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IN THE FIELD

Cultivating cacao: Implications of sun-grown cacao on local food security and environmental sustainability

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Abstract. The reasons why upland farmers on the Indonesian island of Sulawesi are engaged in a cacao boom and its long term implications are addressed in the context of protected area management regulations, and political and economic conditions in Post-Suharto, Indonesia. In the remote case study village of Moa in Central Sulawesi, we found that while few households cultivated cacao in the early 1990s, all had planted cacao by 2000. Furthermore, the vast majority cultivate cacao in former food-crop focused swidden fields under full-sun conditions. Farmers cultivate cacao to establish property rights in light of a land shortage driven in part by the prohibition of farming and forest product collecting in a nearby national park, and to secure a future source of income, a concern that has been exacerbated by Indonesia's economic crisis. However, conversion of swidden fields to sun-grown cacao constrains future food production opportunities, increases susceptibility to drought stress and potential soil nutrient and organic matter losses, and increases household dependence on a commodity that is subject to extreme price volatility. These factors raise significant concerns for local food security and agricultural sustainability.

Key words: Cacao, Cocoa, Conservation, Food security, Indonesia, Shade-grown tree crops

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Introduction

A small, family farm-driven cacao boom has been underway on the Indonesian island of Sulawesi over the last decade, and it has intensified since the economic crisis of 1997 (Sunderlin et al., 2001; Yoddang, 1999; Angelson and Resosudarmo, 1999; McBeth, 1998). Although accurate estimates of the number of farms and the area involved are unavailable, reports indicate that both indigenous populations and recent migrants have been converting and/or intensifying upland areas of Sulawesi to cacao in the past ten years. Observers of the cacao boom have speculated about its causes including the economic crisis (Jamal and Pomp, 1993; Ruf, 1994; Pomp and Burger 1995; Sunderlin et al., 2001), while others discuss cacao's displacement of swidden systems, the conversion of forests in protected areas, and agrarian differentiation stemming from cacao's role in privatizing land holdings, forging new and often inequitable wage-labor relations, and in fostering landlessness (Li, 2001; Sunderlin et al., 2001). Others have raised concern about the sustainability of cacao, given its susceptibility to pests and disease (Yoddang, 1999). In this paper, we address an important yet little discussed dimension of the cacao boom on the island of Sulawesi in Indonesia – the reasons why farmers initiate cultivation of cacao and why they cultivate it under shade grown agroforestry systems or under largely sun-grown conditions. Based on a case study area in Central Sulawesi, we discuss farmers' decisions regarding why, where, and how to cultivate cacao, and the long-term social and ecological implications associated with a trend toward cultivating it under largely sun-grown conditions. Throughout our analysis, we examine connections among farmers' resource access, protected area management regulations, and livelihood strategies and agricultural decisions, and with changes in the broader political economy and ecology of Indonesia during the Post-Suharto era.

Cultivating cacao: In the shade or under the sun?

Cacao (*Theobroma cacao*) is a small tree, originally found in the shaded under story of tropical forests in Central and South America (Purseglove, 1968). The plant produces a small, football-shaped fruit along its trunk and branches that contain seeds or beans. Since at least the time of the classic Maya civilization, cacao has been cultivated and traded, and it now forms the basis of a burgeoning global chocolate industry (Young, 1994).

Cacao and coffee have been cultivated by smallholders in the shade of primary or secondary forest trees for generations throughout the tropics (Purseglove, 1968). Tree crops, with their relatively low labor requirements and high income generating capability, are often attractive "partners" to other local agricultural enterprises, especially rice and vegetable growing in crop-fallow rotational farms or swiddens (Belsky, 1993). Tree crops have been applauded as assets buffeting small farmers against economic and ecological shocks or contingencies (Chambers, 1983). However, small holder tree growing has also been resisted among those lacking long-term and secure property rights and alternative food growing capabilities (Belsky, 1993), and criticized for having negative impacts on food supplies, rural employment, and even on the environment (Arnold and Dewees, 1995). Traditional, shade-grown cacao has tended to be well integrated with local agricultural practices and traditions, and compatible with biodiversity conservation (Beer et al., 1998; Perfecto et al., 1996; Young, 1994). On the other hand, yields from shade-grown crops are typically lower than sun-grown monocultures (Beer et al., 1998; Purseglove, 1968).

Research suggests that shade-grown tree crops provide small farmers with a number of advantages over full-sun grown crops. Shade-grown tree crops tend to maintain productivity for longer periods of time, are less prone to insect and disease losses, and require less capital and labor inputs (i.e., fertilizer, insecticide, and weeding) than full-sun monocultures (Purseglove, 1968; Young, 1989). Furthermore, shade-grown tree farms are likely to contain other valuable products, such as fruit, fiber, medicinals, and timber, which can be harvested as needed, such as when market prices of cacao and coffee are low. Farmers with shade-grown tree crops also typically engage in other agricultural activities, including the production of annual food crops on other parcels. Consequently, households cultivating shade-grown trees, and especially those not using technified systems involving purchased inputs (e.g., seeds, fertilizers, pesticides etc.), are generally less affected by market price fluctuations than farmers cultivating full-sun, technified crops (Collier et al., 1994; Thrupp, 1998). Not surprisingly, shade-grown crops tend to be cultivated by smallholders who lack the capital to convert to technified, full-sun systems. Lastly, shade-grown tree crop systems provide biodiversity and ecosystem functions that benefit farmers as well as the system as a whole (Lenne and Wood, 1999; Perfecto et al., 1996). It is for these reasons that shade-grown coffee and increasingly cacao have been signaled out in labeling efforts to certify "sustainably grown" tropical products. Given the multiple benefits of shade-grown tree crops reported in the literature, how do smallholders themselves view the relative merits and limitations of each system, and how do these understandings translate into what they are actually doing on the ground?

In the following sections, we discuss our research site, methods, and cultivation patterns that we observed in a case study area in Central Sulawesi regarding how and why small farmers are converting upland farms to cacao, and why so many are doing so under sun-grown conditions. Our examination of farmers' cacao practices and their rationales was influenced by household resource access and livelihood strategies, as well as household considerations of broader social, economic, and political conditions and actors, including the military, private conservation organizations, migrants, refugees, and entrepreneurs. We pay close attention to the power relations inherent in defining, controlling, and managing nature, and to documenting at multiple scales of analysis the array of social actors and forces that operate in historically and culturally constituted fields of power (Peet and Watts, 1996). Based on our analysis of the case study, extended through consideration of additional accounts of cacao booms, we conclude with a discussion of some social and ecological implications of replanting the uplands with sun-grown cacao.

Research site and methods

We conducted the study in Moa during 1995–2000. Moa is an isolated forest village comprised of approximately 78 permanent resident households belonging to the ethnic group Uma, who report having lived in the area for centuries. The community is located 25 km from the nearest road, the only road that connects the upland region to Palu, the regional capital of Central Sulawesi. Moa is situated adjacent to Lore Lindu National Park (LLNP), a 230,000 ha preserve established in 1982 for the purpose of biodiversity conservation and watershed protection (Figure 1). The community of Moa historically lived in and around the area now demarcated within LLNP and relied

on forests for hunting, farming, and forest product collecting. With the establishment of LLNP, all of these activities became illegal. As in other cases of resident peoples and national parks (West and Brechin, 1991), residents from Moa resent losing access to agricultural lands and forest products they previously utilized and managed on the basis of community traditions (*adat*). They particularly resent losing access to forest land and products along the periphery of LLNP near the village.

Moa farmers historically cultivated swidden fields in nearby forests after obtaining permission from the community's traditional leader (*kepala adat*). As is typical in other swidden systems, farmers seek permission from the community's leaders to temporarily use a swidden field for the cultivation of annual crops. Obtaining permission is particularly important when a farmer wishes to plant perennial or tree crops, because unlike annual-crops, planting trees confers long-term use and ownership not only of the tree crops, but of the land. However, the increasing value of land in and around Moa has led to an interest by outsiders in purchasing land. A number of non-resident entrepreneurs have visited Moa and inquired about purchasing either farmland or lands already planted to cacao. However, by most accounts, villagers in Moa have resisted selling land, a practice strongly endorsed by community leaders. The latter are extremely worried that people will begin to sell land already privatized, and whether they can retain his authority over allocating land for swidden and planting tree crops, such as cacao. The fragile persistence of customary traditions and community-based land use and control in Moa contrasts strongly with other upland areas in Sulawesi where land sales and agrarian differentiation are well underway (Li, 2001).

Our research entailed multiple sociological and biophysical data-collecting procedures, including both qualitative and quantitative methods. To investigate farmers' resources and rationales for cacao cultivation practices, we held interviews with community leaders, new and old cacao farmers, and a diversity of other village residents. To determine agricultural patterns and their distribution across the community, we surveyed a random sample of 20 households (total households = 78, sample = 25%) in October 1996 before the Indonesian financial crisis and interviewed the same households again in March 1999 after the crisis, and again in August 2000. We used a similar questionnaire in 1996 and 1999, though additional questions were added as new issues arose. Biophysical effects associated with changes in cacao cultivation practices, including tree, epiphyte, liana and bird species diversities, canopy height and structural complexity, solar radiation levels, ambient air and soil temperatures, percent ground cover, and soil nutrient levels are reported elsewhere (Siebert, 2002).

Replanting the uplands with cacao

Moa residents, as is the case with upland households elsewhere in Indonesia, typically earn their livelihood through a combination of on and off farm enterprises that are balanced for short- and long-term gains, and between food and income-generation (Table 1). Rice is the preferred staple food. In Moa, the majority of households cultivate irrigated rice, but most do not produce sufficient amounts of rice to meet annual household demand. Irrigated rice producing households reported in 1996 that the rice they produced fed their households for an average of 7.9 months. However, in 1999, the average had fallen to less than four months. Flooding the previous harvest year had severely limited irrigated rice production. Rice is also traditionally grown in upland swiddens though rarely producing enough to meet household demand. Increased LLNP patrolling and enforcement of the farming ban has led to a decrease in swidden farming by over 20% from 1996 to 1999.

Consequently, generating cash has become critical for households to purchase rice and other foods, as well as for home construction, children's educational expenses, clothing, and other household items. In 1999, half of the households interviewed reported selling rattan as their most important source of income, while 30% said they relied on selling tree crops, principally coffee and cacao. Wild rattan is gathered from forests located within the national park. Coffee has been cultivated in Moa for four decades and 70% of those surveyed had producing coffee trees in 1996. Cacao cultivation, on the other hand, is a more recent enterprise. Prior to 1990, only one household cultivated cacao; by 1996, 75% of those surveyed had planted cacao and 20% had producing trees. By 1999, fully 100% of households were cultivating cacao on one or more parcels, and 55% reported producing trees (Table 1).

Before 1990, cacao cultivation was fairly haphazard and the seeds were rarely marketed. A few trees were planted because of available planting material, but the seeds were never collected, marketed, or locally consumed. When asked about the origin of one mature cacao tree in her yard, one woman told us that she was given the seed from someone outside of the community and she planted it as an ornamental. She had been discarding the cacao seeds for years and was extremely pleased in the late 1990s when she learned they had a market value. The cacao boom in Moa occurred without external support or

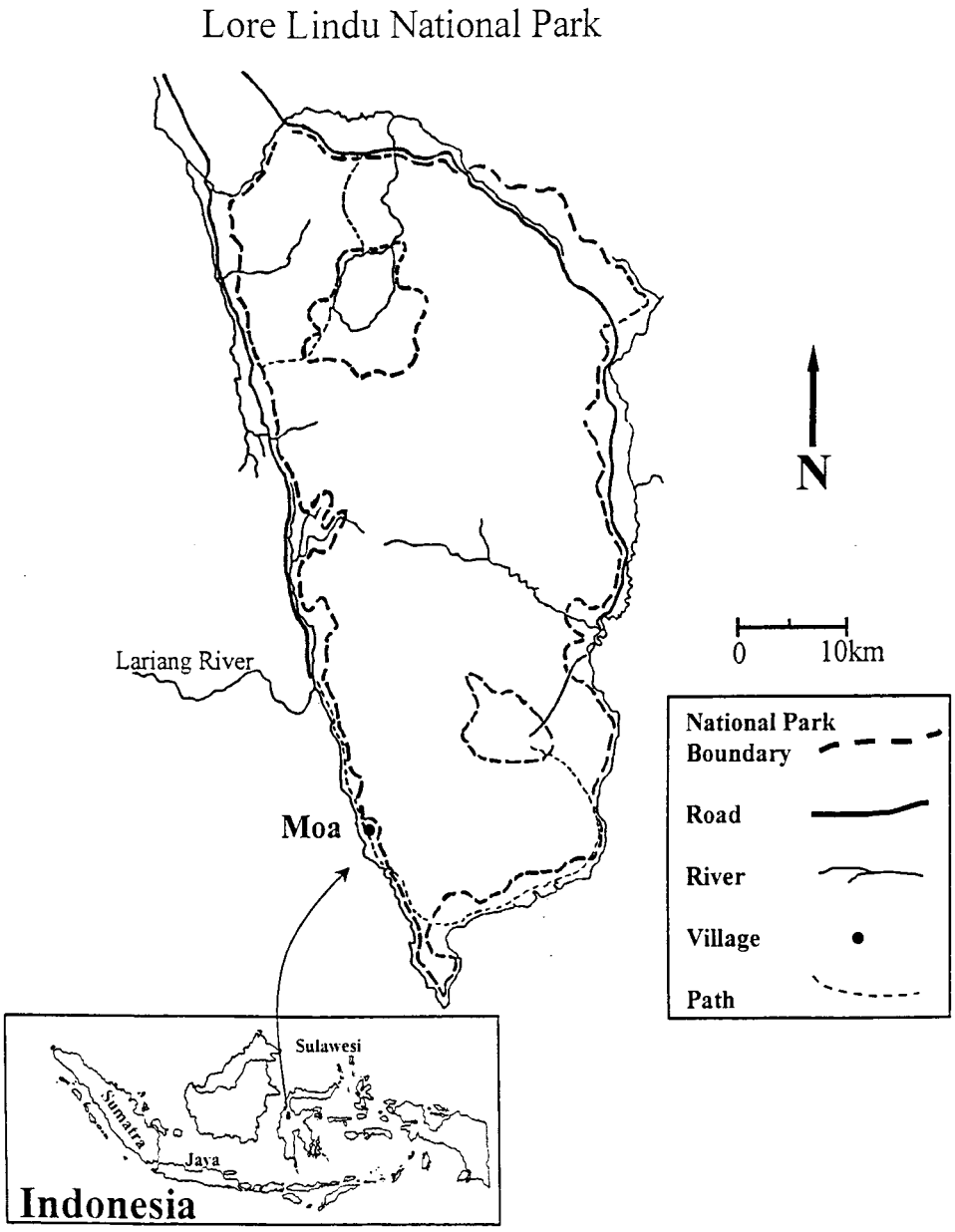

Figure 1. Location of study.

state programs. Rather, farmers learned about cacao and obtained seeds through local networks of family, friends, and neighbors, extending to South Sulawesi where the cacao boom had begun earlier, also largely without external support (Pomp and Burger, 1995).

The most frequently cited reason among households we interviewed for planting cacao was its dual-value for establishing property rights and as a future source of income. Typical of this sentiment is the statement, "Planting cacao is like putting up a sign. It tells others that this land belongs to me." Especially since the establishment of Lore Lindu National Park and its prohibition against farming and forest product collecting, residents are concerned about their long-term access to land. Planting cacao trees enables individual households to establish private rights not only to tree crops, but to the land on which they grow. By planting cacao (or coffee) trees, people told us that feel as if they are investing in their own future support – either they or their heirs will be the ones to harvest the crops. "I am planting cacao for my future," explained an elderly farmer, "I cannot rely on my children to do the hard work that is necessary to make income."

The second most frequently cited reason for planting cacao was its high market price. The local

Table 1. Household livelihood activities and cultivation practices in Moa, Sulawesi, 1996, 1999 ($N = 20$ households).

Livelihood activities[a]	1996	1999
Staple food/rice		
Cultivated irrigated rice	70% (14)	85% (17)
Mean # months rice self-sufficiency	7.9	3.4
% reported most important food source[b]	–	45%
Cultivated swidden (rainfed)	45% (9)	35% (7)
Mean # months rice self-sufficiency	7	–
% reported most important food source[b]	–	15%
% reported most important income source[b]	–	20%
Tree crops		
Households planted cacao	75%	100%
Households with producing cacao	20%	55%
Households planted coffee	90%	90%
Households with producing coffee	70%	70%
% Reported most important income source[b]	–	30%
Rattan collect		
Households that collect and sell rattan	90%	95%
% reported most important income source[b]	–	50%

[a]Other livelihood activities reported: selling gold from panning (2), operating a guest house (1), coconut oil production (1), selling other forest products (1), wages as a carpenter (1).
[b]Unfortunately this question was added to the questionnaire in 1999, no data for 1996.

market price of cacao increased six-fold between mid-1997 and July 1998 (Table 2) due, in large part to the economic crisis that spurred rapid inflation and an increase in the cost of many products including cacao. The price declined to 1.5 times its pre-economic crisis level by December 1998 when adjusted for inflation (Angelsen and Resosudarmo, 1999), but rose to near record highs again in July 2002 (Rp 15,700/kg). This price fluctuation graphically illustrates the volatility of cacao and other internationally-traded cash crops. While farmers are aware of cash crop price volatility, cacao was attractive to households seeking to take advantage of its high price.

A third reason cited by Moa residents for cultivating cacao was its relatively low labor requirements. Unlike swidden, which entails extensive land clearing, field preparation, and planting and weeding of annual crops, cacao cultivation involves only a single planting. Another benefit of cacao, especially relative to the other important tree crop, coffee, is its more rapid maturation. Cacao produces within 2–3 years in contrast to coffee, which requires 4–5 years (Purseglove, 1968). Cacao also yields throughout the year, rather than in one or two, labor-demanding flushes as is the case with coffee.

Table 2. Market prices paid for cacao and coffee in Palu, Central Sulawesi (1996–2000).[a]

	Cacao	Coffee
January 1996	2,100	2,850
July 1996	2,150	3,000
January 1997	2,450	3,000
July 1997	3,250	3,000
January 1998	9,000	4,500
July 1998	17,000	12,000
January 1999	9,000	9,000
July 1999	5,200	8,250
January 2000	4,600	6,750
July 2000	6,300	5,750

[a]Prices in Indonesian rupiah; US$ – rupiah exchange rates has varied from $1 – rupiah 1,800 in 1996 to $1 – rupiah 13,000 in 1998.

Cacao in Moa is planted primarily in former annual-crop focused swidden fields, not primary forests. Fully 82% of households surveyed in 1999 had

planted cacao in either fallowed swidden fields or in older agroforestry-based farms containing coffee and assorted fruit trees, many of which contain a primary or secondary forest canopy. Five (thirteen percent) cacao farms were enlarged from existing farms. Only two (five percent) were planted on recently cleared primary forest. The labor required to fell and clear primary forests, plus reprisals from LLNP guards, deter farmers in Moa from converting parkland to cacao. As one young man remarked, "It is too much work to cut the big trees and clear and plant the cacao ourselves. It is better to wait and have it passed on from our parents."

While the absence of forest clearing for cacao within the park is perhaps comforting to conservationists concerned about farmers' "encroachment" into the park, it nonetheless posses numerous concerns. Most Moa farmers are aware that cacao requires shade. The sophisticated understanding many local farmers developed of cacao in such a short time may stem, in part, from four decades of experience with coffee. "Full sun will kill the cacao" one farmer told us, while another stated "I know it's too hot to plant cacao here without shade. I already saw many cacao trees die in Palu." Indeed, many sun-planted cacao seedlings died in Moa, especially during a recent El Nino dry season. One man alone lost 250 seedlings planted under full-sun conditions.

If the risks associated with sun-grown cacao are locally known, why do farmers cultivate it without shade? The answer has to do with land availability and land use history. The lack of available uncultivated land near the village, due in part to the establishment of LLNP, forces farmers interested in cacao to plant it within farm parcels that were formerly planted to annual crops and hence were without large shade trees. Decisions in Moa regarding where to plant cacao is less about choice and more directly about constraints – they simply have no other land in which to plant cacao except in already cleared fields. In an attempt to compensate for the lack of shade, many farmers copy the practice observed in the nearby village of Gimpu, and that is to intersperse *gamal* (*Gliricidia sepium*), a fast growing, naturalized leguminous tree from Central America with cacao to provide shade. Farmers did not report planting *gamal* for its soil fertility benefits. Planting *Gliricidia*, *Leucaena*, or *Erythrina* as shade trees in cacao plantations is common in Malaysia (Department of Agriculture Malaysia, Industrial Crop Technologies (n.d.), http://agrolink.moa.my/doa/english/croptech/cocotech.html). In 1999, 68% of full-sun cacao parcels in Moa had been planted with *gamal*. However, the shade provided by *gamal* is only a fraction of that provided by a primary or secondary forest canopy, particularly when the *gamal* trees are young. For example, over 74% of available photosynthetically-active radiation reached the forest floor under *gamal* vs. 4.9–15.1% in shade-grown primary or secondary forest conditions (Siebert, 2002).

Other farmers, while recognizing the value of shade for young cacao plants, believe that it is not necessary after plants begin to bear fruit. Many farmers reported that they will cut all shade trees to maximize solar radiation and fruit production, and to minimize the possibility of tree fall damage to their cacao crops. Again, this reveals a sophisticated knowledge of cacao cultivation gained in a very short time, which may be explained, in part, by farmers' many years of experience cultivating coffee. As one farmer explained, "Yes, I plant *gamal* to provide the cacao with shade, but when the fruit comes, I will cut the *gamal*, because if I leave it too long it will die and fall on the cacao plants and break them." Thus, whether because of the absence of shade entirely, the modest shade cast by a light *Gliricidia* canopy or its only temporary presence, cacao cultivation in Moa is increasingly under full-sun conditions.

Social and ecological risks of shade-grown cacao

What are the possible biophysical and social implications of widespread cacao cultivation under full-sun conditions? The environment of central Sulawesi is characteristic of many tropical upland regions. Highly weathered, infertile Ultisols predominate, the topography is rugged and steep, and the climate is humid (udic moisture regime) with 3000–4000 mm average annual precipitation (Schweithelm et al., 1992). These conditions lead to high organic matter decomposition rates, and high soil erosion and water runoff potentials.

Most Moa households do not use petrochemical inputs on their farms due to the expense and distance they must be carried from road access points. Consequently, soil nutrient levels and sustained crop production require fallowing of annual food crop farms after several years, and maintaining organic matter inputs and closed nutrient cycling in shade grown coffee farms. The long-term prospects of continuously cultivating cacao under full-sun conditions are low. In addition to severe drought stress, full-sun cacao farms will likely confront increased drought stress, and declining soil nutrient and organic matter levels (Siebert, 2002). Full-sun cacao may suffer reduced crop yields and greater susceptibility to insect and disease infestation, than shade grown crops. In fact, the pod borer, a pest that has devastated cacao production elsewhere (Ruf, 1994), may already be present in Moa.

There are pronounced biophysical differences between cacao and coffee grown under shade and

full-sun conditions, and an interesting gradation of environmental conditions between the two extremes. The most structurally complex and species diverse farms in Moa were those with a well-developed primary or secondary forest canopy. These sites had the tallest trees, the greatest number of vegetation layers, 100% ground cover by leaf litter or herbaceous growth, and the greatest abundance of epiphytes and lianas. At the other extreme, full-sun grown cacao lacks a forest canopy, has the fewest vegetation layers, only 80% ground cover (by weeds), no epiphytes or lianas and low bird species diversity (Siebert, 2002). Similar biophysical and biodiversity differences have been observed between sun and shade grown perennial crops in many tropical regions (Perfecto et al., 1996; Rice and Greenberg, 2000; Rice et al., 1997).

The conversion of annual farms to full-sun cacao also adversely affects landscape level biodiversity conditions, specifically through eliminating secondary forest succession as occurs when annual farms are fallowed. This contributes to increased fragmentation and isolation of primary forests. In fact, the forests of LLNP are increasingly isolated from forests outside of the park by widespread planting of permanent full-sun cacao farms.

Cacao is an exacting crop, particularly with respect to soil and sun conditions. It requires deep, well-drained, and well-aerated soils with adequate water and nutrients (Purseglove, 1968). Cacao seedlings require partial shade (generally no more than twenty-five percent of full sun) and at low elevations near the equator, mature plants do better under shade as well (Purseglove, 1968). Thus, the present widespread planting of cacao under full-sun is risky and may be short-lived and low yielding.

Cacao and other internationally-traded cash crops are notoriously susceptible to price fluctuations and variable market demand. Price declines are particularly serious with cacao because when it is introduced, regions or whole sectors are involved creating "cacao dependence;" furthermore cacao busts (i.e., recessions) are common (Ruf, 1994). Indeed, some Moa farmers are concerned that growing cacao is risky, because, unlike coffee, which can be consumed by the household or traded for rice with villagers in a neighboring valley, it has no local use or value. "At least if the price of coffee goes down, we can drink it ourselves or trade it for rice with the people from Bada (an adjacent valley)." In fact, most Moa villagers have never even tasted chocolate. When the demand or market price of cacao next drops, Moa households may be ill-prepared to deal with the consequences. As shown above, the majority of households in Moa are not food self-sufficient and with the widespread conversion of food-focused farms to cacao, will be even less able grow food in the future. Furthermore, continuous cultivation of cacao under full-sun conditions, rather than fallowing those parcels and allowing soil nutrient and organic matter levels to build up, will preclude switching from cacao back to annual food crops should the need arise.

Other potential social problems include social inequality, conflicts over property, and landlessness. Customary land management and local ownership still prevail in Moa, although in a tenuous state. The community leader in Moa is very concerned about the long-term implications of people not following historic practices regarding community authority over the allocation of (swidden) land. He says,

> If (Moa community members) make the decision to plant cacao where they want themselves, it will be a big problem. Maybe there will be a problem with the last farmer, or someone with no land to farm will not get any.

While he understands individual incentives to individualize land clearing and planting, he is concerned that the lack of community management over the expansion and intensification of cacao will create conflicts across and within families, for example, among siblings over who will inherit the crops and land. Intra-generational arrangements are exacerbated by returning non-resident children (e.g., from urban areas where the impacts of the financial crisis have been most severe), and also by the responsibility of children to care for elderly parents.

The once high value of cacao has attracted the interests of outside entrepreneurs seeking to buy land, cultivate cacao, and arrange contract labor. In 1998, two Chinese businessmen arrived in Moa in search of land and workers. When we asked the religious leader about this incident, he replied that he told the businessmen:

> . . . selling land was prohibited as land belonged to the Moa community not individuals. In our way, land is never sold to outsiders or we will lose our livelihood and community forever.

He then added, "I worry that all (in Moa) will not follow our traditions (*adat*) in these times of much need and money to be made from this cacao."

Studies of cacao booms elsewhere on Sulawesi attest to the validity of the concerns in Moa. Li (2001) describes the process of agrarian differentiation that accompanied the cacao boom in the Lauje hills to the north of the Tominin Bay. Since 1990, indigenous farmers in the Lauje hills have replaced swidden crops with cacao and the landscape is now largely a monocrop of cacao which, unlike in the past, are individually owned, usually by non-resident elites. Savy

farmers with access to capital, labor, and knowledge about where their ancestors had cleared land have been able to gain individualized ownership over large areas, which they have, in turn, sold to non-resident entrepreneurs. The latter often leave them cared for by wage laborers, often the former landowners. According to Li (2001: 91),

> . . . The less successful farmers, slower to begin planting cacao, lost out to their co-heirs, or sold up to meet immediate cash needs or gambling debts, and are now working for wages or beginning again with cacao and swiddens several kilometres further inland. They, in turn, have begun to displace the swiddeners formerly in those locations, domino style, but there is little primary forest left as an outlet or retreat.

Importantly, Li (2001: 91) suggests the limitations of managerial responses to such processes of agrarian change, noting two potential problems they often raise: 1) the formulation of initiatives such as multi-party/stakeholder analyses or attempts to amend forest laws that are inadequate due to the complexity and speed of agrarian change, and 2) a failure to recognize how laws and policies, institutions and advocacy are themselves part of the agrarian struggle they seek to resolve. In the case of Moa, the designation of LLNP strongly influenced current land tenure systems, especially regarding the availability of land in LLNP.

Lastly, the efficacy of managerial responses are limited by macroeconomic policies such as global free trade agreements and investment priorities that have led to increased cultivation of perennial cash crops for export under technified conditions throughout the tropics (Collier et al., 1994). In Indonesia, these factors have been accentuated by the 1997 economic crisis and resulting economic policy changes, including a drastic currency devaluation that lowered labor and other input costs, and International Monetary Fund and Indonesian government emphases on agricultural exports (McBeth, 1998; Sunderlin, 1999). Indonesian officials remain excited about promoting agricultural exports through the intensification of smallholder farms with cacao (Sunderlin, 1999) despite potential long-term social and agro-ecological problems. When concerns are raised about the new cacao boom, official tend to focus on the usual fears of tropical deforestation involving forest clearing for agricultural expansion, especially in mountainous, protected forest areas, and critical watersheds such as Central Sulawesi (Sunderlin, 1999). There has been little attention to the conditions under which cacao (and other agricultural exports) are cultivated, the potential for long-term agricultural productivity and profitability, and, even more rarely, to its relationship with local food security. Even so, Li's report (2001) makes one question what can or should be done given the circumstances.

Conclusion

Our research suggests that increased cultivation of full-sun cacao in former food-crop focused farms may adversely affect long-term agricultural productivity and sustainability, as well as local livelihood security. Household food self-sufficiency is already unstable and will likely decline in the rush to convert food-focused farms to cacao, a cash crop vulnerable to global market trends. Cultivating cacao in full-sun, under the edaphic and climatic conditions found in Central Sulawesi, is likely to be unsustainable over the long-term and increases the risk of crop failure due to drought, declining soil nutrient levels, and insect and disease infestation. Finally, full-sun cacao cultivation simplifies the forest environment (i.e., the area of secondary forest is reduced as annual farms are no longer fallowed), increases habitat fragmentation, and isolates core protected forest areas from adjacent forest lands.

Shade grown cacao and coffee farms have provided valuable economic benefits in Central Sulawesi and other regions of the tropics for decades. While Moa farmers may reap short-term profits by cultivating cacao under full-sun conditions, they are increasing their vulnerability to environmental and macroeconomic forces beyond their control. The maintenance of traditional shade-grown cacao (and coffee) may represent an economically productive and ecologically sustainable means of utilizing tropical forest-lands in ways that may be compatible with existing livelihood practices and biodiversity conservation interests. But whether farmers in Moa see it this way and are willing to trade long-term security for short-term gain is another story. Unfortunately, the story of modern agriculture suggests an emphasis by local farmers, and national and transnational institutions on short-term productivity rather than on long-term stability or sustainability.

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