

**Evaluation of factors that influence the distribution of *Xyris scabrifolia*
in pitcher plant bog communities of the southeastern United States:
an assessment of current status**

A Final Report for the
Species at Risk Program 1997
Biological Resources Division, USGS

submitted by

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Initially Funded Project Description:

Pitcher plant bog communities were once fairly abundant throughout the southeastern United States. Today, however, less than 3% of their original distribution remains. These communities are floristically rich, with over 100 species within a single bog and with many of those species, plant species at risk. The U.S. Fish and Wildlife Service (USFWS) and the U.S. Forest Service (USFS) need to determine the current status of *Xyris scabrifolia*, Harper's yellow-eyed grass, a yellow-eyed grass that occurs in pitcher plant bog communities on federal and public lands of the southeastern United States. This species was once considered the rarest entity of the genus *Xyris*. It has been listed as a species of concern by the USFWS in Florida, Georgia, Alabama, and Mississippi for over 20 years and is considered a USFS southern regional sensitive species. It is clear from the listings by the USFWS and USFS that a better understanding of the current status, ecological requirements, and potential habitat of *Xyris scabrifolia* will help land managers of federal and public lands meet their conservation efforts to protect this and other species at risk in pitcher plant bog communities of the southeastern U.S. The objectives of this study were to: (1) determine the current status of *Xyris scabrifolia*, (2) characterize the factors that may affect its distribution, (3) determine the potential habitat available on federal lands, and (4) develop a computer database containing general information about the ecology of pitcher plant bog communities and flora within them. I proposed to conduct a general survey of all historic locations of *Xyris scabrifolia* throughout the southeastern United States to determine current status and population sizes. In addition, I proposed to measure a variety of factors such as light, soil, disturbance, hydrology, fire, and management practices within a subsample of bogs containing *Xyris scabrifolia* to determine the factors that may limit its distribution. Multivariate analysis will be used to determine which variables may significantly affect distribution. I also

propose to use aerial photography and soil maps to identify potential habitat for this species on federal lands. Finally, I propose to create digital images of photographic slides of plant species that occur within bogs to develop a database on the flora of pitcher plant bog communities. This information will be used with written descriptive data of each species to create an information base on the ecology of pitcher plant bog communities available on the Internet for public use.

Project Summary:

This project began July 1, 1997. In initial meetings with USFWS - Ecological Services Office, Jackson, MS, it was suggested that the emphasis of the project should concentrate on plant surveys in West Louisiana and East Texas, areas that are not as well surveyed as others. In addition, it was decided at that meeting that there are many gaps in the ecological knowledge of bog habitats in the west gulf coastal plain and this project could serve to fill those gaps by collecting baseline floristic, hydrology and soils data for a select group of bog communities within the west gulf coastal plain. As a result of this meeting, I compiled all known locations of *Xyris scabrifolia* in the gulf coastal states by using existing reports of locations from Mississippi, Alabama, Florida, Louisiana and Texas. In addition, I employed botanical experts to conduct additional plant surveys in Louisiana and Texas. As a result of this effort, I compiled more than 100 known locations of *Xyris scabrifolia* in the gulf states and found new locations for *Xyris scabrifolia* in East Texas bog communities (Fig. 1). I conducted studies of the hydrology of four selected bog communities within the west gulf coastal plain; two sites were established in East Texas (Big Thicket National Preserve) and two in West Louisiana (Kisatchie National Forest) (Fig. 2). Additional sites were desired but limitations of time and funding could not allow for

more than four sites for this study. At each site I established shallow ground water wells along elevation gradients from upland areas down to the bog edge, into the bog and along the water output bank (usually a small creek). I obtained seasonal variation in water flow patterns for each bog by checking water levels every other week during 1998 (26 measurements total) (Figs. 3-6). At each well site I also collected soil samples and analyzed each sample for percent of organic matter, sand, silt and clay (Figs. 7-8). A plant diversity list was made for each bog community (Table 1). These data are currently being statistically analyzed to determine the variation in plant community structure in bog communities in the west gulf coastal plain. In terms of the mapping portion of this project, I was not able to fully investigate the detection of potential habitat for bog communities due to limitations of time. I am currently exploring mapping techniques to detect bog communities and will continue this effort into 1999. In another effort of this project, I constructed a plant database of 100 species associated with pitcher plant bog communities of the west gulf coastal plain. This database will be served on the National Wetlands Research Center's website and includes a photo of the plant and information about its taxonomy, habitat, habit, flowering time, and range. Other related products that have been produced in association with this project include four manuscripts (in review) of the flora of bogs of Texas, a manuscript on the ecology of pitcher plant bogs of the west gulf coastal plain (in preparation), a pitcher plant bog educational display at the National Wetlands Research Center, contributions of slides and written descriptions of pitcher plant bog information to the "Knee Deep in Louisiana Wetlands - an educational CD ROM for teachers of Louisiana," a scientific manuscript of the hydrology of pitcher plant communities of the west gulf coastal plain (in preparation) and a workshop titled "Introduction to Pitcher Plant Bogs and Wet Pine Savannas of the Southeastern United States," held in May 1998, 1999 at the National Wetlands Research

Center. Overall, this project has involved collaboration with many public and private organizations including intra-agency partnerships with the Water Resources Division of USGS, and National Park Service (Big Thicket National Park), USFWS (Ecological Services - Jackson, MS office) , and inter-agency cooperation with the USFS (Kisatchie National Forest) and cooperation with private organizations (Florida Natural Areas Inventory). All public land managers associated with this research have been given a report of the research results on their lands as information to help conserve and manage species at risk in pitcher plant bog communities of the Southeastern United States.

Table 1. Plant species diversity among four bogs within the West Gulf Coastal Plain

(MB=Middle Branch Bog, CB= Cooter's Bog, TC=Turkey Creek Bog and LR=Lance Rosier Bog).

GENUS	SPECIES	FAMILY	MB	CB	TC	LR
<i>Acer</i>	<i>rubrum</i>	Aceraceae	1	1	1	1
<i>Agrostis</i>	<i>hyemalis</i>	Poaceae	1	0	0	0
<i>Aletris</i>	<i>aurea</i>	Liliaceae	1	1	1	1
<i>Alnus</i>	<i>serrulata</i>	Betulaceae	1	1	0	0
<i>Andropogon</i>	<i>ternarius</i>	Poaceae	1	0	0	0
<i>Anthraenantia</i>	<i>rufa</i>	Poaceae	0	1	1	1
<i>Aristida</i>	<i>palustris</i>	Poaceae	0	0	1	1
<i>Aristida</i>	<i>purpurascens</i>	Poaceae	0	1	1	0
<i>Arnoglossum</i>	<i>ovatum</i>	Asteraceae	1	1	1	1
<i>Aronia</i>	<i>arbutifolia</i>	Rosaceae	1	1	1	0
<i>Asclepias</i>	<i>longifolia</i>	Asclepiadaceae	1	1	1	1
<i>Asclepias</i>	<i>rubra</i>	Asclepiadaceae	0	1	0	0
<i>Aster</i>	<i>dumosus</i>	Asteraceae	1	1	1	1
<i>Aster</i>	<i>umbellatus</i>	Asteraceae	0	1	0	0

<i>Axonopus</i>	<i>fissifolius</i>	Poaceae	0	0	1	1
<i>Bartonia</i>	<i>paniculata</i>	Gentianaceae	0	1	0	0
<i>Bartonia</i>	<i>verna</i>	Gentianaceae	0	0	1	0
<i>Bidens</i>	<i>aristosa</i>	Asteraceae	0	1	0	0
<i>Boltonia</i>	<i>diffusa</i>	Asteraceae	0	1	1	1
<i>Burmannia</i>	<i>capitata</i>	Burmanniaceae	1	1	1	1
<i>Calopogon</i>	<i>barbatus</i>	Orchidaceae	1	0	0	0
<i>Calopogon</i>	<i>tuberosus</i>	Orchidaceae	1	1	1	1
<i>Carex</i>	<i>glaucescens</i>	Cyperaceae	1	1	0	1
<i>Centella</i>	<i>asiatica</i>	Apiaceae	0	1	1	1
<i>Chaptalia</i>	<i>tomentosa</i>	Asteraceae	1	1	1	1
<i>Coelorachis</i>	<i>rugosa</i>	Poaceae	0	0	0	1
<i>Coreopsis</i>	<i>linifolia</i>	Asteraceae	1	1	1	1
<i>Coreopsis</i>	<i>tripteris</i>	Asteraceae	0	1	0	0
<i>Ctenium</i>	<i>aromaticum</i>	Poaceae	0	1	0	0
<i>Cynoctonum</i>	<i>sessilifolium</i>	Loganiaceae	1	1	1	1
<i>Cyperus</i>	<i>haspan</i>	Cyperaceae	1	0	0	0
<i>Cyperus</i>	<i>strigosus</i>	Cyperaceae	1	0	0	0
<i>Cyrilla</i>	<i>racemiflora</i>	Cyrillaceae	0	0	1	1

<i>Dichanthelium</i>	<i>acuminatum</i>	Poaceae	0	1	1	1
<i>Dichanthelium</i>	<i>consanguineum</i>	Poaceae	0	0	0	1
<i>Dichanthelium</i>	<i>dichotomum</i>	Poaceae	1	0	0	0
<i>Dichanthelium</i>	<i>scabriusculum</i>	Poaceae	1	0	1	1
<i>Dichromena</i>	<i>latifolia</i>	Cyperaceae	0	1	1	1
<i>Diodia</i>	<i>virginiana</i>	Rubiaceae	0	0	1	1
<i>Drosera</i>	<i>brevifolia</i>	Droseraceae	1	1	1	1
<i>Drosera</i>	<i>capillaris</i>	Droseraceae	1	1	1	1
<i>Eleocharis</i>	<i>microcarpa</i>	Cyperaceae	0	0	1	1
<i>Eleocharis</i>	<i>tuberculosa</i>	Cyperaceae	1	1	1	1
<i>Eragrostis</i>	<i>refracta</i>	Poaceae	0	0	1	1
<i>Eragrostis</i>	<i>spectabilis</i>	Poaceae	0	1	0	0
<i>Erianthus</i>	<i>giganteus</i>	Poaceae	0	1	0	1
<i>Erigeron</i>	<i>vernus</i>	Asteraceae	0	1	0	0
<i>Eriocaulon</i>	<i>decangulare</i>	Eriocaulaceae	1	1	1	1
<i>Eriocaulon</i>	<i>texense</i>	Eriocaulaceae	0	1	0	0
<i>Eryngium</i>	<i>integrifolium</i>	Apiaceae	1	1	1	1
<i>Eupatorium</i>	<i>leucolepis</i>	Asteraceae	1	1	1	1
<i>Eupatorium</i>	<i>rotundifolium</i>	Asteraceae	1	1	1	1

<i>Fuirena</i>	<i>breviseta</i>	Cyperaceae	0	0	0	1
<i>Fuirena</i>	<i>bushii</i>	Cyperaceae	0	0	1	0
<i>Fuirena</i>	<i>squarrosa</i>	Cyperaceae	1	1	0	0
<i>Gelsemium</i>	<i>sempervirens</i>	Loganiaceae	1	0	1	1
<i>Gratiola</i>	<i>brevifolia</i>	Scrophulariaceae	0	0	1	1
<i>Gratiola</i>	<i>pilosa</i>	Scrophulariaceae	0	1	0	0
<i>Hedyotis</i>	<i>boscii</i>	Rubiaceae	0	1	0	0
<i>Helenium</i>	<i>drummondii</i>	Asteraceae	0	1	1	1
<i>Helianthus</i>	<i>angustifolius</i>	Asteraceae	1	1	0	1
<i>Hypericum</i>	<i>crux-andreae</i>	Clusiaceae	0	1	0	1
<i>Hypericum</i>	<i>fasciculatum</i>	Clusiaceae	1	1	1	1
<i>Hypericum</i>	<i>gentianoides</i>	Clusiaceae	1	0	0	0
<i>Hypericum</i>	<i>hypericoides</i>	Clusiaceae	1	0	1	1
<i>Hypericum</i>	<i>setosum</i>	Clusiaceae	0	1	0	0
<i>Hypoxis</i>	<i>hirsuta</i>	Amaryllidaceae	1	1	1	1
<i>Hyptis</i>	<i>alata</i>	Lamiaceae	0	1	1	1
<i>Ilex</i>	<i>coriacea</i>	Aquifoliaceae	0	1	1	1
<i>Ilex</i>	<i>opaca</i>	Aquifoliaceae	1	0	0	1
<i>Ilex</i>	<i>vomitorea</i>	Aquifoliaceae	1	0	1	1

<i>Juncus</i>	<i>debilis</i>	Juncaceae	1	1	0	0
<i>Juncus</i>	<i>diffusissimus</i>	Juncaceae	1	0	0	0
<i>Juncus</i>	<i>marginatus</i>	Juncaceae	1	1	0	0
<i>Juncus</i>	<i>scirpoides</i>	Juncaceae	1	1	0	0
<i>Juncus</i>	<i>tenuis</i>	Juncaceae	1	0	0	0
<i>Juncus</i>	<i>trigonocarpus</i>	Juncaceae	0	1	0	0
<i>Lachnocaulon</i>	<i>anceps</i>	Eriocaulaceae	1	1	1	0
<i>Lachnocaulon</i>	<i>digynum</i>	Eriocaulaceae	0	1	0	0
<i>Liatris</i>	<i>acidota</i>	Asteraceae	0	1	1	1
<i>Liatris</i>	<i>pycnostachya</i>	Asteraceae	1	1	1	1
<i>Linum</i>	<i>medium</i>	Linaceae	0	1	1	1
<i>Liquidambar</i>	<i>styraciflua</i>	Hamelidaceae	1	0	1	1
<i>Lobelia</i>	<i>flaccidifolia</i>	Campanulaceae	0	0	0	1
<i>Lobelia</i>	<i>reverchonii</i>	Campanulaceae	1	1	1	1
<i>Ludwigia</i>	<i>alternifolia</i>	Onagraceae	1	0	0	0
<i>Ludwigia</i>	<i>hirtella</i>	Onagraceae	1	1	0	1
<i>Ludwigia</i>	<i>linearis</i>	Onagraceae	0	0	0	1
<i>Ludwigia</i>	<i>pilosa</i>	Onagraceae	0	0	1	1
<i>Lycopodium</i>	<i>alopecuroides</i>	Lycopodiaceae	0	1	0	0

<i>Lycopodium</i>	<i>appressum</i>	Lycopodiaceae	1	1	1	1
<i>Lycopodium</i>	<i>carolinianum</i>	Lycopodiaceae	1	1	1	0
<i>Lycopodium</i>	<i>cernuum</i>	Lycopodiaceae	1	0	0	0
<i>Magnolia</i>	<i>grandiflora</i>	Magnoliaceae	1	0	0	0
<i>Magnolia</i>	<i>virginiana</i>	Magnoliaceae	1	1	1	1
<i>Marshallia</i>	<i>tenuifolia</i>	Asteraceae	1	1	1	1
<i>Melanthium</i>	<i>virginicum</i>	Liliaceae	0	1	0	0
<i>Mimosa</i>	<i>quadrivalvis</i>	Fabaceae	0	0	0	1
<i>Muhlenbergia</i>	<i>capillaris</i>	Poaceae	1	1	0	1
<i>Myrica</i>	<i>cerifera</i>	Myricaceae	1	1	1	1
<i>Myrica</i>	<i>heterophylla</i>	Myricaceae	1	1	1	1
<i>Myriophyllum</i>	<i>aquaticum</i>	Haloragidaceae	1	1	0	0
<i>Nyssa</i>	<i>sylvatica</i>	Nyssaceae	0	1	1	1
<i>Osmunda</i>	<i>cinnamomea</i>	Osmundaceae	1	1	1	0
<i>Osmunda</i>	<i>regalis</i>	Osmundaceae	1	1	1	0
<i>Oxypolis</i>	<i>filiformis</i>	Apiaceae	0	1	1	1
<i>Oxypolis</i>	<i>rigidior</i>	Apiaceae	0	1	1	0
<i>Panicum</i>	<i>brachyanthum</i>	Poaceae	0	0	1	1
<i>Panicum</i>	<i>rigidulum</i>	Poaceae	0	1	1	1

<i>Panicum</i>	<i>tenerum</i>	Poaceae	0	1	1	1
<i>Panicum</i>	<i>verrucosum</i>	Poaceae	0	0	1	1
<i>Panicum</i>	<i>virgatum</i>	Poaceae	1	1	0	1
<i>Paspalum</i>	<i>floridanum</i>	Poaceae	0	0	1	0
<i>Paspalum</i>	<i>laeve</i>	Poaceae	0	0	0	1
<i>Paspalum</i>	<i>notatum</i>	Poaceae	1	0	0	0
<i>Paspalum</i>	<i>plicatulum</i>	Poaceae	0	1	1	1
<i>Paspalum</i>	<i>praecox</i>	Poaceae	0	0	1	1
<i>Paspalum</i>	<i>setaceum</i>	Poaceae	0	1	0	0
<i>Paspalum</i>	<i>urvillei</i>	Poaceae	1	0	0	0
<i>Persea</i>	<i>borbonia</i>	Lauraceae	1	1	1	1
<i>Pinguicula</i>	<i>pumila</i>	Lentibulariaceae	1	1	1	1
<i>Pinus</i>	<i>palustris</i>	Pinaceae	1	1	1	1
<i>Pinus</i>	<i>taeda</i>	Pinaceae	1	0	1	1
<i>Pityopsis</i>	<i>graminifolia</i>	Asteraceae	0	0	1	0
<i>Platanthera</i>	<i>ciliaris</i>	Orchidaceae	0	1	0	0
<i>Platanthera</i>	<i>integra</i>	Orchidaceae	1	0	0	0
<i>Platanthera</i>	<i>nivea</i>	Orchidaceae	1	0	0	0
<i>Pluchea</i>	<i>rosea</i>	Asteraceae	0	1	1	1

<i>Pogonia</i>	<i>ophioglossoides</i>	Orchidaceae	1	1	0	0
<i>Polygala</i>	<i>cruciata</i>	Polygalaceae	0	1	1	0
<i>Polygala</i>	<i>incarnata</i>	Polygalaceae	1	0	0	0
<i>Polygala</i>	<i>mariana</i>	Polygalaceae	1	1	1	1
<i>Polygala</i>	<i>nana</i>	Polygalaceae	1	0	0	0
<i>Polygala</i>	<i>ramosa</i>	Polygalaceae	1	1	1	1
<i>Proserpinaca</i>	<i>pectinata</i>	Haloragidaceae	0	0	0	1
<i>Pteridium</i>	<i>aquilinum</i>	Dennstaedtiaceae	1	0	0	0
<i>Ptilimnium</i>	<i>capillaceum</i>	Apiaceae	1	1	1	1
<i>Rhexia</i>	<i>lutea</i>	Melastomataceae	1	1	1	1
<i>Rhexia</i>	<i>mariana</i>	Melastomataceae	0	1	1	1
<i>Rhexia</i>	<i>petiolata</i>	Melastomataceae	1	1	0	0
<i>Rhynchospora</i>	<i>caduca</i>	Cyperaceae	0	0	0	1
<i>Rhynchospora</i>	<i>chalarocephala</i>	Cyperaceae	0	1	0	0
<i>Rhynchospora</i>	<i>debilis</i>	Cyperaceae	0	0	0	1
<i>Rhynchospora</i>	<i>elliottii</i>	Cyperaceae	0	1	1	1
<i>Rhynchospora</i>	<i>filifolia</i>	Cyperaceae	0	0	0	1
<i>Rhynchospora</i>	<i>globularis</i>	Cyperaceae	1	1	1	1
<i>Rhynchospora</i>	<i>glomerata</i>	Cyperaceae	1	1	0	1

<i>Rhynchospora</i>	<i>gracilentia</i>	Cyperaceae	1	1	1	1
<i>Rhynchospora</i>	<i>inexpansa</i>	Cyperaceae	1	1	0	1
<i>Rhynchospora</i>	<i>macra</i>	Cyperaceae	1	1	0	0
<i>Rhynchospora</i>	<i>oligantha</i>	Cyperaceae	1	1	1	0
<i>Rhynchospora</i>	<i>plumosa</i>	Cyperaceae	1	1	1	1
<i>Rhynchospora</i>	<i>pusilla</i>	Cyperaceae	0	0	0	1
<i>Rhynchospora</i>	<i>rariflora</i>	Cyperaceae	0	1	1	1
<i>Rubus</i>	<i>louisianus</i>	Rosaceae	1	0	0	0
<i>Sabatia</i>	<i>gentianoides</i>	Gentianaceae	1	1	1	1
<i>Sabatia</i>	<i>macrophylla</i>	Gentianaceae	0	1	0	0
<i>Sarracenia</i>	<i>alata</i>	Sarraceniaceae	1	1	1	0
<i>Schizachyrium</i>	<i>scoparium</i>	Poaceae	1	1	1	1
<i>Schizachyrium</i>	<i>tenerum</i>	Poaceae	1	1	0	0
<i>Schoenolirion</i>	<i>croceum</i>	Liliaceae	0	1	1	1
<i>Scleria</i>	<i>ciliata</i>	Cyperaceae	1	0	0	0
<i>Scleria</i>	<i>georgiana</i>	Cyperaceae	0	0	1	1
<i>Scleria</i>	<i>reticularis</i>	Cyperaceae	1	1	1	1
<i>Scutellaria</i>	<i>integrifolia</i>	Lamiaceae	0	1	1	1
<i>Sisyrinchium</i>	<i>atlanticum</i>	Iridaceae	0	1	1	1

<i>Smilax</i>	<i>laurifolia</i>	Smilacaceae	1	1	1	1
<i>Solidago</i>	<i>patula</i>	Asteraceae	0	1	0	0
<i>Sphagnum</i>	<i>sp</i>	Sphagnaceae	1	1	1	1
<i>Spiranthes</i>	<i>longilabris</i>	Orchidaceae	0	1	0	1
<i>Spiranthes</i>	<i>praecox</i>	Orchidaceae	0	0	0	1
<i>Spiranthes</i>	<i>vernalis</i>	Orchidaceae	1	1	0	1
<i>Tephrosia</i>	<i>onobrychoides</i>	Fabaceae	1	1	0	1
<i>Tofieldia</i>	<i>racemosa</i>	Liliaceae	0	0	1	0
<i>Toxicodendron</i>	<i>vernix</i>	Anacardiaceae	0	1	0	0
<i>Tridens</i>	<i>ambiguus</i>	Poaceae	0	1	1	1
<i>Tridens</i>	<i>strictus</i>	Poaceae	0	0	0	1
<i>Utricularia</i>	<i>cornuta</i>	Lentibulariaceae	1	1	0	0
<i>Utricularia</i>	<i>juncea</i>	Lentibulariaceae	1	1	0	0
<i>Utricularia</i>	<i>subulata</i>	Lentibulariaceae	1	1	1	1
<i>Vaccinium</i>	<i>corymbosum</i>	Ericaceae	1	1	0	0
<i>Viburnum</i>	<i>nudum</i>	Caprifoliaceae	0	1	0	0
<i>Viola</i>	<i>lanceolata</i>	Violaceae	0	0	1	1
<i>Viola</i>	<i>primulifolia</i>	Violaceae	1	1	1	0
<i>Woodwardia</i>	<i>areolata</i>	Blechnaceae	1	0	0	1

<i>Woodwardia</i>	<i>virginica</i>	Blechnaceae	0	1	1	1
<i>Xyris</i>	<i>ambigua</i>	Xyridaceae	1	1	1	1
<i>Xyris</i>	<i>baldwiniana</i>	Xyridaceae	1	1	1	0
<i>Xyris</i>	<i>caroliniana</i>	Xyridaceae	0	1	1	1
<i>Xyris</i>	<i>difformis</i>	Xyridaceae	1	1	0	0
<i>Xyris</i>	<i>drummondii</i>	Xyridaceae	1	1	0	0
<i>Xyris</i>	<i>louisianica</i>	Xyridaceae	0	1	1	1
<i>Xyris</i>	<i>scabrifolia</i>	Xyridaceae	0	1	0	0
<i>Xyris</i>	<i>torta</i>	Xyridaceae	0	1	1	0
<i>Zigadenus</i>	<i>densus</i>	Liliaceae	0	1	0	0

Fig. 1. *Xyris scabrifolia* distribution

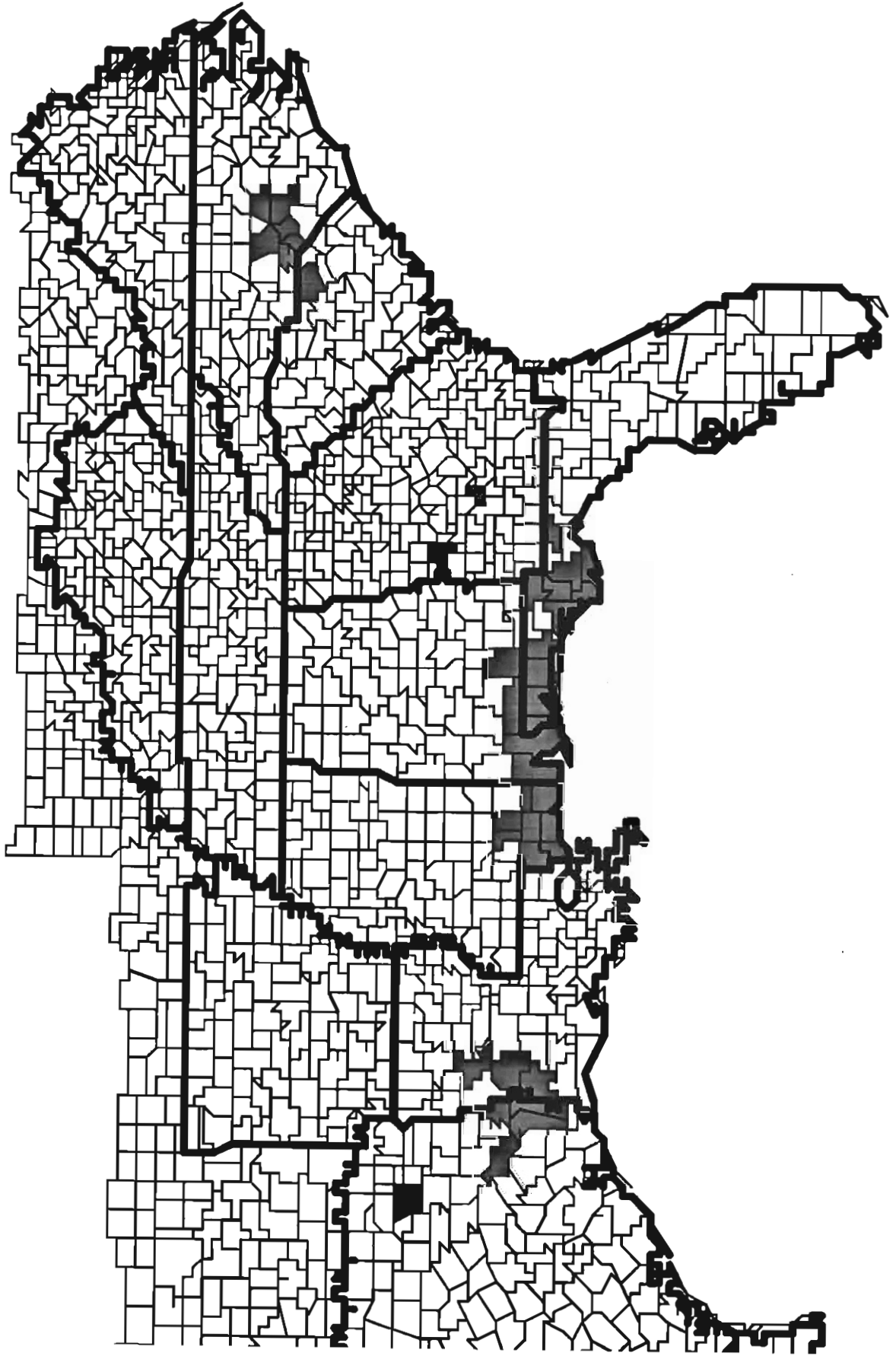


Fig. 2. Study site locations

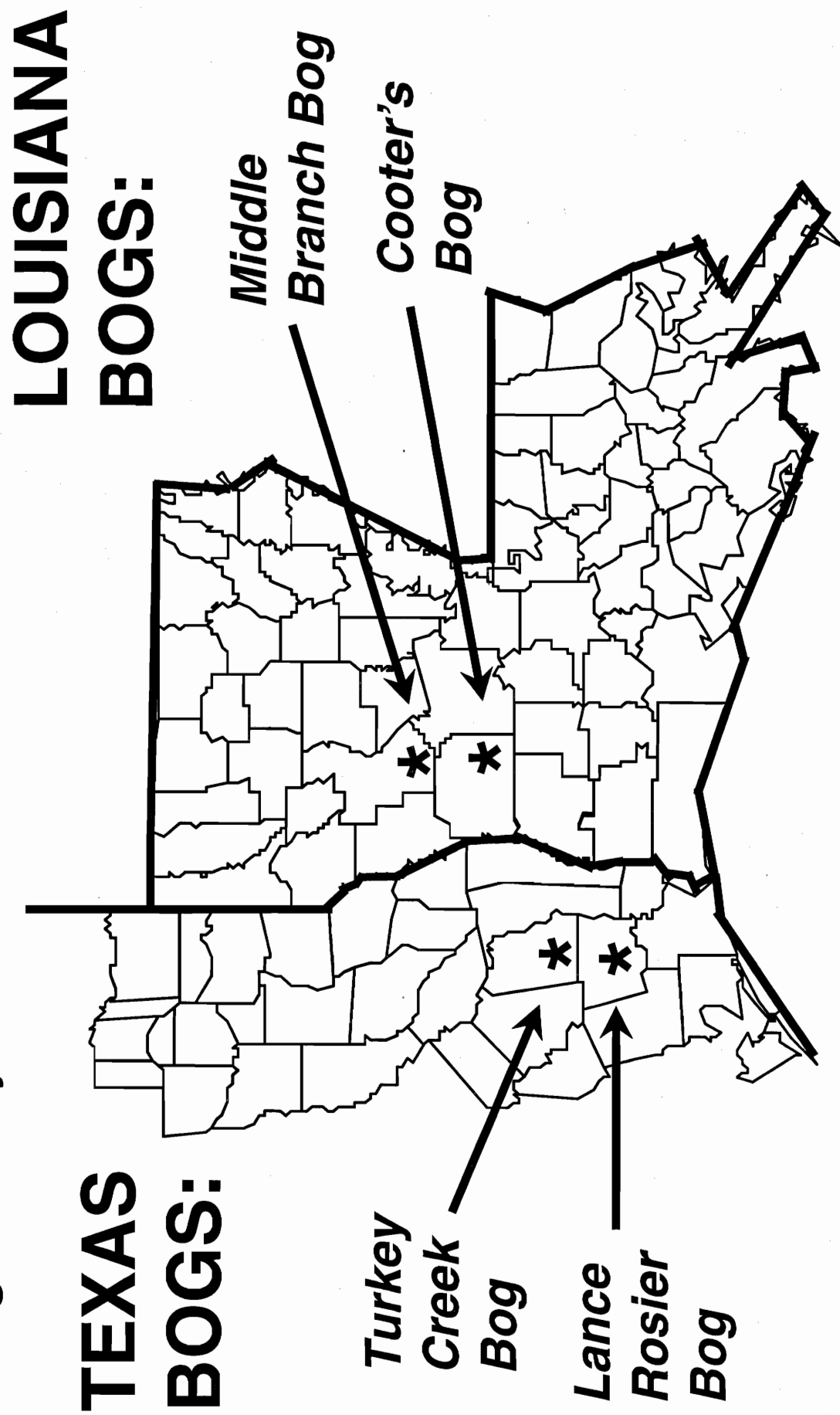
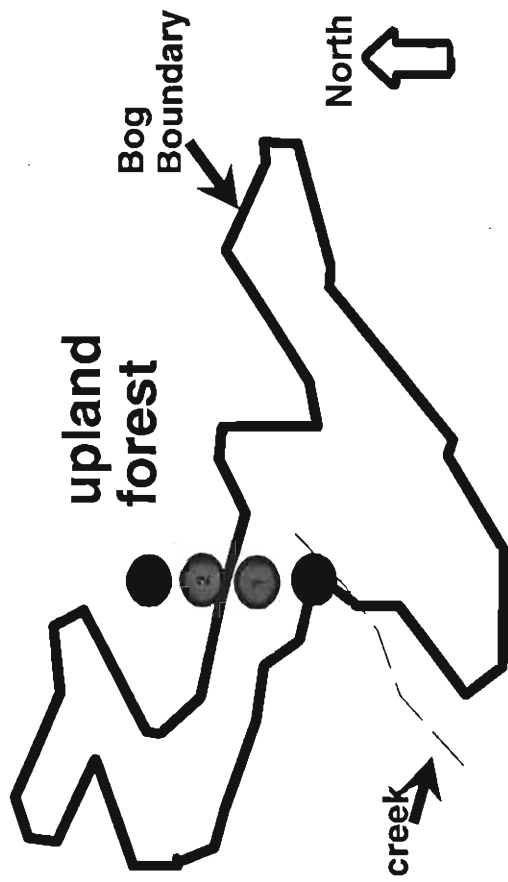


Fig. 3a. Middle Branch Bog water well locations



3b. Middle Branch Bog water level data

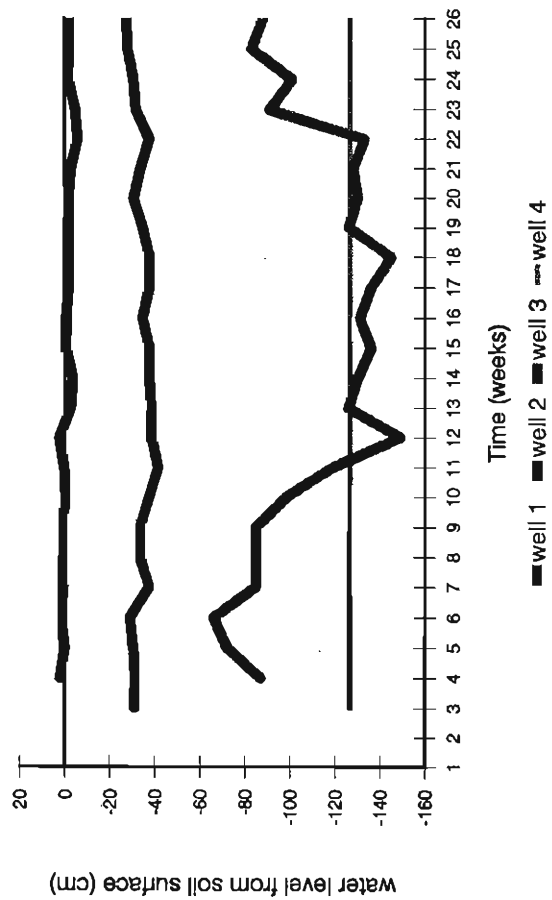
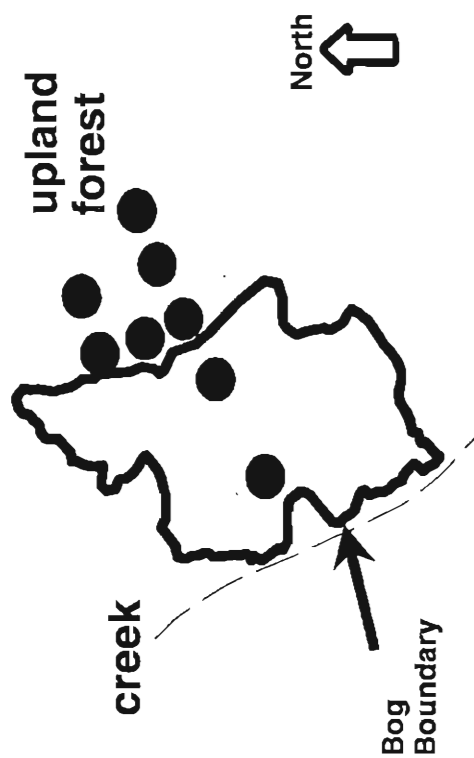


Fig. 4a Cooter's Bog water well locations



4b. Cooter's Bog water level data

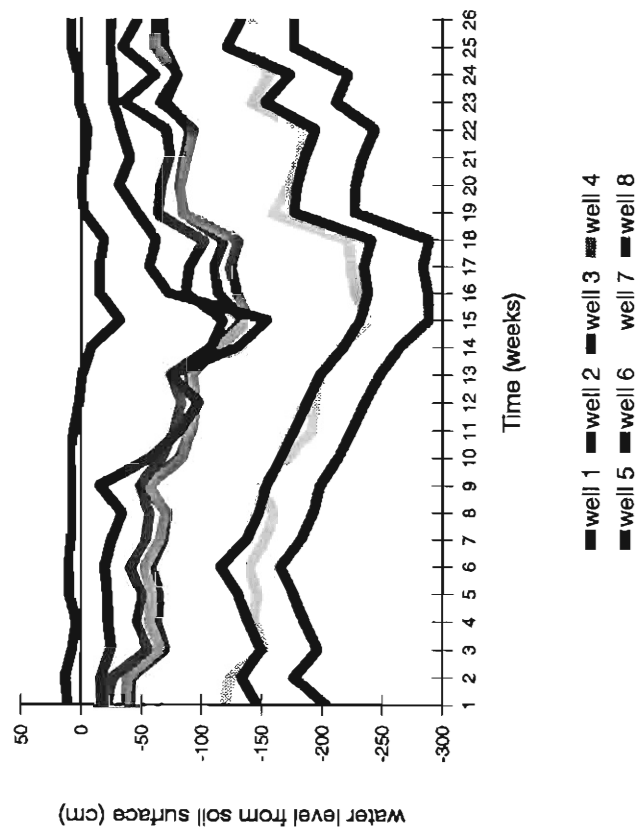
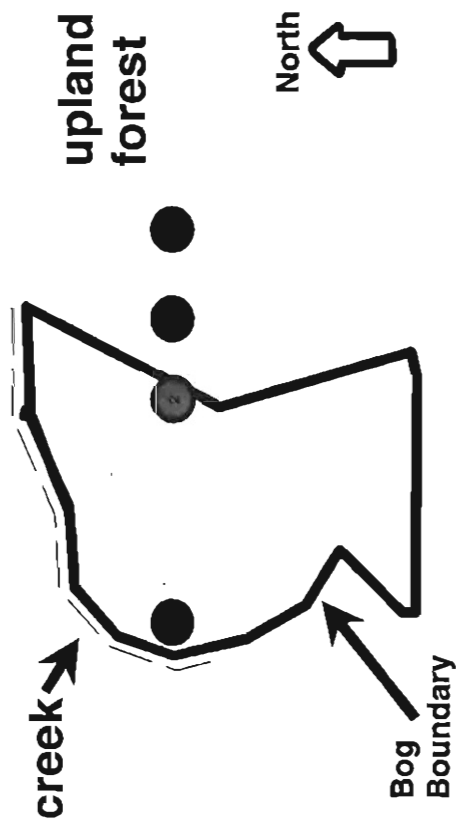


Fig. 5a. Turkey Creek Bog water well locations



5b. Turkey Creek Bog water level data

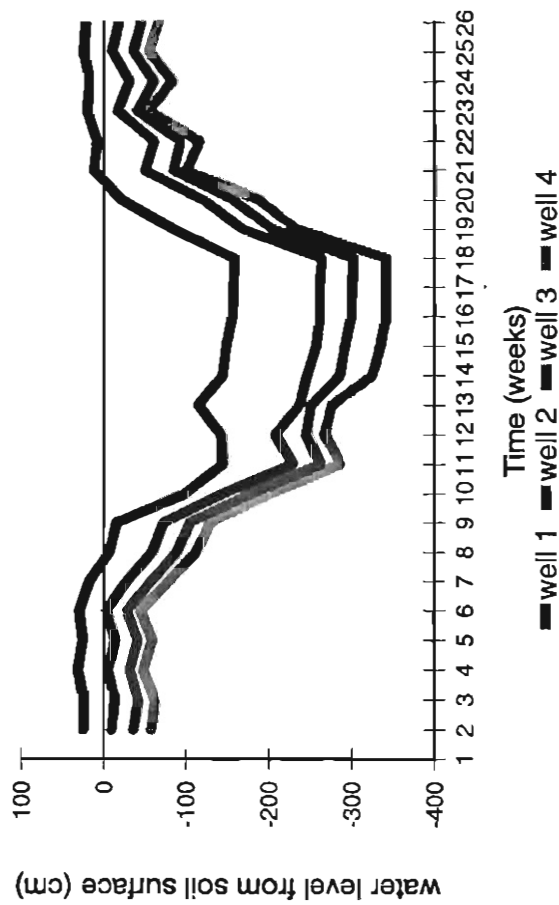
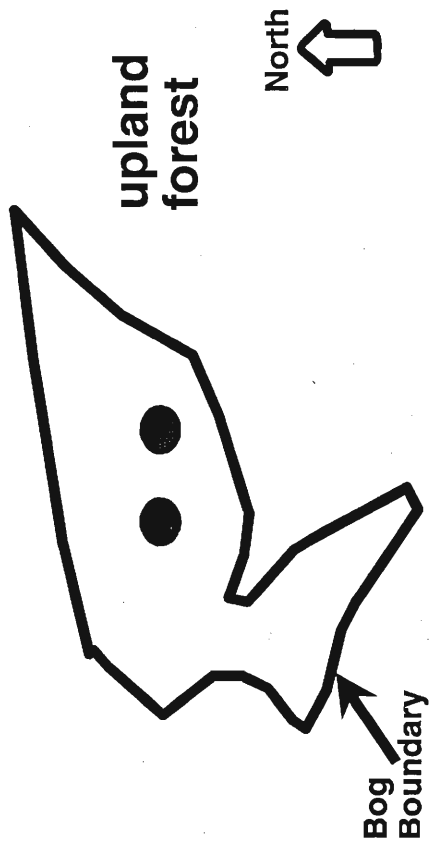


Fig. 6a. Lance Rosier Bog water well locations



6b. Lance Rosier Bog water level data

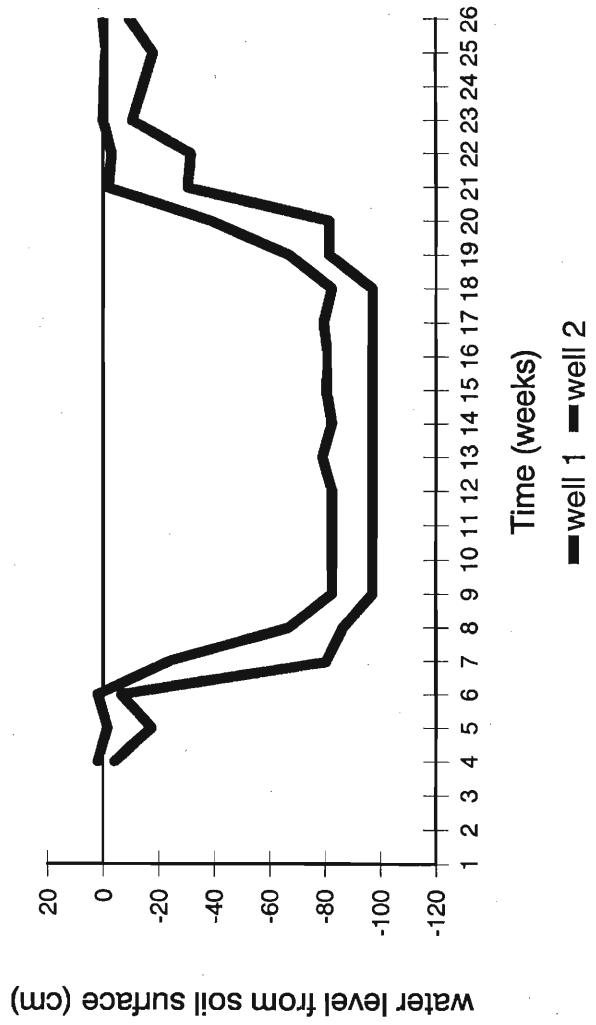
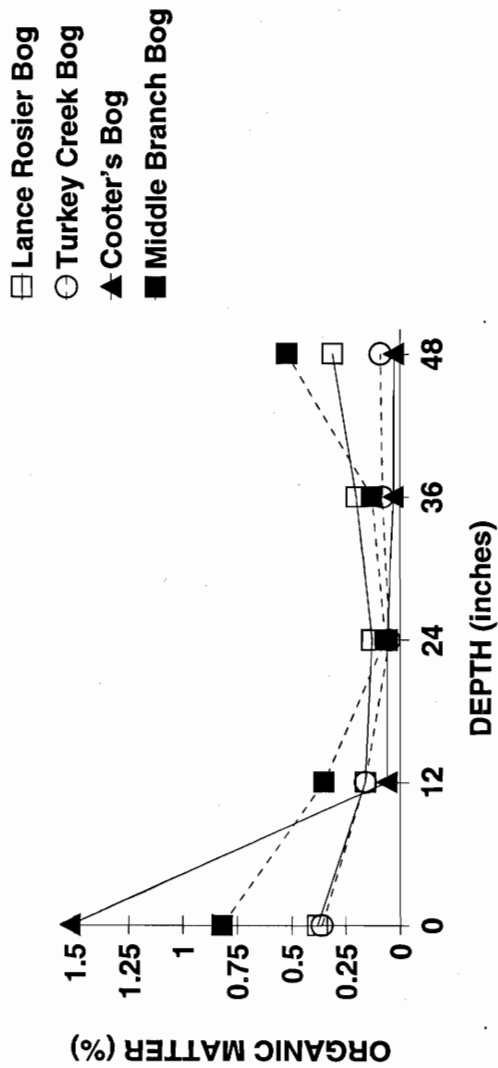
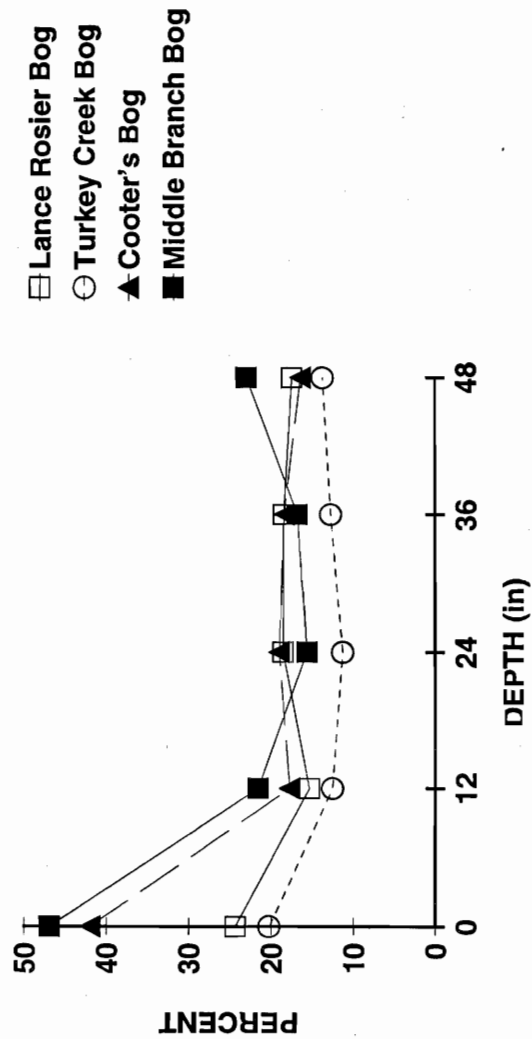


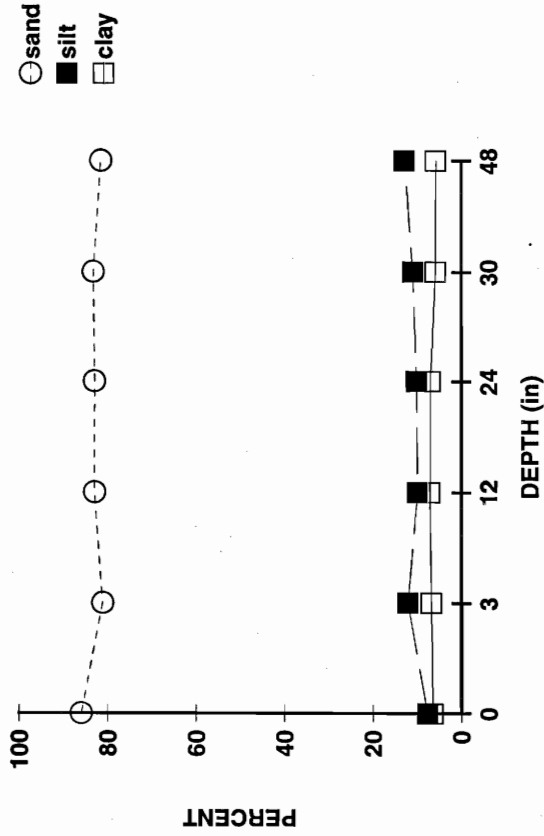
Fig. 7a. Percent Organic Matter



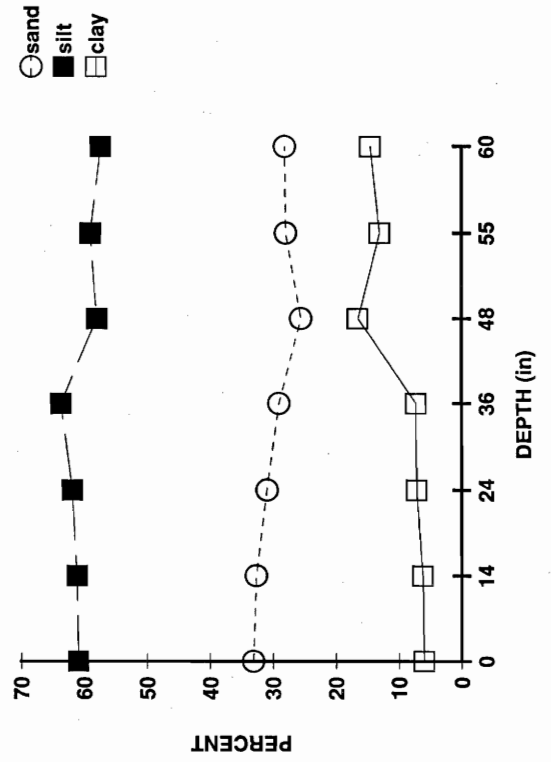
7b. Soil moisture



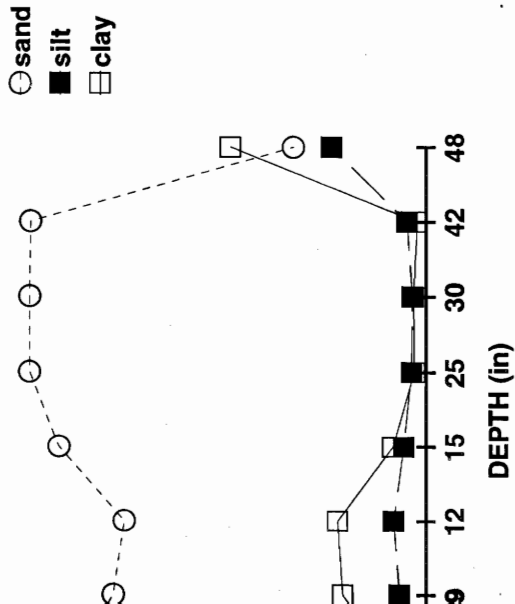
8b. Particle Size Analysis Cooter's Bog



8d. Particle Size Analysis Lance Rosier Bog



Particle Size Analysis Middle Branch Bog



Particle Size Analysis Turkey Creek Bog

