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Abstract

We provide a review of sustainable coffee certifications and results from a quantitative analysis of the effects of Fair Trade, organic and combined Fair Trade/organic certifications on the livelihood strategies of 469 households and 18 cooperatives of Central America and Mexico. Certified households were also compared with a non-certified group in each country. To analyze the differences in coffee price, volume, gross revenue and education between certifications, we used the Kruskal–Wallis (K–W) non-parametric test and the Mann–Whitney U non-parametric test as a *post-hoc* procedure. Household savings, credit, food security and incidence of migration were analyzed through Pearson's chi-square test. Our study corroborated the conditions of economic poverty among small-scale coffee farmer households in Central America and Mexico. All certifications provided a higher price per pound and higher gross coffee revenue than non-certified coffee. However, the average volumes of coffee sold by individual households were low, and many certified farmers did not sell their entire production at certified prices. Certifications did not have a discernable effect on other livelihood-related variables, such as education, and incidence of migration at the household level, although they had a positive influence on savings and credit. Sales to certified markets offer farmers and cooperatives better prices, but the contribution derived from these premiums has limited effects on household livelihoods. This demonstrates that certifications will not single-handedly bring significant poverty alleviation to most coffee-farming families. Although certified coffee markets alone will not resolve the livelihood challenges faced by smallholder households, they could still contribute to broad-based sustainable livelihoods, rural development and conservation processes in coffee regions. This can be done by developing more active partnerships between farmers, cooperatives, certifications and environmental and rural development organizations and researchers in coffee regions. Certifications, especially Fair Trade/organic, have proven effective in supporting capacity building and in serving as networks that leverage global development funding for small-scale coffee-producing households.

Key words: farmer cooperatives, political ecology, rural livelihoods, coffee crisis, alternative markets, sustainable coffee

Introduction

The coffee price crisis starting in the early 1990s, and deepening between 1999 and 2003, had enormous social and economic impacts on coffee producers around the world[1,2]. Between 1989 and 2004, green coffee prices fell from US$1.20 lb^{-1} to between US$0.45 lb^{-1} and US$0.65 lb^{-1}. Although prices have rebounded to levels consistent with the market averages during the previous 50 years (generally between US$1.00 lb^{-1} and US$1.25 lb^{-1})[3], the consequences of the price crash, and the chronic poverty that already existed, remain. In other words, even though prices have recovered, the coffee crisis continues[4,5].

In the midst of this situation, great expectations were placed on the role of several 'sustainable coffee' certification initiatives, as key alternatives for farmers to confront the crisis[6]. Certification systems claim to offer a combination of benefits including higher and more stable prices to farmers, and increased market access and technical assistance. In turn, farmers and their organizations must meet standards and subject themselves to inspections. As the number of certification initiatives increases, and consumers become more aware of different certification options, there is a growing concern to accurately document the real impact of these alternatives on coffee producers and their families. Recent research on sustainable coffee certification points to differentiated impacts on growers for each type of certification[7,8]. These studies provide important comparative examinations of certification standards and practices, often focusing on the macro-impacts of each program. However, most lack household- and community-level data that document the perceived benefits and limitations, as expressed by growers and their families[9].

The general objective of this research was to analyze the effects of Fair Trade and organic certifications on the livelihoods of coffee producer households of Central America and Mexico. Our specific objectives were: (1) to provide a critical review of the different types of sustainable coffee certifications; (2) to analyze the effects of Fair Trade, organic and combined Fair Trade/organic certifications on the livelihood strategies of coffee-producing households in Central America (El Salvador, Guatemala and Nicaragua) and Mexico, including social (e.g., social networks) and economic (e.g., gross coffee revenue) variables. This information was used to discuss the current and potential benefits and limitations of these certifications as a means to support the livelihoods of coffee-producing households.

Review of Sustainable Certification Initiatives

The rise of specialty coffee and sustainability certifications

The Specialty Coffee Association of America (SCAA) defines specialty coffee as follows: 'Sometimes called "gourmet" or "premium" coffee, specialty coffees are made from exceptional beans grown only in ideal coffee-producing climates. They tend to feature distinctive flavors, which are shaped by the unique characteristics of the soil that produces them'[10]. Under the specialty coffee umbrella, certified coffees are those which receive a certificate or label from a third-party, independent agency[11], such as certified Fair Trade (e.g., FLO label) or certified organic (e.g., USDA or Naturland labels). 'Sustainable coffee certification' is an umbrella term encompassing several types of certifications, and combinations of certifications that explicitly address social and environmental concerns and standards. Specialty and sustainable coffee markets have expanded rapidly with increased consumer awareness regarding issues of quality, social equity, taste, health and environment[12,13]. These trends are evident in the expanding retail market values for the specialty coffee market segment, which has increased from less than $4 billion in the early 1990s to over $11 billion in 2006[14]. As of 2004, about 10% of global coffee exports could be considered specialty coffee, and of these an estimated 20% (or 2% of the global supply) carried some type of certification (Table 1). The percentage of specialty and sustainable coffees exported from Central America is significantly above the global average. During the 2002/2003 harvest, an estimated 6% of the region's total exports were sold into organic (1.5%), Fair Trade (3.6%) and Rainforest Alliance (0.75%) certifications[15]. Although small, this certified market segment continues to grow rapidly, with annual rates ranging from 10 to over 30%, depending on the year and the certification program[6,16]. If we expand the 2002/2003 market figures to include Mexico, account for the rapid growth rates among these certification programs and document the presence of newer sustainable coffee certification programs (e.g., Utz certified and Starbucks CAFE Practices), as of 2003/2004, these certified coffees accounted for 8–13% of the region's coffee production.

Certified organic coffee

Organic certification addresses standards that regulate the coffee *production process*. Although there are variations between certifiers, most organic standards include the following: 'ecological' management of farms; soil conservation practices; abstention from the use of synthetic fertilizers, pesticides and genetically modified crops; and intensive on-farm record keeping[8,17,18]. Organic certification also establishes a separate chain of custody ensuring that certified organic food is separated from conventional products in any processing stages.

Organic agriculture has grown quickly in Latin American, expanding from almost 4.9 million ha of certified organic land in 1998, to 5.8 million ha by 2004[19,20]. Expanded production is associated with increasing demand in northern markets, including a 20% growth rate in the volume of organic coffee imports to the USA, since 2004[16]. In 2002/2003, more than 2% of the coffee lands in Central

Table 1. Differentiated and certified coffee in relation to total volumes sold worldwide (2003–2004).

Market segment	Volume (metric tons)	% of total	Source
Conventionally traded coffee	4,659,522	90.70	This table
Estimated exported volume of differentiated coffee	480,000	9.30	Lewin et al.[2]
Total green coffee exported	5,139,522	100	ICO[3]
Certified coffee exports organic	26,400	0.51	Ponte[7]
Fair Trade (of which 14,642 is also organic)	28,283	0.55	TransFair USA[22]
Shade grown	660	0.01	Ponte[7]
Rainforest alliance	10,000	0.19	Courville[11]
Utz Kapeh	14,000	0.27	Courville[11]
Estimated total certified coffee	65,702	1.28	This table
(13.7% of differentiated coffee is also certified)			

Most data refer to 2003. Fair Trade lb, converted to metric tons based on 2.2 lb = 1 kg; 1000 kg = 1 metric ton. Data from TransFair reported originally by FLO. The organic and shade grown data are from Ponte[7] and Fair Trade data are from this table. The estimated 10% growth rate is taken from Ponte[7]. While Ponte considered the overlap between total fair trade production and the 52% that is also certified organic, this summary assumes that the organic total estimated by Ponte excludes the Fair Trade organic coffee. This table is a new estimate addressing the segments in the global coffee trade as of 2003. According to Raynolds et al.[8], Utz Kapeh, Rainforest Alliance and Bird Friendly certified farms have all have substantially increased their production by 2004; however, these three certifications systems report the total volumes of coffee produced on certified farms although much of this coffee is still exported as conventional coffee and not necessarily purchased under these terms (see Table 3 in Raynolds et al.[8]).

America were certified organic, with higher percentages in Nicaragua and Guatemala[21]. Organic coffee does not establish a minimum price paid to producers or exporters, but sets a premium above that established by the New York Board of Trade. In 2002/2003, a survey of importers reported that organic coffee price premiums in Guatemala averaged an estimated $0.40 lb^{-1} above the market, and in Nicaragua and El Salvador they were $0.25 lb^{-1} and $0.30 lb^{-1}, respectively[21]. Globally, an estimated 52% of the coffee produced by certified Fair Trade cooperatives is also organic[22].

Fair Trade

In contrast to organic, Fair Trade certification specifically focuses on smallholder producer organizations, and the relations, prices and standards associated with the trade process[23]. Fair Trade advocates believe that fairer trade can lead to individual and collective empowerment if it follows standards and enforcement mechanisms that support human rights, dignity and sustainable development[24]. 'Empowerment' can be referred to as the ability of individuals and/or groups to act on their own in order to achieve their self-defined goals[25]. Fair Trade originated as a solidarity movement that supported partnerships between northern social justice advocates and impoverished southern producers[5,6]. After these initiatives saw significant growth in the 1980s, leaders in the movement decided to establish standards and certification mechanisms that would allow them to expand the volumes of fairly traded goods. These efforts were consolidated in the early 21st century, when the Fair Trade Labeling Organization (FLO) was established[5]. FLO establishes standards and certifies producers, organizations and traders that pay minimum prices; provides a price premium for social development;

trades directly with smallholder coffee organizations; signs contracts that encourage long-term planning and stability; and provides up to 60% of pre-harvest credit when requested[26].

Although low international coffee prices motivated many farmers and roasters to seek Fair Trade certification, supply continues to outpace demand, and only 20–25% of Fair Trade certified coffee receives a premium. Recently, the USA, a latecomer to Fair Trade certification, has posted exponential growth rates[7]. The USA is now the largest Fair Trade certified coffee market in the world (almost 24,000 metric tons per year in 2006), even though this only amounts to 3% of the entirety of the US market[27]. According to TransFair USA, since 1998 74.3 million lb of Fair Trade certified coffee have been sold, and these sales have contributed to a cumulative total of $60.4 million in price premiums above conventional coffee prices[22].

Bird Friendly, Rainforest Alliance and Utz certified coffees

Shade coffee certifications seek to reward coffee growers that manage their plantations in a way that supports the conservation of tropical species and habitats, with an emphasis on maintaining a diversified shade tree canopy (instead of managing 'full sun' plantations that have no shade trees)[28–31]. Shade coffee certifications have struggled to compete with other labels, and continue to account for market segments smaller than Fair Trade or organic[7,32]. The dominant labels for shade certification have been The Rainforest Alliance (RA) label and Smithsonian Migratory Bird Center's Bird Friendly™ coffee. Smithsonian also requires organic certification, which might result in higher ecological standards than RA[33–35].

RA's certification standards include using minimum levels of native shade tree biodiversity, limiting the use of highly toxic agro-chemicals, maintaining a healthy working and living environment for workers and enforcing national labor laws[36]. Critics of RA claim that environmental standards are lower than those required by certified organic coffee and that social development criteria are below the social objectives of Fair Trade[37].

Utz certified (formerly Utz Kapeh) was launched in 1997 by Royal Ahold, a Netherlands-based supermarket company. It seeks to integrate improved agricultural practices through the 'Euro-Retailer Produce Working Group-Good Agricultural Practices' (EUREP-GAP) with Social Accountability International's (SAI) 8000 social condition guidelines. EUREP-GAP certifies farms for 'good agricultural practices'[38], whereas SAI offers a certification to ensure adequate working conditions for laborers[39]. The initial certification criteria were developed in collaboration with a number of large coffee estates in Guatemala[36]. According to its representative in Guatemala, interviewed in 2004, Utz certified saw a tenfold increase in global sales, from 2000 certified tons of coffee in 2002 to 21,000 tons in 2004.

Assessing the effects of sustainable coffee certification

Several macro-level studies have described sustainable coffee certifications[7,8,36] and documented premiums where certified producers received between US$0.05 lb^{-1} and US$0.50 lb^{-1} above non-certified growers[21]. Other scholars have developed empirically rich ethnographic studies on how international certification systems are translated into the daily lives of small-scale farmer communities and cultures[40–45]. Most of this research agrees that higher prices, training and more connections to international networks are some of the advantages for farmers and cooperatives that sell to Fair Trade and organic markets[37,41,42,46]. Some of the disadvantages include high costs of certification; additional labor investments and lower yields for organic production; the need for increasingly sophisticated record keeping; higher quality standards; and the purchase and payment of certified coffee later in the season[6,41,47]. Conventional coffee, which refers to all non-certified forms of coffee production and trade, is generally sold faster and with far fewer quality requirements[23]. Several studies have documented the economic (e.g., higher prices and financing) and social (e.g., links to support networks and social investment) benefits of Fair Trade to farmer cooperatives[9], but only a few have analyzed these issues at the household level in an international comparative study (but see Jaffee[41] and Arnould et al.[48]).

Research Approach and Methods

Of particular importance to our research was to develop a better understanding of the current livelihood strategies of small-scale coffee farming households and how these are affected by certified coffee markets. The concept of livelihoods, which has been extensively applied in development studies[49], can be defined as 'comprising people, their capabilities and their means of living (e.g., food, income and assets)'[50], and how they make this living meaningful[51]. Our analysis was guided by a political ecology approach, with a focus on rural livelihoods. Political ecological perspectives have focused on livelihoods to analyze the social reproduction of farmer communities in developing countries, and how these are affected by social and ecological processes associated with natural resources access, governance and management[52–54]. Although political ecology argues for the need to examine social and ecological processes across multiple geographic scales (e.g., local, national and global)[55–58], this paper focused mainly on the household and community levels (local/regional). However, our research does address several points of interaction at broader scales, primarily through our discussion of second- and third-level cooperative organizations in different countries, and their international social networks. Our findings also provide insights into the local- and regional-level responses of households and cooperatives to globally driven events, such as the international coffee price crisis[23].

Furthermore, our analysis of household livelihood strategies and their relationship to the coffee commodity chain connects our research to debates on the governance of global value chains[59,60]. An in-depth examination of coffee household livelihood conditions and strategies, as well as their relationship to cooperatives, complements the global value chain literature on coffee. With a few notable exceptions (see Daviron and Ponte[61]), this body of work has focused primarily on regulations, value-added strategies and rent appropriations[62–64]. This paper contributes an in-depth assessment of locally situated social and economic impacts resulting from participation in certified or conventional coffee value chains. Although a deeper discussion of our results, in terms of global value chain analysis, is beyond the scope of this paper, we believe that our findings will inform future examinations of livelihood outcomes associated with the producer end of the value chain.

Research design and methods

Field surveys were conducted between November 2004 and December 2005, providing data for the 2003/2004 coffee harvest. In each country we worked with researcher teams that were based in-country. Two methodological workshops were held previous to field research to develop standardized data collection protocols. Countries, team members and cooperatives were chosen based on previous collaborative history among researchers, a team's established relationship with coffee farmers and cooperatives, and a cooperative's willingness to participate.

Our research design was a stratified survey, with country and certification type as main strata. We chose

Table 2. Number of cases and sample sizes for household surveys per certification type and country.

Country	Certification	Number of cases	Number of household surveys	Mean area under coffee cultivation (ha)[1]	Mean coffee yield
Guatemala	Non-certified	1 cooperative	30	2.1	703
	Fair Trade	1 cooperative	30	1.3	960
	Fair Trade and organic	2 cooperatives	60	1.4	808
El Salvador	Non-certified	1 cooperative	25	1.1	100
	Fair Trade	1 cooperative	30	2.3	766
	Organic	1 cooperative	30	3.6	418
	Fair Trade and organic	1 cooperative	11	3.8	275
Nicaragua	Non-certified	1 cooperative	17	1.8	1760
	Fair Trade	2 cooperatives	31	2.7	1111
	Organic	1 cooperative	39	5.1	696
	Fair Trade and organic	1 cooperative	14	3.8	419
Mexico	Non-certified	2 cooperatives	55	2.5	1046
	Fair Trade and organic	3 cooperatives	97	3.2	501
	Totals for the study:	18 cooperatives	469		

[1] For collectively managed cooperatives we recorded the average area allocated per household.

representative cooperatives from a limited pool of organizations that researchers had a relationship with. This limited the strength of our sampling design, and increased the stratification effect, and limited the number of cases within each certification type, which can result in a loss of precision of the statistical analyses[65]. A similar design was also used by the only other quantitative analyses of Fair Trade coffee certification we are aware of[48]. We chose to do this because, due to the sensitive nature of some of the survey questions (e.g., income and food security), it would have been difficult to survey cooperatives that the teams did not know. For organic and Fair Trade certified cooperatives we sought producer organizations with members that had been producing and selling organic and/or Fair Trade coffee for at least 3 years prior to the study. After establishing collaboration agreements with cooperatives, households were randomly selected from lists of cooperative members. As our main criteria, we attempted to sample a target population of between 25 and 30 households per certification type per country (Table 2). However, this proved difficult in some instances, due to a lack of cooperatives that met the criteria (e.g., at the time, there was only one Fair Trade/organic certified cooperative in El Salvador). In total, we collected data from 469 households that were part of 18 cooperatives.

We defined a 'household' as a single or extended family living in the same residence. Household questionnaires were a combination of close-ended and open-ended questions. Household-level data were collected through an identical questionnaire for both certified and non-certified households, except for the additional questions that only pertained to certified households (e.g., certification type, premium amount, etc.). We triangulated this information with individual semi-structured and informal interviews, focus groups with cooperative board members and other key informants (such as personnel from organizations working in the community)[66–68]. Within countries, households were located in different regions, but had similar farm sizes (Table 2). In the case of collective cooperatives in El Salvador, we calculated area allocations per household as equivalent to tenured land-holdings. Considering that the sample consisted of small-scale producers and cooperatives, we expected coffee yields and production practices to be relatively similar across countries and across certifications.

Variable selection, processing and statistical analysis

Variables were selected based on their relevance to household livelihood strategies (e.g., demographics, sources of income, capacities, networks and migration)[51] and those that could demonstrate tangible benefits from certification (e.g., gross coffee revenue, education of children, increased food security and linkages to support networks)[9,41,69]. Although we included questions related to the costs of certification in our survey, we were unable to collect consistent information on this variable at the household level. Most individual members had limited knowledge or confused perceptions, and board members were reluctant to share specific figures.

In cooperatives where land is collectively owned (all three certified cooperatives in El Salvador, and the organic cooperative in Nicaragua), we divided coffee production volumes and land areas under coffee cultivation by the number of cooperative members, in order to obtain volume and land area figures for each household. These figures were used to calculate gross coffee revenue and yield per hectare figures for households in collective cooperatives. While we recognize that these calculations may

not be perfectly accurate (for example, some households may spend more time working in the collective coffee plantation and thus earn more income from coffee), we are confident that they are comparable to the volume, gross revenue and yield figures for the rest of the households in the study.

In order to compare prices, we calculated a weighted average price for each household, because households that sell certified coffee often sell part of their harvest at the certified price and part of the harvest at the conventional price. We calculated weighted price as

(farm gate price for certified organic coffee) ∗

    (% of coffee harvest sold at organic price)

  + (farm gate price for certified Fair Trade coffee) ∗

     (% of coffee harvest sold at Fair Trade price)

  + (farm gate price for conventional coffee) ∗

     (% of coffee harvest sold at conventional price)

  + (farm gate price for certified Fair Trade/organic coffee) ∗

     (% of coffee harvest sold at Fair Trade/organic price)

This more accurately reflected the prices that farmers obtain at the farm gate. Per household gross revenue from coffee sales was calculated as the volume sold per household multiplied by the price received for that volume. In some coffee cooperatives, such as the Fair Trade and organic cooperatives in El Salvador, the coffee plantation is collectively owned. In these cases, gross coffee revenues were divided equally among member households for the purpose of this analysis.

Information was processed into a database created in Foxpro for Windows. Statistical analyses were run using SPSS software, versions 16.0 and 17.0. To analyze the differences in the coffee price, volume, gross revenue and education between certifications, we utilized the Kruskal–Wallis (K–W) non-parametric test. In addition, for coffee price, volume and gross revenue, we used the Mann–Whitney U non-parametric test as a *post-hoc* test for differences between each pair of certification types, with a significance level of $P < 0.01$, due to the large number of pairings. The K–W test was also used to analyze factors that might contribute to food security, including a comparison of coffee revenue, food production and number of income sources between households that did and did not experience food shortages. We chose these tests because the data did not show clear normality or equal variances (Levene and Kolmogorov–Smirnov tests), and our household samples were uneven for the certification stratum. We were unable to sample for Fair Trade cooperatives in Mexico, or organic in Guatemala and Mexico, and the number of households sampled for each category were also uneven (see Table 2). The K–W test is a recommended alternative to parametric analysis of variance (ANOVA) for populations containing uneven sample sizes[70]. The K–W test compares medians instead of means; therefore for these variables we report medians and interquartile ranges instead of means and standard deviations. Categorical variables (household savings and credit, food security, and migration) were analyzed using Pearson's chi-square test with $P \leqslant 0.05$ considered significant. For all variables, we compared certifications both for the entire sample and within each of the countries.

Results

Cooperatives and households in coffee regions of Central America and Mexico

We found three types of cooperatives in our research. First-level cooperatives were made up of individual members (individuals and/or families), which organized through different processes, such as agrarian reforms or voluntary initiatives. Within the first level cooperative category, we worked with two different types. The first type comprises cooperatives, consisting of individual farmers/families, who own their land and form a cooperative to facilitate marketing, technical assistance, credit and/or interactions with external actors. These farmers continue to manage their farms individually, but follow cooperative guidelines (e.g., organic certification rules). The second type comprises collectively managed plantations, where members do not have individual ownership of land, but have rights or access to land allocations (i.e., residential and agricultural plot assignations), as part of their membership. These cooperatives are managed as a collective and run by an elected board of directors. The second-level cooperatives were formed by the union of first-level cooperatives. These organizations are also called 'cooperative unions' or 'federations'. The third-level cooperatives may include both first- and second-level cooperatives as members, tend to have national representation and are sometimes called 'confederations'.

On average, the 469 households we surveyed were made up of six members, and had similar educational levels ($\leqslant$5th grade). Men and women were equally represented in numbers, and no significant differences were observed in educational levels by gender. Subsistence agriculture was an important livelihood strategy for farmer households. In El Salvador, 42% of the surveyed group produced staple foods (primarily corn and beans), buying less than 40% of their annual food budget. In the other three countries, only 10% of households reported producing staple foods, and these families bought an average of 65% of their annual food budget.

The mean area of owned or allocated land for coffee cultivation was 3.2 ha per household ($N = 469$). Total mean land areas owned by or allocated to households per country were 5.7, 3.1, 2.9 and 1.5 ha for Nicaragua, El Salvador, Mexico and Guatemala, respectively. Within countries, the farms selected shared comparable geographical conditions. All farms managed shaded plantations of *Coffea arabica*, and were located at elevations greater than 500 m above sea level. Characterizations of coffee producers in

Mesoamerica have found similar yields and outputs as a result of farm size and grower type[71]. Our sample was made up of small-scale farmers and their cooperatives, which according to Flores et al.[71] cultivate less than 3.5 ha of land per farmer and produce an average of 1100 lb ha^{-1}, when coffee is conventionally managed. Average yield for the entire sample (736 lb ha^{-1}) was lower than those presented by Flores et al.[71] (Table 2). Organic yields were lower than conventional yields in Nicaragua and Mexico, but higher in Guatemala and El Salvador. Yields are affected by the management capacity and available resources of farmers and cooperatives. Although data comparisons between organic and conventional coffee yields are scarce, in most cases organic plantations tend to produce lower yields and have similar or higher economic costs[72]. In both El Salvador and Guatemala, the organic cooperatives were larger and had well-established organic management programs that were more effective than their conventional counterparts. In Nicaragua and Mexico, where cooperative management and size were very similar across certifications, organic yields were lower. In these cases, conventional farmers were able to increase yields through effective synthetic fertilizer and pesticide management.

We asked the households we surveyed to list the members of their household who generated monetary income and to list the types of income-generating activities undertaken by household members. Half of the members within each household reported generating monetary income. The most frequent income-generating activities were coffee sales, coffee-related employment, sales of other agricultural crops and non-agricultural employment. Interviewees were asked to estimate the percentage of their income that they earned from coffee sales, coffee-related employment or from other income sources, although not all of them provided complete responses to this query ($n = 300$). On average, households reported that coffee sales and coffee-related employment accounted for 67% of their income. Only 37% reported that they earned all of their income from coffee sales and coffee-related employment. We chose to group coffee sales with coffee-related employment for this analysis because some households in the study are members of collectively owned cooperatives, whereby they do not receive income directly from the sale of coffee but rather are paid by the cooperative for their work in the collective coffee plantation. Sales of other agricultural crops contributed 15% of household income on average, while employment in non-agricultural jobs contributed an average of 11%. Non-coffee agricultural employment and income from other sources (primarily support from older children working away from home) comprised an average of 5 and 3% of household income, respectively.

On average, households sold 1450 lb of coffee for the 2003/2004 harvests. This generated an estimated mean gross coffee revenue of US$1064 for the season. Previous studies have estimated the monetary costs of production for smallholders in this region to range from $0.50 to $0.70 per pound of green coffee produced[71]. However, most cost studies have been incomplete, since they fail to include the costs for coffee maintenance, replanting, tools, harvest interest payments, transport and time invested in inspections and training[73]. Subtracting these estimated minimum farm-level production costs from the gross average price per pound in our sample of $0.78 resulted in an estimated average annual net coffee revenue of between $0.28 and $0.08 per lb of coffee. By applying this net value to the average reported volume sold (1450 lb of coffee per year) by the farmers in our sample, we estimated the net coffee revenue per household per year to be in the range between $116 and $406. This range is for the entire sample and not accounting for differences in revenues between certifications. However, it represents an important figure because it shows how low the annual revenue range from coffee production is for all of these farmers, including those that sell all their volumes through certified channels.

Farmers generally do not receive payments for all their coffee in one lump sum. Instead, some receive advance payment as credit, partial payment upon coffee delivery and a third final payment. Most receive a single payment when they sell to intermediaries. Most payments are both insufficient and poorly timed, leaving a thin (or hungry) season that generally falls between April and August for most coffee regions.

Only 15% of all households interviewed reported having monetary savings, these being most frequent in Nicaragua, and least frequent in El Salvador. In Guatemala and Mexico, 15 and 16% of households reported having some savings. Forty percent of all households reported having access to some form of credit, with a marked difference between countries. Approximately 34% of households in the four countries reported at least one member migrating, either within their countries, or internationally. Mexico (in 30.6% of the sample) and Nicaragua (28.8%) had the highest emigration rates of the sample.

Coffee prices, volumes and gross revenue

Gross coffee revenue is determined by three factors: price, total volume (green bean yields) and the proportion of volume that is sold through certified channels (and thus receives the certified price). We first examined how certified cooperatives differ from non-certified cooperatives with respect to each of these factors and then look at the resulting differences in gross revenue.

Annual international conventional (non-certified) coffee prices averaged $0.72 lb^{-1} in 2003/2004[3]. As reported in similar studies, it proved extremely difficult to calculate exactly what price households obtain for their coffee[23]. The different ways in which coffee is sold and the taxes and discounts that occur in each country were not fully understood by many of the farmers. To compare the prices

Table 3. Price, volume and coffee revenue medians (interquartile ranges)[1] for conventional and certified coffee, as reported by all interviewed households in Mexico and Central America ($N = 461$).

	Non-certified ($n = 124$)	Fair Trade ($n = 98$)	Organic ($n = 68$)	Fair Trade/organic ($n = 175$)	K–W test[4]
Median calculated price[2] (US$ lb^{-1})	0.51 (0.24)[3a]	0.68 (0.32)[b]	0.77 (0.36)[c]	0.89 (0.32)[c]	$\chi^2 = 186.98$, $P \leqslant 0.001$**
Median volume in pounds	700 (1300)[a]	1094 (1100)[b]	3550 (3048)[b]	600 (900)[a]	$\chi^2 = 51.1$, $P \leqslant 0.001$**
Median coffee revenue in US$	332.56 (800.06)[a]	1006.48 (635.80)[b]	2733.50 (2164.01)[c]	534.00 (818.16)[a]	$\chi^2 = 55.78$, $P \leqslant 0.001$**

[1] The K–W test uses medians, and the figures in parentheses are interquartile ranges (analogous to standard deviation for the median).
[2] The calculated price is the median price a household received for their coffee in 2003–2004, weighted by the volumes sold at those prices.
[3] Medians followed by a different letter are significantly different by the Mann–Whitney U test ($P \leqslant 0.01$).
[4] * Difference is significant at the $P \leqslant 0.05$ level; ** difference is significant at the $P \leqslant 0.001$ level.

Table 4. Median prices (interquartile ranges)[1] by certification and country ($N = 461$).

Country	Median non-certified calculated price[2] (US$ lb^{-1})	Median Fair Trade calculated price (US$ lb^{-1})	Median organic calculated price (US$ lb^{-1})	Median Fair Trade/organic calculated price (US$ lb^{-1})	K–W test[5]
Guatemala	0.48 (0.95)[3a], $N = 30$	0.64 (0.65)[b], $N = 30$	—	0.81 (0.11)[c], $N = 57$	$\chi^2 = 95.81$, $P \leqslant 0.0001$**
El Salvador	0.51 (0.00)[4a], $N = 25$	0.92 (0.00)[4b], $N = 30$	1.13 (0.00)[4c], $N = 30$	1.06 (0.00)[4d], $N = 11$	$\chi^2 = 70.52$, $P \leqslant 0.001$**
Nicaragua	0.38 (0.39)[a], $N = 17$	0.54 (0.20)[a], $N = 31$	0.77 (0.00)[4b], $N = 38$	1.07 (0.00)[4c], $N = 14$	$\chi^2 = 70.52$, $P \leqslant 0.001$**
Mexico	0.70 (0.27)[a], $N = 52$	—	—	1.11 (0.36)[b], $N = 93$	$\chi = 37.30$, $P \leqslant 0.001$**

[1] The K–W test uses medians, and the figures in parentheses are interquartile ranges (analogous to standard deviation for the median).
[2] The calculated price is the median price a household received for their coffee in 2003–2004, weighted by the volumes sold at those prices.
[3] Medians followed by a different letter are significantly different by the Mann–Whitney U test ($P \leqslant 0.01$).
[4] Coffee is produced and sold cooperatively; thus all households in these cooperatives receive the same median price.
[5] * Difference is significant at the $P \leqslant 0.05$ level; ** difference is significant at the $P \leqslant 0.001$ level.

presented in Table 3, we used information gathered through household surveys and data from first- and second-level cooperatives.

Calculated prices (the sum of the amount of coffee sold at each price, multiplied by the % of total coffee sold at this price) were significantly higher for all certified sales in comparison to conventional markets (K–W, $\chi^2 = 186.98$, df = 3, $P \leqslant 0.0001$), with Fair Trade/organic cooperatives receiving the highest price (Table 3). Price differences between each pair of certifications individually were also significant except between the organic and Fair Trade/organic groups (Table 3).

Significant price differences (for both conventional and certified) were also observed between countries (K–W, $\chi^2 = 60.3$, df = 3, $P \leqslant 0.001$), so it is possible that the comparison between certifications was confounded by the uneven representation of cooperative types in the four countries. Thus, we also compared certified and non-certified cooperatives within each of the countries, through a Mann–Whitney U test. There were significant differences

in calculated price between certification types in all of the countries, with households that were members of certified cooperatives receiving higher prices for their coffee (Table 4). Only in the Nicaraguan case were conventional and Fair Trade prices not significantly different. Because certification types were only represented by members from one cooperative in several of the countries, we cannot state conclusively that certifications were solely responsible for these price differences, as other factors unique to these cooperatives may have contributed to the differences in price. However, because price premiums are generally based on certifications, it is likely that certifications are driving these price differences.

Volumes of coffee produced and sold were highly variable between households. Fair Trade and organic certified households produced significantly more coffee than non-certified households or households holding both certifications (Table 3; K–W, $\chi^2 = 51.10$, df = 3, $P \leqslant 0.001$). It is important to note that these are total volumes, not volumes per area, and they are therefore more reflective of farm

Table 5. Household coffee revenue medians (interquartile ranges)[1] by country and certification (N = 461).

Country	Median non-certified revenue (US$)	Median Fair Trade revenue (US$)	Median organic revenue (US$)	Median Fair Trade/organic revenue (US$)	K–W test[3]
Guatemala	271.84 (389.25)[2]a, N = 30	603.13 (1030.85)b, N = 30	—	534.00 (795.65)b, N = 57	$\chi^2 = 13.862$, $P \leqslant 0.001$**
El Salvador	102.50 (384.38)a, N = 25	1006.48 (0.00)b, N = 30	569.49 (0.00)c, N = 30	1040.92 (471.43)c, N = 11	$\chi^2 = 56.66$, $P \leqslant 0.001$**
Nicaragua	752.80 (2668.26)a, N = 17	2158.00 (2120.00)ab, N = 31	2733.50 (228.62)b, N = 38	1076.57 (2170.50)a, N = 14	$\chi^2 = 8.68$, $P \leqslant 0.034$*
Mexico	561.09 (937.89)a, N = 52	—	—	445.65 (899.46), N = 93a	$\chi^2 = 0.474$, $P \leqslant 0.491$

[1] The K–W test uses medians, and the figures in parentheses are interquartile ranges (analogous to standard deviation for the median).
[2] Medians followed by a different letter are significantly different by the Mann–Whitney U test ($P \leqslant 0.01$).
[3] * Difference is significant at the $P \leqslant 0.05$ level; ** difference is significant at the $P \leqslant 0.001$ level.

areas per household than per hectare productivity. The organic households and Fair Trade households in this study tended to cultivate more land per household than the other two certification groups, which accounts for the higher coffee volumes of the organic households despite their lower per hectare productivity in Nicaragua and Mexico.

Gross revenue from coffee was significantly different between households of the four certification types (K–W, $\chi^2 = 55.78$, df = 3, $P \leqslant 0.0001$), with all certification groups earning higher median revenues than the uncertified group (Table 3). Gross revenues were also significantly different between certification groups when analyzed by country, with the exception of Mexico where revenues in the Fair Trade/organic households were similar to those in the non-certified households due to lower coffee production volumes (Table 5).

As discussed by Bacon[23], certified farmers are usually not able to sell all of their production through certified markets. Reasons for this include quality standards (only the best cherries), limited market demand (as in the case of Fair Trade) and cooperative quotas (e.g., distribution of premiums among the membership). As a result, many certified coffee farmers are forced to sell a portion of their production in the conventional market. Net revenue generated through certified sales can decrease considerably when farmers incur the costs of certification, but are not able to sell their entire production at premium certified prices.

Various factors influence the percent of production that households in certified cooperatives are able to sell at certified prices. The Salvadoran Fair Trade cooperative was able to sell all of its production at certified prices because of the small number of Fair Trade certified cooperatives in this country that produce high-quality coffee. In the Guatemalan and Nicaraguan cases, Fair Trade certified cooperatives were limited by a higher number of Fair Trade cooperatives and higher volumes of production by certified farms. Thus, most of these households sold high proportions of their coffee at conventional prices. Fair Trade/organic certification showed high proportions of volumes sold at certified prices in all cases, with the exception of Mexico (only 54%). In this case, where farmers were members of large cooperative unions (up to 20,000 members), the amount of coffee sold at certified prices was influenced by coffee quality and the standing of first-level cooperatives within their union. A power struggle was reported between first-level cooperatives and their unions, in which their lobbying capacity with the union is an important factor determining the proportions of their total production that they are able to sell at certified prices.

On average, Fair Trade was the certification with the lowest proportion of coffee sold at certified prices, with 60% of total volume sold as Fair Trade. The two certified organic cooperatives sold almost 100% of their certified coffee at certified prices. Fair Trade/organic certification
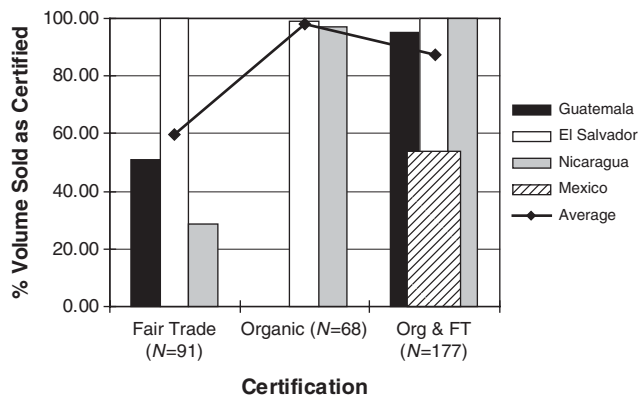
Figure 1. Percentage of total volume of coffee produced by certified households, which was sold through certified channels, for the 2003/2004 harvest.

sold an average of 87% of total coffee produced at certified prices (Figure 1).

Household savings and credit

Households in our survey population were asked whether or not they had any monetary savings. While it is generally uncommon for small-scale coffee-producing households to have savings, the percentage of certified households with savings (17%) was significantly higher than the figure for non-certified households (10%) when all certified households were combined into a single category (Pearson, $\chi^2 = 4.113$, df = 1, $P \leqslant 0.043$). This difference, however, was influenced by the households in the Fair Trade co-operative in Nicaragua, where 55% of respondents reported having savings. This is a much higher percentage than any of the other certified groups and countries. There were no significant differences between certified and non-certified households in any of the other countries.

Credit access showed a similar pattern as savings; however, the association between credit access and certification when all certified households were combined into a single group was not quite statistically significant (Pearson, $\chi^2 = 3.26$, df = 1, $P \leqslant 0.073$). Overall, 43% of all certified households reported having access to credit, compared to 34% of non-certified households. When certification types were considered separately, however, there was a significant association between certification type and credit access (Pearson, $\chi^2 = 9.81$, df = 3, $P \leqslant 0.020$). Higher percentages of Fair Trade (42%) and Fair Trade/organic (48%) households reported having access to credit than organic (30%) and non-certified households (34%). This is not surprising given that Fair Trade contracts often include pre-financing for producers, whereas organic and conventional coffee buyers do not provide this benefit. This pattern held when each of the countries was examined separately, with the exception of Guatemala where nearly all of the non-certified households reported having access to credit.

Food security

Household food security has been used extensively as a measure of welfare by NGOs, governments and the UN. At the 1996 World Food Summit, the Food and Agriculture Organization of the United Nations defined food security as 'all people, at all times, have physical and economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life'[74]. Food security results from many livelihood factors, including food production, income to purchase food and social safety nets[75].

To explore the issue of food security, we asked families if they experienced times when they felt unable to meet their basic food needs. Sixty-three percent of the households interviewed reported that they did struggle to meet their basic food needs. In our sample, households associated with certifications did not fare any better in terms of food security. Our statistical analyses of the entire sample showed significant associations between food security (using household's reports of difficulties in meeting basic food needs as a proxy) and certification, but with a higher percentage of households in all *certified* groups reporting difficulties meeting food needs (Pearson, $\chi^2 = 22.06$, df = 3, $P \leqslant 0.001$) than the non-certified group. When each country was examined separately, only in Guatemala was there a significant association between certification and food security (Pearson, $\chi^2 = 21.78$, df = 2, $P \leqslant 0.001$), again with more certified households reporting difficulties meeting their food needs.

We also asked households to estimate what percentage of their food they produced on farm and what percentage they purchased. There was no significant association between certification and self-sufficiency in food production (K–W, $\chi^2 = 0.246$, df = 1, $P \leqslant 0.620$), with all certification groups purchasing the majority of their food. On average, households purchased 61% of their food. We recognize, however, that food production is only one livelihood factor that may contribute to food security. To tease out some of the reasons why households may or may not be able to meet their food needs, we also examined the relationships between reported ability to meet food needs and gross coffee revenue and number of income sources. There was no significant difference in median gross coffee revenue between those households that did and did not report difficulty meeting their food needs (K–W, $\chi^2 = 0.16$, df = 1, $P \leqslant 0.690$). Having more sources of income was, however, associated with being able to meet food needs (K–W, $\chi^2 = 7.97$, df = 1, $P \leqslant 0.005$). Households that did not experience food shortages reported an average of 2.5 income sources, compared with an average of 2.2 income sources for households that did report food shortages.

Education

We measured differences in educational levels by the percent of school-age children in a household that were

reported to be currently in school. Children were defined as of school age if they were over 6 and under 18 years old. We focused on the current education status of children because coffee certifications are relatively new, and could not be expected to affect the educational outcomes of adults[48]. The median for all certification types was approximately 50% of school-age children in school, with no significant difference between certification types (K–W, $\chi^2 = 1.94$, df = 3, $P \leqslant 0.58$). In none of the four countries did the percentage of school-age children per family attending school differ significantly between certification types and non-certified households.

Migration

Migration can be viewed as a plausible strategy that rural households undertake to support their livelihoods by generating income outside of the region. However, some authors argue that migration can have negative effects on rural communities, as it eventually leads to a depletion of human capital, which is necessary to reproduce existing livelihoods[76,77]. In the case of Fair Trade/organic coffee, some studies and certification advocates have suggested that certification has led to decreased migration from coffee regions[77]. Hence, our main research objective related to migration was to examine if certified cooperatives were experiencing a lower incidence of migration than uncertified farmers. To analyze the effects of certification on emigration, we compared the percentages of households from whom at least one family member had emigrated between certified and non-certified groups. 'Emigration' was defined as leaving the home community in order to work. There was some association between certification and emigration when certification types were compared individually, with 37% of non-certified households, 31% of Fair Trade households, 48% of organic households and 27% of Fair Trade/organic households having had a member migrate (Pearson, $\chi^2 = 11.01$, df = 3, $P \leqslant 0.12$). However, when all certification types were combined into one group, there was no significant association between certification and migration (Pearson, $\chi^2 = 0.92$, df = 3, $P \leqslant 0.34$). Neither was there any clear association when the data were examined on a country-by-country basis. It is unlikely that certifications were contributing to any differences in emigration in our sample.

Participation in social and support networks

Through social networks, which can range from the local to the international, individuals, households and communities can expand their access to resources and other opportunities[78]. For example, Fair Trade certified cooperatives in El Salvador received important donations from organizations associated with Fair Trade during the 2003 earthquakes[79]. In our sample, households reported being linked with at least the six following types of support organizations or networks: (i) first-level cooperatives;

(ii) second-level cooperatives; (iii) national organizations or institutions, including NGOs and government institutions; (iv) international organizations or institutions, including NGOs and donors; (v) religious groups, mostly Evangelical and Catholic church groups; and (vi) local/community groups and committees. Households from Fair Trade/organic cooperatives most frequently reported association with organizations and networks. These households cited second-level cooperatives most frequently (50%), followed by national (46%) and international organizations (44%). Both conventional and Fair Trade households cited international organizations most frequently (26 and 28%, respectively), while certified organic cooperatives cited national organizations most frequently (27%).

Knowledge of certification, accountability and power dynamics

We found that there was still much confusion among farmers and cooperative members about what certifications are, and cooperative member's understanding of what it means to 'be certified'. This has also been documented in previous studies[9], and was consistent with the data provided by all of the certifiers and some of the other actors interviewed. In general, farmers understood organic certification much better than Fair Trade. Organic has clear regulations regarding agricultural practices, which farmers found easy to comprehend. Understanding Fair Trade is more challenging, since its standards are based on notions of justice and empowerment[23,80]. On the other hand, certifications were better understood by board members of first-level cooperatives, and fully understood by staff and board members of second-level cooperatives.

Discussion

Effects of certifications on household livelihoods

Most studies on coffee certifications support our results that Fair Trade, organic or Fair Trade/organic certified cooperatives obtain higher coffee prices. Examples of this research include work in Nicaragua[23,80,81], Guatemala[9], Mexico[9,40,41,43] and El Salvador[46]. Price differences were also observed between countries, which relate to the quality of the coffee (as measured by cupping), but also to 'symbolic quality' associated with the marketing of a 'country' brand or image[61]. Households generally have very little control over these quality factors.

Certifications had a positive effect on the incidence of household savings, especially in the Nicaraguan Fair Trade cooperative. Fair Trade and Fair Trade/organic certifications improved credit access, although credit was usually in the form of pre-financing for coffee and not in the form of loans to households. This is consistent with other studies reporting that Fair Trade/organic certification improves credit access and financial stability for cooperative organizations[23,37,41], although not necessarily

for households. Our research suggests the need for follow-up studies around food security issues, since most households claimed they suffered food shortages. The findings also showed that certified households reported more difficulties in meeting basic food needs than non-certified households. Although certified households earned higher gross coffee revenue, this did not translate to greater food security, possibly due to the higher production costs associated with certified production, or with the timing of payments for coffee production (which usually does not coincide with the 'thin months' between staple crop harvests—June to August). Having more than one income source (i.e., not relying entirely on coffee sales for income) did, however, contribute to household food security, perhaps by providing a year-round income source. A comprehensive investigation of all aspects of food security was beyond the scope of this study, and it is possible that other measures of food security (e.g., frequency of skipping meals) would yield different results. Additional research is needed to understand all dimensions of food security, including local contextual factors, in order to begin un-packing the proximate and root causes among all coffee-producing smallholders. No differences were found in the educational levels of school-age children attending school between certified and non-certified households.

We found no differences in the level of migration of certified and non-certified households. These results differ from two different studies in Oaxaca, which found that the higher prices derived from certified coffee sales allowed households to incur the expenses necessary for members to migrate[42]. An ethnographic study by Jaffee[41] also reported that the outmigration of household members affiliated to cooperatives selling to Fair Trade certified markets was twice as high as the figure for non-certified households. However, the heads of households were less likely to migrate among households connected to Fair Trade.

Social networks are an important asset for rural households in developing countries[37,51,82]. These connections and affiliations help farmers obtain important support from government and non-government actors and provide access to knowledge and capacity building[6]. Our data showed that Fair Trade/organic certified households had higher access to different types of networks than other certifications and non-certified cooperatives, although these data were not analyzed statistically. Similar reports confirm the role of coffee certifications in expanding support networks in El Salvador, Nicaragua and Mexico[37,40,66].

Power dynamics in the coffee value chain

Lack of understanding of certification meanings and standards at the household level, especially for Fair Trade, is a persistent problem that has been repeatedly reported in the literature and confirmed by our research[9,46,80]. However, relatively little research has focused on this topic. More attention has been focused on the power dynamics between national and international certifiers and cooperatives in coffee certified networks[5,44,83]. It is clear from our research that certifications can work well for certain types of cooperatives (e.g., highly organized, high-quality coffee, etc.), but may not be a good option for others. Thus, comprehending the opportunities and limitations of certifications is the first step for farmers to make an informed decision regarding their participation in these types of networks. In our sample, the knowledge and understanding to make the right decisions regarding certifications were missing at the household level.

The predominantly buyer-driven coffee value chain is able to enforce a degree of accountability as producer organizations respond to the demands on the northern part of the chain (i.e., importers, roasters, retailers and certification agencies)[61]. Yet, these producers have few mechanisms for holding buyers accountable[6]. In addition, keeping farmer organizations accountable to their members has also been a long-standing challenge[84] and an increasing preoccupation for stakeholders at the processing (i.e., roasters) and consuming ends of the coffee chain[60]. We found clear concerns related to accountability, lack of transparency and miscommunication between households, cooperatives and unions. This is further complicated by the fact that certification systems can have complex re-percussions on the social dynamics of cooperatives and their interactions with member households and other community stakeholders[44]. These can range from cooperative or community members obtaining direct benefits, such as inspector wages, to the tension that can arise when local inspectors find members that are not meeting required certified standards[85].

Conclusions

Effects of certifications

Our study corroborated the conditions of economic poverty among small-scale coffee farmer households in Central America and Mexico[4,86]. All certifications provided a higher price per pound and higher gross coffee revenue than non-certified coffee. However, the average volumes of coffee sold by individual households were low, and many certified farmers did not sell their entire production at certified prices. This meant that the revenue contribution of coffee sales to household livelihoods was relatively small, regardless of certification. In addition, certifications had insignificant effects on other livelihood-related variables, such as education, and incidence of migration at the household level, although they were positively associated with savings and credit. The combined Fair Trade/organic certification also linked farmers with a higher number and diversity of support networks, a factor that was considered important by all farmers interviewed. As a market mechanism, certification is working effectively by providing better prices for certified coffee, but the contribution derived from these premiums has limited effects on household livelihoods. This demonstrates that certifications alone will

not bring significant poverty alleviation to most coffee families.

Policy recommendations

The relatively small average volumes of coffee produced by most small-scale farmers, and the even lower volumes that they are able to sell at certified prices, point to the need to support livelihood and agricultural diversification in coffee areas[9,87]. These initiatives should be 'related to, but separate from coffee', as was expressed by Salvadoran coffee farmers in a focus group in 2002[88]. Food security remains precarious in most of the households interviewed, which justifies this as a priority area of investment for development interventions in coffee areas. Recent trends in global food prices and availability further support this argument.

Until now, a high level of investment by donors and development organizations has been placed in facilitating second-, and to a lesser degree, first-level cooperatives to acquire Fair Trade and organic certifications and markets[23]. While this has certainly helped build the capacity of cooperatives, our data suggest that some of this support could be re-directed to establish higher accountability within cooperatives and to increase knowledge and decision-making capability related to diversification strategies. This will require investments that are more locally based and less directed towards superficial monitoring of second- and third-level cooperative unions. Misunderstanding of prices, terms and benefits from certifications by both farmers and first-level boards of directors is also a long-standing problem with certifications. This is related to inefficient capacity building, complicated price and credit structures and lack of transparency within some cooperative organizations. Much improvement can be achieved by designing efficient popular educational materials and training approaches on certifications that are adequate for the educational levels of coffee farmers (see Méndez[89]).

Although we have argued that certified coffee markets alone will not resolve the livelihood challenges faced by smallholder households, they could still contribute to broad-based sustainable livelihoods, rural development and conservation processes in coffee regions. This can be done by developing more active partnerships between coffee farmers, certifications and environmental and rural development organizations and researchers[86]. Certifications, especially Fair Trade/organic, have proven effective in supporting capacity building and serving as networks that leverage global development funding for small-scale coffee-producing households. These community level investments should focus on livelihood diversification directed at alleviating the persistent livelihood vulnerabilities of smallholder coffee farmers identified in this and other studies[9,41,48,86].

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