Discussion of "Investing in Nature Can Improve Equity and Economic Returns"

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Summary

- Global analysis of investments in ecosystem services combining GTAP and InVEST
  - Scenarios include removing agricultural subsidies and redirecting funds (Subs Land, Subs Ag R&D), PES programs (Global PES, National PES), and a combined policy (Combined)
  - Services include crop pollination, timber from forests, food from marine fisheries, carbon sequestration
- Key Results
  - Including ecosystem services lowers baseline Global GDP, especially in low-income countries
  - All five policies raise Global GDP relative to baseline, with gross effects in the range of $100-$200 billion
  - Subs Ag R&D has largest net effect on GDP ($125 billion)
  - Combined policy has largest net effect when carbon benefit included ($325 billion)

What's the main point?

- General audience: "We show that investments in nature result in large improvements relative to a business-as-usual path."
- Economics audience: The magnitude of the GDP/welfare changes are of interest.
- Policy audience: What will be the gains/losses to a jurisdiction (e.g., a country) from supporting a coordinated global investment policy?

Modeling Advances

"Using available data of global extent (we) find only four ecosystem services for which we could map proxies at a global scale, and even those data are imperfect" (Naidoo et al. 2008 PNAS)

- Ecosystem services often analyzed at national or local scales (e.g., Lawler et al. 2014)
- Global analyzes often lack spatial detail or do not cover as many services
- Full linkages between ecosystem services and markets is rare
- General equilibrium effects of ES policies is novel

Example: Pollination Services

- The configuration of land uses determines habitat for pollinators
- Abundance of pollinators affects yields for 175 separate crops
- Changes in production affect agricultural prices
- Changes in prices affect land-use decisions

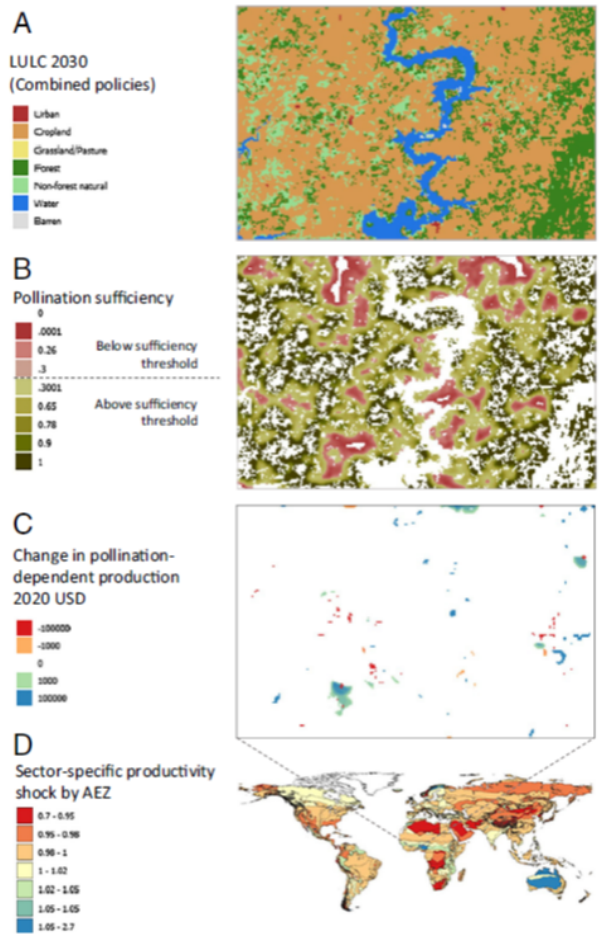


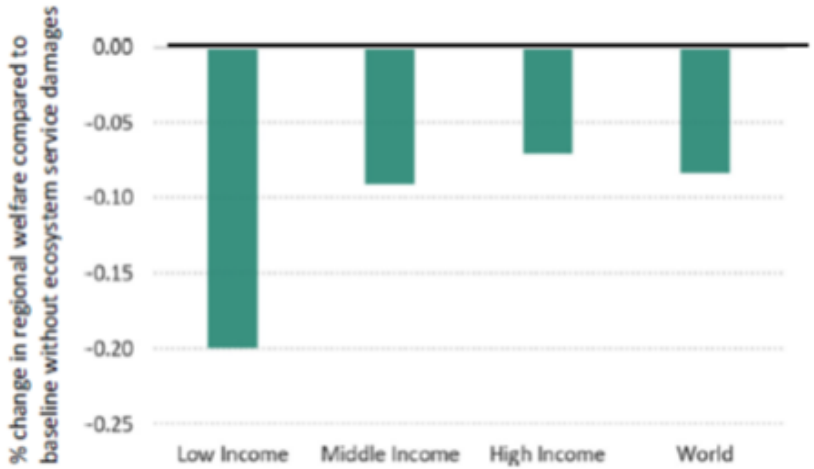
Fig. 4. Tracing land-use change through pollination ecosystem services to agricultural productivity changes. Ecosystem services are calculated in InVEST from LULC maps (*A*) and other inputs. The InVEST model generates biophysical outputs (*B*), which are processed into gridded impacts on productivity (*C*). These are converted to aggregate percentage change per AEZ (*D*), which is the input to the GTAP model.

Magnitudes

- Under BAU, including ecosystem services reduces 2030 Global GDP by $75 billion
- Investing in ecosystem services increases Global GDP by $100-$200 billion per year
- In various places, these changes are referred to as large: "We find that policies that increase investment in nature can generate large increases in GDP relative to BAU."
- Isn't global GDP the right benchmark?
  - Current global GDP is about $100 trillion, so these figures represent about a 0.1 - 0.2 % change

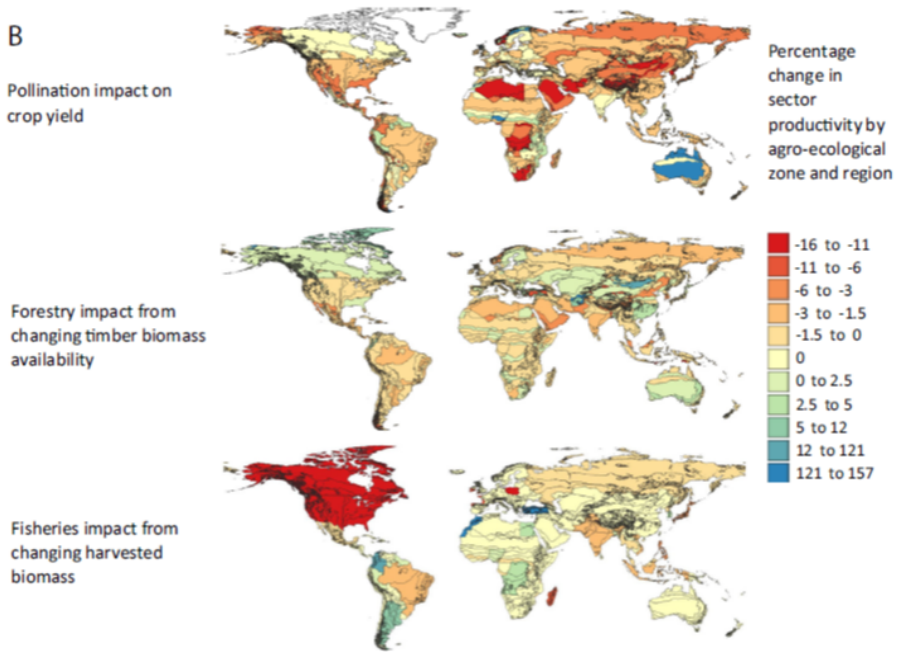
GDP v. Welfare

- Why are equivalent variation measures so much larger than GDP measures?
- Figure at right shows the % change in welfare relative to baseline without ecosystem service damages



Fisheries

- Harvests from marine fisheries appear to decline overall under BAU, and especially so in North America.
- What explains this trend?
- Do any of the investment/policies affect fisheries?



Fisheries

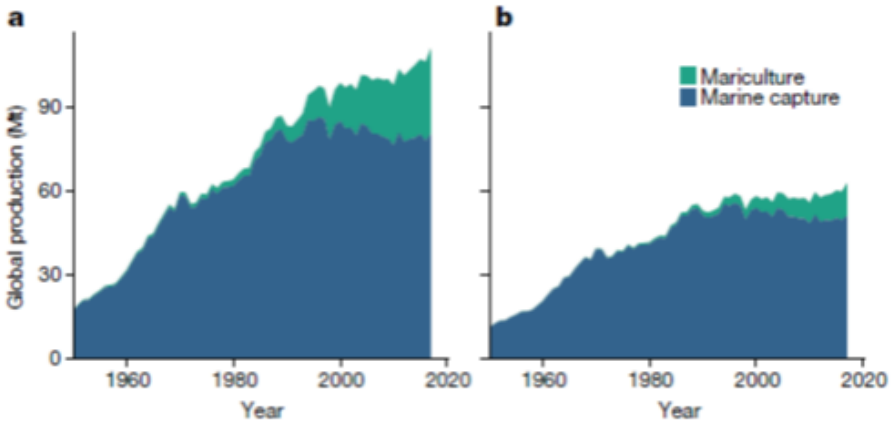
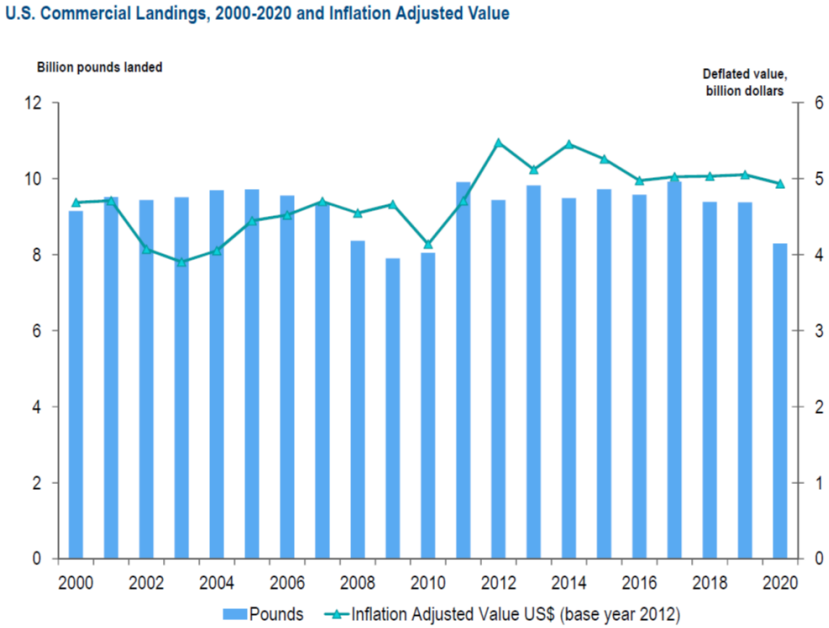


Fig. 1 | Marine harvest and food from the sea over time (excluding aquatic plants). Data are from ref. [9]. **a**, **b**, Harvests (live-weight production) (**a**) are converted to food equivalents (edible production)[10] (**b**). In **b**, there is also an assumption that 18% of the annual landings of marine wild fisheries are directed towards non-food purposes[47].



Future Work

- Other things to add to the model (additional services, climate, imperfect property rights)
- What the Return on Investment?
- Coordinated v. unilateral policies
  - If coordinated policies produce net gains, what's the obstacle to their adoption? Does your model need additional features that explain lack of adoption?
  - Payments for Ecosystem Services programs exist around the world (Salzman et al (2018): \$36-\$42 billion per year in transactions): Can your model explain why some countries act unilaterally? Are exporters more likely to invest?
  - Should a given country invest on their own? Could policy makers use your model to determine whether to invest in ES?