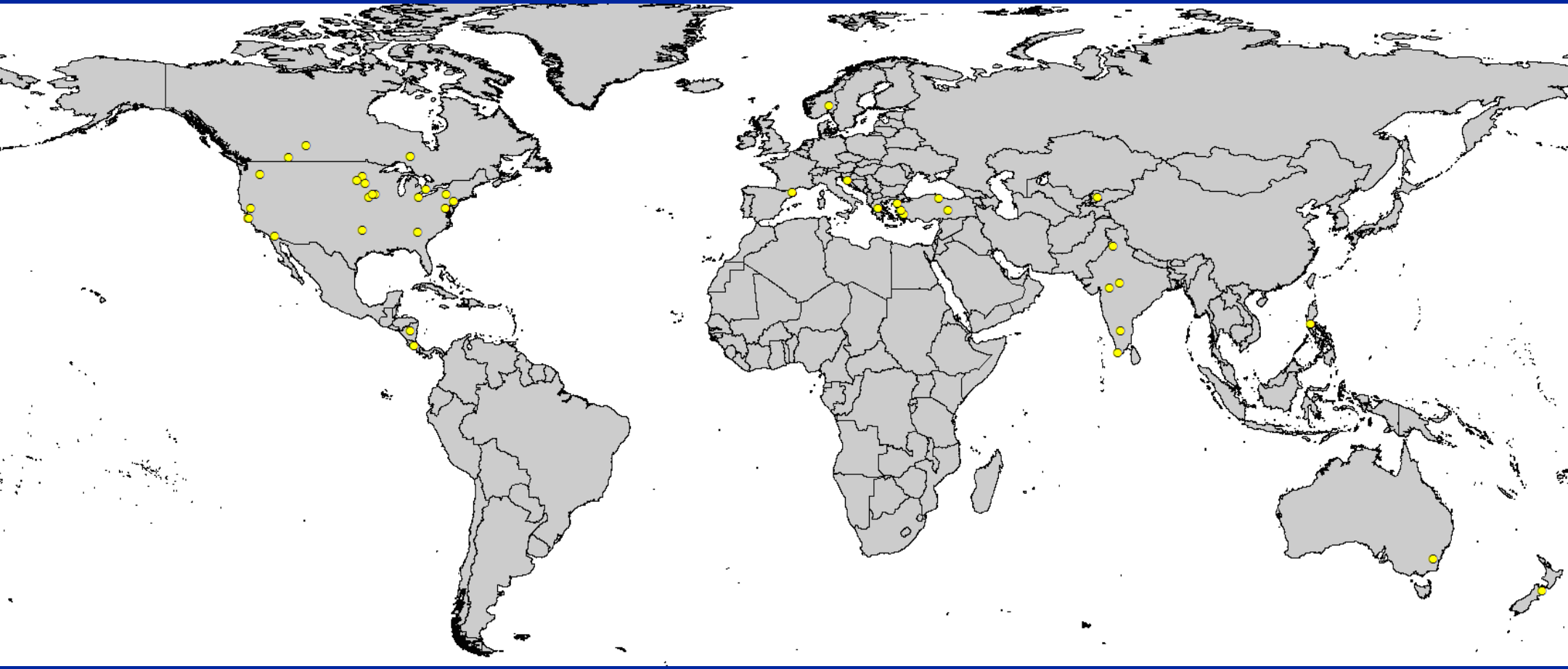
Beyond Yield: The Multiple Benefits of Organic Agriculture



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Metrics of Sustainable Farming

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

For any farm to be sustainable, whether it be conventional or alternative, it must meet each and every one of the four sustainability criteria.

Farming Systems and Sustainability

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

What do studies comparing organic and conventional agriculture tell us?

Starting with production:

- Production includes not just yield but also quality of food.
- Little to no pesticide residues are found on organic foods (from 4 reviews or meta-analyses).
- 14 of 17 reviews or meta-analyses have found some evidence of organic food—produce, grains, milk, and meat--being more nutritious.

Production: Food Quality

- These 14 studies show organic food to have higher concentrations of vitamin C, total antioxidants and total omega-3 fatty acids, and higher omega-3 to -6 ratios).

- The other 3 studies concluded that there were no consistent nutritional differences, with 1 finding conventional chicken and pork to have a 33% higher risk for contamination with antibiotic-resistant bacteria.

Environmental Quality

(from 14 reviews or meta-analyses}

Starting with the soil:

- **Organic systems have better soil quality and less soil erosion.**
- **Organically farmed soils have more organic matter and can store more water, ensuring higher yields during dry periods.**
- **Lands farmed organically are healthier for passing on to future generations.**

Environmental Quality: Pollution, Greenhouse Gas Emissions, and Energy Use

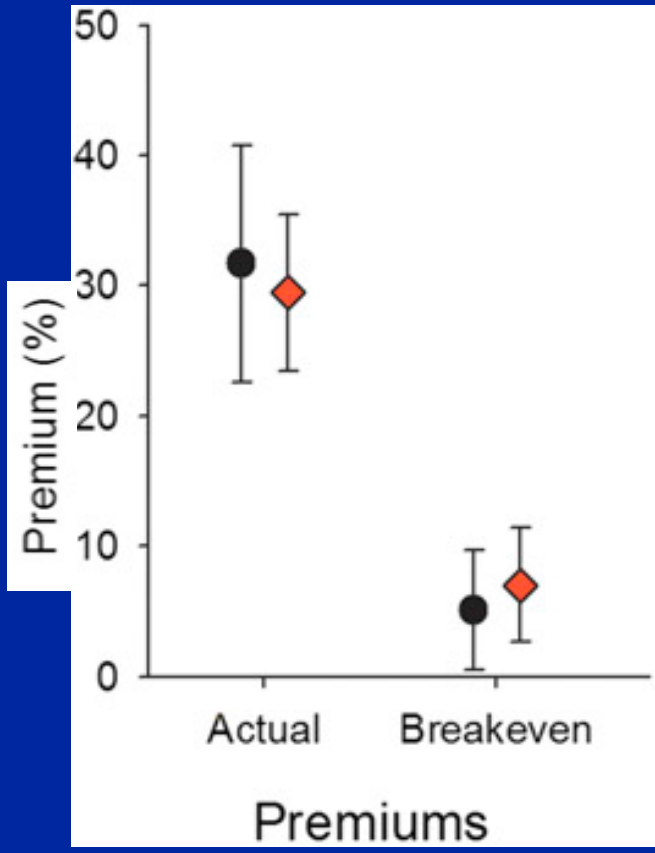
- Organic agriculture has little to no risk of synthetic pesticide pollution of ground and surface waters.
- With respect to nitrate and phosphorous leaching and greenhouse gas emissions, organic farming systems score better than conventional farming when expressed per unit production area, with this positive effect being less pronounced and in some cases reversed when expressed per unit product.
- Organic systems are usually more energy efficient than their conventional counterparts.

Environmental Quality: Biodiversity

- Organic farms have higher below- and above- ground biodiversity.
- They have more diverse functional groups, such as herbivores, pollinators, predators, and producers (plants).
- They have more genetic variation (local varieties, no GMOs).
- They have greater faunal diversity (birds, insects, soil organisms)
- There is often more habitat and landscape diversity on organic farms.

Profitability, Premiums, and Costs

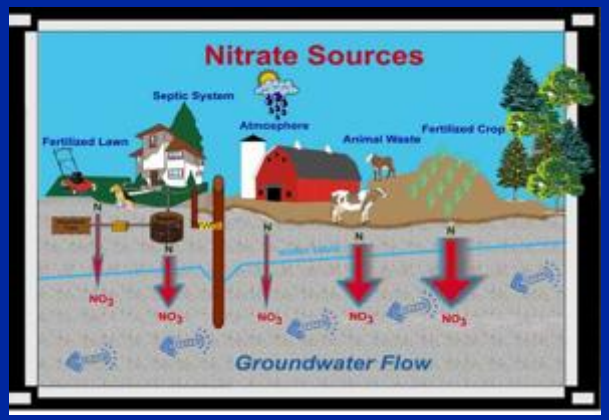
- Organic agriculture was significantly more profitable (22 to 35% greater net present values) and had higher benefit/cost ratios (20 to 24%) than conventional agriculture.
- Although premiums were 29–32%, breakeven premiums necessary for organic profits to match conventional profits were only 5–7%.
- Total costs were not significantly different, but labor costs were significantly higher (7 to 13%) with organic farming practices.

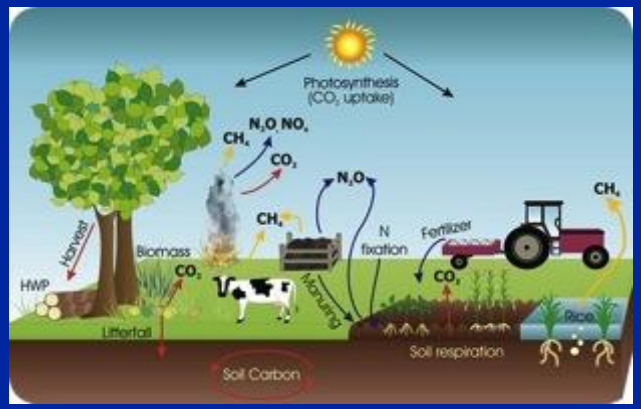


(Crowder and Reganold, Financial competitiveness of organic agriculture on a global scale, *PNAS*, 2015).

Externalities and Ecosystem Services

- Profits neither accounted for externalities nor ecosystem services.
- Putting a price on the negative externalities caused by farming, such as soil erosion or nitrate leaching into groundwater, would make organic agriculture even more profitable.
- Comparison studies show that organic practices increase the ability of farms to provide some economically significant ecosystem services that could make up for price premiums awarded to organic products.





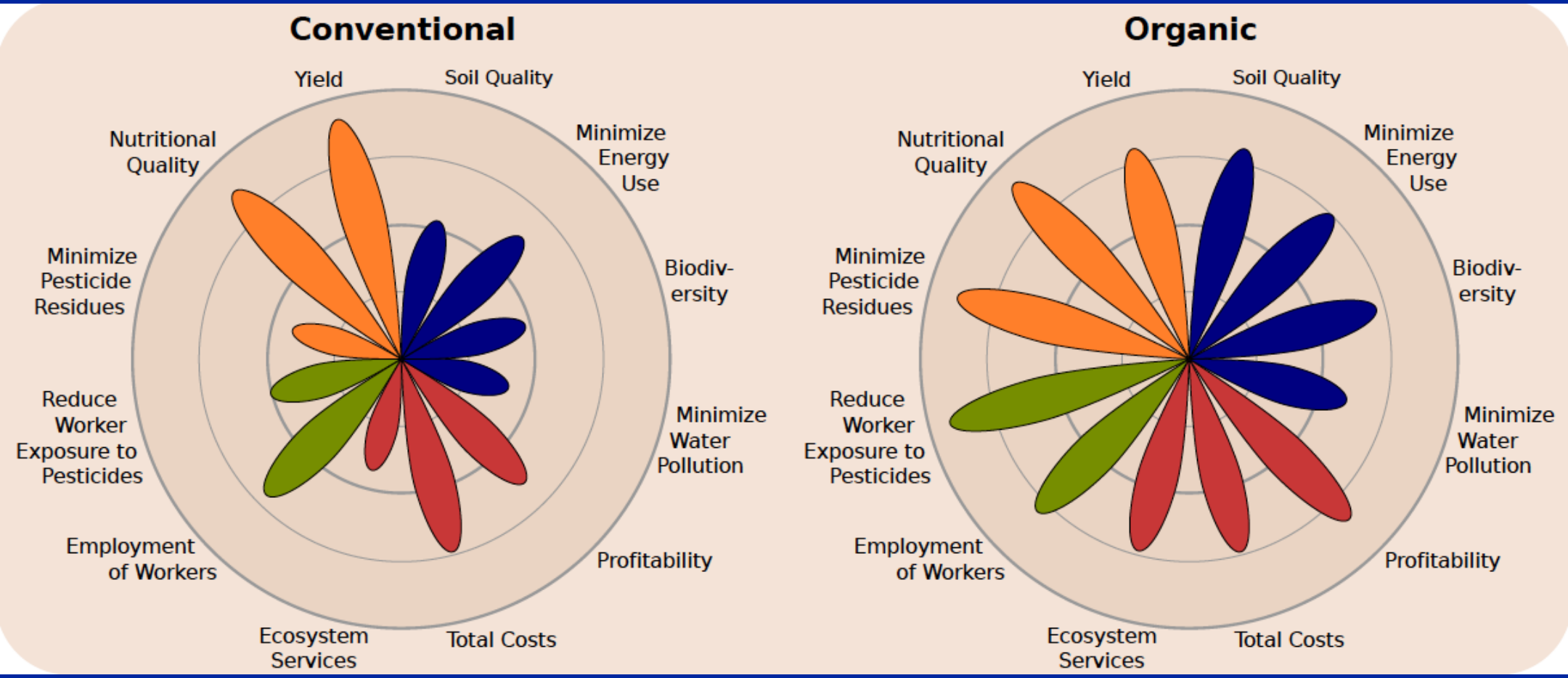
Social Wellbeing

- Both organic and conventional agriculture need to make significant progress to meet social sustainability goals.
- Organic farming has been shown to have some sociocultural strengths, such as positive shifts in community economic development, increased social interactions between farmers and consumers, and greater employment of farm workers.
- Organic farming reduces the exposure of farm workers to pesticides and other chemicals.

Social Wellbeing

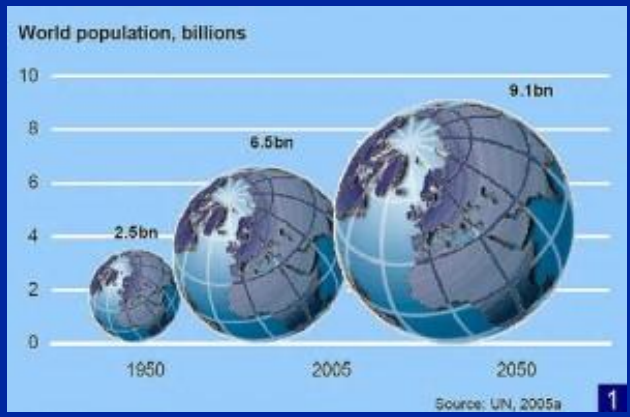
- Organic certification programs have adopted social wellbeing goals.
- Organic certified animals must have access to open air or grazing whenever possible, and sick animals must be treated as needed.
- Local (CSAs and farmers markets) and Fair Trade movements are gaining ground.
- Bottom Line: We have a long way to go.

Assessment of Organic and Conventional Farming in the Four Major Areas of Sustainability



(Reganold & Wachter, Organic agriculture in the 21st century, *Nature Plants*, 2016)

Helping to Feed the World



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

Yes. With multiple sustainability benefits, organic agriculture has room for growth: From 1% of the cropland today being organic to 10 to 15% by 2050.

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