Integrating Climate Change Adaptation (CCA) into Thailand’s Agricultural Sector

Progress and Future: The National Adaptation Process and its Implementation among ASEAN Countries

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Presentation Outline

• Key vulnerabilities and risks in Agricultural Sector
• Agriculture Strategic Plan on Climate Change 2017-2021
• Integrating Climate Change Adaptation (CCA) into Agricultural Development Plan
• Monitoring and Evaluation tools: Future works
I. Key risks and vulnerabilities in Agricultural Sector
Climate Risk Assessment: Flood
Climate Risk Assessment: Drought
Crop Suitability Assessment

Figure 3.2 Suitability of cassava in the current environment as assessed by Ecocrop

Figure 3.3 Suitability of maize in the current environment as assessed by Ecocrop

Figure 3.15 Suitability of rice, KDML105 variety in the current environment as assessed by Ecocrop

Figure 3.16 Suitability of rice, other varieties in the current environment as assessed by Ecocrop

Figure 3.17 Suitability of sugarcane in the current environment as assessed by Ecocrop
## Crop Suitability Assessment

### Current climate suitability

<table>
<thead>
<tr>
<th>Item</th>
<th>Principal Factor</th>
<th>High suitability zone</th>
<th>Correspondence with Current cultivation area</th>
<th>Other potential factor explaining distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassava</td>
<td>Rainfall</td>
<td>Central dry area</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>Rainfall</td>
<td>Central dry area</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Rice KDML 105</td>
<td>Rainfall</td>
<td>Strip around centre</td>
<td>-</td>
<td>Water Management</td>
</tr>
<tr>
<td>Rice (others)</td>
<td>Rainfall</td>
<td>Strip around centre</td>
<td>-</td>
<td>Water Management</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>Rainfall and temperature</td>
<td>No</td>
<td>-</td>
<td>Water Management</td>
</tr>
</tbody>
</table>

- The cultivation areas of **rice and sugarcane** are located in LOW suitability zones while **cassava and maize** are located in HIGH suitability zones.
- Water management is the main reason behind **rice and sugarcane** distributions in LOW suitability zone.
- Vulnerability in **rice and sugarcane** depends on water management efficiency.

Source: CIAT (2012)
### Uncertainty and changes of suitability to 2050

<table>
<thead>
<tr>
<th>Items</th>
<th>Uncertainty</th>
<th>Suitability change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassava</td>
<td>Low</td>
<td>Stable</td>
</tr>
<tr>
<td>Maize</td>
<td>Moderate</td>
<td>High and Low suitability stable</td>
</tr>
<tr>
<td>Rice KDML 105</td>
<td>High</td>
<td>High and Low suitability stable</td>
</tr>
<tr>
<td>Rice (others)</td>
<td>High</td>
<td>High and Low suitability stable</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>Low</td>
<td>Stable</td>
</tr>
<tr>
<td>Durian</td>
<td>High</td>
<td>High and Low suitability stable</td>
</tr>
<tr>
<td>Longan</td>
<td>Moderate</td>
<td>Decease</td>
</tr>
<tr>
<td>Lychee</td>
<td>Low</td>
<td>Stable</td>
</tr>
<tr>
<td>Mango</td>
<td>Low</td>
<td>Stable</td>
</tr>
<tr>
<td>Mangosteen</td>
<td>Moderate</td>
<td>High and Low suitability stable</td>
</tr>
<tr>
<td>Oil Palm</td>
<td>Moderate</td>
<td>High suitability stable</td>
</tr>
<tr>
<td>Orange</td>
<td>Low</td>
<td>Decease</td>
</tr>
<tr>
<td>Pineapple</td>
<td>Low</td>
<td>Decease</td>
</tr>
<tr>
<td>Rubber</td>
<td>Low</td>
<td>Stable</td>
</tr>
<tr>
<td>Rambutan</td>
<td>Moderate</td>
<td>High and Low suitability stable</td>
</tr>
<tr>
<td>Soybean</td>
<td>High</td>
<td>High suitability stable</td>
</tr>
</tbody>
</table>

- The suitability changes of **rice and maize** are random while **cassava and sugarcane**’s suitability will be unchanged in 2050.

- **Orange, pineapple and longan** are more vulnerable to climate change.

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Source: CIAT (2012)

Note: Using the A1B emission scenario (A balanced emphasis on all energy sources)
Climate Change (Accumulative) Impact Estimation

<table>
<thead>
<tr>
<th>Item</th>
<th>Change in yields (2010-2050)</th>
<th>Economic Impact: (^1) Direct calculation (Thousand baht)</th>
<th>Economic Impact: (^2) Surplus analysis (Thousand baht)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassava</td>
<td>2.67%</td>
<td>277,270</td>
<td>15,002</td>
</tr>
<tr>
<td>Maize</td>
<td>-11.28%</td>
<td>-1,850,799</td>
<td>-694,636</td>
</tr>
<tr>
<td>Rice KDML 105</td>
<td>3.60%</td>
<td>651,688</td>
<td>177,867</td>
</tr>
<tr>
<td>Rice (others)</td>
<td>0.48%</td>
<td>430</td>
<td>207,900</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>-4.33%</td>
<td>-2,209,014</td>
<td>-2,493,207</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>-3,130,425</td>
<td>-2,787,074</td>
</tr>
<tr>
<td>Durian</td>
<td>-49.36%</td>
<td>-2,697,929</td>
<td>-4,372,572</td>
</tr>
<tr>
<td>Longan</td>
<td>-98.22%</td>
<td>-1,281,148</td>
<td>-5,259,612</td>
</tr>
<tr>
<td>Lychee</td>
<td>-19.07%</td>
<td>-106,586</td>
<td>-130,615</td>
</tr>
<tr>
<td>Mango</td>
<td>-0.63%</td>
<td>-894,657</td>
<td>-80,000</td>
</tr>
<tr>
<td>Mangosteen</td>
<td>-7.92%</td>
<td>-180,947</td>
<td>-64,135</td>
</tr>
<tr>
<td>Oil Palm</td>
<td>-4.80%</td>
<td>-83,024</td>
<td>-32,895</td>
</tr>
<tr>
<td>Orange</td>
<td>-13.37%</td>
<td>-57,032</td>
<td>-16,025</td>
</tr>
<tr>
<td>Pineapple</td>
<td>-17.44%</td>
<td>-374,780</td>
<td>-122,834</td>
</tr>
<tr>
<td>Rubber</td>
<td>-125.64%</td>
<td>-1,123,283</td>
<td>-1,120,898</td>
</tr>
<tr>
<td>Rambutan</td>
<td>-0.70%</td>
<td>-76,173</td>
<td>-11,713</td>
</tr>
<tr>
<td>Soybean</td>
<td>2.40%</td>
<td>116,618</td>
<td>23,228</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>-9,889,366</td>
<td>-13,975,145</td>
</tr>
</tbody>
</table>

- The total economic impact of CC is between 9.8 to 13.9 thousand million bath.
- Projected yields of Maize and sugarcane will decline by 11.28% and 4.33%.
- Projected rice KDML 105 yield will increase by 3.6% BUT the study from FAO (2013) indicates that projected rice yield will decline by between 5% and 15%.

Source: CIAT (2012)
Note: \(^1\) Direct calculation assumes only yield has changed in the calculations while others remain unchanged.
\(^2\) Surplus analysis measures the total change in welfare of producers and consumers. In estimation, a partial equilibrium model with dynamic prices is used.
II. Agriculture Strategic Plan on Climate Change (ASPCC)  
2017-2021
Development and CC Policy Context (Linkages)

**Climate Change Plans**

- **CC Master Plan 2015-50**
  (แผนแม่บทรองรับการเปลี่ยนแปลงภูมิอากาศ ปี 2558-93)

- **Thailand’s NDC**
  (การมีส่วนร่วมที่ประเทศกำหนด)

- **Thailand’s NAP**
  (แผนการปรับตัวแห่งชาติ)

**Development Plans**

- **12th National Economic and Social Development Plan**
  2017-2021 (แผนพัฒนาฯ 12)

- **Agricultural Development Plan 2017-2021**
  (แผนพัฒนาการเกษตรฯ)

- **Agricultural Climate Change Strategic Plan 2017-2021**
  (ยุทธศาสตร์การปป.ภูมิอากาศด้านการเกษตร)

**Strategic Issues:**

- **Green and Sustainable growth**
- **Climate Resilience and Green and Sustainable growth**

**Climate Change Framework in Agriculture Sector**

**Horizontal Link**
Strategic Issues in Agriculture Strategic Plan on Climate Change (ASPCC) 2017-2021

- Building networks and collaborations
- Enhancing competitiveness in the world market
- Adaptation for enhancing climate resilience
- Sustainable Development
- Technology transforms towards environmental-friendly and low carbon production
Agriculture Strategic Plan on Climate Change (ASPCC) 2017-2021

**Vision** “Thailand’s agriculture has climate resilience and contributes to mitigate climate change problems under the sustainable development pathways”

**Missions**
1) Raising awareness of the impacts and convey information, knowledge and technology to development parties at all levels to enhance the readiness for climate change-related policies
2) Develop the database, knowledge and technology under the cooperation from all sectors to support the adaptation to climate change
3) Participate in mitigation of greenhouse gas emissions in the level consistent to the context of the agricultural sector and enhance a sustainable low-carbon growth
4) Pushing for the integration of adaptation measures and guidelines to cope with climate change in all sectors and at all levels levels
Climate Change Adaptation Priorities in ASPCC 2017-2021

**Priority 1: Water management**
- Integrated and Participatory Water Resources Management
- Increasing water use efficiency
- Expanding irrigation areas
- Increasing number of farm ponds for water storage.

**Priority 2: Sustainable Soil Management**
- Preventing soil degradation (such as planting cover crops, and crop rotation)
- Rehabilitating degraded soils (such as soil condition analysis and organic fertilizer promoting)
- Optimizing agricultural land use through agricultural zoning (by using Agri-Map tools)
### Priority 3: Strengthening farmers’ climate resilience

- Climate change risk map for all main crops
- Promoting climate-risk insurance (Index-based insurance)
- Developing the climate-resilient index for the agricultural sector
- Promoting integrated farming and sustainable agriculture (organic farming and New Theory Agriculture)
- Promoting technology transfer on precision farming and biotechnology
- Developing early warning system (EWS) for agricultural sector
- Promoting market-based policies and economic incentive for climate action.
III. Integrating Climate Change Adaptation (CCA) into Agricultural Development Plan
Driving Forces of ASPCC 2017-2021

**Force 1**
- **Impact Chain Analysis**/Impact assessment
- Multi-criteria analysis (i.e., CCBA)

**Force 2**
- Adaptation and Mitigation Stock-takes (options)
- Adaptation and Mitigation Priorities
- Technology and Capacity building needs assessment

**Climate Change Plans**
- CC Master Plan 2015-50
  (แผนแม่บทรองรับการเปลี่ยนแปลงภูมิอากาศ ปี 2558-93)
- Thailand’s NDC
  (การมีส่วนร่วมที่ประเทศก้าวหน้า)
- Thailand’s NAP
  (แผนการปรับตัวแห่งชาติ)

**Development Plans**
- 12th National Economic and Social Development Plan 2017-2021 (แผนพัฒนา ด.12)
- Agriculture Development Plan 2017-2021
  (แผนพัฒนาการเกษตร)
- Agriculture Strategic Plan on Climate Change 2017-2021
  (ยุทธศาสตร์การป้องกันภูมิอากาศด้านการเกษตร)

**Climate Change Framework in Agriculture Sector**
**Tools:** CCBA and MCA

**S1: Database**

**S2: Adaptation Actions**

**S3: Mitigation Actions**

**S4: Driving Mechanism**

**Climate Change Action Plan**

**Stock-taking**

**Prioritization**

**Multi-criteria Framework**

**Tools: CCBA and MCA**

**Action Plan: Adaptation & Mitigation Options/Actions (September-October 2017)**

**1st Review: In-dept interview**

**2nd Review: Stock-taking and MCA**


- Review Adaptation & Mitigation options
- Review Draft Multi-criteria Framework (identifying tools; CCBA and MCA)

**Consultation Meetings: June-August 2017**
Agricultural Climate Change Strategic Plan (ACCSP) 2017-2021

**TDRI Team**

CC Action Plan Framework (Thematic/Flagship Projects)

CC Stocktaking and CC Action Plan (Thematic Projects):
Jun-Aug 2017

**KU Team**

Capacity building on MCA Development (The Workshop on 7 Jun. 2017)

MCA developing (Set of Criteria) During 2nd workshop in Aug 2017

**UNFCCC Financial and Technology Supports**

NAP Adaptation options in Agriculture

MoAC’s Priorities on Climate Change Actions

More Efficient budget allocations
Impact Chain Analysis in Context of Thailand’s Agriculture

Rising GHG concentration in the atmosphere

1st Hazards
- Temperature change
- Sea Level Rise
- Precipitation change
- Changing temperature & extreme heat
- Stronger storm
- Changing rainfall & extreme precipitation
- Extreme/too high temperature
- Landslide soil erosion
- Drought

2nd Hazards
- Out of pest and disease
- Soil infertility
- Salt water intrusion
- Flood

Exposure
- Fishery/aquaculture
- crops
- livestock

Risk
- Higher water temperature cause stress & weaken aquaculture
- Too High temperature can reduce growth & yield
- - High temperature can cause heat stress in livestock
- - Emerging diseases in animals
- Insufficient water in river/take/pond can reduce habitat
- Inhibit growth/ delay in germination/reduce yield
- Shortage of animal feeds and water animals

Impact income & quality of life & livelihood of farmers

Mission
- Increase productivity
- Increase GDP in agriculture
- Reduce production cost
- Improve farmers quality of life
- Higher cost of production and management

Source: TDRI
Linkage Analysis of ASPCC 2017-21 and All Line-department Strategic Plans

Source: TDRI
“Increase resilience in the agricultural sector towards drought”

**Strategy 2 of ASPCC 2017-2021 (Adaptation for Enhancing CC Resilience)**

### Thematic Project

**Livestock**

**Upstream**
- Research
  - โครงการติดตามและบันทึกพฤติกรรมการเลี้ยงสัตว์เพื่อเพิ่มข้อมูลการเปลี่ยนแปลงสภาพภูมิอากาศ (ก.ปศุสัตว์)

**Midstream**
- Information
  - ฐานข้อมูลเสบียงอาหารและแร่ธาตุเวชภัณฑ์
- Technology
  - พัฒนาระบบเทคโนโลยีสารสนเทศเพื่อการจัดการภัยแล้งด้านปศุสัตว์
  - ประชาสัมพันธ์แจ้งเตือนภัยแล้ง

**Downstream**
- Physical Infrastructure
  - ป้องกัน (ก.พัฒนาที่ดิน)
  - แหล่งน้ำชุมชน (ก.วิชาการเกษตร)
- Warning/Observing
  - โครงการพัฒนาสุขภาพสัตว์เพื่อป้องกันโรคภัยแล้งด้านปศุสัตว์ (ก.ปศุสัตว์)
- Capacity Building
  - ระบบสารสนเทศเพื่อป้องกันภัยแล้งด้านปศุสัตว์ (ก.ปศุสัตว์)
- Management/Planning
  - ระบบสารสนเทศเพื่อป้องกันภัยแล้งด้านปศุสัตว์ (ก.ปศุสัตว์)
- Finance
  - การจัดหาแหล่งเงินทุนเพื่อสนับสนุนการปรับตัวให้กับเกษตรกรเลี้ยงสัตว์ เช่น กองทุนสนับสนุนการพันธุ์สัตว์ พันธุ์พืช 𝚌 Haskell เป็นต้น
Thematic Project 1 (CONTINUED)

"Increase resilience in the agricultural sector towards drought"

Upstream

Crop

Midstream

Downstream

Research

Information

Technology

Physical Infrastructure

Warning/Observing

Capacity Building

Management/Planning

Finance

- Crop

- Strategy 2 of ASPCC 2017-2021
  (Adaptation for Enhancing CC Resilience)

- Upstream
  - Research
  - Information
  - Technology
  - Physical Infrastructure

- Midstream
  - Crop

- Downstream
  - Capacity Building
  - Management/Planning
  - Finance

- Gap 2.1
- Gap 2.2
- Gap 2.3
- Gap 2.4
"Increase resilience in the agricultural sector towards drought"

**Strategy 2 of ASPCC 2017-2021**
(Adaptation for Enhancing CC Resilience)

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**Thematic Project 1 (CONTINUED)**

**Fishery**

**Upstream**

- Research
- Information
- Technology

**Midstream**

- Physical Infrastructure
- Warning/Observing

**Downstream**

- Capacity Building
- Practice/Behavior
- Finance

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**Gap 3.1**

- Selection and research of tolerant fish species

**Gap 3.2**

- Database for managing drought risks

**Gap 3.3**

- Warning system for water management

**Gap 3.4**

- Capacity building

**Gap 3.5**

- Practice/behavior

**Gap 3.6**

- Finance

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**Gap 3.7**

- Promotion of new fish breeds to farmers
IV. Monitoring and Evaluation tools: Future works
Monitoring and Evaluation Framework

CC Policy Impact Evaluation

- Adaptation projects at farmer level: Community-based adaptation (CBA) approach (i.e., New Theory Agriculture (NTA) extension projects): NAP-Ag project.
- Adaptation projects at institutional level (i.e., projects strengthening CC management capacity)

CC Policy Monitoring

- Monitoring tools for CC mainstreaming into agri. Policies
  - CC budget monitoring
  - CC project stocktaking (NAP-Ag)
- CC Adaptation (sectoral) indicators (linking to key CCA policy indicators in ASPCC 2017-2021) (NAP-Ag in next year)
Adaptation projects at farmer level:
Conceptual Framework

• Selected CC Adaptation projects/Policy: New Theory Agriculture (NTA) extension programme
• Linkage to ASPCC 2017-2021: Sustainable Agriculture extension (in Strategy 2)
• Main activity: Shifting agricultural practice to NTA by supporting agricultural input and in-farm landscape adjustment (i.e., small ponds)
• Policy Impact Evaluation method: Randomized controlled trial
It requires **area & resource analysis** to determine production direction and farming activities.

The division is **indicative** rather than prescriptive.
Mr Patphong Mongkholkachanakhun

- 39 rai (6.24 ha) in Sisawath District, Kanchanaburi
- Extremely high production cost and severe soil infertility
  =>
- Adoption of Sufficiency Economy & the New Theory Agriculture in 2006

“Because I could no longer feed my family, I decided to change my farming system from the monoculture to the New Theory”- Mr Patphong Mongkholkachanakhun
Mr. Patphong adjusted the land division ratio slightly to maximize farm production.
Mr Patphong’s practice

- Integration between crops, livestock, fish and biogas.
- Soil improvement techniques through the use of green manure, green mulching and organic matter
- Crop rotation
- Mowing instead of weedicide
- Using cover crops for weed reduction
- Water saving method using nozzle spray sprinkler irrigation system
- Bio-liquid fertilizer
- Biogas from animals for household use.
The New Theory Agriculture practiced by Mr Patphong

Multi-cropping systems
- Rice, bamboo, organic pineapple, banana, papaya, mango, guava, dragon fruit, vegetables and forest trees

Livestock production
- Cows, pigs and poultry (chicken, ducks and Thai native chicken)

Biogas production
- Waste from livestock (animal manure)
- 10 kilograms of gas per month

Fish culture
- Tilapia, silver barb and giant gourami
- Feed: Left-over organic fruits & effluent from biogas production.
- The ponds hold sufficient water, and is used to irrigate the crops all year round.
Integrated farming approach based on the New Theory Agriculture at Mr Patphong’s farm
Implication for food & economic security

- Net farm income per ha (US$ 4,184) is about three times higher than monoculture practice (US$ 1,500).

- **Increased yields and income**
  - US$ 19,773 in 2011
  - US$ 20,640 in 2012
  - US$ 35,700 in 2013 and
  - US$ 47,217 in 2014 (with a total net income US$26,113).

Implications for ecosystem enhancement

- Conserve water
- Improve soil condition
- Save energy
- Lower greenhouse gases emission
Main Conclusions from Mr Patphong’s case study

- The farming practice of Mr Patphong demonstrates a clear **pathway** towards **climate-smart agriculture** which is in line with **the New Theory agriculture**:  
  - improving soil conditions  
  - reducing greenhouse gas emissions  
  - providing better crop yields and better financial returns  
  - promoting **environmental sustainability**.
Adaptation projects at farmer level:

Conceptual Framework

Randomized Controlled Trial

- Baseline Survey
- Random allocation to control and treatment
- Control
- Treatment
- Extension Services
- Extension officers provide service ONLY to farmers RANDOMLY ALLOCATED to treatment arm
- Endline Survey
Thank you !!!