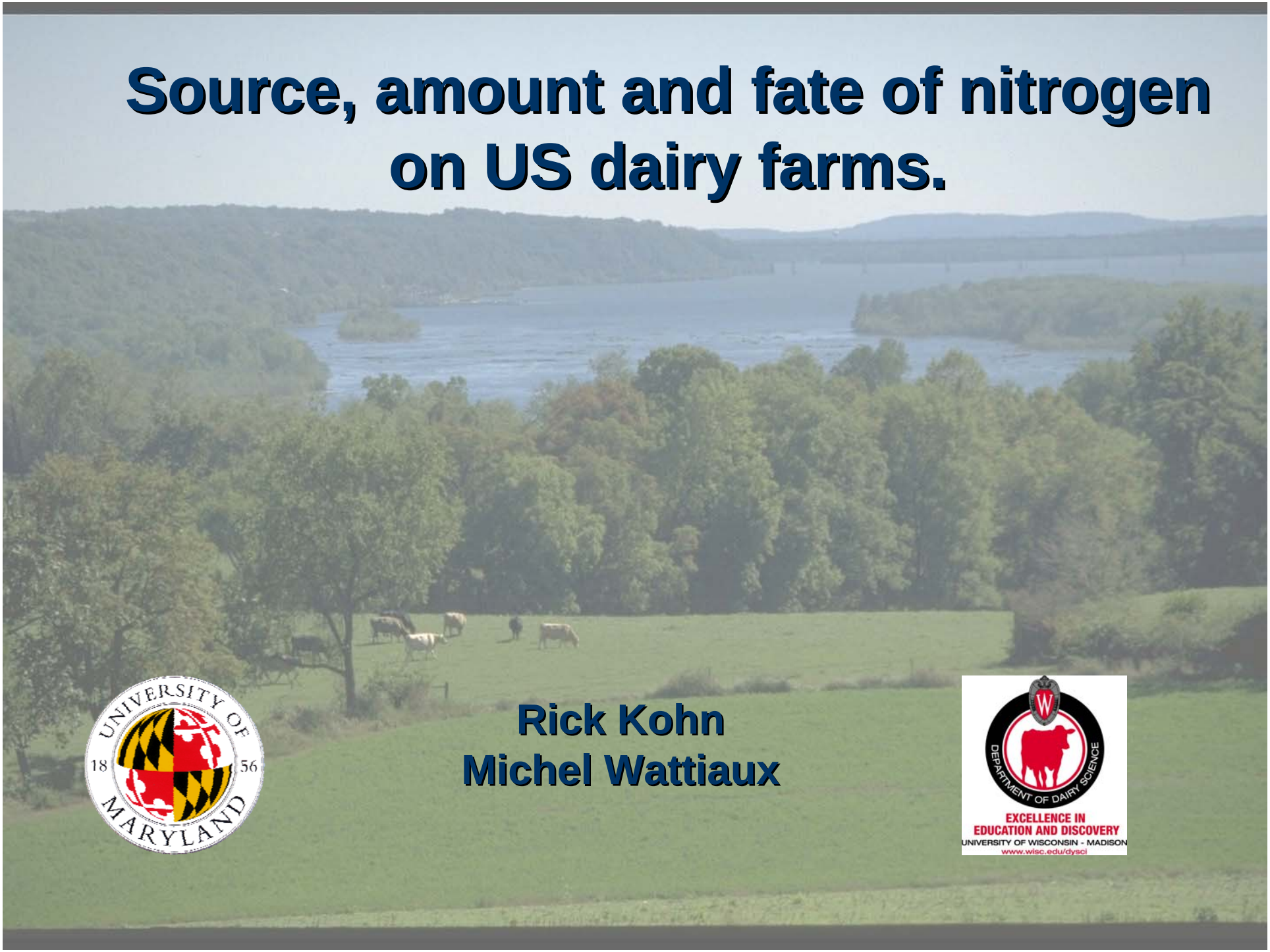
Source, amount and fate of nitrogen on US dairy farms.

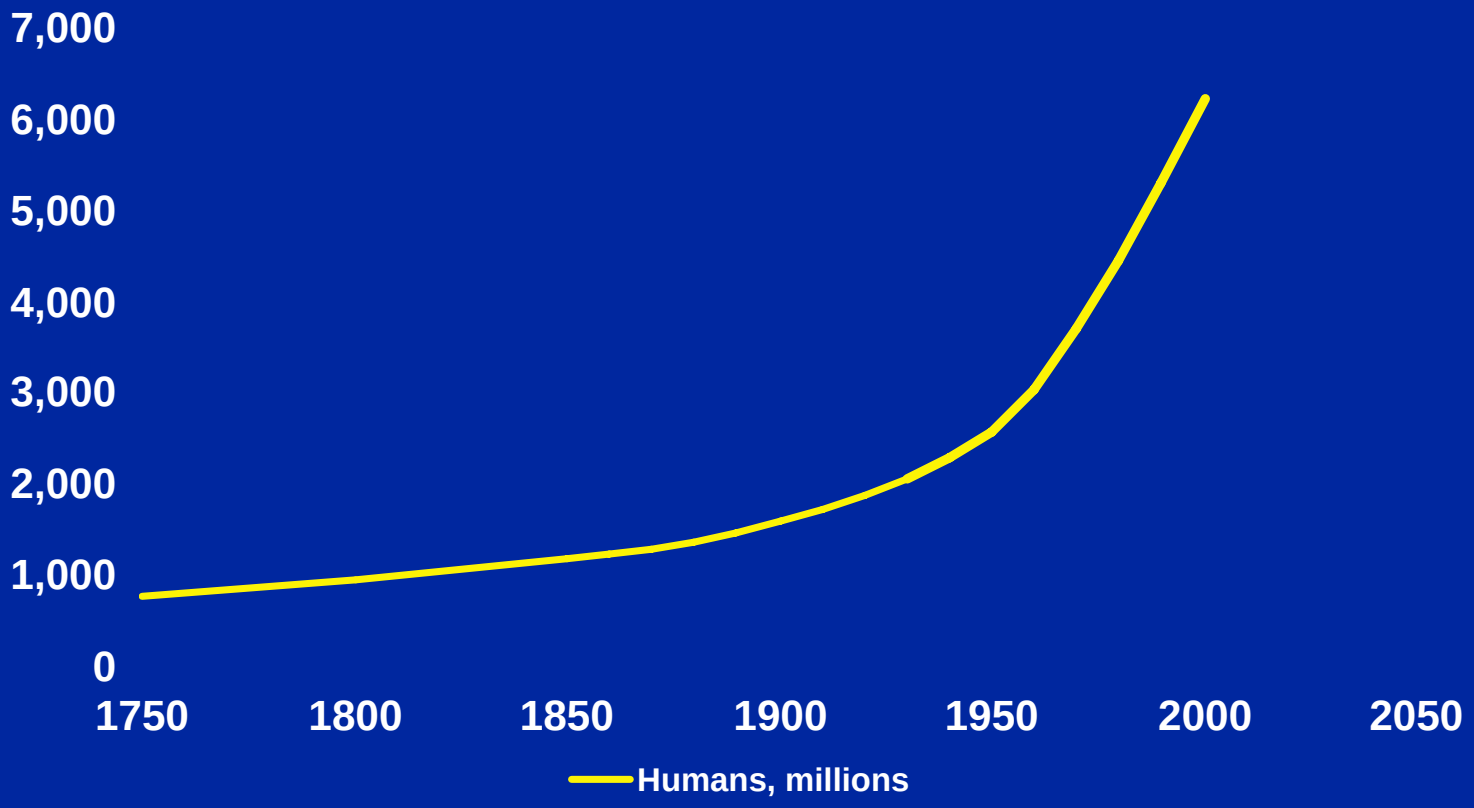


Rick Kohn
Michel Wattiaux

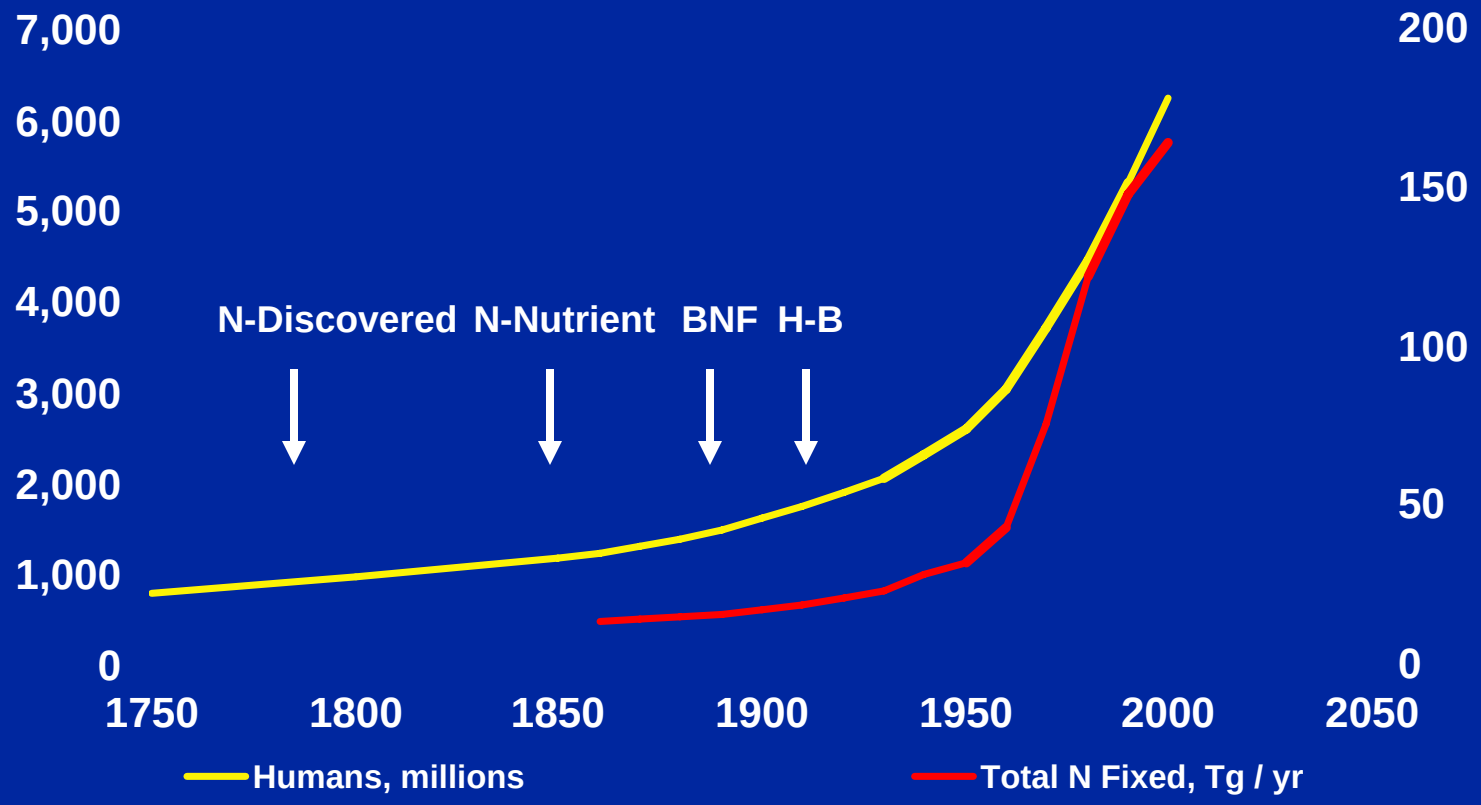
Overview

- Why is reactive N important?
- What are typical farm balances?
- What are critical control points to decrease N losses from dairy farms?

World Human Population



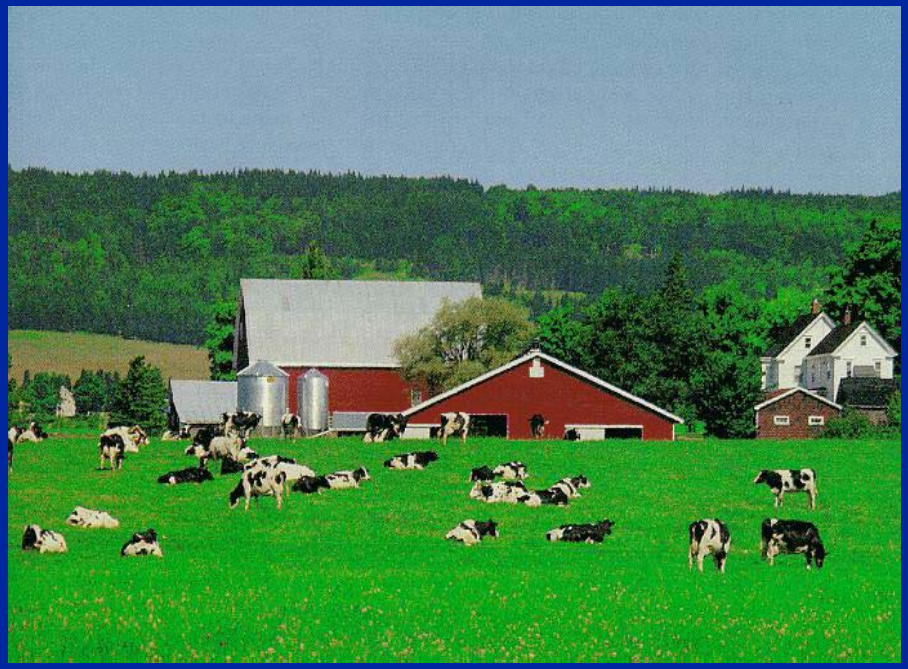
N Fixed for Food and Energy



Galloway JN and Cowling EB. 2002

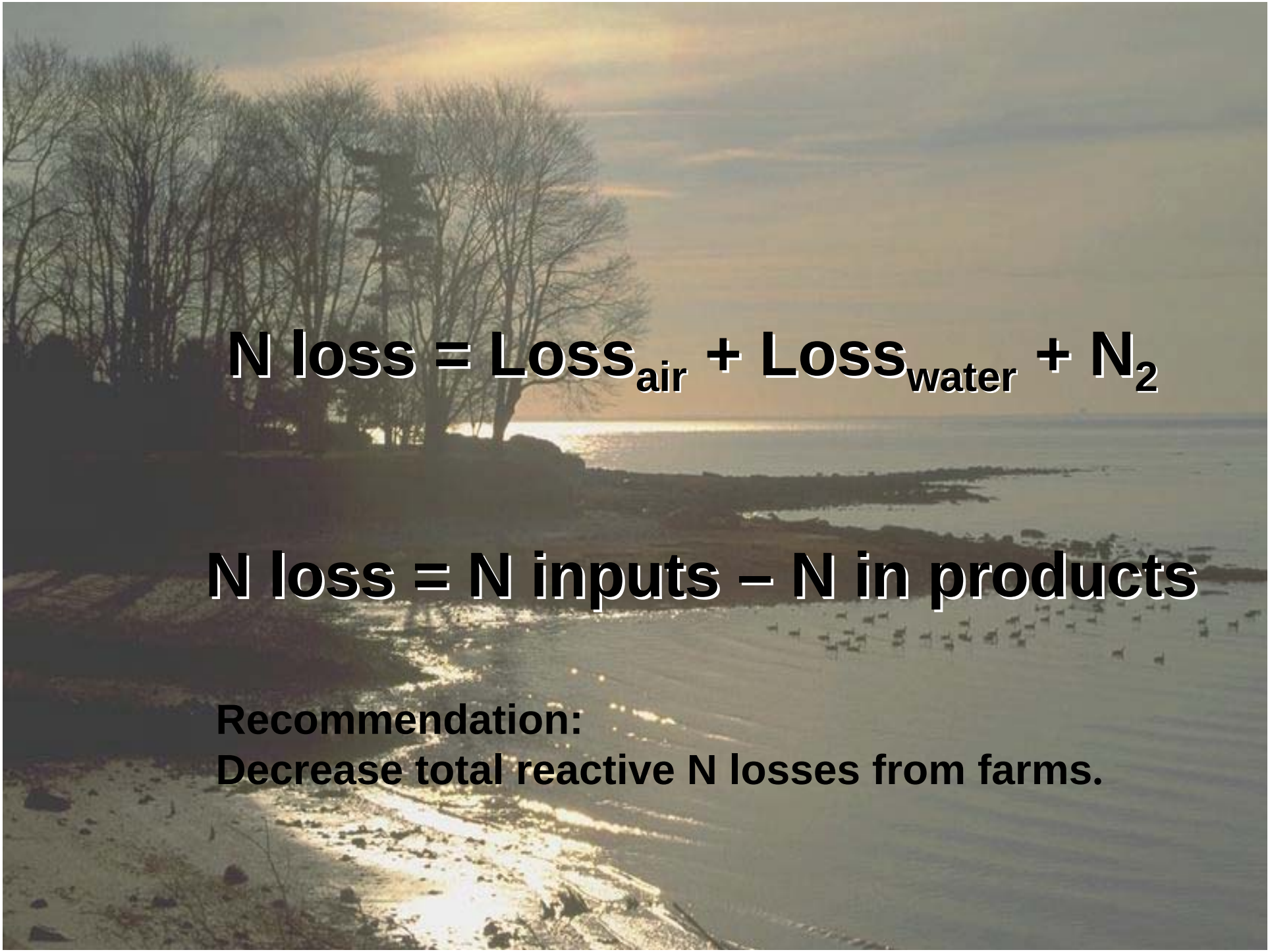
A simple farm model

Inputs



Milk
Meat

Losses


N loss = Loss$_{air}$ + Loss$_{water}$ + N_2
N loss = N inputs – N in products
Recommendation:
Decrease total reactive N losses from farms.

N Balance in Dairy Farms of Different Countries

Item	US[1]	NE[2]	NZ[3]	US[1]	NE[2]	NZ[3]
	Kg ha^{-1} yr^{-1}			Kg cow^{-1} yr^{-1}		
Inputs						
Feed	99	148	15	87	8.5	5
Fertilizer	33	265	71	29	153	24
Fixation	84	0	12	74	0	40
Other	2	0	0	1	0	0
Total	217	413	207	192	238	69
Outputs						
Milk	72	88	82	64	51	27
Crops	16	1	0	14	1	0
Manure	4	12	0	4	7	0
Total	92	101	82	82	58	27
Balance (M. tons yr^{-1})	125	312	125	110	180	42

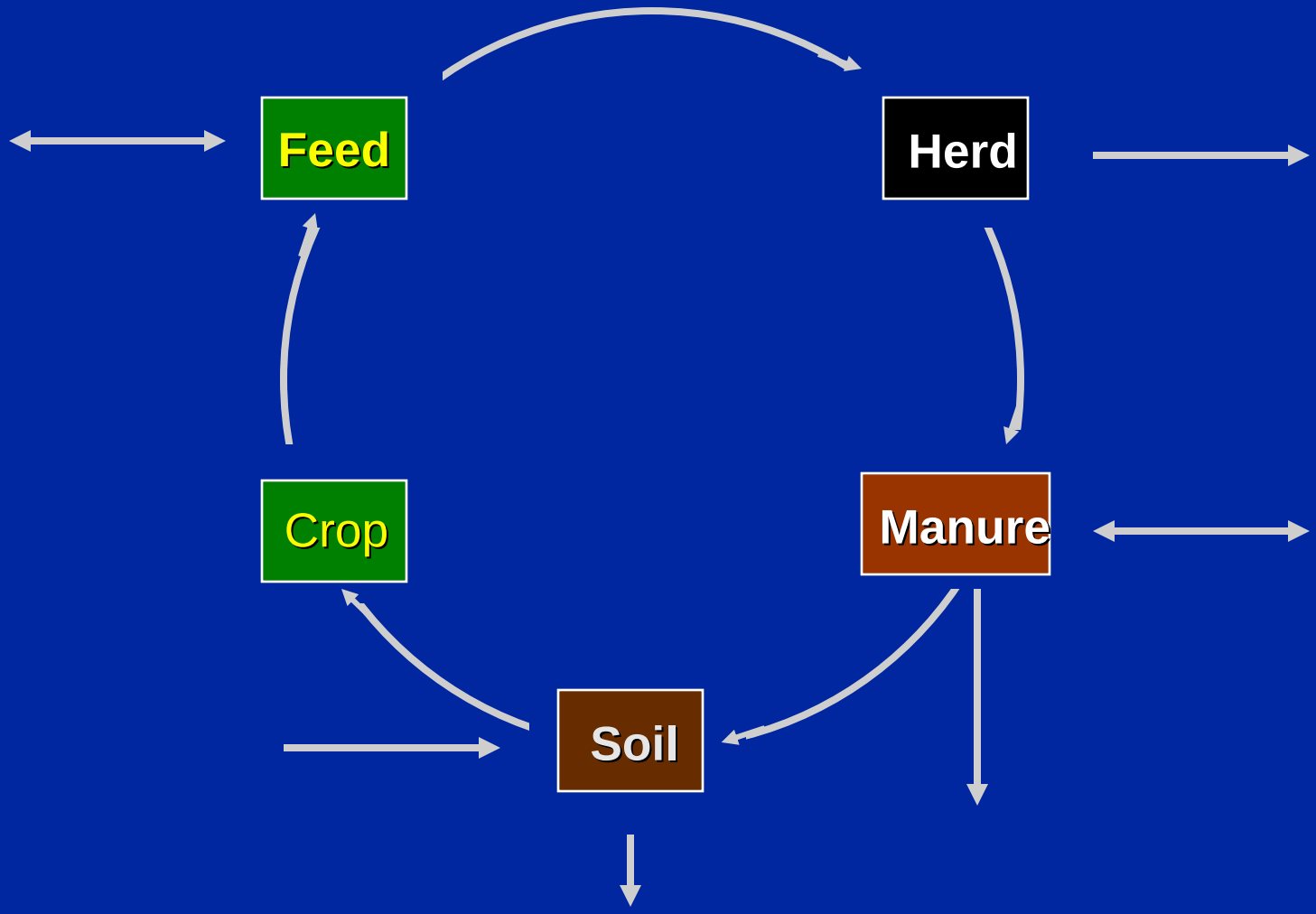
[1]US : United States : 28 Wisconsin farms, 289 cows, 255 ha
[2]NE : The Netherlands : 114 farms, 71 cows, 41 ha
[3]NZ : New Zealand : 5 farms, 666 cows, 222 ha

N Losses in Different Countries

	US	NE	NZ
Potential Loss **N Balance / Milk N**	1.7	3.5	1.5
Efficiency **Milk N / Input N**	0.33	0.21	0.40

[1]US : United States : 28 Wisconsin farms, 289 cows, 255 ha
[2]NE : The Netherlands : 114 farms, 71 cows, 41 ha
[3]NZ : New Zealand : 5 farms, 666 cows, 222 ha

Nitrogen Cycle and Balance

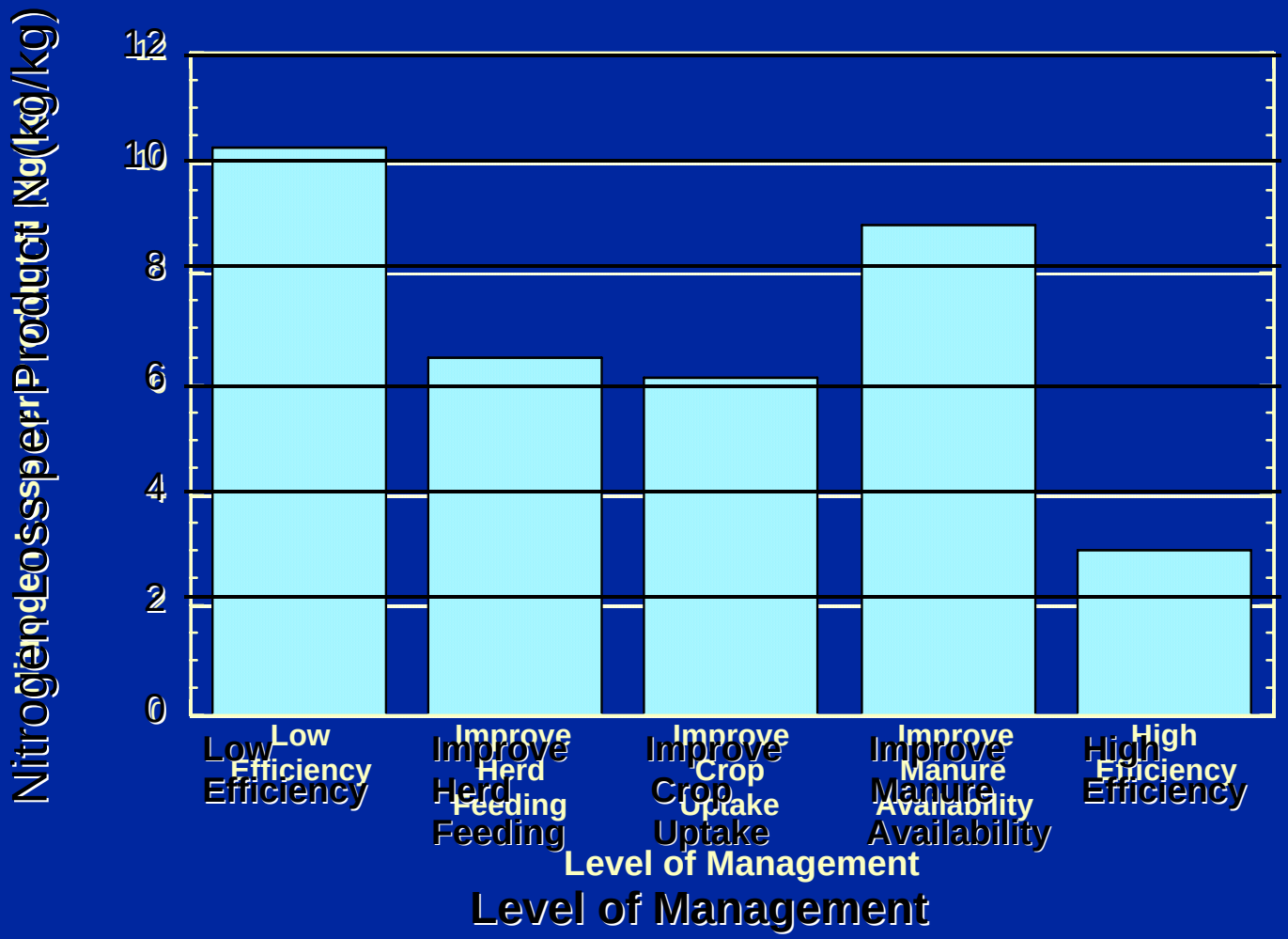


Typical Efficiencies

Sub-system efficiency	Low	High
Animal Product N / Feed N	.16	.24
Feed N / Soil Available N	.50	.75
Soil Available N / Manure N	.25	.50

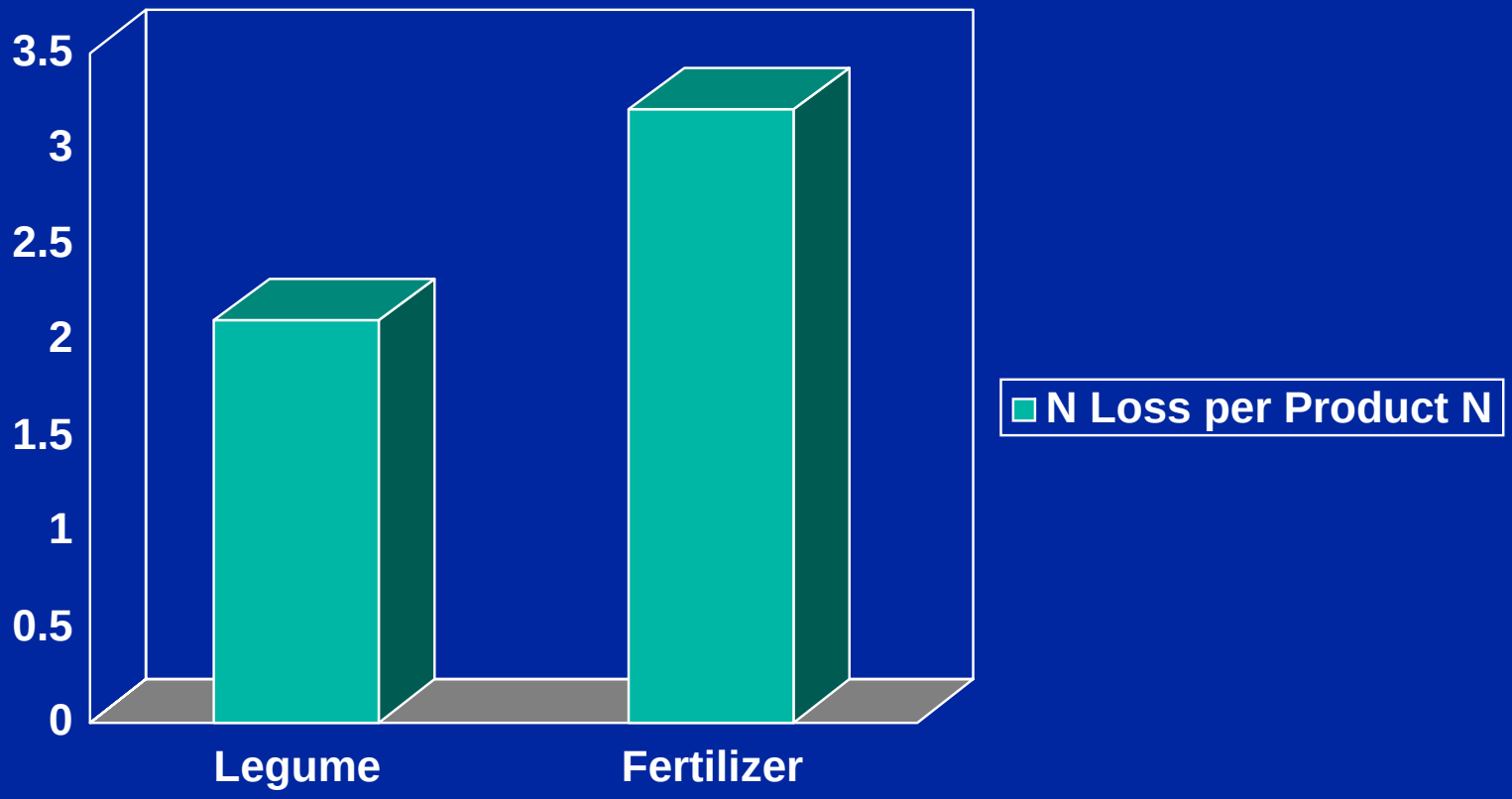
Kohn, et al., 1997. J. Environmental Management

N Losses per Product



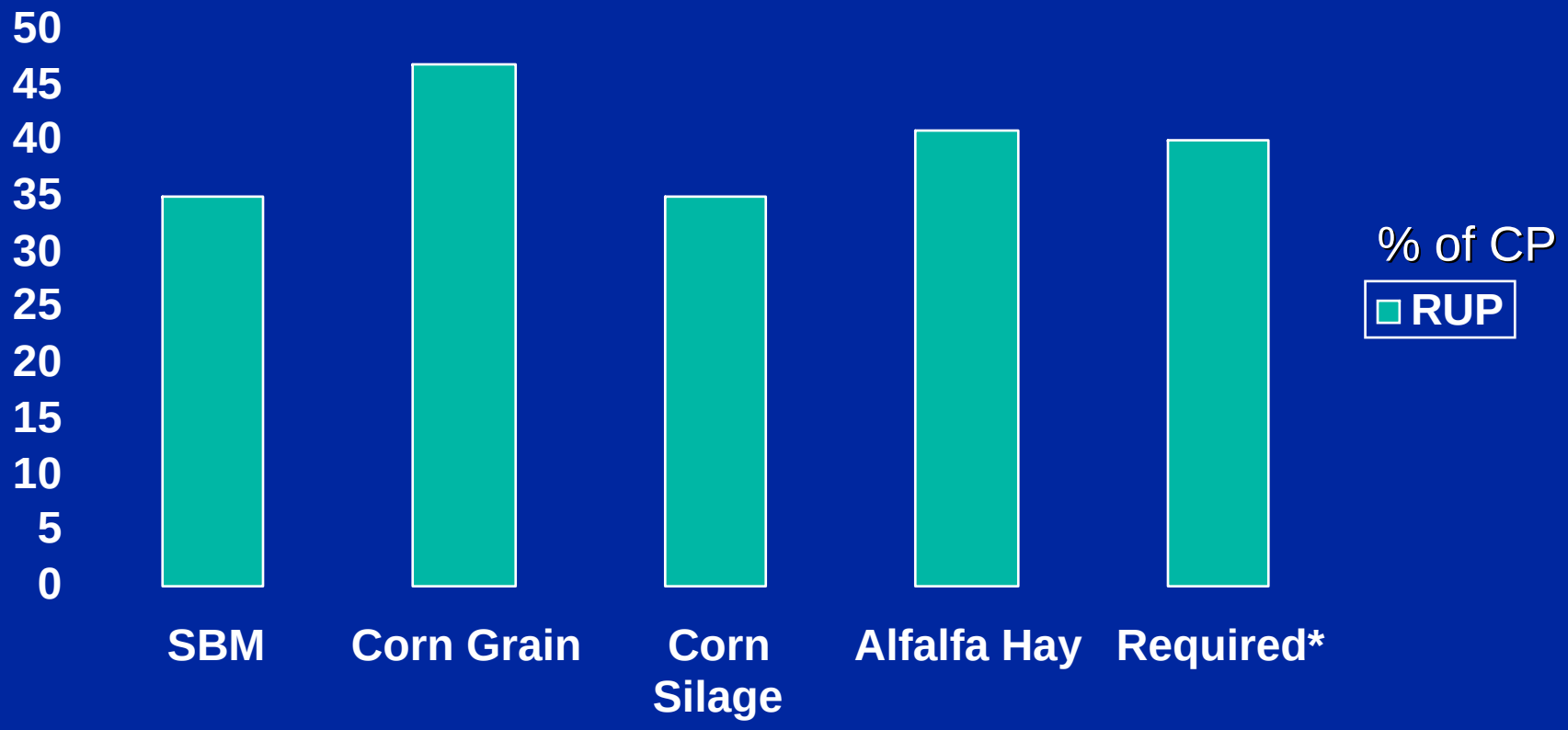
Kohn, et al., 1997. J. Environmental Management

N Losses per Product



Kohn, et al., 1997. J. Environmental Management

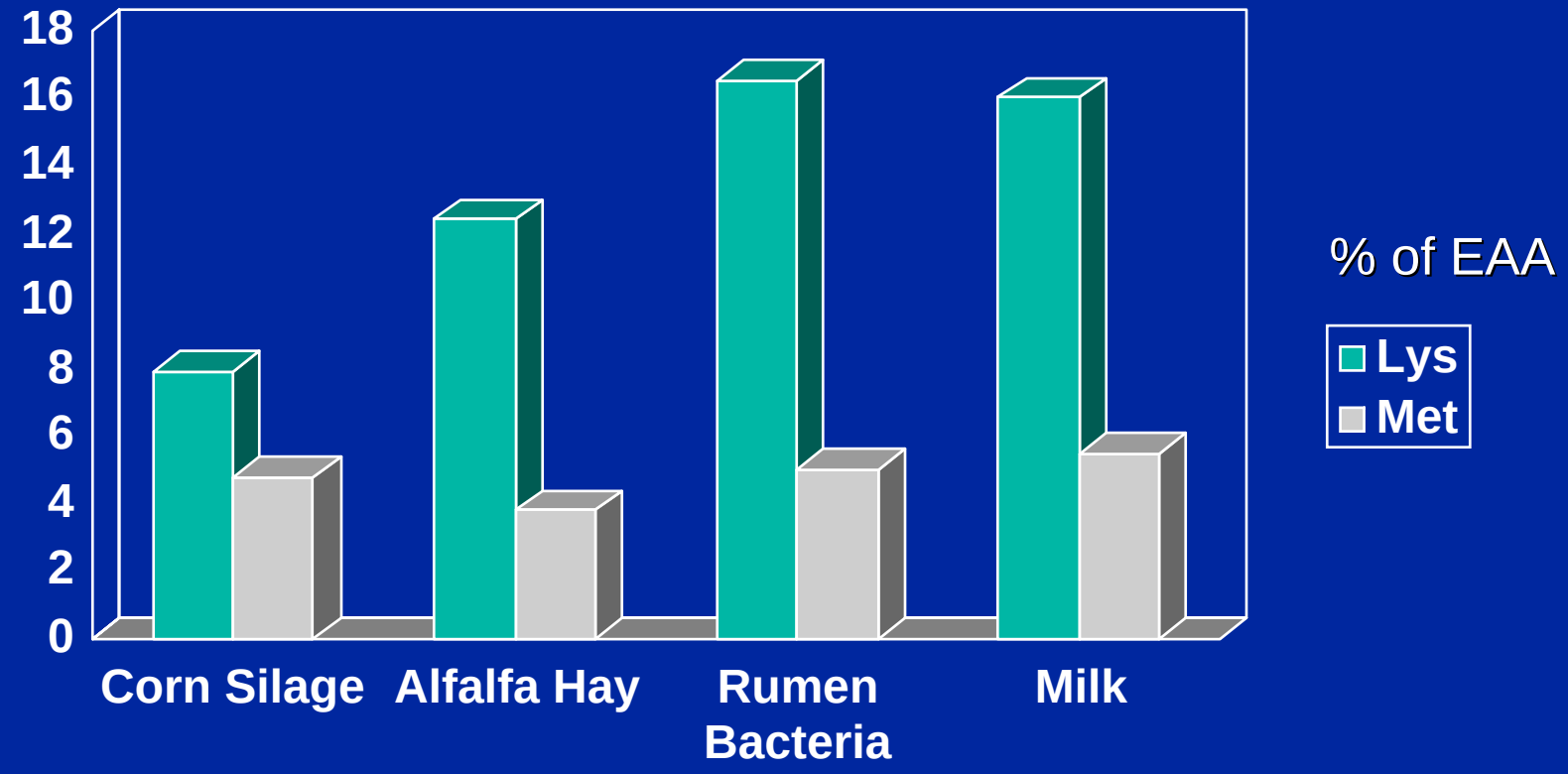
Rumen Undegraded Protein



NRC, 2001

*40 kg/d 3.5% fat milk

Amino Acids



NRC, 2001

Legumes

Positives

- Fixes N close to crop roots
- Fixes amount needed for actual crop growth
- Fixation inhibited by N application

Negatives

- Higher CP than optimal for dairy cattle
- High RDP
- Low Methionine

Ideal Forage

- Legume fixation
- Proper protein to energy ratio
- Proper RDP/RUP
- Balanced amino acid profile

The only thing to add is the byproduct you need to get rid of.