


# Energy Use and Efficiency in Crop Production

Martin Entz, J. Hoepfner, G. Martens, K. Bamford, Dept. of Plant Science, University of Manitoba, Winnipeg, MB R3T 2N2 Email: m\_entz@umanitoba.ca

### Energy use and efficiency in crop production



M. Entz, J. Hoepfner, G. Martens and K. Bamford  
University of Manitoba

### Red River Valley farm

Legend:  
 ■ N fertilizer (40%)  
 ■ Fuel (14%)  
 ■ Seed (12%)  
 ■ Machinery (12%)  
 ■ P fertilizer (12%)  
 ■ Herbicide (8%)

About 7000 MJ/ha/year

**Reducing energy use on the farm**

1. Reduce tillage (14%)
2. Reduce N fertilizer use (40%)
3. Grow legume crops (12%)
4. Organic farming (60%)
5. Crop-livestock integration

### Energy facts


- Agriculture uses 8% of MB fossil fuels
- 2% of world fossil fuels used to produce N fertilizer
- Manitoba farmers efficient – 7 units of energy output/1 unit input

So, what's the problem?

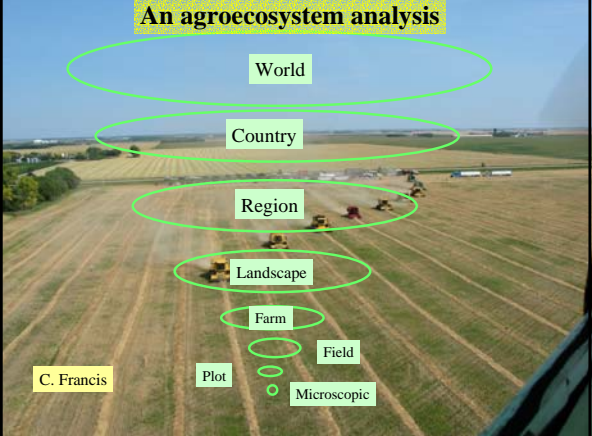


Food production energy costs the same as "fun" energy.

### Choices



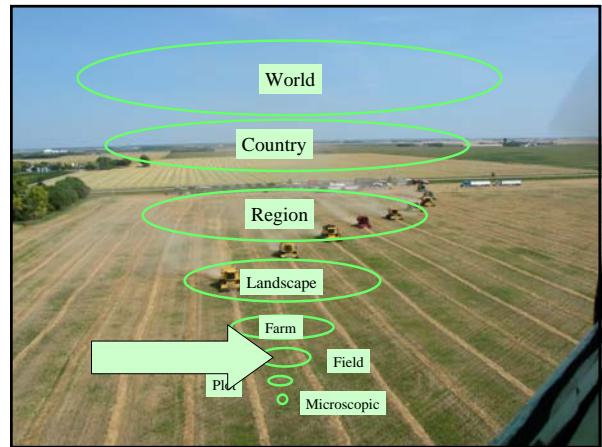
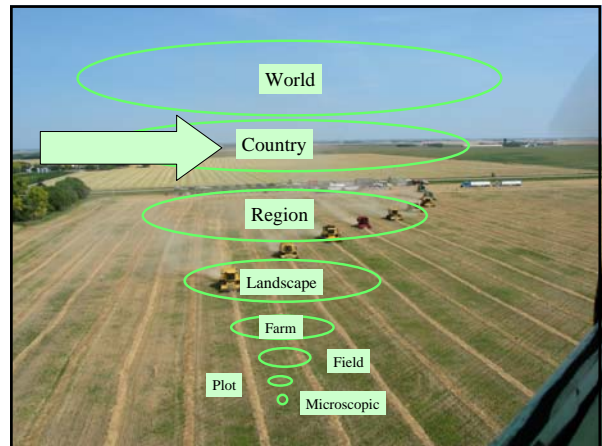
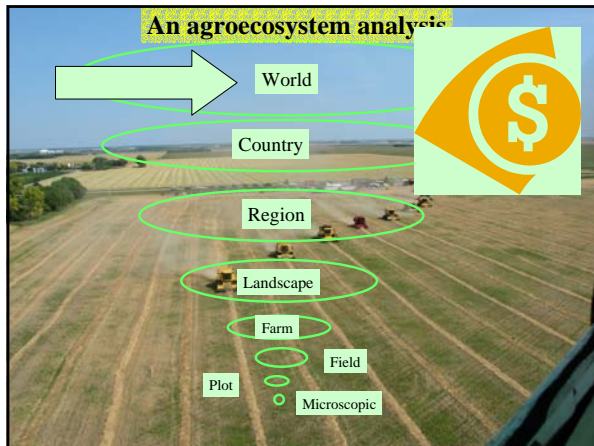
### An agroecosystem analysis



C. Francis

# Energy Use and Efficiency in Crop Production

Martin Entz, J. Hoepfner, G. Martens, K. Bamford, Dept. of Plant Science, University of Manitoba, Winnipeg, MB R3T 2N2 Email: m\_entz@umanitoba.ca



**Table 1.** Comparison of energy use and carbon emissions in zero-till and conventional-till systems in Manitoba.

	Energy Use (MJ/ha/year)		Carbon Emissions (C/ha/year)		Zero-till expressed as % of Conventional till	
	Conv Till	Zero Till	Conv Till	Zero Till	NRG Use	C Emission
Machinery	551.47	370.09	10.55	7.08	67.11	67.12
Fuel	1197.09	762.86	22.56	14.57	62.73	64.58
N-Fertilizer	3886.79	3530.91	54.90	51.53	90.84	93.87
P-Fertilizer	382.90	365.09	7.70	7.34	95.35	95.34
Herbicide	312.36	427.55			136.87	129.82
<b>Total</b>	<b>6330.62</b>	<b>5456.49</b>	<b>100.23</b>	<b>86.39</b>	<b>86.19</b>	<b>86.20</b>

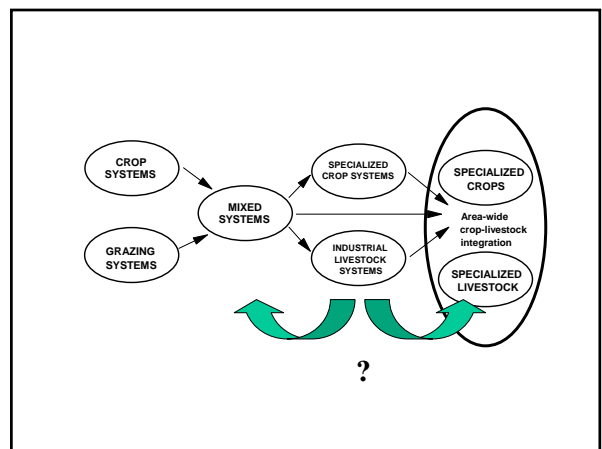
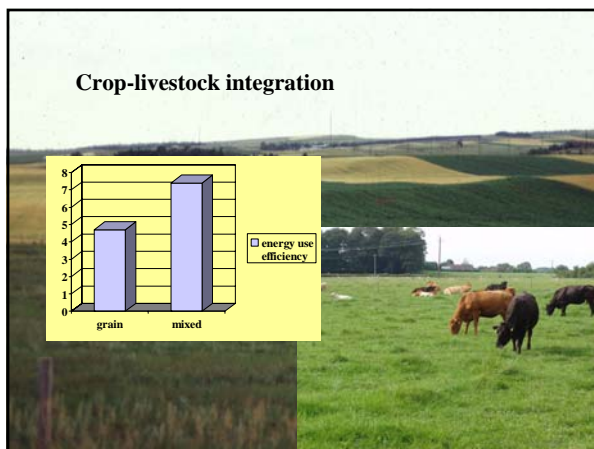
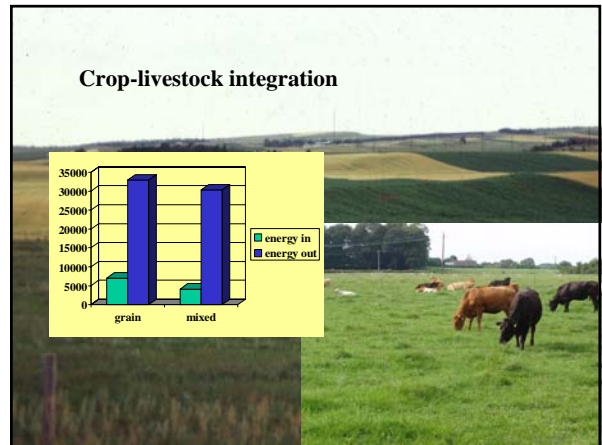
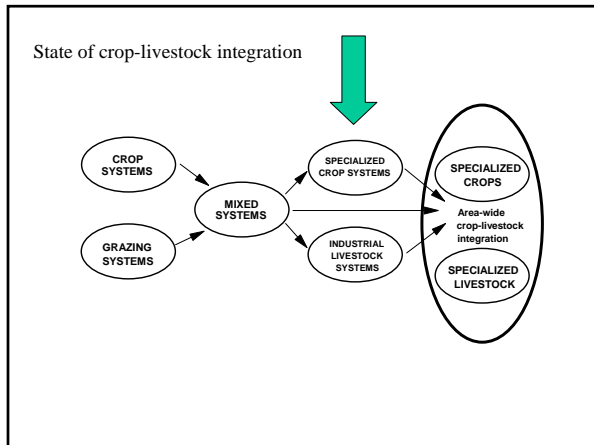
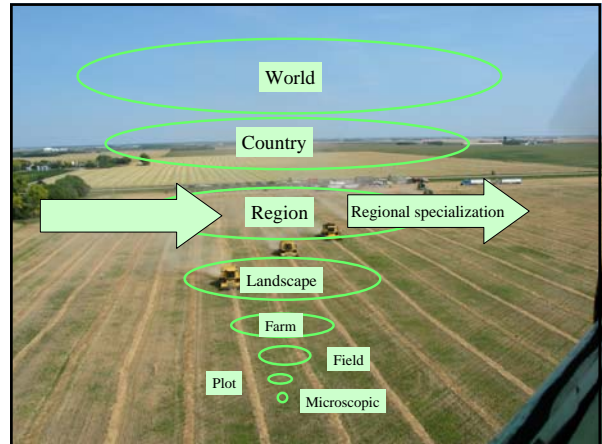
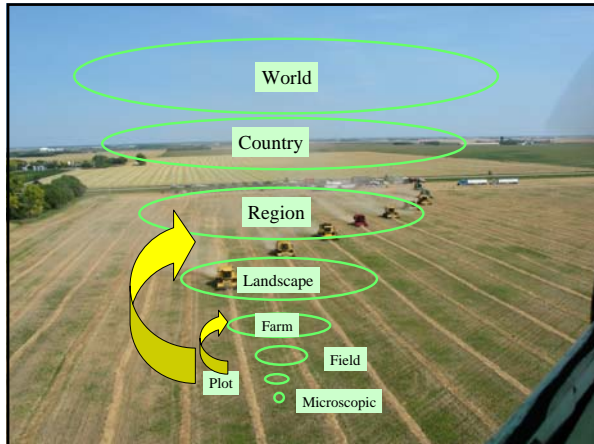
*Note: A green arrow points to the Herbicide row with the text 'Herbicides cheap'.*

<http://umanitoba.ca/outreach/naturalagriculture/articles/energy.html>



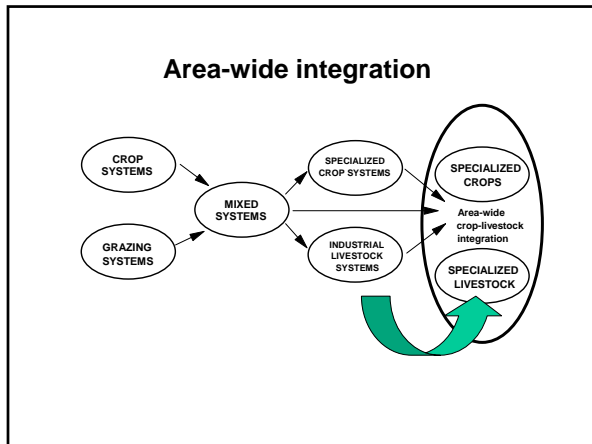
# Energy Use and Efficiency in Crop Production

Martin Entz, J. Hoepfner, G. Martens, K. Bamford, Dept. of Plant Science, University of Manitoba, Winnipeg, MB R3T 2N2 Email: m\_entz@umanitoba.ca

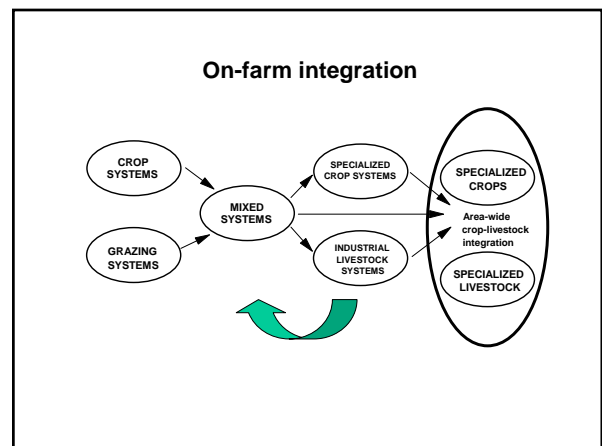
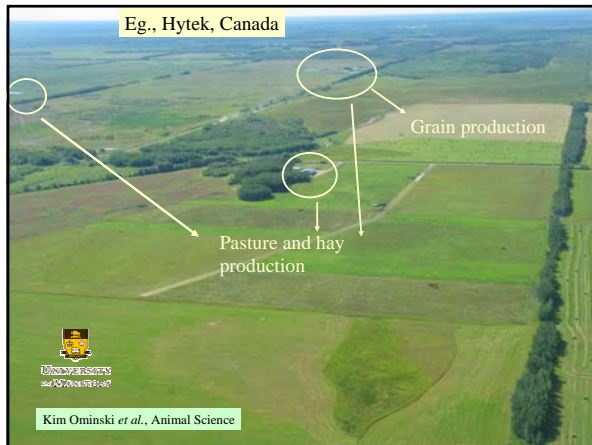


# Energy Use and Efficiency in Crop Production

Martin Entz, J. Hoepfner, G. Martens, K. Bamford, Dept. of Plant Science, University of Manitoba, Winnipeg, MB R3T 2N2 Email: m\_entz@umanitoba.ca



- ### Area-wide integration
- Drivers
  - Excess nutrients
    - Regulations
  - Wide-spread environmental damage
    - Eg., Water quality in Gulf of Mexico and Lake Winnipeg



# Energy Use and Efficiency in Crop Production

Martin Entz, J. Hoepfner, G. Martens, K. Bamford, Dept. of Plant Science, University of Manitoba, Winnipeg, MB R3T 2N2 Email: m\_entz@umanitoba.ca

## Local (on-farm) integration

- Drivers
- On-farm economics
- Soil sustainability
- Pest resistance
- Organic production
- Energy efficiency

Organic, no forages

Organic with 50% forages

[www.umanitoba.ca/afs/plant\\_science/glenlea/glenlea.html](http://www.umanitoba.ca/afs/plant_science/glenlea/glenlea.html)

## Perennial *pastures* in grain rotations

“Plants like to stay put”  
“Animals can walk”



## Herd Management

Where livestock deposit manure

On the land

In the barn

## Impact of manure management on total millet yield (Mg/ha) over 3 years (Powell et al.)

7.1 Mg cattle manure DM/ha (2 nights)

3.2 Mg sheep manure DM/ha (2 nights)

Year	Barn manure (Mg/ha)	Corral manure (Mg/ha)
1st year	~4.2	~6.0
2nd year	~3.0	~4.8
3rd year	~3.0	~5.0

# Energy Use and Efficiency in Crop Production

Martin Entz, J. Hoepfner, G. Martens, K. Bamford, Dept. of Plant Science, University of Manitoba, Winnipeg, MB R3T 2N2 Email: m\_entz@umanitoba.ca

