



# Promoting a Sustainable Agriculture and Food Sector in Thailand

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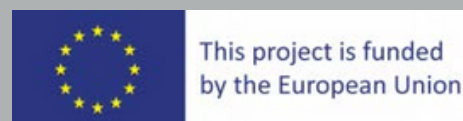
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# I. INTRODUCTION

The rice sector plays an important role in the social, economic, and environmental development of Thailand. Half of Thailand's cultivated land is devoted to rice farming and one in five Thai households produce rice. Thailand is a major rice exporter, providing around a quarter of world exports. Domestically, rice and rice landscapes have deep cultural significance.

Rice production is integrally dependent on the services and resources of nature and impacts upon them. Clean water, healthy soil, and stable climate are the basis of good agricultural production. Thai rice fields provide a complex livelihood system in which trees, crops and livestock are connected. The intensification of rice production over the last 40 years has, however, had significant environmental impacts. Conventional methods of rice production consume a major share of irrigation water, and tend to deplete the soil, release greenhouse gases, and have been associated with a decline in biodiversity. Farmers and rural communities suffer health problems associated with exposure to chemicals used in agriculture, and increases in fine particulate matter (PM2.5) in the air from burning rice straw in the post-harvest season.

The way rice fields are managed therefore has major consequences

not only for Thai rice farming households, but also the Thai public, and the planet. A switch to sustainable rice practice could be expected to bring about significant benefits for environment and people. This policy brief sets out the approach of Thailand in factoring these benefits into agricultural decision making as part of its food systems transformation.

The Economics of Ecosystems and Biodiversity (TEEB) is a key international programme aimed at understanding the importance of nature and incorporating the values of biodiversity and ecosystem services into decision making at all levels. The TEEB for Agriculture and Food (TEEBAgriFood) initiative applies the principles and methods of TEEB to the agricultural sector. It uses a systems approach to conduct economic evaluations of the "ecosystem-agriculture-food" system, revealing its positive and negative externalities, and enhancing policymakers' understanding of the relationship between agriculture, the environment, and society.

Through the TEEBAgriFood application in Thailand, UNEP has collaborated with Office of Natural Resources and Environmental Policy and Planning (ONEP), Ministry of Natural Resources and Environment



(MONRE), Ministry of Agriculture and Cooperatives (MOAC), Ministry of Commerce (MOC), Ministry of Public Health (MOPH), and Ministry of Finance (MOF), and Khon Kaen University to analyse the gains and losses associated with a shift from conventional to sustainable rice production in the Central and Northeast regions. In particular, the TEEB approach has been used to recognize, demonstrate and capture the invisible benefits of nature often taken for granted in public and private sector decision-making. This complements an earlier application to organic rice production in the Northeast region (Box 1).

### **Box 1: TEEBAgriFood assessment of organic rice in Northeast region**

The German Climate Initiative (IKI) funded a previous TEEBAgriFood application to organic rice production in the Northeast region (“the IKI study”). A scenario analysis was prepared to demonstrate the potential trade-offs generated as organic rice production practices in Thailand are extended over an increasingly large area over the period 2019-2035. Four scenarios were developed to understand potential future impacts of government policies, including the One Million Rai Organic Rice promotion policy, and Parliamentary targets for achieving sustainable agriculture by 2030.

The results of the IKI study showed that a transition from conventional to organic rice production could yield significant net economic benefits, principally through reduced health costs of lower agricultural

exposure and air pollution, as well as avoided greenhouse gas emissions from rice stubble burning. Full details are available at: [TEEBAgriFood Assessment - organic rice in the Northeast region - The Economics of Ecosystems and Biodiversity \(teebweb.org\)](https://teebweb.org/teebagri-food-assessment-organic-rice-northeast-region).

Thailand’s 20-Year National Strategy (2018-2037) (Thailand, National Economic and Social Development Council [NESDC] 2019) includes a sub strategy on agriculture and sustainable development which highlights promoting safe, biological and smart agriculture, green economy, ecosystem services and environmental quality. MOAC has enacted the 20-year Agricultural and Cooperatives Strategy (2017-2036) (Thailand, MOAC 2017), which focuses on promoting farmer institutions, increasing farming efficiency, escalating the adoption of product standards, and balancing agricultural resource use with sustainability. The Agriculture Climate Change Strategy (2017-2021) (Thailand, OAE 2018) focuses on reducing GHG emissions by using environmentally friendly technologies in agricultural production such as reducing post-harvest burning, soil management to improve soil carbon stocks, and promoting low carbon agricultural standards. The National Master Plan on Climate Change (2015-2050) (Thailand, ONEP 2019) promotes water management for flooding and drought, crop-zoning strategy, biodiversity and biological technologies, as well as maintaining ecosystem richness and reducing GHGs emission from agricultural sector through reductions of post-harvest stubble burning, rice cultivation, and promoting low carbon agricultural standards.

At the 26th UN Climate Change Conference of the Parties (COP 26) in 2021, Thailand committed to reaching carbon neutrality by 2050 and net-zero GHG emissions by 2065. Thailand has committed to reduce its GHG emissions by 30 percent by 2030 and up to 40 percent, subject to adequate resources and support. Sustainable finance initiatives have been introduced by the Ministry of Finance, the Bank of Thailand, the Securities Exchange Commission, to help channel financial flows to the real economy's transition towards sustainability.

The TEEBAgriFood project supports these policy agendas by demonstrating the rice sector's dependencies on nature, highlighting future benefits from maintaining ecosystem services today, and proposing an alternate way to measure the success in agricultural development in Thailand, incorporating the values of nature and society into decision making.



*Rice is Thailand's main staple crop and primary agricultural export*

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## II. BACKGROUND



The geographic scope of the TEEBAgriFood assessment is the rice area in Central and Northeast regions which together covers more than 80 percent of the total rice cultivation area in Thailand.

The Sustainable Rice Platform (SRP), established in 2011 by international organizations such as the International Rice Research Institute (IRRI), the United Nations Environment Programme (UNEP) and Deutsche Gesellschaft für International Zusammenarbeit GmbH (GIZ), aims to transform the global rice sector through voluntary market transformation towards sustainable production practices. It focuses on improving smallholder livelihoods, reducing the social and environmental footprint of rice production, promoting resource efficiency,

reduced carbon emissions and resilience to climate change. The SRP Standard is an internationally accepted sustainability standard for rice, which comprises 41 requirements structured under eight themes (Figure 1).

In Thailand, the Rice Department of the Ministry of Agriculture and Cooperatives have developed a new, locally adapted, Standard for Rice that is consistent with the SRP Standard. Specifications are available from the National Bureau of Agricultural Commodities and Food Standards (Thailand, National Bureau of Agricultural Commodities and Food Standards [ACFS] 2022). The Standard is currently being introduced to farmers through the Thai Rice NAMA project (GIZ 2023) in Ayutthaya, Ang Thong, Chainat, Sing Buri, Suphanburi, Pathum Thani, and Ubon Ratchathani.

Figure 1: SRP Standard comprises 41 requirements structured under eight themes



Source: Sustainable Rice Platform (2023).

The TEEBAgriFood analysis focusses on five key rice management practices that promote sustainability were selected to represent the essential compliance requirements of the SRP Standard (SRP 2023) related to environmental impacts (greenhouse gas emissions reductions and biodiversity conservation). These are:

1. Improved water management
2. Improved nutrient management
3. Natural systems of soil fertility enhancement
4. Integrated pest management
5. Elimination of burning of rice straw and stubble

The TEEBAgriFood analysis in Thailand assesses the responses of several variables in rice system to increased adoption of sustainable practices as promoted by the SRP Standard. The research team developed models to explore four future scenarios, representing progressively expansive adoption of sustainable practices in areas of rice cultivation in the Central and Northeast regions of Thailand from 2022-2050. These are summarised in Figure 2. Figure 3 shows the predicted location of changes over time upon which the assessment of biophysical and economic impacts are based.

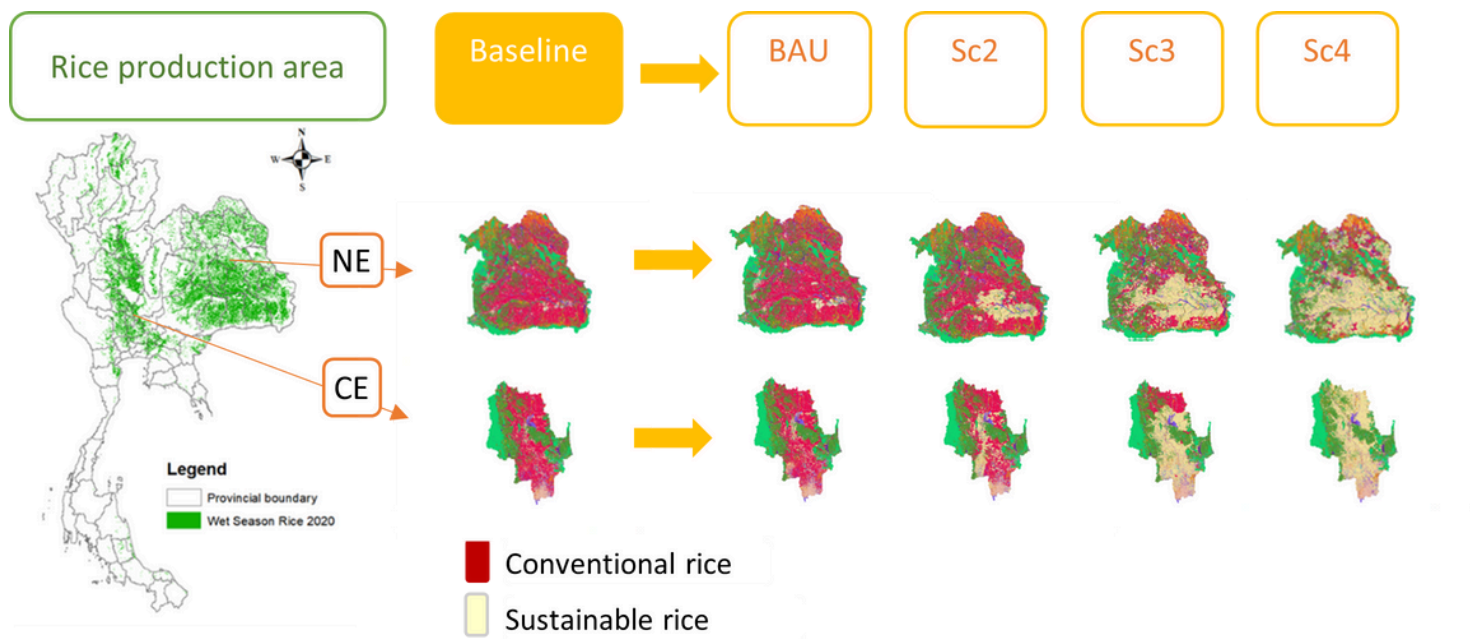
Figure 2 Descriptive Summary of Land Use Scenarios, with area and percentage of total







Figure 3 Projected transformation of rice area to sustainable practice from 2022 to 2050, showing locations in Northeast and Central regions of Thailand, according to four scenarios



Source of maps: 1) Rice production area map: Buddhaboon *et al.* (2022) “Adaptation of Rice production system to climate change in Thailand: Trend and Policy” 2) Scenario maps 2022-2050: Research team. Note: NE = Northeast. CE = rice growing region of Central Thailand

The land use changes projected according to four scenarios above were analysed for the associated changes they would generate in production, environment, and health dimensions over time.

- **Production dimension** – changes in rice yield, production costs and farmer income.
- **Environment dimension** – changes in greenhouse gas emissions, insect biodiversity, water use.
- **Human health dimension** – changes to health from exposure to pesticide poisoning, air pollution.

A cost-benefit analysis was applied to estimate the total value of net benefits from Business as Usual and the three alternative scenarios, as well as to identify the key trade-offs and

synergies across scenarios that could assist in policy design. Potential impacts over time in production, human health and environmental dimensions where modelled and, where possible, an appropriate monetary value or proxy value was applied.

In this way, changes in rice yield, the cost of cultivation, and the profit gained by farmers were assessed and directly valued in monetary terms. Other changes that can be measured quantitatively, including avoided greenhouse gas emissions, and avoided health costs caused by pesticide poisoning and air pollution, were converted to monetary values using established economic techniques and approaches for each variable. Changes to insect biodiversity, trees

on farms, and water use were assessed, but not converted to monetary values.

In summary, the overall result of the scenario analysis is that each alternative scenario generated higher net benefits than business as usual.

Under Business as Usual, over 90% of rice farms in Thailand would continue to follow conventional rice practices in 2050. In scenario 4, more than 80% of rice farms will have switched to sustainable rice practice by 2050, representing a significant transformation of a large land use affecting millions of Thai people.

A direct switch from conventional to sustainable rice under scenario 4 – the most ambitious conversion to sustainable production – could provide up to 50 billion USD dollars of net benefit cumulatively from 2022 to 2050 compared to BAU. This value accrues to both the public and to farmers. Farmers are projected to generate more profit per ha from sustainable rice practice in both regions, particularly in the Northeastern region, driven by reductions in expenditure on chemical fertilizers and pesticides as well as reduced labour costs. Net GHG emissions are projected to be lower under sustainable rice practices compared to conventional, resulting from higher soil organic carbon and from the elimination of stubble burning which would more than offset higher CH<sub>4</sub> and N<sub>2</sub>O emissions from cultivation practices.

The findings also emphasized the potential benefits of sustainable farming practices for promoting biodiversity and natural pest

control through fostering greater insect diversity. Sustainable rice practices yield better water use efficiency and lower levels of nitrogen run-off from rain-fed cultivation. Converting to sustainable rice practices has the potential to mitigate the costs to public health, through reduced use of pesticides and the prohibition of the open burning of rice residues, limiting exposure to toxins and PM<sub>2.5</sub> dust. Data from household surveys indicates that farmers who practice sustainable rice practice tend to be happier and have stronger social ties. Men and women engaged in sustainable rice reported equal participation in their local community organisations and group activities. A significant difference was found in conventional rice practice communities, where women were less active than their male counterparts, and joined fewer group activities.



*A rice field in Ubon Ratchathani, Isan Province*

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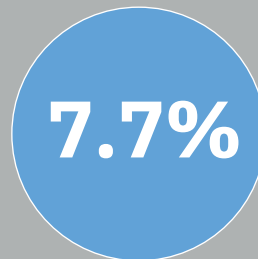
### III. Sample Facts and Figures



Rice fields cover approximately half of Thailand's agricultural area (Office of Agricultural Economics [OAE] 2019).



1 in 5 Thai households are rice producers (Thailand, National Statistical Office [NSO] 2021; OAE 2021).



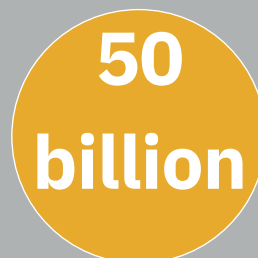
Rice cultivation contributes 7.7% of Thailand's greenhouse gas emissions (Thailand, Office of Natural Resources and Environment Policy and Planning [ONEP] 2022).



Sustainable rice practice would help to eliminate post-harvest rice residue burning, substantially improving air quality.



The area of adoption of sustainable rice practices (Good Agricultural Practices [GAP] and GAP++) as of 2022 was 192,000 ha, (approx 1.67% of total rice area) (Khon Kaen University [KKU] 2023).



A transformational switch from conventional to sustainable rice practices could yield up to 50 billion USD in net benefit by 2050 (KKU 2023).



Sustainable rice farming reduces the health risks associated with pesticide exposure and air pollution from rice stubble burning.



Sustainable rice farming promotes biodiversity by encouraging natural pest control and improving soil health, leading to an increase in beneficial insect populations and overall ecosystem resilience.



Women in sustainable rice initiatives in Thailand are effective communicators, sharing information through formal and informal channels in their community and beyond.

## IV. Public Policy Options

### a. Transition towards fully sustainable rice production and sustainable landscape management to reach the aims of the Bio-, Circular, and Green (BCG) Economy model in Thailand

The BCG economic growth model seeks to capitalise on Thailand's strengths in biological diversity and cultural richness to transform the country into a sustainable, value-based, and innovation-driven economy. The scenario analysis shows that the expansion of sustainable rice area in both regions would bring higher net benefit to rice farmers, public and planet. The clear visible private benefits to farmers are higher profit from growing rice due to better yield and lower cultivation costs, and lower risks of becoming sick from pesticide poisoning. The public receives better benefits from expansion of sustainable rice practice in forms of GHG emissions reduction, better health condition due to less air pollution, and higher efficiency of water use and water availability.

### b. Develop key agricultural performance indicators that go beyond productivity per hectare and growth in added value, towards gains in value for environmental sustainability and public health

A switch from conventional to sustainable rice production practices has the potential to mitigate significant negative health externalities to the Thai public, and reduce localised, national and international environmental externalities. It is important to make visible the connections between nature and rice food systems by quantifying the flow of benefits from ecosystems to food systems and human well-being. This involves identifying where, how much and to whom nature provides benefits, showing the impacts of Business as Usual, and what would be the comparative impacts under alternative agri-environmental planning policy scenarios for the future. Key performance indicators could be developed for key sectors such as rice to steer a long-term transition that meets integrated goals for sustainability.



*Thailand is the world's second largest exporter of rice*



### **c. Support farmers financially during the transition from conventional to sustainable practices**



The findings from this study suggest that sustainable rice practice would generate significant yield improvement compared to conventional counterpart especially in the Northeast region. Combined with the cultivation cost reduction, the profit from growing rice earned by farmers would be significantly increased compared to conventional rice practice. However, an increase in profit could not be realized in the early period of conversion. Meanwhile, the costs of conversion such as soil fertility evaluation, land leveling, and nutrient management are immediate costs faced by farmers. Convincing farmers, many of whom currently see low financial returns from rice cultivation, to adopt sustainable rice practice without any support especially during transition period may not be enough to significantly increase adoption rate. Government could step in to ensure farmers that any costs and risks posed on farmers would be managed and mitigated until the private benefits from adopting sustainable rice practice could be realized by farmers. The main subsidy policies in agriculture currently focus on mitigating financial hardship of farmers. These could be reoriented conditional upon adopting sustainable agricultural practices.

### **d. Support farmers to handle rice stubble decomposition**

Sustainable rice practice could provide high potential net benefit in the dimensions of environment and human health. In the fourth scenario, the benefit of health impact from reducing PM2.5 is particularly high because stubble is not burned in sustainable rice practice. Farmers reliant on earnings from two crops of rice a year are motivated to speed up the process of preparing their fields for the next crop, are reluctant to wait for rice straw and stubble to decompose naturally. Support with technologies and innovations to manage rice residues would help farmers to reduce time and provide more practical ways to adapt away from stubble burning.

### **e. Improve access to voluntary carbon markets**

The emission of greenhouse gases (GHG) from rice fields is generated by cultivation practices (organic fermentation), post-harvest practices (stubble burning), and mitigated by soil carbon sequestration. The expansion of sustainable rice area as projected in the alternative scenarios 2, 3 and 4 would reduce overall GHG emissions, due to the stubble burning prohibition and high soil carbon accumulation. In addition, if the alternate wetting and drying irrigation technique (AWD) could be employed, the GHG emission during cultivation could be further reduced. However, these public benefits are invisible to farmers. The promotion of an economic or market mechanism that could transfer this invisible benefit to financial benefit for farmers could play an important role in transformational change. Ensuring the access of farmers to carbon credits on the voluntary carbon market could be one solution, but this is currently financially infeasible due to the high cost of validation process. Lower transaction costs and internationally acceptable verification methods are needed.

## **f. Consider differential regional circumstances in designing the national strategy for the transition to sustainable rice**

Widespread conversion from conventional to sustainable rice practice would require significant support from the government especially during the early period of conversion. Our study suggests that starting in the Northeast region would be more cost effective than in the Central region, as the net benefit of transformation gained by both private and public are most clearly visible in the Northeast. Mungkung *et al.* (2022) indicate that the current rice cultivation practices in the Northeast region are significantly closer to sustainable rice practice Standard than current practices in the Central region, suggesting that the transformation in the Northeast region would be more practicable and would require lower cost than in the Central region.

## **g. Promoting sustainable rice as a contribution to women's empowerment and social capital development**

Due to primary roles in family welfare, financial management, and field work, women farmers carry direct and indirect impacts when changes in health and environment occur in their community. As a corollary, they are often the first to recognise the benefits when improvements are made through the adoption of healthier and more environmentally friendly methods of farming. The research highlighted equality in men and women farmer's interest and participation in adopting sustainable rice. Female sustainable rice farmers were significantly more active in community groups than women in conventional farming contexts. The work involved in sustainable farming practices is directly relevant to women's role in providing food and managing income for the family, as well as their burden in maintaining family health. Sustainable rice practices are also recognised to require a fair degree of attention to detail and recording of different steps taken. Those who excel at this type of skill can gain a clear role in this work. However, to overcome existing gender barriers, many women need targeted support in accessing training opportunities, which can often include ensuring childcare, considerate timing, and social support. Empowered in this way, on topics that are directly important to them and in which they have a clear role, women in sustainable rice initiatives in Thailand have been shown to be effective communicators, sharing information through formal and informal channels in their community and beyond. Furthermore, given the chance to express their voice, women can develop broader leadership skills, and encourage adoption amongst a wider population of farmers.





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*A certified SRP trainer advises a female farmer*

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*The traditional Thai papaya salad ingredients, such as green papaya and chilies, are frequently cultivated in home gardens by rice-farming families, highlighting the interconnected nature of agricultural and culinary practices.*