Change and the Heartland

How Climate Change Will Affect the Midwest

Big issues, bite-sized lessons

Can the Tall Grass Miscanthus Replace Coal?

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There's been a lot of talk about the benefits of growing the tall grass Miscanthus on midwestern farms. It requires few chemical inputs, sequesters carbon, and can be burned as renewable energy in coal power plants. Some think Miscanthus could join corn and beans as a staple crop. But is it profitable? Would Miscanthus help farmers earn enough money to keep their farms?

It's a complicated question, but agricultural economists at the University of Illinois have been crunching the numbers. The short answer is no. Coal is cheap, and it could cost twice as much to produce the same energy with Miscanthus. The long answer is that there are no short answers.

Coal is cheap, but it has hidden costs. Miscanthus is expensive, but it has hidden benefits. To capture those benefits, the state or federal government might use policies to reward farmers who grow Miscanthus and power plants that burn it.

Madhu Khanna and her colleagues have studied the potential for Miscanthus in Illinois. The study examines different ways that the government might support Miscanthus, the costs of subsidizing it, and how farmers might respond to these subsidies.

Miscanthus Is Relatively Expensive But Better for Climate

Right now you need to burn $1.12 worth of coal to produce 1 gigajoule of energy in Illinois. It would cost at least $2.30 to get that same energy by burning Miscanthus.

But coal has a relatively large carbon footprint. If you substitute Miscanthus for coal, the footprint is much smaller. This is because burning Miscanthus to produce 1 gigajoule of energy emits a much smaller quantity of carbon emissions than burning coal. Moreover, Miscanthus emits "contemporary carbon," whereas coal emits carbon that has been long sequestered underground. There are a number of ways that state and federal governments can convince power plants to make this climate-savvy substitution.

Key Term

Contemporary Carbon

When you burn Miscanthus it releases a lot of CO_2, just like coal does. So why does it have a smaller carbon footprint? The answer lies in the carbon's origin. The carbon in coal comes from deep within the Earth. When we release it into the atmosphere, it increases the overall amount that's up there.

The carbon in Miscanthus was pulled from the atmosphere the same year the plant grew. When we burn Miscanthus we're just recycling carbon the plant took up through photosynthesis. Carbon that's already circulating in the atmosphere is known as contemporary carbon and is not included in carbon accounting.

The ideal power plant would release no carbon at all. But if you have to choose between releasing ancient carbon from coal and "zero-cycle" carbon from plants, contemporary carbon is the better choice.

Billion-Dollar Subsidy Mitigates 11% of Coal Power Plant Emissions

What if you wanted 5% of Illinois energy to come from Miscanthus? This would require a $1 billion subsidy over 15 years (based on 2003 prices), reduce CO_2 emissions from coal power plants by 11% over 15 years, and cause 1.7% of Illinois cropland to be switched to Miscanthus. If you wanted 13% of Illinois

Miscanthus
Economics of a Tall Grass

energy to come from Miscanthus, you would need to spend $3.7 billion in subsidies over 15 years and would reduce emissions from coal plants by 20%.

Government Support Could Be Mandates, Carbon Tax, or Cap-and-Trade

Instead of subsidizing the use of bioenergy, the government could establish other policies to encourage the use of biomass by power plants. For example, it could mandate that power plants get 5% of their energy from biomass. This would create demand for Miscanthus and raise the price that power plants would be willing to pay for it, thereby creating incentives for farmers to grow it.

Alternatively, CO_2 emissions could be taxed, which would increase the cost of carbon-intensive coal, making Miscanthus an attractive option for power plants.

Policies could also set caps for emissions from coal power plants and create incentives for plants to obtain tradable "carbon credits." Credits could be earned by replacing some portion of coal with biomass, which would increase the willingness of power plants to buy CO_2-mitigating Miscanthus even if it is more expensive than coal. Their willingness would increase with the value of their credits.

Khanna's study found that if the goal of these policies is mitigating CO_2 emissions through firing Miscanthus in coal power plants, the carbon tax or a cap-and-trade policy would be the most cost-effective way to support the production and use of this crop.

No matter which policy the government chooses, Khanna's research can project where Miscanthus production is likely to be viable in Illinois given its yields and costs.

Miscanthus Mostly in South, Close to Power Plants

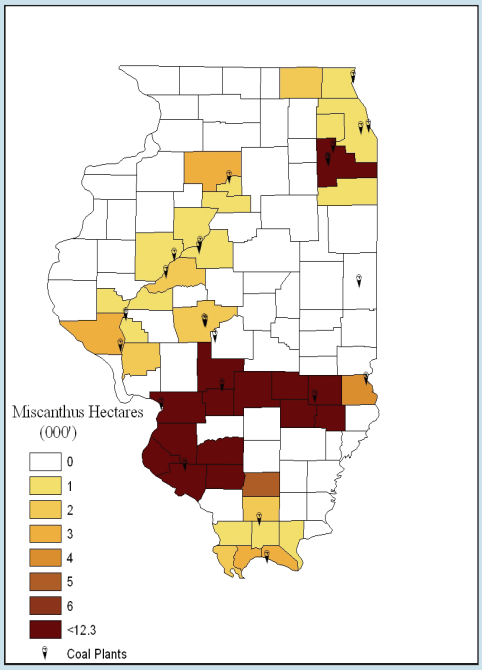
For starters, more Miscanthus will be grown in southern Illinois than northern. Miscanthus likes warm weather. It yields more in the south, and that would make it more competitive against coal. Miscanthus would also be grown close to coal plants, probably within 35 miles, because transporting it longer distances increases both costs and its carbon footprint.

Coal Prices, Climate Shifts, and Innovation Could Affect Miscanthus Adoption

A few things could affect these results. If the cost of coal goes up, the government won't need to support Miscanthus as much. And if breeding or technology increases the yield of Miscanthus, it will be more competitive with coal. Also, coal power plants might learn how to burn Miscanthus in higher proportions with coal. Coal power plants can only co-fire biomass with coal in blends of 5% to 25%. As the blend rate increased, the demand for Miscanthus would increase. And, of course, crop prices could affect these scenarios. If corn production became highly profitable, farmers would be less willing to make the switch to Miscanthus.

Growing Miscanthus for electricity production in Illinois is probably not viable without government support. If that support comes, Miscanthus will be grown more in southern regions and close to power plants, and it will require at least $1 billion of subsidy over 15 years.

Miscanthus Mostly in Southern Illinois



With $1 billion in government support, Miscanthus could occupy 1.7% of Illinois's productive acreage, mostly in the south. That acreage could generate 5% of the state's electricity and reduce emissions from coal power plants by 11%.

About the Researcher

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