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Projecting Rice Self-Sufficiency in the Philippines Through 2050: A Scenario-Based Analysis of Production, Land Use, and Regional Supply

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ABSTRACT

The Philippines stands out as both one of the world's largest rice producers and importers, presenting a significant challenge in feeding its growing population through 2050. This study explores the future of rice production, sufficiency, and resilience in the country by combining three analytical methods: (1) regional production trend analysis using Philippine Statistics Authority data from 2013 to 2025 across all 17 regions; (2) forecasting production, area harvested, and yield through 2050 using Holt's double exponential smoothing; and (3) assessing regional self-sufficiency under land conversion scenarios. Between 2013 and 2023, national palay production rose modestly from 18.44 million to 20.06 million metric tons, while the harvested area stayed steady at about 4.7 million hectares. Yield improvements from 3.89 to 4.17 MT/ha drove production gains. However, rice imports surged from 0.89 million MT in 2017 to an estimated 4.68 million MT in 2024, pushing the import dependency ratio to 28%, it's highest since 1988. Projections show production could reach 22.5 million MT by 2050, yet this falls short of the projected milled rice demand of 16.5 million MT, with a baseline production deficit of 2.4 million MT. Accounting for ongoing land conversion, this deficit could expand to 8 million MT, raising import dependency to 48%. Regionally, by 2050 only three of sixteen regions will remain self-sufficient, with Central Luzon traditionally the rice granary dropping below 100%, while eleven regions face deficits. Without major farming and land protection improvements, the Philippines will grow more import-dependent with less resilient food production.

Keywords: *Rice Sufficiency; Philippines; Exponential Smoothing; Food Security; Import Dependency; Land Conversion; Rice Tariffication Law; Production Forecast; Regional Self Sufficiency*

INTRODUCTION

Rice (Oryza sativa) is the foundation of food security in the Philippines, constituting the primary source of dietary calories for over 112 million people and providing livelihoods for approximately 10 million Filipinos (PSA, 2024; Moya et al., 2015). The Philippines occupies a distinctive position in global rice dynamics: it is simultaneously one of the world's largest rice producers and one of its largest importers, a duality reflecting deep structural challenges in the national food system (Dawe, 2010; Balisacan & Fuwa, 2004). Within the ASEAN region, the Philippines faces competitive disadvantages relative to major exporters such as Vietnam and Thailand, where larger farm sizes, more extensive irrigation, and stronger institutional support enable lower per-unit costs (Bordey et al., 2020).

The pursuit of rice self-sufficiency has defined Philippine agricultural policy for over five decades. The Rice Tariffication Law (RTL, Republic Act No. 11203) of 2019 replaced quantitative import restrictions with tariffs and established the Rice Competitiveness Enhancement Fund (RCEF), but it also depressed farmgate prices by 10 to 15%

(Cororaton, 2020; Clarete et al., 2021). In 2024, Executive Order No. 62 further reduced tariffs from 35% to 15%, prompting record imports (CPBRD, 2026). These policy shifts raise a fundamental question about the future trajectory of Philippine food security: given current production trends, population growth, and trade dynamics, what will the landscape of rice sufficiency look like through 2050, and what level of resilience will the food system possess against external shocks?

Food security encompasses four interrelated dimensions: availability, access, utilization, and stability (FAO, 2021). Philippine rice policy has overwhelmingly focused on availability through national production targets, while the spatial distribution of sufficiency across regions has received less analytical attention. As urbanization converts agricultural land in some regions while others expand rice area, the geography of domestic rice supply is shifting in ways that national aggregate statistics do not capture.

Despite growing literature on Philippine rice production, few studies have integrated regional trend analysis with forecasting models and distributional analysis to assess the future landscape. Bartelet et al. (2025) analyzed regional production stagnation using PSA data from 2013 to 2023 but did not incorporate forecasting. Taer (2025) traced the decline of rice lands but focused on national aggregates. While the IRRI household panel surveys (Moya et al., 2015) have tracked rice farming dynamics over five decades, they have not integrated production forecasting with sufficiency projections. The CPBRD (2026) documented the import surge following trade liberalization but did not connect import trends to farmer welfare.

This study addresses these gaps by: (1) analyzing regional palay production trends across all 17 administrative regions using PSA data from 2013 to 2025; (2) documenting rice import dependency dynamics from 2017 to 2024; (3) applying Holt's double exponential smoothing to forecast area, production, and yield through 2050; (4) projecting the national sufficiency gap under population growth scenarios; and (5) projecting regional self sufficiency ratios to identify which regions will function as food baskets and which will become structurally deficit under continued land conversion.

MATERIALS AND METHODS

Data Sources

This study uses secondary data from the Philippine Statistics Authority (PSA) and supplementary trade data from government and international sources. The PSA Palay Production Survey (PPS) data, accessed through PSA OpenSTAT (openstat.psa.gov.ph), covers all 17 administrative regions from 2013 to 2025. Variables include area harvested (total, irrigated, rainfed) in hectares, production volume (total, irrigated, rainfed) in metric tons, and derived yield per hectare. Rice trade data (import volumes, farmgate prices, retail prices) were obtained from PSA Foreign Trade Statistics and Supply Utilization Accounts, supplemented by CPBRD (2026) and USDA FAS (2025) for 2022 to 2024 import figures not yet available on OpenSTAT. Population data by region were sourced from the PSA Census of Population for census years 2010, 2015, 2020, and 2024.

Holt's Double Exponential Smoothing

Holt's linear trend method (Holt, 1957; Hyndman & Athanasopoulos, 2021) was applied to area harvested, production volume, and yield per hectare for each region and the national aggregate, generating forecasts from 2026 through 2050. The model comprises three equations:

Level: $L_t = \alpha Y_t + (1 - \alpha)(L_{t-1} + T_{t-1})$ Trend: $T_t = \beta(L_t - L_{t-1}) + (1 - \beta)T_{t-1}$ Forecast: $F_{t+h} = L_t + hT_t$

where L_t is the smoothed level, T_t is the trend, Y_t is the observed value, α is the data smoothing factor, β is the trend smoothing factor, and h is the forecast horizon. Parameters were optimized per region via grid search ($\alpha \in \{0.1, ..., 0.9\}$, $\beta \in \{0.1, ..., 0.5\}$) minimizing the Mean Squared Error. Initial level was set to the first observation; initial trend was estimated as the average slope: $T_1 = (Y_n - Y_1)$

$/ (n - 1)$. Forecasted area values were floor bounded at zero. It should be noted that the 25-year forecast horizon (2026 to 2050) substantially exceeds the 13-year data series (2013 to 2025), and prediction uncertainty widens considerably with increasing horizon. While analytical prediction intervals for Holt's method are available (Hyndman & Athanasopoulos, 2021, Ch. 8), the primary purpose of the forecasts in this study is to establish baseline trajectories against which land conversion scenarios are compared, rather than to generate precise point predictions. The 2050 forecasts should therefore be interpreted as trajectory indicators conditional on the continuation of recent trends, not as precise predictions. The scenario analysis (Section 3.5) provides the range of plausible outcomes.

Demand Projection and Sufficiency Gap

Projected rice demand was calculated as: Demand = Population × Per capita consumption. Population was projected from the 2024 census (112.73 million; PSA, 2024) at 0.8% annual growth (see Assumption 2, Section 2.6). Per capita rice consumption was set at 119 kg/year (PSA, 2022; see Assumption 1, Section 2.6). Milled rice production was derived by applying a 0.63 milling recovery rate to palay forecasts (see Assumption 3, Section 2.6). The sufficiency gap was computed as: Gap = Projected demand – Projected milled production.

Import Dependency Ratio

IDR = [Imports / (Domestic Production + Imports)] × 100, using milled rice equivalents. Import data covers 2017 to 2024 from PSA Foreign Trade Statistics, CPBRD (2026), and USDA FAS (2025).

Regional Self-Sufficiency Ratio

The regional self-sufficiency ratio (SSR) was computed for each of the 16 rice-producing regions as: SSR = (Regional milled rice production / Regional demand) x 100, where demand equals regional population multiplied by per capita consumption (119 kg/year). SSR values above 100% indicate surplus regions capable of supplying other areas through interregional transfers; values below 100% indicate deficit regions dependent on transfers or imports. Regional SSR was projected for 2025, 2035, and 2050 under Scenario 2 (2% annual land conversion), applying the same yield improvement trajectory and population growth rate used in the national projections.

Key Assumptions

The projections rest on several assumptions summarized in Table 7. The most consequential are noted here.

Per capita rice consumption (119 kg/year) and population growth (0.8% per year) are held constant, based on PSA (2022) and PSA (2024), respectively. Both have been declining historically, so holding them constant likely overestimates demand, making the sufficiency gap projections conservative. The

0.63 milling recovery rate follows the PSA and PhilRice standard for national accounting.

The land conversion scenarios apply uniform rates across all regions and assume yield continues improving regardless of which land is lost. In practice, conversion disproportionately affects irrigated, high-yield land near urban centers (Taer, 2025; Carating et al., 2014), meaning actual production losses may exceed the projections. Climate change impacts on yield are excluded (Peng et al., 2004; Stuecker et al., 2018), and no policy or technological disruptions are modeled. Both omissions bias the projections optimistically. The net effect is that four of seven assumptions make the projections more optimistic than the actual outcome is likely to be.

Table 7. Summary of key assumptions underlying the projections.

Assumption	Parameter Value	Source	Bias Direction	Net Effect on Gap
Constant per capita consumption	119 kg/yr	PSA (2022)	Overestimates demand	Conservative (gap may be smaller)
Constant population growth	0.8%/yr	PSA (2024)	Overestimates demand	Conservative (gap may be smaller)
Constant milling recovery	0.63	PSA/PhilRice standard	Neutral	Neutral
Uniform regional conversion	1%, 2%, or 4%/yr nationally	Taer (2025); Carating et al. (2014)	Mixed	Understates peri-urban loss
Yield unaffected by land type lost	Holt trend constant	Assumption	Understates production loss	Optimistic (gap may be larger)
No climate change impacts	None modeled	Peng et al. (2004); Stuecker et al. (2018)	Understates production loss	Optimistic (gap may be larger)
No policy/technology disruptions	Trend continuation	Standard limitation	Uncertain	Uncertain

Note: Assumptions 1 and 2 bias projections conservatively (overestimate the sufficiency gap). Assumptions 5 and 6 bias projections optimistically (underestimate the gap). The net direction of bias is uncertain, but the optimistic assumptions (5, 6) affect production directly, while conservative assumptions (1, 2) affect demand, which is the smaller component of the gap calculation.

RESULTS AND DISCUSSION

National Production Trends, 2013 to 2025

National palay production exhibited modest but uneven growth over the study period (Table 1). Production increased from 18.44 million MT in 2013 to a record 20.06 million MT in 2023, declined to 19.09 million MT in 2024, and partially recovered to 19.67 million MT in 2025. The 2013 to 2023 growth of 9% over a decade translates to an annualized rate of less than 1%, substantially below the population growth rate of approximately 1.5% over the same period.

Area harvested remained remarkably stable, fluctuating within a narrow band of 4.56 to 4.82 million hectares (Table 1). This stability contrasts with the documented contraction of the physical rice land inventory (as distinct from area harvested, which includes double cropped land) from 3.6 million hectares in 1980 to 1.9 million hectares by 2012 (PSA, 2022; CARRD, 2015), indicating that the major period of rice land conversion occurred before the study window. Production gains were driven entirely by yield improvements, from 3.89 MT/ha in 2013 to 4.17 MT/ha in 2023 (7.2% increase). National average yield remains approximately 44% below the achievable potential of 6 to 8 MT/ha (Bordey et al., 2020).

Table 1. National palay production, area harvested, yield, milled rice production, and rice imports, Philippines, 2013 to 2025.

Year	Area Harvested (ha)	Palay Productio n (MT)	Yiel (MT/	Milled Rice (MT)	Rice Imports (MT)	IDR (%)
2013	4,746,091	18,439,420	3.89	11,616,834	—	—
2014	4,739,672	18,967,826	4.00	11,949,730	—	—
2015	4,656,227	18,149,838	3.90	11,434,398	—	—
2016	4,556,043	17,627,245	3.87	11,105,164	—	—
2017	4,811,808	19,276,347	4.01	12,144,098	888,086	6.8
2018	4,800,406	19,066,094	3.97	12,011,639	2,006,349	14.3
2019	4,651,490	18,814,827	4.04	11,853,341	3,122,094	20.8
2020	4,718,896	19,294,856	4.09	12,155,759	2,226,122	15.5
2021	4,805,077	19,960,170	4.15	12,574,907	2,975,313	19.1
2022	4,804,591	19,756,513	4.11	12,446,603	3,788,000	23.3
2023	4,815,813	20,059,562	4.17	12,637,524	3,932,000	23.7
2024	4,645,921	19,087,135	4.11	12,024,895	4,680,000	28.0
2025	4,748,885	19,674,390	4.14	12,394,866	—	—

Note: *Source: PSA Palay Production Survey via OpenSTAT (area, production, yield); PSA Supply Utilization Accounts (milled rice); PSA Foreign Trade Statistics, CPBRD (2026), and USDA FAS (2025) for import volumes. IDR = Import Dependency Ratio = Imports/ (Milled Production + Imports) x 100. Milled rice computed at a 0.63 milling recovery rate where SUA data are unavailable. Import data for 2013-2016 not available in PSA dataset. 2022-2024 import volumes from CPBRD (2026) and USDA FAS (2025).*

Regional Production Asymmetries

Regional analysis reveals pronounced spatial concentration and divergent area trajectories (Table 2). In 2023, Central Luzon (3.64 million MT, 18.1%), Cagayan Valley (3.03 million MT, 15.1%), and Western Visayas (2.26 million MT, 11.3%) collectively produced 44.5% of national output. Adding the Ilocos Region (9.9%), the top four regions produced more than half the country's rice.

Yield varied substantially: Central Luzon recorded 5.25 MT/ha, while Central Visayas achieved only 3.00 MT/ha, a 75% differential reflecting differences in irrigation coverage, input access, and extension support. Area change from 2013 to 2025 was strikingly heterogeneous: Central Visayas lost 28.3%, CAR lost 25.1%, Western Visayas lost 23.5%, and Eastern Visayas lost 20.3%. Conversely, MIMAROPA grew 18.6%, BARMM 15.5%, and Northern Mindanao 12.0%. These expansions and contractions approximately offset each other at the national level, producing the observed aggregate stability.

Table 2. Palay production, area harvested, yield, and area change by region, Philippines, 2023 (ranked by production).

Region	Production 2023 (MT)	Area arvested 023 (ha)	eld 23 /ha)	Natio nal Share (%)	Area Change 2013-2025 (%)
Region III - Central Luzon	3,638,431	692,877	5.25	18.1	-3.3
Region II - Cagayan Valley	3,026,088	632,728	4.78	15.1	+5.4
Region VI - Western Visayas	2,263,158	666,296	3.40	11.3	-23.5
Region I – Ilocos	1,990,287	410,925	4.84	9.9	+1.5
Region V – Bicol	1,302,649	344,007	3.79	6.5	-0.6
Region XII – SOCCSKSAR GEN	1,256,406	338,689	3.71	6.3	-3.6
Region IV-B – MIMAROPA	1,210,384	310,185	3.90	6.0	+18.6
BARMM	895,563	258,178	3.47	4.5	+15.5
Region VIII - Eastern Visayas	844,372	241,291	3.50	4.2	-20.3
Region X - Northern Mindanao	824,241	173,969	4.74	4.1	+12.0
Region IX - Zamboanga Peninsula	703,864	170,567	4.13	3.5	+7.7
Region XIII – Caraga	543,431	162,990	3.33	2.7	-6.3
Region XI – Davao	502,745	110,834	4.54	2.5	+7.9
Region IV-A – CALABARZ ON	433,399	108,320	4.00	2.2	-10.2
CAR	331,470	96,233	3.44	1.7	-25.1
Region VII - Central Visayas	293,073	97,724	3.00	1.5	-28.3
PHILIPPIN ES (Total)	**20,059,562**	**4,815,813**	**4.17**	**100.0**	**+0.1**

Note: *Source: PSA Palay Production Survey via OpenSTAT. Area change = (Area 2025 - Area 2013) / Area 2013 x 100. NCR excluded (negligible rice production). Red values indicate area contraction exceeding 10%; green indicates expansion exceeding 10%. The 2024 Negros Island Region reclassification (RA 12000) affects 2025 area figures for Western Visayas and Central Visayas.*

Rice Import Dependency

The Philippines' rice import trajectory underwent structural breaks following the RTL in 2019 and EO 62 in 2024 (Table 3). Pre-RTL imports under quantitative restrictions were 0.89 million MT in 2017 and 2.01 million MT in 2018. Post RTL, imports surged to 3.12 million MT in 2019 (+56%). After a COVID-19 moderation (2.23 million MT in 2020), imports rose continuously: 2.98 million MT (2021),

3.79 million MT (2022), 3.93 million MT (2023), and 4.68 million MT (2024). The 2024 figure represents the highest volume since 1988, driven by EO 62's tariff reduction from 35% to 15% (CPBRD, 2026). The IDR rose from approximately 7% in 2017 to 28% in 2024.

Farmgate palay prices increased from PHP 16.53/kg in 2013 to PHP 20.06/kg in 2018, then declined sharply to PHP 16.95/kg in 2019 following RTL implementation, recovered partially post 2020, and surged to PHP 23.48/kg in 2024 amid global price increases. Retail regular milled rice prices followed a similar pattern, reaching PHP 50.41/kg in 2024. The farmgate to retail spread widened from PHP

23.31/kg in 2018 to PHP 26.93/kg in 2024, suggesting increased value capture by intermediaries.

Table 3. Rice import volume, farmgate and retail prices, and price spread, Philippines, 2013 to 2024.

Year	Rice Imports (MT)	armgate rice PHP/kg)	etail rice PHP/kg)	ice read HP/kg)	Policy Context
2013	—	16.53	34.95	18.42	*Pre-RTL*
2014	—	19.46	39.76	20.30	*Pre-RTL*
2015	—	17.55	39.47	21.92	*Pre-RTL*
2016	—	17.76	39.02	21.26	*Pre-RTL*
2017	888,086	18.08	39.52	21.44	*Pre-RTL; QR regime*
2018	2,006,349	20.06	43.37	23.31	*Pre-RTL; QR regime*
2019	3,122,094	16.95	41.16	24.21	*RTL enacted (RA 11203)*
2020	2,226,122	16.76	39.05	22.29	*Post-RTL; COVID-19*
2021	2,975,313	16.76	38.28	21.52	*Post-RTL*
2022	3,788,000	17.44	39.15	21.71	*Post-RTL; global price rise*
2023	3,932,000	19.88	42.80	22.92	*Post-RTL; record production*
2024	4,680,000	23.48	50.41	26.93	*EO 62 (tariff 35% to 15%)*

Note: *Source: PSA Foreign Trade Statistics, CPBRD (2026), USDA FAS (2025) for imports. PSA OpenSTAT for farmgate and retail prices. Price spread = Retail price minus farmgate price. Import data unavailable for 2013-2016 from PSA dataset. RTL = Rice Tariffication Law; QR = Quantitative Restriction; EO 62 = Executive Order No. 62.*

Exponential Smoothing Forecasts to 2050

Holt's double exponential smoothing, with optimized parameters of $\alpha = 0.1$ and $\beta = 0.1$ for the national aggregates, projects the following trajectories (Table 4):

Area harvested is projected to remain virtually flat at approximately 4.74 million hectares through 2050, reflecting the offsetting regional dynamics (contractions in Visayas/peri urban areas balanced by Mindanao expansion). Production volume is projected to increase from 19.67 million MT in 2025 to approximately 20.28 million MT by 2030 and 22.46 million MT by 2050, driven solely by yield improvements. Yield is projected to grow from 4.14 MT/ha in 2025 to approximately 4.74 MT/ha by 2050, a 14.5% increase over 25 years.

Table 4. Holt's double exponential smoothing: National forecasts for selected years, 2025 to 2050.

Year	Area (M ha)	Palay (M MT)	ld T/ha)	Pop. (M)	emand I MT)	Suppl y (M MT)	nce (M	95% PI for Palay (M MT)
2025	4.75	19.67	4.14	112.73	13.41	12.39	-1.02	*Actual*
2030	4.74	20.28	4.28	117.30	13.96	12.78	-1.18	*18.7 to 21.8*
2035	4.74	20.82	4.40	122.08	14.53	13.12	-1.41	*19.0 to 22.7*
2040	4.74	21.37	4.51	127.05	15.12	13.46	-1.66	*19.3 to 23.5*
2045	4.74	21.91	4.63	132.23	15.74	13.80	-1.93	*19.6 to 24.2*
2050	4.74	22.46	4.74	137.63	16.38	14.15	-2.23	*19.9 to 25.0*

Note: *Source: 2025 values from PSA OpenSTAT. 2030-2050 values from Holt's exponential smoothing (α = 0.1, β = 0.1). Population projected at 0.8% annual growth from 2024 base of 112.73M (PSA, 2024). Per capita consumption = 119 kg/year (PSA, 2022). Milled rice = palay x 0.63. Balance and rice balance = Milled production minus demand. Negative values indicate deficit (import requirement). More negative = larger shortfall. 95% PI = approximate 95% prediction interval for palay production, computed using the analytical formula for Holt's method (Hyndman & Athanasopoulos, 2021, Ch. 8) with residual standard error of 0.59 M MT estimated from the 2013-2025 series. Interval widths increase with forecast horizon, reflecting growing uncertainty.*

Production Scenarios Under Agricultural Land Conversion

The exponential smoothing baseline (Section 3.4) assumes no further loss of rice land, effectively projecting the current area plateau forward. However, Agricultural land conversion remains an active and well-documented process in the Philippines. Taer (2025) reported that approximately 97,593 hectares of farmland were converted to non-agricultural uses annually between 1988 and 2016, equivalent to approximately 2.1% of the current 4.74 million hectare base per year. In Central Luzon, the country's principal rice-producing region, Carating et al. (2014) documented conversion rates of 3 to 5% per year, with prime irrigated rice lands lost to residential subdivisions and industrial zones. Kajisa (2022) corroborated this trend, reporting that average farm sizes in Central Luzon declined from

2.54 hectares in 1970 to 1.79 hectares in 2020. The National Irrigation Administration (NIA) reported that 111,079 hectares of formerly irrigated land in Central Luzon alone were converted between 2012 and 2022 (German et al., 2024). A national-scale spatial analysis by Araza et al. (2026) found a strong correlation (r = 0.89) between cropland loss and built-up expansion, with approximately 31% of converted cropland falling within legally protected zones, indicating weak enforcement of existing land use protections.

To assess the impact of continued land conversion on rice sufficiency, three scenarios were modeled, each applying a different annual area reduction rate to the 2025 base of 4.74 million hectares while holding the Holt yield forecast constant (Table 5, Figure 1). An important assumption underlying all three scenarios is that yield continues to improve at the forecast rate regardless of which land is converted. In practice, land conversion disproportionately affects irrigated, high-yield areas near urban centers (Taer, 2025; Carating et al., 2014), meaning that the scenarios may underestimate production losses if prime agricultural land is lost first. The projections should therefore be considered conservative (optimistic) estimates of production decline under land conversion.

Table 5. Rice sufficiency under three land conversion scenarios, Philippines, 2025 to 2050.

Scenario / Year	2025	2030	2035	2040	2045	2050
Baseline: No further land loss (0%/yr)						
Rice area remaining	4.74 M ha	4.74 M ha	4.74 M ha	4.74 M ha	4.74 M ha	4.74 M ha
Milled rice production	12.36 M MT	12.72 M MT	13.08 M MT	13.44 M MT	13.80 M MT	14.15 M MT
Rice demand	13.52 M MT	14.07 M MT	14.64 M MT	15.24 M MT	15.86 M MT	16.50 M MT
Rice balance	-1.16 M MT	-1.35 M MT	-1.56 M MT	-1.80 M MT	-2.06 M MT	-2.35 M MT
Import dependency ratio	8.6%	9.6%	10.7%	11.8%	13.0%	14.2%
Scenario 1: Conservative (1%/yr)						
Rice area remaining	4.74 M ha	4.51 M ha	4.29 M ha	4.08 M ha	3.88 M ha	3.69 M ha
Milled rice production	12.36 M MT	12.10 M MT	11.83 M MT	56 M MT	11.28 M MT	11.01 M MT
Rice demand	13.52 M MT	14.07 M MT	14.64 M MT	15.24 M MT	15.86 M MT	16.50 M MT
Rice balance	-1.16 M MT	-1.97 M MT	-2.81 M MT	-3.68 M MT	-4.57 M MT	-5.49 M MT
Import dependency ratio	8.6%	14.0%	19.2%	24.2%	28.8%	33.3%
Scenario 2: Historical rate (2%/yr; Taer, 2025)						
Rice area remaining	4.74 M ha	4.28 M ha	3.87 M ha	3.50 M ha	3.16 M ha	2.86 M ha
Milled rice production	12.36 M MT	11.50 M MT	10.69 M MT	9.92 M MT	9.21 M MT	8.54 M MT
Rice demand	13.52 M MT	14.07 M MT	14.64 M MT	15.24 M MT	15.86 M MT	16.50 M MT
Rice balance	-1.16 M MT	-2.57 M MT	-3.96 M MT	-5.31 M MT	-6.65 M MT	-7.96 M MT
Import dependency ratio	8.6%	18.3%	27.0%	34.9%	41.9%	48.2%
Scenario 3: Accelerated (4%/yr; Central Luzon rate)						
Rice area remaining	4.74 M ha	3.86 M ha	3.15 M ha	2.57 M ha	2.10 M ha	1.71 M ha
Milled rice production	12.36 M MT	10.37 M MT	8.70 M MT	7.28 M MT	6.10 M MT	5.10 M MT
Rice demand	13.52 M MT	14.07 M MT	14.64 M MT	15.24 M MT	15.86 M MT	16.50 M MT
Rice balance	-1.16 M MT	-3.70 M MT	-5.95 M MT	-7.95 M MT	-9.76 M MT	-11.40 M MT
Import dependency ratio	8.6%	26.3%	40.6%	52.2%	61.5%	69.1%

Note: *Source: Authors' projections. Area reduction applied annually to the 2025 base of 4.74 M ha. Yield follows the Holt forecast trend (4.14 to 4.74 MT/ha by 2050). Population projected at 0.8%/yr from 2024 base of 112.73 M (PSA, 2024). Per capita consumption = 119 kg/yr. Milled rice = palay x 0.63. Conversion rates: 1%/yr = conservative estimate for continued peri-urban encroachment; 2%/yr = national historical rate derived from Taer (2025), 97,593 ha/yr over 4.74 M ha; 4%/yr = midpoint of Carating et al. (2014) Central Luzon rate of 3 to 5%/yr.*

Scenario Outcomes and Projected Sufficiency Gaps

The three scenarios produce markedly divergent outcomes (Table 5). Under the baseline (no land loss), the sufficiency gap widens from 1.16 million MT in 2025 to 2.35 million MT by 2050, with the IDR reaching 14.2%. Under Scenario 1 (1% annual conversion), area declines to 3.69 million hectares by 2050, the gap nearly triples to 5.49 million MT, and the IDR reaches 33.3%. Under Scenario 2 (2% annual conversion), area contracts to 2.86 million hectares, milled production falls to 8.54 million MT, the gap reaches 7.96 million MT, and the IDR rises to 48.2%. Under Scenario 3 (4% annual conversion), area shrinks to 1.71 million hectares, and the gap widens to 11.40 million MT with an IDR of 69.1%.

Figure 1 illustrates this divergence against the historical production and import record from 1987 to 2050. Domestic milled production has been below demand since approximately 2005, with the gap filled entirely by imports (green bars). After 2025, the four scenario lines diverge progressively, with the gap between each production line and the demand line representing the minimum import volume required.

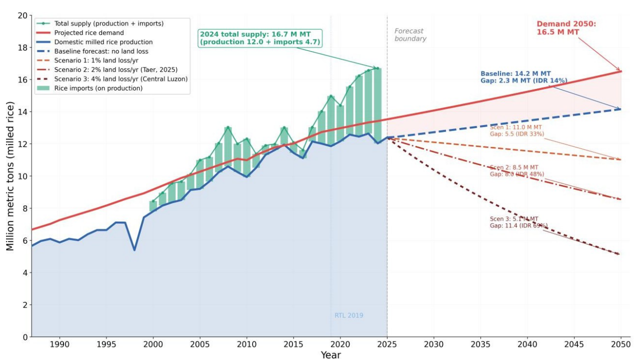

Figure 1. Milled rice production (blue), imports stacked on production (green), total supply (green line), and demand (red), Philippines, 1987 to

2050. Scenarios: baseline (0%), 1%, 2% (Taer, 2025), 4% (Carating et al., 2014) annual land conversion. Source: PSA OpenSTAT; CPBRD (2026); USDA FAS (2025).

Figure 2 traces the historical trajectory of palay area harvested from 1987 to 2025, showing the expansion from 3.35 million hectares in 1987 to the 2013 to 2025 plateau at approximately 4.7 million hectares, with the 1998 El Niño dip to 3.17 million hectares visible. The three conversion scenario projections diverge after 2025, illustrating the range of potential area contraction.

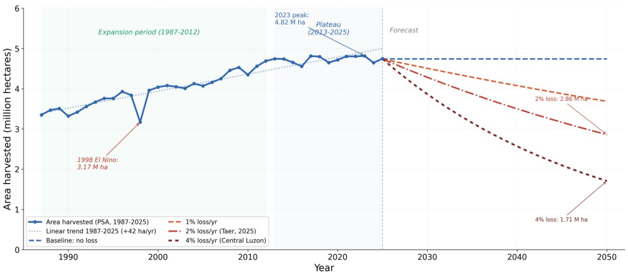

Figure 2. Palay area harvested and conversion scenarios, Philippines, 1987 to 2050. Solid blue: PSA (1987 to 2025). Dotted: linear trend (+42,300 ha/yr). Dashed: projected area under three conversion scenarios. Source: PSA OpenSTAT; CEIC.

Regional Self-Sufficiency Under Land Conversion

To assess the spatial distribution of rice sufficiency vulnerability, the self-sufficiency ratio (SSR) was computed for each region under Scenario 2 (2% annual land conversion) for 2025, 2035, and 2050. SSR is defined as the ratio of regional milled rice production to regional demand (population multiplied by per capita consumption of 119 kg/year), expressed as a percentage. An SSR above 100% indicates a surplus region capable of supplying other areas; an SSR below 100% indicates a deficit region dependent on interregional transfers or imports.

The analysis reveals a stark and widening spatial divide (Figure 3). In 2025, the Philippines has three major rice surplus regions: Cagayan Valley (SSR 434%), Ilocos (199%), and MIMAROPA (198%), which collectively function as the country's rice food baskets. Central Luzon (155%) and Western Visayas (151%) contribute additional surpluses that are transferred to deficit regions. At the other extreme, CALABARZON (SSR 14%) and Central Visayas (19%) are already in critical deficit, producing less than one-fifth of what they consume. The heavily urbanized CALABARZON region, home to 16.2 million people, is the most food insecure region in the country by this metric, dependent almost entirely on rice transfers from Central Luzon, Cagayan Valley, and imported supply.

By 2035, the number of surplus regions shrinks from five to four as Western Visayas declines to marginal status (SSR 122% to below the comfortable surplus threshold). Central Luzon, the traditional rice granary, drops to 122%, a level at which its surplus capacity is severely constrained. CAR (79%), Zamboanga (77%), Eastern Visayas (79%), and Northern Mindanao (69%) all fall below 80%, signaling that they can no longer reliably feed themselves from domestic production. Davao drops to 40%, entering severe deficit territory.

By 2050, only three regions retain SSR values above 100%: Cagayan Valley (242%), Ilocos (110%), and MIMAROPA (113%). Central Luzon falls to 85%, meaning the country's largest rice-producing region can no longer feed its own population. Eleven of sixteen regions are in deficit, with six in moderate deficit (SSR 50 to 75%), two in severe deficit (Davao 28%, Northern Mindanao 48%), and two in critical deficit (CALABARZON 8%, Central Visayas 11%). The entire food system becomes dependent on two to three surplus regions plus imports, creating extreme concentration risk.

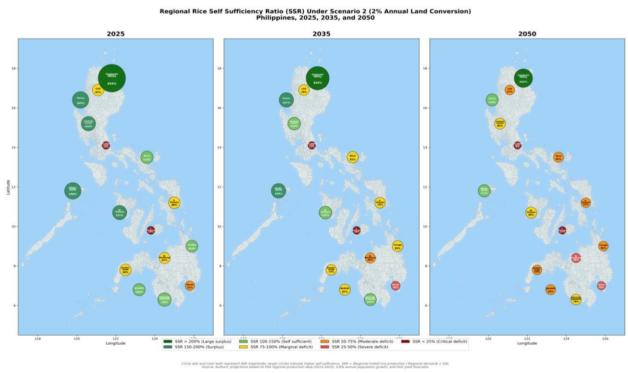

Figure 3. Regional rice self-sufficiency ratio (SSR) under Scenario 2 (2% annual land conversion), Philippines, 2025, 2035, and 2050. Circle size and color represent SSR: larger circles indicate higher self-sufficiency. SSR = milled production/demand x 100. Source: Authors' projections based on PSA regional data.

Table 6. Regional self-sufficiency ratio (SSR, %) under Scenario 2 (2% annual land conversion), 2025, 2035, and 2050.

Region	SSR 2025	SSR 2035	SSR 2050	Status 2050	Classification
Cagayan Valley	434%	344%	242%	Surplus	*Food basket*
Ilocos	199%	157%	110%	Surplus	*Food basket*
MIMAROPA	198%	159%	113%	Surplus	*Food basket*
Central Luzon	155%	122%	85%	Marginal deficit	*Transition region*
Western Visayas	151%	122%	88%	Marginal deficit	*Transition region*
SOCCSKSARGEN	136%	109%	78%	Marginal deficit	*Transition region*
BARMM	108%	87%	63%	Moderate deficit	*Deficit region*

Bicol	114%	91%	65%	Moderate deficit	*Deficit region*
Caraga	103%	83%	60%	Moderate deficit	*Deficit region*
Eastern Visayas	98%	79%	57%	Moderate deficit	*Deficit region*
CAR	97%	79%	57%	Moderate deficit	*Deficit region*
Zamboanga	96%	77%	54%	Moderate deficit	*Deficit region*
Northern Mindanao	87%	69%	48%	Severe deficit	*Deficit region*
Davao	51%	40%	28%	Severe deficit	*Deficit region*
Central Visayas	19%	16%	11%	Critical deficit	*Permanent deficit*
CALABARZON	14%	11%	8%	Critical deficit	*Permanent deficit*

Note: *SSR = (Regional milled rice production / Regional demand) x 100. Demand = regional population x 119 kg/yr per capita consumption. Production projected using Holt's yield forecast with 2% annual area reduction. Status classification: Surplus (SSR > 100%), Marginal deficit (75-100%), Moderate deficit (50-75%), Severe deficit (25-50%), Critical deficit (< 25%). Regions ranked by 2050 SSR descending. NCR excluded.*

Discussion

A Closing Window: Why Yield Gains Cannot Outrun the Problem

The central finding of this study is that Philippine rice production is caught between two structural forces that incremental yield gains cannot overcome. On the demand side, population continues to grow at 0.8% annually, adding roughly 900,000 rice consumers each year. On the supply side, the productive land base has ceased expanding and, under documented historical conversion rates (Taer, 2025), is contracting. The Holt smoothing forecasts show that yield is the only variable still moving in a favorable direction, but at 0.024 MT/ha/year, it is advancing too slowly to compensate. At this rate, closing the yield gap to the 6 to 8 MT/ha achievable potential (Bordey et al., 2020) would take 75 to 160 years. The Philippines does not have that kind of time. By 2035, even the baseline scenario (no land loss) projects a sufficiency gap of 1.56 million MT, and the historical rate scenario projects 3.96 million MT.

This finding extends and sharpens the conclusions of Bartelet et al. (2025), who documented the 9% production growth from 2013 to 2023 but did not project forward. What the forecasts reveal is that the growth Bartelet et al. documented was a product of yield improvement on a stable area base, and that both components are approaching their limits. The area plateau observed from 2013 to 2025 represents the best case, one that requires active land protection to maintain.

The Collapse of the Food Basket System

National aggregate statistics mask a spatial story that is, in many ways, more alarming than the national projections themselves. The Philippine rice food system has long operated on a model of interregional transfers: a small number of surplus regions (the food baskets) produce more than they consume and supply the deficit regions. The regional SSR analysis (Section 3.7, Figure 3) shows that this system is structurally weakening.

In 2025, five regions function as food baskets, led by Cagayan Valley (SSR 434%), Ilocos (199%), MIMAROPA (198%), Central Luzon (155%), and Western Visayas (151%). Together, these five generate the transferable surplus that feeds Manila, CALABARZON (SSR 14%), Central Visayas (19%), Davao (51%), and the other deficit regions. By 2050 under the historical conversion rate, this system narrows to three surplus regions, with Central Luzon and Western Visayas shifting to deficit. The country's internal food supply becomes dependent on Cagayan Valley, which, while still producing a large surplus (SSR 242%), is geographically isolated from the major consumption centers by the Sierra Madre mountain range and is connected by limited road and rail infrastructure (Briones, 2017).

The policy implication is geographic targeting. Investment in rice production yields the highest return in the regions that can still achieve and sustain surplus status: Cagayan Valley's irrigated lowlands, Ilocos's established farming systems, and MIMAROPA's expanding rice areas (Inocencio & Inocencio, 2020). Regions where urbanization has irreversibly consumed rice lands, particularly CALABARZON and Central Visayas, should be managed as permanent deficit regions with dedicated supply chain infrastructure connecting them to surplus sources. The proposed National Land Use Act (NaLUA), pending in Congress for over two decades, is most urgently needed in the transition regions (Central Luzon, Western Visayas, Northern Mindanao) where land conversion has not yet reached irreversible levels but is accelerating (Araza et al., 2026).

Deepening Import Dependency and Systemic Vulnerability

The import trajectory documented in this study (from 0.89 million MT in 2017 to 4.68 million MT in 2024) represents the fastest growth in import dependency in Philippine history (CPBRD, 2026). The RTL and EO 62 policy sequence has, intentionally or not, restructured the Philippine rice supply to rely on imported grain for more than one quarter of consumption. The scenario projections show this is not a temporary condition. Even under the most optimistic baseline (no land loss), the IDR reaches 14% by 2050. Under the historical conversion rate, it reaches 48%, a level at which nearly half of every kilogram of rice consumed by Filipinos would come from abroad.

Dawe (2010) documented the catastrophic consequences of such dependency during the 2007 to 2008 rice crisis, when India and Vietnam imposed export bans that tripled international rice prices within months. At the projected Scenario 2 import volumes of nearly 8 million MT by 2050, the Philippines would be importing more rice than any nation currently does. The concentration of imports from a single primary supplier (Vietnam) amplifies the vulnerability. Building resilience at these levels of dependency requires diversifying import sources across Vietnam, Thailand, Myanmar, and India; maintaining strategic reserves of at least 30 to 50 days of supply; and strengthening regional distribution systems that can redirect domestic surplus to deficit areas during import disruptions.

Comparison with Published Evidence

Table 8 maps the relationship between this study's findings and the published literature across eight thematic domains.

Table 8. Literature mapping: Comparison of current findings with published evidence.

Source	Key Finding from Literature	How Current Study Extends or Challenges	Domain
Bartelet et al. (2025), PLOS ONE	PSA data 2013-2023; documented 9% national production increase and regional stagnation	Current study confirms the 9% growth finding and extends the series to 2025. Adds forecasting (Holt smoothing) and land conversion scenario analysis does not present in Bartelet et al.	Production trends
Taer (2025), Food Security	Traced decline of Philippine rice lands; reported 97,593 ha/yr conversion rate (1988-2016)	This conversion rate is adopted as Scenario 2 baseline (2%/yr). The current PSA area harvested series (1987-2025) shows area expansion, but this metric includes double cropped land counted twice, while Taer measures physical land area. Both findings may be simultaneously correct: physical rice land declined while cropping intensity increased through expanded irrigation and double cropping.	Land conversion
Bordey et al. (2020), PhilRice	ASEAN competitiveness assessment; yield gap of 6-8 MT/ha potential	Current study uses the 6-8 MT/ha benchmark to calculate a 44% yield gap. The scenario analysis shows that closing this gap is the only pathway to reduced import dependency, requiring 75-160 years at current improvement rates.	Yield gap
Cororaton (2020), PIDS; Clarete et al. (2021)	RTL impact: 10-15% farmgate price decline; import surge post-2019	Current study extends the import analysis to 2024, documenting the further surge to 4.68 M MT under EO 62 and the IDR reaching 28%, the highest since 1988. The farmgate price recovery to PHP 23.48/kg in 2024 was not captured in earlier analyses.	Trade policy
Dawe (2010), FAO/Earthscan	2007-2008 rice crisis: export bans tripled prices; import dependency risks	The scenario projections (IDR reaching 33-69% by 2050) demonstrate that the vulnerability Dawe warned about is structurally deepening. At Scenario 2 levels (IDR 48%), a crisis similar to 2007-2008 would be catastrophic.	Import vulnerability
Carating et al. (2014); Araza et al. (2026)	Central Luzon conversion 3-5%/yr; r=0.89 cropland-urban correlation nationally	Adopted as Scenario 3 (4%/yr). The Araza et al. (2026) finding that 31% of conversions occur within protected zones underscores the enforcement failure driving continued land loss.	Land use policy
Scott (1976); Borras (2006)	Structural extraction in SE Asian rice farming; post-reform agrarian inequity	The persistence of tenancy and sharecropping arrangements documented by Scott and Borras provides the theoretical	Agrarian structure

		context for understanding why national production gains may not translate to food security at the household level, a dimension that warrants future research integrating macro and micro level data.	
Peng et al. (2004); Stuecker et al. (2018)	10% yield decline per 1C; ENSO accounts for 10% production variability	The current model does not incorporate climate scenarios, representing a conservative (optimistic) assumption. If climate impacts are layered onto the land conversion scenarios, sufficiency gaps would widen beyond the projections presented.	Climate risk

Note: Sources were identified through targeted searches in Scopus, Google Scholar, PSA publications, and PhilRice databases. Only sources directly cited in the analysis and discussion are included.

The most significant contribution of this study to the existing literature is the integration of production forecasting, land-conversion scenarios, and regional self-sufficiency analysis into a unified framework. Previous studies addressed these dimensions separately. Bartelet et al. (2025) analyzed trends without forecasting. Taer (2025) documented land conversion without connecting it to sufficiency projections. No prior study has mapped the spatial distribution of rice sufficiency across Philippine regions under future land conversion scenarios. The regional SSR analysis reveals that the sufficiency challenge is not simply a question of national production versus national demand, but a question of which regions will feed which other regions, and what happens when that system breaks down.

Limitations and Future Research

Several limitations warrant acknowledgment. The PSA data covers 2013 to 2025, missing the 1980 to 2012 period of major rice land conversion. Holt's method extrapolates recent trends and cannot capture structural breaks from future policy changes, technological breakthroughs, or nonlinear climate impacts. The model does not incorporate climate change scenarios (Peng et al., 2004; Stuecker et al., 2018), which may significantly alter yield trajectories; if climate impacts are layered onto the land conversion scenarios, sufficiency gaps would widen beyond the projections presented. Population projections assume a constant 0.8% growth rate, which may overestimate demand if the demographic transition accelerates. Per capita consumption is held constant at 119 kg/year, although the long term trend is declining. The regional SSR projections assume uniform land conversion rates across all regions, whereas conversion varies substantially depending on urbanization pressure and enforcement of land use regulations. Future research should develop region-specific conversion rates, incorporate climate scenarios, and integrate household-level data on harvest distribution to assess whether regional surpluses translate to farmer food security.

CONCLUSION

This study examined the future landscape of Philippine rice production, sufficiency, and resilience through the convergence of regional trend analysis, exponential smoothing forecasting, import dependency documentation, land conversion scenario modeling, and regional self sufficiency projections. The findings present a sobering but evidence-based assessment.

The Philippines produced a record 20.06 million MT of palay in 2023, yet national production grew by less than 1% annually over the 2013 to 2023 decade. Area harvested has stabilized at approximately 4.7 million hectares, with production gains driven solely by modest yield improvements that average well below half the achievable potential. Rice imports have surged from 0.89 million MT in 2017 to 4.68 million MT in 2024, the highest in nearly four decades, elevating the import dependency ratio to 28%.

Exponential smoothing projects this trajectory to continue: by 2050, production may reach 22.5 million MT through yield gains, but projected milled rice supply of 14.2 million MT will fall short of projected demand of 16.5 million MT by approximately 2.4 million MT under the baseline (no land loss) scenario, and by up to 8.0 million MT under the historical conversion rate scenario (Taer, 2025). This gap implies sustained import dependency of 14 to 48% of national rice requirements, creating structural vulnerability to global supply disruptions and price volatility.

At the regional level, the self-sufficiency analysis reveals a stark spatial concentration of supply vulnerability. By 2050, only three of sixteen regions (Cagayan Valley, Ilocos, MIMAROPA) retain SSR values above 100%, while Central Luzon, the country's traditional rice granary, drops to 85%. The convergence of stagnating production, deepening import reliance, and shrinking number of surplus regions points to a food system that is neither self-sufficient nor resilient, and that cannot become so through production enhancement alone.

Transforming this trajectory requires simultaneous action across three fronts: accelerating yield improvement toward the achievable potential (particularly through irrigation expansion and extension modernization), protecting agricultural lands in the transition regions (Central Luzon, Western Visayas, Northern Mindanao) where conversion has not yet reached irreversible levels, and managing import dependency through supplier diversification and strategic reserves. Without this convergent transformation, the future landscape of Philippine rice will be one of continued import dependency, extreme geographic concentration of supply in two to three food basket regions, and diminished capacity to withstand the supply shocks that global climate change and geopolitical instability will increasingly produce.

The question posed in the title of this study, whether the Philippines can still feed itself, does not admit a simple answer, but the evidence assembled here points toward a conditional one. Under current trends, and absent decisive policy intervention, the answer is no. The country is producing more rice than ever before in absolute terms yet falling further behind its own consumption needs with each passing year, importing at record volumes, losing agricultural land faster than yields can compensate, and concentrating its domestic supply into an ever-narrowing set of regions. What this study makes clear, however, is that the outcome is not yet fixed. The transition regions have not yet crossed the threshold of irreversible land loss. The yield gap remains wide enough that closing it would materially alter the sufficiency trajectory. The food basket regions still produce surpluses large enough to anchor a functional inter-regional supply system. The window for transformative action remains open — but the projections presented here are unambiguous that it is closing, and that the cost of inaction compounds with every year that the necessary reforms are deferred.

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