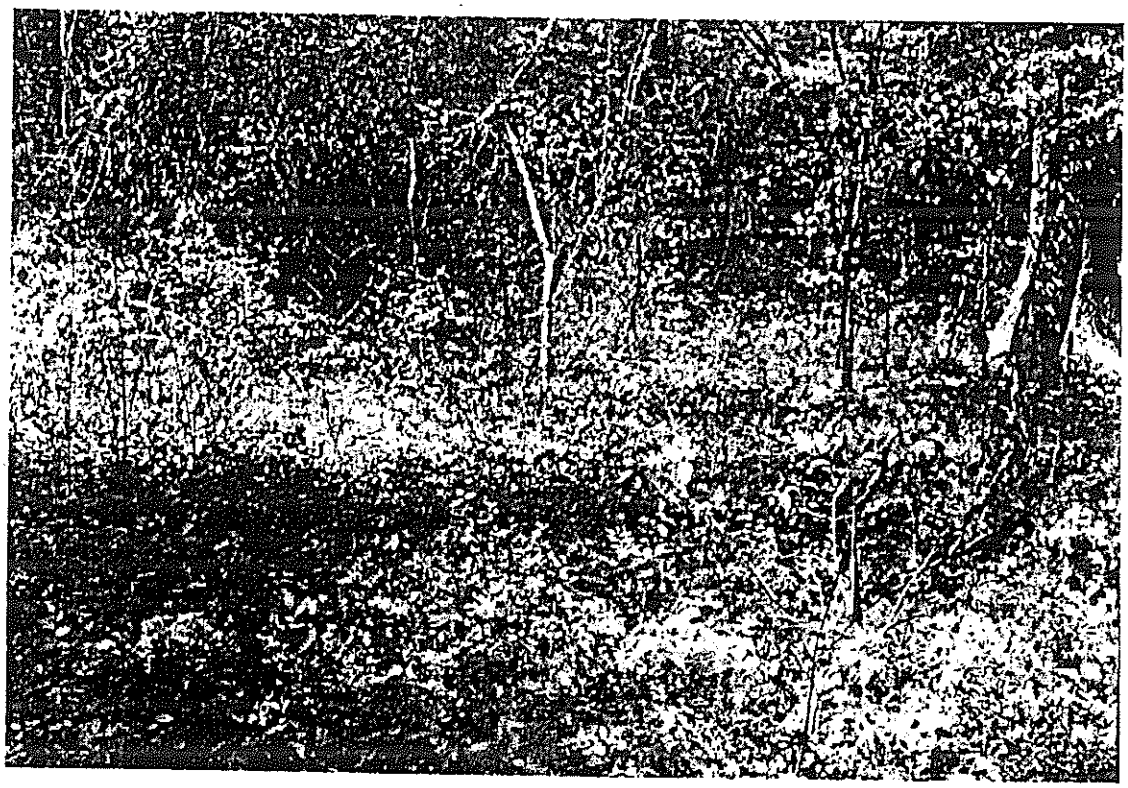


GSRC 15

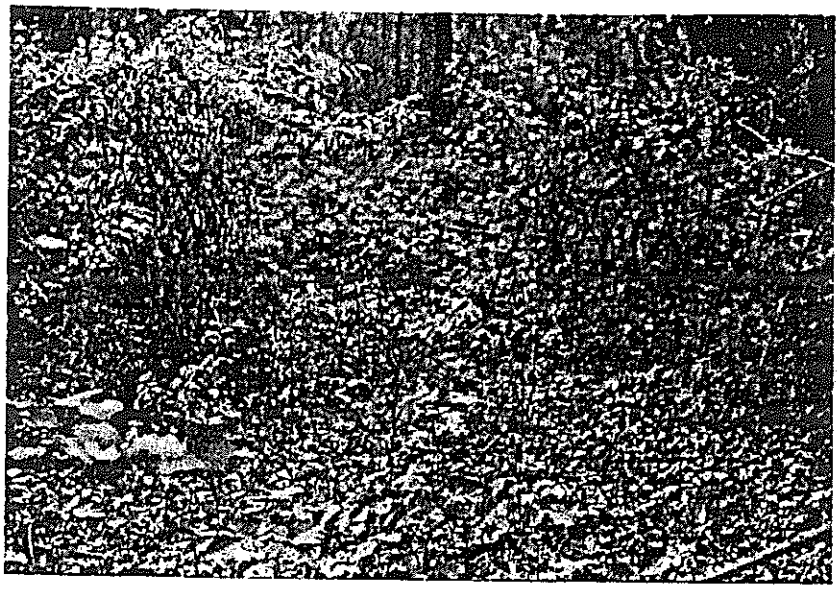
GSRC 16



GSRC 17

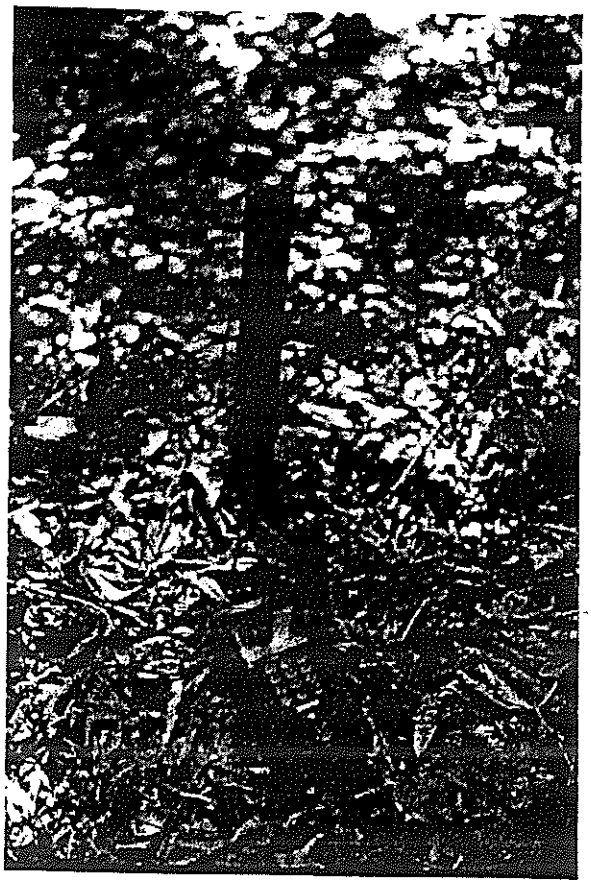


GSRC 18



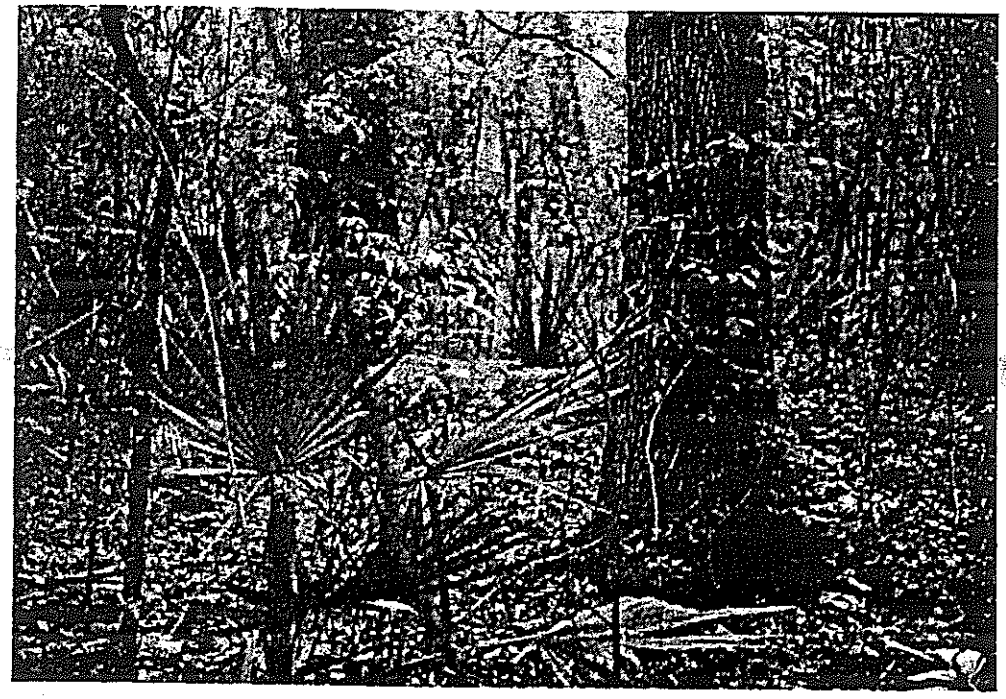
GSRC 19

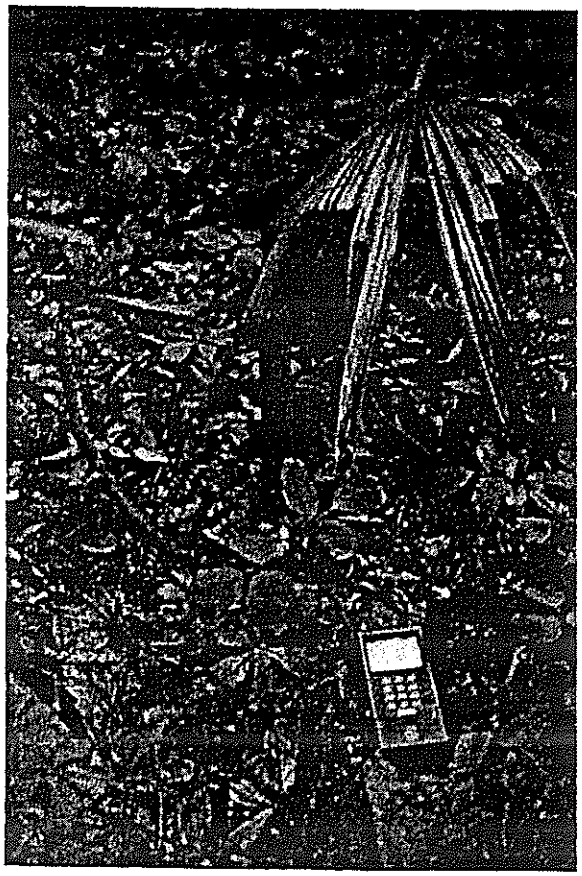
GSRC 20



GSRC 21

GSRC 22



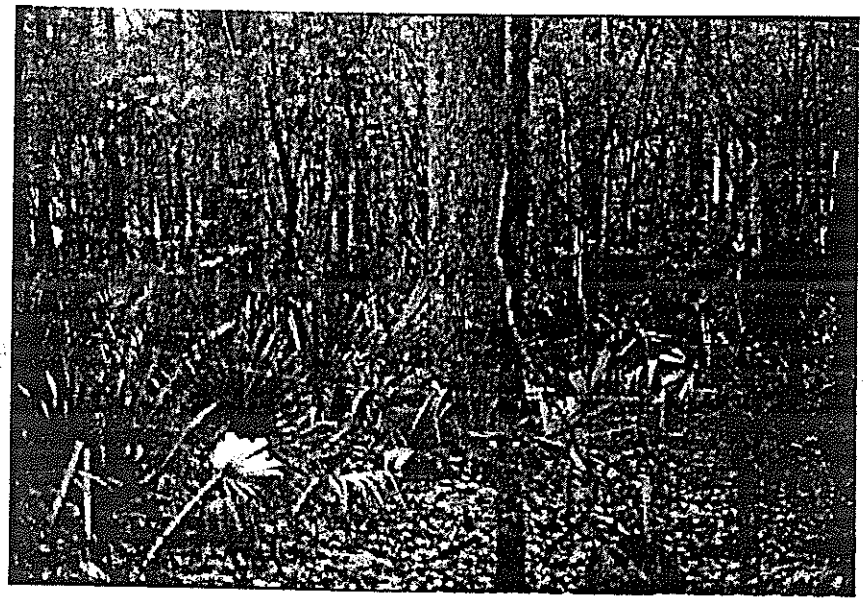


GSRC 23

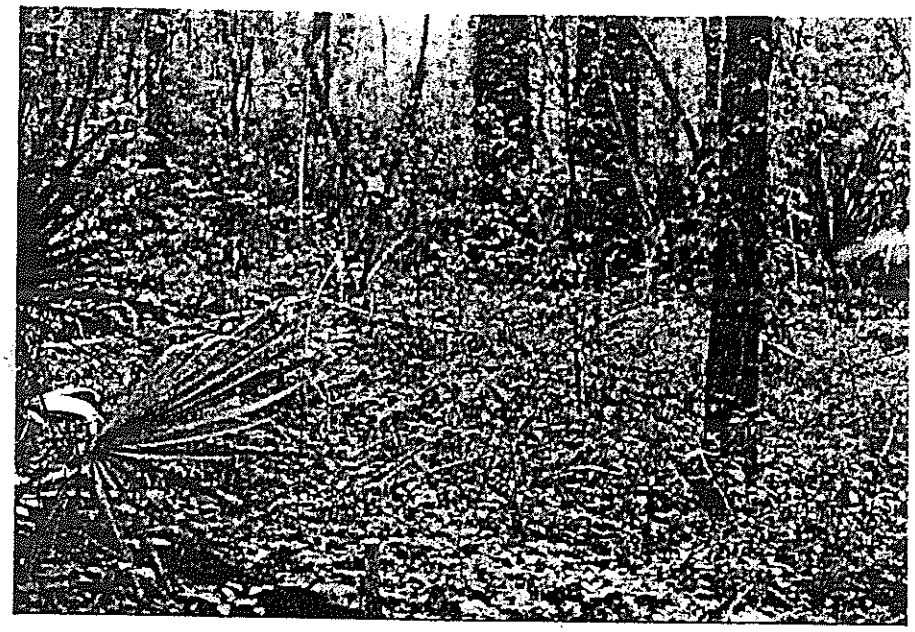
GSRC 24

GSRC 26

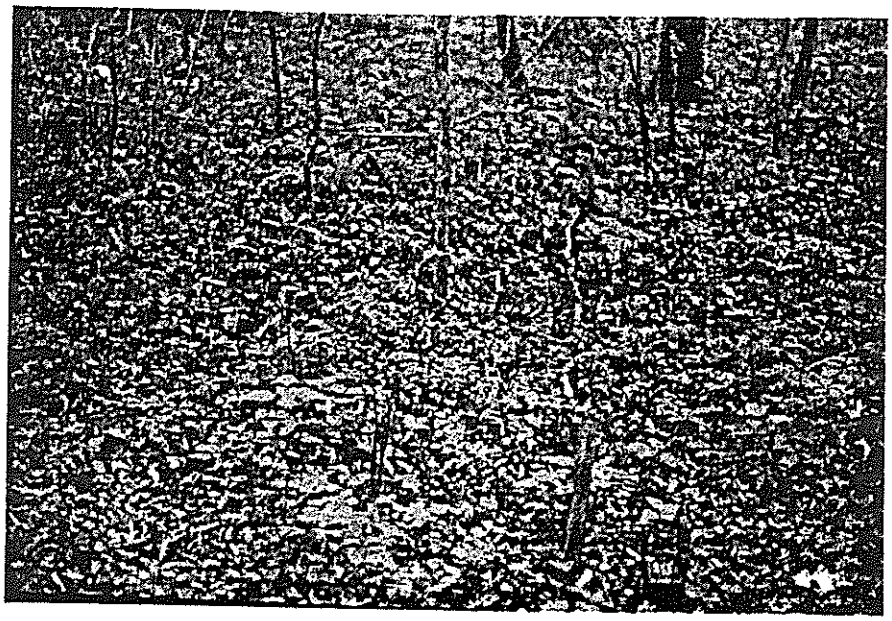
GSRC 27



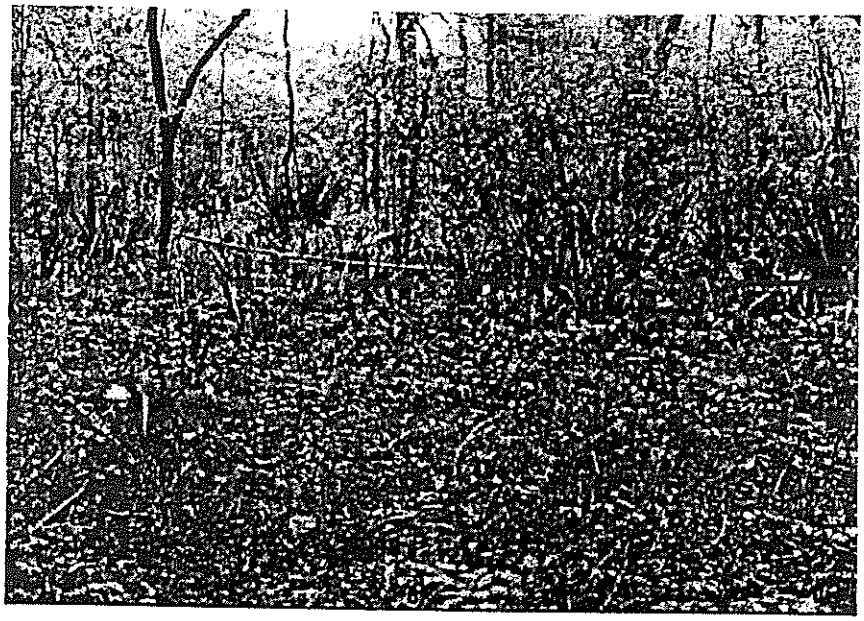
GSRC 28



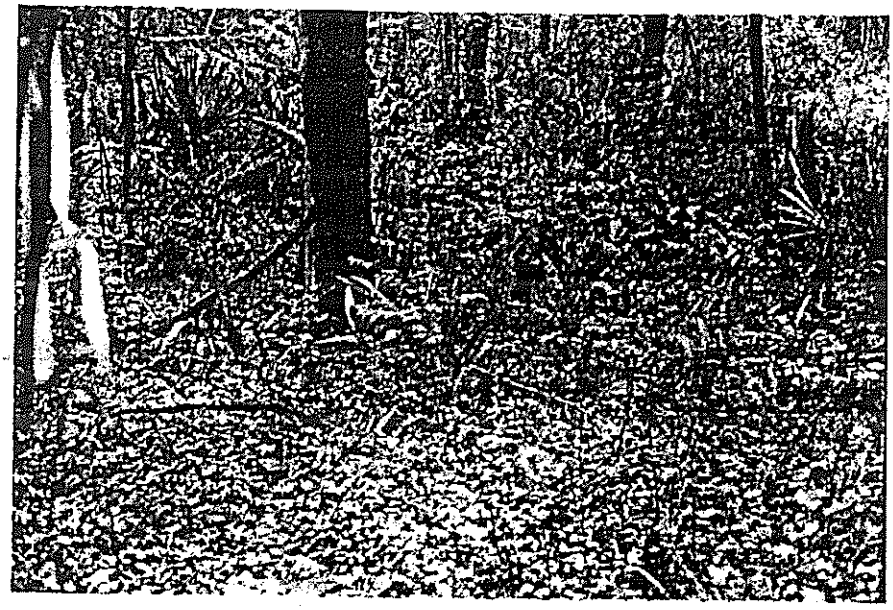
GSRC 29



GSRC 30

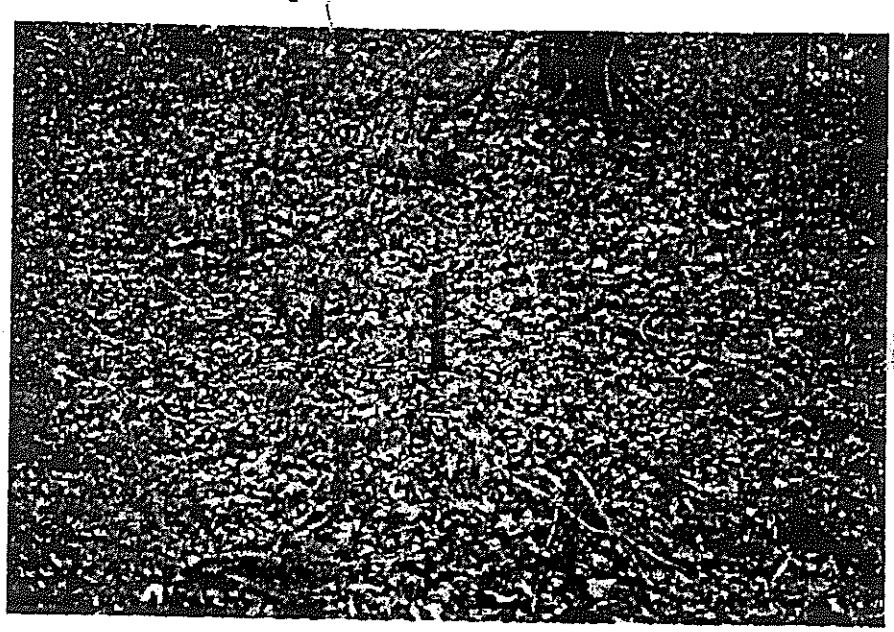


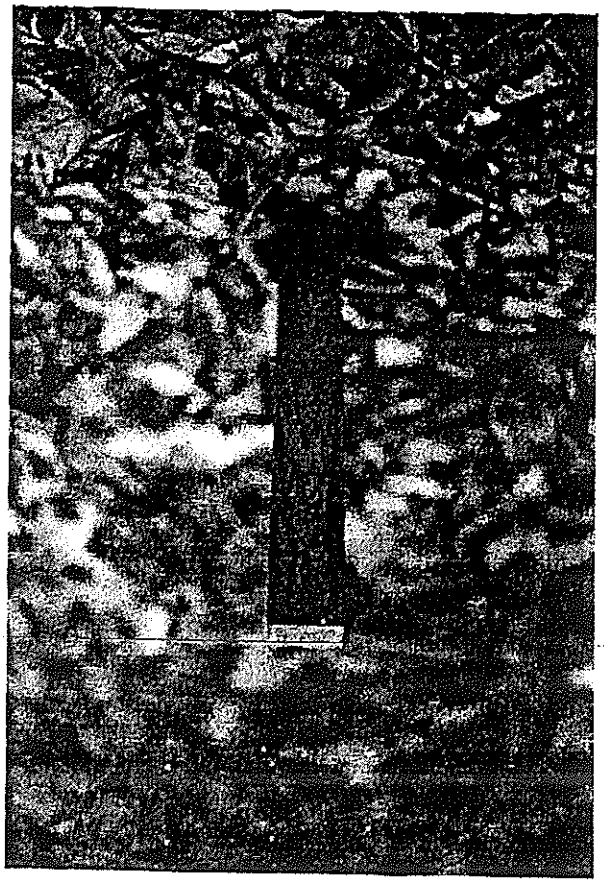
GSRC 31



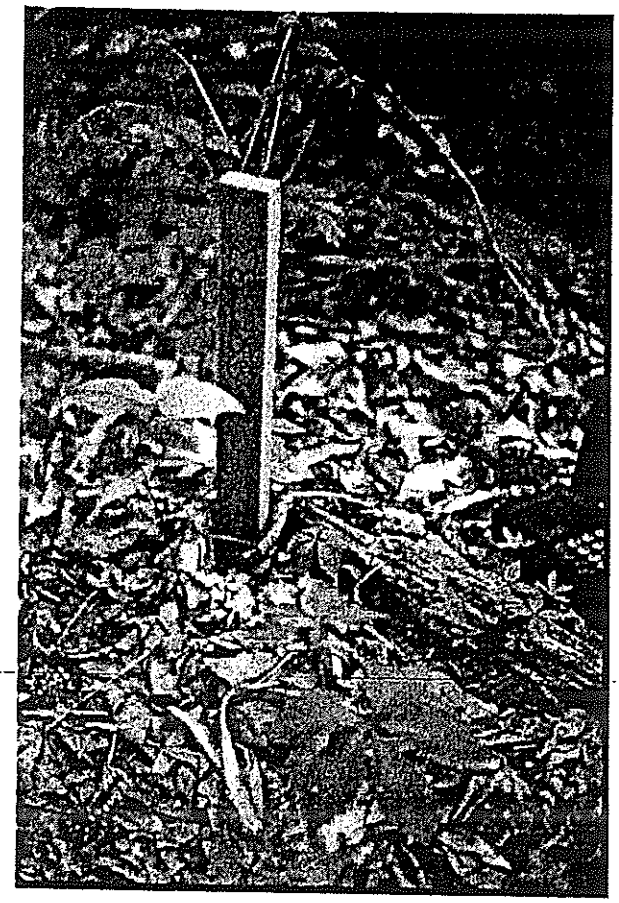
GSRC 31A

GSRC 32

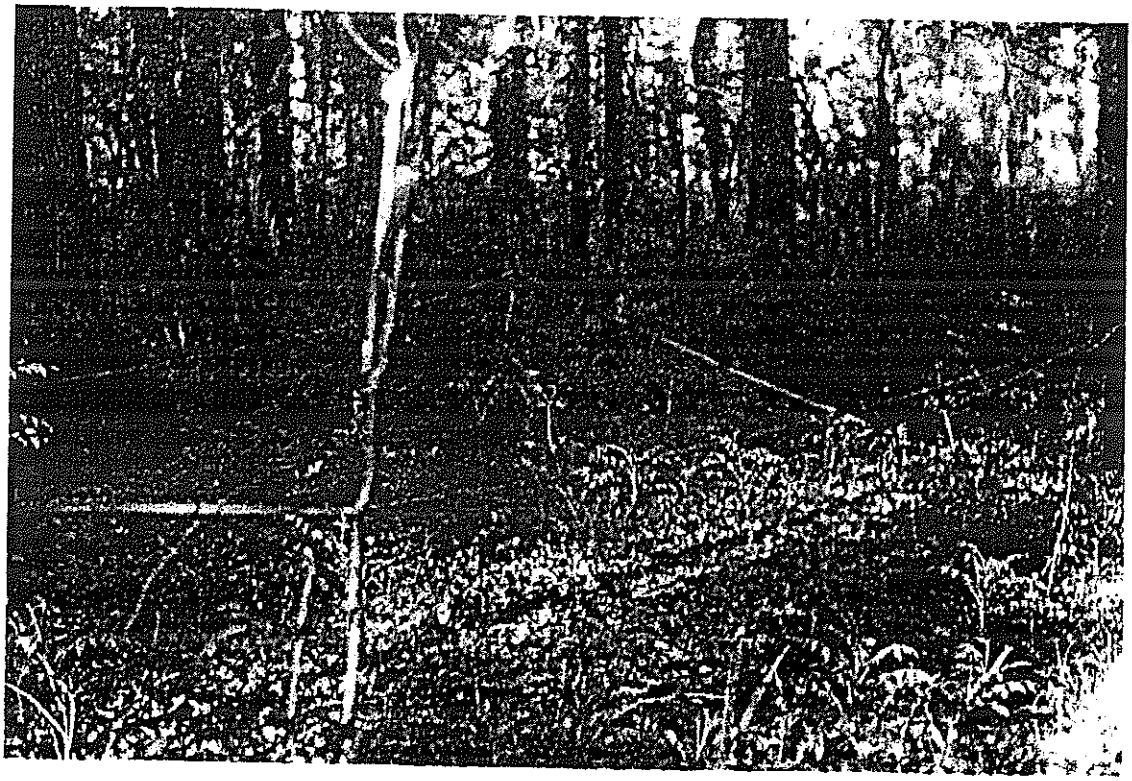




GSRC 33

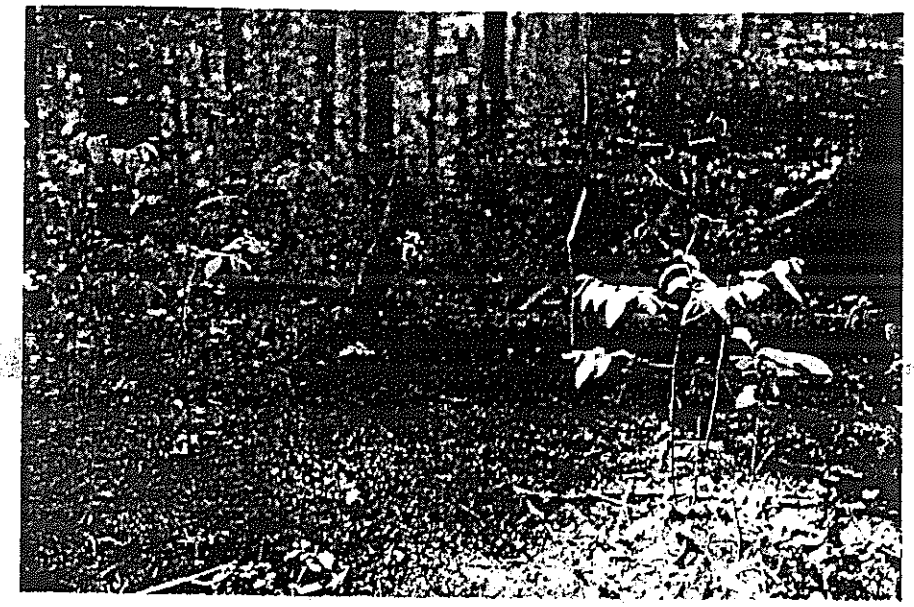


GSRC 34

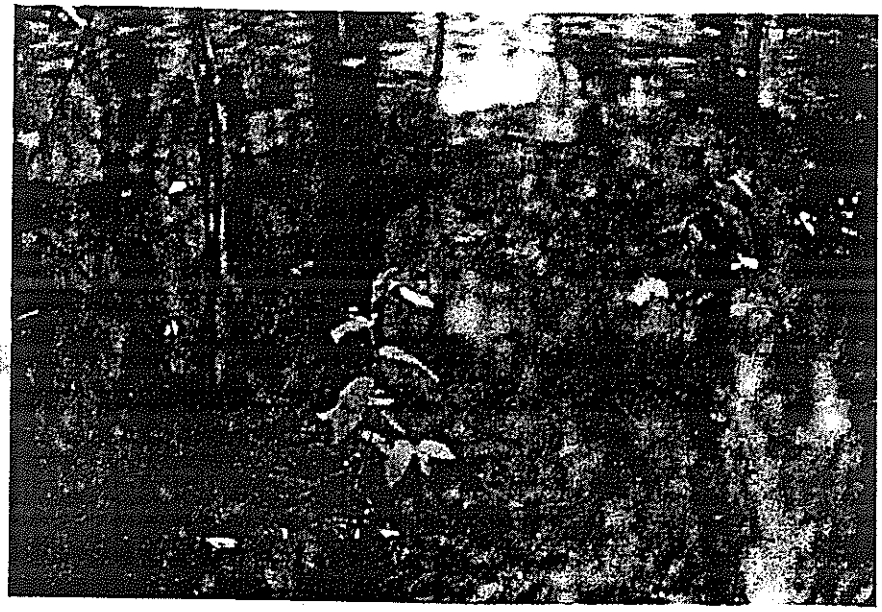


GSRC 35

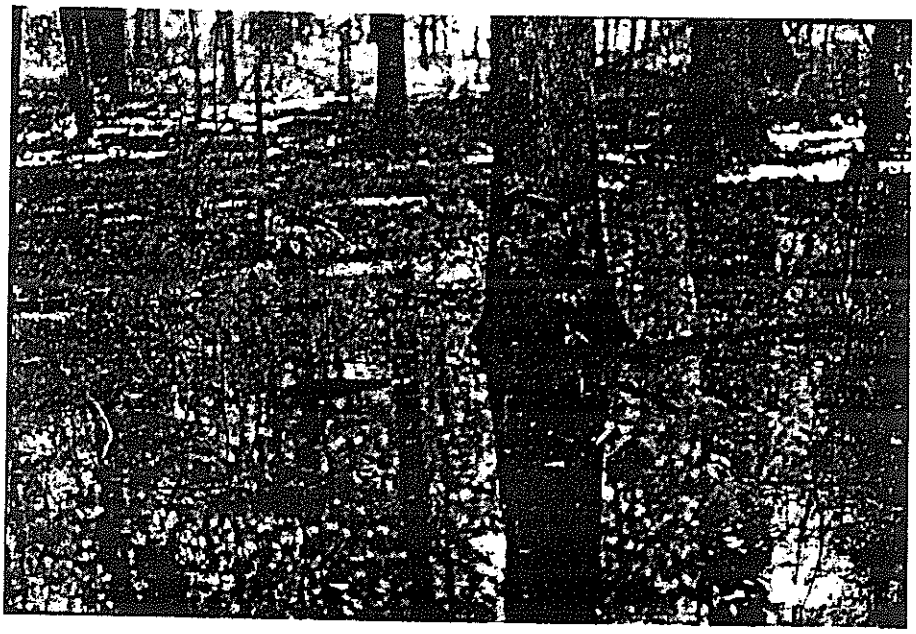
GSRC 39



GSRC 40

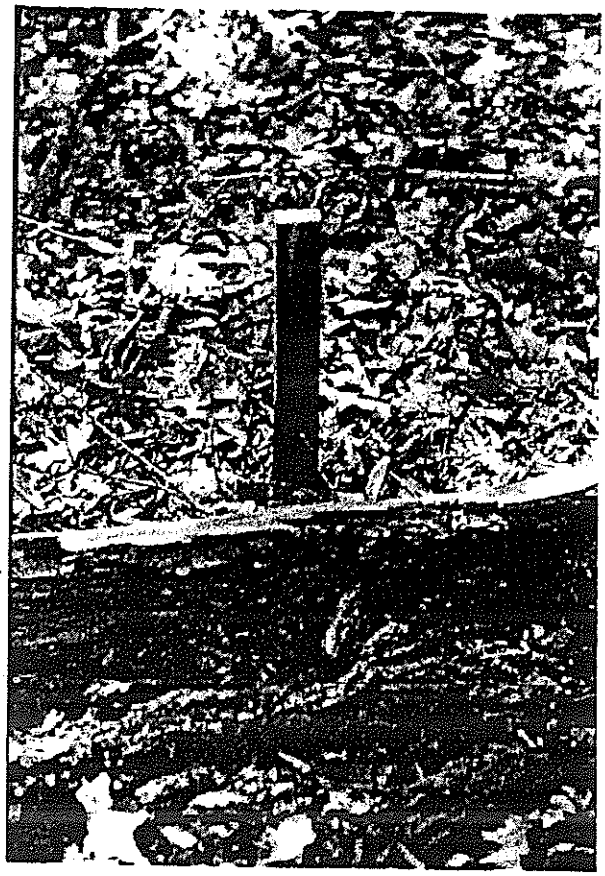


GSRC 41

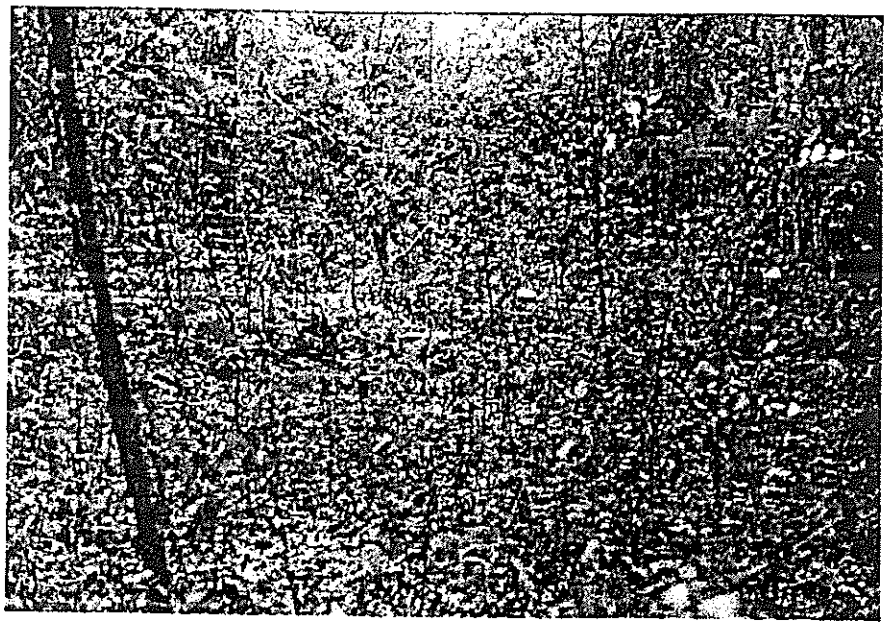


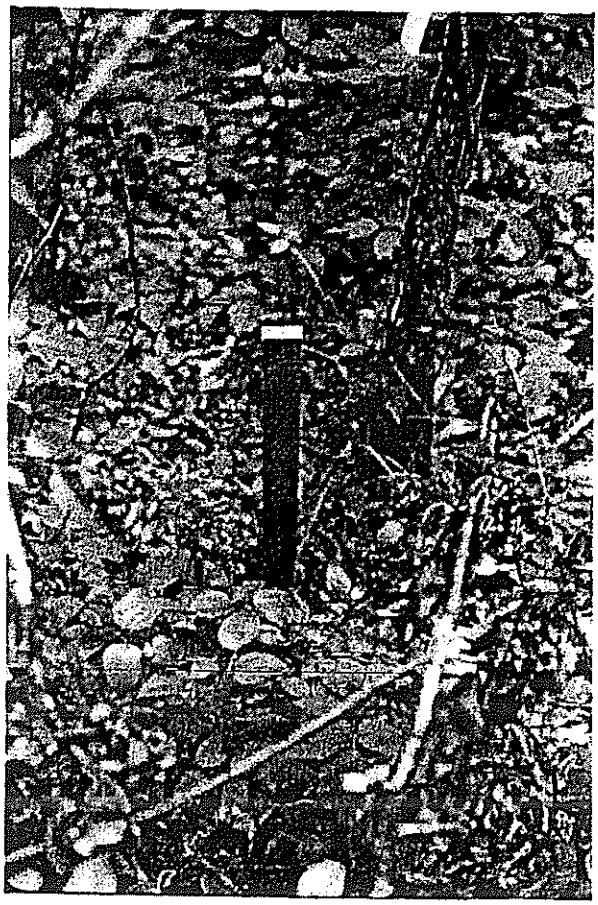
GSRC 42

GSRC 44

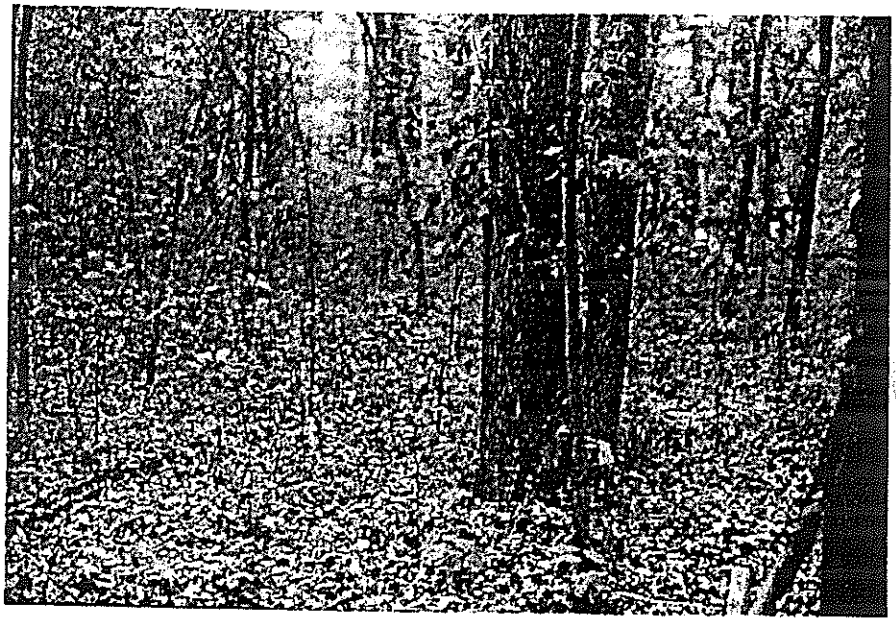


GSRC 45



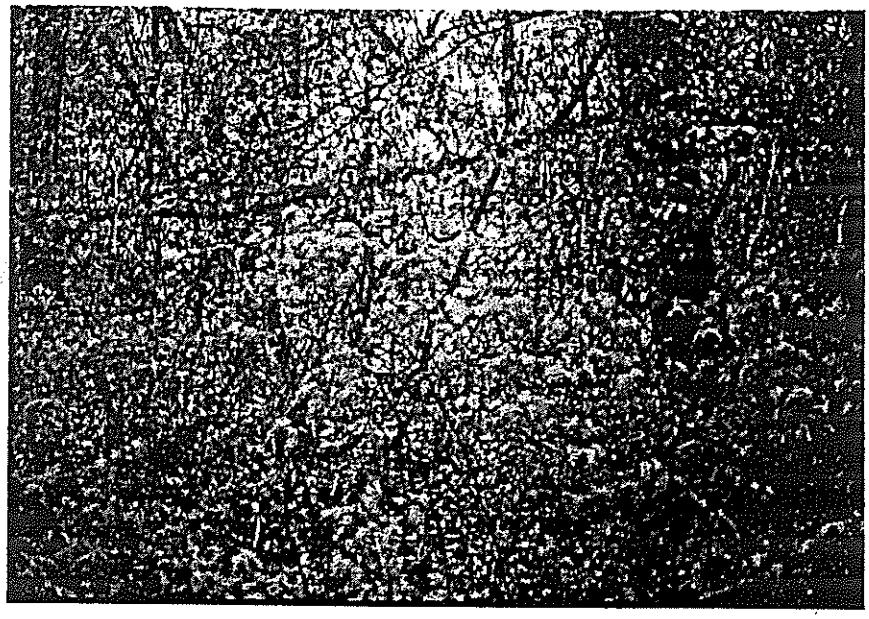


GSRC 46

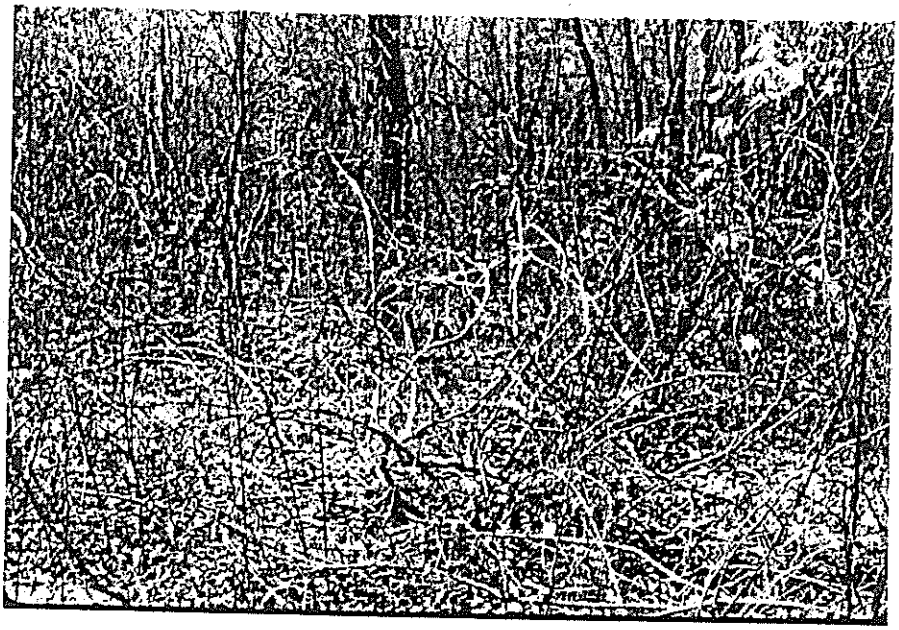


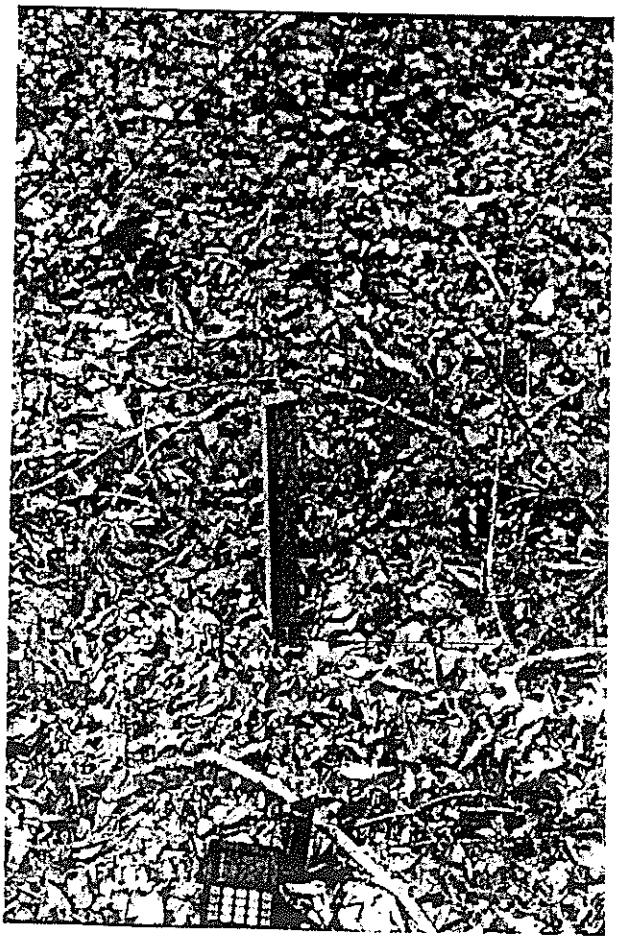
GSRC 53

GSRC 54



GSRC 55





GSRC 56