Working Lands Watershed Restoration Program

Suzanne Rhees | Conservation Projects Coordinator
David Weirens | Assistant Director for Policy and Programs
• “...development of a detailed plan to implement a working lands watershed restoration program to incentivize the establishment and maintenance of perennial crops...”

• Interim report by October 15, 2017 and final report by February 1, 2018

• 11 specific elements

* (Laws 2016, c. 189, s. 4); 103F.519
History: Working Lands Watershed Restoration Program

• Funding for program plan and feasibility study included in 2016 supplemental budget

• Program intent: provide water quality benefits through helping agricultural producers:
  • maintain productive use of land,
  • while supplying biomass feedstocks to produce materials or energy with a lower carbon footprint.
History: Working Lands Watershed Restoration Program

• Program is complementary to the Bioeconomy Production Incentive (2015)

• Commercial financing program for advanced biofuels, biobased chemicals and biomass thermal energy projects

• Responsible biomass sourcing provision to ensure sustainable harvest of crop residues
Why Perennials and Living Cover?

- Changes in agricultural practices
- Changes in precipitation timing and intensity
- Impaired waters
- Economic pressure to increase row crop production
- The limits of “voluntary” and “regulatory” methods
Less alfalfa, more corn, soybeans, pasture
Elements of the plan:

1. A process for selecting **pilot watersheds**
2. An assessment of the amount of **eligible agricultural land**
3. An assessment of **landowner interest**
4. An assessment of **contract terms**, including possible variable payment rates
5. An assessment of the opportunity to leverage **federal funds**
6. An assessment of how to best integrate program with existing **conservation requirements** and benefit **wildlife production**
Elements of the plan:

7. An assessment of complementary state programs
8. An estimate of expected water quality improvements
9. An assessment of viability and water quality benefits of cover crops
10. A timeline for implementation, coordinating with proposed biomass processing facilities
11. A projection of funding sources needed for implementation
Project Organization:

BWSR Project Team

Advisors: MEP, GPI, Corngrowers, etc.

Environmental Initiative: Federal Farm programs and priorities

U MN Water Resources Center: Survey, spreadsheet tool; ag economics

Stakeholders and Interagency Advisors: project feedback and program design

MPCA: Modeling in HSPF
DNR: GSSHA
Project Elements

- Federal programs – what exists and what to expect?
- Landowner Survey – Socioeconomic Factors
- "What would it take" to incentivize conversion of perennials/ addition of cover crops?
- Modeling: what are the goals for water quality improvement?
- The Bioeconomy: What are the most promising markets for perennials and "cash cover crops"?
- Related Factors: Wildlife Habitat, State Conservation Programs
- Spreadsheet tool – what are the relative costs and returns of conventional and alternative crops?
What have we learned so far?

• Cellulosic biofuels in Minnesota and Upper Midwest:
  • Not yet competitive with conventional fuels
  • One remaining pilot plant in Iowa limited to corn stover feedstock
  • “Bolt-on” scenario not likely to be feasible in short term

Watersheds with highest concentration of corn production near ethanol plants (from GPI)
What have we learned so far?

• “Proposed biomass processing facilities” and the state of the bioeconomy:
  • Biofuels the expected initial focus of legislation
  • High oil prices and federal policy drove interest and investment
  • Followed by economic downturn and collapse of the oil market – lack of investment
  • Increasing uncertainty re federal and state policy
Where to focus across a range of biomass uses?

Grazing
- Beef or dairy
- Managed, rotational, mob, etc.

Animal feed, bedding
- Human food products
  - Processing and transport
  - Increasing consumer demand/new product development

Combustion
- Combustion: heat and/or power

Anaerobic Digestion
- Methane
- Biogas

Biofuels and Green Chemicals
- Ethanol
- Butanol
- Biodiesel
- Bio-jet Fuel
Emerging Crops

The EcoSun Prairie Farm: An Experiment in Bioenergy Production, Landscape Restoration, and Ecological Sustainability

Cattail Biomass in a Watershed-Based Bioeconomy: Commercial-scale harvesting and processing for nutrient capture, biocarbon and high-value bioproducts

Emerging Crops

Switchgrass Agronomy 2016
• Perennials grasses: Switchgrass and Miscanthus – biofuel, livestock bedding, soil conditioning, etc.

• Kernza wheat – forage, food products, biofuel

• Alfalfa – hay, mixed forages, other livestock feed, etc.

• Oil seeds – Camelina and Pennycress – oils, bio-jet fuel, bioproducts, livestock feed, etc.

• Mixed forage crops for grazing, feed – grass-fed beef, organic dairy, cow-calf operations, etc.

• Mixed cover crops for soil health
• Grown for animal bedding and dairy cattle feed in Eastern Ontario

• Widely grown in Eastern TN for biofuel

• Pennsylvania-based association of warm season grass producers – in-field processing of poultry bedding
• Grown in Illinois for poultry bedding
• Part of University of Iowa’s power plant goal of 40% renewables by 2020
  • Feedstocks: wood chips, prairie grasses
• Some test plots in MN in 2008

New Eastern Iowa Airport miscanthus crop will fuel University of Iowa power plant
Kernza - Intermediate Wheatgrass

• Both a forage and a food crop

• Marketing and supply-chain development accelerating

• Supply is still intentionally limited

• Yields decline after 2-3 years

• Continuing breeding work to improve yields, seed size

• Strongest interest in vulnerable wellhead protection areas (DWSMAs)
Alfalfa is cornerstone of dairy farm forage ration

Can perform better mixed with perennial grasses or companion crops

“Hay” by definition also includes grass mixtures and other legumes such as clover, crop residue such as cornstalks.

Grown where cattle are still found on the landscape

Subject to weather-related fluctuations
Supply is Localized to the Demand

Milk Cows

Beef Cows

Hay Production

Jared Goplen, UM Extension – Economics of Hay Production in MN

USDA-NASS
Cover crops (mixes)

- Build soil organic matter
- Add nitrogen to the soil
- Break up soil compaction
- Reduce soil erosion
- Create wildlife habitat, attract pollinators
- Annual or perennial – brassicas, cereals, rye, fescue, etc.
- Interseeding is improving viability – but establishment is still weather-dependent
Managed/Controlled Grazing

- A natural disturbance agent in North American grasslands – and beneficial for wildlife
- Minnesota Prairie Plan – grazing and fire as management strategies
- Increasing consumer interest
- MDA Cropland Grazing Exchange
Managed grazing with cover crops and paddocks

Stoney Creek Farm case study
Oilseeds – camelina and pennycress – as relay crop with soybeans
Selecting pilot watersheds

• Criteria
  • Scale, size, landscape character
  • Geographic distribution
  • Proximity to refiners, processors, potential end-users
  • Planning efforts, prior engagement
  • Level of interest, social capacity, local leadership
  • Economics of crop production and conservation
  • Water quality benefits
Root River – Watson Creek
Chippewa River – Upper Shakopee Creek
• What is the likely value of alternative crops?

• What are the environmental benefits?

• What kind of contracts might incentivize farmers to grow alternative crops? What kind of contract terms?

• Relation to existing federal programs (i.e., crop insurance)

• How will social values and local capacity influence participation?
A Study of Farming Practices in Minnesota

Center for Changing Landscapes
UNIVERSITY OF MINNESOTA
Driven to Discover™

Before you begin:
We are conducting this survey to better understand farmer perspectives on soil and water conservation, and farming practices as they relate to perennial and cover crops. This survey is voluntary and confidential. It should take about 20 minutes to complete. Please answer the questions as fully as possible.

Do you use your land for agricultural production?
[] Yes [please complete the survey]  [] No [please discontinue and return the survey]

Once you’ve completed the survey:
Please lick, insert and mail the self-addressed stamped envelope.

Thank you for your help!

• Self-administered mail survey
• Farmers
• Random sample of 500 farmers in each watershed (n = 3000)
• 3-wave mailing
Conversion to cover/perennial crops

Percent of respondents who have converted any portion of their farm from single annual row crops to perennial crops or added cover crops in the past 10 years:

- **Cover crops**: 19.0% (n = 231)
- **Perennial crops**: 23.7% (n = 241)

Percent of respondents who have converted any portion of their farm from single annual row crops to perennial crops or added cover crops in the past 10 years.
Familiarity with perennial/cover crops

- Winter-hardy oilseeds as cover or relay crop
- Kernza
- Mixed grazing and forage crops
- Perennial grasses
- Annual cover crops and small grains for soil health or grazing
- Alfalfa

$n \geq 256$

- Very familiar
- Moderately familiar
- Slightly familiar
- Not at all familiar
Use of perennial/cover crops

Percent of respondents who have planted perennial or cover crops on their farm in the past 10 years (n ≥ 197)
Likelihood of adoption

Winter-hardy oilseeds as cover or relay crop
Kernza
Perennial grasses
Mixed grazing and forage crops
Annual cover crops and small grains for soil health or grazing
Alfalfa

n ≥ 249
- Likely
- Neither likely nor unlikely
- Unlikely
Factors influencing adoption

How likely or unlikely are you to plant perennial or cover crops if...

- I could get higher payments for planting the crops
- I was compensated for lost crop production
- I could get tax benefits for planting the crops
- There were markets available to sell the crops
- Conservation program requirements were less complex.
- Conservation programs were more flexible.

For each factor, the graph shows the percentage of respondents giving each response:

- Likely
- Neither likely nor unlikely
- Unlikely

n ≥ 235
Spreadsheet Decision Tool

• Compares crop yields and returns of major annual crops to perennial crops and addition of cover crops within the six watersheds

• Compares results from conversion of marginal cropland and all cropland

• Marginal soils: based on Land Capability Class – “3” with slopes and 4 – 8

• Cost of conversion varies by Crop Productivity Index

• 14 conversion scenarios, including crops and livestock
<table>
<thead>
<tr>
<th></th>
<th>Freeborn Lake-Cobb R</th>
<th>Shakopee Creek</th>
<th>Getchell Cr/Co. Ditch 9</th>
<th>Rogers Creek</th>
<th>Watson Creek</th>
<th>Whiskey Cr, part L &amp; U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net returns for current annual crops</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn grain</td>
<td>162</td>
<td>126</td>
<td>130</td>
<td>114</td>
<td>121</td>
<td>48</td>
</tr>
<tr>
<td>Soybeans</td>
<td>222</td>
<td>142</td>
<td>169</td>
<td>169</td>
<td>204</td>
<td>71</td>
</tr>
<tr>
<td>Wheat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>65</td>
</tr>
<tr>
<td>Sugar-beets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-43</td>
</tr>
<tr>
<td>All current annual crops</td>
<td>187</td>
<td>133</td>
<td>147</td>
<td>135</td>
<td>149</td>
<td>51</td>
</tr>
<tr>
<td>Net returns for alternative crops</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land retirement</td>
<td>-28</td>
<td>-28</td>
<td>-28</td>
<td>-28</td>
<td>-28</td>
<td>-28</td>
</tr>
<tr>
<td>Switchgrass</td>
<td>75</td>
<td>57</td>
<td>50</td>
<td>66</td>
<td>52</td>
<td>35</td>
</tr>
<tr>
<td>Miscanthus</td>
<td>14</td>
<td>-16</td>
<td>-29</td>
<td>-1</td>
<td>-26</td>
<td>-56</td>
</tr>
<tr>
<td>Kernza</td>
<td>181</td>
<td>149</td>
<td>135</td>
<td>165</td>
<td>138</td>
<td>107</td>
</tr>
<tr>
<td>Covercrop Sm Grain</td>
<td>183</td>
<td>136</td>
<td>148</td>
<td>138</td>
<td>154</td>
<td>59</td>
</tr>
<tr>
<td>Covercrop Corn Soy</td>
<td>149</td>
<td>94</td>
<td>108</td>
<td>97</td>
<td>110</td>
<td>29</td>
</tr>
<tr>
<td>Camelina Corn-Soy</td>
<td>235</td>
<td>170</td>
<td>178</td>
<td>183</td>
<td>192</td>
<td>85</td>
</tr>
<tr>
<td>Camelina Corn-Wht-Soy</td>
<td>207</td>
<td>156</td>
<td>163</td>
<td>162</td>
<td>170</td>
<td>83</td>
</tr>
<tr>
<td>Pennycress</td>
<td>207</td>
<td>156</td>
<td>163</td>
<td>162</td>
<td>170</td>
<td>83</td>
</tr>
<tr>
<td>Grass-fed beef</td>
<td>19</td>
<td>10</td>
<td>7</td>
<td>14</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Beef cow-calf</td>
<td>4</td>
<td>28</td>
<td>28</td>
<td>41</td>
<td>29</td>
<td>15</td>
</tr>
<tr>
<td>Grazing dairy (organic)</td>
<td>137</td>
<td>106</td>
<td>93</td>
<td>121</td>
<td>96</td>
<td>68</td>
</tr>
<tr>
<td>Dairy heifers</td>
<td>28</td>
<td>17</td>
<td>12</td>
<td>22</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Alfalfa hay for sale</td>
<td>290</td>
<td>230</td>
<td>206</td>
<td>260</td>
<td>211</td>
<td>153</td>
</tr>
</tbody>
</table>

| Subsidy required/A Show negatives? |                      |                |                          |              |             |                        |
|------------------------------------|----------------------|----------------|--------------------------|--------------|-------------|                        |
| Land retirement                    | 215                  | 161            | 175                      | 163          | 177         | 79                     |
| Switchgrass                        | 113                  | 75             | 96                       | 69           | 97          | 16                     |
| Miscanthus                         | 173                  | 149            | 175                      | 137          | 175         | 107                    |
| Kernza                             | 6                    | -16            | 11                       | -29          | 10          | -56                    |
| Covercrop Sm Grain                 | 4                    | -4             | -1                       | -3           | -5          | -8                     |
| Covercrop Corn Soy                 | 39                   | 39             | 39                       | 39           | 39          | 22                     |
| Camelina Corn-Wht-Soy              | -20                  | -24            | -17                      | -27          | -22         | -32                    |
| Pennycress                         | -20                  | -24            | -17                      | -27          | -22         | -32                    |
| Grass-fed beef                     | 168                  | 122            | 140                      | 121          | 141         | **51**                 |
| Beef cow-calf                      | 138                  | 99             | 119                      | 94           | 120         | 35                     |
| Grazing dairy (organic)            | 50                   | 27             | 53                       | 14           | 53          | -17                    |
| Dairy heifers                      | 159                  | 116            | 135                      | 113          | 136         | 48                     |
| Alfalfa hay for sale               | -103                 | -98            | -59                      | -125         | -63         | -102                   |
Modeling

Model and Tool Scales

- Site scale models and tools
  - Grided Surface Subsurface Hydrologic Analysis (GSSHA) model
  - Agricultural Conservation Planning Framework (ACPF) Tool (Tomer)
  - Prioritize, Target, and Measure Application (PTMAp)

- Watershed models
  - Land to receiving water simulation
  - Some also include groundwater & river hydrology and transport
    - HSPF, Soil-Water Assessment Tool (SWAT)

- Receiving water models
  - (BATHTUB) for lakes
  - Hydrologic Engineering Center (HEC) models for open channels

Slide provided by Dr. Jonathan Butcher, Tetratech, Inc.
TSS Standard - % Exceedance

Baseline

LCC3+ To Grassland

Cover Crop: 50% of row crop acres
Reduction in TSS Load (%)

LCC3+ To Grassland

Cover Crop: 50% of all row crop acres – A & B soils
Baseline

Cover Crop: 50% of row crop acres
Reduction in Nitrogen Load (%)

LCC3+ To Grassland

Cover Crop: 50% of row crop acres
What would a Working Lands Incentive program look like? Initial concepts

• Different contract terms for
  1. Cover crops
  2. “Cash cover crops”
  3. Perennial crops
• Flexibility on which crops to plant each year
• Risk management
• Watershed or “supplyshed” focus
• Prioritize environmentally-sensitive lands and multiple ecosystem benefits
Next steps

• Interim Report as of October 15

• December 15 Forum: Bioproduct and Bioenergy Market Opportunities for Cover Crops and Perennials

• Federal programs and policies - Farm Bill development

• Complete modeling work

• Develop strategies and elements of a pilot program

• Final report to Legislature: February 1, 2018
Thank You!

http://www.bwsr.state.mn.us/planning/WLWRP/wlwrp.html
suzanne.rhees@state.mn.us
651-296-0768
Annual cover crops and small grains for soil health or grazing

- Sauk River
- Root River
- MN River-Mankato
- LeSueur River
- Chippewa River
- Buffalo River

Winter-hardy oilseeds as cover or relay crop

- Sauk River
- Root River
- MN River-Mankato
- LeSueur River
- Chippewa River
- Buffalo River
Winter rye and soybeans, sugar beets
Cover crops
Oilseeds – Camelina, Pennycress

- Winter-hardy
- Varieties still being developed
- Can be used for edible oil, animal feed, biodiesel, etc.
- “Cash cover crops” - dual cropping winter oilseeds