



# Explaining the Limitations of Agricultural Intensification Initiatives in Sulawesi, Indonesia

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This paper examines why cacao intensification initiatives have failed to significantly increase smallholder yields, improve livelihoods, or slow the pace of land use and cover change in Southeast Sulawesi, Indonesia. I first draw on land use surveys, household surveys, and remotely sensed data (1972-2015) to show how most households across four study villages are transitioning away from cacao amid sustained declines in yields and accelerating forest cover loss for non-cacao commodities. I then combine secondary data and in-depth interviews to show how cacao intensification initiatives have remained disconnected from the power and resource access relations necessitating smallholder livelihood movement away from cacao. Such relations include the dynamics of supply chain concentration, land control, and inequitable access to land and land-based livelihood opportunity that are deteriorating the economics of cacao production and informing smallholders' growing reliance on off-farm, extra-local work. Findings presented here illustrate the tensions between these ongoing livelihood shifts and the full-time farming focus required to successfully enhance yields. They also reiterate the limitations of any approach to agricultural sustainability that remains narrowly production or commodity-centric.

**Keywords:** agricultural intensification, agricultural sustainability, cacao, public-private partnerships, livelihoods, land use, deforestation, Indonesia

## INTRODUCTION

Public-private investments in agricultural intensification are both accelerating and contested. On the one hand, diverse academic, institutional, state, and corporate actors see agricultural intensification as a potential win-win for people and their environments. According to such claims, agricultural intensification can increase yields and profits for the smallholder producers that manage 53–75% (Graeub et al., 2016) of all agricultural land globally (FAO, 2017; Rockström et al., 2017) while 'sparing land' for nature and biodiversity conservation (Green et al., 2005; Balmford et al., 2018; Pretty et al., 2018). Critics, including scholars, activists, and civil society organizations, instead perceive agricultural intensification schemes as a lose-lose approach that will deepen agribusiness control over smallholder livelihoods to the detriment of people and their environments (McMichael, 2012; Holt-Gimenez and Altieri, 2013; Patel, 2013). To date, however, this debate has consisted primarily of abstract modeling exercises and theoretical discussions, leaving largely unanswered the question of why intensification schemes so often fail to shift smallholder land use or livelihoods in practice (Rasmussen et al., 2018).

The smallholder cacao (*Theobroma cacao* L.) sector in Southeast Sulawesi, Indonesia illustrates this phenomenon well: Despite nearly two decades of investment in cacao intensification,

smallholders are abandoning cacao rather than intensifying it. Cacao intensification initiatives in Indonesia claim smallholder livelihood and yield improvements as a central goal, with a resulting improvement in ecological outcomes and forest conservation (Darwis, 2004; ACDI/VOCA, 2005; USAID, 2009; Blommer, 2011; Swisscontact, 2018, **Supplementary Table 1**). Recent studies suggest that their ability to shift land and livelihood outcomes has instead been limited, with current approaches characterized by low rates of program participation and technique adoption (Kindornay et al., 2012; Moriarty et al., 2014; Wijaya et al., 2018). Mirroring broader gaps in the literature, however, there has been little work to explicate the power and resource access relations conditioning observed outcomes. Much work has instead taken the farm and farmer as the primary point of departure, explaining program limitations with respect to deficiencies in farmer knowledge or planting technologies, or in relation to a failure to sufficiently scale or target investments.

Recent reviews suggest that such limitations can be addressed through closer attention to smallholder livelihood trajectories (Dressler et al., 2016; Liao and Brown, 2018). Livelihoods approaches have long been used to grapple with the complex logics linking land use policies, agrarian livelihoods, and environmental change through a focus on people’s assets, activities, aspirations, and capabilities (Chambers and Conway, 1992; Scoones, 2009). The livelihoods trajectories framework (de Haan and Zoomers, 2005) extends this approach to more closely explore how livelihood decisions are shaped by access to opportunities and the workings of power (Resurrección and Elmhirst, 2012). In smallholder commodity frontiers in Indonesia, for instance, such relations can include social differences along lines of class, ethnicity, gender, and generation

(Elmhirst et al., 2017; Park and White, 2017); uneven patterns of land and market control (McCarthy and Robinson, 2016); and shifting aspirations and ideologies (Li, 2014; Peluso, 2017). The livelihood trajectories approach is thus well suited to expanding an understanding of how agricultural intensification initiatives are operating.

This is particularly true where an analysis of livelihood trajectories is coupled to an analysis of corresponding changes in land use and cover. Specifically, and despite the fact that agricultural intensification initiatives often attempt to wrangle diverse socio-environmental challenges into panacea approaches (Ostrom and Cox, 2010), interdisciplinary analyses of their simultaneous effects on livelihoods and landscapes have remained limited (Rasmussen et al., 2018). This lack of integrated assessment obscures, for instance, an understanding of how the shifts in smallholder livelihood or land use practices shaped by intensification initiatives intersect with other dynamics of land change. In Indonesia, such dynamics range from alternative commodity investments among smallholders to state and corporate investments in large-scale plantations and forestry operations (McCarthy and Robinson, 2016).

In what follows, I integrate an analysis of livelihood and land use change trajectories to document and explain the limitations of cacao intensification initiatives, focusing on an explication of their simultaneous limitations for both people and their environments. I base these analyses in four lowland villages characterized by similar challenges with cacao production but contrasting recent histories of investment in cacao intensification (*Besulutu, Polia, Taowengga, and Unahoa*, **Table 1**). Past work suggests that in all four villages, indigenous Tolaki people historically practiced diverse livelihood strategies, including swidden rice production, swamp fishing, sago palm cultivation,

**TABLE 1** | Cacao intensification initiatives in Southeast Sulawesi, Indonesia.

Program	Duration	Stated Purpose	Implementation and Funding	P	T	B	U
The SUCCESS Program	2000–2003	<b>Training:</b> PsPSP.*	ACDI/VOCA (international NGO), American Cocoa Research Institute				
Integrated Pest Management Field School	2002	<b>Training:</b> PsPSP.	Plantation Department, National and Provincial Budgets, Asian Development Bank				
The SUCCESS Alliance Program	2003–2005	<b>Training:</b> PsPSP, grafting techniques, “Farming as a Business.”	ACDI/VOCA, USDA, USAID, World Cocoa Foundation, Mars Corporation				
AMARTA Sulawesi Cacao Alliance	2006–2009	<b>Training:</b> PsPSP, grafting techniques, “Farming as a Business,” post-harvest processing and upgrading bean quality. <b>Infrastructure:</b> 11 buying stations.	Local NGOs, Olam International, Armajaro, USAID, Olam International, Blommer Chocolate Company				
GERNAS	2009–2015	<b>Training:</b> Grafting techniques. <b>Subsidies:</b> Fertilizer, money, cacao grafts.	Plantation Department, Nestle, National and Provincial Budgets				
SCPP	2012–2018	<b>Training:</b> PsPSP, grafting techniques, “Farming as a Business,” post-harvest processing and upgrading bean quality, requirements for certification under UTZ labeling scheme. <b>Infrastructure:</b> Local buying station; village co-operative and community development center.	Swisscontact (development agency), USAID, Cargill, Mondaléz				

Past programmatic activities in each of the four study villages. **P:** Polia, **T:** Taowengga, **B:** Besulutu, **U:** Unahoa, **PsPSP:** the Panen sering, Pemangkasn, Sanitasi dan Pemupukan (Frequent Harvest, Pruning, Sanitation and Fertilization) method of integrated pest and pathogen management. Sources: Key informant interviews and program documents (Darwis, 2004; ACDI/VOCA, 2005; USAID, 2011; Direktorat Jenderal Perkebunan, 2012). Shaded cells indicate the villages in which a given initiative has operated.

and forest product collection. From the late 1980s through the early 2000s, however, high rates of in-migration combined with diverse state policies to propel cacao adoption and forest cover loss. Many smallholders have since managed cacao in sparse shade and with heavy reliance on agri-chemical inputs, particularly following the outbreak of Cacao Pod Borer (CPB) and Black Pod Rot (BPR) in the late 1990s (Kelley, 2018). These practices have contributed to long-term environmental degradation while increasing the capital intensity of production (Belsky and Siebert, 2003).

Since the early 2000s, six major initiatives have advanced yield intensification in the study area (**Table 1**), most of which have emphasized the adoption of agro-ecological practices that can address the deteriorating production ecologies confronting smallholder producers. All but one recent initiative, for instance, has trained growers in the PsPSP approach to integrated pest and pathogen management (*Panen sering, Pemangkasan, Sanitasi dan Pemupukan*, or Frequent harvesting, Pruning, Sanitation and Fertilization). This approach centers good crop husbandry and routine farm management as an alternative to agri-chemical control of CPB and BPR. Since 2007, investments have also supported the distribution of new varieties in the form of grafts (theoretically more pest and pathogen resistant), provided growers with subsidies and fertilizer, and established buying stations where growers receive price premia for high-quality fermented beans. Graft establishment was a particularly important component of Gerakan Revitalisasi Kakao Nasional, or the National Cacao Movement (GERNAS), an Indonesian-government led approach to intensification in the sector. The most recent approach, the Sustainable Cacao Production Program (SCPP), also newly emphasizes grower certification, in this case under the UTZ labeling scheme.

Such initiatives are being pursued globally as part of major corporate sustainability commitments in the cacao sector (Bitzer et al., 2012), many of which now encompass explicit commitments to eliminate deforestation along cacao supply chains (see, e.g., **Supplementary Table 1** for information on Cargill's *Cocoa Promise* program and Mondeléz's *Cocoa Life* program). Throughout, Sulawesi has been a focal site of investment. Not only is Indonesia the world's third largest source of raw cacao (FAOSTAT, 2018). Sulawesi, the largest site of production within Indonesia, is also the world's only major supplier of cacao in the Asia-Pacific and the only site of production capable of supplying Asian markets on a just in time basis. Sulawesi has thus taken on new strategic importance for industry, particularly following the Government of Indonesia's introduction of a 10% tax on the export of unprocessed raw cacao in April 2010 (Moriarty et al., 2014). As one interviewed program representative stated, "*Sulawesi is like the cradle of cocoa sustainability work. We have used this place like a playground, and when it's successful, we export it to West Africa.*"

Despite sustained investment and industry interest, however, and as I show below by drawing on household and land surveys as well as remotely sensed data, cacao intensification initiatives in Sulawesi have largely failed to shift smallholder yields, improve livelihoods, or slow the pace of land use and cover change. Drawing on in-depth interviews and secondary

data, I also explore why this has been the case—here focusing on why most smallholders across the four villages are not intensifying cacao but abandoning it. Consistent with the livelihood trajectories approach, my analysis here includes an exploration of people's perceptions and aspirations, as well as the role these play in shaping smallholders' uneven and limited engagement with recommended approaches. My analysis also involves an examination of the structural constraints and socio-environmental and land change context within which intensification investments have been situated.

Synthesizing across these data, I argue for the need to move beyond a narrowly production or commodity-centric approach to agricultural sustainability, foregrounding instead the power and resource access relations transforming what it means to be a smallholder. As I detail below, a primary reason for the observed disconnect between programmatic goals and programmatic outcomes in the Sulawesi case has been the deterioration in cacao economics over the past three decades. At the same time, it is apparent that the squeeze on smallholder producers does not derive solely from farm-level micro-economics or producer decisions but emerges out of the dynamics of supply chain concentration, land control, and inequitable access to land and land-based livelihood opportunities that are elided rather than addressed by a fixation on best production practices and additional grower labor inputs. I discuss the need to expand the way the sustainability problem and solution are being conceived in Sulawesi and other smallholder cacao economies.

## MATERIALS AND METHODS

This research adopts a case study approach to understand how cacao intensification initiatives have operated and with what effect on land use and livelihood practices. Data leveraged as part of this analysis include 207 household surveys, land use surveys in 289 cacao fields, and remotely sensed data (1972-2015), used here to explore program outcomes vis-à-vis smallholder yields, livelihoods, and land change. To explore why such strong disconnects between program goals and outcomes have emerged, I also draw on 91 in-depth interviews and diverse secondary data. Below, I detail all data used in this study, most of which were collected over a 12-month period spent living in the study area between 2014 and 2015. Insights from an additional six months of work in these areas over the period 2015-2018 are also drawn upon with the goal of corroborating and extending initial findings.

## Reconstructing Cacao Intensification Investments

To understand the history of cacao intensification initiatives in Southeast Sulawesi, and to inform the selection of research sites (described more fully below), I began by conducting in-depth interviews with key informants in the cacao sector and in potential study villages. Key informants included purposively selected senior staff, researchers, and program officers from institutions central to intensification initiatives in Indonesia's cacao sector since roughly the year 2000. These institutions

included the Indonesian Coffee and Cocoa Research Institute; the SCPP; the Mars' Cocoa Sustainability Approach; the Cocoa Sustainability Partnership; and CacaoNet, the Global Network for Cacao Genetic Resources. I focused on interviewing individuals from these institutions given their connections to the two most significant approaches to intensification at the time (the SCPP and GERNAS) and given their involvement in cacao intensification or breeding initiatives since an early point in time (as in the case of Mars and CacaoNet). Overall, 18 such key informant interviews were conducted.

An additional 18 key informant interviews were conducted with purposively selected staff and field officers from the General Directorate of Estate Crops (Direktorat Jenderal Perkebunan) as well as village and farmer leaders involved in program implementation in each of the four villages selected for research. These individuals were consulted to understand the specific details of program implementation within villages, with most farmer leaders from the villages interviewed between 2 and 3 times as new information emerged and to discuss initial findings and observations. These interviews, as with those above, explored respondents' perception of the strengths and limitations of existing approaches, as well as details of their implementation. Interviews took an open-ended form and were considered complete as information began to saturate.

Finally, my understandings of intensification initiatives were supplemented by observation at two cacao industry conferences: the 23rd annual World Cocoa Foundation meeting in Washington D.C. in 06/2013 and the 6th annual Indonesian Cacao Association meeting in Bali, Indonesia in 06/2014. These conferences attracted most lead firms in the sector, including those with a history of engagement in Southeast Sulawesi province, i.e., Mars Corporation, Olam International, Blommer Chocolate Company, Cargill, and Mondelez. The conference in Indonesia also included representatives from the Indonesian Ministry of Agriculture, the Indonesian Ministry of Trade, the Indonesian Coffee and Cocoa Research Institute, and the International Cocoa Organization (ICCO). My observations focused on how these actors identified and discussed challenges in the cacao industry and/or changes in the orientation of cacao intensification initiatives over time.

## Site Selection and Analytical Logic

After reconstructing a general history of cacao intensification initiatives in Indonesia, I then selected four lowland villages in Southeast Sulawesi for an in-depth analysis of the land and livelihood changes shaped by such intensification initiatives. I began by triangulating across multiple lines of evidence (literature review, initial site visits, and secondary data on soils, topography, migration, and agricultural production) to produce an initial list of ~10 villages. Here I was aided by individuals from the World Agroforestry Center involved in developing agroforestry approaches in the area. All of these villages shared similarities in lowland forest ecologies, histories of indigenous Tolaki settlement and land use, and were home to numerous households that had re-organized their livelihood strategies around cacao production over the preceding three decades.

Site visits and informal interviews were then used to finalize the selection of four villages on the basis of distinctions in their histories of cacao and land governance. In considering these distinctions, I attended not only to differences in cacao intensification investment but to distinctions in earlier histories of state land claiming and cacao expansion (**Supplementary Table 2**). My focus in selecting sites on the basis of historical as well as contemporary distinctions in land governance (i.e., since the initial expansion of the crop in the late 1970s) was intended to account for the structuring influence of state land claims and control on trajectories of land-livelihood change in Indonesian context (e.g., Peluso and Vandergeest, 2001). For the sake of this study, I was also interested in how the historical distinctions in state land claiming, cacao adoption, and expansion worked alongside differences in intensification investment since the 2000s to inform pathways of land and livelihood change.

While this focus guided my initial analysis and data collection, however, and while the comparative distinctions between these four sites are introduced in **Supplementary Table 2** and explored in detail elsewhere (Kelley, 2018), it quickly became apparent that cacao intensification initiatives were failing to shift land use or livelihood practices even in those sites where cacao had taken firmest root historically and where cacao intensification investment had been significant and sustained over a nearly two-decade period (represented in this study by the case of Polia, and to some extent, by the case of Besulutu). My analysis of the four villages thus shifted from an emphasis on explaining *differences* in programmatic outcomes to an emphasis on explaining why programmatic uptake had been so persistent across the four villages *despite* distinctions across the sites.

In this sense, rather than attempt to tease out comparative distinctions across the villages, I treat the four villages as collectively comprising a case study that can speak to the limitations structuring intensification initiatives. Per this logic, I understand particular factors or variables as intervening in given areas or different historical moments without assuming the determinacy of that causal relationship across all space or all moments (Ragin and Becker, 1992). My analyses below are organized around those dynamics I believe are most relevant to understanding programmatic limitations despite inter-site distinctions.

## Documenting Intensification Initiative Outcomes on Land Use and Livelihood Practices

To understand how cacao intensification initiatives had shifted livelihood and land use strategies, I conducted household surveys in each of the four villages. In total, 207 surveys were administered (*Besulutu*:  $N = 56$ , *Unahoa*:  $N = 46$ , *Taowengga*:  $N = 58$ , *Polia*:  $N = 47$ ). All households with at least one member physically present in the village during the primary period of field research were included in the survey population and every third physical house in the village was sampled until a sample of 10–25% village households had been achieved. Sampling efforts were distributed evenly across all neighborhoods (*dusun*) with the goal of capturing distinctions in ethnicity and

associated distinctions in land-livelihood strategies that accord with neighborhood affiliation. No effort was made to stratify the sample by program participation as a key goal was to assess overall village engagement with cacao intensification initiatives.

The development of survey questions was an iterative process that involved reference to initial site interviews as well as survey instruments made available through Harvard Dataverse and ICPSR. Reference surveys from these databases were consulted for ideas on how to assess the linkages between land use policies, agrarian livelihoods, and environmental change in tree crop economies. Initial questions were then piloted with three households in each village. The final survey assessed the education and livelihood histories of each household member; household land use, control, and management; and histories of household engagement with cacao production and cacao intensification initiatives. Surveys took between 1 and 2 h to complete and were completed in Indonesian or Tolaki language alongside Safaruddin Sains, a student from *Universitas Halu Oleo*. To assure data quality and prevent respondent fatigue, household surveys were often conducted over multiple visits. All respondents were given an opportunity to refuse participation and no surveys were audio recorded.

Analyses of survey data presented below rely on a post-facto classification of households into one of three groups: **Cw**: cacao-growing households with access to cacao intensification initiatives, **Cwo**: cacao-growing households without access to cacao intensification initiatives, and **NC**: non-cacao-growing households. The goal of comparisons across these groups was not to causally link the programs to particular outcomes but rather to understand how demographic characteristics and land-livelihood relations differed in terms of program participation and across the four study villages given their historical differences. These comparisons thus explore differences in these dynamics along both village lines and in terms of program participation using linear mixed models with the *lme4* package in R (Bates et al., 2019). For instance, to make comparisons in terms of programmatic participation, cacao intensification initiatives (**Cw**, **Cwo**, **NC**) were modeled as fixed effects, village as a random effect, and individual models were built for household response variables of interest (e.g., land ownership or conversion). Survey data are also drawn on in this study to speak to the gendered and generational dimensions of extra-local work.

I then used land use surveys and remotely sensed data to more fully detail ongoing land changes and to cross-validate village-level shifts in cacao management and smallholder land use examined in the household survey. The boundaries of smallholder cacao fields are well delineated in the study area, with fields generally ranging from between one half hectare to two hectares in size. Land use surveys were conducted in a random sample of 289 such smallholder cacao fields (*Besulutu*:  $N = 69$ , *Unahoa*:  $N = 68$ , *Taowengga*:  $N = 75$ , *Polia*:  $N = 75$ ) by Safaruddin Sains in collaboration with two farmer leaders trained in GERNAS and SSCP extension practices. Due to limits in time and cost, no effort was made to link specific plots to households. Because of this, data from the land use survey only captures visible field conditions and cacao management strategies, including evidence of Cacao Pod Borer (CPB) and Black Pod Rot (BPR), BPR management techniques, pruning,

graft adoption and status, field following (e.g., long unharvested pods, dead cacao trees), and field conversion (e.g., felling of cacao trees, either partial or full, and evidence of newly planted commodity crops). These data do not attest to the presence or absence of agri-chemical use, certification, or the frequency of observed management practices.

Previously published remotely sensed analyses are also used to situate an analysis of smallholder land use changes in regional context. These analyses, detailed in Kelley et al. (2017) and Kelley (2018), were conducted by first producing a reference image for the year 2015 using cloud-masking and image filtering within Google Earth Engine (Gorelick et al., 2017) to composite >200 individual Landsat 8 scenes (30 m) (2014–2016) into a gap-free image. This image was subsequently classified using >500 field-collected data points to train a Random Forest “ensemble” classifier (1000 iterations, Belgiu and Drăgu, 2016) to differentiate between cacao, forest, and other dominant land covers. Data on land cover are integrated with datasets on tree cover loss from Kelley et al. (2017) and Hansen et al. (2013) to map tree cover loss in relation to cacao production over three time periods: 1972–1995, 1995–2000, and 2000–2015. Unfortunately, no direct comparison of these reference datasets is possible given differences in the reference year for available maps of tree cover (and by extension, for the calculation of loss rates). Both reference datasets however define tree cover loss as a state-shift from >25% tree cover to <25% tree cover, and dynamics of loss and gain measured by Kelley et al. (2017) from 1995 to 2014 follow the geographical contours of that reported by Hansen et al. (2013) over a similar but shorter period of time, 2000–2014.

## Explaining Observed Outcomes

Finally, to understand observed intensification outcomes in each of the four locations, I relied on qualitative data from in-depth interviews conducted within each of the four villages. My goal in using interviews was to identify commonalities across the four locations that could explain the programmatic limitations apparent from survey and remotely sensed data. Interview data with cacao producers, elders, and other inhabitants of the four study villages also allowed me to iteratively refine my analysis of how programs were operating. How, for instance, did the availability of price premia for fermented cacao in Polia modify the market challenges cacao growers were experiencing across all locations?

Central to this work—in addition to the interviews with village and farmer leaders detailed above—were 55 in-depth interviews conducted with smallholder cacao producers, 29 of whom had been supported by intensification initiatives. Interviewees were purposively selected from households that had participated in the household survey with the goal of capturing a wide range of variability vis-à-vis land access, gender, ethnicity, and livelihood strategies, and interviews were considered complete as findings saturated. All interviews took an open-ended format and sought to capture the goals, values, and aspirations shaping respondents’ engagement (or disengagement) with cacao intensification initiatives. Most interviews were also conducted during visits to individual’s fields and other parts of the landscape to enable qualitative findings to be cross-referenced with land use surveys and land change maps.

Throughout, qualitative data leveraged to explain findings are supplemented with insights from secondary and survey datasets. Secondary datasets drawn on here include unpublished datasets listing state forest holdings, mining concessions, formal industrial use rights, and agricultural concessions obtained in Kendari, Southeast Sulawesi from officials at the National Land Agency, Geospatial Information Agency, and the General Directorate of Estate Crops at various points in time between 2015 and 2019 (Direktorat Jenderal Perkebunan, 2013; BAPPEDA, 2018). Secondary data used for these analyses also include publicly available datasets on cacao yields (Direktorat Jenderal Perkebunan, 2013; FAOSTAT, 2018), and oil palm, logging, and paper and palm concessions (World Resources Institute, 2019). These data are used in this study to understand the extent of state and industrial land holdings and the relative change in cacao yields over time at district and national scales of analysis.

## RESULTS

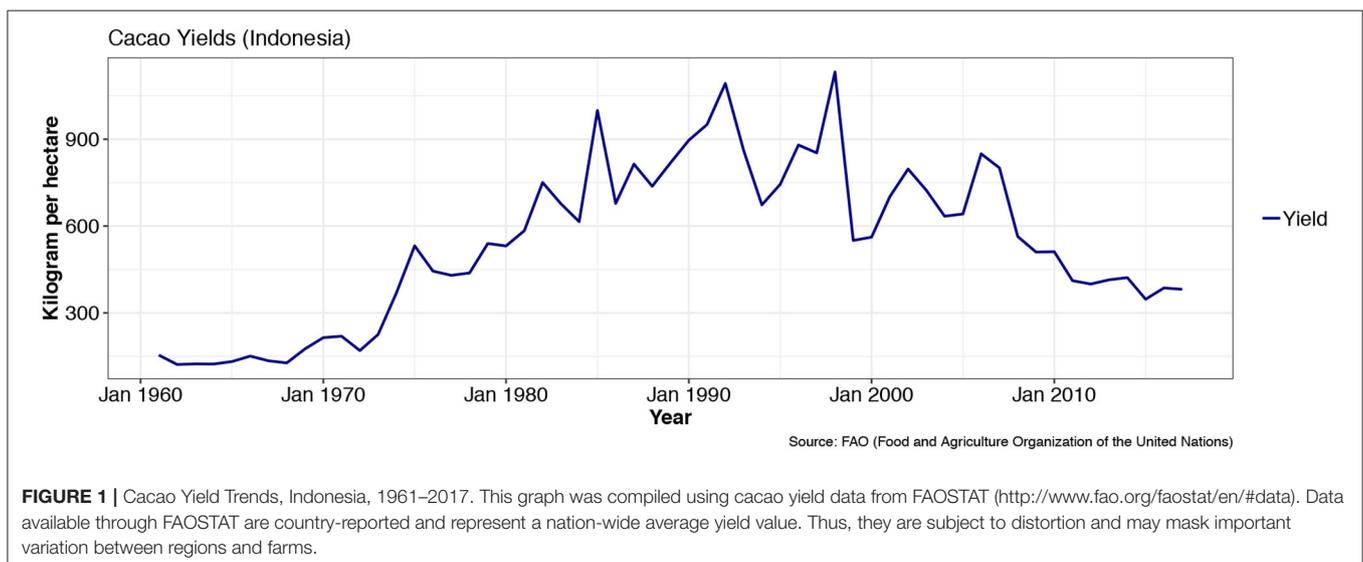
### Cacao Production and Livelihood Context

Livelihoods in Southeast Sulawesi have long consisted of a diverse mix of farming and off-farm work, and cacao has constituted an important part of this mix since the late 1970s, with household adoption of cacao peaking in the four study villages in the late 1990s. Most early adopters in the 1980s and early 1990s were Bugis in-migrants with sufficient capital to pay “land measurement” fees (*pembayaran ukuran*) for access to productive forested land for cacao. Such access was consequential specifically because of the extent of state land claims in the area by the 1980s (Kelley, 2018), and following the establishment of the 1967 Basic Forestry Law, which enabled the state to claim ownership over any land perceived to be under- or unutilized (Peluso and Vandergeest, 2001). In turn, growers with access to state-claimed forest typically benefitted from nearly 15 years of extraordinary

yields with few external inputs. Some individuals joke that the only production input they used during this time was “5-5,” their two hands.

High yields resulted in windfall profits when the Indonesian Rupiah collapsed during the 1997 Asian Financial Crisis (a boon for commodity producers trading against the dollar), leading Ruf and Yoddang (1999: 97) to argue that “[n]o other country has ever achieved such rapid development of this valuable cash crop, in terms of both the amount produced and the prosperity it has brought farmers.” Many early adopting individuals were able to parlay initial cacao profits into additional land holdings, particularly around the late 1990s when the “administrative ambiguity” (McCarthy, 2004) that marked the fall of the Suharto dictatorship made previously state-claimed lands more accessible. In some cases, individuals used the sale of established cacao fields in one location to finance expansion into the less established and expensive land markets becoming available elsewhere. One family in Polia, for instance, used profits from the sale of 2 ha of productive cacao in the late 1990s to acquire 12 ha of unplanted land in Unahoa.

In contrast, individuals who only first gained access to forested land for cacao during this temporary shift in the politics of land access have typically fared more “adversely” (Hickey and Du Toit, 2007). Because such individuals generally lacked access to export markets at this point in time, the Asian Financial Crisis was largely experienced as a time of diminished off-farm work opportunities and higher expenses for rice and food (Sunderlin et al., 2001; Breman and Wiradi, 2002), dynamics compounded by severe drought followed by heavy La Niña rains (Ruf and Yoddang, 2004). Simultaneously, by the late 1990s, pests and pathogens (particularly Cacao Pod Borer) began to emerge in many producing areas. Many households first planting their trees in the late 1990s thus experienced production challenges as soon as their trees began fruiting 3–4 years later. Though pest and pathogen challenges were still manageable with synthetic inputs



at this point in time, the price of fertilizers and other farm inputs had risen by 100–200% between 1997 and 1998 with the removal of Green Revolution-era price subsidies (Ruf and Yoddang, 1999)

These dynamics are reflected in sustained yield challenges in the sector (Figure 1, Supplementary Figure 1) and uneven patterns of household access to and control of land today. Households own and manage  $2.40 \pm 2.77$  and  $2.06 \pm 1.95$  hectares of land on average, accessing this land through diverse arrangements: land sharing (*bagi tanah*), sharecropping (*bagi hasil*), inheritance, leasing (*gadai*), and outright sale and purchase. Land use is largely oriented around the production of key commodity crops, including cacao, peppercorn, rubber, and increasingly, oil palm. Many households also manage fruit trees (rambutan, durian, banana, and langsung) and vegetables (including several varieties of corn, pumpkin, green beans, eggplants, and peanuts) for sale or home consumption. As has been observed elsewhere (Li, 2002, 2014), and reflecting this uneven history of state and market incorporation, access to productive lands is highly differentiated along lines of ethnicity, with indigenous Tolaki people generally possessing less overall land and land in cacao than Buginese in-migrants.

Extensive state claims over land continue to structure the uneven terms of access to remaining forested land. Such claims spanned 2.5 million hectares of land in Southeast Sulawesi as of 2018 (70.5% of provincial area and 96.0% of remaining forest) (BAPPEDA, 2018) and have enabled the state to support extensive rights and procedures for corporations and other institutional actors to exploit forested land while village and smallholder rights remain insecure, under-recognized, and vague within existing laws and policies (McCarthy and Moeliono, 2013). Within the four villages, for example, though some state-claimed land was historically transferred to smallholders for commodity production, 96.4% of remaining forest is held under state control or has been transferred to industrial actors. These tenurial circumstances facilitate ongoing agro-industrialization, as through the >300 concessions granted to corporate mining, forestry, and agricultural entities since 2009 (Direktorat Jenderal Perkebunan, 2013; BAPPEDA, 2018; World Resources Institute, 2019).

Finally, and in ways further detailed and described below, many smallholders are also highly dependent on off-farm, extra-local work, including that available on an expanding number of concessions in Southeast Sulawesi province. Much of this work is largely casualized, temporary, requires high levels of flexibility, and provides few viable prospects for forward advancement. The limited opportunities that exist in the formal sector (e.g., as bank tellers, government employees) also tend to depend on access to capital (Breman and Wiradi, 2002) as well as social connections and access to higher education (Ribot and Peluso, 2009; Rigg et al., 2016). While in general it is young men who out-migrate for work at construction, logging, and mining sites, the longer-distance migration of both individuals and families is increasingly common. Many such individuals work as waged or piecemeal laborers in logging camps and oil palm plantations, benefitting from slightly higher wages than can be obtained locally.

## Cacao Intensification Initiatives and Smallholder Participation and Perceptions

Cacao intensification initiatives in Southeast Sulawesi province began almost immediately following the onset of pest and pathogen losses in the late 1990s, and at first, were almost exclusively organized around farmer field schools (Table 1, Supplementary Table 1). While trainings have remained a core component of extension over time, approaches have been elaborated, and now include various production supports, including material support in the form of fertilizers and new cacao varieties.

Farmer field schools have generally been delivered by trained “Farmer Leaders,” organized around the PsPSP method of integrated pest and pathogen management. This approach, further detailed in Table 2, was first identified as promising elsewhere in the region during the “Cocoa Pod Borer Management Program” from 1995 to 1998 (ACDI/VOCA, 2005: 19) and has subsequently been shown to be successful in reducing pest and pathogen losses and improving yields without the application of pesticides or fungicides (Neilson, 2007; Mujiono et al., 2017). Beginning with the SUCCESS Alliance, growers also began to be trained in “Farming as a Business,” or in the “business management, marketing and economic aspects of cocoa farming” (ACDI/VOCA, 2005: 8). All subsequent programs with the exception of GERNAS have pursued this goal, generally emphasizing household-level economic management, savings, and finance.

TABLE 2 | Overview of the PsPSP approach.

Technique	Purpose
Frequent harvest ( <i>Panen sering</i> )	Frequent harvesting has been recommended on the order of once per week during peak harvest season or once every one to two weeks outside peak harvest season. This technique decreases the population of CPB by removing them from the field before they reach maturity, potentially achieving the same results vis-à-vis pest reduction as can pesticide application.
Pruning ( <i>Pemangkasan</i> )	Pruning is taught to growers as a technique necessary to manage farm micro-climate, preventing the overly humid conditions which foster BPR, a fungal pathogen. Pruning also ensures that tree resources are allocated to fruiting and that most branches receive equal sunlight, ensuring balanced growth.
Sanitation ( <i>Sanitasi</i> )	Sanitation refers to the removal of any pod husks or vegetative material afflicted by any pest or pathogen, ideally by burning it in a contained area at the edge of the farm ( <i>rorak</i> ).
Fertilization ( <i>Pemupukan</i> )	Fertilization is recommended given the likelihood of soil depletion during the course of the harvest season and is ideally done by spreading fertilizer in shallow depressions created by hoeing a small ring around the base of each tree. Growers are also recommended to provide trees with their first fertilization at the onset of the growing season.

This table synthesizes the PsPSP approach based on interview data from eight interviews with program representatives of SCPP and project staff at the General Directorate for Estate Crops involved in prior extension activities. It is also compiled from information contained within program documents (Darwis, 2004; ACDI/VOCA, 2005).

Cacao intensification initiatives have also promoted the adoption of new cacao varieties since 2007. In this area, given that most trees are still relatively young, varieties have largely been distributed as grafts installed into the sides of existing tree trunks, ultimately growing to replace existing branches. Beginning with AMARTA, growers were trained in side grafting techniques and graft nurseries were established. GERNAS, which was implemented in all four study villages, saw the fuller elaboration of this approach. This program, implemented through the Directorate for Estate Crops, provided growers with grafts, fertilizers, and money for pruning, and also installed grafts in growers' fields. While GERNAS has been critiqued for distributing flawed cacao seedlings, the grafts distributed through this program have been found to enhance productivity where growers regularly prune or cut top branches to allow for sufficient soil nutrients, water, and sunlight to reach grafts.

While training and production supports remain core to recent programs, cacao intensification initiatives have also increasingly focused on establishing direct trade linkages with major exporters, processors, and manufacturers. The SUCCESS Alliance initiated this focus, "thus paving the way for increased vertical integration within the industry, leading to quality increases over time" (ACDI/VOCA, 2005: 10). In Southeast Sulawesi, meetings began to be held under the SUCCESS project between Blommer (the largest cocoa processor in North America) and Continaf/PT Mitra Celebes (a cacao exporter) in 2005 (ACDI/VOCA, 2005: 61). In East Kolaka, the AMARTA project in 2007 then institutionalized the alliance between USAID (the funding agency), Blommer Chocolate, and Olam International (a larger cacao exporter and trader). Through this program, growers were told that they would receive higher prices for high quality fermented cacao if sold directly to buying stations established by Olam International (*Interviews*, see also Kindornay et al., 2012: 83-84).

The most recent program, SCPP, emphasizes certification for the first time. Supported by Cargill (the largest processor globally) and Mondeléz (a major manufacturer and end buyer), the SCPP program aims to train growers in methods of production for eventual certification under the UTZ labeling scheme. Growers have been trained in reducing their use of synthetic inputs, replacing these with organic substitutes, including compost, and diversifying farms through intercropping. The SCPP program also aims to extend low-interest credit for inputs to smallholders in coming years, as well as to develop a grower cooperative that forms an intermediary where certified beans are first assessed before being purchased by Cargill at premium. These modes of engagement, a response to some of the programmatic limitations I note below, are only partially assessed in this paper as they were just beginning during the primary period of field research.

Despite modifications, however, recent programs such as SCPP have continued to emphasize growers' lack of production knowledge and have continued to make farmer trainings and management changes central to their model of transformation. As one SCPP progress report articulates, for instance, "Many cocoa farmers have limited knowledge of good agricultural practices and lack access to resources needed to apply this knowledge to improve their business"

(Mondeléz International, 2015). Potentially corroborating this, only 38% of cacao-producing households within the four villages have participated in or otherwise received support from GERNAS and/or SCPP. Nonetheless, and despite relatively low formal participation in extension, almost all growers purport to know recommended techniques, in part because many trainings are now led by designated farmer group leaders, themselves neighbors and other villagers. Not only do growers frequently work alongside one another through reciprocal labor arrangements (*gotong royong*) but, as neighbors, they frequently socialize and exchange information.

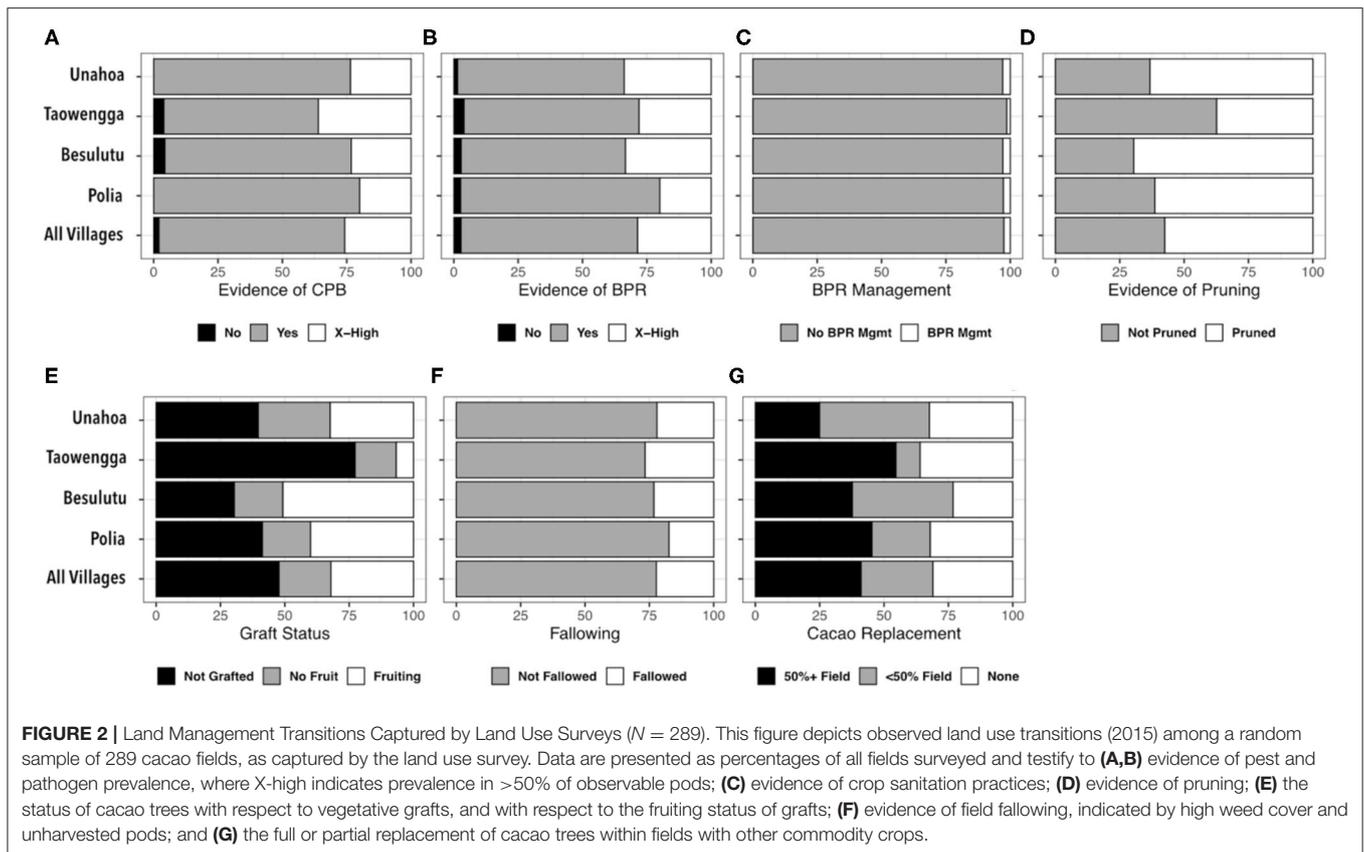
Important to interpreting the findings I present below, most people that have participated in cacao intensification initiatives also feel that trainings have communicated valuable means of addressing and understanding ongoing production losses. For example, with respect to fertilizer, many growers have mentioned that protracted use of urea fertilizer eventually makes the surface of the land so hard (*tanah keras*) that water does not percolate. This observation is consistent with the lessons of extension specialists who explain that urea fertilizer initiates plasmolysis, raising the temperature of the topsoil and killing micro-organisms. During interviews, program participants also regularly highlight "success stories," or instances where growers they knew personally had fully adopted recommended techniques and have achieved yield increases. Many people believe that, if fully implemented and followed as practiced, recommended production practices can thus generate higher yields and profits.

These data suggest that the sustained cacao production challenges growers confront do not derive from limitations in growers' production knowledge, the governance "gap" most commonly centered in program documents. This is particularly true in villages like Polia where cacao intensification supports have been continuous for a near two-decade period. As one grower expressed:

*"At this point, farmers' knowledge is already complete, our understanding [of recommended cacao production practices] is already sufficient... every year we are given programs, every year. Even if it's just a demonstration. Almost every day extension agents meet us in our fields. They ask: what problems do you have? What problems can we overcome together? The problem is that farmers are rarely satisfied [with the results]."*

## Adoption of Recommended Management Practices and Linked Land-Livelihood Outcomes

Indeed, despite wide awareness and acceptance of proposed techniques, the adoption of such approaches has been limited, producing a consistent gap between cacao intensification goals and outcomes. Land use surveys show that CPB and BPR remain highly prevalent in >80% of surveyed fields (**Figures 2A,B**), with BPR sanitation techniques adopted in only seven of 289 surveyed fields (**Figure 2C**), pruning practiced in <50% of fields (**Figure 2D**), and grafts established in only 27% of fields (a product of both low adoption and low survival) (**Figure 2E**).



Cacao intensification initiatives have also failed to raise cacao yields: Household surveys indicate that 92% of households experience yields <50% of what they were at peak production (achieved ~5 years after planting) and regional and national yield data suggest yields fell from a range of 784 to 1132 MT/ha in 1998 to one of 381 to 489 MT/ha in 2017 (Figure 1, Supplementary Figure 1).

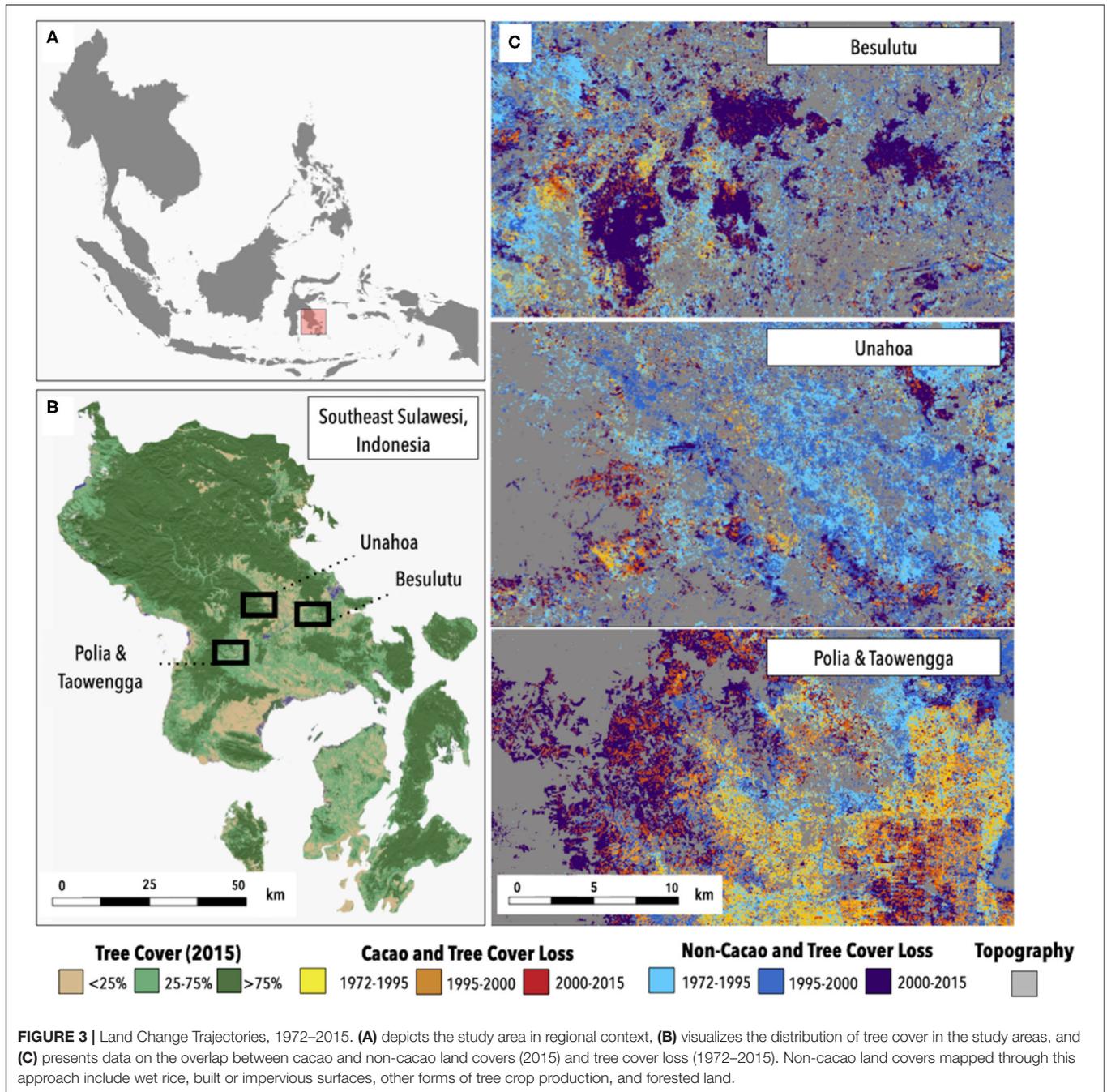
Rather than intensifying production, then, data suggest that most smallholders are transitioning their land use and livelihood practices away from cacao. Household survey data show that 10% of cacao fields were sold between 2010 and 2015 while 44% of households opened forested land for alternative crops and 36% of households divested from all production inputs for cacao, either synthetic or organic. Land use survey data also show that 24% of cacao fields had been completely fallowed by 2015 (Figure 2F) while 73% of fields had been cleared of cacao trees and planted in alternative commodities (Figure 2G). In this context, intensification approaches have also failed to alter land cover change trajectories: While cacao was a primary driver of tree clearance prior to 2000, lands cleared for other commodity investments in the four villages since 2000 now exceed all remaining land in cacao by 369% (Figure 3, Supplementary Table 3).

Interestingly, these trends appear largely consistent across the four sites despite variation in cacao intensification initiatives. They are also consistent with data from grower interviews in Polia and Taowengga, which reveal limited engagement thus far with the post-harvest production practices and arrangements

pursued through the SCPP initiative. Specifically, while some growers have participated in direct purchasing arrangements in the past, many individuals suggest that future direct purchase schemes will only be helpful if they do not require growers transport their beans to purchase stations individually, as is currently the practice. This was particularly true given scarcities of cacao beans in local markets at the time of this field work (2015). At this time, localized scarcities had led small-scale traders to begin competing for grower harvests, making these traders willing to come directly to growers' households to collect harvest (i.e., such that they could repay advances from warehouses). As one grower remarked, this created a scenario in which "chocolate is more sure [of being sold] than gold," a dynamic that further contributed to grower disengagement with post-processing approaches.

Data from the household survey also suggest only modest levels of household engagement with proposed certification in both locations (i.e., even those households formally enrolled in the program continue to use pesticides and herbicides and complain about the frequency of meetings). Grower disengagement with recommended practices and trainings is also acknowledged by program representatives. As one SCPP program officer stated, for instance:

*"There are growers whose management is correct, those whose management is almost correct, and yes, maybe there are many who would consider their management routine though it is not. So when we meet to discuss with them, we ask: how can you fulfill those things you're supposed to, even if they've already fallen off."*



*We have more communication. I tell them that the companies will be interested, and will provide an appropriate price (harga yang pantas), if only they can produce a bean that passes certification.”*

### Explaining the Disconnect Between Cacao Intensification Initiative Goals and Outcomes

Although cacao intensification initiatives have supported yield increases for 8% of households, they have otherwise failed to shift yield, livelihood, or land change trajectories even in those

locations such as Polia where investment in intensification has been sustained over nearly two decades. Why? This section draws on in-depth interviews and secondary data to foreground three factors driving the disconnect between stated programmatic goals and observable outcomes.

### Deteriorating Cacao Economics

First, and contrary to the argument that growers need to be trained in running their farms like a business, nearly all growers abandoning cacao production are doing so because

they feel the crop represents a declining economic proposition. When producers in Indonesia first adopted the crop in the late 1970s and early 1980s, they captured 23.7% of value along the cacao chain (Gilbert, 2006). By the mid-1990s, this share had dropped to 8.1%, and by 2015, the global average was 6.6% (Fountain and Hütz-Adams, 2015). Adjusted for inflation, cacao prices from 2000 to 2015 also fell to average lows matched at only two other points in 160 years of recorded price history (**Supplementary Figure 2**). Simultaneously, producer prices have become more volatile (Purcell, 2018). Interviews with cacao producers and evidence from cacao supply chain interventions elsewhere (Mithöfer et al., 2017; Wijaya et al., 2018) suggest these dynamics closely inform livelihood movement away from cacao. As two growers relate:

*“When cacao is young, it produces well and doesn’t require too much work. After it’s mature, it produces little and requires too much work. Meanwhile the price of chocolate goes up and down. As soon as my peppercorn yields, I will leave it.”*

*“How can we make money if the price of cacao is only 20,000 Rupiah? If the yield is what it is, I lose. I hire laborers to work my field. It’s different from those who work the fields themselves because they don’t know how much money they’re spending [on labor]. So I can count: Okay, if I prune the trees, if I fertilize the fields, if I use laborers continuously, I can count up my expenses and see if they are less than what I get per year in tons. It doesn’t balance out.”*

Another grower stated similar, explicitly connecting it to current extension:

*“If we’re only given this advice, these grafts, cacao production in Indonesia will continue to go down. Except among dumb farmers. Indonesia doesn’t have any more companies producing cacao. That’s proof it’s a bad investment. The expenses don’t match the costs.”*

These challenges are well-recognized by leading representatives of cacao intensification initiatives in Indonesia and other important supply chain actors. As the Consulting Board Member representing Indonesia to the International Cocoa Organization expressed in 2013, for instance, *“Farmers are getting 3% of the chocolate bar. This is the real fact. Sustainability also needs to address the distribution of impact. We need to address very clearly the entire supply chain from farm to bar.”* As the Managing Director and Chairman of one major processing company’s Executive Corporate Responsibility and Sustainability Committee stated, expressing a similar point, *“We do believe that price is key, we do believe that \$3,000 dollars is not a price for sustainable cocoa; we have to be prepared to pay more and we have to make sure that that money travels to farmers, we have to be prepared to pay more for chocolate, we have to be prepared to give smallholders a living.”*

Rather than engage the skewed terms of value capture along cacao supply chains, however, cacao intensification initiatives have largely responded to observed programmatic limitations by introducing opportunities for modest price premia that are predicated on additional farmer labor inputs. This has been

the case in Polia and Taowengga, for instance, where buying stations and certification schemes are being developed (**Table 1**). Rather than improve the profitability of cacao for smallholders, however, these responses generally impose increasing labor or capital requirements in the form of transportation costs and trainings, negating the modest price premia offered. As one person explained:

*“Farmers have to move fast. Why on earth would we ferment cacao? Ferment it several days, actually I’ve fermented it up to a week. The money’s the same. If the difference is just going to be 1-2,000 Rupiah [US \$0.07-\$0.15 per kilogram of raw cacao beans], I’ll let it be.”*

### Ongoing Livelihood Transitions Off-Farm

As detailed above, and despite the deteriorating position of growers within cacao supply chains, cacao intensification initiatives have remained predicated on the assumption of a full-time farmer, with yield increases dependent on routine (and occasionally, capital-intensive) labor inputs. Simultaneously, the sustained depression in cacao yields and incomes appears to contribute to growers’ reliance on off-farm work to buffer farm incomes—working alongside growers’ own perception of the labor-intensity of recommended approaches to produce a situation in which the labor needed for intensification is at odds with the labor most households either have available or are willing to provide. As one person expressed:

*“The advice is good and if we follow it, it works. The problem is... we have to find a side job to keep our life going and this makes it difficult to follow the advice.”*

Across the four villages, survey data show that 46% of adult males ( $N = 284$ ) and 18% of adult females ( $N = 243$ ) are now dependent on some form of extra-local work. Younger individuals are particularly reliant on such work. Of men and women under 35, for instance, survey data show that only 18 and 35%, respectively, identify farming as their primary source of income. These figures stand in striking contrast to the 60 and 59% of men and women over this age who do so (**Table 3**). Though ideally individuals would only out-migrate when farm tasks were minimal, most people do not choose when they leave villages for work. Many people instead wait for a *panggilan* (a call, or a request for work from a known labor recruiter). Off-farm engagements thus generally require a high degree of flexibility, particularly where individuals are indebted to labor recruiters. These conditions impede routine and time-sensitive investments in cacao.

Shifts in agrarian labor relations further limit the effectiveness of intensification initiatives. The relatively higher rates of male out-migration, for instance, constrain investment in cacao because many labor-intensive practices—pod collection, tree pruning, fertilization—are gendered male according to local norms. Interviews suggest that while some women are nonetheless willing to engage in these farm tasks, many prefer peppercorn, a flowering vine generally planted on *gamal* (*Gliricidia spium*), a fast-growing and nitrogen-fixing tree, because its production does not currently demand fertilization or

**TABLE 3** | Livelihood activities by age and gender.

	<25	25-35	35-45	45-55	>55	Total
<b>WOMEN</b>						
Farming is primary	12 (10.5)	31 (27.2)	42 (36.8)	19 (16.7)	10 (8.8)	114
Work outside village	10 (21.7)	21 (45.7)	8 (17.4)	4 (8.9)	3 (6.5)	46
Work outside province	2 (15.4)	8 (61.5)	3 (23.1)	0 (0)	0 (0)	13
<b>All women</b>	50 (20.6)	73 (30.4)	67 (27.6)	32 (13.2)	21 (8.6)	243
<b>MEN</b>						
Farming is primary	18 (14.3)	25 (19.8)	36 (28.6)	28 (22.2)	19 (15.1)	126
Work outside village	39 (29.5)	38 (28.8)	39 (29.5)	11 (8.3)	5 (3.8)	132
Work outside province	10 (26.3)	14 (36.8)	10 (26.3)	4 (10.5)	0 (0)	38
<b>All men</b>	74 (26.1)	72 (25.3)	67 (23.5)	43 (15.1)	28 (9.9)	284

Information on livelihood activities is provided for all individuals within surveyed households with any history of engagement in farming or non-local work ( $N = 527$ ). These data assess whether a given individual (i) engaged in agricultural production as their primary livelihood strategy; (ii) engaged in work outside their home village over the preceding year; or (iii) engaged in work outside Southeast Sulawesi province over the preceding year. Non-parenthetical values present the total number of individuals within a given category while parenthetical values present the proportion of the total within a given category per age class. Work outside village and work outside the province are not mutually exclusive categories; aggregate statistics on extra-local work presented in the main text account for this.

pruning. At the time of this study, peppercorn production was also more attractive economically (**Supplementary Figure 3**). Interviews suggest that many women also invest in peppercorn plantings and harvests to gain more control over associated earnings—important in buffering the irregularity of remittance income. As one woman explained:

*“Peppercorn means we have an income to ourselves. If we wait for our husbands [for remittances] it’s a month. What would you eat in a month if there was nothing on the side?”*

Generational shifts in smallholder livelihood trajectories also limit program impact. Although many younger individuals have inherited family fields and fallows, few have the desire (or often, ability) to manage fields in cacao. Consistent with trends throughout Southeast Asia, many younger individuals now consider farming a backwards occupation and prioritize experience outside villages, even where work is irregular, risky, or involves low remuneration (Rigg, 2006). Other individuals have translated college degrees into off-farm work as teachers or agency officials in nearby towns and villages. Interviews indicate that cacao plots are maintained where the crop serves as a retirement strategy or source of income for older household members but that many younger individuals inheriting fields

have fallowed or sold them. Others intermittently invest labor or capital in new commodity plantings or establish land or yield-sharing arrangements with landless households.

### Narrowly Cacao-Centric Visions of Livelihood and Forest Transformation

Finally, the inability of ongoing investments in cacao to realize programmatic goals surrounding forest conservation and smallholder livelihoods has been shaped by the alignment of interventions around corporate rather than smallholder aspirations. Specifically, programs have been limited by the narrowly production and cacao-centric approach being advanced, one which has worked at odds with the goals of either improving livelihoods or slowing ongoing forest losses.

As mentioned, the island of Sulawesi is the only major site of cacao production in Asia. It is also relatively free from some of the concerns surrounding child labor and political volatility that plague the other largest producing nations in West Africa (Neilson, 2007). Sulawesi, and its strategic importance in sourcing cacao for both markets, is discussed openly by program representatives and reiterated at industry conferences. These considerations help to explain what Neilson (2007: 241) has characterized as the “...movement toward the entwinement of private extension, input credit and purchasing through contract farming” that began to cohere around 2007 through programs such as AMARTA (**Table 1**). To date, no contractual binding exists between growers and end buyers, and such direct-purchasing programs have been contested by Indonesia’s domestic trading lobby. They are also legally ambiguous in Indonesia (*Interviews with Direktorat Jenderal Perkebunan staff, Neilson, 2007*).

Nonetheless, support for cacao now exceeds support for any other crop by a factor of twenty according to interviews with district officials at the Directorate for Estate Crops. In focal sites of production such as Polia, one of those regions identified as a potential center of cacao production moving forward, some growers have also now been trained by over five programs advancing similar techniques (**Table 1**). Rather than enhance movement toward sustainability in the province, however, this disproportionate emphasis on cacao as the vehicle for agrarian and forest transformation has inadvertently reinforced long-standing disparities in access to land and livelihood opportunities. Importantly, this has been to the detriment of livelihoods and forests despite the absence of a clear programmatic effect on cacao yields or production practices.

**Table 4** contextualizes this point by contrasting key demographic, livelihood, and land indicators for non-cacao producing households and cacao-producing households (here differentiating between cacao-producing households supported vs. not supported by recent intensification initiatives). As these comparisons evidence, intensification initiatives are generally supporting those growers with the greatest access to land and capital for cacao as well as those villages (such as Polia and Besulutu) where cacao is already best established (**Table 4**). The 38% of households supported by the two most recent intensification initiatives, GERNAS, and SCPP, for instance, in general own and manage more

**TABLE 4** | Educational, livelihood, and land disparities vis-à-vis cacao production and access to intensification initiatives.

	All			Polia			Taowengga			Besulutu			Unahoa			Means equal?	
	N	All	sd	Cw	Cwo	NC	Cw	Cwo	NC	Cw	Cwo	NC	Cw	Cwo	NC	Program	Village
<b>DEMOGRAPHICS</b>																	
Age (HH head)	207	42.3	10.9	44.4	42.9	45.3	40.8	41.9	40.0	44.2	44.3	38.5	44.2	54.6	38.8	ns	ns
No. members (HH)	207	4.60	1.84	5.08	4.00	4.67	3.58	4.23	4.08	5.33	4.57	4.45	4.69	5.57	4.88	ns	ns
Buginese ethnicity (prop HH)	207	0.54	0.50	0.96	1.00	1.00	0.67	0.23	0.29	0.85	0.71	0.14	0.69	0.14	0.19	**	***
Education (HH head)	207	1.33	1.20	1.19	0.61	0.67	2.17	0.91	1.25	1.22	1.00	1.41	1.46	1.86	2.04	*	***
Secondary ed (prop HH)	207	0.46	0.42	0.41	0.19	0.36	0.64	0.21	0.44	0.43	0.21	0.59	0.54	0.75	0.70	**	***
<b>LIVELIHOODS</b>																	
Land owned	207	2.40	2.77	3.59	2.25	1.20	2.96	1.42	1.10	3.83	2.87	1.27	3.99	2.56	1.72	**	ns
Land Mgd	207	2.06	1.95	3.41	2.73	1.10	2.10	1.45	1.36	3.04	2.58	0.67	2.71	1.81	1.27	*	*
Land leased	207	0.43	1.29	0.18	0.28	0.10	0.83	0.11	0.09	0.67	0.29	0.62	1.22	0.43	0.45	ns	ns
Land borrowed/sharecropped	207	0.26	0.74	0.19	0.78	0.27	0.29	0.47	0.42	0.20	0.21	0.10	0.00	0.00	0.04	*	*
Off-farm work (prop HH)	207	0.46	0.40	0.20	0.18	0.36	0.53	0.63	0.60	0.35	0.36	0.58	0.63	0.61	0.57	ns	***
Labor migration (prop HH)	207	0.35	0.37	0.13	0.29	0.11	0.25	0.40	0.57	0.30	0.29	0.42	0.30	0.51	0.45	*	**
<b>CACAO AND FOREST USE</b>																	
Cacao owned	132	2.01	1.58	2.40	1.81	NA	2.26	1.20	NA	2.43	1.46	NA	2.54	1.24	NA	***	ns
Have reduced inputs (binary)	132	0.36	0.48	0.42	0.22	NA	0.58	0.59	NA	0.26	0.29	NA	0.15	0.29	NA	ns	*
Grafts installed (binary)	132	0.56	0.50	0.81	0.33	NA	0.75	0.05	NA	0.96	0.00	NA	0.85	0.00	NA	***	*
% Cacao holdings converted	132	0.48	0.45	0.38	0.45	NA	0.65	0.45	NA	0.68	0.38	NA	0.44	0.14	NA	0.10	0.19
Forest converted (2010–2015)	297	0.44	1.03	0.87	0.28	0.00	0.21	0.12	0.30	0.70	0.29	0.45	0.69	0.29	0.34	*	ns

Data are presented as averages for all surveyed households ( $N = 207$ ), stratified by access to cacao and intensification initiatives. **Cw**: Cacao-growing households with access to SCPP or GERNAS ( $N = 78$ ), **Cwo**: Cacao-growing households without access to SCPP or GERNAS ( $N = 54$ ), **NC**: households that did not engage in cacao production at the time of the survey (2015). Prop. HH refers to the proportion of household members described by a given category and binary categories refer to whether or not a category applies (where 1: yes, 0: no). Off-farm work and labor migration capture employment activities of household over the past year, expressed as proportion of household members, and all non-binary data on land use and access is expressed in hectares. Results of all significance tests are indicated using \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ , ns: non-significant and were assessed using linear mixed models.

land than do non-supported households and depend less on labor migration or borrowed or sharecropped land (Table 4, *Livelihoods*). Relative to cacao-producing households without programmatic support, they also have higher access to secondary education for their children (Table 4, *Demographics and Education*).

Rather than amplify program impact, these disparities in program access perpetuate the exclusions that characterized the formation of the smallholder cacao economy (see Section Cacao Production and Livelihood Context); here, by equating seriousness in agricultural production with access to land for cacao. As one representative of GERNAS stated, for instance, explaining why grafts were not provided on farms under 1 hectare in size, “0.5 hectares? That’s not a farm. That’s not a farmer.” Similar to this in sentiment are the many program documents and trainings that foreground the importance of “Farming as a Business” (Table 1, Supplementary Table 1). Though it is not clear that targeting land-poor households would increase program impact vis-à-vis cacao yields, what is important is

how this dynamic sharpens perceived disparities in access to land-based livelihood opportunities among those individuals most struggling to hold onto and manage agrarian land holdings. Ironically, these disparities in programmatic access and support have also contributed to livelihood movement away from cacao in at least two senses.

First, for those individuals struggling to hold onto smallholdings, the disproportionate emphasis on cacao (rather than on other commodities or livelihood opportunities better suited to existing labor strains and a more diverse set of smallholder aspirations and preferences) has inadvertently positioned off-farm work and industrial concessions as more viable and inclusive sites of local work. The village of Besulutu illustrates this phenomenon well. Though cacao intensification initiatives in Besulutu began only 3 years after many individuals had first adopted the crop, 29% of households ( $N = 56$ ) transferred independently controlled smallholdings into oil palm through 35-year leases with corporate investors between 2010 and 2015. Interviews in Besulutu indicate that these transfers and

local support for a corporate oil palm concession in the village reflect a lack of support for non-cacao livelihood opportunities. As one person explained:

*How many times have we asked for irrigation support? If we had irrigation, those of us with land at the edge of the swamp would be able to produce our own rice. We could draw water from the river, water isn't an issue here. So many times we've requested it, but they [the government] don't want to focus on this."*

Simultaneously, and to the extent that programs such as GERNAS and SCPP have channeled labor-saving and material supports such as grafts and fertilizer to those individuals with the firmest foothold in the agrarian economy (i.e., in terms of land ownership and management), they have arguably subsidized the alternative commodity investments of such growers. This has implications for forest cover loss where forest fallows are opened for such investments. While households supported by the two most recent intensification initiatives, GERNAS and SCPP, were more likely to adopt grafts in existing fields, they also typically converted a greater proportion of their cacao fields to alternative commodities and cleared significantly more forested land for alternative commodities between 2010 and 2015 than did non-supported households (Table 4, *Cacao and Forest Use*). More data would be needed to confirm how investments inform these clearances. Nonetheless, what appears clear is that inequitable pathways of growth are connected to the dynamics of smallholder livelihood tension and forest cover loss that intensification approaches purport to change for the better. Rather than alleviate these tensions, programs appear to be reinforcing them, here even in the absence of a clear yield effect.

## DISCUSSION

Cacao intensification initiatives propose to steer processes of development in smallholder cacao economies toward greater sustainability for both people and their environments. In practice, however, these approaches have largely failed to significantly increase smallholder yields, improve livelihoods, or slow the pace of land use and cover change despite nearly two decades of investment. This study documents and explains these limitations in four lowland villages in Sulawesi, Indonesia, where most smallholders are not intensifying cacao production but abandoning it. While some people now manage cacao as a short-term source of income while they wait for new commodity crops to yield, many people have begun to clear cacao trees from their fields. Other individuals have fallowed or sold fields as they re-orient their livelihoods around new sources of off-farm and extra-local work, including that available on a growing number of industrial estates in the province. Others are opening forested lands in pursuit of alternative commodity investments. The result is an uneven landscape of socio-environmental change: Farmland investment alongside forest clearance and land abandonment.

Beyond further documenting the limitations structuring cacao intensification initiatives in Indonesia, data presented here help to contextualize the dynamics of agrarian and forest change underlying these limitations. Specifically, data presented here

build on existing work in highlighting three factors fundamental to programmatic limitations. First, the long-term deterioration in smallholder value capture that is undermining grower interest in cacao. Second, the ongoing re-orientation of farming livelihoods around off-farm work, both by necessity and in ways informed by changing smallholder livelihood aspirations. And third, the narrowly production and cacao-centric approach to development that appears to be perpetuating rather than redressing the inequities informing smallholder livelihood challenges and ongoing forest loss. These factors work together to compel the pursuit of highly diversified (rather than specialized) livelihood trajectories such that individuals can best adjust when conditions and relative prices change—an orientation at odds with the focus on full-time farming necessary for actually realizing cacao yield increases.

Though these findings are particularly relevant to the Indonesian case, a growing literature suggests these insights will likely apply to other rapidly transitioning agrarian economies of the Global South. Challenges surrounding equitable access to land-based livelihoods, for instance, though acute in Indonesia, are present in all agrarian economies, as are observed shifts in agrarian livelihood strategies around off-farm, extra-local livelihood pursuits (Bryceson, 2002; Rigg et al., 2016). Further, though the challenges associated with deteriorating agricultural profitability and price volatility are particularly well-documented for the cacao sector (Gilbert, 2006; Fountain and Hütz-Adams, 2015, 2018), evidence of deteriorating producer profits and stability along other agricultural supply chains (Bacon, 2005; Howard, 2016; Stensrud, 2019; Guido et al., 2020) suggests that these findings likely apply to other sectors. This will be particularly true where intensification investments elsewhere are similarly predicated on increasing smallholder labor inputs.

From an applied perspective, this case thus suggests several broader insights for agricultural intensification initiatives. First, and echoing work elsewhere, this case highlights the limitations of an overly production or commodity-centric approach to agricultural sustainability (Bastos Lima and Persson, 2020). While this orientation is not entirely wrong, it is partial, and ignores the downstream supply chain context that is undermining cacao livelihoods at the same time it seeks to transform them for the better. Since the late 1980s, two firms have come to control >70% of cocoa couverture production in the global market; eight traders and grinders >70% of all cocoa trade; and six firms >40% of all chocolate manufacturing globally (Fountain and Hütz-Adams, 2015). Downstream consolidation has given the largest firms greater control over cacao supplies than any producing nation, eliminating the potential for price regulation within producer countries and reinforcing producers' position as "price-takers" (Fold, 2002). Simultaneously, non-commercial speculative trading in cacao futures has risen by 400% since 1986, injecting greater volatility in cacao markets while creating new avenues for risk-hedging and profit-making among lead firms (Purcell, 2018).

These downstream supply chain dynamics contribute to the long-term deterioration in producer economics informing grower movement away from cacao. Though not explored in this study, these dynamics also shape huge risk for smallholders

when farm-gate prices collapse, as was true when cacao prices crashed by 42.8% between 2015 and 2017 due to a 600,000 ton production increase in Côte d'Ivoire (Fountain and Hütz-Adams, 2018). Though cacao intensification schemes have evolved over the past two decades, nearly all approaches continue to take the cacao farm and farmer as the primary point of departure (Mithöfer et al., 2017; Wijaya et al., 2018). Findings from this study speak to the limitations of this approach and lend support to recent advocacy and research surrounding the importance of establishing minimum farm gate price criteria. These criteria should go beyond the premia offered by existing certification schemes and should apply to all growers, regardless of their production strategies (Mithöfer et al., 2017; Fountain and Hütz-Adams, 2019).

Second, this case suggests the need to re-envision the “farmer” slot with respect to intensification. While off-farm work has a long history in agricultural regions, the nature and locations of such work has changed, as have the agrarian contexts within which it is performed (Rigg, 2006; Kelly, 2011; Peluso, 2017; Kelley et al., 2020). Circular as well as permanent patterns of in and out migration for work are often the main livelihood choice of younger generations in agrarian regions (Rigg et al., 2016; Fox, 2018) and are increasingly common even among those households in the Global South with good access to agricultural land (Rigg, 2003; Winkels, 2008). This exodus of workers from rural areas has significant implications for land use and labor relations in many agrarian regions (Cole et al., 2015; Sunam and McCarthy, 2016), implications that remain under-accounted for in existing land use policy formulations (McKay, 2005; Hecht, 2010; Elmhirst and Darmastuti, 2015; Peluso and Purwanto, 2018).

For example, although ongoing livelihood transitions both constrain and shift the composition of agrarian labor, cacao intensification initiatives continue to be organized around the assumption of routine (male) farm inputs. Despite nominal focus on gender equity, for instance, all support for cacao intensification in Southeast Sulawesi must be delivered through farmer groups (Neilson, 2007), a grouping which largely excludes women (Colfer et al., 2015). This orientation is at odds with the dynamic of high male out-migration that appears to be re-gendering field management around female growers and crops more amenable to the specific labor preferences and constraints of such individuals. Though the land and labor shifts associated with off-farm transitions are likely to be highly site-specific (Cole et al., 2015; Kelley et al., 2020), findings from this study suggest that they will be necessary to attend to, particularly where intensification approaches require more on-farm labor than do conventional alternatives. This finding mirrors work from elsewhere suggesting that intensification efforts have overly downplayed the importance of labor constraints (and the emergence of more attractive labor investments) in agrarian areas (Ortega et al., 2016; Jayne et al., 2019; Kopper and Jayne, 2019).

Finally, this case adds to a longstanding body of scholarship highlighting the limitations of any approach to agricultural sustainability that assumes the question of markets (and market incentives) can be abstracted from local social and institutional relations (McCarthy and Cramb, 2009; McCarthy, 2012; Munroe

et al., 2014). Contemporary investments in cacao intensification are predicated on notion that market-led approaches (such as those facilitated by private agribusiness investments) can produce better outcomes for people and forests than was possible under state-led development regimes (Neilson, 2007). To date, however, market-led approaches have largely been agnostic to existing inequities in access to land and land-based livelihoods and/or the dynamics of land tenure and control that mediate and reflect these inequities (McCarthy and Robinson, 2016). Through their failure to engage this dynamic, such programs may be compounding rather than alleviating the disparities now informing land-livelihood tensions and transformations. Findings from this study suggest that such considerations are not supplemental to a focus on smallholder livelihoods and environmental sustainability but integral to them.

## CONCLUSION

Since the 2000s, and against a background of rapid agricultural expansion and forest cover loss, diverse initiatives have been introduced to mitigate the socio-environmental externalities associated with agricultural production while maintaining or intensifying existing yields. Despite sustained debate over the merits and costs of such initiatives, however, little work has explained the frequent disconnect between programmatic goals and outcomes. Findings from this study contribute to this gap with historical and mixed-methodological data from a key site of global commodity production and an important site of recent investment in agricultural intensification. Taken collectively, however, and while reiterating the importance of ongoing conversations surrounding agricultural sustainability, data presented here suggest that achieving more transformative outcomes will require greater attention to the power and resource access relations now redefining smallholder livelihood trajectories. In Indonesia and other rapidly transitioning agrarian economies, this will require a focus on the dynamics of supply chain concentration, land control, and uneven livelihood opportunity and change redefining what it means to be a smallholder “farmer.”

## DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by The Committee for the Protection of Human Subjects at the University of California, Berkeley (<http://cphs.berkeley.edu>). Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

## AUTHOR CONTRIBUTIONS

LCK designed the study, collected and analyzed the data, and wrote the paper.

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## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsufs.2020.529074/full#supplementary-material>

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**Conflict of Interest:** The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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