Selling Sustainability Short? The Private Governance of Labor and the Environment in the Coffee Sector: Data in Brief

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1. Group-level baseline characteristics of the collected observations

Not all certifications are used in each country – and each of the cooperatives – to the same extent. The higher the regional coffee price, the less attractive entry-level schemes with smaller price premiums such as 4C and UTZ Certified become. Thus, 4C was never really rolled out in Costa Rica and UTZ Certified was being dropped by a number of cooperatives in Costa Rica and Colombia at the time of the study. Instead, quality-focused schemes such as Nespresso AAA and Starbucks C.A.F.E. Practices tend to be rolled out in these higher-quality regions, while they are not found in countries such as Honduras. Organic certification furthermore is virtually non-existent in Costa Rica and mainly present in indigenous communities in Colombia, which do not exist in the regions covered by this research. These features of the certified coffee market thus also shaped the final sample to the extent that I am able to report findings for all seven certifications, but that not all certifications can be compared across all three countries.

Furthermore, in Colombia and Costa Rica most cooperatives that engaged in private sustainability standards held both cooperative-wide Fairtrade certification as well as certification with additional standards for specific subgroups. In those cases, I used a two-stage approach to calculate additionality. In a first step, I compared only-Fairtrade certified farmers with a non-certified control group. In the second step, I compared the subgroups with additional standards to matched farmers that were only engaged in Fairtrade certification, given that the subgroups were subject to additional rules, trainings and incentives above and beyond the Fairtrade baseline. Thus, the additionality results for the next sections use a Fairtrade-only comparator group for the Colombian 4C, Rainforest Alliance, Starbucks C.A.F.E. Practices and Nespresso AAA groups, as well as the Costa Rican Rainforest Alliance/AAA and Starbucks C.A.F.E. Practices groups. The Costa Rican Rainforest Alliance/ Starbucks C.A.F.E. Practices contained farmers from both Fairtrade and non-Fairtrade cooperatives, and thus the control group is pooled from both Fairtrade and non-certified farmers. Table 1.1 summarizes the distribution of observations across the three country contexts and seven certification schemes. In the following, I present baseline characteristics of the interviewed farmers by country context.

	Honduras	Colombia	Costa Rica	Total
Fairtrade	48	250	94	392
Fairtrade/organic	47	0	0	47
4C	135	86 (+ FT)	0	221
UTZ Certified	94	0	0	94
Rainforest Alliance	76	81 (+ FT + AAA)	71 (+ FT+AAA) + 81 (+ C.A.F.E.)	309
Starbucks C.A.F.E.	0	84 (+ FT)	118 (+ FT)	202
Nespresso AAA	0	144 (+ FT)	0	144
Non-certified	259	97	139	495
Total	659	742	503	**1'904**

Table 1.1. Total number of collected observations by country and certification scheme

1.1. Baseline characteristics of the groups under analysis: Honduras

The most common way for producers to access private sustainability standards in Honduras is for a larger trader to recruit them, or – in the case of the Fairtrade certification – to be member of a

cooperative. Thus, in this sample we find three groups of farmers (Rainforest Alliance, UTZ Certified, and 4C) that have been organized through a large national coffee trader, as well as samples from two individual cooperatives, both of which have been recipients of international development assistance in addition to their certification efforts.

The Fairtrade/organic cooperative started with the Max Havelaar certification in 1998, and acceded to the FLO standard in 2001 and the organic certification in 2003. It was thus an early mover in the realm of sustainable production. Their proactive attitude has also led them to be included in a number of other development projects, such as a Heifer International project that distributed livestock among farmers in an effort to diversify, and a USAID project that promoted the adoption of vegetable production as an additional source of income.

The Fairtrade (conventional) group, in turn, is a newer cooperative that was only formed in 2009 and has in the past received infrastructure investment support by the Inter-American Development Bank and a number of regional sources to construct a new processing plant, as well as participating in a SAG/USDA/IICA-led program that directly funded their capacity-building to access the Fairtrade brand. They received their Fairtrade certification in 2013 and were beginning to look into a transition toward organic production at the time of data collection, though no concrete efforts had been undertaken to date.

The Rainforest Alliance group was sampled from three different Rainforest Alliance producer groups, at least one of which has its roots in a buyer-driven development program that provided a direct market for the certified coffee. Farmers acceded to the subgroups between 2013 and 2015, with an average of two years of participation. The UTZ group was sampled from four different regional subgroups of farmers that all had also participated in the 4C program. Their first date of certification ranged from 2008 to 2015, with farmers with different entry dates present in each of the four subgroups and an average of three years of participation in the certification group. The 4C group was sampled from five subgroups, in which around one fifth of producers were in the process of re-verification (having completed 3 years), 10% had just gotten their first verification, and the rest were in their second or third year of 4C participation.

Honduras: Baseline characteristics						
Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Number of observations	76	47	48	94	135	259
Age (years)	45.28	46.66	47.48	49.95	47.85	44.16
Share of female producers	0.16	0.02	0.19	0.17	0.19	0.20
Education (years of schooling)	8.49	8.26	7.19	4.88	5.50	5.15
Number of children	3.41	3.57	3.98	3.96	3.81	3.83
Total area (ha)	13.70	9.42	4.05	6.53	5.25	4.80
Coffee area in production (ha)	8.62	2.40	2.66	3.51	3.43	3.15
Altitude (m)	1160.23	1243.12	1085.98	1078.00	1041.48	1038.80
Distance to market (min)	44.87	32.34	53.23	46.33	45.41	49.58
Poverty Probability Index	62.91	59.26	47.17	52.11	51.48	50.60
Probability of living under the national poverty line	38.2%	50.6%	68.7%	57.0%	57.0%	57.0%

Table 1.2. Baseline characteristics of sampled Honduran farmers (before matching)

The surveyed Honduran farmers are, on average, between 45 and 50 years old, are overwhelmingly male – with, at best, 20% of female-headed farms, and shares as low as 2% of women farmers in the Fairtrade/organic group – and have completed between five and eight years of education. We see

important differences between the Rainforest Alliance, Fairtrade/organic and Fairtrade groups, where farmers have reached higher levels of education, and the other sampled groups. This speaks for a degree of self-selection into the certified groups, as both cooperative membership and the submission to strict rules and infrastructure improvements such as water treatment facilities is uncommon among Honduran producers. The farmers have between 2 and 3 hectares of coffee land under cultivation, and thus fit squarely within the smallholder category – with the exception of the Rainforest Alliance group, where the average coffee land in production reaches 8 hectares. All are at similar levels of altitude between 1000 and 1200 m.a.s.l., which is close to the lower limit of Arabica cultivation and does not, usually, allow for high-quality coffee. Farmers need to transport their coffee for 30 to 50 minutes before being able to sell it, on roads that are not always accessible, especially during the rainy season. When calculating the Poverty Probability Index by group, we see that most farmers have a likelihood of over 50% of living under the national poverty line, with only Rainforest Alliance farmers showing a notably higher standard of living.

1.2. Baseline characteristics of the groups under analysis: Colombia

In Colombia, the strong institutional infrastructure through the FNC-cooperative network has meant that the strongest density of certified producers lie in the *eje cafetero*, the coffee belt, and belong to a mid-sized to large cooperatives (Grabs *et al.*, 2016). We thus approached cooperatives in this region, and collaborated with three – two of which were Fairtrade-certified, and one which did not have a certification yet, though it was in the process of researching how to access certification.

The first Fairtrade-certified cooperative (which in the following text will be labeled as [A] when disaggregating results) had two subgroups involved in additional private standards, one of which belonged to the Starbucks C.A.F.E. Practices and the other which was part of the Nespresso AAA group. The cooperative has held Fairtrade certification since 1997, and select producers had become Rainforest Alliance-certified in 2003 before the cooperative's involvement with Nespresso in 2005. These producers then joined Nespresso AAA, and the producers with the highest production volumes were chosen by Nespresso to become certified with Rainforest Alliance again within the AAA group. The cooperative has furthermore entered into collaborations with several organizations, such as the UK-based Fairtrade Foundation, and hosted a pilot project to establish producer pensions that is jointly supported by Nespresso and Fairtrade.

The second cooperative [B] is a regional frontrunner that has pursued a sophisticated differentiation strategy and participates regularly in international coffee events. It engages in a number of quality-focused collaborations with international trading partners, and has furthermore received assistance from microlending programs such as Oikocredit and the Grameen bank. It provides a number of advanced services to its members, such as a guaranteed purchasing program with a base price that is independent from world market movements, and the subsidization of a number of inputs and services. With a long history in the Fairtrade movement, it further acquired the Fair Trade USA certification in 2013. It has also been involved in Nespresso AAA and 4C since at least 2011, and Starbucks C.A.F.E. Practices since 2013.

The Rainforest Alliance/AAA group in the sample is thus made up of farmers from cooperative [A], the 4C group made up solely by producers from cooperative [B], and the Nespresso AAA, C.A.F.E. Practices, and Fairtrade groups are made up by producers from both cooperative [A] and cooperative [B].

The third, non-certified cooperative has been particularly focused on quality and regional differentiation, establishing a quality laboratory, an origin label and supporting producers in their efforts to establish micro-lots, but has felt it missed out on the cooperative-specific benefits of Fair Trade certification (such as accessing the social premium as a basis to co-finance other projects) (interview 44, Colombian cooperative 3, 2016). It was thus starting to look into acquiring the Fair Trade label, but had not yet begun the application or transition process.

Colombia: Baseline characteristics						
Means by group	**Rainforest Alliance/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Number of observations	81	144	84	86	250	97
Age (years)	55.40	52.22	53.77	57.80	53.35	55.89
Share of female producers	0.27	0.22	0.54	0.01	0.27	0.37
Education (years of schooling)	3.85	4.43	5.73	4.93	4.79	7.23
Number of children	3.14	3.03	3.21	3.28	2.96	3.17
Total area (ha)	4.76	4.08	5.54	4.13	5.54	9.87
Coffee area in production (ha)	2.42	1.98	2.86	2.71	2.83	4.02
Altitude (m)	1694.05	1753.84	1710.76	1773.43	1695.93	1666.16
Distance to market (min)	48.77	46.24	46.05	33.53	44.34	41.08
Progress out of Poverty Index	46.96	44.57	45.92	47.81	46.15	49.58
Probability of living under the national poverty line	18.2%	29.6%	18.2%	18.2%	18.2%	18.2%

Table 1.3. Baseline characteristics of sampled Colombian farmers (before matching)

When comparing the Honduran baseline characteristics with those of the Colombian farmers, we can identify some differences, but also many similarities. Colombian farmers tend to be between 55 and 57 years of age – almost 10 years older on average than their Honduran counterparts, which points to the fact that the Honduran coffee sector is attractive enough to produce generational change (LeSage, 2015), while Colombian farmers' children prefer to find other employment opportunities. Perhaps connected to this age difference, farmers' educational level tends to be equal, if not lower, in Colombian farmers than in Honduran producers, with farmer groups showing an average of 4 to 5 years of schooling. Anecdotally, the educational infrastructure during the youth of today's coffee farmers was so poor that some villages only taught a first and second grade class, and that children attended both grades several times before leaving school and working on the farm (field notes, Colombian producer, 2016). Colombian farmers have slightly fewer children – an average of 3 compared with a Honduran average of 3.5 to 4 – and slightly smaller coffee areas in production (between 2 and 3 hectares on average, though the control cooperative shows an average of 4 hectares). They have a similar distance to market, though their roads tend to be better maintained. One important difference is the altitude of this Colombian sample group: most farmers are located at 1600 to 1700 m.a.s.l., a prime altitude for optimal Arabica quality and one reason why private labels such as Nespresso AAA and Starbucks C.A.F.E. Practices source from these regions. Colombian farmers tend to have higher standards of living, as shown in the Poverty Probability Index, with better amenities and lower likelihoods of living under the national poverty line.

1.3. Baseline characteristics of the groups under analysis: Costa Rica

In Costa Rica, both private mills and cooperatives lead certification groups of smallholder farmers (Grabs *et al.*, 2016). To ensure comparability, and due to questions of access, we here chose to focus on cooperatives, and worked with five different cooperatives due to the smaller size of certified groups as compared to Colombian ones. Three of these cooperatives carried Fairtrade certification, which they acquired in 2005, 2006, and 2010, respectively. Furthermore, all of these three cooperatives also have broad-ranging C.A.F.E. Practices programs: one that includes all cooperative members, and two others that have established smaller C.A.F.E. Practices subgroups. In at least one case, acquiring the two standards went hand in hand, as Starbucks bought important quantities of Fairtrade-certified coffee before the economic crisis; however, now they have mostly abandoned that purchasing strategy.

In the case of Nespresso AAA, marketing coffee under private sustainability standards requires the collaboration between cooperatives and private exporters, since the export of Costa Rican Nespresso AAA coffee is in the hands of two large multinational traders that have divided up the regional 'clusters' amongst themselves. Access to this exporting channel then relies on cooperatives' relationships with these traders – which in many cases are also their direct competitors in buying coffee from smallholders. This competition prevented one cooperative from accessing the valuable Nespresso AAA market, while another one was able to work out a tenuous arrangement with the other multinational trader. This resulted in the Rainforest/AAA group in our sample. Due to this hybrid model, the Fairtrade cooperative in question is bound to market the doubly certified coffee through one particular trader, since this trader is both the Nespresso supplier and the Rainforest Alliance certificate holder. Furthermore, the quantities of AAA coffee are so low that participating farmers are given individual quotas to fill. This inconvenience led them to contemplate pursuing their 'own' Rainforest Alliance certification to allow them to sell Rainforest Alliance-certified coffee directly to their other buyers. Furthermore, as is the case in Colombia, Nespresso's micro-region-driven cluster approach may split across the regional influence of cooperatives, excluding otherwise eligible farmers due to their location one valley away. In many such cases, the C.A.F.E. Practices program is pursued as a 'second-best' option, though it tends to pay lower premiums than Nespresso AAA.

Finally, the Rainforest Alliance/C.A.F.E. group is made up of members of two cooperatives which all have also participated in the C.A.F.E. Practices program and later accessed the Rainforest Alliance standard. One cooperative holds Fairtrade certification, while the other does not – I thus included both Fairtrade and non-certified farmers in this particular control group and control for Fairtrade as additional variable to isolate the Rainforest Alliance/C.A.F.E. effects. I differentiate between Rainforest Alliance/AAA and Rainforest Alliance/C.A.F.E. group membership for two reasons: first, the more stringent quality requirements of Nespresso AAA may change the production behavior and cost-benefit calculus of participating farmers; and second, the presence of Nespresso agronomists on the farms could potentially lead to differences in the amount of training provision or additional best-practice support that may influence the adoption of various practices.

In addition, many of the Costa Rican cooperatives have developed creative ways to attempt to access higher-value markets. One has created its own in-house sustainability certification scheme to motivate farmers to adopt better practices; another is pursuing a 'community coffee' certification that will distinguish coffees by their micro-origins and focuses on quality, exclusivity and culture; and a third has been a pioneer of developing 'carbon-neutral coffee' through greenhouse gas mitigation practices. Furthermore, a number collaborate with universities, research centers, development agencies and government-run programs, some have access to microloans through international lending organizations, and some have diversified into other crops (such as sugar cane) or activities (such as the

running of supermarkets to subsidize their coffee marketing activities). We can thus see that for many organized farmer groups, both in Colombia as well as in Costa Rica, the use of private sustainability standards is one strategy among many to distinguish their coffees; and that the improvement of farm-gate prices is at the forefront of these efforts due to the difficult economic situation of their members.

Costa Rica: Baseline characteristics					
Means by group	**Rainforest Alliance/AAA**	**Rainforest Alliance/C.A.F.E.**	**C.A.F.E. Practices**	**Fairtrade**	**Non-certified**
Number of observations	71	81	118	94	139
Age (years)	60.21	52.49	53.88	58.46	56.34
Share of female producers	0.04	0.22	0.13	0.13	0.33
Education (years of schooling)	8.44	10.01	8.21	6.98	9.15
Number of children	3.11	2.56	2.73	2.89	2.53
Total area (ha)	8.86	12.20	6.36	6.07	6.65
Coffee area in production (ha)	6.13	6.04	3.88	3.54	5.33
Altitude (m)	1276.92	1641.17	1401.17	998.36	1607.67
Distance to market (min)	10.24	18.30	14.53	13.57	19.08
Share that own a television	0.71	0.46	0.35	0.12	0.12
Average number of cars owned	1.50	1.97	1.60	1.38	1.42

Table 1.4. Baseline characteristics of sampled Costa Rican farmers (before matching)

In Table 1.4, we can observe that the Costa Rican producers again have a higher average age than the farmers in the Colombian or Honduran samples, with the mean age reaching 58 to 60 years in some groups. The sample includes a similar share of female farmers, though here again there are group-wise differences, with the Rainforest/AAA group being almost entirely male. It is clear that the mean education level is much higher than in the two comparison countries, with most producers having completed at least the six grades of primary school; interestingly, the (only) Fairtrade group shows lower levels of education than either the non-certified farmers or the groups belonging to more advanced standards. This pattern is repeated in the total area and coffee area under production – the Costa Rican producers plant almost twice as much land as do the Colombian and several Honduran groups, but Fairtrade farmers again come in at the bottom. Similarly, they report much lower altitudes than either non-certified farmers or those that form part of quality-driven certification initiatives.[1] This micro-data provides quantitative evidence for interview-based reports that in Costa Rica, the Fairtrade certification tends to be used by lower-quality or –capacity cooperatives in order to gain access to additional financial resources that allow them to compete in two regards: on a national level with high-quality challengers, and on a local level with multinational private exporters who may lure their members away with more attractive pre-financing and price offers. It will remain to be seen whether Fairtrade's regulatory framework empowers producers to overcome these socio-economic differences and adopt best agricultural practices.

The smaller country size and centralized milling infrastructure mean that Costa Ricans only need around one-third of the time of Colombian or Honduran producers to bring their product to market, significantly cutting down on their transportation costs. Finally, the higher stage of the country's development is also visible in individual-level indicators – though the low levels of absolute poverty

[1] Though this data needs to be seen as tentative, since not all data collectors managed to log altitude and GPS data. For this reason, I also decided to exclude altitude as a covariate from the propensity score matching and regression calculations below, since it would have caused the exclusion of an important number of observations.

mean that there is no Poverty Probability Index methodology available for Costa Rica, we can see large differences to the other countries in the disaggregated indicators – for instance, between 95% and 100% of all farmers report having access to potable water and bathrooms, and most own at least one car. We can see the relative differences in wealth levels based on the television indicator, which shows the higher levels of disposable income of the higher-quality groups, particularly Rainforest/AAA, over the Fairtrade and non-certified farmers.

2. Standards as drivers of sustainable intensification: Average Treatment Effects on the Treated

2.1. Productivity and input efficiency

In the following section, I report the productivity of coffee production through the indicator of yields of green coffee (that is, coffee that has been depulped, washed, and dried) in 100 pounds per hectare of coffee area in production (thus, not taking into account area that is currently fallow[2]). The input intensity is calculated as liters of pesticides, or bags of synthetic fertilizer, applied per hectare of coffee area in production. Input efficiency, in turn, is calculated as liters of pesticides, or bags of synthetic fertilizer, applied per 100 pounds of green coffee output. I decided to report input use/output rather than the inverse in order to allow for the use of no synthetic pesticides or fertilizers while still generating output, as is the case for instance in organic production. Those observations would have otherwise been divided by zero and dropped out of the analysis. In general, fertilizer is sold in uniformly sized 50-kg bags. While the concentration of the active ingredient in pesticide preparations may vary, it was impossible to gather more precise data considering the volume of data collected. These numbers should thus be seen as a rough estimate of input efficiency in order to illustrate the underlying argument.

At this point, a brief explanation is in order to help the reader interpret the following tables that report implementation and additionality results. It can first be noted that the analyzed certification groups are ordered roughly according to the stringency of the overall certification requirements, with stringency decreasing as we move from left to right. Comparison groups (non-certified farmers in the case of Honduras, and Fairtrade and non-certified farmers in the cases of Colombia and Costa Rica) are listed on the right-hand side.

The header row further specifies the respective comparison group for each certification group. As explained in section 5.2, some groups (notably all certified groups in Honduras and the Fairtrade groups of Colombia and Costa Rica) are compared against a non-certified (NC) baseline, while the groups that constitute subgroups of Fairtrade cooperatives are compared against a Fairtrade (FT) baseline in order to differentiate the effects of either certification program. As noted, the control group for the Costa Rican Rainforest Alliance/C.A.F.E. Practices group includes both Fairtrade and non-Fairtrade farmers (FT/NC) because this particular certification mix was found in one Fairtrade and one non-Fairtrade cooperative; I subsequently control for Fairtrade membership in the propensity score matching and regression analyses.

As we move down to the results, the first row of results refers to the means by group (demonstrating implementation or non-implementation of a given requirement), with the second and third rows reporting the additionality of certification on the practice in question, as calculated through two procedures. The second row (in cursive) showcases the average treated effect on the treated derived

[2] I made this choice because my primary aim here is to analyze the ecological and economic trade-offs, rather than the economic outcomes alone. For that purpose, it is important to understand the true intensity of production on those areas that are currently in rotation, as well as the amount of inputs used on that area. Using the total coffee area including currently fallow land for these calculations would in effect dilute the intensity of production across a larger area than was being farmed. This choice means that the values I calculate here are slightly higher than national yield averages reported in chapter 9. This is likely due to a combination of the choice to focus on area in production rather than total coffee area as well as the specific circumstances of both treatment and the matched control groups; inferences derived from these results should therefore be limited to the specific purposes of this chapter.

from propensity score matching, whereas the third row (in bold) shows the linear regression or logit results, depending on the indicator in question, when controlling for all covariates. Significant results are indicated through the usual notation (* = p < 0.10; ** = p < 0.05; *** = p < 0.01); and results can be seen as more robust the more significant and similar they are across both estimation approaches. See Appendix 1 in the book manuscript for more detail on the methods used.

Honduras: Productivity and input efficiency						
Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Additionality	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	
Productivity (in 100 lbs/ hectare)	43.39	20.81	22.05	34.20	28.99	31.51
	*6.46*** (2.25)*	*-15.39*	*-2.74*	*2.16*	*-.06*	
	5.42* (1.85)**	**-11.75*** (3.41)**	**-1.47**	**-.40**	**-.11**	
Fertilizer intensity (in bags/hectare)	20.96	3.69	9.67	16.27	14.72	16.23
	*3.96** (2.00)*	-15.21*** (1.71)	*-4.19* (2.51)*	*.73*	*.11*	
	2.69	**-16.28*** (1.88)**	**-3.08** (1.53)**	**-.86**	**-.28**	
Fertilizer efficiency (bags/100 lbs)	0.54	0.27	0.73	0.56	0.59	0.60
	.04	*-.57* (.32)*	*.16*	*.00*	*.01*	
	-.08	**-.56*** (.09)**	**.10**	**-.00**	**-.02**	
Pesticide intensity (liters/hectare)	1.15	0.07	0.17	0.98	1.06	1.80
	*-1.20*** (.35)*	*-2.24*** (.64)*	*-.23*	*-1.09*** (.32)*	*-.41*	
	-1.16* (.37)**	**-2.97*** (.41)**	**-.42* (.22)**	**-1.07*** (.22)**	**-.47** (.18)**	
Pesticide efficiency (liters/100 lbs)	0.03	0.00	0.01	0.03	0.05	0.07
	-.01 (.00)*	*-.09*** (.01)*	*-.00*	*-.04*** (.01)*	*-.00*	
	-.04* (.01)**	**-.11*** (.01)**	**-.02** (.01)**	**-.04*** (.01)**	**-.01**	

Table 2.1. Results on productivity and input use efficiency in Honduras

Colombia: Productivity and input efficiency						
Means by group	**Rainforest/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT*	*vs. FT*	*vs. FT*	*vs. NC*	
Productivity (in 100 lbs /hectare)	38.47	33.69	37.26	36.34	37.21	23.11
	2.91	*-3.75*	*-1.34*	*3.28*	*12.31*** (2.59)*	
	.06	**-2.67**	**.85**	**5.94**	**11.81*** (2.84)**	
Fertilizer intensity (in bags/hectare)	19.43	21.62	24.48	23.62	23.24	18.40
	-6.89 (3.96)*	*-2.57*	*.89*	*-2.91*	*5.46*** (1.50)*	
	-7.95* (2.74)**	**-1.76**	**-.11**	**3.02**	**1.39**	
Fertilizer efficiency (bags/100 lbs)	0.66	0.81	0.77	0.98	0.75	1.10
	*-.15** (.06)*	*.01*	*-.06*	*.05*	*-.10*	
	-.17 (.08)**	**.00**	**-.02**	**-.01**	**-.45*** (.14)**	
Pesticide intensity (liters/hectare)	2.19	2.36	3.54	3.69	3.14	0.89
	-.61	*-.79*	*-.33*	*.16*	*2.28*** (.49)*	
	-.95	**-.68**	**-.05**	**1.39* (.72)**	**1.94*** (.66)**	
Pesticide efficiency (liters/100 lbs)	0.07	0.07	0.10	0.14	0.11	0.03
	-.02	*-.05*	*-.02*	*-.11*	*.07*** (.02)*	
	-.02	**-.03**	**-.01**	**-.01**	**.06*** (.02)**	

Table 2.2. Results on productivity and input use efficiency in Colombia

Costa Rica: Productivity and input efficiency					
Means by group	**Rainforest/ AAA**	**Rainforest/ C.A.F.E.** *vs. FT/NC*	**C.A.F.E. Practices**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*		*vs. FT*	*vs. NC*	
Productivity (in 100 pounds/ hectare)	37.19 *11.95*** (4.18)* **10.31*** (3.84)**	39.79 *9.66*** (2.76)* **7.37** (2.88)**	36.92 *.02* **7.19** (2.87)**	28.55 *-2.97* **-4.21**	32.33
Fertilizer intensity (in bags/hectare)	26.01 *-3.94* **-.13**	27.90 *5.60*** (2.10)* **3.98* (2.1)**	21.86 *6.61*** (2.53)* **5.60** (2.29)**	25.40 *5.08** (2.19)* **6.59*** (2.40)**	17.47
Fertilizer efficiency (bags/100 pounds)	0.88 *-.90*** (.33)* **-.66** (.29)**	0.89 *-.00* **-.25**	0.75 *-.18* **-.37* (.22)**	1.45 *.76*** (.23)* **.54*** (.16)**	0.71
Pesticide intensity (liters/hectare)	7.63 *.42* **1.24**	7.01 *.78* **1.83**	5.82 *.15* **-.13**	5.77 *-1.21* **-.08**	5.26
Pesticide efficiency (liters/100 pounds)	0.28 *-.05* **-.05**	0.20 *-.00* **-.05**	0.19 *-.03* **-.10** (.04)**	0.29 *.07* **.05**	0.21

Table 2.3. Results on productivity and input use efficiency in Costa Rica

2.2. Trainings as pathway toward greater yields and input use efficiency

During field-testing of the questionnaire, it became clear that quantifying training activities is highly complex. Depending on the regional context, several service providers (including cooperatives, regional organizations, coffee institutions, NGOs, and commercial actors) may be active in providing training, especially on good agricultural practices. Furthermore, many farmers were unable to recall the exact number, duration, or type of training activities over the last year. Therefore, I opted for a simpler reporting approach, and simply asked farmers whether they had had access to training activities in recent years, what those trainings covered, and whether they regularly attended and implemented what they learned. The latter variables may be seen as proxies for the incentive structures provided and effectiveness of the training, while the unprompted recall of the training content also speaks to its general effectiveness – if a farmer was nominally trained in good agricultural practices, but does not remember that training sufficiently to report it in this survey, we can infer that it was rather ineffective in creating behavioral change.

Honduras: Trainings as pathway towards sustainable intensification						
Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified** *vs. NC*	**4C**	**Non-certified**
Additionality	*vs. NC*	*vs. NC*	*vs. NC*		*vs. NC*	
Share of producers with GAP training	0.95 *.14** (.06)* **.19*** (.04)**	1.00 *.17*** (.06)* -	1.00 *.16** (.07)* **-**	0.74 *.05* **.00**	0.85 *.04* **.06**	0.74
Share of producers with environmental training	0.79 *.56*** (.05)* **.41*** (.06)**	0.56 *.28* **.49*** (.10)**	0.30 *-.08* **-.06**	0.52 *.32*** (.07)* **.26*** (.06)**	0.36 *.01* **.04**	0.25
Share of producers that always attend training	0.82 *.09* **.12* (.06)**	1.00 .38** (.16) -	0.91 *.30*** (.09)* **.27*** (.05)**	0.63 *.01* **-.03**	0.61 *-.08* **-.04**	0.68
Share of producers that always follow recommendations	0.81 *.21** (.09)* **.20*** (.06)**	0.98 .42** (.16) .35*** (.04)	0.91 *.30*** *(.12)* **.32*** (.05)**	0.59 *.02* **.00**	0.67 *.00* **.07**	0.63
Share of women that always attend training	0.53 *-.06*	0.57 *.24*	0.45 *-.06*	0.51 *.05*	0.46 *.01*	0.47

	.09	**-.03**	**.13* (.08)**	**-.00**	**.04**	
Within-group t-test of means with vs. without environmental training						
Yields (qq/ha)	45.63***	21.03	19.56	33.52	33.06	35.11
	31.78	20.55	23.12	34.36	28.01	30.81
Fertilizer efficiency	.49**	.28	.52	.52	.58	.57
(bags/qq)	.75	.26	.85	.66	.59	.60
Pesticide efficiency	.02*	.00	.00	.03	.04	.04*
(l/qq)	.06	.00	.01	.03	.05	.07

Table 2.4. Results on trainings as pathways to sustainable intensification in Honduras

Colombia: Trainings as pathway towards sustainable intensification						
Means by group	**Rainforest/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT*	*vs. FT*	*vs. FT*	*vs. NC*	
Share of producers with GAP training	0.96	0.97	0.94	0.96	0.96	0.86
	.01	*.02*	*.02*	*.02*	*.08* (.04)*	
	-	**.01**	**-**	**-**	**-**	
Share of producers with environmental training	0.65	0.73	0.45	0.63 [B][3]	0.71 [A] 0.18 [B]	0.77
	-.10	*.20*** (.05)*	*-.00*	*.30***(.10)*	**-.06 [A]**	
	-.04	**.16***(.05)**	**-.03**	**.28*** (.07)**	**-.55*** (.06) [B]**	
Share of producers that always attend training	0.95	0.89	0.84	0.81	0.81	0.79
	-.02	*-.00*	*-.08* (.04)*	*-.04*	*-.02*	
	-	**-.00**	**-.02**	**.07**	**-.02**	
Share of producers that always follow recommendations	0.91	0.90	0.84	0.92	0.86	0.85
	-.05 (.03)*	*.02*	*.02*	*.22** (.08)*	*-.05*	
	-	**.03**	**-.01**	**.09* (.05)**	**-.04**	
Share of women that always attend training	0.40	0.35	0.60	0.28	0.39	0.52
	-.12	*-.03*	*.05*	*.07*	*-.06*	
	-.07	**-.01**	**.05**	**.11**	**-.15** (.07)**	
Within-group t-test of means with vs. without environmental training						
Yields (qq/ha)	40.28	35.23	39.86	37.73	37.63	23.02
	35.11	29.44	35.12	34.07	36.93	23.39
Fertilizer efficiency	.63	.78	.91	1.04	.76	1.10
(bags/qq)	.71	.85	.65	.87	.74	1.18
Pesticide efficiency	.04**	.04***	.05**	.14	.07	.03
(l/qq)	.11	.12	.13	.13	.13	.01

Table 2.5. Results on trainings as pathways to sustainable intensification in Colombia

Costa Rica: Trainings as pathway towards sustainable intensification					
Means by group	**Rainforest/ AAA**	**Rainforest/ C.A.F.E.**	**C.A.F.E. Practices** *vs. FT*	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT/NC*		*vs. NC*	
Share of producers with GAP training	1.00	0.78	0.86	0.93	0.95
	*.08** (.03)*	*-.17*** (.04)*	**-.07* (.04)**	*-.01*	
	-	**-.15*** (.05)**	**-**	**-.01**	
Share of producers with environmental training	0.87	0.42	0.61	0.79	0.71
	.09	*-.27*** (.07)*	*-.21*** (.06)*	*-.04*	
	-	**-.21*** (.07)**	**-.12* (.06)**	**.05**	
Share of producers that always attend training	0.80	0.64	0.64	0.46	0.61
	*.33*** (.08)*	*.28*** (.09)*	*.15* (.09)*	*-.22** (.11)*	
	.36* (.07)**	**.23*** (.06)**	**.23*** (.06)**	**-.18** (.07)**	
	0.86	0.57	0.61	0.65	0.83

[3] The 4C group is constituted of members of one particular cooperative (cooperative [B]) and its comparison group is equally limited to the Fairtrade-certified members of that cooperative. This explains the strong positive additionality effect in this variable which scored very low among Fairtrade-certified farmers of cooperative [B].

Share of producers that always follow recommendations	*.17** (.07)* **.10**	*-.08* **-.05**	*.01* **.04**	*-.17* (.09)* **-.11* (.06)**	
Share of women that always attend training	0.28 *.14*** (.07)* **.17** (.06)**	0.27 *.13** (.06)* **.14** (.07)**	0.16 *.03* **.05**	0.17 *.01* **-.02**	0.24
Within-group t-test of means with vs. without environmental training					
Yields (qq/ha)	38.48 28.41	43.45 37.14	36.07 38.22	28.20 29.81	32.93 30.81
Fertilizer efficiency (bags/qq)	.76*** 1.69	.97 .86	1.08 .86	1.15** 2.51	.69 1.44
Pesticide efficiency (l/qq)	.22** .60	.25 .17	.19 .17	.25* .45	.20 .13

2.3. Record keeping as pathway toward greater yields and input efficiency

Honduras: Record-keeping as pathway towards sustainable intensification						
Means by group *Additionality*	**Rainforest Alliance** *vs. NC*	**FT/organic** *vs. NC*	**Fairtrade** *vs. NC*	**UTZ Certified** *vs. NC*	**4C** *vs. NC*	**Non-certified**
Share of producers that implement record-keeping	0.62 *.26*** (.03)* **.29*** (.05)**	0.94 *.92*** (.03)* **.82*** (.08)**	0.74 *.05* **.14* (.08)**	0.37 *.07* **.09** (.04)**	0.43 *-.03* **.04**	0.34
Hours spent on records/month (of those that keep records)	5.57 *3.61**** *(.90)* **2.14*** (.73)**	2.96 - **-.06**	6.09 *4.21*** *(.99)* **4.49*** (1.67)**	1.87 *.53* **.67**	1.55 *.00* **-.15**	1.97
Share of producers implementing changes based on records	0.87 *.21* **.13**	0.98 - -	0.51 *-.08* **-.13**	0.37 *-.03* **-.11**	0.43 *-.08* **-.07**	0.55
Within-group t-test of means with vs. without record keeping						
Yield (qq/ha)	47.31** 37.05	20.77 21.51	23.31 18.28	30.35* 36.48	26.25 31.05	29.01 32.79
Fertilizer efficiency (bags/qq)	.48 .63	.26 .40	.58 1.16	.49 .61	.57 .59	.55 .62
Pesticide efficiency (l/qq)	.02** .05	.00 .00	.01 .01	.02* .04	.03 .06	.02*** .09

Table 2.7. Results on record keeping as pathway to sustainable intensification in Honduras

Colombia: Record-keeping as pathway towards sustainable intensification						
Means by group *Additionality*	**Rainforest/ AAA** *vs. FT*	**Nespresso AAA** *vs. FT*	**C.A.F.E. Practices** *vs. FT*	**4C** *vs. FT*	**Fairtrade** *vs. NC*	**Non-certified**
… that implement record-keeping	0.48 *.06* **.03**	0.44 *.02* **.12** (.05)**	0.43 *.09* **.09**	0.36 *.05* **.16** (.07)**	0.28 *.18* **.01**	0.23
0-5 hours spent on records/ month (of those that keep records)	0.90 *.15* **-**	0.94 *.06* **-**	0.89 *-.05* **-**	1.00 - **-**	0.87 *-.11** (.04)* **-**	0.64
Share of producers implementing changes based on records	0.74 *-.04* **.03**	0.71 *.08* **.04**	0.78 *.15*** (.03)* **.12**	0.74 - **.17**	0.67 *-.32*** (.05)* **-.29*** (.09)**	0.95
Within-group t-test of means with vs. without record keeping						
Yield (qq/ha)	39.97 37.11	36.21 31.67	41.89 33.99	40.65 33.81	44.16*** 34.41	27.30 21.92

Fertilizer efficiency (bags/qq)	.56* .75	.83 .77	.73 .80	1.28 .80	.69 .77	1.19 1.07
Pesticide efficiency (l/qq)	.09 .05	.07 .07	.09 .10	.13 .14	.06* .12	.09*** .01

Table 2.8. Results on record keeping as pathway to sustainable intensification in Colombia

Costa Rica: Record-keeping as pathway towards sustainable intensification					
Means by group ***Additionality***	**Rainforest/ AAA** *vs. FT*	**Rainforest/ C.A.F.E.** *vs. FT/NC*	**C.A.F.E. Practices** *vs. FT*	**Fairtrade** *vs. NC*	**Non-certified**
… that implement record-keeping	0.65 *.42*** (.07)* **.36*** (.08)**	0.63 *.12* **.21*** (.07)**	0.57 *.29*** (.08)* **.35*** (.06)**	0.26 *-.50*** (.07)* **-.47*** (.06)**	0.72
0-5 hours spent on records/ month (of those that keep records)	0.98 *.00* **.06**	0.71 *-.23*** (.06)* **-.06**	0.75 *-.12* (.06)* **-.16**	0.89 *-.10* **-**	0.95
Share of producers implementing changes based on records	0.88 *.26** (.12)* **.23**	0.72 *.00* **.10**	0.83 *.31** (.15)* **.38*** (.12)**	0.63 *-.18* (.11)* **-**	0.54
Within-group t-test of means with vs. without record keeping					
Yield (qq/ha)	39.62 31.67	41.62 37.08	39.15 34.43	24.89 29.80	31.45 34.55
Fertilizer efficiency (bags/qq)	.82 1.05	.85 .94	.97 1.02	1.42 1.45	.71 .71
Pesticide efficiency (l/qq)	.24 .36	.17 .21	.17 .19	.32 .28	.21 .21

Table 2.9. Results on record keeping as pathway to sustainable intensification in Costa Rica

2.4. Use of soil analysis and expert advice for optimal fertilization decisions

Honduras: Soil analyses as pathway towards sustainable intensification						
Means by group ***Additionality***	**Rainforest Alliance** *vs. NC*	**FT/organic** *vs. NC*	**Fairtrade** *vs. NC*	**UTZ Certified** *vs. NC*	**4C** *vs. NC*	**Non-certified**
Share of producers that received soil analysis	0.58 *.35*** (.04)* **.30*** (.06)**	0.32 *.31*** (.06)* **.49*** (.09)**	0.40 *.27*** (.08)* **.19*** (.07)**	0.11 *.02* **.01**	0.14 *.04* **.03**	0.08
Share of producers that use soil analysis or expert advice for fertilization	0.78 *.38*** (.07)* **.44*** (.06)**	0.64 *.63*** (.07)* **.61*** (.08)**	0.40 *-.05* **.03**	0.30 *.19*** (.05)* **.10** (.05)**	0.29 *.03* **.05**	0.22
Within-group t-test of means with vs. without informed decision-making						
Yields (qq/ha)	43.14 44.26	22.32 18.22	22.22 21.94	38.02 32.57	33.65* 27.09	39.12*** 29.33
Fertilizer efficiency (bags/qq)	.52 .61	.29 .23	.70 .75	.49 .59	.65 .55	.66 .57

Table 2.10. Results on soil analysis as pathway to sustainable intensification in Honduras

Colombia: Soil analyses as pathway towards sustainable intensification						
Means by group ***Additionality***	**Rainforest/ AAA** *vs. FT*	**Nespresso AAA** *vs. FT*	**C.A.F.E. Practices** *vs. FT*	**4C** *vs. FT*	**Fairtrade** *vs. NC*	**Non-certified**
Share of producers that received soil analysis	0.32 *.17*** (.06)*	0.07 [A] 0.56 [B] *.11** (.05)*	0.12 *.03*	0.32 *.08*	0.14 *-.15*** (.01)*	0.36

	.17 (.06)**	**.11** (.05)** [4]	**-.02**	**.10**	**-.18*** (.06)**	
Share of producers that use soil analysis or expert advice for fertilization	0.41 *.10* **.12* (.07)**	0.26 *.01* **-.01**	0.19 *-.02* **-.08**	0.48 .13 .12	0.27 *-.56*** (.13)* **-.70*** (.03)**	0.96
Within-group t-test of means with vs. without informed decision-making						
Yields (qq/ha)	35.55 40.52	40.80** 31.17	43.75 35.87	34.37 38.12	37.23 37.19	23.43 15.50
Fertilizer efficiency (bags/qq)	.70 .63	.76 .81	.59 .81	1.28* .71	.76 .74	1.14 .11

Table 2.11. Results on soil analysis as pathway to sustainable intensification in Colombia

Costa Rica: Soil analyses as pathway towards sustainable intensification					
Means by group ***Additionality***	**Rainforest/ AAA** *vs. FT*	**Rainforest/ C.A.F.E.** *vs. FT/NC*	**C.A.F.E. Practices** *vs. FT*	**Fairtrade** *vs. NC*	**Non-certified**
Share of producers that received soil analysis	0.92 *.58*** (.07)* **.60*** (.07)**	0.75 *.24*** (.07)* **.45*** (.06)**	0.57 *.31*** (.08)* **.26*** (.06)**	0.21 *-.22*** (.05)* **-.23*** (.05)**	0.41
Share of producers that use soil analysis or expert advice for fertilization	0.87 *.09* (.05)* **.11* (.06)**	0.78 *.03* **-.00**	0.84 *-.01* **.03**	0.78 *.09* **.13** (.06)**	0.72
Within-group t-test of means with vs. without informed decision-making					
Yields (qq/ha)	35.38 49.41	39.48 40.87	37.63 33.16	29.43 25.44	33.11 30.29
Fertilizer efficiency (bags/qq)	.80** 1.42	.89 .88	.99 1.02	1.43 1.48	.72 .65

Table 2.12. Results on soil analysis as pathway to sustainable intensification in Costa Rica

2.5. Comparative contributions to yields and input efficiency

Sections 6.2 to 6.4 analyzed how three possible pathways to behavioral change – trainings, record keeping and best fertilization practices – may have contributed to the differences in yields, fertilizer and pesticide efficiency that we observed between different certified and non-certified groups. Up to this point, we have analyzed the different pathways in isolation. This section investigates how they interact, and which pathway may provide the strongest contribution to improved outcomes. To this aim, I ran a multivariate regression on the three outcomes of interest within the certification groups that includes environmental training, record keeping, and informed decision making as independent variables as well as four control variables: gender, age, education and PPI (or, alternatively, the existence of a television) as a proxy for wealth, in order to control for the fact that female farmers may have less access to knowledge or resources, leading to poorer results, that the experience that comes with age may have provided better results, that better educated farmers had a higher knowledge of efficient production, and that cash-strapped farmers may use less inputs out of necessity rather than by choice. I also ran separate regressions using a dummy independent variable that takes 1 when all three pathways are present, to see whether they mutually reinforce each other or whether there are counterproductive influences at work, especially regarding the trade-off between yield-maximizing and environmentally beneficial practices.

[4] This result is driven especially by cooperative [B].

Honduras: Comparative contributions to yields and input efficiency						
Regression results	**Rainforest Alliance**	**FT/ organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Yields (qq/ha)[5]						
Environmental training	11.80*** (4.24)	-1.28	-6.40* (3.47)	-6.33	3.64	-.26
Record keeping	9.74** (3.65)	-2.68	6.81	-6.35* (3.70)	-3.48	-7.36** (3.01)
Fertilization advice	-8.92** (4.42)	5.96	1.68	9.27** (4.56)	5.35	13.36*** (3.84)
Share of producers using all three practices	0.55	0.45	0.21	0.14	0.16	0.11
All three: impact	7.63* (4.18)	4.14	-1.52	-1.40	16.39*** (4.26)	13.68*** (3.33)
Fertilizer efficiency (bags/qq)						
Environmental training	-.22* (.11)	-.03	-.14	-.08	-.01	-.09
Record keeping	-.08	-.25	-.45	-.04	.00	-.01
Fertilization advice	-.03	.10	-.00	-.07	.01	.09
All three: impact	-.13	.03	-.33	-.03	-.00	.01
Pesticide efficiency (l/qq)						
Environmental training	-.01	-.00	-.01	.01	-.01	-.02* (.01)
Record keeping	-.02* (-.02)	.00	-.00	-.00	-.02	-.05*** (.01)
Fertilization advice	-.03* (-.03)	.00	-.00	-.03	.02	.02
All three: impact	-.03* (.01)	.00	-.00	-.01	-.03	-.03

Table 2.13. Results on combining pathways to sustainable intensification in Honduras

Colombia: Comparative contributions to yield and input efficiency						
Regression results	**Rainforest Alliance/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Yields (qq/ha)[6]						
Environmental training	3.90	5.22	-1.58	1.52	-2.05	-.67
Record keeping	3.08	.78	5.81	6.74	9.69*** (3.43)	9.33
Fertilization advice	-6.07	8.74* (4.78)	4.53	-2.78	-2.64	4.65
Share of producers using all three practices	0.14	0.15	0.07	0.13	0.07	0.22
All three: impact	2.48	7.68	16.80*** (5.85)	8.25	.96	8.77
Fertilizer efficiency (bags/qq)						
Environmental training	-.04	-.01	.34* (.18)	-.00	.04	-.14
Record keeping	-.16	.04	-.00	.56	-.06	-.04
Fertilization advice	.12	-.08	-.22	.42	.06	.87*** (.23)
All three: impact	.02	-.23* (.12)	-.29* (.16)	.78	.21	.00
Pesticide efficiency (l/qq)						
Environmental training	-.06	-.07** (.03)	-.06* (.03)	.01	-.04	.01
Record keeping	.06	-.02	-.01	-.00	-.04** (.02)	.06* (.03)
Fertilization advice	.01	.05* (.03)	.02	.06	.01	.02

[5] Additional controls: Age, gender, schooling, PPI (wealth indicator); use of robust standard errors

[6] Additional controls: Age, gender, schooling, PPI (wealth indicator); use of robust standard errors

All three: impact	-.05* (.02)	-.04** (.01)	-.05	.08	-.04* (.02)	.07* (.03)

Table 2.14. Results on combining pathways to sustainable intensification in Colombia

Costa Rica: Comparative contributions to yield and input efficiency					
Regression results	**Rainforest Alliance/AAA**	**Rainforest Alliance/C.A.F.E.**	**C.A.F.E. Practices**	**Fairtrade**	**Non-certified**
		Yields (qq/ha)[7]			
Environmental training	9.53	12.38** (4.97)	-4.94	-1.01	4.94
Record keeping	6.42	6.86	4.94* (2.95)	-6.31* (3.73)	-4.38
Fertilization advice	-19.23	-6.20	3.26	2.14	5.03
Share of producers using all three practices	0.48	0.20	0.36	0.12	0.44
All three: impact	1.75	8.35	1.88	-10.62** (4.48)	.62
		Fertilizer efficiency (bags/qq)			
Environmental training	-.82** (.34)	.01	.31** (.12)	-1.51	-.78*** (.09)
Record keeping	-.10	-.04	-.10	-.03	-
Fertilization advice	-.52	.00	-.09	.37	.03
All three: impact	-.35** (.15)	-.33* (.16)	.07	-.49* (.28)	-.00
		Pesticide efficiency (l/qq)			
Environmental training	-.33	.07	.04	-.17	.06
Record keeping	-.07	-.01	-.04	.04	-
Fertilization advice	-.03	.03	-.01	.00	-.00
All three: impact	-.06	.05	-.01	-.11** (.05)	-.00

Table 2.15. Results on combining pathways to sustainable intensification in Costa Rica

[7] Additional controls: Age, gender, schooling, computer (as wealth indicator); use of robust standard errors

3. Standards as shifters of time horizons: Average Treatment Effects on the Treated

3.1. Waste management and recycling

I here present three indicators that reflect appropriate or inappropriate waste management: the presence of on-farm trash containers and their use (data collectors were also asked whether it was visible that trash was being collected in them); the safe disposal of empty pesticide containers (either by returning them to the point of sale or, if that is impossible – as frequently in Honduras – by washing them three times, puncturing them to avoid their future use for food or water storage, and burying them); and the open-air burning of household waste, which is a non-recommended practice and should be eliminated. Both for the disposal of pesticide containers and household waste disposal, respondents were able to choose from an array of options (e.g. burning in incinerator, waste collection by municipal services) to avoid a desirability bias in the reported answers. The tables also show the shares of reported training on topics regarding recycling and optimal waste management, and I will report on within-group differences whenever applicable, though I do not reprint all of these results for space reasons.

Honduras: Waste management and recycling practices						
Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Additionality	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	
Recycling training	0.56	0.15	0.28	0.16	0.15	0.12
	*.43*** (.05)*	*.15*** (.04)*	*.04*	*.06*	*.01*	
	.37* (.06)**	**-**	**.05**	**.07* (.04)**	**.00**	
On-farm trash collection	0.88	0.98	0.75	0.50	0.41	0.42
	*.40*** (.08)*	*.79*** (.16)*	*.25** (.11)*	*.10*	*-.04*	
	.42* (.06)**	**.66*** (.05)**	**.27*** (.08)**	**.09**	**-.04**	
Safe pesticide container disposal	0.69	0.33	0.33	0.22	0.21	0.17
	*.52*** (.14)*	*.33** (.15)*	*.03*	*.12* (.06)*	*-.04*	
	.46* (.07)**	**-**	**-.00**	**.08* (.04)**	**.01**	
Open-air burning of household waste	0.18	0.02	0.13	0.44	0.47	0.43
	-.16 (.08)*	*-.54*** (.16)*	*-.21** (.10)*	*-.00*	*.07*	
	-.13 (.07)**	**-.39*** (.06)**	**-.28*** (.07)**	**.03**	**.04**	
Within-group t-test of means with vs. without recycling training						
Safe pesticide container disposal	.93***	.00	.66**	.45**	.28	.46***
	.48	.37	.11	.17	.20	.14

Table 3.1. Results on waste management and recycling practices in Honduras

Colombia: Waste management and recycling practices						
Means by group	**Rainforest/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT*	*vs. FT*	*vs. FT*	*vs. NC*	
Recycling training	0.64 [A]	0.72 [A]	0.87 [A]		0.80 [A]	0.11
		0.77 [B]	0.03 [B]	0.50 [B]	0.03 [B]	
	*-.18** (.07)*	*.14** (.05)*	*.01*	*.26*** (.08)*	*.26*** (.04)*	
	-.14 (.06)**	**.13*** (.04)**	**.04**	**.27*** (.04)**	**.04**	
On-farm trash collection	0.38	0.49	0.35	0.52	0.30	0.30
	.10	*.07*	*-.07*	*.22** (.09)*	*.13*** (.04)*	
	-.03	**.08**	**.00**	**.25*** (.07)**	**-.05**	
Safe pesticide container disposal	0.95	0.96	0.93	1.00	0.94	0.93
	-.03	*.05*	*.02*	*0*	*.07*	
	-	**.04**	**.00**	**-**	**.11**	
	0.16 [A]	0.30 [A]	0.24 [A]		0.28 [A]	0.00

Open-air burning of household waste		0.07 [B]	0.08 [B]	0.07 [B]	0.14 [B]	
	-.00	*-.02*	*-.08*	*-.04*	*.20*** (.02)*	
	-.10* (.06)	**-.03**	**-.08**	**-.08**	**-**	
Within-group t-test of means with vs. without recycling training						
On-farm trash collection	.34	.53*	.26	.95***	.46***	.36
	.44	.36	.41	.13	.22	.29

Table 3.2. Results on waste management and recycling practices in Colombia

Costa Rica: Waste management and recycling practices					
Means by group	**Rainforest/ AAA**	**Rainforest/ C.A.F.E.**	**C.A.F.E. Practices**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT/NC*	*vs. FT*	*vs. NC*	
Recycling training	0.76	0.40	0.35	0.39	0.58
	*.44*** (.09)*	*.04*	*-.07*	*-.25** (.10)*	
	.36* (.08)**	**.00**	**-.06**	**-.14* (.08)**	
On-farm trash collection	0.29	0.48	0.57	0.61	0.72
	-.17 (.10)*	*-.06*	*.01*	*-.08*	
	-.27 * (.08)**	**-.10**	**.00**	**-.07**	
Safe pesticide container disposal	0.97	0.96	0.89	0.66	0.96
	*.36*** (.08)*	*.16** (.07)*	*.21*** (.07)*	*-.20** (.08)*	
	.32* (.05)**	**.16*** (.03)**	**.19*** (.05)**	**-.22*** (.05)**	
Open-air burning of household waste	0.03	0.00	0.03	0.06	0.00
	-.02	*-.01*	*-.04*	**.06** (.02)**	
	-.01	**-**	**-.02**	**-**	
Within-group t-test of means with vs. without recycling training					
On-farm trash collection	.33*	.62**	.63	.54	.82***
	.11	.38	.52	.64	.57

Table 3.3. Results on waste management and recycling practices in Costa Rica

3.2. Elimination of the use of most hazardous pesticides

When looking into the dataset, it becomes apparent that of the hundreds of prohibited pesticides, only a small subset is relevant for the coffee sector and was used by either certified or non-certified farmers. Let us thus focus our attention on the regulation and use of those found in use on the ground in certified and non-certified farmer groups: benomyl, carbofuran, endosulfan, metamidophos, mirex, parathion-methyl, and paraquat.

Honduras: Use of highly hazardous pesticides						
Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Additionality	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	
Share of producers using highly hazardous pesticides	0.01	0.02	0.00	0.05	0.04	0.07
	-.01	*-.04*	*0*	*-.04*	*0*	
	-.06* (.02)**	**-.10* (.05)**	**-**[8]	**-.01**	**-.01**	

Table 3.4. Results on the use of highly hazardous pesticides in Honduras

[8] As perfect predictors are not allowed for logit models, the model cannot be run in cases where either none or all producers of either the treatment or control group implement a certain practice due to perfect collinearity between the dependent and independent variable. This explains the missing results in this and subsequent tables.

Colombia: Use of highly hazardous pesticides						
Means by group	**Rainforest/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT*	*vs. FT*	*vs. FT*	*vs. NC*	
Share of producers using highly hazardous pesticides	0.00 *-.02* **-**	0.00 *-.00* **-**	0.00 *-.01* **-**	0.01 *.01* **-**	0.01 *.01* (.00)* **-**	0.00

Table 3.5. Results on the use of highly hazardous pesticides in Colombia

Costa Rica: Use of highly hazardous pesticides					
Means by group	**Rainforest/ AAA**	**Rainforest/ C.A.F.E.**	**C.A.F.E. Practices**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT/NC*	*vs. FT*	*vs. NC*	
Share of producers using highly hazardous pesticides	0.01 *-.02* **-**	0.01 *-.02* **-**	0.01 *.00* **-**	0.02 *-.20** (.10)* **-**	0.22

Table 3.6. Results on the use of highly hazardous pesticides in Costa Rica

3.3. Safe agrochemical use and working conditions

For this set of indicators, the questions on agrochemical safety (protection equipment and storage) only applied to those farmers that had used agrochemicals in their farm management. Respondents were able to choose between several levels of implementation: for instance, they were asked whether, when they apply agrochemicals, they wear the full personal protection equipment, a 'simple' protection (as described above, consisting of long-sleeved clothing, a hat and handkerchief), or none whatsoever. Responses on the agrochemical storage facility and the first aid kit were observational and corroborated by photos; here again, the data collectors were able to choose between 'tidy storage facility, 'storage facility exists, but is not tidy', and 'no storage facility'; and 'complete first aid kit exists on farm', 'first aid kit exists, but off-farm', 'incomplete first aid kit', and none. I focus here on the full implementation indicators. Potable water was defined as 'purified, filtered or coming from a municipal treatment plant', since otherwise respondents interpreted it as 'drinkable' – and all did drink the water they had access to, even if this had negative health consequences.

Honduras: Safe agrochemical use and working conditions						
Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Additionality	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	
Share of producers with agrochemicals training	0.71 *.10* **.11**	0.54 *.31*** (.08)* **.24** (.10)**	0.91 *.26*** (.07)* **.30*** (.07)**	0.59 *.05* **.03**	0.62 *-.01* **-.00**	0.58
Share using complete protection equipment	0.71 *.47*** (.10)* **.56*** (.07)**	0.33 *.33** (.15)* **-**	0.33 *.00* **.06**	0.06 *-.04* **-.02**	0.15 *.04* **.03**	0.10
Share with orderly agrochemical storage facility	0.63 *.57*** (.06)* **.45*** (.08)**	0.22 *.05* **.06**	0.60 *.30* **.38** (.16)**	0.16 *.09* (.05)* **.07**	0.15 *.06* **-.02**	0.08
Share with complete first-aid kit	0.36 *.25*** (.03)*	0.21 *.21*** (.06)*	0.29 *.25*** (.06)*	0.06 *.06** (.02)*	0.07 *.04** (.02)*	0.02

	.26* (.07)**	**.16** (.07)**	**.18*** (.07)**	**.03**	**.04** (.02)**	
Share with potable drinking water	0.80 *.46*** (.03)* **.41*** (.05)**	0.91 *.77*** (.15)* **.77*** (.08)**	0.65 *-.01* **.04**	0.55 *.26*** (.07)* **.25*** (.05)**	0.47 *-.02* **.08* (.04)**	0.34

Table 3.7. Results on safe agrochemical use and working conditions in Honduras

Colombia: Safe agrochemical use and working conditions						
Means by group ***Additionality***	**Rainforest/ AAA** *vs. FT*	**Nespresso AAA** *vs. FT*	**C.A.F.E. Practices** *vs. FT*	**4C** *vs. FT*	**Fairtrade** *vs. NC*	**Non-certified**
Share of producers with agrochemicals training	0.91 *-.04* **-**	0.92 *.04* **.04**	0.94 *.07* **.06* (.03)**	0.71 *-.09* **-.09**	0.86 *.46*** (.11)* **.45*** (.06)**	0.37
Share using complete protection equipment	0.85 *.01* **-**	0.79 *.03* **.08**	0.80 *.11* **.07**	0.61 *-.01* **.05**	0.67 *.24* **.49*** (.08)**	0.28
Share with orderly agrochemical storage facility	0.63 *.47*** (.17)* **.39*** (.11)**	0.45 *.04* **.17** (.08)**	0.54 *.26*** (.10)* **.22*** (.08)**	0.44 *.03* **.02**	0.37 *-.10* **.04**	0.38
Share with complete first-aid kit	0.36 *.01* **.07**	0.33 *.06* **.02**	0.54 *.14** (.07)* **.11* (.06)**	0.50 *.09* **.02**	0.45 *.38*** (.04)* **.39*** (.04)**	0.05
Share with clean drinking water	1.00 [A] - **-**	1.00 [A] 0.67 [B] *.11*** (.03)* **.33*** (.09)**	1.00 [A] 0.16 [B] *-.06* **.04**	0.34 [B] *.05* **-.00**	1.00 [A] 0.14 [B] *.39*** (.04)* **.13* (.07)**	0.18
Within-group t-test of means with vs. without agrochemical training						
Share using complete PPE	.86 .75	.82*** .25	.80 .75	.78*** .06	.72*** .30	.35 .16

Table 3.8. Results on safe agrochemical use and working conditions in Colombia

Costa Rica: Safe agrochemical use and working conditions					
Means by group ***Additionality***	**Rainforest/ AAA** *vs. FT*	**Rainforest/ C.A.F.E.** *vs. FT/NC*	**C.A.F.E. Practices** *vs. FT*	**Fairtrade** *vs. NC*	**Non-certified**
Share of producers with agrochemicals training	0.96 *.07* **.06**	0.62 *-.19*** (.07)* **-.17*** (.06)**	0.69 *-.07* **-.06**	0.87 *-.03* **.04**	0.84
Share using complete protection equipment	0.81 *.22* (.11)* **.25*** (.07)**	0.80 *.06* **.09**	0.86 *.23*** (.07)* **.28*** (.06)**	0.53 *.14* **.12* (.07)**	0.54
Share with orderly agrochemical storage facility	0.91 *.62*** (.08)* **.62*** (.06)**	0.63 *.25*** (.07)* **.28*** (.06)**	0.46 *-.04* **.06**	0.21 *-.06* **-.03**	0.30
Share with complete first-aid kit	0.27 *.20*** (.05)* **.20*** (.06)**	0.25 *.09* **.09** (.04)**	0.05 *-.11*** (.03)* **-.04**	0.09 *-.03* **-.01**	0.10
Share with clean drinking water	0.96 *-.03* **-.03**	1.00 *.00* **-**	1.00 *.00* **-**	0.95 *-.04*** (.01)* **-**	1.00
Within-group t-test of means with vs. without agrochemical training					
Share with orderly agrochemical storage facility	.92 .66	.66 .58	.51* .33	.22 .08	.29 .38

Table 3.9. Results on safe agrochemical use and working conditions in Costa Rica

3.4. Erosion prevention and improving soil health

Given that shade cover, cover crops, as well as live fences and windbreaks, while important for soil health, also provide important co-benefits for climate change resilience, they will be discussed in the next section. This section focuses on the following four indicators of soil health and erosion prevention: the use of over 50% of soil cover (either through cover crops, mulching or other dead organic matter; as corroborated through photos); the use of chemical herbicides as a negative contributor to soil health; the use of organic fertilizers (including composted coffee pulp) on the farms; and the use of stone or wood barriers or terracing to structure steep slopes. Data collectors also logged observational data on whether farms showed visible signs of erosion, corroborating them with photo evidence, which I show as the last indicator.

Honduras: Erosion prevention and soil health						
Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Additionality	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	
Share of producers with more than 50% soil cover	0.08	0.47	0.21	0.22	0.15	0.14
	*-.28*** (.08)*	*.40*** (.07)*	*.01*	*.08*	*.02*	
	-.11* (.03)**	**.30*** (.10)**	**.06**	**.05**	**-.00**	
Share that use herbicides	0.11	0.00	0.00	0.28	0.24	0.35
	*-.31*** (.07)*	*-.45*** (.08)*	*-.09** (.04)*	*-.11* (.06)*	*.01*	
	-.32* (.03)**	**-**	**-**	**-.16*** (.04)**	**-.03**	
Share that use organic fertilizer	0.32	0.96	0.35	0.14	0.16	0.14
	*.15*** (.03)*	*.68*** (.07)*	*.25*** (.05)*	*.03*	*.06* (.03)*	
	.11* (.06)	**.80*** (.04)**	**.31*** (.07)**	**-.01**	**.02**	
Share that use erosion barriers	0.59	0.15	0.33	0.29	0.42	0.40
	.07	*-.20** (.09)*	*-.22* (.12)*	*-.15** (.07)*	*.00*	
	.09	**-.13* (.08)**	**-.13* (.07)**	**-.10* (.05)**	**-.00**	
Share of farms that show signs of soil erosion	0.39	0.06	0.38	0.51	0.51	0.53
	-.07	*-.56*** (.13)*	*-.14*	*-.08*	*.00*	
	-.10	**-.55*** (.07)**	**-.07**	**-.05**	**.01**	
Within-group t-test of means with vs. without environmental training						
Share that use herbicides	.12	.00	.00	.23*	.16*	.20***
	.06	.00	.00	.41	.31	.42

Table 3.10. Results on erosion prevention and soil health in Honduras

Colombia: Erosion prevention and soil health						
Means by group	**Rainforest/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT*	*vs. FT*	*vs. FT*	*vs. NC*	
Share of producers with more than 50% soil cover	0.20	0.08	0.21	0.10	0.18	0.05
	-.13	*-.07*	*.06*	*-.14** (.06)*	*.12*** (.02)*	
	-.03	**-.10*** (.03)**	**.03**	**-.08**	**.17*** (.03)**	
Share that use herbicides	0.04	0.05	0.17	0.24	0.19	0.12
	-.04	*-.08** (.04)*	*.05*	*-.10*	*.03*	
	-.05* (.03)	**-.09*** (.03)**	**.07**	**.01**	**.08* (.04)**	
Share that use organic fertilizer	0.94	0.74	0.80	0.70	0.87	0.44
	.06 (.05)	*-.07*	*-.07*	*-.22*** (.06)*	*.47*** (.15)*	
	.08* (.04)	**-.05**	**-.08**	**-.15*** (.05)**	**.41*** (.07)**	
Share that use erosion barriers	0.23	0.24	0.21	0.09	0.34	0.12
	-.08	*-.23*** (.06)*	*-.27*** (.08)*	*-.14* (.08)*	*.20*	
	-.06	**-.15*** (.04)**	**-.16*** (.05)**	**-.17*** (.05)**	**.22*** (.05)**	
Share of farms that show signs of soil erosion	0.16	0.15	0.19	0.09	0.20	0.23
	.00	*-.05*	*-.06*	*-.01*	*.05*	
	.01	**-.06**	**-.01**	**-.04**	**-.05**	
Within-group t-test of means with vs. without environmental training						

Share that use herbicides	.86 .75	.01*** .13	.05** .26	.14*** .40	.14 .22	.16** .00

Table 3.11. Results on erosion prevention and soil health in Colombia

Costa Rica: Erosion prevention and soil health					
Means by group ***Additionality***	**Rainforest/ AAA** *vs. FT*	**Rainforest/ C.A.F.E.** *vs. FT/NC*	**C.A.F.E. Practices** *vs. FT*	**Fairtrade** *vs. NC*	**Non-certified**
Share of producers with more than 50% soil cover	0.46 *.26*** (.08)* **.25*** (.07)**	0.22 *.00* **-.06**	0.23 *.07* **.05**	0.20 *-.11* **-.21*** (.07)**	0.45
Share that use herbicides	0.75 *-.02* **-.03**	0.81 *-.06* **-.05**	0.73 *-.07* **-.02**	0.74 *-.08* **-.15*** (.05)**	0.91
Share that use organic fertilizer	0.76 *.36*** (.09)* **.38*** (.07)**	0.64 *.37*** (.07)* **.34*** (.04)**	0.64 *.25*** (.06)* **.26*** (.07)**	0.26 *.10* **.16** (.06)**	0.12
Share that use erosion barriers	0.61 *.20* (.11)* **.15* (.08)**	0.49 *-.00* **-.06**	0.46 *.03* **.04**	0.46 *-.35*** (.07)* **-.35*** (.07)**	0.80
Share of farms that show signs of soil erosion	0.55 *-.11* **-.05**	0.68 *-.03* **.05**	0.66 *-.04* **.03**	0.60 *.28*** (.08)* **.18** (.07)**	0.42
Within-group t-test of means with vs. without environmental training					
Share that use herbicides	.75 .66	.88 .76	.84*** .54	.71 .85	.94** .82

Table 3.12. Results on erosion prevention and soil health in Costa Rica

3.5. Climate change resilience

Due to the large number of indicators that it is possible to discuss in this section, I decided to split this analysis in two. In a first step, I summarize several key insights that are either uniform across cases (the non-existence of cover crops) or, in the case of planting decisions, are longer-term 'lock-ins' that show greater variance across countries than across certification groups. The second step then highlights five additional indicators and compares them across categories.

The first general insight is a 'non-finding': although according to the questionnaire data an average of 20 to 30% of producers across groups used cover crops, a subsequent analysis of the corroborating pictures showed that the concept of purposefully planted, potentially nitrogen-fixing crops is still exceedingly rare, with only a handful of cases recorded in Costa Rica. More commonly, what was denoted as 'cover crop' were patches of grass or other weeds that seemed to have sprung up independently and were not eliminated by farmers; yet, this approach did not appear to yield the continuous coverage that a cover crop would need to achieve to provide the resilience-enhancing co-benefits described above. Here, more outreach may be necessary, especially when considering the limited total soil cover results presented in section 7.4.

Second, I find broad differences in the adoption of rust-resistant varieties that are almost entirely due to country-level differences. In Honduras, as noted in Chapter 4, a country-wide replanting campaign has contributed to the fact that 95% of the sampled farmers' plants are rust-resistant, irrespective of certification group. The only exception is the Fairtrade/organic group, where 80% of plants are resistant. Colombia shows similar levels with an average of 90% of rust resistance, with only the 4C group coming

in lower (at 75% of rust-resistant plants). Furthermore, Honduran and Colombian lots are fairly young, with the majority planted after 2010. Costa Rican producers, in turn, show an average of only 23% of rust-resistant crops, with two groups reporting even lower averages (the non-certified group, with 10% and the Rainforest Alliance/C.A.F.E. group, with 17%). Costa Rican lots are also much older than the other countries', with non-resistant plants that are 15 to 30 years old (the oldest lots are reported to be 50 years of age), while resistant lots are usually under 10 years of age. Costa Rica's quality-focused preference for traditional varietals, combined with ageing plantations, here contributes to the fact that coffee rust susceptibility, and the need for disease prevention and response through fungicides, is much higher. This also explains why organic coffee production is almost non-existent in Costa Rica's main coffee producing regions – as one previously organic farmer explained, their proximity to strongly affected conventional plots meant that during the last coffee rust outbreak, they had the choice between spraying fungicides (and losing their certification) or watching their fields die off. They chose the former (field notes, Costa Rican coffee producer, 2015).

Third, there are also visible differences between countries regarding planting densities. While Honduran farms on average have 4'800 coffee plants per hectare, Colombians and Costa Ricans plant an average of 5'400 trees per hectare, with some Costa Rican groups (Rainforest Alliance/C.A.F.E. and non-certified farmers) reaching 5'800 plants per hectare on average. This may reflect the influence of the national coffee institutions (FNC and ICAFE), which tend to encourage farmers to maximize yields by increasing density up to 7'500 – 10'000 plants per hectare (Cortina Guerrero, Moncada Botero and Herrera Pinilla, 2012). Such high densities, however, also contribute to the more rapid spread of diseases and lower the chance of implementing diversified, resilient systems.

In the following section, I will present five additional indicators that may contribute to ecologically friendly disease prevention and sustainable livelihoods in the face of a changing climate: the use of shade trees that protect at least 25% of the coffee plants from direct solar radiation; the use of windbreaks by planting rows of trees (also called 'live fences'); two integrated pest management techniques (the use of coffee berry borer traps and the collection of leftover berries); and the diversification of production, measured by whether the farm produces other crops or pursues animal husbandry. Finally, as a short-term indicator that connects farm resilience with sustainable livelihoods, I report on whether producers reported having experienced food scarcity in the previous year.

Honduras: Climate change resilient practices

Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Additionality	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	
Share of producers with more than 25% shade cover	0.70 *-.11* (.06)* **-.16** (.07)**	0.98 *.50*** (.16)* **.26*** (.04)**	0.96 *.13* (.07)* **.13*** (.04)**	0.81 *-.03* **-.01**	0.87 *.00* **.01**	0.80
Share that use wind breaks	0.76 *.06* **.12* (.06)**	0.36 *-.07* **-.16**	0.67 *-.04* **-.05**	0.43 *-.06* **-.11* (.06)**	0.64 *-.00* **.01**	0.61
Share that use CBB traps	0.83 *.17** (.07)* **.22*** (.06)**	0.70 *.35* **.49*** (.11)**	1.00 *.30** (.13)* **-**	0.70 *.30*** (.10)* **.21** (.08)**	0.61 *.19** (.09)* **.12**	0.41
Share that collect cherries post-harvest	0.68 *-.13* (.06)* **-.10**	1.00 *.33** (.16)* **-**	0.67 *.0* **-.17**	0.88 *.07* **.10**	0.70 *.01* **.01**	0.74
Share that have diversified farm	0.13 *-.00* **-.02**	0.64 *.37*** (.16)* **.51*** (.08)**	0.17 *.0* **-.03**	0.22 *.08* **.08**	0.11 *-.03* **-.04**	0.16
Share that report food insecurity	0.29 *-.13*** (.02)* **-.02**	0.04 *.00* **-**	0.73 *-.01* **-.01**	0.37 *-.06* **-.00**	0.50 *-.12** (.04)* **-.04**	0.47

Within-group t-test of means with vs. without environmental training

Share that use CBB traps	.95***	.83	1.00	.80**	.91***	.73***
	.30	.61	1.00	.46	.37	.29

Table 3.13. Results on climate change resilient practices in Honduras

Colombia: Climate change resilient practices						
Means by group	**Rainforest/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT*	*vs. FT*	*vs. FT*	*vs. NC*	
Share of producers with more than 25% shade cover	0.57	0.49	0.40	0.80	0.45	0.68
	.05	*.03*	*-.11*	*.26*** (.08)*	*-.34** (.14)*	
	.14* (.07)	**.05**	**-.07**	**.36*** (.07)**	**-.23*** (.06)**	
Share that use wind breaks	0.55	0.50	0.30	0.42	0.40	0.94
	.12	*-.15** (.06)*	*-.24*** (.08)*	*-.16* (.08)*	*-.55*** (.04)*	
	-.05	**-.08* (.05)**	**-.12** (.05)**	**.07**	**-.61*** (.03)**	
Share that use CBB traps	0.56	0.44	0.36	0.32	0.43	0.20
	.11	*-.08*	*-.03*	*-.18** (.08)*	*.25*** (.06)*	
	.04	**-.06**	**-.11* (.06)**	**-.01**	**.21** (.09)**	
Share that collect cherries post-harvest	0.99	1.00	1.00	1.00	1.00	1.00
	-.01	*-*	*.00*	*.00*	*.00*	
	-	**-**	**-**	**-**	**-**	
Share that have diversified farms	0.84	0.74	0.79	0.72	0.78	0.89
	.09	*-.00*	*-.00*	*-.04*	*-.02*	
	.02	**-.02**	**-.00**	**-.03**	**-.04**	
Share that report food insecurity	0.01	0.04	0.01	0.10	0.00	0.14
	.01	*.03* (.02)*	*.01*	*.05*	*-.22**	
	-	**-**	**.00**	**.03**	**-**	

Table 3.14. Results on climate change resilient practices in Colombia

Costa Rica: Climate change resilient practices					
Means by group	**Rainforest/ AAA**	**Rainforest/ C.A.F.E.** *vs. FT/NC*	**C.A.F.E. Practices**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*		*vs. FT*	*vs. NC*	
Share of producers with more than 25% shade cover	0.72	0.95	0.81	0.72	0.84
	.02	*.23*** (.07)*	*.16* (.09)*	*-.07*	
	.02	**.17*** (.04)**	**.10* (.06)**	**-.07**	
Share that use wind breaks	0.63	0.38	0.40	0.52	0.65
	*.20** (.09)*	*-.05*	*-.17** (.07)*	*-.17*** (.08)*	
	.00	**-.09**	**-.04**	**-.13* (.08)**	
Share that use CBB traps	0.38	0.11	0.38	0.10	0.26
	*.29*** (.06)*	*.02*	*.22*** (.05)*	*-.17*** (.06)*	
	.32* (.07)**	**.00**	**.29*** (.05)**	**-.16*** (.05)**	
Share that collect cherries post-harvest	0.55	0.28	0.34	0.60	0.71
	.05	*-.17** (.08)*	*-.24*** (.07)*	*-.11*	
	.00	**-.24*** (.07)**	**-.22*** (.07)**	**-.07**	
Share that have diversified farms	0.49	0.77	0.69	0.81	0.46
	*-.34*** (.08)*	*-.00*	*-.19*** (.05)*	*.35*** (.08)*	
	-.27* (.07)**	**.01**	**-.10**	**.34*** (.06)**	
Share that report food insecurity	0.10	0.01	0.07	0.06	0.06
	.07 (.04)*	*-.03*	*.01*	*-.01*	
	.08	**-.02**	**.02**	**-.02**	
Within-group t-test of means with vs. without environmental training					
Share that collect cherries post-harvest	.58	.41**	.43***	.67***	.73
	.33	.19	.19	.30	.62

Table 3.15. Results on climate change resilient practices in Costa Rica

4. Standards as Payments for Social and Ecosystem Services: Average Treatment Effects on the Treated

4.1. Compliance with minimum wage law

Honduras: Compliance with minimum wage law						
Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Additionality	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	
Share that paid minimum wage	0.00	0.17	0.00	0.01	0.00	0.00
	.00	*.16*** (.05)*	*.00*	*.00*	*.00*	
	-	**-**	-	-	-	
Workers' wage per day (in USD)	6.46	6.32	5.07	5.57	5.60	5.65
	*.81*** (.11)*	*.35*	*-.03*	*-.21** (.09)*	*.05*	
	.64* (.11)**	**.00**	**-.12**	**-.17** (.08)**	**.09**	
Pickers' wage (per basket, in USD)	1.51	1.49	1.83	1.52	1.58	1.54
	.00	*.11*** (.02)*	*.12*** (.05)*	*.02*	*-.02*	
	-.02	**.11*** (.02)**	**.09*** (.03)**	**.02**	**-.00**	
Pickers' wage per day (in USD)	9.83	9.24	9.30	8.12	8.86	8.30
	*1.33*** (.37)*	*1.04*** (.39)*	*.71*	*.05*	*-.14*	
	.99* (.31)**	**1.21** (.56)**	**.32**	**.03**	**.24**	

Table 4.1. Results on compliance with minimum wage law in Honduras

Colombia: Compliance with minimum wage law						
Means by group	**Rainforest/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT*	*vs. FT*	*vs. FT*	*vs. NC*	
Share that paid minimum wage	0.99	0.97	0.95	0.95	0.94	0.93
	-.01	*.01*	*-.03*	*.07*	*.05*	
	-	**.02**	**.00**	**.09** (.04)**	**-.08**	
Workers' wage per day (in USD)	12.21	11.93	11.49	11.30	11.32	10.72
	-.08	*.20*	*-.26*	*.77*** (.16)*	*.67*** (.19)*	
	.06	**.20* (.11)**	**-.14**	**.83***(.17)**	**.32** (.13)**	
Agrochemical workers' wage per day (in USD)	16.56	16.20	15.89	15.73	15.81	11.18
	.09	*.02*	*-.33*	*.31*	*4.43*** (.30)*	
	-.21	**.08**	**-.06**	**.95* (.50)**	**4.29*** (.27)**	
Pickers' wage per basket (in USD)	1.78	1.76	1.81	1.87	1.81	1.82
	.18 (.10)*	*-.00*	*.06*	*.03*	*-.02** (.01)*	
	.14* (.05)**	**-.00**	**.03**	**.02**	**-.00**	
Pickers' wage per day (in USD)	16.21	14.69	15.02	12.94	15.70	15.21
	.21	*-1.0*** (.35)*	*-1.01* (.56)*	**-2.37***(.89)**	*.42*	
	.25	**-1.31*** (.25)**	**-.93** (.44)**	**-1.29** (.57)**	**.12**	

Table 4.2. Results on compliance with minimum wage law in Colombia

Costa Rica: Compliance with minimum wage law					
Means by group	**Rainforest/ AAA**	**Rainforest/ C.A.F.E.**	**C.A.F.E. Practices**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT/NC*	*vs. FT*	*vs. NC*	
Share that paid minimum wage	0.40	0.01	0.18	0.18	0.07
	*.21*** (.07)*	*-.16*** (.06)*	*.08*	*.14*** (.04)*	
	.18* (.09)	**-.09*** (.02)**	**.03**	**.15** (.06)**	
Workers' wage per day (in USD)	16.79	14.84	15.21	14.90	15.44
	*1.35** (.67)*	*-.16*	*-.41*	*-.58*	
	1.12	**-.30**	**.16**	**-.16**	

Monthly workers' wage per day (in USD)	18.44 *.83* **.71**	12.41 *-4.54*** (.47)* **-3.45*** (.56)**	13.55 *-3.57*** (1.18)* **-3.32*** (1.11)**	18.24 *1.69** (.71)* **2.16** (.86)**	15.16
Pickers' wage per basket (in USD)	2.28 *.05* **.09** (.04)**	1.91 *-.21*** (.04)* **-.18*** (.03)**	1.97 *-.19*** (.05)* **-.15*** (.03)**	2.13 *.24*** (.02)* **.24*** (.03)**	1.95
Pickers' wage per day (in USD)	19.83 *.28* **.30**	23.96 *1.11* **1.43* (.83)**	22.09 *1.83* **2.52*** (.88)**	19.67 *-2.44* (1.33)* **-3.65*** (.97)**	23.62

Table 4.3. Results on compliance with minimum wage law in Costa Rica

4.2. Child labor prevention and school attendance

Since the issue of child labor is a sensitive topic, I operationalized it through a number of indirect ways in the farm survey. First, I asked whether school-age children attend school, if they help on the farm, and if yes, what activities they perform, to gauge whether they include dangerous activities (below, I report whether they were reported to be engaged in pesticide application). Further, I also asked for the age of the youngest worker hired on the farm, and subsequently compare whether this age is below the legal minimum (14 in Honduras and 15 in Colombia and Costa Rica, as specified in their ILO ratifications and enshrined in national law (ILO, 2018)). As noted above, including children present on the farm during harvest would have shown almost-universal presence of child labor. When asked how certification organizations deal with this potential controversy, the answer from multiple sources was clear: "they almost never schedule audits during the harvest season" (field notes, producer organizations, 2015/16) – thus enabling them to not find any non-compliances.

Honduras: Child labor prevention						
Means by group ***Additionality***	**Rainforest Alliance** *vs. NC*	**FT/organic** *vs. NC*	**Fairtrade** *vs. NC*	**UTZ Certified** *vs. NC*	**4C** *vs. NC*	**Non-certified**
Share of producers that hired minors under 14 years of age	0.13 *-.10*** (.02)* **-.14** (.06)**	0.04 *-.22*** (.07)* **-.46*** (.06)**	0.02 *-.06* -	0.28 *-.14** (.06)* **-.12*** (.04)**	0.28 *-.01* **.02**	0.31
Share of school-age children that attended school	0.90 *.06* **.02**	0.73 *-.05* **-.14**	0.90 *.13* **.03**	0.80 *-.05* **-.04**	0.84 *.10* **.02**	0.78
Share of school-age children that work on farm	0.07 *-.25*** (.07)* **-.20*** (.06)**	0.15 *.07* **-.06**	0.37 *-.07* **.08**	0.33 *.09* **.07**	0.28 *-.03* **-.00**	0.29
Share of school-age children that apply pesticides	0.00 *-.14*** (.03)* **-**	0.00 *.00* **-**[9]	0.17 *-.13* **.08**	0.10 *.06* **.03**	0.06 *.03* **-.01**	0.07

Table 4.4. Results on child labor prevention in Honduras

[9] The smaller n of observations of farms with children occasionally caused propensity score matching and regression models to fail in this table and the following tables. Furthermore, as perfect predictors are not allowed for logit models, the model cannot be run in cases where either none or all producers of either the treatment or control group implement a certain practice due to perfect collinearity between the dependent and independent variable.

Colombia: Child labor prevention						
Means by group	**Rainforest/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT*	*vs. FT*	*vs. FT*	*vs. NC*	
Share of producers that hired minors below 15 years of age	0.00 *-.01* **-**	0.01 *-.00* **-**	0.00 *.00* -	0.00 *0* **-**	0.00 *.00* **-**	0.00
Share of school-age children that attended school	0.72 *.19* **.11**	0.69 *.06* **.06**	0.77 *-.03* **.13**	0.79 - **-.05**	0.67 *-.28*** (.10)* **-.26** (.11)**	0.88
Share of school-age children that work on farm	0.01 *-.02* **-**	0.02 *-.00* **-**	0.00 *-.00* **-**	0.00 *0* **-**	0.01 *.00* **-**	0.00
Share of school-age children that apply pesticides	0.00 *.00* **-**	0.00 *.00* **-**	0.00 - -	0.00 *.00* **-**	0.00 - **-**	0.00

Table 4.5. Results on child labor prevention in Colombia

Costa Rica: Child labor prevention					
Means by group	**Rainforest/ AAA**	**Rainforest/ C.A.F.E.**	**C.A.F.E. Practices**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT/NC*	*vs. FT*	*vs. NC*	
Share of producers that hired minors below 15 years of age	0.11 *.10*** (.03)* **-**	0.05 *.03* **-**	0.00 *.00* **-**	0.00 *-.18*** (.04)* **-**	0.29
Share of school-age children that attended school	0.80 - **-**	0.73 *-.04* **.22**	0.89 *-.10* **-**	0.87 *.00* **-.15**	0.71
Share of school-age children that work on farm	0.00 - **-**	0.00 - **-**	0.00 - **-**	0.00 - **-**	0.00 - **-**
Share of school-age children that apply pesticides	0.00 - **-**	0.00 - **-**	0.00 - **-**	0.00 - **-**	0.00 - **-**

Table 4.6. Results on child labor prevention in Costa Rica

4.3. Protection of aquatic ecosystems

In this section, I present two sets of indicators. The first concerns the treatment of wastewater, in which respondents were asked whether they treat their processing water (*aguas mieles*) in an adequate manner.[10] This question only applied to producers that processed their own beans, and was thus mainly asked of Honduran and Colombian producers. Second, in those farms that have a water source on-farm, data collectors observed whether the water source was fully protected from adverse farm activities (including through live or normal fences, buffer zone crops, or other types of physical barriers) and

[10] As became apparent after data collection, it is possible that the results are an underestimation of the true rate of wastewater treatment due to the wording of the question. Translated from the literal Spanish, the question asked was "Do you treat your waste water adequately by using reactors [the common term for biodigestors] or anaerobic digestion?". While those are by far the most widely used methods of treating processing water, it is possible that alternative technologies, such as biofiltration systems, were not taken into account when responding.

showed no signs of contamination, or whether lower or no levels of protection had been taken. Finally, the data collectors were asked to estimate the distance between crops and water source.

Honduras: Protection of aquatic ecosystems						
Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Additionality	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	
Treatment of waste water	0.47	0.60[11]	0.16	0.07	0.13	0.14
	*.28*** (.11)*	-	*-.18** (.08)*	*-.01*	*-.01*	
	.22* (.07)**	**-**	**.00**	**-.01**	**-.04**	
Share of farms with water source	0.26	0.02	0.40	0.33	0.33	0.22
	*.10*** (.03)*	*-.06* (.03)*	*.23*** (.08)*	*.11* (.06)*	*.08* (.05)*	
	.06	**-.25*** (.04)**	**.26*** (.08)**	**.09* (.05)**	**.13*** (.04)**	
Share of farms with water source with full protection	0.65	1.00	0.63	0.55	0.48	0.55
	.10	-	-	*.06*	*-.02*	
	-[12]	**-**	**.23* (.13)**	**-.00**	**-.08**	
Share of farms with buffer zone of ≥5m	0.85	1.00	0.53	0.48	0.45	0.52
	-	-	-	*-.13*	*.05*	
	.17	**-**	**.18**	**-.01**	**-.01**	
Within-group t-test of means with vs. without environmental training						
Treatment of waste water	.61***	.5	.37*	.13*	.24**	.34***
	.08	.62	.06	.00	.07	.07
Share of farms with water source with full protection	.57	.42***	.57	.45	.42	.2
	.83	.85	.72	.53	.56	.65

Table 4.7. Results on the protection of aquatic ecosystems in Honduras

Colombia: Protection of aquatic ecosystems						
Means by group	**Rainforest/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT*	*vs. FT*	*vs. FT*	*vs. NC*	
Treatment of waste water	0.87	0.42	0.32	0.13	0.27	0.01
	*.30*** (.08)*	*-.01*	*-.04*	*.12*** (.02)*	*.26*** (.02)*	
	.25* (.06)**	**.03**	**-.03**	**.29*** (.04)**	**.21*** (.03)**	
Share of farms with water source	0.14	0.26	0.06	0.47	0.06	0.39
	.00	*.22*** (.03)*	*.00*	*.25** (.09)*	*-.32*** (.10)*	
	.07	**.22*** (.04)**	**.00**	**.21*** (.06)**	**-.32*** (.06)**	
Share of farms with water source with full protection	0.36	0.73	0.80	0.68	0.50	0.63
	-	-	-	-	-	
	-	**.38*** (.14)**	**.35**	-	*.28*** (.07)*	
Share of farms with buffer zone of ≥5m	0.73	0.95	0.80	0.80	0.64	0.97
	-	-	-	-	-	
	-	**-**	**-**	**-**	**-**	
Within-group t-test of means with vs. without environmental training						
Treatment of waste water	.90	.51***	.54***	.17	.48***	.01
	.80	.18	.12	.06	.11	.00
Share of farms with water source with full protection	.42	.70	0.5	.65	.28	.74***
	.25	1.00	1.00	1.00	.71	.14

Table 4.8. Results on the protection of aquatic ecosystems in Colombia

[11] This result reflects a subset of Fairtrade/organic producers, since the Fairtrade/organic cooperative also has a processing plant and accepts cherry coffee delivery, such that not all producers process their coffee themselves. The limited number of observations also caused the propensity score matching mechanism to fail in this instance.

[12] The smaller n of observations of farms with water sources frequently caused propensity score matching and logit models to fail in this and the subsequent tables.

Costa Rica: Protection of aquatic ecosystems					
Means by group	**Rainforest/ AAA**	**Rainforest/ C.A.F.E.** *vs. FT/NC*	**C.A.F.E. Practices**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*		*vs. FT*	*vs. NC*	
Share of farms with water source	0.77 *.29*** (.06)* **.30*** (.08)**	0.30 *-.20*** (.07)* **-.14** (.06)**	0.28 *-.09* **-.09**	0.35 *.22*** (.05)* **.19*** (.07)**	0.24
Share of farms with water source with full protection	0.80 *-.08* **-.05**	0.75 *-.14** (.07)* **-.18* (.09)**	0.88 - **-**	0.85 - **-**	0.85
Share of farms with buffer zone of ≥5m	0.90 *.03* **-**	1.00 *.12* (.06)* **-**	1.00 - **-**	0.90 - **-**	0.88
Within-group t-test of means with vs. without environmental training					
Share of farms with water source with full protection	.77 1.00	.75 .75	.87 .88	.81 .90	.89 .80

Table 4.9. Results on the protection of aquatic ecosystems in Costa Rica

4.4. Prevention of deforestation and land sparing approaches

In order to gauge the potential of coffee production to contribute to deforestation, I analyze a number of indicators drawn from the questionnaire. First, farmers were asked what area of their total holdings consisted of forest in an effort to assess whether they kept conservation areas as part of their total land use. These numbers do not include coffee agroforestry and were adjusted accordingly during data cleaning if farmers double-counted those areas. Then, in a two-part question, farmers reported whether they had expanded their coffee area in the last five years and, if so, what that land had been used for previously. The possibility of choosing from a range of answers (coffee, subsistence agriculture, forest, pasture, fallow, or other) was designed to inspire confidence and lead to lower social desirability bias than if we had asked "did you deforest recently". Finally, farmers were asked whether they had planted trees in the last year. It should be noted that the format of the questionnaire made it impossible to differentiate between HCV, primary and secondary forest, though to our knowledge none of the sampled farmers were directly adjacent to protected areas and no large-scale plantations existed in the vicinity, so that all forest is likely to be natural forest.

Honduras: Deforestation and reforestation practices						
Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Additionality	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	
Percentage of farm land that is forest	0.10 *.03* (.02)* **.04* (.02)**	0.24 *.13*** (.04)* **.22*** (.05)**	0.01 *-.09** (.04)* **-.05*** (.01)**	0.13 *.10*** (.02)* **.07*** (.02)**	0.05 *.00* **.00**	0.05
Share of producers who expanded coffee	0.55 *-.06* **.00**	0.47 *.08* **.10**	0.50 *-.10* **-.08**	0.49 *.08* **.01**	0.60 *.03* **.08* (.05)**	0.49
Share who expanded that replaced forest	0.24 *.00* **.21** (.08)**	0.32 *.20*** (.07)* **.15**	0.00 *-.16* **-**	0.07 *-.07* **-.03**	0.09 *.02* **.01**	0.09
Share that planted trees in last year	0.57 *.33*** (.05)* **.22*** (.07)**	0.77 *.17* **.32*** (.11)**	0.17 *-.04* **-.02**	0.47 *.19*** (.07)* **.18*** (.06)**	0.28 *.06* **.04**	0.27
Within-group t-test of means with vs. without environmental training						
	.20	.46*	0.00	.00	.16	.11

Share who expanded that replaced forest	.42	.11	0.00	.11	.05	.07
Share that planted trees in last year	.62 .46	.84 .66	.2 .15	.69*** .35	.33 .30	.4** .23

Table 4.10. Results on deforestation and reforestation practices in Honduras

Colombia: Deforestation and reforestation practices						
Means by group ***Additionality***	**Rainforest/ AAA** *vs. FT*	**Nespresso AAA** *vs. FT*	**C.A.F.E. Practices** *vs. FT*	**4C** *vs. FT*	**Fairtrade** *vs. NC*	**Non-certified**
Percentage of farm land that is forest	0.06 *.03* **.01**	0.10 *.05*** (.02)* **.04** (.02)**	0.04 *-.00* **-.01**	0.11 *.05***(.01)* **.05** (.02)**	0.05 *-.07** (.03)* **-.09*** (.02)**	0.18
Share of producers who expanded coffee	0.02 *-.01* **-.02**	0.08 *.05* (.02)* **.07** (.03)**	0.04 *.00* **-.00**	0.08 *.07** (.03)* **.13*** (.04)**	0.03 *-.00* **-.01**	0.07
Share who expanded that replaced forest	0.00 - -	0.09 - -	0.33 - -	0.33 - -	0.43 - -	0.00
Share that planted trees in last year	0.14 *.02* **.04**	0.11 *-.01* **-.01**	0.07 *-.03* **-.03**	0.15 *.00* **.13* (.07)**	0.10 *-.24*** (.08)* **-.13** (.06)**	0.18
Within-group t-test of means with vs. without environmental training						
Share who expanded that replaced forest	.00 .00	.11 .00	.5 .00	.25 .5	.25 .66	.00 .00
Share that planted trees in last year	.17 .07	.13* .02	.07 .07	.12 .20	.11 .09	.18 .15

Table 4.11. Results on deforestation and reforestation practices in Colombia

Costa Rica: Deforestation and reforestation practices					
Means by group ***Additionality***	**Rainforest/ AAA** *vs. FT*	**Rainforest/ C.A.F.E.** *vs. FT/NC*	**C.A.F.E. Practices** *vs. FT*	**Fairtrade** *vs. NC*	**Non-certified**
Percentage of farm land that is forest	0.06 *-.00* **-.00**	0.11 *.04** (.01)* **.02**	0.04 *-.02* **-.01**	0.06 *.03** (.01)* **.03** (.01)**	0.03
Share of producers who expanded coffee	0.23 *.03* **.14** (.06)**	0.19 *.00* **.00**	0.09 *-.00* **-.00**	0.07 *-.01* **-.05**	0.14
Share who expanded that replaced forest	0.00 - **-**	0.07 - **-**	0.00 - **-**	0.00 - **-**	0.05
Share that planted trees in last year	0.83 *.28*** (.08)* **.39*** (.07)**	0.23 *-.24*** (.07)* **-.18*** (.06)**	0.36 *-.03* **-.07**	0.44 *-.21** (.10)* **-.18** (.07)**	0.58
Within-group t-test of means with vs. without environmental training					
Share who expanded that replaced forest	.00 .00	.11 .00	.00 .00	.00 .00	.07 .00
Share that planted trees in last year	.85 .66	.32 .17	.48*** .17	.43 .45	.74*** .17

Table 4.12. Results on deforestation and reforestation practices in Costa Rica

4.5. Biodiversity protection through agroecological methods

Based on an observational walk-through of the farm plots and corroborated by visual evidence, data collectors were asked to log whether the farm showed a significant number of different shade species;[13] whether there were native shade trees present; whether the shade trees had multiple strata;[14] and what percentage of the coffee plants (0-25%; 25-50%; 50-75%; or 75-100%) were covered by shade. These indicators were then combined into the agroforestry indicators below. Furthermore, I review whether producers report not using any synthetic inputs for fertilization, disease and weed control.

Honduras: Agroecological practices						
Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Additionality	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	*vs. NC*	
Agroforestry with >25% shade cover	0.43 *.17** (.07)* **.08* (.05)**	0.57 *.20* **.31*** (.11)**	0.04 *-.02* **-.01**	0.34 *.22*** (.06)* **.11** (.04)**	0.19 *.11*** (.04)* **.07* (.04)**	0.12
Agroforestry with >50% shade cover	0.13 *-.03* **-.03**	0.28 *-.01* **.13**	0.00 *.00* **-**	0.07 *.02* **-.03**	0.02 *.00* **-.02**	0.04
No synthetic input use (only organic)	0.00 *-.00* **-**	0.66 *.66*** (.06)* **-**	0.06 *-.06* **-.02**	0.00 *-.03* (.02)* **-**	0.02 *-.04* (.02)* **-**	0.05
Within-group t-test of means with vs. without environmental training						
Share of producers with > 8 shade species	.62 .53	.57** .90	.06 .12	.64*** .30	.54* .38	.43 .33
Share with native tree species	.62 .53	.96 1	.4 .21	.69 .56	.59*** .33	.5** .31
Share with multi-strata shade trees	.79 .8	.42*** .85	.73 .75	.85** .64	.83 .73	.66 .65

Table 4.13. Results on agroecological practices in Honduras

Colombia: Agroecological practices						
Means by group	**Rainforest/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT*	*vs. FT*	*vs. FT*	*vs. NC*	
Agroforestry with >25% shade cover	0.01 *.01* **-**	0.00 *-.02* **-**	0.01 *.01* **-**	0.01 *-.01* **-**	0.01 *-.00* **-.06** (.02)**	0.06
Agroforestry with >50% shade cover	0.00 *.00* -	0.00 *-.01* -	0.00 *.00* -	0.00 *.00* -	0.00 *-.00* -	0.03
No synthetic input use (only organic)	0.00 *.00* **-**	0.01 *.01* **-**	0.00 *-.03* **-**	0.01 *.01* **-**	0.01 *-.00* **-**	0.09
Within-group t-test of means with vs. without environmental training						
Share of producers with > 8 shade species	.00 .03	.00 .00	.02 .00	.01 .03	.00 .01	.09 .18
Share with native tree species	.26 .25	.24 .23	.34** .15	.25* .09	.28 .21	.60 .5
Share with multi-strata shade trees	.07 .14	.15 .07	.10 .15	.37** .12	.16 .18	.22 .27

[13] Since not all farmers were subject to the Rainforest Alliance requirements, and data collectors often did not have time to visit the entire farm, this question asked whether more than 8 – rather than 12 – species were present.

[14] The question asked for three or more strata, which are necessary to provide appropriate habitat for wildlife according to Bird Friendly standards.

Table 4.14. Results on agroecological practices in Colombia

Costa Rica: Agroecological practices					
Means by group	**Rainforest/ AAA**	**Rainforest/ C.A.F.E.**	**C.A.F.E. Practices**	**Fairtrade**	**Non-certified**
Additionality	*vs. FT*	*vs. FT/NC*	*vs. FT*	*vs. NC*	
Agroforestry with >25% shade cover	0.03 *-.02* **-.01**	0.01 *-.03* **-.02**	0.03 *.02* **-.00**	0.05 *.02* **-.04**	0.12
Agroforestry with >50% shade cover	0.01 *-.02* **-.02**	0.00 *-.02* **-**	0.02 *.01* **.00**	0.02 *-.01* **-.03**	0.06
No synthetic input use (only organic)	0.00 *.00* **-**	0.00 *.00* **-**	0.00 *-.01* **-**	0.01 *.01* **-**	0.00
Within-group t-test of means with vs. without environmental training					
Share of producers with > 8 shade species	.11 .00	.05 .02	.06 .02	.06 .00	.17*** .00
Share with native tree species	.53 .44	.64 .64	.76** .54	.82 .85	.83 .87
Share with multi-strata shade trees	.11 .22	.35*** .10	.31 .19	.44** .15	.66*** .10

Table 4.15. Results on agroecological practices in Costa Rica

The impact of shade practices on yields (qq/ha)			
Regression results	**Honduras**	**Colombia**	**Costa Rica**
25% - 50% shade	-8.91*** (1.70)	-4.68*** (1.75)	-2.04
50% - 75% shade	-7.25*** (2.37)	-7.00*** (2.57)	-7.01** (2.90)
75% - 100% shade	-21.18*** (2.61)	-12.79*** (4.16)	-4.22
Select control variables[15]			
Female gender	-2.95* (1.69)	-3.35* (1.83)	-3.95** (1.95)
Age	-.24*** (.05)	-.28*** (.06)	-.09
Years of schooling	-.38* (.20)	-.12	-.30
Household size	-.66** (.28)	-1.26*** (.46)	.44
Coffee area	.26*** (.04)	-.38** (.18)	.16
Region (Occidente/Andes/Tarrazu)	8.31*** (1.36)	3.17* (1.80)	6.28*** (2.02)

Table 4.16. The impact of shade practices on yields

[15] Additional control variables included land tenure, location (distance to school, health service and markets), altitude, and participation in coffee institutions and other farmer organizations (IHCAFE and ANACAFE in Honduras, FNC and Junta Directiva in Colombia, UPA in Costa Rica).

5. Rule cognizance as pathway towards compliance

Honduras: Rule cognizance as pathway towards compliance						
Means by group	**Rainforest Alliance**	**FT/organic**	**Fairtrade**	**UTZ Certified**	**4C**	**Non-certified**
Share with correct certification self-identification	0.78	0.87	0.71	0.07	0.64	0.46
Within-group t-test of means with vs. without accurate certification identification						
Share that paid minimum wage	.00 .00	.17 .16	.00 .00	.00 .00	.01 .00	.00 .00
Share that hired minors below 14 years of age	.06*** .37	.04 .00	.03 .00	.14 .25	.10*** .56	.53*** .11[16]
Share using complete protection equipment	.75 .58	.37[17] .00	.35 .00	.00 .07	.11 .17	.06*** .19
Share with potable drinking water	.89*** .47	.90 1.00	.64 .64	.71 .54	.56*** .30	.11*** .53
Share that replaced forest with coffee	.22 .33	.36 .00	.00 .00	.00 .07	.10 .03	.12 .06

Table 5.1. Rule cognizance as pathway towards compliance in Honduras

Colombia: Rule cognizance as pathway towards compliance						
Means by group	**Rainforest Alliance/ AAA**	**Nespresso AAA**	**C.A.F.E. Practices**	**4C**	**Fairtrade**	**Non-certified**
Share with correct certification self-identification	0.58	0.76	0.11	0.03	0.35	0.67
Within-group t-test of means with vs. without accurate certification identification						
Share that paid minimum wage	1.00 .97	.97 .97	1.00 .94	1.00 .95	.87*** .97	.95 .90
Share that hired minors below 15 years of age	.00 .00	.01 .00	.00 .00	.00 .00	.00 .00	.00 .00
Share using compl. protection equipment	.80 .89	.82*** .25	1.00 .76	1.00 .59	.83*** .55	.23 .33
Share with potable drinking water	1.00 1.00	.92* .82	.77 .60	.00 .33	.19*** .62	.17 .18
Share that replaced forest with coffee	.00 .00	.14 .00	.33	.33	.00 .5	.00 .00

Table 5.2. Rule cognizance as pathway towards compliance in Colombia

Costa Rica: Rule cognizance as pathway towards compliance					
Means by group	**Rainforest Alliance/AAA**	**Rainforest Alliance/C.A.F.E.**	**C.A.F.E. Practices**	**Fairtrade**	**Non-certified**
Share with correct certification self-identification	0.63	0.55	0.44	0.72	0.89

[16] This group contains producers that reported that they were 4C verified. After consulting Coffee Assurance Services, who reported that these producers were not listed among any 4C group, I concluded that it may either contain producers that are in the process of becoming 4C-verified, or those that have visited neighbors or were introduced to the idea of 4C verification through extension agents and thought that this automatically means verification. Either way, this significant result can be seen as a positive spillover effect, since those that – incorrectly – thought they belonged to a private standard indeed behaved as though they did.

[17] Of those that report using agrochemicals.

Within-group t-test of means with vs. without accurate certification identification					
Share that paid minimum wage	.35 .47	.02 .00	.09** .36	.16 .22	.02 .00
Share that hired minors below 15 years of age	.12 .08	.04 .05	.00 .00	.00 .00	.06 .00
Share using compl. protection equipment	.75* .92	.93*** .65	.86 .86	.52 .56	.69 .83
Share with potable drinking water	.92 1.00	1.00 1.00	1.00 1.00	.94 1.00	1.00 1.00
Share that replaced forest with coffee	.00 .00	.08 .00	.00 .00	.00 .00	.00 .00

Table 5.3. Rule cognizance as pathway towards compliance in Costa Rica

6. Overview of standard documents and criteria

Criteria	4C Code of Conduct v. 2.1	UTZ Core Code for Group Certification 2014	Rainforest Alliance 2010 (+ Group Certification 2011)	FLO Fairtrade Standard 2011	Fairtrade/organic (Biolatina, equivalent with EU regulation)	Nespresso TASQ AAA 2013	CAFE Practices Smallholder Scorecard 2014
General incentive setting and compliance management mechanisms							
Training and continuous improvement	Business Partners and workers within the 4C Unit have access to training in relevant technical skills (e.g. Good Agricultural Practices, Good Management Practices) (Y3)	Trainings (at least once a year) on at least two topics per year, to cover all following topics after 4 years: Traceability, good farm maintenance and productivity, IPM techniques, crop diversification, safe handling of pesticides, harvest and postharvest practices, product quality and food safety, record keeping skills, occupational health and safety, protection of water bodies, protection of flora and fauna, climate change, waste management (Y1-4)	*The group administrator must implement a training program for its group members to comply with Sustainable Agriculture Network standards. The people actually doing the job must be those trained.*	Training on IPM, proper handling of agrochemicals and fertilizers, efficient water use, occupational health and safety (Y3), erosion prevention, and workers' rights (Y6)	Training on IPM, proper handling of agrochemicals and fertilizers, efficient water use, occupational health and safety (Y3), erosion prevention, and workers' rights (Y6)	Training on effective execution of TASQ, including protection of endangered species, occupational health, IPM, etc. (0.3 pt)	Training on legal hiring practices, forced labor, the value of wildlife diversity and discouragement of hunting, health and safety including use of personal protective equipment (PPE), storage of agrochemicals, shade management, integrated pest control and disease management including correct pesticide container disposal, pruning, weeding and general agricultural practices, coffee processing and drying (11 pts)
Training of workers	Health and safety programme exists that includes worker training on health and safety issues (Y3)	Training requirements include occupational health and safety, safe handling of pesticides (Y1-4 continuous, at least 2 topics/year)	The farm must have a permanent and continuous training program to educate workers on how to carry out their work correctly and safely.	Training requirements include proper handling of pesticides and other hazardous pesticides (Y3), occupational health and safety (Y3), workers' rights (Y6)	Training requirements include occupational health and safety (Y3), workers' rights (Y6)	Training of personnel includes safe use and handling of pesticides, general occupational health (1.3 pts)	No
Price and premiums	Price mechanisms reflect coffee quality (Y3) and sustainable production practices (green)	*A (market-based) UTZ premium is in place and benefits group members in cash or kind (Y1)*	No	*Fixed minimum price; specified premium to producer organization (Y0)*	*Fixed minimum price; specified premium to producer organization + market-based organic premium (Y0)*	„The producer is familiar with the distribution chain and the price premium that he receives as a member of the AAA Program" – but no specified price premium	No specified price premium; suppliers are expected to show that they „pass on an equitable share of coffee revenues (i.e., financial rewards) through the supply chain to coffee farmers and processors"

Short-term production benefits (input optimization, productivity, quality benefits)							
Productivity	There is awareness on practices that have the potential to maintain or increase profitability and long-term productivity (Y3)	Farm achieves optimal productivity through farming practices such as proper planting material, weed control and pruning/removal of shoots; yield optimization practices (Y2-3)	No; only in definition of Best Management Practices which are "activities or procedures that enable agricultural productivity using available science and technology to conserve ecosystems and natural resources"	5 cents of social premium shall be invested in productivity or quality improvements	5 cents of social premium shall be invested in productivity or quality improvements	In preamble: „The AAA Program is built on three strategic drivers – a commitment to quality as a pre-requisite for inclusion and a focus on improving productivity and social and environmental sustainability"	The farm implements a coffee pruning program to promote new tissue generation (intended to contribute to increased productivity and coffee quality) (1.3 pt)
Quality	First steps are taken to monitor coffee quality against market requirements or national/ international export standards (Y3)	*Product is harvested at the appropriate time and using the best method for optimizing quality and crop health (Y1);* suitable varieties consider quality (Y3); good practices for storage, handling, processing are in place (Y3)	No	5 cents of social premium shall be invested in productivity or quality improvements	5 cents of social premium shall be invested in productivity or quality improvements	*Product quality is pre-requisite for inclusion*	*Product quality is pre-requisite for inclusion*
Minimization of pesticide use	An integrated pest management (IPM) system is being developed: farmers monitor their crop for pest, weeds and diseases and are aware of preventive measures and potential control techniques which are not chemical (Y3)	IPM measures are implemented and documented (which include rotation of pesticides, their justified use at threshold levels of pests; and the use of non-chemical alternatives) (Y2)	The IPM program must give priority to the use of physical, mechanical, cultural and biological control methods, and the least possible use of agrochemicals	Must provide training on IPM (Y3); farmers should demonstrate that pesticides are applied based on knowledge of pests and diseases (Y6)	*Use of all chemical pesticides or plant protection products that are not specifically authorized under the respective (national or private) legislation is prohibited (critical)*	Priority must be given to the use of physical, mechanical, cultural and biological control methods and the least possible use of agrochemicals (1.3 pts)	Pesticides (not including herbicides) are applied only on a spot-application basis or as a last resort (1 pt); Herbicides are not used to control ground vegetation or cover crops and are only used in spot applications for aggressive weeds (1 pt)
Record-keeping of sales and inputs (and their costs)	Coffee is traceable within the 4C Unit (Y3); steps are taken to ensure that main coffee costs and coffee income are kept (Y3)	*Records and invoices are kept to ensure traceability (Y1)*; all applications of inorganic fertilizers and pesticides are recorded (Y4)	*All transactions involving certified products must be recorded (critical)*; upon group member's request, the group administrator must facilitate a group	*Records must be kept on product sales (Y0)*	*Records must only be kept on product sales (Y0)*	*All AAA Coffee transactions must be documented (critical)*; there are records for production, sales, expenses and/or costs; records are analyzed by the producer; data	*Each farm in the supply chain receives a receipt for coffee purchased (zero tolerance)*

			member's ability to create records; the farm must demonstrate by comparative agrochemical inventories and use records that it rotates chemical products and reduces their use for crop production			allows the producer to make financial decisions (1 pt)	
Efficient fertilizer use and use of soil analyses	Application of fertilizer is based on a technical recommendation (Y3); … is in accordance with the needs of the crop based on soil or leaf analysis (green)	Soil fertility and crop nutrient status are monitored every year (can be based on soil maps, soil and/or leaf analysis, or physical symptoms of nutrient deficiencies) (Y2); measures are taken to improve soil fertility according to the nutritional needs of the crop, and any fertilizer used is used efficiently to maximize uptake (Y3)	The farm must have a soil or crop fertilization program based on soil characteristics and properties, periodic soil or foliage sampling and analysis, and advice from a competent and impartial professional or authority	Must provide training on the appropriate use of fertilizers (may be based on knowledge *or* frequently analyzed soil samples) (Y6)	*Organic plant production should contribute to maintaining and enhancing soil fertility as well as to preventing soil erosion; plants should preferably be fed through the soil eco-system and not through soluble fertilisers added to the soil; The total amount of livestock manure applied on the holding may not exceed 170 kg of nitrogen per year/hectare of agricultural area used*	There is a soil or crop fertilization program based on soil characteristics and properties, periodic soil or foliage sampling and analysis and advice from a competent and impartial professional or authority (0.3 pts); the number of soil or foliage samples must correspond with the size of the production area, types of soil, and variations in their properties, as well as results from prior analyses (0.3 pts)	Producer Support Organization's soil management plan includes the analysis of soil samples from representative farms in the network to identify nutrient deficiencies (1 pt) and is implementing its soil and/or foliar analysis plan every two years (1 pt)
Long-term benefits of sustainable production (health and safety, resilience, climate change adaptation)							
Waste management and disposal	Safe disposal of hazardous waste is practiced. Steps are taken to improve waste management (Y3)	Waste is stored and disposed of only in designated areas. Non-hazardous waste is reused or ted whenever possible. Organic waste is used as fertilizer (Y3)	The use of open waste dumps and open-air burning of waste is not permitted; the waste deposit areas must be designed and managed to reduce the risks of environmental contamination and damage to human health. The farm must be free of accumulations of all	*Members must keep their farms free of hazardous waste (Y0);* members must have designated areas for the storage and disposal of hazardous waste; admins must raise awareness among members about re-using organic waste through the implementation of	*Members must keep their farms free of hazardous waste (Y0);* members must have designated areas for the storage and disposal of hazardous waste; admins must raise awareness among members about re-using organic waste through the implementation of	The final or semi-permanent waste disposal areas on the farm must be designed and managed to reduce the risks of environmental contamination and harm to human health; the farm must be clean without accumulations of wastes of any kind;	Farm waste or garbage sites are located at least 100 meters from any water body (1 pt)

			types of waste products and must strategically place waste receptacles on the farm and regularly collect and dispose of their contents	practices that allow nutrients to be recycled (Y3)	practices that allow nutrients to be recycled (Y3); *burning is prohibited on the farm (critical, Biolatina)*	the farm must position waste disposal bins in strategic places on the farm and periodically collect and dispose of their contents (0.6 pts)	
Safe disposal of pesticide containers	Safe disposal of hazardous waste is practiced. Steps are taken to improve waste management (Y3)	*Triple rinsing, perforation, stored safely and disposed by collection, return, and/or disposal system (organized by government or a supplier) (Y1)*	All agrochemical containers must be washed three times before being stored for disposal or return to supplier	*Must not reuse pesticide containers to store or transport drink or food (Y0*), must triple rinse, puncture and store properly (Y3)	*No pesticides or inorganic fertilizers are allowed (Y0)*	No requirements per se, but storage area needs to have „a storage area for empty containers that are triple washed for proper disposal or for return to the supplier" (0.3 pt)	Empty chemical containers are rinsed and punctured, or as required by local regulations, and appropriately disposed of to prevent further use or injury (1.3 pt)
Prohibition of most hazardous pesticides	*Prohibited: Stockholm Convention POPs; Annex III Rotterdam Convention PIC; Montreal Protocol (unacceptable);* self-defined red list (phase out after 3 years) and yellow list (to be reduced) (Y3)	*Prohibited: Not legally registered; Not approved by USA, EU, Japan; Stockholm Convention POPs; Annex III Rotterdam Convention PIC; PAN Dirty Dozen; WHO class Ia and Ib (Y1)*	*Prohibited: Not legally registered; Not approved by USA, EU; Stockholm Convention POPs; Annex III Rotterdam Convention PIC; PAN Dirty Dozen (critical);* plan for eliminating WHO class Ia and Ib	*Prohibited: Self-defined red list based on Stockholm Convention POPs; Annex III Rotterdam Convention PIC; WHO class Ia and Ib, PAN Dirty Dozen (Y0, but can apply for exemption);* self-defined amber list based on USA and EU restrictions	*Prohibited: All chemical pesticides or plant protection products that are not specifically authorized under the respective (national or private) legislation (critical)*	*Prohibited: Not legally registered; Not approved by USA, EU; Stockholm Convention POPs; Annex III Rotterdam Convention PIC; PAN Dirty Dozen (critical)* plan for eliminating WHO class Ia and Ib	*Prohibited: Banned according to national, regional or local laws; WHO class Ia and Ib (zero tolerance)*
Use of PPE	Workers handling pesticides are given personal protection equipment. In the case of small-holders, hazard awareness is being raised and they implement measures for personal protection (Y3)	*Group staff, group members, and group member workers who handle pesticides use personal protective equipment (PPE) and protective clothing that is prescribed for the pesticide used and its method of application (Y1)*	*All workers that come into contact with agrochemicals, including those who clean or wash clothes or equipment that has been exposed to agrochemicals, must use personal protection equipment (critical);* clothes are washed on farm, not in home	Must implement measures to ensure that all people wear appropriate personal protective equipment (PPE) when handling pesticides or hazardous chemicals – incl. garments or equipment which cover the arms and legs, footwear (shoes or boots), a mask when applicable and, if spraying crops above your head, a hat (Y3)	*No chemical pesticides or inorganic fertilizers are allowed (Y0)*	*When applying pesticides, workers use respirators with filters, goggles, rubber boots, water-proof gloves, and impermeable clothing (critical); PPE must be in good condition (critical);* PPE and clothes are washed on the farm, not in the workers' homes (0.3 pt)	All workers that use agrochemicals must use personal protection equipment: respirators with filters, goggles, rubber boots, water-proof gloves, impermeable clothing; no entrance to areas where pesticides were applied 48 hours prior without protective equipment (2.5 pts)

Safe storage of agrochemicals	Pesticides and fertilisers are properly stored away from reach of non-trained people and to avoid polluting the environment (Y3)	*Secure storage of pesticides and inorganic fertilizers (locked, in a way to avoid spillage, in original containers) (Y1)*	The farm stores agrochemicals in a manner that minimizes potential negative impacts on human health and on the environment (not on floor or in contact with absorbent material; number of stipulations for storage area)	*If storage area exists, must be well maintained (locked, ventilated, labeled) (Y0)*; members must store pesticides in a way that minimizes risks and clearly label them (Y3)	*No pesticides or inorganic fertilizers are allowed (Y0)*	Storage areas must be designed, built and equipped to reduce the risks of accidents (1.3 pts); safe storage practices (locked, labeled, separated products, …) (3 pts)	Agrochemical storage site is locked, separate from living areas, with adequate ventilation (2.5 pts)
First aid kit	As part of health and safety programme – „incl. an emergency kit and persons trained in first aid" (green)	First aid boxes are placed at central locations of production, processing, and maintenance sites (Y3)	There must be first aid equipment in the farm's permanent installations and first aid kits available to field workers	*Members must have accessible first aid boxes and equipment in the workplace at all times (Y0)*	*Members must have accessible first aid boxes and equipment in the workplace at all times (Y0)*	First aid kits are available to field workers (0.3 pt)	No
Medical attention	As part of health and safety programme, but not much detail	Group staff, group members, and group member workers have access to first aid services (Y3)	All workers and their families must have access to medical services during working hours and in case of emergency	*Members must have a sufficient number of people trained in first aid in the workplace at all times (Y0)*	*Members must have a sufficient number of people trained in first aid in the workplace at all times (Y0)*	All workers and their families must have access to medical services[1] (0.3 pt)	No – a previous requirement SR-WC3 („Workers and their families should have access to medical care") is not in the latest scorecard (V.3.3)
Potable water	*All workers must have access to safe drinking water while at work (unacceptable)*	*Group staff, group members, and group member workers have access to safe drinking water (Y1)*	All workers of the farm and persons living on the farm must have access to potable water	*Clean drinking water must be provided close by for workers (Y0)*	*Clean drinking water must be provided close by for workers (Y0)*	All farm workers and persons living on the farm must have access to potable water (0.6 pts)	Employer provides workers with convenient access to safe drinking water (1.3 pt)
Erosion prevention	Soil conservation measures have been started (Y3)	Soil erosion is prevented by using soil conservation techniques (Y2)	The farm must execute a soil erosion prevention and control program that minimizes the risk of erosion and reduces existing erosion	Must identify land at risk of soil erosion (Y3) and provide training on practices that reduce or prevent erosion (Y6)	*Organic plant production shall use tillage and cultivation practices that … prevent soil compaction and soil erosion (critical)*	The farm must execute a soil erosion prevention and control program that minimizes risks and reduces current erosion (2pts)	Soil erosion is prevented by specific conservation techniques (shade trees, cover crops, contour lines, terraces, barriers) (12.5 pts)
Soil fertility/ organic inputs	There is some use of mineral and/or organic fertilisers; technical recommendations are available but not necessarily	Measures are taken to improve soil fertility according to the nutritional needs of the crop; any fertilizer used is used efficiently to	Organic and non-organic fertilizers must be applied so as to avoid any potential negative impacts on the environment. The farm must give	Must raise awareness about re-using organic waste (Y3); provide training on the appropriate use of fertilizers; and report on measures	*Only organic inputs allowed, no mineral nitrogen fertilizer; micro-organisms allowed, organic plant production shall use tillage and cultivation*	Fertilization program is based on soil characteristics, periodic soil or foliage sampling and analysis and professional advice (0.6 pts); must	The production area is covered by organic matter or nitrogen-fixing cover crops and planted with nitrogen-fixing shade trees (9 pts)

	implemented; some organic matter is reused (Y3)	maximize uptake (Y3); organic fertilizers and by-products available at farm level are used first (non-binding)	priority to organic fertilization using residues generated by the farm	implemented to improve soil fertility (Y6)	*practices that maintain or increase soil organic matter, enhance soil stability and soil biodiversity (critical)*	avoid negative impacts from fertilization (0.4 pt); must prioritize organic fertilizer (0.3 pt)	
Climate change adaptation measures	No	Documented measures are taken to assist group members in adapting to important climate change impacts identified in the risk assessment (Y4)	No, but mitigation: The farm must implement practices to diminish its emissions of greenhouse gases and increase carbon dioxide sequestration	As example of "activity to maintain or improve sustainable production practises within your eco-system" (Y6)	As example of "activity to maintain or improve sustainable production practises within your eco-system" (Y6)	No	Organization keeps written records of climate change risks and impacts; implements a training program to reduce impact of climate change (2.5 pts)
Windbreaks	‚Boundary plants' as part of soil erosion prevention practices	No	Vegetation barriers (trees, bushes) between production areas and alongside water courses, live fences or barriers, for ecosystem connectivity	No	No	Windbreaks as example of erosion prevention and control program (0.3 pt)	Living barriers as erosion prevention measure (1 pt)
IPM system	Integrated pest, weed and disease management is improved with time (Y3)	IPM measures are implemented and documented (Y2)	The farm must have an integrated pest-management program based on ecological principles for the control of harmful pests (insects, plants, animals and microbes)	Must provide training on IPM, including preventative measures and alternative controls of pests and diseases (Y3)	*Significant restriction of chemical pesticides, pest damage prevented through natural enemies, choice of species and varietals, crop rotation, thermal processes (critical, Biolatina)*	Farm must develop activities in accord with integrated pest management (1.3 pts)	Provision of training on integrated pest control and disease management (1 pt)
Soil cover	As part of soil erosion prevention practices	Soil is covered (e.g. using cover crops, mulch, etc.) when clearing and/or replanting land (Y2)	The farm must use and expand its use of vegetative ground cover to reduce erosion and improve soil fertility; structure and organic material content, as well as minimize the use of herbicides	As example of IPM training (Y3), soil fertility activities (Y3), and training on erosion prevention (Y6)	As example of IPM training (Y3), soil fertility activities (Y3), and training on erosion prevention (Y6)	Must use and expand vegetative cover to reduce erosion and improve soil fertility, ground cover expansion plan (0.6 pts)	Herbicides are not used to control ground vegetation or cover crops and are only used in spot applications for aggressive weeds (1 pt); the production area is covered by cover crops/vegetation (2.5 pts)
Shade cover	As example of "reuse of organic matter"	An adequate number per hectare of suitable shade trees are planted and/or	The agroforestry system's structure consists of a tree community with a	As example of activities "improving soil fertility"(Y3) and	As example of activities "improving soil fertility"(Y3) and	The agroforestry system's structure consists of a tree community with a	At least 40% of the productive area has canopy cover with two layers and

		maintained on coffee plots (Y3)	minimum of 12 native species per hectare on average, average canopy density of at least 40% in the crop area, and the tree canopy consists of two strata	„protecting biodiversity“ (Y6)	„protecting biodiversity“ (Y6)	minimum of 12 native species per hectare on average, average canopy density of at least 40% in the crop area, and the tree canopy consists of two strata (1 pts)	diverse native tree species (12.5 pts)
Suitable varieties	No	Suitable varieties are used for new planting, considering resistance against pests, diseases, and drought[117](Y3)	No	No	In Biolatina organic principles: „choice of appropriate varieties that are disease-resistant“	Mentioned as one example in the definition of IPM, but not in criteria	No
Diversification	No	Diversification of agricultural production and/or other sources of income is encouraged and practiced to adapt to market and/or climate change (non-binding)	No	No	No	Mention of farm diversification through reforestation in preamble, but not in criteria	No
Social and ecosystem services and positive externalities							
Minimum wage	Wage complies with existing national minimum wages or sector agreement (Y3); wage is higher/living wage is paid (green)	*Wage greater or equal to national or regional minimum wage (Y1)*	*Workers must receive pay in legal remuneration greater than or equal to the regional average or the legally established minimum wage, whichever is greater (critical)*	*Wage according to collective bargaining agreement regulations where they exist or at regional average wages or at official minimum wages for similar occupations, whichever is the highest (Y0)*	*Wage according to collective bargaining agreement regulations where they exist or at regional average wages or at official minimum wages for similar occupations, whichever is the highest (Y0)*	*Workers receive remuneration according or greater than to legal minimum wage or regional average, whichever is greater (critical)*	*Wage meet minimum wage or, if minimum wage has not been established, local industry standard wage (zero tolerance)*
Underage workers	*No worst forms of child labor (slavery, debt bondage, children under the age of 18 perform hazardous, dangerous work) (unacceptable)*	*No employment of children under the age of 15 or 14 if that is the national law (Y1)*	*No employment of children under the age of 15 or 14 if ILO Convention 138 exemption, except for neighbors or own children doing traditional work (no worst forms of child labor) (critical)*	*No employment of children under the age of 15 or age defined by local laws whichever is higher (Y0)*	*No employment of children under the age of 15 or age defined by local laws whichever is higher (Y0)*	*No direct or indirect hiring of children under the age of 15 (critical)*	*No direct or indirect contracting of children under the age of 14 (zero tolerance)*
Access to education	The majority of the children under the age of 15 (or of legal	Actions are taken to encourage compulsory school attendance of children	The farm must have mechanisms to guarantee access to education for the	Encouragement to prevent child labor by ensuring safe	Encouragement to prevent child labor by ensuring safe	The farm must have measures for reducing the participation of minors in agricultural	*Children of legal school age attend school and do not work during school hours (zero tolerance)*

	school age) are attending school (Y3)	of group staff, group members, and group member workers (Y4)	school-age children that live on the farm	schooling of children (non-binding)	schooling of children (non-binding)	activities, incl. the installation and maintenance of schools (0.3 pt)	
Water protection	Wastewater from central processing is not directly discharged; actions exist to minimize wastewater pollution from wet processing and sewage (Y3)	*Wastewater treatment system (Y1);* *Water recycling when possible (Y1);* buffer zone around water bodies (2-5 m) (Y2)	*Wastewater from processing operations is not discharged into aquatic ecosystems unless it has undergone treatment (critical); no inorganic or organic solids are deposited into natural water bodies;* protected zones around aquatic ecosystems (5-15 m)	Must handle waste water from central processing facilities in a manner that does not have a negative impact' Must maintain buffer zones around bodies of water (no minimum distance) (Y6)	Must handle waste water from central processing facilities in a manner that does not have a negative impact' Must maintain buffer zones around bodies of water (no minimum distance) (Y6)	*Must not discharge degrading industrial wastewater into aquatic ecosystems (critical);* must treat all farm wastewaters (0.3 pt); vegetative buffer zones around natural ecosystems (3 m) (1 pt)	Wastewater is managed in a way that does not contaminate environment (1 pt); vegetative buffer zones around permanent and seasonal water bodies (2-5 m) (11 pts)
Deforestation	*Cutting of primary forest or destruction of protected areas, prohibited since 2006 (unacceptable)*	*No deforestation or degradation of primary forest has occurred since 2008 (Y1)*	*No destruction of any natural ecosystem since application; no destruction of high value ecosystems due to purposeful farm management activities since 2005; the cutting of natural forest cover or burning to prepare new production areas is not permitted (critical)*	*Avoid negative impacts on protected areas and in areas with high conservation value within or outside the farm or production areas from the date of application for certification (Y0)*	*Avoid negative impacts on protected areas and in areas with high conservation value within or outside the farm or production areas from the date of application for certification (Y0)*	*After 2005, no evidence of the alteration or destruction of high value ecosystems due to activities related to production, deforestation or intentional burns; no cutting of forest to prepare land[1] (critical)*	*No conversion of natural forest to agricultural production since 2004 (zero tolerance)*
Only organic inputs	No	No	No	No	Yes	No	No
Agroforestry	As example of "reuse of organic matter"	An adequate number per hectare of suitable shade trees are planted and/or maintained on coffee plots (Y3)	The agroforestry system's structure consists of a tree community with a minimum of 12 native species per hectare on average, average canopy density of at least 40% in the crop area, and the tree canopy consists of at least two strata	As example of activities "improving soil fertility"(Y3) and „protecting biodiversity" (Y6)	As example of activities "improving soil fertility"(Y3) and „protecting biodiversity" (Y6)	The agroforestry system's structure consists of a tree community with a minimum of 12 native species per hectare on average, average canopy density of at least 40% in the crop area, and the tree canopy consists of two strata (1 pt)	At least 40% of the productive area has canopy cover with two layers and diverse native tree species (12.5 pts)

Notes: Requirements set in cursive are binding, or mandatory, for the attainment of certification. All other Rainforest Alliance criteria are subject to the 80% rule. Starbucks C.A.F.E. Practices has a maximum number of 80 points in the Smallholder scorecard (25 points for the Social Responsibility section, 46 points for

Environmental Leadership-coffee growing, and 9 points for Environmental Leadership-coffee processing), while Nespresso AAA's "Tool for the Assessment of Sustainable Quality" is subdivided into 296 criteria. In order to compare the two, I standardized the point systems and report a score out of 100.