Smil book club

– Part 2 of chapter 2

Sha Jiang

Diesel oil behind seafood

- Marine hunting: widely and intensively practiced
- Energy investment in capture:
  - Pelagic species (living near the surface, e.g. sardines and mackerel)
  - Relatively small: 100 mL/kg
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- Aquaculture
  - Broilers: herbivores; in confinement -> less energy expenditure
  - Carnivorous species (salmon, sea bass, tuna) -> protein-rich fish meals and fish oil derived from catches of wild species
  - Expanding aquaculture: ease the pressure on overfishing; intensify the exploitation of smaller herbivorous species
  - Energy cost: grow sea bass in cage (2-2.5 liters of diesel fuel per kg); capture sea bass in wild -> same order of magnitude

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  - Tuna (most endangered top marine carnivores) -> high demand -> sushi!

Carp vs Tuna!

- Our food supply (Grains, Chicken, Tomato, Seafood) all depends on fossil fuels!

Fuel and food

- Dependency of the growth of food production on modern energy inputs
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  - Not just food production:
    - In the US:
      - **1%** of total national supply -> direct energy use in food production;
      - **16%** in 2007 and **20%** in 2022-> food processing, and marketing, packaging, transportation, wholesale and retail services, household food storage and preparation…..
- We should not continue many of today's food-producing practices.

Can we go back?

- Organic cropping, replying on recycled organic wastes and natural pest control
  - Abandon cities, resettle villages, dismantle central animal feeding operations, bring all animals back to farms (labor and manure)
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  - Nitrogen content
    - Cereal straws: **0.3-0.6** percent
    - Manure mixed with animal bedding: **0.4-0.6** percent
    - Fermented human waste: **1-3** percent
    - Manures applied to fields: **4** percent
    - Urea (dominant solid nitrogen fertilizer): **46** percent
    - Ammonium nitrate: **33** percent
    - Liquid solution: **28-32** percent
  - More labors on the handling, transporting and spreading of manure

Can we go back?

- Sources of nitrogen in croplands
  - Atmospheric deposition (rain and snow containing dissolved nitrate): **20** megatons of nitrogen per year
  - Animal manures: **30** megaton
  - Leguminous crops (green manure cover crops as well as soybeans, beans, peas and chickpeas): **30** megaton
  - Irrigation water: **5** megaton
  - Synthetic fertilizer: **110** megaton (important role in global crop harvests; hard to be totally replaced)
- Expand cultivation of leguminous crops to produce 50-60 megaton
  - Reduce the ability to use one field to produce two crops in a year -> lower the overall food energy yields

Doing with less — and doing without

- There is still hope -> reduce food waste:
  - Reduce crop and animal production -> reduce attendant energy subsidies
  - Excessively high global food loss
    - Daily average per capita requirements of adults: 2000-2100 kilocalories; actual supply is 3200-4000
    - FAO: the world loses ½ of all root crops, fruits, vegetables, ⅓ of all fish, **30%** of cereals, and ⅛ of all oilseeds, meat, and dairy product -> overall ⅓ of total food supply
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    - Well-off countries adopt healthy and satisfactory alternatives
      - Mass-scale Veganism: hominin ancestors were omnivorous; not enough animal protein for human growth (height in Japan, South Korea, and China)

Doing with less — and doing without

- Eat less meat in high-income countries?
  - High-level carnivory has no proven nutritional benefits
  - Reduce crop harvest
- Reduce the dependency on synthetic nitrogenous fertilizer:
  - e.g., improving the efficiency of nitrogen uptake by plants
- Running machinery without fossil fuels -> solar- or wind-generated electricity
- Develop grain or oil crops that can convert inert atmospheric nitrogen to nitrate (like leguminous plants)
- All those solutions are a very long way off -> still a large dependency on fossil fuels in the near future