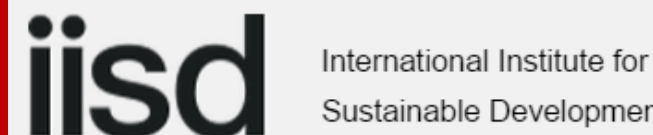




# Integrated Management of Invasive Cattails as Biofuel and as a Wetland Management Strategy in the Northern Great Plains of the United States and Canada.



Dan Svedarsky NWROC, U of MN, Crookston  
Joshua Bruggman UND, NWROC, UMC  
Susan Felege Biology Department, U of North Dakota  
Richard Grosshans, IISD, Winnipeg, MB  
Joe Courneya, Red River Basin Commission  
David Ripplinger, NDSU  
Vanessa Lane, School of Agriculture and Natural Resources  
Gregg Knutson Agassiz NWR



# Overview

- ◎ **Background – past work.**
- ◎ **Recent studies – how much, where, and harvest.**
- ◎ **What next? Issues to address.**



# Early use in Minnesota

- Holt, MN operation used cattail fluff for life vests and insulation during WW II. (Typha, Inc.)
- Harvested seed heads during the winter.





# Planting cattails



# Constructed wetland

(Crystal Sugar Company, Crookston)





# Conventional farm equipment harvest





16 July 1990





30 July 1992

This is an aerial photograph showing a landscape. In the foreground, there is a large, dark, irregularly shaped body of water, possibly a reservoir or a flooded area. The water has some lighter patches, suggesting submerged vegetation or sediment. Behind the water, there is a wide, flat area of green land, likely a field or meadow. The green area is divided into several sections by thin, light-colored lines, possibly roads or ditches. In the upper part of the image, there are more green fields and a small cluster of trees. The overall scene appears to be a rural or semi-rural area.





**22 August 2003**



16 July 1990



22 August 2003



## Legend

### Wetland Restorations

- Complete 246
- Not Complete 14

### Glacial Ridge Project

- Crookston Wellfield
- Private WRP
- TNC
- TNC Gravel Lease
- TNC WRP 1
- TNC WRP 3
- TNC WRP 6
- TNC WRP 7
- TNC WRP 8
- TNC WRP 9
- USFWS
- USFWS WRP

0 0.4 0.8 1.2 1.6 Miles



# Glacial Ridge National Wildlife Refuge.

or implied, nor does the fact of distribution constitute such a warranty.





# Brushy fringe of shallow wetlands at Glacial Ridge



# Murkin, et al. Emergent cover management at Delta Marsh

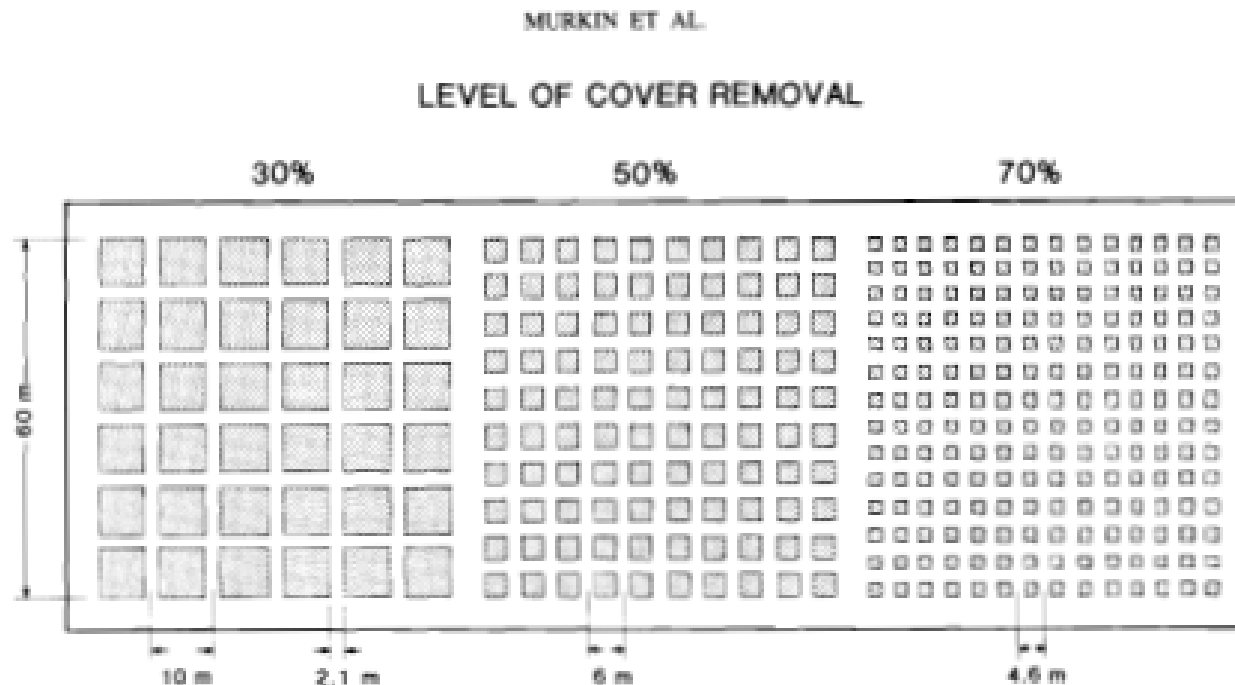


FIG. 1. Design of cover-removal plots. Stippled and clear areas represent cattail and open water, respectively.



# ***The Goal: Hemi-marsh***



# Open marshes, less blackbird depredation on sunflowers





# Research at Northwest Research and Outreach Center, U of MN, Crookston

- Estimate coverage of cattail in patches over 20 acres.
- Evaluate the logistical feasibility and sustainability of harvesting cattails to achieve a 50:50 ratio of open water to emergents.
- Preliminarily assess the market feasibility of cattails as a bioenergy source.
  - Economics of harvesting, densification, transportation, and storage of the feedstock.  
**(David Ripplinger-NDSU)**



# Methods

- Developed GIS maps for all semi-permanent and seasonally flooded wetlands greater than 20 acres in the 10 northwest counties.
- Used National Wetland Inventory (NWI) and aerial photography to identify cattail extent.
- Interviewed land managers to understand history of larger wetlands and attitudes towards harvesting cattails.







"Cattail Summit"



Watershed District

## Collaboration



Int. Inst. for Sus. Dev.  
Winnipeg, MA



MN DNR

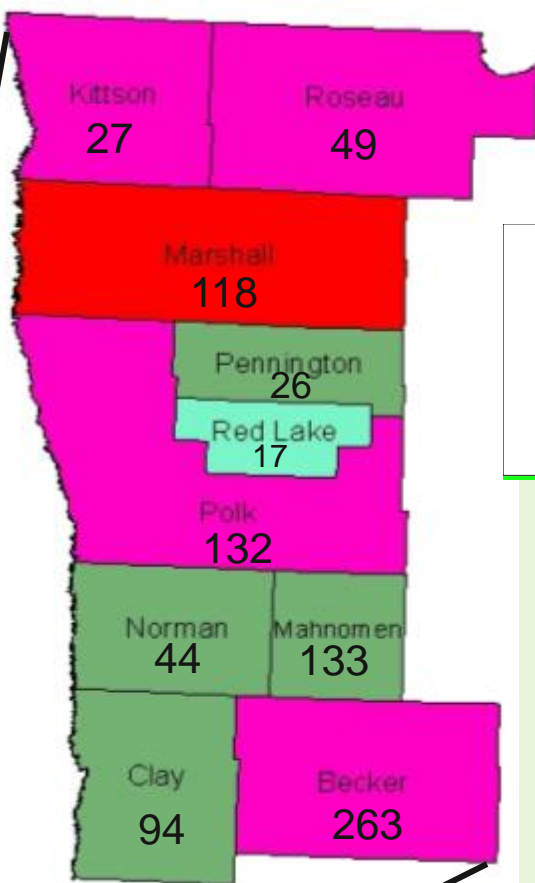
# Findings

- Most of the cattail stands are on public lands (NWR, WMA, WPA and flood-control impoundments managed by watershed districts)
- Most managers perceive dense cattail stands as a problem and favor “liberal” harvest (control?)



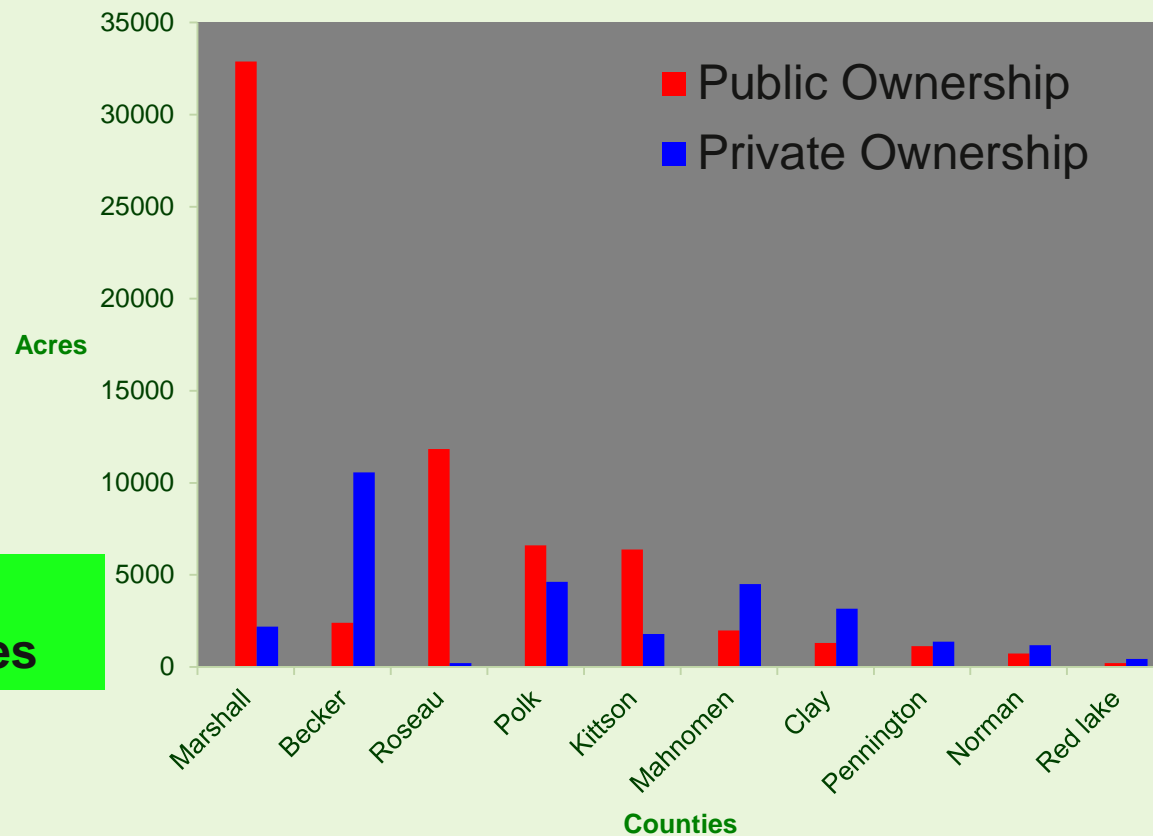


# Cattail cover in northwest Minnesota



**Total units: 903**  
**Total area: 95,500 acres**

## Area of cattails in patches of 20+ acres



# Richard Grosshans hand harvesting in Manitoba in the pilot phase.



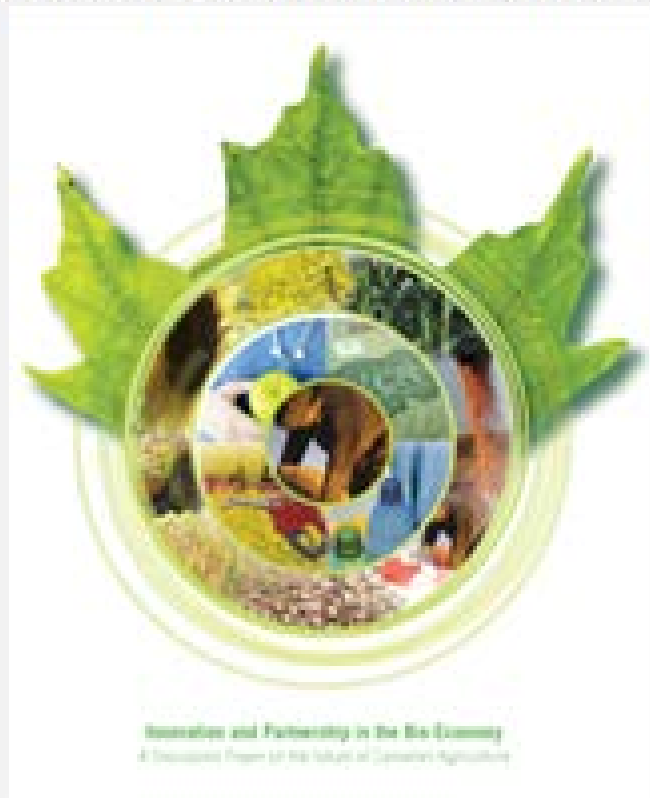
# The Lake Winnipeg Watershed *a large and complicated ecosystem*





# What is the Bioeconomy?

A sustainable economy that uses biological renewable resources (e.g. plants, algae, fish) as input to bioproducts: *bioenergy, liquid fuels, plastics, textiles, chemicals and pharmaceuticals*



# Argo used in Netley-Libau Marsh, Manitoba







Manitoba cattail harvest by  
MacDon units. Sept-Oct, 2012











## Nutrient Capture and Removal

### Cattail Biomass Harvest

Yield: 10 to 20 T/ha

Phosphorus captured:  
20 to 60 kg / hectare

### Biomass Transport (Baled)



### Biomass Densification (cubes, pellets)

Cattail Biomass IN  
Cattail P IN

# Cattail Harvesting for Nutrient Removal and Bioenergy Production

## Bioenergy

Emissions out



*Biomass Burner*

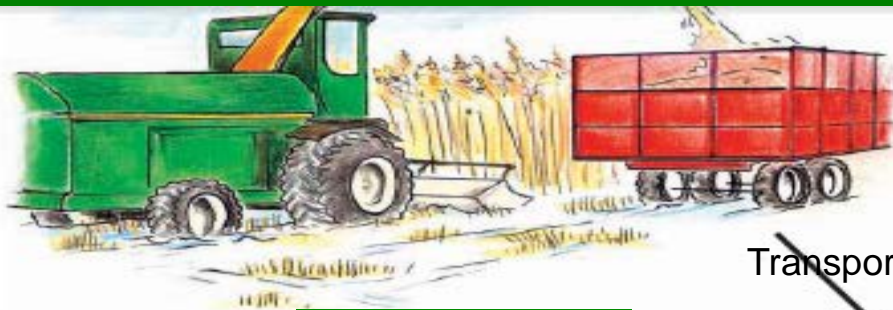
Heat Energy

P Recovery

Ash OUT

88%  
Phosphorous  
Recovery

# The general idea



Harvest

Transport



Storage

Transport

Pelletizing



*Pelletizing*

Transport

Burning pellets



*Burning in pellet furnaces*



# Mattracks from MN



# “Ratrak” from Poland





# Kassbohrer “Piston Bully” from Germany

**Manitoba Opportunities**



Piston Bully - Baling technology for  
Phargmites harvesting. Germany.





# Logic softrack cut and collect system from the U.K.









**Pilot scale  
processing at  
Northwest  
Research and  
Outreach  
Center**

Northwest Manufacturing, maker of  
*Woodmaster* stoves. Red Lake Falls, MN







**What next?**



# Issues to address

- Getting material out of the marsh-logistically and economically.
- Cost to transport to processing site. (No pellet plants in northern Minnesota.)
- Cost and logistics to produce a fuel that is usable in existing burners, economically competitive, and has consistent quantity and quality.

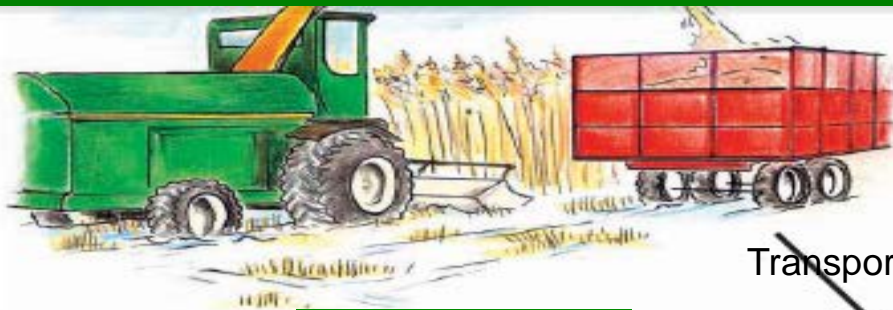


# Harvesting options

Wet year, dry year, average year?



# The general idea



Harvest

Transport



Storage

Transport

Pelletizing



*Pelletizing*

Transport

Burning pellets



*Burning in pellet furnaces*

# Processing



## Tub grinder





# End Products



Torrefaction



Pellets



Pucks



Cubes

# Comparative cost of energy sources

Energy Source	Btu/lb	Cost per ton	Cost per MMBtu
UMC Coal (Sub-Bituminous, delivered)	9,500	\$70	\$ 3.68
Wood pellets picked up (Hayward, WI)	8,000 to 9,000	\$150	\$ 8.82
Wood pellets delivered to Red Lake Falls (Ladysmith, WI)	8,000 to 9,000	\$175	\$ 10.29
Cattail pellets	8,551	?	?





Biomass supply? No pellet plants in NW MN. This plant is in Ladysmith, WI.





Possible role for  
Biobaler for Aspen  
Parkland and brushy  
fringes of marshes.?





# Parnell Impoundment Cattail Study























Key: SPACE      Tool selection  
Key: WINDPAD 9      Enable JO  
Key: WINDPAD 9      Worklight front  
Key: WINDPAD 9      Worklight rear  
Key: WINDPAD 9      Assemble low pressure wheels  
Key: B      Turn on New Holland BB 1000  
Key: V      LFI Pickup  
Key: R      Show HUD

07:59



0 km/h  
61.4% (30%)  
-470 111875  
121,245 S





New York trail groomer

























## Nutrient Capture and Removal

### Cattail Biomass Harvest

Yield: 10 to 20 T/ha

Phosphorus captured:  
20 to 60 kg / hectare

### Biomass Transport (Baled)



### Biomass Densification (cubes, pellets)

Cattail Biomass IN  
Cattail P IN

# Cattail Harvesting for Nutrient Removal and Bioenergy Production

## Bioenergy

Emissions out



*Biomass Burner*

Heat Energy

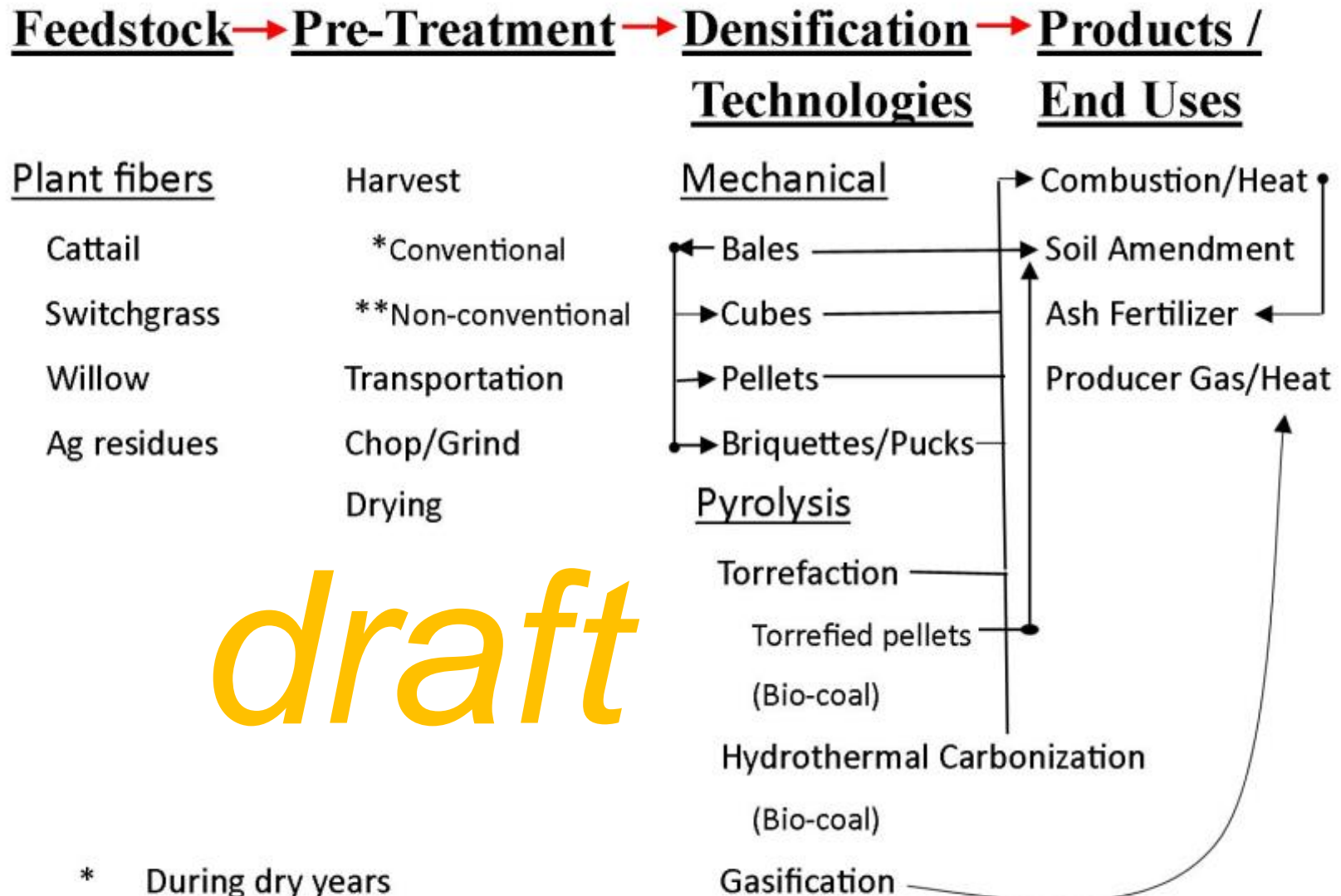
P Recovery

Ash OUT

88%  
Phosphorous  
Recovery



# Integrated systems approach needed



*draft*

\* During dry years

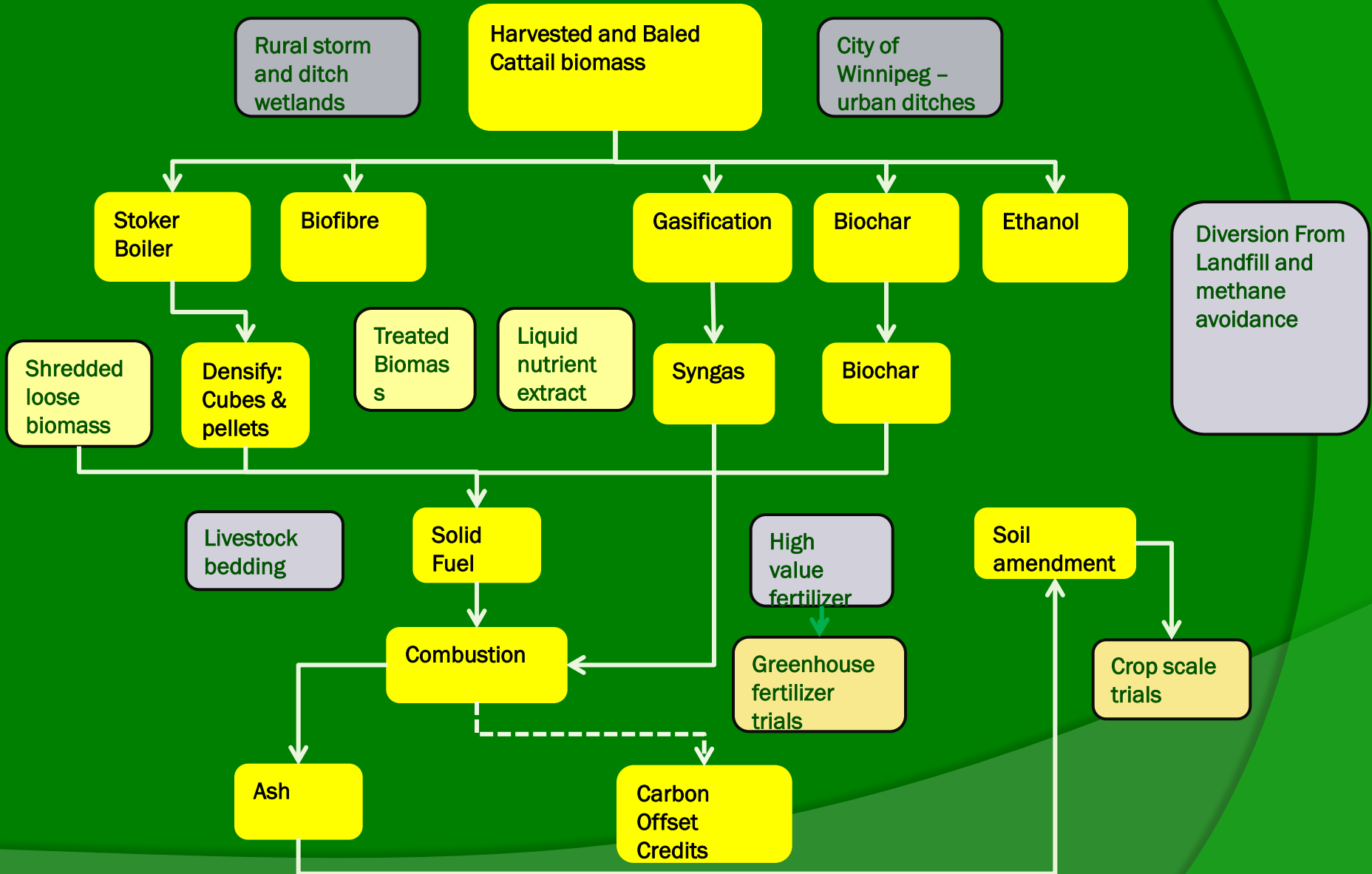
\*\* During wet years





# Life Cycle Analysis – Cattail to Endproducts

- *energy balance and nutrient flow*









**"We need to find new ways of doing old things."** (like using renewable energy and maintaining nutrient cycles.)

**Steve Allard**, UMC Native American student