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Agriculture in Monteverde, Moving Toward Sustainability — Update 2014

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1. Introduction

The agricultural systems and sustainability issues described in the late 1990s remain relevant 15 years later. However, because land use patterns respond to dynamic social and economic conditions, change is taking place on the margins of Monteverde’s land use economy. This 2014 Addendum to Chapter 11, “Agriculture in Monteverde, Moving Toward Sustainability” outlines the direction of these changes, and identifies key global and local trends that appear to drive this change. We comment on: economic trends (J. Stuckey), climate change (F. Camacho), dairy (J. Stuckey), coffee (G. Vargas), and integrated farms (F. Camacho). Table 11.1 presents a list of people interviewed.¹

2. Summary

Climate in the Monteverde bioregion is changing, and Monteverde’s economy is becoming increasingly integrated with global commerce. The climate is becoming warmer and

(generally) drier, and in recent years, weather events (rain, drought, and wind) have become more severe and their timing less predictable.² Monteverde’s production and consumption patterns are increasingly dependent on global markets, prices, and international regulations. Small but growing numbers of landowners are implementing more ecologically, socially, and economically sustainable practices. Dairy

² Trade winds are a hallmark of dry season; they produce generally drier conditions on the Pacific slope and wetter conditions near the continental divide. As cloud water is intercepted at the peaks, the winds flow down the Pacific slope drying out the landscape, and preventing Pacific moisture – the source of the region’s heavy rains – from ascending. Shifts in trade wind patterns, whether linked to ocean temperature cycles, changes in the jet stream or other phenomena, can produce dramatic local effects. When trade winds occur in rainy season, as has happened with some frequency in recent years and notably in 2013 and 2014, we see extreme local variations: more moisture on the Atlantic slope; and on the Pacific slope, wetter highlands and more drought in the lowlands. Generally we see more days of drought, but more intense rainy days, where in a very short amount of time it may rain most of the water of the month, as happened in May 2014 (F. Camacho and J. Stuckey, pers. comm.).

¹ Each of the authors is a long-term Monteverde resident. Where possible, the information reported in this addendum is based on peer-reviewed literature. However, most of the observations about the local economy are based on interviews with local farmers and community leaders.

farmers have adopted some new technologies; their economic future remains uncertain as they face global competition, rising land prices, and demographic shifts. Coffee production patterns may shift as climate warms; many small producers have developed synergies with eco- and educational tourism as a survival strategy.

3. Economic Trends

Two key forces are shaping the Monteverde region's economy.³ First, international free trade agreements are opening Costa Rica to global competition, which puts small producers and businesses at a disadvantage relative to large scale, capital intensive ones. Second, the local grafting of a tourist economy into an agrarian economy has created population growth, with accompanying pressures and opportunities that influence land use. Monteverde's tourist economy grew at a phenomenal, although undocumented, rate until the 2008 global economic downturn. As the population and tax base have grown, infrastructure and access to public services have expanded. This, and increased use of digital and other technologies, has increased quality of life, in the sense that producers and consumers have more choices than before.⁴ The use of cell phones, internet banking, and credit and debit cards is prevalent. Three banks, three milk processors, two supermarket chains, and several national food and beverage distributors operate in the area. With the exception of eggs, most of the food and fresh produce consumed locally comes from outside the area.

Countering this increased commercialism, some Monteverde residents seek to produce and consume food that is grown with environmentally and socially sustainable practices. A small but growing number of

³ We use the term "Monteverde" as defined in Chapter 1, section 1.1, and in Chapter 11, p. 390 of the 2000 publication.

⁴ The area's growing commercial activity has contributed to changing lifestyles. As a simple function of access to services and opportunities, quality of life has generally (but not uniformly) increased. It would be interesting to study perceived changes in quality of life if "quality of life" were to be measured by other indicators, for example "happiness".

integrated farms and gardens provide produce for local markets. Several farmers have linked their farming activities to eco-tourism; some coffee farmers are marketing farm-branded products directly to clients.

3.1 Demographic Trends

A population estimate based on extrapolation of potable water connections administered by local community water associations, (*Acueductos y Alcantarillados*, popularly known as AyA) indicates that Monteverde and surrounding communities comprise on the order of 5,000 to 8,000 inhabitants, not including "floating" tourist populations (V. Molina, pers. comm.) See Table 11.2.

The area has experienced immigration of people from diverse socio-economic and cultural backgrounds. Youth are increasingly mobile. The area is undergoing cultural blending, which is associated with the value of English as an economic language, the effect of local private schools, and educational tourism.

The social and economic effervescence surrounding land use decisions contributes to five trends:

- 1) Tourism has created economic opportunities that drive increased population through immigration and retention of local youth who stay in the area. This increases urbanization pressure, which drives up land prices first in communities closest to urban centers, and then, more gradually, in outlying communities.
- 2) Squeezed by the economics of global trade, some farmers have ceased commercial farming, while others are increasing the scale of their businesses, adopting new technologies or market niches to remain economically viable.
- 3) Youth increasingly pursue secondary and university education, which increases their mobility. Although some leave the area, the growing economy has provided jobs or business opportunities that attract others to stay.
- 4) Youth are leaving the farms. Older farmers may remain tied to the land by culture or by necessity, or may sell their land. This raises a central question: *in the future, who will own the land, and how they will use it?* Land

subdivision for residential or commercial purposes is occurring in some communities, whereas in some cases, new landowners develop integrated, diversified farming systems.

- 5) The wealth generated during tourism's boom years has led to changes in the lifestyles of many residents and in the values of voluntary cooperation for the common good. This change is evident in the growth of consumerism, which, with the advent of lean years in the economy has led to unsustainable debt levels for many entities, and can lead to more social problems, in addition to the existing cases of bankruptcies, foreclosures and unemployment. Financial institutions have facilitated this trend through their lending policies, and by aggressively popularizing the use of credit cards.

3.2 Commercial Trends

Local farm production costs are closely tied to international petroleum and basic grains prices, but due to the particular dynamics of Costa Rica's small economy, input prices tend to rise quickly and fall slowly in response to international price fluctuations. Dramatic fluctuations in international dairy prices have destabilized production and marketing plans (González 2008, Montero 2013, J. Vargas, pers. comm.).

Implementation of free trade agreements, principally with the United States and the European Union will end protective tariffs on imported dairy and other goods, and obligate Costa Rican producers and exporters to conform to rigorous international standards. The Costa Rican government has increased its enforcement of environmental and sanitary regulations. Trade agreements have paved the way for transnational companies to buy local businesses that decide to sell rather than compete. Since the early 2000s, having tied Costa Rica's economic aspirations to international commerce, government administrations have relied on information technology and tourism as economic centerpieces, and have not articulated strong agricultural development and food security policies. (Vargas 2009, and J. Monge, pers. comm.).

3.3 Tourism

Commercial tourism in Monteverde has generated substantial wealth and jobs, and has created important local synergies for economic opportunity. Some land-owners have abandoned farming to establish tourist businesses; others have integrated some tourism activities into their farms. But tourism has not been a stable economic model: it is vulnerable to world events, and to boom-bust cycles. Monteverde's tourism is characterized by seasonal fluctuations in visitation rates, and by intense competition among local businesses. This results in the payment of high commissions to booking agents, which drives up prices and reduces Monteverde's competitiveness as a destination. Availability of jobs in the tourist sector tends to reduce the number of people available for farm work.

Educational tourism seems to be a stabilizing feature of Monteverde's tourism, and a growing market segment. Several universities have campus facilities, staff, and/or programs operating in the area (see **Chapter 10's addendum for more details on "Environmental Education and Sustainability at the University/College Level Primarily for Students from North America"**). Beyond providing jobs and markets for farm products university people and programs have shared information and provided assistance that influence local attitudes and practices linked to land use.

3.4 Institutional Evolution

Monteverde's first District Municipal government was elected in 2002. It and subsequent administrations failed to adopt land use planning, but did increase the amount of revenue for local development. National institutions continue to expand services, tax collection, and enforcement of health, environmental, and other regulations.

By 2014, the Ministry of Agriculture (MAG) plays three roles for Monteverde agricultural producers. Nationally, it monitors compliance with international trade standards, e.g., by certifying that herds are brucellosis-free, and issuing the Veterinary Operating Certificate (CVO), which is required to commercialize farm products (J. Monge and J. Álvarez, pers.

comm.). Monteverde's local MAG officials help farmer organizations gain access to government funds for special projects, and offer technical assistance in dairy, coffee, horticulture, aquaculture, and agro tourism. MAG's assistance responds to demand rather than to national planning priorities, and is constrained by a limited budget (J. Álvarez and J. Martín, pers. comm.).

SENARA (*Servicio Nacional de Aguas Subterráneas, Riego, y Avenamiento* – the government agency that supervises subterranean water, irrigation, and drainage) and MAG promote agricultural irrigation schemes in several communities in the Monteverde region. MAG and INEC, Costa Rica's National Institute for Statistics and Census, are conducting a national agricultural census, which may signal increased government commitment to develop a national agricultural sector plan (Martín 2014).

Locally, the Monteverde Milk Producers' Association (APLM) has gradually expanded sale of farm supplies and technical assistance provision. Productores de Monteverde, S.A., the cheese plant that was founded by the Quakers in 1953, supported the National Milk Producers Chamber's efforts to influence national dairy policies and free trade agreement negotiations. In 2013, Productores de Monteverde S.A. was sold to the Mexican transnational conglomerate Sigma Foods, and continues to operate locally. After decades of having been the only company buying milk in the area, it now competes for local milk with Dos Pinos, Costa Rica's large dairy cooperative, and Coopeleche, a regional dairy cooperative that sells its milk to Florida Farm and Ice, a transnational beverage company. In 2013, CoopeSanta Elena failed, and in 2014 Coopeldos struggles to survive.

4. Agricultural Production in the Face of Climate Change in Monteverde

By Fabricio Camacho C.

4.1 Trends

Critical signs of climate change in the Monteverde area are trends toward an increasing number of dry days, and the gradual increase in minimum temperatures (Pounds *et al.* 2006) and of precipitation in the highlands (IMN 2008). These and other non-documented trends have caused important changes in ecosystem

dynamics. These variations are expressed through the emergence of new disease vectors that have appeared to contribute to the extinction of species such as the golden toad (*Incilius periglenes*) and the harlequin frog (*Atelopus sp.*, Pounds *et al.* 2006), and through the decline of other amphibians and the presence of invasive species representative of warmer lowland climates in the cloud forest.

One would expect that just as changes have occurred in the dynamics of natural ecosystems in Monteverde, changes would also have occurred in the production patterns of agricultural processes. However, no specific analyses of the impact of climate variability on local production exist, so it is imperative document this information.

Global and regional projections indicate that change in the main climatic variables is imminent even under the most drastic scenarios for mitigation and reduction of emissions of carbon dioxide and other greenhouse gases (IPCC 2007, 2013, Anderson *et al.* 2008), therefore it may be concluded that Costa Rica's climate will be subjected to dry and rainy extremes (IMN 2008). Locally, when comparing the average rainfall between 1961 and 1990 with the average projected under the A2 scenario (according to the IPCC nomenclature) between 2071 and 2100 for the mountainous region of the Tilarán mountain chain, that variable will decrease by 17% (IMN 2008). Maximum temperature will rise an average of 6.39 ° C while the minimum temperature will also suffer an increase of 2.88 ° C (IMN 2008).

This new climate scenario may be perceived as a threat or an opportunity for agricultural production in the Monteverde area, as the future distribution of the climatic conditions of the region can reduce or increase the productive capacity of the currently installed systems. For example, coffee production in the region is shifting towards higher altitude areas such as Cañitas and Las Nubes. This could represent a better business opportunity for producers in these communities but also could mean direct competition or displacement for producers in lower areas such as San Luis, where plantations might be more prone to disease and to receiving lower market prices because of lower quality coffee.

4.2 Adapting to Climate Change

The future success of Monteverde's agricultural production will depend on the capacity and speed of local producers to adapt to new climatic conditions. For example, coffee producers in warmer areas could incorporate agroforestry techniques, combining production of shade grown coffee interspersed with food crops and high value forest trees that allow producers to generate food for the household and ensure a more resilient system that could compensate for the lower yield of coffee. Some producers in San Luis have established agroforestry systems for shade grown coffee, although these are motivated by cultural and economic reasons, rather than as a climate change adaptation. However, these systems are more natural, less dependent on external inputs, and resemble traditional plantations and home gardens, which make them more attractive to rural tourism and better adapted to climate change.

Other important factors that influence the level of success of future agricultural production include: 1) the level of producer innovation to acquire technology that allows them to be competitive without exceeding the land's carrying capacity; 2) access to information and technical support from government and private organizations to help producers develop balanced systems; and 3) the ability to develop new market opportunities that recognize the real value of local production.

Demand for food by Monteverde's tourism sector, and by the local population, represent two opportunities to capitalize agriculture. Except for a few small distributors of foods such as eggs, chicken meat, and vegetables, Monteverde currently has no direct, robust connection linking agricultural producers, residents, and tourists, so the majority of its foodstuffs come from other regions, even though the area has adequate conditions to produce fresh food that could be absorbed by the local market.

Monteverde has the potential to increase local produce consumption, but this will require a cultural change by households and commercial consumers (supermarkets, grocery stores, hotels and restaurants) to consume local products. This

change, which would differentiate Monteverde's economy, may be a selling point for tourism. It would generate important links in the local production chain that might be organized through the creation of an entity that coordinates logistics so that producers can connect directly with consumers. In any case, it is important to begin adapting agricultural activity to a model of clean and sustainable production that is closely linked to the market and that guarantees the sound management of natural resources, ensuring a balanced development of production systems that meets but does not exceed the carrying capacity of the land and the needs and aspirations of producers and consumers.⁵

5. Dairy

By Joseph Stuckey

5.1 Economic Trends

Dairy farmers are being squeezed by rising costs. They face the threat of stagnant or falling milk prices as protective tariffs on dairy imports are eliminated, even as the amount of capital needed to stay in business rises. These trends favor large producers over small ones.

5.1.1 Climate Change

Between 1999-2014, water production of 14 springs supplying the Santa Elena *Acueductos y Alcantarillados* (AyA) potable water system fluctuated in 2-3 year cycles that seem responsive to the El Niño and La Niña warming and cooling events, which produce drier and wetter conditions locally (A. Sandí: unpubl.

⁵ "Clean" production refers to a world-wide movement for "cleaner production" based on producing services and goods in an environmentally responsible way, by mitigating and minimizing negative impacts such as water pollution and GHG emissions. One definition for *cleaner production*: "Manufacturing process minimizing waste and applying continuous prevention practices. These method[s] include (1) raw materials and energy conservation, (2) toxic inputs elimination or reduction, and (3) toxic outputs reduction or elimination" (<http://thelawdictionary.org/cleaner-production/>).

data, Santa Elena AyA, pers. comm.).⁶ Although most do not keep weather records, farmers comment that in drier years, higher elevation clouds reduce the beneficial effect of dry season mist, making dry seasons more intense and slowing pasture growth for upland farms that normally receive this precipitation. However, in the drier years (e.g., 2013), farmers report that an increased number of dry sunny days in rainy season favor pasture growth. The drier years are associated with strong, un-seasonal, easterly winds. When such winds occur in rainy season, they prevent the Pacific moisture that normally produces heavy rains from reaching Monteverde, and exert chilling and mechanical effects that slow pasture growth. In recent years, rainfall has tended to be concentrated in fewer, but larger events, so that although total annual rainfall may decline only modestly, more water runs off, causing increased erosion and aquifer depletion. (F. Donato and J. Monge, pers. comm.).

5.1.2 Dependence on Supplemental Feed Grains

Farmers and local agricultural professionals report that the amount of supplemental feed grain being used to produce a kilo of milk may have increased in recent years. Although we found no local studies to test this perception, if true, it would suggest that the profitability of dairy farming may have declined, both because it is more expensive to produce milk using imported feed grains than using farm-grown forages, and because the cost of grain has risen relative to the price of milk (Montero 2008 and Vargas 2009).

5.1.3 Impact of Free Trade Agreements

Costa Rica's milk prices have exceeded world milk prices in recent years (Montero 2013), and its dairy industry has been protected by tariffs amounting to 65% of the value of imported dairy products. The Central American Free Trade Agreement (CAFTA) requires elimination of dairy import tariffs over nine

years, starting in 2016. Falling tariffs will affect milk prices to farmers. To comply with international norms, farmers are also required to invest in new technology and management practices.

5.1.4 Land Ownership Succession

The trend of youth leaving the farm is especially significant for dairying because: a) more people in Monteverde directly or indirectly depend upon dairying than on other types of farming, and b) the success of dairy farms depends on the quality of daily management, which is more difficult to achieve when delegated to hired labor.

5.2 Farm Production Trends

By 2014, the number of small farms producing milk had declined significantly. In the 1990s 17 farms in San Luis sold milk to the dairy plant; by 2014, only four remained (J. Fuentes, pers. comm.). Factors that contributed to this trend include: requirements to install on-farm refrigeration and other technologies, rising production and transportation costs, rising land values, opportunities for on-farm diversification or for off-farm employment, and demographic shifts. During the same period, herds on some of the more specialized farms grew in an effort to become more efficient.

In both lowland and highland dairies, all farms use refrigeration equipment and nearly all use milking machines. About 95% of the milk is transported in tank trucks. Many farms have installed concrete cow paths to reduce erosion. Many farmers have improved their barns and pasture irrigation systems in response to waste regulations. Nearly a dozen farmers use bio digesters and/or earthworm composting systems to process animal waste. Electric fences are increasingly used to manage grazing. Farmers use motorized backpack sprayers to apply herbicides, pesticides, and foliar fertilizer; weed-eaters have mostly supplanted the machete for cutting weeds. Some use harvesting machines to cut forage. Larger farmers keep computerized financial and reproductive health records. (J. Monge and A. Murillo, pers. comm.).

⁶ Santa Elena draws water from 26 springs, and new sources are constantly being sought; long term production data only exist for the 14 older springs.

5.3 Highland Dairy Production Trends

Between the late 1990s and 2014, average highland milk production increased by 60% to about 16 kg per cow per day. Over the same period, the amount of land in production declined, while stocking rates increased slightly. Jerseys became the predominant highland breed, significant because Jersey milk contains more solids than other breeds, and the milk price is linked to milk solids content. These trends seem to result from increased use of supplemental feed grains, supplemental forage feeding in dry season, and genetic improvement through artificial insemination (J. Monge and A. Murillo, pers. comm.).

5.4 Lowland Dual Purpose Dairy-beef Production Trends

Over the same period, lowland milk production increased about 142%, rising from ca. 4.5 kg to 10.9 kg per cow per day, an increase associated with fundamental changes that were made in the production system: planting improved grass varieties; increased cross breeding of beef breeds with higher production, heat resistant dairy breeds; increased use of feed grain supplements; transition from once-a-day to twice-a day-milking; expanded use of parasite controls; increased use of electric fences; and on some farms, installation of irrigation systems to improve pasture growth. By 2014, lowland farmers had not adopted the practice of applying fertilizer to pastures (J. Monge and A. Murillo, pers. comm.).

5.5 Efficiency

Increased production per cow per day in both highland and lowland areas is associated with better management and increased use of various energy inputs. However, it seems probable that the per-cow production average rose, in part, because the number of the smallest farms declined at the same time that the remaining farms were becoming more specialized. Further study is needed to know whether the increased average per-cow production resulted in a net increase of milk coming from these communities to the dairy plant and to assess the relative profitability and environmental sustainability of lowland and highland dairy production systems on the Pacific slope.

6. Coffee in the Local Economy

By Guillermo Vargas L.

As with other agricultural products and processes, the region's coffee economy is changing. With the disintegration of CoopeSanta Elena and the proliferation of brands and marketing channels for Monteverde's coffee, there are no data available to quantify coffee production in 2014, but an outline of the history and current patterns of coffee production can provide insights on its future.

6.1 Before 1950

The families who settled in the Monteverde region in the first quarter of the twentieth century came mostly from the western part of Costa Rica's Central Valley. These families brought with them the culture of coffee production and consumption.

In the 1940s, several families in San Luis and Los Cerros produced enough coffee to sell part of the harvest in Las Juntas, and to the roaster Café La Moderna in Puntarenas. Coffee berries were dried on farms and then peeled by hand in a wooden pestle. Transportation by horse to Las Juntas, and by oxcart and boat to Puntarenas, was slow and arduous. Coffee was not a viable economic option for local residents until the early 1950s, when one of the settlers, Ramón Brenes, commercially developed the cultivation and processing of coffee on his own farm. The abundant water and better sun in the lower part of San Luis created the opportunity to set up a mill at the confluence of the San Luis and Guacimal rivers.

6.2 From 1950 Through the Mid '80s

From 1950 to 1980, coffee became the main economy of small communities of San Luis and Los Cerros, and during harvest, generated employment for residents of Santa Elena, Cerro Plano and Guacimal. The coffee was partially processed (wet processing) in San Luis, and then transported to the Central Valley for drying and classification before being exported. The producers had no direct involvement in or control of those stages. At that time, growers achieved good yields because the soils sustained

much of their original fertility. However, the price received for their labors did not correspond to the export value of the beans, due to ignorance of small farmers of their legal rights, and the existence of multiple intermediaries.

The development of Monteverde's dairy economy presented an opportunity for economic diversification, giving farmers the possibility of obtaining steady incomes and selling to a local company in which they could participate as co-owners. Another opportunity presented itself at the early 1970s, when Coopeldos R.L., a regional coffee cooperative serving producers, was founded. However, poor roads limited the ability of San Luis producers to take advantage of this cooperative marketing opportunity.

6.3 Cooperativization of Coffee (1985-2000)

In the early 1980's, the main coffee producer and owner of the coffee processing plant in San Luis shifted from coffee to beef cattle production. When the San Luis coffee processing plant stopped operating regularly, farmers chose to take their coffee to Coopeldos R.L. or to the Nicoya Peninsula to Cooepilangosta R.L., but both options incurred high transport costs. In response, in 1988 CoopeSanta Elena R.L. started processing and marketing coffee, having leased the San Luis processing plant.

During the 1990s coffee production and marketing in Monteverde expanded significantly. CoopeSanta Elena managed to sell about half of its members' harvest to Montana Coffee Traders, in Montana USA, at prices superior to international prices. Based on an agreement with Productores de Monteverde, S.A. the co-op created "Monteverde Coffee", a brand sold regionally as "Coffee Produced in Harmony with Nature". It also received "Fair Trade" certification, which allowed Monteverde Coffee to be sold at higher prices in international markets. With a ready market and good prices, the area's production increased. However, the cooperative later faced economic problems and weakened. This caused a loss of confidence by farmers, a slight decline in the area's coffee production, and encouraged the search for alternative marketing channels.

6.4 Proliferation of Local Coffee Companies and Weakening of the Cooperative Economy

With the cooperative's weakening, and the rapid growth of tourism, some farmers moved into tourism, as employees, entrepreneurs, or by diversifying their farms to appeal to tourists. For example, agro-tourism has created economic opportunities for several Monteverde families, and has become the third most popular attraction for visitors (after eco and adventure tourism). An estimated 20,000 tourists each year participate in tours of coffee, sugar cane, cocoa and other farms developing more sustainable agro-ecological practice (Holland 2010; G. Vargas, pers. comm.).

Private coffee processing and roasting initiatives began in the early 2000s. By 2014, there were 12 local coffee brands in the Monteverde. Micro-processing and roasting plants proliferated along with the brands. **Café Florencia**, one of several small family-farm initiated brands, illustrates this tendency (see Table 11.7).

6.5 Looking to the Future

In 2014, the coffee economy is diverse: dozens of brands from outside the area compete with Monteverde's own brands. Some local entrepreneurs are seeking strategies for joint marketing of the region's coffee. There is general support for collectively promoting Monteverde as a region that produces high quality coffee. For example, in 2012 producers co-sponsored a Regional Coffee Fair. However, local entrepreneurs who have successfully developed niche markets have a strong incentive to strengthen their own brands, rather than to subsume them under a collective identity.

In a region apt for both coffee production and tourism, one producer reflected on the past and future. "Our region has a special combination of opportunities for producing, processing, and marketing coffee. Our product is known for its high quality, and for sustainable environmental and social practices; however we face marketing constraints related to scale and capital. What can we learn from our previous successes and failures?"

7. Examples of Entrepreneurship and Sustainable Farming in Monteverde

By Fabricio Camacho C.

Thanks to the leadership and vision of organizations and community members in the Monteverde area, as well as favorable climate, soil and market conditions, several agricultural projects have integrated the concept of sustainable production in farming operations. Here, we summarize progress being made with integrated farms, agro-ecotourism, local production and consumption, and farmers' markets.

7.1 Integrated Farms

Integrated farms respect the carrying capacity of the land and incorporate management practices that minimize the negative impacts of agriculture, while maximizing the use of available resources without degrading them to generate direct and indirect benefits for farmers and for the environment and society in a sustainable manner over time (MAG 2008, Navarro 2012). See Table 11.8 for a more technical summary of the concept of integrated farms, and Table 11.9 for a map of several integrated farms in the Montverde region.

(INSERT: Table 11.8, Integrated Farms Technical Summary

INSERT: Table 11.9, Integrated Farms in Monteverde, 2014

7.2 Agro-ecotourism

Although agro-ecotourism has been more predominant on coffee plantations in the Monteverde area (e.g., Café Monteverde, Café San Luis, Café La Bella Tica, Café Don Juan), other farms have also taken advantage of tourism to diversify their productive activities. They often offer guided farm tours, and educational activities linked to the region's natural history and culture; some offer lodging and entertainment for visitors.

The Terra Viva and Rancho Makena projects, in the San Bosco-Las Nubes area, are dairy farms that have incorporated farm production and environmental impact mitigation processes with ecotourism. Both dairies offer lodging in cabins, and opportunities for tourists to engage in farm activities.

Cabinas Capulín and Farm, between Santa Elena and Las Nubes, is a project that produces food (mainly vegetables) with low environmental impact, for home consumption and for sale to the community. The project provides lodging to visitors and the opportunity to participate in farm activities. Other models have been developed which also demonstrate, for tourists, artisan food production mainly for family consumption and local sales, e.g., the Brenes Family Model Farm (La Cruz), Finca La Bella (San Luis) and Finca el Trapiche (Cañitas). These farms do not provide lodging, but charge visitors a fee that helps offset the farm's operating costs. The products of the Brenes Family Farm are sold at the Farmers Market in Santa Elena.

7.3 Production for Home Consumption and Local Market

Although not necessarily motivated by the objective of low impact farming, the Monteverde area is beginning to develop a Farm-to-Table movement led by some hotels and restaurants to produce, on their own land or in partnership with local farmers, some of the food for their own operations. The two most consolidated examples of this model are the Hotel Belmar and the Restaurant and Pizzeria Johnny. Meanwhile, the Monteverde Hydroponic Garden, located at Cabinas Los Pinos in Cerro Plano, produces vegetables and spices for area restaurants and hotels and for direct sale to the public at the garden or at the Monteverde Farmers Market.

Another interesting process is the use of traditional home gardens, small semi-urban gardens, and livestock propagation systems for home consumption, which produce vegetables, fruits and root crops, eggs, poultry, and pork. This type of production requires little space, uses local inputs, and increases family food security. Some families sell their surplus production, or exchange it with neighbors, helping the domestic economy and reducing dependence on external food markets.

Finally, the production of eggs for local consumption is significant in Monteverde. This production process has evolved around small family businesses that produce enough to meet the needs of the local market, a minimum of

5000 eggs per day (C. Santamaría, pers. Comm.). The eggs are distributed directly to local businesses and the Monteverde Farmers Market.

7.4 The Monteverde Farmers Market

In 2014, the Monteverde Farmers Market celebrated its sixth anniversary. This weekly event provides a venue for local producers and producers elsewhere in the country, to sell their products to local consumers. It also functions as an opportunity to strengthen and enrich the cultural ties of friendship and unity among the residents of the community. The mix of producers, consumers, and visitors, as well as the generational diversity, is an example of the cultural richness that characterizes the Monteverde area.

8. Topics for Future Research

A fundamental challenge that applies to all farms is to develop a management culture involving record keeping and analysis. Other pressing questions meriting quantitative and qualitative study include the following.

8.1 Climate Change

1. What impacts has climate change had on agricultural production in the area?
2. What are possible scenarios for the impact of climate change on future agricultural production?
3. What adaptation mechanisms can area farmers undertake?

8.2 Economy

1. How are demographic, economic, and social trends affecting land use options? What outcomes are desired? What policies, incentives, and institutional arrangements are needed to move toward the desired outcomes?
2. What role does indebtedness play in household livelihoods and land use decisions?
3. To what degree does the economic viability of dairy and coffee farms depend upon specialized versus diversified income sources? How might the results of this analysis change if the unit of analysis were

“households” dependent upon dairy or coffee farms, as opposed to “viable farms?”

4. How have educational opportunities expanded options for youth? What are current trends related to youth education, employment, and mobility? For example: how many youth pursue higher education or technical studies? How many are graduating? How many drop out to work locally or in other regions? How many return to live, work or share their knowledge locally? How many have graduated, but work in other parts of the country? How many have studied abroad? How many receive scholarships or support from local organizations, businesses, or private individuals for primary, secondary, or university education? Such a study could involve participation by the students themselves, with support of local organizations.

8.3 Dairy

What can be done to reduce supplemental feed grain use, and to increase production of quality forages? This should be linked to technical assistance on soil fertility management. Artificial insemination programs might consider the use of sires that have been bred to maximize milk production in high forage/low supplemental grain ration contexts. Further study could also be done to measure the relative profitability and environmental sustainability of lowland and highland dairy production systems on the Pacific slope.

8.4 Coffee

1. What climate change adaptation measures are available for local coffee farmers? For example: coffee varieties with greater resistance to Coffee Rust (*Hemileia vastatrix*) and “Ojo de Gallo” (*Mycenia citricolor*); alternatives for natural control of fungus and insects (Coffee Borer Beetle, *Hypothenemus hampei*).
2. What opportunities exist for the development of an umbrella brand for all the local coffee that meets certain quality standards?

8.5 Integrated Farms

What is the current and potential demand for, and capacity to produce local food? With this information it would be useful to design a plan to activate farm production. The study should consider aspects such as funding opportunities (development banks, the Monteverde Community Fund, microcredits), stratification and production coordination, farm product collection systems, storage, distribution, marketing, online ordering platform, technical assistance, local production of inputs, linkages, financial analysis, ecosystem services, carbon neutrality, and rural tourism, among others.

9. Conclusions

Land use in Monteverde is dynamic. The original chapter, written in the late 1990s, focused on agricultural production, stating that “(a) *agrarian society requires healthy land and adequate incomes for farmers*”. In the intervening years, we have seen rapid development of tourism, coupled with biodiversity conservation and various environmental and educational programs. Tourism immediately affects the communities closest to the forest preserves, but its ripples influence job opportunities, immigration patterns, land prices, access to information, and cultural diversity throughout the region. Interaction between the area’s three economic pillars – tourism, dairy and coffee – has created trends that shape opportunities and influence land use decisions. In short, moving the economy towards more sustainable land use goes beyond farming: larger social, economic, and demographic trends shape the opportunities to which farmers respond.

Farmers walk a fine line between profit and loss. Sustainable technologies take capital, and increased managerial effort and labor. We do not observe a trend toward increased managerial capacity of most farmers despite the promotional efforts of various institutions, but we do increasingly see cases of engaged, innovative, committed people who are developing more sustainable production systems. This trend is promising. It is a gradual process that requires cultural change, especially when the cost and the “work” of making the change is “now”, and the benefits are long term, diffuse, or uncertain.

Momentum is growing, in part because tourism provides opportunities for local farmers to diversify, develop market niches, and to gain increased access to information.

Climate change as well as globalization and dependence on external markets represent unprecedented challenges for agricultural producers in the Monteverde area. However, in Monteverde, there exists capacity and leadership to meet these challenges with courage, intelligence, unity, and hard work. The mystique of agriculture, and love for the land have not been eroded and are still alive in people who have learned to work hand in hand with nature. The great challenge that remains in the short term is to transmit knowledge to new generations so that they will be motivated to return to the farms and make the job of feeding society a way of life that gives them an opportunity for employment and personal fulfillment. It is imperative to work with the local market – households as well as hotels and restaurants – to develop strategic alliances so that it can absorb local food production as a distinguishing feature of the economy and tourism.

10. Tables and Figures

10.1 Table 11.1 People Interviewed

The trends identified in this addendum are based on interviews with professionals working for farm support organizations, including the cheese plant, the Monteverde milk producers’ association, the local office of the Ministry of Agriculture, and the AyA, plus farmers, and others.

Resident	Community Activities
Francisco Donato	Director, Monteverde Milk Producer's Association (APLM)
Ronald Briceño	Agronomist, APLM
Jose Aníbal Murillo M.	Cattle Producer Relations Analyst, Productores de Monteverde, S.A.
Juan José Monge M.	Veterinarian, Farm Affairs Manager, Productores de Monteverde, S.A.
Javier Marín	Agronomist, MAG, Santa Elena
Aníbal Álvarez M.	Agronomist, MAG, Director of the Santa Elena office
José Luis Vargas L.	Business consultant, former General Manager, Productores de Monteverde, S.A.
Manuel Torres O.	Forestry Engineer, Monteverde resident
Claudia Rocha M.	Community Outreach Program Coordinator, Monteverde Institute
Juan Ramón Fuentes R.	Dairy herdsman and longtime resident of San Luis and Monteverde
Victorino Molina R.	President, AyA Santa Elena ⁷
Aura Sandí S.	Administrator, AyA Santa Elena
Virgilio Brenes	President, AyA San Luis
Fray González N.	Treasurer, AyA La Guaria
Marvin Ramírez	Administrator, AyA Monteverde
José Vargas G.	Coffee producer in the Monteverde area prior to 1960
Eugenio Vargas L.	Co-owner, Vargas Leitón Family Farm, San Luis
Guillermo Vargas L.	Forestry Engineer, co-owner of Varsan, S.A. Farm, Cañitas
Fabricio Camacho C.	Forestry Engineer, General Manager, University of Georgia San Luis campus
Joseph Stuckey	Dairy farmer, economic and community development specialist
Sarah Stuckey	Co-owner, Costa Rica Study Tours, S.A., Monteverde
Oldemar Salazar	Owner, organic coffee farm, San Luis

⁷ Community Water and Drainage Administrative Association, (Asociación Administradora de los Sistemas de Acueducto y Alcantarillado Comunal, ASADA, also known as AyA).

10.2 **Table 11.2 Indicative Population Monteverde and Surrounding Areas**

Indicative Population – Monteverde and Surrounding Areas

Community	AyA Connections	Est. Population
Cabeceras	234	936
Cebadilla (estimate)	15	60
Guacimal, Fernández, Santa Rosa, & Sardinal	270	1,080
La Cruz (estimate)	15	60
La Guaria	42	168
Las Nubes	36	144
Los Tornos (estimate)	25	100
Monteverde	94	376
San Luis	80	320
Santa Elena, Cerro Plano, Lindora, los Cerros, Cañitas	1,400	5,600
Turín	22	88
Total	2,233	8,932

Notes:

- 1) Local AyA leaders estimate 4 people per connection. However, some connections serve no households; others serve multiple households; some households are served by non-AyA sources. For example San Luis reports 80 connections, but a 2012 community census identifies 103 households with a population of ~400-420 people.
 - 2) Sardinal is not usually considered to be part of the Monteverde region.
- Source: V. Molina, V. Brenes, and other ASADA leaders (pers. comm.).

10.3 Table 11.3 The “Homestay” Industry

Educational tourism, which has been operating in Monteverde since the late 1980s, has been a vehicle for cultural integration. An evidence of this is the “homestay” industry in which local families are paid to host visiting students in their homes. For example, in June 2014, the Monteverde Institute, one of the larger organizations that organize homestays, lists 176 active homestay families in their database. These are distributed among the communities of Santa

Elena, Cerro Plano, Monteverde, Cañitas, Los Llanos, San Luis, and La Cruz (Claudia Rocha, pers. comm.). Hosting homestay students is a popular strategy to augment household income, but often, personal relationships resulting from homestays open doors of opportunity for both nationals and visitors, including occasional marriages, as well as opportunities for travel and education.

10.5 Table 11.5 Dairy Production Indicators

This replicates information from the 2000 chapter to give a comparative snapshot of a typical upland dairy farm in 2014. Information

for the update was compiled by: Juan José Monge, José Aníbal Murillo, Francisco Donato, Ronald Briceño, Javier Marín, and Joseph Stuckey.

Indicator	1990s	2014
Herd size	16 cows, 67% of herd in production	16 cows, 80% of herd in production
Cow breeds	In order of importance: Holstein, Jersey, Brown Swiss, Guernsey	In order of importance: Jersey, Holstein, Brown Swiss, Guernsey
Feed	Rotational grazing on Star Grass pasture; 0.5-2.5 kg/day grain; Elephant or King Grass; salt, minerals, urea, molasses	Rotational grazing continues, but with greater dependency on use of supplemental grain; some silage bales, hay, and cut feed in dry season, as well as salt, minerals, urea, and molasses.
Stocking rate	1.8 cows/ha	2 cows/ha
Milking	Twice per day	Same
Farm size	18 ha total, 14 ha in pasture (CATIE 1983)	10 ha total, 8 ha in pasture
Milk production	10 kg per cow per day	16 kilos per cow per day
Pasture management	Manual fertilization and liming, herbicides (CATIE 1983, Stuckey 1989)	Same
Fertility	Artificial insemination; birth rate 58%; calf mortality rate 8% (CATIE 1983)	Artificial insemination; no data on calving and mortality rates.
Mechanization	In 1995, 60% of farmers used milking machines (up from less than 5% in 1979). Some farms had electric fencing and/or a tractor. No farms had refrigeration (cold water was used to cool milk)	In 2014, almost 100% use milking machines; all have refrigeration, and hot water tanks; 95% transport milk using bulk tank trucks. The use of motorized backpack sprayers and “weed eaters” is common.
Labor	Mostly family labor supplemented by part-time hired help.	Family labor remains important, but the amount of contracted labor is increasing; tendency for youth to study and leave the farms.
Family size	4.5 dependents per farm	3 dependents per farm.

10.6 Table 11.6. Highland/lowland Dairy Indicators, 2013-2014

Data from Farms that Deliver Milk to Productores de Monteverde, S.A. (May 2013 through April 2014)		
Indicator	Highland	Lowland
No. of producers	107	32
Gross milk received at the cheese plant, daily average	27,271.79 kg.	5,238.6 kg.
Farm production, daily average, kg	254.87 kg.	136.96 kg.
No. milking cows per farm, average	16	15
Production, kg per cow per day, average	15.9 kg.	10.9 kg.
Area, ha per farm, average	10 ha	30 ha
Cattle breeds	Jersey, Holstein and crosses between the two	Brown Swiss, Simmental, Gir, and crosses of these with Brahman
Artificial insemination	50% of producers use AI	No AI, use natural mounting
Refrigerated bulk tank	95,0%	100%
Pasture fertilization	Yes. Soils are acidifying, pH<~5.5; require lime, magnesium; high in iron/aluminum; limited phosphate availability.	No.
Forages	African Star grass predominates (<i>Cynodon nlemfuensis</i>), King Grass/maralfalfa (<i>Pennisetum sp</i>), sugar cane, imperial (<i>Axonopus spp.</i>), mulberry (<i>Morus spp</i>), and natural grass. In dry season some use cut feed and hay: transvala (<i>digitalia decumbes</i>), and rice straw.	Improved pastures: <i>Brachiaria brizantha</i> , guinea/mombasa grass (<i>Panicum máximum</i>), sugar cane maralfalfa, natural grass.
Supplemental grain (kg per cow per day)	No data.	1-2 kg
Farm labor (Full time equivalent – FTE)	2 people per farm	3 people per farm
Family labor (FTE)	About 70% of the farms rely on family labor. ~10% milk with hired labor. Most contract occasional labor to build fences and clean pastures.	About 80% of the farms use family labor.

Source: Juan José Monge and José Aníbal Murillo Méndez

10.7 Table 11.7 The Café Florencia Case

Café Florencia is a coffee brand originating on a farm owned by the Vargas Leitón family in San Luis. It has been certified organic since 2009 by Eco-LOGICA, an organic products certifier, through a Costa Rican producers association called Organic Agriculture Movement of the Central Pacific (MAOPAC).

Approximately 25% of the crop is consumed by the Vargas Leitón family (“*a rather large clan!*”). The excess is marketed to:

- International student groups and professors that visit the farm as part of their educational programs,
- The Monteverde Institute,
- One of the local hotels, as part of its Certification for Sustainable Tourism program (CST)⁸,
- A small group of clients in Portland Maine, members of a Community Support Agriculture (CSA) group,
- Other contacts in San José.

⁸ A program of the Costa Rican Institute of Tourism (ICT), <http://www.turismo-sostenible.co.cr/index.php?lang=es>.

10.8 Table 11.8 Integrated Farms Technical Summary

By Fabricio Camacho C.

The technical principles underlying the management of integrated farms are: 1) increased productivity, 2) increased ground cover and water protection, 3) increased water infiltration into the soil profile and decreased runoff, 4) the proper management of soil fertility and maintenance of organic matter, 5) neutralization and / or abatement of contamination and 6) the efficient use of energy (MAG 2008).

On integrated farms, every aspect is planned and linked together blending traditional production methods with modern technologies that enhance the natural productivity of the land through a system that operates on planning and efficient use of space, resources (water, soil, biomass, waste) and energy available to generate fresh, clean, varied and healthy food, and to constantly boost agricultural employment,

income, learning, innovation, mystique, belonging, identity and culture as a result of assimilation of, and immersion in, the environment experienced by people who are involved in the production process (Palomino 2004, Navarro 2012).

It is also estimated that integrated farms are suitable models to combat the aftermath of the Green Revolution as the management system helps to mitigate carbon emissions, to adapt to climate change, and to achieve food security, which impact positively on poverty reduction, promoting more equitable rural development and a better quality of life in rural communities (UNDP SINAC 2013, INTA 2012, Gomez 2011, Palomino 2004).

10.9 Table 11.9 Integrated Farms in Monteverde, 2014

Farm Name	Products	Market	Organic Fertilizer Production	Waste Management	Value added Foods	Educational Activities
University of Georgia, San Luis (1)	Pigs Cow milk Garden produce Fruit	On-campus consumption	Compost Earthworm compost Bio-foliar fertilizer	Tube bio digester	Cheese Sour cream	Students Local residents
La Querencia, San Luis (2)	Vegetables and other garden produce Cow milk Pigs Sheep	Household consumption Local market sales	Compost Bio-foliar fertilizer	Tube bio digester	Dried beef Beverages	Students Local residents
Olivier Garro and Family, San Luis	Chickens Eggs Pigs	Household consumption Local market sales	Compost Chicken manure Bio-foliar fertilizer	Tube bio digester	Chicken and pork processed in pieces	NA
Rancho de Lelo, San Luis (3)	Tilapia Pigs Chickens Eggs Vegetables Coffee	Household consumption Sale in own restaurant Local market sales	Chicken manure Bio-foliar fertilizer	Tube bio digester	Tilapia and pork sold in restaurant	NA
Finca Florencia, San Luis	Coffee Garden produce Fruit Sugar cane	Household consumption Local and international market sales	Compost	NA	Farm branded coffee Certified organic farm(5)	Students
Gregory Paradise Café, San Luis (4)	Coffee Medicinal plants	Household consumption Local and international market sales	Compost Bio-foliar fertilizer	NA	Farm branded coffee Certified organic farm(5) biodynamic	Tourism
La Bella Tica, San Luis (4)	Coffee Pigs Fruit Vegetables	Household consumption Local and international market sales	Compost Bio-foliar fertilizer	Tube bio digester	Farm branded coffee Certified organic farm (5)	Students Tourism
Café San	Coffee	Household	Compost	Tube bio	Farm	Students

Farm Name	Products	Market	Organic Fertilizer Production	Waste Management	Value added Foods	Educational Activities
Luis, San Luis (4)	Fruit Vegetables	consumption Local and international market sales		digester	branded coffee	Tourism
Benito Guindon, Monteverde	Goat milk Cow milk Sheep Vegetables Fruit Garden produce	Household consumption Local market sales	Compost	NA	Goat cheese Marmalades	NA
Life Monteverde, Cañitas (3)	Goat milk Coffee Eggs Garden produce Fruit	Household consumption Local market sales	Compost Earthworm compost Bio-foliar fertilizer	Tube bio digester	Farm branded coffee Goat cheese	Students Local residents

(1) Functions as an integrated demonstration and experimental farm; engages in technology transfer including, for example, the installation of biodigesters in neighboring farms in the Monteverde area. To date, 15 biodigesters have been installed.

(2) Functions as a membership model in which clients pay for farm products in advance and periodically receive harvested products.

(3) Has been awarded the Ecological Blue Flag.

(4) Processes coffee on site. In the case of La Bella Tica and Café San Luis, they buy coffee

from other local producers to process and sell under their own specific brand.

(5) Internationally certified as organic coffee through Movimiento de Agricultura Orgánica del Pacífico Central (MAOPAC) (Central Pacific Organic Agriculture Movement), in affiliation with Certificadora de Productos Orgánicos y Sostenibles Eco-LOGICA, (Eco-LOGIC Organic Products Certifier) <http://www.eco-logica.com/>.

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