

Food systems under different lenses
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A socio-metabolic perspective on the evolution of food regimes

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Three global food regimes (FR)

1 British centered FR from 1870 to 1914/1929: Abolishment of British corn laws, multilateral free trade agreements; gold standard; emerging world market; fossil fuel based transport revolution. Imports from settler colonies fuel British industrialization.

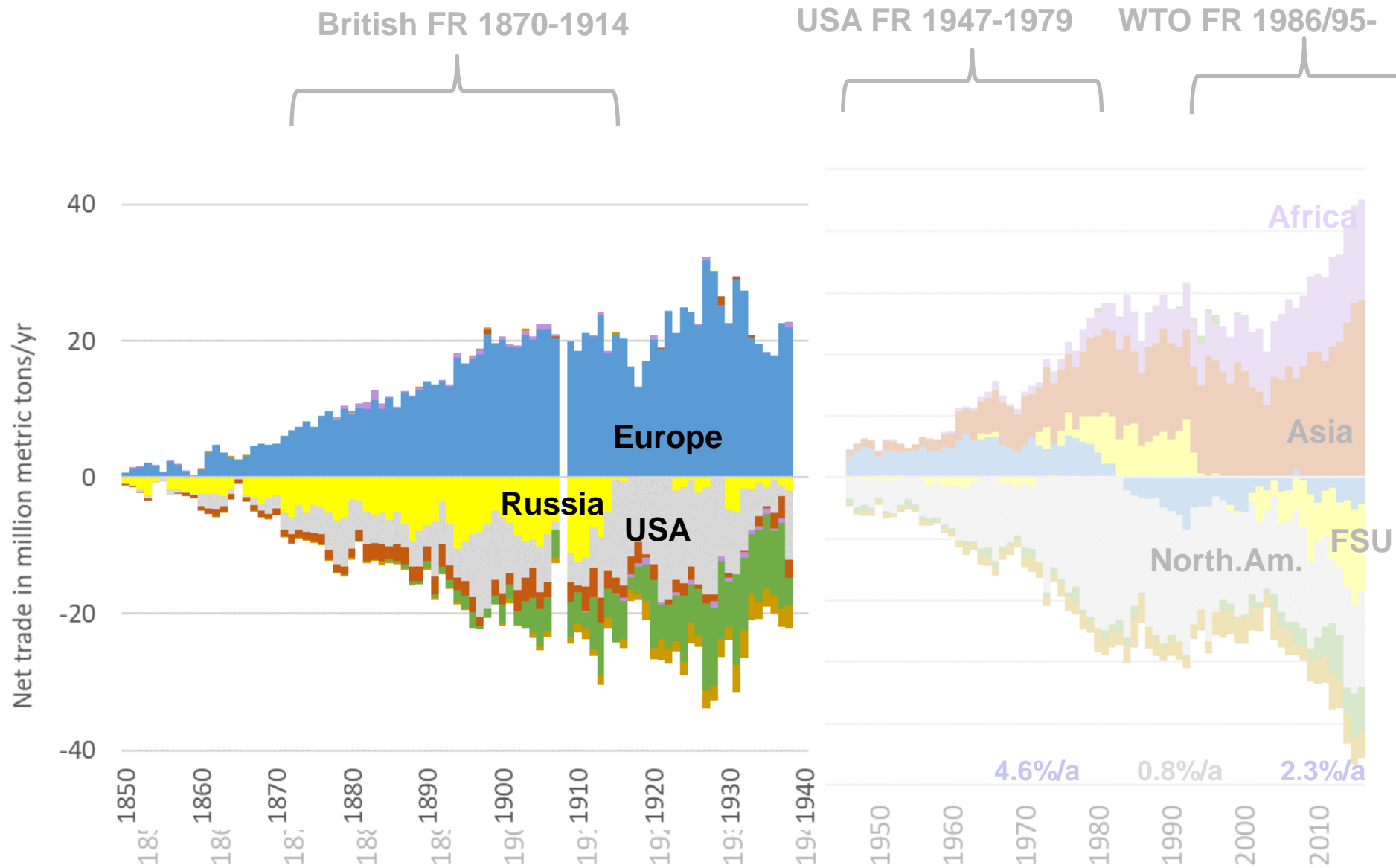
2 US centered FR from 1945 to 1973/1979. Bretton woods and GATT; US\$ as leading currency; protectionist agric. policy and state as strong regulatory institution; industrialization of agriculture; subsidized surplus production; “*meatification*” of the diet. Food trade as an economic and political weapon in the cold war.

3 WTO centered (corporate) FR from 1995- . GATT reform and neoliberal globalization; no clear center; contradictions between cheap, mass produced “*food from nowhere*” and high priced products from extensive/organic production “*food from somewhere*”.

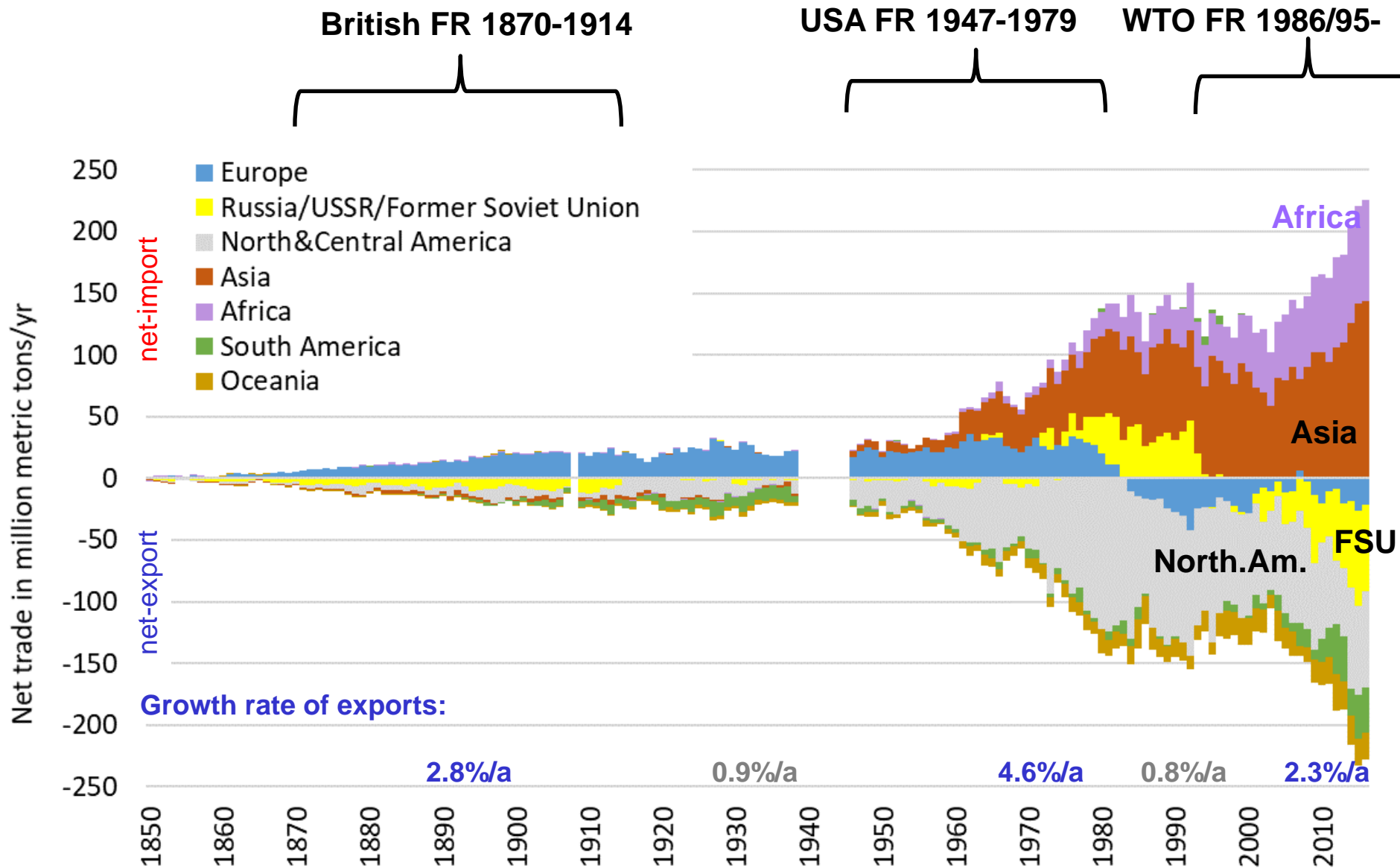
See e.g. Friedmann 2005

Global Trade Flows 1850-2016

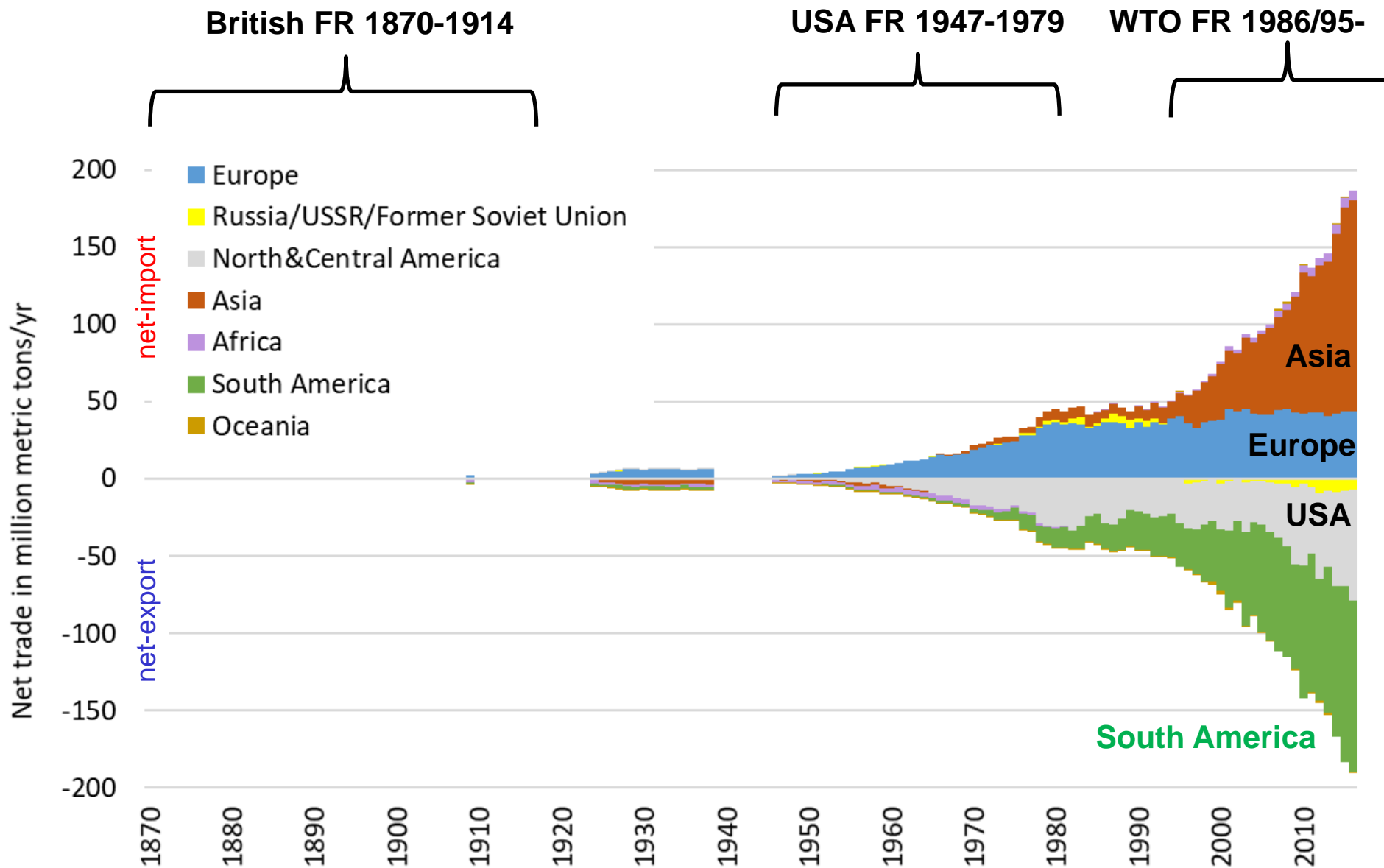
Physical Trade Balance: Cereals 1850-2016



Physical Trade Balance: Cereals 1850-2016



Physical Trade Balance: Oil crops 1850-2016



Resource use and environment

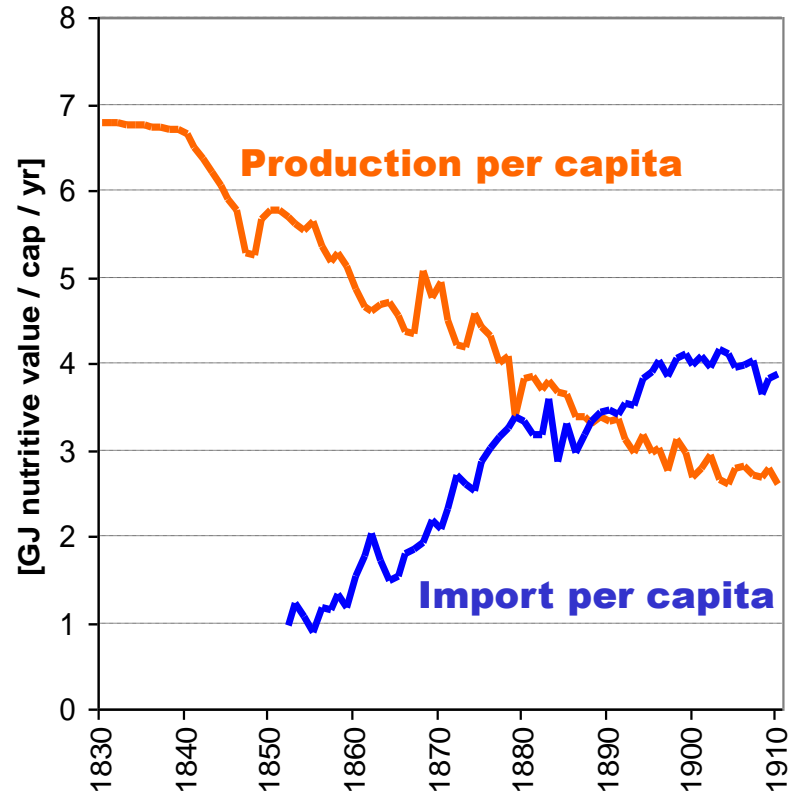
British centred FR: Externalisation of food supply in the UK

Since the 1860s UK food demand was increasingly met by imports. Imports provide cheap nutritional energy for a growing industrial labor force:

Imported food exceeded domestic production ca. 1880.

Around 1900 the „imported cropland area“ reached a similar size as UK cropland; cropland area in the UK declines.

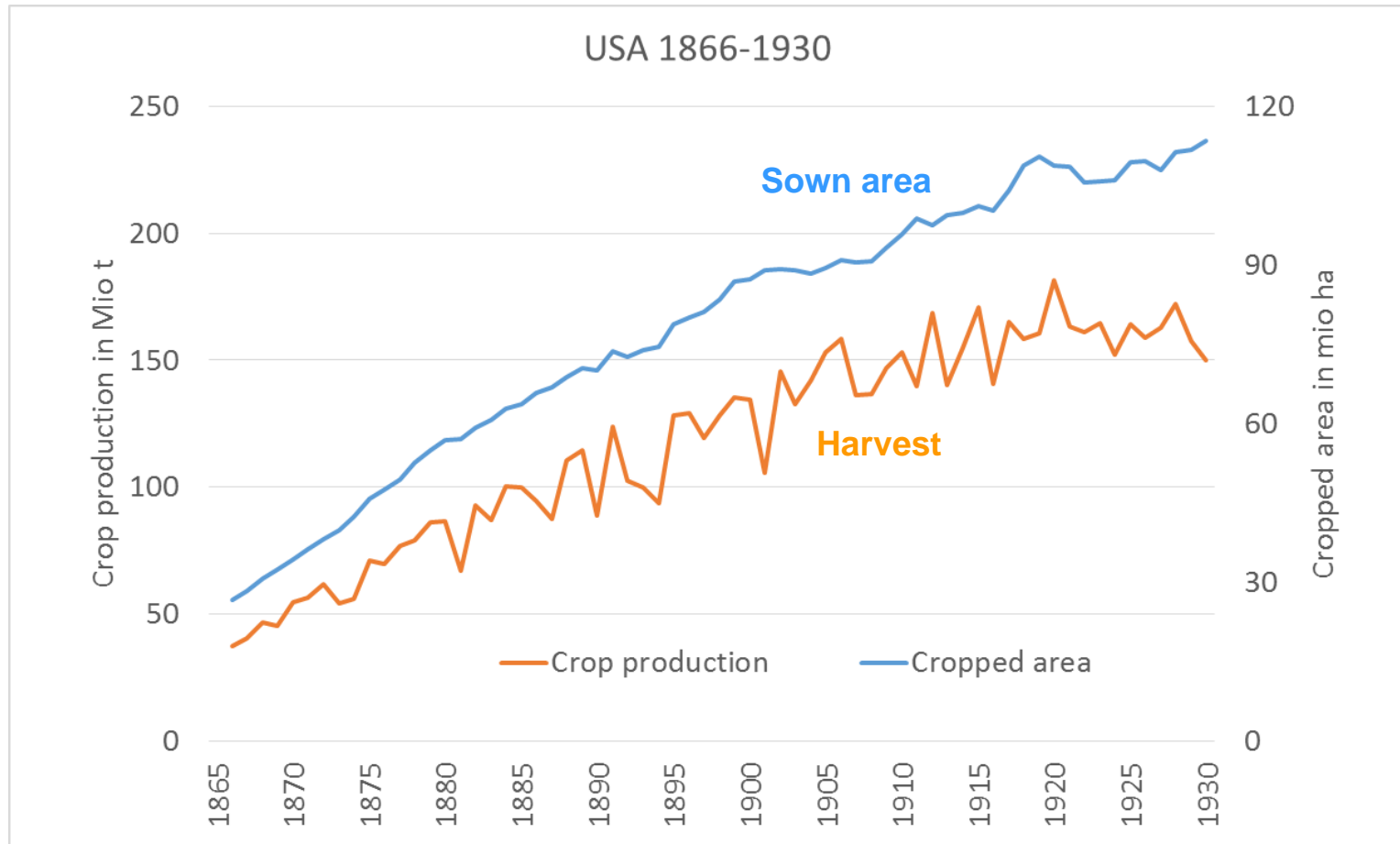
**Cereal production and import
1830 to 1900 in food calories**



Source: Krausmann et al. 2008

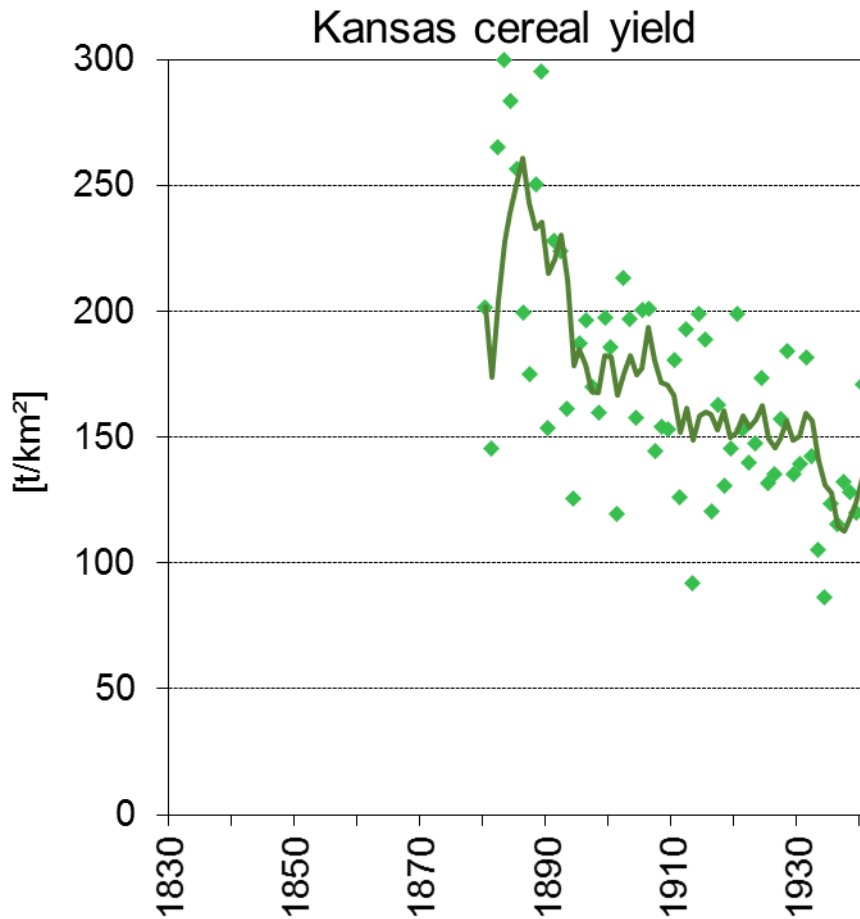


USA 1866-1930: Production increases through the expansion of cropland into new frontiers



Source: Gierlinger 2008

Exploitation of nutrient reservoirs in grassland soils; soil degradation

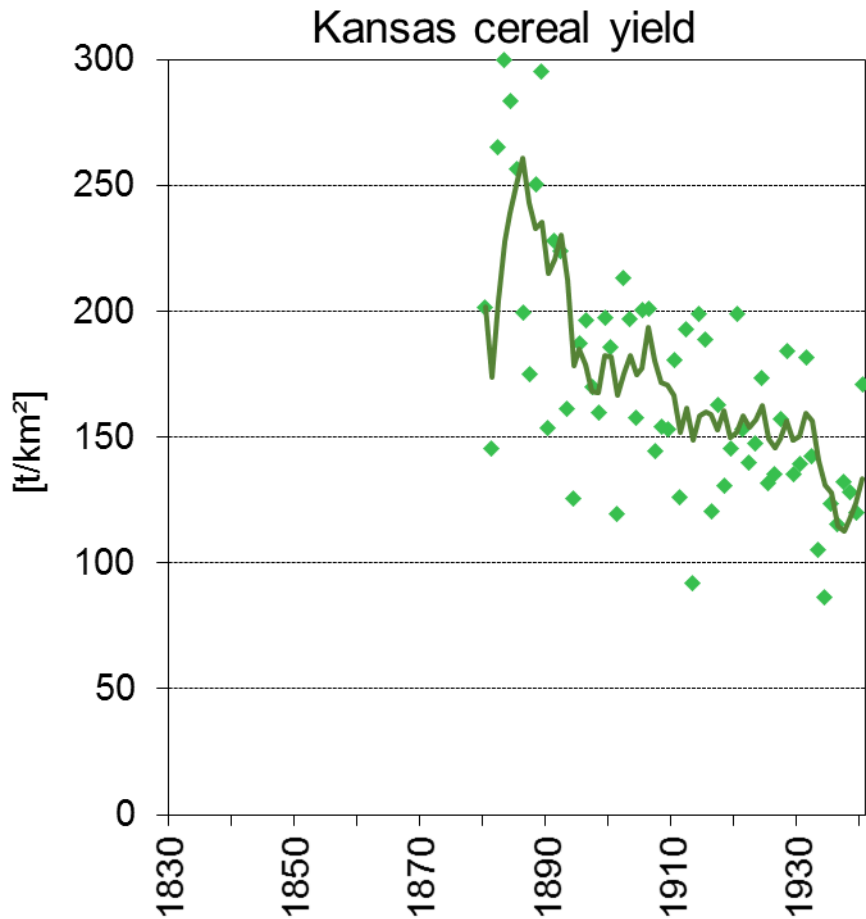


New World periphery:

- Fertile grassland soils are converted into cropland (*frontier agriculture*).
- High labor productivity and high *energy return on investment*.
- *Soil mining*: Exploitation of nutrient reservoirs which have accumulated over long periods of time; low investment into soil fertility management (labor scarcity): Rapid loss of plant nutrients and soil fertility: declining yields; high CO₂ emissions (from soil organic carbon).
- *Limits of land expansion* are reached

Sources: Krausmann et al. 2008; Cunfer and Krausmann 2012

Exploitation of nutrient reservoirs in grassland soils; soil degradation



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F. Krausmann | A socio-metabolic perspective on food re

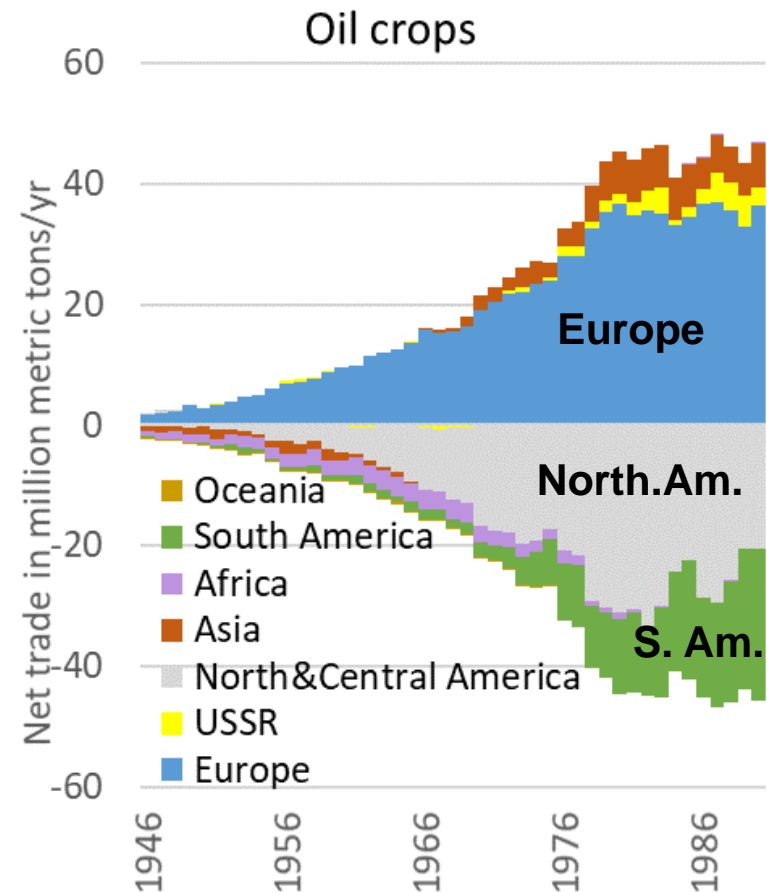
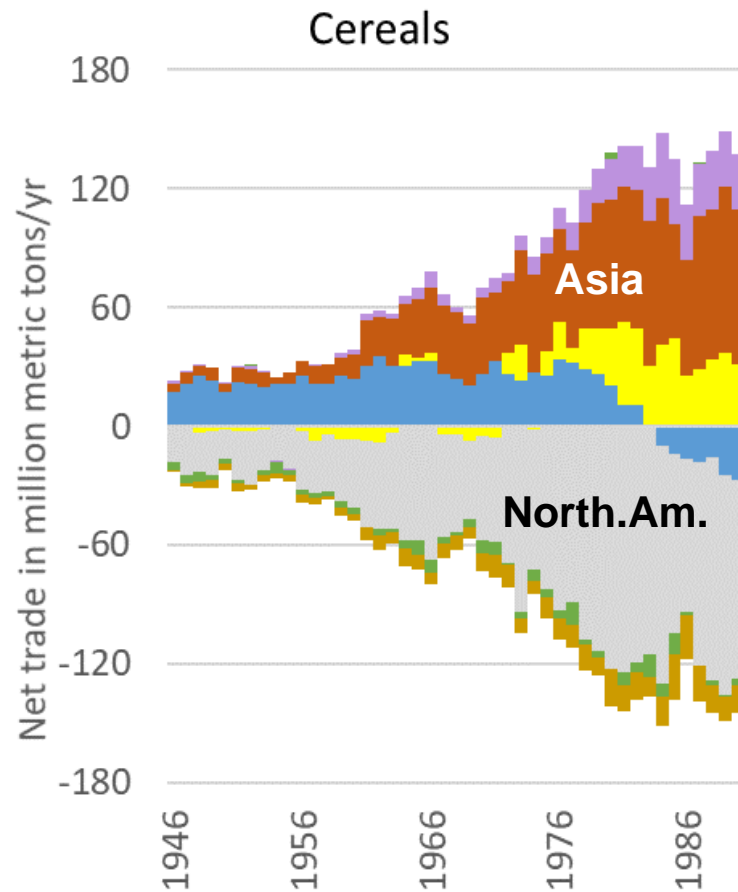
Ecological crisis: *Dust Bowl* – soil erosion in the 1930s



South Dakota 1936

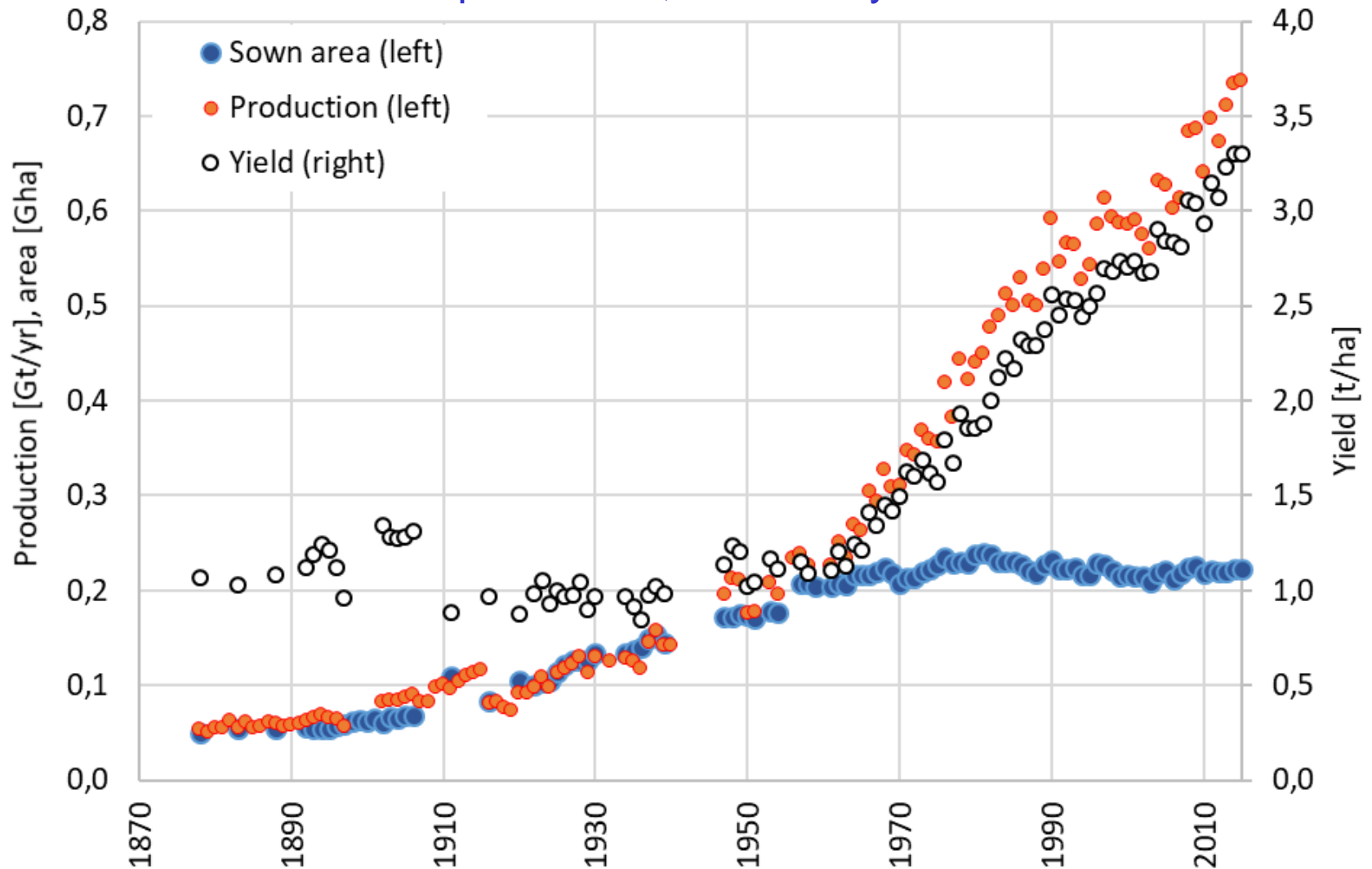
United States Department of Agriculture;
Image Number: 00di0971

US centered FR: Trade with cereals and oil crops 1946-1990

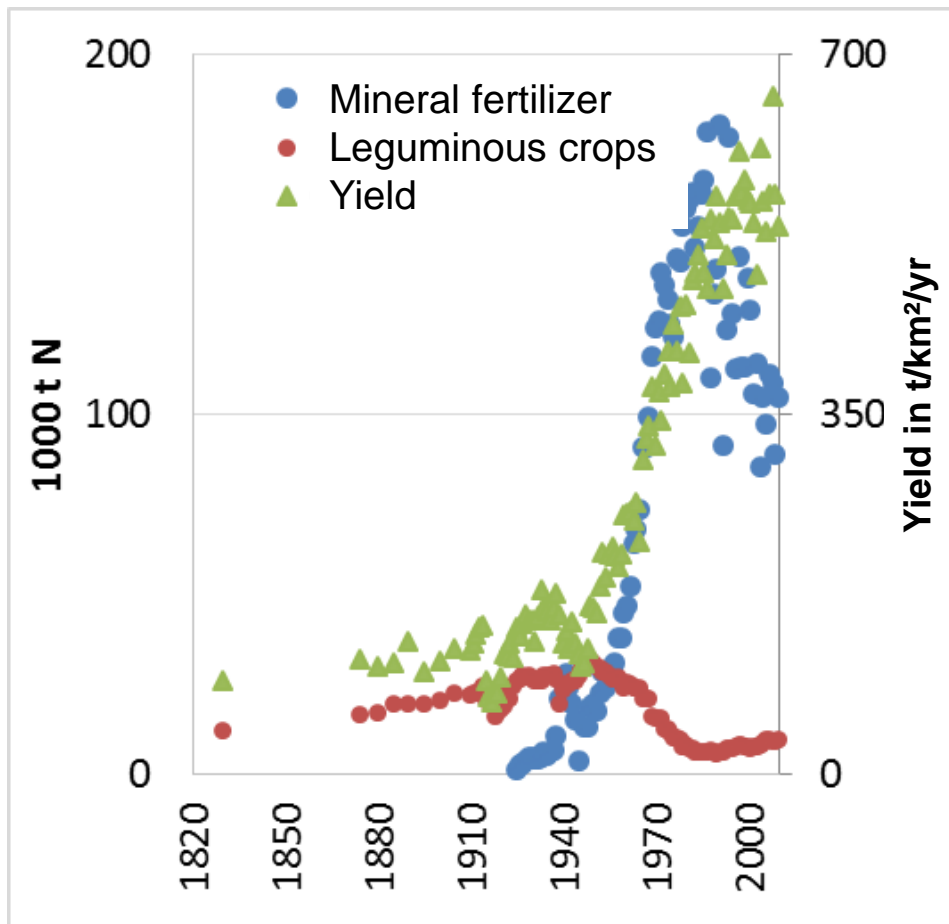


US centered FR: Green revolution - from expansion to intensification.

Global wheat production, area and yield 1870-2016



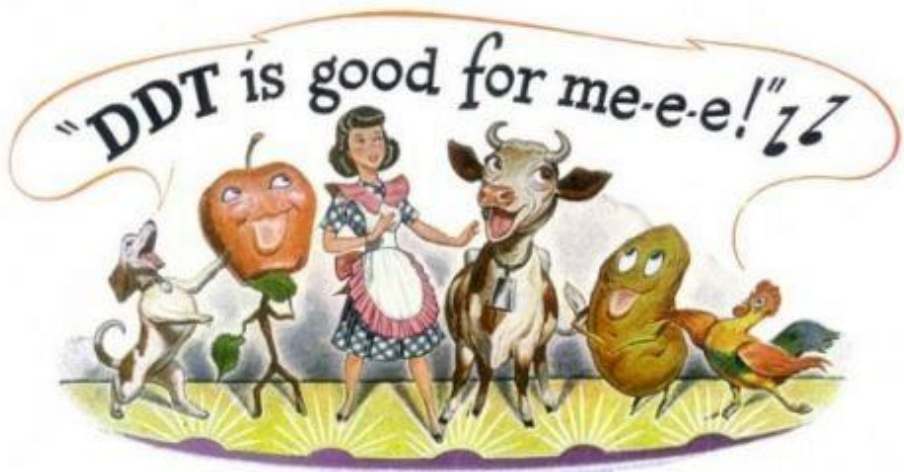
Green Revolution & industrialization of agriculture: Nitrogen supply and crop yield, Austria 1830-2010



- New **fossil fuel based technologies** abolish the plant nutrient bottleneck.
- **Multiplication of yields** -> industrial meat production
- **Area and labor productivity increase** at the expense of the energy productivity of agriculture: **Agriculture turns into an energy sink (EROI<1)**

Source: FAOSTAT 2015, BAWI 2015, IFA 2016, own calculations

Ecological crisis of high input agriculture



Health risks and environmental damage related to industrialized agriculture and Western diet become apparent (e.g.; Rachel Carsons „Silent Spring“, 1963)

Oil price shock: High dependence of agriculture on oil; vulnerability of the food system

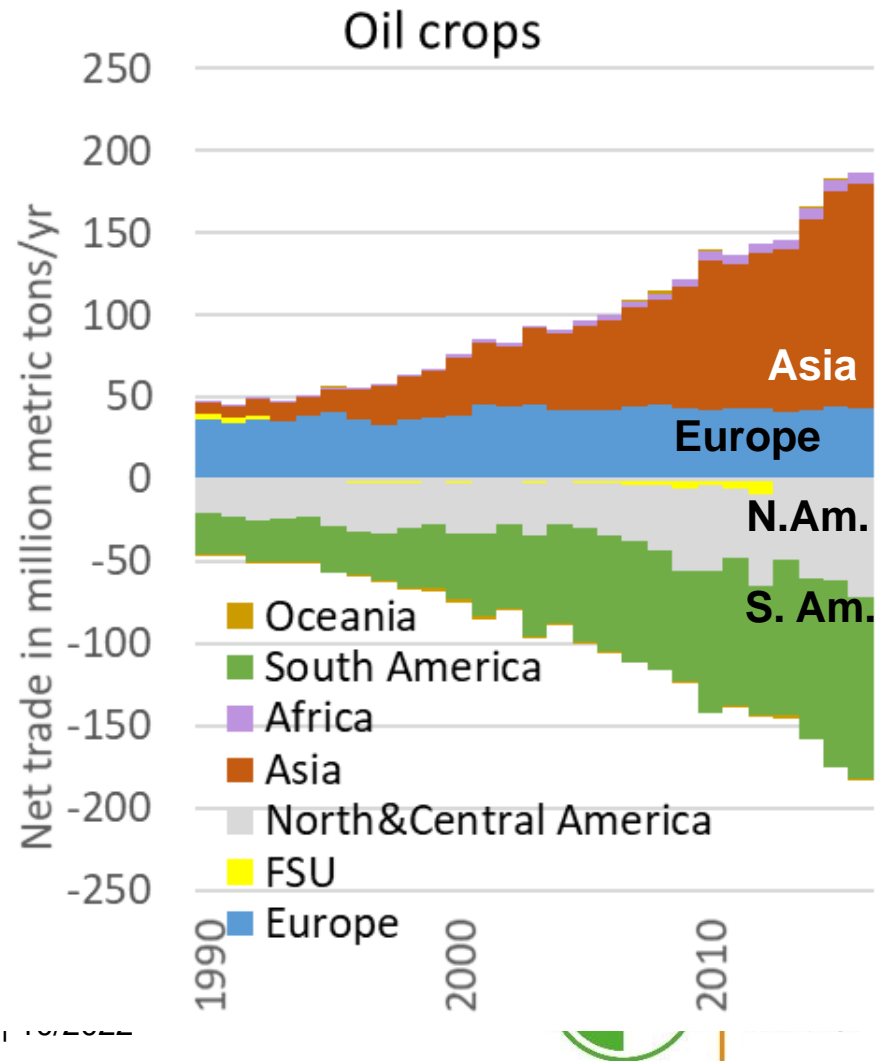
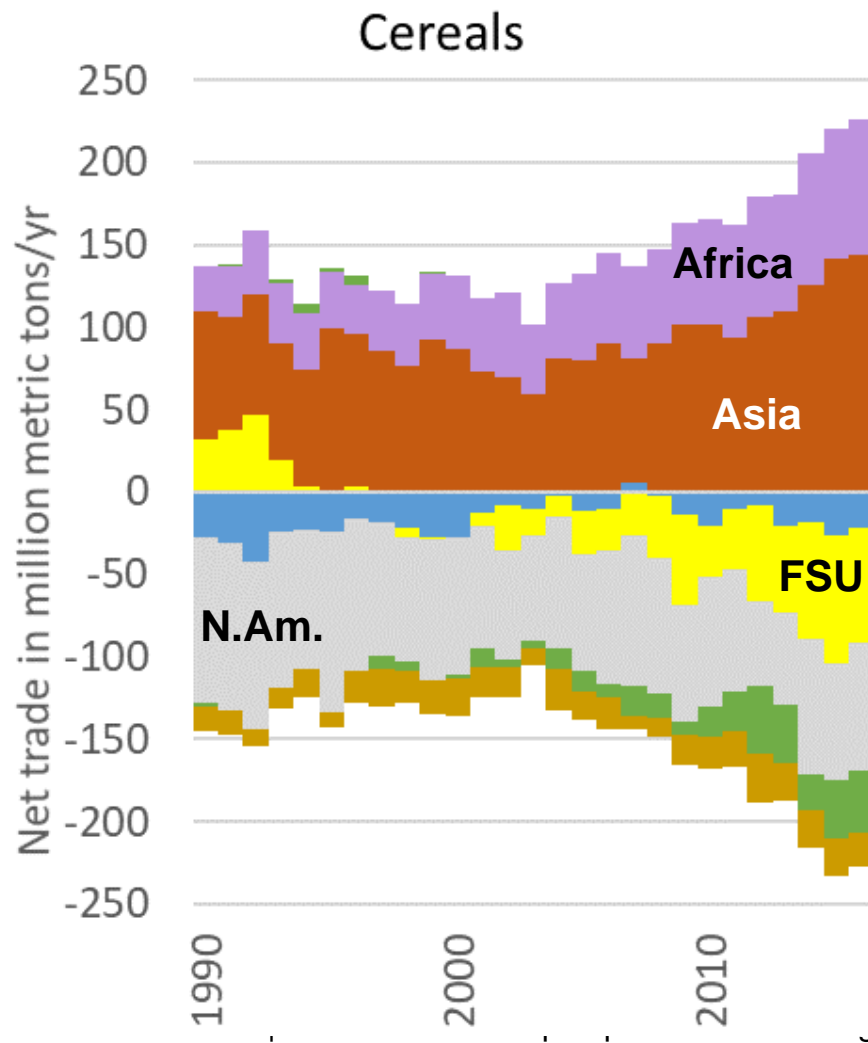
Western diet & meatification

Weekly food supply:
Melander family, Germany

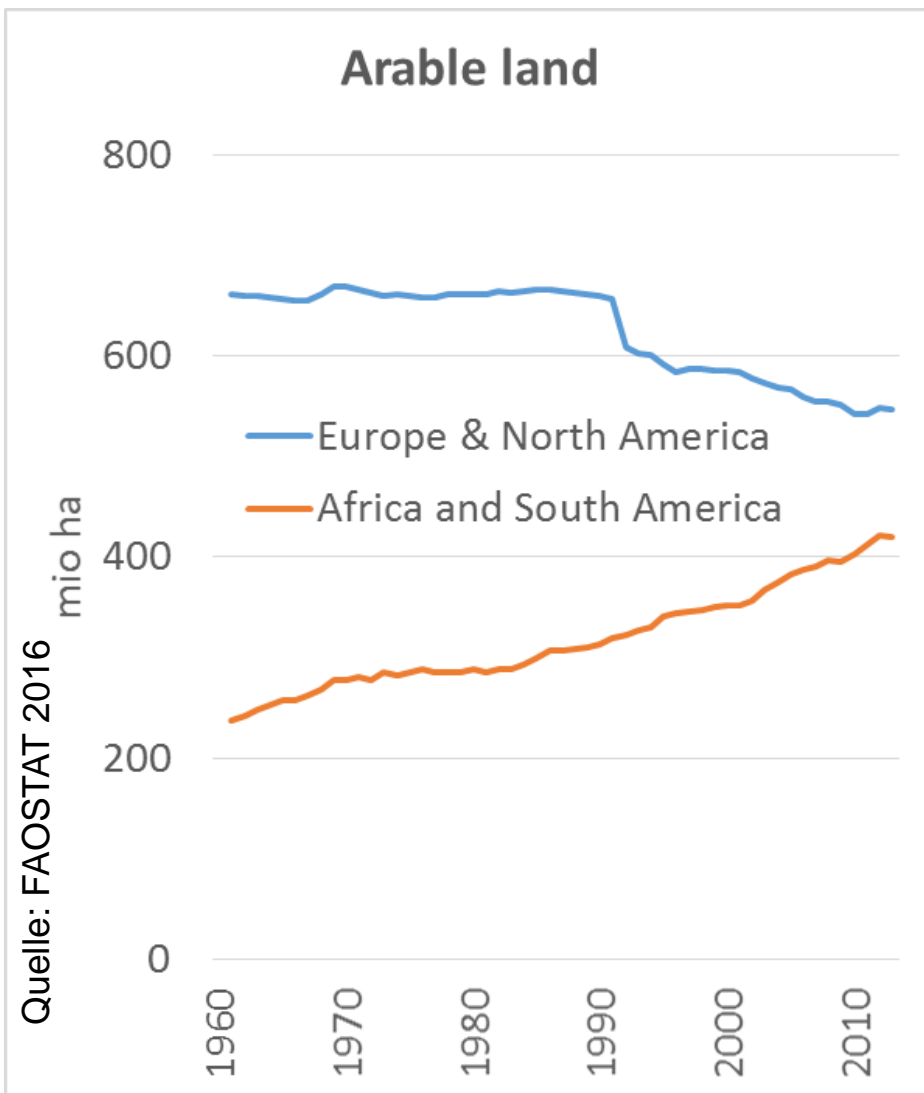


Peter Menzel: Hungry Planet: What the World Eats

WTO centered FR: Trade with cereals and oil crops 1990-2016

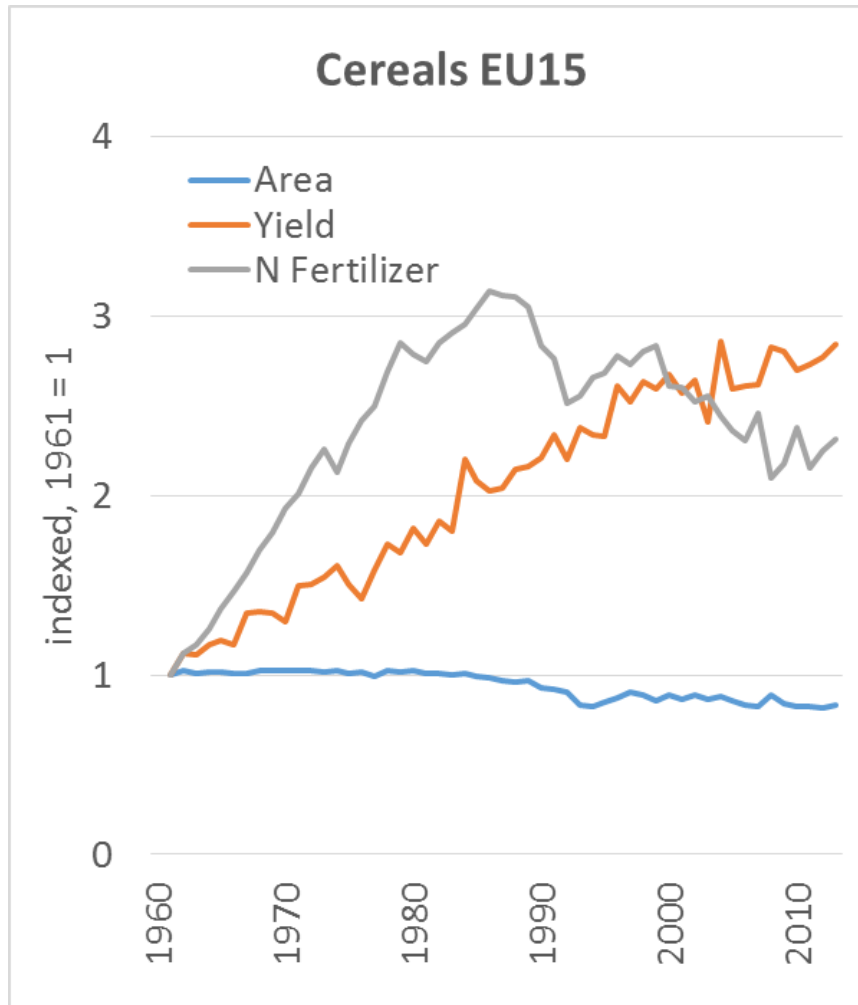


Extensification in Europe, expansion in South America and Africa



- **Expansion of cultivation** in Africa and South America; Reduction of agricultural land in industrialized countries
 - ***Maturation*** of industrial agriculture: Efficiency improvements (e.g.; fertilization)
- > **Contradictory developments:** Ecologization & intensification (GMOs, Biofuels) of production; rising vegetarianism; rising meat consumption

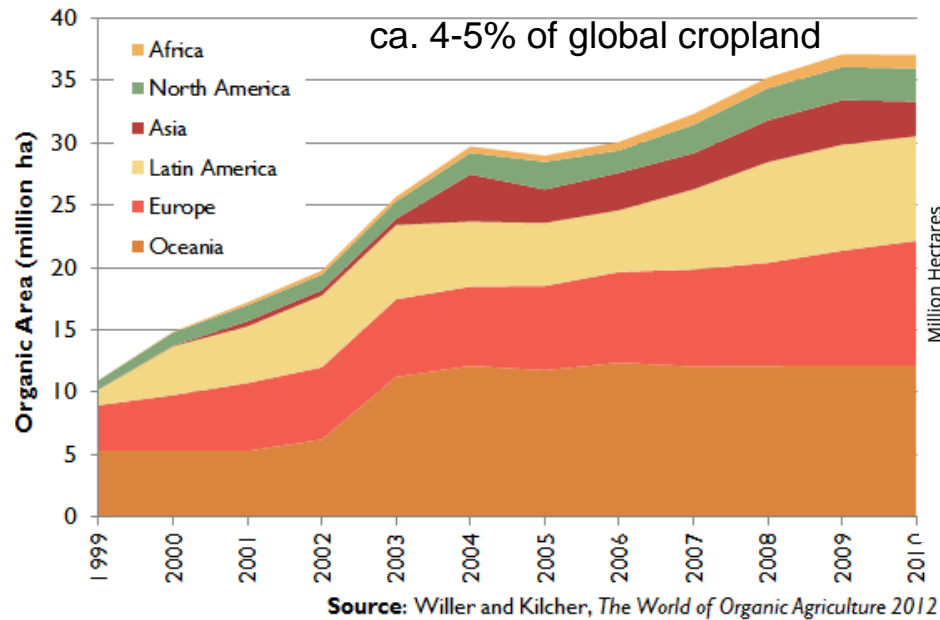
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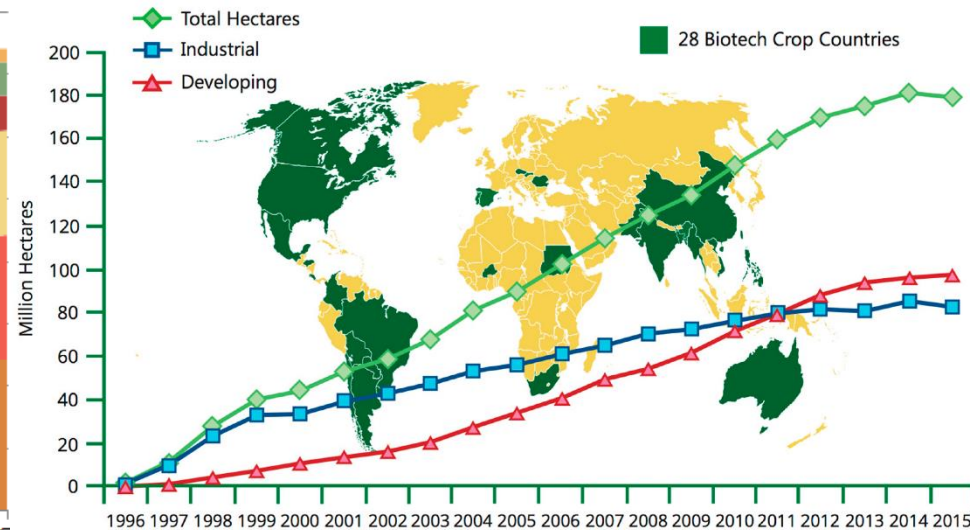
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Contradictory developments: Global expansion of organic farming and biotech crops in the 21st Century

Organic farming (area) by world regions 1999-2010 (72 mio ha in 2020)



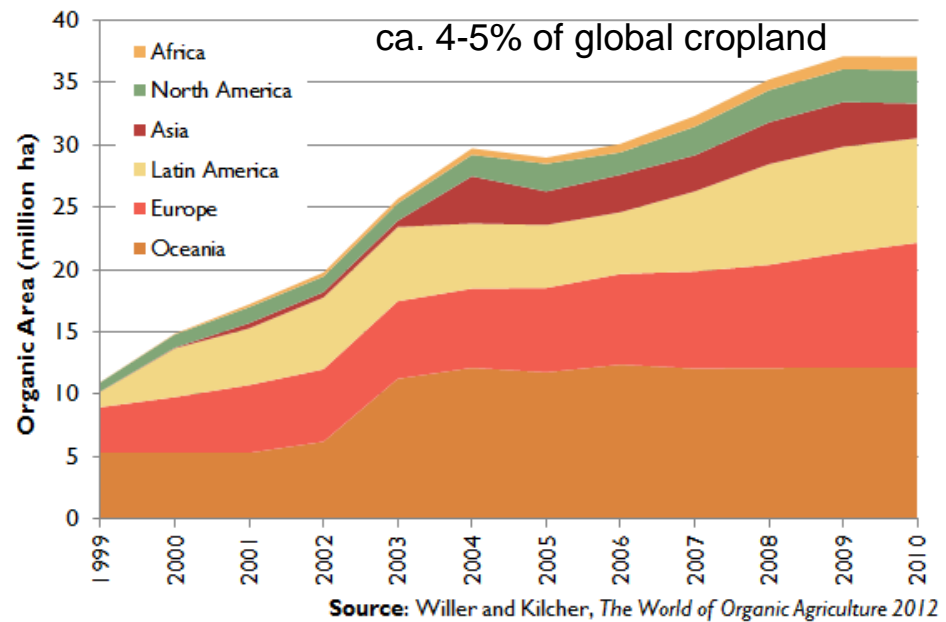
Global biotech crops 1996-2015



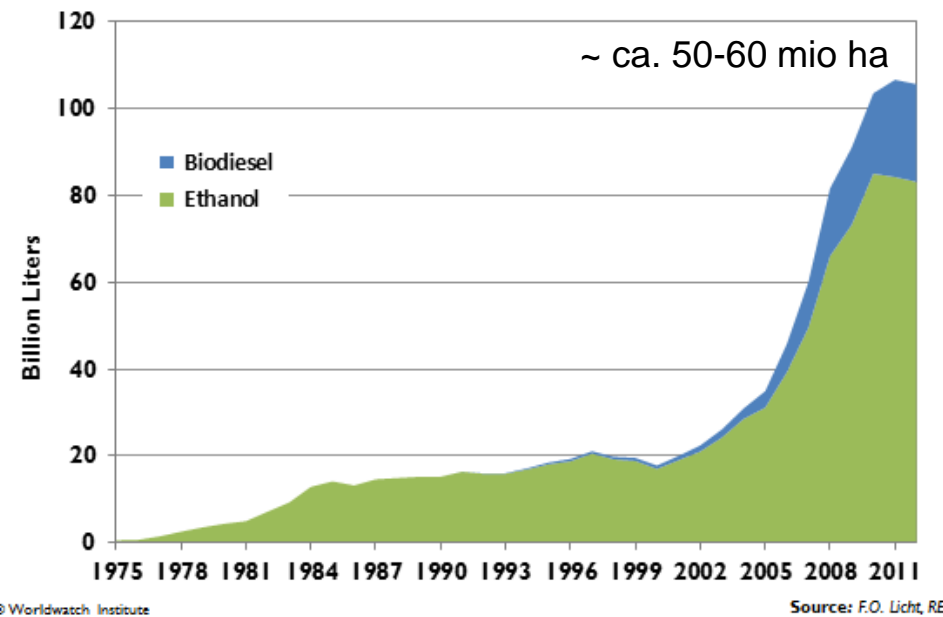
James, C. ISAAA Brief No. 51; Ithaca, NY, USA, 2015

Contradictory developments: Global expansion of organic farming and biotech crops in the 21st Century

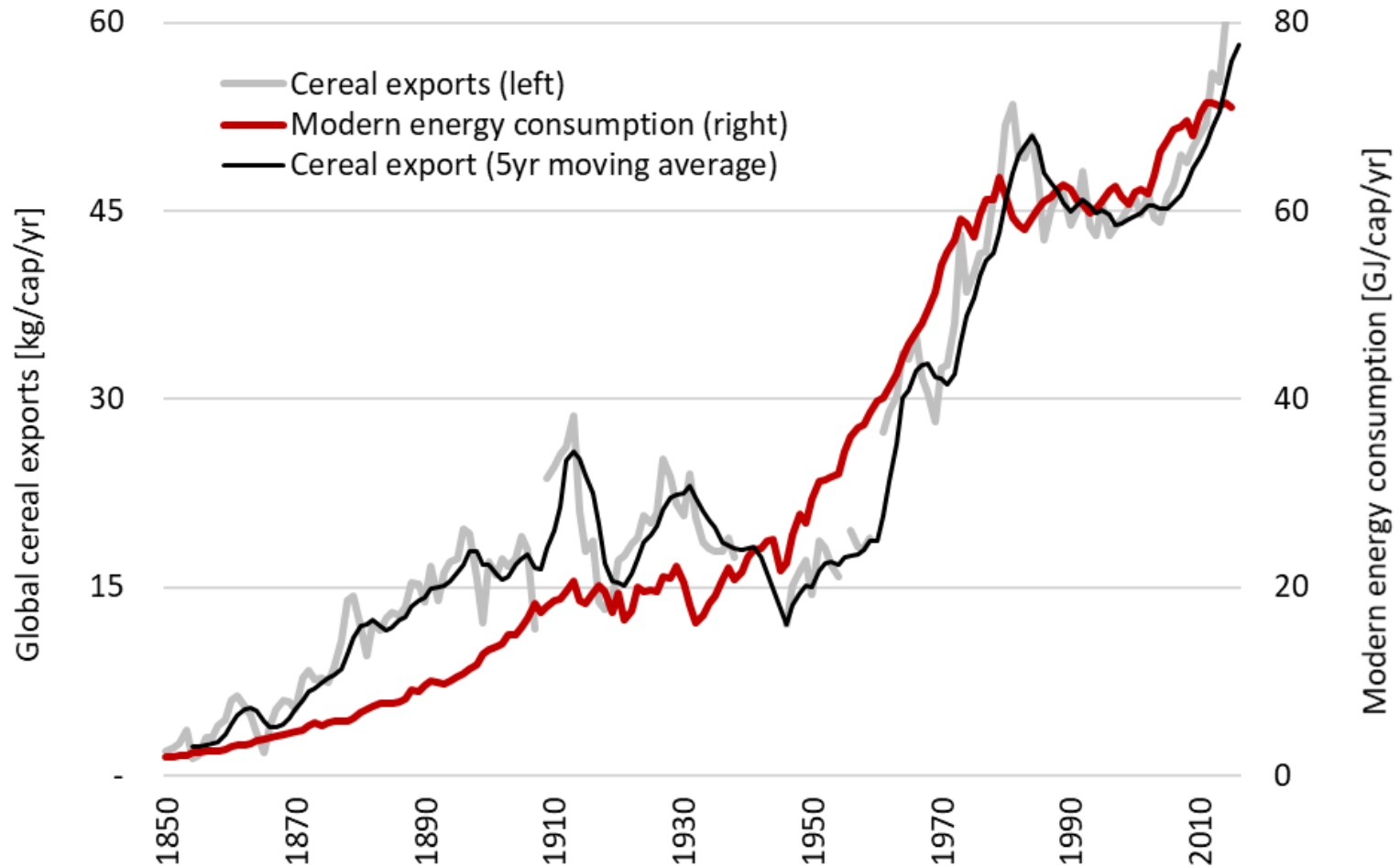
Organic farming (area) by world regions 1999-2010 (72 mio ha in 2018)



Global biofuel production 1975-2012



Global cereal exports and fossil fuel consumption (per capita) 1850-2016



Conclusions

- FR periodization matches well with the periods of surging trade flows (growth vs. stagnation of trade).
- FR correspond to major changes in societies metabolism: Coal based growth in the 19th century, the Great Acceleration after WWII and globalization since the mid 1990s
- FR shifts are related to changes in the resource base of agricultural production and include components of ecological crisis: The first and the second food regime are very distinct in their socio-ecological characteristics and related sustainability challenges, but no clear-cut socio-ecological characteristics for a possible third regime:
- A fundamental shift towards a more sustainable agriculture, however, cannot be observed.

Thank you for your attention

See also:

*Krausmann, F. and Langthaler E. 2019. **Food regimes and their trade links: A socio-ecological perspective.** In: *Ecological Economics* (160), 87-95.*

Data available at:

<https://boku.ac.at/wiso/sec/data-download>