**UNITED STATES DEPARTMENT OF
AGRICULTURE
FOREST SERVICE**

1997 ANNUAL REPORT

**UPDATE OF RESEARCH ACTIVITIES RELATED TO THE
PEN BRANCH RESTORATION EFFORT ON THE
SAVANNAH RIVER SITE**

Prepared by:

Drs. Randall K. Kolka¹, Carl C. Trettin¹ and Eric A. Nelson²

**¹Center for Forested Wetlands Research
Southern Research Station
USDA Forest Service
Charleston, South Carolina**

**²Westinghouse Savannah River Technology Center
Aiken, South Carolina**

January 1998

RESEARCH PROJECT UPDATES

A comprehensive description of Pen Branch restoration plans and related research projects was documented in the 1996 annual report (Kolka and Trettin, 1997). That research is being lead by the USDA Forest Service's Savannah River Institute and the Center for Forested Wetlands Research, Westinghouse Savannah River Technology Center and the Savannah River Ecology Lab in conjunction with other agency and academic researchers. The purpose of this annual report is to update progress over the past year and to project 1998 research expectations for studies included in the Pen Branch Restoration Project. Recent references of publications and presentations that occurred since the preparation of the 1996 annual report are provided for each study. A full, updated reference list is provided at the end of the report.

Stream Community Studies

Stream Morphology and Stream Community Characteristics

Investigators: Drs. Marcel Reichert and John Mark Dean, University of South Carolina, and Dr. Mike Paller, Westinghouse Savannah River Technology Center.

Study Objective:

Determine if fish community and stream morphology data can be used to measure recovery status of stream ecosystems.

1997 Update: All data has been collected and analyzed. A draft report of the research findings is under review.

1998 Projection: Completion of report and submission for peer reviewed publication. Maps and data bases made available to users.

Recent Publications/Presentations:

Reichert, M.J., C.C. Trettin, M.H. Paller, J.M. Dean, J. Seigle, J. Hoyt, A.M. Cameron, and J.D. Flake. Abiotic characterization and fish assemblages of four creeks at the Savannah River Site area in the fall and winter of 1995/1996. *In preparation.*

Ecological Risk Assessment and Stream Restoration Relative to Thermal Flow Disturbance

Investigators: Dean Fletcher, David Wilkins and Dr. Gary Meffe, University of Georgia, Savannah River Ecology Lab.

Study Objective:

Fish in Pen Branch, Fourmile Creek, Meyers Branch and Upper Three Runs Creek are being studied at levels or organization ranging from individual (physiology and behavior), to population (demography and habitat segregation) to interspecific interactions in communities (structure and function). Such a comprehensive study will allow development of mechanistic models of community functional organization based on characteristics of individuals and individual species. Establishment of a long-term database will allow examination of past impacts and current restoration efforts on ecosystem stability and resilience. Data collection is monitoring the short-term effects of the restoration process as well as establishing an early trajectory of the recovery process.

1997 Update: All data has been collected and is currently being analyzed.

1998 Projection: Preparation of manuscripts for peer reviewed publication.

Recent Publications/Presentations: none

Autotroph and Macroinvertebrate Post-Thermal Recovery and Restoration of a Coastal Plain Stream

Investigators: Dr. J Vaun McArthur and Michelle Lakly, University of Georgia, Savannah River Ecology Lab.

Study Objective:

The objective of this study is to assess the recovery status of Pen Branch with regard to aquatic invertebrates. This will be accomplished by investigating the invertebrate community and stream characters that may influence insect distribution and production. This involves data collection from Pen Branch and two reference systems: Upper Pen Branch and Meyer's Branch. Additionally, changes in stream geomorphology since disturbance are being determined and compared to reference streams. These investigations will allow us to assess the current status Pen Branch and determine physical and biotic community changes since the cessation of thermal flows. The second phase of the experiment involves a manipulation study experiment where woody debris, leaf litter, canopy closure and possibly stream morphology of Section F in Pen Branch will be altered to mimic the reference streams. This manipulation will allow us the opportunity to determine the importance of physical factors such as woody debris, litterfall, macrophytes, river form and riparian zones in structuring aquatic communities in Pen Branch and influencing stream recovery in the Coastal Plain.

1997 Update: Sampling, data collection and analysis has been accomplished for the first phase of the study. Installation of the second phase of the study is ongoing. Funding for the second phase of the project was requested through the NERP proposal process. The proposal was unsuccessful. Alternatives to phase two are currently being investigated. Six artificial streams have been installed near Upper Three Runs Creek. These artificial stream structures will now be the focus of phase two of the project.

1998 Projection: Complete the data collection and analysis of phase one and installation and data collection of phase two of the study.

Recent Publications/Presentations: none

Vertebrate Communities

Reptile and Amphibian Characterization of the Pen Branch Corridor at the Beginning of Restoration.

Investigators: Dr. Hugh Hanlin, University of South Carolina-Aiken, and Dr. David Guynn, Clemson University.

Study Objective:

To determine the effectiveness of restoration efforts in the Pen Branch corridor, on the recolonization of reptiles and amphibians. The study purpose was to gather baseline herpetofaunal population data for future use in the assessment of mitigation efforts in the Pen Branch corridor.

1997 Update: Data collection and analysis is complete, Catherine Fulmer Bower's M.S. thesis is complete, other peer reviewed publications under review.

1998 Projection: Submission/publication of X papers.

Recent Publications/Presentations:

Bowers, C.F., H.G. Hanlin, D.C. Guynn, Jr., and J.R. Davis. 1998. Amphibian and reptile characterization of a thermally-impacted stream at the beginning of restoration. *Submitted to Wetlands*.

Bowers, C.F. 1997. Reptile and amphibian characterization of Pen Branch at the beginning of restoration. *M.S. Thesis. Clemson University. 53 pp.*

Fulmer, C.M., D.C. Guynn, Jr., J.R. Davis, H.G. Hanlin, and J.P. McLendon. 1996. Reptile and amphibian characterization of Pen Branch at the beginning of restoration (abstract). *Proceedings of the Annual Conference of the Southeastern Fish and Wildlife Agencies. 50: (In Press).*

McLendon, J.P., H.G. Hanlin, and E. A. Nelson. 1996. Reptile and amphibian characterization of a thermally disturbed braided stream undergoing restoration near Aiken, SC. In: Webb, F.J., Jr. (Ed.), *Proceedings of the Twenty-third Annual Conference on Ecosystems Restoration and Creation. (In Press).*

A Comparison of Avian Communities in Bottomland Hardwoods of Different Successional Stages

Investigators: Drs. Karl Miller and Brian Chapman, University of Georgia.

Study Objectives:

This study has two main focuses. First, the avian communities of bottomlands in different successional stages were compared. Second, the foraging behavior of three forest birds were described (White-eyed Vireo, Northern Parula, and Hooded Warbler).

1997 Update: Manuscript publication in the Wilson Bulletin, submission of second manuscript.

1998 Projection: Publication of second manuscript.

Recent Publications/Presentations:

Buffington, J. M., J. C. Kilgo, R. A. Sargent, K. V. Miller, and B. R. Chapman. 1997. A comparison of bird communities in bottomland hardwood forests of different successional stages. *The Wilson Bull. 109(2): 314-319.*

Buffington, J. M., J. C. Kilgo, R. A. Sargent, K. V. Miller, and B. R. Chapman. 1998. Effects of restoration techniques on the breeding bird communities in a thermally impacted bottomland hardwood forest. *J. of Wildlife Research (Submitted).*

Buffington, J. M., J. C. Kilgo, R. A. Sargent, K. V. Miller, and B. R. Chapman. 1998. Foraging behavior of three passerines in mature bottomland hardwood forests during summer. *Brimleyana (In Press).*

Pen Branch Small Mammal Study

Investigators: Dr. Lynn Wike, Erica Stieve, Tracy Parker and John Gass, Savannah River Technology Center.

Study Objectives:

To determine the effectiveness of restoration efforts in the Pen Branch corridor on the recolonization of small mammals. The study purpose was to gather baseline small mammal population data for future use in the assessment of mitigation efforts in the Pen Branch corridor.

1997 Update: Data collection and analysis is ongoing. Trapping in Meyers Branch was conducted.

1998 Projection: Trapping will be conducted concurrently in both Meyers Branch and Pen Branch. Completion of data collection and analysis, and the development of peer reviewed manuscripts is expected.

Recent Publications/Presentations: none

Vegetation

Comparison of Biomass Partitioning and use of Physiological Parameters in Determining Long Term Survival of Four Wetland Tree Species

Investigators: Dr. Donal Hook and Amy Rozelle, Clemson University.

Study Objectives:

The purpose of this project was to assess physiological and morphological responses of four species (bald cypress, water tupelo, swamp tupelo and green ash) under Pen Branch delta flooding regimes and to evaluate their potential to survive in areas akin to this.

1997 Update: Amy Rozelle completed her M.S. thesis and one presentation was made.

1998 Projection: Development of a peer reviewed manuscript.

Recent Publications/Presentations:

Rozelle, A. 1997. Use of morphological and physiological traits to assess seedling response to flooding stress of four wetland tree species. *M.S. Thesis. Clemson University.*

Rozelle, A., D.D. Hook, M.R. McKevelin, and M.Riley. 1997. Use of physiological parameters of seedling roots for predicting survival of four wetland tree species. Abstract presented at the *Ninth Southern Silvicultural Conference, Clemson University.*

The Use of Root Pruning and Tree Shelters in Regenerating Forested Wetlands in Pen Branch

Investigator: Dr. William Conner, Clemson University.

Study Objectives:

In the Pen Branch delta the feasibility of planting wetland species was examined. Species chosen for planting were bald cypress, water tupelo, swamp tupelo and green ash. Objectives included: monitoring above- and below-ground biomass changes in planted seedlings, determining growth and survival rates, and using these data to develop planting guidelines for future restoration efforts. On four sites seedling roots were pruned to compare responses to non-pruned roots. Additionally, tree shelters were placed on a portion of the seedlings to evaluate effects on seedling response.

1997 Update: Data collection and analysis is ongoing, a final report was submitted to the Forest Service.

1998 Projection: Completion of data collection and analysis, manuscript development.

Recent Publications/Presentations:

Conner, W.H. and E.L. Funderburk. 1996. Evaluate growth and survival of forested wetland species planted in the Pen Branch delta area of the Savannah River Site. *Final Report to the USDA Forest Service, Cooperative Agreement no. 18-409.*

Funderburk, E.L. and W.H. Conner. 1998. Use of root pruning to facilitate planting of wetland species in a thermally impacted area. *Submitted Tree Planters Notes.*

Optimum Overstory Condition for the Survival and Growth of Late-Successional Seedlings

Investigators: Dr. Martha McKevlin and Neil Dulohery and Drs. Carl Trettin and Randy Kolka, Center for Forested Wetlands Research.

Study Objectives:

This study was established to better understand the effects of overstory removal on environmental factors influencing survival and growth of planted seedlings. Specific objectives were to 1) determine the optimum overstory condition for planted seedlings based on seedling survival and growth, 2) determine the effect of overstory condition on specific microsite factors such as light quality and quantity, soil temperature, depth to water table, and herbaceous competition, and to 3) determine the influence of these environmental characteristics on seedling survival, growth, and biomass allocation patterns.

1997 Update: Data bases were turned over to Drs. R.K. Kolka and C.C. Trettin.

1998 Projection: The last sampling is expected this spring. Data analysis and a draft for peer reviewed publication will be completed.

Recent Publications/Presentations: none

Seedling Establishment Monitoring of a Bottomland Hardwood Restoration in South Carolina - The Pen Branch Project

Investigators: Drs. Randy Kolka and Carl Trettin of the Center for Forested Wetlands Research, and Eric Nelson, Savannah River Technology Center.

Study Objectives:

The objective of this study was ascertain if seedling densities in Pen Branch were surviving at a suitable level for restoration goals.

1997 Update: The seedling survey was completed in April, 1997. Data analysis is partially complete. One presentation was made.

1998 Projection: Data analysis will continue and a second presentation will be made and presented as a proceedings to that conference.

Recent Publications/Presentations:

Kolka, R.K., W.P. Casey, C.C. Trettin, and E.A. Nelson. 1997. Vegetation establishment monitoring of a bottomland hardwood restoration in South Carolina. *International Conference of the Society of Ecological Restoration (abstract). Fort Lauderdale, FL.*

Kolka, R.K., C.C. Trettin, E.A. Nelson and W.H. Conner. 1998. Tree seedling survival across a hydrologic gradient in a bottomland restoration. *Submitted to Annual Conference on Ecosystem Restoration and Creation, Tampa, FL.*

Seed Bank Characterization of the Pen Branch Corridor and Delta in Relation to Restoration.

Investigators: Dr. Rebecca Sharitz and George Landman, University of Georgia, Savannah River Ecology Lab, Dr. Randy Kolka, Center for Forested Wetlands Research, and Dr. Eric Nelson, Savannah River Technology Center.

Study Objectives:

This study was established to contribute to the knowledge of wetland vegetation development during a restoration of a thermally impacted bottomland ecosystem. Specific objectives were to 1) compare seed bank composition in planted and unplanted areas of Pen Branch to current vegetation and ascertain what changes in the standing vegetation are likely to occur in the short-term, and to 2) compare seed bank composition across a successional gradient to assess the recovery trajectory of the vegetation in Pen Branch in the early years following restoration efforts.

1997 Update: A project proposal was written and funded through ERDA (Education, Research and Development Association).

1998 Projection: The project will begin in 1998 through the establishment of study plots, collection of samples, and commencement of green house studies.

Recent Publications/Presentations: none

Carbon and Nutrient Cycling

Soil Organic Matter Development and Characterization: Successional Patterns on a Forested Floodplain

Investigators: Dr. Graeme Lockaby and John Wigginton, Auburn University.

Study Objectives:

The objective of this study are to assess the influence of floodplain succession on: 1) rates of litter conversion to soil organic matter, 2) the importance of the enriched labile fraction in soil organic matter development, and 3) forest floor development and carbon and nitrogen characteristics.

1997 Update: Soil and forest floor sampling is completed, laboratory analyses and data collection is ongoing.

1998 Projection: Complete laboratory analyses, data collection and data analysis. Development of Ph.D. Thesis.

Recent Publications/Presentations: none

Comparison of Carbon and Nutrient Fluxes among Wetland Systems at Different Successional Stages

Investigators: Drs. Randy Kolka and Carl Trettin, USDA Forest Service, Center for Forested Wetlands Research.

Study Objectives:

The objective of this study is to investigate the influence of floodplain forest successional state on hydrologic fluxes of carbon and nutrients. Differences in carbon and nutrient transport processes among and within systems will be used as one set indicators to establish a framework for wetland restoration effectiveness.

1997 Update:

Hydrologic transects have been established since May of 1997. Hydrologic transects include 62 nests consisting of a groundwater well and a set of four piezometers placed at depths of 50, 100, 150 and 200 cm. Associated with all transects are 14 continually recording wells placed in the streams with six transects having groundwater recording wells installed. Recording wells are also installed in Steel Creek, near the boardwalk in Pen Branch and near the Risher Rd. bridge in Pen Branch. Sixteen open precipitation (1 collector) and throughfall gauges and collectors (15 collectors) were also established in May of 1997. Groundwater wells, piezometers, open precipitation and throughfall gauges are monitored weekly. Water chemistry is sampled biweekly from the groundwater wells, streams, open precipitation and throughfall collectors. Waters are being analyzed for dissolved organic carbon, nitrate, ammonia, phosphorus, pH, dissolved oxygen, redox status, temperature, conductivity and total dissolved solids. Stream gauging is performed on a seasonal basis at the location of stream recording wells.

1998 Projection:

Hydrology and water chemistry monitoring will continue through 1998. ISCO samplers will be installed to sample for stream water chemistry during hydrologic events. Elevations will be determined for all wells and piezometers. Water chemistry and hydrologic data will be analyzed and presentations and manuscript preparation will begin.

Recent Publications/Presentations: none

Distribution and Function of Organic Matter Pools among Systems of Different Successional Stages

Investigators: Dr. Michael Aust and Laura Giese, Virginia Polytechnic University, and Drs. Randy Kolka and Carl Trettin, Center for Forested Wetlands Research.

Study Objectives:

The objective of this study is to characterize the carbon and nutrient pools and the turnover of these pools along a successional gradient of bottomland hardwood systems. Differences in carbon and nutrient allocation and turnover rates among systems will be used as one set indicators to establish a framework for wetland restoration effectiveness.

This study is integrated with the previous study to develop a holistic approach to the dynamic processes that affect carbon and nutrient allocation and transport in bottomland hardwood wetlands.

1997 Update:

Vegetation plots were established and sampled for herbaceous, shrub and tree composition. Herbaceous plots will be sampled semi-annually and the shrub and tree plots will be sampled again at the end of the study. Litterfall collectors, both above terrestrial and stream zones, were established with monthly sampling periods. Soil and root core samples were collected. A study of litter decomposition rates was established and sampling was begun. Sampling for stream macrophytes and instream detritus transport is being conducted on a seasonal basis. Sediment/redox (rusty rods) were installed to monitor sedimentation/erosion processes and to give an indication redox status in the soils. A thorough description of soils present in the floodplains was completed.

1998 Projection:

Sampling of vegetation plots, litter collectors, stream macrophytes, and instream detritus will continue. Terrestrial and instream coarse woody debris sampling will begin. Collection of laterally transported litter will begin and collection of forest floor and stream sediments will be completed. The litter decomposition study will also be completed. Data analysis and preparation of a thesis and manuscripts will begin.

Recent Publications/Presentations: none

Wetland Assessment

Development of an Assessment Framework for Forested Wetland Restoration on the Savannah River Site - The Pen Branch Project

Investigators: Drs. Carl Trettin and Randy Kolka, Center for Forested Wetland Research, Drs. Eric Nelson and Mike Paller, Savannah River Technology Center, and Dr. John Blake, Savannah River Institute.

Study Objectives:

The overall objective of the Pen Branch Restoration Project is integrate studies from all disciplines involved to develop methods to determine restoration success. The focus is on the assessment of ecosystem level processes that are occurring as succession proceeds. Comparisons of populations and processes across successional gradients and treatments allows the effect of disturbance and restoration activities to be evaluated.

The main objectives of the Forest Service are to develop best management practices for physically performing restorations and to develop monitoring methodologies to assess restoration effectiveness. All of the studies support these objectives. Knowledge gained from the previous studies will enable future restoration efforts to be more efficiently and effectively performed and evaluated.

1997 Update: Several presentations/papers were given/written documenting the overall project.

1998 Projection: Several more presentations and papers are expected. Planning will begin for the Second Pen Branch Symposium. The second symposium is tentatively scheduled for Jan/Feb, 1999 at Clemson University. The objective of the symposium will be to finalize and integrate all Pen Branch related research and develop a comprehensive book or dedicated journal series to document the Pen Branch Restoration Project.

Recent Publications/Presentations:

- Nelson, E.A., R.K. Kolka, and C.C. Trettin. 1998. Interdisciplinary assessment framework for forested wetland restoration. *Society of Wetland Scientists Annual Conference, Anchorage, Alaska.*
- Nelson, E.A., R.K. Kolka, and C.C. Trettin. 1998. Interdisciplinary assessment of wetland restoration in a highly degraded system. *National Conference on Goal Setting and Success Criteria for Coastal Habitat Restoration. Charleston, SC.*
- Irwin, J.E., R.K. Kolka, H.E. Mackey, E.A. Nelson, and H.M. Westbury. 1997. Chapter: Wetlands and Carolina Bays of SRS. *In N.V. Halverson and K.K. Patterson (eds.) SRS Ecology. WSRC-TR-97-0223. In press.*
- Kolka, R.K., C.C. Trettin, and E.A. Nelson. 1997. Development of an assessment framework for forested wetlands restoration. *Proceedings: Annual Conference on Ecosystem Restoration and Creation, Tampa, FL. In press.*
- Kolka, R.K., R.E. Bonar, E.A. Nelson, N.C. Dulohery and D. Gartner. 1997. Forested wetland restoration - the Pen Branch project. *Submitted to Restoration and Management Notes.*
- Kolka, R.K. and C.C. Trettin. 1997. Wetlands research related to the Pen Branch restoration effort on the Savannah River Site. *WSRC-TR-97-00273.*
- Shaver, B., and B. Helmlinger. 1997. Development of an assessment framework for forested wetlands restoration on the Savannah River Site. *Intership Report. Medical University of South Carolina. 73 pp.*
- Wein, G.R., R.R. Sharitz, J.V. McArthur, K.W. McLeod, R.K. Kolka, E.A. Nelson. 1997. Ecological restoration of wetlands in the Southeastern Coastal Plain. *SERDP Conference, Washington DC.*

Compilation of Literature

Peer-Reviewed Publications (Published, Accepted or Submitted)

- Bowers, C.F., H.G. Hanlin, D.C. Guynn, Jr., and J.R. Davis. 1998. Amphibian and reptile characterization of a thermally-impacted stream at the beginning of restoration. *Submitted to Wetlands.*
- Buffington, J. M., J. C. Kilgo, R. A. Sargent, K. V. Miller, and B. R. Chapman. 1997. A comparison of bird communities in bottomland hardwood forests of different successional stages. *The Wilson Bull. 109(2): 314-319.*
- Buffington, J. M., J. C. Kilgo, R. A. Sargent, K. V. Miller, and B. R. Chapman. 1998. Effects of restoration techniques on the breeding bird communities in a thermally impacted bottomland hardwood forest. *J. of Wildlife Research (Submitted).*
- Buffington, J. M., J. C. Kilgo, R. A. Sargent, K. V. Miller, and B. R. Chapman. 1998. Foraging behavior of three passerines in mature bottomland hardwood forests during summer. *Brimleyana (In Press).*

- Funderburk, E.L. and W.H. Conner. 1998. Use of root pruning to facilitate planting of wetland species in a thermally impacted area. *Submitted Tree Planters Notes*.
- Kolka, R.K., R.E. Bonar, E.A. Nelson, N.C. Duloherly and D. Gartner. 1997. Forested wetland restoration - the Pen Branch project. *Submitted to Restoration and Management Notes*.

Theses

- Bowers, C.F. 1997. Reptile and amphibian characterization of Pen Branch at the beginning of restoration. *M.S. Thesis. Clemson University. 53 pp.*
- Buffington, J. M. 1996. A comparison of breeding bird communities in bottomland hardwood forests of different successional stages. *M. S. Thesis, Univ. Of Georgia, Athens, 68 pp.*
- Funderburk, E.L. 1995. Growth and survival of four forested wetland species planted on the Pen Branch Delta, Savannah River Site, SC. *M.S. Thesis. Clemson University. 91 pp.*
- Rozelle, A. 1997. Use of morphological and physiological traits to assess seedling response to flooding stress of four wetland tree species. *M.S. Thesis. Clemson University.*

Abstracts/Proceedings

- Buffington, J. M., K. V. Miller, and B. R. Chapman. 1996. Effects of revegetation techniques on the avian communities in a thermally impacted bottomland hardwood forest (abstract). *In: Nelson, E. (Ed.), Proceedings of the Restoration of Pen Branch Symposium, Savannah River Site. WSRC-MS-96-0257X: 13-14.*
- Buffington, J. M., J. C. Kilgo, R. A. Sargent, K. V. Miller, and B. R. Chapman. A comparison of breeding bird communities in bottomland hardwood forests of different successional stages. *Presented @ 113th Mtg, Amer. Ornithol. Union, Cincinnati, OH.*
- Conner, W.H., L.W. Inabinette, and E.L. Funderburk. 1996. The use of root pruning and tree shelters in regenerating forested wetlands in Pen Branch. *In: Nelson, E. (Ed.), Proceedings of the Restoration of Pen Branch Symposium, Savannah River Site. WSRC-MS-96-0257X: 20-21.*
- Fletcher, D.E., S.D. Wilkins and G.K. Meffe. 1996. Ecological risk assessment and restoration relative to thermal and flow disturbance - fish ecology and stream habitat (abstract). *In: Nelson, E. (Ed.), Proceedings of the Restoration of Pen Branch Symposium, Savannah River Site. WSRC-MS-96-0257X: 15-16.*
- Fulmer, C.M., D.C. Guynn, Jr., J.R. Davis, H.G. Hanlin, and J.P. McLendon. 1996. Reptile and amphibian characterization of Pen Branch at the beginning of restoration (abstract). *Proceedings of the Wildlife Society Annual Conference. 3: 84-85.*
- Fulmer, C.M., D.C. Guynn, Jr., J.R. Davis, H.G. Hanlin, and J.P. McLendon. 1996. Reptile and amphibian characterization of Pen Branch at the beginning of restoration (abstract). *Proceedings of the Annual Conference of the Southeastern Fish and Wildlife Agencies. 50: (In Press).*
- Funderburk, E.L. and W.H. Conner. 1996. Survival and growth of planted forested wetland species, Pen Branch Delta, Savannah River Site, S.C. *Southern Forested Wetlands workshop, Clemson, SC, 25-27 March.*

- Funderburk, E.L. and W.H. Conner. 1995. Growth and survival of forested wetland species planted in Pen Branch Delta on Savannah River Site, SC. *Association of Southeastern Biologists, Knoxville, TN, 19-21 April.*
- Funderburk, E.L. and W.H. Conner. 1995. Restoration techniques for a thermally altered forested wetland. *South Carolina Academy of Science, Greenville, SC, 7-8 April.*
- Kolka, R.K., W.P. Casey, C.C. Trettin, and E.A. Nelson. 1997. Vegetation establishment monitoring of a bottomland hardwood restoration in South Carolina. *International Conference of the Society of Ecological Restoration (abstract). Fort Lauderdale, FL.*
- Kolka, R.K., C.C. Trettin, E.A. Nelson and W.H. Conner. 1998. Tree seedling survival across a hydrologic gradient in a bottomland restoration. *Submitted to Annual Conference on Ecosystem Restoration and Creation, Tampa, FL.*
- Kolka, R.K., C.C. Trettin, and E.A. Nelson. 1997. Development of an assessment framework for forested wetlands restoration. *Proceedings: Annual Conference on Ecosystem Restoration and Creation, Tampa, FL. In press.*
- Lakly, M.B. and J.V. McArthur. 1996. Autotroph and macroinvertebrate post-thermal recovery and restoration in Pen Branch: a descriptive and manipulation study (abstract). *In: Nelson, E. (Ed.), Proceedings of the Restoration of Pen Branch Symposium, Savannah River Site. WSRC-MS-96-0257X: 17-18.*
- McKevlin, M.R. and N. Dulohery. 1996. Optimum overstory condition for survival and growth of late-successional seedlings. *In: Nelson, E. (Ed.), Proceedings of the Restoration of Pen Branch Symposium, Savannah River Site. WSRC-MS-96-0257X: 11.*
- McLendon, J.P., H.G. Hanlin, C.M. Fulmer, and D.C. Guynn, Jr. 1996. Reptile and amphibian characterization of Pen Branch (abstract). *In: Nelson, E. (Ed.), Proceedings of the Restoration of Pen Branch Symposium, Savannah River Site. WSRC-MS-96-0257X: 19.*
- McLendon, J.P., H.G. Hanlin, and E. A. Nelson. 1996. Reptile and amphibian characterization of a thermally disturbed braided stream undergoing restoration near Aiken, SC. *In: Webb, F.J., Jr. (Ed.), Proceedings of the Twenty-third Annual Conference on Ecosystems Restoration and Creation. (In Press).*
- Nelson, E.A., R.K. Kolka, and C.C. Trettin. 1998. Interdisciplinary assessment of wetland restoration in a highly degraded system. *National Conference on Goal Setting and Success Criteria for Coastal Habitat Restoration. Charleston, SC.*
- Nelson, E.A., R.K. Kolka, and C.C. Trettin. 1998. Interdisciplinary assessment framework for forested wetland restoration. *Society of Wetland Scientists Annual Conference, Anchorage, Alaska.*
- Nelson, E. A. 1996. The Restoration of Pen Branch: defining and measuring the progress of a thermally impacted stream becoming a functional wetland ecosystem. *Abstracts from Symposium held on Feb. 13, 1996, Savannah River Site. WSRC-MS-96-0257X. 32 pp.*
- Paller, M., J. Dean, M. Reichert, C. Trettin and W. Specht. 1996. Use of biotic indices to measure the recovery of damaged streams (abstract). *In: Nelson, E. (Ed.), Proceedings of the Restoration of Pen Branch Symposium, Savannah River Site. WSRC-MS-96-0257X: 24.*

Rozelle, A., D.D. Hook, M.R. McKevlin, and M.Riley. 1997. Use of physiological parameters of seedling roots for predicting survival of four wetland tree species. Abstract presented at the *Ninth Southern Silvicultural Conference, Clemson University*.

Rozelle, A.L., and D.D. Hook. 1996. Comparison of biomass partitioning and use of physiological parameters in determining long term survival of four wetland tree species (abstract). In: Nelson, E. (Ed.), *Proceedings of the Restoration of Pen Branch Symposium, Savannah River Site*. WSRC-MS-96-0257X: 22-23.

Rozelle, A.L., D.D. Hook, and M.R. McKevlin. 1995. Use of physiological parameters of seedling roots for predicting survival of four wetland tree species (abstract). *Presented at 16th Annual Meeting, Society of Wetland Sciences, Boston, Mass.*

Stieve, E., T. Parker, and J. Gass. 1996. A small mammal survey of Pen Branch, Lost Lake, and an isolated wood lot. *Presentation at ORISE intern display, July 25, 1996*. WSRC-MS-96-0491.

Wein, G.R., R.R. Sharitz, J.V. McArthur, K.W. McLeod, R.K. Kolka, E.A. Nelson. 1997. Ecological restoration of wetlands in the Southeastern Coastal Plain. *SERDP Conference, Washington DC*.

Wigginton, J.D., B.G. Lockaby, and C.C. Trettin. 1996. Soil organic matter formation during succession on a forested floodplain. *Poster Presentation, Ecological Society of America 81st Annual Meeting, Providence, Rhode Island*.

Miscellaneous Presentations / Reports / In Preparation

Conner, W.H. and E.L. Funderburk. 1996. Evaluate growth and survival of forested wetland species planted in the Pen Branch delta area of the Savannah River Site. *Final Report to the USDA Forest Service, Cooperative Agreement no. 18-409*.

Dulohery, N.J., C.S. Bunton, C.C. Trettin and W.H. McKee. 1995. Reforestation, Monitoring, and Research at Pen Branch: Restoring a Thermally-Impacted Wetland Forest. *Establishment Report. USDA Forest Service. 55 pp.*

Funderburk, E.L. and W.H. Conner. 1998. Growth and survival of four wetland tree species using tree shelters. *In preparation*.

Gartner, D. 1996. Results of 1996 Pen Branch Vegetation Monitoring Survey. *USDA Forest Service Report., 9 pp.*

Kolka, R.K. and C.C. Trettin. 1997. Wetlands research related to the Pen Branch restoration effort on the Savannah River Site. *WSRC-TR-97-00273*.

Irwin, J.E., R.K. Kolka, H.E. Mackey, E.A. Nelson, and H.M. Westbury. 1997. Chapter: Wetlands and Carolina Bays of SRS. In N.V. Halverson and K.K. Patterson (eds.) *SRS Ecology*. WSRC-TR-97-0223. *In press*.

Reichert, M.J., C.C. Trettin, M.H. Paller, J.M. Dean, J. Seigle, J. Hoyt, A.M. Cameron, and J.D. Flake. Abiotic characterization and fish assemblages of four creeks at the Savannah River Site area in the fall and winter of 1995/1996. *In preparation*.

Shaver, B., and B. Helmlinger. 1997. Development of an assessment framework for forested wetlands restoration on the Savannah River Site. *Internship Report. Medical University of South Carolina. 73 pp.*