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Agricultural land and crop production in Myanmar

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ABSTRACT

Southeast Asia's agricultural landscape is known for rice production in lowland areas, diverse upland areas, and the cultivation of 'boom crops' in the borderlands. Despite general similarities across different Southeast Asian countries, each has its own distinct history and patterns of land use, access, and ownership. However, little is documented, particularly for Myanmar, the second largest country in Southeast Asia. We therefore focus on agricultural land ownership and use patterns in Myanmar and employ nationally representative household survey data to document patterns at the national level and by agro-ecological zone. We explore inequality in landholdings, land tenure arrangements and documents, cropping patterns, and irrigation access.

1. INTRODUCTION

Asia underwent major expansion of its total agricultural land until the end of the 20th century (Zhao et al. 2006). Where land expansion was no longer feasible, intensification of land use occurred through increased usage of agricultural inputs resulting in increases in crop yields and land productivity (Hayward et al. 2021; Zhao et al. 2006; Fan and Chan-Kang 2005). The region is well-known for rice production, mainly in vast stretches of lowland areas. Yet a large share of its agricultural area is found in diverse upland and highland areas where a wide range of crops are grown, including maize and horticultural crops. Plantation crops such as oil palm and rubber also occupy a significant share of the total cropped area in Southeast Asia (Birthal et al. 2019).

Despite rapid and profound social and economic transformations occurring in many East and Southeast Asian countries, smallholders continue to dominate in the agricultural sector (Rigg et al. 2016; Lowder et al. 2021). Asian agriculture is characterized by owner-cultivated family farms and relatively small areas of rented land due, in part, to inefficiencies and frictions in land rental markets (Hayami and Otsuka 1993, Rigg et al. 2016). Farmers operate low per capita landholdings but perform additional economic activities to supplement their livelihoods (Rigg et al. 2016). Increasing real wage rates incentivize farmers to replace manual labor with machinery, and agricultural machinery rental markets have become more active and widespread (Otsuka et al. 2016, Diao et al. 2021).

Southeast Asia, including Myanmar, is characterized by varied human and ecological environments and uneven development (Rigg et al. 2016; McGregor et al. 2018). Its countries have distinct histories and patterns of land usage and ownership, differing levels of integration into global markets, and include a mix of low-, middle- and high-income economies (Rigg et al. 2016). Myanmar faces a dearth of documented evidence on its agricultural sector, including on landholding sizes, land use and ownership patterns, and rental markets. In this paper we use nationally representative household survey data collected in 2017 to describe Myanmar's land usage and ownership patterns.

The structure of the paper is as follows. In the next section, we provide background information on agricultural land and crop production in Myanmar. Section 3 describes the data used and our methods of defining and calculating variables of interest. Section 4 discusses land ownership, landholding distribution, and landlessness (focusing on landless households engaged in agriculture). In section 5, we present land use by season and by crop, and access to irrigation by season. We also compare the area allocated to different crops in each season. Section 6 zooms in on the interrelation of land tenure and cropping patterns. In the final section, we synthesize these findings.

2. BACKGROUND ON LAND AND AGRICULTURE IN MYANMAR

During the last half century, the total area of agricultural land in Myanmar increased substantially, from an average 10.6 million hectares in the 1960s to 12.7 million hectares in 2011-2018 (Table 1).¹ Due to the combination of cropland expansion, increasing demand for timber products, and rapid socio-economic development including the construction of large-scale infrastructure, valuable natural resources have faced substantial pressure. Between 1988 and 2017 Myanmar's forest cover decreased by about 11.1 million hectares, with an annual deforestation rate of 0.87 percent (Yang et al. 2019). Among all South, Southeast Asian, and Asia-Pacific countries, Myanmar has been identified as the most severe hotspot of mangrove loss, exhibiting 35 percent loss from 1975-2005 and 28 percent between 2000-2014 (Gandhi and Jones, 2019).

Table 1 Population growth and evolution of average agricultural land area

	1961-1970	1971-1980	1981-1990	1991-2000	2001-2010	2011-2018
Annual population growth (%)	2.3	2.3	1.9	1.2	0.8	0.7
Annual rural population growth (%)	1.8	2.2	1.7	1.0	0.5	0.4
Annual agricultural population growth (%)				0.1	-1.1	-0.9
Agricultural land total (million ha)	10.65	10.45	10.42	10.51	11.60	12.70
Agricultural land per capita (ha/per capita)	0.43	0.34	0.27	0.24	0.24	0.24
Agricultural land /population in agriculture				0.76	0.89	1.02

Source: FAOSTAT and WDI, 2021

Despite substantial expansion of farmland area since the 1960s, agricultural land per capita nearly halved over the same period due to population growth, falling from an average 0.43 to a mere 0.24 hectare per capita (FAOSTAT, 2021). However, the growth of the population working in agriculture has not kept abreast with overall population growth, likely related to structural changes taking place in the country (as indicated by lower population growth in rural as opposed to urban areas). Between the 1990s and 2011-2018 we find an increase from 0.76 hectare to 1.02 hectare of agricultural land per person active in agriculture. The observed increase in total agricultural land area during that period is likely in part driven by large-scale land concessions (Byerlee et al. 2014; Thein et al. 2018). The latter might then also cause an upward bias in the apparent agricultural land area per person active in agriculture, given that concession land is distributed extremely unequally. Detailed household-level data on land acquisition and cultivation instead suggests that households are facing shrinking land sizes in most parts of the country, with the partial exception of Mon State which experiences very high levels of migration and may be experiencing some emergent consolidation of paddy land (Belton et al. 2021).

More than half of the working population in Myanmar is employed in agriculture or allied activities as a primary job, and in rural areas this is as high as two thirds of the employed population (67.1 percent) (MoLIP, 2020). Smallholders are the backbone of Myanmar's agricultural production, accounting for about 90 percent of the country's paddy production

¹ Estimates of the agricultural area differ substantially depending on the source. MRLG (2017) for example estimated the total area of smallholder farms in Myanmar to be 13.1 million ha and an additional 2 million ha in agricultural concessions.

(Shivakumar and Hlaing, 2015). However, agricultural land is highly unequally distributed in Myanmar, and a large share of rural households do not own land (Belton and Filipski, 2019).

Throughout Myanmar's history, policy interventions in or related to the agricultural sector strongly shaped the agricultural landscape, including agricultural land markets and cropping patterns. We discuss these two topics in the subsections below.

2.1 Land tenure and markets

Land policy, laws, and administration in Myanmar have been shaped by colonial and post-colonial rule, an inwardly focused socialist period, a more outward-oriented market-based period, followed by a (neo)liberal democratic transition which abruptly ended early 2021 (Hayward et al. 2021). Throughout these periods, multiple layers of revoked and active laws have accumulated, often conflicting and contradicting one another. Land laws and administration are therefore difficult for farmers and investors to navigate (Boutry et al., 2017; Mark, 2016; Shivakumar and Hlaing, 2015).

All land and natural resources in Myanmar are the property of the State under the constitution (Hayward et al. 2021, p. 11). Prior to 2012, it was not legally permitted to buy or sell land, even though purchases and sales did occur in practice (Mark 2016, Boutry et al. 2017). The 2012 Farmland Law permits for purchases, sales, or other forms of transfers of land, provided the owner has a land use certificate (LUC) known as "Form 7". Prior to Form 7, the two main documents normally held by farmers were the farm booklet and "Form 105". Form 105, where present, is attached to Form 7. It includes a drawing indicating the plot's boundaries and size, the holder's name and type of land use allowed on the plot. Form 105 conferred land use rights, but these rights were not legally transferrable except through inheritance (Boutry et al. 2017)

Following the introduction of the Farmland Law, a major but hasty effort was made to register agricultural parcels. However, many parcels granted Form 7 already had a Form 105, whereas many parcels without Form 105 did not subsequently obtain a Form 7 (Mark 2016, Boutry et al. 2017). Moreover, the pressure to title a vast number of parcels within a short period of time caused numerous errors – often to the benefit of the elite and well-connected (Boutry et al. 2017). Rather than safeguarding tenure security, the process of registration and certification itself stirred land disputes (Boutry et al. 2017) whereas farmers with legal land tenure documents still risk land confiscation (Oberndorf, 2012; Boutry et al. 2017; Thein et al. 2018). Despite major efforts, many parcels are yet to be registered, particularly so in upland and border States. For example, data from Southern Shan show that only 20 percent of all agricultural parcels had either Form 105 or Form 7 in 2018 (Belton et al. 2021).

Accompanying the 2012 Farmland Law was the controversial Vacant, Fallow and Virgin (VFV) Land Law (Mark 2016). The VFV Land Law (2012, amended in 2018) enables individuals, firms, and governments to lease land designated as VFV for various types of development (Vicol et al. 2018). Although sometimes portrayed otherwise, the 2012 VFV law represents a continuation of a long line of laws, including the 1991 Wastelands Law, but stretching as far back as the 1894 Land Acquisition Act, deeming all land without legal titles to be 'wasteland' and providing the government the legal right to reallocate it to other users (Thein et al. 2018; Meehan, 2021). These provisions provided the basis for land confiscations well prior to 2012, which were particularly widespread under the SLORC regime during the 1990s. However, the 2018 amendment of the

VFV Land Law exceeded the stringency of earlier laws by adding the provision that farmers who do not register the use of land classified as VFF will have no use rights and may be fined or imprisoned if they continue to do so (Boutry and Thant, 2020).

The land certification program, in combination with the accompanying VFF Lands Management Law, thus provide legal foundations for potential land expropriations from a vast number of farmers, many of them in upland ethnic areas and in areas abandoned due to conflict (Boutry and Thant 2020; Suhardiman et al. 2021). Whereas the reforms in 2011 offered prospects of land restitution or compensation for rural households affected by land confiscation, this has been a complex promise to deliver on (Mark and Belton 2020). Meanwhile, even post-2011, land confiscations continued to affect rural households (Thein et al. 2018).

Agricultural land in non-Bamar ethnic communities in upland areas is often managed under customary tenure systems (Hayward et al. 2021). In the past, Myanmar policy makers mainly viewed customary land tenure systems and shifting cultivation practices as problematic for economic progress in rural areas (Vicol et al. 2018). Despite a larger openness towards customary tenures systems during the democratic transition period, legal reforms to protect the rights of customary land and shifting cultivators remained incomplete and insufficient. Cultivators are therefore at risk of land under customary tenure systems, and particularly land under shifting cultivation or fallowed land, not being recognized as legitimate land use (in Vicol et al. 2018 – citing Oberndorf 2012).

2.2 Rice-centered crop policies

Rice is Myanmar's main 'political crop'. It is the most commonly grown crop, a key source of income for farm households, the main staple in the national diet, and a key export crop (Aung et al. 2019). Other widely grown crops include pulses, oil seeds (sesame, groundnut) and maize (CSO et al., 2019). The diversity of agro-ecological conditions ensures that a large variety of other crops are cultivated in addition to these main crops. Throughout Myanmar's history, policymakers and leaders have established rice-centered policies and regulations aimed at boosting national rice production. In those parts of the country deemed suitable for rice production, farmers' freedom to choose their crops was restricted, sometimes forcing them to forego more lucrative options.

Between 1964 and 2003 the government applied compulsory procurement of crops, with individual household quotas based on sown area and anticipated yield, intended at fostering rice productivity and ensuring national self-sufficiency in rice. This policy was enforced most strongly in areas most conducive to rice production, particularly in the Delta region. Yet, farmers' incentives to increase productivity were low because farmers not only had to give a large share of their crop to the state to fulfill their "quota" obligation, they also had to sell the remainder to the state at artificially low prices that made it very hard to return a profit (Boutry et al. 2017; Kurosaki 2008). Farmers faced the threat of losing their land rights if they deviated from crop plans formulated by the government or failed to deliver the prescribed quota, especially regarding paddy cultivation (Shivakumar and Hlaing 2015, Boutry et al. 2017). This policy therefore also contributed to high levels of landlessness in the Delta (Boutry et al. 2017). The situation remained problematic when the government excluded rice from marketing liberalization in 1988 (Boutry et al. 2017). Only in 2005 was government paddy procurement abandoned and private traders allowed to export rice

(Boutry et al. 2017; Thein et al. 2005). Nevertheless, farmers were still required to grow rice paddy for at least one season of the year in designated paddy areas.

Only in 2016, policy changed to allow Myanmar farmers “freedom of crop choice”, yet farmers still don’t have the full capacity to choose the crops they cultivate (Thein et al. 2018). The policy announced by the Ministry of Agriculture, Livestock and Irrigation (MOALI) allowed freedom of seasonal crop choice only. The Farmland Law still requires farmers to follow the prescribed usage of the land based on the specific land category of the parcel.² Official permission is required to change land use types, for example for planting perennials on designated lowland or paddy lands or for establishing fishponds on ‘agricultural land’ (Boutry et al. 2017, Filipski and Belton 2018). Moreover, villagers and village authorities are not always aware of changes in legislation related to crop choice (Boutry et al. 2017).

In line with its focus on encouraging rice production, government loans from the Myanmar Agricultural Development Bank (MADB), the main formal provider of credit to farmers in rural areas, favored paddy production (Okamoto et al. 2021). MADB loan sizes are substantially higher for paddy compared to loans given for production of non-paddy crops, which was justified by the Ministry of Agriculture and Irrigation by paddy having higher financing needs compared to many other commonly grown crops (The World Bank 2014; Boutry et al. 2017). In 2012/2013, about 90 percent of the total loan amount disbursed by MADB was for paddy (ibid.). Since May 2018, farmers must prove their eligibility for MADB loans by showing the parcels’ Form 7 attached with Form 105 and the recommendation letter from a loan screening committee (Boutry et al. 2017; Okamoto, 2021).

2.3 Agro-ecological conditions and irrigation

Myanmar farmers operate under a diverse range of agro-ecological conditions. Four agro-ecological zones (AEZ) are typically distinguished: the Dry Zone, the Delta Region, Hills and Mountainous Areas, and the Coastal Zone (Figure 1).³ Rainfed agriculture is still the primary livelihood for majority of rural people (IWMI 2015). Yet, growing rainfed crops has risks, and access to water for irrigation is critical to reduce risks as well as to expand options available to farmers (Boutry et al. 2017; Rosegrant et al. 2018).

The Dry Zone is located in the center of Myanmar and covers roughly one-third of the country’s grain cropping area (Herridge et al. 2019). The rainfall pattern in the Dry Zone is bimodal, and the rainfed crop growing season is normally determined by the monsoon season—between May and October—and the dry spell in July (Boutry et al. 2017). Rice is grown as a rainfed monsoon crop or under irrigation. Other commonly grown crops include pulses, oilseed legumes, sesame, and sunflower. The Dry Zone is the most water stressed of Myanmar’s AEZs. Significant attention was given to investments in irrigation expansion in the Dry Zone, particularly in the 1990s, mainly motivated by the prospect of increased paddy production (Aung et al. 2017, Boutry et al. 2017).

² The land administration system in Myanmar defines four main categories, each with subcategories: (1) agricultural land; (2) forest land; (3) Vacant, Fallow and Virgin Land; and (4) other lands, including aquaculture land, mining land, residential land, village communal land and grazing lands (Thein et al. 2018). Agricultural land includes several sub-categories, the two most common ones are *le* (irrigated lowland designated for rice) and *ya* (‘upland’ – more elevated land not suitable for wet rice cultivation). Other sub-categories are ‘garden land’ and ‘khaing’ (emergent alluvial land).

³ This classification only roughly coincides with the agro-ecologies in the respective Regions, but we stick to these categories that are mapped to the State/Region levels for ease of interpretation and comparison to other reports on Myanmar.

However, the potential for increased crop production was hampered by uneven access, poor maintenance of irrigation infrastructure, and over-exploitation of water sources (Boutry et al. 2017).

Figure 1 Map of Myanmar’s State and Regions and agroecological zones



Source: CSO, UNDP, and WB (2019)

The Delta is due south of the Dry Zone, and covers roughly another third of Myanmar’s land area. Until the late 1920’s, the Delta provided a land frontier for those seeking new agricultural lands (Vicol and Pritchard 2021, Boutry et al. 2017). It has a humid tropical climate, with rainfall mainly during the monsoon season (May to October). The number of crops grown per year is dependent on the availability of irrigation water and salinity of nearby water sources. Crops can be grown all year round in freshwater areas, but in salt-water areas only rainfed crops can be grown during the monsoon season (Boutry et al. 2017). Particularly in the 1990s, the government

heavily promoted irrigation to expand summer paddy production, with the construction of sluice gates and draining channels as well as encouraging farmers' private investment in water pumps. To further encourage summer paddy production, summer paddy was exempt from compulsory procurement (Boutry et al. 2017). Farmers in this area have received the most pressure, historically, to produce paddy, contributing to high levels of land confiscation and landlessness (Boutry et al. 2017).

The Hills and Mountains cover roughly one-fifth of the agricultural land area and are situated in the north, east and southeast of Myanmar, bordering India, China, Laos and Thailand. This peripheral zone is highly ethnically diverse. The Hills and Mountains have often experienced armed conflict, and control over significant areas remain contested or under control of ethnic armed organizations.

Upland parts of the country that are less well suited for rice cultivation were able to maintain somewhat more diverse cropping patterns (Rammohan and Pritchard 2014). Nevertheless, these areas still suffered from restrictions to applying certain cultivation practices, such as fallowing and shifting cultivation (Thein et al. 2018). Where land tenure is organized through customary tenure systems, farmers are plagued by inadequate recognition of customary tenure in the existing national land use policy (Boutry et al. 2018). Moreover, a great many upland farmers cultivate land on a sedentary basis as *de facto* private property, but without formal land use certificates. They too are highly vulnerable to expropriation of their land.

The Coastal Zone contains the two coastal ends of Myanmar: Rakhine State at the western coast of Myanmar (bordering Bangladesh) and Tanintharyi at the southeastern coast of Myanmar (bordering Thailand). These areas contain coastal strips and mangrove areas, and lowland and upland ecologies further inland. These areas are vulnerable to climatic shocks, internal and border conflicts, including large-scale land-grabbing (Barbesgaard 2019). The western coast is prone to cyclone and storm surge flooding (Soe, Thant and Htun 2018) but also the scene of major ethnic conflict targeting the Rohingya population, with ensuing large-scale displacement and a major refugee crisis (Aung 2021). Tanintharyi, a thin strip of land only and one of the least populated regions in the country, holds nearly one third of private agricultural concessions in the country, particularly for oil palm and rubber (Woods, 2015).

3. DATA, METHODS AND DEFINITIONS

We perform descriptive analyses using the Myanmar Living Conditions Survey (MLCS) dataset. MLCS data was collected in 2017 from 13,730 households and is representative at the national, rural/urban, and regional levels. We use weights to correct for sampling bias and follow the classification of agro-ecological zones as suggested by CSO (2019): Dry Zone (Mandalay, Magway, Naypyidaw, Sagaing), Delta (Ayeyarwady, Bago, Mon, Yangon), Hills and Mountains (Chin, Kachin, Kayah, Kayin, Shan), and Coastal (Rakhine, Tanintharyi). Seasonal classifications also follow the setup of the questionnaire: the dry season is roughly from March to May, the wet season from June to October and the cool season from November to February.

In addition to descriptive analyses based on summary statistics, regression analyses are used to explore land tenure and cropping patterns. These regressions are intended to analyze the interplay of different plot and farm household characteristics and are not intended to show causal

linkages. Specifically, we explore the relationship between possession of land documents and parcel characteristics (land size, access to irrigation, type of crop grown, tenure status), farm household characteristics (age and gender of household head, rural or urban residence, total land owned or operated) while also controlling for AEZ.

Throughout the paper we use the term ‘landed households’ to describe households who report owning agricultural land, and ‘landless households’ to refer to those who do not.⁴ Households that access agricultural land via temporary arrangements (renting, sharecropping, borrowing or other) but do not report owning land are not considered landed. We define ‘agricultural households’ as households who operate any agricultural land, including parcels that are rented, sharecropped or borrowed. Households who owned land but did not self-cultivate in the past 12 months, either leaving their land uncultivated or renting or giving out their land to another farmer, are not considered to be agricultural households. In total, the MLCS dataset contains data from 8,228 agricultural parcels, 4,718 landed households, and 5,036 agricultural households.

For each parcel that the household owns, the MLCS questionnaire asks whether the household has a document. However, enumerators did not verify the document itself and the questionnaire does not ask to specify the type of land document. Whereas Form 7 is main ownership document formally recognized for agricultural parcels, it is possible that respondents also considered other types of documents such as Form 105 (the title document that pre-dates Form 7), tax receipts, rental agreements, or any other document that the respondent assumes qualifies as a land document.⁵

A caveat in this analysis is a potential underrepresentation of large-scale farms and plantations given that a population-based dataset such as MLCS likely does not capture farms which are not family-owned, which are for the most part large farms (Lowder et al. 2016). Large landholdings are often planted with perennial crops such as palm oil, rubber or sugarcane, therefore potentially leading to an underestimation of the share of farmland under permanent crops. Moreover, fallow land may be underreported given the troubled history recognizing fallowed land (see above), and given that land fallowed under customary tenure systems may not be considered ‘owned’ by its former cultivators.

4. LAND OWNERSHIP, LANDHOLDING DISTRIBUTION, AND LANDLESSNESS

4.1 Land ownership and distribution

Nationwide, thirty-seven percent of households own agricultural land: 49 percent of rural households and eight percent of urban households (Table 2). Landed households own on average 1 to 2 parcels and about 2.6 hectares of land. Slightly more households cultivate land (39 percent) compared to households owning land (37 percent). Urban agricultural households cultivate fewer

⁴ Ownership is self-reported based on the reported tenure status of the parcel.

⁵ Lambrecht and Mahrt (2019) focused on land tenure in Myanmar using the nationally representative 2015 Myanmar Poverty Living Conditions Survey (MPLCS). The MPLCS questionnaire asks a similar question on land documents and the authors find a similar share of parcels using the MPLCS as we find using the MLCS data in this paper.

parcels on average (1.3 compared to 1.7 parcels), but similar land sizes as rural agricultural households.

Table 2 Land ownership and cultivation, by AEZ and urban or rural location

	National	Delta	Coastal	Dry Zone	Hills
<i>Both rural and urban households</i>					
Landed households (owning land) (%)	37	25	40	43	54
Agricultural households (cultivating land) (%)	39	27	39	44	59
<i>Among landed households (owning land):</i>					
Number of parcels owned	1.62	1.49	1.37	1.81	1.58
Owned area (ha)	2.59	2.95	2.75	2.62	2.07
<i>Among agricultural households (cultivating land):</i>					
Number of parcels operated	1.64	1.51	1.39	1.84	1.59
Operated area (ha)	2.54	2.85	2.77	2.60	2.04
<i>Rural households</i>					
Landed households (owning land) (%)	49	38	45	54	64
Agricultural households (cultivating land) (%)	52	42	44	55	69
<i>Among landed households (owning land):</i>					
Number of parcels owned	1.65	1.50	1.38	1.83	1.63
Owned area (ha)	2.60	2.93	2.66	2.65	2.08
<i>Among agricultural households (cultivating land):</i>					
Number of parcels operated	1.66	1.52	1.40	1.86	1.63
Operated area (ha)	2.54	2.82	2.68	2.62	2.04
<i>Urban households</i>					
Landed households (owning land) (%)	8	3	13	8	26
Agricultural households (cultivating land) (%)	8	3	10	7	27
<i>Among landed households (owning land):</i>					
Number of parcels owned	1.28	1.30	1.19	1.30	1.27
Owned area (ha)	2.52	3.43	4.39	2.02	2.06
<i>Among agricultural households (cultivating land):</i>					
Number of parcels operated	1.33	1.35	1.29	1.33	1.33
Operated area (ha)	2.51	3.46	4.69	2.15	2.01

Note: Bold indicates significant differences between urban and rural households at $p < 0.01$.

Source: Authors' calculations using MLCS (2017)

There are large differences in land ownership patterns across different agroecological zones, even when focusing on the subsample of rural households (Table 2). In rural Delta and Coastal zones there are fewer landowning households (38 and 45 percent, respectively) but they own larger land sizes, 2.9 and 2.8 ha respectively. A much higher share of rural households in the Hills and Mountains own land (64 percent), but the average area owned is the smallest (2.1 ha). Within the urban sample, we find a low share of landed households in the Delta and (3 percent) and Dry Zone (8 percent), which is likely driven by the presence of Myanmar's largest cities (Yangon and Mandalay) in these zones.

A majority of farms (89 percent) have landholdings of 5 hectares or less (Table 3), also called small farms (Jayne et al. 2016). Small farms cover 63 percent of all agricultural land. More than half of all agricultural households (53 percent) cultivate landholdings two hectares or less (Table 3), thus considered smallholder farmers (Lowder et al. 2016). Smallholders cultivate 20 percent of Myanmar's agricultural land area. Three percent of agricultural households operate agricultural land larger than 10 hectares, yet these large landholders cultivate 15 percent of the total land operated (Table 3). Landownership patterns are similar to landholding patterns and are presented separately in Table A.2.

Table 3 Distribution of agricultural households and agricultural land by farm size (total land size operated, in hectares)

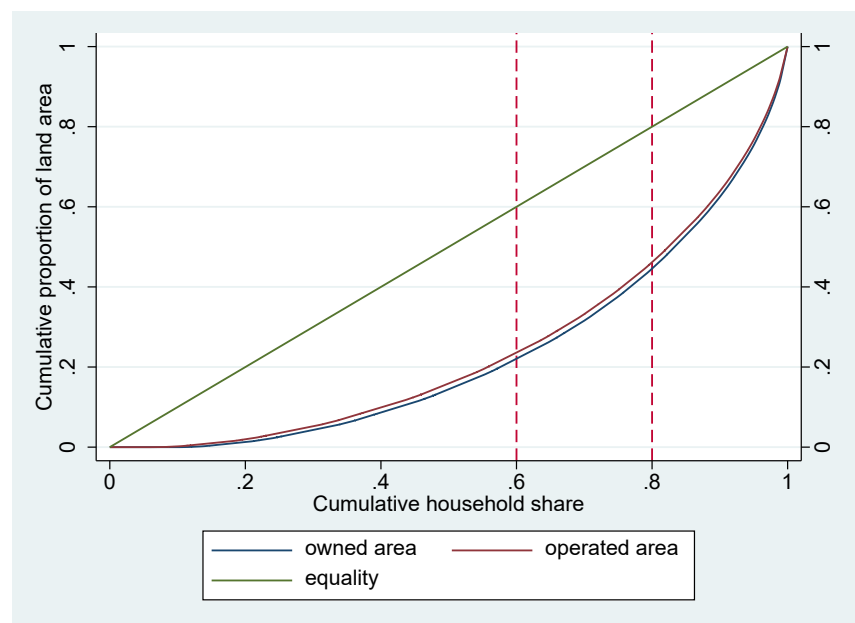
Farm size (in hectares)	Percentage of agricultural households	Percentage of total cultivated agricultural land
≤ 1	26.8	5.6
1+ to 2	25.6	14.0
2+ to 5	36.5	43.3
5+ to 10	8.2	21.6
10+ to 15	2.3	10.8
15+ to 20	0.4	2.4
20+	0.2	2.2
<i>Number of observations</i>	5,036	5,036

Note: Each column adds up to 100%.

The Delta Region is the most unequal in terms of land access with the highest share of landless households as well as the highest spread in land sizes among the landed (Tables A.1 and A.2). This inequality seems to be driven mainly by the Delta’s unique history going back to the 1930s. The area has experienced high levels of debt among rice cultivators causing repossession, followed by the paddy quota era where people who couldn’t meet the quota had land confiscated, land grabbing of the 1990s and 2000s, and displacement following Cyclone Nargis. The distribution of land is less uneven in the Hills and Mountains, arguably because the land frontier has only closed very recently or is yet to be closed.

Finally, Figure 2 shows the cumulative distribution of land area owned and operated by households in Myanmar. The bottom 60 percent of landed households only own about 22 percent of total land, whereas the top 20 percent of landed households own about 55 percent of total land. The Gini coefficient based on the national land distribution among households who cultivate land is 0.477. It is highest in Delta region (0.513) indicating higher inequality and the lowest in Dry Zone. The pattern is similar when considering agricultural households and the area they cultivate (Tables A.2, A.3 and Figure 2). Eleven percent of households who operate land do not own any land but rely on other tenure arrangements, such as renting, borrowing and others.

Figure 2 Cumulative distribution (Lorenz-curve) of land area owned and operated in Myanmar



Source: Authors' calculations using MLCS (2017)

4.2 Land tenure

Agricultural land sales and rental markets are thin in Myanmar. Most agricultural parcels are owner-operated (89 percent) and have been acquired on average 21 years ago, suggesting few changes in ownership during farmers' lifetimes (Table 4). Only 4.5 percent of cultivated parcels are accessed through renting in and 2.5 percent through sharecropping (section 4.1). While concerns over tenure security could discourage landholders from renting out their land, there are at least three other possible explanations. First, most land is used for low value grain crops with low margins, thus providing little incentive to rent in land. Second, most owner-operators do not have any excess land that they are willing to rent or sharecrop out. Third, there is no class of large absentee landowners which could rent or sharecrop out their land. Other arrangements include borrowing or free-leasing (3.5 percent of parcels), some of which may consist of young farmers cultivating their parents' land 'for free' (i.e. borrowing) in anticipation of future inheritance of the land (Boutry et al. 2017). Less than one percent of land is reported as operated under communal tenure arrangements (0.7 percent).

In each agro-ecological zone, owner-operated parcels are predominant, but there are some differences in the occurrence of alternative tenure arrangements. The Delta region has the lowest share of owner-operated parcels (86 percent), a moderate share of rented (5.3 percent), sharecropped (3.6 percent) and borrowed (3.9 percent) parcels, but barely any land obtained from communal tenure arrangements (0.4 percent). The Dry Zone has the highest share of owner-operated parcels (90 percent) and fewer alternative arrangements. Land rentals are most common in the Coastal Zone (8.4 percent), but sharecropping is rare (1 percent). In the Hills and Mountains, we find the largest share of borrowed or free-leased land (4.3 percent) and also

significantly more parcels under communal arrangements (1.7 percent). The latter is consistent with more parcels under customary tenure arrangements, some of which may include use of communal land.

Table 4 Tenure status of agricultural parcels, in percentage

	National	Delta	Coastal	Dry Zone	Hills
<i>Tenure status, in percent parcels^a :</i>					
Owned (%)	88.0	85.7	86.1	89.9	88.1
Rented (%)	4.7	5.3	8.4	4.0	4.1
Sharecropped (%)	2.5	3.6	1.0	2.7	1.3
Borrowed/free-leased (%)	3.7	3.9	4.0	2.9	4.7
Communal (%)	0.7	0.4	0.4	0.3	1.7
Other (%)	0.4	1.1	0.1	0.1	0.1
<i>Among all parcels owned:</i>					
Owner has land document ^b (%)	77.7	87.0	82.6	92.9	41.3
Years since household acquired parcel	21	18	18	25	18
<i>Number of parcels</i>	<i>7,814</i>	<i>1,561</i>	<i>849</i>	<i>2,217</i>	<i>3,187</i>
<i>Number of parcels owned</i>	<i>7,074</i>	<i>1,413</i>	<i>845</i>	<i>2,115</i>	<i>2,701</i>

^a This excludes parcels rented out, sharecropped out or given out for free for cultivation by other households to avoid overlap with parcels rented in, sharecropped in or used for free ^b MLCS does not specify the type of land document. Hence, it may include Form 7, Form 105, a tax receipt, or any other document that the respondent assumes qualifies as land document.

Source: Authors' calculations using MLCS (2017)

More than three quarters of all agricultural parcels have land documents (78 percent). This percentage is similar to what was calculated by Lambrecht and Mahrt (2019) using a 2015 nationally representative dataset (the 2015 MPLCS), who also found that 74 percent of all rural landowners' parcels had a land document. The share of documented parcels is higher when considering parcels with seasonal crops (80 percent) and much lower on parcels planted with permanent crops (56 percent). This may be explained by the country's separate classification and certification schemes for land with seasonal and perennial crops (Boutry et al. 2017). Parcels for seasonal crops, and in particular parcels designated for wet rice cultivation (*le land*), have been the main focus of land registration since at least the British colonial period, and continue to have the highest levels of land use certificates today.

There is a stark difference in the share of owned parcels with land documents across different agro-ecological zones (Table 4). It is the highest in the Dry zone (93 percent) and Delta (87 percent), which are the lowland areas with large areas suitable for paddy cultivation and where historically the reach of the state and agricultural land policy has been the strongest (Belton et al. 2021). On the contrary, land documents are much less common in the Hills and Mountains, where only 40 percent of parcels have some type of document. The land registration and certification system is not well-suited to customary tenure systems and land use patterns (particularly shifting cultivation) which are common in the Hills and Mountains (Boutry et al. 2018).

5. LAND USE PATTERNS

5.1 Cropping patterns

In Table 5, Figure 3 and Table A.4 we explore cropping patterns, expressed in percentage of parcels and agricultural land area, respectively. Most agricultural parcels (89 percent) and agricultural land area (90 percent) are used for seasonal crops, whereas the remainder are used for tree or other permanent crops. Fallowing is rare, with only 1 percent of parcels reported being fallow for all three seasons. This is at least in part explained by tenure insecurity arising from fallowing, as fallow land may be confiscated under the VFV law. Permanent crops are more prominent in the Coastal area (27 percent of agricultural parcels), which is well known for its rubber and other tree crop production. It is lowest in the Dry Zone (3 percent).

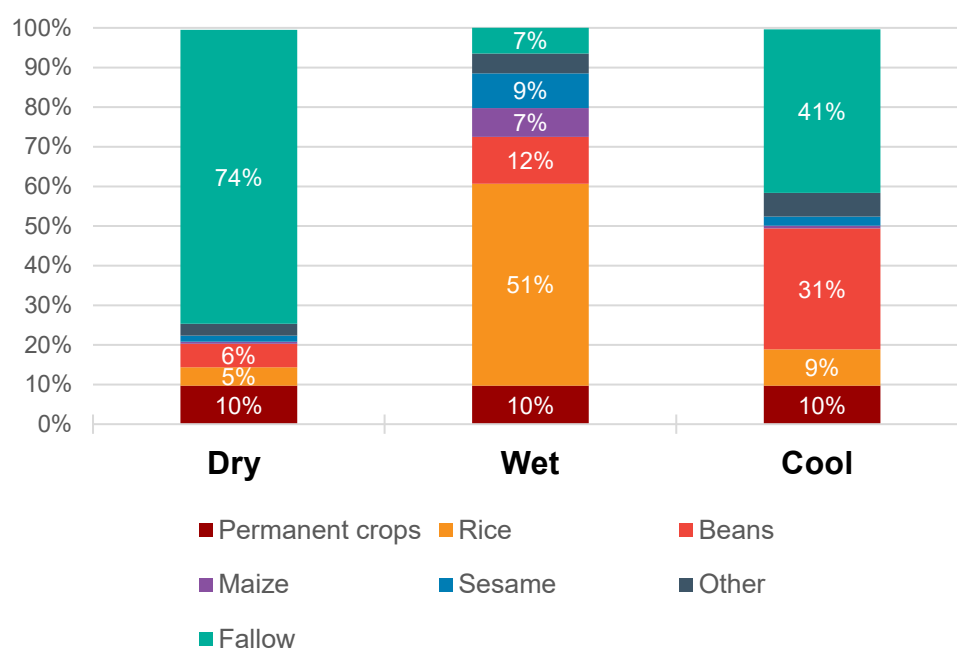
Table 5 Main crops grown on parcels (in percentage of parcels)

	National	Delta	Coastal	Dry Zone	Hills
Permanent/tree crop parcels (%)	11	13	30	4	15
Seasonal crops parcels (%)	89	87	70	96	85
Seasonal parcels in dry season (March-May)					
Fallow/non-operated parcels (%)	80	74	79	79	87
<i>If not fallow, main crops are</i>					
- Rice (%)	26	22	3	33	21
- Beans/pulses (%)	29	36	5	32	11
- Maize (%)	4	4	2	3	7
- Vegetables (%)	13	15	30	4	28
- Sesame (%)	9	4	1	16	2
- Cotton (%)	2	0	0	4	0
- Sugar cane (%)	2	0	1	1	10
- Other (%)	16	19	57	7	21
Seasonal parcels in wet season (June-Oct)					
Fallow/non-operated parcels (%)	10	14	7	11	4
<i>If not fallow, main crops are</i>					
- Rice (%)	56	82	83	40	50
- Beans/pulses (%)	15	5	1	28	6
- Maize (%)	9	0	0	2	32
- Vegetables (%)	3	4	3	2	5
- Sesame (%)	11	4	0	22	2
- Cotton (%)	1	0	0	2	0
- Sugar cane (%)	1	0	0	0	2
- Other (%)	5	4	12	5	3
Seasonal parcels in cool season (Nov-Feb)					
Fallow/non-operated parcels (%)	46	25	66	36	83
<i>If not fallow, main crops are</i>					
- Rice (%)	16	22	14	12	18
- Beans/pulses (%)	58	59	23	65	18
- Maize (%)	2	2	1	2	4
- Vegetables (%)	7	6	24	4	27
- Sesame (%)	4	1	0	5	13
- Cotton (%)	2	0	0	4	1
- Sugar cane (%)	1	0	1	1	6
- Other (%)	10	10	37	9	13
Seasonal parcels fallowed / not operated during all three seasons (%)					
	1	0	2	1	1
<i>Number of parcels</i> ^a	7,814	1,561	849	2,217	3,187
<i>Number of seasonal parcels</i>	6,664	1,274	486	2,118	2,786

Note: This includes parcels operated by the interviewed household or parcels left fallow. Parcels which are rented out are excluded.

^a The number of parcels self-cultivated or fallowed during the wet season. Source: Authors' calculations using MLCS (2017)

Figure 3 Percent of agricultural land area allocated to different crops, by season



Note: This includes all agricultural land, including parcels operated by the interviewed household and parcels left fallow. Parcels which are rented out are excluded to avoid duplication. "Other" includes cotton, sugarcane, vegetables, and other crops which are grown on less than five percent of the agricultural land area in any season.
Source: Authors' calculations using MLCS (2017)

In all three seasons, rice, beans, and pulses dominate on seasonal parcels (Table 5). Sixty-nine percent of seasonal crop farmers cultivated paddy at least once in the past 12 months, and 46 percent cultivated beans or pulses (Table 6). This confirms the predominance of rice as main crop cultivated in Myanmar. Yet despite its prominence in the diet and despite sustained policy emphasis in favor of paddy production, a sizeable share of agricultural households (31 percent) do not grow any rice.

Table 6 Share of agricultural households growing rice, beans and pulses as a percentage of those who operated at least one seasonal parcel in the past year

	National	Delta	Coastal	Dry Zone	Hills
Rice growing households (%)	69	82	86	57	68
Bean and pulses growing households (%)	46	51	10	71	12
<i># households operating min. 1 seasonal parcel</i>	<i>4,435</i>	<i>886</i>	<i>384</i>	<i>1,176</i>	<i>1,989</i>

Not surprisingly, there are clear differences in crop choice across AEZ. In the delta region and coastal zones, 82 percent and 86 percent of households growing seasonal crops respectively cultivated rice, and around half in the Delta cultivated beans or pulses. In the Dry Zone rice is less commonly grown (by 57 percent of households), but pulses and beans are prominent (71 percent of households). The Hills and Mountains follow the national average for rice (68 percent), but only 12 percent grow beans and pulses.

The wet season is the main cropping season in Myanmar, with less than 10 percent of seasonal parcels left uncultivated. Most occur in the Delta (14 percent) where flooding may impede crop production and the least in the Hills (4 percent). Rice is the dominant crop grown during the wet season on 56 percent of the cultivated seasonal parcels. Especially in the Delta and coastal areas, rice dominates wet season crop production (respectively 82 and 83 percent). The Dry zone has somewhat more diversity but still 40 percent of plots cultivate rice, while 28 percent are cultivated with pulses and beans, and 22 percent with sesame. In the Hills, slightly over half of all parcels are cultivated with rice (51 percent), but 33 percent of parcels are cultivated with maize in the wet season – uncommon in other AEZs.

The dry season is the most challenging season for growing seasonal crops with most seasonal parcels left fallow (79 percent). Dry season fallowing rates are similar across the different geographical zones, but highest in the Hills (88 percent of seasonal parcels) and lowest in the Delta (74 percent). Those still able to cultivate during the dry season are mainly growing beans and pulses (28 percent) and rice (27 percent). Vegetables are grown on 12 percent of plots, but they are more common in the coastal zones (30 percent) and in the Hills and Mountains (24 percent).

In total, 46 percent of parcels are not operated in the cool season, though there are major regional differences. Eighty four percent of parcels in the Hills and Mountains and 67 percent in the coastal areas are not operated in the cool season. Irrigation facilities are more favorable in Dry Zone and Delta, where only 36 percent and 26 percent of parcels are left fallow, respectively during the cool season. Rice is less prominent in the cool season compared to other seasons, only grown on 16 percent of parcels cultivated while beans and pulses dominate (58 percent of cultivated parcels), mostly on parcels in the Delta and Dry zone (59 and 64 percent, respectively). Vegetables are also frequently grown in this season, at 6 percent of all parcels nationwide, but up to 25 percent of parcels in the coastal region.

The coastal zone encompasses a range of agro-ecologies and has a unique history, which may explain its larger share of parcels under perennial crops and a high share of “other” seasonal crops planted in all seasons: 56 percent in dry season, 37 percent in cool season, and 12 percent in the wet season respectively. The hills and mountains also cover considerable variation in local agro-ecological conditions and socio-cultural and economic settings and has the second highest share of parcels planted to other crops (23 percent in dry season and 13 percent in cool season).

5.2 Irrigation

Water management and irrigation are key to agricultural productivity in Myanmar. We show the main irrigation sources used on parcels cultivated with seasonal crops in Table 7 and in Figure 4. In this overview, non-irrigated parcels include parcels that solely rely on natural rainfall. In addition, farmers often collect or “harvest” rainwater for irrigation, which is included separately. It also distinguishes between irrigation originating from government, community or individual irrigation channels, or other sources of irrigation.

The dry season is the most water-scarce season in which only few agricultural parcels are cultivated (see section 5.1). Relatively few parcels (37%) are operated in the dry season without additional irrigation. Most of these parcels operated using rainfall only are in the delta region and

Hills and Mountains. Given that rainfall is scarce in the dry season, fewer operated parcels benefit from captured or collected rainfall water (6 percent) relative to other seasons. Irrigation infrastructure facilitates cultivation on more than half of all parcels with seasonal crops (52 percent) during the dry season and serves 57 percent of all agricultural land with seasonal crops.

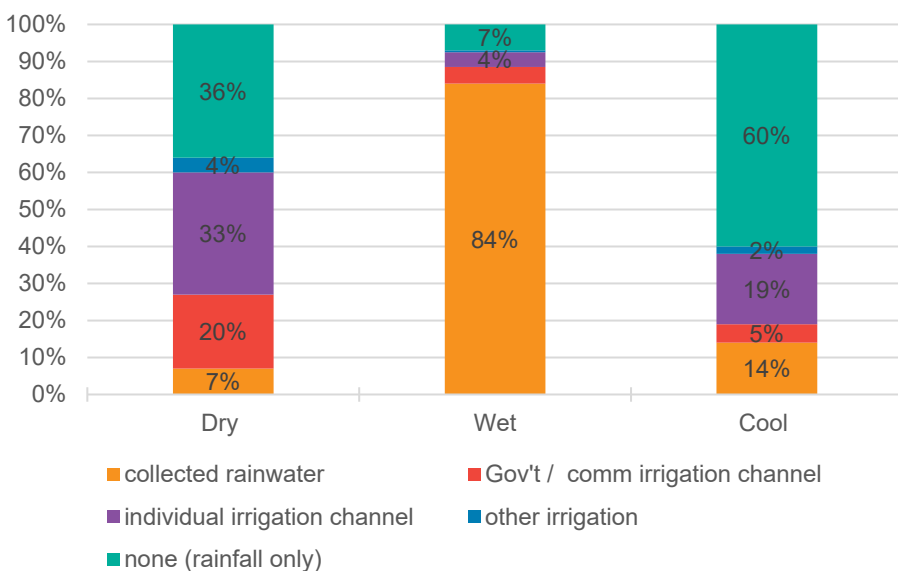
Table 7 Percentage of parcels cultivated with seasonal crops by main irrigation source

	National	Delta	Coastal	Dry Zone	Hills
Dry season					
- Collected/harvested rainwater (%)	6	0	20	10	1
- Government irrigation channel (%)	18	6	0	34	3
- Community irrigation channel (%)	4	1	0	6	5
- Individual irrigation channel (%)	30	34	34	27	31
- Other (%)	5	6	21	2	7
- None (rainfall only) (%)	37	52	25	21	52
<i>No. of operated parcels in the dry season</i>	<i>1,298</i>	<i>306</i>	<i>85</i>	<i>419</i>	<i>488</i>
Wet season					
- Collected/harvested rainwater (%)	80	86	86	75	83
- Government irrigation channel (%)	5	0	0	10	0
- Community irrigation channel (%)	1	0	0	1	2
- Individual irrigation channel (%)	5	1	0	6	9
- Other (%)	1	1	0	1	0
- None (rainfall only) (%)	8	12	14	7	6
<i>No. of operated parcels in the wet season</i>	<i>6,035</i>	<i>1,090</i>	<i>451</i>	<i>1,889</i>	<i>2,605</i>
Cool season					
- Collected/harvested rainwater (%)	13	3	14	21	5
- Government irrigation channel (%)	3	1	0	5	0
- Community irrigation channel (%)	1	0	0	2	6
- Individual irrigation channel (%)	18	26	26	12	19
- Other (%)	3	4	13	2	5
- None (rainfall only) (%)	62	66	47	59	66
<i>No. of operated parcels in the cool season</i>	<i>3,056</i>	<i>897</i>	<i>138</i>	<i>1,383</i>	<i>638</i>

Source: Authors' calculations using MLCS (2017)

Even when rainfall is abundant during the wet season, few parcels are cultivated without additional water management practices (8 percent). Most farmers smooth water supply by actively managing water on their plots using collected and harvested rainwater (80 percent), but irrigation channels also remain key to productivity on 11 percent of all parcels.

Figure 4 Area of seasonal crops under different types of irrigation, by season



Source: Authors' calculations using MLCS (2017)

6. LAND TENURE AND CROPPING PATTERNS

As the final part of our analyses, we zoom in on the interrelation of land tenure and cropping patterns. The prominence of smallholders in Southeast Asian agriculture amidst rural and structural transformation has been a topic of considerable scholarly and policy attention. In the first subsection we therefore explore cropping patterns of smallholder farm households (about half of all Myanmar's agricultural households) and compare them with those on other, non-smallholder farms. Formalization of land rights too, is a field of interest in and beyond Myanmar. Land tenure, land documents, and cropping patterns were strongly interconnected throughout Myanmar's history. In the second subsection we therefore explore how having land documents is tied in with cropping patterns and other parcel and household characteristics.

6.1 Smallholders

Table 8 shows descriptive comparisons of agricultural households who are smallholders (cultivating up to 2 ha) with agricultural households who cultivate more than two hectares. Average land size owned by smallholders is 0.9 ha (1 ha cultivated), over four times lower than the average 4 ha owned by larger farmers (4.3 ha). Whereas smallholders on average cultivate only one parcel, non-smallholders cultivate on average 2 parcels.

Smallholders have acquired their land more recently and have younger household heads (Table 8), which may be the consequence of a 'life cycle' effect where farm households acquire more land over their lifetime (Lambrecht et al. 2021; Boutry et al. 2017). Alternatively, it might support the hypothesis that farm sizes are shrinking, which is different though not necessarily in contradiction with the increased agricultural land size per person active in agriculture mentioned

earlier.⁶ Yet, the relatively small gap in age (only 4 years) between heads of smallholder compared to non-smallholder agricultural households, suggests neither the life cycle nor the shrinking farm sizes are the only driving factors for diverging farm sizes.

Table 8: Characteristics of smallholders and non-smallholders and their parcels operated

	Smallholder farm (≤ 2 ha)	Non-smallholder farm (>2 ha)	
At farm / farm household level			
Share of all farm households (%)	52	48	
Total land size owned (in ha)	0.9	4.0	***
Total land size operated	1.0	4.3	***
Number of parcels owned	1.2	1.8	***
Number of parcels operated	1.4	2.0	***
Age of household head	50	54	***
Has a land document for at least one parcel (%)	70	83	***
Type of crops grown			
Perennials (%)	17	13	***
Rice (%)	58	70	***
Beans/pulses (%)	34	52	***
Maize (%)	13	14	
Sesame (%)	12	20	***
<i>Number of observations</i>	<i>2,883</i>	<i>2,153</i>	
At parcel level (all parcels operated by smallholders and larger farms, respectively)			
Parcel size (in ha)	0.7	2.2	***
Parcel is owned (%)	84	92	***
Household has land document for parcel ^a (%)	69	83	***
Years since household acquired parcel ^a	18	23	***
Type of crops grown			
Perennials (%)	14	8	***
Rice (%)	45	45	
Beans/pulses (%)	28	38	***
Maize (%)	9	8	**
Sesame (%)	9	12	***
Left fallow in minimum 1 season (%)	63	76	***
Seasons cultivated	1.8	1.6	***
Irrigation source in any season			
Collected/harvested rainwater (%)	71	74	***
Govt. /Community irrigation channel (%)	7	7	
Individual irrigation channel (%)	19	14	***
Other irrigation source (%)	4	1	***
<i>Number of observations</i>	<i>3,814</i>	<i>4,414</i>	

Note: ^a Only for the owned parcels.

Source: Authors' calculations using MLCS (2017)

Smallholders less often own the land they cultivate and are less likely the documented owner of their farmland (Table 8). Given they cultivate smaller land sizes, it is reasonable to expect that smallholder farmers cultivate fewer crops than larger farms. Indeed, smallholder farmers are significantly less likely to cultivate rice, beans and pulses, and sesame compared to larger

⁶ When considering agricultural land sizes per person active in agriculture, the latter includes farmers as well as agricultural workers

farmers, but they are more likely to grow perennial crops (Table 8). Smallholders might compensate smaller acreages by cultivating their land more intensively, for example through expanding the number of cropping seasons in combination with or through the use of irrigation. Indeed, smallholders cultivate their parcels more frequently (in terms of seasons cultivated) and more often use individual irrigation channels or other sources of irrigation.

6.2 Land documents

Myanmar's land and agricultural laws and policies have led to strongly intertwined land tenure and cropping patterns. The 2012 Land Law was accompanied by an effort to provide new land use certificates (Form 7) for seasonal crop parcels, rendering earlier land documents obsolete. We use probit regression analyses to explore which parcel and household characteristics are associated with land documents for parcels cultivated with seasonal crops, particularly looking at factors that either are expected to affect the landowner or the authorities' interest or options to document land ownership. A simple comparison of these characteristics of documented and undocumented parcels is shown in appendix table A.5.

By combining different variables into one regression analysis, we can see the association of one variable while controlling for other variables of influence. Table 9 shows four specifications of the model. Columns (1) and (2) include control variables for the different agro-ecological zones, to illustrate the main regional patterns that are sustained after controlling for other characteristics. In columns (3) and (4) we then control at township level, to account for smaller geographical units. In columns (1) and (3) we control for the years since the parcel was acquired; whereas in columns (2) and (4) we instead use a dummy indicator that is coded as 1 if the parcel was acquired after 2012 and 0 otherwise.

Larger parcels and parcels with access to irrigation infrastructure more often have land documents. These parcels are likely of high value, increasing owners' motivation to obtain land documents. Moreover, where government or community irrigation infrastructure is present, it is likely that other infrastructure and services are better developed and more accessible than elsewhere. Hence, the ability and motivation from authorities to extend land use certificates of parcels served by irrigation infrastructure may be relatively high.

Parcels that are cultivated with rice for at least one season in the past year are also more likely to have land documents compared to other parcels. This again aligns with a more extensive focus and reach of government authorities in rice-producing areas and higher expected motivation of authorities to register land that is suitable to rice production. Moreover, it also similarly supports the aforementioned motivation of farmers to have land titles on parcels where they produce paddy to continue accessing loans from MADB. Whereas in columns (1) and (2), where we control only at the level of agro-ecological zones, cultivation of beans and pulses is also positively associated with having land documents and growing maize has a negative association. These effects however disappear when we control for a finer set of geographical units (i.e. at township level), whereas rice continues to be significantly associated with having land documents.

Table 9. Probit regression results showing marginal effects of associates of land documents among parcels with seasonal crops

	National AEZ fixed effects (1)	National AEZ fixed effects (2)	National township fixed effects (3)	National township fixed effects (4)
Parcel size (in ha)	0.011** (0.005)	0.011** (0.005)	0.019*** (0.006)	0.019*** (0.006)
Government/community irrigation	0.168*** (0.059)	0.166*** (0.058)	0.250*** (0.097)	0.249*** (0.091)
Individual irrigation	0.060*** (0.022)	0.059*** (0.022)	0.061* (0.032)	0.060* (0.031)
Planted rice	0.090*** (0.017)	0.090*** (0.017)	0.135*** (0.021)	0.134*** (0.020)
Planted beans/pulses	0.038** (0.016)	0.038** (0.016)	0.013 (0.021)	0.013 (0.021)
Planted maize	-0.059** (0.024)	-0.059** (0.024)	-0.005 (0.032)	-0.005 (0.030)
Planted sesame	0.029 (0.022)	0.031 (0.022)	0.043 (0.028)	0.045 (0.029)
Parcel rented-out	0.143*** (0.035)	0.141*** (0.035)	0.138*** (0.037)	0.136*** (0.036)
Rural residence	-0.011 (0.022)	-0.010 (0.022)	0.014 (0.030)	0.014 (0.032)
Acquired after 2012	-0.040** (0.017)		-0.063*** (0.020)	
Years since parcel was acquired		0.002*** (0.001)		0.003*** (0.001)
Age of household head (in years)	0.002*** (0.001)	0.002** (0.001)	0.002*** (0.001)	0.001* (0.001)
Household head is female	-0.017 (0.016)	-0.018 (0.016)	-0.016 (0.020)	-0.015 (0.021)
Education of household head (in years)	0.009*** (0.002)	0.009*** (0.002)	0.005* (0.003)	0.004* (0.003)
Coastal (base = Delta)	0.011 (0.032)	0.012 (0.031)		
Central dry (base = Delta)	0.050** (0.022)	0.046** (0.021)		
Hills/mountains (base = Delta)	-0.309*** (0.042)	-0.309*** (0.041)		
Township controls	No	No	Yes	Yes
<i>Number of observations</i>	5,926	5,926	4,336	4,336

Standard errors in parentheses. Coefficients are significant at *** p<0.01, ** p<0.05, * p<0.10
Source: Authors' calculations using MLCS (2017)

We also find that parcels that are being rented out more often have land documents. Owners with land titles may either feel more secure in renting, or owners who intended to rent out their land may have felt more urged to obtain documents. One might also expect that land titling efforts could have been more active in places with more active land markets, however such impacts should to some extent be eliminated in our analyses that include township-level fixed effects (such as specification 3 and 4). Unlike what we expected, a rural landowner is not less or more likely than an urban landowner to have land documents after controlling for the other variables in the regression analysis.

Second, we find that parcels that were obtained prior to 2012 (specification 1 and 3) and parcels that have been acquired further back in time (specification 2 and 4) are more likely to have a land document. Thus, parcels obtained after 2012 are less likely to have documents, suggesting that there has not been a successful systematic continuation of land titling efforts. It may also be indicative that parcels with documents prior to 2012 (in particular Form 105) were more likely to also obtain the new Form 7. Given that we don't know exactly which document the owner has, it may also be that older parcels are more likely to have alternative documents (not the new Form 7) that they report as land documents for the parcel.

Parcels owned by households with older household heads are more likely to have land documents, even when simultaneously controlling for the time since acquiring the parcel. Similarly, parcels owned by households where the household head is more educated are more likely to have land documents. There is no significant difference however whether the household head is male or female. The regressions in column (1) and (2) confirm that there are regional patterns to documentation. Holding all else equal, parcels in the Dry Zone are five percent more likely to be documented compared to the Delta. This difference is less sizeable compared to the difference between parcels in the Delta and parcels in the Hills and Mountains, where the latter are thirty-one percent less likely to be documented.

7. CONCLUSIONS

Myanmar's land tenure and cropping patterns are similar to those elsewhere in Southeast Asia where agriculture is characterized by owner-cultivated, small family farms (Hayami and Otsuka 1993, Rigg et al. 2016). Despite the importance of the agricultural sector in rural employment (Lambrecht et al. 2021) more than half of rural households (51 percent) are landless. Half of all agricultural households are smallholders (cultivating no more than 2 hectares) and 89 percent of all agricultural households operate small farms (cultivating no more than 5 hectares). Whereas smallholder and small farms dominate the agricultural landscape in Myanmar, average farm sizes are slightly bigger in comparison to the average in South Asia or East Asia and the Pacific (Lowder et al. 2021).

The distribution of agricultural land is uneven, even within the subpopulation of landed households. The bottom 60 percent of landed households only own about 22 percent of total land, whereas the top 20 percent of landed households own about 55 percent of total land. Land transfers have been officially allowed only since 2012 and land sales and rental markets are still thin, with limited redistribution of land from landed to landless households. Temporary land acquisitions through renting, sharecropping, borrowing, or other arrangements are not common.

Stark regional differences are observed within the country, with very high levels of landlessness in the Delta region (62 percent among rural households) whereas the lowest levels of landlessness are found in the Hills and Mountains. The Hills and Mountains are more associated with ethnic diversity and customary tenure systems, which is reflected in the more frequent occurrence of land access through communal tenure arrangements and borrowing of land, though to a limited extent. The share of landowners having land documents for their parcels is also significantly and substantially lower in the Hills and Mountains – thus also supporting concerns over land tenure security of farmers in this zone.

Rice is still the most common crop, grown by 69 percent of agricultural households. Yet, despite years of rice-oriented policies and its importance in the diet, a substantial share of agricultural households do not cultivate rice. Rice cultivation is most common among agricultural households in the Coastal and Delta zone (86 percent and 82 percent), and less so in the Hills and Mountains (68 percent) and Dry Zone (57 percent). Beans and pulses are also commonly grown by 46 percent of all agricultural households and most commonly so in the Dry Zone (by 71 percent of all households). Other crops are also grown such as the relatively large share of farmers growing maize, considered by some to be a ‘boom crop’ (Woods 2020; Fang and Belton 2020).⁷

Smallholders generally cultivate fewer and smaller plots, are less likely to own their land and less likely to have land documents for the parcels they own. Although they cultivate their land more intensively than larger farmers, this is unlikely to offset the disadvantage of having less agricultural land to generate farm income. Others (e.g. Boutry et al. 2017) have argued that agricultural and farm households progressively acquire and operate more land over their lifetime and thus may also leave their status as being landless and smallholders. This may also point at shrinking farm sizes. Both of these hypotheses seem plausible but could not be confirmed in the quantitative analysis.

The above findings as well as a more in-depth analysis of factors associated with having land documents confirms the role that Myanmar’s history of rice-centered policies have played in shaping the current state of land tenure and cropping patterns. Even after controlling for a range of geographical, household, and parcel characteristics, we find that parcels on which rice is cultivated are more likely to have land documents. The fact that land documentation is incomplete and less common among parcels acquired after 2012, the year when the major push for land use certification occurred, suggests that land certification efforts are not complete and have not been sustained. In Myanmar, as elsewhere, the land use certification system currently in place is not a panacea for land security or augmented crop productivity. Striving towards a system of land classification and land laws in line with and respectful for local realities – especially those aligned with customary land tenure systems – could further improve tenure security, enhance optimal land use patterns, and support higher overall welfare of rural households.

⁷ Crop booms occur when ‘large areas of land are rapidly converted to mono-cropped (or nearly mono-cropped) production of a new crop’ (Hall 2011, p508).

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APPENDIX TABLES

Table A.1 Distribution of agricultural households by total acreage of operated land, in percentage

Total land size operated (hectares)	National	Delta	Coastal	Dry Zone	Hills and mountains	Urban	Rural
≤ 1	26.8	28.3	25.6	22.1	31.8	32.0	26.5
1+ to 2	25.6	20.9	25.6	25.7	31.0	25.4	25.7
2+ to 5	36.5	35.8	35.9	40.9	31.6	29.4	36.9
5+ to 10	8.2	10.7	7.8	9.1	4.1	9.6	8.1
10+ to 15	2.3	3.3	4.8	2.0	1.0	3.7	2.3
15+ to 20	0.4	0.6	0.0	0.3	0.3	0.0	0.4
20+	0.2	0.5	0.3	0.0	0.2	0.0	0.3
<i>Number of observations</i>	<i>5,036</i>	<i>1,051</i>	<i>594</i>	<i>1,218</i>	<i>2,173</i>	<i>628</i>	<i>4,408</i>

Note: Each column adds up to 100 percent.

Table A.2 Distribution of agricultural land area cultivated by farms of different total land sizes, by AEZ and rural/urban residence, in percentage

Total land size operated (hectares)	National	Delta	Coastal	Central Dry Zone	Hills and mountains	Urban	Rural
< 1	5.6	4.8	4.9	4.5	9.3	6.8	5.6
1 to 2	14.0	10.3	13.2	13.7	20.8	14.0	14.0
2+ to 5	43.3	38.7	39.7	47.5	45.0	35.5	43.8
5+ to 10	21.6	25.4	19.1	23.3	13.7	26.2	21.4
10+ to 15	10.8	13.5	20.6	8.8	6.0	17.5	10.4
15+ to 20	2.4	3.4	0.0	1.9	2.6	0.0	2.5
20+	2.2	4.0	2.5	0.2	2.6	0.0	2.3
N	5,036	1,051	594	1,218	2,173	628	4,408

Source: Authors' calculations using MLCS (2017)

Table A.3 Distribution of landed households by land area owned, by AEZ and rural/urban residence, in percentage

Total land size owned (hectares)	National	Delta	Coastal	Dry Zone	Hills and mountains	Urban	Rural
< 1	26.3	26.9	25.6	22.2	31.7	32.7	25.9
1 to 2	25.5	21.3	26.8	25.3	30.3	23.2	25.7
2+ to 5	36.8	36.5	35.5	40.8	31.9	31.6	37.2
5+ to 10	8.3	10.6	6.9	9.4	4.4	8.4	8.3
10+ to 15	2.4	3.3	5.2	2.0	1.1	4.2	2.3
15+ to 20	0.4	0.7	0.0	0.3	0.3	0.0	0.4
20+	0.3	0.6	0.2	0.0	0.2	0.0	0.3
N	4,718	979	631	1,203	1,905	641	4,077

Source: Authors' calculations using MLCS (2017)

Table A.4 Percentage of agricultural land area allocated to different crops, by season (as in Figure 3)

	Dry	Wet	Cool
Rice (%)	5	51	9
Beans (%)	6	12	31
Corn (%)	0	7	1
Vegetables (%)	1	1	2
Sesame (%)	2	9	2
Cotton (%)	0	1	1
Sugarcane (%)	0	1	1
Other seasonal crops (%)	2	2	3
Permanent crops (%)	10	10	10
Fallow (%)	74	7	41

Source: Authors' calculations using MLCS (2017)

Table A.5 Characteristics of documented vs. non-documented agricultural parcels

	All parcels			Parcels with seasonal crops		
	without document	with document		without document	with document	
Share of all parcels (%)	22	78		20	80	
Years since acquisition	16	22	***	16	22	***
Acquired after 2012 (%)	26	16	***	28	16	***
Age of household head	49	55	***	49	55	***
Household head is female (%)	15	18	***	15	18	**
Parcel size (in ha)	1.2	1.7	***	1.2	1.7	***
Total land size owned by parcel owner (in ha)	2.5	3.3	***	2.6	3.3	***
Rural residence of owner (%)	94	95	**	94	96	***
Rented or sharecropped out (%)	2	6	***	2	7	***
Give out for free (%)	0	1	*	0	1	
Type of crops grown						
Perennial crops (%)	22	8	***	n/a	n/a	
Rice (%)	29	48	***	37	52	***
Beans/pulses (%)	16	40	***	20	43	***
Maize (%)	24	4	***	31	5	***
Sesame (%)	5	13	***	7	14	***
Seasons cultivated	1.7	1.7		1.3	1.6	***
Irrigation source in any season						
Collected/harvested rainwater (%)	81	71	***	86	73	***
Govt. /Community irrigation channel (%)	1	9	***	1	10	***
Individual irrigation channel (%)	11	17	***	10	17	***
Other irrigation source (%)	2	2		2	2	
<i>Number of observations</i>	<i>1,834</i>	<i>5,240</i>		<i>1,423</i>	<i>4,516</i>	

^b MLCS does not specify the type of land document. Hence, it may include Form 7, Form 105, a tax receipt, or any other document that the respondent assumes qualifies as land document.

Source: Authors' calculations using MLCS (2017)

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