TEEBAgriFood Supporting Biodiversity and Climate Friendly Land Management in Agricultural Landscapes (The Economics of Ecosystems and Biodiversity)

National Workshop

Integrating the Value of Ecosystems and Biodiversity in Rice Systems in Thailand

12 May 2022

Grande Centre Point Hotel, Ratchadamri Bangkok Thailand

Report prepared by Khon Kaen University

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TEEBAgriFood Thailand

TEEBAgriFood is an initiative of the United Nations Environment Programme (UNEP) which seeks to make visible the impacts and dependencies of the agri-food value chain on nature. These critical contributions and concerns are often not counted in economic transactions and are often overlooked in decision-making. Thailand joins China, India, Indonesia, and Malaysia in the Asia Pacific region as well as other countries (Brazil, Colombia, Georgia, Kenya, Mexico, Tanzania, and Uganda) in piloting the TEEB for Agriculture and Food initiative around the world.

Objectives: TEEBAgriFood aims to inform the agriculture and food planning process in Thailand by providing comprehensive, scientific evidence to support agriculture and food system policies, with direct links to policy priorities of the Ministry of Environment and Natural Resources, and Ministry of Agriculture and Cooperatives.

Partners: TEEBAgriFood Thailand is an initiative under the political lead of the Office of Natural Resources and Environmental Policy and Planning (ONEP), in the Ministry of Natural Resources and Environment. Khon Kaen University is the host research institution, leading a team of researchers from several universities and government agencies to carry out a multidisciplinary analysis of rice agroecosystems. The project is supported with funding from the German government and the European Union.

Focus and location: The initial analysis is focused on the impacts of different intervention options for the promotion of organic rice in Thai rice landscapes in the Northeastern region of Thailand, where rice is the main crop. The follow up analysis is focused on the adoption of sustainable rice production practices in both Northeastern and the Central plains.

Methods: The TEEBAgriFood analysis in Thailand uses a scenario modelling approach to examine the potential future impacts of land-use changes as a result of current organic rice expansion and sustainable agriculture policies. Impacts are assessed at the landscape level in terms of changes in rice-field biodiversity, greenhouse gas emissions, air pollution, and the health impacts of chemical pesticides. Various biophysical and ecosystem services models are used in the analysis, applying locally available data and field data to project changes in natural capital, produced, human and social capital over the medium term. Economic valuation methods are applied to quantify the true costs and benefits of different agricultural approaches in rice agroecosystems. Research is also being conducted with farmers to assess the factors that could encourage farmers to switch from conventional practices to organic practice.

Expected outcomes: Policy makers will be equipped to recognize, measure, and capture the values of biodiversity and ecosystem services into their policy decision-making and strategies for sustainability of the rice production system. The true value of nature-positive production systems can be more fairly assessed alongside conventional agricultural production systems. Analysis of policy-linked scenarios projected over a long-term timeframe can be a powerful tool to assess the future environmental and economic impacts of the actions taken in the present. A holistic economic assessment will support the development of a policy roadmap to better support the integration of environmental, health, social and production goals.

For more information: http://teebweb.org/our-work/agrifood/

1. Workshop objectives

The TEEBAgriFood Thailand National Workshop was held on 12th May 2022 in Bangkok, Thailand and was attended by 110 participants representing 39 institutions. For a list of participants, institutions, as well as the workshop agenda, please refer to Annexes I and II.

The workshop presented the work carried out by local partners under the TEEBAgriFood initiative with a focus on the IKI funded project "Integrating the Value of Ecosystems and Biodiversity in Rice Systems in Thailand" comparing organic and conventional rice in the Northeast of Thailand. Attention was also given during the workshop to the follow-up TEEBAgriFood assessment which is funded through the European Union Partnership Instrument and which is exploring the potential impacts related to the adoption of the Sustainable Rice Platform (SRP) Standard in the commercial rice sector in Thailand.

The main objectives of the workshop were to:

1.1. Present the findings of the pilot TEEBAgriFood assessment on Integrating the Value of Ecosystems and Biodiversity in Rice Systems in Thailand comparing organic rice and conventional rice production systems.

1.2. Convey the project findings to key decision-makers in order for them to understand the potential scale of the costs and benefits of different rice production systems and policy options.
1.3. Identify, in collaboration with national and local authorities and other important stakeholders, how this project may contribute to policy development in Thailand by building on current initiatives and programs.
1.4. Discuss the project management and technical partners who will participate in the continued project.

2. Introductory speakers

2.1 Introductory video presentation

A video of an interview with Dr. Phirun Saiyasitpanich, Secretary General, Office of Natural Resources and Environmental Policy and Planning (ONEP) was projected in the workshop offering his key perspectives on sustainable agriculture and the TEEBAgriFood project

The video is available online

2.2 Opening Remarks

Dr. Jittinun Ruengverayudh, Director of Biodiversity Management Division, Office of Natural Resources and Environmental Policy and Planning (ONEP), Ministry of Natural Resources and Environment (MONRE)

- Dr. Ruengverayudh began by introducing the project and explaining that ONEP as an institution, has a partnership with the International Climate Initiative (IKI) of the German Federal Ministry for the Environment. The research assessment was led by a research team from the Economics Faculty of Khon Kaen University (KKU). The project aims to promote the sustainable agricultural systems in Thailand, specifically rice production, which is the country's primary agricultural commodity. The project seeks to account for the integration of biodiversity and agroecosystems involved in rice production.
- To further support the project's direction and other similar work in the future, the relevant parties, both private and public, must work together to drive research in the area of ecosystem services for rice production using economic instruments. The ultimate goals can provide fruitful results for policy recommendations such as the encouragement of environmental safety for rice production, especially organic rice production.

2.2 Introducing TEEBAgriFood

Dr. Salman Hussain, the Coordinator for The Economics of Ecosystems and Biodiversity (TEEB), and Head of the Economics of Nature Unit, UNEP. A copy of his presentation slides is available online.

The origins and rationale for TEEB and TEEBAgriFood:

- TEEB stands for The Economics of Ecosystems and Biodiversity. This initiative was launched to focus on making the economic case for biodiversity with the objective of mainstreaming the values of biodiversity and ecosystem services into decision making at all levels. In 2014, the focus shifted towards looking at agriculture and food systems which aims to help decision-makers recognize the wide range of benefits provided by ecosystems and biodiversity, demonstrate their values in economic terms and capture those values in decision-making. As such, TEEB looks at the economic choices that are made across a wide spectrum of domains, considering the full set of ecosystem services to draw attention to the invisibility of nature and the depletion of ecosystems and biodiversity.
- The true impacts of agriculture on biodiversity, the environment, society, and the economy in Thailand, as well as globally, are huge when all externalities along the value chains are taken into consideration. These impacts are often hidden and therefore not accounted for.
- Nature-human relationships are very much part of Thai culture, making agriculture a central part of life. As such, the assessment aimed to shed light on the fact that through the TEEBAgriFood approach, which applies a whole systems thinking to the economics of agriculture, the development of organic production in Thailand makes economic sense.
- Similar analyses to the study presented during this workshop are taking place all over the world.
- The TEEBAgriFood approach, which is very much aligned with the Food Systems Summit, advocates for a food systems approach that incorporates the environment, agriculture, water, and health into a broader systems thinking in order to benefit not only biodiversity and climate, but society as a whole with improvements also for livelihoods.
- The TEEBAgriFood assessment in Thailand has taken into consideration the financial and economic returns of rice production in both the short- and long-term comparing the pro-biodiversity option (organic rice) and the alternative (conventional rice).
- The TEEBAgriFood Evaluation Framework phases are used to establish the goal of the assessment. Starting with the policy question, the team determined the entry point and spatial scale. This procedure has been coordinated by KKU and ONEP, with participation from other ministries and stakeholders. The project's scenarios have been co-developed with the involvement of stakeholders through Steering Committees and

stakeholder consultations in order to be viable and securely linked into the policy landscape in Thailand. Stakeholder consultation therefore stands as the project foundation after which modelling is added. The modelling depicts the several ecological and social aspects of the different scenarios in which organic rice production would increase modestly, moderately, extensively, or not at all, i.e. business as usual (BAU). This project's final deliverable is a presentation of the developed scenarios.

Do we have evidence to support policy change for organic rice in Thailand?

- ***The evidence of this study shows that it makes economic sense to switch to organic production***.
- A common perception is that organic production methods produce much lower yields than conventional production methods. However, the research findings provide solid, undeniable proof that organic production, based on Thailand's particular data, is viable and beneficial:
- There is only a 1 percent difference in total projected yields for organic rice production versus conventional rice production over the period assessed to 2035.
- In accordance with the statement this morning of ONEP's Secretary General, Dr Phirun Saiyasitpanich, it makes sense to move from high volume to high value production systems. In this case, switching to organic would retain 99 percent of the volume, while producing high quality yields.
- Only a subset of the positive ecosystem services generated by organic versus conventional rice are quantified and valued in Thai Baht (THB) in this study.
- The study does not put a monetary value on biodiversity gains or nutritional benefits of organic rice, nor on enhanced community cohesion, social capital, and the involvement of women. Enhanced community involvement is incredibly valuable as part of Thailand's culture, and that is being enhanced by choosing organic production.
- Even on the basis of a subset of key impacts, organic production is shown to be much better. In addition, organic production does not include rice burning and also enhances carbon storage.
- Apart from carbon sequestration and storage (which are global public goods) the beneficiaries of organic production are Thai citizens.
- Thai farmers would experience improved air quality, fewer instances of pesticide poisoning and eat food with higher nutritional value. Therefore, the Thai people profit from every change here.

*What are the reasons **why farmers do not adopt organic** if the benefits are so large*? *How should the government intervene*?

- Neoclassical economics assumes that everyone makes rational choices, or seeks to maximise their benefits. Markets are assumed to function efficiently the closer we get to 'complete and perfect information'. These assumptions do not always work for consumers and producers in reality
    - If the consumer is misinformed, s/he will make the wrong decisions.
    - If farmers are being misinformed, there should be a serious attempt to resolve the matter and ensure that they have access to reliable information.
        - In these cases, there is an economic argument for intervention.
- Perhaps farmers' perceptions of the costs of switching to organic, and the perceived decrease in yields, far exceeds what the models tell us.
    - The assumed social discount rate applied in KKU's analysis is 5% but the private discount rate for farmers is likely much higher.
    - In a post-COVID world, a farmer who is impoverished, or has limited access to credit, has a massive discount rate and cannot simply decide to switch to organic even if he/she realizes the yield variability is very low
        - Providing credit/a grant for one year makes economic sense if Thai farmers and citizens then reap the benefits of organic production in perpetuity.
        - If the Thai government is not able to provide funding, alternative solutions should be sought internationally.
- There are also coordination costs/network lock-ins for conventional rice production.
    - That is, it is not worth the while of any one farmer or community to unilaterally develop the supply chains for organics. However, if everyone contributes, then all benefit.
        - It makes economic sense for the government to intervene in such cases to overcome these coordination effects (a network externality).
        - This is a form of market failure – economists know that the market will not function well in the presence of lock-ins, and as such the government needs to intervene.

2.3 Introducing sustainable rice production policies in Thailand.

Mr. Alongkorn Ponlaboot, Special Advisor to the Minister of Agriculture and Cooperatives of Thailand (MOAC) offered an initial address on sustainable agriculture in Thailand.

The concept of sustainable agriculture in Thailand tends to align with the TEEBAgriFood approach, linking ecosystem services and promoting food security and safety. He explained the five new paradigms.

The first approach, which aims to transform the agriculture industry into an online market, is a market-leading production strategy, a platform for products that support the New Normal. Thailand has now applied the market-leading production strategy, which involves

the premium market, the general market, and the specific rice market (or Geographically Indicated “GI” rice). Second, the promotion of agricultural technology is centered on rice production in particular. The production plan for the 3S - Safety, Security, and Sustainability is outlined in the third strategy. All sector plans incorporate proactive management, particularly the "Modern Agricultural-Commercial" model. The sustainable agriculture strategy is supported based on King Rama IX’s Sufficiency Economy Philosophy.

Furthermore, in order to promote rice production, the MOAC has collaborated with the Ministry of Commerce and related organizations such as the Rice Mills Association and the Thai Rice Exporters Association, the Association of Thai rice collectors and distributors, and the Farmer's Institute in the development and improvement of the Thai rice strategy from 2020 to 2024, which is consistent with the vision of promoting value-added in Thai agricultural products.

- For organic rice, the establishment of new programs related to the rice production system, drives the overall needs for operation transition in Thailand.
- The current world situation with the ongoing war in Ukraine and the COVID pandemic, greatly affects agricultural inputs and raw materials (i.e., fertilizers and pesticides), which is leading to a high likelihood of food insecurity or/and food shortages.
- Production and marketing strategies are the main channels to drive forward agricultural food production in Thailand.
- The environmental impacts resulting from food production also affect Thai society (poor farmers). The marketing strategy must be targeted and developed in order to generate an efficient sustainable rice production.
- The rice value chain will be extended from upstream to downstream, such as cosmetics, medical supplies, and supplementary food.

Mr. Alongkorn stated that the aim of MOAC is to promote sustainable rice production for the Thai agriculture sector on the basis of a comprehensive sustainable agroecosystem. The following four indicators for a sustainable agroecosystem constitute a common relationship between biodiversity and the agricultural industry in Thailand:

1. Reduce the environmental impact of rice cultivation to be able to produce rice for a long period of time, taking into consideration the negative impacts of industrial processes.
2. Develop new technologies in rice production systems that benefit small-scale farmers. The current agricultural policy aims to reduce the rice field area (especially for conventional rice) to transform the overall rice production system.
3. Crop rotation should be implemented in sustainable rice production after the harvest has taken place.

4. Multiple sources of agricultural income should be available for farmers to conduct sustainable rice cultivation, rather than relying on a single source. Farmers should be compensated well for sustainable rice production.

Note that small-scale farmers are one sector in the rice production system that should focus on their productivity related to the cost of production. This issue is linked to the mega rice farm project. Small-scale farmers should be encouraged to have increased capacity to be able to set up their own enterprises.

3. Presentation of findings: Integrating the Value of Ecosystems and Biodiversity in Rice Systems in Thailand

Assoc. Prof. Phumsith Mahasuweerachai, Khon Kaen University, the principal researcher of the project introduced the research team (listed below).

Ajarn Phumsith made the following key points in his presentation. A copy of his presentation slides is available online.

- To be able to accomplish sustainable development goals, a transition is needed towards fully sustainable rice production and sustainable landscape management.
- Rice is Thailand's primary food grain, which generates revenue for more than 4.3 million rice-growing families, or 20 million people. As much as 62% of the rice-

growing area of Thailand is in the Northeastern region. Rice fields are a unique agricultural ecosystem.

- Different techniques of cultivation have differing effects on rice field ecosystem services. The emphasis on boosting agricultural yields to increase global market competitiveness has resulted in the use of chemical fertilizers and pesticides. Rice straw is often burnt in the fields to save the time required to prepare the planting space. Burning not only affects the rice, but also has the potential to harm biodiversity and ecosystem services such as soil fertility. It also generates several negative environmental and health consequences, including the emission of different chemicals and greenhouse gases, as well as the exposure to tiny dust particles (PM 2.5).

Organic farming is one strategy for achieving long-term and sustainable food production. Organic rice production does not utilize chemical fertilizers, pesticides, and does not allow the burning of rice stubble, and simultaneously ensures food security and income while also lowering the negative impact on health and the environment. Instead, it emphasizes biological management through ecosystem services and biodiversity development. However, fulfilling all of these objectives is likely to have both positive and negative outcomes. We wanted to examine the trade-offs between natural equilibrium and the productivity of rice.

- The TEEBAgriFood Thailand case study focuses on rice production under the supervision of ONEP. This investigation was directed by a project consultant from KKU and Thai leading universities, namely Kasetsart University, King Mongkut's University of Technology Thonburi (KMUTT), Mahasarakham University, and Ubon Ratchathani University. The Rice Department and the Land Development Department of MOAC are also members of the team.

- The International Climate Initiative (IKI)-funded study intends to investigate the rice farming ecosystem, with a focus on the comparative impact of organic and conventional rice cultivation in Thailand's Northeastern region. Various aspects are observed in the study, not only in terms of economic returns but also environmental impacts in order to guide planning and policy considerations to promote healthy and sustainable rice farming.

Biodiversity

- The diversity of insects in rice paddies was used as a measure because insect diversity helps to control the damages to the rice crop and relates to the reduction in production costs due to the avoidance of pesticide inputs.
- There are two kinds of insects: rice pests (undesirable insects) and insect predators (good insects). If their populations are in balance, the insects can live alongside each other, and pesticides are not required as long as the grain harvest is undamaged.

- On the basis of the TEEBAgriFood evaluation criteria, insect field data were analyzed and existing research literature was reviewed in order to compare the insect diversity of conventional and organic rice fields.
- The Normalized Shannon-Wiener Biodiversity index was used to predict and compare the changes in biodiversity resulting from different rice cultivation methods.
- The Random Forest model was used to determine the variability of different insect species by evaluating the biodiversity responses in rice fields in response to rainfall and temperature variables and land use changes.
- We found that the conventional rice biodiversity index was approximately -0.2, while the organic rice biodiversity index was approximately 0.2.
- In terms of the number and variety of insects in the rice ecosystem, conventional rice cultivation is inferior to organic rice farming.

Greenhouse gas emissions

- Three major sources of GHG emissions in the cultivation of conventional and organic rice were assessed in this study, including:
  1. Greenhouse gas emissions from the rice cultivation process.
  2. Soil organic carbon (SOC) sequestration.
  3. Greenhouse gas emissions from rice residue burning following the harvest.
- The Denitrification-Decomposition (DNDC) model was used to examine long-term changes in GHG emissions (CH4, N2O, and CO2) and soil organic carbon (SOC) from two rice harvests (organic and conventional).
- The DNDC model is unable to account for greenhouse gas emissions from postharvest burning. As a result, the increased GHG emissions must be evaluated instead. In a Global Warming Potential (GWP) comparison of conventional and organic rice production, the methodology of Junpen et al. (2018) was utilized to project GHG and accumulated organic carbon in soil.
- The results for GHG emissions in the cultivation process from conventional rice farming were on average 14.59 tons of CO2 equivalent per hectare. Based on similar soil and flood conditions, organic rice cultivation was found to emit 15.54 tons of CO2 equivalent per hectare on average, or slightly more greenhouse gases than for conventional rice cultivation.
- Regarding soil organic carbon (SOC) stocks, organic rice cultivation was found to improve soil carbon content when compared to conventional rice cultivation. Organic rice cultivation resulted in an average soil carbon buildup of 42.46 tons per hectare. The carbon buildup of soil from conventional rice farming is 38 tons per hectare. As such, organic fields can sequester a greater amount of carbon in the soils than conventional rice fields. The greater the organic area the greater the stock of greenhouse gases in the soil.

- In conventional rice agriculture, greenhouse gas emissions from rice straw burning were calculated to be 0.19 tons of CO2eq per hectare on average[1]. Organic rice production does not allow for the burning of rice stubble, therefore, will produce no greenhouse gas emissions from post-harvest burning.
- Overall, it was found that organic rice production emits lower quantity of greenhouse gases than conventional rice agriculture when all three sources of greenhouse gas emissions and storage are included.

Human health impacts

- Two main issues were analyzed from a health aspect; the costs from exposure to PM2.5, or air pollution, and the issue of exposure to agricultural pesticides.
- The health impacts were studied, as well as the average cost of medical treatment, through household surveys, as well as the willingness for farmers to accept monetary compensation from an incremental increase in the risk of becoming seriously or even fatally ill from pesticide poisoning.
- The method applied to evaluate the impacts of PM2.5 from rice straw burning on human health in this section considers the association between the fine particle component (PM2.5) and the risk of cardiovascular diseases, respiratory illnesses, lung cancer, and mortality due to PM2.5. This enabled the researchers to estimate changes in the health effects of particle exposure, as a result of changes in land use.
- The evaluation of the health effects of PM2.5 exposures is based on information regarding income and population growth. This analysis is evaluated utilizing the Human Capital Approach (AHC), with the concentration of PM2.5, the Gross Provincial Product (GPP), and the population growth rate serving as the datasets.
- The results reveal that the health effects of PM2.5 from burning rice straw are negative externality effects on society.
- Health expenditure on the risk of PM2.5 exposure caused by rice straw burning in 2019 was 519 Baht per hectare ($17.3 USD). This value should be used to assess the social cost of conventional rice cultivation. This amount was calculated using the concept of human productivity loss related to respiratory mortality. The higher the PM2.5 concentration, the higher the productivity loss. As organic rice production area increased, costs of health care decrease.
- A second element of health care expenditures takes into account the medical treatment of farmers, based on a household survey conducted in the study areas. The cost of medical care reported by farmers for acute symptoms is 390 Baht (about $13) per person. As many as 2.17 percent of farmers cultivating rice using conventional methods reported acute symptoms of exposure to pesticides. From the total of 4,300,000 rice

[1] Revised figure, based on post-workshop adjustment.

farmer families, thus, around 90,000 farming households would be impacted. The annual health expenses would be at least 35.1 million Thai Baht (about 1.17 million USD).

- A choice experiment survey was used to examine the health harm caused by pesticides in accordance with a Value of Statistical Life (VSL) . With this technique, a farmer is required to choose between the risk of using pesticides that might result in their death and the loss of income from selling their rice. Approximately $169 per hectare is the trade-off value that farmers are ready to make to lower the danger of death or serious disease brought on by pesticide poisoning. This is the highest value based on the perception of farmers. This value is then applied to the scenario of organic rice expansion using data from the choice experiment.

Production /yield results

- According to the rice production model, there is little difference in the yields of conventional and organic rice. Contrary to conventional agriculture, which depends on chemical fertilizer, organic agriculture depends on nutrients and organic materials. Although the yield of organic rice initially declined, this tendency is no longer noticeable over time. The estimate based on empirical data from the study area has been confirmed by the yield prediction of organic rice production, which has discovered that the result is plausible.

- The reduction in pesticide costs is a result of biodiversity enhancement. The results of our household survey show that organic rice farmers have lower costs per kg of rice produced than conventional rice farmers. Typically, conventional farmers spend 16.67 USD per hectare on pesticides and chemical fertilizers. Farmers switching to organic rice must pay a cost of around 114.58 USD per hectare for preparing paddy fields (eg expanding the width of the rice paddy ridge).

Community and social analysis

The method of growing rice has an impact on interpersonal relationships and teamwork in rural areas. According to the findings of the econometrics model that examined happiness, organic rice producers are significantly happier than other farmers. According to research on farmer collaboration within a group, organic rice farmers have very high levels of cooperation when it comes to happiness. In this sense, prosocial behavior—the voluntary assistance of others—is used to explain farmer cooperation. They frequently have more interpersonal trust, which leads to greater group collaboration. In addition, the gender problem has a significant impact on the outstanding outcomes from organic rice growers. In order for a role model farmer to lead a group of organic rice farmers and effectively develop an organic rice product, female empowerment is crucial. According to their beliefs,

everyone in a group contributes equally to getting the task done since everyone cooperates regardless of gender.

Scenario analysis

- The scenario analysis indicates a trade-off between the future negative and positive consequences of low, moderate, and high expansion of organic rice area in the Northeastern region of Thailand between 2020 and 2035. Although economic returns are addressed, there are also significant costs and benefits in the rice production system that are sometimes unseen, known as "externalised impacts."
- The increase of organic rice area provides societal-wide advantages, both for the environment and human health. However, if the government does not provide enough management and promotion, it may have a direct impact on the farmer's earnings.

Enhancing organic adoption

- Farmers play an important role in expanding organic rice farming regions, and benefit from lower production costs. However, rice yield and earnings may fall at the same time. Farmers may receive lower returns than for conventional rice cultivation if there is no premium price for organic rice.
- One strategy to encourage farmers to embrace organic rice farming is to provide incentives in the form of expenditure subsidies or income subsidies during the transition period between switching from conventional production methods to organic agricultural certification. This is because organic rice farming typically necessitates immediate additional expenditure, particularly during the first three years of adjustment.

Policy recommendations

- The results suggest efficient subsidization. "Model" farmers should be promoted and given grants to further incentivize additional organic rice farmers in the community. "Role model" farmers should have the same or similar economic and social status as those in that community, because they will help encourage other farmers to switch to organic rice cultivation more effectively than "role models" who have better socio-economic status than others in the community.
- Obtaining a standard certificate is crucial for farmers since it is a tool that may distinguish organic rice from conventional rice, allowing them to sell rice at a higher price. Studies have indicated that farmers who cultivate organic rice prefer to revert to conventional rice during the transition phase since it is difficult for them to obtain organic certification. To encourage farmers to continue in the organic farming system, the government and affiliated organizations must establish procedures to assist farmers

in obtaining organic farming certifications in a quick and effective manner. This should encompass both the home standard "Organic Thailand" and the international export standard for organic rice.

- Maintaining farmers' market access is a key factor in ensuring farmers can sell their rice at high prices, which is critical for farmers after adopting organic growing practices. To ensure that farmers can sell their organic rice products at reasonable rates, the government may need to prepare to locate potential markets or directly fulfill the demand and supply of organic rice.

- When the organic rice growing area is considerably larger, i.e. 50 to 90 percent of the overall rice area in the Northeastern region, the oversupply of organic rice will increase in the long run. If the increasing supply of organic rice is proportional to the increased demand for organic rice, the price of organic rice will be roughly similar to that of regular rice. As a result, farmers earn smaller returns than they would with conventional rice production. Therefore, relevant organizations may have a variety of incentive funding to encourage farmers to cultivate organic rice in order to have a beneficial influence on society. Governments should step in to assist to remove market distortions if market forces do not support or are unable to respond to these beneficial external causes, in order to guarantee that positive externalities continue to benefit the broader public.

3.1 Questions and discussion

1. Dr. Krisada Sektrakul, Senior Executive Vice President at the Stock Exchange of Thailand, SET noted that this may be a first research analysis on ESG (environmental and social governance) in Thailand focused on the agricultural sector. He recommended that research be applied in the commercial sector. A suggestion was made that the study's findings could expand to apply the real-world implications for the capital market and market cooperation.

   Stakeholders should be engaged and be linked at each step of rice production. All the steps of production can be traced. For example, a net-zero goal under the environmental, social, and corporate governance (ESG) perspective can be used for the company.

   For instance, the fact that Thai rice products can reduce GHG emissions by a certain amount, is information that should be clearly stated on the package and advertised as a marketing strategy. The approach can be applied to a proposal on how to help rice farmers and how to develop a set price, which should be proposed to policymakers as a win-win solution.

2. ONEP asked about GHG emissions measurement and evaluation and highlighted the topic of how the study accounts for the different geographical characteristics of the field locations i.e., flooded plain or highland paddy fields. Would this distinction have an impact on greenhouse gas emissions? Would it be greater than the findings of this study?

    - The KKU team responded that the study area was the Northeastern region, which was flooded or lowland. The results are consistent with preliminary data from previous studies conducted in Thailand, where sandy loam areas had methane emissions that were measured by this study. The results showed that the values were similar. However, our study shows a slightly lower value, which was due to the nature of the soil texture in the study area being quite sandy.

3. ONEP asked whether conventional rice paddy plantations really released more GHG emissions than organic rice paddy, considering that more organic matter is present in organic fields.
    - Specialist members of the research team clarified. It was noted that the greenhouse gas emissions vary between organic and conventional farming because of soil conditions and the added organic matter to the soil. Normally, if we measure greenhouse gases directly from the experimental plots, we find that organic fields emit more greenhouse gases than conventional fields because a large amount of organic matter is suggested as best practice, such as organic rice stubble.
    - For instance, if rice stubble and other organic matter is put into waterlogged fields, this creates significant quantities of methane and nitrous oxide. However, the amount of nitrous oxide observed in organic fields was far lower than in conventional fields that utilize chemical fertilizers, which contain high quantities of nitrogen urea. When assessing the total emission of greenhouse gases, conventional rice fields frequently appear to emit lower greenhouse gases than organic rice fields.
    - Methane and nitrous oxide are both measured and converted into CO2 equivalents.

4. ONEP asked about the monetary value applied to biodiversity in the assessment. Based on the TEEB paradigm, KKU described the proxy values applied which are related to the reduction in pesticide expenditure and associated health costs.

    - Dr. Salman Hussain noted that there are methods for applying the estimated monetary value of rice production based on TEEB valuation to financially support farmers. One alternative being considered is enhanced carbon credits, which also include biodiversity benefits. While there are extremely good carbon measuring methodology, we do not have exact measurement protocols for biodiversity, particularly because there are genetic, species and habitat biodiversity, and different ways to quantify it. TEEB analyses typically do not value biodiversity alone, since

it is unclear what happens to the value, for example if a species declines in one place but increases somewhere else. KKU's findings demonstrate that there are both carbon and biodiversity benefits. In the near or medium term, this can become a marketable benefit. These advantages might be imparted in the form of credits for organic products produced in a certified organic region.

5. The Biodiversity Management Division of ONEP asked to clarify the results on the price of organic rice.
    - The premium price of organic rice was suggested to be at least 3.5% higher than conventional rice on the market, according to the findings. Based on the data from the last 10 years, if the price of organic rice is only 3.5% higher than the price of conventional rice, farmers will make the same amount of money whether they grow organic rice or conventional rice.

6. The National Bureau of Agricultural Commodity and Food Standards, MOAC raised a question on the policy implications and recommendations regarding the findings.
    - ONEP suggested that an analysis of the impacts of agriculture on biodiversity are relatively new issues. This research also gives evidence to other policy agencies that other important parties outside ONEP that should be synergistic and be involved in environmental policies, such as MOAC's policy in this case.
    - This research also demonstrates that farmers may be motivated to act by cooperating, and if this succeeds, it indicates potential future scenarios.
    - The further comment added by Dr. Salman Hussain was that the premium price for organic rice during the transition period needs substantial support, but due to the fact that farmers are very highly risk-averse, it is hard to access financial support.

4. Presentation: follow up assessment on sustainable rice systems

This session introduced the project funded by the European Union Partnership Instrument (EUPI). Taking up the experience of the initial study, this assessment will examine the pattern of rice farming through sustainable rice initiatives in the commercial rice sector and its effects on health, economy, the environment, and social well-being.

This research defines sustainable rice production through five different practices: 1. water management; 2. nutrient management; 3. pest management; 4. rice straw management; and 5. crop diversification. Regarding the stated SRP, all ideas are welcome. Specifically, crop rotation and rice post-harvest diversity. Moreover, the building of scenarios based on present policy is making progress. For example, Thailand's 20-Year National Strategy (2018-2037) goals, Bio-Circular and

Green Economy (BCG) national agenda, mechanism to lead farmers' decision to adopt the SRP Standard.

Three main points to be addressed in this study are the following:

1. TEEBAgriFood assessment: Find out what the overall effects of Thailand's SRP Standard for sustainable rice cultivation are in terms of natural, human, social, and produced capital.

> 1.1 How would adopting the SRP Standard for sustainable rice farming in Thailand add to the value of natural, human, social, and produced capital? What would the overall effect be?
>
> 1.2 What is the public sector return on investment (ROI) in pro-nature production?

2. What and how will farmers respond to the incentives in order to change to sustainable rice? This question is also to be addressed in terms of the following policy questions:

> 2.1 What would happen to the system if agricultural subsidies were changed or redirected to directly support production methods that are good for the environment in the rice sector?
>
> 2.2 How do small holders benefit from SRP Standard/GAP++-encouraged practices? How do other stakeholders benefit? Where could incentives be most equitably directed to encourage good practices?
>
> 2.3 What would the additional value and overall impact be of other specific policies or investments? The incentives are significant because farmers mitigate the risk that farmers will face from a variety of uncertainties, particularly during the transition phase. Many different sorts of incentives are essential and cannot be ignored.

3. What indicators would be appropriate to include in the study? These variables are taken into consideration to be able to determine the productivity, livelihood development, and economic growth in order to combine a balanced, holistic range of indicators on environmental sustainability and public health and well-being. This question is also to be translated into the following policy questions:

> 3.1 What are the critical national sustainability indicators for successful agrifood policy implementation over the next 20 years?
>
> 3.2 Which natural and human capital costs and benefits need to be prioritized to support the transformational shift to sustainability by 2050?

4.1. Questions and discussion

1. Recommendation from Dr. Krisada, the Stock Exchange of Thailand (SET): How do you define the platform because it has such a broad definition? Furthermore, the scope of the platform should be expanded so that the advantages may be linked to the collaborating and commercial sectors.

2. Mr. Wyn Ellis (Executive Director, Sustainable Rice Platform) provided supplementary information concerning the SRP and its introduction in Thailand.

    - The Sustainable Rice Platform (SRP) started in Thailand in 2009. It has UN organizations backing it, as well as the International Rice Research Institute (IRRI). SRP has developed the world's first sustainability standard for rice. The SRP-verified rice from Thailand is being sold in markets in seven European countries. The SRP program launched an insurance scheme based on the standard to allow rice farmers to verify their rice as sustainable, all working towards a sustainability program since 2020.
    - The difference between sustainable rice and organic standards is that while organic standards require a three-year transition period, SRP-verified rice can become certified or verified in the very first season, meaning that farmers will acquire the financial benefits in the first season rather than having to bear compliance burdens for three years before they start to benefit. This is a strong advantage for farmers financially.
    - The Rice Departments, the Ministry of Agriculture, and the Bank for Agriculture and Agricultural Cooperatives (BAAC) will be involved in the commencement of many significant projects in Thailand the next year. These initiatives are supported by the Global Environment Facility (GEF), administered by UNEP, and carried out by GIZ.
    - Another Green Climate Fund-funded project with SRP at its core is still in early planning stages. The notion of adopting best practices is challenging, yet it is very encouraging to see Thailand spearheading these initiatives more than any other nation.

3. ONEP brought up the need to clarify the definition of sustainable rice cultivation, as well as the difference between Thai and international sustainable rice farming or agriculture, underlining that it is best to rely on the MOAC policies. The participant recommended that KKU confer with the National Bureau of Agricultural Commodity and Food Standards (ACFS) on the sustainable rice measurement criteria.

    ACFS, MOAC commented as follows:

    - This concept will be used to efficiently apply a type of measurable monetary values to inform stakeholders of the benefits of sustainable rice cultivation.
    - Rice cultivation differs between highland and lowland areas. As a result, there are diverse practices in the Northeastern and central regions. The SRP Standard includes a requirement for “alternative wetting and drying” - water management, which influences GHG emissions. Thus, the policy recommendation should be distinct.
    - What and how to launch the incentive from the standpoint of policymakers, and if consumers and producers (farmers) can accept incentives to change.

4. The Department of Water Resources, Ministry of Natural Resources and Environment also made a remark about King Rama IX's philosophy which is known as the Philosophy of Sufficiency Economy. It was highlighted that integrating the philosophy with sustainable agriculture is critical. It might include a variety of agricultural land uses, not only rice growing or a mega-rice farm project. A varied range of crops and animals can be found on certain farms, and these types of land use will increase biodiversity and reaping benefits to animal habitats and plants, which currently exist throughout Thailand.

5. Specialists in the research team added that in the future, limiting greenhouse gas emissions from the agriculture sector alone will not be adequate to achieve a net-zero emissions goal. It would also be beneficial to increase the number of trees alongside certain crop plantations, and to conduct other practices to make substantial progress toward the zero-CO2 ambition and other sustainability goals.

ANNEX 1: Workshop Agenda

National workshop: The Economics of Ecosystems and Biodiversity (TEEB)
Presentation of TEEBAgriFood Assessment in Thailand

Integrating the value of ecosystems and biodiversity in rice system in Thailand

12 May 2022
Grande Centre Point Ratchadamri, Bangkok

8.30-9.00 Registration
9.00-9.10 Opening address

Dr. Phirun Saiyasitpanich, Secretary General, Office of Natural Resources and Environmental Policy and Planning (ONEP)

9.10-9.30 Introductory remarks

Dr. Salman Hussain, Coordinator, The Economics of Ecosystems and Biodiversity (TEEB), United Nations Environment Programme (UNEP)

9.30-9.45 Keynote speech

Mr. Alongkorn Ponlaboot, Counsellor to the Minister for Agriculture and Cooperatives

9.45-10.45 Presentation of research results from initial assessment "Integrating the value of ecosystems and biodiversity in rice systems in Thailand"

Assoc. Prof. Dr Phumsith Mahasuweerachai, Economics Faculty, Khon Kaen University

10.45-11.30 Questions and discussion on the research findings and recommendations for policy approach

11.30-11.45 Introduction of follow-up assessment "Measuring what matters in sustainable rice production" funded by EUPI

Assoc. Prof. Dr Phumsith Mahasuweerachai, Economics Faculty, Khon Kaen University

11.45-12.15 Questions and discussion on the EUPI project
12:15 Close of meeting

ANNEX 2: List of workshop participants

Participant list (On-site) The National workshop supported by the Economics of Ecosystems and Biodiversity (TEEB): Supporting biodiversity and climate friendly land management in agricultural landscapes May 12 2022, 08.30 – 12.00 am. Ratchaphruek room, The Grande Centre Point Hotel, Ratchadamri				
Order	Name-Last name	Position	Institution	Gender
1	ดร. จิตตินันท์ เรืองวีรยุทธ	ผู้อำนวยการกองจัดการความหลากหลายทางชีวภาพ	สำนักงานนโยบายและแผนทรัพยากรธรรมชาติและสิ่งแวดล้อม	female
2	Dr. Salman Hussain	Coordinator, The Economics of Ecosystems and Biodiversity (TEEB)	UNEP	male
3	Rebeca Leonard	Consultant, (TEEBAgriFood)	UNEP	female
4	Wyn Ellis	Executive Director	Sustainable Rice Platform	male
5	นาง นิลุบล กัณหา	ผู้อำนวยการส่วนความหลากหลายทางชีวภาพ	กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช	female
6	นางสาวศิริพรรณ ปัญญาใจ๋	ผู้ช่วยนักวิจัย	กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช	female
7	นางสาวรุจิเรข น้อยเสงี่ยม	นักวิเคราะห์นโยบายและแผนชำนาญการพิเศษ	สำนักงานมาตรฐานสินค้าเกษตรและอาหารแห่งชาติ กองนโยบายมาตรฐานสินค้าเกษตรและอาหาร	female
8	นายพฤทธิ์ เจริญกลกิจ	นักวิเคราะห์นโยบายและแผนปฏิบัติการ	นายสำนักงานมาตรฐานสินค้าเกษตรและอาหารแห่งชาติ กองนโยบายมาตรฐานสินค้าเกษตรและอาหาร	male
9	มนัญชยา ศรีจรูญรัตน์	นักวิชาการมาตรฐานปฏิบัติการ	สำนักงานมาตรฐานสินค้าเกษตรและอาหารแห่งชาติ	female
10	กิตติภรณ์ พ่วงสุข	นักวิชาการมาตรฐานปฏิบัติการ	สำนักงานมาตรฐานสินค้าเกษตรและอาหารแห่งชาติ	male
11	วิทวัส แก้วดี	นักวิชาการมาตรฐาน	สำนักงานมาตรฐานสินค้าเกษตรและอาหารแห่งชาติ	female
12	นางสาวณมาพร อัตถวิโรจน์.	นักวิชาการมาตรฐานชำนาญการพิเศษ	สำนักงานมาตรฐานสินค้าเกษตรและอาหารแห่งชาติ	female
13	นายจักรพันธ์ เภาสระคู	ผู้อำนวยการกลุ่มวิจัยและพัฒนาการจัดการดินเสื่อมโทรม	กรมพัฒนาที่ดิน (กองวิจัยและพัฒนาการจัดการที่ดิน)	male
14	นายณัฐภาส ศรีเลิศ	เศรษฐกรปฏิบัติการ	กรมพัฒนาที่ดิน	male
15	นางสาวอรณิชา แก้วสังข์	เศรษฐกรปฏิบัติการ	กรมพัฒนาที่ดิน	female
16	นางสาวปุณณภา พิสกุล	เศรษฐกรชำนาญการพิเศษ	สำนักวิจัยเศรษฐกิจการเกษตร สำนักงานเศรษฐกิจการเกษตร	female
17	นางสินันต์ธร จันทร	ผู้อำนวยการกลุ่มส่งเสริมการควบคุมศัตรูพืชโดยชีววิธี	กรมส่งเสริมการเกษตร	female
18	น.ส.ศศิประภา มาราช	นักวิชาการเกษตรชำนาญการ	กรมส่งเสริมการเกษตร	female
19	นางสาวอำพร เนติ	นักวิชาการเกษตรชำนาญการพิเศษ	กรมส่งเสริมการเกษตร	female
20	นาสาวกิตติรัตน์ เชื้อนุ่น	นักวิชาการเกษตรปฏิบัติการ	กรมส่งเสริมการเกษตร	female
21	นายสมชาย บุญประดับ	นักวิชาการเกษตรเชี่ยวชาญ	กรมวิชาการเกษตร	male
22	นางสาวพัชร ปิริยะวินิตร	นักวิชาการเกษตรชำนาญการ	กรมวิชาการเกษตร	female

23	นางสาววีวรรณยา คล้อยสาย	นักวิชาการเกษตรปฏิบัติการ	กรมวิชาการเกษตร	female
24	นายเกียรติศักดิ์ กล่ำเอม	ผชช.ด้านพืชอาหารสัตว์	สำนักพัฒนาอาหารสัตว์ กรมปศุสัตว์	male
25	นายจิรายุส เข็มสวัสดิ์	นักวิชาการสัตวบาลปฏิบัติการ	สำนักพัฒนาอาหารสัตว์ กรมปศุสัตว์	male
26	น.ส.สิรินาถ อินทร์อยู่	นักวิชาการสัตวบาลปฏิบัติการ	สำนักพัฒนาอาหารสัตว์ กรมปศุสัตว์	female
27	สุภาวดี นกเสวก	นักธรณีวิทยาปฏิบัติการ	กรมทรัพยากรน้ำ	female
28	ณิชารีย์ เวียงมูล	นักธรณีวิทยาปฏิบัติการ	กรมทรัพยากรน้ำ	female
29	ปียะทิพย์ เอี่ยวพานิช.	ที่ปรึกษา กรมทรัพยากรน้ำ	กรมทรัพยากรน้ำ	female
30	นางสิรีธร อรรฆยานนท์	นักวิชาการป่าไม้ปฏิบัติการ	กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช	female
31	นางสาวเบญจมาภรณ์ วัฒนธงชัย	ผอ.กลุ่มงานประสานงานกลางอนุสัญญา	กองจัดการความหลากหลายทางชีวภาพ สผ.	female
32	นางสาวโสมวรรณ สุขประเสริฐ	นักวิชาการสิ่งแวดล้อมชำนาญการพิเศษ	กองจัดการความหลากหลายทางชีวภาพ สผ.	female
33	พุทธธิดา รัตนะ	นักวิชาการสิ่งแวดล้อมปฏิบัติการ	กองจัดการความหลากหลายทางชีวภาพ สผ.	female
34	อภิญญา เพ็งนอก	นักวิเคราะห์นโยบายและแผน	กองจัดการความหลากหลายทางชีวภาพ สผ.	female
35	นางสาวกมลวรรณ ลิ่มขจรเกียรติ	นักวิเคราะห์นโยบายและแผน	กองบริหารกองทุนสิ่งแวดล้อม สผ.	female
36	นางณัฏฐนิช อัศวภูษิตกุล	ผู้อำนวยการกองบริหารกองทุนสิ่งแวดล้อม	กองบริหารกองทุนสิ่งแวดล้อม สผ.	female
37	น.ส.วาสนา เทพสง่า	เจ้าหน้าที่ประสานงานโครงการ	กองประสานการจัดการการเปลี่ยนแปลงสภาพภูมิอากาศ สผ.	female
38	นายรังสิทศ คำปลิว	นักวิเคราะห์นโยบายและแผนชำนาญการ	สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	male
39	นางสาวสิทธินีย์ ชูนาคา	นักวิเคราะห์นโยบายและแผน	สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	female
40	นางสาวสุพิชญา อินอักษร	นักวิเคราะห์นโยบายและแผน	สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	female
41	ทักษิกร ขจรกุล	นักวิเคราะห์นโยบายและแผน	สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	male
42	สรัลณัท ชวนะศักดิ์	นักวิเคราะห์นโยบายและแผนชำนาญการ	สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	female
43	รัศมี สัมสา	นักวิชาการสิ่งแวดล้อม	ศูนย์วิจัยและฝึกอบรมด้านสิ่งแวดล้อม	female
44	ดร.กฤษฎา เสกตระกูล	รองผู้จัดการ ตลาดหลักทรัพย์แห่งประเทศไทย	ตลาดหลักทรัพย์แห่งประเทศไทย	male
45	นายสุรพงษ์ พวงคต	เศรษฐกรชำนาญการพิเศษ	กรมชลประทาน	male
46	ดร. นิตยา ชาอุ่น	นักวิจัย	ระบบบริหารงานวิจัยและนวัตกรรม มจธ.	female

Participant list (Online) The National workshop supported by the Economics of Ecosystems and Biodiversity (TEEB): Supporting biodiversity and climate friendly land management in agricultural landscapes May 12, 2022, 08.30 – 12.00 am. Ratchaphruek room, The Grande Centre Point Hotel, Ratchadamri				
Order	Name-Last name	Position	Institution	Gender
1	คุณอลงกรณ์ พลบุตร	ที่ปรึกษารัฐมนตรีว่าการกระทรวงเกษตรและสหกรณ์	กระทรวงเกษตรและสหกรณ์	male
2	สวิสา อริยปรัชญา	รองผู้อำนวยการ	สถาบันวิจัยเศรษฐกิจป่วย อึ๊งภากรณ์ ธนาคารแห่งประเทศไทย	female
3	นางสาวเฟื่องลดา ธนะโชติ	นักวิชาการเกษตรชำนาญการ	กรมการข้าว	female
4	รศ.ดร.วิษณุ อรรถวาณิช	นักวิจัยสถาบันวิจัยและพัฒนาแห่งมหาวิทยาลัยเกษตรศาสตร์	สถาบันวิจัยและพัฒนาแห่งมหาวิทยาลัยเกษตรศาสตร์ มหาวิทยาลัยเกษตรศาสตร์	male
5	ขนิษฐา แต้มบุญเลิศชัย		คณะเศรษฐศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย	female
6	นายปณิธิ เทพสง	นักวิชาการคอมพิวเตอร์ปฏิบัติการ	กรมการข้าว	male
7	นางสาวสุเมณีย์ งามสอาด	-	กรมการข้าว	female
8	นางสาวสมใจ แก้วสร	นักวิชาการเกษตรชำนาญการพิเศษ	กองพัฒนาผลิตภัณฑ์ข้าว กรมการข้าว	female
9	นางสาวนิกูล เสนานอก	-	กองพัฒนาผลิตภัณฑ์ข้าว กรมการข้าว	female
10	นางสาวชนิษฐา อ่อนศรี	ผู้จัดการ	สหกรณ์เกษตรอินทรีย์ทัพไทย จำกัด	female
11	นายธาตรี อินทรสูต	นักวิเคราะห์นโยบายและแผนปฏิบัติการ	กรมทรัพยากรน้ำบาดาล	male
12	นางสาว พิชามญช์ อินต๊ะโม	นักสำรวจดินชำนาญการ	กรมพัฒนาที่ดิน	female
13	ดวงพร อังสุมาลี	นักวิชาการเกษตรชำนาญการ	กองเมล็ดพันธุ์ข้าว กรมการข้าว	female
14	นางสุวิมล สี่หิรัญวงศ์	ผู้เชี่ยวชาญด้านความหลากหลายทางชีวภาพด้านการประมงน้ำจืด	ราชการบริหารส่วนกลาง (ผู้เชี่ยวชาญ) กรมประมง	female
15	มณฑกาญจน์ บุญเพิ่มผล	นักวิชาการเกษตรปฏิบัติการ	กองพัฒนาผลิตภัณฑ์ข้าว กรมการข้าว	female
16	พรรวี ม้วงสาร	เจ้าหน้าที่สนับสนุนนักวิเคราะห์	สำนักงานพัฒนาการวิจัยการเกษตร (องค์การมหาชน)	female
17	นาง นิรบล ปั่งกวาน	ประ ธานกลุ่ม	กลุ่มวิสาหกิจ ขุมขน ข้าวอินทรีย์ บ้านกุดเรือใหญ่	female
18	นางอาทิตยา พองพรหม	ผู้เชี่ยวชาญด้านการเพิ่มประสิทธิภาพการใช้ที่ดินในเขตปฏิรูปที่ดิน	สำนักงานการปฏิรูปที่ดินเพื่อเกษตรกรรม	female
19	นางสาวพันธจิต จันทะกล	นักวิชาการสิ่งแวดล้อมชำนาญการ	กรมควบคุมมลพิษ	female
20	นางกุลชนา ดาร์เวล	นักวิชาการเกษตรชำนาญการพิเศษ	กรมการข้าว	female
21	นางวศินี ทวีธนวาณิชย์	วิศวกรชำนาญการ	สำนักพัฒนาน้ำบาดาล กรมทรัพยากรน้ำบาดาล	female
22	ละไม ศรีสวัสดิ์	นักวิทยาศาสตร์ชำนาญการพิเศษ	สำนักวิทยาศาสตร์เพื่อการพัฒนาที่ดิน	female

23	นาง นิรบล ปั่งกวาน	ประธานกลุ่ม	กลุ่มวิสาหกิจชุมชน ข้าวอินทรีย์ บ้านกุดเรือใหญ่	female
24	นางสาววีรณา สมพีร์วงศ์	นักวิทยาศาสตร์ชำนาญการพิเศษ	กรมป่าไม้	female
25	นางสาวฉัตร กมล บุญนาม	นักวิทยาศาสตร์	กรมป่าไม้	female
26	นงลักษณ์ ปิ่นเพ็ชร์	นักวิชาการเกษตรปฏิบัติการ	สำนักคุ้มครองพันธุ์พืช กรมวิชาการเกษตร	female
27	นางพรทิพย์ ถาวงค์	ผู้เชี่ยวชาญด้านพัฒณาผลิตภัณฑ์ข้าว	กรมพัฒณาผลิตภัณฑ์ข้าว กรมการข้าว	female
28	นายวิชัย ศรีนวกุล	นายกสมาคม	สมาคมโรงสีข้าวภาคตะวันออกเฉียงเหนือ	male
29	นายสมัชชา โยชน์ชัยสาร	ผู้ช่วยผู้อำนวยศูนย์วิจัยและพัฒนานวัตกรรม	ธนาคารเพื่อการเกษตรและสหกรณ์การเกษตร	male
30	นายนรินทร์ เชวงนิรันดร์	พนักงานวิจัย 9	ธนาคารเพื่อการเกษตรและสหกรณ์การเกษตร	male
31	กาญจนา พฤษพันธ์	นักวิชาการเกษตรชำนาญการ	สำนักคุ้มครองพันธุ์พืช กรมวิชาการเกษตร	female
32	นางสาวณชาดา เจริฐพานิช	นักวิเคราะห์นโยบายและแผนชำนาญการพิเศษ	สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	female
33	นางสาวพัทธนันท์ พลวังกาญจน์	นักวิเคราะห์นโยบายและแผนปฏิบัติการ	สำนักงานสภาพัฒนาการเศรษฐกิจและสังคมแห่งชาติ	female
34	Wichin Suebpala	Lecturer	Ramkhamhaeng University	male
35-65	30 คน	ไม่สามารถระบุตัวตนได้เนื่องจากไม่ได้ลงทะเบียน	Participants who did not register but attended the workshop	n/a