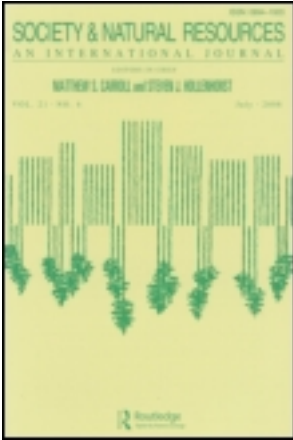


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### Is Certification Associated with Better Forest Management and Socioeconomic Benefits? A Comparative Analysis of Three Certification Schemes Applied to Brazil Nuts in Western Amazonia

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## Articles

# **Is Certification Associated with Better Forest Management and Socioeconomic Benefits? A Comparative Analysis of Three Certification Schemes Applied to Brazil Nuts in Western Amazonia**

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*Nontimber forest product (NTFP) certification has potential to promote sustainable harvest and to bolster rural livelihoods. This research compares environmental and socioeconomic benefits of Brazil nut certification for 231 producers in 17 communities in the trinational border region of Bolivia, Brazil, and Peru during the 2006–2007 harvest. Specific objectives were: (1) to analyze differences in “best management practices” between certified and noncertified producers; (2) to identify socioeconomic*

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benefits associated with certified nuts; and (3) to explore producer perceptions of nut certification. Organic and Fairtrade certification were associated with better postharvest practices and higher prices, while Forest Stewardship Council (FSC) certification was related to preharvest planning. Certification was viewed most positively in Bolivia, where producers gleaned financial and social benefits, moderately in Peru, and least positively in Brazil, where benefits were lower or nonexistent. Partnerships with cooperatives, donors, government, and nongovernmental organizations were essential to maximize conservation and development objectives.

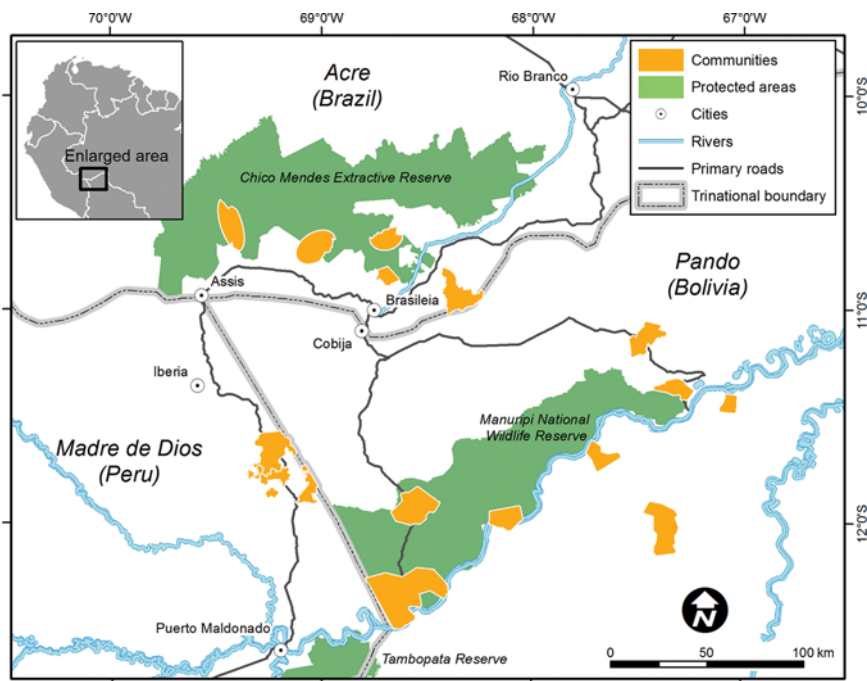
**Keywords** *Bertholletia excelsa*, community forest management, conservation, livelihoods, nontimber forest products (NTFPs)

Increasingly, certification and labeling schemes are promoted to address environmental degradation, social injustice, and consumer health. Certification is a market-based tool used to improve the quality, safety, or management of certain products against a defined set of standards through third-party auditing (Bass et al. 2001). It uses the market to transform the market (Taylor 2005b). Theoretically, on one end of the commodity chain, there is a consumer or retailer who is willing to pay more for a product labeled as environmentally friendly or socially just, and on the other, a producer who seeks market advantages through use of superior practices (Bass et al. 2001). Certification has also been conceptualized as a regulatory mechanism that alters market governance rules (Taylor 2005a), a signal mechanism that illuminates organizational characteristics and practices, and a learning mechanism that promotes knowledge transfer and experiential learning (Overdevest and Rickenbach 2006).

Emerging in the late 1980s, certification in the forestry sector is considered the most advanced of all environmental certification schemes (Auld et al. 2008). It responded to global forest degradation and deforestation concerns, particularly in the tropics, targeting the private sector to circumvent failed international forest policy negotiations. Originally focused on timber, certification of nontimber forest products (NTFPs) has grown in popularity since 1999 (Pierce et al. 2008). According to Walter (2003), four main certification systems are relevant to NTFPs: (1) organic; (2) product quality; (3) Fairtrade; and (4) forest management. Organic and product quality certifications emphasize health and safety standards best suited for food- and pharmaceutical-based NTFPs. Fairtrade certification is socially oriented and encourages and recognizes operations that ensure benefit sharing and better working conditions for small producers. Forest management certification focuses mostly on ecological aspects of harvests, but also includes social and economic standards; Forest Stewardship Council (FSC) certification is the most relevant to NTFPs.

Despite its promise, the ability of certification to provide equitable environmental and development outcomes has been questioned, especially for producers in the global South. Stark discrepancies exist between official standards and local practices (Henne 2010). Commodity chains for certified products include broad networks of actors (i.e., forest managers, product processors, government agencies and nongovernmental organizations [NGOs], and retailers) who hold distinct values and power, which ultimately affect the environmental and social benefits gleaned by producers on the ground (Klooster 2006).

We compared diverse NTFP certification systems adopted by communities engaged in Brazil nut (*Bertholletia excelsa*) harvests in a tricountry border region



**Figure 1.** Map of sampled communities. Map credit: Natalia Hoyos. (Color figure available online.)

in Western Amazonia (Figure 1), which is the current center of the Brazil nut economy, employing tens of thousands of families from rural and periurban areas in nut collection and processing (Stoian 2005). Here, nuts are harvested by agroextractive and indigenous communities and temporary workers hired by private landholders in Pando, Bolivia, mostly by residents of sustainable use conservation areas in Acre, Brazil; and by local harvesters working in Brazil nut concessions (500- to 1000-ha units) in Madre de Dios, Peru (Duchelle et al. 2012). On average, Brazil nuts provide between 11% (Acre) and 43% (Pando) of the total cash and subsistence income for households in nut producing communities (Duchelle et al. 2011). Given that Brazil nut trees are key livelihood assets, Bolivian, Brazilian, and Peruvian legislation prohibit their felling. Thus, we asked: What are the environmental and socioeconomic benefits associated with different Brazil nut certification schemes? Specific research objectives were: (1) to analyze differences in “best management practices” between certified and noncertified producers; (2) to identify socioeconomic benefits associated with supplying or marketing certified nuts; and (3) to explore producer perceptions of nut certification.

### Brazil Nut Ecology and Best Management Practices

Brazil nut trees naturally occur in upland mature forests in Amazonia. Because mature trees are very large (up to 50 m in height and 3 m in diameter), can live hundreds of years (Vieira et al. 2005), occur at relatively high densities, and have a wide geographic distribution, this species provides important local and landscape-level

**Table 1.** “Best practices” for Brazil nut management as outlined in regional extension literature, along with justifications and supporting research for performance

Best management practice	Justification	Example of supporting research
<b>Preharvest</b>		
Map productive trees	Plan harvest, negotiate conflicts	Cronkleton et al. (2010)
Develop management plan	Promote sustainable management, monitor annual production, comply with national forestry legislation	
<b>Silvicultural</b>		
Enrichment plant	Increase density and number of trees	Kainer et al. (1998)
Protect seedlings when clearing agricultural plots	Maintain or enhance regeneration in swidden fallows	Cotta et al. (2008)
Liberate seedlings through clearing	Enhance seedling growth	
Avoid bleeding trees	Avoid potential tree mortality in long term	Kramer and Kozlowski (1979)
Cut vines	Increase fruit production	Kainer et al. (2007)
<b>Harvest and postharvest</b>		
Remove fruit placental tissue	Prevent <i>Aspergillus</i> infection	Souza Álvares and Wadt (2011)
Remove cut/damaged nuts	Prevent <i>Aspergillus</i> infection	Souza Álvares and Wadt (2011)
Transport same day as collection	Prevent <i>Aspergillus</i> infection	Souza Álvares and Wadt (2011)
Dry nuts	Prevent <i>Aspergillus</i> infection	Arrus 2005
Separate stored nuts from contaminants	Prevent <i>Aspergillus</i> infection	Souza Álvares and Wadt (2011)

ecological structural and functional roles. When the large, woody fruits fall during the rainy season, retaining the approximately 25 seeds (nuts), harvesters gather and break them open in the forest (Wadt et al. 2008). Although one meta-analysis suggested that persistent harvests over decades explain insufficient juvenile recruitment (Peres et al. 2003), more recent findings in our study region found healthy regeneration levels under diverse harvest intensities (Zuidema and Boot 2002; Wadt et al. 2008). In Central Amazonia, Scoles and Gribel (2012) conclude that harvest restrictions to improve regeneration are of little to no value.

Government agencies and NGOs in Western Amazonia have outlined a series of “best management practices” to support Brazil nut production (Table 1). Rooted in forestry legislation, certification standards, research on Brazil nut ecology and management, and producer knowledge, these practices can be categorized as: (1) preharvest practices, such as mapping adult trees and developing a management plan; (2) silvicultural practices, including those that promote regeneration (e.g., enrichment planting) and enhance fruit yield (e.g., vine cutting); and (3) harvest and postharvest practices, such as nut drying. These practices have been disseminated via regional extension literature (Wadt et al. 2005; Cardó 2000) and widely promoted through cooperatives and producer meetings.

### **Brazil Nut Certification Systems in Western Amazonia**

Although knowledge of baseline best management practices was widespread at our research sites, only producers who were members of cooperatives and/or associations could access certification and thus translate that knowledge to a certified product. A combination of organic and Fairtrade certification was the most commonly pursued certification option, and although FSC standards for Brazil nuts exist for all three countries, only producers in Madre de Dios had accessed FSC certification (Table 2).

#### ***Organic and Product Quality Certification***

Organic certification focuses on product quality for export to specialized markets in the global North. The worldwide umbrella organization for organic certification, the International Federation of Organic Agriculture Movements (IFOAM), has more than 750 members in 116 countries (IFOAM 2012) and focuses primarily on barring the use of agrochemicals and genetically modified organisms for both wild and cultivated plant and animal products. In part because Brazil nuts are traditionally harvested from native forests without chemical inputs, organic certifiers have focused on product quality, specifically a clean and dry product, free from carcinogenic aflatoxins naturally produced by the fungus *Aspergillus* when nuts remain on the forest floor for an extended period (Hudler 1998). The harvest and postharvest practices promoted by regional IFOAM member organizations and cooperatives dovetail with many of the best practices already identified. Under this scheme, harvesters are encouraged to remove the fruit placental tissue and damaged (cut or rotten) nuts to prevent crop contamination, and to transport nuts as quickly as possible from the forest to fairly standardized elevated and covered wooden storage units to avoid contact with contaminants such as petroleum-based fuels, batteries, and live animals. There, nuts are spread out to dry and reshuffled frequently. Some collectors construct separate, elevated open-air racks to promote faster drying.

**Table 2.** Brazil nut certification initiatives in the trinational region of Western Amazonia

Location	Certification	First year attained	Companies/cooperatives certified under scheme?	Supporting organizations
Pando, Bolivia	Organic	1995	Yes	CARE, Fundacion Puma, Herencia
	Product Quality Fairtrade	2003	Yes	—
	Fairtrade	2001	Yes	CARE, Fundacion Puma, Herencia
Acre, Brazil	FSC	2003	No	CFV, PROMAB
	Organic	2005	Yes*	WWF, EMBRAPA, Ecoamazon, SEBRAE, SEAPROF, CTA
Madre de Dios, Peru	Fairtrade	2005	Yes	WWF, EMBRAPA, Ecoamazon, SEBRAE, SEAPROF, CTA
	FSC	2003	No	WWF, FASE, IMAZON
	Organic	2001	Yes	WWF, ACCA, CAMDE, Peru, FONDEBOSQUE
Peru	Fairtrade	2004	Yes	Candela Perú
	FSC	2003	Yes <sup>†</sup>	ACCA, Candela Perú, ASECAMD

\*The Acre cooperative never attained organic certification, even though it led its members and supporters to believe that the process was complete. Organic Brazil nut certification in Acre was first obtained in 2011 by a separate government cooperative.

<sup>†</sup>The only FSC certified Brazil nut association in Peru suspended it in 2008.

Local NGOs, government agencies, and the cooperatives themselves have financed these structures for individuals and groups.

### ***Fairtrade Certification***

Fairtrade certification emerged from the Alternative Trade movement in the 1970s. Since 1997, the Fairtrade Labelling Organization (FLO) has set Fairtrade standards, which emphasize terms of sale that favor small producers through price premiums, safe working conditions, strong social organization, and more direct producer–market links (FLO 2009). With Fairtrade, the buyer, and not the producer, pays associated certification costs (Taylor 2005b). An early Fairtrade focus on agricultural products has since embraced NTFPs, including Brazil nuts, wild-collected honey, and cashews. Fairtrade certification for Brazil nuts requires producers to be organized in cooperatives, and several are active in Pando, Acre, and Madre de Dios, having received extensive financial support from national and international foundations and NGOs.

### ***Forest Management Certification***

FSC species-specific standards for certification of Brazil nuts have been developed in Bolivia (Certificacion Forestal Voluntaria [CFV] 2006), Brazil (Conselho Brasileiro



de Manejo Florestal [CBMF] 2003), and Peru (Consejo Peruano para la Certificación Forestal Voluntaria [CP-CFV] 2005), and follow FSC's 10 environmental, social, and economic principles (SmartWood 2002). The Asociación de Castañeros Orgánicos de Tahuamanu (ASCART) in Madre de Dios was the first and only Brazil nut group in the region to achieve FSC certification in 2003 through local NGO support. FSC-certified Brazil nut harvests in Peru adhered to national forestry laws, embraced worker safety precautions during harvest, protected regeneration, limited hunting, required clean storage areas, and followed a detailed management plan that included a tree inventory and documentation of silvicultural practices and annual fruit production (CP-CFV 2005). In Pando, no nut producers to date have FSC certification, largely due to difficulties in meeting required standards, along with ongoing property rights insecurity (Pacheco and Cronkleton 2008). Brazil pioneered Brazil nut certification standards, and multiple NGOs and government agencies in Acre attempted FSC certification via local nut cooperatives from 2002 to 2005, just as they had successfully accomplished with smallholder timber operations (Humphries and Kainer 2006). Acrean producers, however, resisted FSC nut certification, credited to a perceived lack of financial benefits in relation to certification costs.

## Methods

### *Communities and Households Sampled*

We evaluated Brazil nut management practices and nut income among certified and noncertified producers in 17 communities in Pando, Bolivia ( $n = 8$ ), Acre, Brazil ( $n = 5$ ), and Madre de Dios, Peru ( $n = 4$ ) (Figure 1). Communities were chosen to represent variation in market access (river vs. road and distance to major market centers) and land tenure types that characterize regional Brazil nut producing communities. In Pando, the eight communities sampled were located both within ( $n = 4$ ) and outside ( $n = 4$ ) the Manuripi National Wildlife Reserve. In Acre, four communities sampled were located in the Chico Mendes Extractive Reserve and the fifth in the Chico Mendes Agro-Extractive Settlement Project. In Madre de Dios, three of the four communities sampled held nut concessions along the Interoceanic Highway, and the fourth was comprised of producers who lived in the town of Puerto Maldonado but had permission to collect nuts in the Tambopata Reserve buffer zone. Most communities represented a mix of certified and noncertified producers, although in several remote communities, no producers sold certified nuts.

From January 2006 to August 2007, we accompanied Brazil nut harvests and applied a household survey with 231 households in the 17 communities. In small communities (<30 families), all available families participated; otherwise, participants were chosen randomly from lists of total households in each community. Thirty-six of 125 (29%), 28 of 77 (36%), and 15 of 29 (52%) households sampled in Pando, Acre, and Madre de Dios, respectively, sold certified nuts.

### *Variables Measured and Analyses*

In the household survey, we quantified implementation of Brazil nut management practices, the role of this product in local economies, and perceptions of nut certification. Management variables surveyed were based on regional best management practices literature (Table 1). Economic variables included: (1) price per kilogram

of nuts sold to middlemen versus certified cooperatives; (2) frequency and amount of outstanding debt from the 2005–2006 harvest; and (3) frequency and amount of money advanced for the 2006–2007 harvest. We also asked certified nut producers to rank their experience with certification on a 5-point Likert scale (1 = extremely negative; 3 = no effect; 5 = extremely positive), and to free-list perceived benefits and disadvantages of certification.

Basic quantitative differences between Brazil nut management practices in the three countries were first illuminated through descriptive statistics. We then used a generalized linear model (binary logit) to test differences using a 95% Wald confidence interval. We searched for relationships between certification and best management practices for each country separately through the use of chi-squared tests. Odds ratios were calculated to measure the relations between the presence of certification and performance of management practices.

We compared economic variables related to nut sales in Pando, Acre, and Madre de Dios based on type of buyer. We first generated descriptive statistics for these variables and then searched for relationships with certification for each country separately through the use of chi-squared tests (for discrete variables) and generalized linear models at 95% Wald confidence intervals (for continuous variables). All analyses were performed using the software SPSS Statistics GradPack 17.0 (SPSS, Inc. 2008).

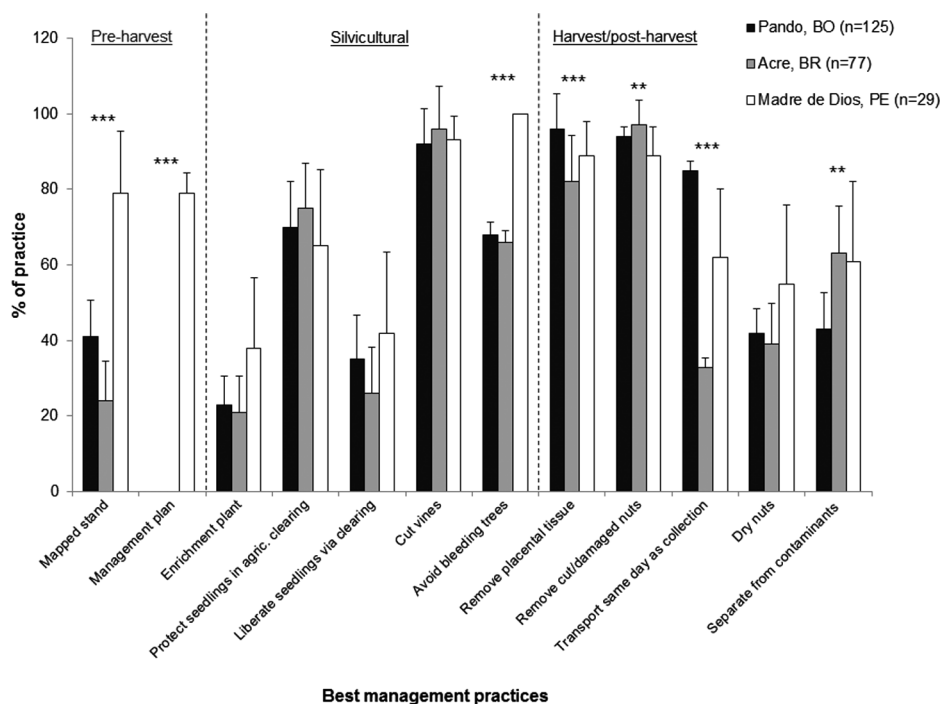
## Results

### *Comparative Management Practices*

Preharvest Brazil nut management practices differed among the three countries (Figure 2). In Madre de Dios, 79% ( $\pm 8.4$  SE) of nut producers mapped their stands, compared with 41% ( $\pm 4.9$  SE) in Pando and 24% ( $\pm 5.4$  SE) in Acre ( $p < .001$ ). While these same Peruvian producers developed nut management plans, no producers in Pando or Acre had such plans.

Management to promote seedling establishment and fruit production (i.e., silvicultural interventions) showed generally similar patterns between the three countries (Figure 2). The most ubiquitous practice shared by producers in all countries was vine cutting. Bleeding trees, cutting the inner bark to release the characteristically red *B. excelsa* resin, was the only significantly different silvicultural practice between countries ( $p < .001$ ). While no producers interviewed in Madre de Dios bled trees, 32% ( $\pm 4.8$  SE) in Pando and 34% ( $\pm 6.2$  SE) in Acre reported bleeding nonproductive or low-producing trees to increase fruit yield.

In examining postharvest management practices, most producers did not allow fruit placental tissues and damaged nuts to enter collection sacks (Figure 2). That said, fewer Acre producers removed the placental tissue (82%,  $\pm 3.4$  SE) compared to their counterparts ( $p < .001$ ), while a slightly lower percentage of producers in Madre de Dios removed cut and damaged nuts (89%,  $\pm 3.9$  SE) than others ( $p = 0.046$ ). Most producers in Pando (85%,  $\pm 3.2$  SE) and Madre de Dios (62%,  $\pm 9.2$  SE) transported their nuts from the forest immediately after collection, whereas fewer producers in Acre (33%,  $\pm 5.5$  SE) did so ( $p < .001$ ). Nearly two-thirds of producers in Acre and Madre de Dios kept stored nuts away from potential contaminants—a higher number ( $p = 0.037$ ) than the 43% ( $\pm 5.3$  SE) in Pando who performed this practice.



**Figure 2.** Percent and *SE* of Brazil nut producers practicing best management practices in Pando, Acre, and Madre de Dios. Significance of between-country comparisons: \*\*\* $p < .001$ , \*\* $p < .05$ ; actual  $p$  values given in text.

We found evidence of storage units and drying structures to improve postharvest management. More than one-third of producers in all countries had their own storage units; however of these, 18% ( $\pm 4.5$  *SE*) in Acre and 38% ( $\pm 9.2$  *SE*) in Madre de Dios also had open-air drying racks, whereas in Pando, nuts were stored and dried in the same closed structures ( $p < .001$ ).

### *Associations between Certification and Management*

In Madre de Dios, all certified producers, regardless of certification type, were 1.8 times more likely to have mapped their stands and developed management plans than noncertified producers ( $p = .004$ ; Table 3). In Acre, certified producers were 8.6 times more likely to have mapped their stands than noncertified producers ( $p < .001$ ), while no such associations were observed in Pando.

Production of certified Brazil nuts was not associated with most silvicultural practices (Table 3), regardless of country. The main exception was that certified producers in Pando and Acre were 1.7 ( $p = .031$ ) and 2.1 times more likely ( $p = .050$ ), respectively, to clear around seedlings when compared to noncertified producers. In Madre de Dios, although nonintuitive, noncertified producers were 2.1 times more likely to protect seedlings in agricultural clearings ( $p = .009$ ).

The strongest associations between certification and management were observed in postharvest practices specifically aligned with organic certification. Certified producers in Pando were 4.3 times more likely to dry nuts than their noncertified

**Table 3.** Odds ratios (OR) and *p* values from Pearson chi-squared tests of association between selling certified nuts and best management practices

Best management practice variable	Pando, Bolivia		Acre, Brazil		Madre de Dios, Peru				
	<i>n</i>	OR	<i>p</i> value	<i>n</i>	OR	<i>p</i> value	<i>n</i>	OR	<i>p</i> value
Preharvest									
Mapped stand	122	0.863	.555	76	<b>8.571</b>	<.001	29	<b>1.75</b>	<b>.004</b>
Management plan	—	—	—	—	—	—	29	<b>1.75</b>	<b>.004</b>
Silvicultural									
Enrichment plant	<b>122</b>	<b>1.405</b>	<b>.331</b>	76	1.333	.519	29	1.633	.316
Protect seedlings in agric. clearing	66	1.044	.793	61	1.082	.634	<b>26</b>	<b>0.468</b>	<b>.009</b>
Liberate seedlings via clearing	<b>121</b>	<b>1.700</b>	<b>.031</b>	<b>76</b>	<b>2.095</b>	<b>.050</b>	26	0.80	.781
Avoid bleeding trees	106	1.226	.159	67	1.169	.395	20	1.000	—
Cut vines	122	1.041	.491	76	1.067	.177	29	2.5	.129
Harvest and post-harvest									
Remove placental tissue	123	1.020	.616	<b>76</b>	<b>1.322</b>	<b>.011</b>	<b>28</b>	<b>1.300</b>	<b>.049</b>
Remove damaged nuts	123	1.004	.929	76	0.985	.696	<b>27</b>	<b>1.333</b>	<b>.040</b>
Transport same day	122	1.080	.311	<b>76</b>	<b>2.571</b>	<b>.003</b>	29	1.467	.196
Dry nuts	122	4.330	<.001	<b>76</b>	<b>15.43</b>	<.001	29	0.560	.089
Separate nuts from contaminants	117	3.789	<.001	<b>76</b>	<b>1.577</b>	<b>.009</b>	28	0.770	.390
Other									
Own storage unit	<b>121</b>	<b>3.413</b>	<.001	<b>76</b>	<b>6.367</b>	<.001	28	1.040	.934
Own dryer	—	—	—	<b>76</b>	<b>infinite</b>	<.001	29	0.778	.597
Knowledge of aflatoxins	<b>123</b>	<b>1.356</b>	<b>.003</b>	76	1.792	<b>.002</b>	<b>29</b>	<b>2.000</b>	<b>.002</b>

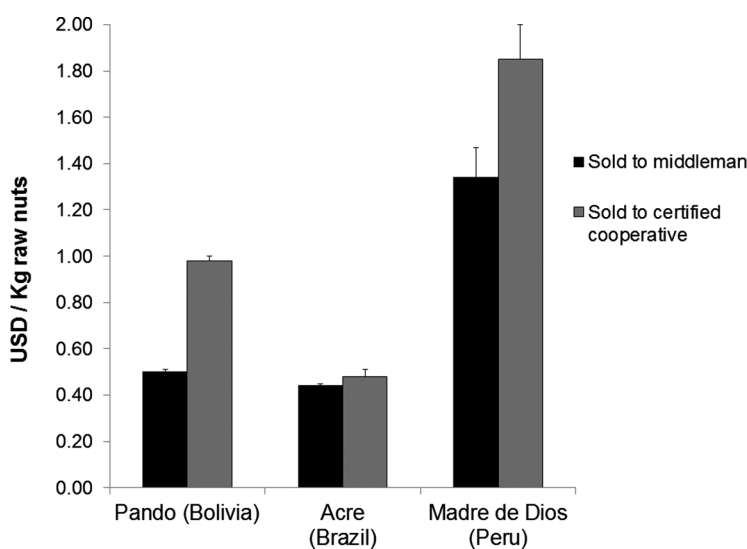
Note. Data in bold indicate  $p \leq .05$ .

counterparts ( $p < .001$ ), 3.4 times more likely to have their own storage unit ( $p < .001$ ), and 3.8 times more likely to keep nuts away from contaminants ( $p < .001$ ). Such positive associations were also evident in Acre, where certified producers were 15.4 times more likely to dry nuts ( $p < .001$ ), 6.4 times more likely to own their own storage unit ( $p < .001$ ), 1.6 times more likely to separate nuts from contaminants ( $p = .009$ ), and infinitely more likely to own their own dryer ( $p < .001$ ). No such associations were observed between certification and management in Madre de Dios. Awareness of aflatoxins was linked to certification in all countries, such that certified producers in Pando ( $p = .003$ ), Acre ( $p = .002$ ), and Madre de Dios ( $p = .002$ ) were 1.4 times, 1.8 times, and 2.0 times, respectively, more likely to be aware of aflatoxins than were noncertified producers.

FSC Brazil nut standards specifically mention that hunting should be limited in Brazil nut stands (CP-CFV 2005). We found, however, no differences in reported hunting ( $p = .609$ ) between Peruvian FSC and non-FSC affiliated producers; indeed, more than 75% of producers in all countries similarly reported hunting during nut harvest, although we have no information on hunting intensity.

### Income from Certification

In Pando, producers who sold raw, unshelled nuts to certified cooperatives as opposed to middlemen received nearly double the price (Figure 3). Of the 257 sales recorded in Pando, the mean ( $\pm SE$ ) price (USD) per kilogram when selling nuts to certified cooperatives (\$0.98,  $\pm 0.02$ ) was significantly higher ( $p < .001$ ) than when sold to middlemen (\$0.50,  $\pm 0.01$ ), a 96% difference. This additional income was



**Figure 3.** Producer prices received when selling Brazil nuts to middlemen versus certified cooperatives in 2007. Prices are based on number of sales recorded (Pando,  $n = 257$ ; Acre,  $n = 98$ ; Madre de Dios,  $n = 37$ ). Cooperative prices were significantly higher than those offered by middlemen in Pando and Madre de Dios, but not in Acre ( $p < .05$ ). Prices for shelled nuts sold in Madre de Dios were converted to raw nuts (3:1 value) to compare with the value of raw nuts sold in Pando and Acre.

**Table 4.** Odds ratios (OR) and *p* values from Pearson chi-squared test of association between nut certification and no debt or advanced payments

Variable	Pando, Bolivia			Acre, Brazil			Madre de Dios, Peru					
	<i>n</i>	Mean ( <i>SE</i> )	OR	<i>p</i> value	<i>n</i>	Mean ( <i>SE</i> )	OR	<i>p</i> value	<i>n</i>	Mean ( <i>SE</i> )	OR	<i>p</i> value
No debt or advance payment												
Noncertified	79	0.10 (0.03)			46	0.46 (0.07)			12	0.50 (0.15)		
Certified	<b>36</b>	<b>0.25 (0.07)</b>	<b>2.469</b>	<b>.037</b>	<b>17</b>	<b>0.53 (0.13)</b>	<b>1.160</b>	<b>.037</b>	8	0.25 (0.16)	0.500	.264
Amount debt (2005–2006)												
Noncertified	78	310 (65)		.553	<b>46</b>	<b>239 (58)</b>		<b>.034</b>	12	124 (74)		.414
Certified	35	239 (97)			17	0 (96)			7	24 (97)		
Amount advance (2006–2007)												
Noncertified	78	678 (145)		.740	19	399 (102)		.483	<b>6</b>	<b>527 (361)</b>		<b>.220</b>
Certified	36	763 (213)			8	267 (158)			8	1113 (313)		

*Note.* Correlations between certification and amount of outstanding debt from the 2005–2006 harvest and of advanced payments received before the 2006–2007 harvest. Data in bold indicate where *p* value is  $\leq .05$ .

generally received in two payments: a portion at the time of sale, which was comparable to the price paid by middlemen, and a second payment after nuts were processed and before the start of the subsequent harvest. In Acre, there was no such statistical difference ( $p = .123$ ) (Figure 3), which can be attributed to administrative failures of the main nut cooperative: the cooperative declared bankruptcy in 2007, and very few Brazilian producers received their promised second payment. In Madre de Dios, the price paid for the sale of organic nuts to the largest Brazil nut company via a Fairtrade-certified cooperative (\$1.85/kg) was significantly higher ( $p = .012$ ) than the price gleaned from sale to middlemen (\$1.34/kg), a 38% difference (Figure 3). Overall, prices received in Madre de Dios were much higher than in Pando or Acre (Figure 3), because Peruvian producers tended to sell a shelled product, even though companies that purchased these nuts to sell on certified markets often discouraged them from shelling to avoid possible contamination (Quaedvlieg 2009).

In Pando, certified producers were 2.5 times less likely to have debt or have accepted an advance payment than noncertified producers ( $p = .037$ ), and 1.2 times less likely in Acre ( $p = .037$ ; Table 4). The amount of debt or advance between certified and noncertified producers was no different except in Acre ( $p = .034$ ), where no certified producers had debt from the 2005–2006 harvest.

### *Producer Perceptions of Brazil Nut Certification*

While overall perceptions of certification differed between certified producers in the three countries, reported benefits and negative aspects were similar. Most certified producers in Pando perceived nut certification as moderately to highly beneficial (92%,  $n = 27$ ). Conversely, in Acre, while 49% ( $n = 14$ ) found that certification was moderately to highly beneficial, 22% felt that it had no effect, and 29% reported that their experience was somewhat to extremely negative. In Madre de Dios, half of certified producers ( $n = 15$ ) felt that certification was neither positive nor negative, and the other half felt that certification was moderately beneficial. The most commonly listed benefit of organic and Fairtrade certification was the better price gained (68% Pando, 47% Acre, 67% Madre de Dios). In Pando, producers also emphasized health care benefits that cooperative members received through Fairtrade certification (16%), and in Acre and Madre de Dios, the higher quality of nuts produced (35% and 33% respectively). The most common negative perception of certification was that it was too much extra work (36% Pando, 33% Acre, 50% Madre de Dios), which Peruvian producers also directly related to FSC certification, given its lack of financial benefits. Additional complaints related to producer requirements to pay nut transportation costs to the cooperatives (36% in Pando), that the promised payment upon nut processing arrived either late or not at all (34% in Acre), and that companies cheated producers by not counting the full value of shelled nuts per bag (50% in Madre de Dios).

### **Discussion**

Our overall objective was to understand whether different NTFP certification schemes were associated with implementation of “best management practices” and positive socioeconomic outcomes. Using Brazil nuts as a NTFP case, we found that organic and Fairtrade certification were often associated with better postharvest practices and higher prices, while FSC-certified Peruvian producers appeared to have

adopted practices related to preharvest planning. While most producers commented on the extra work involved in certification, regardless of scheme, certification was viewed most positively in Pando, where producers gleaned financial and social benefits, moderately in Madre de Dios, and least positively in Acre, where the benefits of certification were lower or nonexistent. Our findings are limited to a general cross-country comparison, since we did not examine the potential effects of community-level characteristics (e.g., market access, land tenure) on management and socioeconomic outcomes within countries. For instance, the different sets of rules and institutions that govern land use activities in the sample areas could explain some of the differences in management practices and socioeconomic benefits beyond certification.

### ***Certification and Best Management Practices***

We found a positive association between certification and preharvest practices in Madre de Dios, and to a lesser extent in Acre. Development of Brazil nut management plans in Madre de Dios may be attributed to FSC certification standards that explicitly mandate compliance with national forestry laws; the Peruvian Forestry and Wildlife Law of 2000 (number 27308) established long-term nut concessions and required producers to inventory their stands and have approved management plans for concession access (SPDA-INRENA 2003). In Brazil, while forestry legislation does not require nut management plans, a handful of mapping initiatives in Acre were undertaken as a first step toward FSC and organic certification, which likely explains the positive association observed between certification and mapped stands there.

Few associations between certification and silvicultural practices were statistically significant. For the most widely adopted practice of vine cutting, certification processes may have helped disseminate that this practice enhances fruit production, as supported by both local knowledge and Western science (Kainer et al. 2007). Bleeding Brazil nut trees was practiced by almost one-third of producers interviewed in Acre and Pando, yet almost no producers in Madre de Dios bled trees, certified or not. Even though wounding can stimulate fruit production in the short term, this practice can negatively impact tree health over time, with wounds serving as invasive routes for pathogens (Kramer and Kozlowski 1979). Statistically, this practice was not associated with certification of any type, but total rejection of this practice in Peru may be attributed to the environmentally focused “no bleeding” message extended by FSC certification.

Certification was associated with harvest and postharvest practices directly related to product quality, typically a key sticking point in consumer satisfaction with NTFPs in northern markets (Pokorny 2008). Across all countries, certified producers expressed greater awareness of aflatoxins than noncertified producers. Practices to produce an aflatoxin-free product were clearly defined, more closely related to immediate market success, and tirelessly promoted by cooperatives as best practices for organic and Fairtrade certification.

### ***Socioeconomic Benefits of Certification***

Our data showed that combined organic and Fairtrade certification was associated with socioeconomic benefits. In addition to higher prices for organic nuts, the Fairtrade price premium had important social benefits because it was received by



and invested back into the cooperative. For instance, in one Pando cooperative, the Fairtrade premium was used to provide members with machetes and sacks for nut harvest, health care benefits, and training opportunities. In Peru, the premium covered member costs of elaborating annual operational nut harvest plans. The success of these certification systems, however, was highly dependent on the cooperatives themselves, as well as on their associated buyers. Pando cooperatives proved most successful where producers actively participated in the nut production chain (Cronkleton and Alborno 2009). In contrast, if a cooperative was not administered soundly, as in Acre, affiliated producers could easily lose the benefits associated with these specialized markets and become disenchanted with certification. In Madre de Dios, although there was an organic price benefit, producers were charged additional shelling fees by the processing companies for certified nuts (Quaedvlieg 2009).

Still, there were some downsides to affiliation with even successful certified cooperatives. For instance, although commercial timber harvests were not officially barred under Bolivian IFOAM member organization standards, the main Pando cooperative strongly discouraged members from doing so on their landholdings. Recent research, however, found evidence that reduced-impact logging in Brazil nut-rich forests rarely and minimally damaged adult *B. excelsa* trees (Guariguata et al. 2009), while low-intensity selective logging did not affect Brazil nut seedling and sapling recruitment (Soriano et al. 2012). Still, the cooperative norm discouraged mixing timber and Brazil nut management lest producers risk losing benefits associated with organic and Fairtrade certified nuts sales.

A central justification for production of Fairtrade-certified Brazil nuts is to break the producer debt cycle with middlemen. While middlemen are often essential actors in NTFP production chains, especially for remote communities with limited means of transport to markets (Padoch 1992), financial dependence on these buyers can be problematic. In Western Amazonia, middlemen arrive in communities at the end of the dry season when income-generating opportunities are minimal. In Pando especially, producers short on cash incur debt to stock up on basic food and clothing, and often purchase larger items such as motorcycles, which they then pay back during nut harvest at a predetermined price/volume set by the buyer. Importantly, households that manage their agricultural plots for more continuous food production are less dependent on such advances (Cano Cardona 2011). If nut production is less than expected, producers that borrow more from middlemen can easily find themselves with outstanding debt. Producers selling through certified cooperatives benefited from receiving their second installment from nut sales during this most vulnerable period. While our data from Pando and Acre showed that certification indeed helped some producers avoid debt and money advances, outstanding debt was no different between certified and noncertified producers. This somewhat contradictory finding was largely because even certified producers sold a portion of their nuts to middlemen, while maintaining the agreed-upon portion for sale to cooperatives, suggesting that producers perceive advantages in engagement with both cooperatives and middlemen. Nonetheless, Bolivian nut producers are currently demanding price transparency among middlemen to obtain higher prices (Cano Cardona et al. 2013).

### Partnerships for Certification

For small producers attempting to reach demanding international markets and meet the many provisions related to the certification process, support from

external organizations is key (Pokorny 2008). Our study highlights the diverse roles of cooperatives, companies, and governmental agencies and NGOs to share information and facilitate producer access to specialized markets through trainings in best management practices and administration, tree inventories and elaboration of management plans, construction of storage units and drying structures, and communication with accredited certifying bodies. That said, different actors have their own reasons for engagement in product-oriented forestry partnerships: Communities may seek livelihood benefits, companies may wish to profit from niche markets, and NGOs and donors may have specific conservation or development objectives (Ros-Tonen et al. 2008). Links in the partnership chain may fail, as with the bankruptcy of the Acre cooperative, leaving affiliated producers without promised benefits and leery of support organizations. Additionally, partner interests may clash, such as in the Peruvian case, whereby despite substantial NGO support for FSC certification, the lack of financial reward and additional workload explained why this one regional case of FSC nut certification ended after 5 years. Still, partnerships can overcome certification challenges and help producers navigate the complex and ever-changing terrain of NTFP certification while continuing to garner benefits. For example, Taylor (2005a) suggests linking FSC with Fairtrade (and we argue also organic) certification to facilitate accrual of FSC benefits with those of price premiums. Indeed, dual FSC and IFOAM Brazil nut certification was achieved for the Kayapó Baú Indigenous Territory in the Eastern Brazilian Amazon in 2006 (Gomes 2008). Also, the International Social and Environmental Accreditation and Labeling Alliance (ISEAL; Auld et al. 2008) already connects FSC, IFOAM, and Fairtrade labeling organizations, and a pilot joint labeling scheme between FSC and Fairtrade International (Fairtrade and FSC Fact Sheet 2010) led to a 2011 marketing of dual-certified timber products, which could be extended to NTFPs (S. Humphries personal communication, 9 July 2012).

## Conclusion

While forest management certification for NTFPs has grown in recent years, specialized markets for these products remain small in comparison to certified timber (Shanley et al. 2008). NTFPs are considered more challenging to certify than timber because of the diversity of products included in this broad category and varying certification standards, along with insufficient information on NTFP ecological and social aspects (Pierce and Laird 2003). Our analysis, however, revealed multiple benefits of organic, Fairtrade, and FSC certification (and combinations thereof) for tropical forests and their residents. Organic and Fairtrade certification clearly had some success as market-based mechanisms. Additionally, we argue that these schemes acted as regulatory mechanisms through their association with postharvest management practices, as signal mechanisms of cooperative administrative success or failure, and as learning mechanisms related to producer knowledge of product quality. Despite these benefits, our study also illuminates obstacles to certification, including the extra work required (particularly for FSC certification), risks associated with cooperative instability, inequity in business relationships, and long-standing relationships with middlemen. While Brazil nut presents unique advantages over other NTFPs (well-established international market, species of strong conservation interest), findings are relevant to other internationally traded NTFPs currently receptive to green or Fairtrade messages (Pierce et al. 2008), such as coffee, cacao, and chicle,

which are likewise harvested by small rural producers and can be certified by these diverse schemes. While the benefits and downsides of the different certification schemes are clearly context dependent, our findings suggest that common certification obstacles, such as product quality, economies of scale, and compliance with administrative and forest management demands of certification (Pierce et al. 2008), might be overcome through stronger partnerships with cooperatives, governments, and NGOs.

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