RICE AREA AND PRODUCTION ESTIMATES FOR THE 2023 MONSOON SEASON

This report by the Asian Disaster Preparedness Center (ADPC) details the rice cultivation in Myanmar for the 2023 monsoon season. It covers the 11 states and regions—Ayeyarwady, Bago, Yangon, Rakhine, Magway, Mandalay, Sagaing, Shan, Kayah, and Kayin—that historically account for around 95 percent of the country's total production. The remaining states—Kachin, Chin, Nay Pyi Taw, and, Tanintharyi—contribute the remaining 5 percent and were not included in this study.

Key Findings

Climate and Conflict: The 2023 monsoon season experienced a delayed onset following Cyclone Mocha, leading to lower early rainfall and higher later rainfall than historical averages. Additionally, the season, despite escalating incidents of conflict, showed resilience in regions/states like Rakhine and Sagaing.

Rice Area Estimates: The total rice cultivation area in 2023 saw a minor decrease of 2 percent from 2022, totaling 4,217,729 ± 425,091 hectares. While these figures could point to a continued decline in rice area, they are within the estimated error margin and could also indicate stability in rice cultivation.

Rice Production Estimates: The overall production of rice in 2023 amounted to 12,955 ± 1,294 thousand tons, a five percent increase from 2022, despite the varying degrees of recovery and decline across the states and regions. This overall growth indicates a positive outlook for rice production in the face of ongoing climatic and geopolitical challenges.

Regional Disparities: The estimated rice areas in Ayeyarwady, Mon, and Mandalay remained stable, demonstrating resilience in their agricultural practices. Bago, Shan, Magway, and Kayah faced notable reductions in area, with Kayah experiencing a significant 26 percent decrease. On the production front, Ayeyarwady, Sagaing, and Rakhine saw increases of 11, 9, and 35 percent, respectively. In contrast, Shan and Kayin each reported an 8 percent decline in production, while Mon and Kayah experienced more pronounced drops of 20 and 23 percent, respectively. The remaining states and regions maintained relatively consistent production levels compared to the previous year.

Background

The monsoon season, which begins in May and extends to November, is critical for Myanmar's agriculture. It not only supports crops grown during the rainy season but also replenishes water reservoirs essential for irrigation throughout the summer.

This past year, Cyclone Mocha marked the onset of the monsoon, causing significant pre-season losses, especially for farmers in the northwest [1]. These challenges were compounded by heavy flooding in lower Myanmar in October and escalated conflicts later in the season [2], which further strained the agricultural sector.

Recent shifts in climate patterns have led to monsoon rains arriving later than usual, as shown in the monthly and cumulative precipitation anomaly charts, where data are compared against a baseline from 1981-2022 (Figure 1). This includes a notably dry June, which falls below the 30+ year historical average, potentially disrupting early rice planting stages.

In contrast, increased rainfall in the later months, particularly October, led to flooded rice fields, adversely affecting crop health. This is illustrated in the Enhanced Vegetation Index (EVI) map for October when rice is at its peak growth stage (Figure 2), indicating decreased crop vigor in areas like Yangon, Bago, and Mon, heavily impacted by the rainfall. Additionally, Rakhine displays a trend of reduced and delayed rainfall, necessitating adaptations to the changing climate conditions in the state.

Overall, the data on precipitation and vegetation health provide context for interpreting the maps of cultivated rice areas and the computations of rice area and production discussed in the subsequent sections.

Cultivated Rice Area Maps

Figures 3 to 6 show comprehensive land cover maps that delineate the distribution of rice fields, agricultural lands, and other land use types within the 11 states and regions known for rice production. These maps were generated using a random forest model applied to both optical and radar satellite data, providing a visual representation of rice cultivation areas during the 2023 monsoon season. For details regarding the data sources, methods, and the scope of limitations, the reader may refer to ADPC's preceding reports, which include comparative rice maps and the area estimations from 2021 and 2022 referenced later in this document [3-4].
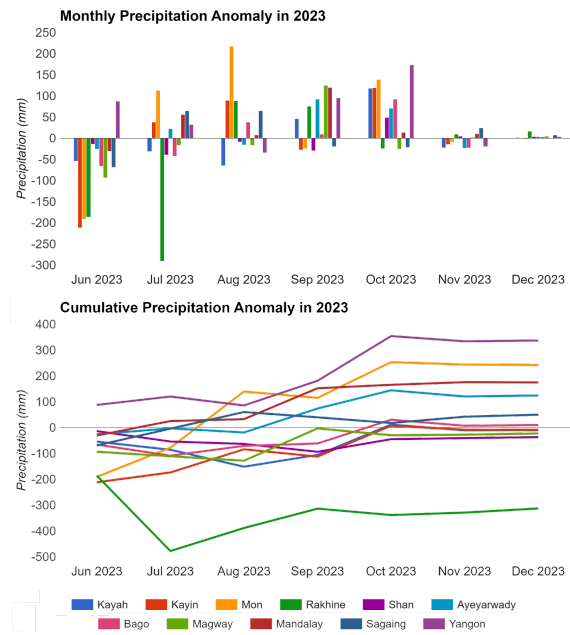

Figure 1. The monthly precipitation anomaly (top) and the cumulative precipitation anomaly (bottom).
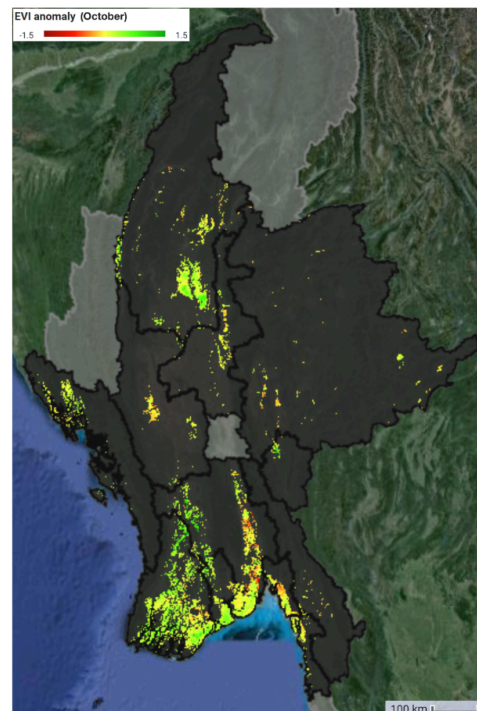

Figure 2. A MODIS-derived Enhanced Vegetation Index (EVI) map of rice fields in October 2023. The 11 states/regions of interest are highlighted in dark gray.
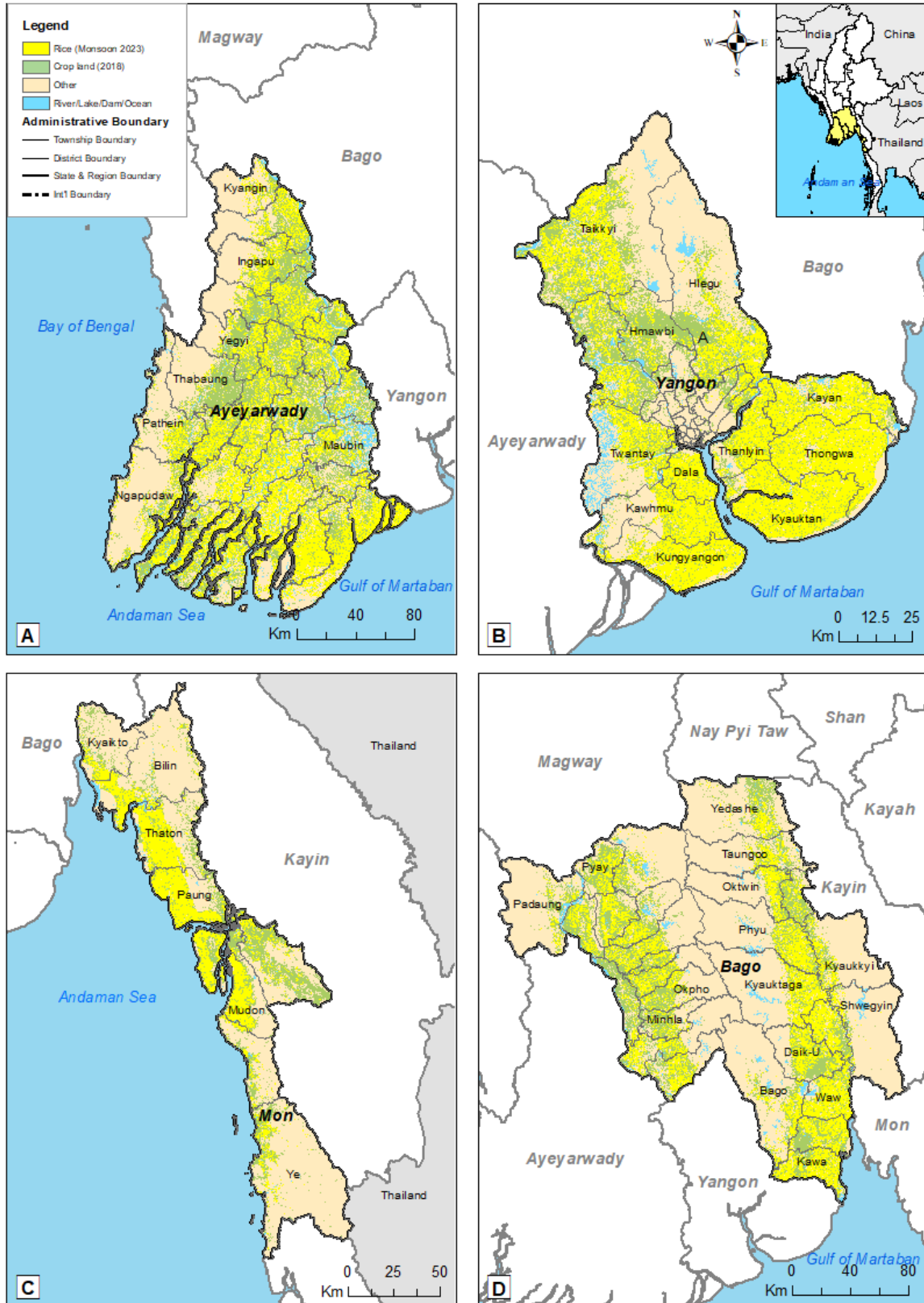
Figure 3. Land cover maps of the cultivated rice area extent in the delta regions of A) Ayeyarwady, B) Yangon, C) Mon State and, D) Bago.
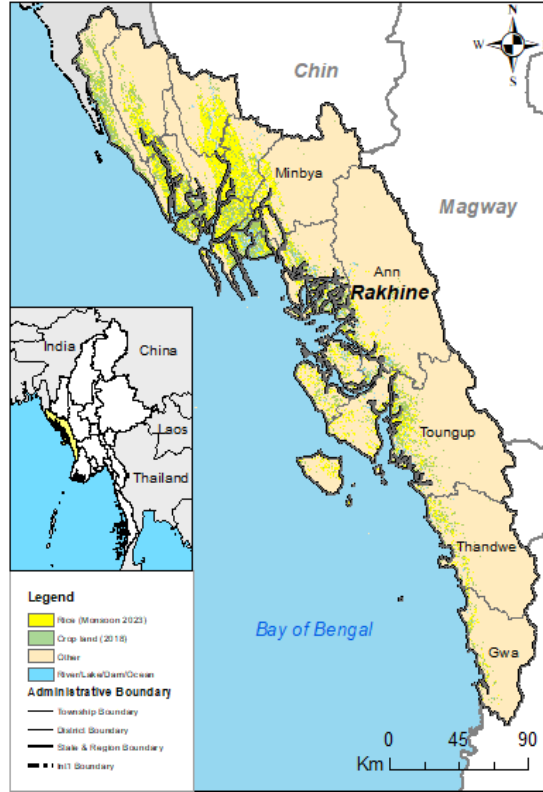
Figure 4. Land cover map of the cultivated rice area extent in the coastal zone of Rakhine State
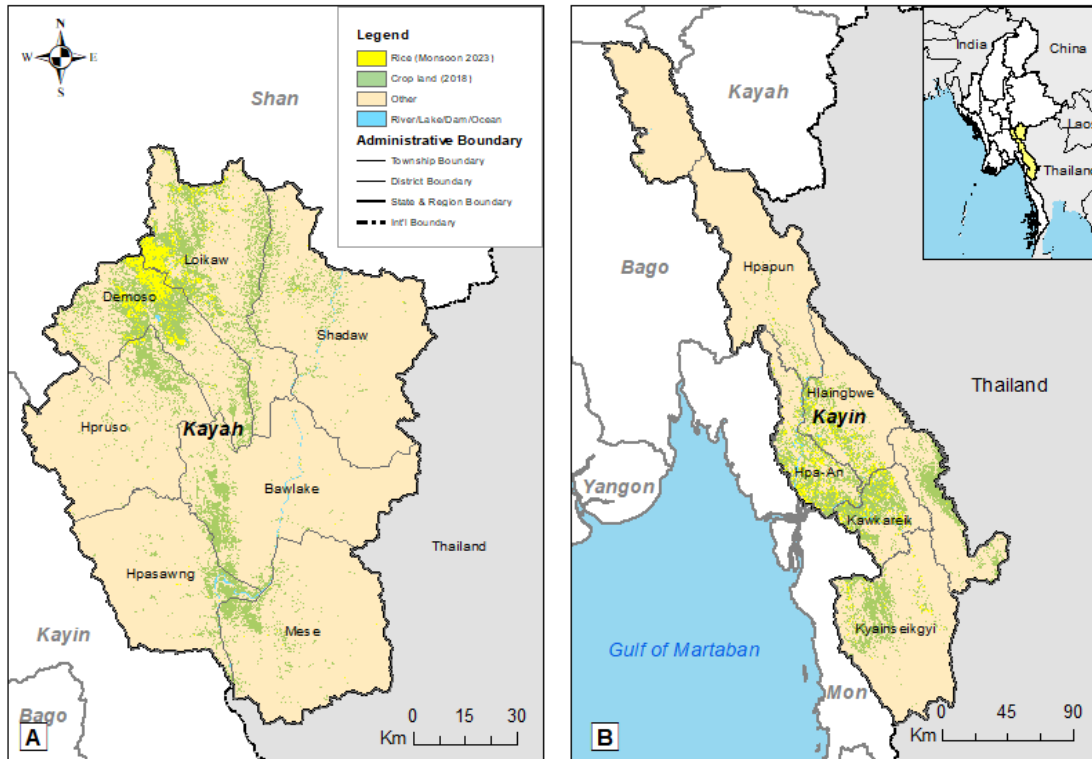

Figure 5. Land cover maps of the cultivated rice area extent in the hills and mountains of A) Kayah and B) Kayin.
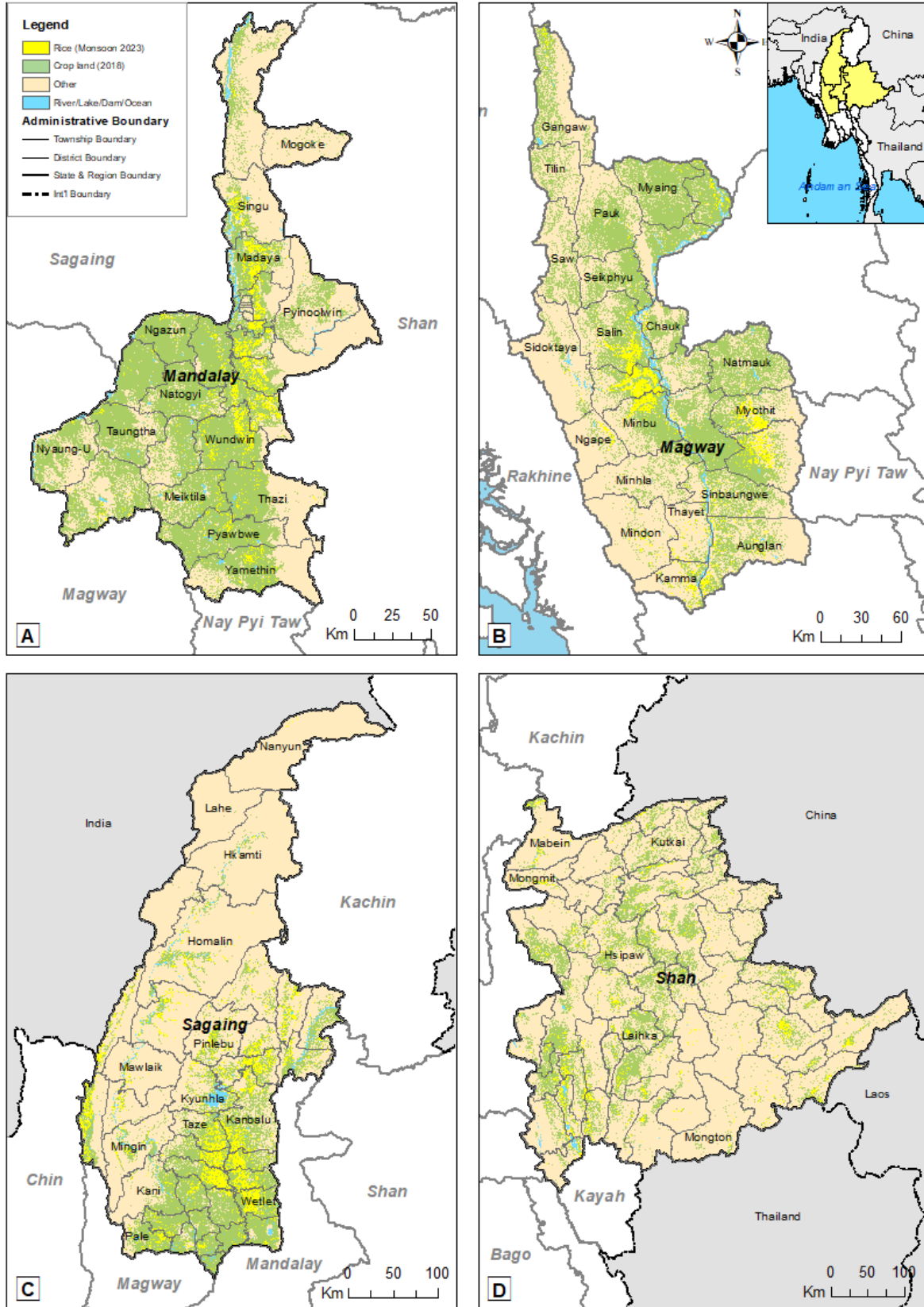
Figure 6. Land cover maps of the cultivated rice area extent in the inland regions of A) Mandalay, B) Magway, C) Sagaing, and D) Shan State

Rice Area Estimates

As seen in Table 1, there are significant fluctuations in rice cultivation area estimates when comparing data from 2021 to 2023. The total rice area experienced a decline of two percent this year from 2022, dropping from 4,305,412 ± 277,718 hectares to 4,217,729 ± 425,091 hectares. This reduction follows a previous decrease of four percent from 2021.

Looking at the coastal region, Ayeyarwady did not change in area in 2023 compared to 2022, maintaining its eight percent increase from 2021. Bago experienced a decrease of five percent from 2022, similar to its five percent decline the year prior. However, this year the townships Okpho, Minhla, and Letpadan in West Bago and Kawa and Htantabin in East Bago showed declines that were not observed the year before. Mon saw an increase of 11 percent from 2021 to 2022 but observed a small decrease of one percent in 2023. In Yangon, after a decrease of two percent from 2021 to 2022, there was a slight recovery, with a one percent increase in 2023.

Rakhine stands out with a significant recovery after a steep 20 percent decline from 2021 to 2022 to a four percent increase in its rice area in 2023. Figure 7 provides a visual analysis using the Normalized Difference Vegetation Index (NDVI) for October, November, and December. The frequency histograms complement these maps, with October's data indicating the majority of rice fields at peak vegetative growth. The transition from growth to harvest becomes apparent in November's histogram shift, followed by a significant decrease in NDVI values by December, indicating barren land. This suggests that despite concerns over the implications of Cyclone Mocha in May and escalating conflict conditions in December, most fields were successfully harvested.
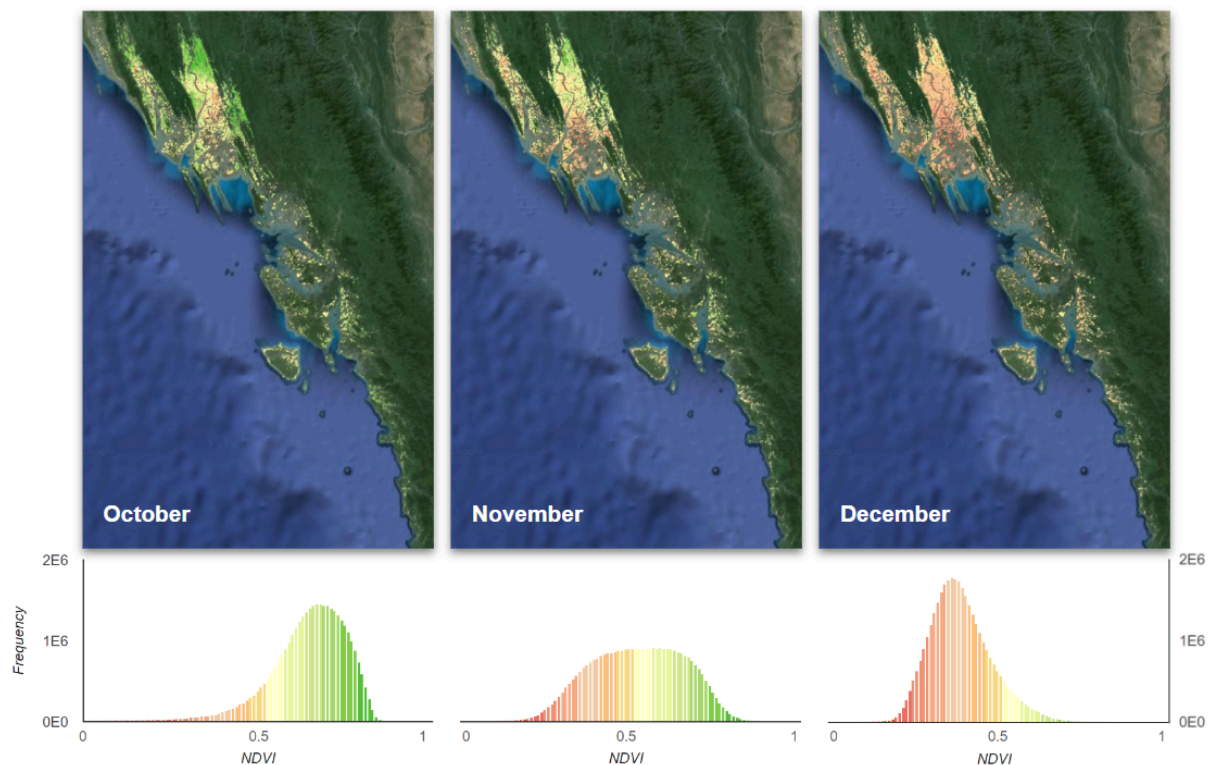

Figure 7. NDVI maps and histograms of Rakhine rice fields from October to December to corroborate whether fields were harvested.

As for the drier inland regions, Sagaing experienced a one percent increase compared to its two percent decline the year prior. Shan, which saw a nine percent decrease from 2021 to 2022, continued to decline by seven percent in 2023. Magway and Mandalay regions continued their downward trend with decreases of four percent and one percent in 2023, respectively, adding to their declines from the previous year.

Kayin's rice area increased by five percent from 2021 to 2022 but saw a reduction of 12 percent in 2023, primarily in Hpa-An and Kawkareik townships along the Gyaing River which were mainly responsible for the increase in 2022 from the year prior. Data for these areas were reviewed and found to be overestimated in 2022. This was due to the misidentification of flooding in low-lying grasslands as rice field inundation when initially mapping the season; however, with the incorporation of additional imagery from 2021 and 2023, the differences were more accurately distinguished.

The situation in Kayah State, which contributes the least to the country's overall rice production, is similar. Here, areas previously classified as rice paddy fields in 2021 were still marked as rice in 2022 due to flooding patterns, despite their barren status. This year, rice production faced a steep decline of 26 percent in 2023, a figure that more accurately reflects a decline from 2021. This significant reduction warrants further attention due to the high levels of coinciding conflict in the area.

Although the general trend suggests a decline in rice cultivation areas, the year-to-year variations are within the range of estimation error. Consequently, it is not possible to assert with certainty that there is a consistent decline in the rice cultivation area. Given that the observed percentage changes in rice cultivation area are relatively small, they actually point toward a general stabilization of rice cultivation across the regions, despite the suggestion of a decreasing trend.

Table 1: A comparison of rice area estimates in key regions of Myanmar from 2021-2023

State or Region	Estimated Rice Area of 2021 (ha)	Uncertainty 2021 (ha)	Estimated Rice Area of 2022 (ha)	Uncertainty 2022 (ha)	% Change 2021-2022	Estimated Rice Area of 2023 (ha)	Uncertainty 2023 (ha)	% Change 2022-2023
Ayeyarwady	1,043,045	105,781	1,126,480	61,956	8%	1,123,997	58,441	0%
Bago	854,024	56,845	805,767	43,511	-6%	764,792	44,452	-5%
Sagaing	590,745	105,921	580,680	25,550	-2%	584,878	28,514	1%
Shan	512,958	147,035	468,169	59,926	-9%	433,669	130,451	-7%
Yangon	362,050	21,545	354,414	23,391	-2%	357,400	16,211	1%
Rakhine	364,220	28,224	291,357	11,946	-20%	304,337	22,916	4%
Mon	187,912	18,865	207,684	18,069	11%	205,354	15,742	-1%
Magway	265,059	53,180	191,018	13,753	-28%	182,601	69,598	-4%
Mandalay	198,470	44,592	156,002	9,360	-21%	154,397	11,552	-1%
Kayin	96,423	22,729	101,309	8,003	5%	89,551	25,571	-12%
Kayah	22,661	2,048	22,532	2,253	-1%	16,752	1,642	-26%
Total	4,497,566	606,764	4,305,412	277,718	-4%	4,217,729	425,091	-2%

Note: Ayeyarwady and Bago regions cultivate deep-water rice, as detailed in the monsoon 2021 and 2022 reports. The cultivation of deep-water rice spans a long season, starting as early as September and extending until March. Deep-water rice fields will be included in the summer maps only to ensure more timely reporting and to prevent double counting of the same growth cycle across the monsoon and Summer reports. Table 1 therefore presents estimates that exclude deep-water rice.

Preliminary Rice Production Estimates

The most recent rice production estimates, shown in Table 2, were derived by multiplying the rice area estimates with preliminary yield results from the International Food Policy Research Institute's (IFPRI) household surveys [5]. Based on this data, total rice production in 2023 exhibited a slight increase of five percent from the previous year, reaching approximately 12,955 ± 1,294 thousand tons. According to surveys conducted by IFPRI, the increase in rice production this year may have been motivated by a decrease in urea prices coupled with a rise in rice prices [5].

Ayeyarwady, Myanmar's leading rice-producing region, saw an 11 percent increase in production in 2023, building on an 8 percent increase in 2022 and exceeding the production levels in 2021. Bago, meanwhile, experienced a slight 3 percent increase this year, recovering from a significant 16 percent reduction in 2022. In contrast, Mon extended its previous year's 6 percent decline with a further 20 percent decrease this year.

Rakhine, notably, displayed a dramatic change. After a sharp 42 percent decline in 2022 from 2021, production in Rakhine rebounded from 2022 with a 35 percent increase in 2023.

Yangon, Magway, and Mandalay saw a stabilization of production after last year's declines of 4, 36, and 27 percent, respectively, changing by one percent each. Sagaing showed resilience, with production recovering from an 11 percent decline in 2022 to a 9 percent increase.

Other regions, such as Shan, Kayah, and Kayin, also underwent notable transformations. Shan continued its downward trajectory with an additional 8 percent reduction this year, following a 10 percent decline previously. Kayin persisted in its declining trend, with further reductions after a 6 percent decrease last year. Similarly, Kayah faced a 23 percent drop in production, following a 13 percent decrease from the prior year.

Overall, the data from 2021 to 2023, as depicted in Figure 8, showcases a range of outcomes across the states and regions. While some have demonstrated adaptability and resilience in the face of challenges, others continue to grapple with the impacts of unpredictable climate conditions and persistent conflict.

Table 2: A comparison of rice production estimates in key regions of Myanmar from 2021-2023.

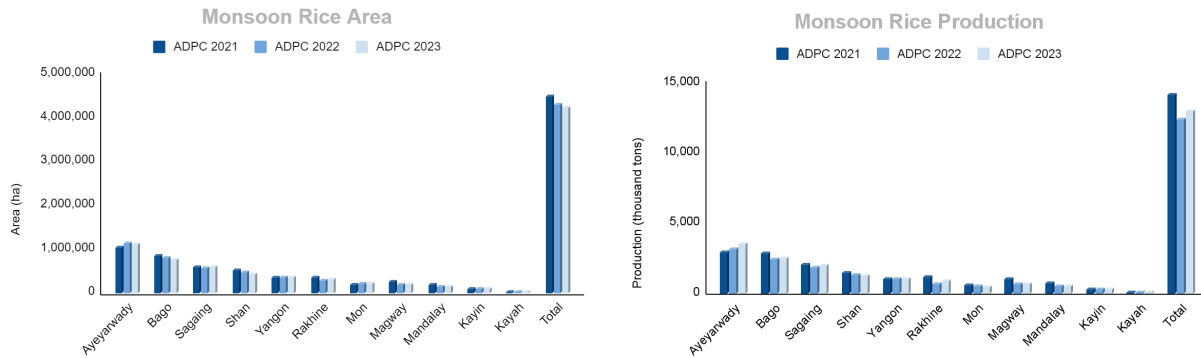| State/ Region	IFPRI 2021 Yield (kg/ha)	2021 Production (thousand tons)	IFPRI 2022 Yield (kg/ha)	2022 Production (thousand tons)	%Difference in Rice Production (2021-2022)	IFPRI 2023 Yield (kg/ha)	2023 Production (thousand tons)	%Difference in Rice Production (2022-2023)
Ayeyarwady	2,820	2,941	2,810	3,165	8%	3,128	3,516	11%
Bago	3,320	2,835	2,970	2,393	-16%	3,230	2,470	3%
Sagaing	3,470	2,050	3,130	1,818	-11%	3,388	1,981	9%
Shan	2,880	1,477	2,850	1,334	-10%	2,824	1,225	-8%
Yangon	2,900	1,050	2,830	1,003	-4%	2,785	995	-1%
Rakhine	3,150	1,147	2,300	670	-42%	2,963	902	35%
Mon	2,990	562	2,540	528	-6%	2,061	423	-20%
Magway	3,710	983	3,270	625	-36%	3,467	633	1%
Mandalay	3,580	711	3,310	516	-27%	3,314	512	-1%
Kayin	3,123	301	2,790	283	-6%	2,899	260	-8%
Kayah	2,506	57	2,200	50	-13%	2,276	38	-23%
Total		14,115		12,384	-12%		12,955	5%

Figure 8. A comparison of rice area (left) and production (right) estimates in key regions of Myanmar from 2021-2023.

Summary and Future Directions

In 2023, Myanmar's monsoon rice cultivation experienced a small 2 percent decrease in total area and a 5 percent increase in production compared to 2022. Despite facing challenges from unpredictable weather and escalating conflict, the country demonstrated resilience in its monsoon rice output.

Looking ahead, efforts will focus on refining the model used to estimate cultivated rice areas by integrating additional ground truth and radar-derived phenological data to enhance the accuracy of monsoon mapping which is particularly difficult to map due to cloud coverage. Mapping activities for the 2024 summer season, as well as for previous summers from 2018 to 2021, are planned. Upon completion, a comprehensive time series analysis covering the period from 2017 to 2024 will be conducted. This extensive analysis is expected to not only improve the quality of data concerning cultivated rice areas and production but also provide deeper insights into the impacts of significant events—such as the COVID-19 pandemic in 2019 and the coup in 2021—on food security in Myanmar.

References

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[3] Asian Disaster Preparedness Center (ADPC). 2022. Rice Map and Area Estimates of Rice Cultivation in Myanmar in the Monsoon Season of 2021
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[5] Myanmar Agriculture Policy Support Activity (MAPSA), 2024 (in prep). Rice productivity in Myanmar: Assessment of the 2023 Monsoon Season. Washington, DC: International Food Policy Research Institute (IFPRI).