

Protecting coffee from intensification

Sustainable agricultural intensification is one approach to meet food security and biodiversity conservation goals simultaneously (1, 2). The yield increases required to achieve these goals can be facilitated by using improved crops (3, 4). Pest-resistant or high-yielding crops may deliver higher returns than unimproved crops and thus alleviate pressures on remaining natural habitats. However, because higher yields increase household income, such improved crops may also incentivize farmers to expand cropland, which negatively affects biodiversity and ecosystem services. Arabica coffee, which is one of the most valuable agricultural commodities in the world, exemplifies this problem.

Wild *Coffea arabica* is a shrub native to the understory of the moist evergreen Afromontane forest of Ethiopia and is the ancestor of all commercial Arabica cultivars worldwide. In its region of origin, arabica coffee was originally harvested from wild populations, but over time, shade trees and coffee shrubs have been increasingly managed by farmers to increase coffee yields (5). Increased coffee yields improve local livelihood, but unfortunately the intensification of coffee agriculture is also degrading forest and causing severe biodiversity losses (6, 7). Even more important, excessive forest management and the use of locally improved arabica coffee cultivars are threatening the mating system and the genetic resources of wild *Coffea arabica*. Past and ongoing conversion of natural moist evergreen forest to heavily managed forest has already resulted in decreased pollen dispersal and increased self-pollination in wild arabica stands (8), and the original coffee gene pool already shows signs of admixture with cultivars (9). To date, three forests with wild *Coffea arabica* populations have been designated as UNESCO Biosphere Reserves in Ethiopia and a few others are proposed as reserves, but there are currently no guarantees that the genetic integrity of any of these populations will be maintained.

If the worldwide coffee industry plans to use the genetic diversity of the

Ethiopian wild coffee to adapt arabica coffee to climate change and emerging pests and diseases (10, 11), more conservation efforts in the Ethiopian coffee forests are urgently needed. The ongoing conversion of the last remaining wild coffee populations to managed agroforests must be halted to conserve wild coffee and its pollinators, and the use of improved cultivars in the immediate vicinity of these populations must be discouraged to avoid introgression of cultivar genes into the wild arabica gene pool.

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