Balancing production and culture: Sustainable agriculture in the Amazon

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Sustainable food production in developing countries is challenging, as it requires balancing scalability with respect for local culture and traditions. Bolivia represents a particularly interesting example; with over 36 recognized indigenous groups encompassing over 70% of the country's population in a relatively small territory, Bolivia is considered one of the most diverse countries in the world (Ferreira et al., 2019). Agriculture in Bolivia employs over 5% of the country's population and represents over 14% of its GDP. Yet, the introduction of new agribusiness approaches has often been met with resistance by the local communities. For example, the use of transgenic seeds in Bolivia is forbidden by law, with a single exception in soybean production (Avila and Izquierdo, 2006). As result, Bolivia is at a disadvantage in relation to its neighbors in agricultural production. In addition, high costs of transport and export of produce due to the landlocked nature of the country, compounded by logistic difficulties of exporting

through a third country, highlight the need of policies that facilitate a larger and more efficient food production.

In 2019, through Supreme Decree 3973, President Evo Morales authorized Bolivian farmers to implement “controlled burning” of lands in the Amazon, Chiquitano, and Pantanal forests (Rivero, 2019). Known locally as “chaqueo”, slash-and-burn agriculture has been commonplace in Bolivia for centuries as an inexpensive means for “land-use change”, to clear and fertilize land for agribusiness (Heuberger et al., 2002). That year, however, unprecedented levels of deforestation and unusually high wind speeds rendered the flames uncontrollable and countermeasure deployment proved prohibitively difficult in these isolated regions. Over 2 million hectares of Bolivian forests were burned, resulting in one of the major ecological catastrophes in modern South American history. It is calculated that recovery would take up to 200 years (5).

It is now clear that government-incentivized norms, as well as cultural attitudes towards the use of fire had a large role in the current ecological situation. Regardless of their scientific validity, these attitudes nonetheless reflect the will of sovereign nations. We therefore argue that to successfully develop long-term policies, citizens must be empowered with the scientific literacy to demand environmental responsibility and cooperation with international agencies. It is only through effective education that citizens and politicians can recognize--and critically evaluate--the real-world outcomes of environmental policies. Given the history of resistance to philanthropic efforts backed by industrialized economies, the temporal sustainment of such support is critical to fostering mutual trust (Bonilla-Aldana et al., 2019). For instance, foreign efforts, including the “Amazonia without fires” program, have not achieved sufficient traction within local groups (Bonilla-Aldana et al., 2019). Past experiences suggest that participatory educational

approaches provide a promising avenue for transmission of relevant scientific concepts, while encouraging interest and action in the issues at hand (Figure 1) (Ferreira et al., 2019; Carosso et al., 2019).

The recent ascent of Jeanine Añez to the presidency of Bolivia has dramatically changed the diplomatic landscape of the country. Implementing an “open-borders” policy that stands in contrast to her predecessor’s, the new administration has received strong support from developed economies, including the United States and the European Union (Jourdan, 2020). The new government has highlighted technology exchange and reforestation as high priorities for the country (Saucedo-Bendek et al., 2020). We therefore hope that allied nations will commit to arming local governments and communities with sustained expertise needed to manage future fire risks. New public policies should prioritize the incorporation of low-cost alternatives to slash-and-burn agriculture, as well as educating farmers in fire behavior and risk management (McDaniel et al., 2006). Specific measures that have demonstrated efficacy in similar contexts include, but are not limited to, the development of cash-transfer programs, tax regulations, and other economic incentives (Jacobi et al., 2017), as well as agronomic approaches that increase nitrogen fixation and land fertility (Calle, 2020), therefore reducing the need of slash-and-burn agriculture (Figure 1).

Bolivia represents an important opportunity for empirically-informed, and consistent, global outreach to local and rural groups. It is only through sustained international attention that the most objectively detrimental impacts of human activity--not merely those attracting temporarily attractive histrionics--can be counteracted with long-term environmental protection.

COMPETING INTERESTS

M.A.M.-R. is the Bolivian Science, Technology and Innovation Ambassador. The authors declare no other conflict of interest.

AUTHOR CONTRIBUTIONS

All authors wrote this manuscript.

Figure 1. Sustainable agriculture in the Amazon. Development of long-term sustainable agriculture in the Amazon requires participatory education approaches to shift cultural attitudes towards fire usage and evidence-based regulations.

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Participatory Approaches

Evidence-based Policy

Sustainable Agriculture

Figure 1
Gandarilla et al