# INTEGRATING THE VALUE OF ECOSYSTEMS AND BIODIVERSITY IN RICE SYSTEMS IN THAILAND

รู้คุณค่าข้าว
เพื่อชีวิตและธรรมชาติ

สำนักงานนโยบายและแผนทรัพยากรธรรมชาติและสิ่งแวดล้อม
OFFICE OF NATURAL RESOURCES AND ENVIRONMENTAL POLICY AND PLANNING

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INTERNATIONAL CLIMATE INITIATIVE

TEEB
The Economics of Ecosystems & Biodiversity

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คณะเศรษฐศาสตร์ มหาวิทยาลัยขอนแก่น
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Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

# TEAM INTRODUCTION

## TEAM MEMBERS

**Phumsith Mahasuweerachai** 01
Economics Valuation and Agricultural Economics Expert.

**Preeyarat Chailangka** 02
Soil, Climate change, and GHG expert

**Warong Suksavate** 03
Ecosystem service Expert

**Jakrapun Suksawat** 04
Ecological economics

**Voravee Saengavut** 05
Spatial analysis Expert

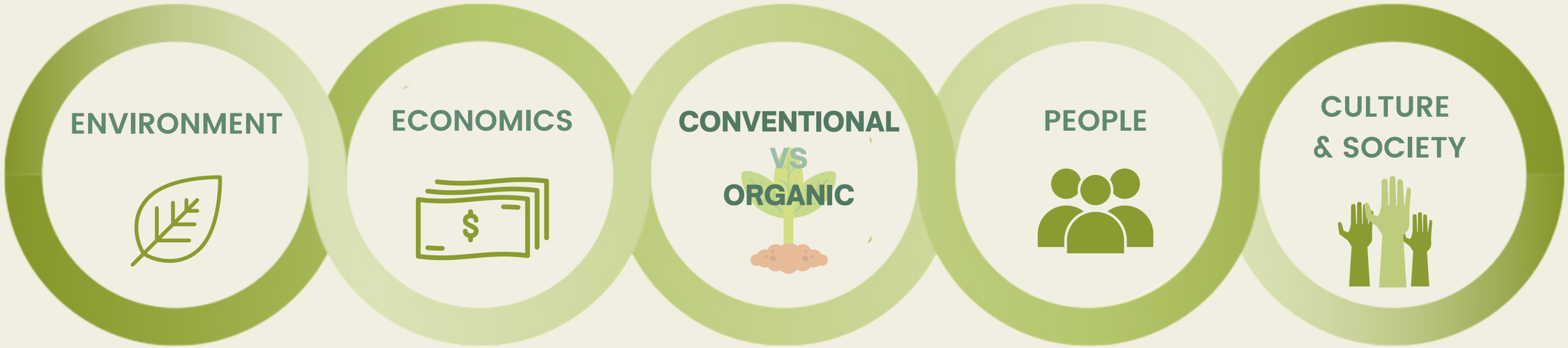
**Tanapipat Walalite** 06
GIS and Biological Expert

**Piyaluk Buddhawongsa** 07
Social Capital Evaluation and Economics Expert

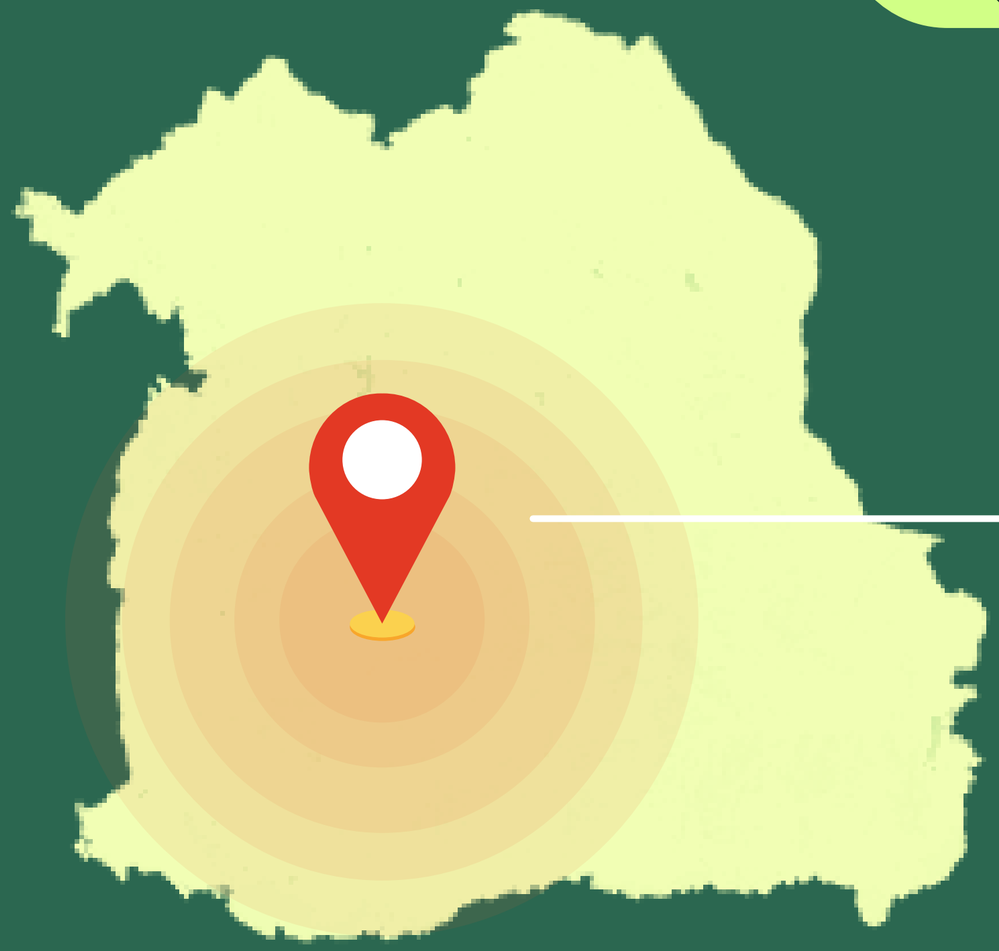
**Phasita Toonsiri** 08
Soil, Climate change, and GHG expert

# Main objective of this study

To compare **net benefit** between conventional and organic rice practices.



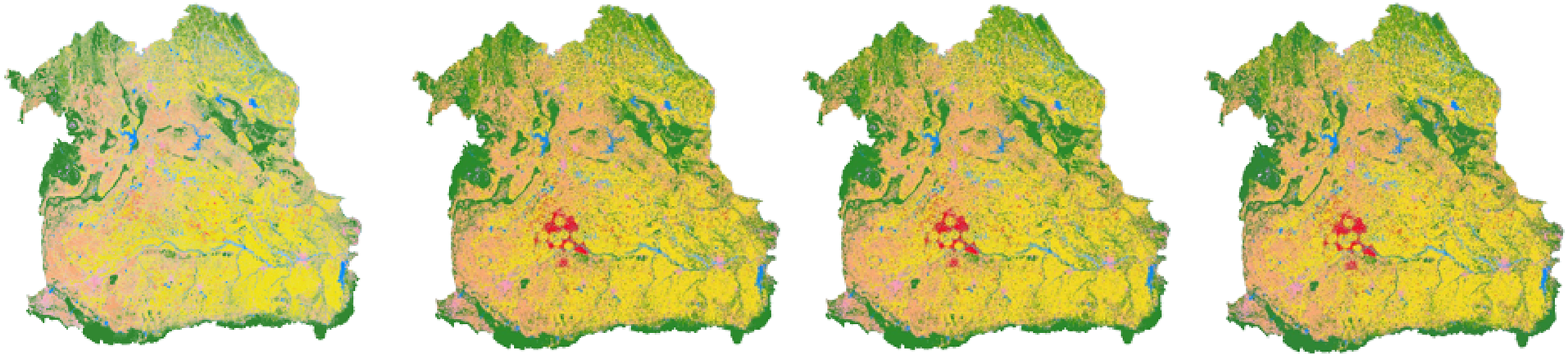
# Scenario Development.



Scenario analysis land platform change from conventional to organic rice.

## Organic rice expansion in BAU scenario. (One million rai)

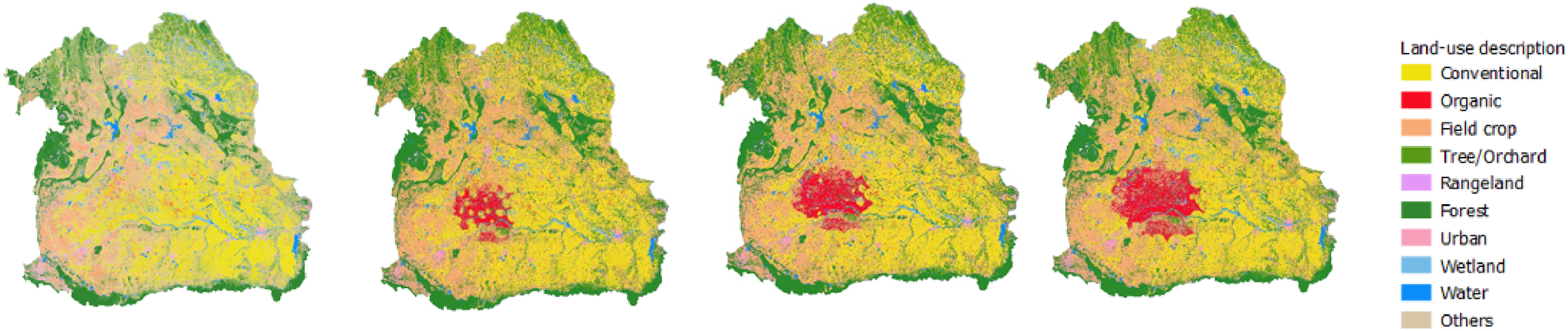
**Year/** Organic area (Rai).



**2019/** 0.58 million rai. **2025/** 1 million rai. (3%) **2030/** 1 million rai. (3%) **2035/** 1 million rai. (3%)

## Scenario 2 : Accelerated organic rice promotion. (One million rai every 5 years)

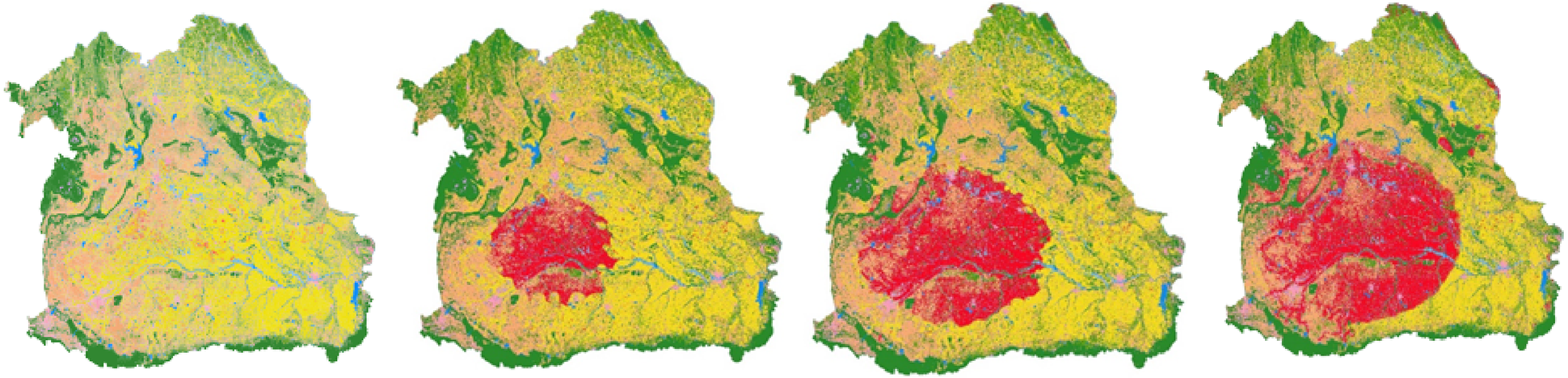
**Year/** Organic area (Rai).




**2019/** 0.58 million rai. **2025/** 2 million rai. (5%) **2030/** 3 million rai. (8%) **2035/** 4 million rai. (11%)

## Scenario 3 : Enhanced organic rice promotion. (One million rai every year)

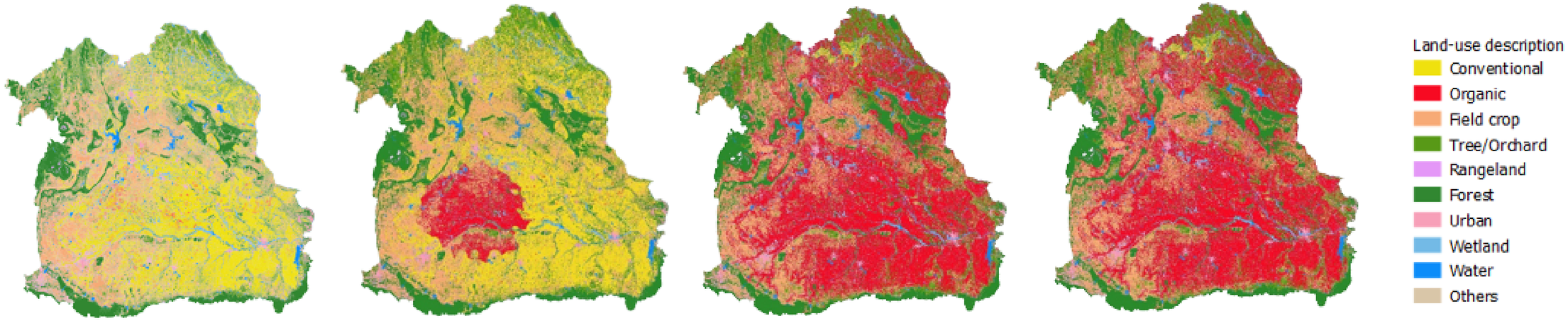
**Year/** Organic area (Rai).



**2019/** 0.58 million rai. **2025/** 5 million rai. (14%) **2030/** 10 million rai. (27%) **2035/** 15 million rai. (41%)

## Scenario 4 : Transformational change towards sustainability. (Thai parliamentary)

**Year/** Organic area (Rai).




**2019/** 0.58 million rai. **2025/** 5 million rai. (14%) **2030/** 32 million rai. (87%) **2035/** 32 million rai. (87%)

# What will be the method and results ?

## ENVIRONMENT

- GHGs
- Biodiversity

## PEOPLE

- Health cost
  - PM 2.5
  - Pesticide

## ECONOMICS

- Rice production

## SOCIETY

- Happiness
- Cooperation
- Prosocial

monetary value ▶

## SCENARIO ANLYSIS

★★★

SWITCH

## SUSTAINABILITY

- Adoption
- Continue

# GHGs Emission

ENVIRONMENT

# What will be the method and results?

## GHGs emission

## Methods:

- DNDC Model
- Literature review

## / Objectives

- Soil organic carbon sequestration
- The greenhouse gas emission from rice cultivation
- The greenhouse gas emission and PM2.5 from rice residue burning

# FACTORS INFLUENCED GHGs EMISSION

## Method: DNDC Model

### SOIL:

- Texture
- BD
- PH
- Clay fraction
- SOC surface

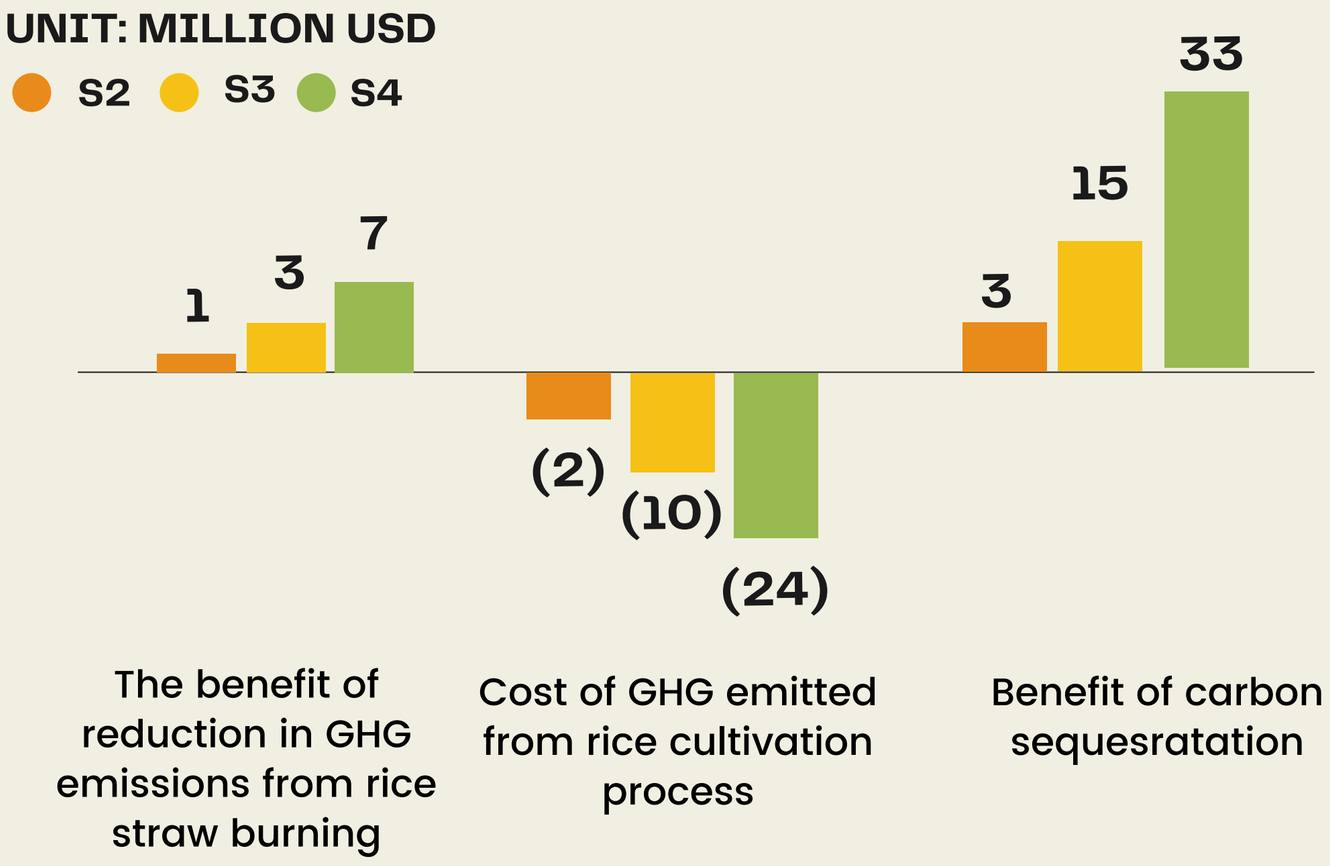
### CROP MANAGEMENT:

- Cropping (Rain-fed)
- Crop Calendar
- Grain Yield
- C Content of grain yield
- Land preparation
- Fertilizer
- Water managment

### CLIMATE CHANGE:

- Daily max temperature
- Daily min temperature
- Daily precipitation

# NPV: The values of GHG emissions categorized by sources




Average: Cultivation

- Organic 15.54 t CO2 eq/ha
- Conventional 14.59 t CO2 eq/ha

Average: SOC

- Organic 42.46 ton C/ha
- Conventional 38.02 ton C/ha

Average: Burning

- Organic 0 t CO2 eq/ha
- Conventional 0.74 t CO2 eq/ha

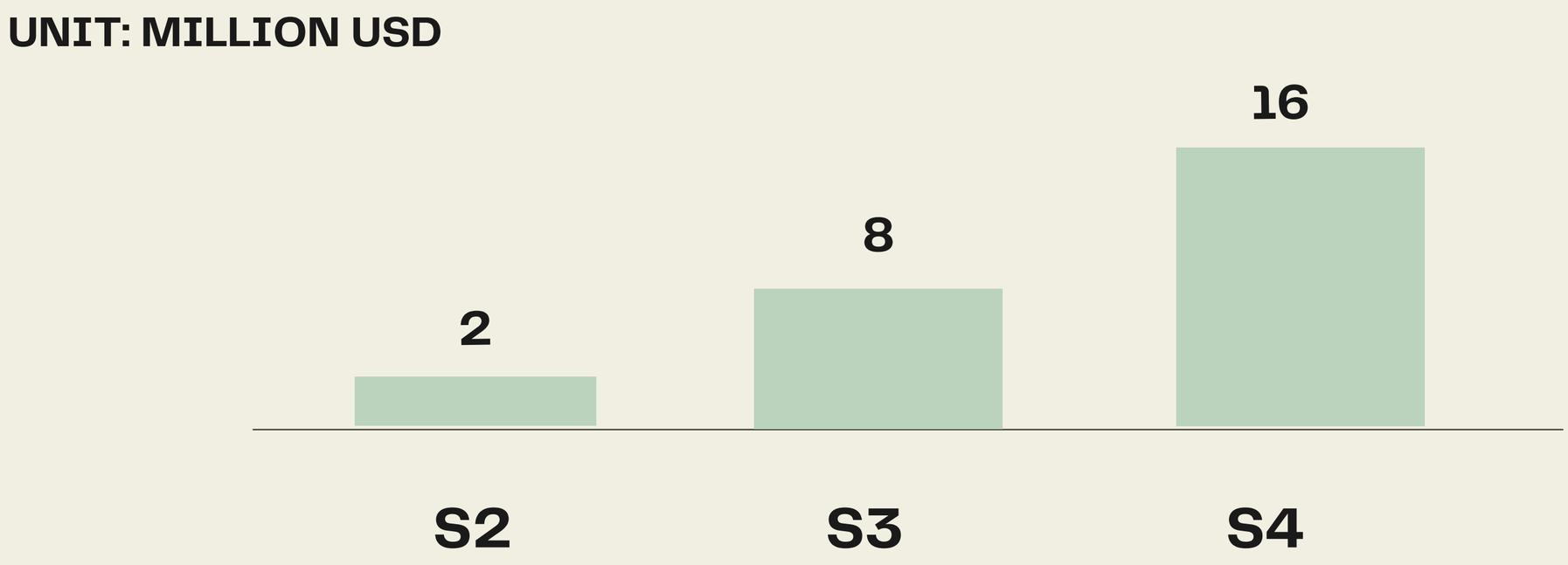
Carbon Price

- 1.67 $/Ton
- Average price of CDM 2016-2020

# NPV: Environmental Externality Dimension

Carbon Price

- 1.67 $/Ton
- Average price of CDM 2016-2020



# Health Dimension

PEOPLE

# What will be the method and results ?

## People : Health

Method:

- Exposure Risk Function
- Household survey
- Choice Experiment.

## / Objectives

- The  effects of PM2.5 to impact on public health cost
- The average cost of medical treatment  from household survey
- The willingness to accept of farmers from reducing fatality risk from pesticide poisoning

# What will be the method and results?

## Health cost: Caused by PM2.5.

### Method:

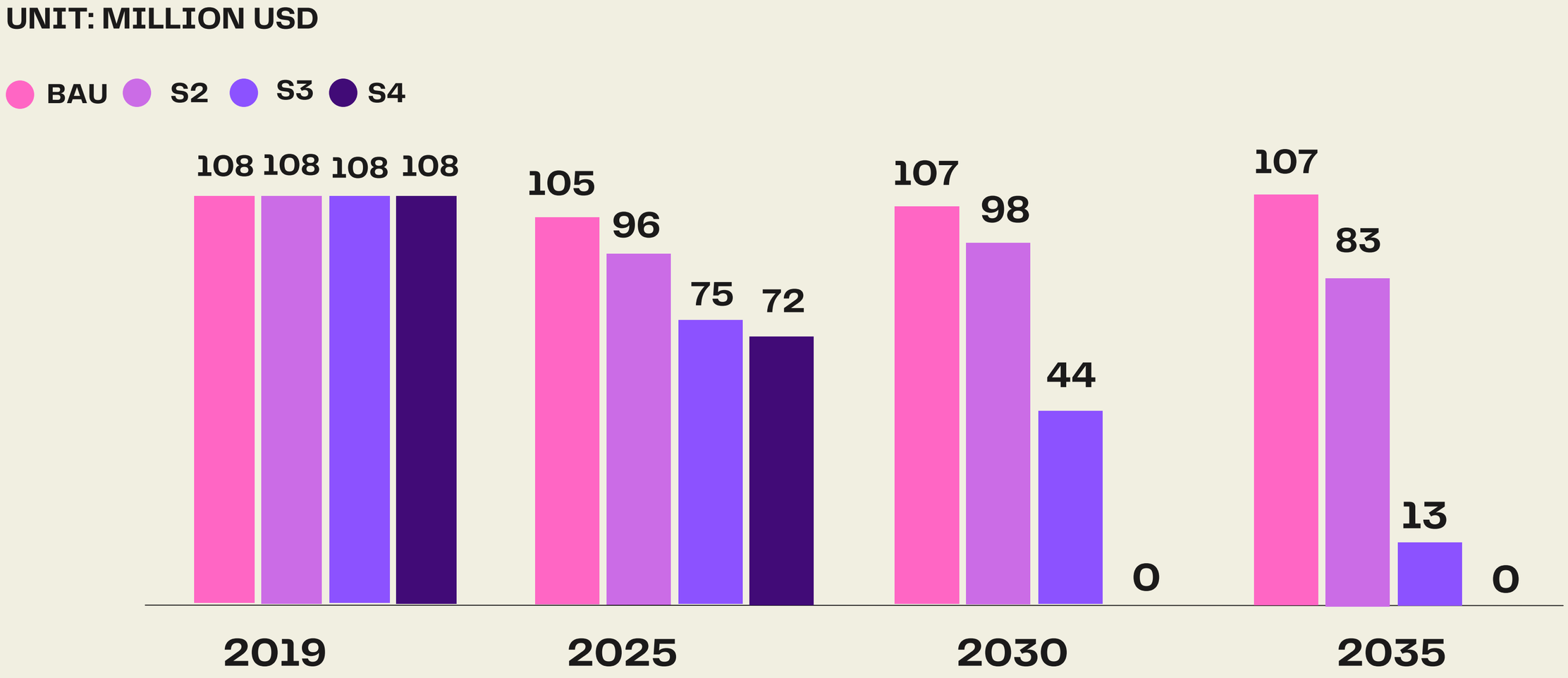
1.Exposure Risk Function

Assessing the health cost model (AHC)

- Concentration of PM2.5.
- Gross Provincial Product (GPP).
- Population growth rate

# Health cost: Caused by PM 2.5
# Method: Exposure Risk Function

Average
- Organic 0 $/ha
- Conventional 17.3 $/ha




HEALTH COST CAUSED BY PM2.5 IN EACH SCENARIO

# Health costs: Pesticide

PEOPLE

# What will be the method and results ?

## Health cost: medical treatment

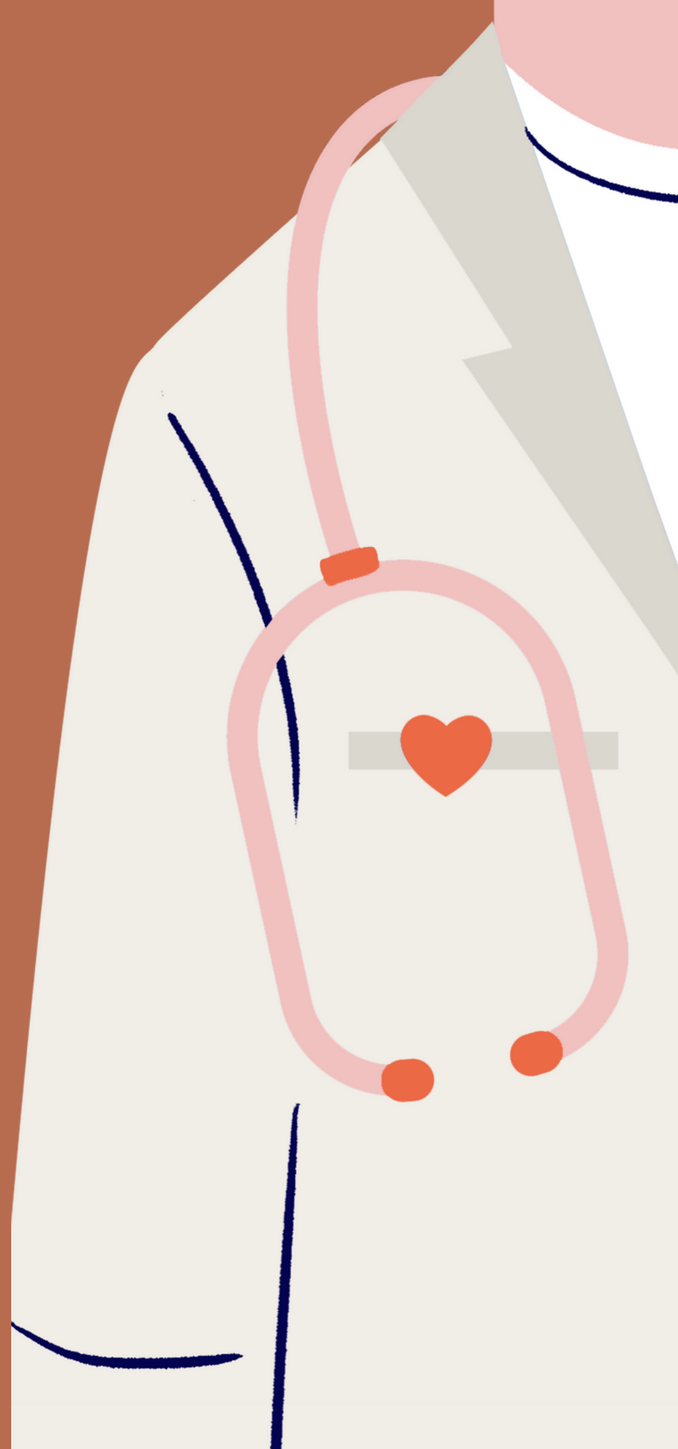
### Method:

1. Household survey

The minimum cost of medical treatment of farmers is 390 Baht (about $13) per individual.

Incidence rate for conventional rice farmer is 2.17 percent. There are 4.3 million rice farmers households. Hence, about 90,000 farmers would be affected.

The health cost would be at least about 35.10 million Baht per croping season (about 1.17 million USD).



# What will be the method and results ?

## Health cost: Caused by pesticide

### Method:

1.Choice experiment survey

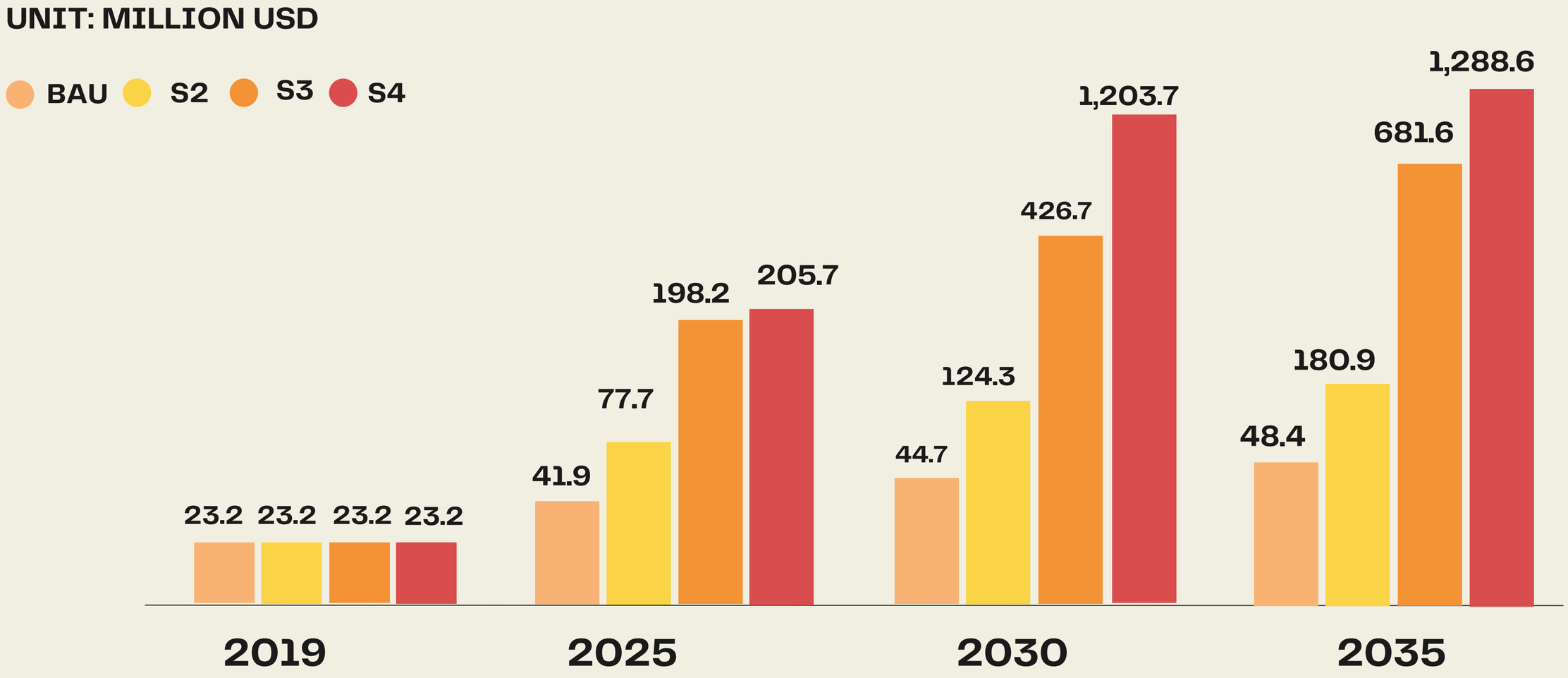
Accepted price rice from reducing fatality risk from pesticide poisoning by $0.08/Kg of rice.

Rice produced is about 2,062 Kg/Ha.

the VSL from reducing fatality risk from pesticide poisoning is $169/Ha.

# Benefit from Health Cost Reduction: Caused by pesticide
# Method: Choice Experiment

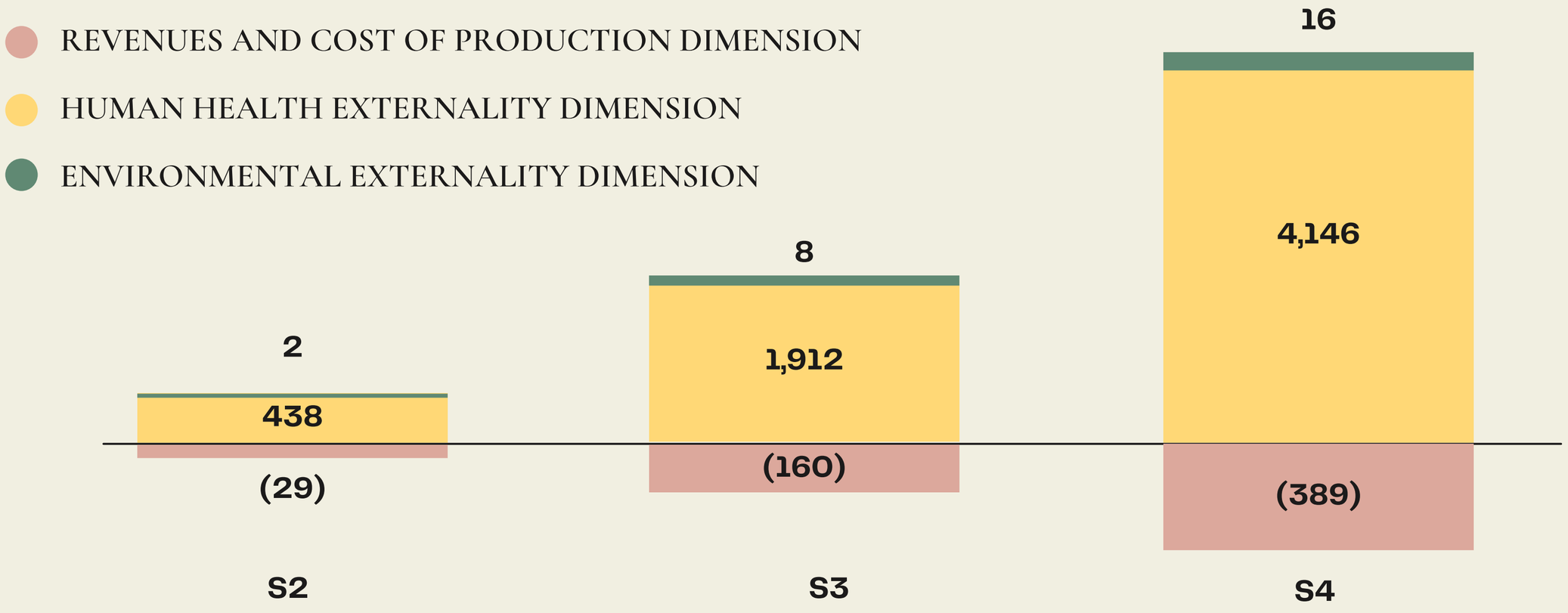
Average
- Organic 0 $/ha
- Conventional 169 $/ha




HEALTH COST CAUSED BY PM2.5 IN EACH SCENARIO

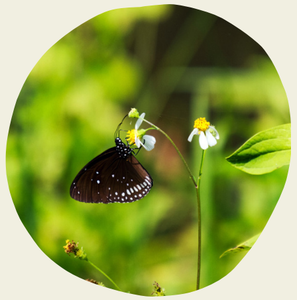
# Total net externality by dimensions due to the expansion of organic rice area

**UNIT: MILLION USD**



# Conclusions

Aside from the monetary advantage, there're several positive externalities associated with the extension of organic rice areas. As a result, when making decisions on cultivation practices, we should consider these other dimensions as well.



The biodiversity rose as the percentage of land used in the organic rice expedition increased.

Expansion of organic rice field has the potential to reduce health costs caused by PM 2.5 and pesticides.

Farmers income would be reduced by organic rice area expansion.

Pesticide costs can be reduced by organic rice area expansion.

An expansion of organic rice area leads to reduction of overall GHG emission

# THANK YOU

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# GHGs From Practices

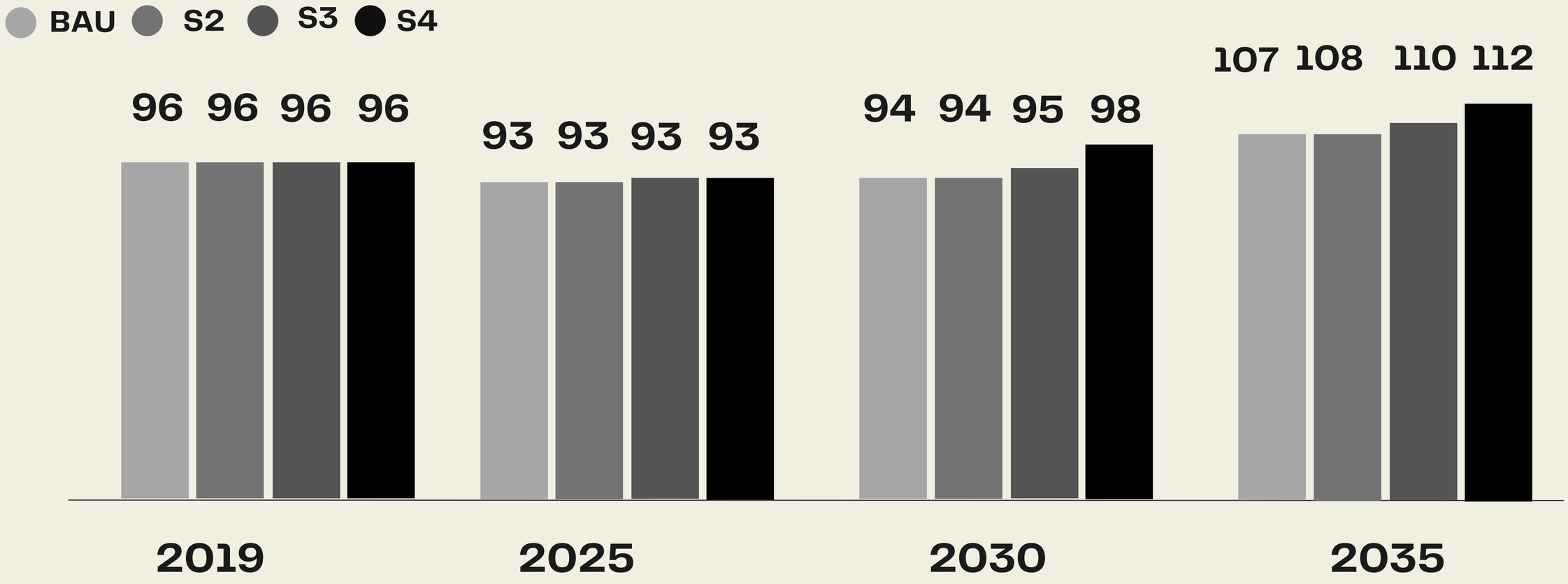
ENVIRONMENT

# GHGs Emission: Cultivation process
# Method: DNDC Model

Average

- Organic 15.54 t CO2 eq/ha
- Conventional 14.59 t CO2 eq/ha

**UNIT: MILLION TON CO2 EQ**

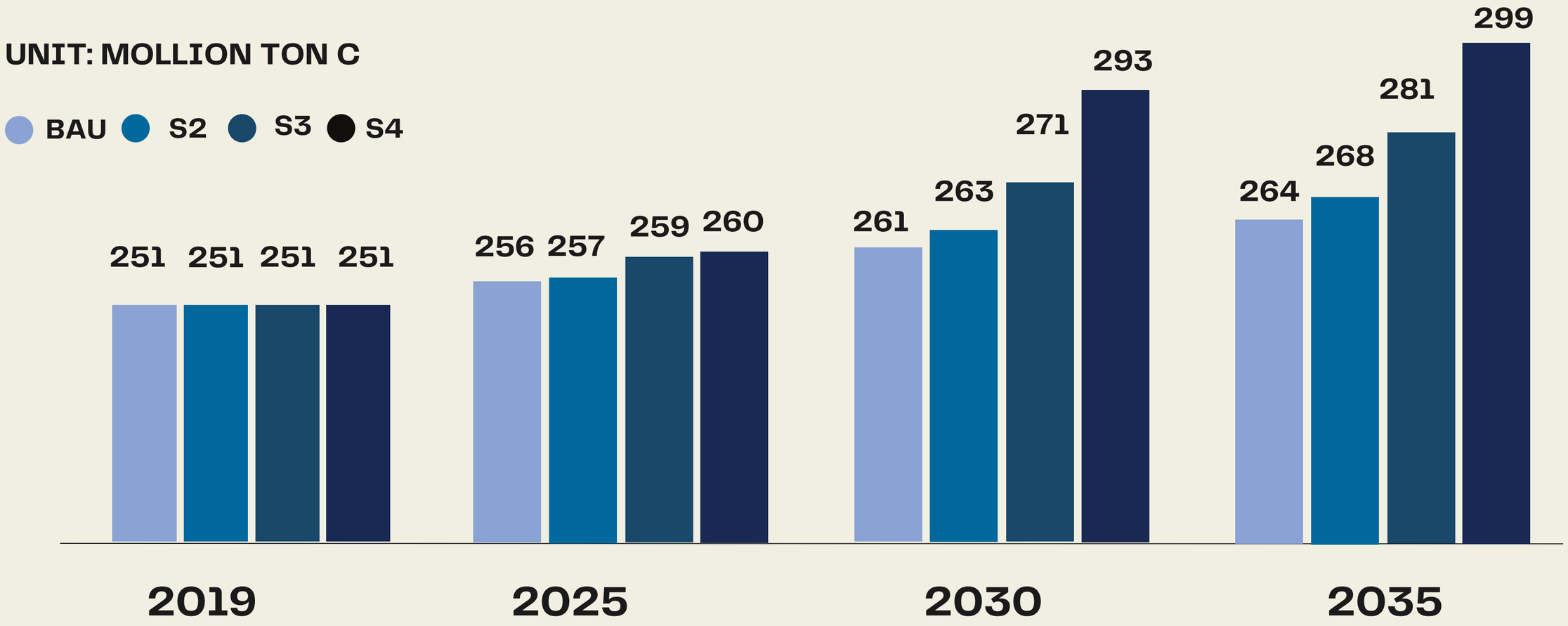



ANNUAL GHG EMISSIONS (CH4 AND N2O) FROM THE RICE FIELDS IN NORTHEAST OF THAILAND

# GHGs Emission: SOC Stock
# Method: DNDC Model

Average

- Organic 42.46 ton C/ha
- Conventional 38.02 ton C/ha




ACCUMULATED SOC STOCKS FROM THE RICE FIELDS IN NORTHEAST OF THAILAND IN

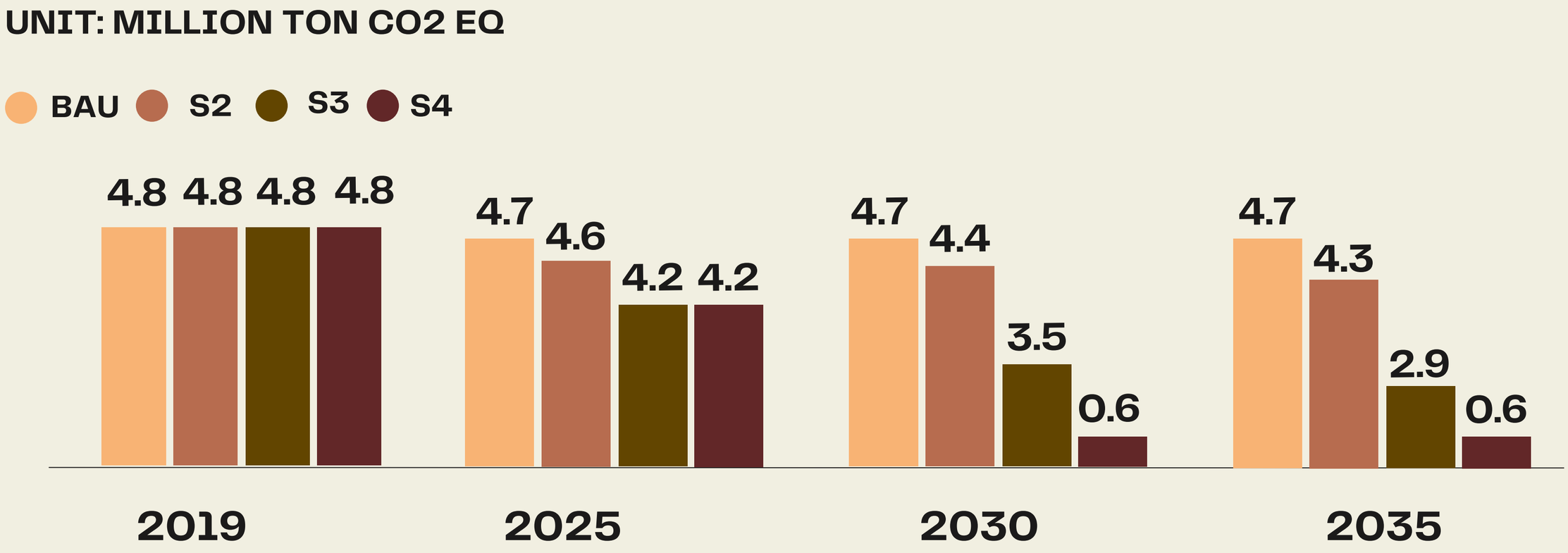
# GHGs From Burning Rice Residues

ENVIRONMENT

# GHGs Emission: Burning Rice Residues
# Method: Literature Review

Average

- Organic 0 t CO2 eq/ha
- Conventional 0.74 t CO2 eq/ha




REDUCTION OF GHG EMISSIONS (PM2.5) FROM BURNING RICE RESIDUES IN EACH SCENARIO

# Policy Recommendations

- To induce farmers to adopt the organic practice, subsidies need to be reoriented, conditional on adopting the sustainable agricultural practice.

- To eliminate the income loss of low yield for organic farmers, organic rice prices should be at least 3.5 percent higher than that of conventional prices.

# Policy Recommendations

- The government should step in to minimize market distortion to ensure the public still benefits from positive externalities generated by organic rice farmers' activities.

- To share the cost of getting certification to focus on promoting the grouping of farmers into discreet areas that can be certified as organic instead of at the individual level.