

Value of Crop Pollination: Gross Ecosystem Product (GEP)

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Introduction

- importance of pollination to crop production
- as a regulatory service, this is a non-market service (e.g., no price) provided by nature.
- Because of human externalities in crop production (pesticides and toxic fertilizers – need to find the list of things that threaten pollinators), valuing the service of pollinators is informs farmers of their commercial value. This is important for XX commercial crops – with a global market value of \$XX (X% of global agriculture).
- Gross-ecosystem product (GEP) is a flow measure of natural capital accounting and provides a means of estimating the commercial value of crop pollination.
- We design a formula to estimate GEP for crop pollination globally with spatial
- Here are our results for global estimates. Most valuable crops for pollination. Countries with important contribution.
- Results showing change in GEP value from 2000 - 2020 (what the trend)
- How does this compare to other natcap estimates of crop pollination. (fit in the literature)

Methodology for Estimating GEP

- GEP formula: $GEP = \lambda \times P \times Q$
- Pollination formula:

$$GEP = \underbrace{(\text{nature's contribution})}_{\lambda} \times \underbrace{(\text{crop price})}_{P} \times \underbrace{(\text{crop yield}) \times (\text{pollinator sufficiency ratio}) \times (\text{pollinator d})}_{Q}$$

- Define each part.

- Discuss importance of each addition in relation to GEP value.
- Discuss the units: ideally at pixel level and then aggregate zonally to level you desire (e.g., nationally)
- Discuss alternative methods to estimate crop pollination and their disadvantage

Data

Crop Yields

- MapSpam
 - Resolution
 - Time span
 - Crops this covers
 - Method
- EarthStat
 - Resolution
 - Time span
 - Crops this covers
 - Method

Pollination Sufficiency and Dependency

- Chaplin-Kramer method for pollinator sufficiency
 - Discussion of the methodology here
 - Requires lulc maps – discuss what used and resolution
- Dependency ratios from source in natcap module
 - Discuss how this is determined (method)
 - Perhaps point to an appendix section with the list of crop and their dependency ratio in descending order.

Crop Prices

- FAO prices - a lot of missing values for USD
- exchange rates - world bank - convert SLC, LCU into USD.
- For remaining missing values, use a simple AR(1) to impute missing values.

Results

- Four grid figure: a map for each year of mapsam with gep values (2000, 2005, 2010, 2020)
- A map of % change in gep value from 2000 to 2020 (twenty year change)
- Table with global values by crop for 2000, 2005, 2010, 2020 and % change from 2000-2020
 - Either all 65 or the top 25 + Rest of Crops summed
- Same table but for countries (Again, limit list to top + ROW aggregate at bottom)
- Discussion of the datasets produced that are now public access (global raster maps for pollination gep by crop)
- Some examples (applications)
 - Specific to a country, year, crop combo that may be important (coffee or another important cash crop)

Robustness

- EarthStat comparision for 2000
- If you remove the imputed values.
- Comparision of Agr. GDP
- Comparision of Agr. GEP (Syalla et al.)
- Other values of crop pollination as a NatCap value or other non-dollar values for global or sub-national levels that we can compare to. Comparision in terms of yeild from crop pollination

Conclusion

References

Appendix

A1: Pollinator Dependency Ratios

table with crop dependency ratios.