THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS

SECOND SURVEY OF CURRENT RESEARCH in the NEW JERSEY PINE BARRENS

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Second Survey of Current Research

in the New Jersey Pine Barrens

Compiled by

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Table of Contents

Introduction

Covering more than 470,000 hectares, the New Jersey Pine Barrens (Pinelands) represents one of the largest relatively-undeveloped tracts of land in the northeastern United States. Overlying an unpolluted aquifer estimated to contain more than 17 trillion gallons of freshwater, this extensive land resource contains more than 800 species of plants and more than 500 species of animals. Thus, the Pine Barrens represents a very valuable land, water, and biological resource. However, the close proximity of the Pine Barrens to the New York City and Philadelphia urban centers threatens its continued existence.

The importance of the Pine Barrens as a natural resource and recognition of its jeopardy has resulted in current preservation efforts on the national, state, and local levels. The National Parks and Recreation Act of 1978 created the country's first national reserve - the Pinelands National Reserve - within the Pine Barrens. The Pinelands Protection Act, enacted by the New Jersey State Legislature in June 1979, created the Pinelands Commission as the regional planning and management entity for the reserve. The Pinelands Commission was charged with the development and implementation of a management plan for the Reserve. The Comprehensive Management Plan developed by the Pinelands Commission recognizes that the Pine Barrens has a multitude of unique natural, physical, and cultural attributes, that it is in the public interest to preserve all of these attributes, and that preservation efforts must include assessment of natural, cultural, commercial, and industrial resources within the context of maximum public utilization.

The Pinelands Commission and its staff have recognized that successful preservation of the Pine Barrens requires input from a variety of interest groups, including the scientific community. Rutgers University established a Division of Pinelands Research within its Center for Coastal and Environmental Studies (CCES) with the encouragement of the Pinelands Commission. The Division of Pinelands Research has functioned to facilitate the flow of information between the scientific community and the Pinelands Commission, offering scientists a unique opportunity to contribute to regional management of the Reserve.

At its inception, the Division of Pinelands Research undertook a survey of the scientific community to determine

the extent and nature of current research within the Pine Barrens. This survey has served two functions: First, the information generated has helped to identify gaps in our understanding of the Pine Barrens ecosystem, and has thus suggested necessary directions of future research. Second, the survey has facilitated immediate communication between those scientists investigating specific problems and the Pinelands Commission and other land managers who require that information for their immediate decisions.

To keep the survey current, and maintain its usefulness as a reference, the survey must be updated at regular intervals. Consistent with this need, research scientists were contacted in late 1985 and early 1986 for input for a second edition of the survey. Since the original survey, additional scientists have begun projects in the region, and others have finished projects and are dropped from the directory. The results of the update are compiled into this second edition.

As in the 1982 survey, research scientists were contacted through the distribution of a questionnaire (Appendix I). The responses were compiled on an IBM micro-computer using the "Symphony" word processing and data management program. Entries were stored in an array allowing access according to investigator, home institution, research site, or research topic. The Division will continue to survey the scientific community, and this report will be updated again at regular intervals.

Acknowledgements

We wish to thank the many respondents for their cooperation in providing the information regarding colleagues currently working in the Pine Barrens. We would especially like to acknowledge the efforts of Matthew S. Hayes (a Graduate School-Camden Graduate Assistant and student in Rutgers Graduate Ecology Program) who did the major portion of the data entry.

How to use this research survey

Our goal in preparing this survey is to help scientists, land managers, teachers, and those like yourself to get in contact with people doing specific research in the Pine Barrens. To use this survey, turn to the index (p.57-61), and scan the list of research topics for the subject nearest to your interests. Then turn to the abstracts of the workers listed under that subject. Research workers are listed by name in alphabetical order in the body of the survey (p. 5 to 52). From the abstracts, choose the people working in your area of interest.

List of Respondents

Berger, Jonathan
Boerner, Ralph E.J.
Boyd, Howard P.
Bozzelli, Joseph W.
Burger, Joanna
Carulli, J.P.
Casuallo, John *
Cheplick, J.P.
Colby, Richard H.
Collins, Scott L.
Crerar, David
Cromartie, William J.
Douglas, Lowell A.
Ehrenfeld, Joan G.
Epstein, Claude M.
Fairbrothers, David E.
Felley, J.D.
Forman, Richard T.T.
Freda, Joseph
Gallagher, Michael G.
Garrett, Peter W.
Geller, Michael D. *
Gibson, David J.
Given, Mac F.
Good, Norma
Good, Ralph E.
Graham, John H.
Handel, Steven N.
Hartzog, Sandra H.
Havens, A.V.
Hayes, Deborah C.
Hayes, Matthew S.
Hordon, Robert M.
Jaworski, Andrew Z.
Kantor, Richard A. *
Kebbekus, Barbara B
Knezick, Donald R.
Kuser, John
Ledig, F.Thomas
List, Albert, Jr.
Little, Silas *
Lord, Thomas R.
Madsen, Eugene *
Manos, Paul S.
Marucci, Philip E.
Matlack, Glenn R.
McCarthy, K.A.
McIntosh, Alan *
Montgomery, James D.
Morgan, Mark D.
Morin, Peter J.
Nicholson, Robert
Quinn, James A.
Roman, Charles T.
Samuelson, Sue
Schick, Kevin
Schuyler, Alfred E.
Shulman, M.D.
Sinton, John
Sitler, Martha
Smith, Chris
Spratt, Henry G.,Jr.
Stasz, James L.
Stoltzfus, Dwight L.
Tedrow, J.C.F. *
Tate, Robert L., III
Tudor, Robert A.
Unnasch, Robert S.
Wallace, R.S.
Williams, Cairn
Windisch, Andrew G.
Zampella, Robert A.
Zappalorti, Robert T.

* = Respondents with interests in the New Jersey Pine Barrens but having no research currently in progress.

BERGER, Jonathan. TMI Public Health Fund, 1622 Locust St., Philadelphia, PA., 19103. Phone: (215)-875-3028.

Title of Research: Patterns of human use and behavior in the New Jersey Pine Barrens (with SINTON, John).

Site Location: Entire Pinelands National Reserve.

Date Project Initiated: November 1979.

Date of Completion: Spring 1982.

Publication Vehicle: (BOOK) Water,Earth and Fire: Land Use and Environmental Planning in the New Jersey Pine Barrens. Johns Hopkins University Press, Spring 1985.

Abstract: Research goals - To document the intimate relationship between the users of the Pine Barrens, the built and natural environment, and the local social organization. To provide guidelines for appropriate planning responses. Method - A review of primary and secondary literature on patterns of historical use, key informant interviews with the full range of contemporary users, observation of users, and small sample surveys leading to a synthesis of quantitative and qualitative information.

BOERNER, Ralph E.J. Department of Botany, Ohio State University, 1735 Neil Avenue, Columbus OH 43210. Phone: (614)-422-3082.

Title of Research: Effect of prescribed burning on foliar nutrient dynamics and growth of two oak species (with LORD, Thomas R.).

Site Location: Lebanon State Forest.

Date Project Initiated: November 15, 1984.

Date of Completion: January 15, 1986.

Publication Vehicle: Journal.

Abstract: We are examining the role of prescribed burning in increasing nutrient availability in upland oak-pine stands. By comparing the seasonal foliar nutrient concentrations, incremental growth patterns, and soil nutrient pools in neighboring burned and unburned sites in Lebanon State Forest, we hope to determine for what time period nutrient availability is increased and whether or not any effects on oak mineral nutrition or growth occur.

BOYD, Howard P. (Retired: Honorary Associate, Department of Entomology, Academy of Natural Sciences of Philadelphia) Home: 232 Oak Shade Road, Tabernacle Township, Vincentown NJ 08088. Phone: (609)-268-1734.

1.Title of Research: Ground-dwelling insects of the New Jersey Pine Barrens.

Site Location: Twelve selected sites in Burlington Co. (Bass River, Pemberton, Tabernacle, Woodland and Washington Twps.) and Ocean Co. (Lacey and Manchester Twps.).

Date Project Initiated: April 1986.

Date of Completion: October 1986.

Publication Vehicle: Journal.

Abstract: By the use of pit-fall traps, I am attempting to determine abundance and identity of ground-running insects, especially tiger beetles (Cicindelidae) and other beetles (Coleoptera) as well as other small invertebrates, especially arthropods, and any other small ground dwelling forms of animal life, including small mammals, extant in the Pine Barrens of New Jersey.

II. Title of Research: Life cycles of a blueberry bud gall (Diptera: Cecidomyidae) and its parasites (Hymenoptera: Chalcidoidae) (with MARUCCI, Philip E.).

Site Location: Wild and abandoned cultivated blueberry bushes and fields within the Pine Barrens area, mainly in Burlington Co., NJ.

Date Project Initiated: Winter 1979/1980.

Date of Completion: Unknown. Open-ended until identification(s) and life cycle(s) are determined.

Publication Vehicle: Journal.

Abstract: To determine and identify life cycles of a blueberry bud gall fly and its parasites. Methods include field and laboratory observations, rearing, record keeping and identification.

BOZZELLI, Joseph W. Chemistry Division, New Jersey Institute of Technology, 323 High Street, Newark NJ 07102. Phone: (201)-596-3568. See KEBBEKUS, Barbara.

BURGER, Joanna. Rutgers, The State University, Nelson Biological Laboratory, P.O. Box 1059, Piscataway NJ 08854. Phone: (201)-932-4318.

Title of Research: Behavior and ecology of Pine Snakes.

Site Location: Suitable areas in Ocean, Monmouth and Burlington Counties.

Date Project Initiated: 1981.

Date of Completion: On-going.

Publication Vehicle: Journals.

Funding Agency: DEP Endangered and Non-Game Species Project (prior to 1981).

Abstract: Overall objectives include the behavior and ecology of Pine Snakes. Specific on-going projects include studies of habitat and nest site selection, hibernation sites, movement of adults, behavior of nesting females and young, temperature relationships of nests, and effects of temperature on sex-determination.

CARULLI, J. P. Dept. of Biological Sciences, Rutgers University NJ 08903. Phone: (201)-932-2843.

Title of Research: Isozyme variation in populations of Aeschynomene virginica and A. indica: An endangered species in the United States (with FAIRBROTHERS, David E.).

Site Locations: Manumuskin River area near the border of Cumberland and Atlantic Counties. Mullica River area near Green Bank, Burlington Co.

Date Project Initiated: Winter 1985.

Date of Completion: Winter 1987.

Funding Agency: Botany Research Fund.

Abstract: Aeschynomene virginica has been designated a threatened species in the U.S. A. indica is a "sister" species native from North Carolina south to Florida and west to Louisiana. It is found in freshwater tidal marshes and other wetlands of the coastal plain. In N.J. the species reaches the northern-most extension of its distribution. Before 1935 it was known from 35 locations in N.J., but now it is limited to two locations. We use individuals grown from seeds collected in native populations for starch gel electrophoresis of enzymes, experimental crosses and morphological studies designed to determine the following: I. Genetic variation in natural populations of A. virginica and A. indica, II. Breeding systems of A. virginica and A. indica. III. Genetic relatedness of A. virginica and A. indica. Only Aeschynomene virginica grows in New Jersey.

CASUALLO, John. NAMS, Stockton State College, Pomona NJ

08240. Phone: (609)-652-1776. (No current Pine Barrens research).

CHEPLICK, Gregory P. Department of Biological Sciences, Rutgers University, P.O. Box 1059, Piscataway NJ 08854. Phone: (201)-932-2844 or 932-2075(message).

Title of Research: Life-history characters and allocation to aerial and subterranean propagules in populations of peanutgrass (Amphicarpum purshii). (with Quinn, James A.)

Site Locations: Near Atsion (N 39°44', W 74°45'); Near Hampton Furnace (N 39°45', W 74°44'; N 39°45', W 74°43'); Near Forked River (N 39°50', W 74°14'; N 39°47', W 74°22'); 2 km. south of Lakehurst (N 39°59'30", W 74°20'00").

Date Project Initiated: June 1974.

Date of Completion: August 1987.

Publication Vehicle: Journal: Oecologia, American Journal of Botany, Journal of Ecology, American Midland Naturalist.

Abstract: This project not only includes short- and long-term field studies on population survivorship and reproduction but also involves detailed experimental analyses under controlled conditions of responses to density and depth of burial and of survivorship and fecundity of plants arising from the two types of propagules (aerial and subterranean). We have found this Pinelands annual grass will appear following a soil disturbance and subsequently disappear with secondary succession. Correlated with its demise at a site is a shift from a production of both aerial and subterranean seed to a production of only subterranean seed. What are the factors responsible for this differential allocation? What is the relative importance of seedlings arising from aerial seed and those arising from subterranean seed in the establishment and maintenance of the new "instant populations"? Why do subterranean seeds stop germinating as succession progresses and readily germinate following a subsequent soil disturbance? Are there genetic differences among the populations in their relative allocation to aerial and subterranean propagules? Answers to such questions will add to our basic knowledge of this species and allow us to manage the necessary habitats in a manner conducive to its continued existence

in the Pinelands.

COLBY, Richard H. Division of Natural Sciences and Mathematics, Stockton State College, Pomona NJ 08240. Phone: (609)-652-1776 ext.355.

Title of Research: Atmosphere-derived pollutants affecting New Jersey forests.

Site Location: Literature search at present.

Date Project Initiated: Summer 1985.

Date of Completion: Summer 1986.

Publication Vehicle: Report to DEP, Division of Parks and Forestry.

Funding Agency: DEP - Division of Parks and Forestry.

Abstract: (1) Survey of concentrations of atmosphere-derived pollutants known to produce injury to forest species elsewhere; (2) Recommendation of a monitoring program that can be used to determine the extent to which New Jersey forests are being damaged.

COLLINS, Scott L. Department of Botany and Microbiology, University of Oklahoma, Norman OK 73019. Phone: (405)-325-1651.

Title of Research: Effect of shrubs and litter cover on tree seedlings in the New Jersey Pine Barrens (with GIBSON, David J.).

Site Location: Lebanon State Forest near Rutgers Field Station.

Date Project Initiated: 1985.

Date of Completion: Continuing.

Publication Vehicle: Journal.

CRERAR, David. Department of Geology, Guyot Hall, Princeton University, Princeton NJ 08544. Phone: (609)-452-4123.

Title of Research: Behavior of metals in the Mullica River, Mullica Estuary and its bay.

Site Location: Mullica River and Estuary.

Date Project Initiated: December 1984.

Date of Completion: December 1988.

Publication Vehicle: Journal.

Abstract: We are measuring the behavior of metals (including Fe, Mn, Zn, Ni, Cu, Cr, Al, and Cd) in the Mullica River and its estuary. Precipitation mechanisms and partitioning of metals between dissolved and suspended loads and bottom sediments are being determined along with detailed chemical speciation. The roles played by increasing salinity, pH, and colloidal adsorption and natural organic acids in controlling metal behavior is a major goal of this project.

CROMARTIE, William J. NAMS, Stockton State College, Pomona NJ 08240. Phone: (609)-652-1776.

Title of Research: Monitoring aquatic ecosystems for long-term effects of low-level pollution.

Site Location: Stockton Campus.

Date Project Initiated: June 1982.

Date of Completion: Continuing.

Publication Vehicle: Preliminary report circulated to Office of Research and Development, U.S. EPA.

Funding Agency: Initial support from American Association for Advancement of Science Environmental Fellowship at EPA, Washigton, DC. Also Stockton Research and Professional Development Award.

Abstract: Initiated as a literature review of monitoring methods, this project is being continued with an attempt to develop protocols for long-term monitoring of aquatic ecosystems on the Stockton campus with applications to such systems generally. Focus is on selection of critical physical and biological variables and formulation of appropriate hypotheses.

DOUGLAS, Lowell A. Department of Soils and Crops, Cook College, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-9771.

Title of Research: Soil mineralogy.

Site Location: Many.

Date Project Initiated: 1961.

Date of Completion: Continuing.

Publication Vehicle: Journal.

Abstract: Defining crystal structure of clay minerals found in soils.

EHRENFELD, Joan G. Center for Coastal and Environmental Studies, Doolittle Hall, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-3609.

1. Title of Research: The effects of Sphagnum moss on the mobility of heavy metals in wetland ecosystems of the New

Jersey Pinelands.

Site Location: McDonald's Branch; Shinns Branch; Brick Township; Tom's River.

Date Project Initiated: June 1984.

Date of Completion: June 1986.

Publication Vehicle: Journal.

Funding Agency: U. S. Dept. Interior, U. S. Geol. Survey.

Abstract: This project is designed to assess the effect of the acid-generating quality of Sphagnum moss on the chemistry of lead and other heavy metals in cedar swamps. The hypothesis under investigation is that Sphagnum, through its cation exchange capicity and hydrogen ion release capacity, can cause heavy metals to become solubilized in wetland waters. A combination of laboratory studies of moss-sediment-water microcosms, and field studies of polluted and unpolluted swamps, is being used to investigate the problem.

II. Title of Research: Spatial distribution of roots in three Pinelands ecosystems.

Site Location: McDonald's Branch; Muddy Road.

Date Project Initiated: September 1985.

Date of Completion: June 1986.

Publication Vehicle: Journal.

Funding Agency: CCES.

Abstract: A study is being undertaken to determine the horizontal and vertical distribution of roots in upland pine-oak communities, transitional pine lowlands, and

cedar wetlands. Excavation of 625 cm^2 pits in each site type is being undertaken to determine root biomass in 10 cm depth segments. The pits in each site are being related to plant above-ground density and distribution. In the cedar swamp, pit location is being related to the hummock-hollow microtopography.

EPSTEIN, Claude M. Natural Sciences and Mathematics, Stockton State College, Pomoma NJ 08240. Phone: (609)-652-1776.

Title of Research: A) Acid deposition in NJ woodlands. B) Soil moisture fluxes in the aeration zone. C) Pine Barrens water resource development.

Site Location: Harrisville, Weymouth, Belcoville, Galloway Twp., Hammontown, Rio Grande, Folsom.

Date Project Initiated: A) 1985 B) 1980 C) 1983

Date of Completion: Continuing.

Publication Vehicle: American Geophysical Union EOS, New Jersey Academy Science Bulletin.

Research Interests: 1) Groundwater hydrogeology of Pine Barrens aquifers 2) Water use and hazards to water supply in Cape May and Atlantic County 3) Historical development of coastal plain aquifers 4) Surface/groundwater relations in vernal ponds.

FAIRBROTHERS, David E. Dept. of Biological Sciences, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-2843. (See CARULLI, J.P.; MANOS, P.S.; MCCARTHY, K.A.; WALLACE, R.S.)

Title of Research: Rare and endangered flora of New Jersey.

Site Location: Entire Pinelands.

Date Project Initiated: 1972.

Date of Completion: Continuing.

Abstract: This is an ongoing research project, with constant searching and recording of rare and endangered species in the state. Strong emphasis is on the Pinelands flora with an attempt to locate new sites, and on monitoring of known sites containing such taxa in order to record their possible changing status.

FELLEY, J. D. Department of Biology and Environmental Science, McNeese State University, Lake Charles LA 70609. See GRAHAM, John H.

FORMAN, Richard T. T. Dept of Landscape Ecology, Harvard University, Cambridge MASS. 02138.

Title of Research: An interest in landscape ecology and in long-term vegetational changes.

FREDA, Joseph. 208 Mueller Lab, Department of Biology, The Pennsylvania State University, University Park PA 16802. Phone: (814)-865-2461.

Title of Research: The effect of low pH on the local distribution of amphibians.

Site Location: Ocean and Burlington Counties.

Date Project Initiated: May 1984.

Date of Completion: August 1984.

Publication Vehicle: Journal.

Funding Agencies: N.J. Enangered and Non-Game Species Program; U.S. Environmental Protection Agency; U.S. Fish and Wildlife Services.

Abstract: I have described the chemical environment of Pine Barrens amphibian breeding ponds. Surveys described the distribution of pine barrens treefrogs and toads in relation to pond pH. Laboratory toxicity tests showed that treefrogs were tolerant to low pH, while toads were very sensitive. Embryos of both species were transplanted into a series of ponds showing a range of pH. Treefrog embryos hatched in all ponds, while toad embryos died in acidic ponds. These data agreed with the field surveys which found treefrogs to be most common in acidic ponds while toads were absent.

GALLAGHER, Michael G. Biology Dept., Rutgers University, Camden NJ 08102.

Title of Research: Two decades of vegetation change in the New Jersey Pine Barrens (with GOOD, Ralph E.).

Site Location: McDonalds and Middle Branch Watershed, Lebanon State Forest

Date Project Initiated: Summer 1983

Date of Completion: Early 1986.

Publication Vehicle: MS thesis.

Funding Agency: Jessie Smith Noyes Foundation.

Abstract: Using permanent plots established in 1953 and vegetation data from 1962, seventy-two plots in seven NJ Pine Barrens communities were resurveyed. Although a severe wildfire in 1963 top-killed all shrubs, most tree oaks, and many pines, resprouting was prevalent. After 21 years, there was a decrease in basal area and canopy cover for all species: open space increased. Pinus rigida increased its dominance relative to other tree species. All species showed a decrease in stem density in the larger classes, and an increase in the smaller. However, the oaks increased much more in the <1" size class (6 to 10 times the 1962 number) than the pines (2 times). Shrub cover in 1983/4 is similar to 1962 coverage for all species.

The idea that fire maintains the presence of P. rigida is supported. Noble & Slayter's Multiple Successional Pathway model has useful but limited application in the Pine Barrens, since all species have

similar life history attributes and exist in mixed stands.

GARRETT, Peter W. USDA Forest Service, Northeastern Forest Experiment Station, P.O. Box 640, Durham NH 03824. Phone: (603)-868-5692.

Title of Research: Improvement of pitch pine and pitch x loblolly pine hybridization.

Site Location: NE-3-73, NE-2-74, NE-3-75 (pitch x loblolly pine plantings) 3 miles east of Mt. Misery, Ocean County, New Jersey.

Breeding orchards at Lebanon Experimental Forest Headquarters, New Lisbon, New Jersey. (73, 74, 75 indicate year initiated).

Pitch pine provenance tests established by Yale University in 1974 3 miles east of Mt. Misery in Ocean County, New Jersey.

Shortleaf pine provenance study established in mid-1950's by Southern Forest Experiment Station, New Orleans, Louisiana. Planted in Ocean County, New Jersey, but exact location unknown.

NE-6-80, NE-4-83 (pitch x loblolly pine plantings) in Monmouth County, New Jersey.

Date of Completion: Continuing. (Pitch x loblolly and pitch pine tests will terminate 20 years after planting. Shortleaf study completed two years ago, but will be revisited in 1986. Breeding orchard will remain active indefinitely.

Abstract: Pitch x loblolly program and pitch pine studies are designed to develop or find trees suitable for planting on "poor" sites such as the Pine Barrens. Shortleaf study is looking for sources that perform best in different areas.

GELLER, Michael D. Stockton State College, Pomona NJ 08240. Phone: (609)-652-1776. (No current Pine Barrens research).

GIBSON, David J. Division of Biology, Ackert Hall, Kansas State University, Manhattan KS 66506. (See COLLINS, Scott).

I.Title of Research: Ecosystem-fragmentation of oak-pine vegetation. (With GOOD, Ralph E.)

Site Location: Throughout northern Pine Barrens.

Date Project Initiated: 1984

Date of Completion: Continuing.

Publication Vehicle: Journals and CCES technical reports.

Abstract: Quantitative data on tree and sapling strata of thirty-five oak-pine stands in the New Jersey Pine Barrens (Pinelands) were collected. Qualitative records of the shrubs and herbaceous species were also made. Of these stands, 19 were forest fragments isolated from the native forest by roads, development, agriculture or encroaching salt marsh. Compared with the native stands, the forest fragments had a higher tree species richness, and a higher density, diversity and richness of saplings. The incursion of new species from other habitats into the forest fragments was indicated by the significantly higher importance percentage of Sassafras albidum trees and saplings compared to native stands. Total species number in the fragments was related to area (R^2 = 0.4, P = 0.006), however the inclusion of stand isolation factors improved the model (R^2 = 0.68). Ecosystem fragmentation will become a more serious problem in these forests as the sapling layer changes manifest themselves in the tree canopy.

II.Title of Research: Shrub/ground layer interactions. (With GOOD, Ralph E.).

Site Location: Lebanon State Forest.

Date Project Initiated: 1985.

Date of Completion: Continuing.

Publication Vehicle: Journal and CCES technical report.

III.Title of Research: Seedling habitat of Pinus echinata

and Melampyrum lineare (With GOOD, Ralph E.).

Site Location: Lebanon State Forest.

Date Project Initiated: 1985.

Date of Completion: Completed.

Publication Vehicle: Journal and CCES technical report.

IV.Title of Research: Competetive thinning in cedar swamps (With GOOD, Ralph E.).

Site Location: Literature study.

Date Project Initiated: 1985.

Date of Completion: Completed.

GIVEN, Mac F. University of Connecticut, Dept. of Ecology and Evolutionary Biology, 75 N. Eagleville Rd., Box U-43, Storrs CT 06268. Phone: (203)-486-4457.

Title of Research: Territoriality, vocal communication, and behavioral ecology of the carpenter frog, Rana virgatipes.

Site Location: 1) Cedar Run Lake, Woodford Cedar Run Refuge, Medford, Burlington County. 2) West Jersey Cranberry Bogs, Burlington County.

Date Project Initiated: May 1983.

Date of Completion: June 1986.

Publication Vehicle: Ph D. thesis and journals.

Funding Agencies: University of Connecticut (1984-1985),

Sigma Xi Grants-in-Aid of Research (1984-1985), Society for the Study of Amphibians and Reptiles Grants-in-Herptology Award (1984), Theodore Roosevelt Memorial Fund of the American Museum of Natural History (1985), and the Gaige Award of the American Society of Ichthyologists and Herpetologists (1985).

Abstract: Variability in male mating strategies related to body size has been documented in many anuran amphibians. For species with prolonged breeding seasons, the costs of vocalization, territory maintenance, and reduced foraging opportunities can impose energetic constraints on reproductive males. These types of behavior may affect the amount of energy available for growth. My dissertation is a study of male intrasexual competition for mates in the carpenter frog, Rana virgatipes, in the Pinelands of New Jersey, U.S.A. First, the natural history, territorial behavior, and acoustic interactions will be described through field observations and experimentation. From these results, I will explore 1) variation in behavior as a function of size, 2) energy status and growth rates as a function of size, and 3) tradeoffs between energy status and behavior.

GOOD, Norma. Center for Coastal and Environmental Studies, Doolittle Hall, Rutgers University, New Brunswick NJ 08903. Phone: (609)-428-1396.

Title of Research: Succession following Atsion fire. (with GOOD, Ralph E.)

Site Location: Atsion, NJ - Rt. 206.

Date Project Initiated: April 1985.

Date of Completion: Continuing.

Funding Agency: CCES Internal.

Publication Vehicle: Journal such as Bartonia.

Abstract: Permanent plots (5x5 m.) have been established throughout the pitch pine lowland site at Atsion that was heavily burned in 1983/84. In addition to following recolonization and succession, soil chemistry will be

analyzed.

GOOD, Ralph E. Biology Dept., Camden College of Arts and Sciences, Rutgers University, Camden NJ 08102. Phone: (609)-757-6146. OR Center for Coastal and Environmental Studies, Division of Pinelands Research, Busch Campus, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-3141. See COLLINS, Scott; GALLAGHER, Michael; GIBSON, David; GOOD, Norma; MATLACK, Glenn R.; MCCARTHY, K.A.; MORGAN, Mark D.; STOLTZFUS, Dwight; WINDISCH, Andrew; HAYES, Matthew S.

GRAHAM, John H. Biology Department, Rider College, Lawrenceville NJ 08648. Phone: (609)-896-5093.

I.Title of Research: Niche ontogeny and progressive deviation in two congeneric sunfishes.

Site Location: Success Lake, Collier's Mills Wildlife Management Area, Ocean Co., Collier's Mills Pond, Collier's Mills Wildlife Management Area, Ocean Co.

Date Project Initiated: May 1979.

Publication Vehicle: Journal; Symposium Proceedings; Freshwater Wetlands and Wildlife Symposium, Savannah River Ecology Laboratories: 9th Symposium 24-27 March 1986.

Abstract: The banded sunfish, Enneacanthus obesus, and the bluespotted sunfish, E. gloriosus, exhibit progressive morphological deviation during development. Early developmental stages of the two species resemble one another more than they resemble their own adult stages and more than the adult stages resemble one another. Contrary to expectations, however, their niches do not diverge concommitantly with morphology.

Both species spawn in early spring, thus larvae, juveniles, and adults are of comparable size at all times. Morphological similarity is greatest for fish less than 9mm SL. The larvae of both species exhibit a dual pattern of resource use with feeding peaks just after sunrise and just before sunset. Although there is much dietary overlap, E. obesus feeds to a greater extent on aquatic invertebrates that live on the leaves and

stems of submerged macrophytes, while E. gloriosus takes more free-swimming invertebrates. These differences remain throughout life.

II.Title of Research: Genomic coadaption and developmental stability within introgressed populations of Enneacanthus gloriosus and E. obesus (Pisces, Centrarchidae) (with Felley, J. D.).

Site Location: Ponds and drainages of the Raritan River, the Delaware River, and various Pine Barrens drainages.

Date Project Initiated: Spring 1981.

Date of Completion: completed.

Publication Vehicle: Evolution, vol 39(1): 104-114.

HANDEL, Steven N. Dept of Biological Sciences, Nelson Labs, Rutgers University, Piscataway NJ 08854. Phone: (201)-932-3341.

I.Title of Research: Population biology of Sarracenia purpurea, the pitcher plant.

Site Location: Lebanon State Forest.

Date Project Initiated: Spring 1986.

Date of Completion: 1988.

Publication Vehicle: Journal.

Abstract: The significance of carnivory for persistance, growth, and reproduction will be determined experimentally by manipulating insects captured and nutrients available to the roots.

II.Title of Research: Clonal growth in wild cranberry.

Site Location: Lebanon State Forest.

Date Project Initiated: Spring 1986.

Date of Completion: 1988.

Publication Vehicle: Journal.

Abstract: The pattern of clonal growth and its importance in invasion of space and in controlling fruit production will be tracked.

HARTZOG, Sandra H. Stockton State College, Natural Science and Mathematics, Pomona NJ 08240. Phone: (609)-652-1776 ext. 546.

I.Title of Research: Population genetics of the "Pygmy Pines" of the New Jersey Pine Barrens (with students).

Site Location: East and West Plains, off routes 72 and 539.

II.Title of Research: A study of vegetation in the Stockton Sewage Sprayfield (ecological changes after 10 years of spray); I am doing a follow-up study of recovery after spraying was discontinued.

Site Location: Stockton, Pomona, N.J.

III.Title of Research: Archaeology of a prehistoric, multicomponent Indian site.

Site Location: Egg Harbor Township, Atlantic County, N.J.

Date Project Initiated: Spring 1986.

Funding Agency: Stockton State College and owner of property.

Abstract: A rationale and goals for excavation of the Egg Harbor Township multicomponent Indian site is available

on request. The project will be submitted to Dr. Lorraine Williams, curator of the State Museum, and Jonathan Gell, State Historic Preservation Office, Green Acres.

HAVENS, A. V. Department of Meteorology, Cook College. Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-9520.

Title of Research: Impact of climatic variability on agriculture. (with SHULMAN, M. D.)

Site Location: Northeast Regional Research Project sites.

Date Project Initiated: 1956.

Date of Completion: September 1986. (Hopefully until 1991 if funding continues.)

Publication Vehicle: Journals; Experimental Station Bulletins.

Abstract: Most of the research has involved computerized analysis of climatic and related agricultural data for New Jersey and the Northeastern United States. A series of Experimental Station Bulletins have been published. Some contain some Pine Barrens data.

HAYES, Deborah Childs. Rutgers Field Station, P.O.Box 206, New Lisbon NJ 08064. Phone: (609)-894-8849.

Title of Research: Validation of wetlands buffer model (with GOOD, R.E., ZAMPELLA, R.A., ROMAN, C., and EHRENFELD, J.).

Site Location: Development areas within the Pine Barrens.

Date Project Initiated: April 1986.

Date of Completion: 1989.

Publication Vehicle: Final report to funding agency.

Funding Agency: Jessie Smith Noyes Foundation.

Abstract: We are investigating the effect of distance from development areas on hardwood and cedar swamps. We are considering nutrient balance, hydrology, and species composition in order to evaluate the effectiveness of the buffer model set out by Roman and Good (1983). We hope to determine a suitable distance from human development for maintaining wetland integrity.

HAYES, Matthew S. Center for Coastal and Environmental Studies, Doolittle Hall, Busch Campus, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-3378.

Title of Research: Vegetation of forested salt marsh islands: Effects of area, elevation, isolation , and edaphic factors (with GOOD, Ralph E.).

Site Location: Great Bay.

Date Project Initiated: May 1986.

Date of Completion: August 1987.

Publication Vehicle: Journal.

Abstract: Located in the Great Bay (southern New Jersey coast) are a number of islands of forest vegetation surrounded by salt marsh and brackish water. These islands have probably been formed by the rise in sea level and were likely once a part of the mainland. The purpose of this study is to determine species diversity and abundances in each island's forest vegetation, to delineate the relationship between the vegetation and certain measured variables (area, elevation, isolation, and various edaphic factors) and to compare island vegetation with that of similar stands on the mainland.

HORDON, Robert M. Dept. of Geography, Rutgers University, New

Brunswick NJ 08903. Phone: (201)-932-3107, 4103.

Title of Research: Application of the Cornell Water and Land Resources Analysis System (WALRAS) to the New Jersey Pinelands.

Site Location: Hammonton Area

Date of Completion: October 1983.

Funding Agency: Water Resources Research Institute.

JAWORSKI, Andrew Z. Pinelands Commission, P.O. Box 7, New Lisbon NJ 08064. Phone: (609)-894-9342.

Title of Research: Effectiveness of standard and alternative-design septic systems in renovating effluent in Pinelands soils. (with NICHOLSON, Robert.)

Site Location: Evesboro, Medford, Woodland, Mullica and Egg Harbor Twps.

Date Project Initiated: September 1983.

Date of Completion: September 1985.

Publication Vehicle: Not published.

Funding Agency: Pinelands Commission.

Abstract: Studied nitrogen reducing capability of 3 pressure-dosing, 2 standard, and 1 waterless toilet and graywater septic system in the Pinelands.

KANTOR. Richard A. Division of Coastal Resources, Department of Environmental Protection, State of New Jersey, CN 401, Trenton NJ 08625. Phone: (609)-292-9762. (No current Pine Barrens Research.)

KEBBEKUS, Barbara B. Air Pollution Research Lab, New Jersey Institute of Technology, Dept. of Chem. Eng., Chem., and Envtl. Science, 323 King Blvd, Newark NJ 07102. Phone: (201)-596-3587.

Title of Research: Analysis of airborne organic vapors. (with BOZZELLI, Joseph W.)

Site Location: Batsto village.

Date Project Initiated: 1979.

Date of Completion: 1980.

Abstract: Ambient air was sampled every sixth day over nearly two years. Samples were analyzed by high resolution gas chromatography for 25-30 toxic organic vapors including benzene and other aromatics, one and two carbon chlorinated hydrocarbons and methobenzene. The site was used as a "background" sampling area for comparison with samples taken in more industrial areas. A report on the three-year project including the Pine Barrens data will be submitted to the US EPA in March 1982: "Toxic and carcinogenic vapors in the ambient atmosphere in the New Jersey-New York area."

KNEZICK, Donald R. Dept. of Horticulture and Forestry, Cook College, Rutgers University, P.O. Box 231, New Brunswick NJ 08903. Phone: (201)-932-9645.

Title of Research: Single clone orchard production of southern pine hybrids.

Site Location: New Lisbon, N.J.; Piscataway, N.J.

Date Project Initiated: 1981.

Date of Completion: 1986.

Publication Vehicle: Journal.

Abstract: This project is designed to determine if mass

artificial pollination of single clone orchards is an effective and economical means of mass producing southern pine hybrids.

KUSER, John. Dept. of Horticulture and Forestry, Cook College, Rutgers University, Box 231, New Brunswick NJ 08903.

I.Title of Research: Pitch pine improvement (see KNEZICK, Donald).

Funding Agencies: Morie Co.; R. Clayton and Sons; NJ DEP, Div. Parks and Forestry; U.S. Govt.- McIntire-Stennis.

Abstract: Select trees for a first generation seed orchard by progeny-testing 125 phenotypically superior parent trees. Selection criteria are straight trunks and fast growth/large size compared to neighboring trees.

II.Title of Research: Vegetative propogation of pitch pine.

Funding Agencies: See above.

Abstract: Our goal is to increase rootability of stump or water sprouts to 90% with a view to clonal propagation.

LEDIG, F. Thomas. Institute of Forest Genetics, 1960 Addison St., Berkeley CA 94704. Phone: (415)-486-3458.

Title of Research: Genecology of pitch pine.

Site Location: Many sampling sites, and a uniform garden planting (ca. 14 acres) near North Branch, Lebanon State Forest.

Date Project Initiated: 1969.

Date of Completion: 1990.

Publication Vehicle: Book chapters; Journals; Proceedings; Forest Service Research Papers.

Funding Agencies: American Philosophical Society; National Science Foundation; U.S.D.A. Forest Service (current).

Abstract: The objective of this investigation was to determine how a wide-ranging pine species adapts to diverse environments. Concern focused on population structure and on photosynthetic physiology. Study techniques included the use of uniform gardens to eliminate environmental variation and reveal genetic differences among populations. The structure of variation in most traits was clinal; e.g. there was a continuous gradation in seedling height related to the climate in which the population originated. Characteristics measured in situ, such as wood specific gravity, also changed gradually from north to south. Genetic variation in rate of photosynthesis, measured as CO2-exchange, was not pronounced. However, when temperature was varied, photosynthesis was relatively more stable for northern than for southern populations. Apparently northern populations have evolved a degree of physiological homeostasis as a result of selection in severely fluctuating climates. Soluble enzymes were extracted from seed, separated by electrophoresis, and stained by employing their affinity for specific substances. The process revealed isozymes, or multiple molecular forms, in several enzyme systems. Because of the haploid nature of pine seed, genetic segregation could be demonstrated by 1:1 ratios among seed from heterozygotes. Gene frequencies differed among populations, although not greatly. Average heterozygosity was comparable to that in man or fruit flies, and inbreeding appeared low. There was no tendency for trees with similar genotypes to occur together in stands, a result with significance for selection schemes, and perhaps, one that can be extrapolated to other pines. Linkage between genes was found, representing a beginning in mapping the conifer chromosomes.

LIST, Albert, Jr. Dept. of Bioscience and Biotechnology, Drexel University, Philadelphia PA 19104. Phone: (215)-895-2626.

Title of Research: Survey and illustration of Bryophytes and Lichens in the New Jersey Pinelands; Study and illustration of the vascular flora of the Pine Barrens.

Site Location: Many locations.

Date Project Initiated: 1980.

Date of Completion: Early 1987, book to appear 1988 or sooner.

Publication Vehicle: Book: Plants and their Habitats in the New Jersey Pine Barrens. A thoroughly illustrated (by the author) field guide with keys suitable for layman and scientist. Drawings of over 600 vascular plants, over 100 bryophytes, and dozens of the lichens are in the book. All drawings are completely new and original. Five years in preparation, so far. The book does not pretend to cover all weeds, or the hybrids among oaks, although many roadside weeds are included. It is primarily intended to be a useful pictorial guide to the plants, and distinguishes ten or eleven habitat types using Hans Olssens Phytosociological system to some extent.

Nature of the Project: To illustrate in detail every significant plant in the Pine Barrens. Project has involved thousands of hours with grasses, sedges, rushes, composites, peat mosses (Sphagnum), genera of lichens, especially Cladonia and Cladina, and numerous other genera. I would enjoy talking with anyone who has studied any of these groups, and am always willing to compare notes or go on field trips. Dr. List has well over 10,000 color pictures of plants in the Pine Barrens. They are of high quality and clarity, and have been used in talks to a large number of different groups, and in courses taught to various groups, or classes at Drexel.

LITTLE, Silas 301 Creek Road, Moorestown NJ 08057. (No current Pinelands research). See ROMAN, Charles T.

LORD, Thomas R. Department of Biology, Burlington County College, Pemberton-Browns Mills Road, Pemberton NJ 08068. Phone: (609)-894-9311. See BOERNER, Ralph E.J.

MADSEN, Eugene. Department of Agronomy, 119 Tyson Building, Penn State University, University Park PA 16802. (No current

Pine Barrens research.)

MANOS, Paul S. Dept. of Biological Sciences, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-2843.

Title of Research: Isozyme variation in northeastern american red oak species. (with FAIRBROTHERS, D. E.)

Site Location: West Pine Plains, Route #539 near Fort Dix Property; Atsion Lake Region; White's Bog Region; Route #539 near Webbs Mill.

Date Project Initiated: March 1983.

Date of Completion: January 1986.

Publication Vehicle: Journals.

Funding Agencies: Division of Pinelands Research, Rutgers University; Bureau of Biological Research, Rutgers University.

Abstract: Starch gel electrophoresis is performed on individual seedlings grown from acorns from populations of six North American species, all native to the Pinelands of N.J. Eleven enzymes encoding 18 loci were detected and 60% were polymorphic. Such allozyme analysis will focus on population structure and systematic interpretations based on this new genetic information. Gene frequency data from four populations of Q. ilicifolia show that genetic diversity in oaks is concordant with results attained from plant species with similar life-history traits.

MARUCCI, Philip E. Rutgers University Cranberry and Blueberry Research Laboratories, New Jersey Agricultural Experiment Station, Box 29 Penn State Forest Rd., Chatsworth NJ 08019. Phone: (609)-726-1020. See BOYD, Howard P.

MATLACK, Glenn R. Division of Pinelands Research, Rutgers Field Station, P.O. Box 206, New Lisbon NJ 08064. Phone: (609)-894-8849.

I.Title of Research: The effects of landscape fragmentation on oak-pine upland forest (with Good, R.E.).

Site Location: Throughout the Pine Barrens.

Date Project Initiated: January 1986.

Date of Completion: January 1987.

Funding Agency: New Jersey DEP.

Abstract: The dissection of oak-pine forest into isolated stands has been a major consequence of human development around the periphery of the New Jersey Pinelands. A previous study (see GIBSON, D.J.) has related density and diversity of tree species to fragment size and isolation, and to physical aspects of individual sites. The goal of the present study is to extend this analysis to herb and shrub species.

Fifteen fragment stands have been located, and these will be compared with nineteen stands contiguous with larger forests. Vegetation will be surveyed by quadrats in a stratified random design. We hope our results will be useful to land managers in questions of forest conservation. At the same time, we will test several hypotheses about factors controling forest herb/shrub distribution.

II.Title of Research: The seed bank as a parallel community in oak-pine upland forest.

Abstract: In a project complementing the fragmentation study (above), the soil seed bank will be sampled in each oak-pine fragment and each contiguous stand. Seed in the soil will be estimated from germination in soil samples in the greenhouse. Seed-species diversity and density will be compared with the respective vegetative plant community, and with physical attributes of each stand. The seed bank is a history of past vegetation at a particular site, and an important reservoir of colonists for future disturbances. Nevertheless, seedbanks have rarely been described in the general context of the plant community.

MCCARTHY, K. A. Dept. of Biological Sciences, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-2843.

Title of Research: Vegetation dynamics of intermittent freshwater ponds in Atlantic County, N.J. (with FAIRBROTHERS, D. E. and GOOD, R. E.)

Site Location: Hirst Pond and Goose Ponds, Atlantic County, N.J.

Date Project Initiated: January 1984.

Date of Completion: June 1986.

Publication Vehicle: Not determined at this time.

Funding Agencies: Sigma Xi and Nature Conservancy.

Abstract: Study of water level effects on germination. Vegetation transects are being used for a guide to seed bank sampling. Replicates for greenhouse water regime experiments are used to sample seed bank potential. The seed bank data are being correlated with species composition of the standing vegetation studied by the line transect method. Field seedling survivorship is being compared to vegetative offspring survivorship. Survival of individuals arising from perennating organs will also be monitored. A study of soils is also included.

MCINTOSH, Alan. Dept. of Environmental Sciences, Cook College, Rutgers University, New Brunswick NJ 08903. (No current Pine Barrens research.)

MONTGOMERY, James D. Ecology III, Inc., RD1, Berwick PA 18603 Phone: (717)-542-2191.

I.Title of Research: Pteridophytes of New Jersey.

Site Location: Entire state.

Date Project Initiated: 1979.

Date of Completion: Continuing.

Publication Vehicle: Book, Journals.

Abstract: Project goal is an update of the ferns and fern-allies of New Jersey (essentially an update of the work of Chrysler and Edwards, 1947). Ecology, past and present distribution, and abundance of New Jersey pteridophytes are included.

II. Title of Research: Ferns of New Jersey. (with FAIRBROTHERS, D. E.)

Site Location: Throughout N.J. and the entire Pinelands.

Date Project Initiated: 1980.

Date of Completion: 1987.

Publication Vehicle: Will be published as a book, also Montgomery, J.D. amd D.E. Fairbrothers, 1985. Geographical Distribution of N.J. Pteridophytes. Bartonia 51: 52-57.

Abstract: This is to be a manual of the ferns of New Jersey, including the Pinelands. The manual will contain nomenclature, all taxa, ecological information, geographical distribution, and present status concerning rare and endangered species.

MORGAN, Mark D. Department of Biology, Rutgers University, Camden NJ 08102. Phone: (609)-764-1247. (See SPRATT, Henry G., Jr.)

I. Title of Research: Biological control of hydrogen ion flux in the New Jersey Pinelands. (with GOOD, Ralph E.)

Site Location: McDonalds Branch.

Date Project Initiated: September 1984.

Date of Completion: August 1987.

Publication Vehicle: Journal.

Funding Agency: NJ DEP, Rutgers University.

Abstract: The goal of this 3-year project is to quantify the role of biological processes in regulating the flux of hydrogen ions in the Pinelands surface waters. In year one, we focused on iron metabolism in the McDonalds Branch watershed. Our data suggest that (i) microorganisms are responsible for catalysing the oxidation of ferrous to ferric iron in the soil and water of McDonalds Branch, (ii) the organisms are not chemo-litho-autotrophs, although they may be chemo-litho-heterotrophs or heterotrophic iron-depositing bacteria, (iii) iron oxidation in water over short time periods is not affected by pH changes up to 0.6 units, additions of carbon or inorganic nutrients or additions of heterotrophic microorganisms, and (iv) environmental heterogeneity and temperature are the primary factors that regulate the rate of iron oxidation.

II. Title of Research: Impact of acid precipitation on streamwater chemistry in the New Jersey Pinelands. (with GOOD, Ralph E.)

Site Location: Numerous streams in Pinelands watersheds. Precipitation collectors at Double Trouble, Bass River, and Batsto.

Date Project Initiated: August 1984.

Date of Completion: August 1986.

Publication Vehicle: Journal.

Funding Agency: N. J. Conservation Foundation through the Pew Trust.

Abstract: The objective of this study is to determine if, and to what extent, a change in precipitation pH directly affects stream pH in the New Jersey Pinelands. This objective is accomplished by direct comparison of detailed precipitation and stream chemistry measurements

made by Yuretich et al. (1981) in the early 1970s with similar data collected during the present study. Previous data suggest that precipitation pH has significantly declined during this interval. Thus, a direct cause and effect relationship between precipitation and stream pH should be evident, if it exists, by changes in stream pH.

III.Title of Research: Limnology of Pinelands surface waters.

Site Location: Oswego and Nescochaque Lakes

Date Project Initiated: August 1981.

Date of Completion: Continuing.

Publication Vehicle: Journal.

Funding Agency: Rutgers - internal.

MORIN, Peter J. Dept. of Biological Sciences, P.O. Box 1059, Busch Campus, Rutgers University, Piscataway NJ 08854. Phone: (201)-932-2801.

Title of Research: Experimental studies of amphibian community structure.

Site Location: Colliers Mills, Greenwood Forest, Bass River State Forest, Tuckahoe.

Date Project Initiated: 2/1/85.

Date of Completion: 7/1/87.

Publication Vehicle: Journal.

Funding Agency: NSF.

Abstract: Experimental manipulations of tadpoles and their predators in natural ponds, artificial ponds and laboratory microcosms will test theories of community organization by measuring the relative impact of intra- and interspecific competition and predation on the growth, survival, and species composition of Pine Barrens anurans. Experiments will explore how the sequence of colonization (priority effects) and indirect effects of initial prey species composition (indirect mutualism and commensalism) affect the impact of predators on competing prey. Results will also extend input/output models of community dynamics to include effects of predation on one or more competing species. Experimental studies of resource utilization, of herbivory on periphyton, and of interference will identify mechanisms of competition, and test whether measures of resource overlap accurately predict the intensity of experimentally demonstrated competition. Other laboratory studies will examine population consequences of size- and species-selective predation on predator-mediated competition among tadpoles. A survey of phenotypic variation in competetive ability among tadpoles from ponds of different competitor diversity will test predictions about the coevolution of competitors in island communities.

This study involves basic research into the mechanisms responsible for the distribution and abundance of organisms. Such knowledge is a prerequisite for general theories that will eventually predict the consequences of the introduction or loss of species from natural communities. These studies and the resulting theories will provide the framework for integrating previous findings about the basic interactions among species in natural communities.

NICHOLSON, Robert. Pinelands Commission, P.O. Box 7, New Lisbon NJ 08064. See JAWORSKI, Andrew Z.

QUINN, James A. Department of Biological Sciences, Rutgers University, P.O. Box 1059, Piscataway NJ 08854. Phone: (201)-932-2844 or 932-2075(message). See CHEPLICK, Gregory P.

ROMAN, Charles T. Division of Pinelands Research, Center for Coastal and Environmental Studies, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-4881.

1.Title of Research: The development and field testing of

a model for delineating buffer protection areas between Pinelands wetlands and adjacent upland development. (with GOOD, Ralph E.)

Site Location: NJ Pinelands.

Date Project Initiated: October 1981.

Date of Completion: Continuing.

Publication Vehicle: Technical reports; Proceedings; Journal.

Abstract: One year of literature review preceded the development of a proposed buffer delineation model for N. J. Pinelands wetlands. The proposed model was designed to function within the framework of the Pinelands Comprehensive Management Plan with the primary objective of providing a systematic and consistent mechanism for assigning environmentally appropriate site-specific buffer areas between wetlands and proposed development. The proposed model underwent a 1.5 year testing and verification program. Appropriate revisions were made, and the model is currently providing guidance to the Pinelands Commission staff and applicants.

II. Title of Research: A field study of vegetation, soils and hydrological relationships in pitch pine-dominated upland-wetland transitions in the N. J. Pinelands. (with ZAMPELLA, Robert A. and JAWORSKI, Andrew Z.)

Site Location: Lebanon State Forest.

Date Project Initiated: Summer 1982.

Date of Completion: Spring 1983.

Publication Vehicle: Journal (Water Resources Bulletin 1985 21(6): 1005-1012.)

Abstract: Wetland protection regulations and guidelines often require the delineation of precise wetland boundaries on a case-by-case basis. In this study, conducted in the New Jersey Pinelands, an ecological

characterization of vegetation composition, soil and hydrologic relationships along upland to wetland Pinus rigida-dominated transitions provided the basis for a multiparameter approach to wetland boundary delineation. The transitional data set was analyzed by direct gradient analysis, cluster analysis and ordination. It is concluded that vegetation composition can be a principle factor in delineating wetland boundaries along natural upland to wetland transitions. However, where distinct vegetation changes are not observed, a feature of our study sites, a multiparameter approach should be used.

III.Title of Research: An evaluation of the N. J. Pinelands wetland management program. (with ZAMPELLA, Robert A.)

Date Project Initiated: Spring 1983.

Date of Completion: Spring 1983.

Publication Vehicle: Journal (Wetlands 1983 3: 124-133).

Abstract: Wetland vegetation types of the New Jersey Pinelands include cedar and hardwood swamps, pitch pine lowlands, inland and coastal marshes, and bogs. These wetlands comprise 30-35% of the 470,000 ha. Pinelands region. In response to both federal and state legislative mandates, a Comprehensive Management Plan was developed by the New Jersey Pinelands Commission to preserve and protect the unique and essential character of the Pinelands ecosystem. Under the Plan, wetlands are protected by a regional land allocation program, a land acquisition program, and a wetlands management program. The wetlands management program prohibits most development within wetland boundaries and requires the preservation of an upland buffer to the wetland. In this paper, the Comprehensive Management Plan's land allocation program is reviewed as it relates to wetlands protection, and the wetlands management program is described. The accomplishments of these wetlands protection initiatives since the implementation of the plan are assessed. It is suggested that a comprehensive wetlands protection program such as the one applied in the Pinelands can be effectively implemented elsewhere on a regional scale.

IV.Title of Research: Cedar swamps of the N. J. Pinelands - Literature review. (with GOOD, Ralph E. and LITTLE, Silas.)

Date Project Initiated: September 1983.

Date of Completion: December 1985.

Publication Vehicle: Book; Proceedings.

Abstract: This literature review of N. J. Pinelands cedar swamps included topics such as distribution, site characteristics, vegetation patterns and processes and management-protection strategies.

SAMUELSON, Sue. Dept. of American Studies, Douglass College, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-9179.

Title of Research: Ongoing research on various aspects on Pinelands/South Jersey folklife and folk culture.

Site Location: General research on regional identity concentrates on the entire South Jersey area. Research on Pinelands festivals at Medford, Chatsworth, Tuckerton, and Egg Harbour and Hammonton. Research on cemeteries in the area roughly bounded by Chatsworth, Mays Landing, Millville, and Medford.

Date Project Initiated: Fall 1983.

Date of Completion: Ongoing.

Publication Vehicle: Journal.

Abstract: I initially began my research in the Pinelands as part of the Library of Congress' Pinelands Folklife Project in 1983. My current topics are an outgrowth of issues, items, and problems that I encountered during that period. The three main topics of current investigation include: regional identity in South Jersey as it has traditionally included "Pineys" and "others", and as it has been altered by the creation of the Reserve; how community identity and pride is exhibited in festivals and celebrations, both public and private; and the evolution and current status of an aspect of cemetery culture in certain areas of the Reserve where graves are

covered with crushed glass (a locally significant industry) to replace the grass which cannot be supported by the sandy soil without extensive use of fertilizers and imported topsoil (which has occurred in more recent years).

SCHICK, Kevin. Department of Environmental Protection, Bureau of Environmental Evaluation and Risk Assessment, 401 E. State St., 6th Floor, Trenton NJ 08625. Phone: (609)-633-6801.

Title of Research: The lower pH tolerance of selected Pine Barrens fish species.

Site Location: Fish collected at various streams and lakes in the Pine Barrens (Oswego Lake, Landing Creek, Mullica River, etc.). Experiments conducted at the Rutgers Marine Station.

Date Project Initiated: Fall 1983.

Publication Vehicle: Ph. D. Thesis.

Abstract: Field data indicate that the swamp darter, Etheostoma fusiforme, is present in the highly acidic waters of the New Jersey Pine Barrens. The tessellated darter, Etheostoma olmstedi, is restricted to higher pH, peripheral or disturbed Pine Barrens habitats. Laboratory experiments were conducted using a gradual pH reduction scheme, in order to determine if a significant difference in pH tolerance exists between the two species.

Etheostoma fusiforme was significantly more tolerant to low pH than E. olmstedi, with mean survival times between 164.4 and 101.1 hours, respectively. The effects of fish size upon pH tolerance were observed between three established size classes for either species. The ecological significance of the pH tolerance differences between the two species is discussed in terms of their distribution.

SCHUYLER, Alfred E. Academy of Natural Sciences of Philadelphia, 19th and the Parkway, Philadelphia PA 19103. Phone: (215)-299-1193.

Title of Research: Monitoring the distribution and abundance of aquatic and wetland plants in counties within a 50 mile radius of Philadelphia.

Site Location: General area of study includes Pine Barrens.

Date Project Initiated: 1962.

Date of Completion: Continuing.

Publication Vehicle: Journal.

Abstract: Periodic trips are made to the New Jersey Pine Barrens to monitor distributions of rare aquatic and wetland plants. Voucher specimens are collected and deposited in the herbarium of the Academy of Natural Sciences.

SHULMAN, M. D. Dept. of Meteorology and Oceanography, Cook College, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-9520. See HAVENS, A.V.

SINTON, John. NAMS, Stockton State College, Pomona NJ. Phone: (609)-652-1776. See BERGER, Jonathan.

SITLER, Martha. P.O. Box 2, Science Building, Rutgers University, Camden NJ 08102. Phone: (609)-757-6312.

Title of Research: The effect of pH on the chemical ecology of freshwater macrophytes in New Jersey Pine Barrens streams.

Site Location: Cooks Branch, Oswego River, Batsto River, Albertson, Sleeper Branch.

Date Project Initiated: September 1985.

Date of Completion: July 1986.

Publication Vehicle: Journal.

Abstract: The objective of my study is to compare elemental content of plant tissue and water mineral content of Pine Barrens streams. Rivers of differing pH are being monitored in order to determine the effect of pH on tissue element content and to gain insight into the chemical parameters that control macrophyte distribution. Macrophyte species Juncus militaris and Scirpus subterminalis are to be used for tissue analysis. Both surface stream water and pore water will be analyzed. Plants will be considered in terms of both roots and shoots. Analyses for stream and pore water will include pH, SO4--, CO2, NH3, Ca++, Mg++, total dissolved Fe and Al, K+, Na+, NO3-, and PO4-3. Analysis of plant roots and shoots will include Ca++, Mg++, total dissolved Fe and Al, K+, and Na+.

SMITH, Chris. Soil Conservation Service, Ocean County.

Title of Research: Water table monitoring program. (with TUDOR, Robert A.)

Site Location: Ocean County, NJ.

Date Project Initiated: 1984.

Date of Completion: Ongoing

Abstract: The Division would like to produce a water quality model that would indicate the amount of cumulative development that would be allowed without degrading the water quality of Lakes Bay. This study goal would be to set a limit for development in the Lakes Bay region.

A report analyzing the water quality of Lakes Bay, quantifying the amount of pollution from new proposals and projecting a calculated maximum amount of development that would be within the assimilative capacity of the Bay and would not adversely impact shellfish beds.

The data produced in this case study will serve as a model for evaluating the acceptibility of development in similar environments.

SPRATT, Henry G., Jr. Rutgers Field Station, P.O. Box 206, New Lisbon NJ 08064. Phone: (609)-894-8849.

Title of Research: Biological control of hydrogen ion flux in Pinelands hydrologic systems with emphasis on proton consuming activities (e.g. microbial sulfate reduction). (with GOOD, Ralph E. and MORGAN, Mark.)

Site Location: Cedar swamps: McDonalds Branch, Reeds Branch, Coopers Branch, and Shinns Branch.

Date Project Initiated: September 1985.

Date of Completion: Summer 1986.

Publication Vehicle: Journal.

Abstract: The relative importance of microbial sulfate reduction in the control of proton flux through anaerobic peat of swamps of the New Jersey Pine Barrens is addressed. Compartmentalization of sulfate-sulfur into various reduced-sulfur fractions is used to accurately determine rates of microbial sulfate reduction in peat samples, using both distillation iodometric titrations and 35S-tracer experiments to quantify pool sizes and rates of incorporation into the different pools, respectively. Controlling factors of microbial sulfate reduction, such as substrate coavailability (e.g. SO4-- and various organics), will be addressed to determine limits on this microbial process. Once the microbiology of the process is woorked out, the potential for control of higher levels of activity due to acidic deposition to those wetlands by microbial sulfate reduction will be addressed.

STASZ, James L. HOME: P.O. Box 71, North Beach MD 20714. Phone: (301)-257-9540. OFFICE: Maryland-National Capitol Park and Planning Commission, 14741 Governor Oden Bowie Drive, Upper Marlboro MD 20772. Phone: (301)-952-3650.

Title of Research: Populations dynamics of endangered species in the New Jersey Pine Barrens.

Date Project Initiated: July 1984.

Date of Completion: On-going; probably after 1990.

Publication Vehicle: Journal (Bartonia).

Abstract: Primary goals are to obtain an understanding of colonization, growth rates, reproduction triggers, and long term survival (includes types of disturbance which cause local extirpation), seed-banking, etc. in a select group of Pinelands species: Scirpus Longii, Rhynchospora Knieskernii, Calamovilfa brevipilis, Muhlenbergia Torreyana, Carex Barrattii, Narthecium americanum, Tofieldia racemosa, Eupatorium resinosum, Juncus caesariensis, Rhynchospora oligantha, Rhynchospora pallida, and a few more. Includes mapping, tagging of known-age plants, seed samples collected for germination, and tagging plants and observing growth response to natural pertubations. A secondary theme: distribution of scarcer species e.g. Calamagrostis Pickeringii, Fimbristylis puberula.

STOLTZFUS, Dwight L. Center for Coastal and Environmental Studies, Doolittle Hall, Busch Campus, Rutgers University, New Brunswick NJ 08903. Phone (Home): (215)-256-8470.

Title of Research: Ecology of Atlantic white cedar swamps: A study of causes and effects of ecosystem fragmentation (with GOOD, Ralph E.).

Site Location: Cedar swamps in Lebanon, Double Trouble, Penn, Bass River, and Wharton State Forests.

Date Project Initiated: June 1984.

Date of Completion: Spring 1987.

Funding Agencies: 1985-New Jersey Dept. of Environmental Protection, Rutgers Division of Pinelands Research.

Abstract: Atlantic white cedar swamps have decreased significantly in total area and have become increasingly fragmented in the last few hundred years. These trends are primarily the result of natural succession where

hardwood species have replaced cedar in many wetland areas. Improper logging practices and fire, in some instances, have promoted this replacement of cedar by hardwood species. In order to preserve this valuable wetlands habitat, it is important to complete additional studies of the ecology of these swamps and the causes and effects of fragmentation in these ecosystems.

In my study I have surveyed nearly all of the cedar swamps within the Preservation Area of the Pinelands National Reserve through personal observation and the study of aerial photographs. I have selected 18 swamps and grouped them according to size and surrounding vegetation. Six have been included in each of three categories. Within each size category, three cedar swamps surrounded by pitch pine lowland and three surrounded by hardwood swamps have been selected. The work within these selected sites involves: (1) sampling the present vegetation (trees, shrubs, and herbs), (2) placement of 74 wells for measurement of water table and pH, (3) measurement of light intensity, (4) measurement of peat depth, and (5) determination of age and relative quality of the site through tree corings and height measurements.

An additional phase of this study involves cedar swamps which have been disturbed within the last 30 years. Nine swamps which have been logged within the last 30 years have been selected and grouped according to time since logging: 1-10 years, 10-20 years, and 20-30 years. Five swamps which have been burned within the last 10 years and five abandoned cranberry bogs have been selected for study. The work within each of these sites involves sampling the present vegetation only (trees and shrubs).

TEDROW, J. C. F. (No current Pine Barrens research.)

TATE, Robert L., III. Department of Soils and Crops, Cook College, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-9810.

Title of Research: Work being conducted on NJAES-15187: Microbial oxidation of soil organic matter and NJAES-15288: Gains, losses and management of soil nitrogen.

Site Location: Lebanon State Forest.

Date Project Initiated: July 19, 1983.

Date of Completion: June 1988.

Publication Vehicle: Journal.

Abstract: Mineralization rates in Atsion and Lakehurst sands of the New Jersey Pinelands are being measured with overall objectives of estimating the quantities of N mineralized annually and of determining the relative contribution of bacterial and fungal populations to mineralization processes. The ultimate objective of the project is to elucidate the linkage between the microbial populations involved in these mineralization processes and higher plants. Nitrogen mineralization has been assessed by the buried bag procedure with undisturbed and sieved soil samples. Activity of fungal and bacterial populations are determined through inhibition of glucose catabolism by selective antibiotics. Both nitrogen mineralization assessment methods yield similar results, although some significant differences were observed with the Lakehurst sand. To date, annual nitrogen yields for the Atsion and the Lakehurst sands were 36 and 30 kg N/ha for both soils in the seived soil samples. Net N mineralization in both soils exhibited distinct seasonal patterns with maxima in summer and minimum rates in the winter. Nitrification accounted for only about 5% of the total N mineralized in both soils. Bacterial populations accounted for 25-40% and 10% of the mineralization in the Lakehurst and Atsion soils, respectively.

TUDOR, Robert A. Division of Coastal Resources, New Jersey Department of Environmental Protection, CN 401, Trenton NJ 08625. See SMITH, Chris.

UNNASCH, Robert S. Ecology and Evolution Dept., S.U.N.Y. of Stony Brook, Stony Brook NY 11794. Phone: (516)-246-5038.

Title of Research: Seed predation and limits to recruitment in the Pine Barrens scrub oak *Quercus ilicifolia* and blackjack oak *Quercus marilandica*.

Site Location: Long Island dwarf pine barrens; New Jersey dwarf pine barrens (east plains).

Date Project Initiated: 1982.

Date of Completion: 1984.

Publication Vehicle: Journal.

Funding Agencies: Sigma Xi, personal.

Abstract: During the past several years I have been interested in determining the key factors limiting seed survival and germination success of large seeded plants. My investigation of these factors in the scrub oaks of the pine plains has yielded much enlightening data. Acorn weevils (Curculio sp.) destroy between 20% and 30% of the annual mast. These rates of predation seem constant over years, and hence the weevils do not significantly affect recruitment of oak seedlings. Peromyscus leucopus is the single agent of acorn dispersal in my study sites. Seeds not discovered under the maternal parent, dispersed, and cached by mice perish; apparently from dessication. Those rediscovered in caches are invariably consumed. The number of seeds escaping rediscovery seems to be dependent on the winter mortality schedule of mice. This hypothesis is currently being examined.

WALLACE, R. S. Dept. of Biological Sciences, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-2843.

Title of Research: Isoelectrically-focused proteins of populations of Opuntia humifusa (Raf.) Raf. (Cactaceae). (with FAIRBROTHERS, D. E.)

Site Location: Whitesbog area, Burlington Co.; Atsion, Burlington Co. East coast of U.S. from Long Island to Florida.

Date Project Initiated: 1982.

Date of Completion: 1985.

Publication Vehicle: R. S. Wallace and D. E. Fairbrothers. 1985. Isoelectrically-focused seed proteins of populations of Opuntia humifusa (Raf.) Raf. (Cactaceae). Biochem. Systematics and Ecology 13: (submitted in June).

Funding Agencies. Bureau of Biological Research, Rutgers University; Botany Research Fund, R. U.

Abstract: Soluble seed proteins of Opuntia humifusa were found to be useful in population comparisons when isoelectrically-focused in polyacrylamide gels. UPGMA analysis of similarity indices resulted in clusterings of populations from similar geographic areas or habitat types. Within-population enzymatic variation was found to be very small or absent. Evidence of hybrid introgression was also detected electrophoretically, with both general protein and enzymatic staining. The population from Whitesbog, N.J. was dissimilar to other northern populations, and most likely was introduced into the Pinelands from the Carolinas.

WILLIAMS, Cairn. Nelson Biological Laboratories, Rutgers University, Piscataway NJ 08854. Phone: (201)-932-3341.

Title of Research: The roles of carnivory in and competition among four species of carnivorous plants in the New Jersey Pine Barrens.

Site Location: Webbs Mill.

Date Project Initiated: June 1986.

Date of Completion: August 1987.

Abstract: Field and greenhouse studies will be used to determine to what extent carnivory affects the growth and reproduction of Drosera filiformis, D. intermedia, D. rotundifolia, and Sarracenia purpurea. More specifically, studies are designed to see how growth and reproduction are affected if insects are excluded or fed to the plants in specific amounts. In addition, prey species pools will be determined for the three Drosera species, to see to what extent they are competing for the same prey.

WINDISCH, Andrew G. Biology Dept., Rutgers University, Camden NJ 08102. Phone: (609)-757-6146.

I.Title of Research: Delineation of the New Jersey Pine Plains and Associated Communities.

Site Location: NJ Pine Plains.

Date Project Initiated: 1981.

Date of Completion: 1985.

Publication Vehicle: Schenectada.

Abstract: The purpose of this study is to delineate the Pine Plains and the Low-Mid Transitional Plains using large-scale, black-and-white aerial photographs and systematic ground reconnaissance.

II.Title of Research: Fire intensity and stem survival in the NJ Pine Plains. (with GOOD, Ralph E.)

Site Location: NJ Pine Plains.

Date Project Initiated: 1984.

Date of Completion: 1986.

Abstract: The purpose of this study is to test the hypothesis that the natural variation in fire intensity within Pine Plains wildfires is responsible for significant variation in stem survival after fire. This variation creates patches with differing stem-size and age-class distributions, which prevail until the next killing crown fire.

ZAMPELLA, Robert A. New Jersey Pinelands Commission, P.O. Box 7, New Lisbon NJ 08064. Phone: (609)-894-9342. (See ROMAN, Charles T.)

Title of Research: Hydrogeology of transitional pitch pine lowlands.

Site Location: Lebanon State Forest, Woodland Township, Burlington County; Coopers Branch; South Branch Mt. Misery Brook, and Middle Branch, Mt. Misery Brook subbasins.

Date Project Initiated: Summer 1985.

Date of Completion: Summer 1987.

Publication Vehicle: Journal.

Funding Agency: Pinelands Commission.

Abstract: This is an extension of a previously completed investigation (Roman et al. 1985) that characterized vegetation, soil and hydrologic relationships along upland to wetland Pinus rigida-dominated transitions. The objective is to provide a more comprehensive description of soils and to characterize long term water fluctuations along this gradient. The investigation includes the completion of detailed soil logs, vegetation analysis, and biweekly water table monitoring of ground water wells at three sites located in Lebanon State Forest, Burlington County.

ZAPPALORTI, Robert T. Herpetological Associates, Inc., 1018 Berkeley Avenue, Beachwood NJ 08722. Phone: (201)-349-5065.

1.Title of Research: Habitat utilization by the Timber Rattlesnake, Crotalus horridus (Linnaeus) in southern New Jersey with notes on hibernation and home range.

Site Location: Greenwood Forest Wildlife Management Area, Ocean County.

Date Project Initiated: September 1981.

Date of Completion: December 1984.

Abstract: An ecological study of the timber rattlesnake, Crotalus horridus was conducted between September 1, 1981 through December 31, 1984 in Greenwood Forest Wildlife Management Area, Ocean County, New Jersey. Ten C.

horridus were monitored and relocated by radiotelemetry for periods of 4 to a maximum of 17 months. Data were taken on five habitat variables and four climatic variables at each telemetric relocation of the ten specimens. Home-range of 8 C. horridus were determined by plotting each movement on a grid map of the study area. Based on the preliminary results of our investigation, it seems C. horridus utilizes large tracts (39.2 - 116 acres) of upland and lowland habitat types. In order to gather more conclusive hard data, Herpetological Associates, Inc. suggests this study be continued at least two more years, radio-tracking up to 20 rattlesnakes (10 males and 10 females).

II. Title of Research: On the importance of disturbed sites to habitat selection in Pine Snakes (Pituophis melanoleucus) in the Pine Barrens of New Jersey (with BURGER, Joanna).

Site Location: Toms River, Ocean County.

Date Project Initiated: April 1978.

Date of Completion: August 1983.

Publication Vehicle: Journal.

Abstract: We studied habitat selection in 51 Pine Snakes (Pituophis melanoleucus) in the Pine Barrens of New Jersey to evaluate the importance of man-disturbed habitats. All snakes were found in Pine-Oak and Pitch Pine habitats, and none were located in Cedar Swamps or Oak Pine habitats. Most snakes were located in disturbed habitats such as along abandoned roads, railroad beds, hunting shacks and abandoned settlements. These habitats are not presently exposed to human disturbances, but they were open, with little canopy cover and no dense ground cover. Overall, Pine Snakes were found in Pitch Pine sections rather than low lands and cedar bogs. Specific habitat preferences related to soil type (Lakehurst), ground cover and ground vegetation. Snakes preferred open sand and pine needles over other ground cover types, and were usually closest to pitch pine and sedge, while avoiding blueberry, saw briar, and scrub oak. There were no sexual differences in habitats selected. Nesting females were not included in the analysis for habitat differences since they all were found in open sand areas. Over 80% of the snakes were found in man-disturbed habitats, suggesting that such areas need to be preserved as well as undisturbed, pristine sections.

APPENDIX 1

NEW JERSEY PINE BARRENS CURRENT RESEARCH QUESTIONNAIRE
(for update of 1982 survey)

Name(s) of Principal Investigator(s):

Institution Affiliation(s):

Professional Address(es):

Office Phone: (Area Code) Number:

Title of Research Project:

Specific Location(s) of Research Site(s):

Date Project Initiated:

Expected Date of Project Completion:

Publication Vehicle (Book, Journal, Other). If "Other," specify:

Funding Agency(ies) (OPTIONAL):

Abstract. Please give a concise outline of research project including research goals, general methodology, etc. You may attach additional sheets if necessary.

May we have a list of all your New Jersey Pine Barrens publications for inclusion in our Compendium of New Jersey Pine Barrens Literature. The latter is also being updated.

Please list the names, professional addresses and, if known, office phone numbers and research topics of other researchers currently conducting research in the New Jersey Pine Barrens that you think we might have overlooked.

Please complete this questionaire and return to: Glenn R. Matlack, Rutgers Pinelands Field Station, P.O. Box 206, New Lisbon, NJ 08064. Thank you.

APPENDIX 2

Index of Research Topics

Topics currently being investigated in the Pine Barrens, followed by workers addressing those topics. Descriptions of research projects are listed alphabetically by research workers' names in the body of the survey (p. 5 to p. 52).

Genetics

Knezick, D.R.; Kuser,J.; Ledig, F.T.; Hartzog, S.H.; Graham, J.H.; Garrett, P.W.; Wallace, R.S.; Manos, P.S.; Fairbrothers, D.E.

Heavy metals

Morgan, M.D.

Hydrology

Hordon, R.M.; Nicholson, R.; Zampella, R.A; Hayes, D.C.

Lakes and ponds

Schick, K.; Morin, P.J.; McCarthy, K.A.; Morgan, M.D.; Fairbrothers, D.E.

Microbiology

Tate, R.L.; Spratt, H.G.

Mosses and Lichens

List, A.

Oaks

Unnasch, R.S.; Manos, P.S.; Fairbrothers, D.E.

Pinelands culture

Hartzog, S.H.; Samuelson, S.

Pine Plains

Good, R.E.; Unnasch, R.S.; Windisch, A.G.

Pines

Ledig, F.T.; Knezick, D.R.; Kuser, J.; Hartzog, S.H.; Garrett. P.W.

Plants, ecology

Good, R.E.; Handel, S.N.; Good, N.; Gibson, D.J.; Stoltzfus, D.L.; Stasz, J.L.; Roman, C.T.; Fairbrothers, D.E.; McCarthy, K.A.; Gallagher, M.; Unnasch, R.S.; Zampella, R.A.; Matlack, G.R.; Quinn, J.A.; Cheplick, G.P.; Hayes, D.C.; Hayes, M.S.; Williams, C.

Plants, guidebook

List, A.

Population biology

Matlack, G.R.; Handel, S.N.; Unnasch, R.S.; Gibson, D.G.; Quinn, J.A. ; Cheplick, J.P.; Williams, C.

Rare and endangered species

Stasz, J.L.; Schuyler, A.E.

Introduction

Covering more than 470,000 hectares, the New Jersey Pine Barrens (Pinelands) represents one of the largest relatively-undeveloped tracts of land in the northeastern United States. Overlying an unpolluted aquifer estimated to contain more than 17 trillion gallons of freshwater, this extensive land resource contains more than 800 species of plants and more than 500 species of animals. Thus, the Pine Barrens represents a very valuable land, water, and biological resource. However, the close proximity of the Pine Barrens to the New York City and Philadelphia urban centers threatens its continued existence.

The importance of the Pine Barrens as a natural resource and recognition of its jeopardy has resulted in current preservation efforts on the national, state, and local levels. The National Parks and Recreation Act of 1978 created the country's first national reserve - the Pinelands National Reserve - within the Pine Barrens. The Pinelands Protection Act, enacted by the New Jersey State Legislature in June 1979, created the Pinelands Commission as the regional planning and management entity for the reserve. The Pinelands Commission was charged with the development and implementation of a management plan for the Reserve. The Comprehensive Management Plan developed by the Pinelands Commission recognizes that the Pine Barrens has a multitude of unique natural, physical, and cultural attributes, that it is in the public interest to preserve all of these attributes, and that preservation efforts must include assessment of natural, cultural, commercial, and industrial resources within the context of maximum public utilization.

The Pinelands Commission and its staff have recognized that successful preservation of the Pine Barrens requires input from a variety of interest groups, including the scientific community. Rutgers University established a Division of Pinelands Research within its Center for Coastal and Environmental Studies (CCES) with the encouragement of the Pinelands Commission. The Division of Pinelands Research has functioned to facilitate the flow of information between the scientific community and the Pinelands Commission, offering scientists a unique opportunity to contribute to regional management of the Reserve.

At its inception, the Division of Pinelands Research undertook a survey of the scientific community to determine

the extent and nature of current research within the Pine Barrens. This survey has served two functions: First, the information generated has helped to identify gaps in our understanding of the Pine Barrens ecosystem, and has thus suggested necessary directions of future research. Second, the survey has facilitated immediate communication between those scientists investigating specific problems and the Pinelands Commission and other land managers who require that information for their immediate decisions.

To keep the survey current, and maintain its usefulness as a reference, the survey must be updated at regular intervals. Consistent with this need, research scientists were contacted in late 1985 and early 1986 for input for a second edition of the survey. Since the original survey, additional scientists have begun projects in the region, and others have finished projects and are dropped from the directory. The results of the update are compiled into this second edition.

As in the 1982 survey, research scientists were contacted through the distribution of a questionnaire (Appendix I). The responses were compiled on an IBM micro-computer using the "Symphony" word processing and data management program. Entries were stored in an array allowing access according to investigator, home institution, research site, or research topic. The Division will continue to survey the scientific community, and this report will be updated again at regular intervals.

Acknowledgements

We wish to thank the many respondents for their cooperation in providing the information regarding colleagues currently working in the Pine Barrens. We would especially like to acknowledge the efforts of Matthew S. Hayes (a Graduate School-Camden Graduate Assistant and student in Rutgers Graduate Ecology Program) who did the major portion of the data entry.

List of Respondents

Berger, Jonathan
Boerner, Ralph E.J.
Boyd, Howard P.
Bozzelli, Joseph W.
Burger, Joanna
Carulli, J.P.
Casuallo, John *
Cheplick, J.P.
Colby, Richard H.
Collins, Scott L.
Crerar, David
Cromartie, William J.
Douglas, Lowell A.
Ehrenfeld, Joan G.
Epstein, Claude M.
Fairbrothers, David E.
Felley, J.D.
Forman, Richard T.T.
Freda, Joseph
Gallagher, Michael G.
Garrett, Peter W.
Geller, Michael D. *
Gibson, David J.
Given, Mac F.
Good, Norma
Good, Ralph E.
Graham, John H.
Handel, Steven N.
Hartzog, Sandra H.
Havens, A.V.
Hayes, Deborah C.
Hayes, Matthew S.
Hordon, Robert M.
Jaworski, Andrew Z.
Kantor, Richard A. *
Kebbekus, Barbara B
Knezick, Donald R.
Kuser, John
Ledig, F.Thomas
List, Albert, Jr.
Little, Silas *
Lord, Thomas R.
Madsen, Eugene *
Manos, Paul S.
Marucci, Philip E.
Matlack, Glenn R.
McCarthy, K.A.
McIntosh, Alan *
Montgomery, James D.
Morgan, Mark D.
Morin, Peter J.
Nicholson, Robert
Quinn, James A.
Roman, Charles T.
Samuelson, Sue
Schick, Kevin
Schuyler, Alfred E.
Shulman, M.D.
Sinton, John
Sitler, Martha
Smith, Chris
Spratt, Henry G.,Jr.
Stasz, James L.
Stoltzfus, Dwight L.
Tedrow, J.C.F. *
Tate, Robert L., III
Tudor, Robert A.
Unnasch, Robert S.
Wallace, R.S.
Williams, Cairn
Windisch, Andrew G.
Zampella, Robert A.
Zappalorti, Robert T.

* = Respondents with interests in the New Jersey Pine Barrens but having no research currently in progress.

How to use this research survey

Our goal in preparing this survey is to help scientists, land managers, teachers, and those like yourself to get in contact with people doing specific research in the Pine Barrens. To use this survey, turn to the index (p.56-59), and scan the list of research topics for the subject nearest to your interests. Then turn to the abstracts of the workers listed under that subject. Research workers are listed by name in alphabetical order in the body of the survey (p. 5 to 52). From the abstracts, choose the people working in your area of interest.

BERGER, Jonathan. TMI Public Health Fund, 1622 Locust St., Philadelphia, PA., 19103. Phone: (215)-875-3028.

Title of Research: Patterns of human use and behavior in the New Jersey Pine Barrens (with SINTON, John).

Site Location: Entire Pinelands National Reserve.

Date Project Initiated: November 1979.

Date of Completion: Spring 1982.

Publication Vehicle: (BOOK) Water,Earth and Fire: Land Use and Environmental Planning in the New Jersey Pine Barrens. Johns Hopkins University Press, Spring 1985.

Abstract: Research goals - To document the intimate relationship between the users of the Pine Barrens, the built and natural environment, and the local social organization. To provide guidelines for appropriate planning responses. Method - A review of primary and secondary literature on patterns of historical use, key informant interviews with the full range of contemporary users, observation of users, and small sample surveys leading to a synthesis of quantitative and qualitative information.

BOERNER, Ralph E.J. Department of Botany, Ohio State University, 1735 Neil Avenue, Columbus OH 43210. Phone: (614)-422-3082.

Title of Research: Effect of prescribed burning on foliar nutrient dynamics and growth of two oak species (with LORD, Thomas R.).

Site Location: Lebanon State Forest.

Date Project Initiated: November 15, 1984.

Date of Completion: January 15, 1986.

Publication Vehicle: Journal.

Abstract: We are examining the role of prescribed burning in increasing nutrient availability in upland oak-pine stands. By comparing the seasonal foliar nutrient concentrations, incremental growth patterns, and soil nutrient pools in neighboring burned and unburned sites in Lebanon State Forest, we hope to determine for what time period nutrient availability is increased and whether or not any effects on oak mineral nutrition or growth occur.

BOYD, Howard P. (Retired: Honorary Associate, Department of Entomology, Academy of Natural Sciences of Philadelphia) Home: 232 Oak Shade Road, Tabernacle Township, Vincentown NJ 08088. Phone: (609)-268-1734.

1.Title of Research: Ground-dwelling insects of the New Jersey Pine Barrens.

Site Location: Twelve selected sites in Burlington Co. (Bass River, Pemberton, Tabernacle, Woodland and Washington Twps.) and Ocean Co. (Lacey and Manchester Twps.).

Date Project Initiated: April 1986.

Date of Completion: October 1986.

Publication Vehicle: Journal.

Abstract: By the use of pit-fall traps, I am attempting to determine abundance and identity of ground-running insects, especially tiger beetles (Cicindelidae) and other beetles (Coleoptera) as well as other small invertebrates, especially arthropods, and any other small ground dwelling forms of animal life, including small mammals, extant in the Pine Barrens of New Jersey.

II. Title of Research: Life cycles of a blueberry bud gall (Diptera: Cecidomyidae) and its parasites (Hymenoptera: Chalcidoidae) (with MARUCCI, Philip E.).

Site Location: Wild and abandoned cultivated blueberry bushes and fields within the Pine Barrens area, mainly in Burlington Co., NJ.

Date Project Initiated: Winter 1979/1980.

Date of Completion: Unknown. Open-ended until identification(s) and life cycle(s) are determined.

Publication Vehicle: Journal.

Abstract: To determine and identify life cycles of a blueberry bud gall fly and its parasites. Methods include field and laboratory observations, rearing, record keeping and identification.

BOZZELLI, Joseph W. Chemistry Division, New Jersey Institute of Technology, 323 High Street, Newark NJ 07102. Phone: (201)-596-3568. See KEBBEKUS, Barbara.

BURGER, Joanna. Rutgers, The State University, Nelson Biological Laboratory, P.O. Box 1059, Piscataway NJ 08854. Phone: (201)-932-4318.

Title of Research: Behavior and ecology of Pine Snakes.

Site Location: Suitable areas in Ocean, Monmouth and Burlington Counties.

Date Project Initiated: 1981.

Date of Completion: On-going.

Publication Vehicle: Journals.

Funding Agency: DEP Endangered and Non-Game Species Project (prior to 1981).

Abstract: Overall objectives include the behavior and ecology of Pine Snakes. Specific on-going projects include studies of habitat and nest site selection, hibernation sites, movement of adults, behavior of nesting females and young, temperature relationships of nests, and effects of temperature on sex-determination.

CARULLI, J. P. Dept. of Biological Sciences, Rutgers University NJ 08903. Phone: (201)-932-2843.

Title of Research: Isozyme variation in populations of Aeschynomene virginica and A. indica: An endangered species in the United States (with FAIRBROTHERS, David E.).

Site Locations: Manumuskin River area near the border of Cumberland and Atlantic Counties. Mullica River area near Green Bank, Burlington Co.

Date Project Initiated: Winter 1985.

Date of Completion: Winter 1987.

Funding Agency: Botany Research Fund.

Abstract: Aeschynomene virginica has been designated a threatened species in the U.S. A. indica is a "sister" species native from North Carolina south to Florida and west to Louisiana. It is found in freshwater tidal marshes and other wetlands of the coastal plain. In N.J. the species reaches the northern-most extension of its distribution. Before 1935 it was known from 35 locations in N.J., but now it is limited to two locations. We use individuals grown from seeds collected in native populations for starch gel electrophoresis of enzymes, experimental crosses and morphological studies designed to determine the following: I. Genetic variation in natural populations of A. virginica and A. indica, II. Breeding systems of A. virginica and A. indica. III. Genetic relatedness of A. virginica and A. indica. Only Aeschynomene virginica grows in New Jersey.

CASUALLO, John. NAMS, Stockton State College, Pomona NJ

08240. Phone: (609)-652-1776. (No current Pine Barrens research).

CHEPLICK, Gregory P. Department of Biological Sciences, Rutgers University, P.O. Box 1059, Piscataway NJ 08854. Phone: (201)-932-2844 or 932-2075(message).

Title of Research: Life-history characters and allocation to aerial and subterranean propagules in populations of peanutgrass (Amphicarpum purshii). (with Quinn, James A.)

Site Locations: Near Atsion (N 39°44', W 74°45'); Near Hampton Furnace (N 39°45', W 74°44'; N 39°45', W 74°43'); Near Forked River (N 39°50', W 74°14'; N 39°47', W 74°22'); 2 km. south of Lakehurst (N 39°59'30", W 74°20'00").

Date Project Initiated: June 1974.

Date of Completion: August 1987.

Publication Vehicle: Journal: Oecologia, American Journal of Botany, Journal of Ecology, American Midland Naturalist.

Abstract: This project not only includes short- and long-term field studies on population survivorship and reproduction but also involves detailed experimental analyses under controlled conditions of responses to density and depth of burial and of survivorship and fecundity of plants arising from the two types of propagules (aerial and subterranean). We have found this Pinelands annual grass will appear following a soil disturbance and subsequently disappear with secondary succession. Correlated with its demise at a site is a shift from a production of both aerial and subterranean seed to a production of only subterranean seed. What are the factors responsible for this differential allocation? What is the relative importance of seedlings arising from aerial seed and those arising from subterranean seed in the establishment and maintenance of the new "instant populations"? Why do subterranean seeds stop germinating as succession progresses and readily germinate following a subsequent soil disturbance? Are there genetic differences among the populations in their relative allocation to aerial and subterranean propagules? Answers to such questions will add to our basic knowledge of this species and allow us to manage the necessary habitats in a manner conducive to its continued existence

in the Pinelands.

COLBY, Richard H. Division of Natural Sciences and Mathematics, Stockton State College, Pomona NJ 08240. Phone: (609)-652-1776 ext.355.

Title of Research: Atmosphere-derived pollutants affecting New Jersey forests.

Site Location: Literature search at present.

Date Project Initiated: Summer 1985.

Date of Completion: Summer 1986.

Publication Vehicle: Report to DEP, Division of Parks and Forestry.

Funding Agency: DEP - Division of Parks and Forestry.

Abstract: (1) Survey of concentrations of atmosphere-derived pollutants known to produce injury to forest species elsewhere; (2) Recommendation of a monitoring program that can be used to determine the extent to which New Jersey forests are being damaged.

COLLINS, Scott L. Department of Botany and Microbiology, University of Oklahoma, Norman OK 73019. Phone: (405)-325-1651.

Title of Research: Effect of shrubs and litter cover on tree seedlings in the New Jersey Pine Barrens (with GIBSON, David J.).

Site Location: Lebanon State Forest near Rutgers Field Station.

Date Project Initiated: 1985.

Date of Completion: Continuing.

Publication Vehicle: Journal.

CRERAR, David. Department of Geology, Guyot Hall, Princeton University, Princeton NJ 08544. Phone: (609)-452-4123.

Title of Research: Behavior of metals in the Mullica River, Mullica Estuary and its bay.

Site Location: Mullica River and Estuary.

Date Project Initiated: December 1984.

Date of Completion: December 1988.

Publication Vehicle: Journal.

Abstract: We are measuring the behavior of metals (including Fe, Mn, Zn, Ni, Cu, Cr, Al, and Cd) in the Mullica River and its estuary. Precipitation mechanisms and partitioning of metals between dissolved and suspended loads and bottom sediments are being determined along with detailed chemical speciation. The roles played by increasing salinity, pH, and colloidal adsorption and natural organic acids in controlling metal behavior is a major goal of this project.

CROMARTIE, William J. NAMS, Stockton State College, Pomona NJ 08240. Phone: (609)-652-1776.

Title of Research: Monitoring aquatic ecosystems for long-term effects of low-level pollution.

Site Location: Stockton Campus.

Date Project Initiated: June 1982.

Date of Completion: Continuing.

Jersey Pinelands.

Site Location: McDonald's Branch; Shinns Branch; Brick Township; Tom's River.

Date Project Initiated: June 1984.

Date of Completion: June 1986.

Publication Vehicle: Journal.

Funding Agency: U. S. Dept. Interior, U. S. Geol. Survey.

Abstract: This project is designed to assess the effect of the acid-generating quality of Sphagnum moss on the chemistry of lead and other heavy metals in cedar swamps. The hypothesis under investigation is that Sphagnum, through its cation exchange capicity and hydrogen ion release capacity, can cause heavy metals to become solubilized in wetland waters. A combination of laboratory studies of moss-sediment-water microcosms, and field studies of polluted and unpolluted swamps, is being used to investigate the problem.

II. Title of Research: Spatial distribution of roots in three Pinelands ecosystems.

Site Location: McDonald's Branch; Muddy Road.

Date Project Initiated: September 1985.

Date of Completion: June 1986.

Publication Vehicle: Journal.

Funding Agency: CCES.

Abstract: A study is being undertaken to determine the horizontal and vertical distribution of roots in upland pine-oak communities, transitional pine lowlands, and

cedar wetlands. Excavation of 625 cm^2 pits in each site type is being undertaken to determine root biomass in 10 cm depth segments. The pits in each site are being related to plant above-ground density and distribution. In the cedar swamp, pit location is being related to the hummock-hollow microtopography.

EPSTEIN, Claude M. Natural Sciences and Mathematics, Stockton State College, Pomoma NJ 08240. Phone: (609)-652-1776.

Title of Research: A) Acid deposition in NJ woodlands. B) Soil moisture fluxes in the aeration zone. C) Pine Barrens water resource development.

Site Location: Harrisville, Weymouth, Belcoville, Galloway Twp., Hammontown, Rio Grande, Folsom.

Date Project Initiated: A) 1985 B) 1980 C) 1983

Date of Completion: Continuing.

Publication Vehicle: American Geophysical Union EOS, New Jersey Academy Science Bulletin.

Research Interests: 1) Groundwater hydrogeology of Pine Barrens aquifers 2) Water use and hazards to water supply in Cape May and Atlantic County 3) Historical development of coastal plain aquifers 4) Surface/groundwater relations in vernal ponds.

FAIRBROTHERS, David E. Dept. of Biological Sciences, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-2843. (See CARULLI, J.P.; MANOS, P.S.; MCCARTHY, K.A.; WALLACE, R.S.)

Title of Research: Rare and endangered flora of New Jersey.

Site Location: Entire Pinelands.

Date Project Initiated: 1972.

Date of Completion: Continuing.

Abstract: This is an ongoing research project, with constant searching and recording of rare and endangered species in the state. Strong emphasis is on the Pinelands flora with an attempt to locate new sites, and on monitoring of known sites containing such taxa in order to record their possible changing status.

FELLEY, J. D. Department of Biology and Environmental Science, McNeese State University, Lake Charles LA 70609. See GRAHAM, John H.

FORMAN, Richard T. T. Dept of Landscape Ecology, Harvard University, Cambridge MASS. 02138.

Title of Research: An interest in landscape ecology and in long-term vegetational changes.

FREDA, Joseph. 208 Mueller Lab, Department of Biology, The Pennsylvania State University, University Park PA 16802. Phone: (814)-865-2461.

Title of Research: The effect of low pH on the local distribution of amphibians.

Site Location: Ocean and Burlington Counties.

Date Project Initiated: May 1984.

Date of Completion: August 1984.

Publication Vehicle: Journal.

Funding Agencies: N.J. Enangered and Non-Game Species Program; U.S. Environmental Protection Agency; U.S. Fish and Wildlife Services.

Abstract: I have described the chemical environment of Pine Barrens amphibian breeding ponds. Surveys described the distribution of pine barrens treefrogs and toads in relation to pond pH. Laboratory toxicity tests showed that treefrogs were tolerant to low pH, while toads were very sensitive. Embryos of both species were transplanted into a series of ponds showing a range of pH. Treefrog embryos hatched in all ponds, while toad embryos died in acidic ponds. These data agreed with the field surveys which found treefrogs to be most common in acidic ponds while toads were absent.

GALLAGHER, Michael G. Biology Dept., Rutgers University, Camden NJ 08102.

Title of Research: Two decades of vegetation change in the New Jersey Pine Barrens (with GOOD, Ralph E.).

Site Location: McDonalds and Middle Branch Watershed, Lebanon State Forest

Date Project Initiated: Summer 1983

Date of Completion: Early 1986.

Publication Vehicle: MS thesis.

Funding Agency: Jessie Smith Noyes Foundation.

Abstract: Using permanent plots established in 1953 and vegetation data from 1962, seventy-two plots in seven NJ Pine Barrens communities were resurveyed. Although a severe wildfire in 1963 top-killed all shrubs, most tree oaks, and many pines, resprouting was prevalent. After 21 years, there was a decrease in basal area and canopy cover for all species: open space increased. Pinus rigida increased its dominance relative to other tree species. All species showed a decrease in stem density in the larger classes, and an increase in the smaller. However, the oaks increased much more in the <1" size class (6 to 10 times the 1962 number) than the pines (2 times). Shrub cover in 1983/4 is similar to 1962 coverage for all species.

The idea that fire maintains the presence of P. rigida is supported. Noble & Slayter's Multiple Successional Pathway model has useful but limited application in the Pine Barrens, since all species have

similar life history attributes and exist in mixed stands.

GARRETT, Peter W. USDA Forest Service, Northeastern Forest Experiment Station, P.O. Box 640, Durham NH 03824. Phone: (603)-868-5692.

Title of Research: Improvement of pitch pine and pitch x loblolly pine hybridization.

Site Location: NE-3-73, NE-2-74, NE-3-75 (pitch x loblolly pine plantings) 3 miles east of Mt. Misery, Ocean County, New Jersey.

Breeding orchards at Lebanon Experimental Forest Headquarters, New Lisbon, New Jersey. (73, 74, 75 indicate year initiated).

Pitch pine provenance tests established by Yale University in 1974 3 miles east of Mt. Misery in Ocean County, New Jersey.

Shortleaf pine provenance study established in mid-1950's by Southern Forest Experiment Station, New Orleans, Louisiana. Planted in Ocean County, New Jersey, but exact location unknown.

NE-6-80, NE-4-83 (pitch x loblolly pine plantings) in Monmouth County, New Jersey.

Date of Completion: Continuing. (Pitch x loblolly and pitch pine tests will terminate 20 years after planting. Shortleaf study completed two years ago, but will be revisited in 1986. Breeding orchard will remain active indefinitely.

Abstract: Pitch x loblolly program and pitch pine studies are designed to develop or find trees suitable for planting on "poor" sites such as the Pine Barrens. Shortleaf study is looking for sources that perform best in different areas.

GELLER, Michael D. Stockton State College, Pomona NJ 08240. Phone: (609)-652-1776. (No current Pine Barrens research).

GIBSON, David J. Division of Biology, Ackert Hall, Kansas State University, Manhattan KS 66506. (See COLLINS, Scott).

I.Title of Research: Ecosystem-fragmentation of oak-pine vegetation. (With GOOD, Ralph E.)

Site Location: Throughout northern Pine Barrens.

Date Project Initiated: 1984

Date of Completion: Continuing.

Publication Vehicle: Journals and CCES technical reports.

Abstract: Quantitative data on tree and sapling strata of thirty-five oak-pine stands in the New Jersey Pine Barrens (Pinelands) were collected. Qualitative records of the shrubs and herbaceous species were also made. Of these stands, 19 were forest fragments isolated from the native forest by roads, development, agriculture or encroaching salt marsh. Compared with the native stands, the forest fragments had a higher tree species richness, and a higher density, diversity and richness of saplings. The incursion of new species from other habitats into the forest fragments was indicated by the significantly higher importance percentage of Sassafras albidum trees and saplings compared to native stands. Total species number in the fragments was related to area (R^2 = 0.4, P = 0.006), however the inclusion of stand isolation factors improved the model (R^2 = 0.68). Ecosystem fragmentation will become a more serious problem in these forests as the sapling layer changes manifest themselves in the tree canopy.

II.Title of Research: Shrub/ground layer interactions. (With GOOD, Ralph E.).

Site Location: Lebanon State Forest.

Date Project Initiated: 1985.

Date of Completion: Continuing.

Publication Vehicle: Journal and CCES technical report.

III.Title of Research: Seedling habitat of Pinus echinata

and Melampyrum lineare (With GOOD, Ralph E.).

Site Location: Lebanon State Forest.

Date Project Initiated: 1985.

Date of Completion: Completed.

Publication Vehicle: Journal and CCES technical report.

IV.Title of Research: Competetive thinning in cedar swamps (With GOOD, Ralph E.).

Site Location: Literature study.

Date Project Initiated: 1985.

Date of Completion: Completed.

GIVEN, Mac F. University of Connecticut, Dept. of Ecology and Evolutionary Biology, 75 N. Eagleville Rd., Box U-43, Storrs CT 06268. Phone: (203)-486-4457.

Title of Research: Territoriality, vocal communication, and behavioral ecology of the carpenter frog, Rana virgatipes.

Site Location: 1) Cedar Run Lake, Woodford Cedar Run Refuge, Medford, Burlington County. 2) West Jersey Cranberry Bogs, Burlington County.

Date Project Initiated: May 1983.

Date of Completion: June 1986.

Publication Vehicle: Ph D. thesis and journals.

Funding Agencies: University of Connecticut (1984-1985),

Sigma Xi Grants-in-Aid of Research (1984-1985), Society for the Study of Amphibians and Reptiles Grants-in-Herptology Award (1984), Theodore Roosevelt Memorial Fund of the American Museum of Natural History (1985), and the Gaige Award of the American Society of Ichthyologists and Herpetologists (1985).

Abstract: Variability in male mating strategies related to body size has been documented in many anuran amphibians. For species with prolonged breeding seasons, the costs of vocalization, territory maintenance, and reduced foraging opportunities can impose energetic constraints on reproductive males. These types of behavior may affect the amount of energy available for growth. My dissertation is a study of male intrasexual competition for mates in the carpenter frog, Rana virgatipes, in the Pinelands of New Jersey, U.S.A. First, the natural history, territorial behavior, and acoustic interactions will be described through field observations and experimentation. From these results, I will explore 1) variation in behavior as a function of size, 2) energy status and growth rates as a function of size, and 3) tradeoffs between energy status and behavior.

GOOD, Norma. Center for Coastal and Environmental Studies, Doolittle Hall, Rutgers University, New Brunswick NJ 08903. Phone: (609)-428-1396.

Title of Research: Succession following Atsion fire. (with GOOD, Ralph E.)

Site Location: Atsion, NJ - Rt. 206.

Date Project Initiated: April 1985.

Date of Completion: Continuing.

Funding Agency: CCES Internal.

Publication Vehicle: Journal such as Bartonia.

Abstract: Permanent plots (5x5 m.) have been established throughout the pitch pine lowland site at Atsion that was heavily burned in 1983/84. In addition to following recolonization and succession, soil chemistry will be

analyzed.

GOOD, Ralph E. Biology Dept., Camden College of Arts and Sciences, Rutgers University, Camden NJ 08102. Phone: (609)-757-6146. OR Center for Coastal and Environmental Studies, Division of Pinelands Research, Busch Campus, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-3141. See COLLINS, Scott; GALLAGHER, Michael; GIBSON, David; GOOD, Norma; MATLACK, Glenn R.; MCCARTHY, K.A.; MORGAN, Mark D.; STOLTZFUS, Dwight; WINDISCH, Andrew; HAYES, Matthew S.

GRAHAM, John H. Biology Department, Rider College, Lawrenceville NJ 08648. Phone: (609)-896-5093.

1.Title of Research: Niche ontogeny and progressive deviation in two congeneric sunfishes.

Site Location: Success Lake, Collier's Mills Wildlife Management Area, Ocean Co., Collier's Mills Pond, Collier's Mills Wildlife Management Area, Ocean Co.

Date Project Initiated: May 1979.

Publication Vehicle: Journal; Symposium Proceedings; Freshwater Wetlands and Wildlife Symposium, Savannah River Ecology Laboratories: 9th Symposium 24-27 March 1986.

Abstract: The banded sunfish, Enneacanthus obesus, and the bluespotted sunfish, E. gloriosus, exhibit progressive morphological deviation during development. Early developmental stages of the two species resemble one another more than they resemble their own adult stages and more than the adult stages resemble one another. Contrary to expectations, however, their niches do not diverge concommitantly with morphology.

Both species spawn in early spring, thus larvae, juveniles, and adults are of comparable size at all times. Morphological similarity is greatest for fish less than 9mm SL. The larvae of both species exhibit a dual pattern of resource use with feeding peaks just after sunrise and just before sunset. Although there is much dietary overlap, E. obesus feeds to a greater extent on aquatic invertebrates that live on the leaves and

stems of submerged macrophytes, while E. gloriosus takes more free-swimming invertebrates. These differences remain throughout life.

II.Title of Research: Genomic coadaption and developmental stability within introgressed populations of Enneacanthus gloriosus and E. obesus (Pisces, Centrarchidae) (with Felley, J. D.).

Site Location: Ponds and drainages of the Raritan River, the Delaware River, and various Pine Barrens drainages.

Date Project Initiated: Spring 1981.

Date of Completion: completed.

Publication Vehicle: Evolution, vol 39(1): 104-114.

HANDEL, Steven N. Dept of Biological Sciences, Nelson Labs, Rutgers University, Piscataway NJ 08854. Phone: (201)-932-3341.

I.Title of Research: Population biology of Sarracenia purpurea, the pitcher plant.

Site Location: Lebanon State Forest.

Date Project Initiated: Spring 1986.

Date of Completion: 1988.

Publication Vehicle: Journal.

Abstract: The significance of carnivory for persistance, growth, and reproduction will be determined experimentally by manipulating insects captured and nutrients available to the roots.

II.Title of Research: Clonal growth in wild cranberry.

Site Location: Lebanon State Forest.

Date Project Initiated: Spring 1986.

Date of Completion: 1988.

Publication Vehicle: Journal.

Abstract: The pattern of clonal growth and its importance in invasion of space and in controlling fruit production will be tracked.

HARTZOG, Sandra H. Stockton State College, Natural Science and Mathematics, Pomona NJ 08240. Phone: (609)-652-1776 ext. 546.

I.Title of Research: Population genetics of the "Pygmy Pines" of the New Jersey Pine Barrens (with students).

Site Location: East and West Plains, off routes 72 and 539.

II.Title of Research: A study of vegetation in the Stockton Sewage Sprayfield (ecological changes after 10 years of spray); I am doing a follow-up study of recovery after spraying was discontinued.

Site Location: Stockton, Pomona, N.J.

III.Title of Research: Archaeology of a prehistoric, multicomponent Indian site.

Site Location: Egg Harbor Township, Atlantic County, N.J.

Date Project Initiated: Spring 1986.

Funding Agency: Stockton State College and owner of property.

Abstract: A rationale and goals for excavation of the Egg Harbor Township multicomponent Indian site is available

on request. The project will be submitted to Dr. Lorraine Williams, curator of the State Museum, and Jonathan Gell, State Historic Preservation Office, Green Acres.

HAVENS, A. V. Department of Meteorology, Cook College. Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-9520.

Title of Research: Impact of climatic variability on agriculture. (with SHULMAN, M. D.)

Site Location: Northeast Regional Research Project sites.

Date Project Initiated: 1956.

Date of Completion: September 1986. (Hopefully until 1991 if funding continues.)

Publication Vehicle: Journals; Experimental Station Bulletins.

Abstract: Most of the research has involved computerized analysis of climatic and related agricultural data for New Jersey and the Northeastern United States. A series of Experimental Station Bulletins have been published. Some contain some Pine Barrens data.

HAYES, Deborah Childs. Rutgers Field Station, P.O.Box 206, New Lisbon NJ 08064. Phone: (609)-894-8849.

Title of Research: Validation of wetlands buffer model (with GOOD, R.E., ZAMPELLA, R.A., ROMAN, C., and EHRENFELD, J.).

Site Location: Development areas within the Pine Barrens.

Date Project Initiated: April 1986.

Date of Completion: 1989.

Publication Vehicle: Final report to funding agency.

Funding Agency: Jessie Smith Noyes Foundation.

Abstract: We are investigating the effect of distance from development areas on hardwood and cedar swamps. We are considering nutrient balance, hydrology, and species composition in order to evaluate the effectiveness of the buffer model set out by Roman and Good (1983). We hope to determine a suitable distance from human development for maintaining wetland integrity.

HAYES, Matthew S. Center for Coastal and Environmental Studies, Doolittle Hall, Busch Campus, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-3378.

Title of Research: Vegetation of forested salt marsh islands: Effects of area, elevation, isolation, and edaphic factors (with GOOD, Ralph E.).

Site Location: Great Bay.

Date Project Initiated: May 1986.

Date of Completion: August 1987.

Publication Vehicle: Journal.

Abstract: Located in the Great Bay (southern New Jersey coast) are a number of islands of forest vegetation surrounded by salt marsh and brackish water. These islands have probably been formed by the rise in sea level and were likely once a part of the mainland. The purpose of this study is to determine species diversity and abundances in each island's forest vegetation, to delineate the relationship between the vegetation and certain measured variables (area, elevation, isolation, and various edaphic factors) and to compare island vegetation with that of similar stands on the mainland.

HORDON, Robert M. Dept. of Geography, Rutgers University, New

Brunswick NJ 08903. Phone: (201)-932-3107, 4103.

Title of Research: Application of the Cornell Water and Land Resources Analysis System (WALRAS) to the New Jersey Pinelands.

Site Location: Hammonton Area

Date of Completion: October 1983.

Funding Agency: Water Resources Research Institute.

JAWORSKI, Andrew Z. Pinelands Commission, P.O. Box 7, New Lisbon NJ 08064. Phone: (609)-894-9342.

Title of Research: Effectiveness of standard and alternative-design septic systems in renovating effluent in Pinelands soils. (with NICHOLSON, Robert.)

Site Location: Evesboro, Medford, Woodland, Mullica and Egg Harbor Twps.

Date Project Initiated: September 1983.

Date of Completion: September 1985.

Publication Vehicle: Not published.

Funding Agency: Pinelands Commission.

Abstract: Studied nitrogen reducing capability of 3 pressure-dosing, 2 standard, and 1 waterless toilet and graywater septic system in the Pinelands.

KANTOR. Richard A. Division of Coastal Resources, Department of Environmental Protection, State of New Jersey, CN 401, Trenton NJ 08625. Phone: (609)-292-9762. (No current Pine Barrens Research.)

KEBBEKUS, Barbara B. Air Pollution Research Lab, New Jersey Institute of Technology, Dept. of Chem. Eng., Chem., and Envtl. Science, 323 King Blvd, Newark NJ 07102. Phone: (201)-596-3587.

Title of Research: Analysis of airborne organic vapors. (with BOZZELLI, Joseph W.)

Site Location: Batsto village.

Date Project Initiated: 1979.

Date of Completion: 1980.

Abstract: Ambient air was sampled every sixth day over nearly two years. Samples were analyzed by high resolution gas chromatography for 25-30 toxic organic vapors including benzene and other aromatics, one and two carbon chlorinated hydrocarbons and methobenzene. The site was used as a "background" sampling area for comparison with samples taken in more industrial areas. A report on the three-year project including the Pine Barrens data will be submitted to the US EPA in March 1982: "Toxic and carcinogenic vapors in the ambient atmosphere in the New Jersey-New York area."

KNEZICK, Donald R. Dept. of Horticulture and Forestry, Cook College, Rutgers University, P.O. Box 231, New Brunswick NJ 08903. Phone: (201)-932-9645.

Title of Research: Single clone orchard production of southern pine hybrids.

Site Location: New Lisbon, N.J.; Piscataway, N.J.

Date Project Initiated: 1981.

Date of Completion: 1986.

Publication Vehicle: Journal.

Abstract: This project is designed to determine if mass

artificial pollination of single clone orchards is an effective and economical means of mass producing southern pine hybrids.

KUSER, John. Dept. of Horticulture and Forestry, Cook College, Rutgers University, Box 231, New Brunswick NJ 08903.

I.Title of Research: Pitch pine improvement (see KNEZICK, Donald).

Funding Agencies: Morie Co.; R. Clayton and Sons; NJ DEP, Div. Parks and Forestry; U.S. Govt.- McIntire-Stennis.

Abstract: Select trees for a first generation seed orchard by progeny-testing 125 phenotypically superior parent trees. Selection criteria are straight trunks and fast growth/large size compared to neighboring trees.

II.Title of Research: Vegetative propogation of pitch pine.

Funding Agencies: See above.

Abstract: Our goal is to increase rootability of stump or water sprouts to 90% with a view to clonal propagation.

LEDIG, F. Thomas. Institute of Forest Genetics, 1960 Addison St., Berkeley CA 94704. Phone: (415)-486-3458.

Title of Research: Genecology of pitch pine.

Site Location: Many sampling sites, and a uniform garden planting (ca. 14 acres) near North Branch, Lebanon State Forest.

Date Project Initiated: 1969.

Date of Completion: 1990.

Publication Vehicle: Book chapters; Journals; Proceedings; Forest Service Research Papers.

Funding Agencies: American Philosophical Society; National Science Foundation; U.S.D.A. Forest Service (current).

Abstract: The objective of this investigation was to determine how a wide-ranging pine species adapts to diverse environments. Concern focused on population structure and on photosynthetic physiology. Study techniques included the use of uniform gardens to eliminate environmental variation and reveal genetic differences among populations. The structure of variation in most traits was clinal; e.g. there was a continuous gradation in seedling height related to the climate in which the population originated. Characteristics measured *in situ*, such as wood specific gravity, also changed gradually from north to south. Genetic variation in rate of photosynthesis, measured as CO2-exchange, was not pronounced. However, when temperature was varied, photosynthesis was relatively more stable for northern than for southern populations. Apparently northern populations have evolved a degree of physiological homeostasis as a result of selection in severely fluctuating climates. Soluble enzymes were extracted from seed, separated by electrophoresis, and stained by employing their affinity for specific substances. The process revealed isozymes, or multiple molecular forms, in several enzyme systems. Because of the haploid nature of pine seed, genetic segregation could be demonstrated by 1:1 ratios among seed from heterozygotes. Gene frequencies differed among populations, although not greatly. Average heterozygosity was comparable to that in man or fruit flies, and inbreeding appeared low. There was no tendency for trees with similar genotypes to occur together in stands, a result with significance for selection schemes, and perhaps, one that can be extrapolated to other pines. Linkage between genes was found, representing a beginning in mapping the conifer chromosomes.

LIST, Albert, Jr. Dept. of Bioscience and Biotechnology, Drexel University, Philadelphia PA 19104. Phone: (215)-895-2626.

Title of Research: Survey and illustration of Bryophytes and Lichens in the New Jersey Pinelands; Study and illustration of the vascular flora of the Pine Barrens.

Site Location: Many locations.

Date Project Initiated: 1980.

Date of Completion: Early 1987, book to appear 1988 or sooner.

Publication Vehicle: Book: Plants and their Habitats in the New Jersey Pine Barrens. A thoroughly illustrated (by the author) field guide with keys suitable for layman and scientist. Drawings of over 600 vascular plants, over 100 bryophytes, and dozens of the lichens are in the book. All drawings are completely new and original. Five years in preparation, so far. The book does not pretend to cover all weeds, or the hybrids among oaks, although many roadside weeds are included. It is primarily intended to be a useful pictorial guide to the plants, and distinguishes ten or eleven habitat types using Hans Olssens Phytosociological system to some extent.

Nature of the Project: To illustrate in detail every significant plant in the Pine Barrens. Project has involved thousands of hours with grasses, sedges, rushes, composites, peat mosses (Sphagnum), genera of lichens, especially Cladonia and Cladina, and numerous other genera. I would enjoy talking with anyone who has studied any of these groups, and am always willing to compare notes or go on field trips. Dr. List has well over 10,000 color pictures of plants in the Pine Barrens. They are of high quality and clarity, and have been used in talks to a large number of different groups, and in courses taught to various groups, or classes at Drexel.

LITTLE, Silas 301 Creek Road, Moorestown NJ 08057. (No current Pinelands research). See ROMAN, Charles T.

LORD, Thomas R. Department of Biology, Burlington County College, Pemberton-Browns Mills Road, Pemberton NJ 08068. Phone: (609)-894-9311. See BOERNER, Ralph E.J.

MADSEN, Eugene. Department of Agronomy, 119 Tyson Building, Penn State University, University Park PA 16802. (No current

Pine Barrens research.)

MANOS, Paul S. Dept. of Biological Sciences, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-2843.

Title of Research: Isozyme variation in northeastern american red oak species. (with FAIRBROTHERS, D. E.)

Site Location: West Pine Plains, Route #539 near Fort Dix Property; Atsion Lake Region; White's Bog Region; Route #539 near Webbs Mill.

Date Project Initiated: March 1983.

Date of Completion: January 1986.

Publication Vehicle: Journals.

Funding Agencies: Division of Pinelands Research, Rutgers University; Bureau of Biological Research, Rutgers University.

Abstract: Starch gel electrophoresis is performed on individual seedlings grown from acorns from populations of six North American species, all native to the Pinelands of N.J. Eleven enzymes encoding 18 loci were detected and 60% were polymorphic. Such allozyme analysis will focus on population structure and systematic interpretations based on this new genetic information. Gene frequency data from four populations of Q. ilicifolia show that genetic diversity in oaks is concordant with results attained from plant species with similar life-history traits.

MARUCCI, Philip E. Rutgers University Cranberry and Blueberry Research Laboratories, New Jersey Agricultural Experiment Station, Box 29 Penn State Forest Rd., Chatsworth NJ 08019. Phone: (609)-726-1020. See BOYD, Howard P.

MATLACK, Glenn R. Division of Pinelands Research, Rutgers Field Station, P.O. Box 206, New Lisbon NJ 08064. Phone: (609)-894-8849.

I.Title of Research: The effects of landscape fragmentation on oak-pine upland forest (with Good, R.E.).

Site Location: Throughout the Pine Barrens.

Date Project Initiated: January 1986.

Date of Completion: January 1987.

Funding Agency: New Jersey DEP.

Abstract: The dissection of oak-pine forest into isolated stands has been a major consequence of human development around the periphery of the New Jersey Pinelands. A previous study (see GIBSON, D.J.) has related density and diversity of tree species to fragment size and isolation, and to physical aspects of individual sites. The goal of the present study is to extend this analysis to herb and shrub species.

Fifteen fragment stands have been located, and these will be compared with nineteen stands contiguous with larger forests. Vegetation will be surveyed by quadrats in a stratified random design. We hope our results will be useful to land managers in questions of forest conservation. At the same time, we will test several hypotheses about factors controling forest herb/shrub distribution.

II.Title of Research: The seed bank as a parallel community in oak-pine upland forest.

Abstract: In a project complementing the fragmentation study (above), the soil seed bank will be sampled in each oak-pine fragment and each contiguous stand. Seed in the soil will be estimated from germination in soil samples in the greenhouse. Seed-species diversity and density will be compared with the respective vegetative plant community, and with physical attributes of each stand. The seed bank is a history of past vegetation at a particular site, and an important reservoir of colonists for future disturbances. Nevertheless, seedbanks have rarely been described in the general context of the plant community.

MCCARTHY, K. A. Dept. of Biological Sciences, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-2843.

Title of Research: Vegetation dynamics of intermittent freshwater ponds in Atlantic County, N.J. (with FAIRBROTHERS, D. E. and GOOD, R. E.)

Site Location: Hirst Pond and Goose Ponds, Atlantic County, N.J.

Date Project Initiated: January 1984.

Date of Completion: June 1986.

Publication Vehicle: Not determined at this time.

Funding Agencies: Sigma Xi and Nature Conservancy.

Abstract: Study of water level effects on germination. Vegetation transects are being used for a guide to seed bank sampling. Replicates for greenhouse water regime experiments are used to sample seed bank potential. The seed bank data are being correlated with species composition of the standing vegetation studied by the line transect method. Field seedling survivorship is being compared to vegetative offspring survivorship. Survival of individuals arising from perennating organs will also be monitored. A study of soils is also included.

MCINTOSH, Alan. Dept. of Environmental Sciences, Cook College, Rutgers University, New Brunswick NJ 08903. (No current Pine Barrens research.)

MONTGOMERY, James D. Ecology III, Inc., RD1, Berwick PA 18603 Phone: (717)-542-2191.

1.Title of Research: Pteridophytes of New Jersey.

Site Location: Entire state.

Date Project Initiated: 1979.

Date of Completion: Continuing.

Publication Vehicle: Book, Journals.

Abstract: Project goal is an update of the ferns and fern-allies of New Jersey (essentially an update of the work of Chrysler and Edwards, 1947). Ecology, past and present distribution, and abundance of New Jersey pteridophytes are included.

II.Title of Research: Ferns of New Jersey. (with FAIRBROTHERS, D. E.)

Site Location: Throughout N.J. and the entire Pinelands.

Date Project Initiated: 1980.

Date of Completion: 1987.

Publication Vehicle: Will be published as a book, also Montgomery, J.D. amd D.E. Fairbrothers, 1985. Geographical Distribution of N.J. Pteridophytes. Bartonia 51: 52-57.

Abstract: This is to be a manual of the ferns of New Jersey, including the Pinelands. The manual will contain nomenclature, all taxa, ecological information, geographical distribution, and present status concerning rare and endangered species.

MORGAN, Mark D. Department of Biology, Rutgers University, Camden NJ 08102. Phone: (609)-764-1247. (See SPRATT, Henry G., Jr.)

I.Title of Research: Biological control of hydrogen ion flux in the New Jersey Pinelands. (with GOOD, Ralph E.)

Site Location: McDonalds Branch.

Date Project Initiated: September 1984.

Date of Completion: August 1987.

Publication Vehicle: Journal.

Funding Agency: NJ DEP, Rutgers University.

Abstract: The goal of this 3-year project is to quantify the role of biological processes in regulating the flux of hydrogen ions in the Pinelands surface waters. In year one, we focused on iron metabolism in the McDonalds Branch watershed. Our data suggest that (i) microorganisms are responsible for catalysing the oxidation of ferrous to ferric iron in the soil and water of McDonalds Branch, (ii) the organisms are not chemo-litho-autotrophs, although they may be chemo-litho-heterotrophs or heterotrophic iron-depositing bacteria, (iii) iron oxidation in water over short time periods is not affected by pH changes up to 0.6 units, additions of carbon or inorganic nutrients or additions of heterotrophic microorganisms, and (iv) environmental heterogeneity and temperature are the primary factors that regulate the rate of iron oxidation.

II. Title of Research: Impact of acid precipitation on streamwater chemistry in the New Jersey Pinelands. (with GOOD, Ralph E.)

Site Location: Numerous streams in Pinelands watersheds. Precipitation collectors at Double Trouble, Bass River, and Batsto.

Date Project Initiated: August 1984.

Date of Completion: August 1986.

Publication Vehicle: Journal.

Funding Agency: N. J. Conservation Foundation through the Pew Trust.

Abstract: The objective of this study is to determine if, and to what extent, a change in precipitation pH directly affects stream pH in the New Jersey Pinelands. This objective is accomplished by direct comparison of detailed precipitation and stream chemistry measurements

made by Yuretich et al. (1981) in the early 1970s with similar data collected during the present study. Previous data suggest that precipitation pH has significantly declined during this interval. Thus, a direct cause and effect relationship between precipitation and stream pH should be evident, if it exists, by changes in stream pH.

III.Title of Research: Limnology of Pinelands surface waters.

Site Location: Oswego and Nescochaque Lakes

Date Project Initiated: August 1981.

Date of Completion: Continuing.

Publication Vehicle: Journal.

Funding Agency: Rutgers - internal.

MORIN, Peter J. Dept. of Biological Sciences, P.O. Box 1059, Busch Campus, Rutgers University, Piscataway NJ 08854. Phone: (201)-932-2801.

Title of Research: Experimental studies of amphibian community structure.

Site Location: Colliers Mills, Greenwood Forest, Bass River State Forest, Tuckahoe.

Date Project Initiated: 2/1/85.

Date of Completion: 7/1/87.

Publication Vehicle: Journal.

Funding Agency: NSF.

Abstract: Experimental manipulations of tadpoles and their predators in natural ponds, artificial ponds and laboratory microcosms will test theories of community organization by measuring the relative impact of intra- and interspecific competition and predation on the growth, survival, and species composition of Pine Barrens anurans. Experiments will explore how the sequence of colonization (priority effects) and indirect effects of initial prey species composition (indirect mutualism and commensalism) affect the impact of predators on competing prey. Results will also extend input/output models of community dynamics to include effects of predation on one or more competing species. Experimental studies of resource utilization, of herbivory on periphyton, and of interference will identify mechanisms of competition, and test whether measures of resource overlap accurately predict the intensity of experimentally demonstrated competition. Other laboratory studies will examine population consequences of size- and species-selective predation on predator-mediated competition among tadpoles. A survey of phenotypic variation in competetive ability among tadpoles from ponds of different competitor diversity will test predictions about the coevolution of competitors in island communities.

This study involves basic research into the mechanisms responsible for the distribution and abundance of organisms. Such knowledge is a prerequisite for general theories that will eventually predict the consequences of the introduction or loss of species from natural communities. These studies and the resulting theories will provide the framework for integrating previous findings about the basic interactions among species in natural communities.

NICHOLSON, Robert. Pinelands Commission, P.O. Box 7, New Lisbon NJ 08064. See JAWORSKI, Andrew Z.

QUINN, James A. Department of Biological Sciences, Rutgers University, P.O. Box 1059, Piscataway NJ 08854. Phone: (201)-932-2844 or 932-2075(message). See CHEPLICK, Gregory P.

ROMAN, Charles T. Division of Pinelands Research, Center for Coastal and Environmental Studies, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-4881.

I.Title of Research: The development and field testing of

a model for delineating buffer protection areas between Pinelands wetlands and adjacent upland development. (with GOOD, Ralph E.)

Site Location: NJ Pinelands.

Date Project Initiated: October 1981.

Date of Completion: Continuing.

Publication Vehicle: Technical reports; Proceedings; Journal.

Abstract: One year of literature review preceded the development of a proposed buffer delineation model for N. J. Pinelands wetlands. The proposed model was designed to function within the framework of the Pinelands Comprehensive Management Plan with the primary objective of providing a systematic and consistent mechanism for assigning environmentally appropriate site-specific buffer areas between wetlands and proposed development. The proposed model underwent a 1.5 year testing and verification program. Appropriate revisions were made, and the model is currently providing guidance to the Pinelands Commission staff and applicants.

II. Title of Research: A field study of vegetation, soils and hydrological relationships in pitch pine-dominated upland-wetland transitions in the N. J. Pinelands. (with ZAMPELLA, Robert A. and JAWORSKI, Andrew Z.)

Site Location: Lebanon State Forest.

Date Project Initiated: Summer 1982.

Date of Completion: Spring 1983.

Publication Vehicle: Journal (Water Resources Bulletin 1985 21(6): 1005-1012.)

Abstract: Wetland protection regulations and guidelines often require the delineation of precise wetland boundaries on a case-by-case basis. In this study, conducted in the New Jersey Pinelands, an ecological

characterization of vegetation composition, soil and hydrologic relationships along upland to wetland Pinus rigida-dominated transitions provided the basis for a multiparameter approach to wetland boundary delineation. The transitional data set was analyzed by direct gradient analysis, cluster analysis and ordination. It is concluded that vegetation composition can be a principle factor in delineating wetland boundaries along natural upland to wetland transitions. However, where distinct vegetation changes are not observed, a feature of our study sites, a multiparameter approach should be used.

III.Title of Research: An evaluation of the N. J. Pinelands wetland management program. (with ZAMPELLA, Robert A.)

Date Project Initiated: Spring 1983.

Date of Completion: Spring 1983.

Publication Vehicle: Journal (Wetlands 1983 3: 124-133).

Abstract: Wetland vegetation types of the New Jersey Pinelands include cedar and hardwood swamps, pitch pine lowlands, inland and coastal marshes, and bogs. These wetlands comprise 30-35% of the 470,000 ha. Pinelands region. In response to both federal and state legislative mandates, a Comprehensive Management Plan was developed by the New Jersey Pinelands Commission to preserve and protect the unique and essential character of the Pinelands ecosystem. Under the Plan, wetlands are protected by a regional land allocation program, a land acquisition program, and a wetlands management program. The wetlands management program prohibits most development within wetland boundaries and requires the preservation of an upland buffer to the wetland. In this paper, the Comprehensive Management Plan's land allocation program is reviewed as it relates to wetlands protection, and the wetlands management program is described. The accomplishments of these wetlands protection initiatives since the implementation of the plan are assessed. It is suggested that a comprehensive wetlands protection program such as the one applied in the Pinelands can be effectively implemented elsewhere on a regional scale.

IV.Title of Research: Cedar swamps of the N. J. Pinelands - Literature review. (with GOOD, Ralph E. and LITTLE, Silas.)

Date Project Initiated: September 1983.

Date of Completion: December 1985.

Publication Vehicle: Book; Proceedings.

Abstract: This literature review of N. J. Pinelands cedar swamps included topics such as distribution, site characteristics, vegetation patterns and processes and management-protection strategies.

SAMUELSON, Sue. Dept. of American Studies, Douglass College, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-9179.

Title of Research: Ongoing research on various aspects on Pinelands/South Jersey folklife and folk culture.

Site Location: General research on regional identity concentrates on the entire South Jersey area. Research on Pinelands festivals at Medford, Chatsworth, Tuckerton, and Egg Harbour and Hammonton. Research on cemeteries in the area roughly bounded by Chatsworth, Mays Landing, Millville, and Medford.

Date Project Initiated: Fall 1983.

Date of Completion: Ongoing.

Publication Vehicle: Journal.

Abstract: I initially began my research in the Pinelands as part of the Library of Congress' Pinelands Folklife Project in 1983. My current topics are an outgrowth of issues, items, and problems that I encountered during that period. The three main topics of current investigation include: regional identity in South Jersey as it has traditionally included "Pineys" and "others", and as it has been altered by the creation of the Reserve; how community identity and pride is exhibited in festivals and celebrations, both public and private; and the evolution and current status of an aspect of cemetery culture in certain areas of the Reserve where graves are

covered with crushed glass (a locally significant industry) to replace the grass which cannot be supported by the sandy soil without extensive use of fertilizers and imported topsoil (which has occurred in more recent years).

SCHICK, Kevin. Department of Environmental Protection, Bureau of Environmental Evaluation and Risk Assessment, 401 E. State St., 6th Floor, Trenton NJ 08625. Phone: (609)-633-6801.

Title of Research: The lower pH tolerance of selected Pine Barrens fish species.

Site Location: Fish collected at various streams and lakes in the Pine Barrens (Oswego Lake, Landing Creek, Mullica River, etc.). Experiments conducted at the Rutgers Marine Station.

Date Project Initiated: Fall 1983.

Publication Vehicle: Ph. D. Thesis.

Abstract: Field data indicate that the swamp darter, Etheostoma fusiforme, is present in the highly acidic waters of the New Jersey Pine Barrens. The tessellated darter, Etheostoma olmstedi, is restricted to higher pH, peripheral or disturbed Pine Barrens habitats. Laboratory experiments were conducted using a gradual pH reduction scheme, in order to determine if a significant difference in pH tolerance exists between the two species.

Etheostoma fusiforme was significantly more tolerant to low pH than E. olmstedi, with mean survival times between 164.4 and 101.1 hours, respectively. The effects of fish size upon pH tolerance were observed between three established size classes for either species. The ecological significance of the pH tolerance differences between the two species is discussed in terms of their distribution.

SCHUYLER, Alfred E. Academy of Natural Sciences of Philadelphia, 19th and the Parkway, Philadelphia PA 19103. Phone: (215)-299-1193.

Title of Research: Monitoring the distribution and abundance of aquatic and wetland plants in counties within a 50 mile radius of Philadelphia.

Site Location: General area of study includes Pine Barrens.

Date Project Initiated: 1962.

Date of Completion: Continuing.

Publication Vehicle: Journal.

Abstract: Periodic trips are made to the New Jersey Pine Barrens to monitor distributions of rare aquatic and wetland plants. Voucher specimens are collected and deposited in the herbarium of the Academy of Natural Sciences.

SHULMAN, M. D. Dept. of Meteorology and Oceanography, Cook College, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-9520. See HAVENS, A.V.

SINTON, John. NAMS, Stockton State College, Pomona NJ. Phone: (609)-652-1776. See BERGER, Jonathan.

SITLER, Martha. P.O. Box 2, Science Building, Rutgers University, Camden NJ 08102. Phone: (609)-757-6312.

Title of Research: The effect of pH on the chemical ecology of freshwater macrophytes in New Jersey Pine Barrens streams.

Site Location: Cooks Branch, Oswego River, Batsto River, Albertson, Sleeper Branch.

Date Project Initiated: September 1985.

Date of Completion: July 1986.

Publication Vehicle: Journal.

Abstract: The objective of my study is to compare elemental content of plant tissue and water mineral content of Pine Barrens streams. Rivers of differing pH are being monitored in order to determine the effect of pH on tissue element content and to gain insight into the chemical parameters that control macrophyte distribution. Macrophyte species Juncus militaris and Scirpus subterminalis are to be used for tissue analysis. Both surface stream water and pore water will be analyzed. Plants will be considered in terms of both roots and shoots. Analyses for stream and pore water will include pH, SO4--, CO2, NH3, Ca++, Mg++, total dissolved Fe and Al, K+, Na+, NO3-, and PO4-3. Analysis of plant roots and shoots will include Ca++, Mg++, total dissolved Fe and Al, K+, and Na+.

SMITH, Chris. Soil Conservation Service, Ocean County.

Title of Research: Water table monitoring program. (with TUDOR, Robert A.)

Site Location: Ocean County, NJ.

Date Project Initiated: 1984.

Date of Completion: Ongoing

Abstract: The Division would like to produce a water quality model that would indicate the amount of cumulative development that would be allowed without degrading the water quality of Lakes Bay. This study goal would be to set a limit for development in the Lakes Bay region.

A report analyzing the water quality of Lakes Bay, quantifying the amount of pollution from new proposals and projecting a calculated maximum amount of development that would be within the assimilative capacity of the Bay and would not adversely impact shellfish beds.

The data produced in this case study will serve as a model for evaluating the acceptibility of development in similar environments.

SPRATT, Henry G., Jr. Rutgers Field Station, P.O. Box 206, New Lisbon NJ 08064. Phone: (609)-894-8849.

Title of Research: Biological control of hydrogen ion flux in Pinelands hydrologic systems with emphasis on proton consuming activities (e.g. microbial sulfate reduction). (with GOOD, Ralph E. and MORGAN, Mark.)

Site Location: Cedar swamps: McDonalds Branch, Reeds Branch, Coopers Branch, and Shinns Branch.

Date Project Initiated: September 1985.

Date of Completion: Summer 1986.

Publication Vehicle: Journal.

Abstract: The relative importance of microbial sulfate reduction in the control of proton flux through anaerobic peat of swamps of the New Jersey Pine Barrens is addressed. Compartmentalization of sulfate-sulfur into various reduced-sulfur fractions is used to accurately determine rates of microbial sulfate reduction in peat samples, using both distillation iodometric titrations and 35S-tracer experiments to quantify pool sizes and rates of incorporation into the different pools, respectively. Controlling factors of microbial sulfate reduction, such as substrate coavailability (e.g. SO4-- and various organics), will be addressed to determine limits on this microbial process. Once the microbiology of the process is woorked out, the potential for control of higher levels of activity due to acidic deposition to those wetlands by microbial sulfate reduction will be addressed.

STASZ, James L. HOME: P.O. Box 71, North Beach MD 20714. Phone: (301)-257-9540. OFFICE: Maryland-National Capitol Park and Planning Commission, 14741 Governor Oden Bowie Drive, Upper Marlboro MD 20772. Phone: (301)-952-3650.

Title of Research: Populations dynamics of endangered species in the New Jersey Pine Barrens.

Date Project Initiated: July 1984.

Date of Completion: On-going; probably after 1990.

Publication Vehicle: Journal (Bartonia).

Abstract: Primary goals are to obtain an understanding of colonization, growth rates, reproduction triggers, and long term survival (includes types of disturbance which cause local extirpation), seed-banking, etc. in a select group of Pinelands species: Scirpus Longii, Rhynchospora Knieskernii, Calamovilfa brevipilis, Muhlenbergia Torreyana, Carex Barrattii, Narthecium americanum, Tofieldia racemosa, Eupatorium resinosum, Juncus caesariensis, Rhynchospora oligantha, Rhynchospora pallida, and a few more. Includes mapping, tagging of known-age plants, seed samples collected for germination, and tagging plants and observing growth response to natural pertubations. A secondary theme: distribution of scarcer species e.g. Calamagrostis Pickeringii, Fimbristylis puberula.

STOLTZFUS, Dwight L. Center for Coastal and Environmental Studies, Doolittle Hall, Busch Campus, Rutgers University, New Brunswick NJ 08903. Phone (Home): (215)-256-8470.

Title of Research: Ecology of Atlantic white cedar swamps: A study of causes and effects of ecosystem fragmentation (with GOOD, Ralph E.).

Site Location: Cedar swamps in Lebanon, Double Trouble, Penn, Bass River, and Wharton State Forests.

Date Project Initiated: June 1984.

Date of Completion: Spring 1987.

Funding Agencies: 1985-New Jersey Dept. of Environmental Protection, Rutgers Division of Pinelands Research.

Abstract: Atlantic white cedar swamps have decreased significantly in total area and have become increasingly fragmented in the last few hundred years. These trends are primarily the result of natural succession where

hardwood species have replaced cedar in many wetland areas. Improper logging practices and fire, in some instances, have promoted this replacement of cedar by hardwood species. In order to preserve this valuable wetlands habitat, it is important to complete additional studies of the ecology of these swamps and the causes and effects of fragmentation in these ecosystems.

In my study I have surveyed nearly all of the cedar swamps within the Preservation Area of the Pinelands National Reserve through personal observation and the study of aerial photographs. I have selected 18 swamps and grouped them according to size and surrounding vegetation. Six have been included in each of three categories. Within each size category, three cedar swamps surrounded by pitch pine lowland and three surrounded by hardwood swamps have been selected. The work within these selected sites involves: (1) sampling the present vegetation (trees, shrubs, and herbs), (2) placement of 74 wells for measurement of water table and pH, (3) measurement of light intensity, (4) measurement of peat depth, and (5) determination of age and relative quality of the site through tree corings and height measurements.

An additional phase of this study involves cedar swamps which have been disturbed within the last 30 years. Nine swamps which have been logged within the last 30 years have been selected and grouped according to time since logging: 1-10 years, 10-20 years, and 20-30 years. Five swamps which have been burned within the last 10 years and five abandoned cranberry bogs have been selected for study. The work within each of these sites involves sampling the present vegetation only (trees and shrubs).

TEDROW, J. C. F. (No current Pine Barrens research.)

TATE, Robert L., III. Department of Soils and Crops, Cook College, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-9810.

Title of Research: Work being conducted on NJAES-15187: Microbial oxidation of soil organic matter and NJAES-15288: Gains, losses and management of soil nitrogen.

Site Location: Lebanon State Forest.

Date Project Initiated: July 19, 1983.

Date of Completion: June 1988.

Publication Vehicle: Journal.

Abstract: Mineralization rates in Atsion and Lakehurst sands of the New Jersey Pinelands are being measured with overall objectives of estimating the quantities of N mineralized annually and of determining the relative contribution of bacterial and fungal populations to mineralization processes. The ultimate objective of the project is to elucidate the linkage between the microbial populations involved in these mineralization processes and higher plants. Nitrogen mineralization has been assessed by the buried bag procedure with undisturbed and sieved soil samples. Activity of fungal and bacterial populations are determined through inhibition of glucose catabolism by selective antibiotics. Both nitrogen mineralization assessment methods yield similar results, although some significant differences were observed with the Lakehurst sand. To date, annual nitrogen yields for the Atsion and the Lakehurst sands were 36 and 30 kg N/ha for both soils in the seived soil samples. Net N mineralization in both soils exhibited distinct seasonal patterns with maxima in summer and minimum rates in the winter. Nitrification accounted for only about 5% of the total N mineralized in both soils. Bacterial populations accounted for 25-40% and 10% of the mineralization in the Lakehurst and Atsion soils, respectively.

TUDOR, Robert A. Division of Coastal Resources, New Jersey Department of Environmental Protection, CN 401, Trenton NJ 08625. See SMITH, Chris.

UNNASCH, Robert S. Ecology and Evolution Dept., S.U.N.Y. of Stony Brook, Stony Brook NY 11794. Phone: (516)-246-5038.

Title of Research: Seed predation and limits to recruitment in the Pine Barrens scrub oak Quercus ilicifolia and blackjack oak Quercus marilandica.

Site Location: Long Island dwarf pine barrens; New Jersey dwarf pine barrens (east plains).

Date Project Initiated: 1982.

Date of Completion: 1984.

Publication Vehicle: Journal.

Funding Agencies: Sigma Xi, personal.

Abstract: During the past several years I have been interested in determining the key factors limiting seed survival and germination success of large seeded plants. My investigation of these factors in the scrub oaks of the pine plains has yielded much enlightening data. Acorn weevils (Curculio sp.) destroy between 20% and 30% of the annual mast. These rates of predation seem constant over years, and hence the weevils do not significantly affect recruitment of oak seedlings. Peromyscus leucopus is the single agent of acorn dispersal in my study sites. Seeds not discovered under the maternal parent, dispersed, and cached by mice perish; apparently from dessication. Those rediscovered in caches are invariably consumed. The number of seeds escaping rediscovery seems to be dependent on the winter mortality schedule of mice. This hypothesis is currently being examined.

WALLACE, R. S. Dept. of Biological Sciences, Rutgers University, New Brunswick NJ 08903. Phone: (201)-932-2843.

Title of Research: Isoelectrically-focused proteins of populations of Opuntia humifusa (Raf.) Raf. (Cactaceae). (with FAIRBROTHERS, D. E.)

Site Location: Whitesbog area, Burlington Co.; Atsion, Burlington Co. East coast of U.S. from Long Island to Florida.

Date Project Initiated: 1982.

Date of Completion: 1985.

Publication Vehicle: R. S. Wallace and D. E. Fairbrothers. 1985. Isoelectrically-focused seed proteins of populations of Opuntia humifusa (Raf.) Raf. (Cactaceae). Biochem. Systematics and Ecology 13: (submitted in June).

Funding Agencies. Bureau of Biological Research, Rutgers University; Botany Research Fund, R. U.

Abstract: Soluble seed proteins of Opuntia humifusa were found to be useful in population comparisons when isoelectrically-focused in polyacrylamide gels. UPGMA analysis of similarity indices resulted in clusterings of populations from similar geographic areas or habitat types. Within-population enzymatic variation was found to be very small or absent. Evidence of hybrid introgression was also detected electrophoretically, with both general protein and enzymatic staining. The population from Whitesbog, N.J. was dissimilar to other northern populations, and most likely was introduced into the Pinelands from the Carolinas.

WILLIAMS, Cairn. Nelson Biological Laboratories, Rutgers University, Piscataway NJ 08854. Phone: (201)-932-3341.

Title of Research: The roles of carnivory in and competition among four species of carnivorous plants in the New Jersey Pine Barrens.

Site Location: Webbs Mill.

Date Project Initiated: June 1986.

Date of Completion: August 1987.

Abstract: Field and greenhouse studies will be used to determine to what extent carnivory affects the growth and reproduction of Drosera filiformis, D. intermedia, D. rotundifolia, and Sarracenia purpurea. More specifically, studies are designed to see how growth and reproduction are affected if insects are excluded or fed to the plants in specific amounts. In addition, prey species pools will be determined for the three Drosera species, to see to what extent they are competing for the same prey.

WINDISCH, Andrew G. Biology Dept., Rutgers University, Camden NJ 08102. Phone: (609)-757-6146.

I.Title of Research: Delineation of the New Jersey Pine Plains and Associated Communities.

Site Location: NJ Pine Plains.

Date Project Initiated: 1981.

Date of Completion: 1985.

Publication Vehicle: Schenectada.

Abstract: The purpose of this study is to delineate the Pine Plains and the Low-Mid Transitional Plains using large-scale, black-and-white aerial photographs and systematic ground reconnaissance.

II.Title of Research: Fire intensity and stem survival in the NJ Pine Plains. (with GOOD, Ralph E.)

Site Location: NJ Pine Plains.

Date Project Initiated: 1984.

Date of Completion: 1986.

Abstract: The purpose of this study is to test the hypothesis that the natural variation in fire intensity within Pine Plains wildfires is responsible for significant variation in stem survival after fire. This variation creates patches with differing stem-size and age-class distributions, which prevail until the next killing crown fire.

ZAMPELLA, Robert A. New Jersey Pinelands Commission, P.O. Box 7, New Lisbon NJ 08064. Phone: (609)-894-9342. (See ROMAN, Charles T.)

Title of Research: Hydrogeology of transitional pitch pine lowlands.

Site Location: Lebanon State Forest, Woodland Township, Burlington County; Coopers Branch; South Branch Mt. Misery Brook, and Middle Branch, Mt. Misery Brook subbasins.

Date Project Initiated: Summer 1985.

Date of Completion: Summer 1987.

Publication Vehicle: Journal.

Funding Agency: Pinelands Commission.

Abstract: This is an extension of a previously completed investigation (Roman et al. 1985) that characterized vegetation, soil and hydrologic relationships along upland to wetland Pinus rigida-dominated transitions. The objective is to provide a more comprehensive description of soils and to characterize long term water fluctuations along this gradient. The investigation includes the completion of detailed soil logs, vegetation analysis, and biweekly water table monitoring of ground water wells at three sites located in Lebanon State Forest, Burlington County.

ZAPPALORTI, Robert T. Herpetological Associates, Inc., 1018 Berkeley Avenue, Beachwood NJ 08722. Phone: (201)-349-5065.

1.Title of Research: Habitat utilization by the Timber Rattlesnake, Crotalus horridus (Linnaeus) in southern New Jersey with notes on hibernation and home range.

Site Location: Greenwood Forest Wildlife Management Area, Ocean County.

Date Project Initiated: September 1981.

Date of Completion: December 1984.

Abstract: An ecological study of the timber rattlesnake, Crotalus horridus was conducted between September 1, 1981 through December 31, 1984 in Greenwood Forest Wildlife Management Area, Ocean County, New Jersey. Ten C.

horridus were monitored and relocated by radiotelemetry for periods of 4 to a maximum of 17 months. Data were taken on five habitat variables and four climatic variables at each telemetric relocation of the ten specimens. Home-range of 8 C. horridus were determined by plotting each movement on a grid map of the study area. Based on the preliminary results of our investigation, it seems C. horridus utilizes large tracts (39.2 - 116 acres) of upland and lowland habitat types. In order to gather more conclusive hard data, Herpetological Associates, Inc. suggests this study be continued at least two more years, radio-tracking up to 20 rattlesnakes (10 males and 10 females).

II. Title of Research: On the importance of disturbed sites to habitat selection in Pine Snakes (Pituophis melanoleucus) in the Pine Barrens of New Jersey (with BURGER, Joanna).

Site Location: Toms River, Ocean County.

Date Project Initiated: April 1978.

Date of Completion: August 1983.

Publication Vehicle: Journal.

Abstract: We studied habitat selection in 51 Pine Snakes (Pituophis melanoleucus) in the Pine Barrens of New Jersey to evaluate the importance of man-disturbed habitats. All snakes were found in Pine-Oak and Pitch Pine habitats, and none were located in Cedar Swamps or Oak Pine habitats. Most snakes were located in disturbed habitats such as along abandoned roads, railroad beds, hunting shacks and abandoned settlements. These habitats are not presently exposed to human disturbances, but they were open, with little canopy cover and no dense ground cover. Overall, Pine Snakes were found in Pitch Pine sections rather than low lands and cedar bogs. Specific habitat preferences related to soil type (Lakehurst), ground cover and ground vegetation. Snakes preferred open sand and pine needles over other ground cover types, and were usually closest to pitch pine and sedge, while avoiding blueberry, saw briar, and scrub oak. There were no sexual differences in habitats selected. Nesting females were not included in the analysis for habitat differences since they all were found in open sand areas. Over 80% of the snakes were found in man-disturbed habitats, suggesting that such areas need to be preserved as well as undisturbed, pristine sections.

APPENDIX 1

NEW JERSEY PINE BARRENS CURRENT RESEARCH QUESTIONNAIRE
(for update of 1982 survey)

Name(s) of Principal Investigator(s):

Institution Affiliation(s):

Professional Address(es):

Office Phone: (Area Code) Number:

Title of Research Project:

Specific Location(s) of Research Site(s):

Date Project Initiated:

Expected Date of Project Completion:

Publication Vehicle (Book, Journal, Other). If "Other," specify:

Funding Agency(ies) (OPTIONAL):

Abstract. Please give a concise outline of research project including research goals, general methodology, etc. You may attach additional sheets if necessary.

May we have a list of all your New Jersey Pine Barrens publications for inclusion in our Compendium of New Jersey Pine Barrens Literature. The latter is also being updated.

Please list the names, professional addresses and, if known, office phone numbers and research topics of other researchers currently conducting research in the New Jersey Pine Barrens that you think we might have overlooked.

Please complete this questionaire and return to: Glenn R. Matlack, Rutgers Pinelands Field Station, P.O. Box 206, New Lisbon, NJ 08064. Thank you.

APPENDIX 2

Index of Research Topics

Topics currently being investigated in the Pine Barrens, followed by workers addressing those topics. Descriptions of research projects are listed alphabetically by research workers' names in the body of the survey (p. 5 to p. 52).

Genetics

Knezick, D.R.; Kuser,J.; Ledig, F.T.; Hartzog, S.H.; Graham, J.H.; Garrett, P.W.; Wallace, R.S.; Manos, P.S.; Fairbrothers, D.E.

Heavy metals

Morgan, M.D.

Hydrology

Hordon, R.M.; Nicholson, R.; Zampella, R.A; Hayes, D.C.

Lakes and ponds

Schick, K.; Morin, P.J.; McCarthy, K.A.; Morgan, M.D.; Fairbrothers, D.E.

Microbiology

Tate, R.L.; Spratt, H.G.

Mosses and Lichens

List, A.

Oaks

Unnasch, R.S.; Manos, P.S.; Fairbrothers, D.E.

Pinelands culture

Hartzog, S.H.; Samuelson, S.

Pine Plains

Good, R.E.; Unnasch, R.S.; Windisch, A.G.

Pines

Ledig, F.T.; Knezick, D.R.; Kuser, J.; Hartzog, S.H.; Garrett. P.W.

Plants, ecology

Good, R.E.; Handel, S.N.; Good, N.; Gibson, D.J.; Stoltzfus, D.L.; Stasz, J.L.; Roman, C.T.; Fairbrothers, D.E.; McCarthy, K.A.; Gallagher, M.; Unnasch, R.S.; Zampella, R.A.; Matlack, G.R.; Quinn, J.A.; Cheplick, G.P.; Hayes, D.C.; Hayes, M.S.; Williams, C.

Plants, guidebook

List, A.

Population biology

Matlack, G.R.; Handel, S.N.; Unnasch, R.S.; Gibson, D.G.; Quinn, J.A. ; Cheplick, J.P.; Williams, C.

Rare and endangered species

Stasz, J.L.; Schuyler, A.E.