Economic Benefits of Pollination to Global Food Systems – Evidence and Knowledge Gaps: Final Report

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Summary

Pollinators and the food system

1) **Animal pollination is important to global crop productivity.** Over 75% of globally important crops benefit from animal pollination, including high value fruits (e.g. apples), stimulants (e.g. coffee), animal feed (e.g. soy) and oilseeds (e.g. palm).
2) **Pollination directly benefits production but indirectly benefits all actors throughout the food system.** Ample pollination is important to underpinning crop yield, quality and stability for producers but can also benefit other actors in the food system by reducing waste, ensuring reliable supplies, and maintaining prices. Current research focuses on the direct benefits of pollination to production while neglecting other actors, particularly waste.
3) **All actors in the food system can impact upon pollinators.** Production has direct impacts on pollinators though changes in land use and management, applying agrochemicals and through the use of managed pollinators that increase resource competition and disease occurrence. However, processing, retailing and consuming actors can all drive these direct pressures through their demands for specific crops and crop products and all actors, particularly transport and production, can contribute substantially to greenhouse gas emissions.
4) **The benefits of pollination services are important to achieving food system objectives.** By supporting the availability of quality, nutritious foods and reducing waste, pollinators are important to achieving food system objectives such as food security, equitable access to food and resilient production.

Pollinators and Global Trade

5) **Trade in animal pollinated crops is important to international food systems**. Approximately 18% of average national crop consumption (local production + imports - exports) stems from animal pollinated crops, with 3-8% of this consumption arising directly from pollination. Losses of pollinators therefore represents a significant risk to food systems on an international scale.
6) **The importance of pollinated crop imports for consumption and/or export will affect how vulnerable different actors within national food systems are to pollinator losses.** Current literature focuses on the vulnerability of local production to pollinator losses. In reality, a country's trade in pollinated crops can fall into four categories: local dependence (supplies depend on local pollinators), exporting (the export of pollinated crops is a significant economic activity), globally dependent (much pollinated crop consumption is imported) and throughout (countries export almost as much as they import). In each category, different actors will have different degrees of vulnerability to pollinator losses locally and globally.

Measuring and valuing pollinator natural capital

7) **Measuring and valuing pollinator natural capital stocks is important for informed decision making.** National accounts of pollinator natural capital are important for measuring and monitoring the supply of ecosystem services to the food system relative to its demand and estimating the value of these stocks.

8) **Pollinator natural capital stocks cannot be directly measured but must be estimated from primary field data.** Although pollinator populations can be indirectly measured from pollinator monitoring schemes, such schemes are challenging to implement at large scale. Furthermore, as pollinators require multiple habitats to persist and sustain themselves, they cannot simply be attributed to specific habitat types like other natural capital assets. Instead, a combination of species-distribution models of key crop pollinators and process-based models of pollinator abundance within the landscape should be employed to estimate the stocks of key pollinators.
9) **Valuing pollinator natural capital flows is difficult because of the challenges in double counting.** As pollination contributes to crop productivity, its value is theoretically captured by asset valuation of crops. An alternative approach is to value pollination as the costs of replacing pollinator natural capital with honeybees (manufactured capital) but this is unrealistic in many countries where paid pollination isn't commonplace and managed pollinator number are insufficient. A better approach is to value flows of pollination services as a separate asset, subtracted from the asset value of crop production.
10) **Measuring pollinator natural capital is constrained by the availability of ecological data.** Although modelling methods for modelling pollination service stocks and flows exist, they are constrained by a lack of information on i) the identity of key pollinators to specific crops, ii) the links between land use pressures and pollinator populations, and iii) the links between crop pollination and yield, relative to other inputs.

Valuing pollination services in the food system

11) **Economic studies into the benefits of pollination overwhelmingly focus on production**. There are very few studies within the literature that consider the value of benefits to other food system actors or account for the impacts of global trade on the economic vulnerability of countries to pollinator losses.
12) **Economic studies into the impacts of food system actors on pollination focus on production.** The majority of studies have only examined the direct economic impacts of land use and management on pollination. Some studies have explored consumer willingness to pay for pollinator-friendly produce, but no assessment of the impacts of changing consumer demands on environmental standards on pollinators directly has been done.
13) **The value of pollinator natural capital may not always be sufficient to justify preservation at a farm scale**. Several studies into the trade-offs between land use conversion and pollination service provision have concluded that the benefits of pollination from any given habitat patch may be less than the value of additional crops in the same area. In order to more accurately assess this trade-off, the value of pollination should be measured over time and alongside other potential ecosystem service benefits from the same habitat.

High priority research for valuing pollinators in the food system

14) **Further ecological data is needed for accurate natural capital modelling.** Focused field research to establish basic information on the identity of key pollinators to major and emerging crops is essential in many countries. Systematic pollinator monitoring can provide the necessary information to accurately model and map pollinator natural capital stocks across space and time. Experimental research to establish the marginal benefits of pollination, relative to other crop inputs is essential to accurately measure and value the scale of benefits to production.
15) **Analysis of the structure of food systems is crucial to fully measure values.** Analysis of national crop trade and utilization is a necessary step to identify key locally grown and imported animal-pollinated crops. Focused research through interviews and market analysis will be required to identify the structure of specific crop-supply chains within a food system. Developing a simple,

easily replicated international pollinator risk index, based on known pressures to pollinators, is important to identify countries that are vulnerable to pollination service losses.

Conclusion

16) By focusing on the localised interaction between pollination and production (both benefits to and impacts of), current research significantly under-values the benefits of pollination to global food systems. As the value of pollinator natural capital is potentially less than the opportunity costs of expanding agricultural activities, it is important to better capture the value of pollination to these other actors to incentivise greater participation in and funding of pollinator management. More accurate and useable pollinator natural capital accounts can be generated by creating well defined workflows from pollinator monitoring to modelling.