

# Can intensive farming save nature?

Last month, Sharpless and Hirshfield (*Guest Editorial*, 2012; 10[8]: 399) discussed how conservation and food production do not compete in the oceans. In the terrestrial realm, of course, the situation is different; as they pointed out, “On land there is a constant struggle between conservation and food production”.

There are roughly 130 million km<sup>2</sup> of ice-free land on this planet. Fully one-third of this land is currently used for agriculture (~12% and ~22% devoted to croplands and grazing, respectively). We have converted or modified ~20% of Earth’s forests and ~50% of its savannas, grasslands, and shrublands for farming. The pressure to convert land is unrelenting; the expected growth of the world’s human population, combined with shifts in diet as people become wealthier, may require a doubling of global food production by 2050. Roughly another 25 million km<sup>2</sup> (~20%) of land is estimated to be suitable for farming. While this is a lot of land, most of it lies beneath tropical rainforests, which have high ecosystem-service value. Thus, farming has been and will continue to be the major cause of habitat and biodiversity loss.

This realization has recently sparked a lively debate about the biodiversity benefits of land *sparing* (intensifying farming on existing lands, thus sparing land for nature) versus land *sharing* (which promotes lower intensity, but more extensive, “wildlife friendly” farming systems). Although the debate is far from settled, empirical studies to date suggest that land sparing may be more effective in protecting biodiversity, especially for forest-dependent species and species with limited ranges. This is not to deny that land sharing can increase the quality of the matrix and facilitate dispersal of organisms between remnant habitat fragments, thereby leading to higher biodiversity as compared with intensive farming systems. But intensifying existing croplands might have a greater benefit for overall biodiversity by minimizing the clearing of intact habitat.

Of course, there is a large caveat. A major criticism of land sparing is that there is scant empirical evidence that agricultural intensification actually leads to land sparing in practice. In fact, intensification is often accompanied by further expansion, as neighboring farmers adopt the novel practices. This implies either that the demand for the agricultural product has increased because of intensification or that the land sparing has occurred in another region of the world. Whether intensification can create increased demand of agricultural products is an important question; it depends on whether demand remains elastic as supply increases. Various new uses have been found for corn (as corn syrup, corn starch, and more recently, ethanol), for example, as a result of production beyond the needs of human food and livestock feed. Measuring land sparing through empirical analysis is thus confounded by: (1) the lack of a “control” situation to compare against – perhaps cropland would have expanded even faster had it not been for intensification; and (2) the fact that national-level analysis may fail to account for “leakage” of land sparing to other parts of the world.

So where does this leave us? What agricultural policies would maximize conservation? We believe that policies should be tailored to different conditions in different regions: land sparing is better suited to the tropics, whereas land sharing provides more benefits in temperate regions. In the tropics, there remain vast areas of intact forest habitat that are currently threatened by agriculture. This is also where hunger is widespread. Intensification in these regions can protect the rainforest, feed more people, and provide opportunities for economic development. The temperate regions, on the other hand, have experienced a long history of intensive agriculture, have already substantially modified biodiversity, and have relatively little intact natural habitat left. Intensification, rather than extensification, is the major source of environmental degradation (eg depletion of freshwater resources and eutrophication from nutrient runoff). Moreover, agriculture in temperate regions is mainly devoted to animal feed and biofuel production; and obesity, rather than malnutrition, is of greater concern. In temperate regions, then, land sharing is the better alternative.

We also need to broaden the debate beyond biodiversity. There are numerous other ecosystem services – including climate regulation, water flow and quality regulation, pollination, soil fertility, and so forth – of interest to conservation. The conversation should therefore be about “environmentally friendly farming” rather than wildlife friendly farming versus land sparing. Furthermore, it is imperative to consider the sustainability and resilience of the agricultural system itself.

The bottom line is clear. Finding more environmentally friendly ways to ensure that the projected 10 billion people of this planet have an adequate diet is one of the major challenges of conservation; on land, conservation cannot escape from the reality of agriculture.



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