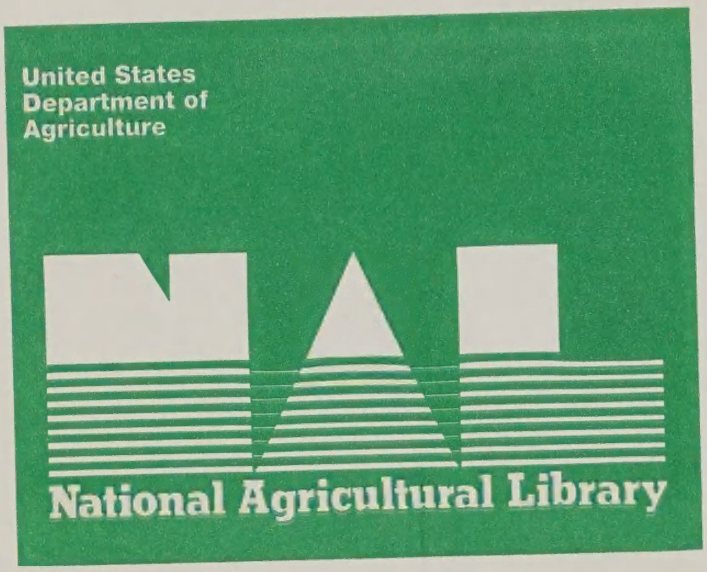
The Third
Eastern Native Grass
S Y M P O S I U M

October 1 - 3, 2002

Hosted by the

North Carolina Botanical Garden

THE UNIVERSITY OF NORTH CAROLINA
AT CHAPEL HILL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On the cover: ©Eastern Native Grasses by Dot Wilbur-Brooks

Welcome
to

The Third
Eastern Native Grass
S Y M P O S I U M

October 1 – 3, 2002

Hosted by the
North Carolina Botanical Garden
Held at
The Friday Center for Continuing Education
THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

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Notes

Emergency
In case of any emergency, please go to the Friday Center reception desk, phone (919) 962-3000.

Exhibits
All exhibits and displays are located in the Friday Center atrium.

Local Tours
Advance registration required. Please wear clothing appropriate for the fall season — tours will be held rain or shine. Tour buses, marked to correspond with each tour, will load outside the Friday Center. Tours may involve extensive walking, so please wear comfortable walking shoes.

Meals and Breaks
Breakfast
Breakfast is on your own each morning, but you may enjoy plenty of pastries, fruit and drinks at the Friday Center.

Breaks
Please check the Symposium schedule for official break times. The Friday Center offers "continuous" refreshments, coffee and tea throughout the day.

Lunches
All lunches are provided. Box lunches are provided on Wednesday.

Dinners
The evening receptions on Tuesday and Wednesday will offer hors d'oeuvres and drinks that should be substantial enough to serve as dinner. However, you are welcome to visit any of the many excellent restaurants in Chapel Hill. Please refer to the Chapel Hill/Orange County Visitors Bureau *Visitor Guide*.

Memo Board
A questions and memo board will be maintained in the registration area for Symposium participants.

Messages
Phone messages should be directed to the Symposium registration desk.

Name Badges
Please wear your name badge at all times.

Posters
Posters will be set up in Dogwood A and B of the Friday Center.

Receptions
As noted in the schedule, the North Carolina Botanical Garden will host a Welcome Reception at 6:00 on Tuesday evening — you will have the opportunity to enjoy food, drink, music, plants and seventy sculptures by artists with North Carolina ties (displayed amid the plant collections). A Reception with Exhibitors and Posters (with Presenters present) will take place in the Friday Center on Wednesday evening at 6:00.

Speakers and Presenters
All speakers and presenters are invited to use one of the Friday Center day offices for preparation. Please inquire about availability at the registration desk.

Symposium Updates
Please refer to the *Updates List* at the registration desk for all Symposium changes.

Notes

Tuesday and Thursday CONCURRENT SESSIONS				
Day	**Room**	**10:30 a.m. – 12:00 p.m.**	**1:30 p.m. - 3:00 p.m.**	**3:30 p.m. - 5:00 p.m.**
Tuesday	Grumman	Southeastern Native Grasslands	Native/Natural Community Restoration I	Wildlife Habitat and Biodiversity I
	Dogwood A & B	Erosion Control/ Reclamation	Establishment and Management I	Establishment and Management II
Wednesday	See Below	Posters, Tours, and Workshops		
Thursday	Grumman	Panel Discussion: Seed and Nursery Production and Marketing	Panel Discussion: Ecological and Institutional Barriers	Panel Discussion: Field Establishment and Management
	Dogwood A	Establishment and Management III	Biofuel and Forage Production I	Biofuel and Forage Production II
	Dogwood B	Piedmont Prairies	Native / Natural Community Restoration II	Wildlife Habitat and Biodiversity II
	Mt. Laurel	Landscaping and Rights-of-Way I	Landscaping and Rights-of-Way II	Workshop: Grass Identification

Wednesday LOCAL TOURS AND WORKSHOPS		
Meeting Location	**8:00 a.m. - 12:00 p.m.**	**1:00 p.m. - 5:00 p.m.**
Dogwood A & B	Posters	
Friday Center	Piedmont Natural Areas Tour	
Friday Center	Botanical Garden and Arboretum Tour	
Friday Center	Hoffman's Nursery Tour	
Friday Center	Mason Farm Biological Reserve Tour (North Carolina Botanical Garden)	
Friday Center	Audubon Sanctuary Program Tour (Finley Golf Course)	
Friday Center	Forage Program at NC State University /USDA, ARS Tour	
Friday Center		Grass Identification (Totten Center)
Friday Center		Seed Harvesting (by hand) and Cleaning (small scale)
Friday Center		Establishment (PLS Calculation, Drill Calibration, Depth Adjustment, Drill Operation)
Friday Center		Native Grass Crafts (NCBG Herb House)

Notes

Symposium Goals

Increased interest in the use of native grasses in the East has led to the organization of a regional symposium highlighting native grass uses, adaptations, and importance. The symposium goals are to share information, experiences, and research about recent projects involving native grasses. There will be many opportunities to coordinate efforts, form new partnerships, and further our common goals.

Keynote Speakers

Alan Weakley

Newly appointed Curator of the UNC-Chapel Hill Herbarium, Alan Weakley has distinguished himself through his publications on the flora, plant systematics, natural communities and conservation needs of North Carolina and the Southeast and through his work with conservation organizations. In 1984, he became a botanist and ecologist with the North Carolina Natural Heritage Program. In 1994, he joined The Nature Conservancy as Senior Regional Ecologist for the Southeastern United States, moving up to Chief Ecologist for TNC's allied organization, NatureServe, in 1999.

Rick Darke

Rick Darke is a landscape consultant, author and photographer focused on the balance of nature and culture in the regional American Landscape, and an internationally recognized authority on ornamental grasses. His books include *The Color Encyclopedia of Ornamental Grasses*, also on CDROM, and *In Harmony with Nature: Lessons from the Arts & Crafts Garden.* His next book, *The American Woodland Garden: Capturing the Spirit of the Deciduous Forest* will be published fall 2002 by Timber Press. In 1998, the American Horticultural Society honored Darke with its Scientific Award, which recognizes individuals "who have enriched horticulture through outstanding and notable research."

Schedule

Tuesday, October 1, 2002

8:00 a.m.

WELCOME AND ANNOUNCEMENTS — Grumman
Ken Moore
Assistant Director for Education, Collections, and Operations, North Carolina Botanical Garden

9:00 a.m. – 10:00 a.m.

KEYNOTE SPEAKER — Grumman
Alan Weakley, Curator, UNC Herbarium, Chapel Hill, North Carolina
Native Grasslands of the Southeastern United States

10:00 a.m. – 10:30 a.m. - BREAK

10:30 a.m. – 12:00 noon – CONCURRENT SESSIONS

SOUTHEASTERN NATIVE GRASSLANDS — Grumman
Moderator: Rob Evans, NatureServe

1 *Soils: Base Saturation and 19th Century Piedmont Agricultural Patterns*
Douglas Helms

2 *Isolated Prairies of the West Gulf Coastal Plain*
Barbara R. MacRoberts and Michael H. MacRoberts

3 *What Were the Dominant Native Grasses of the Carolinas?*
Cecil Frost

4 *Management and Research of Longleaf Pine – Wiregrass Communities on St. Marks National Wildlife Refuge, Florida, 1940-2002*
Joseph P. Reinman

EROSION CONTROL/RECLAMATION Dogwood A & B

Moderator: Martin vander Grinten USDA-NRCS, Corning, New York

1 *Gravel Pit, Copper, and Iron Mine Reclamation In New York and Northern New England*
John A. Dickerson

2 *Establishing Native Warm-Season Grasses on Abandoned and Reclaimed Coal Mines in the Northeastern United States*
Robert Glennon and Martin vander Grinten

3 *Establishment of Native Perennial Grasses on Superfund Sites Contaminated with Heavy Metal in the Eastern United States*
Robert Glennon and Martin vander Grinten

4 *Harbison-Walker Superfund Site Restoration, Cape May County, New Jersey*
Christopher Miller and William Skaradek

12:00 noon – LUNCH

1:30 – 3:00 p.m. – CONCURRENT SESSIONS

ESTABLISHMENT AND MANAGEMENT I Dogwood A

Moderator: John Dickerson, USDA-NRCS

1 *Influence of Storage Time and Storage Conditions on Comparative Germination of Eastern Gamagrass in the Greenhouse and Laboratory*
Donald T. Krizek, Mary J. Camp, Susan R. Maxon, Kathleen M. Davis, and Jerry C. Ritchie

2 *Establishing Native Warm-Season Grasses Using Conventional- and No-till Technology with and without Plateau Herbicide*
Craig A. Harper and Charles E. Dixon

3 *Bahia Grass Conversion to Native Warm Season Grasses*
Thomas G. Barnes and Brian Washburn

4 *Flowering and Seed Production Response of Wiregrass to Defoliation*
John Silvoy, Sharon Pfaff, and Roger Gates.

NATIVE COMMUNITY RESTORATION I Grumman

Moderator: Roger Hansard, USDA-NRCS, Raleigh, North Carolina

1 *Developing a Framework for Pine-bluestem Community Restoration in the Interior Highlands of Arkansas and Oklahoma*
Ronald E. Masters

2 *Two Approaches to Reintroduction: Economy or Expense*
Jeff Glitzenstein

3 *River Cane, A Unique Woody Grass*
Adam Turtle

4 *Restoring America's Canebreaks: An Ecosystem Management Challenge*
Christopher G. Brantley and Steven G. Platt

3:30 – 5:00 p.m. – CONCURRENT SESSIONS

ESTABLISHMENT AND MANAGEMENT II Dogwood A

Moderator: John Englert, USDA-NRCS, Beltsville, Maryland

1 *Establishment Rates of Pure and Mixed Stands of Short and Tall Native Grasses on a Roadside Slope*
Samuel O. Doak, Erik Ervin, and Jody Daniels

2 *Evaluation of Pre-emergent Herbicides for Increasing Establishment of Native Grasses on Roadsides*
Samuel O. Doak, Erik Ervin, and Lloyd Hipkins

3 *Establishment of Native Grasses and Forbs using Plateau Herbicide*
Jef Hodges

WILDLIFE HABITAT AND BIODIVERSITY I Grumman

Moderator: John-Ann Shearer, USFWS, Raleigh, North Carolina

1 *Priority Birds Dependent on Southeastern Grassland Communities*
Charles Hunter

2 *Establishing Native Warm Season Grasses to Improve Wildlife Habitat on a Landscape Scale: Pennsylvania Conservation Reserve Enhancement Program*
Scott Klinger

3 *A Grassland Bird Habitat Project in Mecklenburg County*
Jeff Esely

4 *Habitat Restoration of Pine Savannas and Mississippi Sandhill Crane Response*
Scott G. Hereford and Charles A. Wilder, Jr.

5 *Effects of Eastern Red Cedar Removal on Birds Wintering in the Texas Post Oak Savannah*
Richard Hines

6:00 p.m. – WELCOME RECEPTION – North Carolina Botanical Garden
Heavy hors d'oeuvres, drinks, music, and Sculpture in the Garden show

Wednesday, October 2, 2002

ALL DAY
Exhibitors present, posters available for viewing — Dogwood A and B

MORNING and AFTERNOON
Local tours and hands-on workshops

6:00 p.m. – RECEPTION, EXHIBITORS, and POSTERS WITH PRESENTERS PRESENT – Friday Center
Heavy hors d'oeuvres and drinks

Thursday, October 3, 2002

8:00 – 8:30 a.m.

WELCOME
Peter White — Grumman
Director, North Carolina Botanical Garden

8:30 – 10:00 a.m.

KEYNOTE SPEAKER
Rick Darke — Grumman
Landscape Consultant, Author, and Photographer
Celebrating Grasses in the American Landscape

10:00 – 10:30 a.m. - BREAK

10:30 a.m. – 12:00 noon – CONCURRENT SESSIONS

ESTABLISHMENT AND MANAGEMENT III — Dogwood A
Moderator: Chris Miller, USDA-NRCS, Somerset, New Jersey

1 *Native Grass Ecovars: Potential for the Southeastern USA*
S.R. Smith, Jr., A.T. Phan, and D.B. Wark
2 *Establishment and Management of Silvopasture in the Southeastern United States*
J. Robinson, M. Hall, and S. Brantly
3 *Establishment, Production and Management of Switchgrass for Biomass Feedstock in the Northeastern U.S.*
Matt Sanderson, Howard Skinner, Curtis Dell, and Bill Curran
4 *Sorghum-sudangrass as an Aid in the Establishment of Switchgrass (Panicum virgatum L.)*
Robert Cossar and Brian Baldwin

LANDSCAPING/RIGHTS-OF-WAY I — Mt. Laurel
Moderator: John Englert, USDA-NRCS, Beltsville, Maryland

1 *Planning For the Unplanned: Incorporating Ecological Restoration Techniques into the Practice of Landscape Design*
Larry Weaner
2 *Selection, Installation, and Maintenance of Ornamental Beds for Golf Courses*
Terry L. Vassey
3 *North Carolina's Native Wildflower Program*
Don G. Lee
4 *Potential Native Grasses and Forbs for the Southern Appalachians*
Gary Kauffman

PANEL DISCUSSION
Seed and Nursery Production and Marketing of Local Ecotypes — Grumman
Moderator: John Hoffman, Proprietor, Hoffman's Nursery
Terry Schultz, Proprietor, Carolina Greenery
John Englert, USDA-NRCS

PIEDMONT PRAIRIES — Dogwood B
Moderator: Laura Fogo, USFWS, Wadesboro, North Carolina
1 *Historic Piedmont Prairies: Implications for Management of Rare Piedmont Plants*
Lawence S. Barden
2 *A Piedmont Grass/Forb Prairie*
James Matthews
3 *Piedmont Prairie Restoration in Mecklenburg County, NC, Nature Preserves*
Gary Marshall
4 *Remnant Diabase Grasslands in North-Central North Carolina*
R. Evans, S. Hiltner, D. Kanipe, and M. Pyne

12:00 noon – LUNCH

1:30 – 3:00 p.m. – CONCURRENT SESSIONS

BIOFUEL AND FORAGE PRODUCTION I — Dogwood A
Moderator: David Parrish
1 *Biomass Production and Forage Quality of Eastern Gamagrass on an Acid Compact Soil at Beltsville, MD*
Donald T. Krizek, Jerry C. Ritchie, James B. Reeves, Ali M. Sadeghi, and Charles D. Foy
2 *The Interrelationships of Anatomy, Productivity, Physiology, and Forage Quality in Switchgrass*
D.S. Fisher, J.C. Burns, and D.H. Timothy
3 *Nutritional Value of Eastern Gamagrass Conserved as Hay or Silage*
Jong-Su Eun, J.C. Burns, V. Fellner, and M.L. Gumpertz
4 *A New Eastern Gamagrass Cultivar for the Southern United States*
Janet Grabowski, Scott Edwards, and Joel Douglas

LANDSCAPING/RIGHTS-OF-WAY II — Mt. Laurel
Moderator: Larry Weaner, Landscape Architect
1 *Development of Sustainable Native Wildflower and Grass Meadows for Maryland Highway Roadsides*
R. Jay Ugiansky, John Englert, Jennifer Kujawaski, and Dan Dusty
2 *Incorporating Grasslands into the Suburban Landscape-Prairie for Profit*
Marc Pastorek
3 *Landscaping with Fire*
Terry Schultz

NATIVE COMMUNITY RESTORATION II — Dogwood B
Moderator: James Matthews, Department of Biology, UNC-Charlotte
1 *The Duralde Prairie Restoration Project, Cajun Prairie on a Federal Refuge*
Charles M. Allen and Vicki Grafe
2 *The Eunice Cajun Prairie Restoration Project*
Charles M. Allen and Malcolm F. Vidrine
3 *Vegetation Composition of Early Successional Longleaf Pine Conservation Priority Area fields in Southern Georgia, USA*
Brian J. Gates, John P. Carroll, Robert J. Cooper, and Daniel B. Warnell
4 *Mycorrhizae in Restoration of Native Plant Communities at The Nature Conservancy's Disney Wilderness Preserve, Kissimmee, FL*
Amy Miller

PANEL DISCUSSION
Ecological and Institutional Barriers to the Use of Native Herbaceous Plants — Grumman
Moderator: Cecil Frost, North Carolina Department of Agriculture and Consumer Sciences - Plant Conservation Program
Don Lee, North Carolina Department of Transportation
David Patterson, North Carolina Department of Agriculture and Consumer Services
Calvin Ernst, Ernst Conservation Seeds

3:30 – 5:00 p.m. – CONCURRENT SESSIONS

BIOFUEL AND FORAGE PRODUCTION II

Dogwood A

Moderator: Duane Pysher, USDA-NRCS, Harrisburg, PA

1 *Eastern Gamagrass Response to N Fertilizer*
J.L. Douglas, S.D. Edwards, D.J. Lang, R.L, Elmore, R. L. Ivy, and J.L. Howell

2 *Estimating N Dynamics Under Field Conditions to Improve Switchgrass Production in Virginia*
R. Lemus, D. Perrish, and D. Wolf

3 *Nutrient Uptake Dynamics and Biofuel Potential of Switchgrass in Maryland*
K.W. Staver

4 *Managing Eastern Gamagrass as a Bioenergy Crop in the Southeast*
S.D. Edwards and J.L. Douglas

PANEL DISCUSSION

Field Establishment and Management of Native Forbs

Grumman

Moderator: William Skaradek, USDA-NRCS, Cape May Courthouse, New Jersey
Janet Grabowski, Agronomist, USDA-NRCS, Coffeeville, Mississippi
R. Jay Ugiansky, Resource Conservationist, USDA-NRCS, Beltsville, Maryland
Scott Singer, Wildlife Biologist, USDA-NRCS, Bloomsburg, Pennsylvania

WILDLIFE HABITAT AND BIODIVERSITY II

Dogwood B

Moderator: Terry Sharpe, North Carolina Wildlife Resources Commission

1 *Herbaceous Plant Response to Biennial Burning Cycles Applied at Different Dates During the Growing Season: Preliminary Results*
Tom Philipps, James K. Rickard, Sandra Rideout, and D. Wade

2 *Effects of Prescribed Burning and Thinning in Natural Piedmont Loblolly-Shortleaf Pine Stands on Small Mammal Populations*
Kathy King Chapman

3 *Winter Grassland and Bird Community Dynamics in Pine Savanna Habitats: The Role of Fire*
Mark Woodry and C. Ray Chandler

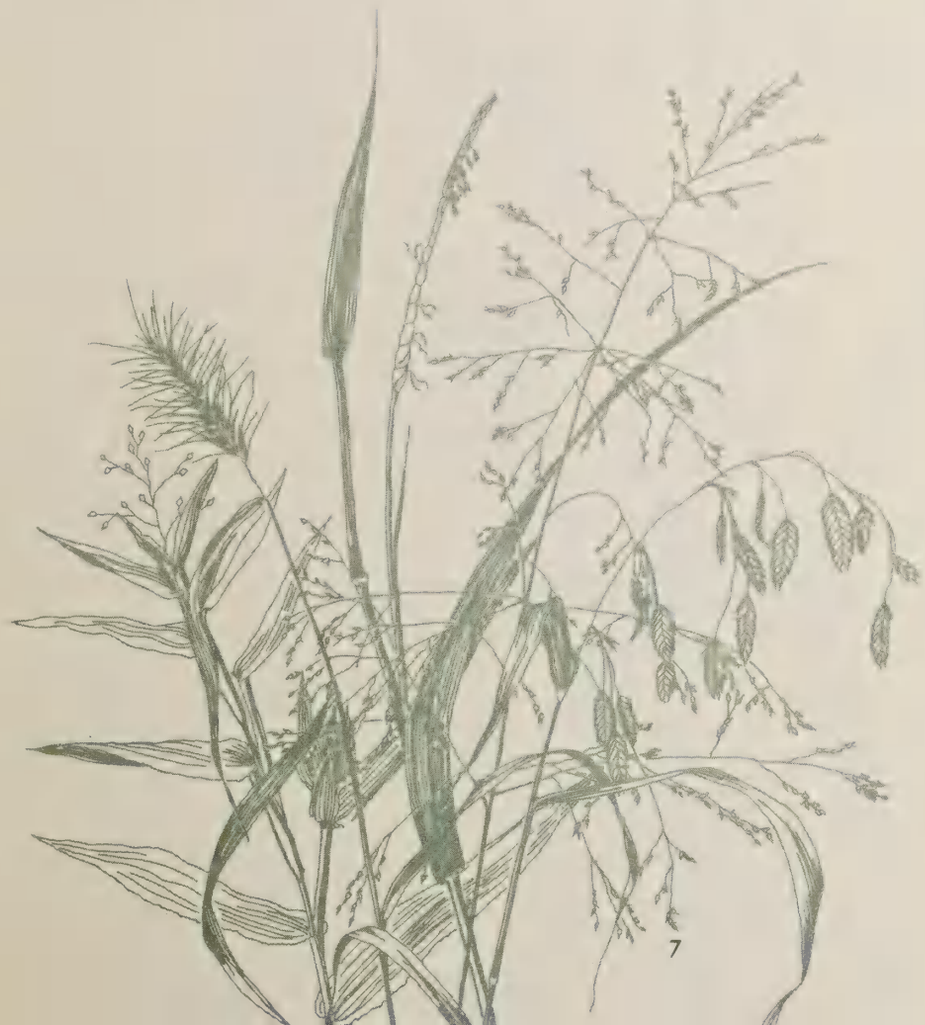
4 *Linear Early-Successional Habitats and Bermuda Grass Invasion*
Jason K. Burkhart, John P. Carrol, and D. B. Warnell

WORKSHOP

Grass Identification

Mt. Laurel

Presenter: Jon Stucky, Department of Botany, North Carolina State University, Raleigh, North Carolina



Notes

Concurrent Sessions

KEYNOTE AND ORAL PRESENTATIONS

Tuesday and Thursday
October 1 and 3, 2002

The Friday Center

Notes

The abstracts are in alphabetical order by first author.

The Duralde Prairie Restoration Project, Cajun Prairie on a Federal Refuge (10/3, 1:30-3:00)

Charles M. Allen and Vicki Grafe

Native Community Restoration II

Colorado State Ft Polk Branch, Ft Polk, LA 71459, U.S. Fish And Wildlife Service, Lacassine Wildlife Refuge, Lake Arthur, LA.; native@camtel.net

Cajun Prairie once covered 2.5 million acres in southwest Louisiana but has been reduced by agricultural practices (tilling) to less than 100 acres in small, disjunct remnant strips along railroad rights of way. The Duralde Project was started in 1994 on abandoned agricultural land that was densely covered with a stand of Tallow Trees (*Sapium sebiferum*). The U.S. Fish and Wildlife Service obtained the land and initiated a Cajun Prairie Restoration Project. The thousands of tallow trees were removed and the land disked. The 300-acre tract is used as an experimental area for Cajun Prairie Restoration and also as a refugium for Cajun Prairie species. About 90 acres were seeded with commercial seeds of big blue stem (*Andropogon gerardii*), switch grass (*Panicum virgatum*), Indian Grass (*Sorghastrum nutans*), and Eastern Gamma Grass (*Tripsacum dactyloides*). The Eastern Gamma and Switch Grass are now dominating with a few scattered clumps of the other species. About 200 acres of the refuge were planted with seeds harvested from a native prairie in Texas, and small areas on the refuge have been seeded with Cajun Prairie seeds. Plugs of Cajun Prairie have been transplanted into small areas across the refuge. Several monitoring projects are ongoing, including the time of year for planting seed with preliminary results indicating December as the best, followed by February and with May the worst. Monocultural seed plots were planted in November of 2001 using about 50 Cajun Prairie forb species. The site is burned annually, and spot herbiciding is used to control the Tallow Trees.

The Eunice Cajun Prairie Restoration Project (10/3, 1:30-3:00)

Charles M. Allen and Malcolm F. Vidrine

Native Community Restoration II

Colorado State Ft Polk Branch and LSU at Eunice, Eunice, LA. 70535

Cajun Prairie once covered 2.5 million acres in southwest Louisiana but has been reduced by agricultural practices (tilling) to less than 100 acres. The remaining Cajun Prairie is in small, disjunct remnant strips along railroad rights of way. The Eunice Cajun Prairie Restoration Project was started in 1988 as a joint community effort to restore and preserve a small amount of Cajun Prairie. It is a ten-acre site located inside the city limits of Eunice. The site preparation included herbiciding, burning, and tilling. Seeds and transplant that were native to southwest Louisiana were used to reestablish the vegetation. Management practices have included controlled burning and spot herbicide treatment. Approximately 300 native Cajun Prairie species have become reestablished on the restoration site with little bluestem (*Schizachyrium scoparium*) now becoming the dominant grass. The restored site also includes considerable numbers of big bluestem (*Andropogon gerardii*), switch grass (*Panicum virgatum*), and Indian grass (*Sorghastrum nutans*). Other species of note on the site include blazing stars (*Liatris* spp.) and hairy sunflower (*Helianthus mollis*). The major management problem is the control of Chinese Tallow Tree (*Triadica sebifera* syn = *Sapium sebiferum*).

Historic Piedmont Prairies: Implications for Management of Rare Piedmont Plants (10/3, 10:30-12:00)

Lawence S. Barden

Piedmont Prairies

Professor of Biology, University of North Carolina at Charlotte; LSBarden@email.uncc.edu

From 1540 to1750, European explorers and traders in the Piedmont region of North and South Carolina reported many prairie-like openings ranging in size up to 40 km across. However, historical evidence of Piedmont prairies has been inaccessible to most restorationists and land managers. I summarize historical information on prairie landscapes of the Carolina piedmont region at the time of European-American exploration and settlement. Historical and meteorological evidence suggests that these prairies were primarily the products of Native American burning and agriculture.

Bahia Grass Conversion to Native Warm Season Grasses (10/1, 1:30-3:00)

Thomas G. Barnes and Brian Washburn

Establishment and Management I

Department of Forestry, University of Kentucky, Lexington, KY 40546-0073; barnes@uky.edu

Bahia grass (*Paspalum notatum*) is an exotic, South American species which has been widely planted as a pasture and right-of-way grass. It is a dense, sod-forming species that can rapidly spread to exclude most native plants and provides little food for wildlife except wild turkeys. The objective of this study was to evaluate the efficacy of several herbicides for eradicating bahia grass and to establish the native warm season grasses (NWSG). The study was conducted at the Santee Cooper Diversion project located in the coastal plain physiographic province. The completely randomized block experiment was conducted on dredge spoil soils (pH 6.5, 2.2% organic matter, 85% sand, 10% silt, 5% clay). Prior to implementing the treatments the site was burned to remove any standing biomass and litter. The following treatments were evaluated: 1) two quarts glyphosate per acre, 2) twelve ounces imazapic per acre, 3) two quarts glyphosate followed by four ounces imazapic per acre at seeding, 4) two quarts glyphosate followed by twelve ounces imazapic at seeding, 5) one pint clethodim followed by four ounces imazapic at seeding, 6) one pint clethodim followed by eight ounces imazapic at seeding, and 7) an untreated check. One quart of non-ionic surfactant and two and one-half pounds of ammonium sulfate/acre were added to each herbicide treatment. Approximately one-month after initial herbicide treatment the plots were broadcast seeded with a mixture of two pounds PLS (a total seeding rate of six pounds PLS) big bluestem (*Andropogon gerardii*), little bluestem (*Schizachryrium scoparium*), and Indian grass (*Sorghastrum nutans*). Plots were sampled at the end of the first and second growing seasons using five, one m2 plots. We collected information on the percent total vegetative cover, percent bahia grass, # NWSG seedlings in year one, % NWSG, % bare ground, and plant species richness.

Restoring America's Canebrakes: An Ecosystem Management Challenge (10/1, 1:30-3:00)

Christopher G. Brantley and Steven G. Platt

Native Community Restoration I

US Army Corps of Engineers, New Orleans District, CEMVN-PM-RP, PO Box 60267, New Orleans, LA 70160-0267, and Biology Department, University of the South Sewanee, TN

Canebrakes are regarded as critically endangered ecosystems, having been greatly reduced from their former extent. Although cane is still found as mostly an understory component in a variety of forest types throughout the southeastern United States, at one time, canebrakes were a dominant landscape feature. Historic accounts indicate that hundreds of thousands of hectares characterized this ecosystem. It will take a goal-driven approach based on a vision of desired future conditions to restore and maintain a viable canebrake ecosystem. This approach must integrate various ecological, economic, and social factors. In order for scientists and land managers to make effective contributions, the White House Ecosystem Management Task Force developed principles and guidelines for ecosystem management. These principles and guidelines can be applied to the remaining cane areas in the southeastern United States. Recently, several of these items have been addressed, and while it has been simple to address the sustainability, native biological diversity, and best science components of the Task Force guidelines, measurements such as ecological units, time frames, and health of the ecosystem will likely need determined coordination between public and private sectors. An effective management must adequately describe appropriate space and time scales for canebrakes as well as an evaluation of the effects cumulative small-scale consequences will have on the larger landscape. There is also a need to develop and apply multiple indicators that will accurately reflect a viable and functioning ecosystem. We emphasize the use of natural processes in restoring and maintaining the canebrake ecosystem. Development of a set of functional goals and design criteria is the likely next step towards restoration. Monitoring effective indicators of canebrake ecosystem progress and the success of restoration strategies will evaluate the overall performance of canebrake ecosystem restoration.

Linear Early-Successional Habitats and Bermuda Grass Invasion, (10/3, 3:30-5:00)

Jason K. Burkhart, John P. Carrol, and D. B. Warnell

Wildlife and Biodiversity II

D. B. Warnell School of Forest Resources, University of Georgia, Athens, GA 30602; jkb8965@owl.forestry.uga.edu

The Northern Bobwhite Quail (*Colinus virginianus*) (bobwhite) is a highly productive species that also suffers high annual mortality rates. Annual results from the Breeding Bird Survey show a steady decline in bobwhite populations over the last thirty years in Georgia. This precipitous decline is believed to be a result of the loss of early successional habitat types that are necessary for their survival. They consist of upland sites that are covered mainly in annual grasses and forbs, with overhead coverage for protection and open at ground level for ease of movement. Linear habitats established by the Bobwhite Quail Initiative (BQI) in the Upper Coastal Plain of Georgia serve to provide quality habitat for the bobwhite. These linear habitats are established around existing row crop field ecosystems. We conducted intensive vegetation surveys in several randomly established study plots. We used line intercepts to monitor presence at one-half meter intervals, and we used stem counts to monitor ground level density. Perennial grasses are the most common invasive recorded. The most aggressive of the invasives is bermuda grass (*Cynodon dactylon*). As many of the fields involved were once pasture land or at the least are adjacent to pasture land, this finding is not surprising. Bermuda grass encroaches rapidly from the edges of established lines and will spread across managed habitats in one growing season. Because this habitat management creates linear features, invasion by bermuda grass appears to be more important than in block habitats that have a greater area. Beneficial, and generally native, species present before the encroachment of bermuda grass are out competed as the bermuda grass virtually becomes a monoculture in some areas. As bermuda grass presence increases, so does the ground-level density of the grass. This spread quickly decreases the quality of the habitat for bobwhites and early successional songbirds. In particular, habitat is degraded for young bobwhites. We currently have further research underway to identify a cost effective method for controlling the spread of bermuda grass in linear habitats.

Keywords: northern bobwhite quail, bermuda grass, vegetation surveys, early-successional, perennial grass

Effects of Prescribed Burning and Thinning in Natural Piedmont Loblolly-Shortleaf Pine Stands on Small Mammal Populations (10/3, 3:30-5:00)

Kathy King Chapman

Wildlife Habitat and Biodiversity II

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Small mammals on the Piedmont National Wildlife Refuge, Georgia, were intensively trapped using a combination of drift fences and snap traps on 21 plots with 5 different treatments and a control in fall and winter. Three-hundred-five mammals including 5 rodent species and 3 shrew species were caught in naturally regenerated sawtimber-sized loblolly (*Pinus taeda*) - shortleaf (*Pinus echinata*) pine stands. Small mammal relative abundance increased an average of 3 times the first growing season after prescribed winter burns in thinned stands compared to unburned, unthinned stands. Numbers declined each growing season after burning. Mammal numbers on thinned only stands were intermediate between fourth growing season burns and unmanaged stands. There was a positive correlation between small mammal numbers and understory vegetative cover. Small mammal abundance and species diversity is influenced by the management of pine habitat on the Refuge. Statistically numbers and biomass of small mammals are significantly greater in first and second growing season burn stands than in stands which had only been thinned and unmanaged stands. The third and fourth year burns had a downward trend in numbers and biomass as the effects of burning diminish. Compared to the management practice of thinning alone, prescribed burned plots had a decrease in the frequency of woody plants and an increase in forbs and grasses. This and the greater percentage of combined vegetative cover may be contributing factors in the increase of numbers and biomass of small mammals on burned areas. The results of this study suggest that white-footed mice (*Peromyscus leucopus*) alone could serve as an indicator of habitat manipulation, or the lack thereof, in older Piedmont pine stands. This species was the most abundant mammal captured. In biomass, there was a significant difference between first year burns and all other treatments. White-footed mice follow the same general trends in numbers and biomass as all species combined.

Sorghum-Sudangrass as an Aid in the Establishment of Switchgrass (Panicum virgatum L.) (10/3, 10:30-12:00)

Robert Cossar and Brian Baldwin

Establishment and Management III

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Switchgrass (*Panicum virgatum* L.) is an erect warm-season (C4) perennial grass which was common on the plains of North America. It has been used for many years for pasture, re-seeding programs, and recently is being investigated as a possible source of biomass for use as alternative fuels. However, seed of native grasses

can have low germination rates due to seed dormancy, and seedlings that do germinate are notoriously slow to establish. The objective of this work was to determine if sorghum-sundangrass (*Sorghum bicolor* L.) could be planted in conjunction with switchgrass. First year biomass would come from the sorghum while the switchgrass established in the understory. The experiment, established under normal field conditions, consisted of a RCB design with four replications of four treatments (varying amounts of sorghum-sundangrass seed plus a fixed amount of switchgrass, and switchgrass alone). Stand counts of both species were taken starting at 14 days after planting. Additional data taken included: sorghum-sundangrass stand count, switchgrass height, final switchgrass stand, and sorghum yield. After sixty days, the sorghum-sundangrass was harvested and final yields assessed. Statistical analysis showed no significant difference in sorghum yield among treatments of 16, 10, and 6 sorghum plants per meter of row (5, 3, and 2 per foot of row). Switchgrass height decreased with increasing density of sorghum stand. Switchgrass stand count decreased from 37 to 14 per 6.1 meters (20 ft.) of row, with increasing sorghum population, however, successful stands of switchgrass have been reported with as few as 1 plant for every 0.6 meter (2 ft.) of row. Persistence during the winter and spring green-up will indicate if co-seeding is a viable option for switchgrass establishment, allowing producers to acquire a biomass crop from sorghum during the first year while switchgrass is establishing.

Keywords: switchgrass, sorghum-sudangrass, establishment, yield, co-seeding

Celebrating Native Grasses in the American Landscape Garden (10/3, 9:00)

Rick Darke

Keynote Speaker

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The unique textures, colors, forms, and luminous qualities of grasses can greatly enhance the drama and appeal of designed landscapes. In addition, grasses are a tough bunch, adapted to difficult conditions, with utility matching their beauty. This talk will explore potential roles of native grasses in gardens that draw on the patterns and processes of the Eastern regional landscape.

Gravel Pit, Copper, and Iron Mine Reclamation In New York and Northern New England (10/1, 10:30-12:00)

John A. Dickerson

Erosion Control/Reclamation

Plant Materials Specialist, USDA-NRCS, Syracuse, NY.;
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Since the mid 1970s, a long-term project has investigated and demonstrated effective plant cover for highly disturbed surface mine lands in the Northeast. From initial plot trials, the work has progressed through large-scale plantings and evaluation of planting technique and planting date, to application. Testing has included grass-forb mixtures and grass-introduced legume mixtures. Native warm season grasses have become the preferred cover type, with an evolution of the recommended seed mix over time. Plantings on mined sites with percent fines below 15 have only been successful with native grass. No topsoil replacement has been required. Native warm season grasses appear to stabilize and moderate site conditions to the point that volunteer species are able to establish on sites that had previously remained bare for several decades. Effective planting technique involves the use of bulldozers to track the broadcast seed into the surface. Germination reliably occurs in the cleat marks providing a good spatial distribution of plants. Success with native grasses has been demonstrated in locations with frost-free seasons as short as 100 days, however aspect does make a large visual difference in plant biomass production on those areas.

Keywords: Northeast, surface mines, reclamation, native grass, warm season grass, planting technique, tracking

Establishment Rates of Pure and Mixed Stands of Short and Tall Native Grasses on a Roadside Slope (10/1, 3:30-5:00)

Samuel O. Doak, Erik Ervin, and Jody Daniels

Establishment and Management II

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Interest in using native grasses for stabilization of roadside and other disturbed sites is increasing, but there is little work comparing the establishment rates of native species and those of adapted species. This experiment was designed to provide comparative establishment information under roadside construction conditions. Pure and mixed stands of native gasses and two adapted species were planted on a newly constructed roadside slope, cut out of a hillside in Blacksburg, Virginia. The native grasses were divided into two categories. The short species planted were buffalograss (*Buchloe dactyloides*), blue grama (*Bouteloua gracilis*), sideoats grama (*Bouteloua curtipendula*) and little bluestem (*Schizachyrium scoparium*). The tall species used were big bluestem (*Andropogon gerardii*), indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*) and deertongue (*Dichanthelium clandestinum*). The adapted species planted were hard fescue (*Festuca longifolia*) and tall fescue (*Festuca arundinacea*). The adapted species established faster and provided a higher percentage of ground cover than the native species in the first year. In the second year, the stands with Buffalograss and Blue grama in the mix provided a percentage of ground cover similar to the adapted species and by the end of the third year all the short native species, except sideoats grama, were statistically equal to the adapted species. The taller native species established much slower than either the adapted or the short native species. By the end of three years, only one tall species, big bluestem, achieved a percentage ground cover similar to the adapted species. The native grasses can provide similar percentage of ground cover as some currently used adapted species, but may take several years to achieve what the adapted species cover in a single season.

Keywords: native grasses, native plants, establishment, roadside, slopes, ground cover, vegetation, adapted species, mixed stands, plantings

Evaluation of Pre-emergent Herbicides for Increasing Establishment of Native Grasses on Roadsides (10/1, 3:30-5:00)

Samuel O. Doak, Erik Ervin, and Lloyd Hipkins

Establishment and Management II

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The use of native plants in roadside situations is increasing. The slow establishment rate of many native grasses requires several years to provide ground cover adequate for erosion control and produce a permanent stand. This is especially true in roadside sites where poor soils and the removal of existing vegetation favor the growth of annual grassy weeds, which can reduce or eliminate native plantings. The objective of this study was to evaluate several commercially available pre-emergent herbicides to determine their usefulness in reducing weed competition and increasing native grass establishment.

The herbicide treatments were imazapic, quinclorac, dithiopyr, pendimethalin, oxadiazon, prodiamine, metsulfuron and an untreated control. The native grass species planted were buffalograss (*Buchloe dactyloides*), blue grama (*Bouteloua gracilis*), sideoats grama (*Bouteloua curtipendula*), little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), indiangrass (*Sorghastrum*

nutans) and switchgrass (*Panicum virgatum*). A site in Blacksburg Virginia with a clayey B-horizon was used for this experiment. The initial treatments were applied on 16 May with seeding on 17 May 2000. Herbicides only, were applied in the second year on 17 April 2001. The control plots initially had the best percentage of germination but the native grasses were quickly reduced by the weed competition. Imazapic, oxadiazon and quinclorac all significantly reduced annual weed competition and helped establish most of the native grass species, although the best improvements were species specific. Pendimethalin, dithiopyr and prodiamine had good weed control but generally hindered or prevented germination of most native grass species. Metsulfuron results were equal to the untreated plots. Blue grama plots treated with imazapic or oxadiazon all achieved over 70 percent cover, while indiangrass plots treated with imazapic or oxadiazon all achieved over 63 percent cover.

The use of selected pre-emergent herbicides can greatly improve specific native grass establishment in sites where the vegetation has been removed.

Keywords: native grasses, native plants, establishment, pre-emergent, herbicides, ground cover, vegetation, weed control

Eastern Gamagrass Response to N Fertilizer (10/3, 3:30-5:00)

J.L. Douglas, S.D. Edwards, D.J. Lang, R.L. Elmore, R. L. Ivy, and J.L. Howell

Biofuel and Forage Production II

Corresponding author: Joel L. Douglas, USDA-NRCS, Jamie L. Whitten Plant Materials Center, 2533 CR 65, Coffeeville, MS 38922; phone: 662-675-2588; fax: 662-675-2369; jdouglas@ms.nrcs.usda.gov

An eastern gamagrass [*Tripsacum dactyloides* (L.) L.] accession (9062680) selected by the USDA-Natural Resources Conservation Service, Jamie L. Whitten Plant Materials Center may have potential for forage use in the southeastern U.S., but information on it's response to N fertilizer is lacking. Objective of this study was to evaluate yield response, physiological efficiency (PE), apparent fertilizer nitrogen recovery (AFNR), and nitrogen use efficiency (NUE) of 9062680 to N fertilizer. Nitrogen rates of 0, 134, 268, 403 and 538 kg ha-1 were applied to replicated plots at Coffeeville, Prairie and Starkville, MS in three equal split applications. The first application of N was applied at green-up and after each harvest except for the final harvest. Nitrogen rates of 134, 268, 403 and 538 kg ha-1 significantly increased DM yield over the 0 rate at all locations. Dry matter yield ranged from 3200 to 13 499 kg ha-1 depending on N rate and location. Physiological efficiency declined as N rates increased and ranged from 38-90 kg kg-1. Apparent fertilizer nitrogen recovery was highest at the 268 kg ha-1 but declined at the higher N rates. Recovery ranged from 14 to 30%. Nitrogen use efficiency decreased with increased N rates and ranged from 7 to 17 kg kg-1. Nitrogen use efficiency was highest at N rates of 134 and 268 kg ha-1.resulting in NUE of 13 to 17 kg kg-1. Preliminary results indicate N rates of 134 and 268 kg ha-1 produce reasonable yields with the highest NUE, PE and AFNR for accession 9062680. This study will continue in 2002.

Keywords: eastern gamagrass, nitrogen fertilizer, dry matter yield, apparent fertilizer nitrogen recover, nitrogen use efficiency, physiological efficiency

Managing Eastern Gamagrass as a Bioenergy Crop in the Southeast (10/3, 3:30-5:00)

S.D. Edwards and J.L. Douglas

Biofuel and Forage Production II

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Eastern gamagrass [*Tripsacum dactyloides* (L.) L] is a native warm season perennial grass capable of producing high yields with low nitrogen fertilizer applications. A three-year field study is being conducted at Coffeeville, MS to evaluate biomass production of eastern gamagrass as a potential bioenergy crop for the southeastern U.S. under a one and two cut harvest system. Dry matter (DM) production and chemical composition were collected from a four-year-old stand of eastern gamagrass (accession 9062680). Nitrogen fertilizer was applied in April 2000-2001 at 134 kg/ha-1 for the one cut and split (67 kg/ha-1 in April and June 2000-2001) for the two cut. A one cut was made 14 September 2000 and 8 August 2001. A two cut was made 13 June and 14 September 2000, and 18 June and 12 September 2001. In 2000 and 2001, a one cut produced 8,700 and 13,889 kg/ha-1 DM, respectively and the sum of the two harvests in 2000 and 2001 for the two cut was 14,810 and 14,649 kg/ha-1 DM, respectively. The difference in DM production between years for a one cut was harvest date. It appears that eastern gamagrass produces peak biomass at seed maturity and production declines rapidly thereafter. Percent ash and N did not vary between years and was not effected by harvest system. Percent ash and N for the one cut was 4.2 and 0.8, respectively, and the average percent ash and N for the two cut was 4.0 and 1.0, respectively. These results indicate that eastern gamagrass has potential as a biomass energy crop and that a one cut harvest made at seed maturity maximizes biomass production and percent ash and N.

A Grassland Bird Habitat Project in Mecklenburg County (10/1, 3:30-5:00)

Jeff Esely

Wildlife Habitat and Biodiversity I

Conservation Science Specialist, Mecklenburg County Division of Natural Resources, Reedy Creek Nature Center, 2900 Rocky River Rd, Charlotte, NC 28215

Dramatic losses of grassland habitat in the eastern United States have been implicated in the population declines of many birds. For several grassland-associated species, these declines are to a degree that their continued existence is threatened in many parts of their historical range. In the period of 1966-1994, for example, Eastern Meadowlarks in the eastern United States decreased at a rate of 3% per year, while the annual rates of decline were 4% for Loggerhead Shrikes, 6% for Grasshopper Sparrows, and 9% for Henslow's Sparrows. Much of the remaining grassland habitat in the Piedmont exists in the form of small, fragmented patches, which have been demonstrated to be unsuitable for many "area sensitive" species. Therefore, efforts in grassland bird conservation should be directed towards the maintenance of larger continuous habitat patches. In Mecklenburg County, a potential grassland expansion project is being studied at McDowell Nature Preserve. This preserve currently contains several small (< 30 acre), closely spaced fields, separated by a 55 acre patch of forest. The proposed plan is to convert this forest patch into field habitat, thus creating one large (≈140 acre), continuous grassland with greater interior area, and reduced edge density. This expansion would serve as a regional refuge for grassland species, and it is predicted that species richness and avian nesting success should be improved on the larger grassland. A nest study was initiated in 2001 to measure the current reproductive productivity on the site. While results varied among species, preliminary findings indicate that while cowbird parasitism was low (8%), predation rates were relatively high. Overall, the results of this

study warrant further consideration of the project, and additional census and nesting data would be collected before, during, and after the conversion procedure, so that the actual effects of the expansion could be measured.

Keywords: grassland birds, area sensitivity, nesting success

Nutritional Value of Eastern Gamagrass Conserved as Hay or Silage (10/3, 1:30-3:00)

J-S. Eun[1], J. C. Burns[2], V. Fellner[1], and M. L. Gumpertz[1].

Biofuel and Forage Production I

[1]North Carolina State University and [2]USDA-ARS, Raleigh, NC; jeun@unity.scsu.edu

Eastern gamagrass (*Tripsacum dactyloides* (L.) L.), a native, warm-season, perennial tall grass, was evaluated for its potential as a forage source in dairy rations. Twenty lactating Holstein cows were fed gamagrass hay or silage without or with supplemental corn to determine effects on milk production. Diets fed in the production trial were also used in continuous cultures to evaluate effects on ruminal fermentation. Diets consisted of gamagrass hay (GH), gamagrass silage (GS), gamagrass silage + low corn (GSLC), gamagrass silage + medium corn (GSMC), and gamagrass silage + high corn (GSHC) with CP levels similar across treatments. Conserving gamagrass as hay or silage did not affect milk yield. Feeding supplemental corn increased milk yield but only at the medium and high levels of corn inclusion ($P < 0.05$). Milk fat, protein, and lactose contents were similar across all treatments; there was a tendency for milk protein to be higher with GSHC diet ($P < 0.07$). Gamagrass silage increased the conversion of feed N to milk N compared to gamagrass hay ($P < 0.01$). Contrary to expectation, conserving gamagrass as silage lowered milk urea nitrogen (MUN) compared to hay. Supplemental corn further reduced MUN concentration. Increasing the level of corn supplementation in GS linearly decreased culture pH ($P < 0.04$) whereas NH_3-N was similar across treatments (27.9 mg/100 ml). Reduced concentrations of MUN are indicative of improved N status of cows. Difference in N efficiencies for cows fed gamagrass as hay or silage may be related to changes in the protein fraction during the conservation process.

Keywords: eastern gamagrass, corn, dairy cows, continuous cultures

Remnant Diabase Grasslands in North-Central North Carolina (10/3, 10:30-12:00)

R. Evans, S. Hiltner, D. Kanipe, M. Pyne

Piedmont Prairies

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The diabase geology of North-central North Carolina supports remnants of several historically prevalent plant communities whose original characteristics must be extrapolated from their fragmented and degraded current state. This suite of vegetation types ranges from annual grass-dominated glades, through perennial grass-dominated barrens, to distinctive oak-shortleaf pine woodlands. Of these diabase-influenced vegetation types, which host a number of rare and disjunct species tracked by the NC Natural Heritage Program, the most poorly understood and speculative is the perennial grass-dominated barrens. These currently maintain a tenuous existence along roadsides, under powerlines, and on private and public lands, only a few of which are adequately protected and managed. We will provide an overview of the flora of existing sites and present preliminary results of an inventory of remnants in a 3 county study area (Durham, Granville, Orange). Using soil maps, expert knowledge, rare plant locations, and field surveys, we have compiled a list of known sites and a quality ranking process by which to evaluate these sites. Further, we will discuss issues involved in the restoration, management and potential expansion of these sites for long-term protection.

The Interrelationships of Anatomy, Productivity, Physiology, and Forage Quality in Switchgrass (10/3, 1:30-3:00)

D.S. Fisher, J.C. Burns, and D.H. Timothy

Biofuel and Forage Production I

USDA-ARS, South Atlantic Area, 1420 Experiment Station Rd, Watkinsville, GA 30677

Switchgrass (*Panicum virgatum*) has shown promise as a native subtropical grass for both forage production and wildlife habitat in the eastern USA. A group of 6 types from a collection made in the humid east were selected to represent a range in estimated nutritive value and yield potential. In an effort to more fully evaluate this germplasm and test methods of identifying material of value in cultivar development, we examined the plant material for variation in photosynthetic rates, carbohydrate accumulation, leaf anatomy, and forage quality. We found that dry matter yield was correlated with lamina concentrations of starch. The strongest correlation with yield was found with starch measured near sundown ($r = 0.98$) but the correlation was also strong with the estimated fluctuation in carbohydrate from evening to morning ($r = 0.83$). This fluctuation occurs due to an accumulation of carbohydrate during the day while photosynthesis is in excess of carbohydrate export and the decline that occurs due to carbohydrate export without photosynthesis at night ($r = 0.83$). Significant variation was found in lamina thickness, vascular bundle perimeter and area, and in the spacing of the vascular bundles. Vascular bundle spacing ($r = -0.74$) and lamina thickness ($r = -0.76$) were negatively correlated with estimates of dry matter in cell walls. An index of the percent vascular bundle in cross sectional area was negatively correlated with variation in starch content ($r = -0.84$) and digestion ($r = -0.93$) and positively correlated with estimates of cell wall ($r = 0.79$), lignin ($r = 0.95$), and hemicellulose ($r = 0.91$). Variation in starch content from evening to morning may be useful in plant breeding programs for switchgrass improvement since it may provide selection for increased yield without selecting for higher cell wall components and consequently reduced nutritive value.

What Were the Dominant Native Grasses of the Carolinas? (10/1, 10:30-12:00)

Cecil Frost

Southeastern Native Grasslands

North Carolina Department of Agriculture and Consumer Services, Plant Conservation Program

Before European settlement, the landscape of the Carolinas supported a rich diversity of grasslands and fire-maintained woodlands having flourishing grassy understories. With exception of fire-refugial communities such as mountain cove hardwood forests and steep north slope beech communities on the Piedmont, most uplands were visited by fire at one frequency or another. Today's grass-forb remnants likely represent less than 2% of the original extent. With exception of coastal marshes and the drier longleaf pine/wiregrass habitats, we do not know the original dominant grasses, and original species composition can only be inferred from those species hanging on in the fire-suppressed landscape. Most species diversity, including most rare species, is found in the herb layer. Exclusion of fire from natural communities has led to development of multistoried woody vegetation, excessive shade, litter buildup and consequent depauperization of the herb layer. Loss of the species-rich grass-forb layer throughout eastern North America is an ecological catastrophe still largely unrecognized. We have learned enough, however, about presettlement fire frequencies in recent years to begin to reconstruct the original ground cover landscapes of the Carolinas.

Vegetation Composition of Early Successional Longleaf Pine Conservation Priority Area Fields in Southern Georgia, USA (10/3, 1:30-3:00)

Brian J. Gates John P. Carroll and Robert J. Cooper

Native Community Restoration II

Daniel B. Warnell School of Forest Resources, University of Georgia, Athens, GA 30602; big1774@owl.forestry.uga.edu

It has been documented that the longleaf pine (*Pinus palustris*) ecosystem is essential habitat for many species of wildlife and that the ecosystem's distribution has dramatically decreased since European settlement of North America. Changes to the Farm Bill in 1998 established a National Longleaf Pine Conservation Area (CPA) within the Conservation Reserve Program (CRP) with a goal of restoring the longleaf pine ecosystem. In this CPA, longleaf pine is planted on private lands in former agricultural fields. The understory of longleaf pine ecosystem is traditionally comprised of a variety of fire resistant and native grasses and forbs. However, invasive and often exotic, agricultural pests, such as Bermuda grass (*Cynodon dactylon*) and coffee weed (*Senna obtusifolia*) could easily dominate old-field longleaf pine stands and could make these stands less valuable for wildlife. Regulations within this CPA require that these pest species be controlled; however this is very difficult in practical terms. We monitored vegetation, during May to July 2001, in 41 recently established (6 months to 3 years) longleaf pine stands in South Georgia to assess ground vegetation. We measured vegetation density, composition, percent coverage of grasses, forbs, shrubs/saplings, bare ground, and debris, and average pine sapling height. In addition, certain species were identified and quantified in each field including Bermuda grass, broom sedge (*Andropogon virginicus*), bahia grass (*Paspalum notatum*), crab grass (*Digitaria* spp.) and coffee weed. Our preliminary results suggest that the majority of the field's vegetative understory was composed of forbs (31.7%). In many cases, coffee weed was a major component of the forb content occurring in over 23% of all plots surveyed. Grass composed 21.8% of the field's understory, with Bermuda grass being the most abundant grass species (in 18% of the plots surveyed). Other exotic grass species, bahia grass and crab grass, were not as common, occurring in only 4.7% and 5.3% of the plots surveyed respectively. The only native grass surveyed, broom sedge, occurred in only 1.6% of the plots surveyed.

Keywords: longleaf pine, *Pinus palustris*, longleaf pine ecosystem, longleaf pine CPA, Farm Bill, CRP, old fields, Bermuda grass, bahia grass, crab grass, native grass, coffee weed, exotic grass species, invasive grass species, agricultural weeds

Establishment of Native Perennial Grasses on Superfund Sites Contaminated with Heavy Metal in the Eastern United States (10/1, 10:30-12:00)

Robert Glennon[1] and Martin vander Grinten[2]

Erosion Control/Reclamation

[1] U.S Fish and Wildlife Service, Edenton, North Carolina; bob_glennon@fws.gov; and [2] Natural Resources Conservation Service, Big Flats, New York

Native perennial grasses have been used to revegetate superfund sites contaminated with heavy metals throughout the eastern United States since those areas have been reclaimed. Most of the sites have the contaminated soil removed and the native perennial grasses are being utilized due to their adaptation to the dry, infertile acidic subsoil or fill imported to cover the area. Secondary advantages are low maintenance, wildlife habitat development, and tendency of the stands to allow succession to occur. They have been used to stabilize contaminated soil on site at the Palmerton Superfund site where 2,000 acres of steep mountainside were contaminated with zinc, cadmium, and lead from a smelting operation in east-central Pennsylvania. Researchers from the USDA, Natural Resources Conservation Service; USDA, Agricultural Research Service; and Pennsylvania State University collaborated to conduct greenhouse studies and conducted field trials with native and exotic grasses and legumes and sludge and fly ash mixtures to revegetate the area. The results of their work have been used to develop a reclamation plan for the site and revegetate 1,000 acres. Many species were screened in greenhouse trials to narrow the number of treatments to be tested in the field. Several single species and mixtures of species (tall fescue/birdfoot trefoil, perennial ryegrass/flatpea, intermediate wheatgrass, switchgrass, big bluestem) were tested, established successfully and have persisted. The traditional tall fescue/birdsfoot trefoil and perennial ryegrass/flatpea mixtures established the quickest, but formed a solid stand that is not readily colonized by seeds carried by the wind or wildlife. The warm season grasses allowed colonization, but were slow to establish. The native cool season intermediate wheatgrass established quickly and also allowed colonization due to its nature as a bunch grass. The sludge:fly ash ratio of 1:1 optimized establishment of herbaceous plants.

Keywords: native perennial grasses, superfund site revegetation, switchgrass, indiangrass, big bluestem, little bluestem, intermediate wheatgrass, sludge, fly ash

Establishment of Native Warm-Season Grasses on Abandoned and Reclaimed Coal Mines in the Northeastern United States (10/1, 10:30-12:00)

Robert Glennon[1] and Martin vander Grinten[2]

Erosion Control/Reclamation

[1] U.S Fish and Wildlife Service, Edenton, North Carolina; bob_glennon@fws.gov; and [2] Natural Resources Conservation Service, Big Flats, New York

The Natural Resources Conservation Service has conducted field trials with other agencies over the past thirty years to test the establishment and persistence of native warm season grasses on abandoned and reclaimed coal mines in the northeastern United States. The results of these trials have been transferred to routine field use in technical standards and specifications and university extension publications. The major commercially available species (deertongue, switchgrass, indiangrass, big bluestem, little bluestem, eastern gamagrass, coastal panicgrass) have all been established successfully and have persisted on mine sites. They pose less competition to planted trees and shrubs than non-native groundcovers do, and allow more colonization by native forb species. Each species has a unique niche in the reclamation strategy from the low pH and aluminum and manganese tolerance of deertongue, to the stiff-stemmed wildlife cover value of switchgrass, to the high forage quality of eastern gamagrass. Mixtures of these grasses can be accommodated by combining compatible species and adjusting seeding rates so no one species dominates the mixture. Standard establishment recommendations such as early sowing to achieve stratification, good seed-to-soil contact by drilling and packing, and weed control are as critical as they are on natural soil.

Keywords: native warm season grasses, mine reclamation, deertongue, switchgrass, indiangrass, big bluestem, little bluestem, coastal panicgrass, eastern gamagrass

Two Approaches to Reintroduction: Economy or Expense (10/1, 1:30-3:00)

Jeff Glitzenstein

Native Community Restoration I

9509 Liska Rd, Tallahassee, FL 32311

Broadly speaking, one might describe two approaches to starting new populations of rare plant species. By analogy with air travel, I will refer to these as first class and economy class. The first class approach, employed by persons or organizations with substantial financial resources, consists of the following: (1) Perform careful quantitative macro-habitat and microhabitat studies so as to most effectively chose an introduction site. (2) Collect genetic data from a variety of populations. (3) Introduce sufficient numbers of plants

from a sufficient number of locations to encompass the known genetic variation. (4) Utilize sophisticated demographic monitoring to carefully project future population trends and assess risk events. If you can afford it, this is the way to go. The economy approach, which can be employed those by with limited resources but substantial field experience, includes the following steps: (1) Choose an introduction site based on easily evaluated qualitative criteria, e.g. soils maps and common plant associates. (2) Introduce seeds or seedlings at ecologically appropriate times; pay careful attention to rainfall events and frosts and protect new plants if necessary. (2) Don't worry about genetics in the short term but maintain a long-term goal of gradually adding to genetic diversity. (3) Introduce as many plants as practical at any single point in time but gradually increase population size over the long-term. (4) Utilize the Menges-Gordon approach to population monitoring. Because it is low cost, the economy approach can be used to simultaneously initiate many new rare plant populations with minimal effort. We have been utilizing this approach to start multiple new populations of rare and common longleaf pine ground-layer plants on sites ranging from research plots in Francis Marion National Forest, SC, to our front lawn, a *Paspalum notatum* savanna on a sand ridge near Tallahassee, FL. We conclude that starting new populations of longleaf pine ground-layer species may be relatively simple and, if practiced by enough individuals, may contribute substantially to the long-term persistence of those species.

A New Eastern Gamagrass Cultivar for the Southern United States (10/3, 1:30-3:00)

Janet Grabowski, Scott Edwards, and Joel Douglas

Biofuel and Forage Production I

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In 2003, the USDA Natural Resources Conservation Service (NRCS) Jamie L. Whitten Plant Materials Center, Coffeeville, Mississippi, will be releasing a new cultivar of eastern gamagrass for forage and biomass production, soil stabilization, and water quality and wildlife habitat improvement. The cultivar, NRCS accession 9062680, will be named Highlander. The source material for this cultivar was collected in Montgomery County, Tennessee. Chromosome counts indicate that it is a tetraploid (2n = 72). Highlander was tested at various locations throughout the southeastern and south central United States and it provided average annual dry matter (DM) forage yields of 16 456 kg ha-1 on a 45-day cutting schedule. Tests at Coffeeville have shown potential DM yields of 13 850 kg ha-1 when plants were cut once annually for bioenergy fuel production. This cultivar has shown resistance to a devastating root and crown rot that killed mature plants of other eastern gamagrass accessions at Coffeeville. Tentative identification of the causal organisms showed that species of *Pythium* and *Rhizoctonia* were present and may have acted together as a disease complex. Highlander seed should be available on the commercial market for the 2005 planting season.

Keywords: *Tripsacum dactyloides*, forage, bioenergy, *Pythium*, *Rhizoctonia*

Establishing Native Warm-Season Grasses using Conventional- and No-till Technology with and without Plateau® Herbicide (10/1, 1:30-3:00)

Craig A. Harper and Charles E. Dixon

Establishment and Management I

charper@utk.edu

Native warm-season grasses provide habitat for a wide variety of wildlife species associated with early successional habitats. Efforts to establish these grasses have not always been successful. We sowed big bluestem, little bluestem, indiangrass, and switchgrass (8 pounds PLS per acre) in separate, replicated plots using conventional tillage with top-sowing and no-till technology to compare establishment success at 2 Experiment Stations. Further, we evaluated the effectiveness of Plateau® herbicide (8 ounces per acre) with both planting methods in a split-plot design. More big bluestem (12.9 : 3.8 per m2), little bluestem (8.1 : 2.8 per m2), and indiangrass (15.5 : 4.5 per m2) seedlings were established when planted via no-till than by top-sowing ($P < 0.001$) at the Middle Tennessee Experiment Station; however, there were no differences in number of seedlings established at the Highland Rim Experiment Station. Precipitation at Highland Rim was less during the initial growing season than that at Middle Tennessee and the average number of seedlings established was lower also. Plateau® herbicide eliminated competition by crabgrass on all plots, but also reduced the number of switchgrass seedlings. However, even when reduced by Plateau®, adequate cover remained for wildlife in the switchgrass plots (1 - 2 bunches per m2). When sowing big and little bluestem and indiangrass for wildlife, we recommend a rate of 5 - 6 pounds PLS if drilled and 8 pound PLS if top-sowed to create favorable structure at ground level for nesting, brooding, and escape cover. When sowing big bluestem or switchgrass for hay/pasture, we recommend a rate of 8 - 10 pounds PLS using a no-till drill.

Soils: Base Saturation and 19th Century Piedmont Agricultural Patterns (10/1, 10:30-12:00)

Douglas Helms

Southeastern Native Grasslands

Senior Historian, Natural Resources Conservation Service, P. O. Box 2890, Washington, DC 20013-2890

The relationship of native grasses to neutral soils has been observed in the Southern Piedmont. The same chemical soil conditions that make neutral, base-rich soils favorable habitat for grasses would also benefit some agricultural crops. This correlation would be particularly true before the availability of commercial fertilizers, including lime, to correct acidity. Soil Taxonomy, the soil classification system of the National Cooperative Soil Survey, uses base saturation (by sum of cations) as one of the criteria to define the order, Alfisols. Soil surveys of Piedmont counties provide maps and other information on the scattered Alfisols of the Piedmont. Ultisols, the dominant soil order of the Piedmont, are defined in part by low base saturation. This presentation will examine the relationship of agricultural production, farm structure, and slavery to the pattern of Alfisols and Ultisols found in Piedmont counties. In addition to soil survey data and historical literature, the presentation will rely on an analysis of farm- and county-level data in manuscript agricultural censuses for 1850 to 1870 to examine the effect of soils on agriculture.

Habitat Restoration of Pine Savannas and Mississippi Sandhill Crane Response (10/1, 3:30-5:00)

Scott G. Hereford and Charles A. Wilder, Jr.

Wildlife Habitat and Biodiversity I

Mississippi Sandhill Crane National Wildlife Refuge, 7200 Crane Ln, Gautier, MS 39553

Key objectives of the 19,000 acre Mississippi Sandhill Crane National Wildlife Refuge in Jackson County (extreme southeastern), Mississippi are to recover and protect the Mississippi sandhill crane (*Grus canadensis pulla*) and to restore and maintain the native wet pine savanna. The Mississippi sandhill crane is an endangered subspecies found in the wild only on and adjacent the refuge. The wet pine savanna is a fire-maintained grassland with scattered pines and a highly species-rich ground cover of graminoids, forbs (including distinctive taxa like carnivorous plants) and small shrubs. It is also one of the more endangered ecosystems with only 3-5% of the original area in the southeastern United States remaining.

Clewell (1999) defined four distinctive habitats as part of this system: pine flatwoods, wet prairie, cypress flats, and cypress strands. Because of fire suppression, silviculture, and development, these habitats were converted to gallberry and titi thickets, hardwood forests, and forested swamps. Largest challenges in restoration included altered hydrology, woody plant colonization, and invasive plants.

Restoration included a combination of management strategies such as prescribed fire; mechanical treatments to remove woody plants; use of water control structures and creation of small shallow water areas; and pest plant chemical and mechanical treatment. A large and long-term crane population restocking, predator control, protection, and small food plots were other important crane recovery strategies. Several thousand acres of pine savanna were restored. Flowering of native bunchgrasses was the highest in generations. Some of the tracts were used as reference sites for other restoration projects. Crane use of restored sites was significant. The crane population increased from 30-35 individuals including 5-6 breeding pairs to over 120 individuals including nearly 25 breeding pairs. Other trust species such as Henslow's sparrows greatly benefited.

Keywords: *Grus canadensis*, habitat, pine savanna, restoration, sandhill crane, savanna, national wildlife refuge

Effects of Eastern Red Cedar Removal on Birds Wintering in the Texas Post Oak Savannah (10/1, 3:30-5:00)

Richard Hines

Wildlife Habitat and Biodiversity I

U.S. Fish and Wildlife Service, White River NWR, P.O. Box 308, DeWitt, AR 72142, 870-946-1468; richard_hines@fws.gov

During the winter of 1999-2000, a comparative study was conducted in a post oak savannah to determine preferred habitats of wintering birds. A census of birds was conducted along 16 permanent transects placed across two sections of the Pat Mayse Wildlife Management Area (WMA) in northeastern Texas in order to determine the effect of eastern red cedar *Juniperus virginiana* removal as part of an ongoing savannah restoration project. Along these transects, eight separate habitat types typifying various stages of succession in a post oak savannah were evaluated for responses of both resident and migratory birds wintering on the site. Of the eight habitat types the cedar clump habitat and cedar thicket habitat ranked low for preferred habitats. Preferred habitats were heavy brush followed by hardwood clumps. While eastern red cedar is considered a nuisance invasive species, there was concern that cedar may provide important winter habitat (thermal, etc). This study indicates elimination of eastern red cedar will not impact wintering avian communities, providing that other more preferred habitats are available.

Establishment of Native Grasses and Forbs Using Plateau Herbicide (10/1, 3:30-5:00)

Jef Hodges

Establishment and Management II

Total Resource Management (formerly Environmental Repair Services); jef@prairiesource.com

Native warm season grasses have developed the reputation of being difficult to establish. The recent introduction of Plateau herbicide, by BASF, has significantly increased establishment success. Anecdotal evidence, based upon 5 seasons of establishment experience shows, when Plateau herbicide and proper techniques are used, stands can be established in one growing season. In addition, using specified strategies, Plateau application rate and application timing can enhance existing stands infested with invasive exotic species and be used to speed the establishment of prairie restorations that include non tolerant desirable species.

Keywords: native warm season grasses, establishment, Plateau herbicide

Priority Birds Dependent on Southeastern Grassland Communities (10/1, 3:30-5:00)

William C. Hunter

Wildlife Habitat and Biodiversity I

U.S. Fish and Wildlife Service, Division Migratory Bird Management, 1875 Century Boulevard, Suite 240, Atlanta, GA 30345; chuck_hunter@fws.gov

A review of priority birds for conservation attention will be presented to include species dependent upon natural communities such as prairies, bogs, glades and barrens, savannas, flatwoods, and sandhills from the southeastern United States. Management considerations for both natural and artificial habitats will be discussed.

Keywords: priority birds, southeastern United States, prairies, glades, barrens, savannas, flatwoods, sandhills

Potential Native Grasses and Forbs for the Southern Appalachians (10/3, 10:30-12:00)

Gary Kauffman

Landscaping/Rights-of-Way I

USDA Forest Service, P.O. Box 2750, Asheville, NC 28802-2750

A 4-year study to identify appropriate native plant mixes for use on federal lands along the Blue Ridge Parkway was initiated in 1998 with money provided by the National Biological Survey. Short-term objectives for this study was to identify potential native plant species for quick establishment, collect local ecotypes of these species and experimentally study them at different sites along the Blue Ridge Parkway and the National Forests in North Carolina. Twenty-one grasses, three sedges, one rush, and forty-five forbs were gathered in 1998. The collected grasses and forbs were established within increase beds at three separate locations varying in elevation from 2200 to 5500 feet. These increase beds provided germplasm for additional establishment trials. Species were evaluated as to their suitability for establishment within recently disturbed soil. After three years of establishment the evaluated species has been reduced to the hardiest species, having survived three successive droughts. The successes included 2 cool season grasses, 4 warm season grasses, and 21 forbs. A series of potential grass/forb species list were developed based on different height classes and by elevation gradients. Weed control presented problems without application of a preemergent herbicide or detailed long term soil preparation prior to sowing. One alternative weed suppression method was developed with the use of *Coreopsis pubescens* and *Rudbeckia triloba*, two forbs that serve as early seral nurse crops.

Establishing Native Warm Season Grasses to Improve Wildlife Habitat on a Landscape Scale: The Pennsylvania Conservation Reserve Enhancement Program (10/1, 3:30-5:00)

Scott Klinger

Wildlife Habitat and Biodiversity I

Pennsylvania Game Commission, Bloomsburg, PA

Over the past 30 years grassland bird populations have declined by over 80% across southeastern Pennsylvania. As agricultural land has been lost to development, the intensity of farming increases on remaining agricultural lands. As a result, undisturbed grassland nesting cover has become an endangered habitat. The value of

native warm-season grasses (NWSG) for grassland bird nesting and winter cover has been well documented. Unfortunately, in the Northeast, farmers have been slow to adopt NWSG. During 2001, 2002 and 2003 a public and private partnership in Pennsylvania has the potential to establish over 25,000 acres of NWSG in 20 southeastern Pennsylvania counties through 10-15 year contracts under Pennsylvania's Conservation Reserve Enhancement Program (PA CREP). One of the objectives of the PA CREP is to restore grassland habitats and declining grassland wildlife populations in the region. In addition to annual rental payments for 10-15 years, the United States Department of Agriculture (USDA) and the State of Pennsylvania provide 100% reimbursement for establishing NWSG. Establishing NWSG on approximately 1,500 Pennsylvania farms will more than triple the acres of NWSG established during the past 20 years. A variety of methods are being used to educate landowners, custom operators, and agency and Non-Government Organization (NGO) staffs in the establishment and management of NWSG. Soil amendment recommendations for establishing NWSG were modified by Penn State University and USDA. The Pennsylvania Game Commission has provided 18 NWSG fluffy-seed drills to the 20 county partnership, plus an incentive payment for their cooperators. Custom operators are also sowing mixtures of de-bearded NWSG seed with modified conventional drills. Single species of NWSG, NWSG mixtures, and mixtures of NWSG and forbs are being sown. Native warm-season grasses are primarily being established in row crop and small grain residues, but also in some hay land.

Influence of Storage Time and Storage Conditions on Comparative Germination of Eastern Gamagrass Seed in the Greenhouse and Laboratory (10/1, 1:30-3:00)

Donald T. Krizek[1], Mary J. Camp[2], Susan R Maxon[2], Kathleen M. Davis[3], Jerry C. Ritchie[4], Miguel L. McCloud[1], and James Cline[1]

Establishment and Management I

[1]Sustainable Agricultural Systems Laboratory, ARS, USDA; dkrizek@asrr.arsusda.gov; [2]Biometrical Consulting Service, USDA, [3]National Plant Materials Center, NRCS, USDA, and [4]Hydrology and Remote Sensing Laboratory, ARS, USDA, Beltsville, MD 20705-2350

Previous studies reported at the 2nd Eastern Native Grass Symposium indicated that 1998 and 1999 seed lots of Germtec II TM treated seed of eastern gamagrass [*Tripsacum dactyloides* (L.) L] showed a decline in germination over a six-month period (March to Sept 1999). The study was repeated three times in 2000 using 1998, 1999, and 2000 seed lots of the above seed stored at 4C to determine the number of days for maximum germination. Germination tests were conducted in ARS and NRCS greenhouses, using a peat-vermiculite mix and a quadratic curve was fit for each replicate starting at its first non-zero germination day. From the curve, the day at which no further germination would be expected (Maxday) was calculated and the Maxday values were then analyzed with Lot as a fixed factor and Run as a block (random factor). Storage time (Lot) was found to have a significant effect on time and rate of germination. The average days for maximum germination of 1998 and 1999 seed lots were comparable, viz., 20.5 and 21.6 days which was significantly shorter than that determined for the 2000 seed lot, viz. 33.3 days. The median germination time for the 1998, 1999, and 2000 seed lots was 8.1, 9.6 and 15.2 days, respectively and the average percentage germination at day 28 for the three seed lots was 73.6, 51.1 and 52.9 days, respectively. This was comparable to results obtained in three State Seed Testing Laboratories in GA, NC, and OK, using water controls and an additional lot of 2000 seed that had been stored at room temperature vs. 4C. As in the greenhouse, the 1998 and 1999 seed lots had a significantly higher percentage of germination than the 2000 seed lots (regardless of storage condition for the 2000 seed). These results indicate: (1) that the 2000 seed lot may have developed physiological and/or morphological barriers to germination during maturation; (2) that a long period of storage time does not necessarily have an adverse effect on germination results; and (3) that 21 days may be sufficient for running germination tests on this species.

Biomass Production and Forage Quality of Eastern Gamagrass Grown on an Acid Compact Soil at Beltville, MD (10/3, 1:30-3:00)

Donald T. Krizek[1], Jerry C. Ritchie[2], James B. Reeves III[3], Ali M. Sadeghi[4], Charles D. Foy[1], Dennis C. Gitz III[5], Errol G. Rhoden[6], John R. Davis[7], and Mary J. Camp[8]

Biofuel and Forage Production I

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A field study was conducted at the Beltsville Agricultural Research Center from 1997 to 2001 to determine the yield and forage quality of 'Pete' eastern gamagrass [*Tripsacum dactyloides* (L.) L.] grown on an acid, compact soil. Total yield from two cuttings in 1997, 1998, 2000, and 2001 on unlimed, no-till sites averaged 3801, 4469, 6007, and 3039 kg/ha, respectively. A single cutting in July 1999 averaged 1981 kg/ha. In general, yields varied with position on the slope, bulk density, and thickness of the topsoil, but not with pH. Average yield was generally lowest at the top of the slope where the thickness of the Ap horizon was thinner, the soil was strongly acid (pH 4.3 - 4.4), and the bulk density and penetrometer resistance were generally greatest. The silt content and bulk density of the soil and the distribution of rainfall appeared to be important determinants of yield. Significant differences in yield were found among sites, year, and harvest date. Acid compact soils had little or no effect on forage quality and composition with only slight differences as a result of site. Time of harvest had a greater effect on forage quality than site. Overall, eastern gamagrass plants had a high fiber content as reflected by high values of neutral detergent fiber (NDF) and acid detergent fiber (ADF) but were not particularly high in lignin content. Crude protein and digestibility were relatively high although not as much as reported for some forage crops. Despite stress imposed by reduced topsoil, low pH, high bulk density, saturated soils in the spring, and deficits in soil moisture in the summer, eastern gamagrass produced relatively high yields with good forage quality. These findings indicate that it is ideally suited for reclamation of acid, compact soils and for producing high yields of forage on marginal lands.

Keywords: Acid compact soils, Aerenchyma, Biomass, Bulk density, Eastern gamagrass, Forage quality, Low pH, Stress tolerance, *Tripsacum dactyloides*

North Carolina's Native Wildflower Program (10/3, 10:30-12:00)

Don G. Lee

Landscaping/Rights-of-Way I

NC DOT-REU 1557 Mail Service Center, Raleigh, NC 27699-1557, (919) 733-2920

The North Carolina Wildflower Program began in 1985 with encouragement from individuals and garden clubs. Wildflowers

create dazzling displays of color from spring through fall for the state's travelers, proving that roadsides can be beautiful as well as functional. While some of the most popular wildflowers used by NCDOT are not native to North Carolina, there are several lovely natives that contribute handsomely to the program. Since the early 1990's the NCDOT has progressively fostered the use of more natives in our wildflower program. Initially, native wildflower seed was often found to be commercially unavailable or cost prohibitive. Thus, the NCDOT began a program of farming and harvesting native species for the purpose of producing more seed to be planted statewide along our roadsides. NCDOT has harvested the seed of New England Aster, Narrow-leaved or Swamp Sunflower, Annual Sunflower, Goldenrod and Bur-Marigold to be planted in wildflower beds, thereby increasing the use of these native species. The NCDOT has also grown several varieties of natives in a production agriculture operation on land made available by the Division of Forest Resources in Goldsboro, North Carolina. This land is currently planted with 33 acres of Bur-Marigold (*Bidens aristosa*) and 9 acres of Narrow-leaved Sunflower (*Helianthus angustifolius*). Seed harvested from this operation allows the NCDOT to provide many more acres of native wildflowers along our roadsides. The NCDOT recently purchased a gravity table to enhance the seed cleaning equipment already in use by the Div. of Forest Resources. The NCDOT owns and operates a K-2 Gleaner combine for harvesting the seed. The NCDOT works in conjunction with Dr. Fred Yelverton of North Carolina State University on wildflower research including solarization and herbicide tolerance of native species. Native wildflowers are essential to the success of the NCDOT Wildflower Program.

Estimating N Dynamics Under Field Conditions To Improve Switchgrass Production In Virginia (10/3, 3:30-5:00)

R. Lemus, D. Perrish, and D. Wolf

Biofuel and Forage Production II

Corresponding author: R. Lemus, Department of Crop and Soil Environmental Sciences, Virginia Tech, Blacksburg, VA 24061; rlemus@vt.edu

Determining an N budget (inputs, outputs, and internal fluxes of N) for switchgrass (*Panicum virgatum* L.) can improve management and lower production costs. The objectives of this research were to study the N budget of switchgrass stands and to estimate their N use efficiency. The study was conducted on two well-established 'Cave-in-Rock' switchgrass stands in the Piedmont and Ridge and Valley regions of Virginia. Treatments of 0, 90, 180, and 270 kg N ha-1 were applied in May 2001. Shoot, root, and soil samples were collected in July, September, and November. Nitrogen applications did not increase yields on either site. Averaged across sites, yields of 10.5, 11.4, 11.6, and 11.6 Mg ha-1 were observed with rates of 0, 90, 180, and 270 kg N ha-1, respectively. Higher yields were observed at the Ridge and Valley site, while higher soil C and N were observed at the Piedmont site. Nitrogen was translocated from shoots to roots between September and November. Shoot and root N concentrations – but not yield – increased with increased N applied, i.e., there appeared to be "luxury consumption" of N. These data suggest switchgrass biomass production can be maximized with relatively low levels of applied N.

Keywords: *Panicum virgatum*, nitrogen use efficiency, biomass

Isolated Prairies of the West Gulf Coastal Plain (10/1, 10:30-12:00)

Barbara R. MacRoberts and Michael H. MacRoberts

Southeastern Native Grasslands

Bog Research, 740 Columbia, Shreveport, Louisiana 71104 and Museum of Life Sciences, Louisiana State University in Shreveport, Shreveport, LA 71115

Prairies (open grasslands) are one of the best-studied plant associations in the world. Thousands of books and papers have been written on them and entire conferences focus on special aspects of their ecology, management, and restoration. Southeastern prairies, except for the prairie belt of Alabama and Mississippi, have been woefully neglected in this literature. However, they were extensive in pre-European times and there still exist many small, isolated prairies in the piney woods of the West Gulf Coastal Plain — east Texas, west Louisiana, and south Arkansas — that remain intact with their natural vegetation. We review distribution, floristics, management, and edaphic conditions of these little known and understudied grasslands.

Keywords: West Gulf Coastal Plain, calcareous prairies, isolated prairies, southeastern prairies

Piedmont Prairie Restoration in Mecklenburg County, NC Nature Preserves (10/3, 10:30-12:00)

Gary D. Marshall

Piedmont Prairies

Natural Resource Specialist, Mecklenburg County Park and Recreation Department Division of Natural Resources, Conservation Section North, Gall Sample Road, Huntersville, NC 28078; MARSHGD@co.mecklenburg.nc.us

Three sites designated as Piedmont Prairie Restoration Areas have been established in Mecklenburg County Nature Preserves, totaling approximately 74 acres. The McDowell Prairie was a series of agricultural fields where hay and grain was grown. The restoration began with the use of prescribed fire. Root tubers of Schweinitz's sunflower (a federally endangered species) were rescued from a road construction project, transplanted into the area. Since the McDowell site was formerly farmland, mechanized equipment was utilized to mow weeds, prepare the soil, and plant seed purchased from commercial sources. Mowing, burning, and herbicide application occur periodically, as needed, to help keep unwanted plants from invading the restoration area. The Dodge City Prairie, like the McDowell Prairie, is also in the McDowell Nature Preserve. It is visible from NC Rt. 49 at Shopton Road West. This site was approximately 10 acres of open field, most recently planted in corn and wheat. It is bordered by forest on two sides and roads on the other two, and like the others, was planted with a variety of warm season native grasses (WSNG) including Indian grass, big bluestem, little bluestem, and switchgrass. The Latta Prairie is located in a former mature hardwood forest, clear-cut in 1986, 6 years before Mecklenburg County purchased the property. Pioneer species like red bud, sweet gum, black cherry and eastern red cedar quickly established. The Department contracted with NCFS to install fire lines, shear off the trees and compact them (K-G & drum-chop). The first prescribed fire took place in 1995 and the Latta prairie has been burned each year since. The steep slope and heavy concentration of rock prevented the land from being tilled. Hand plantings using locally collected native seed or rootstock have occurred in several small plots and transects. Two other Piedmont Prairie Restoration sites are in the early stages.

Developing a Framework for Pine-bluestem Community Restoration in the Interior Highlands of Arkansas and Oklahoma (10/1, 1:30-3:00)

Ronald E. Masters

Native Community Restoration I

Tall Timbers Research Station, 13093 Henry Beadel Drive, Tallahassee,. FL 32312-0918; rmasters@ttrs.org

Shortleaf pine (*Pinus echinata*) – bluestem (*Andropogon* spp.) habitats were once a prevalent landscape component in the Ouachita Mountains. Frequent fire maintained these woodlands as distinctly open, pine-dominated communities with a bluestem grass to shrub dominated understory. Fire suppression has led to the replacement

of pine-grassland woodlands with closed canopy pine-hardwood forest types throughout the southeastern United States. For landscape and ecosystem restoration, quantitative knowledge of historical vegetation patterns across the landscape is essential in order to develop accurate restoration targets. Historical land use documents such as General Land Office (GLO) survey notes have successfully been used to describe presettlement and settlement landscapes. Analysis of GLO data in the Ouachita Highlands of Arkansas and later in Oklahoma provided targets for stem density, basal area and information on tree species composition for renewal of the pine-bluestem community. In the absence of quantitative data, plant community composition and fire regime may be inferred by review of sediment cores from bogs, human settlement patterns, and historical accounts. Sediment cores provide insights on long term community dynamics and possible occurrence of fires. Historical accounts give insights to help develop restoration targets based on plant and animal occurrence records. They may provide insight for developing a suitable fire regime from descriptions of aboriginal firing patterns and seasonality of those patterns. Where possible fire chronologies can be used to refine recommended fire regimes and landscape interaction. Understanding gained from long-term small scale experiments on fire frequency and plant community response can further enhance development of management plans. Implementing a restoration plan may require direct intervention to restructure the system in a manner that is conducive to perpetuating it with fire, particularly where time is critical for saving fire-dependant species.

A Piedmont Grass/Forb Prairie (10/3, 10:30-12:00)

James Matthews

Piedmont Prairies

Department of Biology, UNC-Charlotte, McEniry Bldg, 9201 University City Blvd, Charlotte, NC 28223

A four-acre wet, grass/forb prairie was discovered in the course of the Cabarrus County natural heritage survey. The site has not been impacted by plowing for over 150 years, having been mowed for hay during the times that equipment could be used. The dominant species of grass are Big Bluestem (*Andropogon gerardii*) and Eastern Gamma grass (*Tripsacum dactyloides*). The primary forb of interest is the Canada lily (*Lilium canadense* ssp. *editorum*). The site has been burned and/or mowed in the past four years, showing changes in the density and species composition of the vegetation.

Mycorrhizae in Restoration of Native Plant Communities at The Nature Conservancy's Disney Wilderness Preserve, Kissimmee, FL (10/3, 1:30-3:00)

Amy Miller

Native Community Restoration II

University of Florida, College of Natural Resources and Environment; aamiller@botany.ufl.edu

Restoration of pastures dominated by exotic grasses to the globally outstanding native species diversity of the pine flatwoods ecosystem will aid in the recovery of this vanishing community type in the southeast. Understanding how mycorrhizae fungi respond to restoration efforts and mycorrhizae colonization of native pine flatwoods species such as wiregrass (*Aristida beyrichiana*), can improve the success of pasture restoration efforts. Symbiotic relationships between plants and arbuscular mycorrhizae fungi are widespread. Mycorrhizae fungi aid plants in acquisition of nutrients and water (Sylvia 1999). Many pine flatwoods plant species including wiregrass (C. Kindell, FNAI, pers. comm.), have symbiotic associations with mycorrhizae. Mycorrhizae fungi have proven to play a vital role in prairie restoration, increasing native species cover in plots where inoculum was introduced below sown seeds (Smith et al.1998). Other studies have shown that soil disturbance and fallow treatments significantly reduce mycorrhizae populations (Kabir et al. 1999). This could have implications for pasture restoration since site preparation consisting of soil disturbance and fallow periods is often required to reduce exotic species (Harper-Lore 1998). The objectives of the study are: 1) to investigate the effect of pilot upland restoration efforts at The Nature Conservancy's Disney Wilderness Preserve (DWP, Osceola and Polk Counties, Florida) on the mycorrhizae inoculation potential (MIP) of the soils in the pilot plots and compare those potentials with the soil of the adjacent pastures and nearest high quality flatwoods, 2) to determine the differences in mycorrhizae colonization of wiregrass roots in the pilot plots and adjacent flatwoods, and 3) to investigate the effect of site preparation on the MIP of a 98 acre restoration site (compared to its adjacent pasture) and tracking mycorrhizae recovery and change over time. MIP tests will be performed to determine differences in inoculation potential among soil samples taken in the field.

Keywords: pasture restoration, wiregrass, *Aristida beyrichiana*, pine flatwoods ecosystem, Florida, mycorrhizae, mycorrhizae inoculation potential

Harbison-Walker Superfund Site Restoration, Cape May County, NJ (10/1, 10:30-12:00)

Christopher Miller and William Skaradek

Erosion Control/Reclamation

Christopher Miller: Regional Plant Materials Specialist (USDA-NRCS); cmiller@nj.nrcs.usda.gov; and William Skaradek: Manager, Cape May Plant Materials Center (USDA-NRCS)

On September 17th, 1999, the land known locally as the "Magnesite Property," comprising approximately 125 acres of undeveloped beachfront, dune, coastal wetlands and disturbed, former industrial area, came into the public domain through the efforts of New Jersey's Green Acres Program. This property represents a significant addition to the existing Higbee Beach State Wildlife Management Area and to Cape May Point State Park. From 1941 to 1983, Dresser Industries operated the Harbison Walker - Cape May Works, also known as the Northwest Magnesite Plant. Operations at the plant consisted of reacting softened, clarified sea water from Delaware Bay with limestone to produce a magnesium hydroxide solution. This solution was filtered and then fired in rotary kilns to produce magnesite refractory brick. The factory closed in 1983 and was demolished. Environmental contamination was cleaned up by Dresser Industries pursuant to the Environmental Cleanup Responsibility Act (ECRA). The only remains of the plant are a 10' chain link fence surrounding the plant site, a water tower, and scars on the landscape including a "landfill" of process waste primarily consisting of waste magnesite and limestone. The alkalinity of the process raw materials and waste is high enough to prevent the establishment of native vegetation. A plan to restore native vegetation to the scarred industrial portion of the property was developed by the Cape May Plant Materials Center and the Regional Plant Materials Specialist in cooperation with the NJ Department of Environmental Protection. The plan involved amending the high alkaline soil by incorporating dredge disposal material to the magnesite material. Seeding with a native cool/warm season grass and forb mixture was done in early winter as a dormant seeding. The site was then covered with a coir fiber erosion control matting to prevent seed desiccation and movement. First year plant establishment was encouraging. This paper will discuss the procedure undertaken and the progression of native plant establishment through two growing seasons on this unique site.

Keywords: magnesite, native grasses/forbs, dormant seeding, coir fiber matting

Incorporating Grasslands into the Suburban Landscape-Prairie for Profit (10/3, 1:30-3:00)

Marc Pastorek

Landscaping/Rights-of-Way II

Meadowmakers, 248 Charles Daughdrill Road, Carriere, MS 39426; ddarla@datastar.net

Meadowmakers Corporation is a design and contracting firm dedicated to bringing prairie landscaping to the horticulture mainstream in the southeastern United States. Our company provides locally collected propagules for installation projects by collecting from various locations within one hundred miles of the planting site. On occasion, seed will be collected and grown in nurseries to accelerate the establishment process. Plant rescues from development/construction sites have been organized to salvage doomed genetics. We have used twelve acres of property in Pearl River County Mississippi as an experimental site for restoration techniques. There are monoculture plots planted for future seed harvesting and plots established as collections from the various prairies of Mississippi, Louisiana, and Alabama. The original restoration work began in November of 1997 with many species becoming well established since then. Annual controlled burning has been used as a management tool to suppress invasive exotic plants such as Chinese Privet (*Ligustrum sinense*), Common honeysuckle (*Lonicera* species), and Vasey grass (*Paspalum urvillei*).

Herbaceous Plant Response to Biennial Burning Cycles Applies at Different Dates During the Growing Season: Preliminary Results (10/3, 3:30-5:00)

Tom Philipps and Joe O'Brian

Wildlife Habitat and Biodiversity II

Thomas Philipps, Botanist, U.S. Forest Service, Southern Research Station, 320 Green St., Athens, Ga. 30602

The increase in acreage treated with growing season fire during the past decade is indicative of the increased interest in burning during this period to enhance southern pine forest health and diversity. Information on how burn dates within the growing season can be manipulated to vary the mix of species is of practical importance. The objective of this study was to determine the response of herbaceous and woody plants to eight, 3-week treatment application windows during a biennial growing-season burn cycle at the Piedmont National Wildlife Refuge (PNWR) in Georgia. Early results indicate other environmental factors, possibly rainfall amounts, have had a greater impact on vegetational trends than prescribed burning.

Keywords: growing season burns, Lower Piedmont, wildlife Refuge, ordination, prescribed fire

Management and Research of Longleaf Pine – Wiregrass Communities on St. Marks National Wildlife Refuge, Florida, 1940-2002 (10/1, 10:30-12:00)

Joseph P. Reinman

Southeastern Native Grasslands

U.S. Fish and Wildlife Service, St. Marks National Wildlife Refuge; Joseph_Reinman@fws.gov

Longleaf pine (*Pinus palustris)* forests and savannahs once dominated more than 92 million acres in the Southeastern Coastal Plain. Historical records describe these forests as being relatively open with herbaceous groundcovers that were primarily grassland in nature. Today no more than three million acres remain, most of which is highly modified from the historic condition. St. Marks National Wildlife Refuge has actively managed longleaf pine sandhill and flatwoods forests by prescribed fire and overstory manipulation since 1940. This management has evolved over time from dormant season prescribed fires and even-aged pine management to prescribed fires throughout the year and multi-aged pine management. Research of these management activities has been ongoing since the late 1970's. Season of fire study plots were established in 1980 in conjunction with Tall Timbers Research Station and continue to be managed and evaluated. Fire research has documented plant responses including viable wiregrass (*Aristida beyrichiana)* seed production and seedling growth, shifts in groundcover flowering, longleaf pine recruitment, and overstory and midstory oak (*Quercus* spp.) declines as a result of a shift from dormant season to growing season fires. Research has also evaluated groundcover responses to mechanical site preparation techniques, wiregrass restoration, and methods of restoring longleaf pine overstories and groundcovers in slash pine (*P. elliottii)* plantations. Studies of wildlife associated with longleaf pine communities have included red-cockaded woodpeckers (*Picoides borealis*), indigo snakes (*Drymarchon corias couperi*), flatwoods salamanders (*Ambystoma cingulatum*), striped newts (*Notophthalmus perstriatus*), and neotropical migratory birds. The refuge continues to seek partnerships with researchers interested in examining various aspects of longleaf pine ecology and management.

Establishment and Management of Silvopasture in the Southeastern United States (10/3, 10:30-12:00)

J. Robinson, M. Hall, and S. Brantley

Establishment and Management III

S. Brantley: US Army Corps of Engineers, New Orleans District, PO Box 60267, New Orleans, LA 70160

Silvopasture integrates intensively managed forest overstory with sustained production of well managed, forage understory. With 164 million acres of forest, and 19 million acres of pasture in the southeastern United States, there is assuredly a place for the integration of the two. Systems have been implemented in Alabama, Florida, Georgia, Louisiana, and South Carolina with grazing systems under low-density conifer plantings that meet the criteria for "Silvopasture." Managers have utilized native, warm season grasses, bahia / clover, bermudagrass / clover, and tall fescue / clover mixes principally for forage. These systems allow trees to be grown as a long-term product; while on the same acreage an annual income is generated from grazing livestock. In these silvopasture systems longleaf pine, loblolly pine, or slash pine is grown at low stocking densities (35-300 stems per acre). This allows over half the sunlight to reach the ground for growing forage. Sound forest management in these unique situations requires thinning and pruning periodically throughout the rotation in order to maintain the proper light level for sustained forage production. As a result, much higher ratios of wood products fall into the categories of sawtimber or veneer products, which are valued much more than pulpwood. Greater total production and enterprise diversification advantages may drive the initiation of silvopasture establishment and management throughout the southeast, but side benefits can include erosion control, improved animal habitat, and increased carbon sequestration.

Keywords: silvopasture, longleaf pine, native warm season grass

Establishment, Production, and Management of Switchgrass for Biomass Feedstock in the Northeastern U.S. (10/3, 10:30-12:00)

Matt A. Sanderson, R. Howard Skinner, Curtis Dell, and Bill Curran

Establishment and Management III

USDA-ARS Pasture Systems and Watershed Management Research Unit, Department of Crop and Soil Science, The Pennsylvania State University

Switchgrass (*Panicum virgatum* L.) has been identified as a model

herbaceous energy crop for the U.S. Estimates indicate that approximately 8 million tons of biomass could be available from dedicated energy crops grown in the northeastern U.S. in the future if priced at $50 per dry ton delivered. Other estimates indicate that about 3 million acres are suitable for dedicated biomass production from switchgrass in the northeast. Thus, perennial herbaceous energy crops could be a significant new agricultural crop in the northeast in the future. The principal constraints to switchgrass production in the northeast are reliable and economic establishment techniques and efficient use of external nitrogen inputs. The economics of producing energy crops depend on biomass yield, conversion efficiency, and cost of fossil fuel. Higher costs of biofuels compared to fossil fuels can be rationalized on the basis of external costs such as environmental benefits. These benefits include reduced runoff and erosion and associated reduced losses of soil nutrients and organic matter; increased incorporation of soil C, which improves soil properties, especially on degraded land; and reduced use of agricultural chemicals. Use of warm-season perennial grasses may also mitigate increases in atmospheric CO_2. A near zero net C exchange, depending on fertilizer and fossil fuel use results from using biomass-derived fuels instead of fossil fuels, but also includes potential net CO_2 reduction by sequestration of C in soil organic matter. Increases in soil organic C under warm-season perennial grasses have been reported for plot experiments in the northeastern U.S. Biomass cropping systems may also be useful in recycling municipal sewage sludge and livestock manure and as a buffer strip for protecting riparian zones. New research on biofuels at the USDA-ARS Pasture Systems and Watershed Management Research Unit will focus on sustainable biofuels cropping systems.

Keywords: herbaceous energy crops, warm-season grasses, biofuels, carbon sequestration

Landscaping with Fire (10/3, 1:30-3:00)

Terry Schultz

Landscaping/Rights-of-Way I

Carolina Greenery, (910) 947-3150; habitats@carolinagreenery.com

See how prescribed fire is used in designed landscapes. Even when used in designed applications, many of our southern, fire-adapted native plants require fire to achieve their full health and vigor. Post-fire plant responses also create an interesting and valuable ecological demonstration. This presentation will show how fire is used in designed native plant landscapes to realize the full aesthetic of fire-adapted plants and to promote native plant ecology. Carolina Greenery provides consultation, project oversight and management, and native plants for wildlife habitat enhancement, ecological restoration and demonstration projects, and designed landscape areas.

Flowering and Seed Production Response of Wiregrass to Defoliation (10/1, 1:30-3:00)

John Silvoy, Sharon Pfaff, and *Roger Gates.

Establishment and Management I

NRCS Plant Materials Center, Brooksville, FL; University of Georgia, Crop & Soil Sciences Department; and *South Dakota State University, Rapid City, SD.

Wiregrass (*Aristida beyrichiana* Trin. & Rupr.) is keystone species of the longleaf/wiregrass communities of the Southeast, contributing significant amounts of fine fuels for understory burn management programs. Therefore, those wishing to reestablish pineland habitats often desire to first establish wiregrass. Dependable commercial supplies of seed are needed to meet this growing demand. Little information is available to enhance seed production, either from existing natural stands or from monoculture production fields. Cultural methods, which will maximize viable seed production and stand longevity, need to be developed. Experiments were conducted over two seasons on nursery plantings at the Brooksville, FL, NRCS Plant Materials Center and natural stands at the Univ. of GA Alapaha Station to quantify management effects on seed production. Seed production was monitored in nursery plantings at Brooksville, following mowing or July burning, with or without K fertilization. Clipping wiregrass plants close to ground level was as effective stimulating production of reproductive tillers as burning, but plant survival was improved. Potassium fertilization did not influence seed production or viability. In natural stands at Alapaha, ground level mowing with a sickle bar, followed by raking, increased the proportion of plants producing reproductive culms and the number of culms per plant in flower compared to unmowed areas. In the second year, rotary mowing (100 mm stubble) did not stimulate flowering.

Keywords: *Aristida*, wiregrass, seed production, mowing, burning, fertilization, potassium

Native Grass Ecovars: Potential for the Southeastern USA (10/3, 10:30-12:00)

S.R. Smith, Jr., A.T. Phan, and D.B. Wark

Establishment and Management III

Virginia Tech, 424 Smyth Hall (0403), Blacksburg, VA 24061; raysmith@vt.edu

There is increased interest in utilizing native grasses for conservation, restoration, livestock and landscape plantings, but their use is often limited by seed production and availability. Selection and breeding for increased seed production offers one option, but there are concerns that selection may reduce genetic diversity and result in a loss of important adaptation characteristics. The objective of this paper is to outline the native grass ecovarTM (ecological variety) development strategy used in the northern Great Plains and describe its potential application in the Eastern USA. The term ecovarTM (ecological variety) was coined to describe plant material where maintenance of genetic diversity was just as important as selection for specific characteristics. This paper will describe the collection, selection and evaluation process for three native grasses: little bluestem, blue grama, and junegrass. Up to 1000 plants were collected for each of these species from 11 to 20 locations in western Canada. Extensive measurements were made on all collected plants and the characteristics that related to seed production were used to select a broad based, genetically diverse ecovarTM for each species. The maintenance of genetic diversity was measured using morphological and DNA markers (RAPD). Results for blue grama showed that only nominal shifts occurred in genetic diversity during the process of selection for improved seed yield. We believe that the ecovarTM development strategy has potential application in the Eastern USA to increase the availability of regional broad based native grass seed sources. This paper will outline how the ecovarTM or similar strategy could be employed in the region. (Keywords on next page.)

Keywords: native grass, ecovarTM, genetic diversity, little bluestem (*Schizachyrium scoparium*), blue grama (*Bouteloua gracilis*), junegrass (*Koeleria macrantha*)

Nutrient Uptake Dynamics and Biofuel Potential of Switchgrass in Maryland (10/3, 3:30-5:00)

K.W. Staver

Biofuel and Forage Production II

University of Maryland, College of Agriculture and Natural Resources, Wye Research and Education Center, P.O. Box 169, Queenstown, MD 21658; ks82@umail.umd.edu

Warm-season grasses are being widely promoted in Maryland through state and federal programs to enhance wildlife habitat and reduce nonpoint source pollution from agriculture. They are being planted primarily in buffer areas next to streams and wetlands. However, with recent concerns regarding global climate change due

to increasing atmospheric CO2 concentrations, the potential for using warm-season grasses as a renewable energy source has received increasing attention. In addition, options are needed to make buffer areas economically viable if subsidy programs are no longer available, without unduly sacrificing water quality and wildlife benefits. The primary objective of this study is to evaluate biofuel production and nutrient uptake capabilities of Switchgrass (*Panicum virgatum* L.) and Eastern Gammagrass (*Tripsacum dactyloides* L.) under a range of nutrient loading conditions. Replicated plots of Eastern Gamagrass and Switchgrass (Kanlow) were planted in 1996. Nitrate leaching has been monitored continuously since the 1996 growing season. In June 1998 poultry litter was applied at 3 and 6 tons/acre. In May 2000 an additional Switchgrass treatment was established that received an application of 112 kg N/ha as ammonium-nitrate. Above-ground dry matter and nutrient content were measured in early September 1998 and plots were harvested in early April 1999 just prior to the onset of new growth. It was harvested in early April 1999 just prior to the onset of new growth. It was determined that biofuel characteristics would be greatly improved by delaying harvest until spring due to leaching of K with relatively little loss of total yield. It also was determined that Eastern Gammagrass had relatively little potential as a biofuel crop but was superior to Switchgrass in terms of potential for4 total N uptake. In subsequent years, plots were harvested in spring with no additional nutrient applications. Spring-harvest yield, nutrient uptake, and energy content data from 1999-2002 will be presented along with a brief description of the small-scale boiler system installed to utilize switchgrass.

River Cane, A Unique Woody Grass (10/1, 1:30-3:00)

Adam Turtle

Native Community Restoration I

Earth Advocates Research Farm, 30 Myers Road, Summertown, TN 38483-7323

First described in 1788, our native "cane" (*Arundinaria gigantea*) has over the years had no fewer than 23 different names. It has been both over and under studied and there are many misconceptions. The potential benefits of restoring cane include its historical uses and applications, remediation of abused ecologies, and as yet not fully explored "high tech" avenues. The 'problems" include identifying appropriate and/or elite ecotypes, nursery production, and establishment/management. These will be addressed briefly. I am an ethnobotanist and operator of a Bamboo specialized nursery and will share the results of 23 years of field study, literature search, and experiment in a multi-faceted overview. Some original conclusions will be presented. History, lore, known attributes, potential applications and current problems will be discussed.

Development of Sustainable Native Wildflower and Grass Meadows for Maryland Highway Roadsides (10/3, 1:30-3:00)

R. Jay Ugiansky, John Englert, Jennifer Kujawaski, and Dan Dusty

Landscaping/Rights-of-Way II

USDA-NRCS National Plant Materials Center, Bldg. 509, Soil Conservation Rd., Beltsville, MD, 20705; Rjay.Ugiansky@md.usda.gov

A cooperative project with the Maryland State Highway Administration was initiated in 1999 to study the establishment and maintenance of native meadows comprised of diverse grasses and wildflowers native to Maryland. The establishment of these roadside meadows will increase species diversity, improve wildlife habitat, and reduce maintenance costs. Our objectives are to develop practical methods of establishing mixes of native wildflowers and grasses, taking into consideration time of year, seedbed preparation, equipment needed, and post-planting treatments. We will develop mixes using appropriate species of wildflowers and grasses to provide a primary matrix for cover and provide a sustainable wildflower display, as well as assess the suitability of currently underutilized but commercially available species of native wildflowers for use along highway roadsides. We will assess the maintenance that might be required to keep the meadow sustainable. From our results we will develop standards and guidelines that may be used by Maryland State Highway Administration and others for seeding roadside wildflower mixes. Three mixes were used in the study: a tall mix, a short mix and a mix of underutilized species. Thirty-six establishment trial plots were seeded in June 2000, May 2001 and November 2001. The 9 treatments combined timing of seeding, planting method, and mulching. Twenty-four maintenance trial plots were seeded in May 2001 with plugs planted in July 2001. The 4 treatments included mowing, 4 oz./acre Plateau pre-emergent, 4oz/acre Plateau post-emergent, and a control. Evaluations began in August 2001 and will continue into 2003. The majority of plots were very successful, with very few weeds. Seedling vigor and weed prevalence varied more with the site conditions and the timing of seeding than with the seeding method. Species prevalence did vary with the timing of seeding and the seeding method. As expected, some species were found to be intolerant of 4oz/acre pre-emergent Plateau, with many experiencing delayed germination and growth.

Keywords: wildflower, grass, meadow, Maryland, highway, roadsides, establishment, maintenance, seeding, mowing, Plateau, sustainable

Selection, Installation and Maintenance of Ornamental Grass Beds for Golf Courses (10/3, 10:30-12:00)

Terry L. Vassey

Landscaping/Rights-of-Way I

General Superintendent, Sea Trail Golf Resort Sunset Beach, NC 28468

The use of ornamental and native grasses in a more formal bed setting is increasing on today's golf courses. For that reason, there are more species of grasses available than ever before. Many of the traditionally wild types (native and prairie grasses) are being hybridized and/or selected for a more ornamental look. Improvements in size, vegetative colors, brighter showier inflorescence (seed heads), growth habits and overall ease of maintenance requirements have been made. The most striking example is switchgrass (*Panicum virgatum*). Switchgrass, used mostly as a forage grass, is native to the American Midwest. Being a C4 warm season grass, it provides a tremendous amount of quality animal feed in the summer months when cool season grasses can falter. It has also been used in soil conservation mixes because it provides maintenance free soil cover. One new release, that is particularly note worthy, is Dallas Blue switchgrass. It has a beautiful, almost Carolina blue, color and displays a bright purple inflorescence in the fall. Additionally, other switchgrass varieties such as Heavy Metal™ , Cloud Nine™ and Prairie Sky™ to name only a few are also available. Other grasses that have been developed beyond their wild look are indiangrass (Sioux Blue™), little bluestem (The Blues™) and pink Muhly (Lenca). These are all very hardy in this area and once established are virtually maintenance free.

Native Grasslands of Southeastern North America (10/1, 9:00)

Alan Weakley, Robert Evans and Milo Pyne

Keynote Speaker

Corresponding author: Alan Weakley, University of North Carolina Herbarium, CB# 3280, Coker Hall, University of North Carolina, Chapel Hill, NC 27599-3280; phone: (919) 962-6931; weakley@unc.edu.
Rob Evans: NatureServe; rob_evans@natureserve.org;
Milo Pyne: NatureServe; mylo_pyne@natureserve.org

Glades, barrens, and prairies are among the plant communities naturally dominated by herbaceous or grassland vegetation. In the Southeastern United States these remnant native grasslands occur across all major physiographic provinces, from the Coastal Plain to the Interior and Appalachian Highlands in a wide range of ecological settings. We will provide an overview of these plant communities within the context of broadly defined categories recognized as distinct "ecological groups" in the United States National Vegetation Classification system. Some of these groups include; West Indian Prairies, Maritime Grasslands, Emergent Pond Marshes, Southern Appalachian Grass Balds, Coastal Plain Patch Prairies, Highlands Patch Prairies, and Riverscour Prairies. Our discussion will focus on the ecological setting, general floristic composition, and variation among these grasslands. If time permits, we will discuss the current conservation status of these communities

Keywords: Southeastern prairies, native grasslands, West Indian Prairies, Maritime Grasslands, Emergent Pond Marshes, Southern Appalachian Grass Balds, Coastal Plain Patch Prairies, Highlands Patch Prairies, Riverscour Prairies

Planning For The Unplanned: Incorporating Ecological Restoration Techniques into the Practice of Landscape Design (10/3, 1:30-3:00)

Larry Weaner

Landscaping/Rights-of-Way II

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As the fields of landscape design and ecological restoration become increasingly intertwined, it is important to explore ways that the two disciplines can effectively interact. Landscape designers, concerned with human needs and aesthetics, and restoration ecologists, concerned with ecological function, can share numerous techniques to enhance the effectiveness of their respective practices. From the perspective of the landscape designer, blending the traditional practices of horticulture and landscape design, with the patterns and processes of native plant communities can add entirely new dimensions to their work. The thoughtful use of native plants can help to express the distinctive natural character of the regions in which they are working, while decreasing the amount of time and resources required for landscape upkeep. Considering and planning for natural processes of change to affect the designed landscape can also help decrease maintenance needs, increase long term viability and offer an enriched experience to users. Be they, private, commercial or public spaces, built landscapes can become ecological contributors by providing wildlife habitat, controlling stormwater runoff and reducing pollutants associated with fertilizers, herbicides, pesticides and fossil fuel consumption. The replacement of large turf areas with native meadows, woodland ground layer plantings and other native treatments alone could have a significant effect in this regard. While this approach to landscape design could have obvious ecological and practical benefits, widespread acceptance will never occur if it is not implemented with an understanding of context and aesthetics. In this presentation case studies will be used to illustrate these concepts, including residential gardens, woodlands that combine new plantings and natural recruitment strategies, native meadow installations, and the design of a plant community based passive park. Projects will be followed in detail, from conception to full establishment, illustrating the exciting results that can be achieved when ecological restoration is combined with the visual art of landscape design.

Winter Grassland Bird Community Dynamics in Pine Savanna Habitats: The Role of Fire (10/3, 3:30-5:00)

Mark Woodry and C. Ray Chandler

Wildlife Habitat and Biodiversity II

Mark S. Woodry: U.S. Fish and Wildlife Service, 6578 Dogwood View Parkway, Suite B, Jackson, MS 39056; mark_woodrey@fws.gov; and C. Ray Chandler: Department of Biology, Georgia Southern University, Statesboro, GA 30460; chandler@gsaix2.cc.GaSo&.EDU

Winter grassland bird communities of pine savannas are poorly known, partly because most grassland birds are difficult to identify and partly because the public views savanna habitats as boring and uninteresting, resulting in little time spent looking for these elusive bird species. Our research into the effects of fire on winter bird communities in pine savanna habitats was conducted at the Mississippi Sandhill Crane and Grand Bay National Wildlife Refuges in Jackson County, Mississippi from 1993 through 2000. We found that although bird species diversity may be low for pine savanna habitats relative to other habitat types, these areas are important to several winter bird species of high conservation concern in the Southeast as well nationally. Two species of highest concern in the Southeast, the Henslow's Sparrow (*Ammodramus henslowii*) and Sedge Wren (*Cistothorus platensis*), were the most commonly detected species in recently burned sites. Other species of conservation concern found during our study include Mississippi Sandhill Crane (*Grus canadensis pulla*), LeConte's Sparrow (*Ammodramus leconteii*) and Loggerhead Shrike (*Lanius ludovicianus*) while Yellow Rails (*Coturnicops noveboracensis*), Black Rails (*Laterallus jamaicensis*), Short-eared Owls (*Asio flammeus*), Bachman's Sparrows (*Aimophila aestivalis*) and Grasshopper Sparrows (*Ammodramus savannarum*) were rarely detected in this study. In addition, our data suggest that the relative abundance of grassland birds of conservation concern depends upon the season of and time since burning. Henslow's Sparrows and Sedge Wrens are most abundant in sites burned the previous growing season but these species were not detected in the first winter following a dormant season burn. This is likely due to the lack of suitable herbaceous vegetation, which is important for providing food and cover for these species, the winter immediately following a dormant season burn. However, during the second winter following a dormant season burn, these species are detected more frequently than are other species.

Notes

Poster Presentations

Wednesday
October 2, 2002

Dogwood A and B
The Friday Center

Notes

Forage Production

1 *Yield, Quality and Persistence of Thirteen Genotypes of Eastern Gamagrass at Three Southern Locations*
J.L. Douglas, C.M. Owsley, L.M. Tharel

2 *Grazing Management of Eastern Gamagrass in Southwest Georgia*
M. Owsley, M. Kirkland, S. Brantly, D. Surrency

3 *Yield of Eastern Gamagrass with Interseeded Legumes*
P.R. Salon and M. Schmidt

4A *Temperature and CO_2 Effects on Eastern Gamagrass Photosynthetic Performance*
D.C. Gitz, J.C. Ritchie, J. Baker, D.T. Krizek, V.R. Reddy

4B *Eastern Gamagrass Grown in Sunlit Controlled Environmental Chambers at Two Carbon Dioxide Levels and Three Temperatures*
J.C. Ritchie, D.C. Gitz, D.T. Krizek, V.R. Reddy

5 *Effect of Acid Soils on the Growth and Development of Eastern Gamagrass*
R.J. Smith and E.G. Rhoden

6 *Quality of Stockpiled Eastern Gamagrass Forage at Two Southeast Locations*
E.G. Rhoden, J.G. Ritchie, R.J. Smith, D.T. Krizek, and M. Mcintyre

7 *Rediscovery of the Southern Corn Stalk Borer: Potentially Serious Pest of Eastern Gamagrass and Strategies for Mitigation*
D.T. Krizek, M.A. Solis, P.A. Touhey, P.D. Millner, and J.C. Ritchie

8 *Optimum Fertilization of Native Grasses*
N.H. Ranells and J.T. Green

9 *Estimating Nitrogen Dynamics Under Field Conditions to Improve Switchgrass Production in Virginia*
R.W. Lemus, D. Parrish, D.D. Wolf

10 *Photosensitization in Meat Goat Kids Grazing Alamo Switchgrass*
S.A. Elmore, S.T. Lee, K.L. Anderson, J.M. Luginbuhl, T.T. Brown, J.M. Cullen

11 *Seasonal Yield of Native Warm Season Grass*
R.F. Spitaleri, J.H. Henning

12 *Simulating Native Grasses and Improved Grasses on Diverse Range Sites in Texas*
J.R. Kiniry, H. Sanchez, J. Derner, J. Greenwade

13 *A Method of Establishing Native Warm Season Grass Mixtures and Improved Loblolly Pine*
M.D. Hall

14 *Elymus virginicus and Elymus hystrix as Potential Native Cool Season Forage Grasses in the Northeast United States*
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Establishment Technology

Conservation

Wildlife Habitat

30 *The Northern Bobwhite Conservation Initiative: A Report on the Status of the Northern Bobwhite and a Plan for Recovery of the Species*
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31 *Grassland Bird Breeding Use of Managed Grasslands on National Wildlife Refuges within Region 5 of the U.S. Fish and Wildlife Service*
M. Runge and L. Mitchell

32 *North Carolina's Cooperative Upland Habitat Restoration and Enhancement Program*
T. Sharpe and K. Pipkin

33 *Grassland Restoration Opportunities on a Piedmont North Carolina Landscape*
D. Sawyer and D. Hayes

Technology Transfer

34 *PLANTS, A Database for Plant Information on the World Wide Web*
J.F. Henson

Landscaping

35 *Landscaping of Disturbed Sites in North Carolina with Native Grasses*
Snow Creek Landscaping

36 *Warren Wilson College: Grasses and Wildflower Project*
D. Mercer

Highway Rights-of-Way Vegetation

37 *Managing a Marginal Roadside as a Sustainable Landscape*
A. Arnold

38 *Developing Local Native Grass Seed Sources in Georgia*
C. Gray

Restoration

39 *Vegetation Composition Trends for Restored Piedmont Prairies on Mecklenburg County Nature Preserve Lands*
S. Daves

Ecology

40 *Natural Native Warm Season Grass Riparian Vegetation in West Virginia*
J. Vandevender

Notes

The abstracts are in alphabetical order by first author.

Managing a Marginal Roadside as a Sustainable Landscape

Alison Arnold
The North Carolina Arboretum, Asheville, NC

In 1990 the North Carolina Arboretum staff inherited a one-half mile support road with a 3:1 cut covered with 'Kentucky 31' tall fescue (*Lolium arundinaceum*). Over the next several years, a process took place of killing out most of the tall fescue cover and transplanting over fifty thousand plugs of native grasses and forbs to establish an early succession landscape now interpreted as a sustainable landscape. Various areas of the road corridor received other approaches and treatments to demonstrate to Arboretum visitors the various methods for managing slopes typical to mountain landscape settings. Grass species: prairie dropseed (*Sporobolus heterolepsis*), broomsedge (*Andropogon virginicus*), giant golden oats (*Stipa gigantean*), Indiangrass (*Sorghastrum nutans*), tufted hairgrass (*Deschampsia caespitosa*), flattened oatgrass (*Danthonia compressa*), and little bluestem (*Schizachyrium scoparium*). Forb species include: butterflyweed (*Ascelpias tuberosa*), white heath aster (*Aster ericoides*), and gayfeather (*Liatris spicata*). Treatments demonstrate various management methods such as: direct plugging of grasses into the dead fescue cover, grass plugging followed one tear later with forbs, forbs planted first followed by grass plugging and leaving a small amount of fescue as a comparative baseline. Ongoing management challenges include: determining what other species should be encouraged or removed, burn frequency, responding to public comment in regards to 'weedy look', and helping volunteers understand the difference between wanted and unwanted weeds.

Keywords: marginal landscape management, native grasses, slope stabilization

Switchgrass and Eastern Gamagrass Establishment and Management Using Herbicides

C. Benjamin Coffman[1] and Lester Vough[2]
[1]USDA-ARS, Sustainable Agriculture Laboratory, Beltsville, MD; [2]University of Maryland, College Park, MD

Switchgrass (*Panicum virgatum*) and eastern gamagrass (*Tripsacum dactyloides*) are slow to germinate and easily overwhelmed by annual weeds. There are no herbicides registered for preemergence weed control. An investigation was conducted with corn herbicides to determine their effectiveness. Seed was sown and the herbicides were applied on June 10, 1999. Visual weed cover and crop stand estimates were made in late August, 1999. Weed cover ranged from 20% to 50% and crop stand from 10% to 50%. Switchgrass was lowest in plots treated with alachlor plus atrazine and weed cover was lowest in plots treated with s-metolachlor plus atrazine. Eastern gamagrass crop stand in 2000 ranged from 40% to 60% and weed cover from 30% to 60%. In May 2000 a postemergence application of 2,4-D and dicamba was made across all treatments including the controls to manage perennial dicots. All plots were mowed to six inches in July and biomass samples were obtained four weeks later. Switchgrass yields ranged from 892g/m^2 to 572 g/m^2 for acetochlor plus atrazine and s-metolachlor plus atrazine , respectively. Eastern gamagrass yields ranged from 611 g/m^2 to 958 g/m^2 for dimethenamid plus atrazine and alachlor plus atrazine, respectively.

Keywords: warm season grasses, weed control, corn herbicides, IR-4

Use of Carbon Banding to Maximize Field Establishment of Switchgrass

Shannon Crowley and Paul Meints
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Switchgrass (*Panicum virgatum*) is typically a poor competitor under open field establishment. This study was conducted to determine if the carbon banding establishment system will reduce weed competition during early stand establishment in switchgrass. Pre-chill, ethylene pre-chill, and moisturizing seed treatments were applied pre-plant. The experiment was established as a RCB design blocking on field establishment treatments of killed sod, tilled field, tilled field with oat cover crop, and carbon banding followed by diuron [3-(3,4-dichlorophenyl)-1,1-dimethylurea] application. Statistical analysis showed differences in emergence impacted by field establishment practice. The carbon banding technique eliminated weed competition during the first two months of establishment. However, diuron injury occurred on switchgrass plants due to heavy rain diluting the carbon bands immediately following planting. Therefore, plots utilizing oat as a cover crop averaged 90% higher switchgrass emergence and establishment than the carbon banding/diuron plots and were 46% higher than the tilled field establishment. Within pre-plant seed treatment, moisturizing resulted in 52%, 38%, and 34% increased emergence and establishment over prechill, untreated control, and ethylene pre-chill, respectively. The carbon banding establishment system reduced early weed competition. However, safer methods must be developed to avoid herbicide damage to switchgrass seedlings.

Keywords: switchgrass, *Panicum virgatum*, carbon banding, diuron, pre-chill, ethylene pre-chill, moisturizing

Vegetative Composition Trends for Restored Piedmont Prairies on Mecklenburg County Nature Preserve Lands

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Piedmont prairies are believed to have been a major historical component of the North Carolina Piedmont. The Mecklenburg county division of Natural Resources has been restoring several prairies for the past seven years. McDowell Prairie (ten hectares) and Dodge City Prairie (two hectares) were previously agricultural fields that have been planted with five native grass species. Latta Prairie (fourteen hectares) has been converted from a young forest by drum-chopping, burning, and planting locally collected seeds of three native grass species. The prairies are maintained with prescribed burning, brush cutting, and occasional use of herbicides for exotics. McDowell and Latta Prairies harbor rare plants including Schweinitz's sunflower (*Helianthus schweinitzii*) and Georgia aster (*Aster georgianus*).

Belt transect surveys at Latta prairie show that the number of *Helianthus schweinitzii* stems increased from 295 to 1182. Personnel from the University of North Carolina Charlotte and Haw River Program (HARP) used the point transect method for vegetative surveys of the prairies. Non-native species coverage on McDowell Prairie declined from 183.9% in 1999 to 17.5% in 2001. Non-native species coverage at the Dodge City Prairie decreased from 137.2% in 1999 to 47.2% in 2001. Native species coverage decreased from 150.4% in 1999 to 144.87% in 2001. McDowell and Dodge City Prairies are dominated by graminoids at 51% and 69% relative coverage. Coverage of vegetation more than doubled on Latta

Prairie between 1999 and 2001, with graminoids and shrubs dominating at 35% and 38% respectively in 2001.

Keywords: piedmont, prairie, native grasses, vegetative composition, percent coverage

Selection for Reduced Seed Dormancy in Switchgrass, Big Bluestem and Indiangrass

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Grass producers who wish to use switchgrass (*Panicum virgatum*), big bluestem (*Andropogon gerardii*), and Indiangrass (*Sorghastrum nutans*) for forage, land restoration, or biomass production face problems of field establishment due to seed dormancy. Large percentages of seed fail to germinate when planted less than 24 months after harvest. Seed dormancy was selected against in natural populations of big bluestem and Indiangrass using genotype recurrent selection. Mother plants were selected based on the performance of their seed in a controlled germination/dormancy test. Harvested seed was placed in a germinator 60 days after frost. Seed from approximately 60 mother plants was randomly assigned to 6 replications of 100 seed. Seed were placed in a germinator under alternating 20/30°C temperatures. Only seed whose seed germinated in less than 15 days were placed in an isolation block for further seed production and screening. Switchgrass seed was screened for reduced dormancy using phenotypic selection to establish a mother plant nursery. A subsequent screening for vigor and genotype evaluation for non-dormant seed will be conducted on these plants. Populations from this research have the potential for use in agricultural biomass production as well as prairie restoration.

Keywords: switchgrass, (*Panicum virgatum*), big bluestem, (*Andropogon gerardii*), Indiangrass, (*Sorghastrum nutans*), forage, land restoration, biomass production, seed dormancy, recurrent selection

The Northern Bobwhite Conservation Initiative: A Report on the Status of the Northern Bobwhite and a Plan for Recovery of the Species

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The range of the northern bobwhite included in the Northern Bobwhite Conservation Initiative (NBCI) incorporates nearly 787 million acres. From 1980 to 1999, the autumn bobwhite population declined 65.8% while declines in bobwhite breeding numbers averaged 3.8% per year from 1982 to 1999. The NBCI is organized to delineate population and habitat objectives for 15 Bird Conservation Regions to facilitate coordination and cooperation with other bird management plans, e.g., Partners in Flight. The NBCI also includes chapters detailing specific management practices for agricultural land, grasslands, and forests, and one chapter-outlining implement of the plan.

Restoring northern bobwhites to their desired density will require the addition of 2.8 million coveys to the current population. Achieving this population will necessitate impacting the habitat on 81.1 million acres of farm, forest, and rangeland. However, the recommended land management practices would change the primary land use on only 6.2% of this acreage. Implementation of the NBCI will require the continuing cooperation of federal, state, and private wildlife organizations and of individual landowners and managers. Much of the needed funding can be derived from existing federal and state programs, though increased appropriations will be required, and some new funding initiatives may be needed. If immediate action is taken the bobwhite's decline may be arrested in five years, and the restoration may be effected in 20-25 years.

Key words: Northern Bobwhite Conservation Initiative, NBCI, population decline, population objectives, habitat objectives, land management practices, landowners, land managers

Vegetative Barrier, A New Conservation Buffer Practice

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In 1991, the USDA-Natural Resources Conservation Service (NRCS) and the USDA-Agricultural Research Service (ARS) began a cooperative effort to evaluate vegetative barriers as a conservation practice for sloping cropland. Vegetative barriers are defined as narrow, permanent strips of dense, perennial vegetation established in parallel rows perpendicular to the dominant slope of the field. They control soil erosion by encouraging benching, retarding and reducing surface runoff, dispersing concentrated flow, and reducing ephemeral gully development. They also entrap sediment-borne and soluble contaminants. Results from research and field studies were used to develop a national conservation practice standard. In March 1991 the vegetative barrier practice was accepted for inclusion in the USDA-NRCS National Handbook of Conservation Practices with practice code 601. Stem size and density of the plant material used for this practice is crucial for its sediment trapping efficiency, especially in concentrated flow areas. Switchgrass (*Panicum virgatum*), a native warm season perennial bunchgrass, has been shown to be a viable plant material for this practice. There are numerous switchgrass cultivars available but selection of the proper cultivar for the geographic area and soil drainage is advisable. Consult a local NRCS field office or the plant materials program (http://plant-materials.nrcs.usda.gov) for the cultivar recommended for your region.

Keywords: erosion control, conservation buffers, vegetative barriers, conservation standard 601, switchgrass, *Panicum virgatum*

Yield, Quality, and Persistence of Thirteen Genotypes of Eastern Gamagrass in Three Southern Locations

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Thirteen southern eastern gamagrass (*Tripsacum dactyloides*) genotypes have been identified as potential cultivars but forage production parameters are lacking. Objectives of this study were to determine yield, quality, and persistence of these 13 genotypes at three southern locations. Genotypes were established in 1995 in a randomized complete block with four replications at Americus, GA, Booneville, AR, and Coffeeville, MS and forage attributes and persistence determined for three consecutive years. Yields ranged from 7.5 to 19.1 Mg ha^{-1} depending on genotype, location, and year. When averaged over locations and years, accession 9062680 was the

highest yielding genotype (17 MG ha^{-1}). Cutting date and genotype influences forage quality estimates of CP, ADF, and NDF. Average CP ranged from 60 to 110 g kg^{-1} DM, ADF from 370 to 420 g kg^{-1} DM, and NDF from 670 to 730 g kg^{-1} DM. Florida genotypes winter killed in 1997 at Booneville and Coffeeville but persisted at Americus. A *Rhizoctonia* and *Pythium* complex caused severe damage to all genotypes at Coffeeville except 9062680. Two genotypes, 9062680 and 9058495, were identified for future cultivar release.

Keywords: eastern gamagrass, *Tripsacum dactyloides*, southern genotypes, CP, ADF, NDF, *Rhizoctonia*, *Pythium*

Native Warm Season Grass Establishment through Federal Cost Sharing Programs in New Jersey

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Native warm season grasses plantings have become common for at least the last five years in new Jersey through the US Fish and Wildlife Service Partners for fish and Wildlife program and several USDA Farm Bill programs including the Wildlife Habitat Incentives Program and the Conservation Reserve Program. Average costs of warm season grass establishment in New Jersey are 4400 per acre. Cost share rates for landowners vary depending upon the government program utilized. Warm season grass establishment has been accomplished by conventional tillage practices and with no-till methods. Generally the best establishment has been achieved by a long-term weed control program with the use of appropriate herbicides. Very good results have been observed without any herbicide use at least in one case. Seedings have been completed in almost every month from March through November with the best results from May seedings. The majority of warm season grass establishment has been done with wildlife habitat improvement as the primary objective of the landowner. Habitat for wildlife species such as grasshopper sparrow, bobolink, northern harrier, northern bobwhite quail, and eastern wild turkey has been improved.

Key words: warm season grass, establishment, Partners for Fish and Wildlife Program, Wildlife Habitat Incentives Program, Conservation Reserve Program, weed control, herbicides

Establishing Methods for Switchgrass

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Switchgrass (*Panicum virgatum*) is a native warm season grass that is capable of producing high yields across many soil types and environmental conditions. A limiting factor in the wide spread use of switchgrass is slow and inconsistent establishment due to weed competition. A possible solution to this problem is to select a planting date and seedbed preparation technique that minimizes weed competition. The objective of this study was to evaluate establishment method (broadcast and no-till drill) and planting date (fall and spring). Planting dates included April 15 (3 treatments), June 1 (1 treatment), and October 1 (4 treatments). Percent stand measurements were made three weeks after green up and at the end of the growing season. In 1999, only two treatments had measurable stands. The treatment with Roundup at 1 lb ai/ ac in mid August then planting no-till into fall prepared seedbed averaged a 40% stand. The treatment with Gramoxone at 1 lb ai/ac in April then planting broadcast into a spring prepared seedbed (G1SD) averaged 60%. The G1SD treatment had a 100% stand in 2000, while no other treatment produced more than a 5% stand. It appears that broadcast planting in the spring into a chemically controlled seedbed increases switchgrass establishment.

Keywords: switchgrass, *Panicum virgatum*, establishment, weed control, planting dates

Landscaping of Disturbed Sites in North Carolina with Native Grasses

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Snow Creek Nursery and Landscaping supports the use of native grasses in commercial landscape projects. Grasses are the major component of the early successional plant pallet that we use most often in our ground plane treatment of disturbed sites. Little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), broomsedge (*Andropogon virginicus*), switchgrass (*Panicum virgatum*), shortbeard plumegrass (*Saccharum contortus*), bottlebrush grass (*Hystrix patula*), Virginia wildrye (*Elymus virginicus*), Canada wildrye (*Elymus canadensis*), and purpletop (*Tridens flavus*) in various mixtures are combined with an appropriate mix of native forbs and woody plants to create naturalistic plantings. Stone Creek employs a variety of techniques that include installing three-inch plugs and sowing custom blended seed mixes. Management of the plantings is another important service that Snow Creek offers clients interested in diverse and sustainable landscapes. Photographs of projects in progress, as well as those being managed will be offered for display.

Keywords: Snow Creek Nursery and Landscaping, native grasses, nursery, landscaping, establishment, management, plugs, seed mixes

Photosensitization in Meat Goat Kids Grazing 'Alamo' Switchgrass

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The purpose of the study was to elucidate the cause of clinical photosensitization, elevated liver and kidney specific serum enzymes, and histologically evident hepatopathy observed in a herd of 3 to 5 month-old Boer cross goats (*Capra hircus*) grazing 'Alamo' switchgrass (*Panicum virgatum*) during the summer of 2001. Twenty-four (30%) out of 81 goats subsequently developed clinical signs of lethargy, poor body condition, and skin ulcerations. Six affected goats were euthanized and presented for necropsy. Necropsies revealed hepatocellular necrosis, Kupffer cell hypertrophy and hyperplasia, biliary hyperplasia, and fibrosis, and mild cholangitis. Birefringent crystals were present in the bile ducts and Kupffer cells. Hepatic lesion severity appeared to correlate with increased switchgrass exposure time. Renal lesions included proximal tubule dilation with evidence of necrosis admixed with various stages of degeneration and regeneration in the medullary region. Erosive to ulcerative skin lesions, supportive of photosensitization, were complicated by parapoxviral dermatitis, dematophillosis, and mixed bacterial colonization. Serum chemistry abnormalities include BUN, total bilirubin, AST, and decreased values for albumin, cholesterol, and triglycerides. Gas chromatography-mass spectrometry indicated that diosgenin was the major steroidal sapinogen in the switchgrass grazed by the affected goats. This study suggests that the diosgenin present in the switchgrass sample was both hepatoxic and nephrotoxic to young goats.

Keywords: switchgrass, *Panicum virgatum*, meat goat, *Capra hircus*, photosensitization, diosgenin, steroidal sapinogen

Native Cool Season Grass Evaluation for the Northeast

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Native cool season grass development has received little attention in the past. This changed with the passage of the 1996 Farm Bill Program and a growing desire by agencies and resource managers to have native cool season grasses available for conservation plantings. There are virtually no commercially grown cultivars or tested selections available for the Northeast. The plant materials program of the USDA, Natural Resources Conservation Service initiated a study in 1998 to collect, evaluate, select, and release native cool season grasses with known origin to be commercially produced with seed available for use in the Northeast. The three plant materials centers (PMCs) in the Northeast (the National PMC in Maryland, the Cape May PMC in New Jersey, and the big flats PMC in New York) are interesyed in the following grasses: Canada brome (*Bromus pubescens*), Canada bluejoint (*Calamagrostis canadensis*), stout woodreed (*Cinna arundinacea*), drooping woodreed (*Cinna latifolia*), poverty oatgrass (*Danthonia spicata*), crinkled hairgrass (*Deschampsia flexuosa*), Canada wildrye (*Elymus canadensis*), hairy wildrye (*Elymus villosus*), Virginia wildrye (*Elymus virginicus*), red fescue (*Festuca rubra*), little barley (*Hordeum pusillum*), bottlebrush grass (*Elymus hystrix*), and junegrass (*Koeleria cristata*). Field collections of these species were made in 1999 and 2000 and are currently being evaluated at each plant materials center. At the conclusion of the evaluation process, plants will be released as cultivars or tested/selected source-identified releases. With those new plant releases in the near future, resource managers will have the opportunity to incorporate native cool season grasses in their conservation seedings. For more information on conservation plantings, see our website at http://plant-materials.nrcs.usda.gov.

Keywords: native cool season grasses, collection, evaluation, release, conservation plantings, Farm Bill Program, plant materials program

Organic Matter Dynamics under Long-Term Switchgrass and Tall Fescue Sites in the Upper Southeastern United States

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The fate of carbon in different ecosystems has garnered increasing attention due to concerns over global warming. Switchgrass plots were planted at eight locations across five upper-tier southeastern states in 1992 and maintained with one- and two-cut management systems for ten years. Comparisons of soil organic matter and carbon were among soil samples taken from 'Alamo' switchgrass (*Panicum virgatum*) and 'Kentucky 31' tall fescue (*Lolium arundinaceum*) alleys. Soil samples were collected to a 10-cm depth in 1995 and 2001 as well as to the bottom of the Ap horizon in 1992 and 2001 (from 10 to 30 cm depth, depending on the site). Percent organic matter in soils was determined using the Walkey/Black method. From 1992 to 2001, with one-cut management, soil organic matter consentration increased about 50% in the Ap horizon of switchgrass plots when averaged across all sites. The upper 30 cm of the soil profile contained the majority (68%) of switchgrass roots. Little difference in soil organic matter between switchgrass and tall fescue in the upper 10 cm of the soil profile was observed when comparing samples from 1996 and 2001.

Keywords: switchgrass, *Panicum virgatum*, tall fescue, *Lolium arundinaceum*, soil organic matter

Temperature and Carbon Dioxide Effects on Eastern Gamagrass Photosynthetic Performance

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Eastern gamagrass (*Tripsacum dactyloides*) was grown in large $1m^3$ bins on a sand:vermiculite mix with regular fertigation with a complete nutrient solution in closed transparent cuvettes (Soil Plant Atmosphere Research (SPAR) sunlit chambers) at 370 or 740 ppm CO_2 and 20/14°, 27.5/21.5°, or 35/29° day/night temperatures. Plants were allowed to develop from mid-May to mid-October. Leaf and canopy photosynthesis was investigated. Results from leaf based observations were consistent with canopy level observations. Temperature effects on assimilation were much more pronounced than CO_2 effects. Increased temperatures led to increased assimilation rates, and quantum use efficiencies as Fv/Fm and CO_2 assimilation vs. PAR. In plants grown at the lowest temperatures the maximum rate of carbon assimilation was reached at relatively low flux densities (maximal flux utilization 1500 micromol m^{-2} s^{-1} PAR) as compared to high temperature plants (2500 micromol m^{-2} s^{-1}). Enhanced CO_2 consistently decreased maximal flux utilization across treatments. This effect was most pronounced in plants grown at the lowest temperature regime.

Keywords: eastern gamagrass, *Tripsacum dactyloides*, C4, temperature, CO_2, photosyntheseis

Response of Two Switchgrass Ecotypes to Seed Storage Conditions and Prechilling

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Freshly harvested switchgrass (*Panicum virgatum*) seeds exhibit widely varying levels of innate seed dormancy. Seed storage conditions have been shown to affect the maintenance of dormancy. Studies were conducted at the USDA Natural Resources Conservation Service Jamie L. Whitten Plant Materials Center, Coffeeville, Mississippi to determine the response of 'Alamo' and a native collection (746) to storage environment, storage duration, and prechilling treatment. Seeds of 746 responded positively to both a 14-day cold, moist prechill at 7°C and higher storage temperatures, experienced in both a room temperature storage environment (approximately 21°C) and during the spring and summer months in a warehouse environment (approximately 38°C). The response decreased with increased storage duration. 'Alamo' showed little response to either storage environment or prechilling. Some dormancy was retained in the 746 seeds throughout the 11-month storage period in all environments; however, storage in a seed cooler at 7°C resulted in increased dormancy. Seed lots with an increased level of innate dormancy, such as 746, may require higher storage temperatures or prechilling before planting to ensure germination. Seed lots with a lower level of innate dormancy will not benefit from such treatments.

Keywords: seed dormancy, seed storage, storage duration, prechill, switchgrass, *Panicum virgatum*, Alamo

Developing Local Native Grass Seed Sources in Georgia

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The greatest problem facing the use of native grass and other herbaceous species in the southeastern United States has been the lack of local seed sources. Seed obtained from local populations is more likely to be adapted to the environmental conditions found in the region than seed sources from distant areas.

To address this need, an effort was begun in fall 2000 to collect native warm season grass seed from natural populations throughout the piedmont regions of Georgia. Callaway gardens, whose stewardship goals include converting their existing non-native pasture lands to native grasses, offered the use of one of these fields for planting the collected seed in increase plots.

The seed obtained from the collections and plots will be used for: increase plots; research to develop planting techniques for these species on right-of-way and for restoration projects, erosion control, and other applications; and eventual commercial production.

To date, this project has been entirely a volunteer effort, with most of the materials, equipment, and much of the labor provided by Callaway. We are currently seeking funding and exploring potential partnerships to continue and expand the collection and grow-out effort.

Future goals include: increasing the number of species collected to include additional warm season grasses as well as forbs, sedges, and rushes; and expanding the collection to other regions of the state.

Keywords: native warm season grasses, local seed sources, seed increase, seed collection, Callaway Gardens, Georgia Department of Transportation

A Method of Establishing Native Warm Season Grass Mixtures and Loblolly Pine

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In pre-colonial times, the mixed pine and hardwood forests of the South were sufficiently open to permit the growth of grasses and provide grazing in forests. Specialization of silviculture and agriculture has greatly decreased the use of grazing in forests. An increasing interest in agroforestry, wildlife habitat development, and additional grazing resources led to the investigation of establishment techniques for native grasses and trees together. A successful trial of broadcasting seeds on a mechanically prepared site led to a large-scale trial on a 15-acre plot that was to be prepared for pine tree establishment using a three-pass method. Immediately following discing, a mixture of 'Kaw' big bluestem, 'Cheyenne' Indiangrass, and 'Alamo' switchgrass was broadcast at a rate of 18 pounds per acre. Loblolly pine was hand planted the following winter at a 6-foot by 10-foot spacing (726 trees per acre). The stand has been visually monitored since planting. Plant populations were satisfactory when evaluating them for wildlife habitat and grazing forage. There have been no adverse effects to the pines due to the introduction of the grasses or the grazing. Frequency sampling of vegetation indicated significant more native warm season grasses in the treated area than the untreated area.

Keywords: agroforestry, three-pass method, mechanical site preparation, silvopastoral, switchgrass, Indiangrass, big bluestem, loblolly pine

PLANTS: A Database for Plant Information on the World Wide Web

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The PLANTS World Wide Web site provides basic botanical information about all of the plant species that occur in the United States and its territories. The PLANTS site also provides more detailed information about plants that are in the following groups: conservation plants, noxious and invasive plants, threatened and endangered plants, and culturally significant plants. PLANTS provides the following assets: checklists of species by state; checklists of species by either family or genus; National Wetland Inventory wetland indicator status of plants that occur in wetlands; classification reports that enable users to search and download PLANTS information using any attribute or combination of attributes that are contained in the database. The PLANTS home page provides access to the following modules: alternative crops, plant materials information from the Natural Resources conservation Service plant materials centers. The PLANTS URL is http://plants.usda.gov.

Keywords: PLANTS, botanical information, nativity, plant names

Simulating Native Grasses and Improved Grasses on Diverse Range Sites In Texas

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Simulation models addressing soil erosion and water quality issues on range sites should realistically simulate grass dry matter yields across a wide diversity of soils and climate regimes. This study was designed to evaluate the ability of the ALMANAC (Agricultural Land Management Alternatives with Numerical Assessment Criteria) model to simulate native range grass biomass production and improved pasture production under diverse climatic conditions and soils in Texas. The objective was to compare range grass production at rangeland ecological sites, as reported in USDA-NRCS soil surveys, with production simulated by ALMANAC using the most common grasses for each site. The model was run with multiple years of daily weather data on different soils from a diverse set of sites in Texas. Model inputs included parameters for the soil series, grass species characteristics, and locally measured climate data. The soils, climate, and grass parameter data sets described can be useful starting points for deriving data for additional range sites, giving model users examples of realistic input data. The model shows promise as a tool for realistically simulating grass production on a diverse group of soils and in diverse climatic conditions.

Keywords: grass modeling, range yields, grass biomass

Rediscovery of the Southern Corn Stalk Borer: a Potentially Serious Pest of Eastern Gamagrass and Strategies for Mitigation

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Eastern gamagrass (*Tripsacum dactyloides*) is considered relatively free of insect pests and plant pathogens. Plots of eastern gamagrass established at the Beltsville Agricultural Research Center in

Beltsville, MD were grown successfully for several years without noticeable damage from insects or plant pathogens. However, in June 2001, random patches of eastern gamagrass showed a mysterious rapid, severe dieback two weeks after harvesting the plants (at a height of 15 cm) for biomass and forage quality. Upon close inspection, larvae were found emerging from the crown tissue. Microscopic examination of the larvae revealed the presence of both noctnid (army worms) and pyraloid (snout moth) larvae. Although adult moths were never observed, the pyraloid larvae were identified as the southern corn stalk borer [*Diatraea crambidoides* (Grote) Crambidae, LEPIDOPTERA]. This pest feeds upon corn, grain sorghum, Johnson grass, and attacks eastern gamagrass. A literature search revealed that this pest occurs from Delaware/Maryland to /florida and inland states (KS, OK, OH, MS, and AZ) through Mexico and northern South America but it has not been reported in its northern most distribution until 1891. Farmers should be alert for this pest because it is highly destructive. Cultural strategies for mitigating damage will be discussed.

Keywords: Corn stalk borer, cultural management practices, *Diatraea crambidoides*, dieback, eastern gamagrass, *Tripsacum dactyloides*, insect pests, pyraloid larvae, snout moths

Estimating Nitrogen Dynamics under Field Conditions to Improve Switchgrass Production in Virginia

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Determining a nitrogen budget (inputs, outputs, and internal fluxes of nitrogen) for switchgrass (*Panicum virgatum*) can improve management and lower production costs. The objectives of this research were to study the nitrogen budget of switchgrass stands and to estimate their nitrogen use efficiency. THe study was conducted on two well-established 'Cave-in-Rock' switchgrass stands in the Piedmont and Ridge and Valley regions of Virginia. Treatments of 0, 90, 180, and 270 kg N ha^{-1} were applied in May 2001. shoot, root, and soil samples were collected in July, September, and November. Nitrogen applications did not increase yields on either site. Averaged across sites, yields of 10.5, 11.4, 11.6, and 11.6 Mg ha^{-1} were observed with rates of 0, 90, 180, and 270 kg N ha^{-1} respectively. Higher yields were observed at the ridge and valley site, while higher soil carbon and nitrogen were observed at the Piedmont site. Nitrogen was translocated from shoots to roots between September and November. Shoot and root nitrogen concentrations – but not yield – increased with increased nitrogen applied, i.e., there appeared to be 'luxury consumption' of nitrogen. These data suggest switchgrass biomass production can be maximized with relatively low levels of applied nitrogen.

Keywords: switchgrass, *Panicum virgatum*, nitrogen use efficiency, biomass

Rehabilitation of Partially Reclaimed Soils with Native Grass Species

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The restoration of mined land begins by recognizing plant species that can respond to management under poor soil conditions. The objective of this study was to assess potential use of plant species for partially reclaimed mined land. The study was located at the Powell River Project Education Center in southwest Virginia. Sixteen treatments were established in the summer of 1990 using 12 plant species in pure stands and mixtures in a split plot arrangement with 4 replications. Prior to establishment, a 2:1 mixture of composted wood chips and dry sewage sludge (112 Mg ha^{-1}) was applied to provide nitrogen, phosphorus, and organic matter. Biomass samples were collected from 1996-2001 to determine botanical composition and biomass production. Samples were separated by target species (the species originally planted), and non-target grasses, forbs, and legumes. Switchgrass (*Panicum virgatum*) produced the most biomass (8.9 Mg ha-1) across years compared to other grasses. Grasses showed a higher target biomass in 1996 compared to 1997 and 1998. Significant differences were observed in bioeffeciency with switchgrass, tall fescue (*Lolium arundinaceum*), and reed canarygrass (*Phalaris arundinacea*) having the highest value. Data showed that species chosen for revegetation of these soils could provide opportunities for changing land use but it will depend on the intended post-mine use of these soils and the plant species being utilized.

Key words: switchgrass, *Panicum virgatum*, grass, restoration, biomass, mined-land revegetation, bioefficiency

Warren Wilson College: Native Grasses and Wildflowers Project

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Warren Wilson College, Asheville, NC

Warren Wilson College is a small liberal arts and science college located in the Swannanoa Valley. The college has earned a reputation for its commitment to campus greening and environmental stewardship. A recent initiative is the native grasses project started by the student landscaping crew. This project aims to promote the use of native plants in commercial landscaping and encourage the reintroduction of natives into areas where they have been extirpated. It will allow for the increased use of native and local materials within the community at large by educating about indigenous species.

The native grasses project has recently has recently grown and become a permanent part of the Warren Wilson community. It began as a small-scale project operating with limited and periodic funding. Over the past few years, numerous species of grasses and wildflowers have been propagated. Seed from plants was sown along the Blue Ridge parkway, in Pisgah National Forest, and on Warren Wilson College land. Currently, construction of a new greenhouse is being completed. This facility will allow for the propagation of two large crops of grasses and wildflowers a year. These plants may be used by the College as well as by other organizations and groups.

Keywords: native grasses and wildflowers, Warren Wilson College, landscaping, campus greening

Grazing Management of Eastern Gamagrass in Southwest Georgia

Charles M. Owsley[1], Malcolm Kirkland[1], Sid Brantley[2], and Donald Surrency[3]
[1]USDA, Natural Resources Conservation Service, Americus, GA; [2]USDA, Natural Resources Conservation Service, Auburn, AL; [3]USDA, Natural Resources Conservation Service, Thomson, GA

Grazing management of eastern gamagrass is being demonstrated at the Jimmy Carter Plant Materials center in Americus, Georgia. The USDA Natural Resources Conservation Center is located in the upper coastal plains region of southwest Georgia. Livestock producers in this part of the country often disregard native forages in deference to introduced forage species. One reason for utilization of the introduced species is the higher level of grazing management required for persistence of native plants in the face of high grazing pressures.

This demonstration attempts to show how management of the frequency and severity of defoliation by growing cattle can result in persistence of eastern gamagrass while providing forage in adequate quantity and quality to justify utilization of this native plant in livestock operations. Eastern gamagrass (*Tripsacum dactyloides*) was

established on 2.02 ha in the spring of 1993 and subsequently divided into 10 uniform paddocks. In the summers of 1999-2001 a rotational grazing system was utilized that provided a maximum grazing period of 3.5 days per cycle and a minimum plant stubble height of 25 cm.

NRS analysis of fecal samples indicated an average forage crude protein of 10-14% and digestible organic matter of 62-67%. Average daily gains of 0.72 kg per animal were realized during the demonstration.

Keywords: eastern gamagrass, *Tripsacum dactyloides*, grazing management, southwest Georgia

Optimum Fertilization of Native Grasses

Noah N. Ranells and James T. Green, Jr.
North Carolina State University, Raleigh, NC

Appropriate nitrogen fertilization rates are required to establish and maintain native grasses. A two-year experiment was conducted to determine above ground dry matter production and nitrogen accumulation at five levels of nitrogen fertilization with ammonium nitrate. The experiment was a randomized complete block design with four replications. Forages consisted of one perennial, eastern gamagrass (*Tripsacum dactyloides*) and two annuals, crabgrass (*Digitaria sanguinalis*) and sorghum-sudangrass (*Sorghum bicolor*). The five nitrogen rates (0, 112, 224, 336, 448 kg ha^{-1}) were applied three to four times from May to August. In both years, the un-irrigated site did not ensure optimal establishment of annual grasses and gamagrasses provided more reliable yields early in the season. Higher nitrogen rates produced greater dry matter production and nitrogen uptake. Data from both years will be summarized and apparent nitrogen recovery values will be presented.

Keywords: Fertilization, nitrogen recovery, native grasses, eastern gamagrass, *Tripsacum dactyloides*, crabgrass *Digitaria sanguinalis*, sorghum-sudangrass, *Sorghum bicolor*

Quality of Stockpiled Eastern Gamagrass at Two Southeast Locations

Errol G. Rhoden [1], Jerry C. Ritchie[2], Ronald J. Smith[1], Donald T. Krizek[3], and Michael McIntyre[1]
[1]Tuskegee University, Tuskegee, Alabama; [2]Hydrology and Remote Sensing Laboratory; [3]Sustainable Agricultural Systems Laboratory, USDA,Agricultural Research Service,Beltsville, MD

Adequate forage quantity and quality, especially during the cool season, are limiting factors to cattle production in the southeastern United Sates. Eastern gamagrass (*Tripsacum dactyloides*) is being considered as a forage with potential to overcome some of these concerns. A two-year study to determine the quality of stockpiled eastern gamagrass was conducted at Beltsville, MD and Tuskegee, AL in 1999-2000. eleven clippings, based on dormancy period, were taken at Beltsville, MD (11/19-4/29) and eight were collected at Tuskegee, AL (11/29-2/29). Eastern gamagrass plots at Tuskegee were fertilized with 25-25-25 kg/ha N-P-K and were unfertilized at Beltsville. Acid detergent fiber (ADF), neutral detergent fiber (NDF), and crude protein (CP) content, as well as concentrations of calcium (Ca), phosphorus (P), potassium (K), magnesium (Mg), and iron (Fe) were evaluated as quality factors. Acid detergent fiber content increased as NDF and CP decreased with the length of time eastern gamagrass was stockpiled. Calcium levels were highest for November/December and then declined at both locations (6.14 vs. 8.15 g/kg for Beltsville and Tuskegee, respectively) as stockpiling period progressed. Iron levels in the stockpiled forage were highest at Beltsville in April (42.4 mg/kg) and in February for Tuskegee (45.9 mg/kg). The data also show that P, K, and Fe were below the NRC ranges recommended for lactating beef cattle and therefore, would require a supplementation if fed forage from either location. Ca:P and K⊗Ca +Mg) ratios were maintained through the stockpiled period and the levels were concducive for beef cattle production.

Keywords: eastern gamagrass, *Tripsacum dactyloides*, stockpiled forage, forage quality

Eastern Gamagrass Grown in Sunlit Controlled Environment Chambers at Two Levels of Carbon Dioxide and Three Temperatures

Jerry C. Ritchie[1], Dennis C. Gitz[2], Donald T. Krizek[3], and Vangimalla R. Reddy[2]
[1]Hydrology and Remote Sensing Laboratory; [2]Alternative Crops and Systems Laboratory; [3]Sustainable Agricultural Systems Laboratory, USDA, Agricultural Research Service, Beltsville, MD

Eastern gamagrass [*Tripsacum dactyloides* (L.) L.] was grown in six Soil Plant Atmosphere Research (SPAR) sunlit controlled-environmental chambers (0.5 x 2 m, 16 plants per chamber) at two levels of carbon dioxide (370 and 740 ppm) and three temperatures (20/14, 27.5/21.5, and 35/29 C day/night) for 20 weeks (mid-May to mid-October 2001). Shoots (tillers taller than 10 cm) were harvested at 10 and 15 weeks and total plants (roots, crowns, shoots) were harvested at 20 weeks. Biomass of shoots, crowns, and roots increased significantly with increased temperature. Biomass was consistently higher in chambers with increased carbon dioxide. Biomass allocation differed with treatment with percent roots by weight being highest with high carbon dioxide and low temperature treatment. Percent roots by weight decreased with increasing temperature. Our results suggest little effect on growth for a single growing season at increased carbon dioxide. However the consistently higher biomass at higher carbon dioxide treatments suggests the potential for cumulative effects over time.

Keywords: eastern gamagrass, *Tripsacum dactyloides*, C4, temperature, CO_2, photosyntheseis

Grassland Bird Breeding Use of Managed Grasslands on National Wildlife Refuges within Region 5 of the U.S. Fish and Wildlife Service

Michael Runge[1] and Laura Mitchell[2]
[1]USGS Patuxent Wildlife Research Center, Laurel, MD; [2]U.S. Fish and Wildlife Service, Milton, DE

We are assessing the geographic relationships between different grassland management techniques used on thirteen National Wildlife Refuges in the northeastern United States, the vegetation structure and composition, and grassland bird use of managed areas during the breeding season. Specifically, the study is looking at three treatments: native warm-season grass fields (WSG) managed through burning, non-native cool-season grass fields (CSG) managed through burning, and CSG fields managed through mowing.

The management needs of this group of declining bird species in the Northeast U.S. include (1) determining how the choice of dominant grass species (WSG vs. CSG) and the management technique (mow or burn) affect vegetation structure and density, (2) how the vegetation structure and density affects grassland bird use, and (3) establishing data about species distribution and habitat use to support decisions about regional priorities for management.

The results of this study will be used by the U.S. Fish and Wildlife Service Northeast Region to establish regional grassland breeding bird habitat management objectives and strategies.

Keywords: native warm season grasses, grassland breeding birds, grassland management, vegetative structure, vegetative density, northeastern United States

A Comparison of Herbicides for the Establishment of Warm Season Grasses

Paul R. Salon and Martin van der Grinten
USDA, Natural Resources Conservation Service, Corning, NY

Weed control is one of the biggest challenges in establishing native warm season grasses. Although Plateau is registered for use on warm season grasses in most states, its use on switchgrass (*Panicum virgatum*) and eastern gamagrass (*Tripsacum dactyloides*) is not recommended. This study compares the effects of Plateau both pre and post emergence with Accent, Basis, 2,4-D, Bicep Magnum Lite II (Pre) and mowing on the establishment of switchgrass, eastern gamagrass, big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), and little bluestem (*Schizachyrium scoparium*). The grasses were planted at the big Flats Plant materials Center in corning, NY on 6/13/01 in a conventionally prepared seedbed. The Plateau pre-emergence treatment had the best weed control and allowed for the adequate establishment of eastern gamagrass, but reduced biomass 41% compared to the Bicep treatment. The other warm season grasses established extremely well with no biomass reduction except switchgrass which did not emerge. The Plateau post emergence treatment killed the switchgrass and eastern gamagrass but had good stands of the other grasses. The Accent and Basis herbicides reduced the vigor of most of the grasses except for little bluestem. The biomass averaged for the Accent and Biomass treatments for the eastern gamagrass, switchgrass, big bluestem, and Indiangrass was reduced by 40, 43, 56, and 91% rrespectively from the best herbicide treatment for that species. Stand density was maintained for all species except for Indiangrass.

Keywords: switchgrass, *Panicum virgatum*, eastern gamagrass, *Tripsacum dactyloides*, big bluestem, *Andropogon gerardii*, Indiangrass, *Sorghastrum nutans*, little bluestem, *Schizachyrium scoparium*, Plateau, Accent, Basis, 2,4-D, Bicep Magnum Lite II

Yield of Eastern Gamagrass with Interseeded Legumes

Paul R. Salon and Mark Schmidt
USDA, Natural Resources Conservation Service, Corning, NY

Eastern gamagrass is a palatable and digestible perennial warm season grass that can be used for hay, haylage, and in managed pasture situations. Its use on steeper slopes instead of corn silage will reduce soil erosion and water quality problems. Its perennial nature and large root system would increase carbon sequestration. Companion planting with legumes would be beneficial for reducing erosion, adding nitrogen, and improving yield, forage quality, and weed control. Eastern gamagrass (cultivar Pete') was established in 1998 at 3 sites on Tioga silt loam, Valois gravelly silt loam, and Howard gravelly silt loam soils in New York.

Alfalfa, birdsfoot trefoil, black medic, red clover, white clover, and oats were interseeded into the gamagrass after a July cultivation. The companion crops established well and provided good erosion control in the fall and winter. The companion crops persisted well into the third year with percent cover for red clover, white clover, birdsfoot trefoil, and alfalfa of 97.8, 96.1, 75.0, and 74.0% respectively. In 2000 we had abnormally cool temperatures. The perennial companion crops competed with the gamagrass reducing yields compared to the control. The gamagrass yields when grown with alfalfa, white clover, red clover, and birdsfoot trefoil were 69.6, 71.3, 73.3, and 86.3% of the control respectively.

There were significantly higher gamagrass yields outside the companion crop study area due to lack of cover crop competition and better weed control. The eastern gamagrass yields in these areas for two cuttings, on the above soil types were 2.99, 2.75, and 2.11 dry matter tons per acre respectively.

Keywords: eastern gamagrass, *Tripsacum dactyloides*, forage yields, New York, legume companion crops

Elymus virginicus and Elymus hystrix as Potential Native Cool Season Forage Grasses in the Northeast United States

Matt A. Sanderson[1], R. Howard Skinner[1], Jennifer Kujawski[2], and Martin van der Grinten[3]
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Most forage grasses used in the northeastern United States are introduced species. Our objective was to evaluate northeastern collections of the native cool- season grasses Virginia wildrye (*Elymus virginicus*) and eastern bottlebrush grass (*Elymus hystrix* var. *hystrix*) for yield, persistence, and forage quality. Sixteen accessions and two commercial sources of *Elymus virginicus* and thirteen accessions and one commercial source of *Elymus hystrix* were transplanted into single-row field plots during the summer of 2000 at Beltsville, MD, Rock Springs, PA, and Big Flats, NY. Two orchardgrass (*Dactylis glomerata*) cultivars were the control treatments. Yield and morphology (leaf width, length, mass; tiller density, plant height) data were collected during 2001 and 2002. Leaf morphology varied widely among accessions of both species. Yields of *Elymus virginicus* ranged from 8 to 57 grams of dry matter per plant in 2001. Yields of *Elymus hystrix* ranged from 4 to 40 grams of dry matter per plant in 2001. Orchardgrass plants were much more productive and yielded an average of 30 to 140 grams per plant. Both *Elymus virginicus* and *Elymus hystrix* were very sensitive to drought. *Elymus hystrix* was eliminated at Rock Springs by insect damage to growing points and roots. These results indicate limited potential as productive forage grasses for these native grasses without genetic improvement.

Keywords: Virginia wildrye, *Elymus virginicus*, eastern bottlebrush grass, *Elymus hystrix*, orchardgrass, forage, grazing

Grassland Restoration Opportunities on a Piedmont North Carolina Landscape

David Sawyer[1] and Don Hayes[2]
[1]North Carolina Wildlife Resources Commission, Traphill, NC; [2]North Carolina Wildlife Resources Commission, State Road, NC

Working with private landowners through the Cooperative Upland Habitat Restoration and Enhancement (CURE) program the North Carolina Wildlife Resources Commission is establishing early succession habitats over a 5,000-acre area in the western piedmont. This area of rural landscape was selected because its' current land use cover types were considered beneficial for bobwhite quail and landowner attitudes were considered positive for habitat management. The area is owned by twenty landowners and contains about equal amounts of forested and agricultural land. Agricultural land primarily consists of row crops, pastures, and hay fields that support the area's dairy and beef cattle farms. The project is designed to improve habitat for bobwhite quail and early succession songbirds by maintaining at least 2% of each cooperating property in some form of early successional habitat.

Landowners have provided sites for natural succession/grassland establishment on cropland field borders, pasture/stream edges, low-quality hardwood stands, and small farm-fields. Restoration efforts include control of fescue sod, prescribed burning, fall disking, livestock exclusion, and seeding of native grasses. Population trends of bobwhite quail and songbirds as well as habitat changes will be monitored throughout the five-year project. Our experiences

may prove beneficial to efforts in native grassland enhancement and establishment in other farming communities.

Key words: Cooperative Upland Habitat Restoration and Enhancement Program, CURE, early successional habitat, grassland

North Carolina's Cooperative Upland Habitat Restoration and Enhancement Program

Terry Sharpe[1] and Kate Pipkin[2]
[1]NC Wildlife Resources Commission, Hoffman, NC;
[2]NC Wildlife Resources Commission, Raleigh, NC

The North Carolina Wildlife Resources Commission has implemented the Cooperative Upland Habitat Restoration and Enhancement Program (CURE) to restore populations of Northern Bobwhites and other wildlife associated with grassland and shrubland habitats. To support the effort, the Division of Wildlife Management has reorganized, added 8 positions, developed administrative procedures, identified three focal areas, and initiated work with landowners and farmers. The CURE program will be focused into small geographic areas (cooperatives) where numerous habitat improvements can be implemented on adjoining properties.

Three focal areas were identified, based on statewide habitat analysis and initially targeting those landscapes with the best potential for increasing bobwhite populations. Interested groups of landowners applied and cooperatives were selected based on landscape attributes and human dimensions surveys. Within each of 3 focal areas a cooperative of around 5,000 acres is being developed on private lands. The Commission will work with the landowners to develop management plans and fund installation of habitat improvements. Populations of bobwhites and songbirds dependent upon grassland/shrub habitats are being monitored.

Goals of the program and practices utilized to establish and maintain habitat are consistent with those of numerous partners. Success and expansion of the effort is contingent upon support from cooperators ranging from landowners and farmers to private conservation organizations to state and federal agencies.

Keywords: Cooperative Upland Restoration and Enhancement Program, CURE

Rediscovering Native American Bamboo and Its Potential Role in Water Quality

William B. Skaradek
USDA, Natural Resources Conservation Service, Cape May Courthouse, NJ

River cane, switchcane, or native bamboo (*Arundinaria gigantea* or *Arundinaria tecta*) are two species of bamboo native to the North American continent. Their range extends from Maryland to Indiana, Florida, and Texas. The species were once widely distributed throughout the Southeast. Cultivation, burning, and grazing have destroyed the extensive stands called canebreaks. Loss of the canebreaks may have played a role in the disappearance of the Carolina parakeet and the Bachman's warbler. In the spring of 1999, the Cape May Plant Materials Center of the USDA, Natural Resources Conservation Service began a project to assist Native American groups restore canebreaks. The center has collected plant material and developed propagation techniques. The results of this study will be applicable to streambank stabilization and riparian buffer projects in which native bamboo has a role.

Keywords: river cane, switchcane, native bamboo, *Arundinaria gigantea*, *Arundinaria tecta*, canebreak restoration, propagation, streambank stabilization, riparian buffers

Why Coastal Municipalities Need to Know About Beachgrass Population Genetics

William B. Skaradek
USDA, Natural Resources Conservation Service, Cape May Courthouse, NJ

Money for funding coastal beach replenishment projects continues to become more limited and difficult to obtain. Municipalities must improve their ability to compete for those limited funds by demonstrating innovative approaches to managing coastal dune resources. The improvements will demonstrate to the public and funding agencies a higher benefit:cost ratio for funds allocated to projects in those municipalities. Advances in genetics have it easier to identify the different genotypes of American beachgrass that exist and develop improved plant material. The improved plant material will: improve the success of plantings, increase the longevity of stands, maximize the sand-trapping efficiency of plants established, and allow genetic diversity within the dune system. The poster will give the reader an overview of the following areas: sand distribution dynamics, typical dune cross sections, the adverse effects of sand fencing on 'Cape' American beachgrass, the reasons for the short life of 'Cape' American beachgrass, the application of basic biology and genetics to dune grass management, basic genetic fingerprinting, reasons genetic fingerprinting will become a regular management tool for public works officials.

Keywords: 'Cape' American beachgrass, sand distribution dynamics, typical dune cross sections, sand fencing, genetic fingerprinting

Aerenchyma Development in Native Warm Season Grass Cultivars

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USDA, Agricultural Research Service, University Park, PA;
USDA, Agricultural Research Service, Beaver, WV;
USDA, Natural Resources Conservation Service, Cape May Courthouse, NJ

The primary objective of this study was to determine the suitability of selected warm season grass species/cultivars for use in riparian buffers where flooding can be expected. This study focused on the development of aerenchyma in the roots of plants placed under flooding compared to non-flooding conditions. One-year-old plants from twenty-six cultivars representing six native warm-season grass species (big bluestem, *Andropogon gerardii* - 7 cultivars; little bluestem, *Schizachyrium scoparium* – 1 cultivar; switchgrass, *Panicum virgatum* – 10 cultivars; Indiangrass, *Sorghastrum nutans* – 5 cultivars; prairie cordgrass, *Spartina pectinata* – 1 cultivar; eastern gamagrass, *Tripsacum dactyloides* - 2 cultivars) were transplanted into 15-cm diameter by 120-cm deep PVC pots and grown under well-drained or waterlogged conditions. After approximately 100 days, pots were opened and root samples collected for root length distribution and aerenchyma formation determinations. Aspects of aerenchyma development included percent of cross sectional area as aerenchyma and whether the aerenchyma development was schizogenic (typical of constrictive aerenchyma)or lysigenic (characteristic of facultative aerenchyma which usually develop after stress initiation). This relationship between aerenchyma development and ability to extend roots into waterlogged soils will be discussed.

Keywords: warm-season grasses, aerenchyma, flooding, riparian buffers

Effect of Acid Soils on the Growth and Development of Eastern Gamagrass

Ronald J. Smith and Errol G. Rhoden
Tuskegee University, Tuskegee, Alabama

Eastern gamagrass (*Tripsacum dactyloides*), a perennial warm season grass, has been reported to tolerate a wide variety of sol conditions, including flooding, drought and acidity, but its reaction to different soil types has not been thoroughly investigated. Eastern gamagrass (culitivar 'Pete') with high forage potential, was tested to ascertain its performance in several acid soil types from the eastern and central United States under greenhouse conditions. The soil types studied were divided into two groups- those above and those below pH 5.5. An Orangeburg loamy sand (fine, loamy, thermic, Typic Kandidult) pH 5.7 gave the tallest plants (88.26 cm). In contrast, the shortest plants were those growing in Matawan-Hammonton loam (fine-loamy, siliceous mesic, aquic Hapludult) with a pH of 4.6 (74.61 cm). The most profuse tillering occurred in Lucy loamy sand (fine, loamy, thermic, Arenic Kandidult) having a pH of 6.1 with 46.0 tillers per plant at time of harvest. Plant dry weight ranged from 2.04 g/plant (pH 5.4) to 3.43 g/plant (pH 5.6) for Meth (fine, mixed, thermic, Ultic Hapludalf). Overall, plants averaged 83.1 cm in height, 41.99 tillers/plant and 2.61 g/plant. Eastern gamagrass plants grown in different acid soils performed similarly when pH increased and decreased. There was 3% and 4% increase in tillering and plant height, respectively, between plants grown in soil with pH above 5.5 over those below 5.5. soils with pH greater than 5.5 produced plants that averaged 84.09 cm in height, while those soils having pH less than 5.5 averaged 80.77 cm. Plants grown in soils with pH greater than 5.5 averaged 42.59 tillers/plant while those grown in soils less than pH 5.5 averaged 41.41 tillers. Therefore, 'Pete' eastern gamagrass performed favorably across the soil types and pH studied. These results indicate that a comprehensive study of eastern gamagrass populations could identify cultivars that are adaptable to specific soil types and conditions.

Keywords: eastern gamagrass, *Tripsacum dactyloides*, soil types, pH, height, tillering, forage production

Seasonal Yield of Native Warm Season Grasses

Robert Spitaleri and Jimmy Henning
University of Kentucky, Lexington, KY

Native warm season grasses are productive summer-producing forage crops that support excellent grazing animal performance. These grasses would form a valuable part of an improved forage pasture system, providing good forage during a time when the predominant cool-season forage species are not productive. The objective of this study was to determine the effect of variety on total and seasonal yield of eastern gamagrass (*Tripsacum dactyloides*), switchgrass (*Panicum virgatum*), Indiangrass (*Sorghastrum nutans*), and big blurestem (*Andropogon gerardii*). Varieties were established on a Maury silt loam in July, 2000 using transplants grown in float trays in a greenhouse. Experimental design was a randomized block replicated four times. Two harvests were made in 2001 for three of the species while indiangrass varieties matured late and were harvested only once. First harvests were made when most of the varieties were at 50% emergence of inflorescence. Means for dry matter yields by species were 14.6, 14.3, 13.4, and 10.5 Mg ha-1 for indiangrass, gamagrass, switchgrass, and big bluestem, respectively. In 2001, switchgrass and big bluestem varieties produced 72% and 70% of their total yield respectively by June 30. In contrast, 38% of eastern gamagrass yield occurred prior to June 30.

Keywords: native warm season grasses, total yield, seasonal yield

An 'Alamo' Switchgrass Population with Reduced Seed Dormancy

Charles R. Tischler[1], Justin D. Derner[1], H. Wayne Polley[2], and Hyrum B. Johnson[2]
[1]USDA, Agricultural Research Service, Temple, TX;
[2]Texas A&M University, Temple, TX

'Alamo' switchgrass (*Panicum virgatum*) seed often germinate poorly without stratification pretreatment. This is one of the reasons 'Alamo' switchgrass is difficult to establish. Positive results with other warm season grass species prompted us to use recurrent selection as a tool to reduce post-harvest seed dormancy in this species. We first harvested seed from a stand of 'Alamo' in 1992, immediately placed the seed in a germinator at 35°C-25°C, and saved the seedlings germinating within two weeks. These seedlings were subsequently planted in the field, intermated, and seed was again harvested and germinated as described, with resulting plants placed in the field once again. A total of four cycles of recurrent selection were performed. In spring, 2000, 163 'early germinators' from the fourth cycle were planted in the field. Seed was harvested from individual plants, and the 24 plants having seed with the highest germination percentages were dug and replanted in four replications and intermated. Seed from these 24 plants were tested for germination (under both temperature conditions) than unselected 'Alamo'. Our protocol has successfully reduced post-harvest dormancy in 'Alamo' switchgrass, and the experimental population is being evaluated for field establishment and possible release as a germplasm.

Key words: 'Alamo' switchgrass, *Panicum virgatum*, seed dormancy, recurrent selection, germination

Native Grasses on Riparian Areas in West Virginia

John Vandevender
USDA, Natural Resources Conservation Service, Alderson, WV

Within the Cacapon River basin of eastern West Virginia lies a native plant community unlike any other encountered in the state. This riverine plant community is situated in the Ridge and Valley Physiographic Province and has deciduous hardwood overstory typical of unmanaged riverine areas. While the understory vegetation is nistorically typical, it is decidedly atypical to the understory vegetation currently found in practically all other riverine communities in West Virginia. The following species of native warm season grasses may be observed within this riverine plant community: big bluestem (*Andropogon gerardii*), eastern gamagrass (*Tripsacum dactyloides*), switchgrass (*Panicum virgatum*), prairie cordgrass (*Spartina pectinata*), Indian woodoats (*Chasmanthium latifolium*), Virginia wildrye (*Elymus virginicus*), and paspalum (*Paspalum* spp.), and others. Several native legume and forb species may also be present within the plant community. The purpose of this paper is to document the diversity and distribution of the native grasses in this plant community.

Keywords: native warm season grasses, riverine plant community, West Virginia, Cacapon River basin

Local Tours and Workshops

Wednesday
October 2, 2002

Meeting Location
The Friday Center

Notes

Wednesday, October 2, 2002
(Box lunch provided for all)

Local Tours

8:00 a.m. – 5:00 p.m. – ALL-DAY TOURS

Piedmont Natural Areas
Tour Guides: Milo Pyne, Senior Regional Ecologist – SE, NatureServe
Steve Hiltner, Ellerbe Creek Watershed Association

Botanical Gardens and Arboreta – North Carolina Botanical Garden (UNC), J.C. Raulston Arboretum (North Carolina State University), Sarah P. Duke Gardens (Duke University)
Tour Guide: Ken Moore, Assistant Director for Education, Collections, and Operations, North Carolina Botanical Garden

Hoffman's Nursery
Tour Guides: John Hoffman, Proprietor, Hoffman's Nursery
Janie Bryan, Acting Curator and Seed Technician, North Carolina Botanical Garden

8:00 a.m. – 12:00 noon – HALF-DAY TOURS

Mason Farm Biological Reserve (North Carolina Botanical Garden)
Tour Guides: Johnny Randall, Assistant Director for Conservation, North Carolina Botanical Garden
Misty Franklin, Conservation Officer, North Carolina Botanical Garden
Rebecca Pappert, Conservation Assistant, North Carolina Botanical Garden

Audubon Sanctuary Program (Finley Golf Course)
Tour Guides: Charles Peacock, Department of Crop Science, North Carolina State University

Forage Program at North Carolina State University/ USDA, ARS
Tour Guides: James Green, Department of Crop Science, North Carolina State University
Joe Burns, Department of Crop Science, North Carolina State University

Workshops

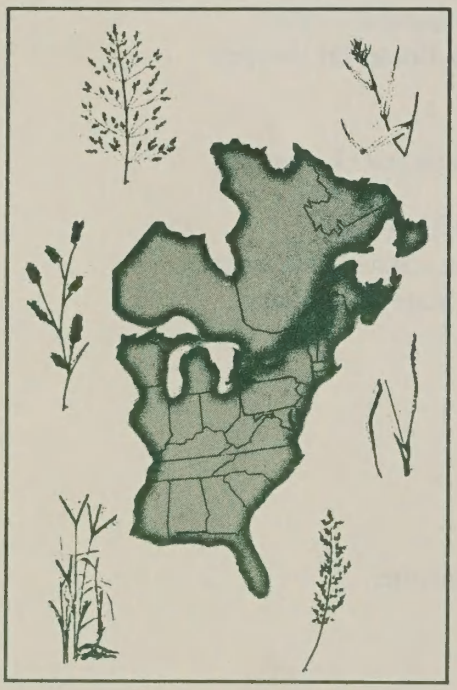
1:00 PM – 5:00 PM

Grass Identification
Facilitator: Alexander Krings, North Carolina State University Herbarium

Seed Harvesting (by hand) and Cleaning (small scale)
Facilitators: Bob Glennon, USFWS, Edenton, NC
Dan Dusty, Farm Manager, USDA-NRCS, Beltsville, Maryland

Establishment (PLS Calculation, Drill Calibration, Depth Adjustment, Drill Operation)
Facilitators: Larry Pollard, Traux Company, Minneapolis, Minnesota
John Dickerson and Jay Ugiansky, Establishment Without Drills

Native Grass Crafts
Facilitator: William Newman, Traditional Craftsman



The Third

Eastern Native Grass SYMPOSIUM

October 1 - 3, 2002

Chapel Hill, North Carolina