LCCMR Minnesota Statewide Conservation and Preservation Plan

INSTITUTE ON THE ENVIRONMENT

UNIVERSITY OF MINNESOTA

CR Planning Community Resources

Bonestroo

Biofuel Energy Use Team (Mulla and Fosnacht, co-leads)

- Identify biofuel and energy trends and impacts, including potential trends in energy and fuel conservation
- Map priority natural resource areas affected by these trends
- Identify energy-related investment and policy choices that impact natural resources

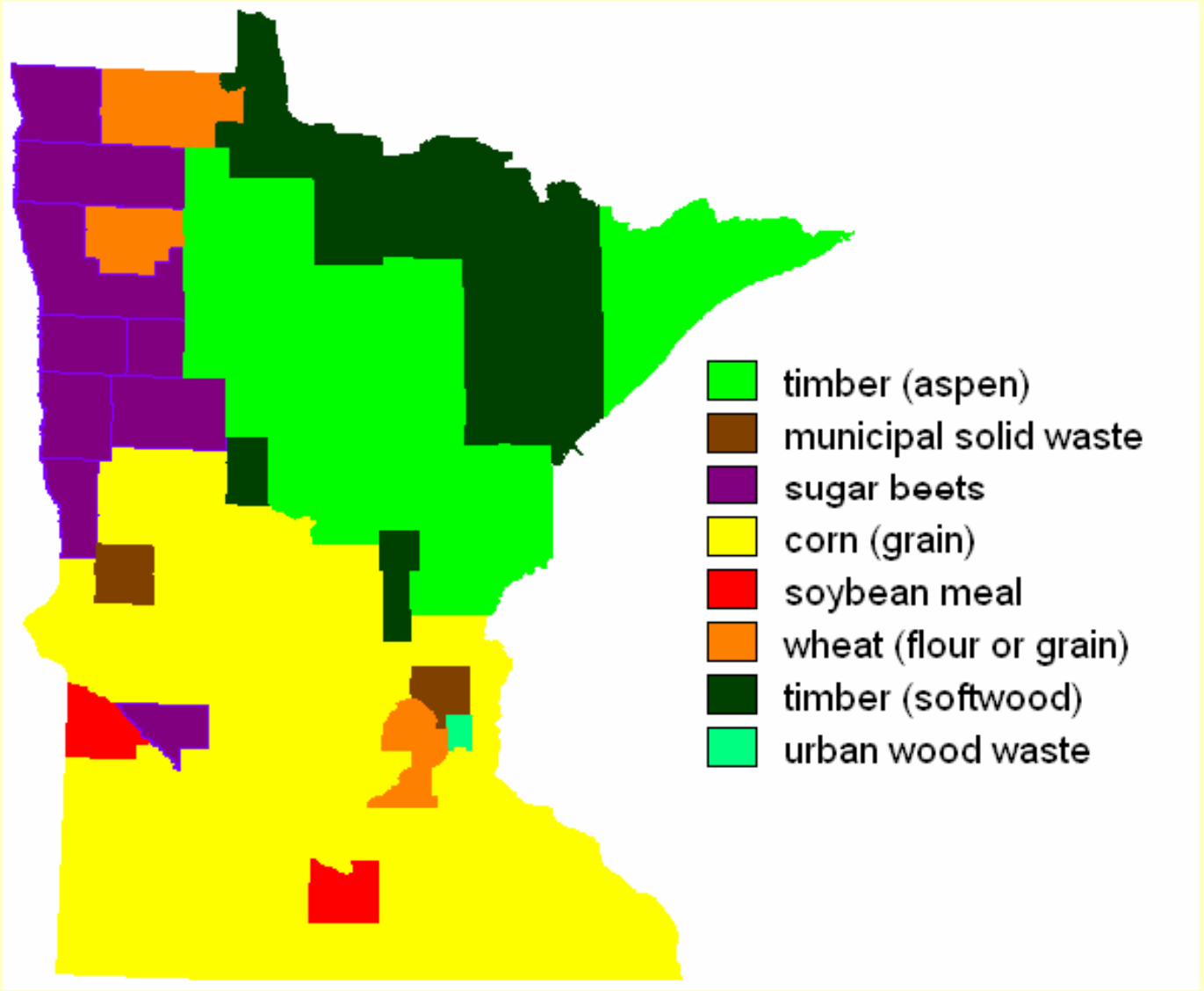
Energy production and use: Progress

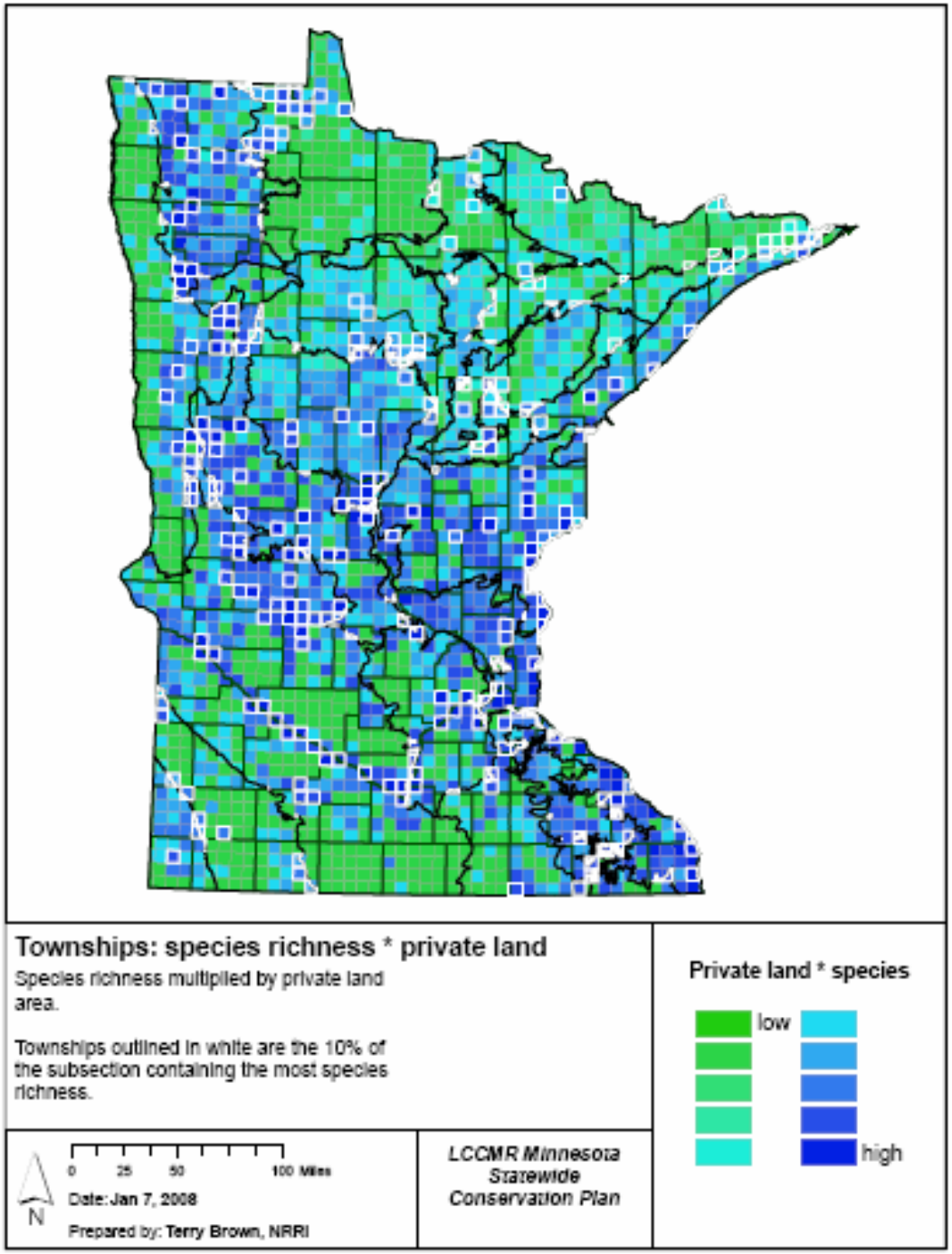
- Examine 3 overarching energy & environmental policy scenarios relevant to future sustainable energy systems
  - 1. Continuation of **current** energy & environmental policy & incentives
  - 2. Shift to policies/practices that promote **significant conservation** of energy and alternative energy sources
  - 3. Scenario 2 + policies/practices that promote **significant environmental benefits** from land use practices
- For each scenario: identify trends, evaluate biofuel options and impacts, recommend strategies

Agricultural Land-use Options

- 3 major options for Ag. Landscapes
  - *Corn-soybean rotation*
    - Probably more corn, collection of corn biomass
  - *Monocultures of perennial energy crops*
    - Switchgrass, miscanthus, hybrid poplar, others
  - *Polycultures of perennial energy crops*
    - Grass-legume mixtures, native prairie plantings
- For each overarching scenario:
  - We will determine expected pattern of options across ag. landscapes
  - We will determine expected environmental impacts and benefits/costs of each pattern
- Ex.: Environmental scenario likely means more perennials

Largest bio-feedstock by county in Minnesota





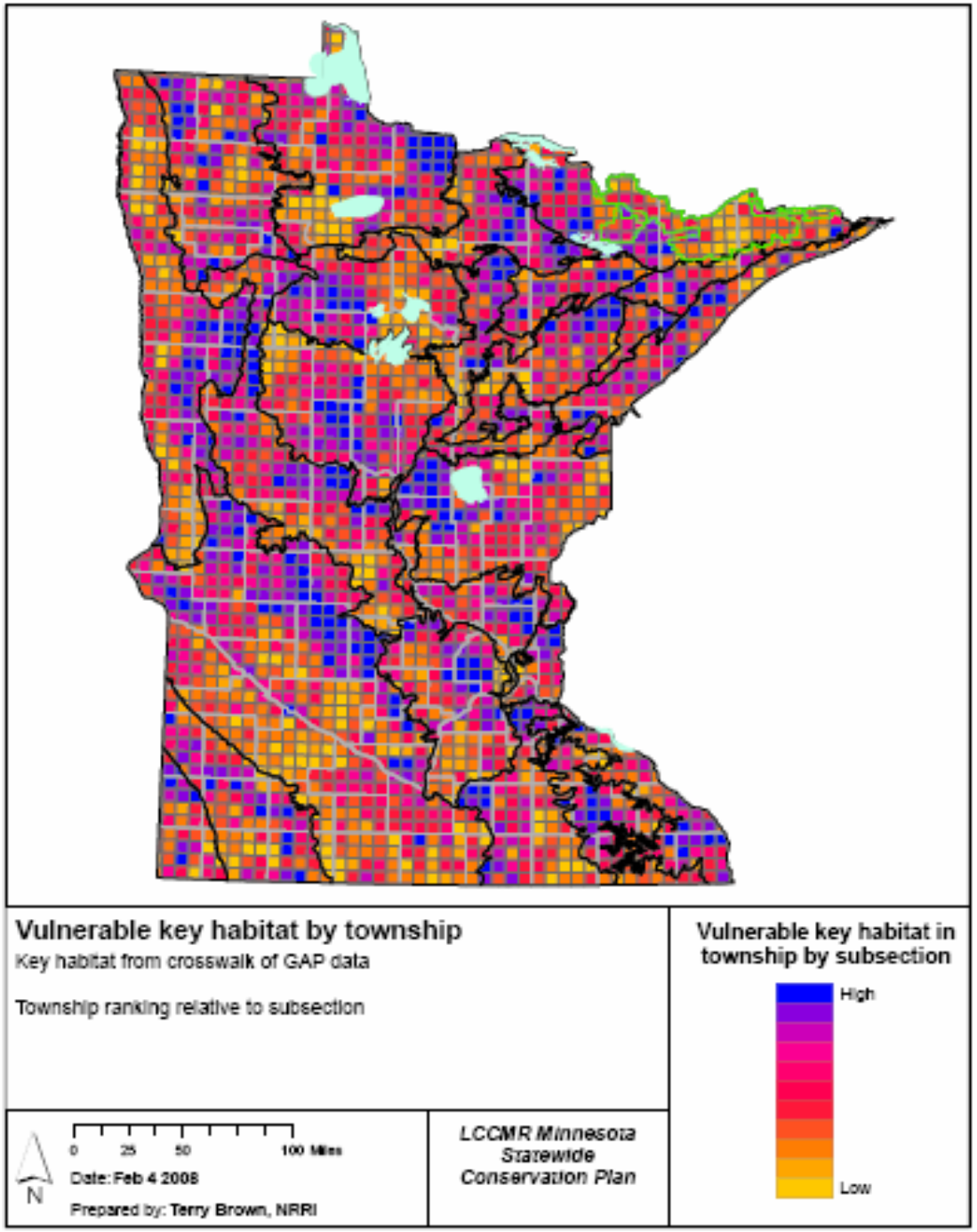
Example of mapping step:

Species of Greatest Conservation Need

Species richness by township

and

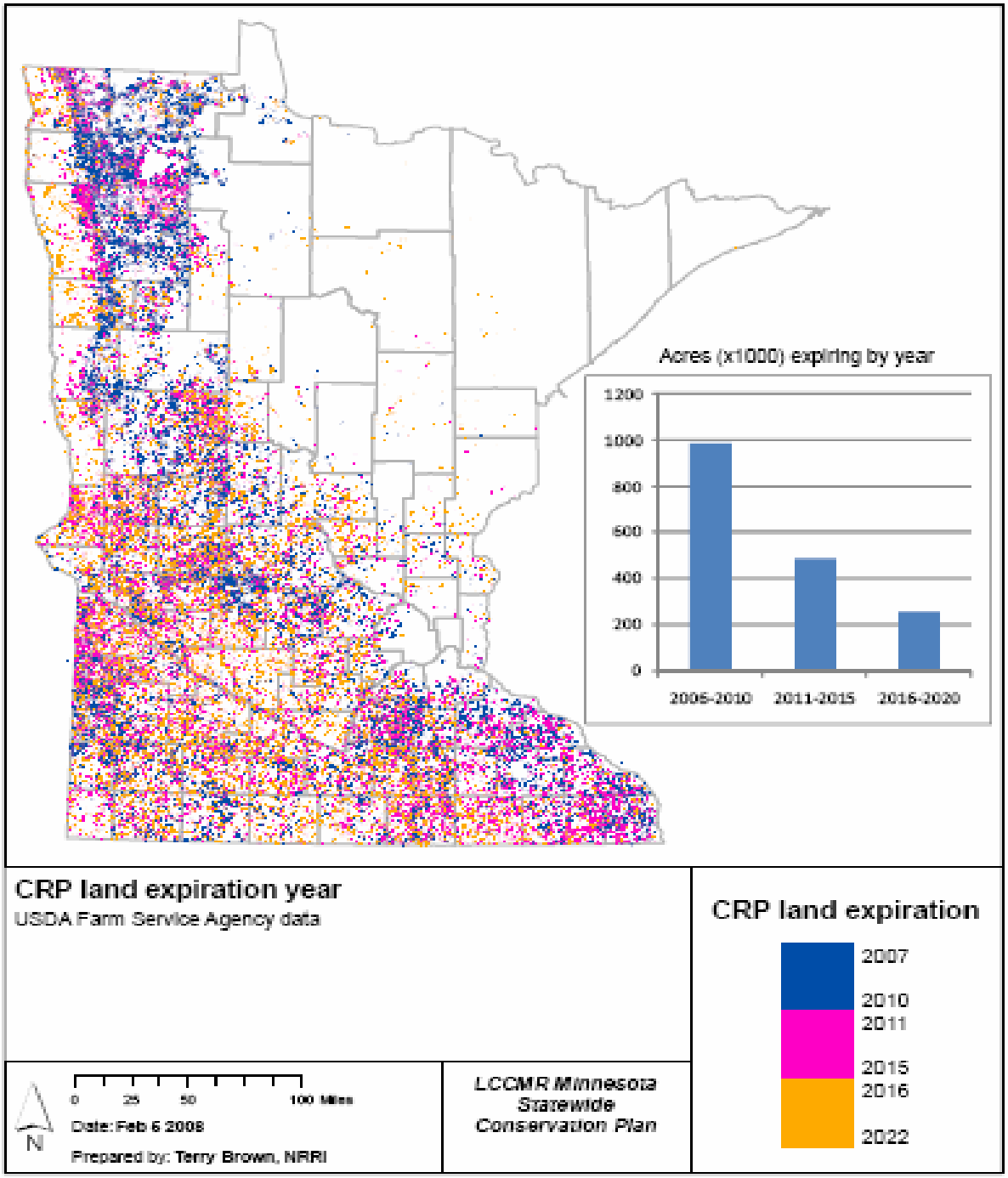
Top 10% of townships within each Ecological Section



Example of mapping step:

Vulnerable key habitats

The darkest blue color in each Ecological Subsection shows the townships with the top 10% of vulnerable key habitats for that subsection



Trend Analysis Example:

Conservation Reserve Program

Year of expiration of enrolled acreage

Landscape Decision Matrix for Future Land Use Scenarios

Vulnerability

Suitable for Perennial Biofuel Crops	Suitable for Annual Crops with BMPs or Perennial Biofuel Crops
Suitable for Housing Developments	Suitable for Annual Crops

Productivity

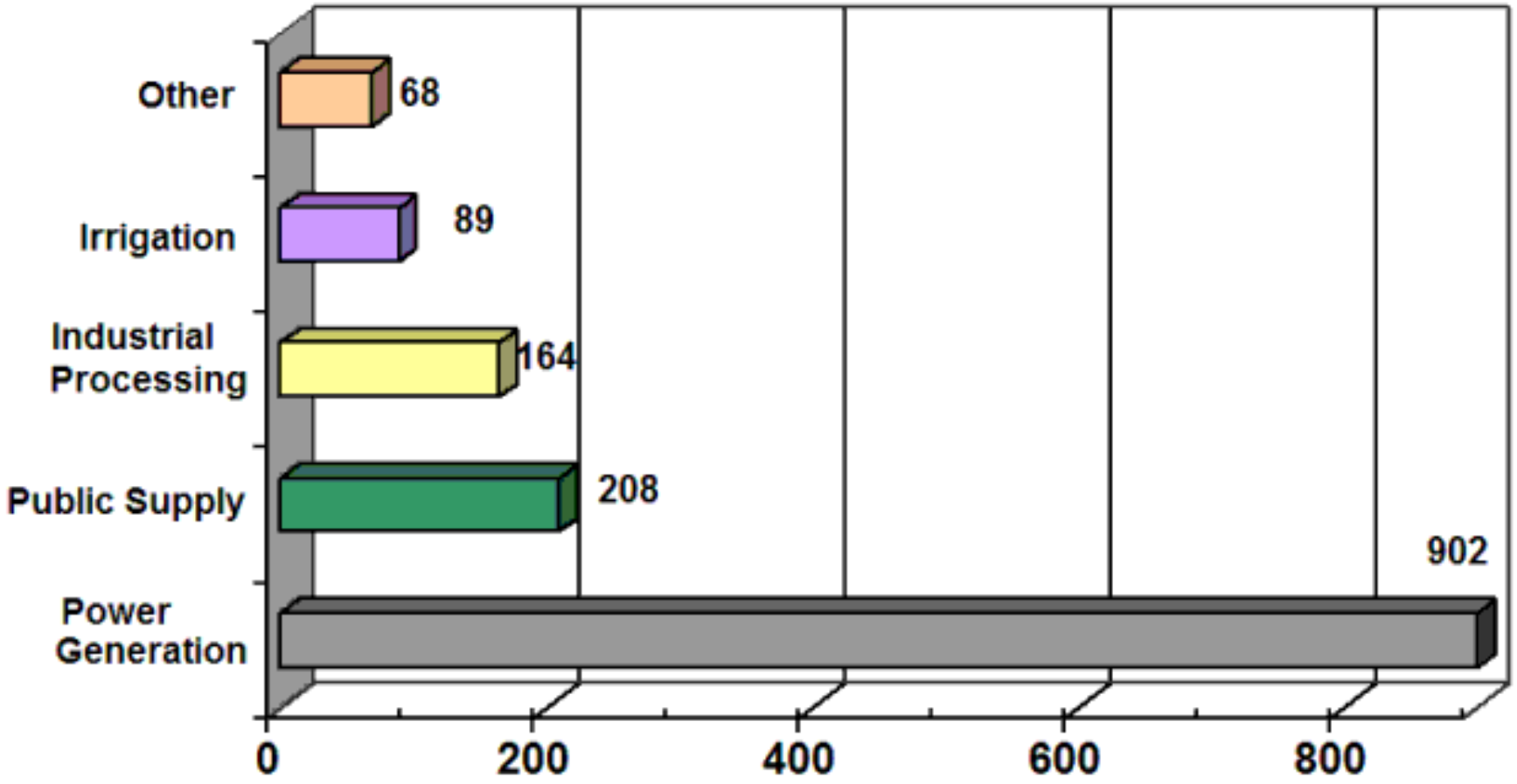
Water Budget for Corn-Soybean Rotation in Le Sueur River

Component	Water Budget (mm/yr or %)
Precipitation	850 (100%)
Evapotranspiration	569 (67%)
Streamflow	214 (100%)
Tile Drainage	127 (59%)
Surface Runoff	39 (18%)
Shallow Groundwater	41 (19%)
Interflow	3 (1%)
Shallow Recharge	28 (13%)
Deep Recharge	4 (2%)

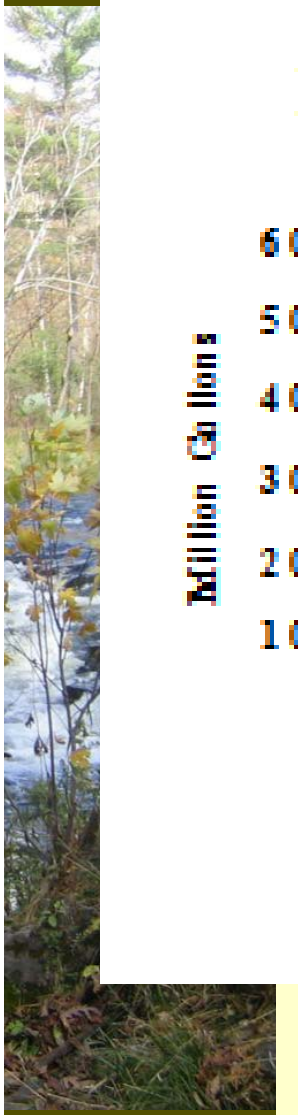
LCCMR Studies on Ground Water Sustainability (Nieber, Shmagin, Kanivetsky, Mulla, Wilson)

- Minnesota ground water is used for a variety of economic enterprises
- Ground water discharge also feeds many wetlands, streams and rivers in Minnesota
- How does the renewable capacity of ground water vary across the state for both surficial and deep aquifers?
- What are the current and projected demands for ground water consumption?

Minnesota Water Use 2005



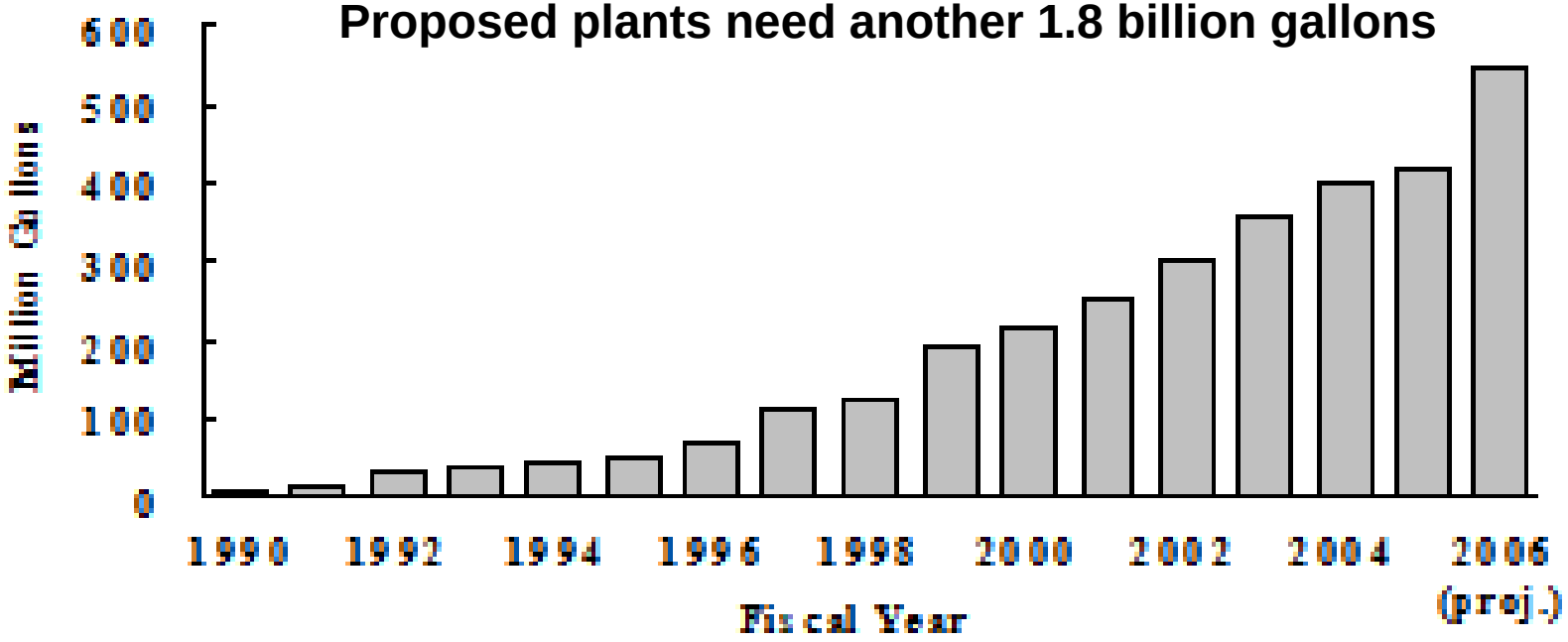
MN DNR Waters



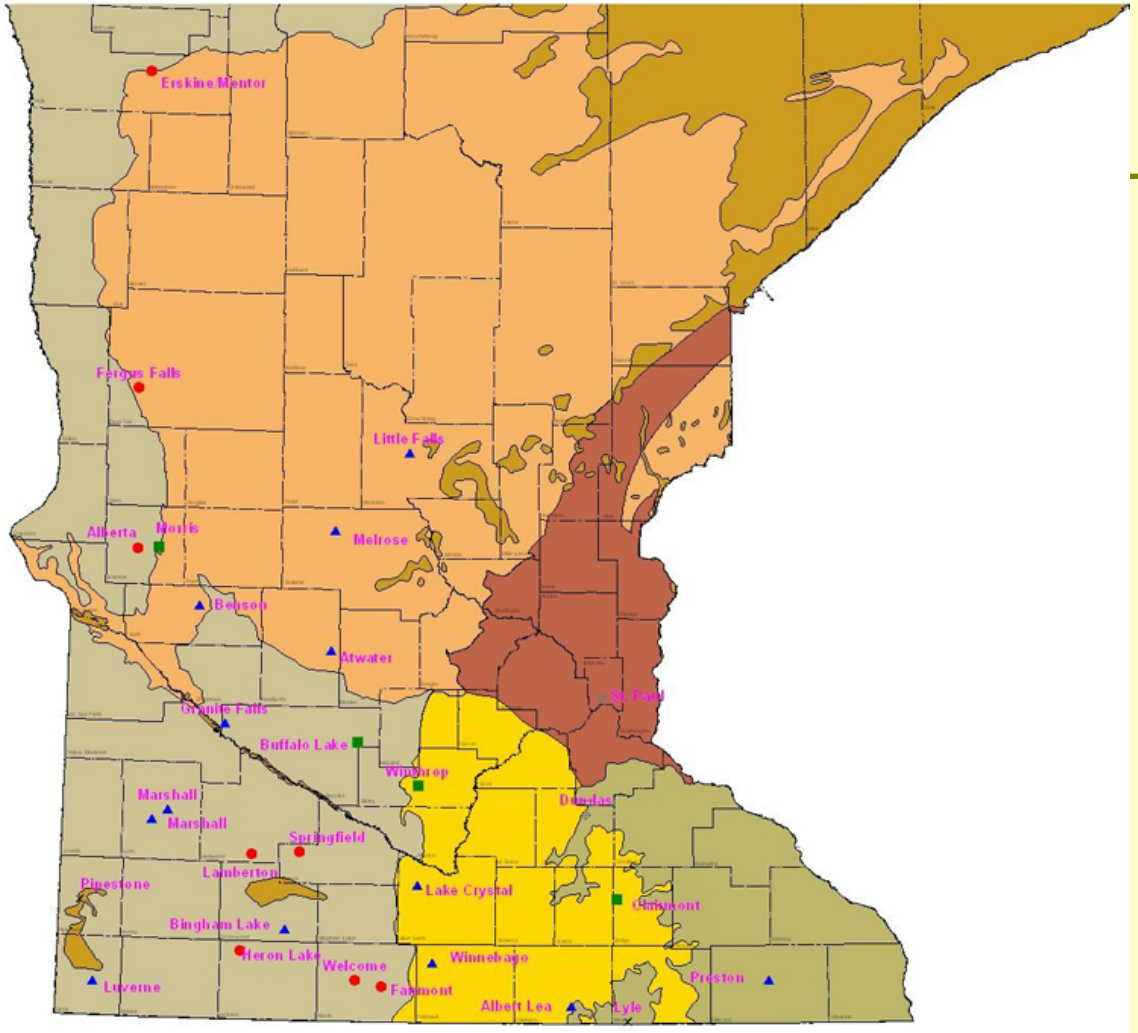
Ethanol Production in Minnesota

2.4 billion gallons of water needed in 2006

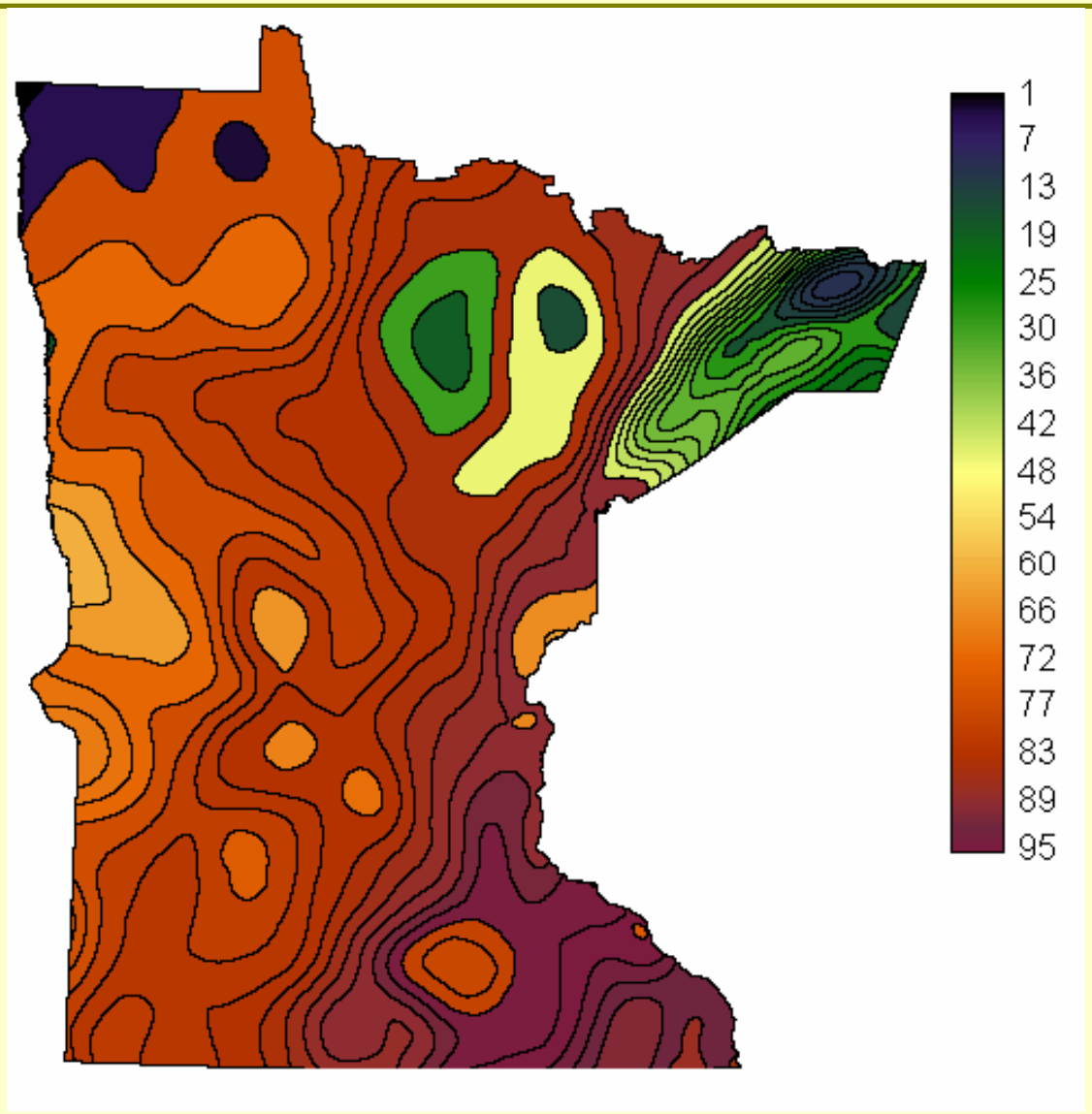
Proposed plants need another 1.8 billion gallons



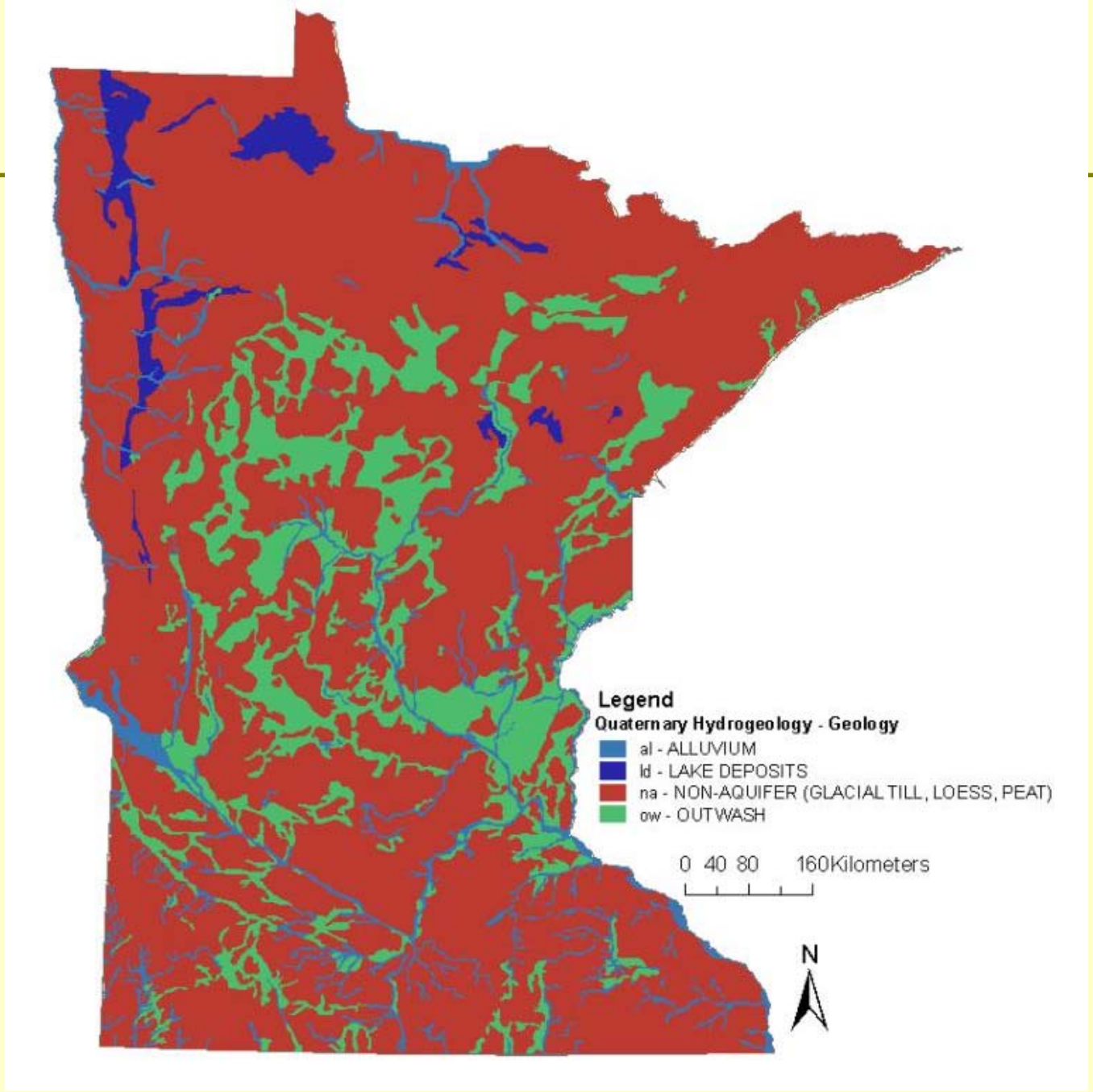
Minnesota Ethanol Plants & Water Availability by Aquifer Type



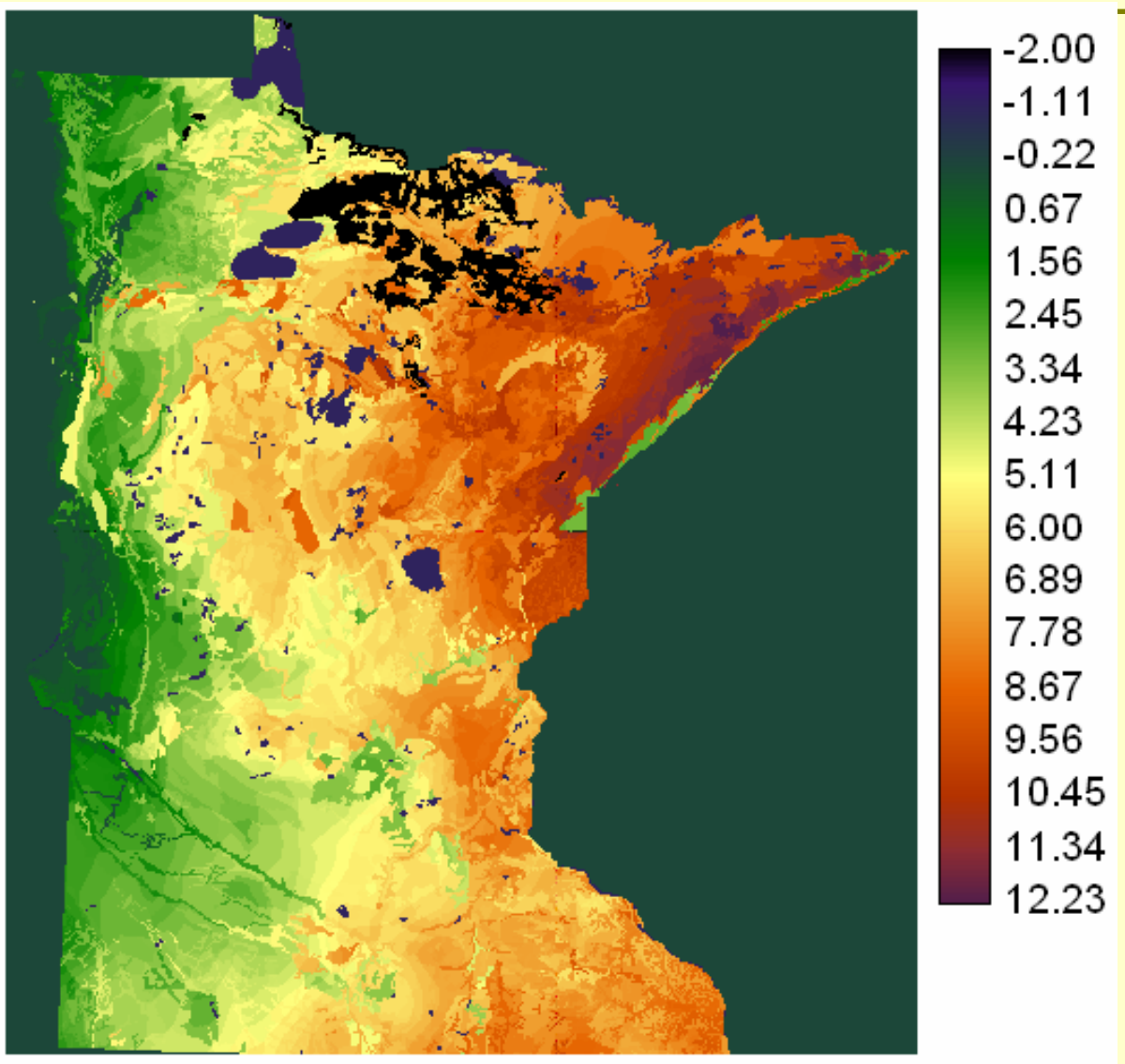
Precipitation 30-year normals (in/yr), 1970-2000



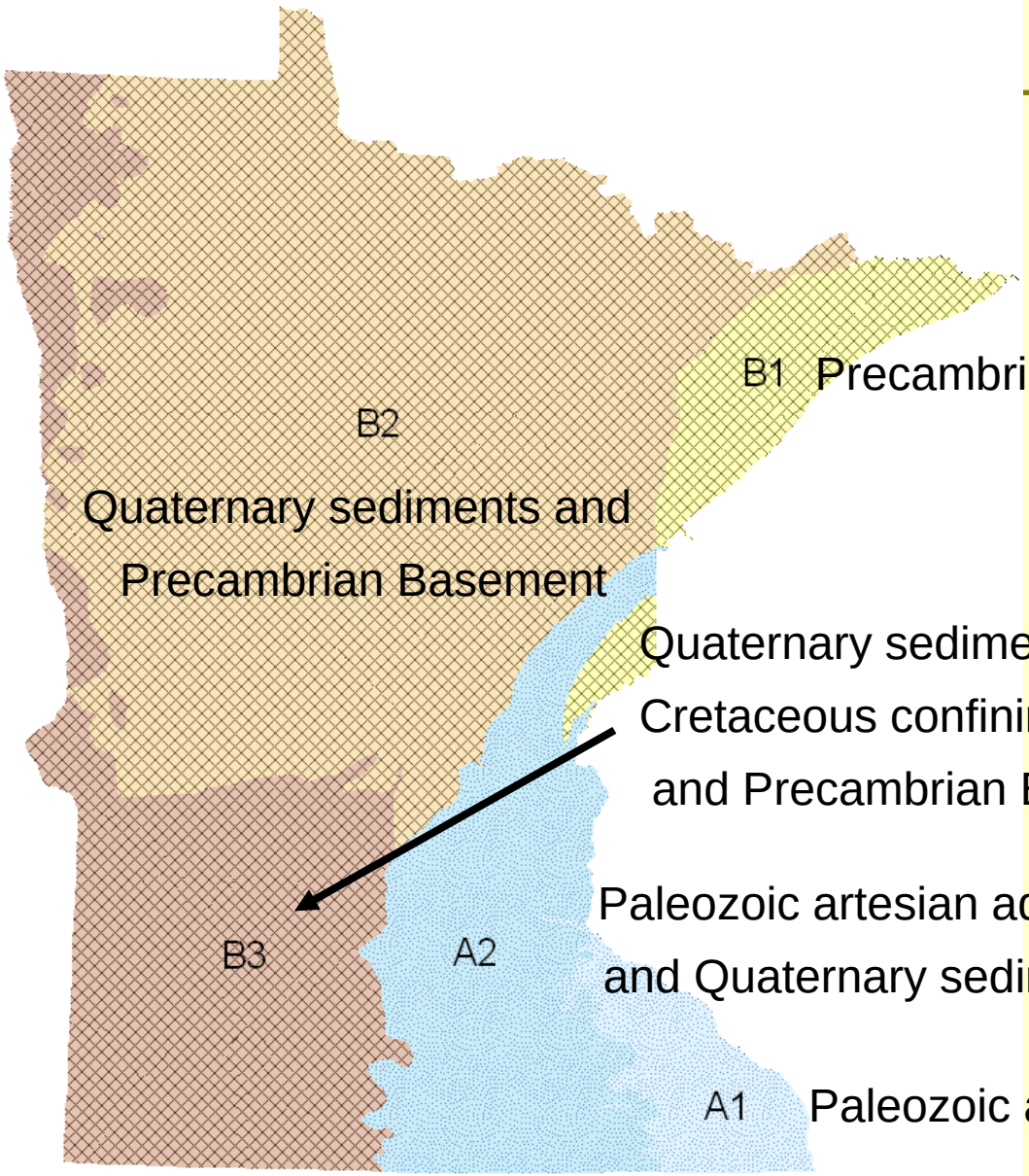
MN Climatology


Legend
Quaternary Hydrogeology - Geology
al - ALLUVIUM
ld - LAKE DEPOSITS
na - NON-AQUIFER (GLACIAL TILL, LOESS, PEAT)
ow - OUTWASH
0 40 80 160Kilometers
N

Surficial Groundwater Recharge
G. Delin – USGS (in/yr)



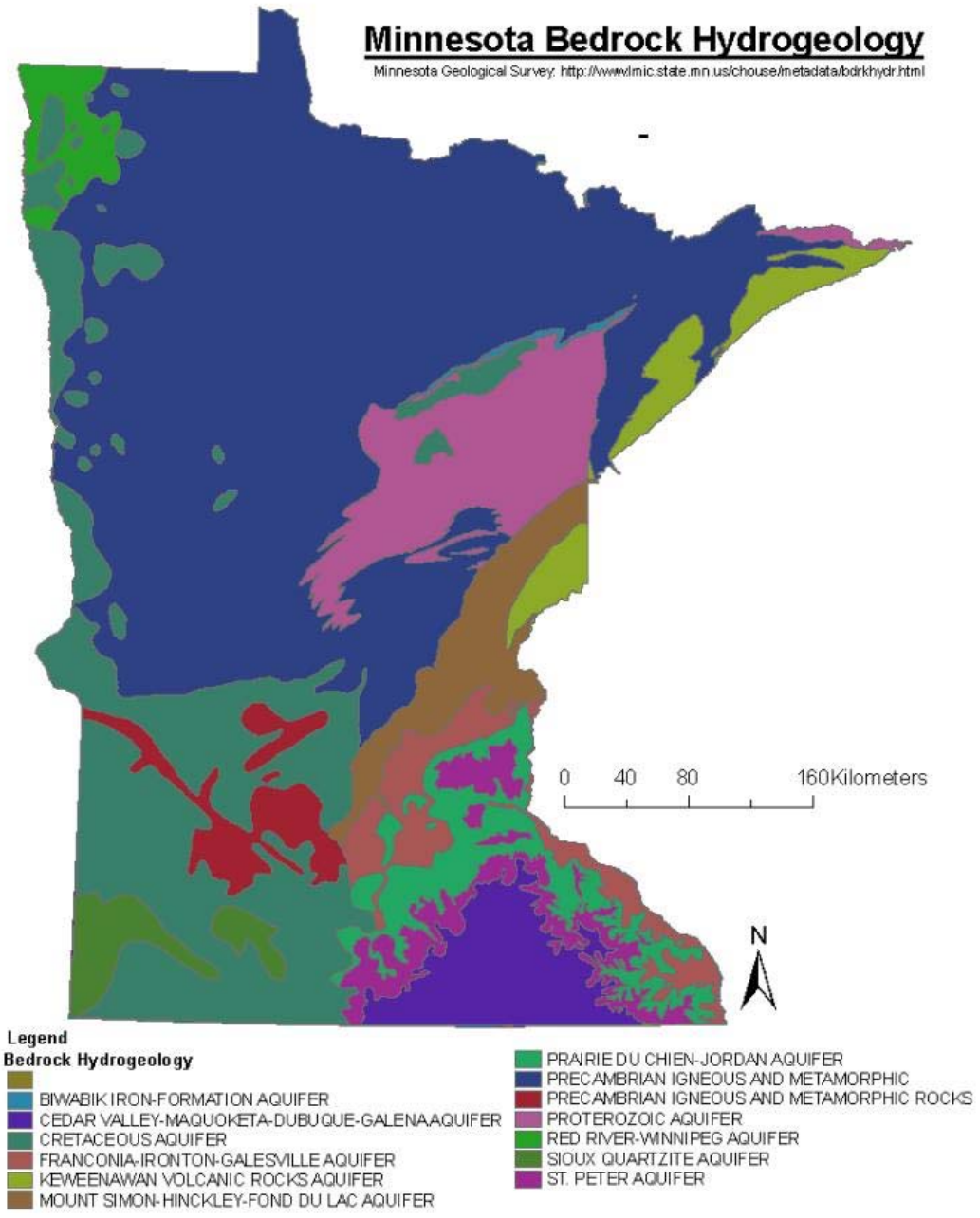
Minnesota Bedrock Hydrogeology



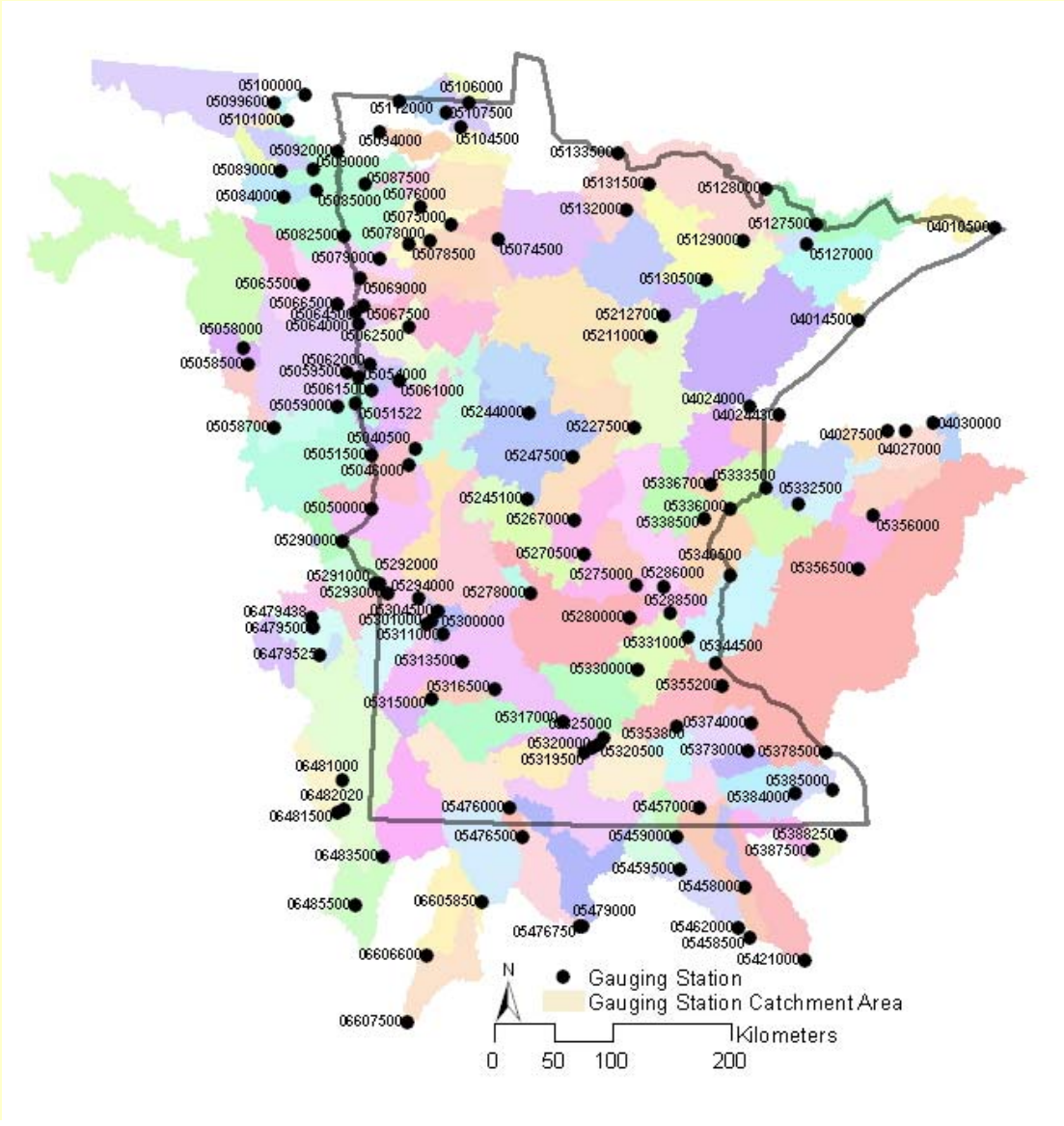
Hierarchical Hydrogeological Subdivision in Minnesota

Minnesota Bedrock Hydrogeology

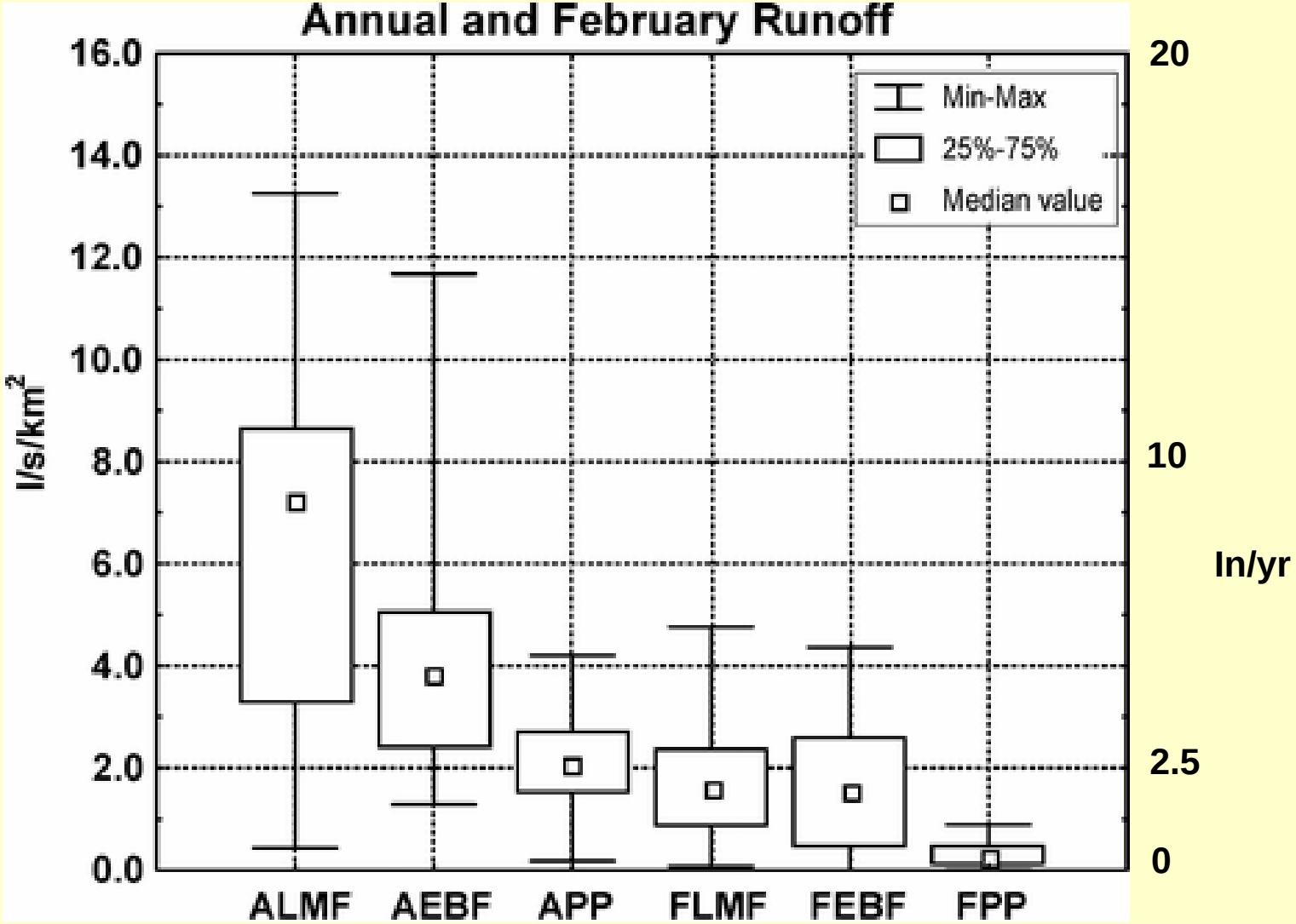
Minnesota Geological Survey: http://www.lmic.state.mn.us/chouse/metadata/bdrkhydr.html



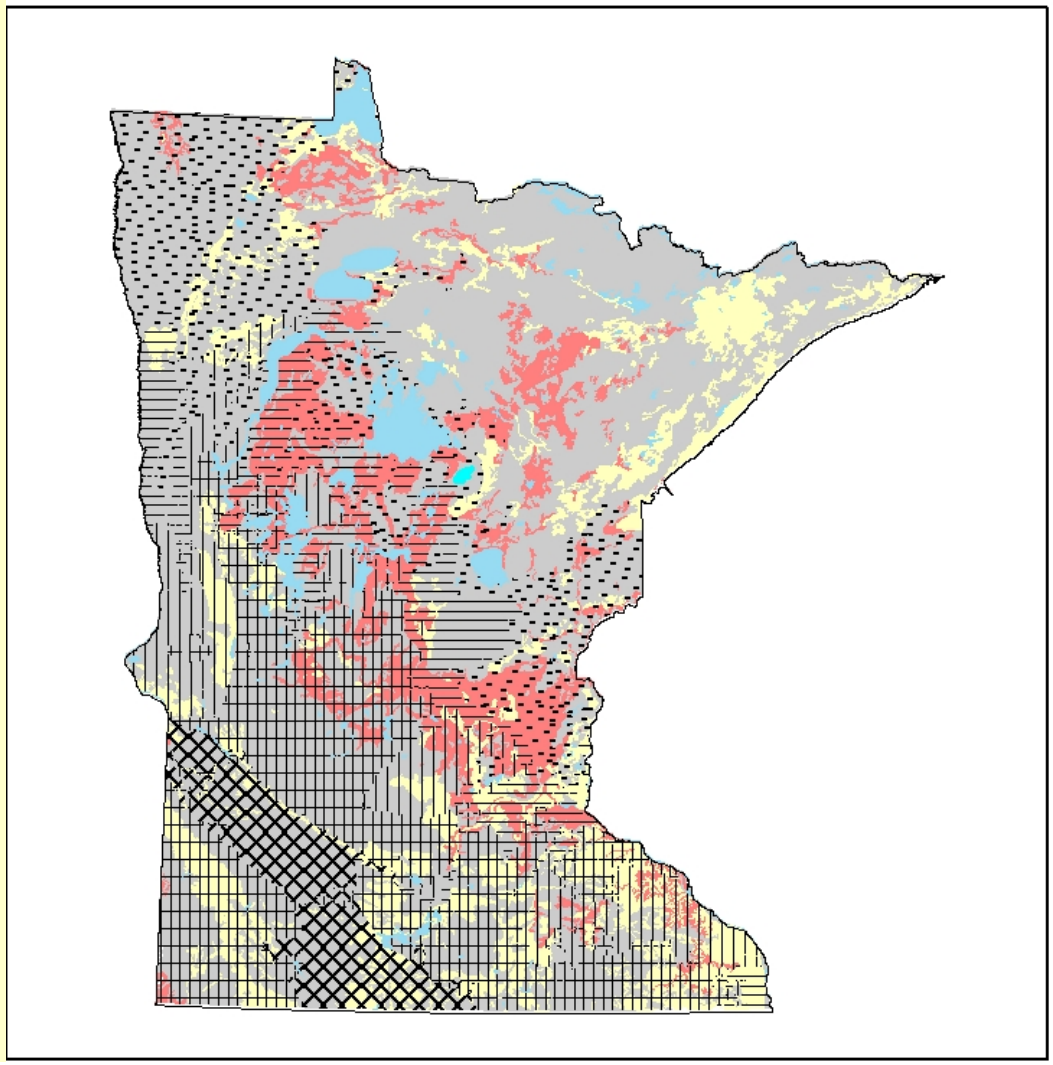
LCCMR Aquifer Recharge Study



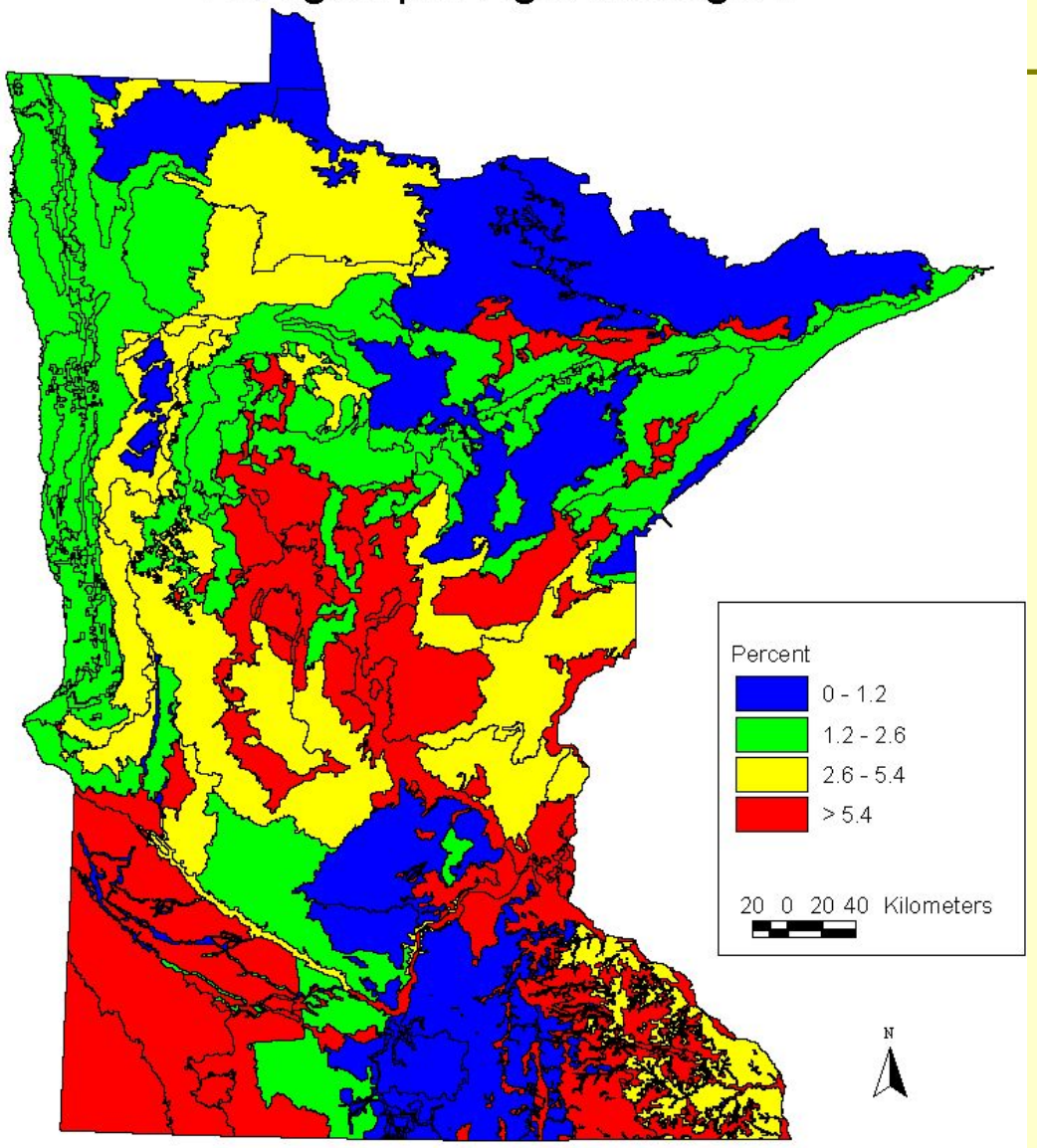
Monthly runoff for *LMF* Laurentian Mixed Forest; *EBF* Eastern Broadleaf Forest; *PP* Prairie Parkland (Shmagin and Kanivetsky, 2002)



Acetochlor Usage and Predicted Leaching Potential



Proportion of Wells Exceeding 3 mg/L Nitrate-Nitrogen per Agroecoregion



Data Provided by the Minnesota Department of Health Source Water Protection Unit

Conclusions

- Minnesota's land is expected to provide many types of functions
  - Food, fiber and feed
  - Biofuels
  - Alternative energy
- At the same time we expect
  - Clean, sustainable water
  - Rich, diverse fish and wildlife resources
- Balancing these two objectives requires careful planning, wise policy and targeted incentives