Alarming Trends in Biofuels

- Habitat destruction
- Fuelstock type
- Land use conversion
- Economic cost
- Fuel first, food second mentality

Pictures: Mike Bomford, KSU
Prairie Switchgrass (*Panicum virgatum*)

- Cellulosic ethanol or a stock for heterotrophic algae
- Warm-season grass
- Perennial
- Erosion control
- High nutrient use efficiency
- Native to KY
- Difficult to establish

http://www.andersonprairie.org/pictorialguide/plantguide/switchgrass.jpg
Rights-of-way

- Includes medians and lands adjacent to roadways
- $4.356 Million at 4 cycles a year
- Not cropland
- Not “prime habitat”
Methods

- FSA 2008 Orthoimagery (2 foot pixels)
- Digitized treeless rights-of-way polygons = mowable area of Kentucky interstates and parkways
Methods

• Literature review for published switchgrass production values and ethanol conversion rate
• Records request for government fuel statistics
• Calculated potential ethanol production

\[
\text{Potential Ethanol Production (gallons)} = \left( \frac{\text{Mowable Area (acres)}}{\text{Published Switchgrass Production Values (tonnes/acre)}} \right) \left( \text{Ethanol from Switchgrass Conversion Rate (gallons/tonnes)} \right)
\]
Methods: Roadways Analyzed
## Results

<table>
<thead>
<tr>
<th>Road</th>
<th>Linear distance (km)</th>
<th>Area (acres)</th>
<th>Area per linear distance (acres/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-24</td>
<td>1020</td>
<td>2569</td>
<td>2.5</td>
</tr>
<tr>
<td>I-265</td>
<td>282</td>
<td>574</td>
<td>2.0</td>
</tr>
<tr>
<td>I-275</td>
<td>256</td>
<td>625</td>
<td>2.4</td>
</tr>
<tr>
<td>I-471</td>
<td>23</td>
<td>78</td>
<td>3.4</td>
</tr>
<tr>
<td>I-64</td>
<td>1679</td>
<td>3763</td>
<td>2.2</td>
</tr>
<tr>
<td>I-65</td>
<td>1192</td>
<td>2713</td>
<td>2.3</td>
</tr>
<tr>
<td>I-71</td>
<td>642</td>
<td>1424</td>
<td>2.2</td>
</tr>
<tr>
<td>I-75</td>
<td>1179</td>
<td>2815</td>
<td>2.4</td>
</tr>
<tr>
<td>All Sampled Parkways</td>
<td>4220</td>
<td>7002</td>
<td>1.7</td>
</tr>
<tr>
<td>Total</td>
<td>10,493.23</td>
<td>21,563</td>
<td>2.1</td>
</tr>
</tbody>
</table>
# Ethanol Production Estimate

<table>
<thead>
<tr>
<th>Description</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivar Yield Ranges (Bransby, etc.):</td>
<td>0.0 to 18.0 tons acre -1 yr-1</td>
</tr>
<tr>
<td>Appalachia Region Yield estimate</td>
<td>4.4-6.5 tons acre-1 yr-1</td>
</tr>
<tr>
<td>Total Right-of-way area</td>
<td>21,563 acres</td>
</tr>
<tr>
<td>Potential switchgrass production</td>
<td>58,448 – 89,001 tons</td>
</tr>
<tr>
<td>Biomass to ethanol conversion rate (Lynd et al 1991)</td>
<td>80. gallons/ton</td>
</tr>
<tr>
<td><strong>Total ethanol production</strong></td>
<td><strong>7,590,176 – 11,212,760 gallons/yr</strong></td>
</tr>
</tbody>
</table>
Ethanol Use by Capitol Motor Vehicle Pool

Amount of ethanol in fuel blends by fuel type (G)

- Premium E10
- Plus E10
- Unleaded E10
- E85
Conclusion

• Ethanol should be produced in a sustainable manner to minimize the impact to the environment.
• Ethanol produced from the rights-of-way cannot replace all petroleum use in Kentucky.
• We must decrease our fuel demand.
• Ethanol may serve as a bridge until alternative vehicles or better public transportation are widely available and in use.
Conclusion Continued

• Ethanol can contribute by
  – Small-scale production
    • On farm
    • Regional
    • Niche markets
  – Prioritizing food before fuel
  – Utilizing land that is already at an economic cost
    • Rights-of-way
    • Under power lines
    • Mined lands
Further Research

• Potential Problems
  – Difficult to get Switchgrass established
  – Increased roadkill?

• Future Work
  – Economic feasibility study
  – Assess other marginal lands for biofuel production
  – Ethanol production from existing plant communities in rights-of-way
Diverse prairie grasslands are 240 percent more productive than grasslands with a single prairie species. That’s a huge advantage. Biomass from diverse prairies can, for example, be used to make biofuels without the need for annual tilling, fertilizers, and pesticides, which require energy and pollute the environment. Because they are perennials, you can plant a prairie once and mow it for biomass every fall, essentially forever.” D. Tilman
Acknowledgements

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• Kentucky Transportation Cabinet, Will Holmes, Zaheer Timol
• EPA P3 Grant
References

Biofuels: The Good, the Bad, and the Ugly, a seminar presented to the Kentucky State University Whitney Young Honors School, Fall 2008. [http://organic.kysu.edu/SlussBiofuel.pdf](http://organic.kysu.edu/SlussBiofuel.pdf)


NASS 2007, National Agricultural Statistics Service


Weaver, JE. Prairie Plants and Their Environmental. A Fifty Year Study in the Midwest. University of Nebraska press, Lincoln, NE, 1968.
Proposed General Atomics Biofuels Plant: Proximity to Rights-of-way

How much dedicated cropland could be saved by using the rights-of-way?