Montana's Energy Future Symposium

MONTANA STATE UNIVERSITY

Montana's Energy Development:

Overview of Potential Impacts

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Big Sky Carbon Sequestration Partnership

Critical Points

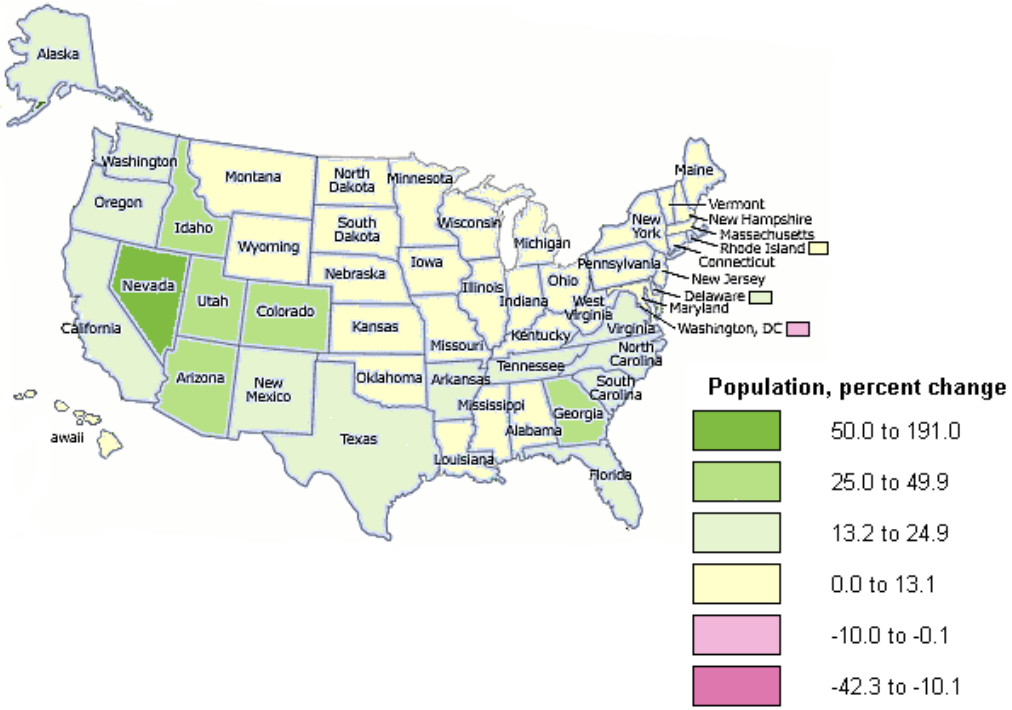
- MT has many opportunities for energy development (**coal, biomass**, etc.)
- Economic growth is directly related to electricity growth: low-cost reliable electric power is key to economic well-being
- Coal is the primary source of fuel for electric generation but ***all*** sources are needed
- Coal is abundant, accessible and affordable
- Biomass/ethanol potential is large and still in exploratory and feasibility stage
- Today: focus on potential biomass impacts, with a few introductory comments about coal

Projected Energy Demand– National Perspective

- Over next 25 years, 53% increase in use of electricity
  - Requires construction of 1200 new power plants of 300MW (or approximately 65 plants/yr)
  - By 2025, coal will continue to generate in excess of 50% of electricity consumed
  - 100,000 MW of new coal fired power capacity to be built
  - Coal is also major potential contributor to nation's transition to the "hydrogen economy"
- Over next 25 years, 50% increase in transportation

Big Sky Regional Population Growth

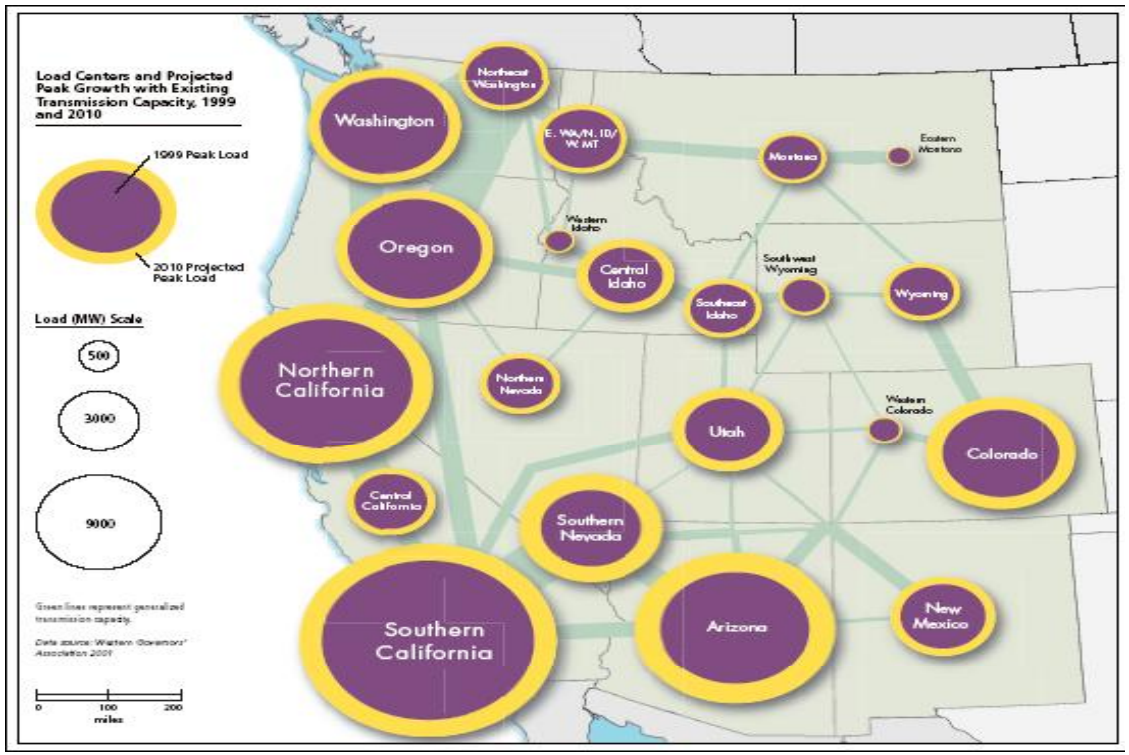
- Western states are the fastest growing region in the U.S.



Expanding populations + Growing economies = Increased energy demand

Energy Transmission Infrastructure

- The Big Sky region is central to many load centers, but is currently constrained by transmission capacity



MT Coal Potential

- 6th largest coal producer in U.S.
- 40 million tons per year over the last decade.
- The price per ton various but average for 2004 was $6.78 per ton
- Total value over $271 million per year.
- Employs about 700 – payroll about $44m

Colstrip Power Complex

- Four coal-fired generating units - 2,094 MW
- Employs about 300 people
- Co-owned by
  - PPL Montana LLC,
  - Portland General Electric
  - Puget Sound Energy
  - PacifiCorp
  - AVISTA Corporation
  - NorthWestern Energy LLC
- Consistently ranked as one of the lowest cost fuel plants

Industrial Coal Gasification?

- Price of natural gas paid by MT industrial customers has risen 138% since 1999
- Largest natural gas consumers in MT:
  - Conoco and Exxon oil refineries (Billings)
  - Stone Container pulp and paper mill (Missoula)
  - MSU heating system (Bozeman)
  - Barretts Mineral Inc. talc processing (Dillion)
- Rising gas prices and supply volatility have contributed to loss of US manufacturing jobs
- Industrial coal gasification could be attractive alternative to natural gas

Coal to Liquid ?

- Technically feasible (South Africa and China)
- Large capital investment - may require incentives
- MT Governor's interest for Powder River County: estimate 2,000 jobs and 150,000 bpd
- Could contribute to MT energy and economic development and energy security for the U.S.

Biomass for Bioenergy and Bioproducts

USDOE and USDA strongly committed to expand role of biomass as an energy resource

- reduce need for oils and gas imports
- support growth of ag, forestry, and rural economies
- foster new domestic industries – biorefineries

Goal: 30% replacement of US petroleum consumption by 2030

Question: are land resources capable of producing sustainable supply of biomass to meet above goal? (1.4 billion dry tons per year, 7-fold increase over current levels)

Answer: theoretically yes; (forests, 368mdt; ag 998mdt)

USDA/DOE report indicates relatively modest changes in land use

Key assumptions: 50% increase in corn yields, no-till used extensively, technology improvements, 55m acres of idle cropland put into bioenergy crops

Biomass for Bioenergy and Bioproducts

- Montana already grows crops suited for ethanol production: wheat, barley, corn

- Two state level incentives for production:
  (i) reduction in state motor fuels tax collected on ethanol blends at specially marked pumps
  (ii) 30 cent per gallon incentive to the ethanol producer using Montana agricultural products

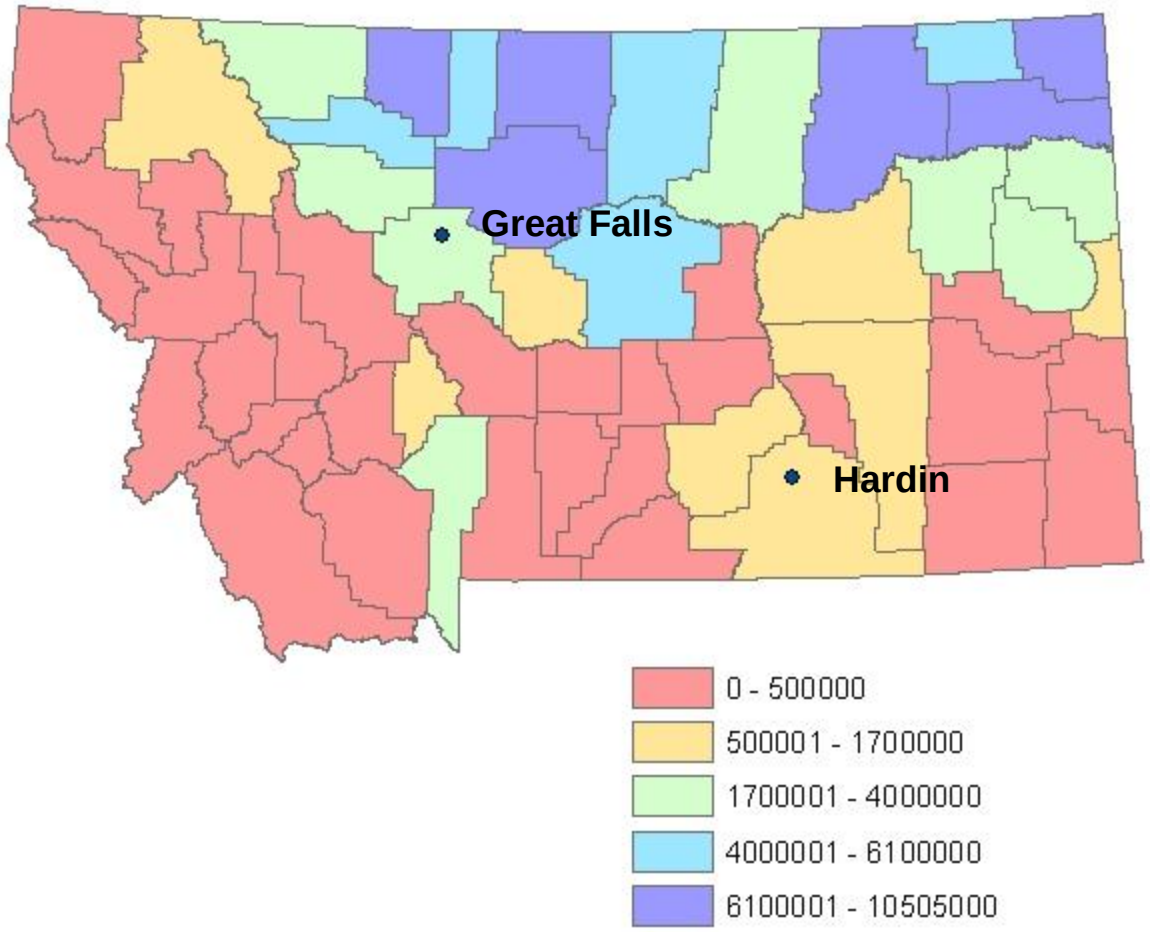
- Status of ethanol production facilities
  a number of plants operated in 1980s (closed)
  5 proposed facilities, including Hardin and Great Falls

Bioenergy Potential in Montana

(Source: DOE, Energy Efficiency and Renewable Energy)

- estimated 9.8 billion kWh of electricity could be generated using renewable biomass fuels in Montana --
- supply the annual needs of 983,000 average homes, or 260 percent of the residential electricity use in Montana
- Based on residues and energy crops
- Energy crop production needed: 2.8m dry tons/yr
- Economic feasibility – possible with high energy prices and incentives

Bushels of Wheat Produced in Montana



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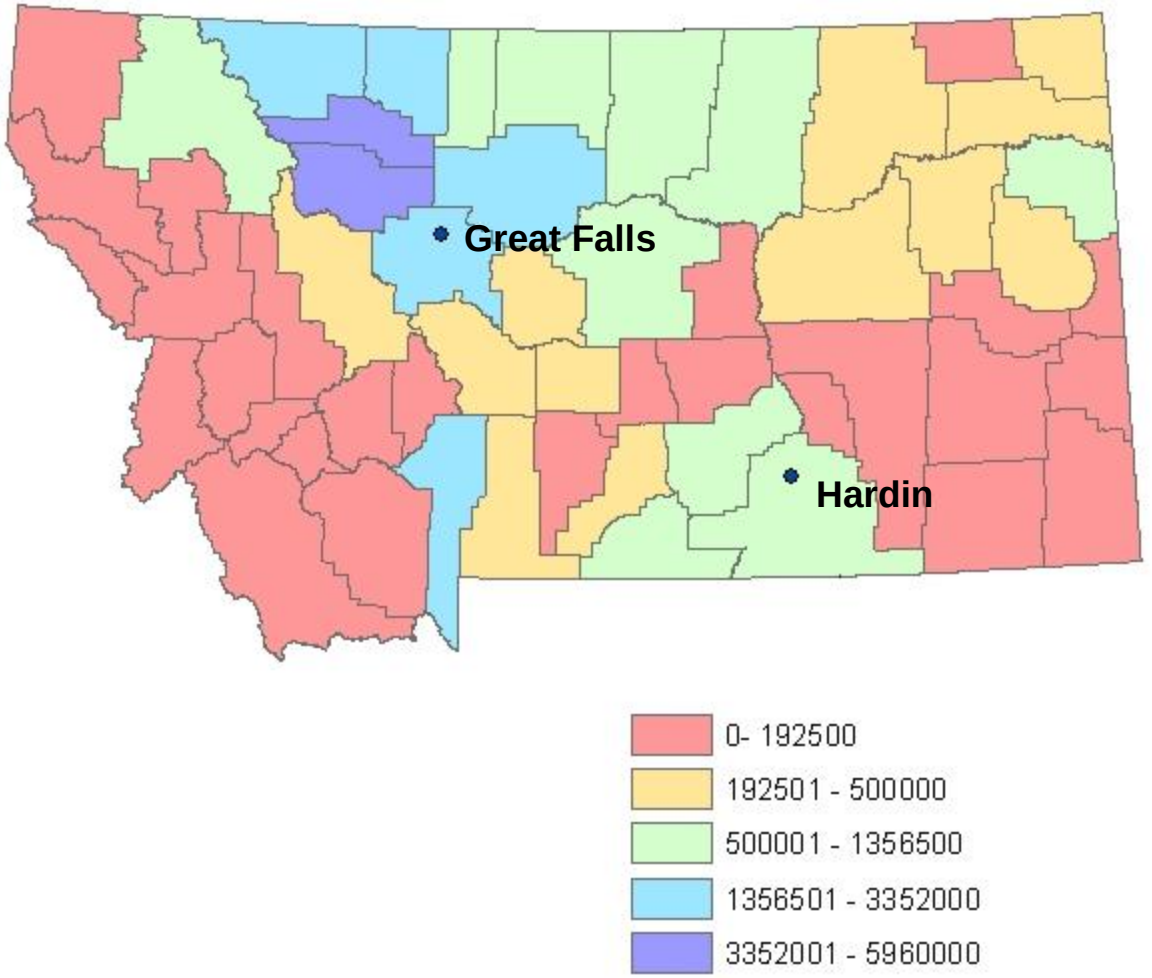
Bushels of Barley Produced in Montana



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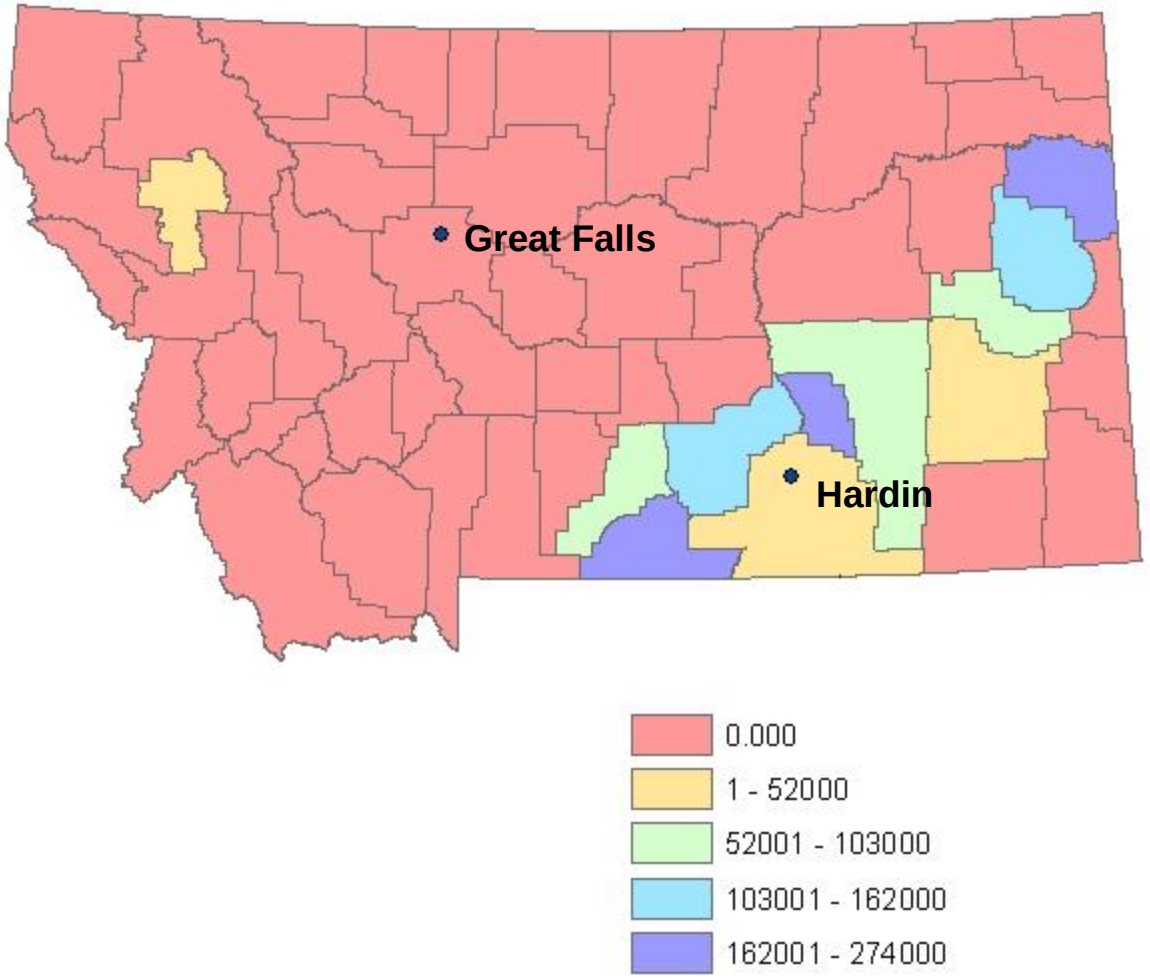
Bushels of Corn Produced in Montana



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Economic Impacts :

- A 50 MGY ethanol plant in MT
  - •40-50 - permanent jobs
  - • $3 million in annual additional income,
  - •$1 million in additional annual tax revenues
  - •$140 million to the local economy during plant construction
- •Jobs created would be high paying compared with the average MT job

(Source: Mt DEQ study, Jan 2005)

- **Decision to build an ethanol plant is based upon:**
  - feedstock price and availability
  - investment costs
  - electric energy costs
  - water availability and access to markets
- **Critical factor:** If the cost per ton of starch from Montana grain sources can compete favorably with the cost per ton of starch from Midwest corn, then Montana ethanol plants will be competitive

Effects of Producing Ethanol in Montana on the Agricultural Sector

- Additional market for Montana grain growers
- Production would potentially increase the demand for local agricultural products and possibly raise crop prices, which could increase farmer's net income
- Enough off-specification grain is produced each year in Montana (1 to 3 percent of Montana's total crop) to supply at least a 50 MGY ethanol plant
- The distillers grains that do go to ethanol production could still be used for animal feed after being processed for ethanol, thereby reducing or avoiding cost impacts in stock growers

Other Economic and Environmental Effects from Producing Ethanol in Montana

• **Ethanol is biodegradable**. Using ethanol as a gasoline oxygenate rather than MTBE could reduce or stop the water contamination and associated remediation costs in Montana that can occur from MTBE

• Ethanol blend gasoline produces **lower emissions** of carbon monoxide, unburned hydrocarbons, volatile organic compounds, and fine particulate exhaust products of conventional fuels

•Producing ethanol fuel in the United States better ensures **energy security,** reduces the U.S. trade deficit, and reduces the need for securing Middle East oil

•**Increased air quality** from cleaner burning fuel with ethanol

• **Substitutes** for fossil-based transportation fuel.

Proposed Ethanol and Bio-Diesel Plants

• ***Sustainable Systems*** bio-diesel plant, Culbertson. They will contract up to 250,000 acres, target of 15,000,000 gallons per year production with option to expand, use primarily camolina and canola.

• ***Montana Fuel and Feed*** *ethanol plant and feed yard*, Miles City. 15 million bushels of a grain crop needed; 33 employees at ethanol plant and 40 in the feeding facility.

• ***Rocky Mountain Ethanol*** in Hardin. Corn and barley-based

• **Rocky Boy's Proposed Ethanol Plant** - near Laredo (40 million gallon facility) Estimated average annual acreage under contract: 355,000 acres - Likely crop: Wheat

• ***Fort Belknap Tribe Ethanol Plant*** - A bioenergy/feedlot complex is being proposed that will produce 20 million gallons of fuel-grade ethanol per year and produce approximately 116,602 tons of wet cake annually.

• ***Peaks & Prairies Plant*** – Malta (bio-diesel)

• ***HTM & Associates*** – Conrad (ethanol)

• ***Basin Creek Power*** – Butte (bio-diesel)

Biomass Power Generation

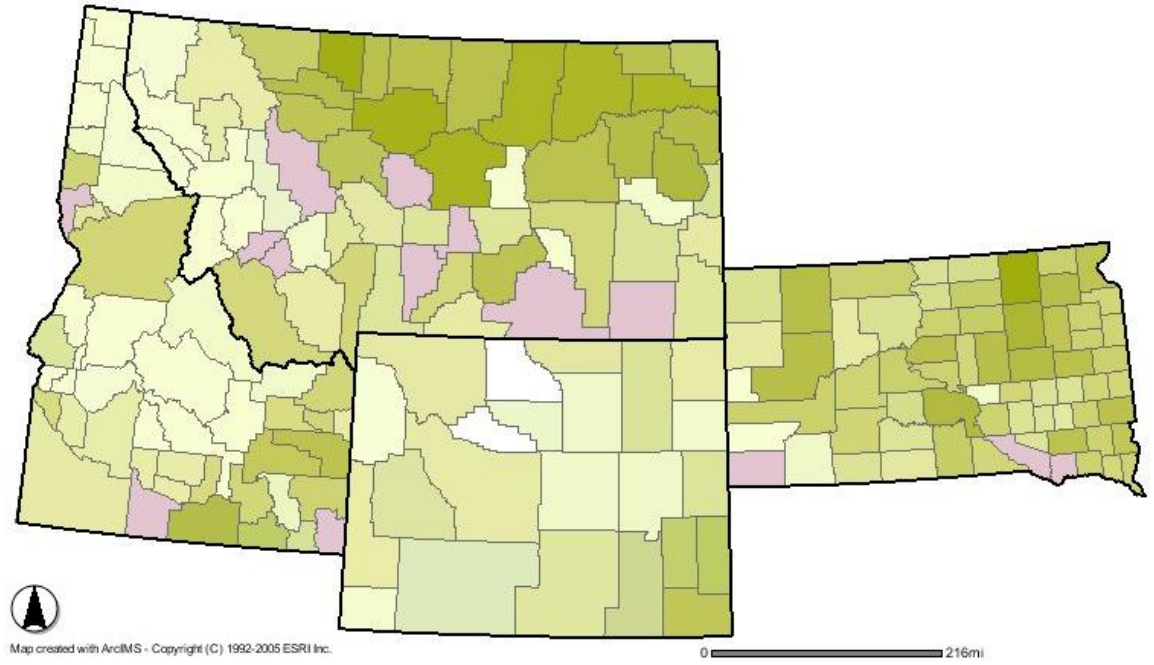
- **Direct fired systems**: $0.06/kWh more expensive electricity than coal-fired
  Would require a $48/ton CO2 credit to be competitive with coal
  148% less global warming potential
  99% reduction in fossil-fuel use

- **Combined Cycle biomass** $.03/kWh more expensive electricity than coal-fired
  - CO2 credit of $22/ton to be competitive with coal
  - 94% less global warming potential
  - 98% less fossil-fuel consumption

Biomass/coal co-firing:
could be implemented at existing coal-fired plants?
based on 3-yr payback requirement, carbon credit requirements could be as low as $5/ton to be competitive with coal
19% less global warming potential
12% less fossil fuel consumption

Terrestrial Carbon Sequestration

- The Big Sky region has extensive land mass that provides a tremendous potential for greenhouse gas offsets



Forests, tillage/no-till cropland, grazing, pasture, and rangeland
- including Conservation Reserve Program (CRP) lands