

POLICY PERSPECTIVES

Global Coverage of Agricultural Sustainability Standards, and Their Role in Conserving Biodiversity

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Abstract

Voluntary sustainability standards have increased in uptake over the last decade; here, we explore their potential contribution to biodiversity conservation and other aspects of agricultural sustainability. We reviewed the content of 12 major crop standards and quantified their global coverage. All standards included some provisions for the protection of biodiversity, but we only identified two with criteria that prohibited all deforestation. We found records of certified cropland in 133 countries, and estimated that certified crop area increased by 11% (range 8.8–13.5%) per year from 2000 to 2012, but still only covered 1.1% (range 1.0–1.2%) of global cropland. The crops with the highest levels of certification were heavily traded commodities: coffee, cocoa, tea, and palm oil each had 10% or more of their total global production area certified. Coverage was lower for other crops, including the world's most important staple foods (maize, rice, and wheat). Sustainability standards have considerable potential to contribute to conservation, but there is an ongoing need for better evaluation of how effectively they are implemented. We present examples of ways in which governments, companies, financial institutions, and civil society can work together to scale up and target certification to places where it can have the greatest positive impact.

Introduction

Worldwide, agriculture is a leading cause of habitat loss, soil erosion, pollution, water-stress, and greenhouse-gas emissions. Smallholder farmers struggle to make a living in markets distorted by subsidies and inequitable trading relations, and problems of child and slave labor persist. In response to these environmental and social challenges, many countries have commitments to promote sustainable agriculture in national policy, as well as under Aichi Target 7 of the Convention on Biological Diversity which calls for “areas under agriculture... [to be] managed sustainably” by 2020. The United Nations' Sustainable

Development Goals also highlight the importance of sustainable agriculture for addressing global hunger and food security. As a complement to state-led governance, voluntary sustainability initiatives seek to codify the practice of sustainable agriculture in standards, defining criteria which producers must meet to be certified as environmentally and socially responsible (Milder *et al.* 2015).

Certification under these standards has expanded rapidly in recent years and its coverage highlighted as a key indicator of progress toward Aichi Target 7 (Tittensor *et al.* 2014). Certification provides a mechanism for improving practices and accountability in transnational supply chains (Blackman & Rivera 2011; Newton *et al.* 2013;

Potts *et al.* 2014; Tscharncke *et al.* 2015). It could be especially important in low- and middle-income tropical countries where the negative impacts of commodity production are rapidly increasing (Gibbs *et al.* 2010), and where governments often lack capacity and resources to regulate agriculture effectively (Barrett *et al.* 2001).

Certification also has limitations (Waldman & Kerr 2014), with complex and expensive certification processes limiting access for smallholders (Loconto & Dankers 2014; Brandi *et al.* 2015). Certified production also outstrips market demand, for example, only around 25% of certified coffee is sold as such (Potts *et al.* 2014). Certification is not the only pathway to agricultural sustainability, but it does provide a structured system to achieve and document improvements through clearly defined indicators and auditing mechanisms.

With increasing public and corporate interest in sustainable consumption, it is important to understand the contribution of certification to sustainable agriculture. We obtained data from published reports, and by direct contact with standard organizations. We reviewed each standard's content and assessed their potential contribution to conservation and other sustainability targets, quantified global coverage, and identified opportunities to enhance the role of certification. We focused on 12 major standards with an explicit biodiversity component for which data were available (Table 1).

How can certification support conservation?

Certification schemes have diverse origins and objectives: organic standards recognize crops grown without synthetic pesticides and fertilizers, fair trade aims to improve market access and prices for disadvantaged producers, and commodity roundtables were established to address the negative impacts of palm oil, soy, and other crops. Standards do not necessarily address all facets of sustainability, but most (including all those considered here) define criteria relating to biodiversity conservation as well as other environmental and social outcomes (UNEP-WCMC 2011).

We reviewed the inclusion of criteria relevant to conservation in the 12 major standards (Table 1). Most have: some requirement for producers to evaluate impacts and develop a management plan, but the extent to which biodiversity is considered is not always clear. All standards require farmers to meet legal obligations relating to protected areas, and most include provisions to protect priority areas such as primary forests. Our interpretation is that only two of the standards, Rainforest Alliance/Sustainable Agriculture Network (RA/SAN)

and Proterra, have criteria that aim to avoid all deforestation. Others, such as the Roundtable on Sustainable Palm Oil (RSPO), generally prohibit deforestation in high conservation value areas but may permit it elsewhere. Many standards include criteria to provide on-farm natural habitats, often riparian buffers, and some encourage conservation interventions in production areas, such as increasing the diversity and density of shade-cover trees (e.g., RA/SAN). On-farm biodiversity is further protected by restrictions on hunting and invasive species (e.g., Roundtable on Responsible Soy (RTRS)). All standards encourage soil and water conservation and regulate agrochemical use, with the aim of protecting both workers and ecosystems. An emerging theme is the inclusion of requirements to reduce greenhouse-gas emissions (e.g., Roundtable on Sustainable Biomaterials).

The efficacy of different standards for conservation is variable, both because of differences in criteria, and in whether all criteria need to be met for certification. To conform to the Common Code for the Coffee Community (4C), for example, producers can compensate for poor performance in one area (e.g., biodiversity conservation) by achieving a high rating in another (e.g., soil conservation).

Does certification achieve its objectives?

There is evidence for a range of social, economic, and environmental benefits of certification (Loconto & Dankers 2014; Potts *et al.* 2014), but here, we focus on biodiversity conservation. Selection bias poses a challenge to disentangling the extent to which certification changes farmer practices, rather than rewarding self-selecting farmers who already meet most requirements (although both scenarios can support sustainability objectives). Several studies have now examined the environmental effects of certification using rigorous methods such as propensity-score matching (reviewed by Lambin *et al.* 2014; Tscharncke *et al.* 2015), and provide evidence for positive impacts of certification. For example, organic coffee certification in Costa Rica reduced inputs of chemical pesticides, fertilizers, and herbicides, and increased adoption of shade trees and soil conservation practices (Blackman & Naranjo 2012); similar results were demonstrated in Colombia (Ibanez & Blackman 2016). RA/SAN certified coffee farms in Colombia showed greater increases in shade-tree cover compared to uncertified farms, and certified farmers were more likely to use practices that reduce water use and pollution (Rueda & Lambin 2013; Rueda *et al.* 2014). In Ethiopia, certified forests with wild-harvested coffee were less likely to be deforested than uncertified forests and those without coffee (Takahashi & Todo 2014).

Table 1 Agricultural certification standards reviewed in this article, with the total area under certification, largest crops by area (up to three), countries with largest area (up to three), and an indication of biodiversity criteria which are required (filled circles), ambiguous/partial (open circles), or absent (dashes)

Standard	Area certified (ha) in 2012	Largest crop(s) by area	Countries with largest area	Requirements relevant to biodiversity conservation									
				Impact evaluation and management plan	Avoid impacts on protected areas and HCV	Avoid impacts on protected natural habitats (excl. HCV)	Provide on-farm habitat	Protect wildlife from hunting/over exploitation	Reduce impacts of invasive species	Reduce pollution from agro-chemical use	Water conservation	Soil conservation	Reduce greenhouse gas emissions
Organic cropland (IFOAM)	14,952,715	Cereals, coffee, and oilseeds	Spain, Italy, and United States	–	•	–	•	○	–	•	•	•	–
Rainforest Alliance/SAN	2,283,514	Coffee, cocoa, and tea	Côte d'Ivoire, Ghana, and Kenya	•	•	•	•	•	•	•	•	•	•
Roundtable on Sustainable Palm Oil	2,105,433	Palm oil	Indonesia, Malaysia, and Papua New Guinea	•	•	–	•	•	•	•	•	•	•
Fairtrade	1,827,500	Coffee, cocoa, and tea	Dominican Republic, Ecuador, and Peru	○	•	–	•	•	•	•	•	•	•
Proterra	1,293,845	Soybean	Brazil	•	•	•	•	•	•	•	•	•	•
Common Code for the Coffee Community (4C)	1,033,041	Coffee	Brazil, Colombia, and Vietnam	○	•	•	•	•	–	•	•	•	○
UTZ	834,706	Coffee, cocoa, and tea	Côte d'Ivoire, Sierra Leone, and Ghana	○	•	•	•	•	–	•	•	•	•
Better Cotton Initiative	683,000	Cotton	Pakistan, Brazil, and India	○	○	•	•	–	–	•	•	•	○
Cotton Made in Africa	564,286	Cotton	Zambia, Côte d'Ivoire, and Mozambique	○	•	–	–	–	–	•	•	•	–
Bonsucro	500,000	Sugar cane	Australia and Brazil	•	•	○	•	–	–	•	•	•	•
Roundtable on Responsible Soy	354,967	Soybean	Brazil, Argentina, and India	•	•	•	•	•	•	•	•	•	•
Roundtable on Sustainable Biomaterials	14,186	Sugar cane	Peru	•	•	•	•	•	•	•	•	•	•

Note: Specific requirements and how they are measured and audited vary considerably between standards. One further standard listed by Potts et al. (2014), Global GAP, is not included here, as data were unavailable.

Nonetheless, the literature also illustrates complex trade-offs and unintended consequences of certification. While promoting wildlife-friendly certified agroforests in Mexico could maintain on-farm habitat for some forest species (Philpott & Bichier 2012), they also risk incentivizing conversion of natural forests to agroforests (Tejeda-Cruz *et al.* 2010). In India, demand for organic fertilizer has resulted in increased livestock numbers and grazing impacts in protected forests (Madhusudan 2005). Protecting forest fragments in oil palm landscapes in Borneo increased species richness of birds, but was less effective than protecting an equivalent area of contiguous forest (Edwards *et al.* 2010).

Whether certification will make a meaningful contribution to biodiversity conservation at regional and global scales will depend both on efficacy and geographic coverage. While certified products are rapidly moving from niche to mainstream markets (Potts *et al.* 2014), there has been no systematic assessment of the geographic coverage patterns of agricultural certification, and thus of its likely contribution to conservation goals at scale.

Rapid growth, but limited global coverage

To address this, we quantified coverage in hectares by country and crop in each year (2000–2012) for the 12 major certification standards for which data were available (see Supporting Methods). We combined data from these standards, while recognizing that they vary in their emphasis on different sustainability components, and in the stringency of their requirements.

Total area under certification increased by an estimated 11.0% (range 8.8–13.5%) annually, from approximately 5.7 million hectares in 2000 to 15–25 million hectares in 2012 (Figure 1). There was an unknown degree of overlap between different standards (as farms may hold multiple certifications), so our central estimates were based on the midpoint between the area if no standards overlapped, and that if they overlapped completely, on a country-by-country basis. By 2012, certification had reached relatively high levels for some crops, covering 24% of all coffee production areas and 14% of all cocoa areas. However, across all crops, coverage remained low, at just 1.1% (range 1.0–1.2%) of global cropland (Figure 2, Supplementary Information). Staple crops, which are often consumed locally or domestically, had relatively small areas under certification: coverage of wheat, maize, and rice ranged from just 0.1% to 0.5% (Figure 2). In contrast, widely certified crops were also highly exported: e.g., coffee, cocoa, tea, and palm oil (proportion of crop certified vs. proportion of crop ex-

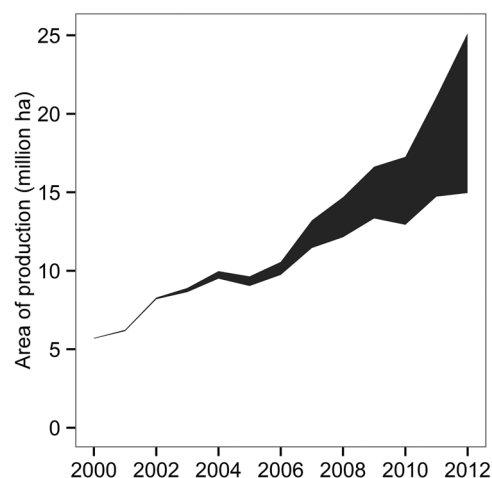


Figure 1 Total area managed under certification for cropland commodities in 2012. Since multiple certifications can apply to the same area of land, we estimated the minimum area as the area of the single largest standard, and the maximum area by summing areas across all standards, on a country-by-country basis.

ported: $\beta = 0.47 \pm 0.07$, $P < 0.0001$, adjusted $R^2 = 0.71$, Figure 3).

These patterns were perhaps unsurprising given that the impetus for certification originated mostly with consumer, company, and civil society demand in developed countries with recent growth focused on managing specific environmental and social risks associated with tropical commodities. There are fewer incentives for farmers in developing countries to adopt certification for domestic crops.

Certified cropland was found in 133 countries and territories (out of 207 considered). Those with the highest percentage of certified cropland were the Dominican Republic (15%, primarily cocoa) and Zambia (14%, primarily cotton)—both classified as middle-income by the World Bank (Figure 4, Tables S1 and S2). Certification coverage was especially sparse in the 31 countries classified as low-income (Figure S1). Sierra Leone, with 8% of its cropland certified (exclusively cocoa), was the only low-income country with more than 2% coverage (Tables S1 and S2). Certification, while potentially important for the livelihoods of a large number of individual farmers, covered little farmland in the world's poorest countries.

Could spatial targeting increase the benefits of certification?

If the current rate of increase in certified area were maintained, global coverage could reach approximately 4% (range 2–6%) by 2020 (see Supplementary Materials):

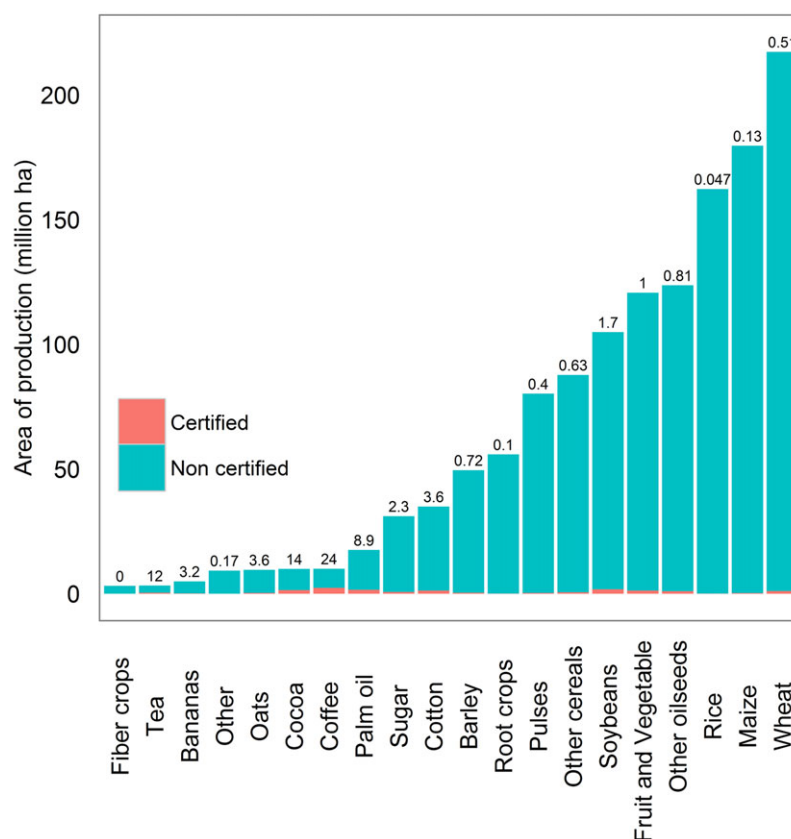


Figure 2 Harvested areas for different commodity groupings in 2012, with certified area shown in pink and the percentage certified given above each bar.

a modest contribution to Aichi Target 7. However, certification could contribute disproportionately to sustainability goals if it were targeted toward the places where benefits could be optimized. For example, where a specific issue (e.g., clearance of rare habitats) is of particular concern, where standards have criteria to address that issue (e.g., prohibition on habitat conversion), and where enabling conditions exist (e.g., government policies that complement certification). Some broad targeting of certification already exists: commodity roundtables focus on crops like oil palm and soybeans that pose acute risks through land-rights violations and tropical deforestation. However, there have been few efforts to target it spatially to incentivize best practices and reduce the negative impacts of agriculture.

For example, certification that reduces agrochemical use could be applied in key water-supply catchments and priority areas for aquatic species sensitive to pollution. The “Salmon-safe” certification advocates this concept within key Pacific salmon catchments, introducing management to reduce erosion, sediment runoff, water withdrawals for irrigation, and pesticide use (<http://www.salmonsafe.org/>).

Where certification can improve yields and incomes through good farming practices, it could be applied as a development intervention in poor communities. For example, Africa grows around 11% of the world’s coffee, but yields there are 30% lower than on any other continent (FAO 2015). RA/SAN certification improved the well-being of coffee farmers and reduced their exposure to price volatility in Colombia (Rueda & Lambin 2013), and might also improve the livelihoods of African coffee farmers.

Frontiers of expansion for commercial plantations of oil palm, rubber, and pulpwood, such as those in the Afrotropics (Rival & Levang 2014) and Neotropics (Gilroy *et al.* 2015), could be foci for the application of standards to safeguard primary forests and other areas of conservation value. Certification could help preserve and buffer natural habitats, and improve compliance with existing but poorly implemented laws. For example, certification of groups of farms could help maintain tree cover in coffee farms close to natural habitats, and prevent further habitat conversion (Rueda *et al.* 2015; Tschamtker *et al.* 2015). Further efforts are needed to identify places where certification could help address

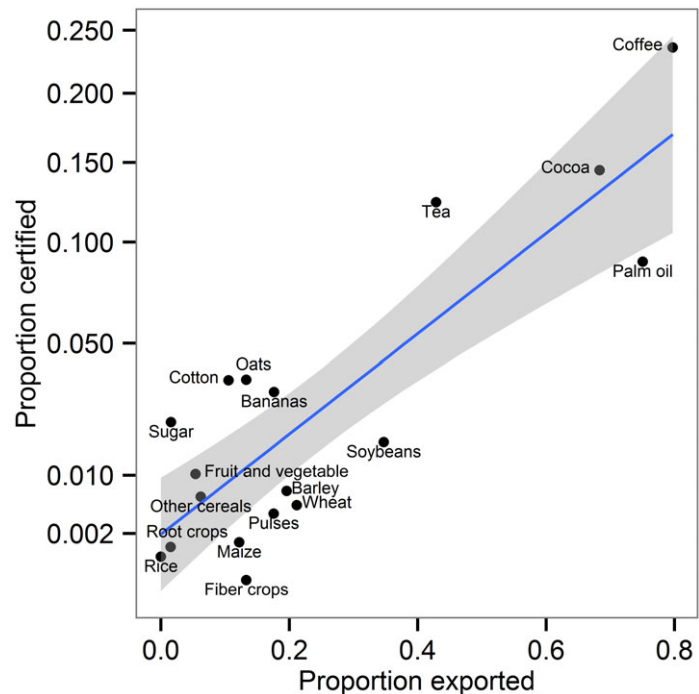


Figure 3 The relationship between the proportion of harvested area certified and the proportion of crop production that is exported. Y-axis scale is arcsine-transformed.

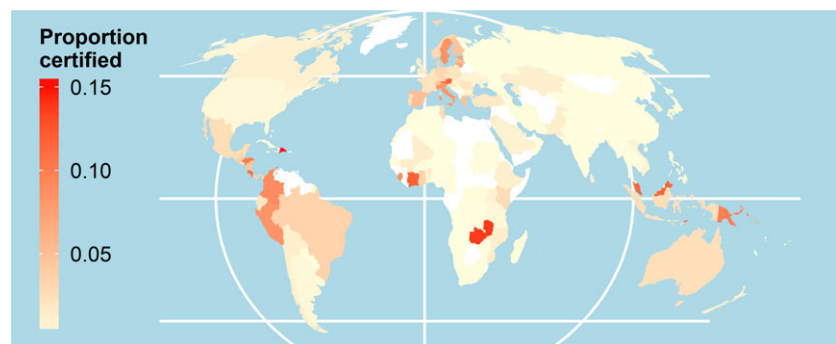


Figure 4 Proportion of harvested crop area certified by country. Countries with no identified certification are shown in white.

specific sustainability issues, and to define which enabling conditions are the best predictors of success.

Working together to scale up certification strategically

Currently, geographic patterns of certification are market-driven, reflecting companies' sourcing areas for key commodities, and their existing relationships with exporters (e.g., Getz & Shreck 2006; Neilson 2008). Adopting a more strategic approach for increasing certification in priority areas will require cooperation between a number of actors—so-called “hybrid governance” (Lambin *et al.* 2014). Governments and civil society need to act alongside leading companies and financial institutions: identifying where certification might have

the greatest benefits, raising awareness and support for action, and requiring or incentivizing certification in those places. Potential roles of different actors are outlined below.

Governments

Governments play a key role in defining the context for certification, for both the products their countries produce and those they import. Although certification could substitute for public policy in places where governance is weak, it is likely to be most effective where governance provides a strong supportive framework. Governments within producer countries could have a greater influence on certification uptake and support strategic targeting by requiring sustainability criteria as a condition of project licensing in high-risk areas. This approach is being

explored through “jurisdictional certification” initiatives, for example, by RSPO and the provincial government in Central Kalimantan, Indonesia, to address specific challenges producers face in reducing deforestation, greenhouse gas emissions, and improving social welfare. In Papua New Guinea, the abuse of oil palm “special agricultural business leases” to acquire land for logging (Nelson *et al.* 2014) might be mitigated by ensuring that all applicants are members of the RSPO, will comply with their criteria, and have good track-records. Mandatory government-led initiatives could also replace or complement third-party certification standards, ensuring that sector laggards, adhere to minimum standards. For example, national standards for oil palm in Indonesia and soybeans in Brazil have been developed, although there remains a risk of weak standards displacing stronger ones (Hospes 2014).

Governments in importing countries face diplomatic and regulatory complexities to prefer (or avoid) imports based on specific geographic origin, but have a range of other policy tools at their disposal that can directly and indirectly support efforts to spatially target certification. For example, international aid could finance certification as an intervention in identified priority areas for social and economic development (e.g., least developed countries).

Private sector

Corporate enterprises are free to set production criteria for the goods they purchase, and are increasingly making commitments to sustainable sourcing, prompted by NGO pressure, competition to establish a positive brand image, and because sustainable sourcing makes good business sense (Dauvergne & Lister 2012). Some commitments already have a spatial component, for example, companies participating in the Amazon soya moratorium refused to buy soy grown on land deforested since 2006 (Gibbs *et al.* 2015); while Unilever and Marks and Spencer recently made a commitment to preferentially source from jurisdictions that reduce deforestation and greenhouse gas emissions. Certification is one of the most promising mechanisms for delivering and auditing commitments such as zero-deforestation pledges (Brown & Zarin 2013; CLUA 2014). As discussed earlier, however, most standards do not exclude all deforestation, so additional criteria may be needed to ensure this specific objective.

When large companies make sustainability commitments, they are effectively choice editing: taking certain decisions out of consumers’ hands. Because of the scale of business purchasing, this is likely to be more effective at increasing demand for certification than rely-

ing upon individual consumers. For example, Unilever, which buys 1% of the world’s cocoa, has committed to using only certified sources by 2020. Multinational companies, that boycott unsustainable producers across their supply chains, may help to drive uptake of certification in economies where standards do not yet have much salience with the public, such as India and China (Newton *et al.* 2013).

Financial and development sectors

Financial institutions increasingly use sustainability criteria to assess loans and investments. For example, the Equator Principles, adopted by 80 international institutions, support sustainable resource management through independent certification systems (Equator Principles 2013). The UN Principles for Responsible Investment Certification provides a transparent and convenient way of screening and auditing adherence to some sustainability criteria (Ring 2015). In principle, financial institutions could design investment criteria to incentivize strategic spatial targeting, such as requiring compliance with standards requiring zero (gross) deforestation in sectors and regions where deforestation is a concern.

Investments by financial and development institutions (e.g., World Bank, African Development Bank, USAID, and DFID) are governed by social and environmental safeguards and could support uptake and targeting of certification to maximize benefits. For example, the International Finance Corporation, which funds farmer training centers, could target regions where there is little certification, supporting farmers in the application process. Targeted support for microfinance schemes could also assist smallholder participation in certification, by allowing farmers to cover the costs of certification and upgrade their production systems and infrastructure (Rueda & Lambin 2013).

Civil society

The identification of where certification can have the most social and environmental benefit will likely fall to civil society organizations (including NGOs, academics, the media, and in some cases standard governance bodies). Working with more powerful actors can bring accusations of “greenwashing” (Robinson 2012)—but also has great potential. For example, WWF has played a significant role in the establishment, monitoring, and improvement of the commodity roundtables, such as the RSPO and the RTRS. Targeted campaigns by activist organizations such as Greenpeace have influenced the sustainability commitments of a number of businesses, such as the zero-deforestation commitments and Soy Moratorium

described earlier. Moreover, companies as well as governments increasingly look to civil society organizations to identify critical issues, monitor success, and demand improvements from market-based sustainability initiatives including certification. Civil society can support spatial targeting of certification by continuing to highlight the issues, sectors, and locations where certification and complementary forms of governance could make the greatest positive contribution.

Conclusion

Our analysis of certification indicates that while there uptake for some crops and regions has been strong; globally, most cropland is not covered by voluntary standards. For certification to deliver greater conservation impact, there is a need to prioritize standards and practices to those places where they can make the greatest difference. We see two emerging opportunities for certification to support biodiversity conservation and other aspects of sustainability. First, public and corporate organizations can mandate the adoption of certification standards or their component requirements, prioritizing high-risk crops and places, to deliver on their sustainability commitments. These commitments could include jurisdictional government policies, corporate sourcing policies (e.g., zero-deforestation commitments), and finance sector lending guidelines (e.g., the Equator Principles). Second, we see an increasing role for certification schemes not just in setting benchmark standards, but also in catalyzing uptake of better practices at the field level; streamlining systems for value-chain auditing, traceability, and transparency; improving monitoring and evaluation; and sharing innovation from certification systems to be adapted and used by other actors.

Certification schemes alone will not ensure biodiversity protection or agricultural sustainability, but their mission-driven nature and private governance structures put them in a unique position to innovate and demonstrate best practice. Although worldwide coverage of certification is relatively small, it could play an increasingly important role in biodiversity conservation if it is scaled up, prioritized to where it is most needed, and coordinated with public and corporate policy.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web site:

Figure S1: Boxplot showing the percentage of cropland certified broken down by World Bank income ranking.

Table S1: Certified cropland area by country in 2012

Table S2: Certified area estimates in hectares for each crop grouping within each country in 2012

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