Integrating Livestock into Dryland Organic Crop Rotations

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Outline

1) Broad benefits and examples

2) Models of integration and case studies

3) Challenges to mixed farming

4) Next steps and current research

Utilizing Feed Sources

- Crop residues
- Failed crops
- Food and processing wastes

Livestock Work

- More than just draft animals
- Harvest their own feed
- Distribute manure and nutrients
- Clear ground
- Turn soil
- Manage residues

Cover Crops and Green Manures

- Increased turnover of biomass and nutrient release
- Encourage cover crops, green manures, pastures

http://plantcovercrops.com/grazing-cover-crops/

- Biological N fixation
- Improved soil quality
- Up to 75% of nitrogen returned
- Dung beetles

Pest Management

- Poultry insect control
- Ruminants alter pest/disease habitat
- Use of cover crops and pasture phase

Weed Management

- Poultry – seeds and young weeds
- Ruminants – preferences
- Use of cover crops and pasture phase

Economics

- Diversified income
- Potential to increase productivity and land-use efficiency and reduce inputs
- Profit from grazing cover crops
- Flexibility

TABLE 3 Increased Profits from Livestock in Integrated Agroecosystems

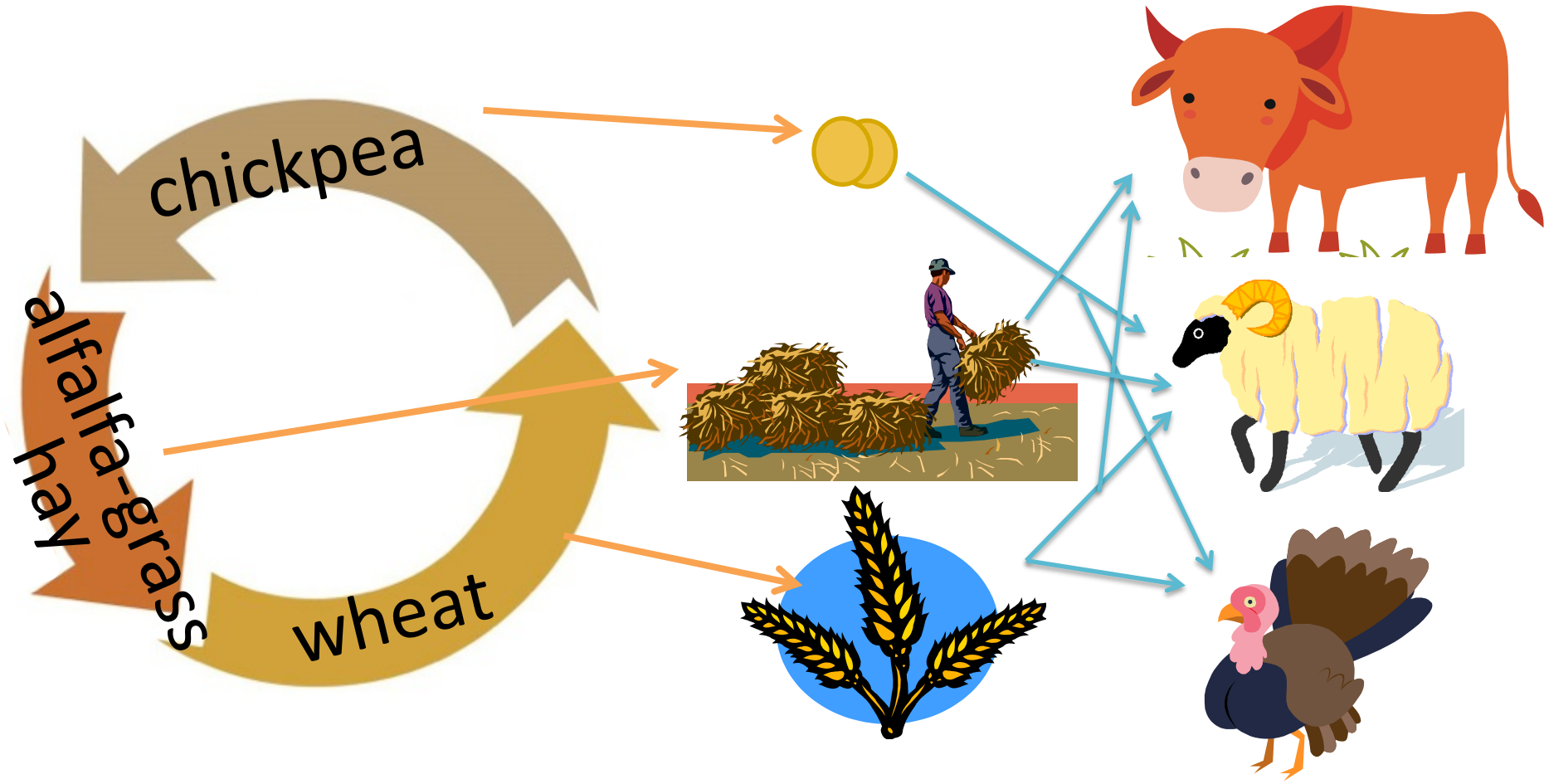
Agroecosystem	Profits from animals (excludes profits from crops)	Source
Cattle grazing winter ryegrass cover crop	$170–$560/ha	(Bransby, 1999)
Cattle grazing winter ryegrass cover crop	$227–323/ha	(Hill et al., 2004)
Sheep and broilers grazing for five months during spring-fall growing season	$2,077/ha	(Lowy, 2009)
Cattle grazing winter ryegrass or oat cover crop	$200/ha	(Siri-Prieto et al., 2007)

Hilimire, 2011

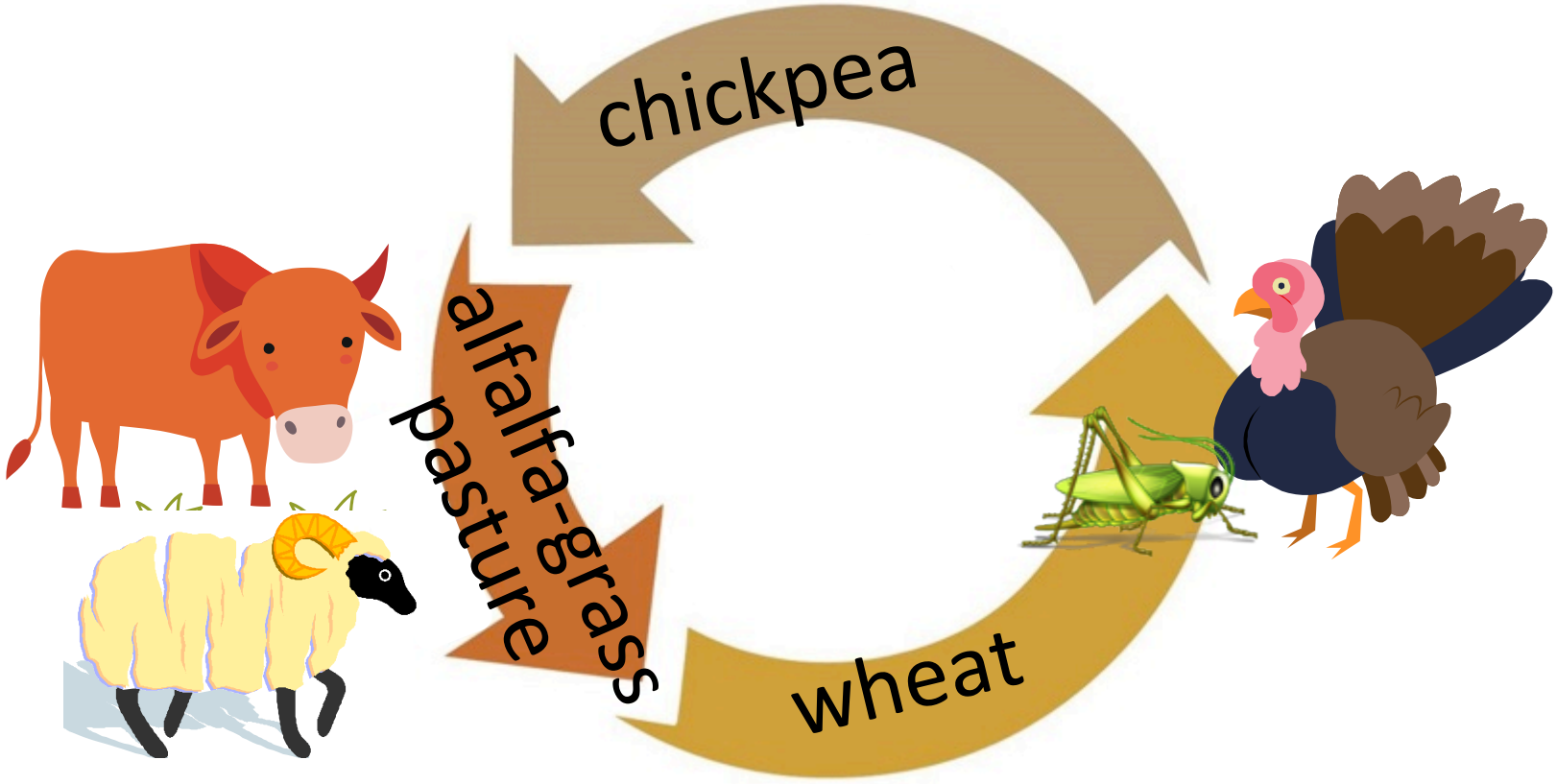
Models and Examples

- Models
  - Intensive, Extensive, Ownership, Integration
- Examples
  - S & S Homestead
  - Zakarison Partnership
  - Beefing Up the Palouse

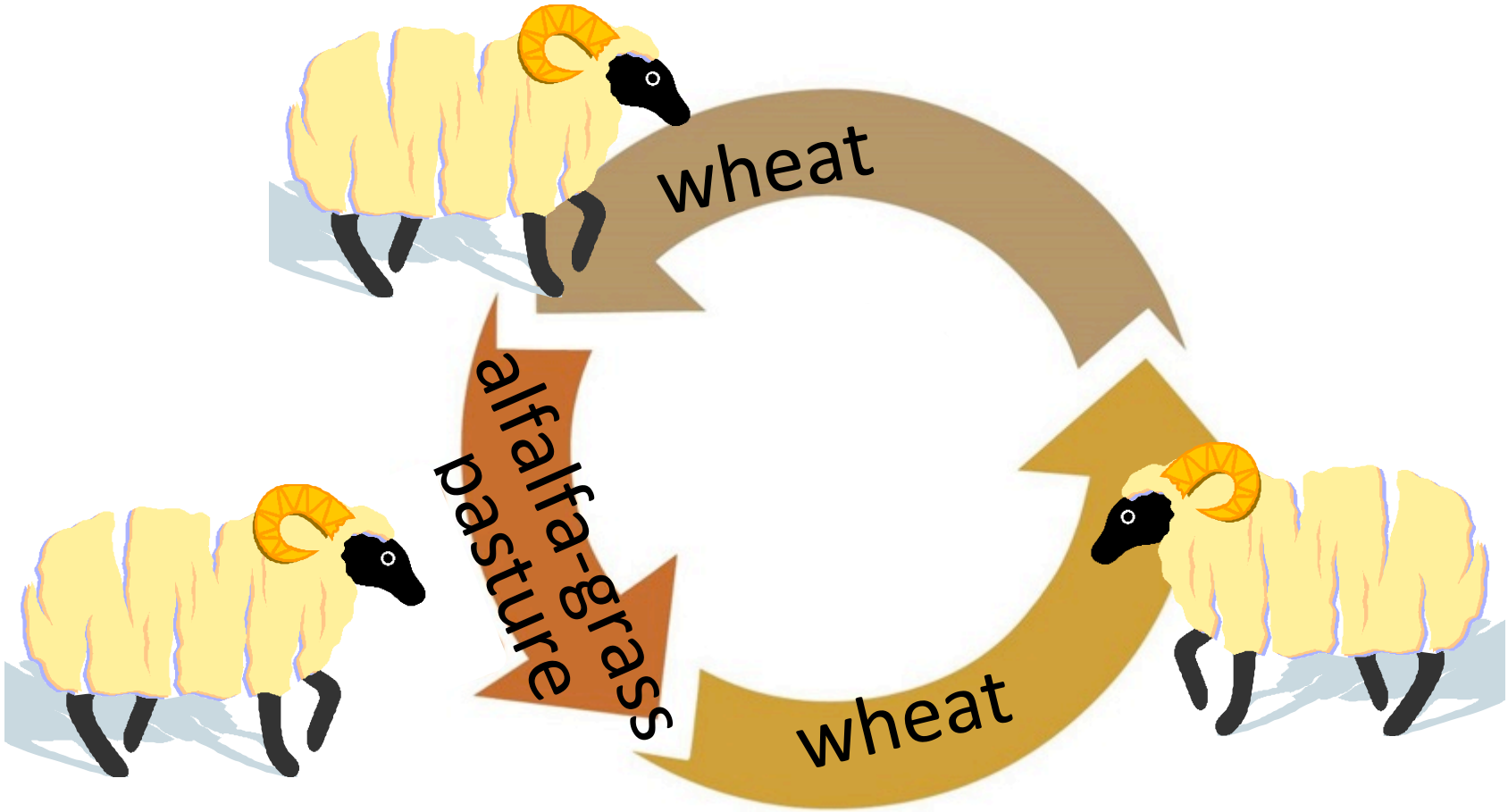
High Diversity Low Integration



High Diversity Crop-Livestock Integration



Low Diversity, Highly Integrated Crop-Livestock System



Ownership of Livestock

Full Ownership

- Greater opportunities for true integration
- Year-round management
- Breeding / reproduction
- Infrastructure
- Knowledge & skills
- No winters in Arizona

Low/no Ownership

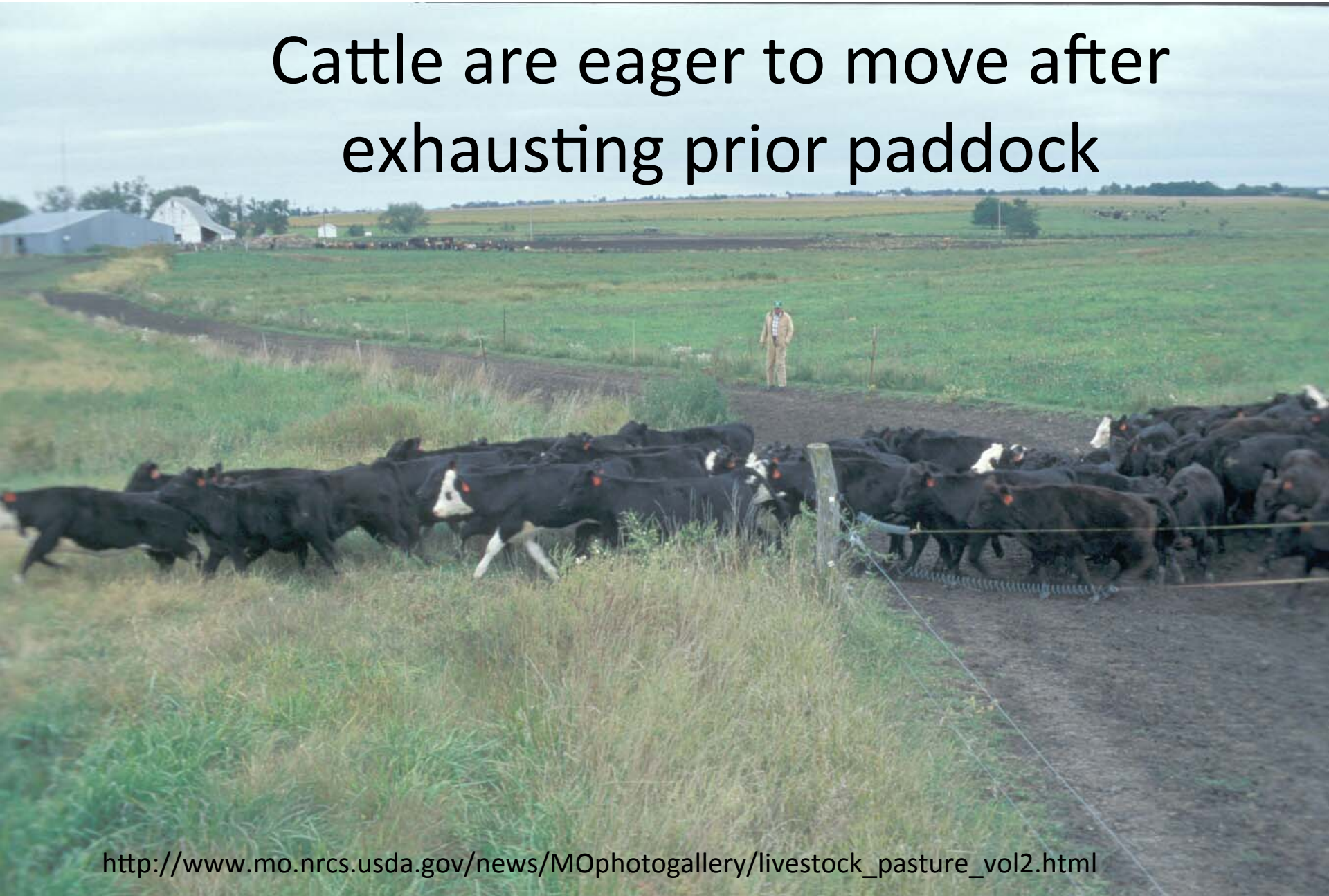
- Transport between farms
- Land owner paid for weight gain
  - OR trade/pay for weed/residue management by livestock
- Less infrastructure
- Little/no livestock knowledge and management

Grazing Intensity

2 AUM (Animal Unit Months)/acre =2 animal units for 1 month
1 animal unit for 2 months (seasonal)
0.2 animal units for 10 months (extensive)
16 animal units for 2 days (intensive, rotational)*

Well-managed, intensive rotational /planned grazing MAY increase total productivity (AUM)

Cattle are eager to move after exhausting prior paddock



http://www.mo.nrcs.usda.gov/news/MOphotogallery/livestock_pasture_vol2.html

S & S Homestead Farm

Small-scale, self-sufficient production

- Grains, beef, pork, lamb, vegetables, fruit, eggs, skins
- Full ownership, full integration
- 15 inch precip

"Penny saved = penny earned"
Fuel, electricity, machines, services, wages, health care, supplements, transportation, entertainment

Photo and modified text: Henning Sehmsdorf

S & S Homestead Farm
Rotational grazing and feeding

- Summer: cattle forage in pasture, fences moved incrementally to manure field evenly
- Winter cattle feed on hay along temporary fences
- Winter feeding area planted to barley in spring
- Barley catches excess nutrients and recycles as feed grain, straw

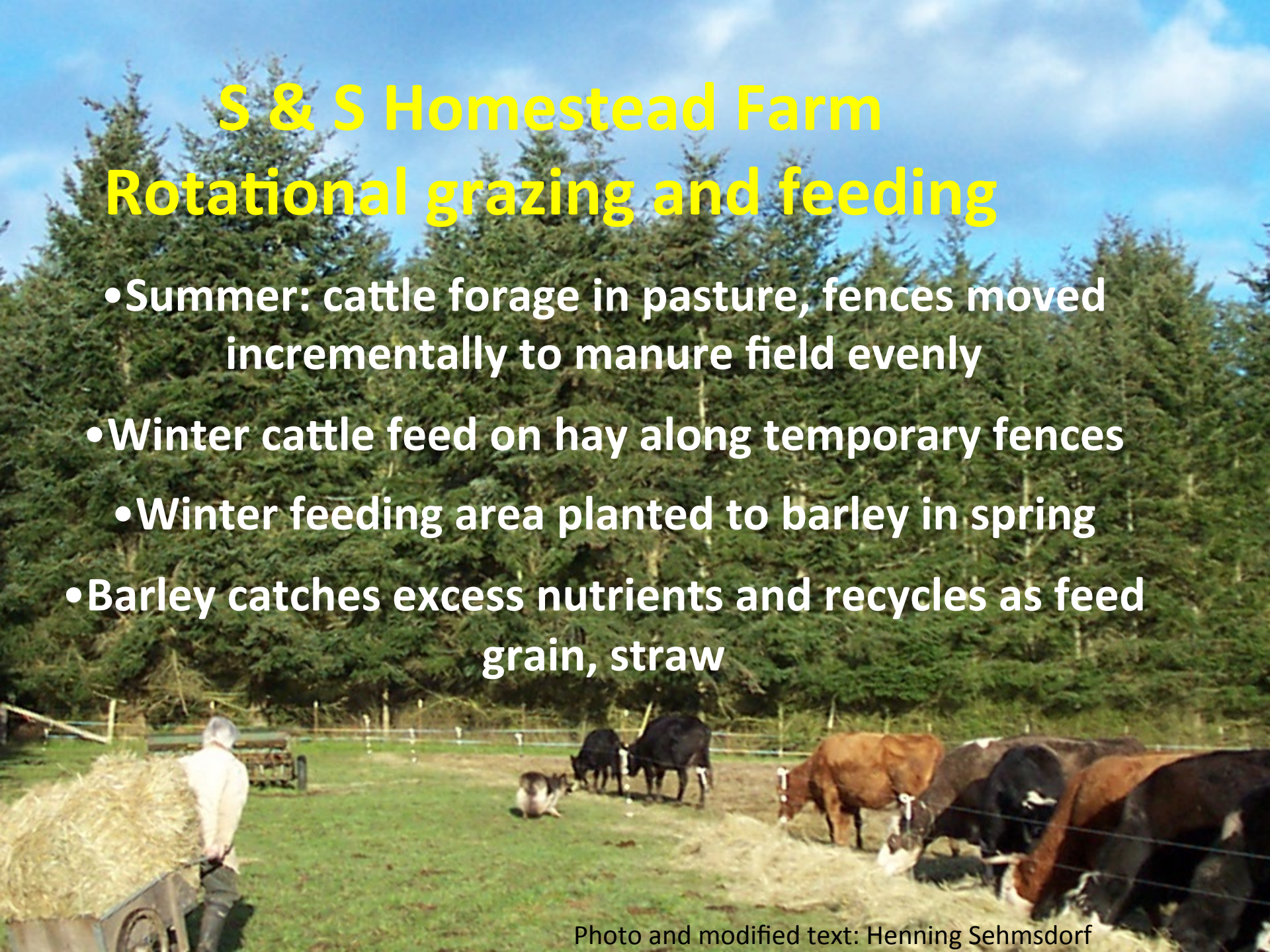


Photo and modified text: Henning Sehmsdorf

Zakarison Partnership

Diversified crops and livestock
Full ownership, high integration
Motivation: Lower net energy use
20 inch precip

- Wheat, peas, barley, camelina, pasture, hay
- Sheep
- Poultry
  - Graze selected pasture - summer
  - Feed on grains
- Mules
  - Limited pasture
  - Hay
  - Provide field services
- Milk goats
  - Provide lamb milk replacement
  - Penned
  - Hay, grain


Photo: Jonathan Wachter


Photo: Lynne Carpenter-Bogg

Sheep

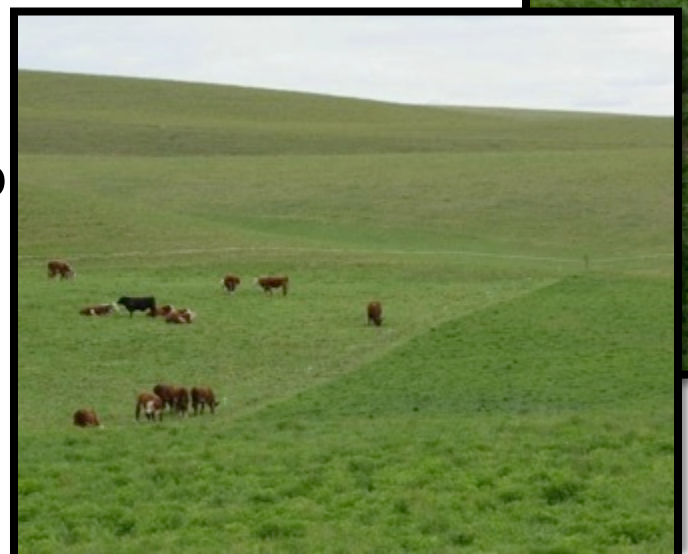
- Graze on grain stubble
- Pasture
- Limited grain
- Winter hay

“Beefing Up the Palouse”

- Approx. 1.5 million acres in WA in Conservation Reserve Program (CRP)
  - Highly erodible land
  - Poor economy
- Convert 6,000 acre dry Palouse farm (G&L) into a sustainable integrated crop-livestock operation
- win-win for our farmers and the environment

G & L Farm: Beefing Up the Palouse

- 10 inch annual precip
- Rotational paddocks created on 500 acres
- High stock density, 200-300 head
- Move livestock each 1-14 days over ~90 days
- Few permanent fences, use temporary fencing
- Land owner paid owner fo



BUP Economics

- CRP contract near Benge, WA pays $50 / acre year
- Wheat-fallow pays $-80 to $80 per acre per year

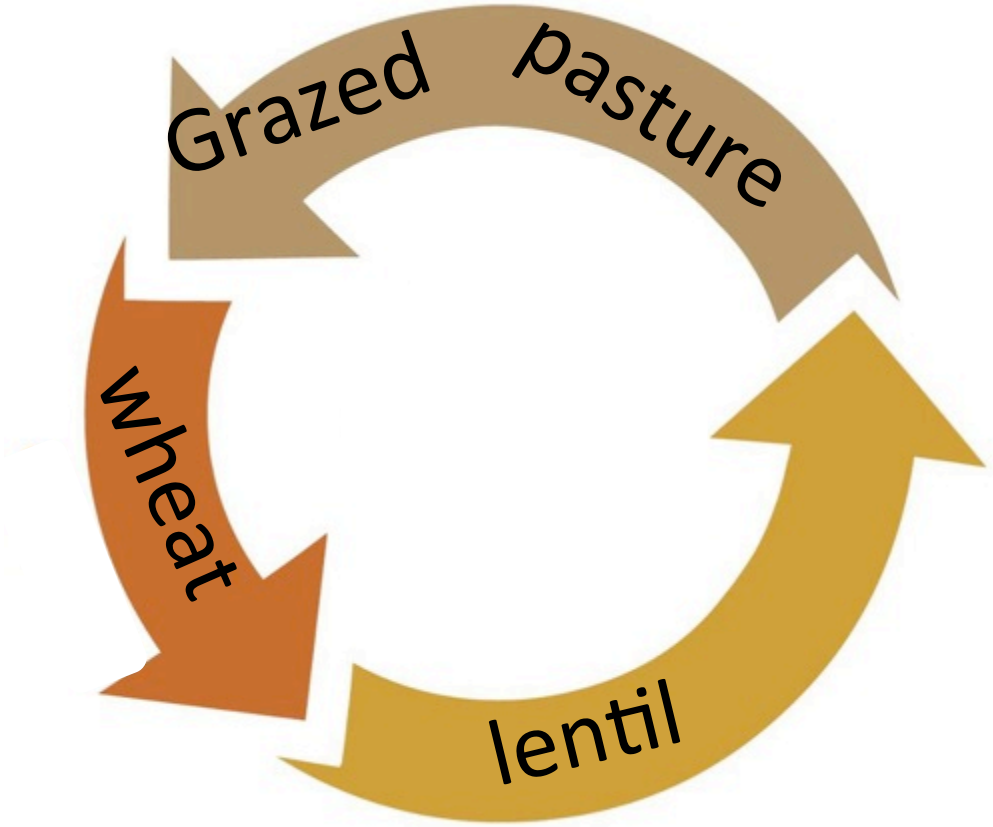
- In 2008, livestock grazing paid $50
- In 2008, cows gained 2.5 lb per day, April – Aug.
- In 2009, increased stocking rate by 50% but lost a few cattle to bloat

Yr 1: 1.7 AUMs were supported + hay
Payment to landowner = to CRP
Also supported a part-time cattle manager.

Yr 2: 2.5 AUMs supported
This is 75% more than the average
1.5 AUMs estimated by NRCS, made possible by pasture improvement and planned grazing.

Working toward complete organic sustainable system

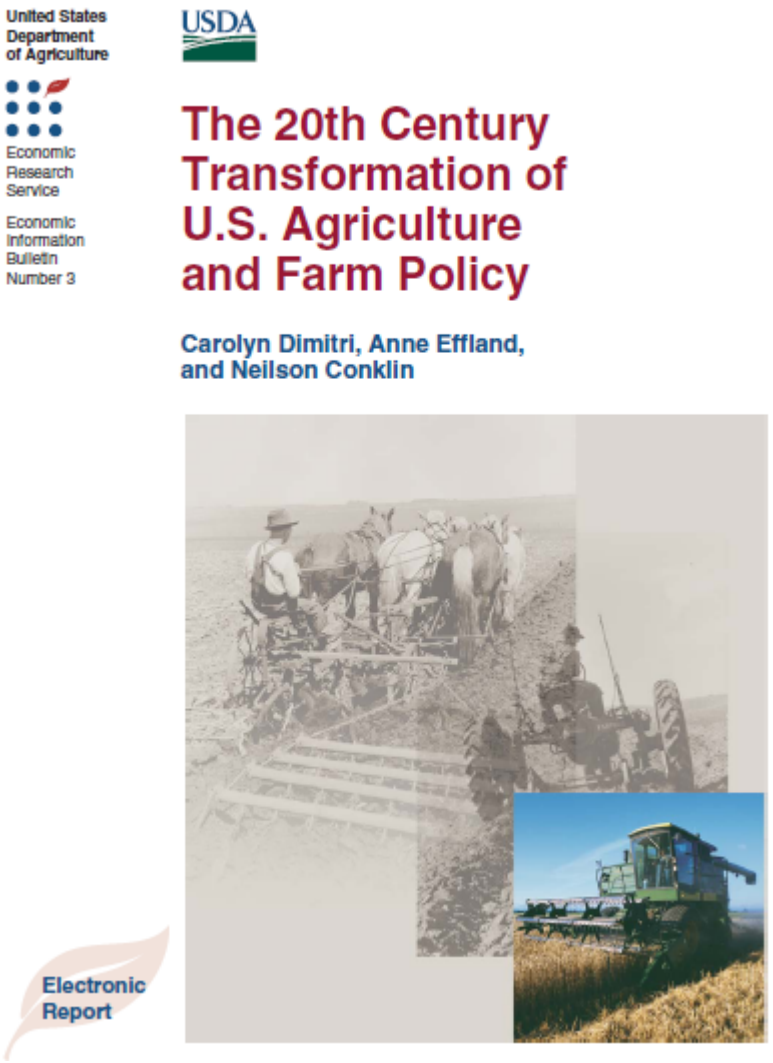
- 6-12 yr rotation
- Organic certified
- Minimal inputs
- More labor



But, CRP won out…

Challenges to Mixed Crop-Livestock Farms

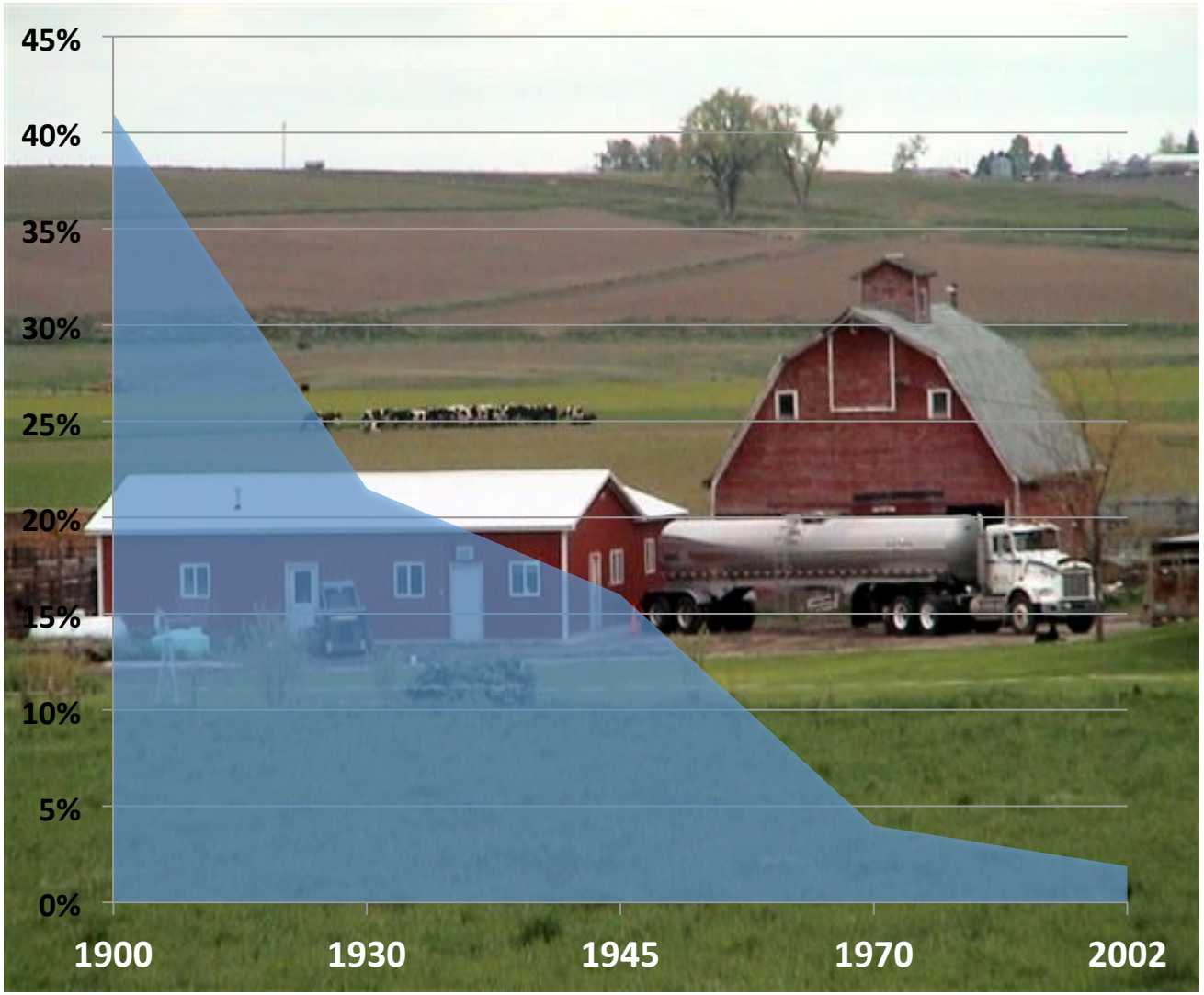
- Access to cheap grazing (CRP, opportunity costs)
- Labor and time intensive
- Lack of knowledge and research
- Processing facilities
- Ability to finish animals
- Wintering facilities + feed
- Water access + delivery
- **Economics and Policies**



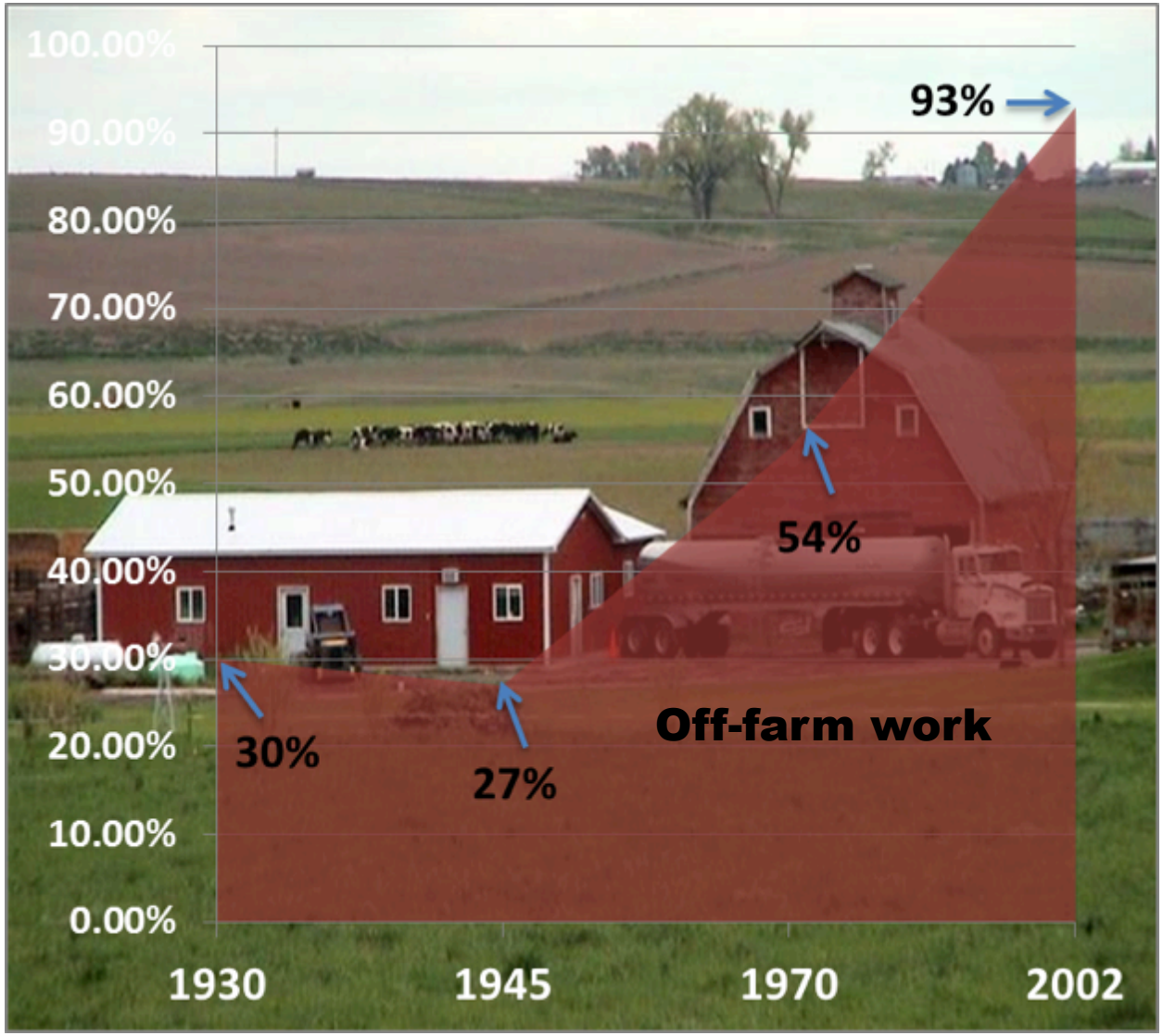
20th Century Transformation of U.S. Ag & Farm Policy Report

Dimitri et al.
USDA-ERS
Econ. Info. Bull., No. 3

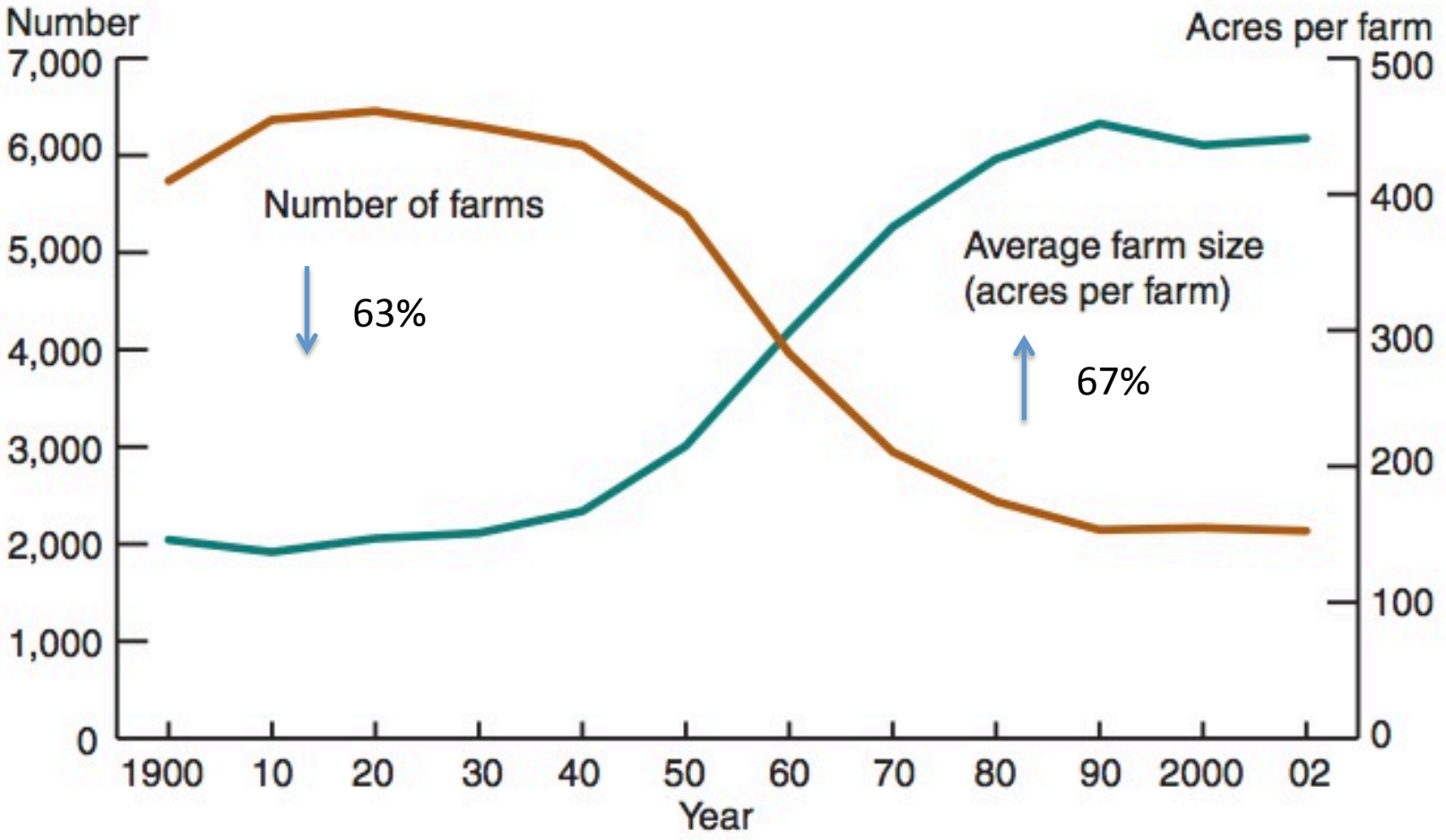
Proportion of U.S. workforce employed in agriculture



Proportion of farmers working off-farm 100 or more days per year

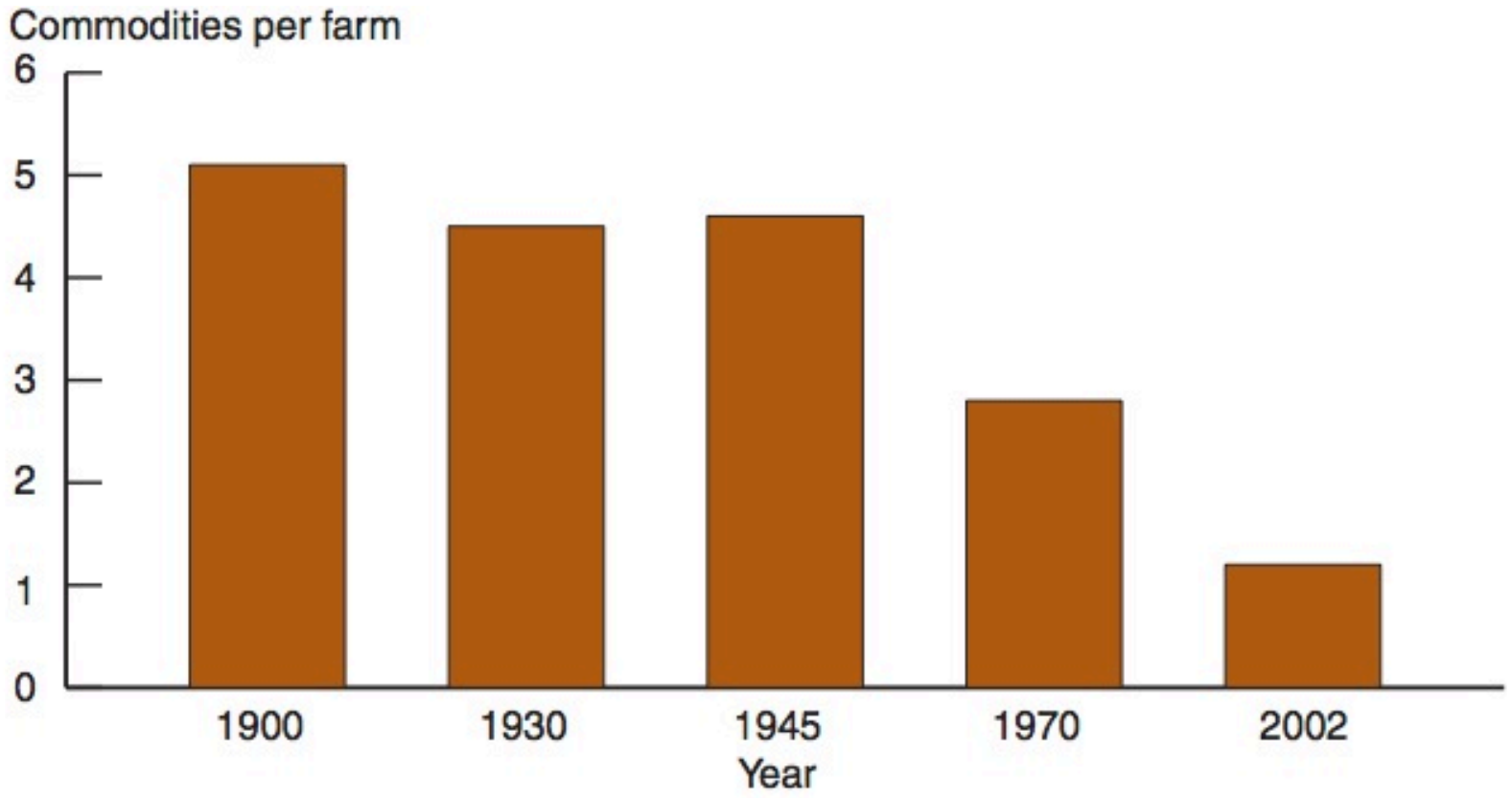


Number of farms and average farm size (acres per farm) in U.S., 1900 - 2002



Source: Compiled by Economic Research Service, USDA, using data from *Census of Agriculture, Census of Population*, and *Census of the United States.*

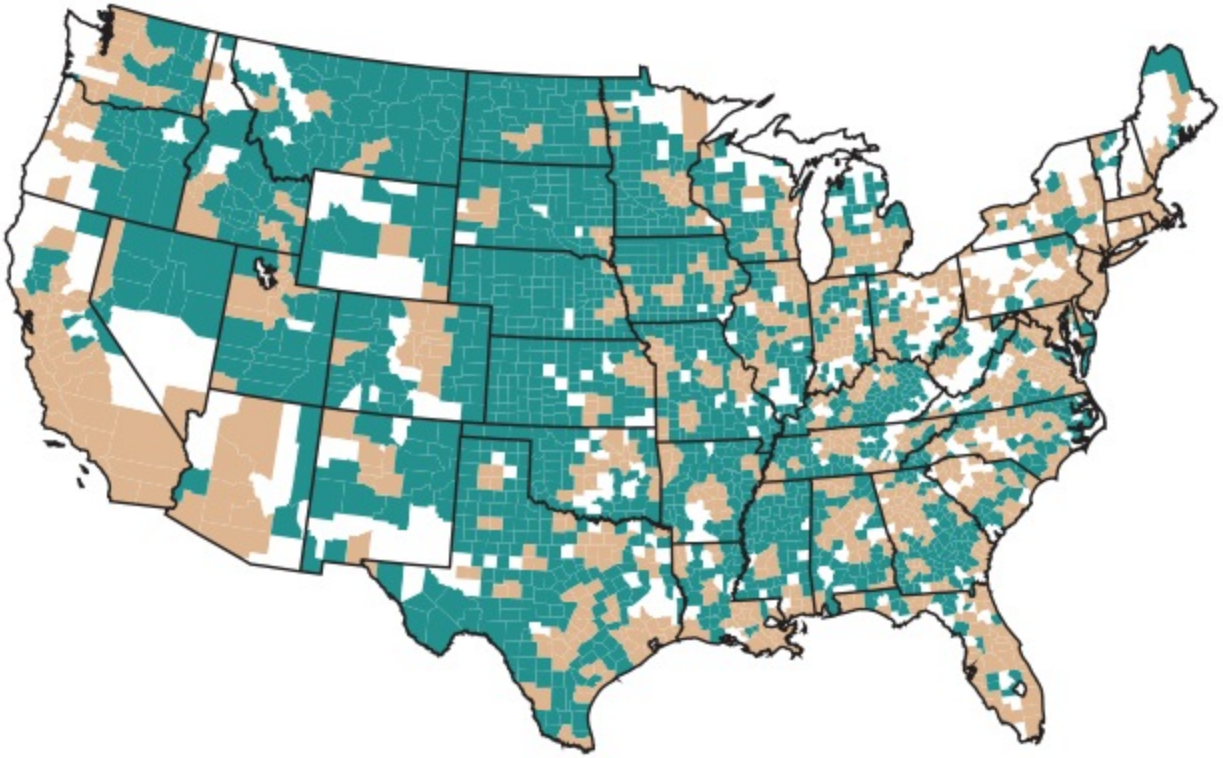
As farms have become more specialized, the number of commodities produced has decreased



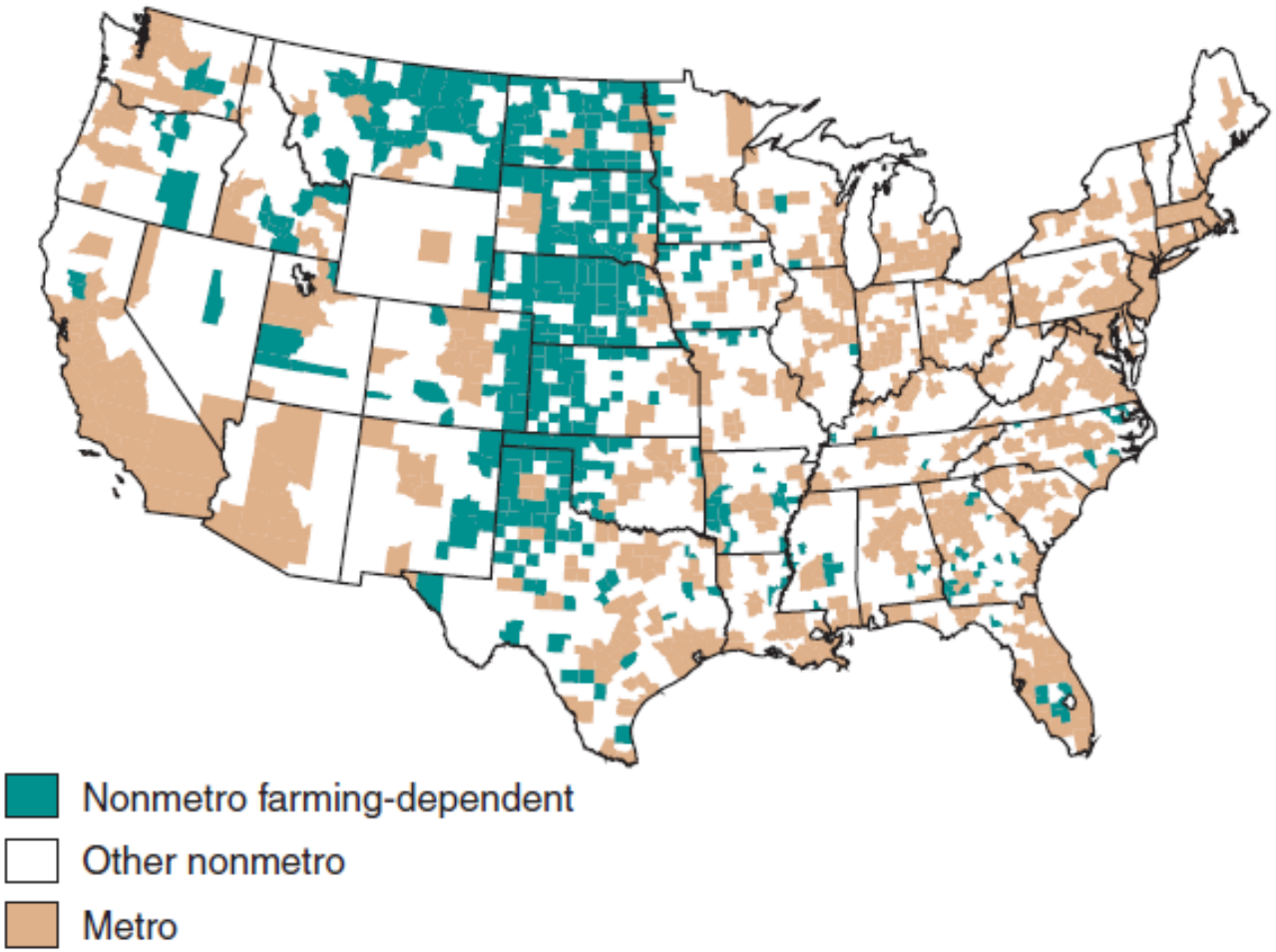
Note: The average number of commodities per farm is a simple average of the number of farms producing different commodities (corn, sorghum, wheat, oats, barley, rice, soybeans, peanuts, alfalfa, cotton, tobacco, sugar beets, potatoes, cattle, pigs, sheep, and chickens) divided by the total number of farms.
Source: Compiled by Economic Research Service, USDA, using data from *Census of Agriculture, Census of the United States,* and Gardner (2002).

Nonmetro farming-dependent counties, 1950 and 2000

1950



2000



Source: Economic Research Service, USDA. Farming-dependent counties are defined by ERS. For 1950, at least 20 percent of income in the county was derived from agriculture. For 2000, either 15 percent or more of average annual labor and proprietors' earnings were derived from farming during 1998-2000 or 15 percent or more of employed residents worked in farm occupations. Metro/nonmetro status is based on the Office of Management and Budget (OMB) June 2003 classification.

Milestones in U.S. agricultural policy

1933
Agricultural Adjustment Act: First "farm bill" established the New Deal mix of commodity-specific price and income support programs.

1936
Soil Conservation and Domestic Allotment Act: First direct links created between soil conservation and commodity programs.

1949
Agricultural Act: Established policy of high, fixed-price supports and acreage allotments as permanent farm policy. Programs revert to the 1949 provisions should a new farm bill fail to pass.

1965
Food and Agricultural Act: Introduced new income support payments in combination with reduced price supports and continued supply controls.

1973
Agriculture and Consumer Protection Act: Introduced target prices and deficiency payments to replace price supports, coupled with low commodity loan rates, to increase producer reliance on markets and allow for free movement of commodities at world prices.

Decades of downside crop price protection

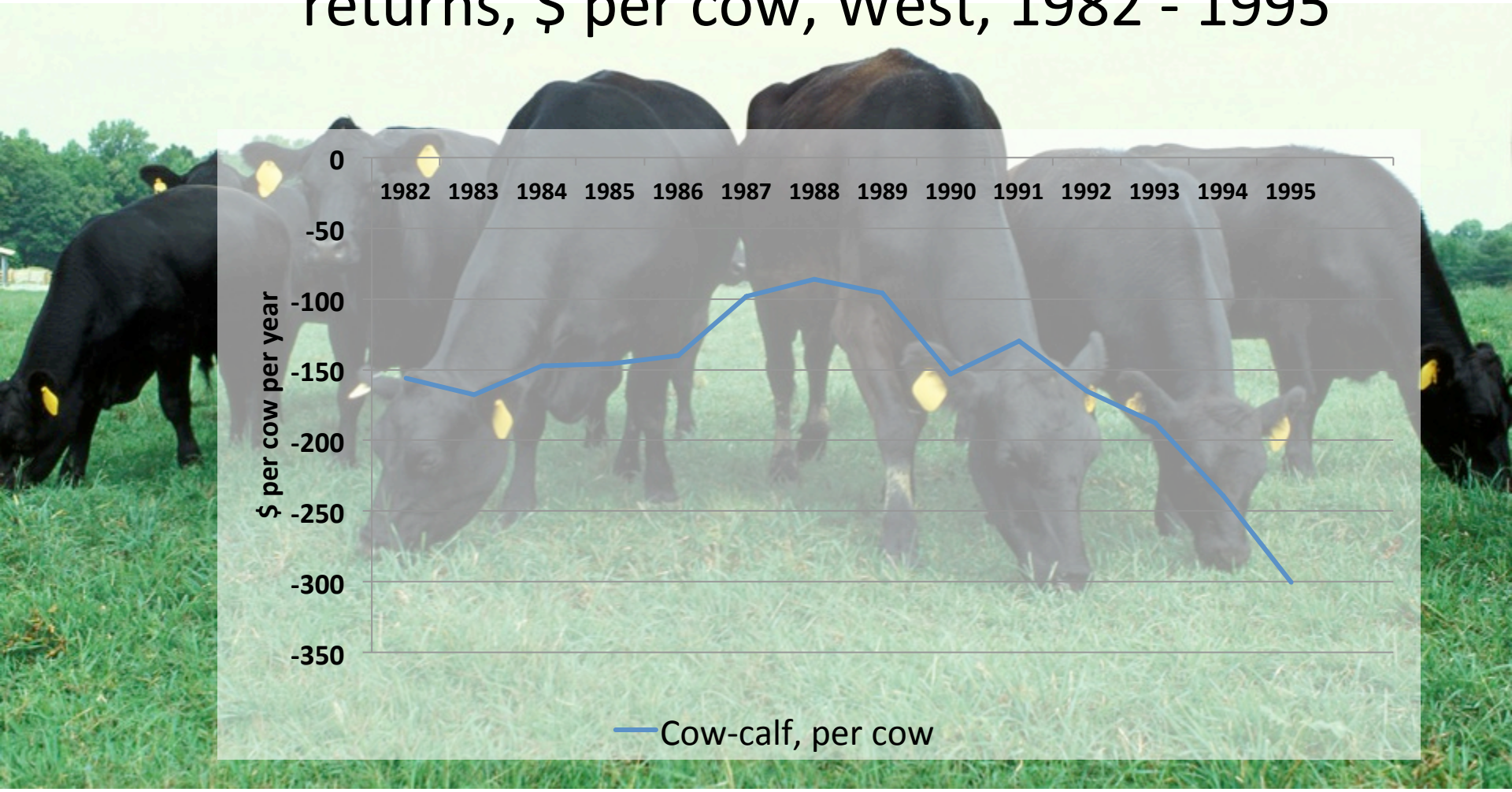
1996

Federal Agriculture Improvement and Reform Act: Replaced price support and supply control program with program of direct payments based on historical production. Introduced nearly complete planting flexibility.

2002

Farm Security and Rural Investment Act: Introduced counter-cyclical payments program triggered when current prices fall below a target level, but paid based on historical production. Introduced working-lands conservation payments through the Conservation Security Program. Continued planting flexibility and program of direct payments based on historical production, allowing updating of historical base acres and adding historical soybean acres.

Cow-calf production cash costs and returns, $ per cow, West, 1982 - 1995



Source: USDA Economic Research Service Data Sets

Current Research

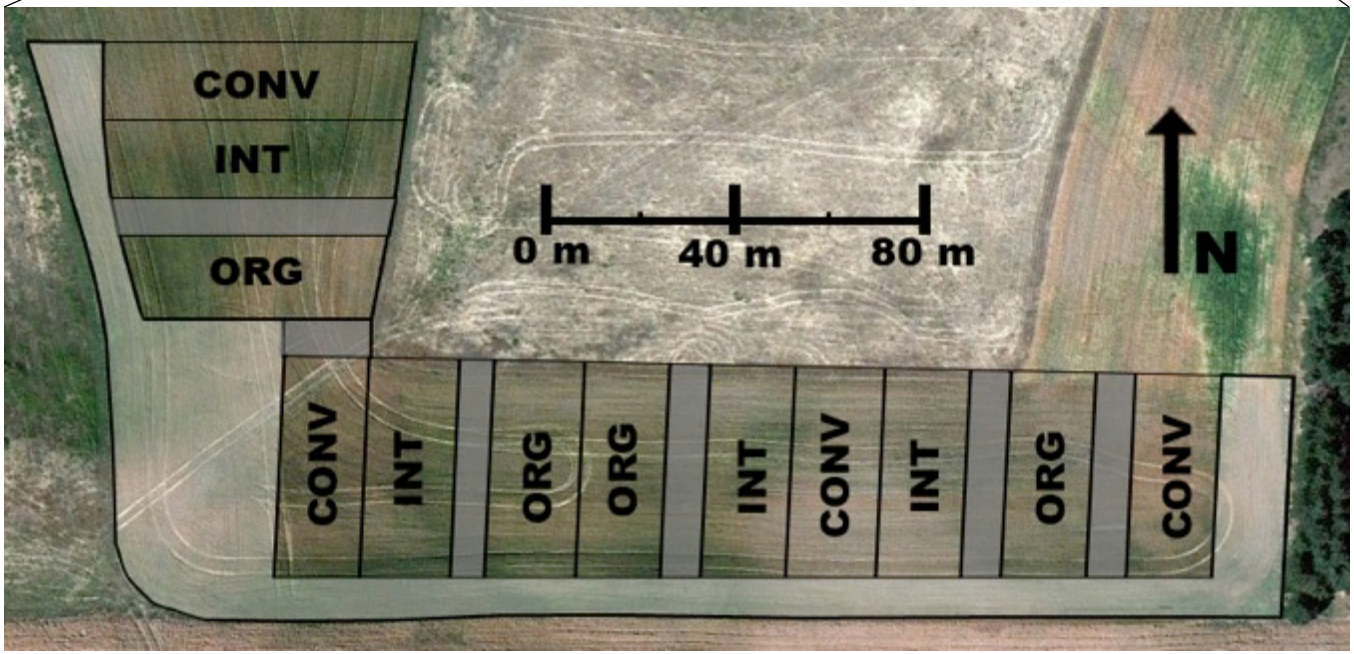
Performance of integrated sheep-legume-wheat rotations on the Palouse

Palouse

22 inch precipitation

Typical area crops:

Winter Wheat, Spring Wheat, Chickpeas, Lentils



Conventional

Rotation:

Pea / Winter Wheat / Spring Wheat

- Fertilizer inputs based on soil tests
- Revenues from crop sales
- Conventional weed, pest, and disease management

Integrated

Rotation:

Winter Pea Green Manure / Winter Wheat / Spring Wheat

Grazed

Grazed stubble
+ early weeds

- Reduced N fertilizer inputs
- Supplemental fertilizer based on soil tests
- Grazing on green manure
- Grazing for residue management & early season weed control
- Revenues from crop and lamb meat sales
- Allowed conventional tools + fertilizers

Organic

Rotation:

3 yrs Alfalfa Hay / Pea Crop / Winter Wheat

Hayed + Grazed

Grazed stubble + early weeds

- Hay/Grass during certification transition years 2012-2014
- Revenue from crop, hay, and lamb meat sales
- Legume nitrogen for all crop N needs
- Weed control via grazing and crop competition

Compare the 3 treatments in terms of:

Economic performance

Productivity

Changes in soil quality and erosion

Greenhouse and ammonia emissions