

Biofeedstock Research in Madison, WI



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Value-Added Products from Forages and Bioenergy Crops

CRIS Project 3655-41000-004-00D

Current personnel

Paul Weimer (0.8)

Matt Digman (0.7)

Michael Casler (0.2)

To be added

Peter Vadas (0.4)

Ron Hatfield (0.2)

John Ralph (0.2)

Michael Sullivan (0.2)

CRIS Project 3655-41000-004-00D

- Biomass production, harvesting and storage
 - Agronomy and management
 - Breeding and genetics
 - Harvesting and storage
- Biomass conversion
 - Pre-treatments
 - Value-added co-products from consolidated bioprocessing
 - Fermentability screening of biomass materials

Agronomy & Production

- One-harvest switchgrass biofeedstock production system in hardiness zones 3/4.
 - Persistence is maximized at late summer/early autumn harvest dates, due to limited time for regrowth
 - Higher fiber, lignin, and ash at later harvest dates may be detrimental for fermentation and/or combustion.
 - All of these plant traits are under genetic control and can be manipulated fairly easily in a breeding program.
 - Existing combinations/correlations of traits are related to selection of germplasm from diverse hardiness zones.

Future Directions in Agronomy

- Nitrogen nutrition (with University Park, PA)
 - What is the effect of reducing (or eliminating) the use of inorganic N fertilizer on switchgrass biomass yield and cultivar rankings?
 - Can associations with N-fixing bacteria or vesicular arbuscular mycorrhizae be used to provide significant nitrogen nutrition to switchgrass?
- Harvest management
 - Cultivar x harvest management interactions for one-harvest systems: late summer, late autumn, late winter

Bioenergy in Farming Systems

- Comparison of economics and energy balances among likely crop rotations
 - Continuous corn, Continuous switchgrass, Alfalfa-corn
 - Impact of plant genetics or management on economics and energy balances
- Integration into crop-livestock systems
 - Do bioenergy crops offer income sources as an alternative to increasing the number of livestock?
 - Could greater crop profitability enable reduced animal density and improve nutrient management?

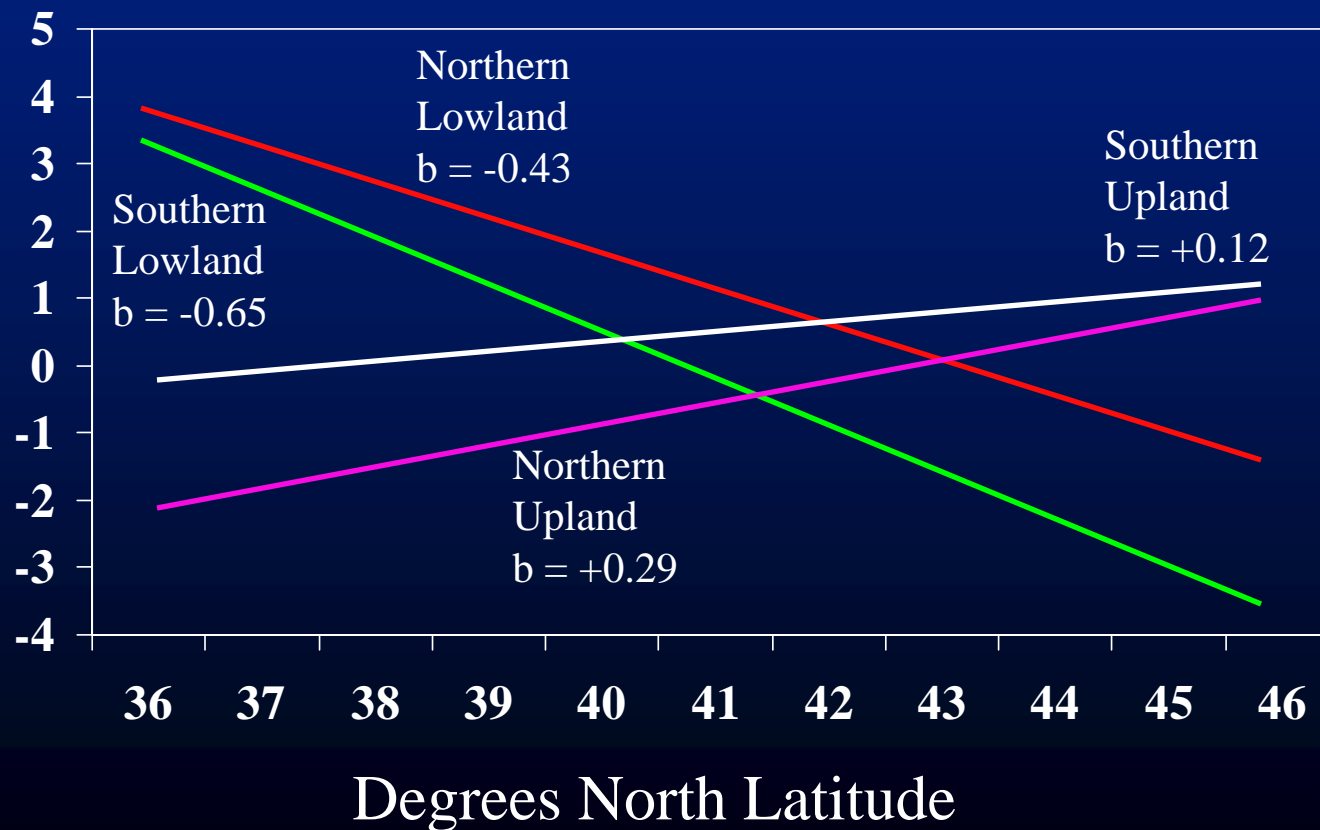
Switchgrass Breeding & Genetics

- 1996 through 2006 (11 years)
- Collection and development of germplasm for hardiness zones 3-6, east of the Mississippi River.
- Release of WS4U and WS8U northern upland germplasms.
- Impending release of 'St. Croix' switchgrass with superior biomass yields in HZ 3 & 4.
- Switchgrass gene pools for North America.
- ARS locations: Lincoln, NE; Mandan, ND

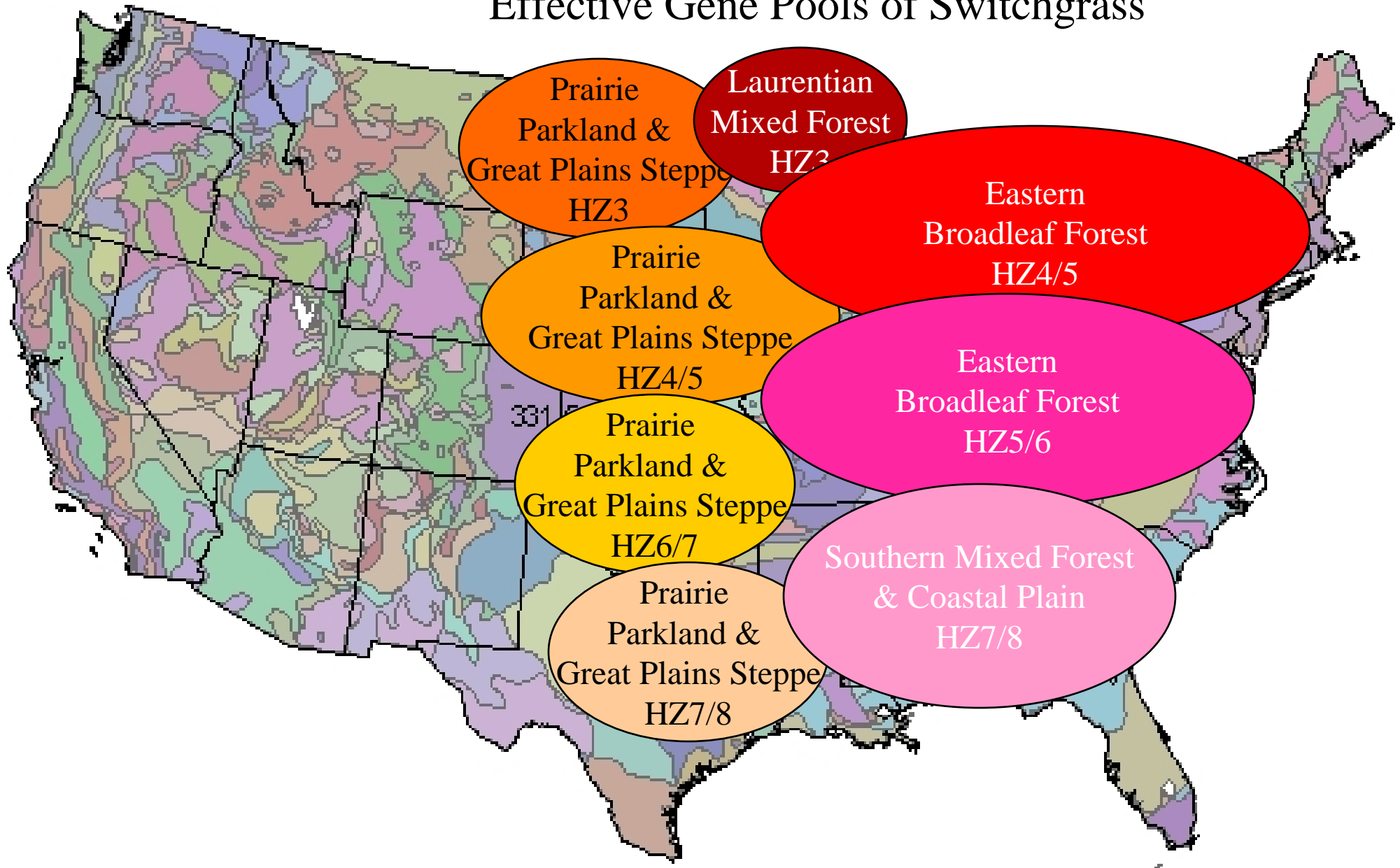
Biomass yield: Cytotypes & Origins

$P < 0.01$ (all group comparisons)

Biomass Yield Deviation (Mg/ha)



Effective Gene Pools of Switchgrass



Breeding/Genetics - Next 5 years

- Gene discovery - cell-wall traits
- Development of functional DNA markers
- Deployment of DNA markers - marker selection
- Upland x Lowland hybrids - feasibility, heterosis
- Nitrogen nutrition - selection under low-N
- Species: expansion to reed canarygrass, big bluestem, indiagrass
- ARS locations: Lincoln, NE; Ithaca, NY

Harvesting & Storage

SCA with Kevin Shinnars, Dept. of Biol. Syst. Eng.,
University of Wisconsin (with St. Paul, MN)

- Harvesting, pre-processing, and storage of crop residues
 - Novel single-pass harvesting systems to reduce energy use
 - Alternative storage technologies to reduce DM losses
- Harvesting, pre-processing, and storage of perennial grasses and alfalfa as biofeedstocks
 - Harvest dates, conditioning treatments, drying time
 - Alternative storage technologies