



# Modern Smallholders: Creating Diversified Livelihoods and Landscapes in Indonesia

Digby Race<sup>1</sup>  · Aneka Prawesti Suka<sup>2</sup> · Silvi Nur Oktalina<sup>3</sup> · Achmad Rizal Bisjoe<sup>4</sup> · Nurhaedah Muin<sup>4</sup> · Novita Arianti<sup>5</sup>

Accepted: 27 November 2021  
© Steve Harrison, John Herbohn 2021

## Abstract

Encouraging smallholders to diversify their livelihoods has been a long-held policy objective of many governments to create resilient rural communities that can cope with seasonal variations in food production and price fluctuations in commercial markets. Due to the dynamic nature of smallholders' livelihoods, the relative contribution of different sources to household income often remains unclear. Recent research in Indonesia used a household survey of a stratified sample of smallholders ( $n=240$ ) in eight villages (five districts) to obtain data of smallholders' income and the relative importance of agroforestry. The research analysed income data from the same households (80%) collected in 2013, 2017 and 2020, providing longitudinal data of livelihoods and household income. Results revealed important information about the nature of Indonesia's rural economy, whereby many smallholders received most of their income from off-farm sources (56% of income). While most smallholders still reported farming as their primary occupation, their families' livelihoods are diverse and mainly supported by non-farm enterprises. Even the mix of farming enterprises is evolving, with agroforestry a prominent land-use and source of household income in Indonesia (29% of income), indicating that smallholders are intentionally diversifying their land-use and livelihoods. Our research found that conventional agricultural enterprises generated just 14% of household income, yet remains vital for household food security. The high proportion of off-farm income for smallholders has important implications for land management and rural development across Indonesia, as smallholders forgo intensification of their farming systems and instead opt for diversification—and at scale, creating resilient landscapes and livelihoods.

**Keywords** Agroforestry · Diversification · Farm land · Household income · Off-farm income

---

✉ Digby Race  
drace@usc.edu.au

Extended author information available on the last page of the article

## Introduction

While the world's population is becoming increasingly urbanised, smallholders (small-scale farmers who manage <2 ha) remain important land managers—with an estimated 480 million smallholders, who comprise 84% of farm enterprises and manage 12% of the world's agricultural land (Lowder et al. 2016). Most smallholders manage mixed farming systems that diversify beyond commodity agriculture, yet little is known about how their livelihood strategies are changing to meet varying opportunities and pressures (Gautam and Andersen 2016; Vadjunec et al. 2016). While smallholders in lower-income countries are vital to a country's food security, there is concern that smallholders are not adapting at the scale needed to maintain food production (Thorton et al. 2018). Furthermore, there is increasing evidence, such as in China (He et al. 2020) and India (Reddy et al. 2014), that smallholders are pursuing opportunities beyond agriculture, leading to the transformation of local economies, rural landscapes and society. The global situation is reflected in Indonesia, where about 56% of the population now live in urban areas and cities with an increasing trend (O'Neill 2021), and agriculture contributed an average of just 5.2% per year to Indonesia's GDP during 2000–2010. Indonesia's Ministry of Agriculture (Ministry of Agriculture, 2015b) published the Grand Strategy of Agriculture Development (GSAD) 2015–2045 to guide the development of the rural economy from being largely focused on primary production to one based on high-value integrated bio-industries. While smallholders feature in the narrative of the GSAD policy, it is uncertain how smallholders with low incomes and marginal resources can increase their yields and grow high-value crops.

Smallholders also have a central role in Indonesia's evolving forest policy, particularly in terms of expanding the supply base for the commercial timber industry and undertaking reforestation of degraded landscapes. Smallholders are small-scale farmers whose traditional farming practices have commonly included some management of trees or forest management for multiple purposes (Race and Wettenhall 2016), typically by planting timber species on plots ranging from less than 1 to 2 ha (Erbaugh et al. 2017). There are significant areas of smallholder agroforestry and commercial plantations—at least 1.5 million ha in Java alone situated on community private lands—known as peoples' forests or *hutan rakyat* (Royo and Wells 2012) or as farmers' privately-owned forests (Fujiwara et al. 2018).<sup>1</sup> These smallholders are significant timber producers in the Indonesian forestry sector. In Central Java, smallholder production from private land generates more timber than plantation forests managed by the state-owned forestry enterprise, *Perum Perhutani* (Erbaugh et al. 2017). However, growing trees as a component of agroforestry does not necessarily translate into future prosperity for smallholders, as they typically face considerable economic, institutional and regulatory barriers when seeking to commercialize forest products (Maryudi et al. 2016; Nambiar 2019).

<sup>1</sup> Earlier studies describe privately owned forests as forest resources consisting of home gardens (*pekarangan*), dryland (*tegalan*), and woodlots (*alas* or *kitren*) (Fujiwara et al. 2018).

Also, there remains international concern about the extent the Indonesian government can effectively control the country's forest resources and its capacity to protect and manage forests sustainably (Siscawati et al. 2017; Royer et al. 2018; Sloan et al. 2019). A policy of people-centered social forestry is viewed by many governments, including Indonesia's, as a means to solving several forest management challenges (Gilmour 2016). Encouraging smallholders to be actively involved in forestry has also been recognised as a way to resolve the long history of conflict over land tenure between the state, local and Indigenous communities, and private companies (Purnomo and Anand 2014). It was during Indonesia's democratisation process that began in the late-1990s that the government looked to the potential of community-based forest management, with a key role to be played by smallholders, in its reform of forest policy. The purpose of Indonesia's forest policy at this time was to provide greater access to state-owned forests and resources for local communities and, therefore, contribute to poverty reduction among forest-dependent people (Lindayati 2002; Li 2007; Safitri 2010; Urano 2013). Whether commercial forestry contributes much to the income of smallholders in Indonesia, and if it is favoured by wealthy smallholders rather than poor smallholders is unclear. Even at a broader level, it is uncertain what contribution smallholders make to economic development because of the inherent difficulty of capturing accurate data (Midgley et al. 2017; Carle et al. 2020). At a landscape scale, the dynamics of land-use change are typically complex, multi-dimensional and non-linear, making accurate projections based on current trends notoriously difficult (Wilson 2007; Meyfroidt et al. 2018; Riggs et al. 2021). This article discusses recent research that explored the relative contribution (importance) of farm-based and off-farm enterprises to smallholders' household income (cash received), with special attention paid to income from agroforestry. The research described below also sought to clarify whether the proportion of farm and off-farm income varied over time, and was markedly different proportionally for smallholders in different 'wealth' categories. It also explored whether agroforestry (i.e. integrated farming of trees, crops and livestock) is favoured by high income households with a greater 'buffer capacity' and resilience than low income households (Ifejika Speranza et al. 2014). We have a special interest in agroforestry as planting trees on farmland indicates that smallholders are committing to a particular land-use for the life of the trees (i.e. the medium- to long-term, say 5+ years). Yet growing trees is typically a much less intensive crop to manage compared to common annual agricultural crops (e.g. cassava, rice), so affords opportunities for smallholders to allocate their time elsewhere, leading to enterprise diversification and potentially greater overall income.

## The Indonesian Context

### Smallholder Forestry in Indonesia

In the last few years, and especially since the election of President Widodo in 2014, the Indonesian government has initiated a large reform process of the management of state-owned forests and other lands, including initiating a widespread

**Table 1** Forest area established under individual schemes in Social Forestry program (September 2018) (MoEF, 2018)

Scheme of Social Forestry	Area (ha)	Percentage (%)
Village Forest	1,047,287	52.17
Community Forest	498,867	24.45
Community Plantation Forest	298,304	14.86
Forest Partnership	143,147	7.13
Customary Forest	27,950	1.39
Total	2,007,555 ha	100%

**Table 2** Data of Indonesia's Social Forestry program at the national and selected Provincial levels (September 2018) (MoEF, 2018)

Location	Target area for Social Forestry (ha)	Area established (ha)	Number of licences (units)	Number of households
Indonesia (national)	12,700,000	2,007,557	4,880	476,113
Province level (location of study sites):				
Yogyakarta	3,518	1,565	45	5,005
Central Java	1,514	9,804	31	10,361
South Sulawesi	393,131	51,360	454	32,177

social forestry program which aimed to transfer at least 12.7 million ha of land to smallholders for the establishment of commercial forests by 2019 (Siscawati et al. 2017; Royer et al. 2018; Herawati et al. 2017; Ministry of Environment and Forestry [MoEF], 2018). However, to date only about 2 million ha have been granted to smallholders, about 15% of 12.7 million ha target.<sup>2</sup> The area of forests established under the five schemes that comprise the social forestry program is presented in Table 1. Data about the social program at the national level and at the study sites for this research in the Provinces of Central Java, Yogyakarta and South Sulawesi are presented in Table 2.

The Community Plantation Forest (known in Indonesia as *HTR*) scheme was launched in 2007 and comprises about 15% of the area established to date by the whole social forestry program. The HTR scheme is mainly intended to support the nation's commercial forest industries by allowing smallholders to establish timber plantations designated as *Production Forests* (MoEF 2018). The forest area of the HTR scheme is much smaller than the area of forests established on private land (known as private forest, *hutan rakyat*), indicating that in some situations smallholders are confident in growing trees for commercial timber production as individuals without the need for direct support from one of the schemes in the government's social forestry program (Rakatama and Pandit 2020). The MoEF (2018) recently reported that the total area of private forests established was 5,149,746 ha, much

<sup>2</sup> Data from MoEF as at September 2018, distributed to the Social Forestry Working Group.

larger than the combined area of forests so far established under the social forestry program, indicating that smallholders have readily responded to market signals from the local forest industries.

Despite the government's ambitious target for the social forestry program, only a small area has been achieved (about 15%, see Table 1). The main factors that have led to the relatively small uptake of the various schemes in the social forestry program relate to constraints with the government and communities where social forestry program is targeted (Rakatama and Pandit 2020). The government has a complicated and lengthy bureaucratic process for obtaining licenses for commercial timber production, harvesting, transport and processing (Banjade et al. 2016; Sis-cawati et al. 2017); many of the government's staff lack the experience to manage relationships with diverse stakeholders and resolve conflict between different parties (Banjade et al. 2016; Royer et al.; 2018); and there tend to be weak relationships between government and non-government organisations, leading to poor coordination and understanding of how the different schemes in the social forestry program are intended to operate (Kusumanto and Sirait 2012). Since the President's launch of the 12.7 million ha target for the social forestry program in 2014, the MoEF has been streamlining the application (permit) process by reducing the steps involved and technical requirements (Banjade et al. 2016; Rohadi et al. 2017).

The government's ambition as expressed in the national forest policy is to have millions of smallholders trading profitably within the commercial forestry sector, yet this may not reflect the economic reality faced by smallholders. Understanding the global timber trade is warranted to explore whether the macro-economic conditions (e.g. long-term timber demand relative to supply in South East Asia) support the investment by millions of smallholders across Indonesia in commercial timber production.

## Global and Domestic Context for Commercial Forestry in Indonesia

The global annual production of industrial round wood was estimated to be about 1.8 billion m<sup>3</sup> in 2010, and is forecast to increase in volume to about 2.2 billion m<sup>3</sup> per annum by 2100, albeit the accuracy of long-term forecasts is fraught (Daigneult and Sohgen 2011). While annual production of industrial round wood is expected to increase over the long term, there has been a shift to increasing consumption of wood-based panels (made with cheaper composite timber) since 2000 and away from consumption of more expensive sawn timber (FAO 2018). Nonetheless, there is forecast to be a continuing increase in global production and consumption of sawn timber through to 2030, with the Asia and Pacific region anticipated to be a net importer during this period (FAO 2009). Recent data for Asia alone revealed a vast trade deficit of 73.8 M m<sup>3</sup> of industrial round wood (imports of 77.9 M m<sup>3</sup>) (FAO 2019), in line with earlier projections.

Indonesia exports several processed timber products, for example furniture, wood panels, paper, pulp, woodworking, and a mix of other products (e.g. prefabricated building items, chip wood, handicrafts and veneer) (MoEF 2018). While exporting high-value timber products has the potential to increase, analysts have found that the

furniture and handicraft manufacturers also face onerous regulations regarding production and exporting (International Tropical Timber Organization [ITTO], 2018a). If the regulations for exporting timber products can be streamlined, then there appears potential for Indonesia to increase exports of processed timber products to the USA for example, given the growing popularity of teak furniture globally yet that trade was valued at just USD 1 million per year (ITTO 2018b). Overall, the current and forecast global trade in timber generally, and sawn timber and wood-based panels in particular, will continue to increase, notably in the Asia–Pacific region. This suggests demand for commercial timber in Indonesia is likely to remain strong, yet whether this translates into competitive stumpage prices, particularly for smallholders, remains uncertain.

In response to international concerns about continuing tropical deforestation and the sustainability of Indonesia's commercial forest sector, the Indonesian government introduced a compulsory certification procedure for all timber exporters, as a process to verify the legality and origin of all timber sourced from Indonesia. While the certification process is proving challenging for all parties to consistently adhere to in Indonesia (Susilawati et al. 2019), including smallholders (Fujiwara et al. 2015), the international trend toward greater regulation of sustainable forestry is likely to continue (United Nations Department of Economic and Social Affairs 2021). The timber legality assurance system (*Sistem Verifikasi Legalitas Kayu*, SVLK) has been developed by the Indonesian government and now Indonesia exports SVLK-approved timber products to 166 countries, including 27 countries in the EU with a commercial value of USD 125.8 million up to December 2016 (Indonesia and European Union [IEU] 2016). Indonesia exports processed timber products and unprocessed logs to many countries, with China being the single biggest markets for processed timber products valued at USD 2.8 billion in 2017 (MoEF 2017). The combined value of Indonesia's processed timber exports reached USD 11.62 billion in 2019, with China consistently the single largest destination (MoEF 2020).

Indonesia's total log production in 2017 amounted to about 44.4 million m<sup>3</sup>, consisting of logs from plantations (about 38 million m<sup>3</sup>), natural forests (5.4 million m<sup>3</sup>) and privately owned or leased forests (962,940 m<sup>3</sup>) (MoEF 2017).

### Indonesia's Rural Land-Use

Land use is often dynamic in a country with rapid population growth and rising living standards, with conflict over land 'rights' common in Indonesia. Also, the expansion of agricultural land is one of the main drivers of deforestation in Indonesia (Bou Dib et al. 2018a; Kusriani 2011), which has a direct impact on the environment and the socio-economic status of the surrounding community (Bou Dib et al. 2018a;2018b; Pagiola 2000). There has been a large increase in the area of plantation crops over the past two decades, with about 15 million ha in 1997 to about 25 million ha in 2017. The main plantation crops include: oil palm, coconut, rubber, coffee, cocoa, cloves, cashew and sugar cane, with dominant crops and markets varying throughout Indonesia. While the area of rice fields declined slightly (about 4%) over the same 20-year period to about

8 million ha in 2017, the nation's total rice yield increased by over 50% to about 75 million t (Statistics Indonesia [SI], 1998; SI, 2018). The main reason for the decline in area of rice fields was the conversion of farm land into settlements and buildings (Firdaus and Budisusanto 2016). There was a steady increase in the area of ponds for fish farming to 605,909 ha in 2017. In general, pond areas are built by converting mangrove forests of coastal areas (Pratama et al. 2016; Setiawan et al. 2015).

In 1997, the proportion of Indonesia's workforce employed in the agricultural sector was about 45% (39.4 million people). However, by 2020 the proportion of the workforce employed in agriculture had declined to about 28% (37.7 million), indicating employment is shifting away from the agricultural sector (World Bank 2021). The proportion of the workforce engaged in the agricultural sector is similar for most provinces in Indonesia, with the exception being the urbanized province of Jakarta (SI, 2018). These data indicate the declining importance of agriculture to Indonesia's economy, with most of the emerging employment shifting to the trades or services sectors (SI, 2018). Given the net loss of land from agriculture in Indonesia, recently estimated to be around 50,000–100,000 ha per year, a progressing increase in farm productivity (intensification) is required to maintain the country's overall level of food production (MoA, 2015).

The livelihoods of farmers tend to reflect the socio-economic capacity of the individual family and local economic conditions, rather than the more distant influences of macro-economic settings. For example, even though Indonesia has an expanding economy and growing population, it does not necessarily translate into profitable agricultural or forestry opportunities for smallholders. After all, many countries have raised concerns about national food security, yet smallholders often do not receive the price signals from domestic markets that encourage them to grow commodities on a profitable and sustained basis (FAO, 2017). Smallholders tend to be flexible in their land-use and livelihood strategies in response to market conditions, so many are willing to invest in trees and other unconventional crops when market demand shifts in favour of these other enterprises (Vogt et al. 2015). Predicting the nature and relative importance of different influences, and cumulative effects, on smallholder behaviour is invariably complex (Gautam and Andersen 2016; Kotir et al. 2017), yet allowing smallholders flexibility in their land-use and enterprise development has been found to be important for enhancing livelihood resilience (Vogt et al. 2015). Given that 60% of Indonesia's poor live in rural areas (BPS 2018), understanding how to stimulate the agriculture and forestry sectors remains a logical policy goal, particularly if the intersection of the two sectors—agroforestry, can contribute to the resilience and sustainability of smallholders' livelihoods and landscapes (Sinclair et al. 2017). Often intensification of farming is viewed as the most feasible way to improve rural livelihoods (Herrero et al. 2014), even if environmental trade-offs are apparent (Shaver et al. 2015; Smith et al. 2019).

## Materials and Methods

### The Value of Commercial Forestry to Smallholders' Livelihoods

As mentioned above, this article discusses research that aimed to understand how smallholders are diversifying their livelihoods and the relative importance of farm-based and off-farm enterprises to household income. The research also sought to understand whether agroforestry was routinely practiced by smallholders, and if so, was it favoured more by high 'wealth' smallholders with more farmland and greater financial reserves, than low 'wealth' smallholders.

The authors' facilitated local workshops among 10–20 smallholders to discuss and develop locally-relevant 'wealth' categories for smallholders in their village. Each workshop identified variables considered by the workshop participants as important indicators of a family's 'wealth' status (e.g. area of farmland, number and type of livestock, number and type of vehicles, size of home, social status within community). Once the 'wealth' categories were defined, each household within the village was allocated by the participants to either the 'low', 'medium' or 'high' category. The authors' then randomly selected 30 households in each village from the stratified sample with the proportion of 'low', 'medium' and 'high' wealth households reflective of the wider village population. The number of respondents in each 'wealth' category for each village was kept constant throughout the period of 2013 to 2020, which varied between the villages sampled (as indicated in Table 3).

The research analysed data collected from a sample of 240 households in eight villages (located in three provinces: Central Java, South Sulawesi, Special Region of Yogyakarta), obtained at three time points—2013, 2017 and 2020 (80% coincidence of households) to explore any changes in the data over time. Households that were not able to participate in the subsequent surveys in 2017 or 2020, were replaced by households in the same village which belonged to the same 'wealth' category as the absent household. This approach enabled us to retain a response rate to the survey of 100% in each village, with 80% of households included in the original survey in 2013 were re-surveyed in 2017 and 2020. The data was primarily collected using a household survey (structured questionnaire, mostly completed within 1–2 h), with the data analysed across different 'wealth' categories. While the household surveys were conducted in 2013, 2017 and 2020 (and data reported in this article), households were asked to report the financial data for the calendar year prior to the survey (i.e. the survey conducted in 2013 enquired about financial data in 2012). In Indonesia, the calendar year also equates to the financial year. The household survey was completed by a numerator using an interview style to ask a wide range of questions relating to the demographic, agronomic and financial aspects of the household and their farmland. The interviews were conducted with any adult from the household who volunteered to participate, which was usually a man as the nominated head of the household. All interviews to complete the survey were conducted in *bahasa Indonesia* (Indonesia's national language). A more detailed discussion of the household survey method used in this research is provided elsewhere (Race et al. 2019).



**Table 3** Overview of sample population for household survey (2013, 2017 and 2020)

Village	District	'low' wealth (%)	'medium' wealth (%)	'high' wealth (%)	Cultivated land area 2013 (ha)	Cultivated land area 2017 (ha)	Cultivated land area 2020 (ha)
Benjala	Bulukumba	27	67	7	1.11	0.74	0.94
Malleleng	Bulukumba	23	47	30	1.45	1.56	1.57
Dengok	Gunungkidul	33	54	13	1.19	0.94	0.86
Jepitu	Gunungkidul	10	77	13	1.3	2.07	1.55
Katongan	Gunungkidul	30	63	7	0.55	0.46	0.71
Giling	Pati	40	40	20	0.83	0.10	0.89
Gunungsari	Pati	47	43	10	1.04	1.26	0.62
Payak	Pati	70	27	3	1.98	0.85	0.36
		35%	52%	13%	1.18 ha	1.11 ha	0.94 ha

Source: Authors' primary data 2013, 2017 and 2020



**Fig. 1** Locations of study area districts, Indonesia

The research was conducted in three districts in Indonesia where the research team had established long-term relationships with the local communities in the districts of Bulukumba (South Sulawesi province), Gunungkidul (Special Region of Yogyakarta) and Pati (Central Java) (see Fig. 1). The three districts were selected to provide a cross-section of experiences about smallholder forestry and varying levels of government support and industry activity. Given the diversity of smallholder practices, commercial opportunities and wider socio-economic characteristics at the district or village level across Indonesia, we do not claim that the three districts involved in our research reflect the situation of all villages in Indonesia. The capability of each household (e.g. number of physically active adults, financial reserves) and the productivity of farmland varied within a single village and between the villages sampled. Nonetheless, within the constraints of our research, we believe the results from this study are informative of the wider context in which smallholder forestry is supported by government across much of Indonesia.

While the research team was familiar with the District forest agency staff and community at the study locations, the level of rapport with individual households was viewed as insufficient to influence how smallholders responded to the household survey. All households in the selected villages were identified to be belonging to one of three wealth categories (i.e. ‘low’, ‘medium’ and ‘high’ wealth), using a locally derived wealth index. The wealth category that each household belonged to is thought to have a correlation with the extent of enterprise diversification and the type and scale of agroforestry that smallholders may be involved in. For example, ‘low’ wealth households were anticipated to be most interested in short-rotation forest enterprises with a short period before financial returns, even if representing lower commercial value over the long-term, compared to ‘high’ wealth households which may be more willing to offset short-term income for larger returns in the long-term (e.g. high-quality large diameter timber production). It was also thought that ‘low’ wealth households would have a smaller area of farmland than ‘high’ wealth households, and so be more likely to be engaged in off-farm employment or non-farm enterprises.

**Table 4** Average household income in 2020 at study sites (USD)

Wealth category	Bulukumba	Pati	Gunungkidul
Average	3,590	2,813	3,575
Low	1,014	1,210	2,632
Medium	4,024	2,976	2,299
High	5,733	4,254	5,794

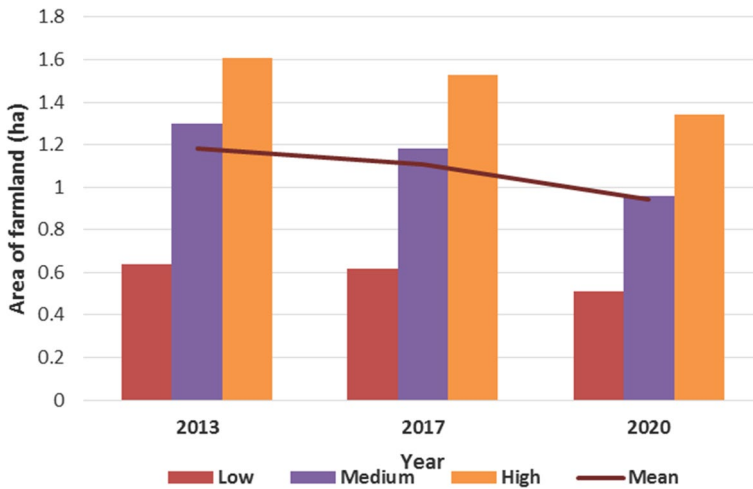
Source: Authors' primary data, 2020

## Overview of Sample Population

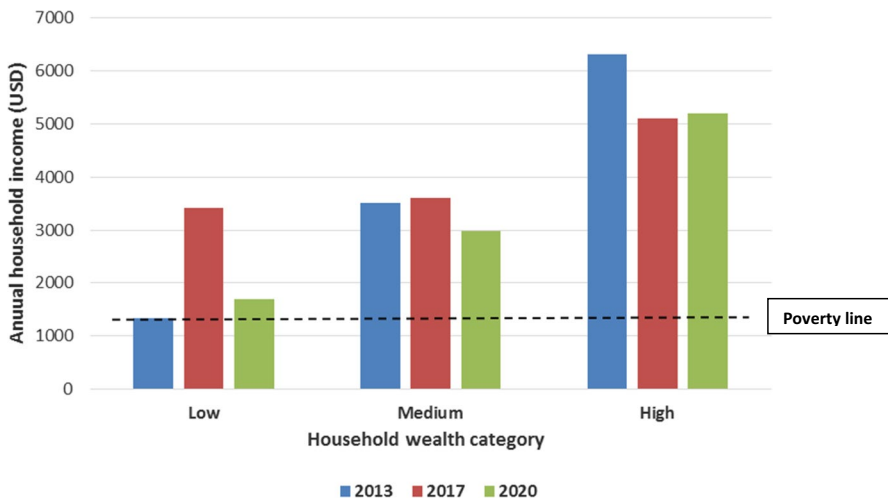
A high proportion of survey respondents who participated in the survey conducted in 2013 were re-surveyed in 2017 (overall 85%,  $n = 204$ ,  $N = 240$ ) and re-surveyed in 2020 (80% of sample surveyed three times) (Table 3). Most respondents were males in 2020 (90%,  $n = 216$ ), although a sizeable minority of respondents in the village of Malleleng (20%) were female. The majority of the sample population was from 'medium' (52%) or 'low' (35%) wealth households, with 'high' wealth households comprising just 13% of the sample (see Table 3), reflecting the wider village population.

## Results

The most common primary occupation of the survey respondent was reported as 'farmer' in all years surveyed. The average area of cultivated land ('Cultivated land area', Table 4) by the surveyed households decreased during 2013 to 2017 by about 6% (0.07 ha) and decreased further during 2017 to 2020 by about 15% (0.17 ha). When the data is disaggregated for the wealth categories, the average areas were: 'low' wealth of 0.64 ha, 'medium' wealth of 1.3 ha and 'high' wealth of 1.61 ha in 2013. When re-surveyed in 2017, the average area of cultivated land across all wealth categories had decreased during the period of 2013–2017 and again decreased during the 2017–2020 period. Over the whole period of 2013–2020, the decline in area of cultivated farm land was pronounced across all wealth categories, with data revealing a decline of about 20% for 'low', 26% for 'medium' and 17% for 'high' wealth households (Fig. 2). Critically in terms of food production, all wealth categories reported a decline in the area of irrigated rice production ('*padi*') during the 2013–2020 period, indicating that not only were farmers cultivating less farmland but they had also reduced the intensity of their farming than previously. Overall, the data also indicated that few households were seeking to increase household income by expanding the area or production of farming. Also, the areas for 'low' and 'medium' wealth households surveyed (87% of sample) are much smaller than the two hectares suggested by some as the minimum farm size in Indonesia to sustain a farm family's livelihood (Neilson 2016).



**Fig. 2** Average farmland per household (ha). *Source:* Authors' primary data 2013, 2017 and 2020



**Fig. 3** Average annual household income per 'wealth' category: 2013, 2017 and 2020 (USD, adjusted to 2020 data). *Source:* Authors' primary data 2013, 2017 and 2020

Although the 'wealth' categories were constructed using more than simply household income (such as, the number and type of vehicles owned by household, the number and type of livestock, construction material of house), it was anticipated that there would be a considerable difference in the amount of annual income between the three categories. The household income data was adjusted to 2020, with the inflation adjustment factors applied for 2013 data of 1.460 and 2017 data of 1.143. Also, the average family size reported in the household

**Table 5** Area of farmland per household across 'wealth' categories (2020)

Wealth category	Area of farmland (ha)
Low	0.51
Medium	0.96
High	1.34

Source: Authors' primary data, 2020

sample in 2020 was 3.4 (number of people living permanently in the family home). Using the Indonesian government's figure of the notional poverty line of USD 386.4 per capita per annum (Statistics Indonesia (BPS) 2019), it provides a guide to the poverty line for the households involved in this research of USD 1,313 per annum (see Fig. 3). It is important to note that farming households typically generate at least some produce that is consumed by the family, so in reality elevating the household by the commercial value of the produce consumed above the notional poverty line. The data revealed income differences as anticipated, although there was a noticeable decline in the average income for 'high' wealth households from 2013 compared to 2017 and 2020, and a marked increase in average income for 'low' wealth households in 2017 (see Fig. 3).

When the data was disaggregated for the different 'wealth' categories and the three study sites (8 villages in 3 districts), much more variation in average annual household income in 2020 was revealed (see Table 4). The households surveyed in the districts Bulukumba ( $n=60$ ) and Gunungkidul ( $n=90$ ) had a considerably higher average income compared to the district of Pati ( $n=90$ ). Also of note in the data was that the 'low' wealth households reported a higher average annual income in 2017 than the 'medium' wealth households in 2020, indicating that household income of a single year should not be used as the sole indicator of household capacity or wealth.

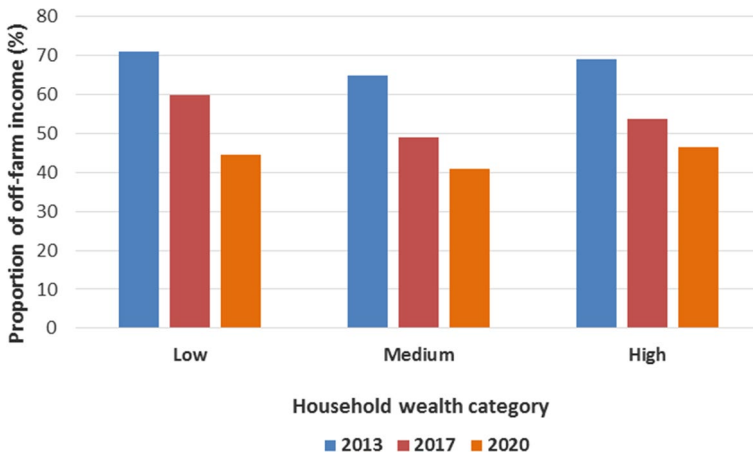
The research found that agroforestry provided an important contribution to all households, comprising an average of 29% to household income (i.e. 'low' 27%, 'medium' 31% and 'high' 28%), with this proportion being relatively stable over the three data collection times—an average of 26% in 2013, 31% in 2017 and 27% in 2020. Timber was the most important contributor to the household income from agroforestry, with timber more than half of the income from agroforestry (55%), with a slight increase in proportion from 52% in 2013, 58% in 2017 and 55% in 2020. It was somewhat surprising to find that even among 'low' wealth households that commercial timber production was an important source of income, given they were likely to be seeking income from short-rotation species and have little available farmland.

Most smallholders in the sample (mainly 'low' and 'medium' wealth households) had far less than the threshold area of farmland (2 ha) (Neilson 2016) to sustain a family's livelihood fully from agriculture, indicating that they must have other (non-farm) means of sustaining their livelihoods. Indeed, the average

**Table 6** Average household income from off-farm (non-farm) sources across 'wealth' categories, 2013, 2017 and 2020

Wealth category	Proportion of off-farm household income (%)			
	2013	2017	2020	Average
Low	71	60.3	44.7	58.7
Medium	65.5	49.1	41	51.9
High	69.4	53.7	46.6	56.6

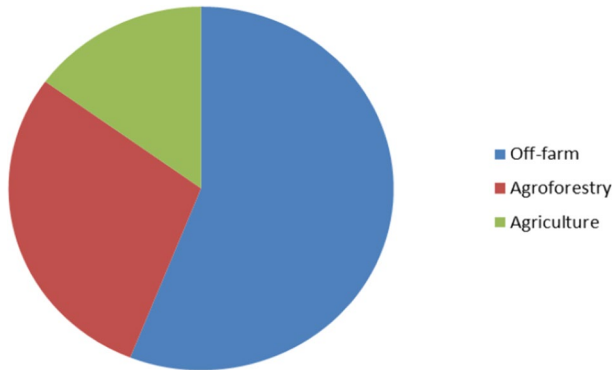
Source: Authors' primary data, 2013, 2017 and 2020

**Fig. 4** Average proportion of off-farm income. *Source:* Authors' primary data 2013, 2017 and 2020

farmland across all 'wealth' categories was considerably smaller than the suggested 2 ha threshold (see Table 5).

The area of farmland is a broad proxy for agricultural 'wealth', and the productive potential (site quality) of farmland is likely to be highly variably between 'wealth' categories within a single village, and between villages. That is, the same unit of farmland may have a very different productive potential for a 'low' wealth household in Katongan (Gunungkidul) compared to a 'high' wealth household in Malleleng (Bulukumba). Nonetheless, given that the average area of farmland from a diverse sample across eight villages in three districts is well below the 2 ha threshold, it indicates that most smallholders must be sourcing a considerable proportion of income from off-farm (non-farm) sources.

The research data revealed that smallholders rely heavily on off-farm (non-farm) income to sustain their family's livelihood, with the sample population across all 'wealth' categories obtaining on average a majority (55.7%) of their household income from off-farm sources (see Table 6). Although there is a declining trend across the 2013–2020 period, the data indicates a consistently high proportion of household income from off-farm sources (see Fig. 4).



**Fig. 5** Average proportion of household income from different sources—all households (%). *Source:* Authors’ primary data from 2013, 2017 and 2020

**Table 7** Relative average household income from different sources across ‘wealth’ categories (aggregate mean data from 2013, 2017 and 2020)

Wealth category	Off-farm (%)	Agroforestry (%)	Agriculture (%)
Low	59	27	14
Medium	52	31	17
High	57	28	15

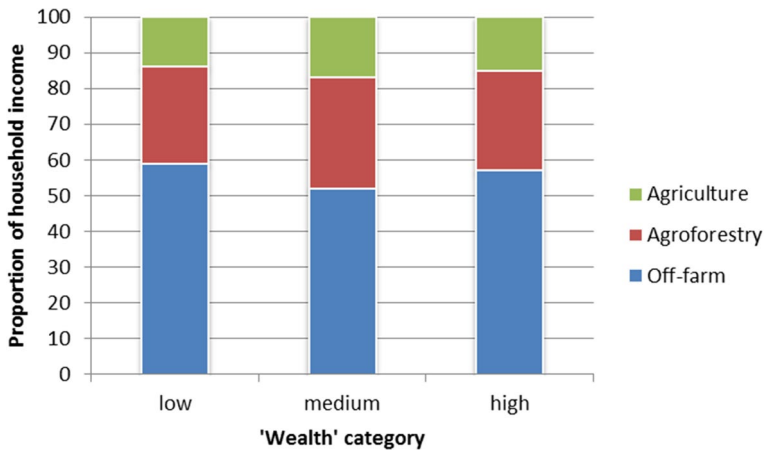
Source: Authors’ primary data, 2013, 2017 and 2020

Furthermore, the data from this research revealed agriculture (crops and/or livestock) contributes a small proportion of annual household income across all ‘wealth’ categories, ranging between 14–17% of annual household income (mean 15%). When the data is aggregated for all ‘wealth’ categories and averaged over the three years of collection, off-farm income (56%) is clearly a dominant source of income for many rural households (see Fig. 5).

Management approaches for timber production are often less intensive than that required for most annual/estate crops and livestock, so generally a medium- to long-term investment in tree crops will enable smallholders time to undertake non-farming employment or develop alternate small enterprises simultaneously with timber production (see Table 7).

Timber production may be an enterprise that can be further developed by smallholders with a range of property sizes, particularly if they have a focus on high-quality timber production. Given that timber provides the largest contribution to the overall income from agroforestry, there would seem a degree of complementarity for smallholders to develop high-value timber production (relatively less intensive management than commodity crops and livestock) alongside their off-farm enterprises (Fig. 6).

To detect if there was a sustained change in land-use in the three study districts, we analysed secondary data over a longer period (about 25 years). There was little change in area of ‘agricultural’ land-use in Pati and Gunungkidul over the



**Fig. 6** Relative average proportion of household income from different sources for 'wealth' categories (%) *Source:* Authors' primary data from 2013, 2017 and 2020

**Table 8** Land-use change in study locations, 1990–2016 (ha) (MoA, 2017)

Land-use	Bulukumba		Pati		Gunungkidul	
	1990	2016	1990	2016	1990	2016
Forest (ha)	4,216	4,167	23,682	25,241	33,110	21,553
Agriculture (ha)	25,571	101,404	108,147	115,727	109,766	110,275

'forest' is comprised of 'primary dry land forest', 'secondary dry land forest', 'primary wet land forest', 'secondary mangrove forest' and 'plantation forest'; and 'agriculture' is comprised of 'estate/plantation', 'dry land agriculture', 'dry land agriculture mixed with shrub' and 'rice field'

1990–2016 period, yet a marked increase in 'agricultural' land-use in Bulukumba over the same period. Similarly, there was little change in the 'forest' area in Bulukumba and Pati during the 1990–2016, and a marked decline in 'forest' area in Gunungkidul over the same period (see Table 8).

## Discussion

This research found that household income for smallholders can fluctuate markedly, with the data indicating that high 'wealth' households may earn little more than medium 'wealth' households in a given year. While the fluctuation in income from agriculture is not a new phenomenon, it partly explains why smallholders seek to diversify their income sources—even to the point of pursuing off-farm opportunities. Perhaps the most surprising result from this research is that the proportion of off-farm income is consistently high for farmers across all 'wealth' categories, and that commodity agricultural enterprises provide a relatively minor contribution to household income. The caveat with this interpretation is that smallholders typically



rely on agriculture for a range of produce consumed by families at home that is not usually counted as an equivalent to income, and again this resource could be expected to offset some of the fluctuations in household income and provide a level of food security that would not typically be available for non-farming households.

The survey also recorded that smallholders are engaged in a wide range of non-farming enterprises to sustain their livelihoods, including opportunistic labouring (e.g. contract labour for large building projects), semi-skilled part-time employment (e.g. working at agricultural and forestry processing factories, such as rice mills and sawmills) and self-managed small businesses (e.g. courier, food stall). While commodity agriculture remains a dominant land-use in Indonesia's rural landscapes, it appears that commodity agriculture has a limited role in sustaining the livelihoods of smallholders, particularly when households are constrained by the area of farmland. Analysts and policy-makers will need to be careful to distinguish between agriculture as a dominant land-use in rural landscapes and the relative importance of its contribution to smallholders' income. This point may be critical in terms of developing effective strategies for poverty alleviation in rural Indonesia—where our data related to 'low' wealth (poor) smallholders indicates that a small proportion of their income is sourced from agricultural production and they have small areas of farmland (0.51 ha in 2020).

High value forestry (i.e. well designed and managed, market-focused) appears profitable for smallholders who have access to a vibrant local economy, which in turn appears underpinned by increasing global demand for high-quality timber, meaning smallholders typically receive clear and strong price signals for producing timber. That agroforestry represents a considerable proportion of household income (average of 29%) for smallholders across the 'wealth' typology appears to be an important point for policy-makers, in that while land size logically correlates to the proportion of income from commercial forestry, smallholders who source a large majority of their income from off-farm sources still invest in tree crops. This finding is consistent with other analysts' views (Vogt et al. 2015) that smallholders tend to be opportunistic entrepreneurs, pursuing a flexible portfolio of enterprises (e.g. on and off-farm) and land-uses (e.g. annual crops and long-term forestry). Our research revealed an apparent contradiction that even when smallholders identified strongly with the aspirations, culture and identity of a 'farmer' (Verkaart et al. 2018), they may not actually source much of their income from commodity agriculture. Other authors have also advised caution about how the term 'smallholder' is defined and used (Vadjunec et al. 2016), as when narrow indicators of what defines a smallholder are used (e.g. proportion of income from agriculture, size of farmland), then it can misinform the design of policy instruments seeking to enhance the livelihoods of smallholders. For example, a focus on new crops or highly productive livestock may do little to enhance the livelihoods of poor smallholders when agriculture contributes just a minor part of their household income. Support to build their entrepreneurial skills or market knowledge may be a more effective strategy to enhance the livelihoods of poor smallholders with little farmland.

Given that the current generation of smallholders are engaged in much more than conventional farming, the ideology of smallholders may also evolve, with the next generation perhaps seeing themselves more as 'land managers' who manage

an integrated mosaic of land-uses and businesses, rather than seeing themselves as ‘farmers’. Seminal work by Scoones (2009, p.172) had earlier advised adopting a ‘mobile and flexible term’ for understanding smallholders’ livelihoods as ‘... in reality people combine different activities in a complex ... portfolio of activities.’ Others have found that resilience requires smallholders to develop sustainable farming practices together with livelihood diversification (Ifejika Speranza 2013), implying that to achieve socio-ecological resilience requires smallholders to pursue a strategy that combines a mix of both on-farm enterprises and off-farm employment.

The diversification pursued by the current generation of smallholders, such as increasing the range of enterprises, crop varieties (e.g. commodity and cash crops), or providing contract labour outside the farm (e.g. contract labouring on other farms or labouring in non-farm industries), signals the need for them to develop knowledge and skills that are transferable beyond farming, and needed by Indonesia’s evolving modern economy—analytical, creative, entrepreneurial and productive (e.g. participation in niche, high-value industries such as certified timber production for appearance applications and furniture or certified oil palm production) (Schonveld et al. 2019). While the capacity and wealth of individual smallholders will of course translate into different opportunities, smallholders around the world are generally adept at forming strategic alliances with intermediary traders and processors to gain access to markets (Brown and Ekoko 2001). Indonesia’s Grand Strategy of Agriculture Development (GSAD 2015–2045) (MoA, 2015b) sets out an ambitious agenda to move smallholders from simply being primary producers focused on the demands of local markets, to being skilled producers linked to integrated high-value bio-industries. It is an ambitious vision found elsewhere in Asia albeit with varying degrees of success (Cramb et al. 2017).

The GSAD could be translated into the commercial forestry sector, where increasing the efficiency and productivity of timber supply chains (value chains) could see more emphasis on localised processing of timber, at least for the preliminary stages of processing, so to reduce transportation of waste and water in ‘green’ timber. Also, the introduction of new technology can create a ‘step change’ in the opportunities and potential for smallholder forestry, such as veneer mills being able to produce more valuable products from small diameter logs than previously (Arnold et al. 2013). Building on the World Economic Forum’s (2018) concept of the ‘4th industrial revolution’, there appears potential to re-define and position commercial forestry as part of the modern economy, with smallholders being central actors. For instance, with improved coordination of value chains, with greater communication between actors—increasing expectation of products meeting tighter specifications in terms of quality, quantity and timing (e.g. processors exporting to markets international standards)—with accepted standards (specifications) enabling more digital trading (communication, market conditions, transactions) and automation of processing and manufacturing (shift from semi-skilled to high-skilled jobs), smallholders could remain valued suppliers. While there is exciting potential for smallholder forestry in Indonesia and other countries in Asia, there are numerous challenges and inefficiencies that need to be addressed before it becomes a reliable and sustainable sector (Midgley et al. 2017; Nambiar 2019).

The strong social networks that typically bind and support rural communities offer a pathway to build the capacity, knowledge and skills of smallholders—the ‘agency’ needed for resilience (Ifejika Speranza et al. 2014). Awareness of emerging markets, experience with production systems, and relationships with market brokers can all be shared within smallholders’ social networks. The concept of social networks has been applied in a wide range of fields, both the social and physical sciences (Borgatti et al. 2009; Scott 2011). Social networks have been shown to foster the capacity to buffer, adapt to, and shape change by providing resources needed to cope with external stresses and disturbances (Adger 2003; Scott 2011), and fostering innovation and collective activity (Folke et al. 2005; Moore and Westley 2011; Newman and Dale 2005; Race and Sumirat 2015). The role of social networks among smallholders is evident when new crops, practices or technology are adopted and shared over time in a village. Positive experiences with timber production from sengon (*Paraserianthes falcataria*) initially by just a small number of smallholders has seen the species planted more widely in a district, value chains established, and downstream processing expand. Social networks appear to also have helped smallholders from around Indonesia in pursuing a variety of strategies to enhance their livelihoods, with agricultural intensification, enterprise diversification (on and off-farm) and migration (Hapsari, Muin and Bisjoe, 2018). The strength of local networks among farmers has also been adapted to advisory/extension initiatives, with experienced smallholders supported to mentor their neighbours interested in agroforestry (Muktasam et al. 2019; Reid 2017).

## Conclusion

The research identified that the livelihoods of many smallholders in Indonesia are not tied closely to the production of commodity agriculture, despite the majority of survey respondents reporting their primary occupation was as a ‘farmer’. Indeed, the majority of the smallholders involved in this research derived most of their household income from off-farm sources and about 29% of their income from agroforestry. While the rural landscape still supports vast areas of productive agriculture, the livelihoods of most smallholders involved in our research have diversified beyond agriculture—to the point where the majority of smallholders’ income was sourced from off-farm sources. The agrarian appearance of the landscape belies the structural shift in the rural economy, whereby smallholders derive most of their household income beyond commodity agriculture. The results from this research raise doubts about pursuing a strategy of farm intensification as a means to improve smallholders’ livelihoods. This research found that most smallholders are intentionally pursuing a strategy to diversify their farmland (e.g. integrating crops, livestock and trees) and undertake off-farm employment or develop small businesses. It appears most smallholders are forgoing farm intensification and instead opting for land-use and livelihood diversification—arguably creating resilient landscapes and livelihoods.

It may be more beneficial for policy-makers to support the up-skilling of smallholders with generic and transferable knowledge and skills, so they have the flexibility to pursue on and off-farm opportunities as they emerge. The data from

this research raises critical questions about agricultural initiatives to enhance the livelihoods of ‘low’ and ‘medium’ wealth rural households, given that most smallholders earn just a small proportion of their income from agricultural crops and/or livestock. We recommend greater effort be invested to assist smallholders optimize the management of their portfolio of enterprises (e.g. staged development, integration of low- and medium-intensity enterprises, sequencing of investment, exploiting synergies) and their entrepreneurial capacity, reflecting where they derive the majority of their income. This research indicates this approach may be equally appealing and valuable for ‘low’ and ‘high’ wealth smallholders as both categories of households typically pursue a portfolio of on- and off-farm enterprises.

Indonesia’s GSAD (MoA, 2015b) also suggests that education and training for people engaged in rural development needs to be viewed as more than just formal education over an extended period, but also include short-term specific re-skilling for a wide range of careers, including smallholders interested value-adding to their current enterprises and developing generic skills that will enable them to gain employment beyond the agricultural sector—Indonesia’s rural economy is far broader and diverse than agriculture (e.g. market analysis, financial literacy, digital capability, networking). In relation to smallholder forestry, agencies and organisations responsible for extension programs need to encourage farmers to improve their overall business skills in managing their investment in commercial forestry. Analysts have recently found that economic gains were the main benefit from social forestry schemes in Indonesia (Rakatama and Pandit 2020). This means having a focus not just on the silviculture or technical aspects of forest management, but giving priority also to improving smallholders’ knowledge about timber markets and prices, market access and quality standards, and downstream linkages with processors and manufacturers. The Indonesian government’s Social Forestry program could play an important role in supporting smallholders diversify, if it the available support can be tailored to suit their land-use and livelihood goals.

Rural Indonesia, as elsewhere in the world (e.g. China, India) (Reddy et al. 2014; He et al. 2020), is witnessing a profound structural shift in the economy, with the modern smallholder needing to be an agile entrepreneur managing a diverse portfolio of farm-based and off-farm enterprises. In a country as culturally, economically and geographically varied as Indonesia (e.g. people live on more than 10,000 islands), synchronising macro-economic policies with the micro-economic conditions at the village level as experienced by smallholders is far from being a straightforward task, so it would appear unrealistic to expect a single approach or model farm to be relevant or successful throughout Indonesia. As such, allowing local stakeholders (including smallholders) a greater capacity to access and translate national-level support to invest in business and land-use arrangements that suit their personal circumstances will be important for smallholders to successfully transition into the modern economy. This research indicates that many smallholders have chosen to forgo farm intensification and have instead opted to mix diverse land-uses with pursuing off-farm opportunities—and at scale, smallholders have the potential to create resilient landscapes and livelihoods.

**Acknowledgements** The authors sincerely thank the many research informants who completed the ESD Household survey. We also thank our research associates and project partners at field locations for their invaluable support with data collection and field logistics over many years. The authors appreciate the valuable comments received by Dr William Jackson and three anonymous reviewers on earlier versions of this article. The research discussed in this article was a component of larger research projects that received primary support from the Australian Centre for International Agricultural Research (FST/2008/030 and FST/2015/040). Approval for the methodology was granted by the Australian National University's Human Research Ethics Committee (approval 2012/204) and the University of the Sunshine Coast's Human Research Ethics Committee (approval A/17/979).

## Declarations

**Conflict of interest** The authors declare that they have no conflict of interest.

## References

- Adger WN (2003) Social capital, collective action, and adaptation to climate change. *Econ Geogr* 79:387–404
- Agrawal A, Chhatre A, Hardin R (2008) Changing governance of the world's forests. *Science* 320:1460–1462
- Arnold RJ, Xie YJ, Midgley SJ, Luo JZ, Chen XF (2013) Emergence and rise of eucalypt veneer production in China. *Int for Rev* 15:33–47
- Banjade MR, Herawati T, Liswanti N, Mwangi E (2016) Introduction Tenure reform in Indonesia When? What? Why? Centre for International Forestry Research (CIFOR): Bogor, Indonesia.
- Borgatti SP, Mehra A, Brass DJ, Labianca G (2009) Network analysis in the social sciences. *Science* 323:892–895
- Bou Dib J, Alamsyah Z, Qaim M (2018a) Land-use change and income inequality in rural Indonesia. *Forest Policy Econ* 94:55–66
- Bou Dib J, Krishna VV, Alamsyah Z, Qaim M (2018b) Land-use change and livelihoods of non-farm households: The role of income from employment in oil palm and rubber in rural Indonesia. *Land Use Policy* 76:828–838
- Brown K, Ekoko F (2001) Forest encounters: Synergy among agents of forest change in Southern Cameroon. *Soc Nat Resour* 14(4):269–290
- Carle JB, Duval A, Ashford A (2020) The future of planted forests. *Int for Rev* 22(1):65–80
- Cramb R, Manivong V, Newby JC, Sothorn K, Sibat PS (2017) Alternatives to land grabbing: exploring conditions for smallholder inclusion in agricultural commodity chains in Southeast Asia. *J Peasant Stud* 44(4):939–967
- Daigneault A, Sohgen B (2011) Role of New Zealand forests in global climate change mitigation. Paper presented at the 2011 New Zealand Agricultural & Resource Economics Society (NZARES) Conference: New Zealand, 25–26 August 2011
- Erbaugh JT, Nurrochmat DR, Purnomo H (2017) Regulation, formalization, and smallholder timber production in northern Central Java, Indonesia. *Agrofor Syst* 91:867–880
- Firdaus MI, Budisusanto Y (2016) Analysis of land rights control in 2014–2015: case study: Lumajang District, Lumajang Regency (Analisa Penguasaan Hak Atas Tanah Tahun 2014 - 2015 (Studi Kasus : Kecamatan Lumajang, Kabupaten Lumajang). *Jurnal Teknik ITS*, 5 (2)
- Folke C, Hahn T, Olsson P, Norberg J (2005) Adaptive governance of social-ecological systems. *Annu Rev Environ Resour* 30:441–473
- Food and Agriculture Organisation of the United Nations (FAO) (2009) *The State of the World's Forests 2009*. FAO
- Food and Agriculture Organisation of the United Nations (FAO) (2017) *The future of food and agriculture—Trends and challenges*. FAO: Rome, Italy.
- Food and Agriculture Organisation of the United Nations (FAO). (2019) *FAOSTAT*. Forestry online database (updated 2nd August 2019). FAO
- Food and Agriculture Organisation of the United Nations (FAO) (2020) *Global forest resource assessment 2020: Key findings*. FAO

- Food and Agriculture Organisation of the United Nations (FAO) (2018) The State of the World's Forests 2018: Forest pathways to sustainable development. FAO
- Fujiwara T, Awang SA, Widayanti WT, Septiana RM, Hyakumura K, Sato N (2015) Effects of national community-based forest certification on forest management and timber marketing: a case study of Gunung Kidul District, Yogyakarta, Indonesia. *Int for Rev* 17(4):448–460
- Fujiwara T, Awang SA, Widayanti WT, Septiana RM, Hyakumura K, Sato N (2018) Socioeconomic conditions affecting smallholder timber management in Gunungkidul District, Yogyakarta Special Region, Indonesia. *Small-Scale Forestry* 17:41–56
- Gautam Y, Andersen P (2016) Rural livelihood diversification and well-being: Insights from Humla, Nepal. *J Rural Stud* 44(2016):239–249
- Gilmour D (2016) Forty years of community-based forestry: a review of its extent and effectiveness. Food and Agriculture Organization of the United Nations (FAO)
- Hapsari E, Muin N, Bisjoe ARH (2018) Variety of Community Forest Farmers' Income Sources of Income to Support Livelihoods in Bunja Hamlet, Bulukumba Regency. In: Proceedings of the National Seminar on Social Forestry (Ragam Sumber Penghasilan Petani Hutan Rakyat untuk Menjangkau Penghidupan di Dusun Bunja kabupaten Bulukumba. Prosiding Seminar Nasional Perhutanan Sosial)
- He M, Huang S, Zhang Y, Rahman MM (2020) From peasant to farmer: transformation of forest management in China. *Small-Scale for* 19:187–203
- Herawati T, Liswanti N, Banjade MR, Mwangi E (2017) Forest Tenure Reform Implementation in Lampung Province: From Scenario to Action. Centre for International Forestry Research (CIFOR)
- Herrero M et al (2014) Exploring future changes in smallholder farming systems by linking socio-economic scenarios with regional and household models. *Glob Environ Chang* 24:165–182
- Ifejika Speranza C (2013) Buffer capacity: capturing a dimension of resilience to climate change in African smallholder agriculture. *Reg Environ Change* 13:521–535
- Ifejika Speranza C, Wiseman U, Rist S (2014) An indicator framework for assessing livelihood resilience in the context of social-ecological dynamics. *Glob Environ Chang* 28:109–119
- Indonesia and European Union (IEU) (2016) VPA Annual Report 2014–2015. European Union FLEGT Facility
- International Tropical Timber Organisation (ITTO) (2018a.) Tropical timber market report: 16–31 May 2018. ITTO, 22 (10)
- International Tropical Timber Organisation (ITTO). (2018b). Tropical timber market report: 16–31 October 2018. ITTO, 22 (20)
- Kotir JH, Brown G, Marshall N, Johnstone R (2017) Drivers of change and sustainability in linked social-ecological systems: an analysis in the Volta River Basin of Ghana, West Africa. *Soc Nat Resour* 30(10):1229–1245
- Kusrini. (2011) Changes in land use and affecting factors in Gunungpati District, Semarang City (*Perubahan Penggunaan Lahan dan Faktor yang Mempengaruhi di Kecamatan Gunungpati Kota Semarang*). *Majalah Geografi Indonesia* 25(1):25–42
- Kusumanto Y, Sirait MT (2012) Community Participation in Forest Resource Management in Indonesia: Policies, Practices, Constraints and Opportunities. Working Paper WP0046–04. World Agroforestry Center
- Li TM (2007) Practices of assemblage and community forest management. *Econ Soc* 36(2):263–293
- Lindayati R (2002) Ideas and institutions in social forestry policy. In: Colfer C, Resosudarno IA (eds) Which way forward. People Forest, and Policy Making in Indonesia. Washington: Resource for the Future. Bogor: Center for International Forestry Research (CIFOR). Singapore: Institute of South-east Asian Studies
- Lowder SK, Skoet J, Raney T (2016) The Number, Size, and Distribution of Farms, Smallholder Farms, and Family Farms Worldwide. *World Dev* 87:16–29
- Maryudi A (2016) Choosing timber legality verification as a policy instrument to combat illegal logging in Indonesia. *Forest Policy Econ* 68:99–104
- Meyfroidt P et al (2018) Middle-range theories of land system change. *Glob Environ Chang* 53:52–67
- Midgley SJ, Stevens PR, Arnold RJ (2017) Hidden assets: Asia's smallholder wood resources and their contribution to supply chains of commercial wood. *Aust for* 80(1):10–25
- Ministry of Agriculture (MoA) (2015a) Indonesian production statistics 2015. Ministry of Agriculture
- Ministry of Agriculture (2015b) Grand Strategy of Agriculture Development: 2015–2045. Ministry of Agriculture
- Ministry of Agriculture (MoA) (2017) Indonesian production statistics 2017. Ministry of Agriculture

- Ministry of Environment and Forestry (MoEF) (2017) Indonesian forest production statistics 2017 (*Laporan kinerja Kementerian Lingkungan Hidup dan Kehutanan tahun 2017*). Ministry of Environment and Forestry
- Ministry of Environment and Forestry (MoEF) (2018) The State of Indonesia's Forests 2018. Ministry of Environment and Forestry, Republic of Indonesia, Jakarta, Indonesia
- Ministry of Environment and Forestry (MoEF) (2020) The State of Indonesia's Forests 2020. Ministry of Environment and Forestry, Republic of Indonesia, Jakarta, Indonesia
- Moore M, Westley F (2011) Surmountable chasms: networks and social innovation for resilient systems. *Ecol Soc* 16(1):5
- Muktasam A, Reid R, Race D, Wakka AK, Oktalina SN, Agusman; Herawati, T., Bisjoe, A.R.H. (2019) Enhancing the knowledge and skills of smallholders to adopt market-oriented tree management practices: lessons from Master TreeGrower training courses in Indonesia. *Aust for* 82:4–13
- Nambiar EKS (2019) Tamm Review: Re-imagining forestry and wood business: pathways to rural development, poverty alleviation and climate change mitigation in the tropics. *For Ecol Manage* 448:160–173
- Neilson J (2016) Agrarian transformations and land reform in Indonesia. In: McCarthy J, Robinson K (eds) *Land and Development in Indonesia: Searching for the People's Sovereignty*, pp. 245–264. Indonesia Update Series, College of Asia and the Pacific, The Australian National University. ISEAS, Yusof Ishak Institute, Singapore.
- Newman L, Dale A (2005) Network structure, diversity, and proactive resilience building: a response to Tompkins and Adger. *Ecol Soc* 10(1):2
- Oberman R, Dobbs R, Budiman A, Thompson F, Rossé M (2012) The archipelago economy—unleashing Indonesia's potential. McKinsey Global Institute, McKinsey and Company.
- O'Neill A (2021) *Urbanization in Indonesia 2019*. Statista ([www.statista.com](http://www.statista.com)). Accessed 10 June 2021
- Ostrom E (1990) *Governing the Commons: The evolution of institutions for collective action*. Cambridge University Press.
- Pagiola S (2000) *Land use change in Indonesia*. Background Paper Prepared for the Environment Department, World Bank: Washington, DC, USA
- Pratama AH, Gunawan B, Cahya B (2016) Social Impact of Mangrove Land Conversion in Dimensions as Rural Sustainability. *Jurnal Ilmiah Peuradeun* 4(3):357–368
- Purnomo EP, Anand PB (2014) The conflict of forest tenure and the emergence of community based forest management in Indonesia. *Journal of Government and Politics* 5(1):1
- Race D, Sumirat B (2015) Exploring the implications of social inequalities in community forestry: emerging lessons from two forests in Indonesia. *Int J Sustain Dev* 18(3):211–228
- Race D, Wettenhall G (eds) (2016) *Adding value to the farmers' trees: experiences of community-based commercial forestry in Indonesia*. em PRESS Publishing, pp 124
- Race D, Suka AP, Irawanti S, Surati Oktalina SN, Bisjoe ARH, Muin N, Purwanti R, Sumirat B (2019) Smallholder forestry: the role of commercial forestry in rural livelihoods in Indonesia. *Int For Rev* 21(2):225–237
- Rakatama A, Pandit R (2020) Reviewing social forestry schemes in Indonesia: Opportunities and challenges. *For Policy Econ* 111:1052
- Reddy DN, Reddy AA, Nagaraj N, Bantilan C (2014) *Rural non-farm employment and rural transformation in India*. Working Paper Series #57, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Research Program: Markets, Institutions and Policies
- Reid R (2017) Developing farmers and community capacity in Agroforestry: is the Australian Master TreeGrower program transferable to other countries? *Agrofor Syst* 91:847–865
- Riggs RA, Achdiawan R, Adiwinata A, Boedhihartono AK, Kastanya A, Langston JD, Priyadi H, Ruiz-Pérez M, Sayer J, Tjiu A (2021) Governing the landscape: potential and challenges of integrated approaches to landscape sustainability in Indonesia. *Landscape Ecol*. <https://doi.org/10.1007/s10980-021-01255-1>
- Rights Research Initiative (RRI) (2015) *Who own the world's land? A global baseline of formally recognized indigenous and community land rights*. RRI
- Rohadi D, Dunggio I, Herawati T, Wau D, Laode Y (2017) *Promoting the Development of Community Plantation Forest in Boalemo District Indonesia*. Centre for International Forestry Research (CIFOR)
- Royer SD, Noordwijk MV, Roshetko JM (2018) Does community-based forest management in Indonesia devolve social justice or social costs? *Int for Rev* 20(2):167–180

- Royo N, Wells A (2012) Community Based Forest Management in Indonesia: a review of current practice and regulatory frameworks. Background paper for The Forest Dialogue on Investing in Locally Controlled Forestry, Yogyakarta, Indonesia, 6–9 February 2021
- Safitri MA (2010) Community-Based Forest Management in Indonesia: solving two centuries of social and environmental injustice? In: Safitri MA (PhD thesis). Forest tenure in Indonesia: the socio-legal challenges of securing communities' rights. Leiden: Faculty of Law, Leiden University
- Sandbrook C, Nelson F, Adams WM, Agrawal A (2010) Carbon, forests and the REDD paradox. *Oryx* 44:330–334
- Schoneveld GC et al (2019) Certification, good agricultural practice and smallholder heterogeneity: differentiated pathways for resolving compliance gaps in the Indonesian oil palm sector. *Glob Environ Chang* 57:1–18
- Scoones I (2009) Livelihoods perspectives and rural development. *J Peasant Stud* 36(1):171–196
- Scott J (2011) Social network analysis: developments, advances and prospects. *Soc Netw Anal Min* 1:21–26
- Setiawan Y, Bengen DG, Kusmana C, Pertiwi S (2015) Estimasi Nilai Eksternalitas Konversi Hutan Mangrove Menjadi Pertambakan di Delta Mahakam Kabupaten Kutai Kartanegara. *Jurnal Penelitian Hutan Tanaman* 12(3):201–210
- Shaver I et al (2015) Coupled social and ecological outcomes of agricultural intensification in Costa Rica and the future of biodiversity conservation in tropical agricultural regions. *Glob Environ Chang* 32:74–86
- Sinclair F, Rosenstock TS, Gitz V, Wollenberg L (2017) Agroforestry to diversify farms and enhance resilience. In: Dinesh D, Campbell B, Bonilla-Findji O, Richards M (eds) 10 best bet innovations for adaptation in agriculture. CGIAR Research Program on Climate Change, Agriculture and Food Security, pp 14–19
- Siscawati M, Banjade MR, Liswanti N, Herawati T, Mwangi E, Wulandari C, Silaya T (2017) Overview of forest tenure reforms in Indonesia. Centre for International Forestry Research
- Sloan S et al (2019) The forest transformation: Planted tree cover and regional dynamics of tree gains and losses. *Glob Environ Chang* 59:1–18
- Smith HE et al (2019) Impacts of land use intensification on human wellbeing: Evidence from rural Mozambique. *Glob Environ Chang* 59:1–13
- Statistics Indonesia (BPS) (1998) Statistical Year Book of Indonesia 1998. Statistics Indonesia (*Badan Pusat Statistik*)
- Statistics Indonesia (BPS). (2018). Gross Regional Domestic Product of Provinces in Indonesia by Industry 2013–2017. Statistics Indonesia (*Badan Pusat Statistik*): Jakarta, Indonesia, 2018.
- Statistics Indonesia (BPS) (2018) Human Development Index 2017. Statistics Indonesia (*Badan Pusat Statistik*)
- Statistics Indonesia (BPS) (2018) Statistical Year Book of Indonesia 2018. Statistics Indonesia (*Badan Pusat Statistik*)
- Statistics Indonesia (BPS) (2019) Calculation of the national poverty line. Statistics Indonesia (*Badan Pusat Statistik*)
- Susilawati D, Kanowski P, Setyowati AB, Resosudarmo IAP, Race D (2019) Compliance of smallholder timber value chains in East Java with Indonesia's timber legality verification system. *Forest Policy Econ* 102:41–50
- Thornton PK et al (2018) Is agricultural adaptation to global change in lower-income countries on track to meet the future food production challenge? *Glob Environ Chang* 52:37–48
- United Nations Department of Economic and Social Affairs (2021) The Global Forest Goals Report 2021. United Nations Forum on Forests Secretariat. United Nations
- United Nations Development Program (UNDP) (2018) Human Development Index and its components. United Nations
- Urano M (2013) Problems in Indonesian Community-Based Forest Management policies: examination of Village Forest (HD) programs in the provinces of Jambi and East Kalimantan. Hokusei Gakuen University, Hokkaido, Japan
- Vadjunec JM, Radel C, Turner BL (2016) Introduction: The continued importance of smallholders today. *Land* 34(5):1–12
- Verkaart S, Mausch K, Harris D (2018) Who are those people we all call farmers? Rural Kenyan aspirations and realities. *Dev Pract* 28(4):468–479



- Vogt ND, Pinedo-Vasquez M, Brondizio ES, Almeida O, Rivero S (2015) Forest transitions in mosaic landscapes: Smallholder's flexibility in land-resource use decisions and livelihood strategies from World War II to the present in the Amazon Estuary. *Soc Nat Resour* 28(10):1043–1058
- Wilson GA (2007) *Multifunctional Agriculture: A Transition Theory Perspective*. CAB International, Wallingford, United Kingdom
- World Bank (2018) GDP per capita (current US\$). The World Bank
- World Bank (2021) Labor force, total—Indonesia. Derived using data from the International Labor Organization, ILOSTAT database on the 29th January 2021. The World Bank: Washington, USA. [www.worldbank.org](http://www.worldbank.org) on the 11th June 2021
- World Economic Forum (WEF) (2018) *The Future of Jobs Report 2018*. Switzerland, Geneva

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

## Authors and Affiliations

Digby Race<sup>1</sup>  · Aneka Prawesti Suka<sup>2</sup> · Silvi Nur Oktalina<sup>3</sup> · Achmad Rizal Bisjoe<sup>4</sup> · Nurhaedah Muin<sup>4</sup> · Novita Arianti<sup>5</sup>

Aneka Prawesti Suka  
alamatneka@yahoo.com

Silvi Nur Oktalina  
silvi.nuroktalina@ugm.ac.id

Achmad Rizal Bisjoe  
arhbisjoe@yahoo.com

Nurhaedah Muin  
nurhaedah\_muin@yahoo.com

Novita Arianti  
novi@trees4trees.org

- <sup>1</sup> Tropical Forests and People Research Centre, University of the Sunshine Coast, Maroochydore, QLD 4558, Australia
- <sup>2</sup> Forestry Research Development and Innovation Agency, Ministry of Environment and Forestry, Bogor 16118, Indonesia
- <sup>3</sup> Vocational College, University of Gadjah Mada, Yogyakarta 55281, Indonesia
- <sup>4</sup> Forestry Research Development and Innovation Agency, Ministry of Environment and Forestry, Makassar 90243, Indonesia
- <sup>5</sup> Trees for Trees, Srdol Bumi Indah VI, Semarang, Central Java 50261, Indonesia