15

Certification Process in the Coffee Value Chain

Achievements and Limits to Foster Provision of Environmental Services

Gabriela Soto and Jean-François Le Coq

Introduction

Various mechanisms have been promoted to foster the provision of ecosystem services. Product certification is one of the most promising and developed instruments to reward the socially and environmentally friendly practices of market producers.

This strategy started with organic production and Fair Trade, but in recent years has grown to a wide variety of certification labels, with the coffee sector experiencing the largest development. Before and during the coffee crisis of 2000 to 2003, different labels emerged, such as Smithsonian Bird Friendly coffee, Rainforest Alliance, Starbucks CAFE practices (Coffee and Farmer Equity practices), Utz Kapeh (now Utz Certified), the Common Code for Coffee Community (4C) and recently Nestlé's Nespresso AAA label. This trend is not unique to the coffee sector; similar certifications are being developed for sustainable cocoa, pineapple, cattle and palm oil. This strategy is growing and proving an important potential in changing how our food is produced.

With more years of implementation, the coffee sector offers a wide perspective to analyse the achievements and limits of this strategy in fostering environmental services. This chapter describes the development of the certified coffee market and the characteristics of the different certification strategies within Central America. We then review their achievements and limitations in promoting ecosystem services, particularly related to biodiversity conservation, and their reported socio-economic impacts. Finally, we propose areas of improvement to increase their potential as a tool to foster the provision of ecosystem services in the region.

Origin and Development of Sustainable Coffee Labels

There are three stages in the creation of sustainable coffee labels that explain the differences in objectives, methods and impacts. The first phase is linked to the global development of organic and Fair Trade (Fairtrade Labelling Organizations, or FLO, certified) production. This phase experienced exponential market growth during the 1980s, but did not enter into the Latin American coffee sector until the early 1990s, and it gained strength during the coffee crisis of 2000 to 2003 (Ponte, 2004). The second phase incorporates the development of labels with a biodiversity protection focus, during the late 1990s, such as the Smithsonian Institute Migratory Bird Centre's Bird Friendly certification and Rainforest Alliance's Sustainable Agriculture Network (SAN) (see Chapter 3 in this volume). The Rainforest Alliance label was first well known in the forestry and banana sectors, and later in the coffee sector. During and after the coffee crisis, the third group of sustainable coffee labels was developed, incorporating socially responsible coffee trading companies, such as Starbucks CAFE practices, Nespresso AAA, Utz Kapeh (now Utz Certified), promoted by Ahold (a collaboration between a supermarket in The Netherlands and coffee farmers in Guatemala), and 4C (a joint effort between coffee trading and producer organizations) (see Figure 15.1).

Organic production and Fair Trade initiated the awareness process of a consumer willing to fund the required changes at the farm level, in order to ensure a greater supply of ecosystem services and to improve producers' quality of life (Raynolds, 2002; Loureiroa and Lotade, 2005). Through these two labels the basis for third-party certification was also developed (Ponte, 2004).

Organic certification was launched in Europe and the US under the leadership of organic farmers and alternative consumers groups and associations, such as the Soil Association (England), Naturland and Bioland (Germany) and, in the US, the California Certified Organic Farmers (CCOF), the Organic Growers and Buyers Association (OGBA), the Organic Crop Improvement Association (OCIA), Oregon Tilth Certified Organic (OTCO) and Florida Organic Growers (FOG). In 1991, both Europe and the US enacted laws controlling the marketing of organic products (EU Regulation 2092/91 and US Organic Foods – Farm Bill Act 1990) because of the increase in public interest

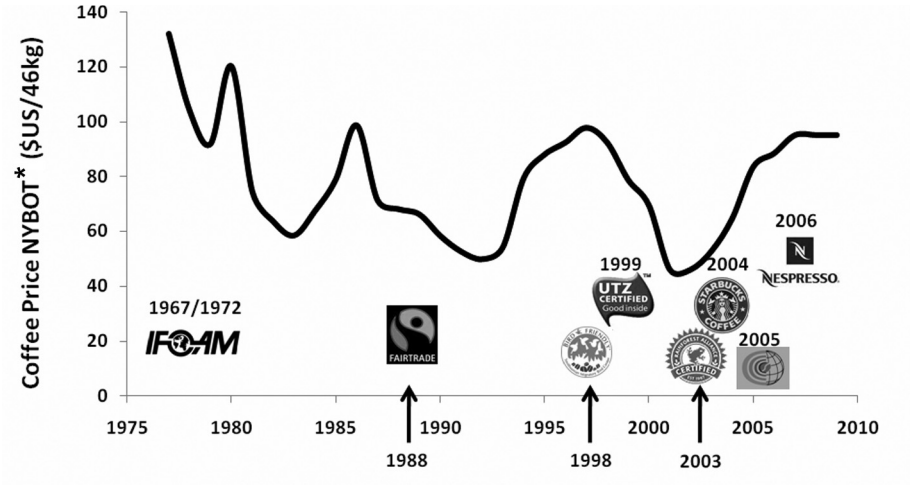

Figure 15.1 *World coffee prices and development of sustainable coffee labels over time*

Source: chapter authors, using information from ICO (2009)
* New York Board of Trade

in organic products. In 1999, the United Nations published the *Codex Alimentarius* for organic production. Among the sustainable coffee labels, only organic production has standards with legal status.

By 2000, the organic and Fair Trade coffee market was widely developed in large part due to the development of consumer consciousness and a legally established guarantee system. According to a *Coffee Sustainable Survey* of the US Coffee Specialty Industry, by the year 2001, 66 per cent of the coffee roasters sold at least one brand of organic or Fair Trade coffee and 77 per cent thought that the overprice of US$0.59 to $0.69 per pound of coffee was suitable (Giovannucci, 2001). But it was the coffee crisis that was the impetus of all coffee certifications (see Figure 15.2). The production of organic, Fair Trade, CAFE practices, Rainforest Alliance and Utz Certified coffee grew among farmers due to the better prices and the lower perceived risk (Ponte, 2004; Giovannucci and Potts, 2008). A survey conducted in 2010 showed that 16 per cent of all coffee entering the US market is certified, with an important primacy of Starbucks coffee, with around 2280,000 bags of 46kg in 2009. Rainforest Alliance and Nespresso AAA, although with a smaller volume, are showing the greatest average growth in the last four years (74 and 70 per cent, respectively) (Giovannucci, 2010).

Growth and development of coffee labels in Central America

In Central America, as in the rest of the world, organic and Fair Trade lead the way in coffee-sector certifications. Organic coffee was promoted by non-governmental organizations (NGOs) with a history of supporting agroecology

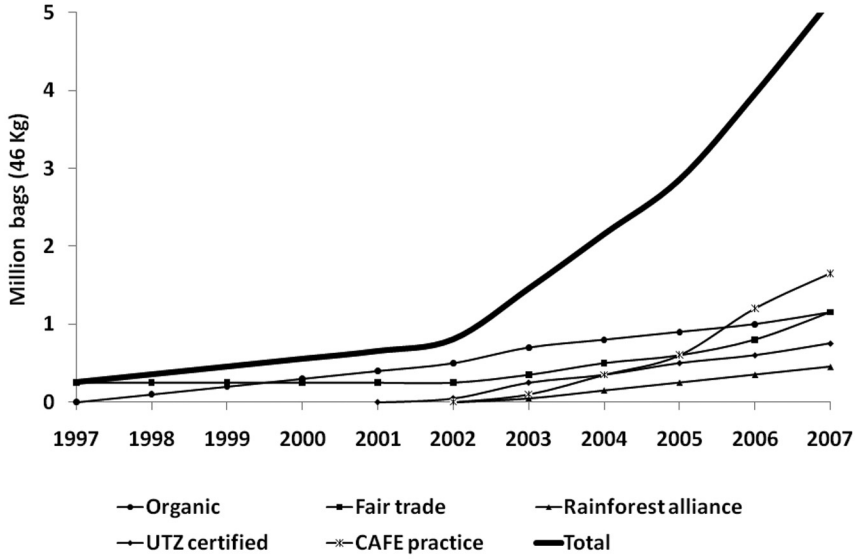

Figure 15.2 *Coffee certification growth in the world market, 1997–2007*

Source: chapter authors, using information from ICO (2009)

in co-operatives or small farmers' associations, as well as by foreign producers based in the region with strong ties to the US and European Union (EU) markets (Britt Coffee in Costa Rica in 1994, OCIA Chapter in Guatemala in 1996, etc.). Organic and Fair Trade production grew exponentially in the region during the coffee crisis and was an important strategy to support farmers in overcoming the coffee crisis (Lyngbaek et al, 2001; Ponte, 2004; Philpott et al, 2007; Cárdenas, 2008).

Fair Trade certification development was linked to the European market and funding agencies, such as Ebert Foundation and the Consortium of Cooperatives of Coffee Growers (COOCAFE) from Guanacaste and Montes de Oro, one of the pioneers who started marketing Fair Trade coffee in 1989 (Ronchi, 2002). The impact of Fair Trade certification in overcoming the coffee crisis was also crucial. Farmers with organic and Fair Trade labels were able to sell coffee at much better prices than conventional coffee (see Table 15.1).

Other labels, such as Rainforest Alliance, Starbucks CAFE practices and Utz Certified label, also grew rapidly during and post-crisis in Central America (see Table 15.1). Not all countries in Central America were able to differentiate between the amounts of exported speciality coffee as the Instituto Hondureño del Café (IHCAFE) could for Honduras.

Table 15.1 *Honduras speciality coffee exported (volumes and sale prices) from the 2005–2006 harvest*

Coffee seal	*Volume (bags of 46kg)*	*Average price (US$/bag)*
Organic	40,479	132.7
Utz Kapeh	17,578	105.8
Fair Trade/organic	10,395	138.2
Rainforest Alliance	9052	112.3
Fair Trade	8185	129.3
Organic/Fair Trade/Rainforest Alliance	2317	150.0

Source: IHCAFE (2006)

Strategies of Sustainable Coffee Certification

This section presents the characteristics of the various existing certification systems and analyses their limits and opportunities to foster ecosystem services (ES) provision.

The success of certification as a strategy to increase the supply of ecosystem services on farm depends on the different components of the certification structure:

- the objective and content of the standards that determine the level of intentionality towards ES provision;
- the certification structure which affects the liability of the requisite compliance control, its costs and the degree of access for farmers; and
- the market recognition that determines the economic incentive for the farmers' effort (investment) to comply with the normative and provide ES.

Certification must not only ensure service provision, but promote the profitability of the certified activity, such as coffee production. Thus, each component has the challenge of achieving a balance between these two main objectives: guarantee the ES provision for consumers' trust, and guarantee farmers' access and profitability. For example, the standards should be strict enough to guarantee the ES provision, but not so strict that farmers would not comply. Inspectors' farm visits should be sufficient to guarantee standards compliance, while maintaining affordability for the farmer (see Table 15.2).

The objectives and content of the standard

We analysed the standards in terms of objectives and contents, and discussed the implications in terms of potential effects on ES provision.

Objectives

It is important to understand that ecosystem services provision is not always the priority for all sustainable coffee standards (see Table 15.3). Specific labels

Table 15.2 *Challenges of the certification structure to guarantee the ES provision, farmer access and profitability*

Standard component	*Ecosystem services (ES) provision*	*Producer: Facilitate access and increase revenues*
Standards objectives and contents	Guarantee the provision of ES.	Enable cost-effective productivity. Promote a farmer strategy of continuous improvement.
Standards compliance control structure: accreditation body, certification body and inspectors	Guarantee equal compliance to the standards in all regions and among all farmers and farmers' organizations. Maintain a reliable guarantee system that is transparent for consumers, buyers and governments.	Adapt to local conditions. Be respectful of farmers' traditions and practices. Ensure that costs are accessible for farmers. Keep costs accessible to national and international agencies (these costs will eventually be transferred to the farmer).
Market recognition	Establish prices according to the ES provided. Give preference to products providing more ES.	Provide market prices (premiums) that compensate for the required investments and the decrease in productivity. Ensure stable prices, which will give confidence to the producer for long-term investments.

focus on social priorities rather than environmental, such as Fair Trade, while other certifications put more emphasis on ensuring that coffee quality meets their niche market requirements, such as CAFE practices and Nespresso AAA, who only certify coffee produced 800m above sea level. Seals are sometimes developed to promote the use of a baseline for sustainable coffee production (such as 4C).

Nevertheless, consumers do not perceive differences among labels, but maintain the perception that every sustainable coffee label guarantees environmental protection, appropriate social conditions and a fair price for farmers.

Table 15.3 *Main objectives of the different sustainable coffee labels*

Label	*Environment*	*Social*	*Cup quality*[1]
Organic	+ + + +	+	–
Smithsonian Bird Friendly[2]	+ + + +	+	–
Fair Trade[3]	+	+ + + +	–
Rainforest Alliance	+ + +	+ + +	–
Utz Certified	+ +	+ +	–
Starbucks CAFE practices	+ + +	+ +	+ + +
4C	+ +	+ +	–
Nespresso AAA	+ +	+ +	+ + +

Notes: 1 Organoleptic characteristics. 2 Organic certification required. 3 In 2008, Fairtrade Labelling Organizations (FLO) added a detailed section on environmental standards.
Source: authors, based on interviews with auditors and certified co-operatives

Table 15.4 *Basic requirements of sustainable coffee certification standards and compliance control system*

Criteria/ requirements	*Organic*	*Smithsonian Bird Friendly*	*Fair Trade*	*Rainforest Alliance*	*Starbucks CAFE practices*	*Utz Certified*	*4C*
Criteria specific for coffee	No	Yes	No	Yes	Yes	No	Yes
Allow synthetic pesticides use	No	No	Yes	Yes	Yes	Yes	Yes
Transition period required before certification	3 years	Must be organic	No	No	No	No	No
Compliance assessment		Full compliance system			Scoring system		

Many labels have widened their scope of action to face this challenge, such as Fair Trade's environmental standards improvement or Rainforest Alliance's inclusion of climate change standards.

Content and design process of certification standards

Certification criteria vary among the different labels based on their objectives and the scope of standards. Some certifications are generic for all crops, while others are specific to coffee, allowing a greater degree of precision in aspects such as shade (see Table 15.5). Thus, organic, Fair Trade, Rainforest Alliance and Utz Certified are not coffee specific, whereas Smithsonian Bird Friendly, Starbucks CAFE practices and 4C are coffee specific (see Table 15.4).

The technical support behind each of the standards is also variable and depends on when the standards were developed and what methods were used to develop them. The first versions of the organic standards were written during the 1960s and 1970s by farmers and consumer associations in Europe or the US. These standards were later voted into the International Federation of Organic Agricultural Movements' (IFOAM's) General Assembly, with participants from around the world. While these methods were very democratic and participative, ecosystem services technical data was limited. In contrast to this strategy, the Smithsonian Bird Friendly seal developed its standards based on scientific data of the impact of coffee intensification (Rice, 1999) upon migratory bird behaviour in the Mesoamerican coffee landscape (Greenberg et al, 1997a, 1997b). As a result, these coffee-specific standards have a clear objective for a defined region. Bird Friendly seal research has since become the template for defining new criteria for other standards.

Variability of contents and possible practices regarding ES provision

Since shade structure and management are directly linked to biodiversity within the coffee system (Perfecto et al, 1997; Moguel and Toledo, 1999; Mas

Table 15.5 *Coffee shade requirements in sustainable coffee labels*

Requirement	*Organic*	*Smithsonian Bird Friendly*	*Rainforest Alliance*	*Utz Certified*	*Starbucks CAFE practices*	*4C*
Regulation version	NOP-USDA, 834/2007 889/2008	April 2002	February 2009	Version 1.1 January 2010	November 2009	May 2009; generic indicators February 2010
Must have shade in the coffee plantation	No mention of shade	Yes	Only for crops usually managed in agroforestry systems or in a natural forest region	If compatible with local production practices and considering productivity	Shade required where the natural vegetation was forest	No mention of shade
Diversity (number of species ha^{-1})		10	12	–	'Several species'	–
Minimum height of main species (m)		12	–	–	–	–
Strata		3	2	–	–	–
Percentage minimum shade year round		40	40	–	Additional points for 10%, 40% or 75% shade	
Native species		'Top strata'	'Preferable'	–	Additional points if only native species are used	

and Dietsch, 2004), they provide a good example of understanding standards' variability regarding impacts upon ES provision. Standards that are not coffee specific, such as organic, do not mention shade structure in their requirements; but shade must be implemented to control weeds, promote biodiversity and manage coffee nutrition within the farm system. On the other hand, standards such as Smithsonian Bird Friendly clearly define the number of trees per hectare, the height of the trees and a minimum shade percentage (see Table 15.5).

The lack of shade criteria or the fact that shade is optional within the scoring system has made it possible to have Utz Certified, 4C, Starbucks CAFE practices, Fair Trade, organic and Rainforest Alliance certified farms with few or no shade trees. The implications of this for ecosystem services provision will be discussed further in this chapter (see also Chapter 3 in this volume).

The scoring system used in Rainforest Alliance, Starbucks CAFE practices or Utz Certified offers the farmer the possibility of being certified and receiving consumer recognition (potential premium) at the initial stages of implementing criteria while improving farm management. Full compliance with the standards is a requirement to be a certified farm for organic and Smithsonian Bird Friendly programmes. The scoring system strategy risk comes from the consumer's perception of certified farms. Most consumers are not aware of the

different standards, which potentially could result in lost confidence when they see a full sun farm certified as a sustainable farm.

Adaptations of content and variability of certification application and practices

Some labels have made an effort in adapting standards to regional conditions. In 2009, Rainforest Alliance hosted workshops to discuss the coffee standard of each Mesoamerican country, with participation from farmers, co-op technicians, government extension agents and the academic sector, to guarantee that the standards are adapted to local conditions and to define training issues for local inspectors.

As a result of this consulting process, some standards were adapted to local conditions. For example, Rainforest Alliance and Starbucks CAFE practices define the shade requirement based on the natural growth of the area before agriculture. Therefore, if the natural growth in an area was forest, shade is required, but if it was prairie, shade is not necessary. One of the concerns with this 'optional and gradient' standard system is that there is more room for interpretation by inspectors. Adequate training for inspectors or auditors is fundamental for the success of the programme. Farmers often complain about the interpretation variability of the standards pending the inspector's visit each year.

The regional standards adaptation process has been analysed by developing standards committees worldwide for many years. On the one hand, adaptation has the advantage of considering different biophysical and socio-

Table 15.6 *Components and characteristics of the standards compliance control structure of sustainable coffee certification*

Standards compliance control structure	*Functions*
Accreditation body	Controls the operation of the certification agencies based on ISO 65 and ISO 19011 requirements, as well as each specific standard. The accreditation body can be a private company or a governmental institution such as the National Organic Programme of the US Department of Agriculture (USDA).
Certification agency	Certifies coffee production and processing based on: • the farm management plan (FMP) provided by the producer; • the inspection report, which establishes potential non-compliances.
Inspector verifier	The inspector receives a copy of the FMP from the certification agency. The inspector then visits the farm and/or the processing plant. A detailed report is sent to the certification agency with the potential non-compliances observed in the field.
Farmer or farmers' organization	• Develop a FMP and send it to the certification agency to apply for certification. • The inspector visits the farm or processing plant. • A corrective plan of action is developed to comply with the non-compliances found on the farm.

Table 15.7 *Application structures for different labels in coffee certification in Costa Rica*

Who?	*Organic*	*Smithsonian Bird Friendly*	*Fair Trade*	*Rainforest Alliance*	*Utz Certified*	*4C*	*Starbucks CAFE practices*	*Nespresso AAA*
Defines the standards	National and international legislation	Smithsonian Institute of America	International advisory committees coordinated by each of the headquarters of these labels				Starbucks in collaboration with Conservation International	Designed by Rainforest Alliance*
Controls private agencies' activities (accreditation)	Governments: NOP-USDA** in the US; Plant Health and Quarantine Service in Central American countries	Must be ISO 65 accredited	They certify themselves or work in collaboration with other certification agencies	Most of the certification is done by themselves or in strategic alliances with NGOs	ISO 65 accredited agencies; they also monitor the certification agencies	Certify themselves	ISO 65 accredited agencies and Scientific Certification Systems†	Rainforest Alliance
Controls standards compliance (certification function)	Private agencies or government offices	Independent private agencies	Fairtrade Labelling Organizations (FLO) certified	Control division of Rainforest Alliance	Independent private agencies	Internal personnel	Independent private agencies	Rainforest Alliance auditors
Rule of compliance assessment	Full compliance system			Scoring system				

Notes: †Private company contracted by Starbucks to develop its certification system.
* The Nespresso AAA are not public standards.
** National Organic Program of the United States Department of Agriculture.

economic conditions of each region; on the other, it could increase the variability of implementation and, by doing so, risk losing consumers' credibility. For example, a coffee farmer in Central America who invests in shade management and accepts a decrease in productivity may feel it is unfair to have the same label as a full sun coffee from the Cerrado in Brazil.

Structures of the Control System

The compliance control system structure of sustainable coffee certification is critical to the certification strategy because it is the mechanism that gives credibility to the eco-label strategy. Thus, it should be transparent, fair and strict enough to be trustworthy. Nevertheless, it should be cost effective and adaptable in order to ensure farmer adoption. In this section, the different control structures and their implications in terms of system liability and efficiency are presented.

The basic structures of the certification control system

Certification's compliance control system is essentially composed of three main actors who assume three specific functions (see Table 15.6).

Each label has developed different certification structures from the field visits selection criteria (see Table 15.7). The fact that organic standards are enforced by public regulation makes the standards definition a very structured, open process, relying on government official implementation. However, in most cases, modifications are difficult and time consuming for all stakeholders, while private standards are easier to modify.

Differences are also observed in the accreditation system. While organic certification is mainly government controlled (private accreditations are also available, such as the Organic Accreditation System (OAS) from IFOAM), there are standard-setting bodies that conduct the certification themselves, where accreditation by a third party is not required (e.g. Rainforest Alliance certification). The advantage of having an accreditation system is that the division of roles between the standard-setting and standard-controlling bodies increases the transparency of the process. However, it also increases the certification cost. Nonetheless, Utz Certified and Starbucks CAFE practices have implemented accreditation systems through their regional offices with no additional cost for the certification agency or the farmers.

Cost control, monitoring and farmers' accessibility

One of the highest costs in the promotion of ecosystem services through certification is compliance inspection and monitoring. The certification process moves about US$200 million worldwide, from field inspectors and agency coordination and certification decisions, to agencies in accreditation processes with governments as well as private agencies (e.g. ISO 65). Sooner or later these costs are transferred to the producer or the consumer, and have become a

Table 15.8 *Organic, Fair Trade and Rainforest Alliance certification costs of eight case studies in coffee production in Costa Rica, 2007*

Label	*Zone*	*Form of certification*	*Coffee area (ha)*	*Certification cost (US$ ha^{-1})*
Organic	Los Santos (Tarrazú)	Individual	3.5	43.8
	Central Valley	Individual	56.4	33.4
	Pérez Zeledón	Association	6.6	12.6
Fair Trade	Los Santos	Co-operative	4.2	0.7
	Pérez Zeledón	Co-operative	2.1	0.5
Rainforest Alliance	Los Santos (Tarrazú)	Co-operative	2.8	11.8
	Central Valley	Individual	49.7	40.1
	Turrialba	Individual	675	9.6
Conventional	Los Santos	Individual	7.1	0
	Pérez Zeledón	Individual	8.5	0

Source: adapted from Moreno et al (2009)

growth constraint. Case studies in Costa Rica show high variability in certification costs (Moreno et al, 2009) (see Table 15.8), depending on certification type (individual or group), agency, size of and access to farms, number of inspection days, etc. The size of the organization (number of certified producers) is a factor that strongly affects the certification cost per hectare (fixed costs versus variable costs). In the study sample, we worked with organizations of different sizes (Coopetarrazú with 2600 producers; CoopeAgri – Fair Trade certified with 16,000 producers; and associations of organic producers with 15 to 20 producers), which justified the variation in costs per hectare. Surveys with cocoa producer organizations in Central America reported similar certification costs for organic and Fair Trade certification (PCC, 2010).

Currently, many efforts have been made to reduce these costs at the producer level, including collective certification of small producer groups; funding agencies supporting small producers to cover certification costs; training of local inspectors instead of working with international inspectors; local certification agencies; reducing the frequency of visits; etc. The reduction of these costs should be a constant quest of the certification programmes themselves. For example, the Smithsonian Bird Friendly label achieved cost reduction through its union with organic certification, which enables it to reduce the number of inspection visits to one for both certifications, to reduce the frequency of audits from one per year to one every three years, and to avoid accreditation cost for agencies. Other labels such as Starbucks CAFE practices and Rainforest Alliance have developed similar efforts. Farmers' organizations that adopt multi-certification and a common system of internal control systems are able to reduce the costs of investment in training, record-keeping, etc. at the farm level.

Multiplicity of standards and access to farmers

Another difficulty that farmers encounter in the organic sector is to have different standards for different markets. The current structure of the organic market states that no matter where the products are produced in the world, they must be produced following the standards of the regions where the products are sold. Producers selling to the US market must meet the NOP standards (Part 205 of Title 7 of the Code of Federal Regulations USDA), while producers exporting to Europe must comply with European Union Regulations 834/2007 and 889/2008, and exports to Switzerland or Japan must comply with Biosuisse or Japanese Agricultural Standard (JAS) regulations, respectively. As a result, producers from exporting countries who want to maintain their access to diversified markets have more constraints than producers from developed countries, such as Europe and the US, in selling to their local markets.

This additive effect of requirements has made farmers feel that the regulations are constantly changing and becoming stricter with time. This was mentioned as one of the reasons why farmers are stepping out of organic coffee in Central America (Haggar and Soto, 2010).

Variability of rules of compliance and access to farmers

Another aspect relevant to farmers' access is the method of evaluation of compliance. Different labels are currently using two systems: the full criteria compliance method used by organic, Smithsonian Bird Friendly and Fair Trade, and the scoring system. In the full compliance system, the producer must ensure that all requisites are certified. In the scoring scheme, most of the requisites have a score and a minimum score certifies a producer (e.g. 60 per cent of the total score for CAFE practices). However, a balance between the three main topics (environmental, social and transparency factors) is required. Farmers, for example, cannot have high scores in social issues that will balance low performances in environmental issues. In addition, there are compulsory 'critical criteria'. Among these criteria are aspects such as minimum salaries, child labour, anti-discrimination, etc. This scoring assessment system is used by Rainforest Alliance, Starbucks CAFE practices, Utz Certified and 4C.

There are two consequences regarding the differences in the assessment system. First, full compliance systems are stricter than scoring systems and tend to be more clearly understood by consumers; but the scoring system offers a more inclusive pattern from the producers' point of view. It enables facilitation of a continuous improvement process within the framework of the certification, whereas in a full compliance system, farmers have to develop the compliance by themselves. Second, the existence of various assessment systems tends to complicate the comparison between certifications regarding their impact upon provision of ecosystem services; certified farmers with a scoring system may have a variety of farmers' practices.

Incentives for Certification and Farmers' Interests

Producers adopt certification for a variety of reasons: an interest in protecting the environment and family health, access to niche markets, better prices or price stability, or (as a certified producer said in Nicaragua) 'I would do anything not to go through the same anxiety that I suffered during the coffee crisis.' But the reason why they decided to become certified does not matter; they will not remain unless they are recognized for their efforts. We describe here the modalities of economic rewards to producers and analyse their results and limitations.

Characteristics of economic incentives

Economic rewards to compensate the certified producers' efforts take various forms according to various labels. The common perception is that certification will lead to a premium over the conventional market price. Yet, the reality is more complex.

The only certification which establishes a premium as part of the standard is Fair Trade, which explicitly regulates commodity prices, and obligates traders to pay a minimum price as well as a premium for development of US$5 to $10 kg^{-1} of coffee. No other certification has control over the certified coffee price. However, some of the labels developed by coffee businesses have established a reward system. For example, Starbucks gives a one-time premium to CAFE practices producers who make improvements during the initial years. Producers of Utz Certified coffee or Nespresso AAA are offered a fixed

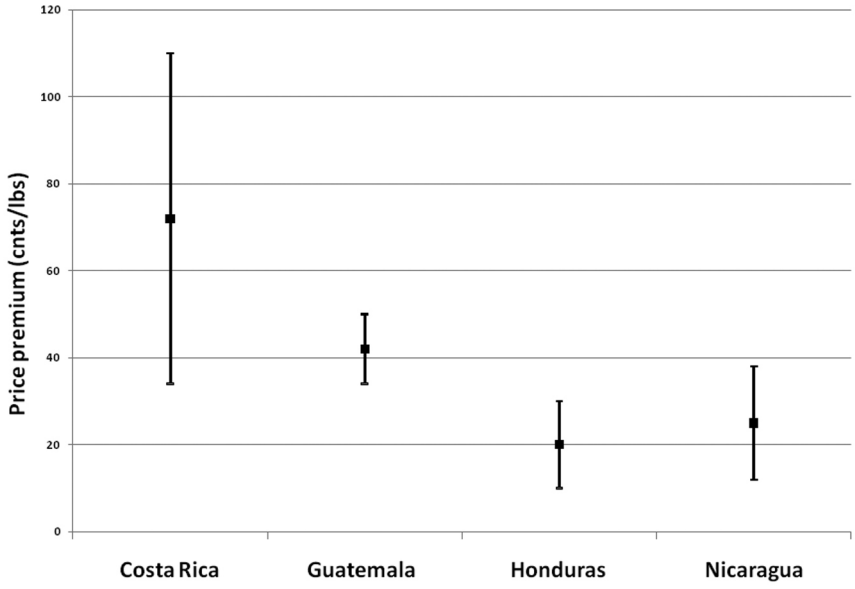

Figure 15.3 *Price premium for organic certified coffee in Latin America harvest 2002/2003*

Source: adapted from CIMS (2004)

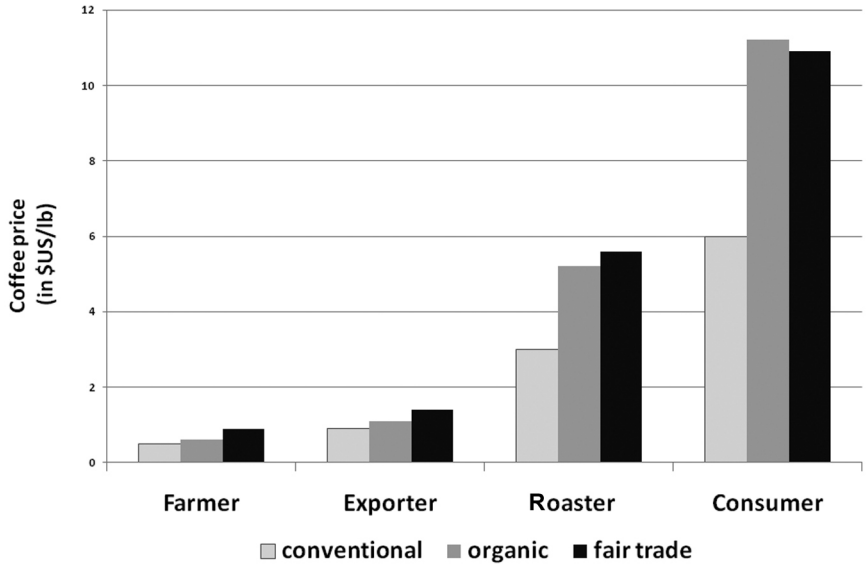

Figure 15.4 *Coffee price distribution in the coffee value chain*

Source: CIMS (2004) and ICO (2004)

premium (from US$2 per 46kg for the former, to US$5 per 46kg for the latter, according to producers interviewed by the authors in Costa Rica in 2007). For organic and Rainforest Alliance, the premium is an element of price negotiation between producers and traders and, thus, depends on market rules. Whereas Rainforest Alliance association is constantly and actively promoting its label with traders and roasters, there is no specific promotion for organic products. Organic certification agencies are specifically forbidden to do so by ISO 65 accreditation requirements. Nevertheless, since it is the better-known label in the market, the premium for organic is usually the largest one (see Table 15.1 and Figure 15.5). Other labels, such as 4C, do not promote a premium system. Therefore, the premium linked to certification, with the exception of organic, is generally very limited in comparison to conventional price. According to our estimation, in 2007 in Costa Rica, the average premium level, except for organic, represented between 1.5 and 7.5 per cent of the conventional price.

A second characteristic of the economic reward is that there is no guaranteed reward level. The reward level is variable and depends on offer and market demand in this market segment and on the price level in the conventional market. For example, the premium for organic/Fair Trade production was around US$70 to $100 per 46kg compared to conventional production during the coffee crisis during early 2000; however, it was only US$5 to $10 per 46 kg in 2009 during a high price conjuncture in international markets (Haggar and Soto, 2010).

Table 15.9 *Evolution of the number of organic producers in Central America*

	Number of organizations participating in workshops	*Number of organic producers in these organizations**		*Percentage change in the total number of organic producers Between 2004–2005 and 2009*
		2004–2005	*2009*	
Guatemala	5	1277	738	–42%
Nicaragua	7	2718	2485	–8%
Costa Rica	7	897**	388**	–57%

Notes: * Information based on workshops held in 2010 in Nicaragua, Costa Rica and Guatemala. Data provided by producers participating in the workshops. These are not country averages but averages of the organizations that they represent.
** Data collected by students from CATIE (Quispe, 2007; Ramirez, 2010). This is a country average.
Source: adapted from Haggar and Soto (2010)

As the economic reward is linked to the coffee commodity market, the price of coffee depends not only on certification, but also on other factors such as quality, technology and organoleptic characteristics, as well as marketing of the product or how well the region is known (Tarrazú in Costa Rica; Antigua or Huehuetenango in Guatemala). Thus, the premium reflects not only the ES provision, but also commercial attributes. Organic producers in countries such as Costa Rica and Guatemala benefited from better organic production premiums than other countries in the region for their quality and origin of fame. For example, during the 2002 to 2003 harvest, they received an average premium of US$70 per 46kg of green coffee, while countries such as Nicaragua and Honduras received a premium of US$20 to $30 (see Figure 15.3) (Kilian et al, 2004).

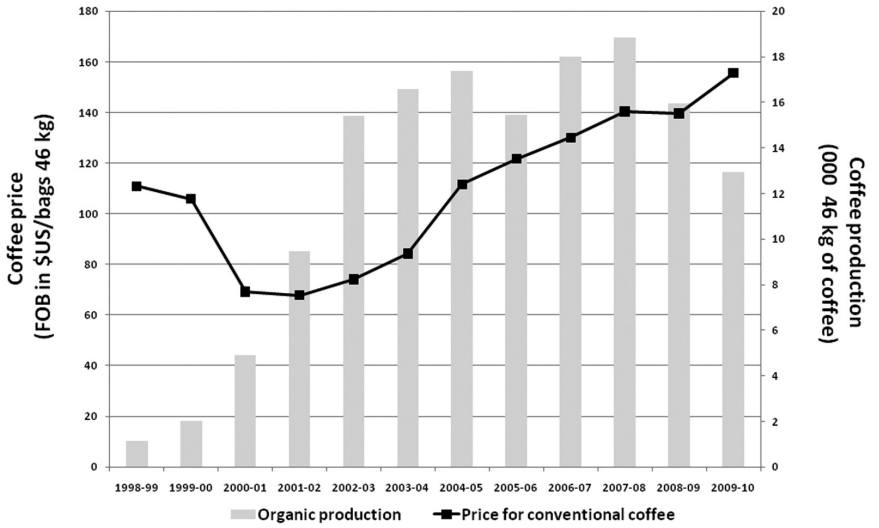

Figure 15.5 *Organic coffee production (46kg bags) in Costa Rica from 1989 to 2009–2010 harvest*

Source: authors based on ICAFE data from 2010

Another characteristic of economic rewards is no premium guarantee since certification does not give a guarantee to effectively sell the coffee as certified coffee. For most eco-labels, it is common that producers have to sell a part or sometimes all of their certified production as conventional production because they cannot find a trader interested in the product. This has been particularly the case for Fair Trade, Utz Certified and Rainforest Alliance during the last few years since certified production exceeded demand. Indeed the volume effectively sold as Fair Trade, Utz Certified and Rainforest Alliance at the Central American level was only 14, 32 and 32 per cent of the certified production, respectively (authors, based on Kilian and Pratt, 2009).

Finally, the rewards distribution along the commodity chain is not regulated by the certification standard. Thus, the producers have no guarantee of receiving the entire premium that the consumers paid for the product. Indeed, the price premium paid by the consumer is distributed among all of the actors of the commodity chains. In many cases, the additional price paid by the consumer is higher than the additional price received by the producers (see Figure 15.4) (CIMS, 2004).

Economic rewards and benefits for producers: The importance of productivity

In spite of economic rewards, the number of organic coffee producers in Central America has suffered a decrease during the last few years (see Table 15.9). Moreover, according to personal communications with leaders of co-operatives and producers in the region, the producers' interest in other coffee labels is also declining. The common reason to explain this tendency is that economic rewards do not cover the producers' efforts to comply with certification standards. The benefits for producers are a critical factor in the sustainability of the certification strategy.

Organic certification shows that because recognition for the provision of ES is paid by quintal of coffee, what is important is not just the premium received per quintal, but also the number of quintals sold. During periods when the difference between organic/Fair Trade production compared to

Table 15.10 *Comparison of productivity in organic and conventional farms in Central America, 2009*

	*Average productivity in organic farms (quintals ha^{-1})**	*Average productivity in conventional farms (quintals ha^{-1})**	*Reduction of productivity between organic and conventional (%)*
Guatemala	10	13	23
Nicaragua	10	14	29
Costa Rica	12	25	52

Notes: * Data provided by producers participating in the organic coffee crisis analysis workshops. There are no country averages, but averages from the regions that they represent.
1 quintal = 46kg of green coffee.
Source: adapted from Haggar and Soto (2010)

conventional production was important (e.g. US$70 to $100 during the coffee crisis years), the producer felt rewarded and the amount of organic coffee production increased (see Figure 15.5); but during periods of high conventional coffee prices, the organic or Fair Trade premiums do not pay for the differences in productivity (as in 2009, where the differential was US$5 to $10). This reduction of productivity results from the density and management of shade trees, and the limited use of organic fertilizers.

The differential between organic and conventional productivity is not equal in all Central American countries (see Table 15.10); countries with higher productivity in conventional coffee, such as Tarrazú in Costa Rica or Huehuetenango in Guatemala, are regions where most organic farmers have already converted to conventional or some other sustainable certification. Moreover, in areas with recognized quality coffee and high coffee price, such as Tarrazú, there is no interest in organic production since organic coffee premiums do not compete with the premium obtained for quality.

For other labels, the situation seems less stringent. Although the economic rewards are lower than for organic coffee, the reduction of productivity when complying with requisites seems to be less than for organic coffee. For example, CIMS (2006) shows that in the region, Rainforest Alliance and Utz Certified coffee productivities ranged from 38 quintals to 40 quintals ha^{-1}, which was comparable to conventional production levels.

Finally, producers' perceptions are also an important element for the sustainability of the eco-label mechanism. A survey showed that while producers' satisfaction was initially high, it has decreased over time because the economic reward is less than originally offered (Giovannucci and Potts, 2008).

Impact of Sustainable Coffee Certification upon the Provision of Ecosystem Services and Farmers' Welfare

Provision of ecosystem services

The provision of ecosystem services from agroforestry systems has been widely documented (Schroth et al, 2004; Montagnini, 2006; Jose, 2009), and there is clear evidence that the two main factors that will increase biodiversity and the provision of ES are shade tree diversity and distance to forest patches (including impact of riparian forest, live fences, etc.) (see also Chapter 3 in this volume). However, farmers have little control over the organization of the landscape outside of their farm, so shade management is the area where certification could have an impact in improving the provision of ES. But after reviewing the variability that exists in the shade criteria and in the implementation of these criteria in the field (see Table 15.5), one may wonder about the real impact of certification upon the provision of ES. Unfortunately, there is little scientific evidence which compares the impact of the different seals upon the provision of ES, with the exception of organic and Smithsonian Bird Friendly (see Table 15.11).

Table 15.11 *Studies comparing the provision of ecosystem services in certified coffee farms in Mesoamerica and Brazil*

Ecosystem service	*Indicator*	*Region*	*Certification*	*Main results*	*Source*
Biodiversity and pests and disease	Fruit-consuming butterflies and forest birds	Chiapas, Mexico	Organic, Rainforest Alliance, Bird Friendly and conventional	More variation with shade structure than with certification label. Farms with more complex shade structures were more diverse.	Mas and Dietsch (2004)
	Trees, epiphytes, birds, ants and yield	Chiapas, Mexico	Organic, Organic + Fair Trade, conventional and 'similar to' Rainforest Alliance and Bird Friendly (no certified farms in the region)	The ideal for biodiversity is standards more specific to tree requirements.	Philpott et al (2007)
	Tree diversity	Costa Rica	Organic, conventional, Fair Trade, Rainforest Alliance, CAFE practices and Utz Certified	CAFE practices, Rainforest Alliance and Utz Certified no difference in percentage shade from conventional. Rainforest Alliance, organic and Fair Trade were different from conventional in the biodiversity of trees.	Quispe (2007)
	Ants	Turrialba, Costa Rica	Organic and conventional (including a diversity gradient of high diverse to low diverse)	Organic farms had higher species richness.	Barbera et al (2004)
	Cicadellidae			Higher diversity of Cicadellidae on organic shaded systems.	Ramos (2008)
				Less nests in organic shaded systems.	Varon et al (2007)
Hydrological services	Native species number and conservation of water resources	Minas Gerais, Brazil	Rainforest Alliance and conventional	Rainforest Alliance had higher numbers of native species and better water conservation.	Palmieri (2008)
Soil quality	Soil carbon	Cartago, Costa Rica	Organic and conventional	More homogeneous distribution of soil carbon in organic farms.	Payan et al (2009)

Table 15.11 *Studies comparing the provision of ecosystem services in certified coffee farms in Mesoamerica and Brazil (Cont'd)*

Ecosystem service	*Indicator*	*Region*	*Certification*	*Main results*	*Source*
	Organic matter, mycorrhizae and nematodes	Guatemala and Brazil	Organic and conventional	Higher contents of organic matter, mycorrhizae, bacteriophages and nematodes in organic production.	Alfaro (2004)
	30 indicators of soil quality	Turrialba, Costa Rica	Organic and conventional with and without timber trees and bananas	Higher additive Index of Soil Quality (ICSA) (combination of different variables of soil) in organic farms.	Porras (2006); George (2006)
	Ground cover	Costa Rica	Organic, conventional, Fair Trade, Rainforest Alliance, CAFE practices and Utz Certified	Significant differences in the ground cover of organic farms.	Quispe (2007)
	Earthworms and microbial biomass and yield	Turrialba, Costa Rica	Organic and conventional with different shade trees	Similar yields and microbial biomass between organic and conventional farms. More earthworms in organic.	Sanchez de León et al (2006)
	Soil fertility	Turrialba, Costa Rica	Organic and conventional with different shade trees	Higher P, Ca and K, and lower acidity after four years of organic management.	Soto et al (2007)
Provision	Other products extracted from the organic farm	Turrialba Costa Rica	Organic and conventional	Organic farms were more profitable when considering the other food products produced on-farm; but coffee productivity was lower on organic farms.	Cárdenas (2008)
	Profit and coffee yield	Costa Rica	Organic and conventional	22% less yield in organic, 5% more profitable.	Lyngbaek et al (2001)
Carbon sequestration	Carbon footprint	Turrialba, Costa Rica, and Masatepe, Nicaragua	Organic and conventional with different shade trees	Higher CO_2 kg^{-1} ha^{-1} on conventional farms; higher CO_2 kg^{-1} of coffee on organic farms due to lower yields.	Noponen et al (2010)

Comparative studies of the impact of certification upon ES provision have several constraints. The first and most common is the definition of the categories of management systems to be compared (e.g. organic versus conventional), when management practices within each of these categories can be variable (trees or no trees, pruned trees or free growth, etc.). Other studies compare before and after certification; but most farmers did not keep records before certification, so the study must rely on the farmers' memories, which are subject to error. Another strategy is to compare certified and uncertified farms in a specific time, matching and comparing socio-economic and biophysical characteristics. The drawback of this methodology is limited access to databases to identify certified and uncertified farms with the same characteristics, or, alternatively, the high cost of a sampling effort. Facing these difficulties, the ISEAL alliance developed a code of good practices to conduct impact studies for this type of analysis (see http://community.isealalliance.org/content/ Impacts-code).

Other aspects to be considered when interpreting the results are regional differences, such as the existence of strong environmental national regulations, which could alter the results (Alonso and Jiménez, 2009). Preliminary data on the impact of organic, Fair Trade, Rainforest Alliance, Utz Certified and Starbucks CAFE practices in Honduras, Nicaragua, Costa Rica, Peru and Kenya collected within the COSA project (a multi-criteria cost–benefit analysis of sustainable practices in coffee) show a wide range of economic and biodiversity impacts of the same labels in different countries (Giovannucci and Potts, 2008).

A review of ecosystem services provision in certified coffee farms in the Mesoamerican region and Brazil (see Table 15.11) shows a trend towards positive impacts of organic, Smithsonian Bird Friendly and Rainforest Alliance. More research is required to determine the impact of the most recent labels, such as Utz Certified, CAFE practices, Nespresso AAA or 4C.

The challenge that the standard-setting bodies are facing is how to develop standards to improve the provision of ES, but to be understood and implemented by farmers. Should the standards refer to the provision of ES (e.g. to avoid erosion), or should the practice to avoid erosion be requested (e.g. construct terraces in the field). It is clear that for the inspector visiting the farm once a year for two or three hours (depending on the size of the farm and access to all fields), it would be easier, for example, to verify the presence or absence of the terraces than to measure laminar erosion.

The other question that remains is: are the standards strong enough to make the necessary changes in farm practices to improve provision of ES? Quispe (2007) compared changes in farming practices before and after certification in Costa Rica, observing limited changes on the Utz Certified, Rainforest Alliance and Starbucks CAFE practices certified farms (reduction of one herbicide application, no changes in fungicides or fertilizers used), and observing no change in the percentage of shade, even though Rainforest Alliance producers increased tree plantings in the plantation (too small at the

time of the study to see their impacts reflected in shade percentage). The only producers with radical changes in management practices were organic producers who modified most of their practices (e.g. removing herbicides, fungicides and synthetic fertilizers).

On the other hand, auditors and verifiers monitor regulation compliance for changes in plantation management practices. But they should also use indicators to quantify the provision of ecosystem services without increasing the costs of certification (two- to three-hour visits per farm depending on farm size) (see Chapter 3 in this volume).

Social impacts of certification

Some coffee certifications have important social implications (De Lima et al, 2008; Rivera, 2008), especially Fair Trade certification (Ronchi, 2002; Bacon, 2005). Although social impacts are not covered in this chapter, they should not be ignored as a fundamental component of the strategy's success: they are an important part of consumers' preference criteria.

In Central American regions where education or health access was limited, the impact of CAFE practices and Rainforest Alliance certification on large farmers has made an important difference in farmers' communication. In Costa Rica, where social security and access to education is available in most coffee areas, the major impact has been in workers' housing, especially harvesters, who often come from neighbouring countries. The strongest economic impact of implementing these standards has been felt on medium-sized farms (5ha) (Moreno, 2008).

Conclusions

The growth in recent years of the green label sector is a promising strategy to promote the required changes to foster ecosystem services provision through market mechanisms. One of the main achievements of sustainable certification processes has been to improve the link between the producer (family and production system) and the consumer. Consumer preference in the market is a tool to obtain changes at the farm level. If this link is valuable and powerful, it is also extremely fragile and subject to market rules. Certification development experience in Central America highlights some limitations and lesson learned:

- As a result of consumers' concern about reduced knowledge on certification issues, the different certifications tended to converge and make more room for environmental concerns.
- Continuous evolution of the standards has tended to fine-tune the criteria of the norm. Nevertheless, there is still room for improvement in the mobilization of technical knowledge to improve ES provision guarantees in the criteria of the norm.
- The compliance standard control structure of existing certifications offers a good level of guarantee to consumers. However, this control system is

Table 15.12 *Areas of improvement of certification to promote the provision of ES*

Areas of improvement	*Possible actions*
Improve the guarantee for provision of environmental services (ES)	Develop inspection methodologies that allow the use of more indicators to quantify the provision of ecosystem services. Evaluate changes to regulations that encourage greater provision of ES. Adapt the rules to local biophysical and socio-economic conditions. Harmonize criteria for interpretation of standards by auditors and inspectors in the field.
Cost reduction	Various actions are possible to reduce certification costs, such as more government involvement in the certification process (a test is being carried out in Costa Rica with a mixed private–state certification; inspections will be done where government extension agents working in different regions will conduct the inspection and send the report to the private certification agencies; inspection costs are covered by the government). Participatory certification for local (and international) markets, as well as alliances between certification programmes to reduce inspection costs, should also be encouraged. Sell certified coffee in local markets.
Improve the recognition of producer investment in sustainable production	In the case of organic production, harmonize regulations in the various export markets. Establish better distribution of the 'premium' among the commodity chain. Various options at the institutional or standard level can be used, including standard regulations (such as Fair Trade) and state regulations. Modify the balance of power between producers and their organizations and other actors of the commodity chain. Develop information and promotion campaigns on certification to ensure consumers' preferences.
Improve productivity (especially for organic farms)	Promote intensification of production under certification commitment to maintain or upgrade profitability of certified production. Identify risk management practices under certification commitment to secure the incomes of producers. Promote technical assistance support.

costly for individual smallholder farmers; as a result, several efforts have been made to reduce these costs.

- Certification has led to various forms of remuneration to compensate farmers' efforts. Nevertheless, the balance between remuneration and effort is not sufficient to develop sustainable economic interests for producers, especially in organic farming.

This strategy to motivate changes on farm through market incentives has great potential but also great challenges ahead. Some improvements are necessary to promote ES provision through the certification strategy (see Table 15.12). Improvements may be difficult since the certification strategies have inherent tensions and trade-offs, such as between the complexity of requisites and the capacity to evaluate; between flexibility of requisites (adaptation) and consumers' credibility perception; between the accuracy of control and its

costs; and between levels of effort asked of farmers and the compensation provided by the market. In order to develop this strategy, further support from governments is required, as well as further identification of robust and easily tested criteria for standard requisites. Alternative propositions are therefore needed for better market recognition and to improve farmers' productivity under different certification schemes.

Acknowledgements

We are grateful for the financial support provided by the European Union via CAFNET (Connecting, Enhancing and Sustaining Environmental Services and Market Values of Coffee Agroforestry in Central America, East Africa and India) collaborative project and by the French Agence Nationale de la Recherche (ANR) through the SERENA (Environmental Services and Rural Land Uses) project. Support was also provided by Pôle de Compétences en Partenariat (PCP): Agroforestry Systems with Perennial Crops, CIRAD–CATIE–INCAE–Bioversity–CABI–Promecafé.

References

Alfaro, V. T. M. (2004) *Matéria Orgânica e indicadores biológicos das qualidades do solo na cultura do café sob manejo agroforestal e orgânico*, PhD thesis, Universidade Federal Rural do Rio de Janeiro, Brazil

Alonso, S. and Jiménez, G. (2009) 'Impacto de las regulaciones ambientales en las estrategias de comercialización de café costarricense', *Revista Iberoamericana de Economía Ecológica*, vol 10, pp29–43

Bacon, C. (2005) 'Confronting the coffee crisis: Can fair trade, organic, and specialty coffees reduce small-scale farmer vulnerability in northern Nicaragua?', *World Development*, vol 33, no 3, pp497–511

Barbera, N., Hilje, L., Hanson, P., Longino, J., Carballo, M. and de Melo, E. (2004) 'Diversidad de especies de hormigas en un gradiente de cafetales orgánicos y convencionales', *Manejo Integrado de Plagas y Agroecología*, vol 72, pp60–71

Cárdenas, A. (2008) *Incentivos económicos para la producción ecoamigable en fincas cafetaleras en el Corredor Biológico Volcánica Central – Talamanca, Costa Rica*, MSc thesis, CATIE, Costa Rica

CIMS (2004) *Prices of Sustainable Coffee from Latin America*, CIMS, Costa Rica

CIMS (2006) *Opciones de Mercado para el café sostenible: Resultados consultoría realizada por CIMS para COOCAFE, Costa Rica*, CIMS, Costa Rica

De Lima, A. C., Novaes Keppe, A. L., Palmieri, R., Correa Alvarez, M., Maule, R. F. and Sparovek, G. (2008) *Impact of Sustainable Network (SAN) Certification on Coffee Farms: Case Study in the Southern Region and Cerrado Areas of the State of Minas Gerais, Brazil*, Instituto de Manejo e Certificacao Florestal e Agrícola (IMAFLORA), Brazil

George, A. (2006) 'Estudio comparativo de indicadores de calidad de suelos en fincas de café orgánico y convencional en Turrialba, Costa Rica', masters thesis, CATIE, Costa Rica

Giovannucci, D. (2001) *Sustainable Coffee Survey of the North American Specialty Coffee Industry*, Report for the Word Bank, Washington, DC

Giovannucci, D. (2010) 'Take this personally', Presentation, Speciality Coffee Association, Anaheim, US

Giovannucci, D. and Potts, J. (2008) *Seeking Sustainability: COSA Preliminary Analysis of Sustainability Initiative in the Coffee Sector*, IISD, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1338582

Greenberg, R., Bichier, P., Cruz, A. and Reitsma, R. (1997a) 'Bird populations in shade and sun coffee plantations in Central Guatemala', *Conservation Biology*, vol 11, no 2, pp448–459

Greenberg, R., Bichier, P. and Sterling, J. (1997b) 'Bird populations in rustic and planted shade coffee plantations of Eastern Chiapas, Mexico', *Biotropica*, vol 29, no 4, pp501–514

Haggar, J. and Soto, G. (2010) *Análisis del Estado de la Caficultura Orgánica*, Consultoría para la Coordinadora de Comercio Justo en América Latina, Turrialba, Costa Rica

ICO (International Coffee Organization) (2009) 'Coffee prices', January, International Coffee Organization, London, www.ico.org/frameset/priset.htm

IHCAFE (Instituto Hondureño del Café) (2006) *Informe de actividades cosecha 2005–2006*, Instituto Hondureño del Café, Honduras

Jose, S. (2009) 'Agroforestry for ecosystem services and environmental benefits: An overview', *Agroforestry Systems*, vol 76, pp1–10

Kilian, B. and Pratt, L. (2009) 'Challenges and perspectives of the Central American coffee sector', Presentation at SCAA, Atlanta, GA, 15–16 April

Kilian, B., Pratt, L., Jones, C. and Villalobos, A. (2004) 'Can the private sector be competitive and contribute to development through sustainable agricultural business? A case study of coffee in Latin America', *International Food and Agribusiness Management Review*, vol 7, no 3, pp1–25

Loureiroa, M. L. and Lotade, J. (2005) 'Do fair trade and eco-labels in coffee wake up the consumer conscience?', *Ecological Economics*, vol 53, no 1, pp129–138

Lyngbaek, A. E., Muschler, R. G. and Sinclair, F. L. (2001) 'Productivity and profitability of multistrata organic versus conventional coffee farms in Costa Rica', *Agroforestry Systems*, vol 53, pp205–213

Mas, A. H. and Dietsch, T. V. (2004) 'Linking shade coffee certification to biodiversity conservation: Butterflies and birds in Chiapas, Mexico', *Journal of Applied Ecology*, vol 14, pp642–654

Moguel, P. and Toledo, V. M. (1999) 'Biodiversity conservation in traditional coffee systems of Mexico', *Conservation Biology*, vol 13, pp11–21

Montagnini, F. (2006) *Environmental Services of Agroforestry Systems*, Food Products Press, US

Moreno, C. (2008) *Aplicabilidad de la legislación y las normas de certificación en sistemas agroforestales de café (SAFC) en Costa Rica y sus efectos en la rentabilidad del productor*, MSc thesis, CATIE, Costa Rica

Moreno, C., Navarro, G., Le Coq, J. F. and Soto, G. (2009) 'Farmers' perception and economic constrains in the implementation of the legal framework and voluntary certification systems influencing coffee AFS in Costa Rica', Paper presented to the 2nd World Congress on Agroforestry, Nairobi, Kenya

Noponen, M., Healey, J., Edwards-Jones, G., Haggar, J. and Soto. G. (2010) 'Coffee agroforestry systems in Costa Rica: Carbon emissions vs. sequestration', Poster

presentation, SENRGY, Bangor University, Wales, and CATIE, Costa Rica
Palmieri, R. (2008) *Impactos socioambientais da certificação Rainforest Alliance em fazendas produtoras de café no Brasil*, MSc thesis, Universidade de São Paulo, Piracicaba, Brazil
Payan, F., Jones, D. L., Beer, J. and Harmand, J. M. (2009) 'Soil characteristics below *Erythrina poeppigiana* in organic and conventional Costa Rican coffee plantations', *Agroforestry*, vol 76, no 1, pp81–93
PCC (Proyecto Cacao Centroamérica) (2010) *Informe de taller no 2*, Enero 2010, CATIE, Costa Rica
Perfecto, I., Vandermeer, J., Hanson, P. and Cartín, V. (1997) 'Arthropod biodiversity loss and the transformation of a tropical agroecosystem', *Biodiversity Conservation*, vol 6, pp935–945
Philpott, S., Bichier, P., Rice, R. and Greenberg, R. (2007) 'Field testing ecological and economical benefits of coffee certification programmes', *Conservation Biology*, vol 21, no 4, pp975–985
Ponte, S. (2004) 'Standards and sustainability in the coffee sector: A global value chain approach', United Nations Conference on Trade and Development, International Institute for Sustainable Development, Winnipeg, Canada, p49
Porras, C. M. (2006) 'Efecto de los sistemas agroforestales de café orgánico y convencional sobre las características de suelos en el Corredor Biológico Turrialba – Jiménez, Costa Rica', masters thesis, CATIE, Costa Rica
Quispe, J. (2007) *Caracterización del impacto ambiental y productivo de las diferentes normas de certificación de café en Costa Rica*, MSc thesis, CATIE, Costa Rica
Ramirez, A. (2010) 'Impacto económico de las diferentes certificaciones de café sostenible en Costa Rica', masters thesis, CATIE, Costa Rica, in preparation
Ramos, M. (2008) 'The effects of local and landscape context on leafhopper (Hemiptera: Cicadellinae) communities in coffee agroforestry systems of Costa Rica', PhD dissertation, University of Idaho-CATIE, Turrialba, Costa Rica
Raynolds, L. (2002) 'Consumer/producer links in fair trade coffee networks', *Sociologia Ruralis*, vol 42, no 4, pp404–424
Rice, R. (1999) 'A place unbecoming: The coffee farm of Northern Latin America', *Geographical Review*, vol 89, no 4, pp554–579
Rivera, L. (2008) *Una aproximación al análisis de provisión de capitales como determinante de la adopción de sistemas agroforestales de café certificado en Costa Rica*, MSc thesis, CATIE, Costa Rica
Ronchi, L. (2002) *The Impact of Fair Trade on Producers and Their Organisations: A Case Study with COOCAFE in Costa Rica*, Poverty Research Unit, Sussex, UK
Sanchez De León, Y., De Melo, E., Soto, G., Johnson-Maynard, J. and Lugo-Pérez, J. (2006) 'Earthworm population, microbial biomass and coffee production in different experimental agroforestry managed systems in Costa Rica', *Caribbean Journal of Science*, vol 42, no 3, pp397–409
Schroth, G., da Fonseca, G. A. B, Harvey, C. A., Gascon, C., Vasconcelos, H. and Izac, A. N. (2004) *Agroforestry and Biodiversity Conservation in Tropical Landscapes*, Island Press, Washington, DC
Soto, G., García, L., Haggar, J., de Melo, E., Munguía, R. and Staver, C. (2007) *Efecto del sistema de manejo del café (*Coffea arabica*) orgánico y convencional, con diferentes árboles de sombra sobre las características de suelo en un andisol en Nicaragua y un ultisol en Costa Rica*, Congresos Nacional de Suelos, Costa Rica

Varon, E., Eigenbrode, S. D., Bosque-Perez, N. and Hilje, L. (2007) 'Effect of farm diversity on harvesting of coffee leaves by the leaf curring ant *Atta cephalotes*', *Agricultural and Forest Entomology*, vol 9, pp47–55

Zhang, W., Ricketts, T. H., Kremen, C., Carney, K. and Swinton, S. M. (2007) 'Ecosystem services and dis-services to agriculture', *Ecological Economics*, vol 64, no 2, pp253–260