

What 40 Years of Science Tells Us About Organic Agriculture



Photo: Jim Richardson

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Overview

- Background of organic agriculture
- Sustainability metrics for agriculture
- 40 years of studies comparing organic and conventional farming
- Future of organic farming



Organic agriculture: History of being contentious

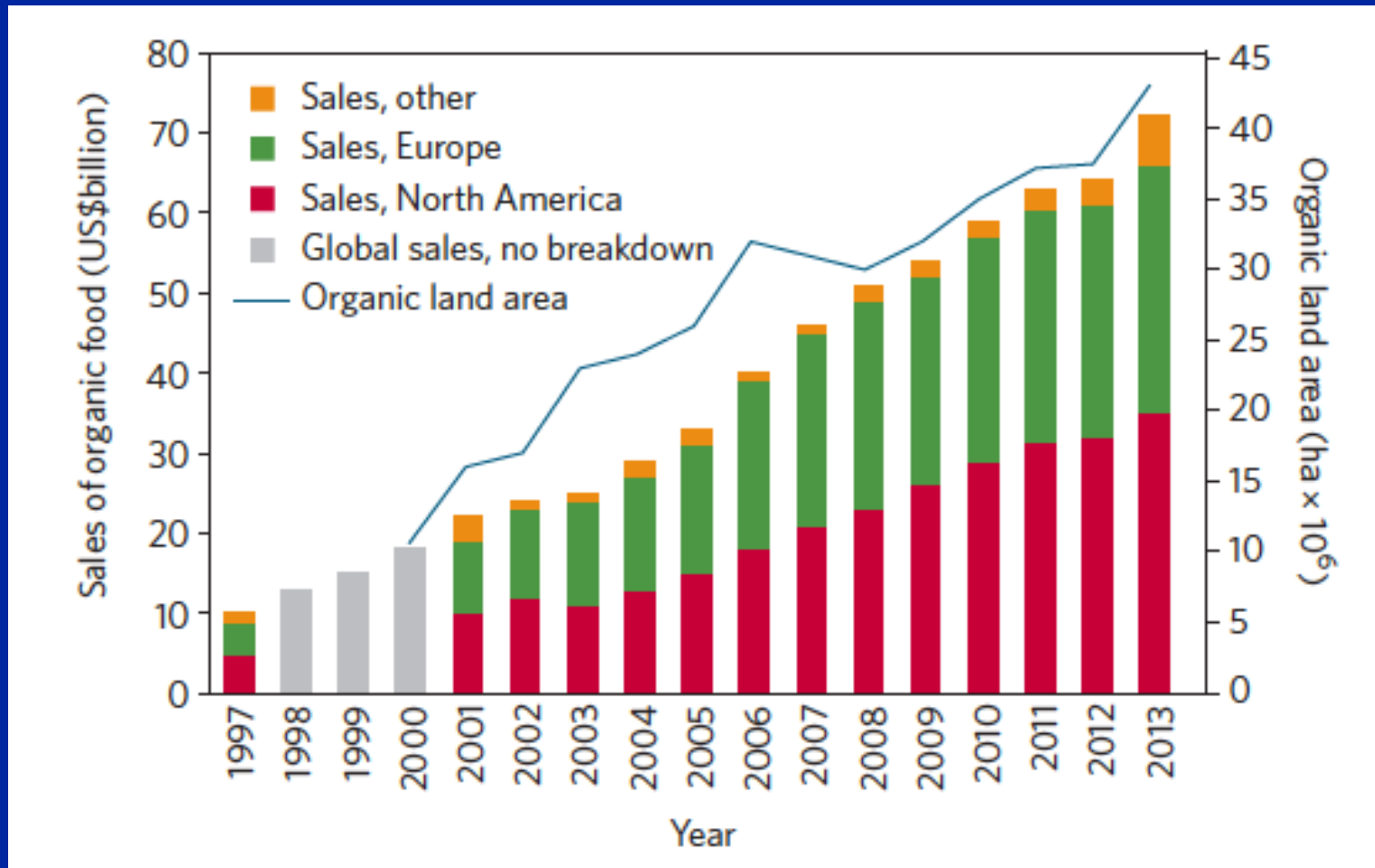


- In 1971, then US Secretary of Agriculture Earl Butz: “Before we go back to organic agriculture in this country, somebody must decide which 50 million Americans we are going to let starve or go hungry”.

Critics argue that organic agriculture relies on more land to produce the same amount of food as conventional agriculture and that adopting organic agriculture on too large a scale could potentially threaten wildlife, forests, and biodiversity.

How's organic agriculture doing?

The number of organic farms, the extent of organically farmed land, the amount of research funding devoted to organic farming, and the market size for organic foods have steadily increased.



How's organic agriculture doing?

- Organic food and beverage sales in 2015 represented 5% of U.S. food and beverage sales (up from 0.8% in 1997).
- Recent international reports recognize that organic agriculture balances multiple sustainability goals and will be of increasing importance in global food and ecosystem security.



Why do consumers buy organic food?

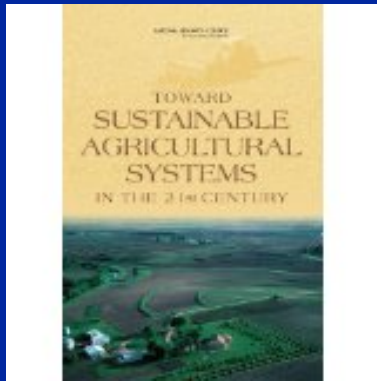


1. Avoid pesticides
2. Avoid GMOs and irradiation
3. Avoid hormones and antibiotics in meat
4. Protect the environment

5. More dietary nutrients
6. Better taste
7. Protect children
8. Preserve family farming



Metrics of Sustainable Farming



- Adequate Yields of High Quality
- Environmentally Safe
- Economically Viable
- Socially Responsible

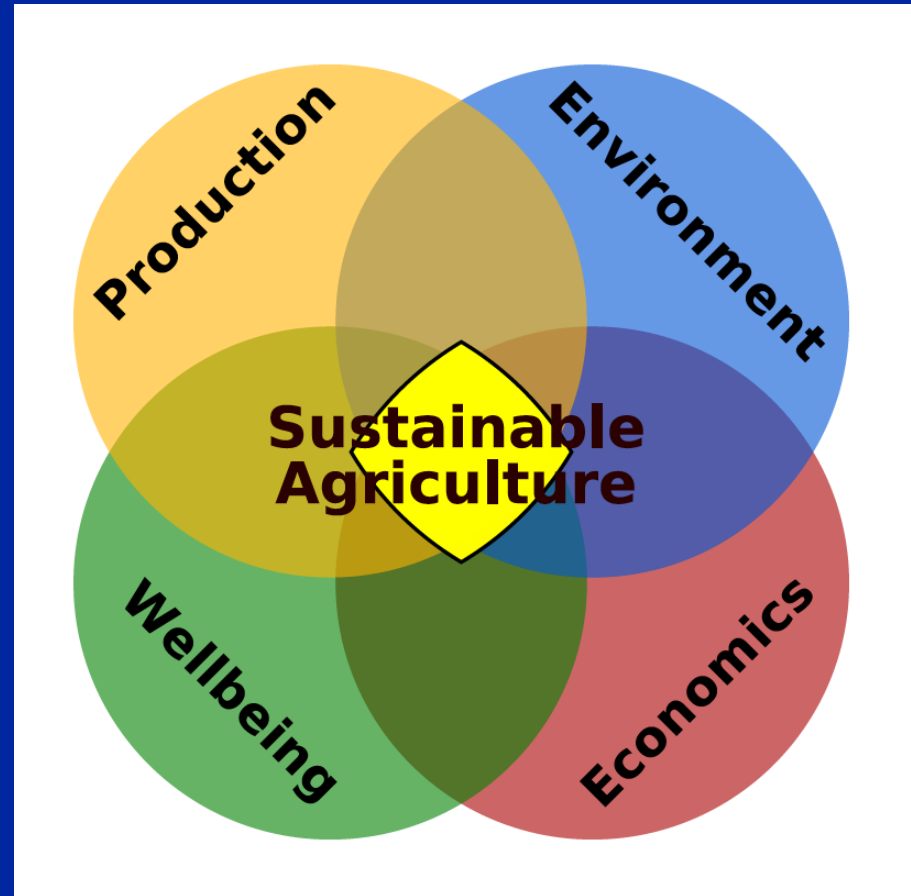
Sustainable intensification = increasing crop production per unit area and improving environmental, economic, and social sustainability (FAO, 2008)

Organic and conventional farming systems are like bookends on a shelf with other systems in between.



Do we have enough sustainability data to assess organic and conventional farming?

- **Production -- Yes**
- **Environment -- Yes**
- **Economics -- Yes**
- **Social Wellbeing -- No**



What Do Studies Comparing Organic and Conventional Farming Tell Us?



(Reganold, J.P. and J.M. Wachter. 2016. Organic agriculture in the 21st century. *Nature Plants*)

Crop Yields

(per hectare)

- Under favorable climate and soil conditions, organic crop yields are generally lower (8-25%) (from 5 reviews and meta-analyses).
 - 27–28% less for fruit and wheat
 - 6–11% less for rice, soybeans, corn & grass-clover
- Equal to higher yields under severe drought
- Improvements with organic-specific breeding



Food Quality

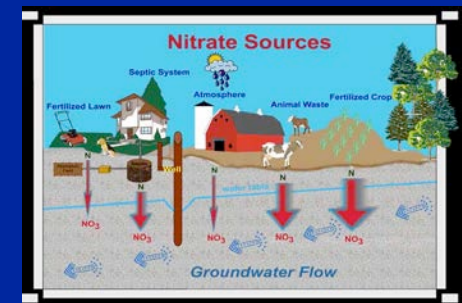


- **14 of 17 reviews or meta-analyses have found some evidence of organic food being more nutritious.**
 - **Higher vitamin C, total antioxidants, and total omega-3 fatty acids**
 - **Lower risk of antibiotic-resistant bacteria (1 study)**
- **Little to no pesticide residues are found on organic foods (from 4 reviews or meta-analyses).**
 - **Exposure in children**
 - **American Academy of Pediatrics (2012)**
 - **European Parliament Report (2016)**

Environmental Quality

(from 14 reviews or meta-analyses)

- Organic systems have better soil quality and less soil erosion.
- Organic systems have little to no risk of synthetic pesticide pollution of ground and surface waters
- Nutrient leaching, greenhouse gas emissions
 - Organic systems generally performed better per area
 - Sometimes opposite when expressed per unit of production
- Organic systems are usually more energy efficient

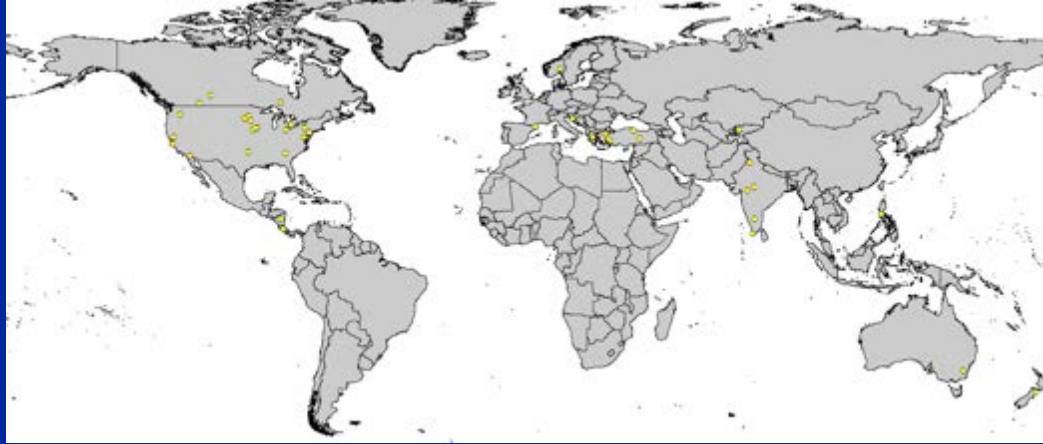


Environmental Quality: Diversity

- Often more habitat and landscape diversity on organic farms.
- Organic farms have greater below- and above-ground biodiversity (birds, insects, soil fauna and microbes).
- They have more diverse functional groups, such as herbivores, pollinators, predators, and producers (plants)



Economic Performance



- **With price premiums, organic agriculture was significantly more profitable (22 to 35% greater net present values) and had higher benefit/cost ratios (20 to 24%) than conventional agriculture.**
 - Premiums were 29–32%
 - Breakeven premiums were 5–7%
 - 10–18% lower yields
- **Total costs were the same; labor costs higher (7 to 13%)**

Externalities and Ecosystem Services

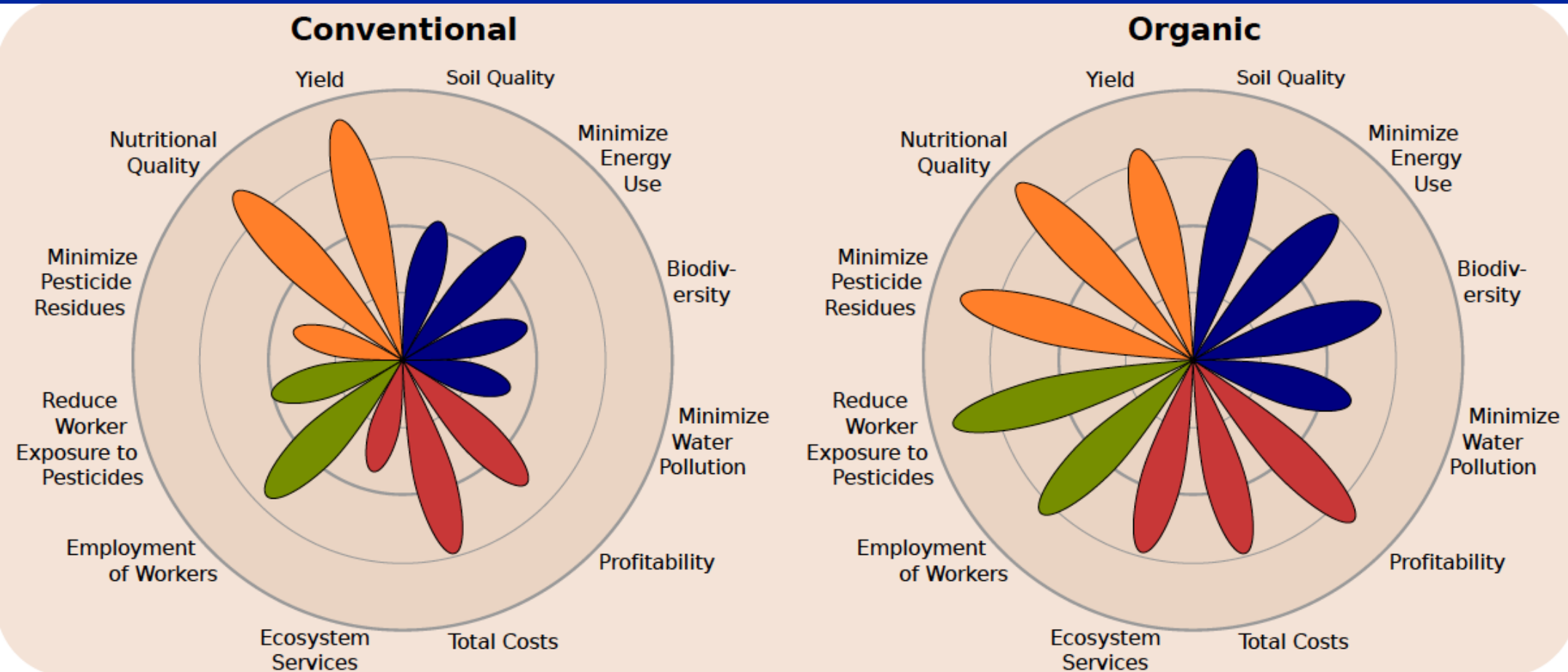
- **Putting a price on negative externalities caused by farming, such as soil erosion or nitrate leaching into groundwater, would make organic agriculture even more profitable.**
- **The few studies done with ES generally show that organic practices increase the ability of farms to provide some economically significant ecosystem services relative to conventional practices.**

Social Wellbeing

- Both organic and conventional farming systems need to make significant progress to meet social sustainability goals.
- Organic farming has been shown to have some sociocultural strengths.
 - Increased social interactions between farmers and consumers
 - Greater employment of farm workers and cooperation among farmers.
 - Reduced exposure of farm workers to pesticides and other chemicals.



Assessment of Organic Farming relative to Conventional Farming in the Four Major Areas of Sustainability



(Reganold & Wachter, *Nature Plants*, 2016)

Future of Organic Agriculture



**US Secretary of Agriculture Tom Vilsack in 2013:
“Organic agriculture is one of the fastest growing
segments of American agriculture and helps
farmers receive a higher price for their product as
they strive to meet growing consumer demand.”**

Future of Organic Agriculture

- The global organic market is expected to increase by 2.5 times from about \$80 billion in 2016 to US\$200 billion by 2020 (\$456 billion by 2025).
- Organic farming has room for growth: From 1% of the cropland today being organic to 10 by 2050.



Costco gets creative to meet shoppers' huge appetite for organics

(Seattle Times, 1 April 2016)

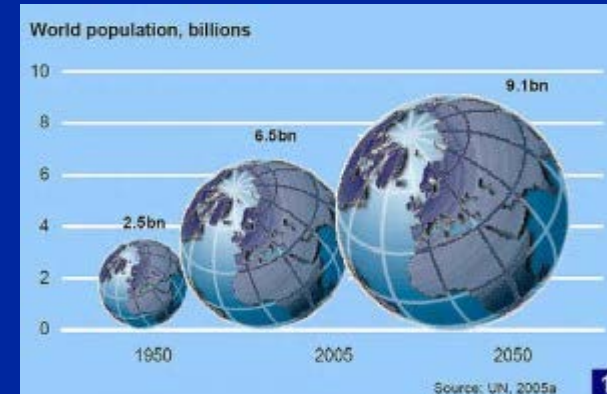


1 of 3 Kimberly Fee pushes a shopping cart holding her son, Cameron, 4, at Costco in Issaquah. Costco is working to boost its supply of organics. (Bettina Hansen/The Seattle Times)

To boost its supply of organic foods, Costco is trying something new: It's working with farmers to help them buy land and equipment as it struggles to keep pace with customer demand.

Helping to Feed the World

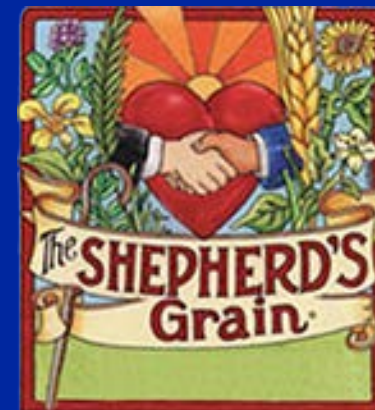
Can organic farming systems play a significant role in feeding the human population?



Yes. And so can other innovative farming systems, such as conservation agriculture, integrated, and mixed farming.

These other innovative farming systems share common practices and values with organic farming.

Shepherd's Grain



- Shepherd's Grain growers use no-till operations and harvest wholesome grains from farms across the Inland Northwest.
- Shepherd's Grain was founded by two Palouse no-till farmers.



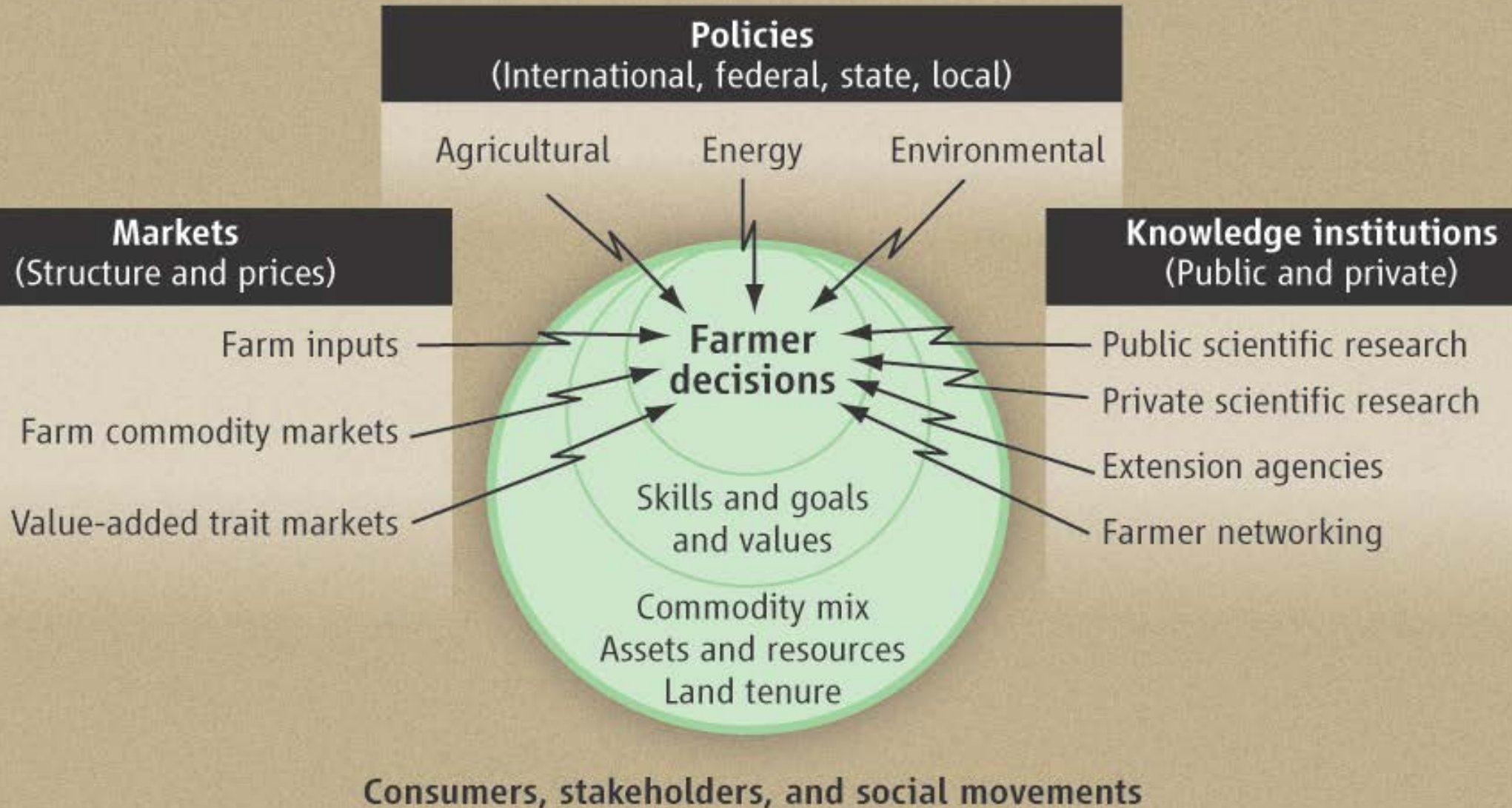
Shepherd's wheat flours are sustainability brand products certified by the Food Alliance.

Coexistence of Different Farming Systems

- No one farming system will safely feed the planet, but rather a blend of multi-functional farming systems will be needed.
- Adoption of these more innovative systems is hindered by market structures, policy incentives, and uneven development and availability of scientific information that guide **farmers' decisions**.



Drivers and Constraints Affecting Farmers' Decisions



Consumers have responsibility

- Consumers play a vital role in the foods they choose to eat.
- Consumers should eat a mostly plant-based diet—yes, reduce meat consumption.
- Consumers should reduce their food waste and eat appropriate portions, too.



What kind of agriculture do we want?

