Farmer Land Use Vision and Dynamics in Pagar Alam

Photo: World Agroforestry (ICRAF)/Isnurdiansyah

1. Introduction

Pagar Alam administrative area covers around 63,352 ha of upland area and is located approximately 300 km from Palembang, the capital of South Sumatra Province. In 2017, most of land use in Pagar Alam was for coffee agroforestry and protection forest area, making up for 36% and 30% of the city's total area, respectively (Amaruzaman et al., 2021). Pagar Alam is located at the foot of Mount Dempo and is an upstream area of Musi Watershed. Musi is South Sumatra's largest watershed, spanning nearly almost the entire province, with an area of approximately 7.7 million ha and a length of 750 km.

Pagar Alam has five subdistricts: North Dempo, South Dempo, Central Dempo, North Pagar Alam, and South Pagar Alam, as well as 35 non-autonomous villages. Although Pagar Alam has city status, it is still dominated by rural areas with agricultural activities and most of its community members/households work as farmers (Table 1).

Since the 19th century, Pagar Alam has been known as coffee and tea producer in South Sumatra. Rubber crop is also developed in this area on a moderate scale. To date, Pagar Alam has consistently produced the best quality tea for export. Coffee and rubber are commonly planted and managed by farmers, while tea is managed by State-owned Agricultural Company (PTPN) VII.

Key Message

- Tree-based farming systems (such as coffee and rubber) managed by farmers in Pagar Alam, should be maintained and supported because they are suitable for hilly and upland areas.
- The area of coffee land use in Pagar Alam has remained relatively stable over the last 13 years, owing to the communities' reliance on this commodity as their primary source of income and the growing market for high-quality coffee. This is in line with farmers' preference to implement better coffee agroforestry pattern that includes additional fruit commodities that can be sold (commercially) to increase their family income.
- Vegetable farming system is a land use system that will continue to grow in the future because of its high economic potentials and low land requirements. However, the implementation of this system in Pagar Alam uplands should consider sustainable agricultural management and soil conservation techniques in the land slope.
- Understanding land use change dynamics, farmers' preferences, and vision for expected farming systems to manage, and large-scale agricultural investment potentials in the city can help policymakers in formulating on-target agricultural policies. This also allows for the implementation of prevention activities in Pagar Alam production landscape to mitigate environmental impacts

Table 1. Characteristics of five subdistricts in Pagar Alam in 2019

Information	North Dempo	Central Dempo	South Dempo	North Pagar Alam	South Pagar Alam
Number of non-autonomous villages	5	5	7	8	10
Average elevation (m.a.s.l.)	850	900	700	900	1.000
Total area (km^2)	127.1	144.1	243.9	55.5	63.2
Proportion to Pagar Alam area (%)	20.1	22.7	38.5	8.8	10
Distance to the capital (km^2)	13	9.8	16.4	5.5	1.6
Protection area (km^2)	33.50	85.3	122.1	10.1	4.7
Demographic aspect					
Population	23,437	13,177	15,133	43,729	50,652
Proportion to total population (%)	16.0	9.0	10.4	29.9	34.7
Density (persons/km^2)	184	91	62	787.9	801.5
Farming households (% of total households)*	89.5	91.5	88.7	49.4	39.3

Source: Statistics Pagar Alam, 2020 and *National Agricultural Census, 2013

Land cover and land use dynamics are highly affected by land owner decision, including those of farmers, communities, companies, and governments. Farmers' decision about which farming system to use on their lands will affect land cover mosaic at the landscape level. Farming system selection is influenced by government policies, in terms of incentives and prohibitions on certain commodities. It is also affected by farmer preferences which are determined by commodity price, farmer knowledge on planting procedure, and farmer access to technology and production facility. Understanding the land cover dynamics and farmer vision for preferred commodity and farming system to use in the future will help policymakers in projecting land use change in their areas, allowing strategies, and policies to be prepared in accordance with local development goals.

2. Pagar Alam Land Cover Dynamics in 2005-2018

Based on IndoGreen project's spatial analysis, most of the land covers in Pagar Alam are tree-based farming systems, involving crops such as coffee, rubber, and tea. Tree-based farming system covered approximately 53-55% (33,500-35,000 ha) of the total area in 2005-2018, which was relatively stable. In the same period, the forest area decreased by 7% or 4,300 ha, making Pagar Alam's forests area around 24% of the total area.

Coffee and rubber are two primary commodities largely managed by farmers in Pagar Alam. In 2005-2018, coffee land cover increased by 17%, nearly covering half of Pagar Alam area, while rubber land cover decreased by 14% (Table 2).

Photo 1. Land cover with agroforestry system in Pagar Alam.

Table 2. Pagar Alam land cover area (ha) and percentage (%)

No	Land cover	2005		2010		2018	
		ha	%	ha	%	ha	%
1	Undisturbed forest	21,265	33.6	19,787	31.2	15,444	24.4
2	Logged-over forest	3,220	5.1	3,458	5.5	4,745	7.5
3	Rubber monoculture	7,658	12.1	2,886	4.6	762	1.2
4	Rubber agroforestry	2,533	4.0	3,511	5.5	493	0.8
5	Coffee agroforestry	19,160	30.2	26,000	41.0	29,871	47.2
6	Mixed garden	2,233	3.5	1,037	1.6	1,413	2.2
7	Small-scale oil palm	0,3	0	44	0.1	44	0.1
8	Timber	182	0.3	6	0	5.5	0
9	Tea plantation	1,764	2.8	1,625	2.6	1,522	2.4
10	Irrigated rice field	3,052	4.8	2,504	4.0	3,040	4.8
11	Annual crop	367	0.6	549	0.9	1,606	2.5
12	Shrub	206	0.3	212	0.3	1,710	2.7
13	Settlement	359	0.6	485	0.8	1,752	2.8
14	Cleared land	60	0.1	78	0.1	729	1.2
15	Others (waterbody, cloud)	1,296	2.0	1,170	1.8	217	0.3
Total		63,352	100	63,352	100	63,352	100

3. Pagar Alam agricultural land use dynamics

In addition to spatial analysis, land use dynamics are also analysed based on information provided by farmers in a household survey taken in 2019. The distribution of land use among 950 lands/plots surveyed includes simple and complex coffee agroforestry farms (69%), rubber farm (2%), rice field (9%), vegetable farm (12%), and bush/fallow (7%) (Isnurdiansyah et al., 2021). In addition, land area distribution (of the 756-ha surveyed) includes simple and complex coffee agroforestry farms (76%), rubber farm (3%), rice field (7%), vegetable farm (6%), and bush/fallow (8%). Both survey data at the farmer level are already consistent with spatial mapping result (Table 2).

During the survey, respondents were also asked about their land history, including farming system they use when they initially own/manage their lands, five years ago, plan for the next three years, and their current farming system. These were explored to understand land change dynamics as a result of farmers decision-making, in terms of historical land use and future vision.

Most farmers manage coffee farms, both in the form of simple and complex agroforestry. The former refers to a coffee farm with at least five species including the main crop, whereas the latter is a coffee farm with at least one species in addition to the main crop.

Most of the respondents' lands, such as rubber farm, rice field, and simple coffee agroforestry, show a decreasing trend ranging from 5% to 21% compared to five years ago. Meanwhile, the proportion of respondents managing vegetable farms has increased by 93%. Most of the vegetable farms were converted from rice field, simple coffee agroforestry, and bush/fallow. In general, bush/fallow land cover has significantly decreased because many farmers already use it (Figure 1).

An increase in complex coffee agroforestry plots tends to reduce the number of simple coffee agroforestry plots. This is because the simple coffee agroforestry has gradually evolved into complex ones over the period of five years. The number of bush/fallow plots decreased significantly, approximately 43% fewer than five years ago. Bush/fallow was converted into coffee agroforestry, vegetable farm, and rice field (Table 3). In general, farming systems in Pagar Alam has remained nearly unchanged over the last five years, indicating that farmers do not easily switch their crop commodities.

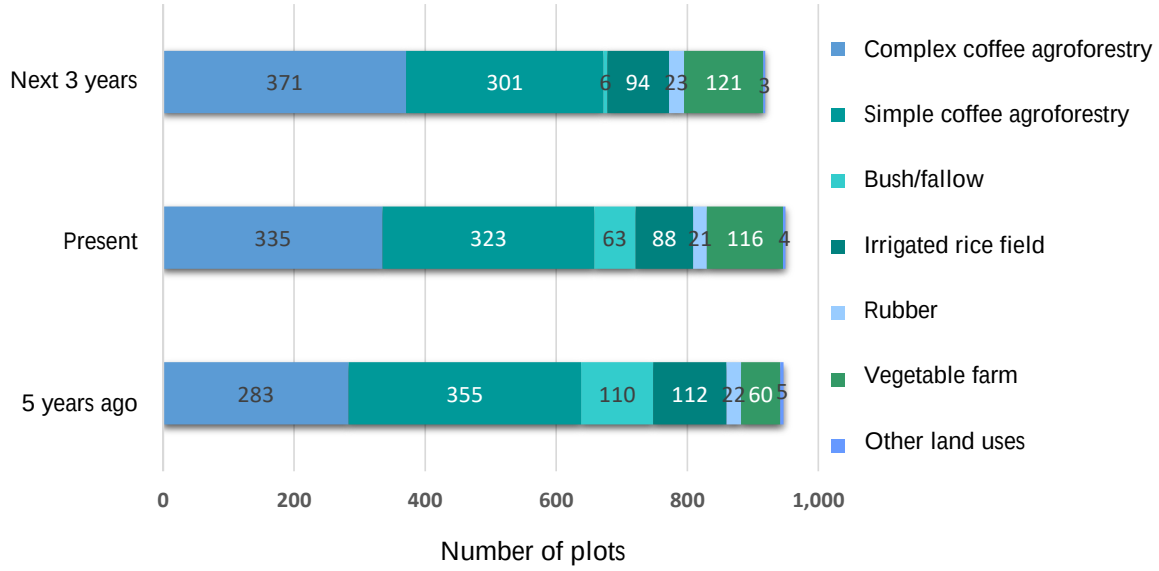

Figure 1. Pagar Alam agricultural land use dynamics

Changes in land use for each plot prior to ownership/ management occurred at different times. However, it is interesting to observe how farming households decide on land use when they receive new plots to manage. Compared to the use of plots before they were owned/managed, the number of vegetable farms has tripled. This indicates that number of farming households who implement these agricultural practices is growing, and they do so by converting bush/fallow, coffee agroforestry, and rice fields (Figure 1 and Table 4).

Table 3. Comparison of farming systems on the same land during the survey and five years ago

Farming system five years ago	(%)	Farming system during the survey	Number of plots
Coffee agroforestry* Bush/fallow Other land uses	93.7 5.4 0.9	Complex coffee agroforestry	335
Coffee agroforestry Bush/fallow Other land uses	92.3 6.5 1.2	Simple coffee agroforestry	323
Vegetable farm Coffee agroforestry Rice field Bush/fallow Other land uses	49.1 18.1 20.7 11.2 1.8	Vegetable farm	116
Rice field Bush/fallow Other land uses	97.8 1.1 1.1	Rice field	88
Rubber Coffee agroforestry	95.2 4.8	Rubber	21
Bush/fallow Coffee agroforestry Other land uses	88.9 6.3 4.8	Bush/fallow	63

Note: *Coffee agroforestry includes both simple and complex systems

The proportion of complex coffee agroforestry plots also increased by 98%, from only 169 plots (prior to ownership/management) to 335 plots during survey. The proportion of rubber farms increases by about 75%. Rice field plots fell by 27%, indicating that the preference for farming rice is gradually declining (Figure 1).

Table 4. Comparison of farming system on the same land during the survey and when lands initially owned/ managed by farmers.

Farming system when lands initially owned/ managed by farmers	(%)	Farming system during the survey	Number of plots
Coffee agroforestry* Bush/fallow Other land uses	69.3 24.2 6.5	Complex coffee agroforestry	335
Coffee agroforestry Bush/fallow Other land uses	75.2 20.4 4.4	Simple coffee agroforestry	323
Bush/fallow Coffee agroforestry Vegetable farm Rice field Other land uses	26.7 23.3 23.3 22.4 4.3	Vegetable farm	116
Rice field Bush/fallow Coffee agroforestry	96.6 2.3 1.1	Rice field	88
Rubber Bush/fallow Coffee agroforestry	52.4 38.1 9.5	Rubber	21
Bush/fallow Coffee agroforestry Other land uses	84.1 6.4 9.5	Bush/fallow	63

Note: *Coffee agroforestry includes both simple and complex systems

4. Agricultural land use vision and farming system profitability

For the next three years, the majority of Pagar Alam respondents want to change the current farming system into complex coffee agroforestry, rice field, and vegetable farm (Figure 1 and Table 5). Only a few plans to add more rubber plots for the next three years because they are dissatisfied with the price, and many rubber farms are even left unmanaged. For the next three years, several respondents plan to convert their plots of bush/fallow, coffee, rubber, and vegetable into other land uses uncommon in Pagar Alam, such as orange, timber, and lemongrass (Table 5).

In addition to profit, farmers' decision to change agricultural land they own/manage in the future is also influenced by initial costs of land clearing and production costs (Table 6). Profit from vegetable farms can be up to eight time higher than those from coffee agroforestry, but it requires higher initial investment and more workers. Farmers only incur production costs if they do not convert their lands. Familiarity of farmers with farming system or farming culture also influences their decision to keep or convert their lands (plots). The majority of farmers in Pagar Alam still consider coffee farming as a culture passed down through generations from their ancestors, so that many farmers continue to farm coffee even though they farm other commodities. (Amaruzaman et al., 2021).

Table 5. Comparison of farming system during the survey and the following three years

Farming system during the survey	Number of plots	Farming system plan for the next 3 years	(%)
Complex coffee agroforestry	335	Coffee agroforestry* Bush/fallow Vegetable farm	94.3 4.9 0.8
Simple coffee agroforestry	323	Coffee agroforestry Bush/fallow Other land uses	90.4 7.6 2.0
Rubber	21	Rubber Bush/fallow Other land uses	69.6 17.4 13.0
Vegetable farm	116	Vegetable farm Rice field Coffee agroforestry Other land uses	77.6 6.9 5.2 10.3
Rice field	88	Rice field Coffee agroforestry Other land uses	89.8 6.8 3.4
Bush/fallow	63	Coffee agroforestry Vegetable farm Bush/fallow	65.1 12.7 9.5

Note: *Coffee agroforestry includes both simple and complex systems

Photo 2. Coffee agroforestry is a long-standing culture in Pagar Alam

Table 6. Profitability of Pagar Alam farmers' farming system (Isnurdiansyah et al., 2021)

	Land clearing cost in millions IDR/ha	Man-day (HOK) in farming system	Input cost (excluding workers) in millions IDR/ha	Return to Land in millions IDR/ha/year	Return to Worker in thousands IDR/Man-day
Coffee agroforestry	2.5	38	0.6	6.2	93.9
Rubber monoculture	2.4	18	1.4	3.6	9.8
Rubber agroforestry	2.4	10	1.9	0.9	60.9
Vegetable crops	35.3	282	18.4	50.3	104.2
Irrigated rice field	12.0	178	3.1	10.3	72.4
Orange farm	4.0	9	3.6	24.5	291.6
Lemongrass	12.7	164	4.5	11.6	80.3

5. Conclusion and recommendation

Conclusion

- It is known that Pagar Alam's agricultural land use changes dynamically at different times, but there have been no significant changes in farming system types. Pagar Alam farmers tend to manage tree-based farming system (such as coffee and rubber) as well as annual agricultural system (such as irrigated rice field and vegetable crops).
- Farmers who decide to convert lands and develop a new farming system are influenced by the intention to increase their income, as well as capital availability and technical capability if the farming system is new.
- Most of Pagar Alam farmers are open to commercial farming innovation. Large companies are interested to invest in commercial farming systems, which may change local community behaviour and land use.

Recommendation

- Policymakers and implementers should understand farmer's vision and preferences for changing the existing farming system and agricultural land use. Converting tree-based land use to another may have ecological impacts, including a decrease in quality and quantity of environmental services in the future. Sustainable farming systems and production landscapes (particularly in upland area with steep slopes) should be continuously maintained and monitored by taking disaster vulnerability into account. In terms of economic aspect, large-scale capital investment and policies on farming system development require detailed consideration of negative externalities and feasibility from environmental aspect.

Referensi

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