Balancing Land and Livestock on Wisconsin Dairy Farms

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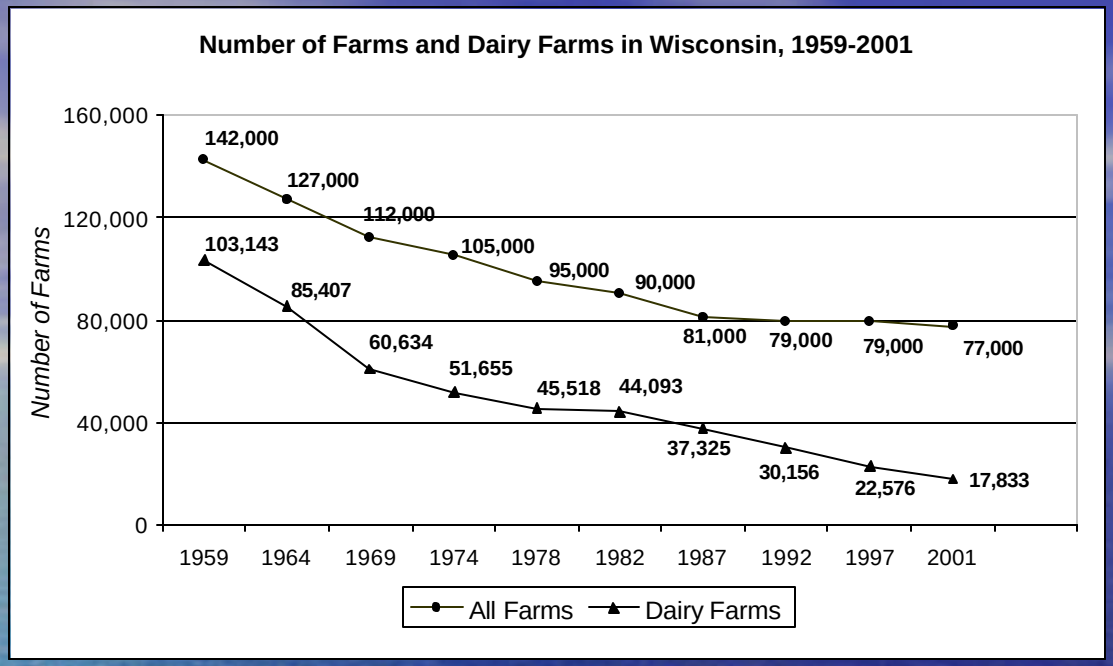
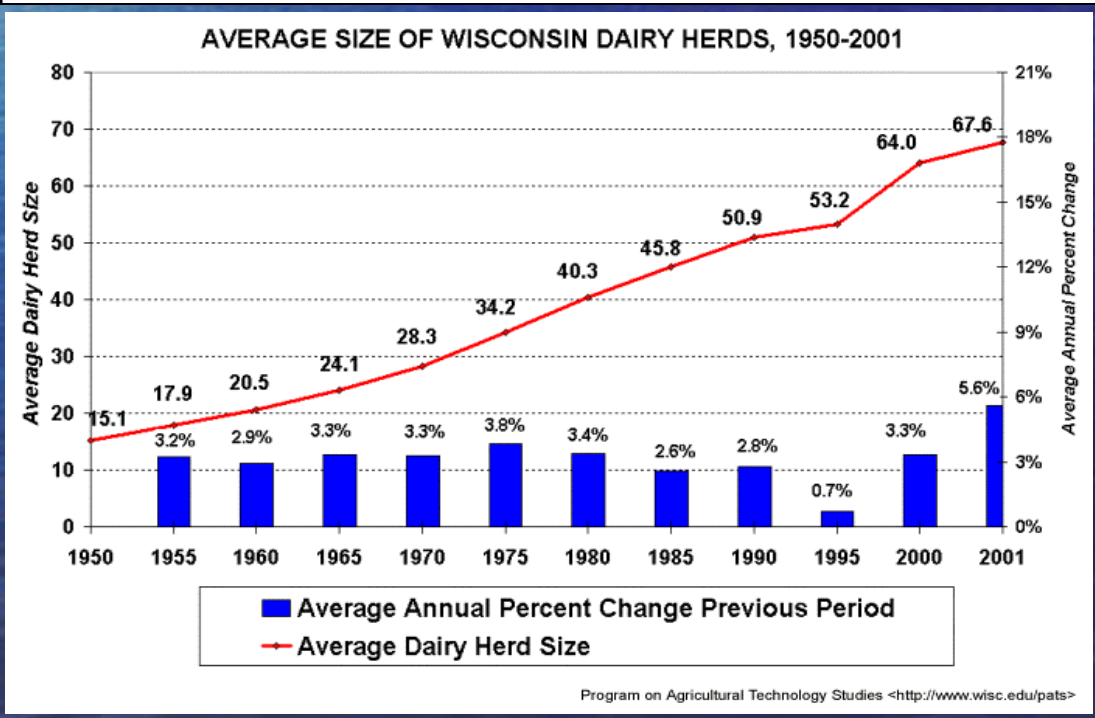
THE UNIVERSITY of WISCONSIN MADISON


Number of Farms and Dairy Farms in Wisconsin, 1959-2001
Number of Farms
160,000
120,000
80,000
40,000
0
142,000
127,000
112,000
105,000
95,000
90,000
81,000
79,000
79,000
77,000
103,143
85,407
60,634
51,655
45,518
44,093
37,325
30,156
22,576
17,833
1959
1964
1969
1974
1978
1982
1987
1992
1997
2001
All Farms
Dairy Farms


AVERAGE SIZE OF WISCONSIN DAIRY HERDS, 1950-2001
Average Dairy Herd Size
Average Annual Percent Change
80
70
60
50
40
30
20
10
0
21%
18%
15%
12%
9%
6%
3%
0%
15.1
17.9
20.5
24.1
28.3
34.2
40.3
45.8
50.9
53.2
64.0
67.6
3.2%
2.9%
3.3%
3.3%
3.8%
3.4%
2.6%
2.8%
0.7%
3.3%
5.6%
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2001
Average Annual Percent Change Previous Period
Average Dairy Herd Size
Program on Agricultural Technology Studies <http://www.wisc.edu/pats>

Purpose of the Study

- To examine the degree to which WI dairy farmers, while expanding herd sizes, have managed to maintain an adequate cropland base for recycling manure nutrients according to nutrient management standards.

Animal density as an indicator of nutrient balancing potential

- Increasingly being used in parts of the U.S. and Europe
- Addresses the core movement of nutrients within the dairy farm nutrient cycle

Methods

Program on Agricultural Technology Studies 1999 Dairy Farm Poll:

Used data on livestock inventories and crop production data to calculate Animal:Land Ratios (ALRs) for 750 farms

Total cropland: Sum of all cropping acreages

Tilled cropland: Same as total except only 1/3 of hay and 65% of Soybeans

Manured cropland: Actual amount of land on which manure was spread

Table 1. Calculated animal:cropland ratio threshold levels for Wisconsin dairy farms

Animal density category	Animal:cropland ratio (AU acre-1)[a]	(acres/cow)	Implication for nutrient management
Low	< 0.75	2	Crop P requirements met by manure, N deficit [b]
Medium	0.75 to 1.5	1 to 2	P surplus, crop N requirements met by manure
High	>1.5	less than 1	P and N surplus

Source: adapted from Klausner (1997) and Powell et al. (2001)

[a] One animal unit (AU) is the equivalent of 1000 lbs. live animal weight, where 1.4 AU is the approximate equivalent of one dairy cow. One acre of cropland represents a mixed corn and legume (alfalfa/soybean) cropping system.

[b] Assumes a P-adequate diet; 0.38% P on dry matter basis

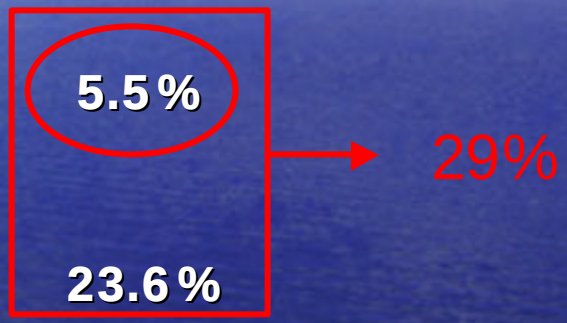
RESULTS

Total and Tilled ALRs: Indicator of nutrient balancing potential between crop and livestock components of nutrient cycle, indication of land-constraint

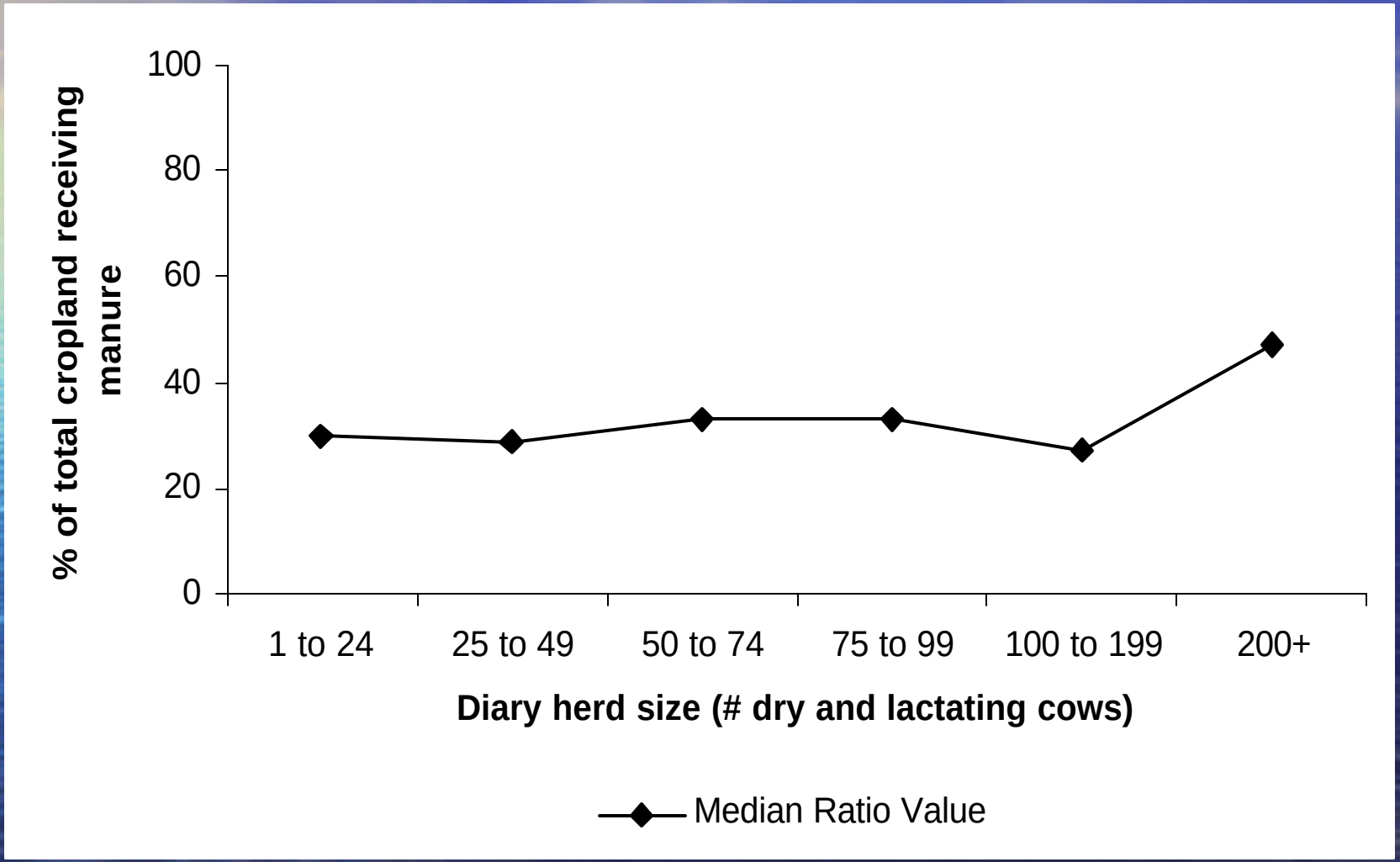
Animal:Land Ratio		Percent of Farms	
ACLR			
Low *(P Balance, N deficit)*	(n=475)	62.9%	95%
Medium *(P Surplus, N Balance)*	(n=245)	32.5%	
High *(P and N Surplus)*	(n=35)	4.6%	
ATLR			
Low *(P Balance, N deficit)*	(n=188)	24.9%	79%
Medium *(P Surplus, N Balance)*	(n=406)	53.8%	
High *(P and N Surplus)*	(n=161)	21.3%	

Manured Cropland ALRs: Considering Actual Manure Spreading Behaviors

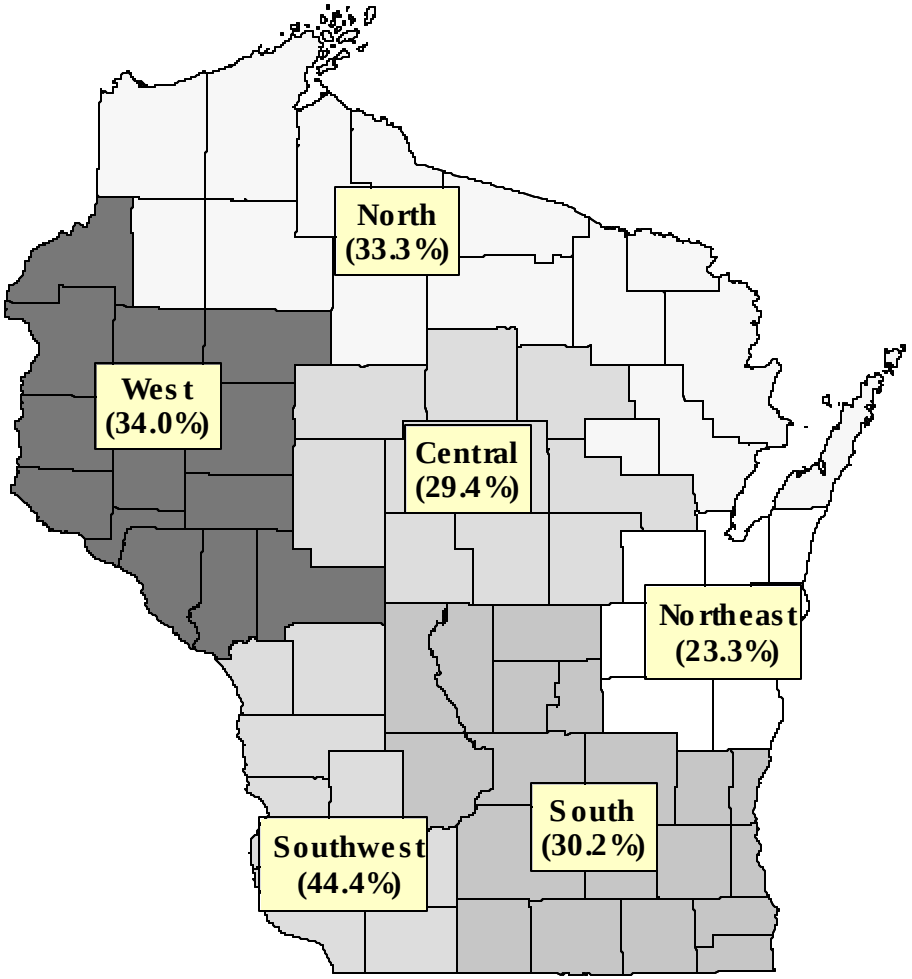
Animal:Land Ratio	Percent of Farms	
Low *(P Balance, N deficit)*	(n=42)	5.5%
Medium *(P Surplus, N Balance)*	(n=180)	23.6%
High *(P and N Surplus)*	(n=542)	70.9%



Differences between “Total Cropland” and “Manured cropland” animal density calculations indicate a large manure gap on farms of various sizes



“Manure Gap” by Dairy Region



(Median Ratio Value)

Considering spatial and biophysical factors that influence manure spreading behaviors

(1) Soil Texture

(2) Land Tenure

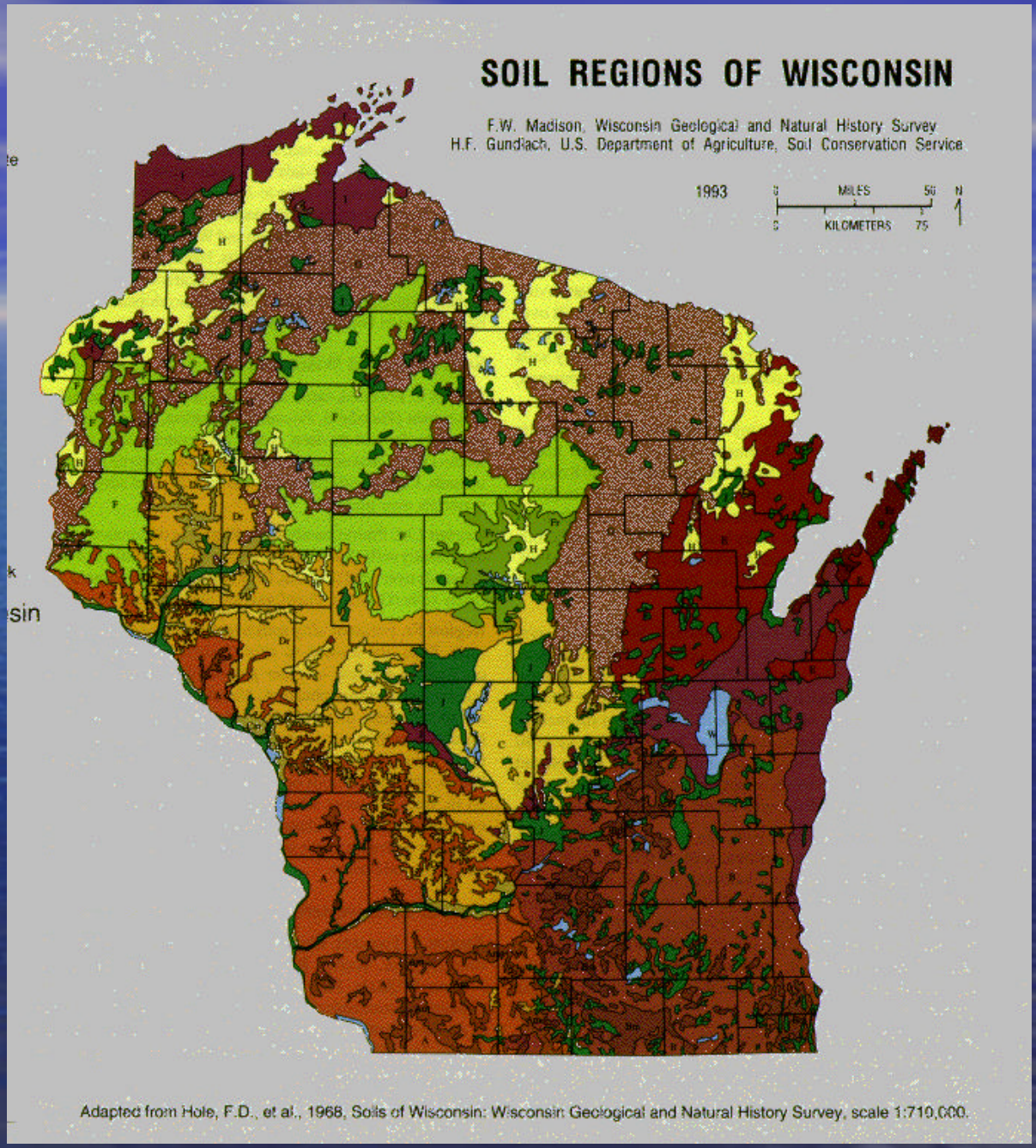
(3) Development Pressures

1) Soil Texture

Differences in “manure spreading windows”

SW Soils: **coarsely textured, silt loams, relatively high permeability**

NE Soils: **finely textured, clayey and red loam, less permeable**



2) Land Tenure

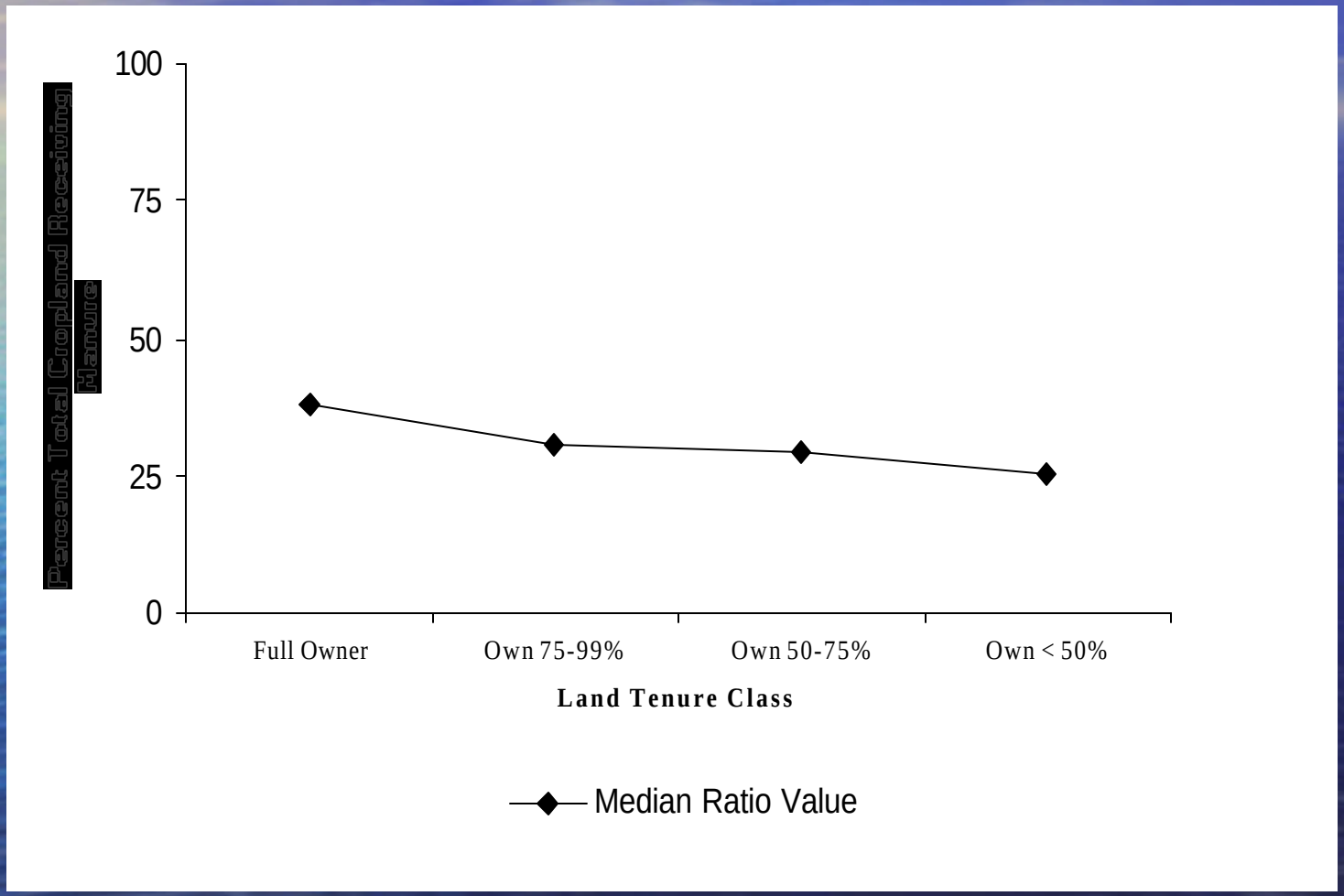
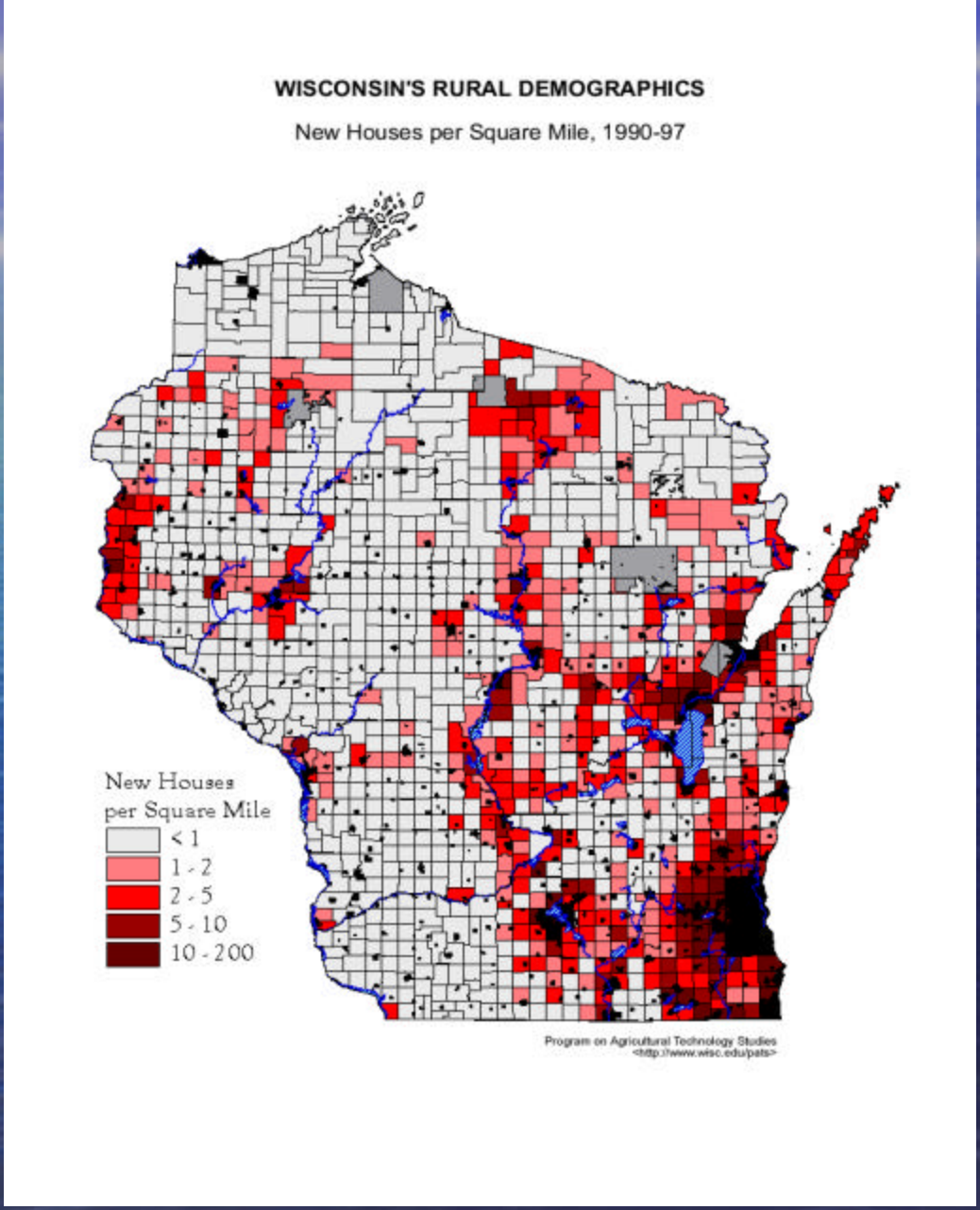


Table 9. Average acres of rented land and land tenure ratio by dairy region

Region	Mean Acres Rented Land *(acres)*	Percent Operated Cropland Owned *(%)*
South	194	67.6
Southwest	96	76.9
West	137	76.1
Central	117	76.1
Northeast	169	68.7
North	132	61.4

3) Development Pressures



Conclusions

Most WI dairy farms have maintained adequate cropland acreage to recycle manure nutrients

Need to recognize that animal density is likely to be an issue in implementing nutrient management standards on a small percentage of farms

- Total and Tilled ALR estimates are conservative
- 5 to 21% of dairy farms produce manure in excess of crop N req’ts
- “Manured” ALR estimates indicate a large, and regionally variant manure gap

There is a need to better our understanding of how Biophysical and Development constraints influence manure spreading areas →

Basis of sampling framework for "On Farmers' Ground" project

- **On-farm nutrient management study**
- **Principal Investigators:**

  Mark Powell, U.S. Dairy Forage Research Center

  Doug Jackson-Smith, Utah-State University

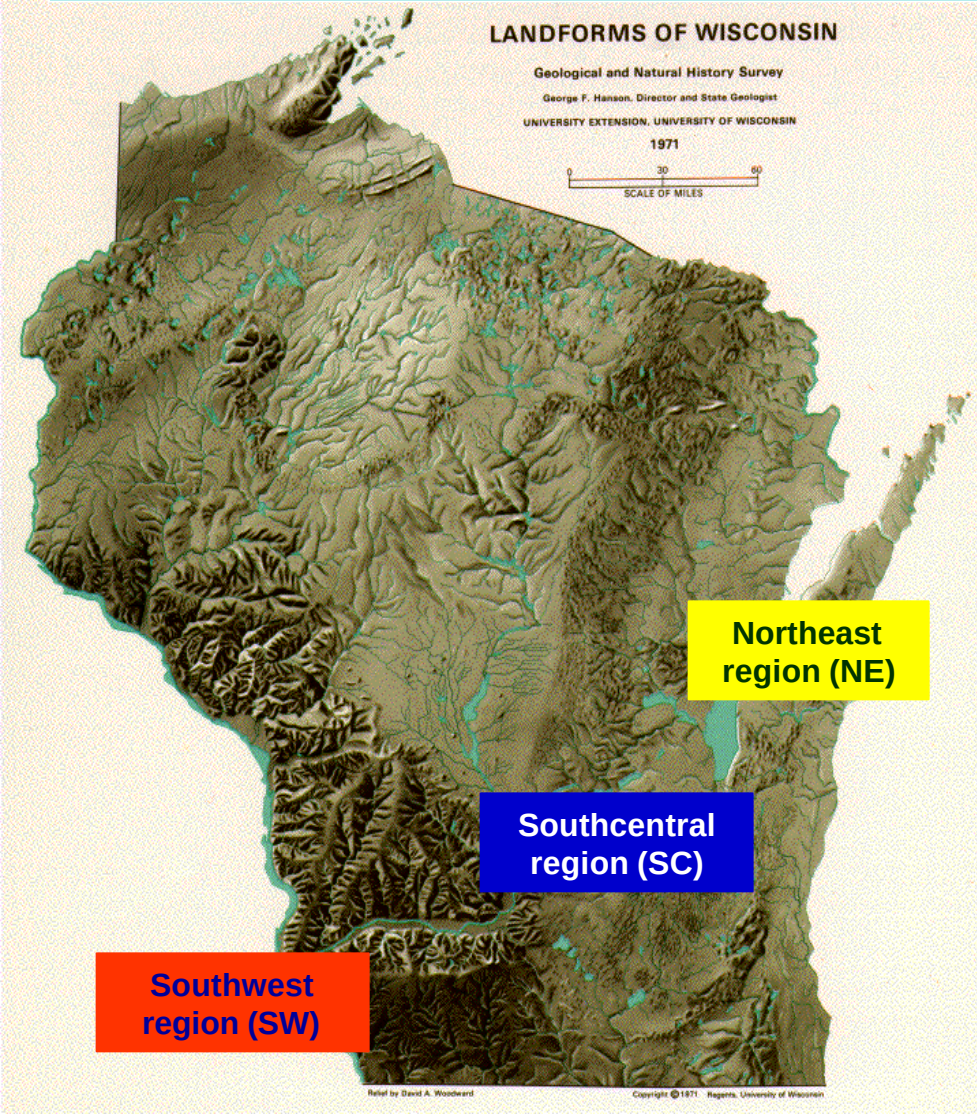
Coordinators:

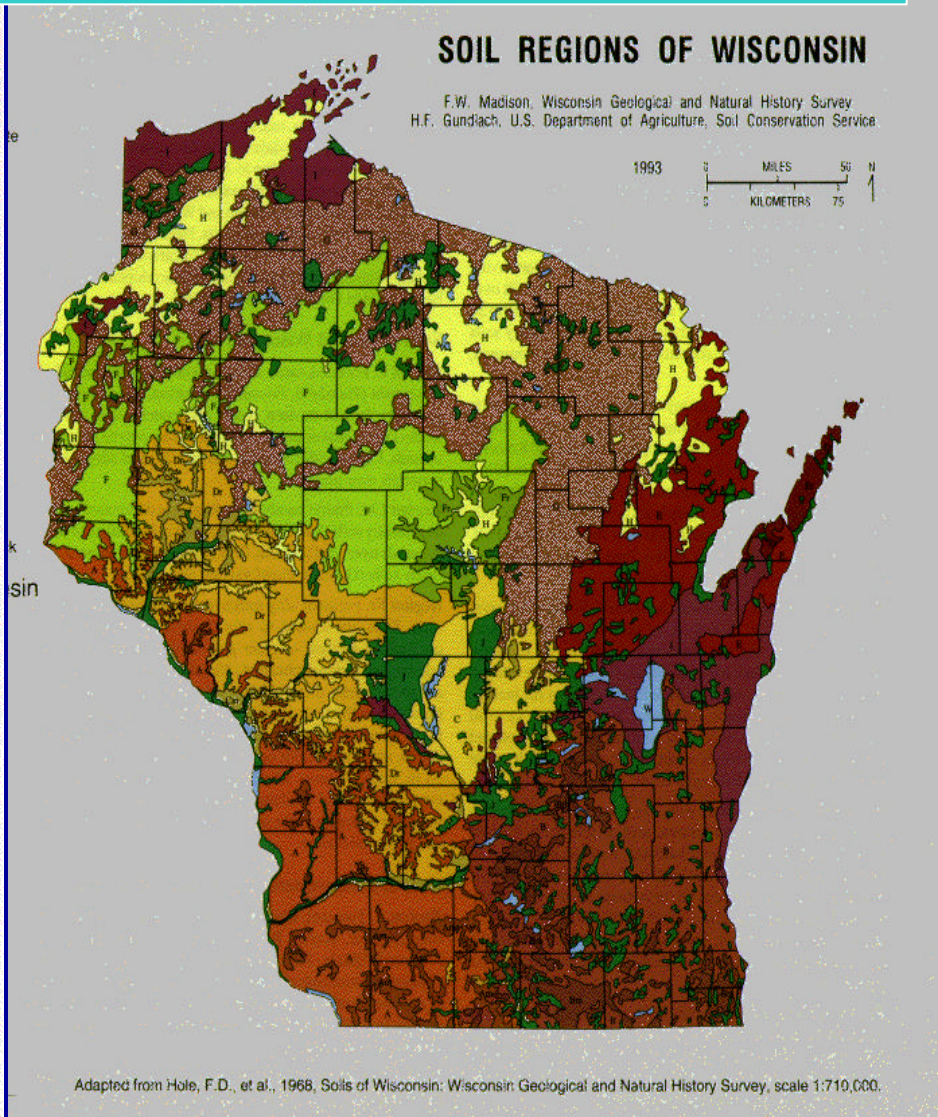
Daniel McCrory

Heather Saam

Region selection

Narrowed sample to approximately 260 dairy farms within three geographically distinct regions based on soil types and landforms





Farm selection

Within each REGION a total of 6 farms were randomly selected from each Animal Density category.

6 – Low Animal Density

6- Medium Animal Density

6 – High Animal Density

Regional Total

SW region n=18
SC region n=18
NE region n=18
Total sample n=54