



Palm oil and biodiversity

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The environmental impacts of palm oil production have been in the spotlight for many years. Opinions abound about the impacts of oil palm plantations on biodiversity and ecosystem function, but how many of these are supported by research and to what extent are policies and practice informed by science? This Info Brief summarizes a systematic review of the scientific evidence and highlights some of the findings of immediate interest to policy and research communities.

Overview

The media is full of stories about both the damage done to the environment by oil palm plantations and about the huge success of palm oil production for countries trying to raise their economic standards. Developing sustainable businesses ('Green Business') means achieving economic success without damaging the environment. But just how much damage is being done by palm oil production? What does the science tell us? A systematic review is the best method for assessing this type of question, where there is plenty of disagreement and not much robust analysis.

Key questions

- Are biodiversity and ecosystem functions adversely affected by palm oil production?

- Are the impacts on biodiversity in other regions similar to those in South-East Asia, for example in West Africa, or tropical Latin America?
- Does plantation age affect biodiversity?
- Do different management practices or certification schemes have different impacts?

Key findings

- The variety of different species living in an oil palm plantation is lower than in the natural forest.
- The overall number of individual organisms in the plantation is not always lower than in the natural forest.
- There is very little evidence about the effects of palm oil production on ecosystem functions.
- More research is needed to help inform policy on these key questions.

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Background

Much has been written about the potential negative effects of oil palm cultivation; deforestation and land-use change from natural habitats to plantations may lead to the loss of biodiversity and disrupt ecosystem functions. However, given the importance of palm oil to global trade and rural development, particularly in South-East Asia and West Africa, it is unreasonable to expect the cultivation of palm oil to decrease in the medium-term (see Figure 1).

It is important to know the extent to which biodiversity can be maintained in oil palm landscapes and how they can best be managed to reduce ecological degradation and promote biodiversity alongside oil palm production.

Systematically reviewing the evidence on the effects of oil palm cultivation on biodiversity offers the best opportunity of understanding what scientific research has found to date. Specifically, this review sought to establish what science can tell us about species abundance, richness and composition in oil palm plantations, and what we know about how ecosystem functions are affected by them.

Using a systematic review approach

Systematic reviews are transparent and replicable, and seek to avoid the potential biases found in most literature reviews. They were developed in medicine to provide policymakers and practitioners with robust evidence that is as free from vested interests as possible. They are increasingly used for the same purpose in the area of natural resource management.

A systematic search was conducted on all available grey and academic literature using a repeatable search strategy. All articles derived from the search were evaluated against pre-established criteria. Both the search strategy and the quality criteria are publicly available.

The key criteria were that the original study:

- was conducted in the tropics
- reported original data

- had a comparison (oil palm) and a control (either primary or secondary forest) area to evaluate the effect of forest conversion on wild species.

The idea of using pre-established criteria is to limit selection bias when conducting the search, so that personal preferences cannot influence the selection of studies. Hence, only those studies that are scientifically robust will be included in the review.

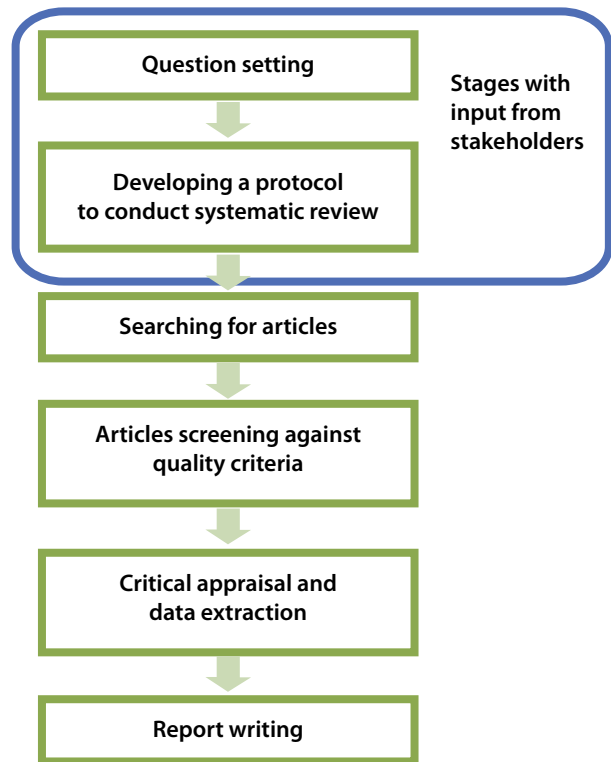


Figure 2. Stages of a systematic review

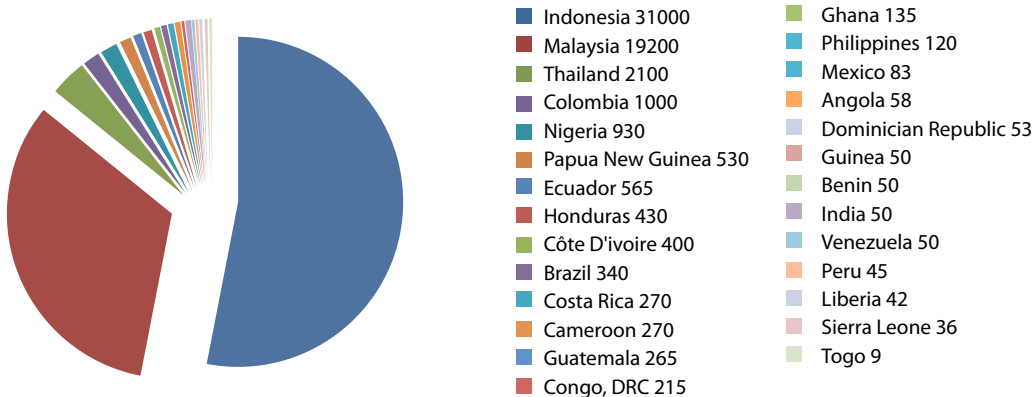


Figure 1. Global palm oil production (1000 MT)

Source: United States Department of Agriculture 2013

What the systematic review revealed

- The evidence base is limited.** Although the search returned a large number of diverse articles (9,143) only 25 of those fulfilled all of the quality criteria. Those that did not, were excluded at different stages (after reading the title, then the abstract, then finally the full paper – Figure 3). Of those 25 studies, 80% were conducted in one country (Malaysia) (Figure 4).
- Oil palm plantations have fewer species than primary or secondary forests.** The review showed that there were fewer species in oil palm plantations (figures 5 and 6), but it was not able to demonstrate clearly whether there is a difference across taxa.
- Overall abundance of individuals may not be impacted.** The review showed that the number of individuals increases in some species while it decreases in others.
- Species composition is different between plantations and forest areas.** Interestingly, this result was almost uniform regardless of the taxa studied.
- There is not enough evidence to determine causes of differences or relate the changes to ecosystem functions.** Disappointingly, none of the studies had specifically focused on ecosystem functions and reported whether these functions were affected by oil palm plantations. Some studies did discuss this topic without providing data, so it is clear that there is interest in finding out more.

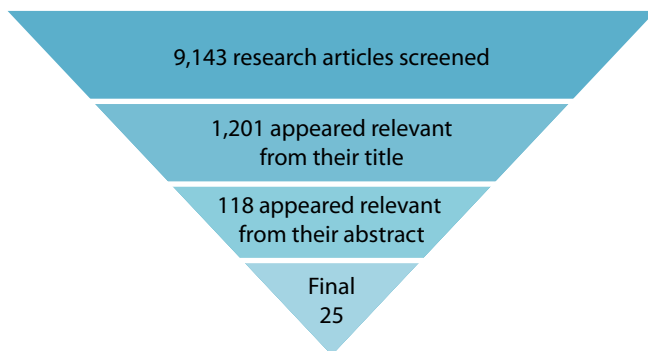
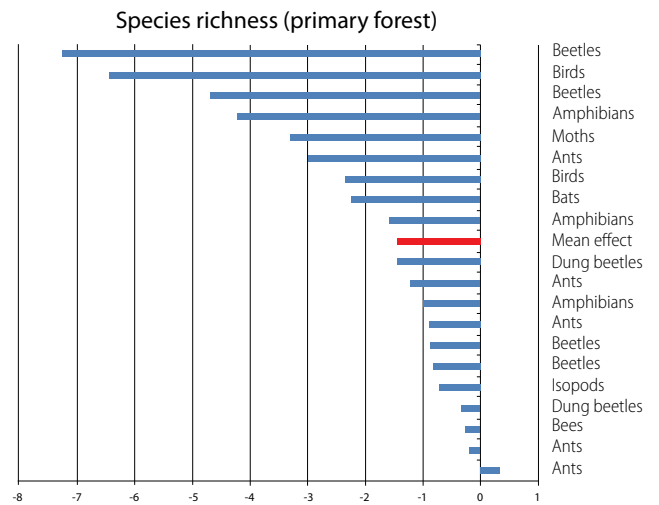


Figure 3. The number of articles at different stages of the screening process



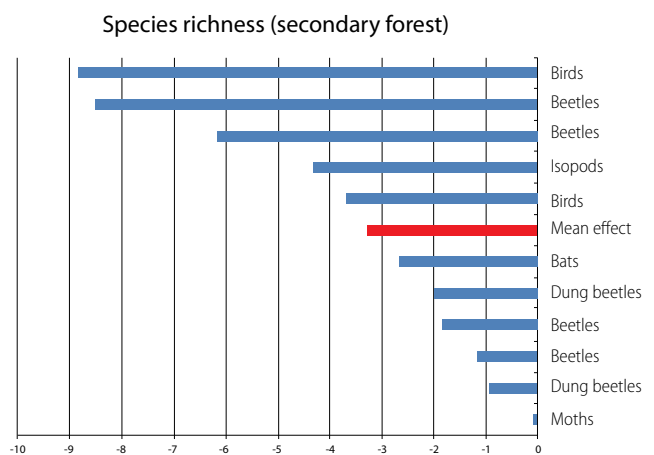
Figure 4. The location of the studies comparing biodiversity in oil palm plantations and forest areas (natural and secondary forest).



The estimated magnitude of the relationship

Figure 5. Difference in species richness between primary forest and oil palm plantation. Each entry on the y-axis represents a data point from a study. Some studies reported data for more than one species within taxa, e.g. two different beetle species, which explains the repetition of taxa on the axis

Note: The effect is negative on the left side of the zero line (i.e. fewer species in oil palm plantation) and positive on the right. The mean effect size (the estimated magnitude of the relationship) is highlighted in red.



The estimated magnitude of the relationship

Figure 6. Difference in species richness between secondary forest and oil palm plantation. Each entry on the y-axis represents a data point from a study. Some studies reported data for more than one species within taxa, e.g. two different beetle species, which explains the repetition of taxa on the axis

Note: The bars on the left side of zero line indicate a negative change. The mean effect size (the estimated magnitude of the relationship) is highlighted in red.

Recommendations

- Avoiding conversion of forests to plantations should be among land-use planning priorities.
- In the light of poor knowledge on biodiversity-related ecosystem functions, a precautionary approach to biodiversity and environmental management should be taken alongside the best management practices available.
- Landscape level studies are needed that contribute better knowledge of the impacts at larger scale – beyond simple habitat comparisons – as well as studies with a focus on functional values important to maintaining specific processes (e.g. bio-control, the nutrient cycle, pollination).

- Proper impact evaluation studies, which include the design and establishment phase of the plantation as well as day-to-day management, are needed to assess the impacts of certification and different management practices.

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