

2008 LCCMR Proposal

LCCMR ID: 07-083-000

Project Title:

Protecting and Enhancing Minnesotas Native Prairie Plant Resources

LCCMR Staff Confirmed or Revised Priority:

Selected Topics - Native Prairies - Create prairie seed banks of local ecotypes

LCCMR 2008 Funding Priority: Native Prairies

Total Project Budget: \$ \$5,884,365

Proposed Project Time Period for the Funding Requested:

7/1/08 - 6/30/13

Other NonState Funds: \$

0

Project Manager: Donald Wyse

Sponsoring Organization: U of M

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Location:

County: Lyon

City / Township:

Other: 8 MN Prairie Subecological Regions

Summary:

This collaborative research will collect, preserve and increase seed supply of Minnesota source-identified native prairie plants and evaluate their adaptation to diverse soil and moisture environments across Minnesota's ecoregions

MAIN PROPOSAL

PROJECT TITLE: Protecting and Enhancing Minnesota's Native Prairie Plant Resources

II. DESCRIPTION OF PROJECT RESULTS

Federal and state land management policies now emphasize the recovery of natural ecosystem structure and function through the restoration of lands and roadsides with plantings of native species whose geographical origin is known and verifiable ("identity-preserved"). The use of identity-preserved native seed will ensure the adaptation of planting materials to local conditions. However, this increased demand for locally adapted, identity-preserved native seed, together with the anticipated demand for locally adapted seed for use in large scale polyculture mixtures for biofuel production, will rapidly exceed current supplies. Our proposal is to develop a comprehensive identity-preserved native plant ecotype program based on collaborations among the U of Mn, MnDA MnDNR, MnDOT MCIA, BWSR, NRCS, Minnesota Native Seed Producers Association and other organizations. The program will increase the seed bank supply of identity-preserved ecotypes of native grasses, forbs, and legumes while at the same time protecting the genetic diversity of Minnesota's native plant species. The program will develop practices to improve seed production of identity-preserved native plant ecotypes, identify seed transfer zones appropriate for native ecotypes, and improve long-term benefits from restoration and polyculture plantings including improved water quality, soil health, and wildlife habitat.

Result 1. Collect Native Plant Seed to Develop Identity-Preserved Populations. \$ 2, 213, 000

Seed collections of 6 grasses, 6 legumes, and 18 forbs will be made from prairie remnants in each of Minnesota's 8 prairie based ecological subsections, with 10 collection sites per ecological subsection (see map) made as staggered seasonal collections from both mesic and wetland fringe sites. Diversity array technology (DArT) a high-throughput, robust genetic marker technology, ideal for little-studied species, will be used to genetically fingerprint each of the populations. **Deliverable 1.** Seed collections will result in a diverse seed bank of over 80 Minnesota native ecotypes for each of the 30 species for a total of at least 2,400 identity-preserved populations. CD 7/12. **Deliverable 2.** DArT will be used to DNA fingerprint all 2,400 ecotype populations immediately after harvest. CD 7/12. **Deliverable 3.** Seed samples from each population will be placed in long-term cold storage to preserve each population. CD 7/12.

Result 2. Increase Supply of Identity-Preserved Ecotype Prairie Seed. Budget: \$ 1,520,000

Each of the identity-preserved ecotype populations will be propagated in production fields at the U of Mn Research and Outreach Center's and managed according to standards for certification by MCIA for source identified materials. **Deliverable 1.** Produce 2-10 lbs. of source-identified Generation 1 seed of each native ecotype (one acre each). CD 7/12. **Deliverable 2.** Source-identified Generation 1 seed will be used to establish Generation 2 seed production fields, and long-term ecological studies CD 7/12. **Deliverable 3.** Generation 2 source-identified Minnesota ecotype seed (20 to 1,200 lb/population) will be made available to private growers for large scale commercial seed production for use in public and private restoration projects. CD 7/13.

Result 3: Maintain Genetic Diversity and Adaptability of Native Plant Populations. \$1,257,835

We will monitor the change in genetic diversity in identity-preserved native plant populations during seed cleaning and processing, nursery procedures, and seed production. Plants from the identity-preserved seed collection will be grown in common gardens in selected ecoregions and across microsites with diverse abiotic (soil/water) conditions within an ecoregion to measure phenotypic and genetic changes that could impact adaptability. **Deliverable 1.** Seed from selected native seed collections will be assessed for genetic diversity using DArT technology at

each step in the seed production process. CD 7/13. **Deliverable 2.** A long-term common garden study will be initiated to evaluate the impact of moving seed varying distances within and between ecological regions and the impact of microsites with diverse abiotic conditions on the adaptability of the populations to these sites. CD 7/13. **Deliverable 3.** Information developed in the common garden studies will be used to develop guidelines for seed transfer zones within and between ecoregions for each of the identity-preserved native plant populations. CD 7/13.

Result 4. Make Native Inoculum Available for Native Legumes. Budgets: \$ 893,530

The unavailability of *Rhizobia* (N fixing bacteria) appropriate for each legume species could limit restoration development, diversity and productivity. Strains of *Rhizobia* specific to each legume species in the Minnesota ecotype collection will be collected, developed, and evaluated. *Rhizobia* strains will be isolated from soil and then evaluated for host range, for the benefits they can provide to each legume, and for their genetic diversity across and within ecoregions

Deliverable 1. Collect *Rhizobia* containing soil samples for each legume species from 10 sites in each ecoregion and isolate 25 *Rhizobia* strains from each of the 420 legume/site combinations for a total of 10,500 isolates. CD 7/10. **Deliverable 2.** Strains for each legume will be field tested for nitrogen fixation potential, strain persistence in the soil, and response to management; made available to seed producers CD 7/12. **Deliverable 3.** Conduct genetic characterization of promising *Rhizobium* strains from different legume species and each ecoregion. CD 6/13.

III. TOTAL PROJECT REQUEST BUDGET

Staff: U of Mn, 1-scientist 10% 12,061/yr, 4-techs 100% \$240,000/yr and 10-support positions 50% \$150,000/yr, seed research; 1- post doctoral fellow 100% \$42,480/yr, 1-tech. 100% \$50,426/yr, 1-grad. student 100% \$ 35,000, Rhiz. research; 4-student labor 25% \$25,000/yr, 1-post doctoral fellow 100% 42,480/yr, 1-tech. 100% \$50,426, 2-grad. students 100% \$70,000/yr, ecological studies; 1-tech. 50% \$25,000/yr DNA analysis. **Contract for services:** Mn Cons. Corps 3-tech. \$45,000/yr; Bonestroo, plant collection \$15,000/yr; Diversity Arrays Technology Ltd., DNA discovery array \$20,000/species \$600,000, genotyping \$40/sample-2,400 samples \$96,000; U of Mn, utilities \$10,000/yr, land rental \$26,000/yr; **Travel:** U of Mn, 50,000mi/yr \$0.50/mi \$25,000/yr, lodg. \$5,000/yr seed collection; travel and lodg. \$8,000/yr Rhiz., \$8,000/yr ecological studies; **Equipment and supplies:** U of Mn, light room and freezer \$24,000; supplies \$38,000/yr *Rhizobium* study; supplies \$50,000/yr seed studies, supplies \$30,000/yr ecological studies; seed cleaning/processing equipment \$120,000; MCIA germination chambers \$30,000; **TOTAL BUDGET:** \$ \$5,884,365; Five year budget.

IV. OTHER FUNDS AND PARTNERS

A. Project Partners: Mn Cons. Corps, \$225,000; Bonestroo, P. Bockensted \$75,000; NWROC, L. Smith \$500,000; SWROC, P. Nickel \$500,000; SROC, F. Izuno \$500,000; Agro. and Plant Genet, C. Sheaffer/ D. Wyse \$1,109,935; Agro. and Plant Genetics, N. Ehlke/G. Meuhlbauer/N. Jordan \$1,257,835; Soil, Water, and Climate, P. Graham \$893,530; Ecology, Evolution and Behavior, C. Lehman \$60,305; CINRAM, D. Current \$100,000; MCIA, G. Beil \$30,000.

B. Other Nonstate Funds: Pheasants Forever, M. Holland; Mn Native Plant Society, S. Milburn; MnDNR, J. Garms; Mn Native Seed Producers Assn, B. Olson; MnDA, C. Dale; MnDOT, D. Stenlund; BSWR, D. Shaw; NRCS, P. Flynn; These individuals and organizations will support the project with their time, knowledge, land, and native plant resources.

C. Past Spending: None

D. Time: The budget is designed to support the first five years of a long-term project to collect, genotype, and propagate seed of identity-preserved native plants to meet commercial needs, and to initiate ecological studies to inform development of seed zone policies for Minnesota.

Project Manager Qualifications:

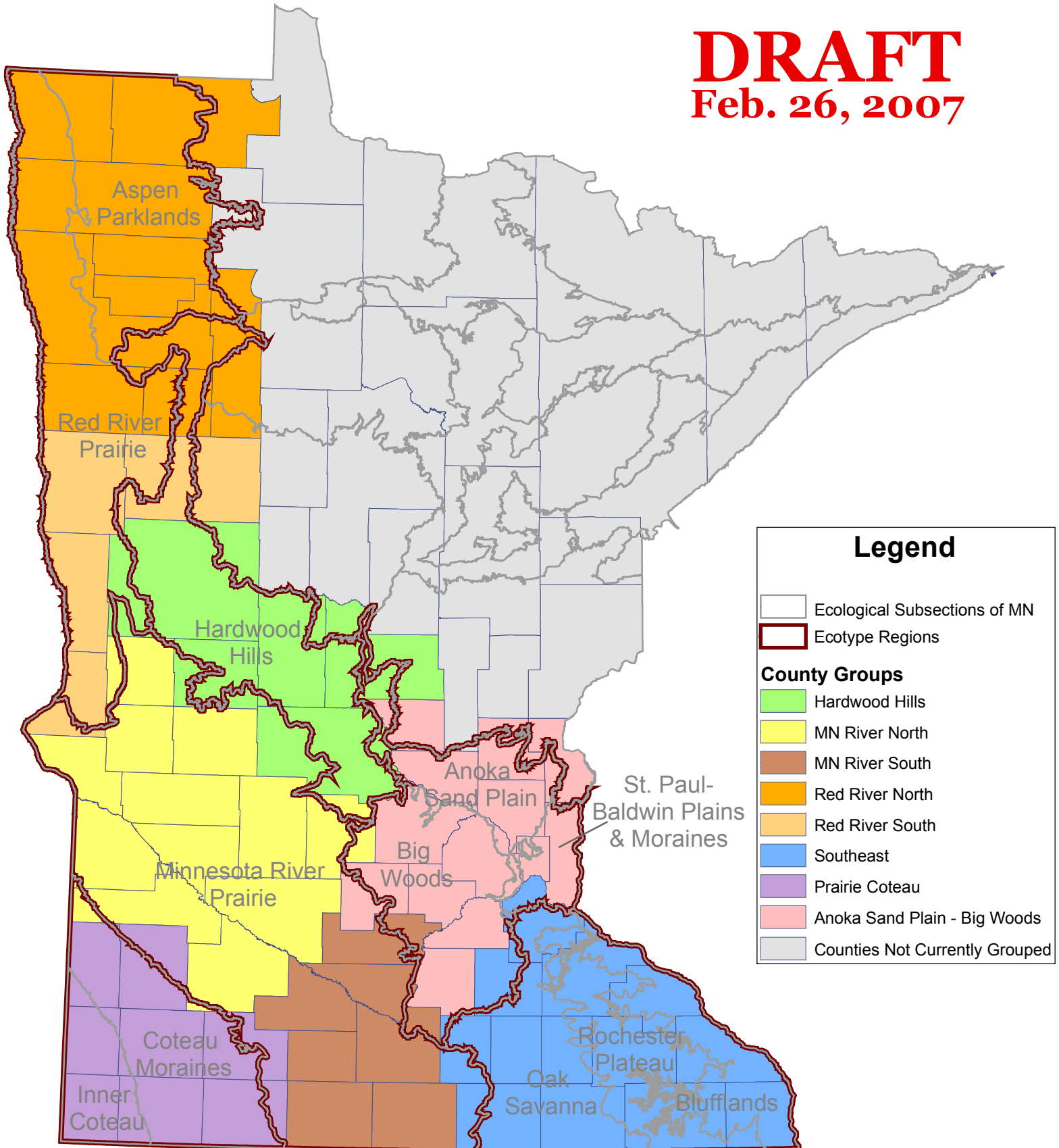
Donald Wyse is a Professor in the Department of Agronomy and Plant Genetics at the University of Minnesota, St. Paul. His research concentrates on biological weed management, development of sustainable agriculture systems, as well as legume and grass seed production systems. He has focused his research efforts on the development of perennial plant systems, including prairie polycultures, and has studied their impact on soil and water quality. He has lead several multi-disciplinary research teams composed of university faculty and scientists from both state and federal agencies. He has experience in managing large multi year grants. Dr. Wyse was the founding Director of the Minnesota Institute for Sustainable Agriculture and currently serves as Co-Director of the Center for Integrated Natural Resources and Agricultural Management at the University of Minnesota. Recent activities of the Center have led to the development of the Mississippi River—Green Land, Blue Waters Initiative that includes universities, state and federal agencies, and NGO's that have been organized to deal with the landscape issues that impact the water quality in the Mississippi River.

Organization Description:

The performing organization is The University of Minnesota which is an 1862 Land Grant Institution with the capacity to manage large multi-year grants.

Ecotype Regions and Associated County Groups Based on Ecological Subsections

DRAFT
Feb. 26, 2007



0 15 30 60 90 120 Miles

