ST1 Research Plan

I. Title of Research

Development of knowledge base for climate change (CC)

II. Organizations

- Thai side

Representative	Affiliated Organization
Nontawat JUNJAREON	Kasetsart University (KU)
Chaiporn JAIKAEO	Kasetsart University (KU)
Jitti NIRAMITRANON	Kasetsart University (KU)
Anan PHONPHOEM	Kasetsart University (KU)
Aphirak JANSANG	Kasetsart University (KU)
Suraphan INKEAW	Royal Irrigation Department (RID)
Sombhop WONGWILAI (To be confirmed)	Thai Meteorological Department (TMD)

- Japanese side

Representatives	Affiliated Organization
Eiji IKOMA	University of Tokyo
Masashi KIGUCHI	University of Tokyo
Naota HANASAKI	National Institute of Environmental Studies
Hiroaki SHIRAKAWA	Nagoya University

III. Research Sites

Research sites for this group are based on the group's outputs as follow

- Computer system for research support
  - Climate change data center at Kasetsart University
- Survey of projects related to adaptation to climate change in Thailand
  - Various agencies and institutes in Thailand with climate-related departments
- Mobile sensing units and telemetry system
  - Hydrology irrigation center for central region in the province of Chainat
  - Flux observation site at a rainfed paddy field in Ratchaburi

IV. Societal Needs for the Research

- Information to be published on the ADAP-T website will increase society awareness towards the climate change
- Up-to-date and easy-to-access observation data will make more accurate prediction on climate change and how it is going to impact the societies, resulting in more appropriate adaptation policies being made

V. Challenges to the Research

- How to collect and validate data from various sources and organisations
- How to provide climate-related data to other sub-teams with flexible and user-friendly interface
- How to collect observation data in real-time or quasi-real-time from physical locations where traditional telemetry systems are not sufficient, such as locations out of reach of cellular coverage or too high above ground
- How to manipulate the research output data to meet the needs of various stakeholders, such as research sub-teams, public users, government organisations, research institutes

VI. Expected Results

Output 1	The data processing system able to support all sub-teams' requirements
Output 2	A database of existing climate change projects across Thailand, including comparison matrix on each project's main focuses
Output 3	A portal website or a web service to provide near-real-time daily and hourly data from RID and TMD to other sub-teams. The following observation data will be provided: ● Runoff data ● Minimum and maximum temperature ● Wind speed and direction ● Precipitation ● Atmospheric pressure ● Humidity
Output 4	Working prototypes of ● Unmanned mobile units for collecting observation data ● Semi-automatic observation data collection system via smartphone
Output 5	A website of ADAP-T project ● Project Members ● Research Aims ● Research expected output ● Yearly updated progress status ● News updated

VII. Major Activities

Output 1	1. Maintaining IMPAC-T Data center 2. Survey for required data of all groups 3. Adjusting the capacity of the servers to meet the needs of each research group 4. Developing a new user interface 5. Training and workshop
Output 2	1. Survey needs and collect data 2. Design the system and UI 3. Building a software 4. Testing the software and evaluate 5. Training
Output 3	1. Survey needs and collect data 2. Designing the system and UI 3. Building a software 4. Software testing and evaluation 5. Modification and improvement 6. Training
Output 4	1. Survey existing technology and application 2. Design the mobile sensing units 3. Building a prototype 4. Installation on testing sites 5. Testing and evaluation 6. Training
Output 5	1. Survey needs and data collection 2. Design the system and UI 3. Building a website 4. Test the software and installation 5. Updating information and maintenance 6. Training

VIII. Research Schedule

	JPY2016				JPY2017				JPY2018				JPY2019				JPY2020			
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Output 1																				
1. Maintaining IMPAC-T Data center																				
2. Survey for required data of all groups																				
3. Adjusting the capacity of the servers to meet the needs of each sub-team																				
4. Developing a new user interface																				
5. Trainings and workshops			x			x				x								x		
Output 2																				
1. Survey needs and collect data																				
2. Design the system and UI																				
3. Building a software																				
4. Testing the software and evaluate																				
5. Training															x					
Output 3																				
1. Survey needs and collect data																				
2. Designing the system and UI																				
3. Building a software																				
4. Software testing and evaluation																				
5. Modification and improvement																				
6. Training															x					
Output 4																				
1. Survey existing technology and application																				
2. Design the mobile sensing units																				
3. Building a prototype																				
4. Installation on testing sites																				
5. Testing and evaluation																				
6. Training																		x		
Output 5																				
1. Survey needs and data collection																				
2. Design the system and UI																				
3. Building a website																				
4. Test the software and installation																				
5. Updating information and maintenance																				
6. Training										x										

IX. Resource Input

- Requirements and results from other sub-teams
- Observation data from RID and TMD
- Data from websites in relation to climate change topics
- Existing data from IMPAC-T

Research Plan for Seasonal Forecast (ST1)
Empirical/Statistical Model and Statistical Downscaling

General Description:
Conduct applied research to develop a statistical model for operational seasonal prediction, conduct model assessment and verification studies to improve decision support products for local and regional climate related disasters primarily, water resources and agricultural guidelines.

Research Plan:

- Formulations and construction of a statistical model using selected statistical and mathematical techniques.

- Program and develop the model's core calculations to a forecasting system.

- Model experiments and inter-comparisons with other models, mainly on statistical model.

- Conduct the Multi-Model Ensemble on the statistical model. The predictors from the CAOMS and other model simulations such as JMA, CFSv2, NASA, GFDL, NCAR, and CMCs are fed into the statistical model to estimate the corresponding local and regional climate characteristics.

- Improve the model skill corresponding to local and regional climate. Local and regional climate information is derived by first determining a statistical model which relates large-scale climate variables (predictors) to regional and local variables (predictands).

- Contribute to inter-comparison study for the validation of several product output from dynamical model; CAOMS, JMA, CFSv2, NASA, GFDL, NCAR, and CMCs.

- Assess the performance of the statistical model by feeding of other dynamical models as mention above to document the strengths and weaknesses of each forecasting system corresponding to statistical model and provide feedback to the modeling community.

- Conduct probabilities forecasts verification and bias corrections for operation and conduct applied research to Statistical Downscaling.

- Conduct diagnostic research on climate variability using the NCEP and ECMWF reanalyses, the CFS and others to document the mechanisms associated with features such as onset of the rains, dry/wet spell frequency, and extreme events such as floods.

- As needed contribute to the operations of Thai Meteorological Department (TMD), National Centers for Environmental Prediction (NCEP), and ADAP-T project including the preparation of local and regional climate risk assessments.

Activities	FY1				FY2				FY3				FY4				FY5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
i. Empirical/Statistical Model (SM)																				
a. Formulations and construction of a statistical model																				
b. Program and develop the model's core calculation																				
c. Model experiments and inter-comparisons																				
d. Model evaluation and verification																				
e. Improve the model skill corresponding to local and regional climate																				
ii. Multi-Model Ensemble on Statistical Model																				
a. Conduct the Multi-Model Ensemble on the SM																				
b. Estimate the corresponding local and regional climate																				
c. Assess the performance of the statistical model																				
d. Probabilities forecasts verification and bias corrections																				
iii. Statistical Downscaling																				
a. Program and develop the model's core calculation																				
b. Model experiments and inter-comparisons																				
c. Statistical Downscaling's evaluation and verification																				
iv. Statistical Model's Evaluation and Verification																				
a. Pentad/Decadal//Monthly																				
b. Seasonal																				
v. Statistical Model's Dissemination results																				
a. Pentad/Decadal//Monthly																				
b. Seasonal																				
vi. Application Statistical Model's result Workshop for various sectors																				
a. Water policy and management, Agriculture and Insurance, Urban/Rural																				

Attachment

CONTENTS TO BE INCLUDED IN THE RESEARCH PLAN

I. Title of Research (Group category*1)
ST1-Future Scenario -hydro-meteorology-
Development of future scenario in hydro-meteorology

II. Organizations
  i. Thai and Japanese representatives, affiliated organization
    Ms. Yuwadee Suwanmanee, Thai Meteorological Department
    (researchers in University, TBD)
    Dr. Masashi Kiguchi, Institute of Industrial Science, the University of Tokyo
    Dr. Shinjiro Kanae, Tokyo Institute of Technology
  ii. Related organizations and type of their participation*2
    a. Collaborating organizations
      Thai Meteorological Department
    b. Organizations providing data for the research
      Thai Meteorological Department
      Royal Irrigation Department
    c. Organizations utilizing results of the research and their institutional role in Thailand
      Thai Meteorological Department
      Royal Irrigation Department
      and each research activities in ST2

III. Research sites*3
Whole Thailand

IV. Societal Needs for the Research
  i. Issues and phenomena adversely affecting the society in relation with the research
    To illustrate future world in hydro-meteorology
  ii. Governmental policy and measures in relation with the research
    To indicate future condition for assessment of counter measures
  iii. Needs for the Research to solve i) and/or realize ii)
    (TBD)

V. Challenges to the Research
  i. Availability of related research and project, its status as well as its relation to the planned research
    (TBD)
  ii. Expected challenges to derive results from the research
    (TBD)

VI. Expected Results
  i. Expected Research Results and contributions to the Project
    To prepare "ADAP-T forcing data (AFD)" and "ADAP-T driving data (ADD)".
    Spatial Resolution is 5 min (~=20km).

REMARKS

*1: describe a category to which the research belongs as listed below

List of category:
- ST1...research under ST1
- ST2-W...research under ST2 water
- ST2-F...ST2 forest
- ST2-R...ST2 fural
- ST2-U...ST2 urban
- ST2-C...ST2 coast
- ST2-S...ST2 sedimentation
- ST3...research under ST3

*2: describe assumed participation of organizations such as providing information, comments and feedback to the Research, participating in workshops, being a member of co-design process, etc.

*3: describe research sites

*4: describe a period of total research and each major activity as "Research Team's Plan of Operation"

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application

To utilize for impact assessment of climate change in Thailand.

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups

Using AFD and ADD, climate change effects (change of precipitation for projection of river discharge) in each sector could be estimated.

VIII. Research schedule[*4]

FY2016

To gather hydro-meteorological information to update "IMPAC-T forcing data (IFD)" (Watanabe et al., 2013)

To provide IFD and IDD (IMPAC-T driving data) among ADAP-T committee.

FY2017

To make "ADAP-T forcing data (AFD)" using available GCMs under RCP 4.5 and 8.5.

FY2018~

To make "ADAP-T driving data (ADD)" using H08 and SiBUC

To investigate the extreme rain events, statistic change, etc.

IX. Resource Input

i. Input by the Thai side

Calculation resources of Climate Change Data Center, Kasetsart University

Hydro-meteorological information

ii. Input by the Japanese side (Dispatch Japanese researchers, Receiving Thai counterparts to Japan, Procurement of equipment, Other cost to cover activities in Thailand)

Dispatch Japanese researchers

Technical training in Japan

Attachment

CONTENTS TO BE INCLUDED IN THE RESEARCH PLAN

I. Title of Research (Group category*1)
Social future scenario (ST-1)

II. Organizations
i. Thai and Japanese representatives, affiliated organization
Prof. Yongut Trisurat(Kasetsart University)
Dr.Weerakaset Suanpaga (Kasetsart University)
Dr. Hiroaki Shirakawa (Nagoya University)

ii. Related organizations and type of their participation*2
a. Collaborating organizations
University of Tokyo

b. Organizations providing data for the research
ONEP,DWR,and RID

c. Organizations utilizing results of the research and their institutional role in Thailand
Land use is the essential factor for policy making. This group will provide the information how land use pattern will change under the different economic development scenario.

III. Research sites*3
Whole Thailand

IV. Societal Needs for the Research
i. Issues and phenomena adversely affecting the society in relation with the research
Rapid deforestation has occurred in northern Thailand over the few decades and it is expected to continue. On the other hand, urban area has expanded. It is afraid that rapid urban growth cause various problems, such as water shortage.

ii. Governmental policy and measures in relation with the research
The government has implemented conservation policies aimed at maintaining forest. On the other hand, the government has been promoting agribusiness, forestry and so on. However, it is not clear that natural and social impacts by land use change.

iii. Needs for the Research to solve i) and/or realize ii)

REMARKS

*1: describe a category to which the research belongs as listed below

List of category:
- ST1...research under ST1
- ST2-W...research under ST2 water
- ST2-F...ST2 forest
- ST2-R...ST2 fural
- ST2-U...ST2 urban
- ST2-C...ST2 coast
- ST2-S...ST2 sedimentation
- ST3...research under ST3

*2: describe assumed participation of organizations such as providing information, comments and feedback to the Research, participating in workshops, being a member of co-design process, etc.

*3: describe research sites

*4: describe a period of total research and each major activity as "Research Team's Plan of Operation"

To reduce natural and social impacts by land use change, prediction of future land use is important.

V. Challenges to the Research

i. Availability of related research and project, its status as well as its relation to the planned research

Many study conduct prediction for future land use pattern. However, they focused on the relatively small area. There are very few study try to predict it in the country level.

ii. Expected challenges to derive results from the research

This study is going to predict future land use pattern by using stochastic land use model. The advantage of this approach is that the model can estimate potential development. On the other hand, it is challenge that in order to improve accuracy, social data such as population, income, convert to grid data.

VI. Expected Results

i. Expected Research Results and contributions to the Project

This study will predict future land use pattern in Thailand based on the different economic scenario, such as economic growth, population density, government regulation and so on.

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application

This study will contribute for adaptation policies such as agriculture, forestry, urban planning etc.

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups

(1) Development of stochastic land use model

(2) Exchange/sharing of findings among other Sub-Team

VIII. Research schedule*4

(Appendix)

IX. Resource Input

i. Input by the Thai side

ii. Input by the Japanese side (Dispatch Japanese researchers, Receiving Thai counterparts to Japan, Procurement of equipment, Other cost to cover activities in Thailand)

dispatch Japanese researchers,
receiving Thai counterparts to Japan,
study meeting in Japan,
Statistics, GIS data
Publication of papers
PC

November 13, 2015

RESEARCH PLAN

I. Title of Research (Group category*1)

ST1-Ground Water Group:
Shallow Groundwater Management for Agriculture Water Supply
at the Central of Chao Phraya Basin.

II. Organizations

i. Thai and Japanese representatives, affiliated organization

Thai: Dr. Desell Suanburi (KU), Dr. Weerakaset Suanpaga (KU), Dr. Naruekamon Janjirawuttikul (LDD)

Japanese: Koshi YOSHIDA (Ibaraki U.)

ii. Related organizations and type of their participation*2

a. Collaborating organizations

Kasetsart University (KU), Land Development Department (LDD) and Ibaraki University.

b. Organizations providing data for the research

Kasetsart University (KU), Land Development Department (LDD) and Ibaraki University.

c. Organizations utilizing results of the research and their institutional role in Thailand

LDD: validate and implement the research findings in Thailand

III. Research sites*3

Central Plain of Chao Praya River, Thailand

IV. Societal Needs for the Research

i. Issues and phenomena adversely affecting the society in relation with the research

Sedimentation at widely part in vicinity along both side of Chao Phraya river at the central of Chao Phraya basin is generally found as thick clay layer. Narrow of sand or gravel channels partly occur somewhere underlay at crop or paddy land use zone. Shallow sand or gravel deposit layers function as high yield of water supply which can be taken for agricultural activities. When a shorten crisis of surface water supply could not support agricultural propose, a significant alternative resources of water supply must be these shallow groundwater layers. At the situation of normal water supply decrease, a proper water supply approach for farmer should be effectively managed by themselves, as a result of matching of shallow groundwater location to agricultural land use zone. In addition, Climate Change leads to less rainfall, less recharge into underground but more amount of groundwater taken for human use which may lost in groundwater balance.

ii. Governmental policy and measures in relation with the research

Department of Water Resources (DWR) has a responsibility to monitor a groundwater level and to control a ground water use in whole country. LDD provides a soil property maps which is necessary to evaluate a relation between groundwater resources and meteo-hydro condition.

iii. Needs for the Research to solve i) and/or realize ii)

1. To determine the potential of shallow ground water resources and the existing of shallow groundwater zone relate to the area of agriculture land use.
2. Assess water supply management for appropriate crop or paddy area.

V. Challenges to the Research

i. Availability of related research and project, its status as well as its relation to the planned research

Kasetsart University study team already have experiences to study about sediments and limestone zone classification by using 2D resistivity imaging technique at Chong Sarika Area, Pattana Nikom District, Lopburi Province

ii. Expected challenges to derive results from the research

1. Critical groundwater level observation may apply for the prediction of critical ground water use which may help to future manage water supply for appropriate planting.
2. Known shallow groundwater characteristic may help to design proper shallow well at particular local area.

VI. Expected Results

i. Expected Research Results and contributions to the Project

1. Map of shallow groundwater zones may help for effective alternative water supply resources (with a suitable location) for agriculture activity.
2. Effective management e.g. to understand the variation of groundwater level may related to amount of groundwater taken for water supply in agricultural use.

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application

Implementation of appropriate groundwater utilization for agricultural water supply will be undertaken through the LDD's agencies.

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups

(Major activities through research period):

Please see attachments

(Exchange of intermediate findings with other Sub-Teams):

This will be undertaken through meeting, seminar, conferences and etc organized by the ADAP-T project.

VIII. Research schedule*4

(Please see attachments)

IX. Resource Input

i. Input by the Thai side

- Thai researchers : Dr. Desell Suanburi (KU),
  Dr. Weerakaset Suanpaga (KU),
  Dr. Naruekamon Janjirawuttikul (LDD)
- Existing Geo-mapping data and GIS data of the study area, 2D resistivity imaging technique

Request Input

1. Field monitoring systems (i.e. weather station, soil moisture sensor, ground water sensor, etc.)
2. Land rent
3. Cost of soil, plant and water analysis
4. Allowance for research assistant
5. Climatic data (1985 – 2015)
6. Multi-Frequency EM Conductivity Meter

ii. Input by the Japanese side

- Japanese researchers :Koshi YOSHIDA (Ibaraki Univ.)
  Existing Rainfall-Runoff model, Crop Growth model.

Equipment Input

1. Field router systems with Web-camera
2. Decagon data logger and meteo-hydro sensors
3. Water level sensor for GW monitoring
4. Consumable thing for soil and water analysis
5. Multi-Frequency EM Conductivity Meter

ATTACHMENT #1

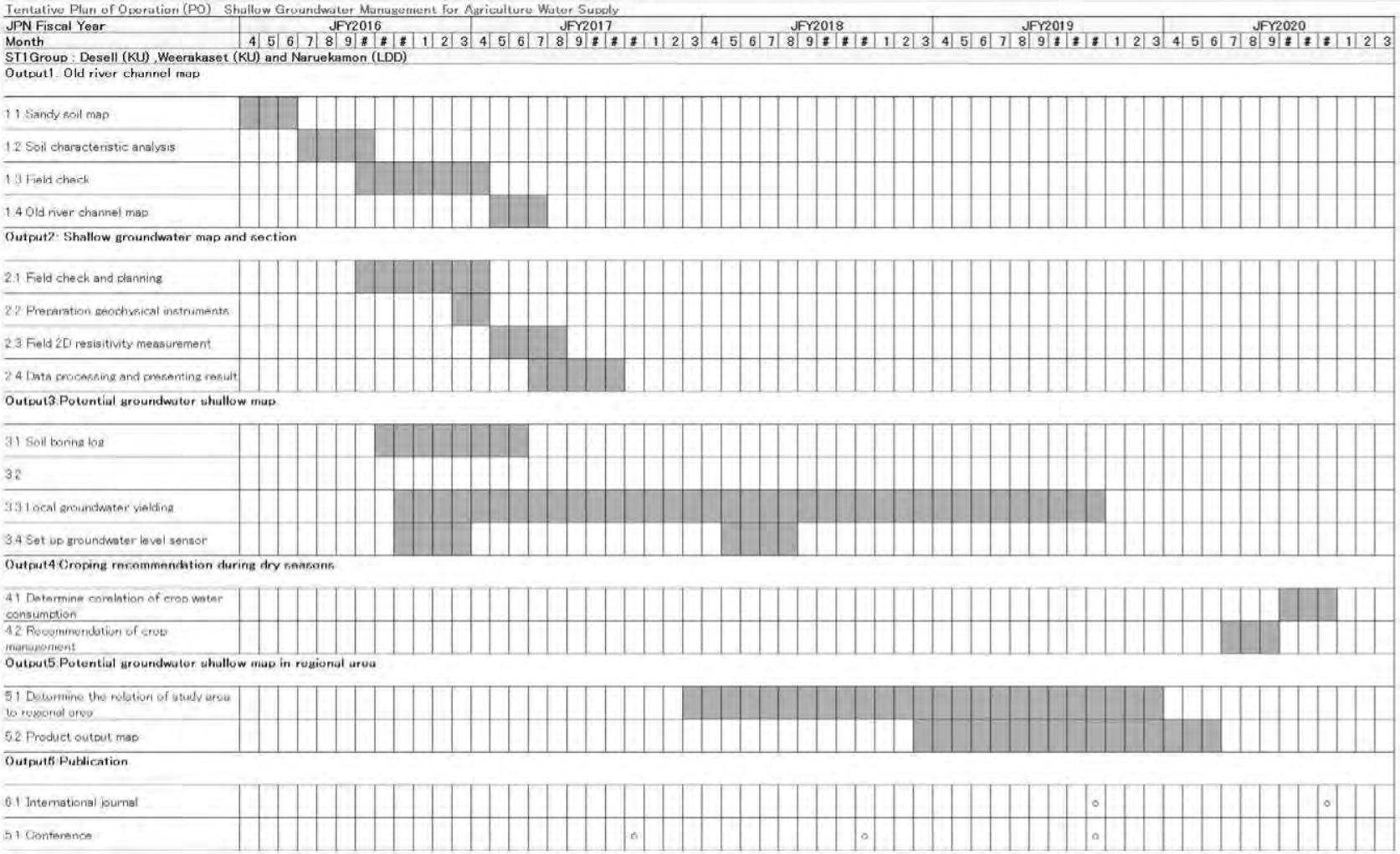
Adaptations' Research schedule 2016-2020

Activities	Output	2016	2017	2018	2019	2020
1. Soil characteristics analysis and estimation of old river channel line	Old river channel map					
2. (1)Field observation by using 2D resistivity measurement and ground water level monitoring (2) Estimation of Local ground water yielding and Potential grand water use under current condition	Shallow ground water map under current condition					
3. (1)Determine correlation of crop water consumption and Recommendation of crop management (2) Crop yield estimation and Product output map	Cropping recommendation during dry seasons					
4. (1)Impact assessment of CC on ground water availability (2) Proposal of adaptation ways for sustainable ground water use	Available groundwater map under CC condition					

Social implication ? → Shallow GW maps for sustainable use → LDD

ATTACHMENT #2

Tentative Plan of Operation (PO) Shallow Groundwater Management for Agriculture Water Supply



Research Plan

I. Title of Research : Precipitation prediction with QPE/QPF technique (Group 5 ST1)

II. Organization : Thai Meteorological Department

III. Research sites : Thailand

IV. Societal Needs for the Research

Thailand is one of the regions around the world that is frequently affected by heavy precipitation. Rainstorms may bring various hazards including flood, inundation, and landslide. These extreme disasters events have caused loss and damage to the economy by affecting agriculture, industry and community areas. To prevent and mitigate damage from such disasters, the distribution of rainfall amounts and accurate precipitation forecasting is very important to society. Because of the present, precipitation has adversely affect people's daily activities, their property, and even their lives.

The topography of Thailand is rugged and mountainous the availability of ground measuring stations is limited and unevenly distributed, making assessment of water resources and flood forecasting difficult. Then accurate quantitative precipitation estimation (QPE) and quantitative precipitation forecasting (QPF) by development of QPE/QPF products using radar data, satellite data, rain gauge data and numerical weather prediction (NWP) output is more importance for water resources assessment and flood prediction.

V. Challenges to the Research

Quantitative precipitation estimation (QPE) and quantitative precipitation forecasting (QPF) is one of the most important and significant challenge of weather forecasting. It has been challenging generate spatial distribution of precipitation and amount of precipitation will fall over a given area in a given period of time. Aiming to the challenges, meteorologists and hydrologists have made great efforts jointly and achieved evident progresses on improving QPE/QPF products to get closer to the hydrological requirements and can be used more widely in hydrology and disaster reduction in practice such as integrate QPE/QPF into real-time operational flood forecasting and disaster monitoring and warning.

The outcome of research will strongly affects daily decisions in governmental and business activity.

VI. Expected Results

High resolution precipitation products support to hydrological forecasting, disaster risk reduction, water resource management and decision-maker.

The amount of rainfall under Climate Change (CMC) such as extreme precipitation.

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research group

Disseminating result in NetCDF format and images via TMD website (www.tmd.go.th) and social network.

Support the output to customer and stakeholders, other research group, and university such as Khon Kean University etc

VIII. Research schedule :

1) QPE research schedule (5 years (2016-2020))

Year 2016 – Year 2017

1.1 Meteorological Radar (METRADAR-QPE)

• Literature Reviews/Discussions among Thai and Japanese researchers	FY1 (M 1 - 3)
• Radar site surveys and appropriate setting parameter for each radar site	FY1 (M 1-12)
• Data Collection	FY1 (M 1-6)
• Simple Statistical Quality Control (QC)	FY1 (M 1-6)
• Generating and archiving nationwide composites of radars base reflectivity every 15 minutes with lowest level intensity techniques (EIL) at 2 kilometers disseminating result in NetCDF format and images via TMD website (www.tmd.go.th), social network and other research group	FY1 (M 7) – FY2 (M3)
• Estimation of Quantitative Precipitation with First Calibration Factor and First Validation and Verification	FY1 (M 10) - FY2(M3)
• Estimation of Second Calibration Factor Quantitative Precipitation and Second Validation and Verification	FY2 (M 1-12)
• Training course on radar data/Himawari-8 data calibration techniques for QPE and integrated METRADAR-QPE and METSAT-QPE PE by the expertise from Japan	FY2

1.2 Meteorological Satellite (METSAT-QPE)

• Literature Reviews/Discussions among Thai and Japanese researchers	FY1 (M 1- 3)
• Next-Generation Data Collection	FY1 (M 1) - FY2 (M 12)
• Quality Control (QC)	FY1 (M 1-6)
• Training course on Himawari-8 in Meteorological Satellite Center (MSC) of JMA (2 persons)	FY1
• Cloud Classification and Cloud Climatological analysis	FY1 (M 7-12)
• Estimation of Quantitative Precipitation and Validation and Verification	FY2 (M 1-12)

Year 2018 – Year 2020

Multi source QPE

• Integrated METRADAR-QPE and METSAT-QPE	FY3 (M 1) - FY4 (M 12)
• Calibration and Verification	FY3 (M 1) - FY4 (M 12)
• High resolution precipitation product	FY4 (M 1) - FY5 (M 12)
• Case study for extreme precipitation events	FY4 (M 1) - FY5 (M 12)
• Disseminating hourly high resolution precipitation map via TMD website (www.tmd.go.th), social network and other research group	FY5
• Workshop/seminar (get feedback from users)	FY3 /FY4 / FY5
• Research to operation	FY5

2) QPF research schedule (5 years (2016-2020))

2.1 Spatial and Temporal High Resolution Meso-Scale Model (Year 2016 – Year 2017)

• Discussions and planning on research activities among Thai and Japanese researchers.	FY1(M 1- 2)
• Install, set up and run WRF model simulation short range forecast on TMD server, focusing on severe weather, heavy rainfall and precipitation prediction in Northeastern of Thailand	FY1(M 1- 3)
• Model configuration Configuration and selection the suitable physics schemes such as microphysics, cumulus parameterization, shortwave, longwave radiation, land surface, Urban surface, planetary boundary layer and run test case for Northeastern of Thailand, especially in Khon Kaen province.	FY1(M 1-12)
• Model performance Extreme even Server Thunderstorm	FY2 (M 1-12)
• Validation and comparison for each physics and dynamics options	FY2 (M 6-12)

2.2 Data assimilation (Year 2017 – Year 2018)

• Training course on local data assimilation technique by the expertise from the Japan University or MRI, JMA	FY2
• Collect data from local meteorology observation; radar data; wind profiler for localization data assimilation	FY2 (M 1) - FY2 (M6)
• Velocity Doppler Data	FY2 (M 1) - FY3 (M 12)
• Next generation meteorological satellite Atmospheric Motion Vector	FY2 (M 1) - FY3 (M 12)

2.3 None Real-time simulation (Year 2019 – Year 2020)

• Prediction of Quantitative Precipitation	FY4 (M 1-12)
• Evaluation and Verification	FY4 (M 1-12)
• Provide the model products to the users and feedback	FY5 (M 1-12)

2.4 End user response Management (Year 2016 – Year 2020)

• Applications	FY1 (7 M) - FY5 (12M)
• Evaluation	FY3 (1M) - FY5 (12M)
• Follow up Award	FY5 (7-12M)
• Workshop/seminar	FY2 /FY4 / FY5

2.5 Research to operation (Year 2020)

IX. Resource Input

1) Input by the Thai side

- Collection local meteorological data in Khon Kean province
- Radar site surveys
- Workshop/seminar in Thailand such as
  - Seminar or training workshop on “Use and interpretation QPE/QPF products application, preparation, adaptation for Climate Change in Khon Kaen, Thailand”
  - Workshop/seminar (get feedback from users) etc

2) Input by the Japanese side (round trip flight ticket to Japan, accommodation, local transportation etc)

- Training course on regional data assimilation for improvement in QPF products in Japan (2 persons)
- Training course on Himawari-8 in Meteorological Satellite Center (MSC) of JMA (2 persons)
- Training course on radar data/Himawari-8 data calibration techniques for QPE and integrated METRADAR-QPE and METSAT-QPE PE by the expertise from Japan (2 persons)
- Award for customer and stakeholders
- Data storage
- Two computer notebook
- Part-time staff

I. **Sub-Team 2**: Assessment of adaptation measures to CC and development of co-design method

ST2- Forestry Sector

II. Organizations

i. Thai and Japanese representatives, affiliated organization

Thai representatives

1) Assist. Prof. Dr. Wanchai Arunpraparut – Project Leader*
2) Prof. Dr. Nipon Tangtham – Technical Advisor
3) Prof. Dr. Yongyut Trisurat – Member
4) Assoc. Prof. Dr. Naris Bhumpakphan – Member
5) Dr. Veenus Tuankrue – Member

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III. Related organizations and type of their participation

This research project will work with main departments which are involved in climate change adaption in connection with forest landscape restoration and biodiversity. These organizations include Royal Forest Department (RFD), Department of National Parks, Wildlife and Plant Conservation (DNP) and Office of Natural Resources and Environmental Policy and Planning (ONEP). Their roles in the project are tabulated as follows:

Organization	Institutional role	Expected data	Co-design process
RFD (Mr.Suthad Kongyeam)	Control, regulate and protect forest outside protected areas for sustainable uses; implement and promote afforestation;	reforestation area, national reserved forest map, forest cover map	Yes
DNP (Ms. Ratana Lukanawarak)	Conserve and preserve national parks, wildlife and plants; restore ecology; monitor forest biodiversity and rehabilitate degraded forest inside protected areas	protected area map, systematic plant inventory data, wildlife occurrence, watershed monitoring data (in any)	Yes
ONEP	Formulate and coordinate policies and plans for natural resources; environmental conservation and administrative management; conduct research; monitor	Watershed classification	No

	performance on implementation of policies and plans		

IV. Research sites

This research will include a test site at the Tha Dee sub-watershed in Nakhon Srithammrat Province and implementation sites (Upper Nan watershed in Nan province and Phu Khieo-Nam Nao forest complex). The Tha Dee sub-watershed covers approximately 112 km^2 and supply water for agriculture by upstream villages and for piped water in the Nakhon Srithammarat municipality. In recent years, the upstream watershed has been deteriorated by natural disturbance and expansion of rubber plantation and frequently causes fresh floods in downstream. Trisurat *et al.* (in press) conducted research on predicted effects of land use and climate change on water yield and sediment load.

Nan province in northern Thailand covers approximately 11,470 km^2 and is dominant with high topography. However, forest cover of the province has been gradually deteriorated due to poor enforcement, expansion of cash crop (maize) cultivation and para-rubber plantation. Agricultural land use is now driven by contract framing from big company.

Another research site is located in the Phu Khieo-Nam Nao forest complex in north-eastern Thailand. It comprises 10 protected areas with the total area of approximately 6,000 km^2. It covers a large tract of forested high plateau with valuable protection of 3 important watersheds and biodiversity in the region. A population of 200-500 elephants was estimated to range over the complex[i]. Other species include tiger, banteng, serow, leopard, etc. In addition, a lot of endangered and rare plant species were recorded in limestone ecosystem in the complex[1].

V. Societal Needs for the Research

The continuation of forest degradation in head watershed of Nan province causes consequent problems on increasing sediment load, and increasing vulnerability of natural disaster and extreme events (flash flood and landslide in rainy season and drought crisis in dry season) in the Nan and lower Chao Phraya basin. In addition, deforestation in the Phu Khieo-Nam Nao forest complex causes habitat fragmentation, habitat loss, escalated edge effects and consequently increased extinction rates. Large- and medium-sized mammals are generally the first species to disappear or shifts their distribution ranges. Besides deforestation, climate change is an emerging indirect driver to changes in watershed services (e.g., stream flows and sediment yields). In addition, changes in temperature and precipitation potentially cause shifts in species distributions and ecosystems. They also would limit the expansion of species into new sites or cause them to die out.

Thus, the Royal Thai Government in particular the Ministry of Natural Resources and Environment and Ministry of Agriculture and Cooperatives are very concerned on these issue and has identified these issue as a national agenda. The National Policies, Measures and Plan on Conservation and Sustainable Use of Biodiversity (2013-2017) and the National Master Plan on Climate Change Adaptation (2015-2040) were

[1] Tetsana *et al*. (2015). Important plants of limestone ecosystem in Phu Khieo-Nam Nao Forest Complex.

developed in recent to mitigate to guide adaption measures to plausible future. In addition, the DNP intends to establish biodiversity corridors to facilitate wildlife migration between fragmented habitats in the Phu Khieo-Nam Nao forest complex.

Given the uncertainty of future climatic conditions and extensive deforestation in the study areas, it is important to understand their potential effects on forest biodiversity and watershed services. However, there have been limited studies on the relative and synergistic effects of these drivers on species distributions and watershed services in the tropics, partly due to the fact that complete and systematic biodiversity survey data are available for only a few species.

VI. Challenges to the Research

It should be noted that many departments (e.g., RFD, DNP, LDD and ONEP) are working to promote sustainable agriculture, land use zoning and natural resources conservation in Nan province. In addition, some GIS layers at provincial levels (scale 1:50,000) have been developed and updated to support this important mission. In addition, the similar approach was conducted at the Tha Dee sub-watershed in Nakhon Srithammarat Province using InVEST (Integrated valuation of ecosystem services and trade-off) tool[ii], survey data and model default data. Therefore, it is essential to develop national and site specific data, especially vegetation coefficient retention of sediment and nutrient loads for accurate assessment to be further mainstreaming in Thailand. In addition, land use and climate change impact on species distributions and forest ecosystems was separately conducted in Thailand and in the tropics. However, the subsequent effects of species shifts in distribution on forest ecosystem composition change and plant community and finally on wildlife distributions have never done in the tropical Asia.

This research intents to assess the relative contributions of the individual drivers of land use change and climate change, and their combined effects under different scenarios. In addition, the optimun resource investment for landscape restoration in the watershed (afforestation, enforcement, altered agricultural practices) are expected. The research in Phu Khieo-Nam Nao forest complex expects to demonstrate state of the art science using scenarios and models identify risk areas of land use and climate change effects and suitable biodiversity corridors which will be the first pilot research for Thailand.

VII. Expected Results

The research goal is to strengthen forest landscape management and restoration for watershed services and biodiversity conservation to response to future land use and climate change. Expected outputs of the research are as follows:

Output 1: Predicted land-use change maps based on different demand scenarios

Output 2: Quantified watershed services and functions (e.g., water yield, sediment and nutrient retention) and maps under climate change scenarios

Output 3: Priority areas for landscape restoration in accordance to payment for ecosystem services (PES) and optimum investment

Output 4: Adaptation approach of people in watershed (e.g., agricultural practices, crop varieties,, growing season, settlement location)

Output 5: Maps of predicted shifts in plant and wildlife distributions and their vulnerability

Output 6: Proposed extension or new protected areas and biodiversity corridors to response climate and land-use change

To proactively strengthen decision-making in which society anticipates and minimizes adverse impacts, the idea of a water fund for watershed conservation or PES is expected. The PES will be contributed by government, NGOs and private companies to protect and rehabilitate degraded forests in upstream areas.

The entire research duration is 5 years from 2016 to 2020. Major activities are as below:

Output	Major activity	Y1	Y2	Y3	Y4	Y5
Output 1*	1.1) Gather and develop GIS environmental layers	/				
	1.2) Develop participatory land demand scenarios		/			
	1.3) Generate predicted land-use maps based on the designed scenarios		/			
Output 2**	2.1) Select representative of head-watershed (pilot watershed)	/	/			
	2.2) Hydro-meteorological instrumentations, gather actual water yield, sediment and nutrient load and coefficient values	/	/			
	2.3) Calculate, calibrate and verify water yield, sediment and nutrient retention			/		
Output 3*	3.1) Work with local stakeholders and responsible agencies to develop mechanisms for PES				/	
	3.2) Estimate the amount of PES for possible mitigation and/or response activities				/	
	3.3) Allocate the estimated PES budget for forest landscape restoration and necessary measures in high priority areas					/
	3.4) Work with co-design institutions to monitor and evaluate the implementation					/
Output 4***	4.1) Gather and collect plant and wildlife occurrence data	/	/			
	4.2) Generate present and future distribution maps of selected plant, wildlife species, and plant communities			/		
	4.3) Assess vulnerability of plant, wildlife species and ecosystems				/	
Output 5***	5.1) Work with multi-stakeholders to determine potential conservation measures				/	
	5.2) Identify suitable area for implementation of the proposed activities					/
	5.3) Monitor and evaluate the implementation					/
Output 6*	6.1) Transfer knowledge and technology					/
	6.2) Develop adaptation measures of climate change					/
	6.3) Develop handbook(s) and guideline(s)					/

Note: * Both study sites

** Upper Nan watershed

*** Phu Khieo-Nam Nao forest complex

VIII. Resource Input

The estimated budget to be contributed by the Thai Government is US$ 370,000 (Baht 11,100,000) and the input by the Japanese side (JICA) is US$ 388,800 (Baht 11,664,000).

[i] Shoshani, J and Tassy, P. (1996). The Proboscidea: evolution and palaeoecology of elephants and their relatives. Oxford University Press.

[ii] Tallis et al. (2011). InVEST 2.1 beta user's guide: integrated valuation of ecosystem services and tradeoff. The Nature Conservancy (TNC), Stanford.

Research PLAN (for ST2-R sub group R1)

I. Title of Research: Enhancement in Production System Management of Major Economic Crops under Drought Crisis: Case Studies of Rice and Orchids

II. Organizations

i. Thai and Japanese representatives, affiliated organization

From Thailand

1) Project Director: President ,KU
2) Deputy Project Director, Assoc. Prof.Dr. Tanya Kiattiwat, Faculty of Engineering KU.
3) Project managers for sub-sector R2, Asst. Prof. Dr. Sudsaisin Kaewrueng, Faculty of Agriculture KU
4) Project co-researcher 1, sub-sector R2, Asst. Prof. Dr. Sutkhet Nakasatien, Faculty of Agriculture KU
5) Project co-researcher 2, sub-sector R2, Asst. Prof. Dr. Patchariya Boonkokaew, Faculty of Agriculture KU

From Japan (Co-leading of rural sector)

6) Koki Homma (Ph. D)
Graduate School of Agricultural Science, Tohoku University, 1-1 Tsutsumidori Amamiyamachi, Aoba, Sendai, 981-8555, JAPAN

Affiliated organization

7) Mr.Setapong Lekawatana, Acting Vegetable, Floriculture and Herb Promotion Expert, Department of Agricultural Extension, 2143/1 Phahonyothin Rd., Kwaeng Latyao, Chatuchak, Bangkok 10900, Thailand

ii. Related organizations and type of their participation

a. Collaborating organizations

The organization where supports the study for providing the field observation and trial is under the research station of Faculty of Agriculture which the researcher come from. Right now, Lopburi Research Station is planed to be used.

b. Organizations providing data for the research

To relate our study result from greenhouse testing of ambient for modeling with the observation field ambient, some data may receive from the ex-project , IMPAC-T, i.e. soil temperature. For macro climate data may receive from Meteorological Department.

c. Organizations utilizing results of the research and their institutional role in Thailand

Department of Agricultural Extension, DOAE, will be the co share department starting from having consultancy to the representative of the farm plot for playing role as farm field experiment. Then at the end this department still have role for promoting our results to the other farms.

III. Research sites

The greenhouse test is planed to set up at the central greenhouse under Faculty of Agriculture, located in Bang Khen campus. The field observation is set up in Khok Samrong District, Lopburi province, 120 km from Bangkok. These are two main places for conducting our research on paddy experiment. And also the farmer orchid farms in Samut Sakhon province, 130 km from Bangkok, will be selected for orchid studying.

IV. Societal Needs for the Research

i. Issues and phenomena adversely affecting the society in relation with the research

Rice and orchids are the two representatives of major economic crops that are usually affected by the crisis of drought that can directly and indirectly contribute to the economic lose. Thus, the cultural practice which encompass many methodologies such as land preparation, fertilization, pest control using chemicals, etc., is considered to be the methods that can be improves to alleviate the damage from drought.

ii. Governmental policy and measures in relation with the research

Refer to ONEP Strategy Plan, strategy 1 adaptation on impact of climate change (6 articles), in article 2 risk management of agriculture and food security (3 items with 17 options), option 7 "Development of interaction between agriculture and water management in adapting the crop water management with varied water quantity"

iii. Needs for the Research to solve i) and/or realize ii)

Rice yield was affected by less of soil moisture content, strengthening of root system might resist to drought. One of the method that will be use is by verifying the cultivar condition associate to strengthen root and healthy of paddy at any growth stage. The specific parameters relate to seed planting depth, tilling depth, will be observed with root and growth development and yield. The other methods that will be also used in this experiment is by applying chemical compounds that would promote the response mechanisms either adaptation or tolerance under unfavorable conditions. This is would sustainably be the management that can both alleviate the economic lose and, as well, the for the risk reduction for the farmers.

Orchid is also diminishing flower and yield whenever irrigate with impurity fresh water, saline water, which normal occur during drought and sea water intrusion period. The techniques to determine balancing saline water by adding fresh water and find out the optimum level of salty tolerant for orchid. In the same time various kinds of growing media of saving water use instead of normal practice will be tested.

V. Challenges to the Research

i. Availability of related research and project, its status as well as its relation to the planned research

Case Study for Rice:

Normally, the growth development in rice yield was affected by less of soil moisture content, therefore, strengthening of root system might resist to drought. One of the method that will be use is by verifying the cultivar condition associates to strengthen root and healthy of paddy at any growth stage. The specific parameters relate to seed planting depth, tilling depth, will be observed with root and growth development and yield. The other methods that will be also used in this experiment is by applying chemical compounds that would promote the response mechanisms either adaptation or tolerance under unfavorable conditions. This is would sustainably be the management that can both alleviate the economic lose and, as well, the for the risk reduction for the farmers.

Case Study for Orchid:

Orchid is also diminishing flower and yield whenever irrigate with impurity fresh water, saline water, which normal occur during drought and sea water intrusion period. The techniques to determine balancing saline water by adding fresh water and find out the optimum level of salty tolerant for orchid. In the same time various kinds of growing media of saving water use instead of normal practice will be tested.

ii. Expected challenges to derive results from the research

Case Study for rice:

The farmers practice in depositing seed depth, tilling depth may vary from farm to farm, and still be unknown for better condition for growth development versus circumstance of various stage of drought. This achievement could support water management for rice in future. The use of growth regulator in the group of neonicotinoid (Thiamethoxam: $C_8H_{10}ClN_5O_3S$) will be applied on rice seeds, comparing between the drought tolerance and susceptible varieties, before transplanting. This technique will improve the rice seedling vigor and root growth and development, especially during the seedling establishment period.

Case Study for Orchids: Techniques to be imposed such as the applications of anti-stress chemical compounds, plant growth regulators for retarding the growth and development, i.e., placobutazol, together with the modified usage of foamed sugarcane bagasse blocks and baked clay as growing media.

VI. Expected Results

i. Expected Research Results and contributions to the Project

For rice, the first one result from this study is the optimum planting seed depth, tillage depth condition will be the new indicator for rice cultivar. For orchid, the second result expected from the study yields the optimum of growing media with having property in saving water. The final one is the common result for rice and orchid adaptation, the achievement is paid by knowing of chemical compound type and its concentration rate suggested for the most safe adoption.

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application

In the study we are applying the observation to the real farmer farms, so after study, we are sure that the farmers will forward more and extend to other farms. By the escort with the officer from Department of Agricultural Extension, DOAE, which is an a part of researcher team here, the transfer of our results could be conducted to other regions of Thailand.

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research group

VIII. Research schedule

There are three main out puts are derived in plan operation PO including 3 out puts.

Output 1: The planting techniques covering the tillage and seedling transplanting methods to optimize and increase the adaptability levels under drought conditions achieved.

The activities are listed as follow;

1.1 To set up experiment materials to cope experiment treatments for studying paddy tolerant via cultivation practice, once at the beginning of project commencing.

1.2 To diagnose paddy field condition, i.e. land preparation, soil properties in rainfed paddy field. Field observation data will be transmitted to modeling the soil bin in greenhouse.

1.3 To establish the soil bin based on field condition as appraised from [b], it need one month before running crop experiment in each season.

1.4 To monitor rice growth and yield from the alternative treatment and compare to the control case, non-destructive samples oriented.

1.5 To monitor crop responses by alternative treatment applied at the important stages of crop growth, destructive samples oriented.

Output2: The automatic and economical watering system for the orchid production developed

2.1 To test the salty water that orchid can tolerant, (1 years)

2.2 To assess ambient in orchid farmer farms with highly successful production

2.3 To evaluate the water use in the studied farm and its relation to the existing ambient.

2.4 To determine water use & installing the watering system for orchid to safe water use

Output 3: The rice seed and seedling improvement techniques and orchid media modification methods that can be appropriately adopted for improving the drought adaptability and tolerance for rice and orchids

3.1 To develop Technique for rice seedling vigor and establishment improvement

3.2 To test orchid growing media modification for drought condition

All activities are planned to finish within 4 years and 1 year is left for spare time. Intermediate study result will keep and share the techniques learned to other related sub group, such as, a sub group which study in groundwater use, coastal adaptation.

IX. Resource Input

i. Input by the Thai side

Location for experiment: Faculty of Agriculture, Bangkhen Campus, Lopburi Research Station

Laboratory equipment: Central laboratory of Faculty of Agriculture

ii. Input by the Japanese side (Dispatch Japanese researchers, Receiving Thai counterparts to Japan, Procurement of equipment, Other cost to cover activities in Thailand)

Laboratory equipment: Graduate School of Agriculture, Kyoto University, JAPAN
Consulting and field activities excursion included.

I. Drought Monitoring Platform (Rural-ST2)

II. Organizations

i. Thai and Japanese representatives, affiliated organization

- Prof. Mongkol Raksapatcharawong and Prof. Watcharee Veerakachen, Chulabhorn Satellite Receiving Station (CSRS), Kasetsart University;
- Prof. Kazuo Oki, University of Tokyo and
- Prof. Masayasu MAKI, Tohoku Institute of Technology

ii. Related organizations and type of their participation

- Thai Meteorological Department (TMD) (type b)
  TMD provides rain gauge data for calibrating the Rainfall Estimation Model by Satellite (heritage from IMPAC-T).
- Office of Agricultural Economics (OAE) (type b and c)
  OAE is responsible for economic data related to more than 20 major crops in Thailand. Their data is used by the Thai Government to adopt policies, make decisions related to agricultural practice. They can provide phenological and demographic data to the drought model to generate drought vulnerability map. This informative map can be utilized by OAE to make a more insightful report to the Thai Government.

III. Research sites

This research mainly develops drought monitoring model based on satellite data which can be performed entirely in the lab. For adaptation approach, the chosen site(s) would be in the Northeastern part of Thailand whose area is among the top priority in the AEZ plan.

IV. Societal Needs for the Research

i. Issues and phenomena adversely affecting the society in relation with the research

Drought is one of the major reasons for farmers to leave their hometown for a better job in big cities. This migration has impacts on the public welfare, economics, and social. Moreover, some farmers even pawn or sell their land to the rich, leaving them no ways for a living. This widens the gaps between the rich and the poor and leads to social problems.

ii. Governmental policy and measures in relation with the research

As a consequence from (i), the government has to spend more budget on the state welfare, rather than putting the budget into enhancing infrastructures that can strengthen the economics and benefit most people. Therefore, the governments have been trying to adopt the previous Land Reform policy, and more importantly the Agricultural Economic Zoning (AEZ) policy. However, there has been not much progress because the government does not have enough information nor good tools to effectively drive such policies. This research on the development of drought monitoring platform can provide the government an insight into how drought can severely affect the farmers before it is too late. Hence, the government can issue a short- and long-term measures for

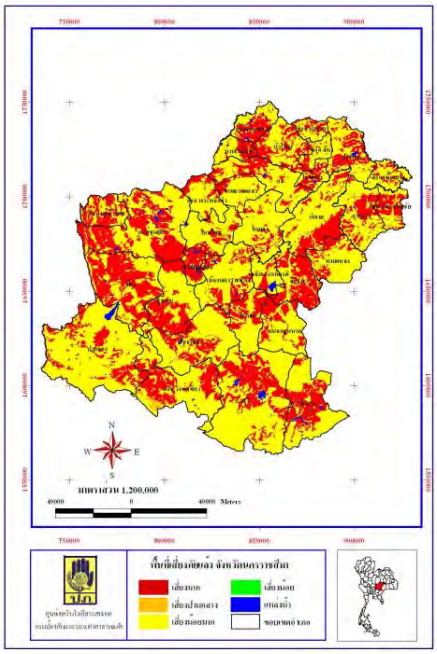
mitigation and adaptation. Short-term measures can be crop change promotion whereas long-term measure can involve several agencies to synergize such as building reservoirs and enforce agricultural zoning policy.

iii. Needs for the Research to solve i) and/or realize ii)

This research on the development of drought monitoring platform can provide the government an insight into how drought can severely affect the farmers before it is too late. It can help the government to realize (ii) which can solve (i).

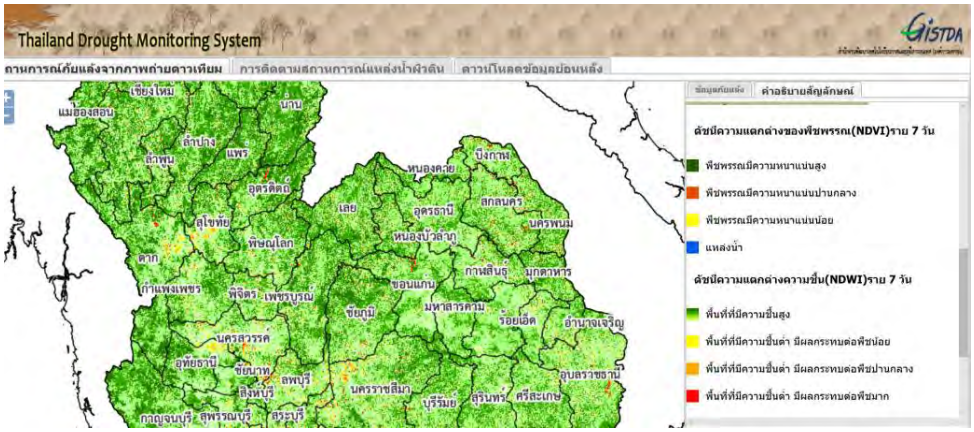
V. Challenges to the Research

i. Availability of related research and project, its status as well as its relation to the planned research



Department of Disaster Prevention and Mitigation is responsible for announcing and publishing the drought risk map for Thailand. Figure on the left shows drought risk map for Nakhon Ratchasima province in August 2015. However, such map is not frequently updated and is not disseminated in a GIS form, so it cannot be further processed by users. It is also not a drought vulnerability map.

Currently, there exists a similar platform based on satellite observation from GISTDA. The website is easily accessible to all but the information provided is not quite useful to drought monitoring. NDVI and NDWI values are some indicators to drought but they have to be processed together with other relevant data such as precipitation, TCI, VCI, and so on. In addition, phenological and demographic data are required to further generate the drought vulnerability map.



Website http://drought/gistda.or.th/ provides drought monitoring information from satellite data based on NDVI and NDWI on a weekly basis. This figure reports that most of Thailand are very humid during August 21-28, 2015.

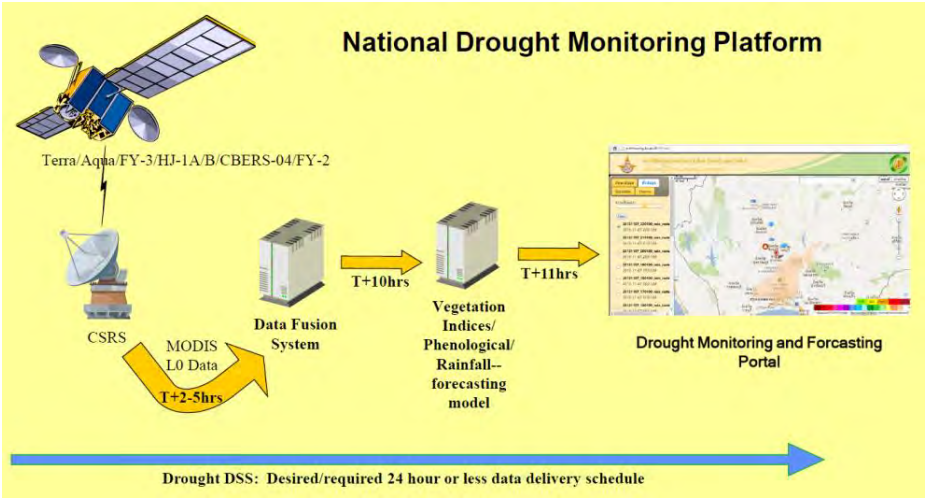
ii. Expected challenges to derive results from the research

User acceptance and perception of Drought Monitoring Platform based on satellite data can be a great challenge. In the past, remote sensing played a very limited role in government sectors due to the lack of experts and insufficient satellite data availability. So users may think that operational system based on satellite data is not practical. This stereotype has to be clarified by the advantages and limitations imposed by using satellite data to get a correct perception. It is inevitable that satellite data is the most viable data resource for country-wide drought monitoring system.

VI. Expected Results

i. Expected Research Results and contributions to the Project

There will be a Drought Monitoring Platform that can provide drought risk map country-wide on a weekly basis. In addition, an algorithm to combine phenological and demographic data will be pursued to generate a drought vulnerability map. Such results can be analyzed with other group's results (via Multi-Criteria Analysis) to provide useful information to the government for adaptation and mitigation to Climate Change.



This figure shows concept and data flow of the proposed Drought Monitoring Platform

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application

Crop changes scheme can be applied to the selected site. The process begins with OAE taking the research result and co-developing adaptation plan with KU and other relevant agencies. Such plan will be proposed to the government (or appropriate chain of commands) for implementation. The OAE could implement by itself or let the Department of Agricultural Extension (DAE) to implement.

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups

JFY2016-4Q Drought Monitoring Platform starts operation.

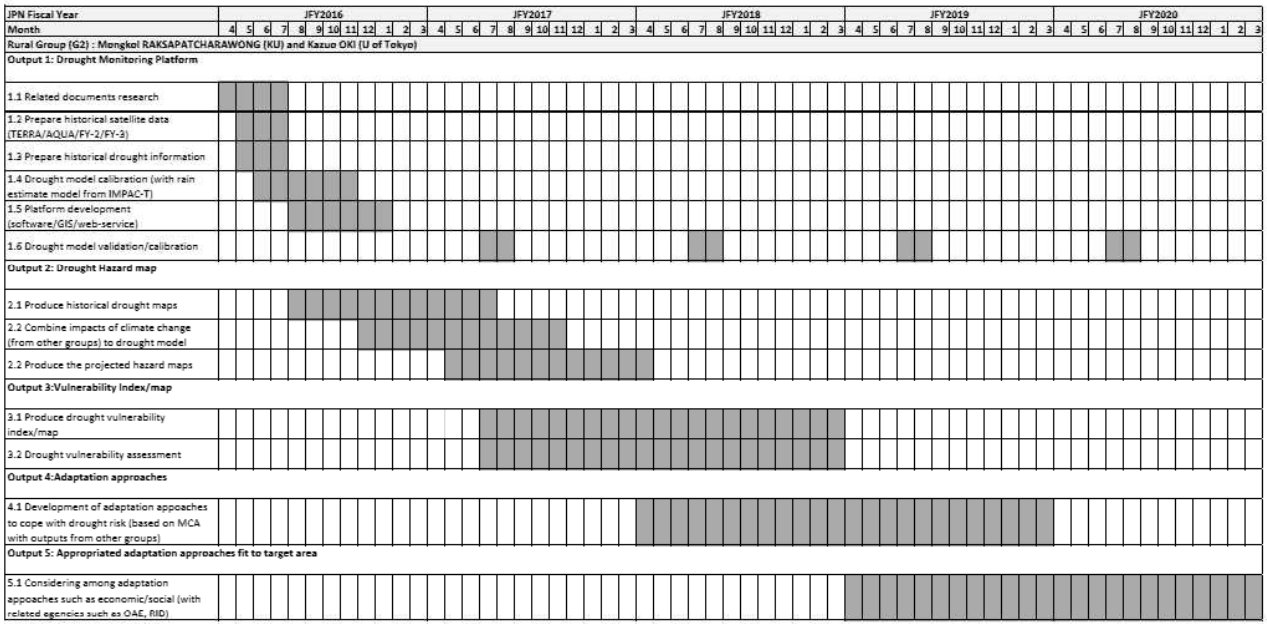
JFY2016-4Q Exchange/sharing data with other Sub-Teams (forecast rain model in the future).

JFY2017-2Q Drought Vulnerability Map is generated, assessment begins.

JFY2017-1Q Development of adaptation approaches begins.

JFY2019-1Q Co-develop adaptation approach and implementation on the selected site(s) with OAE and relevant agencies.

VIII. Research schedule



IX. Resource Input

i. Input by the Thai side

- Most of the satellite data required for research and operation including HJ-1A/B, CBERS-04, TERRA, AQUA, SUOMI-NPP, FY-2, and FY-3
- All computer facility including computing nodes, database, web server, etc.
- Relevance ground data, demographic and phenological data.
- Field activities for Thai researchers in Thailand.

ii. Input by the Japanese side (Dispatch Japanese researchers, Receiving Thai counterparts to Japan, Procurement of equipment, Other cost to cover activities in Thailand)

- Receiving Thai researchers to Japan for training on remote sensing applications and site visit to drought-related and/or agriculture disaster control/management.
- Field activities for Japanese researcher in Thailand
- Additional satellite data from Japanese satellites.
- Procurement of equipment:

  (Field monitoring system using UAV)

  1) UAV: eBee (senseFly, Switzerland)
  2) Multi-spectral camera: multiSPEC 4C camera (senseFly, Switzerland)
  3) Image analysis software: ENVI/IDL (Harris, USA)
  4) Operating PC: EliteBook (HP, USA)

October 28, 2015

RESEARCH PLAN

I. Title of Research (Group category*1)

ST2-Rural Group (G3): Cropping systems/ crop calendars adapted to climate change conditions –focusing on salt-affected soils in rural areas of Northeast Thailand.

II. Organizations

i. Thai and Japanese representatives, affiliated organization

Thai: Supranee SRITAMBUN (Land Development Department, LDD), Mallika SRISUTHAM (Khon Kaen University, KKU)

Japanese: Koshi YOSHIDA (Ibaraki U.)

ii. Related organizations and type of their participation*2

a. Collaborating organizations

Khon Kaen University (KKU), Land Development Department (LDD), Ibaraki University, Tohoku University, and Tohoku Institute of Technology.

b. Organizations providing data for the research

Khon Kaen University (KKU), Land Development Department (LDD), Ibaraki University, Tohoku University, and Tohoku Institute of Technology

c. Organizations utilizing results of the research and their institutional role in Thailand

LDD: validate and implement the research findings in NE Thailand

III. Research sites*3

Salt-affected areas in Khon Kaen Province, NE Thailand

IV. Societal Needs for the Research

i. Issues and phenomena adversely affecting the society in relation with the research

Salt-affected soils are major environmental problems in NE Thailand. They have serious adverse effects on various aspects of agriculture, and consequently, sustainability of the rural society.

ii. Governmental policy and measures in relation with the research

Improvement of salt-affected soils in NE Thailand is a major concern of LDD and other relevant institutions including KKU. Currently, numerous efforts have been carried out for this purpose, but existing knowledge is still inadequate.

iii. Needs for the Research to solve i) and/or realize ii)

Previous research has revealed the need for information on **temporal variation of some relevant soil properties, including electrical conductivity (ECe) and sodium adsorption ratio (SAR) for all year round under both the present climatic condition and the climate change (CC) condition.** This information together with the information generated by using the crop models and geo-informatics techniques under this same research group will be useful for adaptation of appropriate cropping

systems as well as crop calendars.

V. Challenges to the Research

i. Availability of related research and project, its status as well as its relation to the planned research

To date, related research has focused on degree, variability and spatial variability of EC and SAR in the dry season. For wet season, this kind of information is available to some very limited extent. Notably, temporal variation of EC and SAR is unknown for current climatic condition and CC condition.

ii. Expected challenges to derive results from the research

LDD will be responsible for implementation of the results to the farmers. Appropriate cropping systems and crop calendars in salt-affected areas of NE Thailand will be adapted to climate changes.

VI. Expected Results

i. Expected Research Results and contributions to the Project

Adaptation (mitigation) of cropping systems and crop calendars for CC.

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application

Implementation of appropriate cropping systems and crop calendar as well as management practices to cope with the problem of salt-affected soils will be undertaken through the LDD's agencies.

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups

(Major activities through research period):

Please see attachments

(Exchange of intermediate findings with other Sub-Teams):

This will be undertaken through meeting, seminar, conferences and etc organized by the ADAP-T project.

VIII. Research schedule*4

(Please see attachments)

IX. Resource Input

i. Input by the Thai side

- Thai researchers :Supranee SRITUMBOON (LDD)
  Mallika SRISUTHAM(KKU)
  Somsak SUKCHAN (LDD)
  Prof. Dr. Roengsak KATAWATIN(KKU)
- Existing GIS data of the study area including relevant land attributes e.g., soils, landforms, land covers/uses, climate, and etc.

Request Input

1. Field monitoring systems (i.e. weather station, soil moisture sensor, ground water sensor, etc.)

2. Land rent
3. Cost of soil, plant and water analysis
4. Allowance for research assistant
5. Climatic data (1985 – 2015)
6. Ground water data

ii. Input by the Japanese side

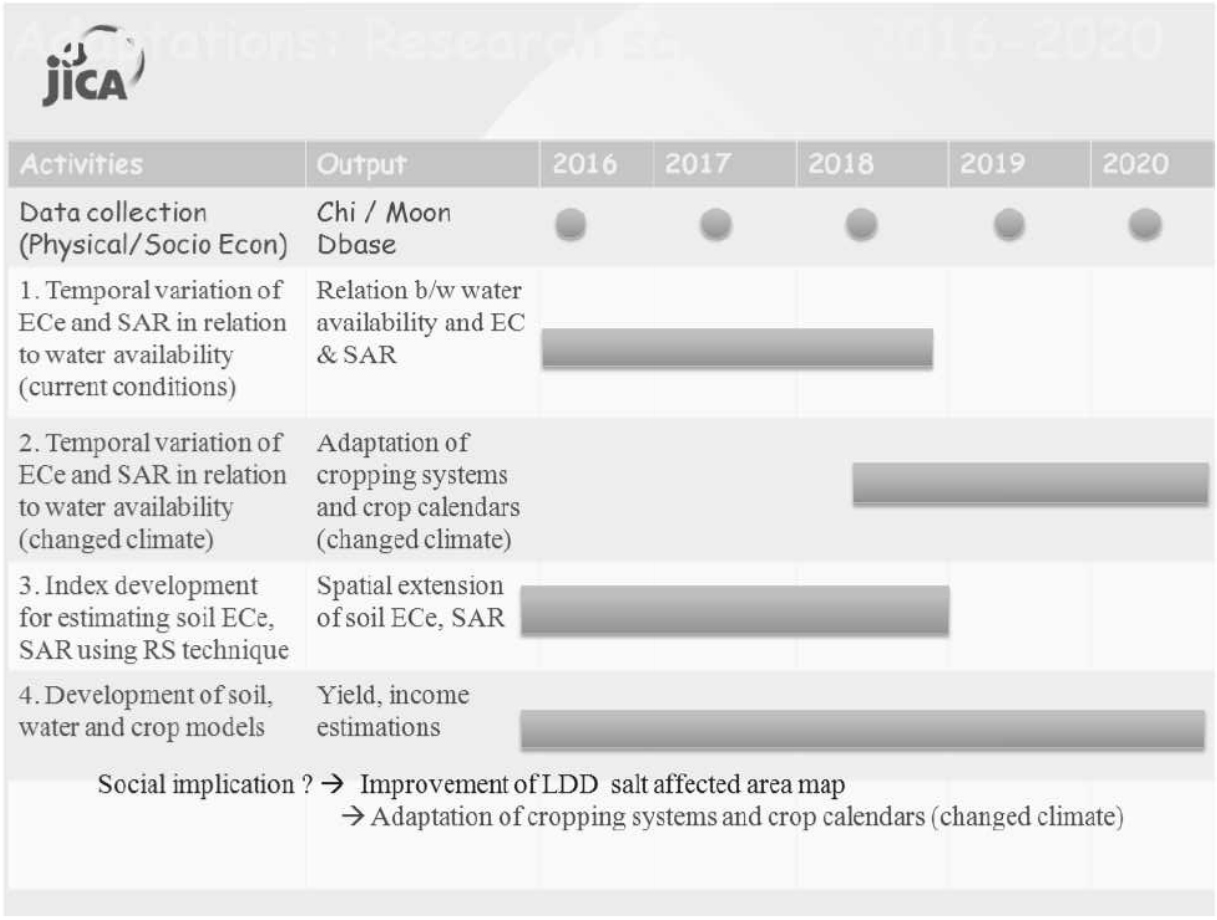
- Japanese researchers :Koshi YOSHIDA (Ibaraki Univ.)
  Koki HOMMA (Tohoku Univ.)
  Masayasu MAKI (Tohoku Institute of Technology)

Existing Rainfall-Runoff model, Crop Growth model, Remote sensing and geo-mapping technologies.

Equipment Input

1. Field router systems with Web-camera
2. Decagon data logger and meteo-hydro sensors
3. Portable Spectral radiometer: MS720
4. Drone: Boomerang (G-Wing, Japan)
5. Multi Spectral camera (include GPS and Solar incident light sensor)
6. Consumable thing for soil and water analysis

ATTACHMENT #1



ATTACHMENT #2

Tentative Plan of Operation (PO)

JPN Fiscal Year	JFY2016												JFY2017												JFY2018												JFY2019												JFY2020											
Month	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Rural Group (G3) : Supranee, S.(LDD), Somsak, S. (LDD), Mallika, S. (KKU), Roengsak, K. (KKU), Yoshida, K.(Ibaraki Univ.), Homma, K. (Tohoku Univ.) and Maki, M. (Tohoku Tech. Institute)																																																														
Output1: Database of Chi and Moon watersheds, NE Thailand																																																													
1.1 Collection / updating of physical and socio-economics data																																																													
Output2: Relationship between water availability and, ECe and SAR																																																													
2.1 Analyses of weather data for temporal variation of water availablity under current climatic conditions																																																													
2.2 Analyses of soil ECe and SAR periodically in relation to 2.1																																																													
2.3 Assessing the relationship between water availability and, ECe and SAR																																																													
Output3: Adaptation of cropping systems and crop calendar under climate change conditions based on temporal variation of ECe and SAR																																																													
3.1 Analyses of simulated weather data for temporal variation of water availablity under climate change conditions																																																													
3.2 Assessing the temporal variation of soil ECe and SAR in relation to water availability under climate change conditions																																																													
Output4: Spatial extension map of soil ECe, SAR																																																													
4.1 Index development for estimating soil ECe, SAR using RS technique																																																													
Output5: Yield and income estimations for appropriate adaptation ways																																																												
5.1 Development of soil, water and crop models																																																												

CONTENTS TO BE INCLUDED IN THE RESEARCH PLAN

I. Title of Research (Group category*1)
Building framework of community action plan based on climate change impact on vulnerability of flood-prone areas at watershed level (ST2-W)

II. Organizations
i. Thai and Japanese representatives, affiliated organization
Thai: Dr. Sarintip Tantanee (Naresuan University)
Japanese: Dr. Shinta Seto (Nagasaki University)
ii. Related organizations and type of their participation*2
a. Collaborating organizations
Department of Disaster Prevention and Mitigation (co-design organization)
Phitsanulok municipality
b. Organizations providing data for the research
Thai Meteorological Department
c. Organizations utilizing results of the research and their institutional role in Thailand
Department of Disaster Prevention and Mitigation
Municipalities
Sub-district administrative organizations

III. Research sites*3
Yom river basin

IV. Societal Needs for the Research
i. Issues and phenomena adversely affecting the society in relation with the research
There is no framework of community action plan based on climate impact on vulnerability of flood prone areas at watershed level.
ii. Governmental policy and measures in relation with the research
To build the people's awareness toward natural disasters; enable them to perform correct surviving practices
iii. Needs for the Research to solve i) and/or realize ii)
Preparation, validation, and analysis of ground-based radar data
Hydrological modeling to show flood-prone areas
Downscaling of rainfall data under future climate scenario
Development of vulnerability maps and categorization of flood risk levels based on watershed-level radar rainfall products.

V. Challenges to the Research
i. Availability of related research and project, its status as well as its relation to the planned research

REMARKS

*1: describe a category to which the research belongs as listed below

List of category:
- ST1...research under ST1
- ST2-W...research under ST2 water
- ST2-F...ST2 forest
- ST2-R...ST2 fural
- ST2-U...ST2 urban
- ST2-C...ST2 coast
- ST2-S...ST2 sedimentation
- ST3...research under ST3

*2: describe assumed participation of organizations such as providing information, comments and feedback to the Research, participating in workshops, being a member of co-design process, etc.

*3: describe research sites

*4: describe a period of total research and each major activity as "Research Team's Plan of Operation"

Satellite-based rainfall measurement under the GPM(Global Precipitation Measurement) mission

ii. Expected challenges to derive results from the research

Spatiotemporal downscaling of the satellite-based rainfall product (such as GSMaP) for practical use in local community

VI. Expected Results

i. Expected Research Results and contributions to the Project

Watershed-based radar rainfall products.

Vulnerability map over the research area under future climate

Categorization method of hydrological flood risk levels

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application

Dissemination of the knowledge for adaptation of climate change to local communities

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups

Ground-radar data would be provided by TMD and will be validated by gauge and/or satellite rainfall data. Watershed-level rainfall data shall be shared with TMD and other sub teams.

Future meteorological scenario would be provided by ST1. Rainfall data will be downscaled to local community level.

Vulnerability maps and categorization results of flood risk levels shall be transferred to ST3.

VIII. Research schedule[*4]

JFY 2016 Collection and analysis of rainfall data

JFY 2017 Preparation of hydrological modeling

JFY 2018 Development of vulnerability map

JFY 2019 Categorization of flood risk levels

JFY 2020 Development of framework for adaptation of climate change at watershed level

IX. Resource Input

i. Input by the Thai side

1) Providing researchers and graduate students to participate in research activities
2) Allocate office for the project at Faculty of Engineering, Naresuan University
3) Providing supporting staff for arranging onsite workshop
4) Software: ArcGIS 10.2, MIKE 11

ii. Input by the Japanese side (Dispatch Japanese researchers, Receiving Thai counterparts to Japan, Procurement of equipment, Other cost to cover activities in Thailand)

Dispatch of Japanese researchers and students for workshops and rainfall measurement

Receiving Thai members to Japan for Training course on satellite-based rainfall measurement

October 14, 2015

Attachment

CONTENTS TO BE INCLUDED IN THE RESEARCH PLAN

Title of Research (Group category*1)

ST2-W

I. Organizations

i. Thai and Japanese representatives, affiliated organization

Dr. Chaiwat Ekkawatpanit, King Mongkut University of Technology Thonburi
Dr.Duangrudee Kositgittiwong,, King Mongkut University of Technology Thonburi
Mr.Adisorn Champathong, Royal Irrigation Department
Mr.Somkid Saphaokam, Royal Irrigation Department
Mr.Thada Sukhapunnaphan (Advisor), Royal Irrigation Department
Mr.Jaray Thongduang (Advisor), Royal Irrigation Department
Miss Kalyanee Suwanprasert, Department of WaterResources
Dr.Naota Hanasaki, National Institute for Environmental Studies NIES

ii. Related organizations and type of their participation*2

a. Collaborating organizations
Royal Irrigation Department, Department of Water Resources
b. Organizations providing data for the research
Royal Irrigation Department, Thai Meteorology Department,Department of Water Resources
c. Organizations utilizing results of the research and their institutional role in Thailand
Royal Irrigation Department, Department of Water Resources

II. Research sites*3

Upper Chao Phaya River basin

III. Societal Needs for the Research

i. Issues and phenomena adversely affecting the society in relation with the research

Due to climate variability and highly water use from stakeholders in the basin, related agencies get harder uncertainty in water resources management. As stated in papers, agricultural water use contributes 75% of total water use in Thailand. It is necessary to deeply study on such water use in order to manage it more properly based on more advance academic basis.

REMARKS

*1: describe a category to which the research belongs as listed below

List of category:

- ST1...research under ST1
- ST2-W...research under ST2 water
- ST2-F...ST2 forest
- ST2-R...ST2 fural
- ST2-U...ST2 urban
- ST2-C...ST2 coast
- ST2-S...ST2 sedimentation
- ST3...research under ST3

*2: describe assumed participation of organizations such as providing information, comments and feedback to the Research, participating in workshops, being a member of co-design process, etc.

*3: describe research sites

*4: describe a period of total research and each major activity as "Research Team's Plan of Operation"

ii. Governmental policy and measures in relation with the research
Government agencies formulate the policy and measures based on analyses of statistical data including their experiences. In a critical period of either flood and drought, related agencies always attend meetings and closely cooperate to monitor and solve the problems.

iii. Needs for the Research to solve i) and/or realize ii)
More advance knowledge and technologies should be provided to cover the uncertainties due to the climate variability and other changes in future. The research will be benefit to relate agencies in terms of enhance capability that directly useful to social needs.

IV. Challenges to the Research

i. Availability of related research and project, its status as well as its relation to the planned research
So far, the quasi real-time simulation using H08 Model has been developed continuously since IMPAC-T Project. Additionally, developing of input map involving land-uses in this basin is ongoing. We can further apply such materials for ADAP-T Project.

ii. Expected challenges to derive results from the research
concrete adaptation measures for agricultural water management
Real time simulation in Upper Chao Phaya River basin is one of a challenging task. Moreover, developing the H08 Model to match with social needs is also challenging to our team.

V. Expected Results

i. Expected Research Results and contributions to the Project
-Improvement of real time simulation
-Providing real time information in Upper Chao Phaya River basin to related agencies and public via website.
-Providing flood and drought risk information.
-Providing knowledge and measures to improve agricultural water management to related agencies.

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application
-Measures to cope with flood and drought for local people by providing the information to related agencies.

VI. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups
Use ST1 data for real time simulation purpose. Besides, our team will reflect research outputs to ST3.

VII. Research schedule*4
See attached a table bellow

VIII.Resource Input

i. Input by the Thai side

-Field survey and data set

-Co-developing the H08 Model for research purposes.

ii. Input by the Japanese side (Dispatch Japanese researchers, Receiving Thai counterparts to Japan, Procurement of equipment, Other cost to cover activities in Thailand)

-Automatic Weather Stations (AWSs) in Nan River Basin (requested to be installed to develop the near-real time simulation)

-Dispatching Japanese researchers

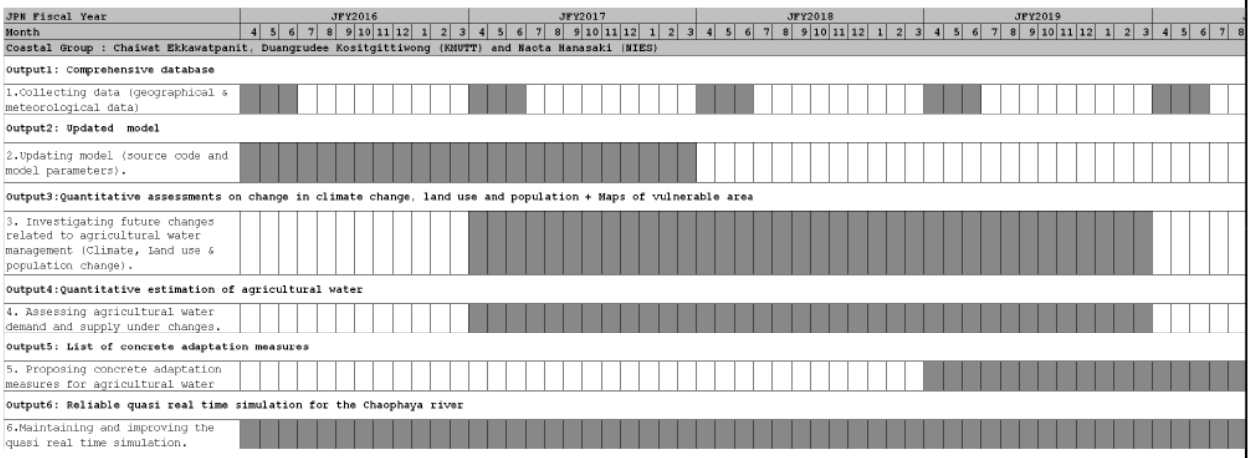
-Receiving Thai counterparts to Japan

-Full/partial supports budget for field survey and collecting data.

-2 Macbooks(KMUTT,RID) for simulate H08 model

- Replace computer servers in the fourth year, because the IMPAC-T servers will be worn out.

Table



ADAP-T

Research Plan

ST2-Freshwater Group 3

I. Title of Research

Dry Season Water Allocation and Adaptive Measures under Climate Change in Chao Phraya River Basin

II. Organizations

i. Thai and Japanese representatives, affiliated organization

Name	Affiliation	Assignment(s)
THAI SIDE		
Aksara Putthividhya	Chulalongkorn University	Team Leader/Data Collection/Model Development/Data Analyses/Adaptive Measures/Publications
Piyatida Ruangrasamee	Chulalongkorn University	Data Collection/Model Development/Data Analyses/Adaptive Measures/Publications
Thada Sukapunnapan	RID	Data Source/Adaptive Measures Implementation
Phonchai Klinkhachorn	RID	Data Source/Adaptive Measures Implementation
Aranya Fuangsawasdi	DGR	Data Source/Adaptive Measures Implementation
Tussanee Natethad	DGR	Data Source/Adaptive Measures Implementation
Sittisak Manyou	DGR	Data Source/Adaptive Measures Implementation
Boonlert Archevarahuprok	TMD	Data Source/Adaptive Measures Implementation
JAPANESE SIDE		
Kenji Tanaka	Kyoto University	SiBUC Technical Advisor/Training/Adaptive Measures/Rainfall-Runoff –Baseflow Relationship/Probabilistic Forecasting of Reservoir Inflows and Precipitation
Tomohito Yamada	Hokkaido University	GCM Outputs and Scenarios Advisor
Naota Hanasaki	NIES, Japan	Overall Freshwater and Modeling Advisor

ii. Related organizations and type of their participation*2

a. Collaborating organizations

RID, DGR, and TMD

b. Organizations providing data for the research

RID, DGR, and TMD

c. Organizations utilizing results of the research and their institutional role in Thailand

Organization	Institutional Role(s)
RID	1. Implementation of activities aimed at achieving, collecting, storing, controlling, distributing, draining or allocating water for agricultural, energy, household consumption or industrial purposes under irrigation laws, ditch and dike laws and other related laws. 2. Implementation of activities related to prevention of damages from water; safety of dams and appurtenant structures; safety of navigation in commanded areas and other related activities that may not be specified in annual plan. 3. Implementation of land consolidation for agriculture under the Agricultural Land Consolidation Act. 4. Implementation of other activities designated by laws or properly assigned by Cabinet or Minister.
DGR	1. Develop and manage groundwater resources to their full potential so as to promote the growth of the nation development in a sustainable manner. 2. Regulate the utilization and conservation of groundwater through laws and regulations with clear enforcement steps. 3. Perform hydrogeologic survey, study, and evaluate on groundwater resources potential. 4. Develop and transfer state-of-the-art technology to the Department's personnel on a continuous basis. 5. Promote and encourage self-sufficiency of regional-office personnel in groundwater resources management. 6. Develop equitable groundwater allocation systems for stakeholders from all regions and sectors. 7. Develop and enhance the Department's Geographic Information System (GIS) and hydrogeologic database. 8. Develop monitoring systems and groundwater investigation procedures and promulgate awareness of adverse impacts due to groundwater overexploitation in terms of groundwater availability and groundwater quality. 9. Rehabilitate impaired groundwater environments using appropriate technologies. 10. Develop transparent, unbiased, and efficient organizational and administrative systems within the Department. 11. Promote technical research activities directly relevant to the Department's mission. 12. Promote public awareness and understanding in appropriate use and conservation of groundwater resources. 13. Supply data, training, water quality analysis, develop and manage groundwater to business sector.
TMD	1. To supply weather forecasts for the entire country and publicize disaster warnings to fulfill the requirement from administration and management in natural disaster

	mitigation 2. To build the people's awareness toward natural disasters; enable them to perform correct surviving practices; and reduce effects from natural disasters by using modern technologies together with IT services 3. To become the meteorological IT data and service center at the national level for users in any ventures 4. To improve and develop the Departments research works 5. To strengthen the Department's roles in international cooperation concerning meteorology and environment with the purpose of profound comprehension on changing world situation.

III. Research Sites

GCM/RCM/SiBUC Modeling Work – The Entire Chao Phraya River Basin

Existing Dry Season Water Allocation Plan – The Entire Chao Phraya River Basin

Spatial Vulnerability Map and Adaptive Measures – Upper Chao Phraya River Basin (Probabilistic Forecast of Reservoir Inflows and Precipitation+Optimization of Routine for Reservoir Operation)/Mid Chao Phraya River Basin(Rainfall-Runoff-Baseflow Profiles)/Lower Chao Phraya River Basin (Water Quality Issues and Saltwater Intrusion)

Practically and Economically Feasible Adaptation Approaches – Target Area-Based (based on Hot Spots for Built-In Adaptive Measures)

IV. Societal Needs for the Research

This study will spread the concept of adaptive water resource management. Thailand is in the process of revising water resource management after the great flood of 2011 and the severe droughts in the consecutive years. The study satisfies the immediate need of the government. This project will not only expand the envelope of field observations and model development but enhance both technology and scientific interaction between partnerships which directly results to society benefits. Within the period of project, people in our society will understand more in natural of water environment and realize the good water allocation in efficiency, equity, sustainability.
In Japan, concerns over increasing extreme weather events and climate change is increasing. The country is facing large structural change in agriculture due to aging and the trend of free trade. Visualization of the change will raise public awareness.

V. Challenges to the Research

i. Availability of related research and project, its status as well as its relation to the planned research

Exceptionally less rainfall in rainy season and prolonged dry season has recently caused the nation-wide drought situation in Thailand. Some area has been facing an intensive groundwater exploitation for irrigation purpose during drought and for a growing water demand from the extensive industrial development. Our study area is in the Chao Phraya river basin located in a large central plain of Thailand where large irrigation serviced fields are scattered all over. With the critical drought problem, water allocation plan for the entire basin is becoming more challenging. The majority of storage water (70%) in the two biggest dams (i.e., Bhumibol and Sirikit dams) has been used for irrigation and distributed among several irrigation projects from the Northern to Central Lower Chao Phraya river basin. Insufficient surface water led to an individual private groundwater well installation to compensate the frequent surface water shortage. The uncontrolled heavy pumping has subsequently induced groundwater table decline in some parts of the irrigated areas, causing the severe current and future groundwater accessibility problems for the entire public water users. This precarious situation definitely asks for the comprehensive study of trends and ranges of climate change, including extreme events and their impacts on social societies; practical measures to combat droughts and extreme flooding. Natural disasters caused by extreme weather events are one of the most influence factors to damage the national healthy economic growth. According to meteorological data in this region (ADB, 2010), Southeast Asia has been increasingly subject to floods and is susceptible to stronger tropical cyclones and storm surges. Extreme weather events are expected to increase in intensity and frequency, causing extensive damage to property, productive assets, human life, and livelihood. Climate change is expected to affect water resources by intensifying floods and droughts in Thailand. Better adaptive measures are in need to cope with climate change impacts both at the basin scale and target-area based scale in practically and economically feasible ways.

ii. Expected challenges to derive results from the research

Research gaps/challenges are still in need to put a step forward to the concept of adaptive measures in water management under climate uncertainties includes:

- Forcing data set updating (rainfall, runoff)
- Inclusion of land use as dynamic factor in the management model.
- Improvement/Revision any future rainfall and climate projection from IMPAC-T to ADAP-T
- New forecasting technique using lag correlation analysis.
- Probabilistic forecast of reservoir inflows and precipitation
- Optimization routine for reservoir operation
- Conjunctive water management practice, in which refers to a management approach similar to Integrated Water Resources Management (IWRM) with the emphasis placed upon the combined use of both surface and subsurface water to meet the total local water demand.
- Understanding the interactions between groundwater and surface water can be crucial for water resources management, and in the future determination of migration pathways for contaminants.
- Degree of interactions depends on a number of factors including topography, underlying geology, subsurface hydraulic properties, temporal and spatial variation in precipitation, and local groundwater flow patterns.

- Mitigate impact of extreme weather events in the changing climate.

VI. Expected Results

i. Expected Research Results and contributions to the Project

Expected research outputs/contributions from this research includes the following:

1. Output 1: Existing Water Allocation Plan in Chao Phraya River Basin
2. Output 2: Rainfall-Runoff-Baseflow Profiles in Chao Phraya River Basin (Inputs from ST1)
3. Output 3 : Future Projection and Seasonal Forecasting (Inflow) (Sharing and Comparisons of Outputs with ST2-Freshwater Group 2)
4. Output 4 : Spatial Vulnerability Map (Upstream, Midstream, and Downstream) (Sharing and Comparisons of Outputs with ST2-Freshwater Group 1-Related Conjunctive Use of Surface Water and Groundwater)
5. Output 5 : Adaptive Measures
6. Output 6 : Practically and Economically Feasible Adaptation Approaches (Target Area-Based)
7. Output 7 : Training/Conference/Annual Meeting with Japanese Researchers
8. Output 8 : Graduate students and postdoctoral fellows will participate from Japanese side and they will visit Thailand to interact with collaborators. Japanese side will receive students/experts from Thai side for technological transfer. They are welcome to analyze Japanese situation for comparison with their own situation.

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application

This study will spread the concept of adaptive water resource management. Thailand is in the process of revising water resource management after the great flood of 2011 and the severe droughts in the consecutive years. The study satisfies the immediate need of the government. This project will not only expand the envelope of field observations and model development but enhance both technology and scientific interaction between partnerships which directly results to society benefits. Within the period of project, people in our society will understand more in natural of water environment and realize the good water allocation in efficiency, equity, sustainability.

In Japan, concerns over increasing extreme weather events and climate change is increasing. The country is facing large structural change in agriculture due to aging and the trend of free trade. Visualization of the change will raise public awareness.

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups

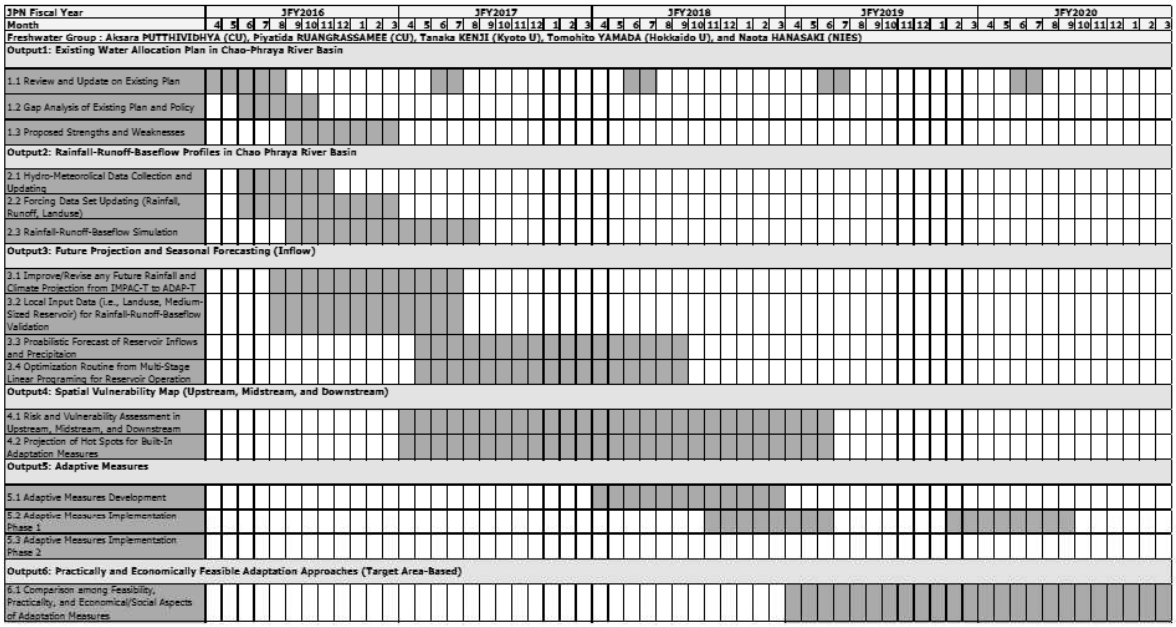
Activities in this research group includes the following:

1. Output 1: Existing Water Allocation Plan in Chao Phraya River Basin

1.1 Review and Update on Existing Plan
    1.1.1 Current plan from annual reports
    1.1.2 Interviewing with institutes in charge
    1.1.3 Conducting field survey
1.2 Gap Analysis of Existing Plan and Policy
1.3 Proposed Strengths and Weaknesses

2. Output 2: Rainfall-Runoff-Baseflow Profiles in Chao Phraya River Basin (Inputs from ST1)
    2.1 Hydro-Meteorological Data Collection and Updating
    2.2 Forcing Data Set Updating (Rainfall, Runoff, Landuse) – Landuse Scenario Implementation from Well-Established Scenario from Dr. Yongtuth
    2.3 Rainfall-Runoff-Baseflow Simulation
3. Output 3: Future Projection and Seasonal Forecasting (Inflow) (Sharing and Comparisons of Outputs with ST2-Freshwater Group 2)
    3.1 Improve/Revise any Future Rainfall and Climate Projection from IMPAC-T to ADAP-T
    3.2 Local Input Data (i.e., Landuse, Medium-Sized Reservoir) for Rainfall-Runoff-Baseflow Validation
    3.3 Probabilistic Forecast of Reservoir Inflows and Precipitation
    3.4 Optimization Routine from Multi-Stage Linear Programming for Reservoir Operation
4. Output 4: Spatial Vulnerability Map (Upstream, Midstream, and Downstream) (Sharing and Comparisons of Outputs with ST2-Freshwater Group 1-Related Conjunctive Use of Surface Water and Groundwater)
    4.1 Risk and Vulnerability Assessment in Upstream, Midstream, and Downstream
    4.2 Projection of Hot Spots for Built-In Adaptive Measures
5. Adaptive Measures
    5.1 Adaptive Measures Development
    5.2 Adaptive Measures Implementation Phase 1
    5.3 Adaptive Measures Implementation Phase 2
6. Practically and Economically Feasible Adaptation Approaches (Target Area-Based)
    6.1 Comparison among Feasibility, Practicality, and Economical/Social Aspects of Adaptive Measures
7. Training/Conference/Annual Meeting with Japanese Researchers

8. Research schedule[*4]



9. Resource Input

i. Input by the Thai side

- Academic resources
- Receiving Japanese counterparts to Thailand
- Local expenses supported by TICA

ii. Input by the Japanese side (Dispatch Japanese researchers, Receiving Thai counterparts to Japan, Procurement of equipment, Other cost to cover activities in Thailand)

- Academic training and advice
- Receiving Thai counterparts to Japan
- Local expenses supported by JICA

CONTENTS TO BE INCLUDED IN THE RESEARCH PLAN

I. Title of Research (Group category*1)
ST2-U

II. Organizations
i. Thai and Japanese representatives, affiliated organization
G1: Napaporn Piamsa-nga (KU), Shinichiro Nakamura (Nagoya U)
G2: Sanit Wongsa (KMUTT) , Varameth Vichiensan(KU), Shinichiro NAKAMURA (Nagoya U)
ii. Related organizations and type of their participation*2
a. Collaborating organizations: Bangkok Metropolitan Administration
b. Organizations providing data for the research: Bangkok Metropolitan Administration, Thai Meteorological Department
c. Organizations utilizing results of the research and their institutional role in Thailand: Bangkok Metropolitan Administration. They published the climate change master plan for Bangkok metropolitan area in 2015.

III. Research sites*3
Bangkok Metropolitan Area

IV. Societal Needs for the Research
i. Issues and phenomena adversely affecting the society in relation with the research
Urban flood disaster
ii. Governmental policy and measures in relation with the research
Bangkok Master Plan on Climate Change 2013-2023
iii. Needs for the Research to solve i) and/or realize ii)
Urban flood is the most severe disaster in Bangkok metropolitan area. And the disaster risk have been expected to increase under the climate change. Developing the evaluation methods and adaptation measures are important to mitigate the disaster impact and realize the risk. Especially, the quantitative evaluation of adaptation measures is needed.

V. Challenges to the Research
i. Availability of related research and project, its status as well as its relation to the planned research
Y. Yamashita et al. (submitted) developed the evaluation system in order to estimate the flood disaster damages (decreasing value of the living opportunities) via the transportation network breaking down in Bangkok metropolitan area (Fig.1). Although the previous research used

REMARKS

*1: describe a category to which the research belongs as listed below

List of category:
- ST1...research under ST1
- ST2-W...research under ST2 water
- ST2-F...ST2 forest
- ST2-R...ST2 fural
- ST2-U...ST2 urban
- ST2-C...ST2 coast
- ST2-S...ST2 sedimentation
- ST3...research under ST3

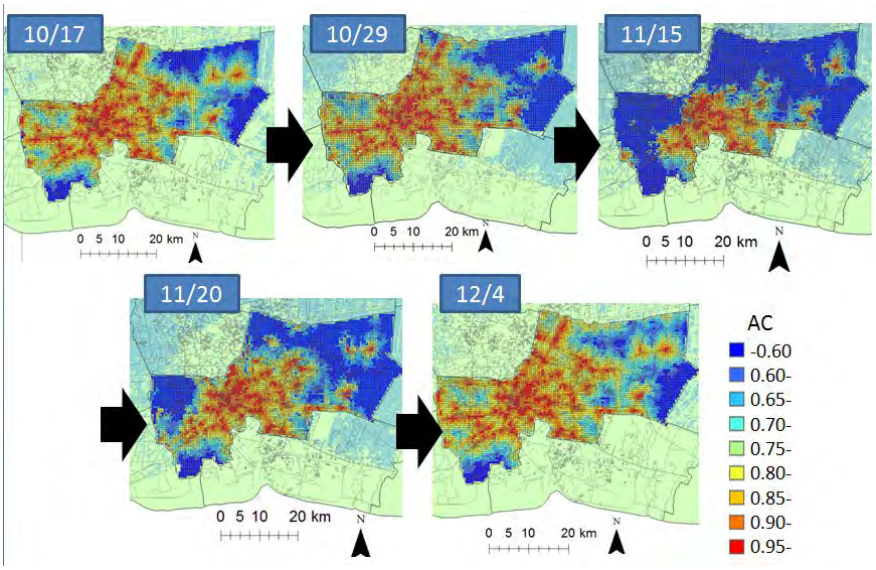
*2: describe assumed participation of organizations such as providing information, comments and feedback to the Research, participating in workshops, being a member of co-design process, etc.

*3: describe research sites

*4: describe a period of total research and

the 2011 flood inundation area as the input data, they did not apply to the flood hazard under the climate change and urban flood caused by sewage overflow.

each major activity as "Research Team's Plan of Operation"



ii. Expected challenges to derive results from the research

Our challenges are to improve the evaluation system and apply to the urban flood hazard under the climate change. Particular challenges are below;

a) Make the design rainfall for urban area under the climate change(G1)

b) Develop the urban flood model and inundation map(G2)

c) Improve the flood disaster evaluation system (update the special data)(G2)

d) Make the urban flood risk map (G1, G2)

e) Evaluate the adaptation measures (G1, G2)

And the research flow is below;

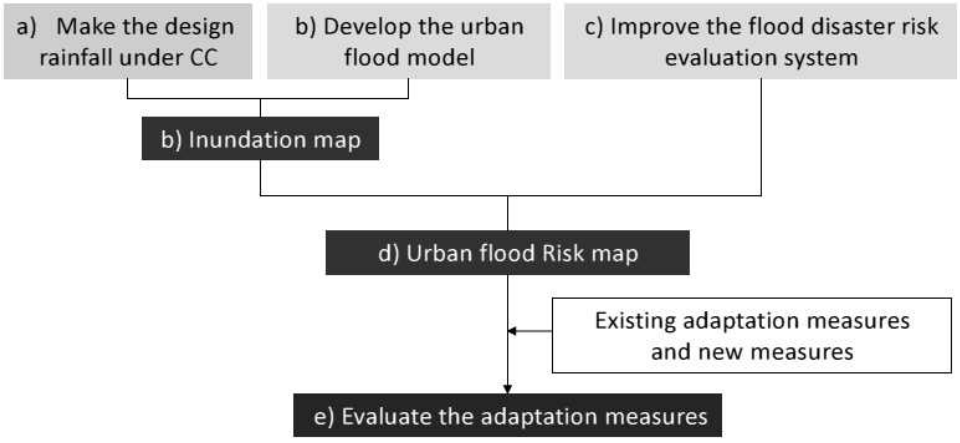


Fig.2 ST2-U research flow

VI. Expected Results

i. Expected Research Results and contributions to the Project

ST2-U provide the flood disaster evaluation system in Bangkok and make it possible to evaluate the adaptation measures to reduce the urban flood damages.

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application

The flood disaster evaluation system provide the quantitative indicators to evaluate the adaptation measures and support building consensus among the stakeholders.

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups

ST2-U needs the predicted precipitation data under climate change which are provided by Sub-Team 1. And the quantitative indicators which are produced by the flood disaster evaluation system will be provided to Sub-team 2.

VIII.Research schedule*4

	2016	2017	2018	2019	2020
a) Make the design rainfall for urban area under the climate change(G1)	←	→			
b) Develop the urban flood model and inundation map(G2)	←	→			
c) Improve the flood disaster evaluation system (update the special data)(G2)	←	→			
d) Make the urban flood risk map (G1, G2)			←	→	
e) Evaluate the adaptation measures(G1, G2)					↔

IX. Resource Input

i. Input by the Thai side

- Design rainfall for urban area under the CC
- Urban flood model and inundation map
- Spatial(urban facilities and transportation network) data

ii. Input by the Japanese side (Dispatch Japanese researchers, Receiving Thai counterparts to Japan, Procurement of equipment, Other cost to cover activities in Thailand)

- Flood disaster evaluation system

Attachment

CONTENTS TO BE INCLUDED IN THE RESEARCH PLAN

I. Title: Adapting to sea level rise in coastal zone (Group category*1: ST2-C…ST2coast)

II. Organizations
   i. Thai and Japanese representatives, affiliated organization
      Thai: Dr.Sompratana RITPHRING
      Assist.Prof. Faculty of Engineering, Kasetsart Univ, Thailand
      Japan: Dr.Keiko UDO
      Assoc.Prof. International Research Institute of Disaster Science, Tohoku Univ, Japan
   ii. Related organizations and type of their participation*2
      a. Collaborating organizations
         Department of Marine and Coastal Resources (DMCR)
      b. Organizations providing data for the research
         The heritage from IMPAC-T will be used for ADAP-T together with the field observations.
      c. Organizations utilizing results of the research and their institutional role in Thailand
         Department of Marine and Coastal Resources (DMCR)

III. Research sites*3
   Coastal zone for the whole country (except islands)

IV. Societal Needs for the Research
   i. Issues and phenomena adversely affecting the society in relation with the research
      - No -
   ii. Governmental policy and measures in relation with the research
      DMCR has the responsibility to cope with the coastal zone management in terms of climate change and so on.
   iii. Needs for the Research to solve i) and/or realize ii)
      - No -

V. Challenges to the Research
   i. Availability of related research and project, its status as well as its relation to the planned research
      There are few researches in terms of adapting measures in relation with coastal zone management in Thailand. Most of the previous ones did not jump into detail of effect of sea level rise, prioritization the alternative countermeasures, social impact and so on. Then, this project will be the pioneer.
   ii. Expected challenges to derive results from the research

REMARKS

*1: describe a category to which the research belongs as listed below

List of category:
- ST1...research under ST1
- ST2-W...research under ST2 water
- ST2-F...ST2 forest
- ST2-R...ST2 fural
- ST2-U...ST2 urban
- ST2-C...ST2 coast
- ST2-S...ST2 sedimentation
- ST3...research under ST3

*2: describe assumed participation of organizations such as providing information, comments and feedback to the Research, participating in workshops, being a member of co-design process, etc.

*3: describe research sites

*4: describe a period of total research and each major activity as "Research Team's Plan of Operation"

Some adapting measures will effect the local activities, coastal communities' settlements, that should be carefully considered.

VI. Expected Results

i. Expected Research Results and contributions to the Project

Coastal databases, projected shoreline, hazard maps, coastal vulnerability index and maps, adapting approaches.

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application

Some public hearing and/or focus group discussions will be needed during this project time.

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups

The knowledge sharing among researchers will be done during domestic meetings as well as small group discussions, which will be held several times a year.

VIII. Research schedule*4

See attachment of PO

IX. Resource Input

i. Input by the Thai side

Field survey, setting up domestic meetings, installation and maintenance the equipment, presentations and publications, and adopting research assistant.

ii. Input by the Japanese side (Dispatch Japanese researchers, Receiving Thai counterparts to Japan, Procurement of equipment, Other cost to cover activities in Thailand)

October 14, 2015

Attachment

CONTENTS TO BE INCLUDED IN THE RESEARCH PLAN

I. Title of Research (Group category*1)
ST2-S(G1 and 2)

II. Organizations
  i. Thai and Japanese representatives, affiliated organization
  Dr. Suttisak Soralump, Kasetsart University
  Dr. Chaiwat Ekkawatpanit, King Mongkut's University of Technology, Thonburi
  Prof. So Kazama, Tohoku University
  ii. Related organizations and type of their participation*2
    a. Collaborating organizations
    Royal Irrigation Department, Department of Mineral Resources
    b. Organizations providing data for the research
    Royal Irrigation Department, Thai Meteorology Department, Department of Mineral Resources
    c. Organizations utilizing results of the research and their institutional role in Thailand
    Royal Irrigation Department, Department of Mineral Resources, Rural road department,
    Local Government Office, Electrical Generating Authority of Thailand

III. Research sites*3
Khao Phanom City, Krabi Province
Chiang Mai Province or other areas in Northern Thailand
Whole Thailand

IV. Societal Needs for the Research
  i. Issues and phenomena adversely affecting the society in relation with the research
  Safety of the energy transmission system through the landslide area, Safety of dam and reservoir from the climate change, Safety of people who lives in the landslide prone area.
  ii. Governmental policy and measures in relation with the research
  Mainstreaming of LDCRM into government country developing plan
  iii. Needs for the Research to solve i) and/or realize ii)
  Meeting with government persons
  Future projection data from ST3

REMARKS

*1: describe a category to which the research belongs as listed below

List of category:
- ST1...research under ST1
- ST2-W...research under ST2 water
- ST2-F...ST2 forest
- ST2-R...ST2 fural
- ST2-U...ST2 urban
- ST2-C...ST2 coast
- ST2-S...ST2 sedimentation
- ST3...research under ST3

*2: describe assumed participation of organizations such as providing information, comments and feedback to the Research, participating in workshops, being a member of co-design process, etc.

*3: describe research sites

*4: describe a period of total research and each major activity as "Research Team's Plan of Operation"

V. Challenges to the Research

i. Availability of related research and project, its status as well as its relation to the planned research

We can use IMPAC-T results and human network.

ii. Expected challenges to derive results from the research

Sedimentation disaster prevention by hardware and software in test sites. (Khao Phanom)

New warning system will be introduced in Northern Thailand

Coupling probability and physical models

VI. Expected Results

i. Expected Research Results and contributions to the Project

Continuous improvement of warning system

Providing real time hazard information in whole Thailand

Providing risk information (damage cost)

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application

Avoidance from sedimentation disaster for local people

Suitable development in view of landuse by risk map

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups

Use ST1 data system for real time hazard estimation

Use ST2-F knowledge and social experiences

Input long term sedimentation hazard to ST2-C for sedimentation yield data

Future projection of sedimentation risk from ST3 data

VIII. Research schedule[*4]

See attached a table bellow

IX. Resource Input

i. Input by the Thai side

Field survey and data set

Local people information

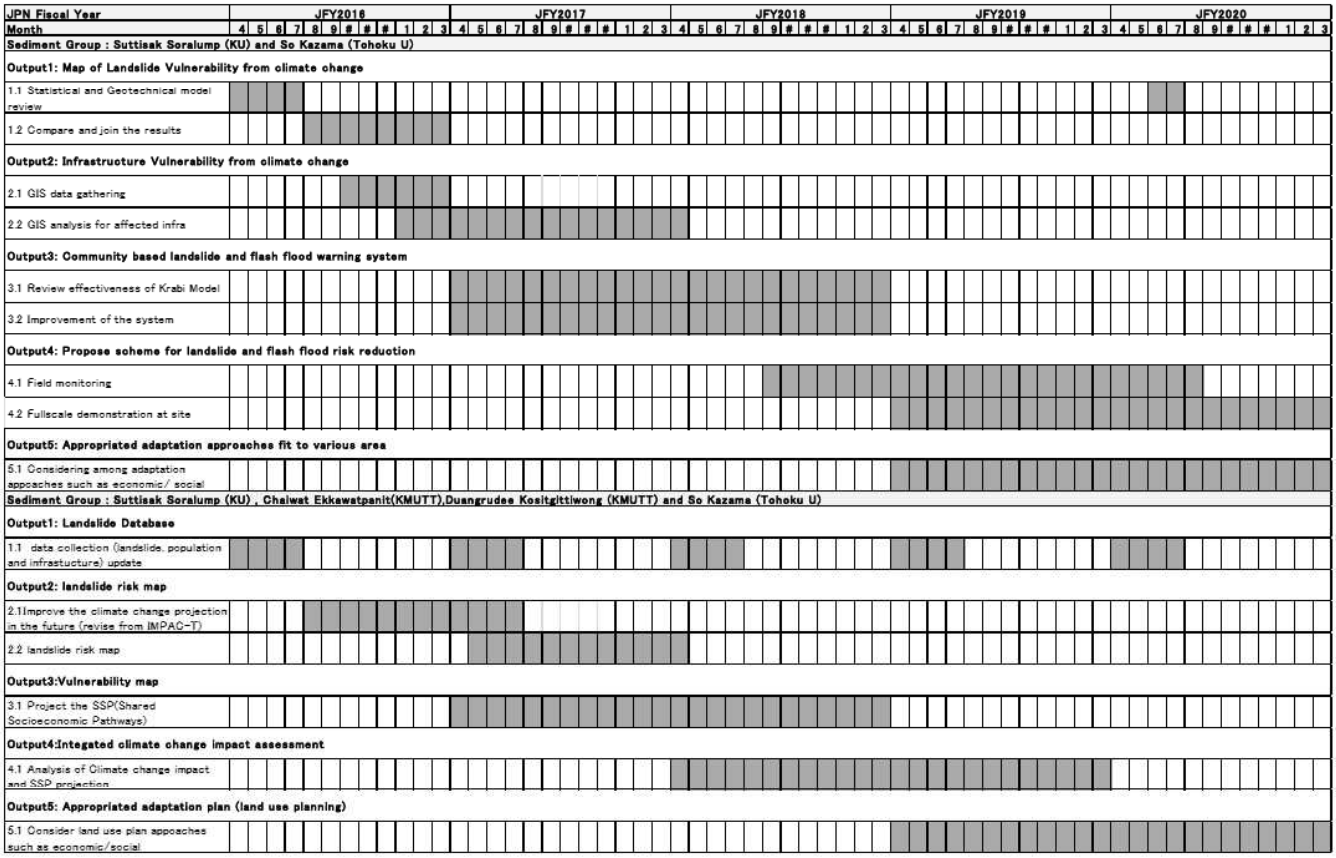
Warning system setting and evaluation

ii. Input by the Japanese side (Dispatch Japanese researchers, Receiving Thai counterparts to Japan, Procurement of equipment, Other cost to cover activities in Thailand)

Dispatching Japanese researchers

Development of risk evaluation model

Table


JPN Fiscal Year
JFY2016
JFY2017
JFY2018
JFY2019
JFY2020
Month
4 5 6 7 8 9 # # # 1 2 3 4 5 6 7 8 9 # # # 1 2 3 4 5 6 7 8 9 # # # 1 2 3 4 5 6 7 8 9 # # # 1 2 3 4 5 6 7 8 9 # # # 1 2 3
Sediment Group : Suttisak Soralump (KU) and So Kazama (Tohoku U)
Output1: Map of Landslide Vulnerability from climate change
1.1 Statistical and Geotechnical model review
1.2 Compare and join the results
Output2: Infrastructure Vulnerability from climate change
2.1 GIS data gathering
2.2 GIS analysis for affected infra
Output3: Community based landslide and flash flood warning system
3.1 Review effectiveness of Krabi Model
3.2 Improvement of the system
Output4: Propose scheme for landslide and flash flood risk reduction
4.1 Field monitoring
4.2 Fullscale demonstration at site
Output5: Appropriated adaptation approaches fit to various area
5.1 Considering among adaptation appoaches such as economic/ social
Sediment Group : Suttisak Soralump (KU) , Chaiwat Ekkawatpanit(KMUTT),Duangrudee Kositgittiwong (KMUTT) and So Kazama (Tohoku U)
Output1: Landslide Database
1.1 data collection (landslide, population and infrastucture) update
Output2: landslide risk map
2.1Improve the climate change projection in the future (revise from IMPAC-T)
2.2 landslide risk map
Output3:Vulnerability map
3.1 Project the SSP(Shared Socioeconomic Pathways)
Output4:Integated climate change impact assessment
4.1 Analysis of Climate change impact and SSP projection
Output5: Appropriated adaptation plan (land use planning)
5.1 Consider land use plan appoaches such as economic/social

CONTENTS TO BE INCLUDED IN THE RESEARCH PLAN

I. Title of Research (Group category*1)
Knowledge sharing for planning comprehensive strategy to CC (ST-3)

II. Organizations
i. Thai and Japanese representatives, affiliated organization
Dr.Weerakaset Suanpaga (Kasetsart University)
Dr. Chaiporn Jaikaew (Kasetsart University)
Dr. Jitti Niramitranon (Kasetsart University)
Dr. Hiroaki Shirakawa (Nagoya University)
Dr. Eiji Ikoma (The University of Tokyo)

ii. Related organizations and type of their participation*2
a. Collaborating organizations
University of Tokyo

b. Organizations providing data for the research
ONEP,DWR,OAE,RID and TMD

c. Organizations utilizing results of the research and their institutional role in Thailand
The results of ST3 will contribute to develop the National adaptation plans. The roles of the above organization is as follows; provision of data, comments/feedback for the research results, participation for co-design process such as workshops.

III. Research sites*3
Whole Thailand

IV. Societal Needs for the Research
i. Issues and phenomena adversely affecting the society in relation with the research
Natural hazards, such as flood, drought, gave serious impacts on citizen, and industries in Thailand. For example, in Chao Phraya Basin, huge flood was occurred in 2011. On the other hand, serious drought was occurred in 2015 in the same basin. It is afraid that natural hazards will increase and give more serious impacts on the society due to climate change.

ii. Governmental policy and measures in relation with the research
The Thai government issued "National Climate Change Master

REMARKS

*1: describe a category to which the research belongs as listed below

List of category:
- ST1...research under ST1
- ST2-W...research under ST2 water
- ST2-F...ST2 forest
- ST2-R...ST2 fural
- ST2-U...ST2 urban
- ST2-C...ST2 coast
- ST2-S...ST2 sedimentation
- ST3...research under ST3

*2: describe assumed participation of organizations such as providing information, comments and feedback to the Research, participating in workshops, being a member of co-design process, etc.

*3: describe research sites

*4: describe a period of total research and each major activity as "Research Team's Plan of Operation"

Plan" in 2015. The plan indicates basic direction of adaptation policy. And the government has created "National strategy on climate change" by every five year.

iii. Needs for the Research to solve i) and/or realize ii)

In order to promote adaptation policies effectively, it is essential that various stake holders' understanding and cooperation on the policies. Therefore, it is important to make clarify the natural and social impacts of each policies, and to share that results among stake holders.

V. Challenges to the Research

i. Availability of related research and project, its status as well as its relation to the planned research

Regarding with evaluation of adaptation policy, there are many studies which evaluate from view point of economic aspect, however, the number of comprehensive study which includes non-economic factors are sill limited. Bruin et al.(2009) examine the priority of adaptation policies in Holland by using multi criteria analysis. They evaluate 7 sectors' 96 policies from eight criteria, in short, importance, urgency, no regret, co-benefit, mitigation effect, technological complexity, social complexity and institutional complexity. However this study does not examine the portfolio of policies. The purpose of study of ST-3 is to examine the portfolio of various adaptation policies to build resilient society.

ii. Expected challenges to derive results from the research

The first, it is needed to make clarify that adaptation policy options. The second, it is important to examine evaluation criteria and evaluation methodology which are suitable for Thai society. In order to overcome these challenges, it is important to study not only policy evaluation in Thailand but also it in other countries.

VI. Expected Results

i. Expected Research Results and contributions to the Project

ST3 will develop policy simulation tool. The tool will help stakeholders to understand natural and social impacts by each adaptation policy and consider combination of policies.

ii. Anticipated "social implementation" (i.e. application to societal needs) of research results and conditions/process required for application

This study will contribute to make national adaptation policies under the cooperation of Thai Government through evaluation of adaptation policies.

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups

(1) Exchange/sharing of findings among other Sub-Team
(2) Development of web application for decision making support tool of adaptation policy.
(3) Creating knowledge base for National Adaptation Plans

VIII. Research schedule*4

(Appendix)

IX. Resource Input

i. Input by the Thai side

ii. Input by the Japanese side (Dispatch Japanese researchers, Receiving Thai counterparts to Japan, Procurement of equipment, Other cost to cover activities in Thailand)

dispatch Japanese researchers,
receiving Thai counterparts to Japan,
study meeting in Japan,
Statistics, GIS data
Publication of papers
PC

VIII 政府関係機関概要

報告書本文 ４－７節で記載した以外の ADAP-T に関連するタイの関係機関について、以下に記載する。TMD, RID, ONEP に関しては本文４－７節を参照。

表 VIII- 1 タイ主要関係機関一覧

名称(英語)		略称	名称(和)
情報・通信・技術省: Ministry of Information and Communication Technology （MICT）			
	Thai Meteorological Department	TMD	タイ気象局
農業・協同組合省: Ministry of Agriculture and Cooperatives （MOAC）			
	Royal Irrigation Department	RID	王立灌漑局
（1）	Land Development Department	LDD	土地開発局
（2）	Royal Forest Department	RFD	王立森林局
（3）	Department of Agricultural Extension	DOAE	農業普及局
（4）	Office of Agricultural Economics	OAE	農業経済室
（5）	Agricultural Land Reform Office	ALRO	農地改革局
天然資源・環境省: Ministry of Natural Resources and Environment （MONRE）			
（6）	Department of National Parks, Wildlife and Plant Conservation	DNPWPC	国立公園･動物･植物保全局
（7）	Department of Groundwater Resources	DGR	地下水局
（8）	Department of Marine and Coastal Resources	DMCR	海洋･海岸資源局
（9）	Department of Mineral Resources	DMR	鉱物資源局
	Office of Natural Resources and Environmental Policy and Planning	ONEP	天然資源･環境政策計画局
（10）	Department of Water Resources	DWR	水資源局
（11）	Thailand Greenhouse Gas Management Organization	TGO	温室効果ガス管理機構
内務省: Ministry of Interior （MOI）			
（12）	Department of Disaster Prevention and Mitigation	DDPM	災害防止･軽減局
科学技術省: Ministry of Science and Technology （MOST）			
（13）	Hydro-Agro Informatics Institute	HAII	農業水文情報研究所
その他			
（14）	National Research Council of Thailand	NRCT	国家学術会議
（15）	Bangkok Metropolitan Administration	BMA	バンコク首都圏庁

1　LDD（土地開発局）

1)　組織概要

名称（En）　Land Development Department, MOAC
略称　LDD
名称（和）　（農業・協同組合省）土地開発局
ビジョン　参加の原則に基づき、長期的な持続可能性を促進しつつ、土壌の肥沃度と農業生産性を向上させる。

2)　職務

1. 土地経済学に関連する土地データの国勢調査を含め、土壌調査を実施し、土壌資源マップを作成する。
2. 持続可能な土地資源のため、土地利用計画を実施する。
3. 土壌、土地改良、土壌と水の保全、流域保全並びに土地開発と農民の要求に付随するその他の課題に関連する研究と実験を実施する。
4. 関連する政府関係者、農民、および農民の要求に応じて土地開発技術を普及する。

3)　組織図

組織体制：本部（バンコク）－Regional Office（12 Offices）－Provincial Office（76 + Bangkok Office）となっている。

Provincial Office には、ボランティアがいて、全ての村をカバーしている。LDD には土質を専門とする研究者もいる。各 Regional Office に分析部門も有している。

- Office of the Secretary
- Personnel Division
- Finance Division
- Planning Division
- Information and Communication Technology Center
- Office of Survey and Mapping Technology
- Office of Research and Development for Land Management
- Office of Science for Land Development
- Office of Engineering for Land Development
- Soil Resources Survey and Research Division
- Division of Soil Biotechnology
- Division of Land Use Policy and Planning
- Land Development Regional Office
- Land Development Station
- Khao Hin Sorn Royal Development Study Center
- The Royal Project Land Development Center
- Phikul Thong Royal Development Study Center
- Khao Cha-ngum Degraded Land Rehabilitation Study Center
- Nong Phlap – Klat Luang Land Management and Development

4)　ADAP-T との関係

LDD では Soil Resources Survey and Research Division が ADAP-T の主要 C/P 部門となる。加えて、ST2-Rural3 チームが Khon Kaen の Regional Office と研究を行う。

5)　気候変動に関する政策との関係

気候変動によりタイ東北部では塩害がより顕著になることも想定され、それに対する適応策や土地利用の規制、作付作物の変更といった施策を農民に指導する立場にある。ADAP-T の成果を活用し、社会実装を行っていくうえでも関係が深い機関である。

6)　水資源管理との関係

土壌改良等による節水型農業の実施により、効率的な水資源管理への関与が可能となる。タイ東北部における塩害には日本の研究者が継続的に研究を行ってきており、気候変動を踏まえた適応策を研究する意義は大きい。

2　RFD（王立森林局）

1)　組織概要

名称（En）	Royal Forest Department, MOAC
略称	RFD
名称（和）	（天然資源・環境省）王立森林局

2)　職務

タイにおける森林行政は、天然資源環境省（Ministry of Natural Resources and Environment）が担う。2002 年に森林行政は、王室林野局（Royal Forest Department）から天然資源環境省の下に移行し、国立公園・野生生物保護局、海洋沿岸植物局、林野局の 3 部局へと再編されている。

タイの森林行政に関する法制度としては、森林管理法（1941 年）、国立公園法（1961 年）、国有保存林法（1964 年）、森林プランテーション法（1992 年）、野生生物保全・保護法（1992 年）がある。このほか、1990 年初頭よりコミュニティ林業法の制定が議論され、2007 年に法案は議会を通過しているが、一部のコミュニティにおいて、保護区域内にある既存のコミュニティ林へのアクセスを妨げかねないといった批判もあり、法的な異議申立てによりその施行は先延ばしになっている。

タイでは、民有地に造成された森林を除いて、森林はすべて国が所有している。FAO によれば、220 万ヘクタールの森林が民間企業または個人の所有と推計されている。

3)　組織図

組織の全体像は不明。

4)　ADAP-T との関係

ADAP-T の C/P となる部局も不明である。

5)　気候変動に関する政策との関係

現時点で気候変動適応策に関する RFD としての政策等は持っていない。ONEP から出される方針に従って、その時点の Director から指示が出されている状況にある。

気候変動緩和策、適応策において、森林政策の果たす役割は大きく、ADAP-T における森林に関連する研究成果を RFD の政策決定に反映できる可能性がある。

6) 水資源管理との関係

統合水資源管理の観点から森林の管理・運営は密接な関係があり、健全な水循環を構築する上で重要な要素となる。森林による水資源の涵養について、その機能はわかっているものの、科学的な根拠に基づく研究がなされることは意義が高い。

3 DOAE（農業普及局）

1) 組織概要

名称（En） Department of Agricultural Extention, MOAC
略称 DOAE
名称（和） （農業・協同組合省）農業普及局

2) 職務

農業普及局は以下に示す権限と責務のもとで、農業生産量の増大、農産品の価値の増大、農業振興に関する施策やガイドラインの確立、商品や生産物の品質コントロール、所得創出のための農業技術移転、生産保障、農業キャリア確立などのタスクを請け負う。

1. 農業従事者や営農組織を奨励、育成する。
2. 農業従事者に対して職業訓練や農業サービスを提供する。
3. 農業従事者に向けて、農業知識の移転や農作物、水産物、畜産物のマネジメントについて奨励、調整を行う。
4. その他、局の権限と義務に基づき法的に必要、あるいは省や内閣が任命するタスクについて実行する。

3) 組織図

組織の全体像は不明。

4) ADAP-T との関係

ADAP-T の C/P となる部局も不明である。

5) 気候変動に関する政策との関係

渇水に強い水稲栽培の技術や科学的な材料の適用などをすることにより、将来の気候変動への適用性を高めようとするというモチベーションを持ち合わせているが、DOAE としては現時点では、気候変動に関する政策等は持っていないと、ヒアリングにおいて確認をした。DOAE は、ADAP-T においては、ST2-Rural1 チームと協働する予定となっている。

6) 水資源管理との関係

渇水への耐性の高い水稲栽培や経済作物の普及によって、効率的な水資源管理への貢献

が期待される。

4　OAE（農業経済室）

1)　組織概要

名称（En）	Office of Agricultural Economics, MOAC
略称	OAE
名称（和）	（農業・協同組合省）農業経済室
職員数	約 600 名（うち、バンコクに約半数、Bureau of Agricultural Development Policy and Planning に 80-100 名のスタッフが在籍している。）

2)　職務

OAE は、タイの農業分野の基本政策文書となる農業開発計画（Agricultural Development Plan）を策定している。現在実行中のものは 2012～2016 年を計画年次としている。

OAE の農業開発政策・計画局は、農業に係る CCAP および NAP を作成する中心部局であり、MOAC 内の各部局が作る政策を調整し、ONEP への協力も行う。OAE は農業に係る CCAP および NAP を取りまとめる機関であり、NAP に係る調査事業も実施している。

3)　組織図

組織の全体像は不明。

4)　ADAP-T との関係

ADAP-T では、ST2 Rural（農業農村）-2 と ST3-I（情報共有と適応策のための政策プログラムの総合評価）と関係があり、後者の C/P は農業開発政策・計画局（Bureau of Agricultural Development Policy and Planning）となる。

5)　気候変動に関する政策との関係

OAE は農業分野の気候変動戦略計画と気候変動適応策（NAP）の立案を担当している。ADAP-T の社会実装でも重要な役割を担うと考えられる。

6)　水資源管理との関係

OAE の水資源管理との関連性は不明。

5　ALRO（農地改革局）

1)　組織概要

名称（En）	Agricultural Land Reform Office
略称	ALRO
名称（和）	農地改革局
設立	1973 年

2) 職務

- 農民に土地と住宅地を配分する。
- 再開発地域における自然環境資源の再活用
- 社会基盤開発支援
- 農地改革を試みる農民への資金援助

農地改革実施組織

ALRO は農地改革の実施母体として設置されており、政策決定権限を持つ NLRC の傘下において機能している。NLRC の議長は MOAC の大臣であり、政策策定や、農地改革プログラム承認の権限を持つ。NLRC は LRA の同一化（identification）、農家の選定基準、農業規模の策定といった、農地改革におけるガイドライン、指示、決まり事、規制などを定め、提供している。ALRO の機能監視も行っている。

ALRO の役割

省（ministry）を構成する数々の局（department）が存在するが、ALRO は局と同等の権限を持ち、農地改革プログラム実施を管理している。しかし、農地改革はその他の局の管轄にも影響するため、ALRO 自身の役割について再確認する必要も出てきている。ALRO は農地改革手配や、農地再配分管理も行っている。政府事業動向によると、ALRO は今後コーディネート機関として機能することになるという。その要望はむしろほかの政府機関から出ている。そうはいっても、農地開発の程度が比較的まだ進んでいない公的な土地においては、ALRO 自身が農家をはじめとして村の道路や小規模なため池を含む灌漑施設へ水を供給する役割として機能している。

3) 組織図

組織の全体像は不明。

4) ADAP-T との関係

ADAP-T の C/P となる部局は不明。

5) 気候変動に関する政策との関係

ALRO の気候変動に関する政策文書の有無は確認できていない。

ALRO はタイにおける農地改革の実施主体であり、気候変動適応策として農作物の適地適応作物への転作の指導といった施策などが想定され、ADAP-T における研究成果も同様に ALRO で活用可能であると考えられる。

6) 水資源管理との関係

ALRO は灌漑施設を含む小規模なため池へ水を供給する役割があるとされており、新規開拓地等においては水資源管理と密接な関係がある。

6　DNP（国立公園・動物・植物保全局）

1)　組織概要

名称（En）　Department of National Parks, Wildlife and Plant Conservation, MONRE
略称　DNP
名称（和）　（天然資源・環境省）国立公園･動物･植物保全局
ビジョン：　森林保護地域の管理を行う中心的組織として、持続的に関与する。

2)　職務

1. 森林資源や野生動物を保全、保護、復元する。
2. 研究、開発および技術サービスを行う。
3. 森林資源や野生動物の管理について、適切な技術に基づいて関与していく。
4. バランスのとれた、持続可能な天然資源の利用を促進する。

3)　組織図

天然資源環境省
国立公園・野生動物・植物局
中央

- 局次長
- 監査官
- 9 級/10 級森林専門官
- 局内監査班
- 管理システム開発班

総務事務所

- 監督事務班
- 担当事務班
- 研修班
- 財務班
- 広報事務班

協定野生動植物保護部

- 一般事務
- 野生植物保護班
- 野生動物の国際取引規制監視班
- 野生動植物保全班
- 希少・絶滅危惧植物種研究班

法務部

- 一般事務

森林火災予防抑制制御事務所

- 一般事務
- 保全区域保護計画班
- 保護抑制実行班
- 森林火災処理班

計画情報事務所

- 一般事務
- 計画・予算班
- 評価フォローアップ班
- 王室プロジェクト調整班
- 国際渉外班　・情報センター

保全区域復元開発事務所

- 一般事務
- 保全区域復元班
- 森林資源調査分析班
- 情報地質班
- 保全林区域内土地・集落管理班
- 工学基準技術班
- 森林区域面積測量班
- 森林技術開発班

王室プロジェクト担当事務所

- 一般事務

・法務班
・調査班
・訴訟班

森林・種子保全研究事務所
・一般事務
・昆虫学・森林微生物学班
・エコロジー・森林環境班
・森林植物学班
・森林遺伝・バイオテクノロジー班
・保全林管理開発班

野生動物保全事務所
・一般事務
・野生動物保全区域管理班
・野生動物保護班
・振興拡充班
・野生動物研究班
・生動物育成班
・野生動物種維持区管理開発教育センター

・第 1-16 保全区管理事務所
・一般事務
・資源保全保護班
・火災予防・対応班
・保全区域復元開発班
・国立公園班
・野生動物保全班
・水源管理班
・研究班

・王室プロジェクト調整班 1
・王室プロジェクト調整班 2
・計画・予算班

水源保全管理事務所
・一般事務
・水源研究班
・水資源管理班
・水資源評価班
・水源集落振興開発班
・水源保全開発教育センター

国立公園事務所
・一般事務
・国立公園教育研究班
・レクリエーション班
・国立公園開発班
・国立公園内資源管理班
・国立公園開発管理教育センター
・国立海洋公園開発管理教育センター

（地方事務所）
・第 1-16 保全区管理事務所
・第 1 保全区管理事務所（プラチンブリ―）
・第 3 保全区管理事務所（バーンポーン）
・第 4 保全区管理事務所（スラータニー）
・第 5 保全区管理事務所（ナコーンシータマラート）
・第 6 保全区管理事務所（ソンクラー）
・第 7 保全区管理事務所（ナコーンラーチャーシーマー）
・第 8 保全区管理事務所（コンケン）
・第 9 保全区管理事務所（ウボンラーチャターニー）
・第 10 保全区管理事務所（ウドンターニー）
・第 11 保全区管理事務所（ピサヌローク）
・第 12 保全区管理事務所（ナコンサワン）
・第 13 保全区管理事務所（プレー）
・第 14 保全区管理事務所（タ―ク）
・第 15 保全区管理事務所（チェンラーイ）
・第 16 保全区管理事務所（チェンマイ）

4) ADAP-T との関係

ADAP-T の C/P となる部局は不明。

5) 気候変動に関する政策との関係

森林や海岸における気候変動に対する適応策については、国立公園内であれば関係機関と協力しながら DNP が検討する。CCMP に関して、ONEP への協力は実施している。

現時点で気候変動適応策に関する DNP としての政策等は持っていない。ONEP から出される方針に従って、その時点の Director から指示が出されている。

6) 水資源管理との関係

DNP は国立公園の管理や自然環境の保全を行っており、新規開発等では規制する側の立場である。洪水等、水関連災害のハード対策を実施する上では、科学的な根拠から開発と自然環境保全のバランスが考慮され、事業の実施が促進されることが望まれる。

7　DGR（地下水局）

1)　組織概要

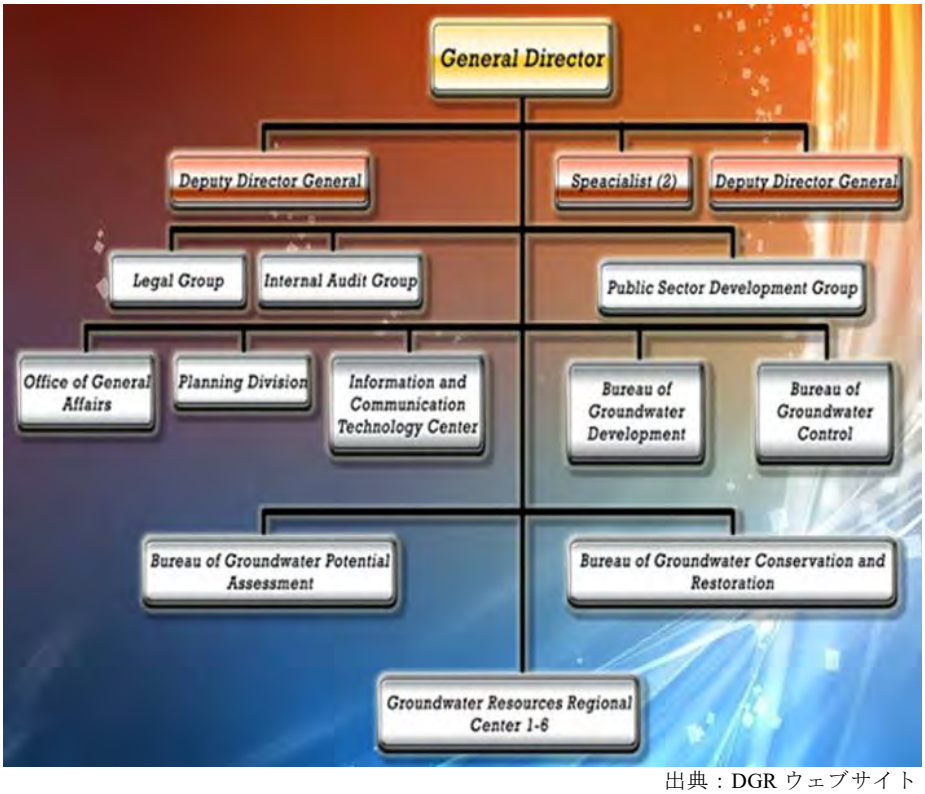
名称（En）	Department of Groundwater Resources
略称	DGR
名称（和）	地下水局
ビジョン	水資源分野の国防と持続的な将来開発を確固たるものにするため、タイの総合的な地下水源開発を管理する。

2)　職務

任務と主な役割

- 持続的な国家開発成長を促進するため、地下水源を管理・開発する。
- 透明な施行手順に基づいた法律と規制のもとに、地下水源の有効利用と保護を規制する。
- 水力地学（hydrogeology）調査・検討を行い、地下水源ポテンシャルについて評価する
- 開発と最新の技術移転を地下水局職員に対し継続的に行う。
- 地方の地下水源管理事務所職員の自助力（self-sufficiency）を向上する。
- 地下水源を利害関係者・利害関係セクターへ公平に分配するシステムを確立する。
- GIS システムと水力地学（hydrogeology）データベースを開発・効率化する。
- モニタリング・システムと地下水調査手順の開発、地下水の過剰利用が引き起こす地下水量減少と水質への悪影響の周知
- 適切な技術を以て不完全な地下水環境を修復する。
- 地下水局内において、透明な、バイアスのない、かつ効果的な性格を持つ管理システムを確立する。
- 地下水局の任務に直接的に関与する技術研究活動の促進。
- 地下水源の適切な利用についての市民の理解度を高める。
- 民間セクターへ、地下水源についての管理、開発、水質分析等の情報提供・指導を行う。

3)　組織図



出典：DGR ウェブサイト

4)　ADAP-T との関係

ADAP-T の C/P となる部局は不明。

5)　気候変動に関する政策との関係

気候変動による影響により、地下水資源に対する負荷、依存が増大する恐れがある。一方で、塩害地域においては海面の上昇に伴い、地下水の塩水化といった影響が予想されており、IPCC2007 においても、「気候変動による地下水への影響により、元来淡水資源に乏しく、地下水が利用可能な唯一の淡水資源であるような地域では、近い将来、地下水さえも利用不可能または利用に適さない状態になる恐れがある」と警告している。

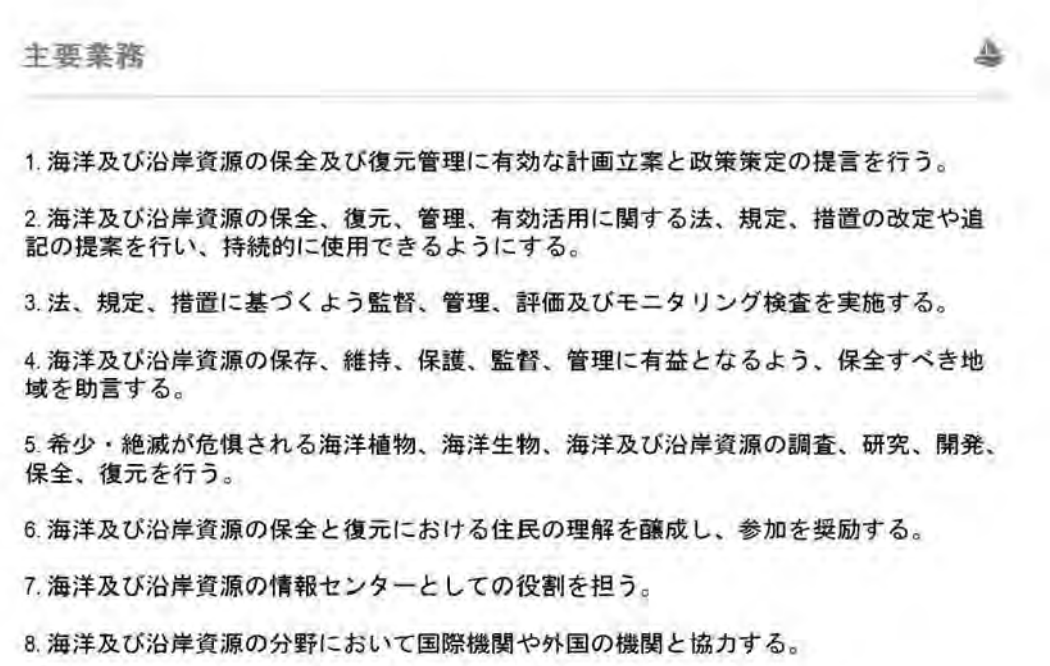
6)　水資源管理との関係

水資源管理において地下水の持続可能な活用は重要な要素であり、ADAP-T による研究成果により気候変動による地下水への影響や適切な管理手法が提案されることで、気候変動によって起こるであろう影響に対して、戦略的に地下水を管理・活用することが可能となる。

8　DMCR（海洋・海岸資源局）

1)　組織概要

名称（En）　Department of Marine and Coastal Resources, MONRE
略称　DMCR
名称（和）　（天然資源・環境省）海洋･海岸資源局
ビジョン



出典：DMCR ウェブサイトの組織図を調査団が翻訳

2)　職務

1. マネジメントの観点から海洋と沿岸地域の資源を保全・回復する計画を作成するための意見を述べる。
2. 海洋と沿岸地域の資源を持続可能な形で利用できるよう、保全・管理および使用に関する規制や施策を更新・改正する。
3. 規制や施策に従って、監督・モニタリングを行う。
4. 海洋と沿岸地域における資源の保全・保護・制御のための推奨リソースを保護する。
5. 絶滅危惧種を含む希有な海洋植物や動物など、海洋と海岸地域の資源の保全・回復に向けた研究開発。
6. 海洋と沿岸地域における資源の保全・回復に関する国民参加を奨励し、理解を醸成する。
7. 海洋と沿岸資源についてのゼロ情報。
8. 海洋と沿岸地域の資源に関して国際機関や他国と協調する。

3)　組織図

出典：DMCR ウェブサイトの組織図を調査団が翻訳

4)　ADAP-T との関係

ADAP-T においては、Marine and Coastal Resources Research Institute が DMCR 内の C/P となり、ST2-C において協働する予定となっている。

5)　気候変動に関する政策との関係

沿岸地域の保全の観点から、海面上昇に対する対応策を検討すべき立場にある。一方で、気候変動適応策に関する政策等を有しているかは不明。

ADAP-T の研究成果が海面上昇等の気候変動による影響を考慮された政策、施策として採用されることにより、気候変動に脆弱な沿岸域に対し有効な対策が可能となる。

6)　水資源管理との関係

台風やサイクロンといった水関連災害の管理、被害の軽減を実施する上で、ADAP-T による研究成果は重要である。

9　DMR（鉱物資源局）

1)　組織概要

名称（En）	Department of Mineral Resources, MONRE
略称	DMR
名称（和）	（天然資源・環境省）鉱物資源局
ビジョン	鉱物資源局は、社会全体の利益と幸福のため、人々の参加を通じて鉱物資源を管理する。

2)　職務

1. 鉱物資源の保護・節約・回復や鉱物資源の管理のための分野、政策や計画を推奨する
2. 鉱物法の関連セクションで指定された職務を実行する。
3. 鉱物資源の管理に関する法令、規制、対策の改良・修正・発効に対して推奨するとともに、関連する法令、規制、対策についてモニタリングと執行を実施する。
4. 鉱物資源の調査、検査、研究、能力開発・分配・サービス並びに鉱物資源に関する協調を他国や国際機関と行う。
5. 地質や鉱物に関する基準を設定し、国家の参考のために鉱物サンプルを保存する。
6. 上述の他、法で指定された、あるいは天然資源環境省や内閣によって割り当てられた、その他の職務を実行する。

3)　組織図

出典：DMR ウェブサイト

4)　ADAP-T との関係

ADAP-T においては、DMR 内の C/P として Bureau of Environmental Geology が、ST2-S と協働する予定となっている。（上図網掛け部）

5)　気候変動に関する政策との関係

気候変動等に伴い、土砂関連災害の増加も憂慮されており、DMR がタイにおける担当機関となる。土砂災害危険地域における重要インフラ施設に対する防災施策等、ADAP-T の研究成果が有効活用される。

6)　水資源管理との関係

土砂関連災害の管理、被害の軽減を実施する上で、ADAP-T による研究成果は重要である。

10　DWR　（水資源局）

1)　組織概要

名称（En）　Department of Water Resources, MONRE

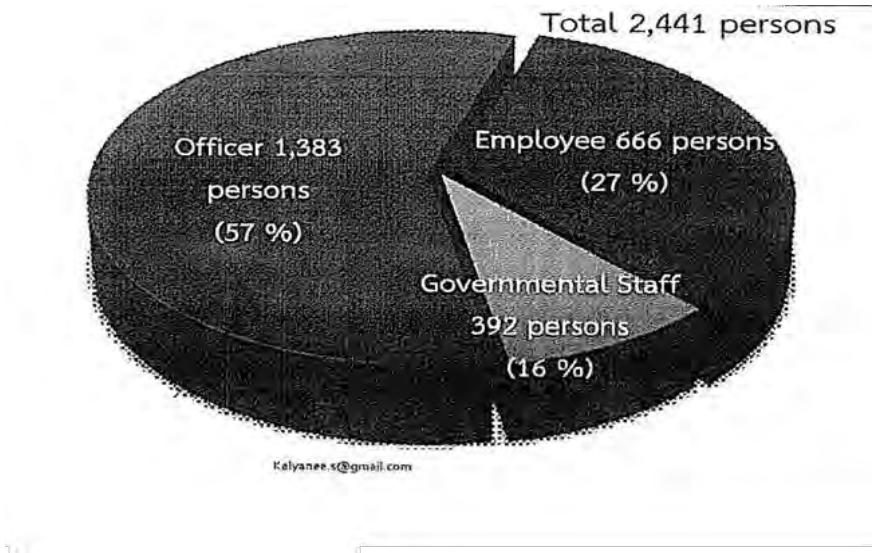
略称　DWR

名称（和）　（天然資源・環境省）水資源局

ビジョン　内閣は 2000 年 7 月 25 日、『国家水資源ビジョン』を策定し、2025 年までに、タイ国内全域で安全な水へ十分なアクセスを可能にするために、規律と持続性のある水資源管理組織および法の整備をさまざまなセクターの協力の下で進めていくことを発表した。『国家水資源ビジョン』に続いて、2000 年 10 月 31 日に『国家水資源方針』を策定。1997 年タイ王国憲法に基づき、ネットワーク構築、開発、他の資源管理と一体となった水資源管理に重点を置き、環境への影響に配慮しつつ、経済、社会の発展を促す水資源管理を行っていく方針が示された。

2002 年の省庁改組で組織された水資源局（DWR）は、水資源に関する政策、基本計画の策定、教育研究、資源保全推進、水域の再生などを行う局レベル組織である。住民との協働事業も進めており、流域小委員会を通じて住民参加を奨励している。

職員数　2,441 名



出典：DWR プレゼンテーション

2)　職務

・ 水資源に関する政策、基本計画を策定する。
・ 水資源の管理、開発、保全、回復並びに水関連問題の調整、監視、評価、問題解決を行う。
・ 持続可能な水資源開発に向けて、マクロレベル並びに流域レベルの双方において、水資源に関する能力開発、基準策定、技術移転を行う。
・ DWR の所掌範囲には、洪水、渇水、鉄砲水、地すべりといった水関連災害も含まれるとしている。

3)　組織図

DWR は以下の組織から構成されている。

-開発･水文学研究部
-水資源管理部
-水資源政策・計画部
- 流域保全・修復部
-水資源危機防止センター
-総務部、内部監査部、法務部、行政組織改善部
- 住民連携推進部
- 水域開発部
- 国際協力連携部
- 水資源情報センター
- 地方水資源部（第 1～10 管区地方事務所）

出典：DWR プレゼンテーション

4)　ADAP-T との関係

DWR の所掌業務は、ADAP-T とは幅広く関連しており、現時点では ST3-K（情報共有と適応策のための政策プログラムの総合評価）における協業が想定されているが、今後、各研究チームの研究が進む段階で関連する部局や情報共有を行うといった研究チームに関連する。

5)　気候変動に関する政策との関係

DWR が作成したタイ水資源管理戦略（WRMST）には、気候変動に係る適応策についての記述が不足しており、NAP その詳細を記載していく必要がある。そのためには、気候変動によって変化する気象条件と水資源管理への影響を明確に把握する必要があり、ADAP-T の成果に期待する。

なお、MONRE 内で CCAP を取りまとめる部局は ONEP であり、DWR が ONEP に対してインプットを行う。

6) 水資源管理との関係

DWR は、タイの水資源に係る政策立案者である。水資源分野では、オペレーターとして RID の存在が巨大であるが、水資源を統合的に管理する組織として、DWR が 2002 年に新しく設立された。

11 TGO（温室効果ガス管理機構）

1) 組織概要

名称（En）	Thailand Greenhouse Gas Management Organization
略称	TGO
名称（和）	温室効果ガス管理機構

2) 職務

背景

タイは 1992 年 6 月に UNFCCC に調印し、1995 年 3 月に会議に批准した。地球的規模の脅威である気候変動が深刻になっているが、タイは Non-Annex I 国の一つとして、気候変動問題に対処するため国際社会の実施施策への貢献している。京都議定書のもと温室効果ガス削減のための環境に優しくクリーンな技術を促すため、当該国の持続的な経済成長のための能力開発とともに、CDM 実施を促進している。MONRE は、内閣決議の結果 UNFCCC と京都議定書の実施機関となり、2007 年に MONRE は UNFCCC と京都議定書実施の制度フレームワークを改新した。

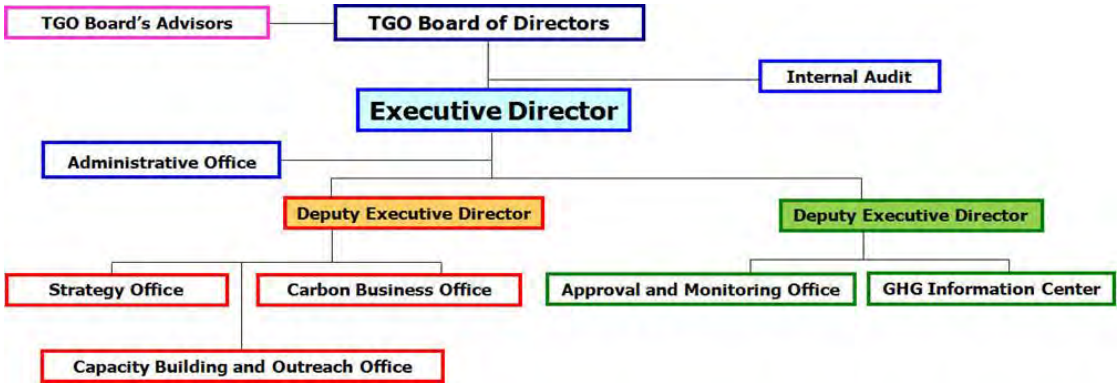
温室効果ガス管理機構（TGO）は、タイにおける GHG 排出削減のための実施機関として新しく設立された政府機関である。TGO は低炭素社会実現へ向けた行動、GHG 排出削減市場への投資、GHG 情報センターの設立、承認へ向けた CDM プロジェクトのレビュー、能力開発の機会提供と CDM 利害関係者への積極的な救済、低炭素促進のための行動、特にタイにおける DNA-CDM 事務所の役割の向上、などといった特定の目的をもって設立されている。

TGO の目的と義務

Letter of Approval の発行とプロジェクト管理に向けた CDM プロジェクトの分析とスクリーニング;

- CDM プロジェクトと CER 市場の促進;
- To be the National Information Clearing House of Greenhouse Gas;
- 温室効果ガス削減管理に取り組む政府と民間セクターの能力開発
- 市民への温室効果ガスに関する情報共有
- 気候変動緩和に関するすべての行動の促進と支援

3)　組織図



出典：TGO ウェブサイト

4)　ADAP-T との関係

TGO では、ワークショップ等の手段により ASEAN 支援の一環として 10 カ国への技術や情報の普及に取り組んでいるとのことから、ADAP-T の成果の内外への情報発信において、協調・実施することを模索することとしている。

5)　気候変動に関する政策との関係

TGO は上述のとおり、特に気候変動緩和策のうち、タイにおける GHG 排出削減を実施する機関として設立されており、気候変動との関係は深い。

また、TGO では ASEAN 支援の一環として 10 カ国への技術普及に取り組んでおり、それらの国からも気候変動適応策に関する要望があったとされており、ADAP-T の研究成果にも関心が寄せられている。

6)　水資源管理との関係

TGO と水資源管理との関連性は不明。

12　DDPM（災害防止・軽減局）

1)　組織概要

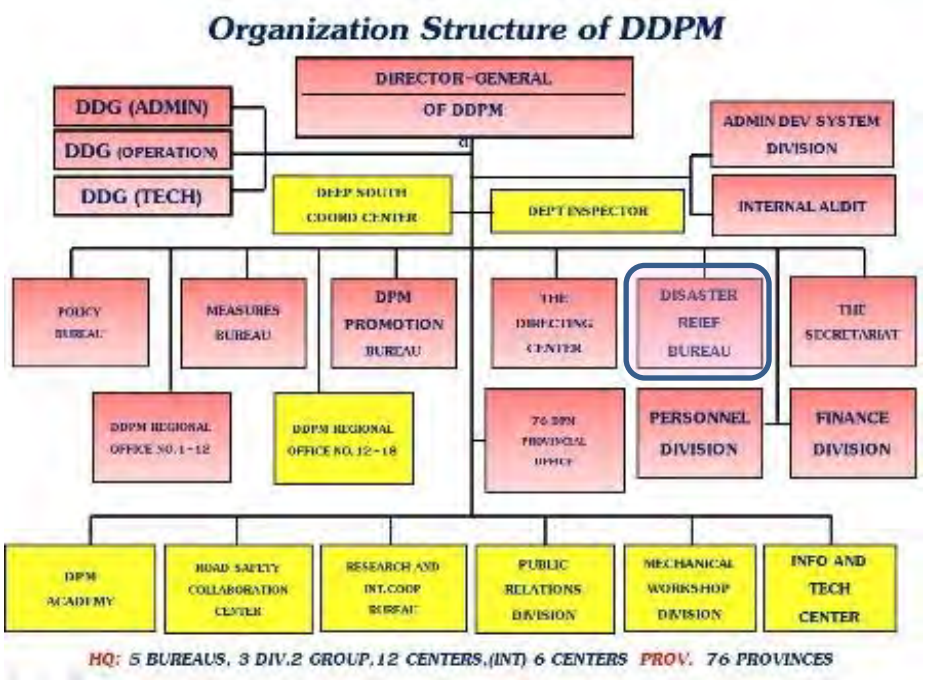
名称（En）	Department of Disaster Prevention and Mitigation, MOI
略称	DDPM
名称（和）	（内務省）災害防止･軽減局
ビジョン	DDPM は、災害時に緊急対応を行う組織である。国家的な大災害については首相直轄で危機対応がなされるため、実質的には中小規模災害への緊急対応が主な業務である

2)　職務

- 災害防止と軽減に関する政策、指針及び施策を策定する。
- 災害防止、警報、軽減に関する調査、分析、研究、システム開発を行う。
- 災害防止と軽減に関する IT 技術を整備する。

・ 災害防止活動に対する人々の参加を促進する。
・ 災害リスクに対する意識を啓蒙する。
・ 災害マネジメントや災害救援に対する能力強化やスキル向上のための研修を提供する。
・ 被災者や災害復旧を支援するためのプログラムを促進、支援、実施する。
・ 大規模災害における被災者を支援するための事業を指揮、調整する。
・ 国内および国際機関/組織とのコーディネートを行う。

3) 組織図



出典：DDPM ウェブサイト

4) ADAP-T との関係

ADAP-T の C/P となる Natural Disaster Policy Division は組織図の Disaster Releaf Bureau（網掛け部）に属している。加えて、ST2-Water（淡水）1 の研究チームが Phitsanulok の地方事務所と協業することを予定している。

5) 気候変動に関する政策との関係

DDMP では CCAP や NAP といった政策文書を作る予定はないとしている。

但し、現在は TMD が実施している洪水予警報業務が DDPM に移管される予定とされており、気候変動適応策を実施する機関として重要な役割を担うものと考えられる。

DDMP は、"Master Plan for Flooding toward 2009-2014"（M/P ではなく戦略計画のようなものらしい）を作っており、ADAP-T がその改定に役立てばよいと考えている。

6) 水資源管理との関係

DDPM は様々な災害について関係機関と情報共有を行っている。洪水や渇水については RID、DWR および DGR と、海岸に関しては DMCR と、土砂災害については DMR と、森林破壊については RFD と、それぞれ連携している。

水関連災害の管理の観点から水資源管理に関係がある。JICA では DDPM に対して、「防災能力向上プロジェクト」のフェーズ 1 が 2006 年～2008 年、第 2 フェーズが 2010 年から 2014 年まで支援を実施した。

13 HAII（農業水文情報研究所）

1) 組織概要

名称（En）	Hydro-Agro Informatics Institute, MOST
略称	HAII
名称（和）	（科学技術省）農業水文情報研究所
ビジョン	より良い農業と水資源管理をサポートするための科学技術を開発･適用することが主な職責である。
背景	水資源と農業管理のための情報技術を提供するために､タイ統合水資源管理（TIWRM）と農業情報ネットワーク（AIN）というプログラムが National Electronics and Computer Technology Center（NECTEC）のもと設立された。それらの活動プログラムが、2009 年 1 月に農業水文情報研究所（HAII）科学技術省傘下の公的機関となった。
職員数	110 名（公式ウェブサイトより）

2) 職務

1. 農業や水資源管理に関するデータの収集・合成・分析を含む科学技術の研究開発を実施する。
2. 農業や水資源管理の効率性向上のために研究開発の成果を他の機関に普及する。
3. 国内外で、共同研究開発を推進する。
4. 公共の利益のために、アクセス可能かつ効果的にサービスを拡大し、研究開発の成果を普及する。

3) 組織図

組織図は不明。

4) ADAP-T との関係

ADAP-T との関係性は高いと考えられる一方で､現時点では HAII の ADAP-T における役割は特定されていない。

5) 気候変動に関する政策との関係

気候変動に対応するために、農業と水資源管理に関する科学技術の知見を発展させ適用することは、HAII のビジョンと合致しているが具体的な政策等は不明。

6) 水資源管理との関係

HAII は科学技術省の所管の本設立されている機関であり、タイ国内にある様々水資源や

農業関係の情報を集め、Thai Water Web（ポータルサイト）を構築している。

14　NRCT（国家学術会議）

1)　組織概要

名称（En）　National Research Council of Thailand
略称　NRCT
名称（和）　国家学術会議

2)　職務

背景:　The National Research Council of Thailand（NRCT）は国家学術会議法 B.E.2502（1959）を以て設立され、研究に関する事象を管理する国家機関の一部として内閣により選定された。NRCT はまた首相に要求された際に提言を行う役割を担っている。

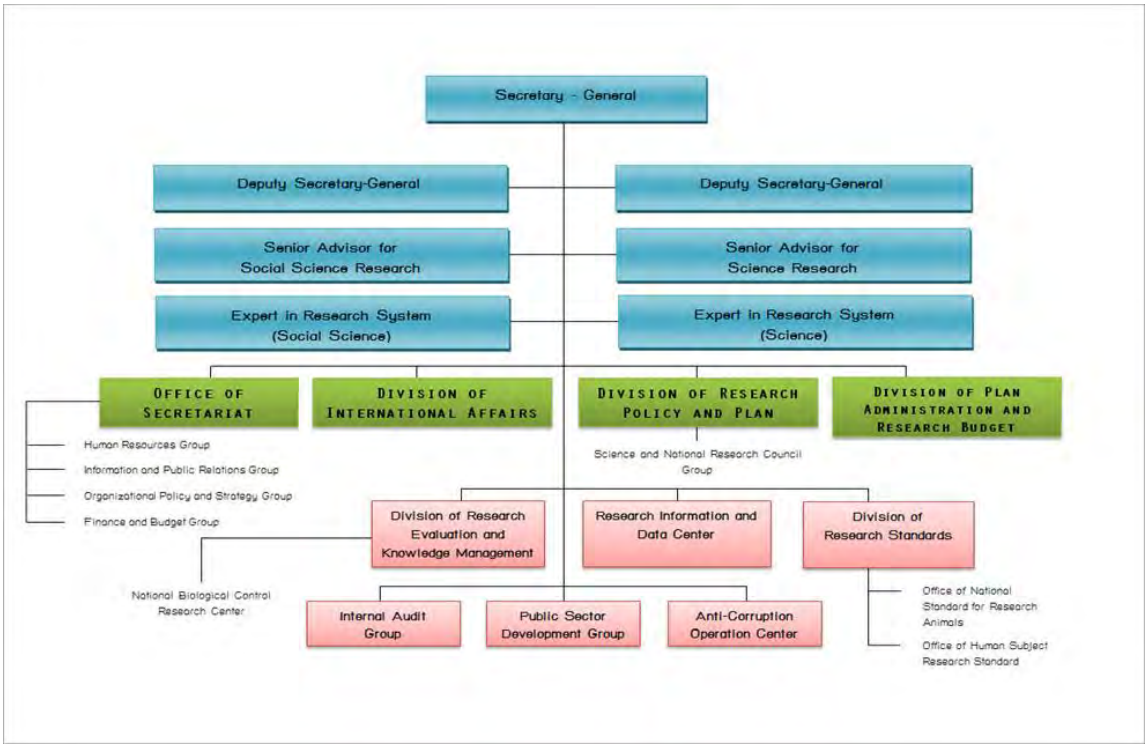
NRCT の実施機関は 3 つの部門を有している。一つ目は、首相を委員長、副首相を副委員長、そして大臣たちをアドバイザーとする国家学術委員会（National Reserach Council）、二つ目は国家学術調査委員会執行委員会（National Research Council Executive Board）、そして三つ目は事務局長を長とする、タイ国家学術調査委員会事務局（Office of the National Research Council of Thailand headed by Secretary-General）である。

国家学術会議政策と戦略:　NRCT の主な機能の一つに、国家学術会議政策と戦略の策定、そして国家の研究の方向性を定める、ということがある。5 年の期間にわたる国家学術会議政策・戦略は、1977 年に制定された。この戦略は政府機関により提出された年間予算配分の調査プロポーザルの分析のための調査実施ガイドラインとして策定されている。NRCT は国家経済と社会開発計画に関連する政策基準も作成している。

第 8 国家学術政策戦略（2012-2016）は、バランスのとれ持続性のあるタイ国家開発のため、質の高い研究を有効利用することを目的としている。予算配分の優先は以下の 13 の研究目的プロジェクトである；十分な経済成長への適用、国家安全保障とグッドガバナンス、教育改革と知識の創造、水資源管理、地球温暖化と再生可能エネルギー、持続的な農業、健康促進、伝染病の予防（Prevention and Rehabilitation）、環境の管理と開発、工業セクターへの最新技術の投入、観光業管理、高齢化社会、ロジスティクス、そして研究システム改革である。現在の政策・戦略は以下の 5 つの戦略を擁している。

- 社会的可能性と能力の開発
- 経済的可能性と能力の開発
- 自然環境と環境資源の保護と促進
- 潜在的な研究者の発掘と能力開発
- 知識管理、研究成果、改革、投資、資源、そして知識の商業的・公的有効利用へ向けた国家学術研究システムの改革と、それらが公的社会と市民社会に広く共有されること

3)　組織図



出典：NRCT ウェブサイト

4)　ADAP-T との関係

ADAP-T においては、タイ国内で発生する費用に対する国内研究資金の提供者としての役割が期待されている。

5)　気候変動に関する政策との関係

Climate Change Research Strategy for Thailand を ONEP と共同で策定している。

第 8 次国家研究方針・戦略（2012-2016）にも、ADAP-T と関係が深い Water-resource Management; Global Warming and Alternative Energy; Agricultural Sustainability が優先分野として挙げられている。

NRCT では気候変動に関する数多く研究を実施しており、Database を保有している。

6)　水資源管理との関係

NRCT では水資源関連の研究もしていると思われるが、ADAP-T との関係性は不明。

15　BMA（バンコク首都圏庁）

1)　組織概要

名称（En）　Bangkok Metropolitan Administration
略称　BMA
名称（和）　バンコク首都圏庁

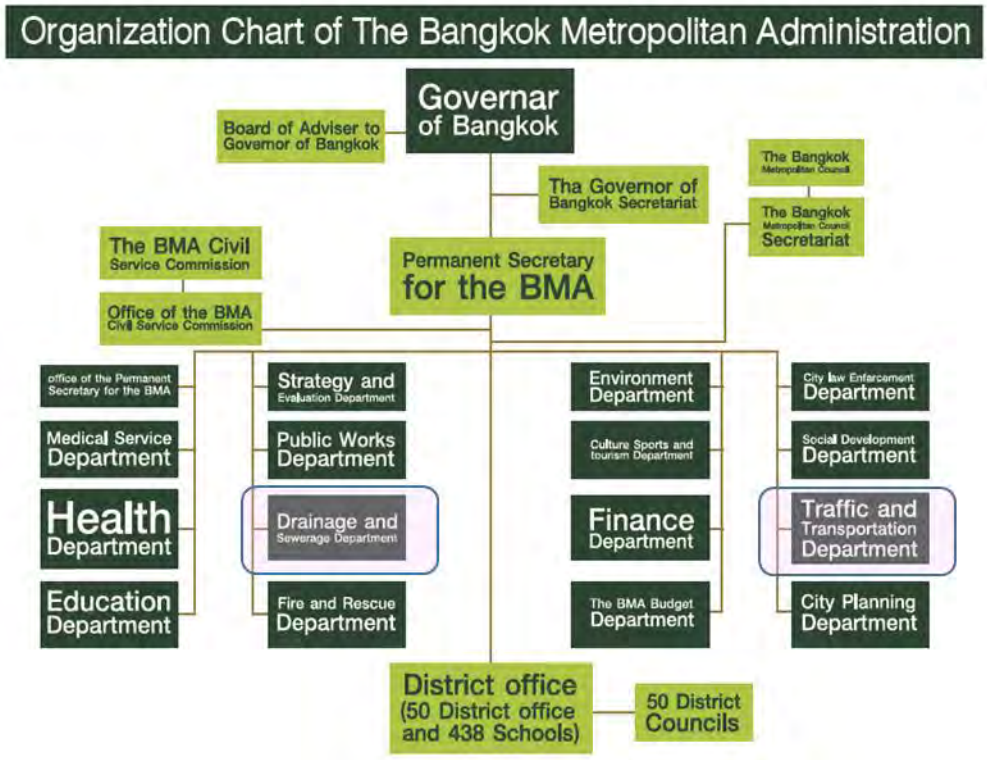
2)　職務

BMA の主な役割

バンコク都市条例法 1985（Bangkok Metropolitan Administration Act 1985）やその他の関連法によると、BMA の主な機能を果たす役割を以下に示す（特に ADAP-T に関連する分野を抽出）

- 災害の予防と緩和
- 都市計画
- 道路環境、河川と排水システム、道路の建設と維持管理、地方自治体を結ぶ排水システムの維持管理と情報提供
- 交通サービスと巨大交通網システムの提供
- スラム街の家屋とスラムの環境改善
- 環境の開発と保護
- インフラの提供
- 地方の開発計画の策定
- 観光業の促進
- 廃棄物、し尿、排水の処理
- 山岳地帯と自然環境の保護
- 地方開発における地方自治体の権威向上と促進
- 特定の法律に応じて地方自治体に資金を配分
- 技術開発の促進
- 排水処理施設の維持管理
- 環境汚染管理

3)　組織図



出典：BMA ウェブサイト

4)　ADAP-T との関係

2015 年 11 月の段階で、ADAP-T に BMA が関与することは間違いないが、C/P の部局、担当者は明確になっていない。ST2-U との協業が想定されており、Drainage and Sewerage Department や Traffic and Transportation Department の参画が期待される。

5)　気候変動に関する政策との関係

JICA の協力によって、バンコク都気候変動対策マスタープランを作成している。

ADAP-T における研究成果が、バンコクにおける都市計画、排水計画、交通計画等に活用されることが期待される。

6)　水資源管理との関係

バンコク都市圏の運河や排水を管理し、汚水処理を実施するなど、BMA も水資源管理に関与している。

また、渇水時の節水の呼びかけや洪水に対する警報など、市民と直結する活動を実施していることから、ADAP-T との関連性が高い。

IX　質問票

１．各研究チームへの研究計画提出の要請

October 14, 2015

THE ADVANCING CO-DESIGN OF INTEGRATED STRATEGIES WITH ADAPTATION TO CLIMATE CHANGE IN THAILAND （ADAP-T）

Request to Each Research Group for Preparation of Research Plan

The Advancing Co-Design of Integrated Strategies with Adaptation to Climate Change in Thailand （ADAP-T） project （hereinafter referred to as "the Project"） will be carried out by the below three Sub-Teams:

Sub-Team 1: Development of knowledge base for climate change（CC）
Sub-Team 2: Assessment of adaptation measures to CC and development of co-design method
Sub-Team 3: Knowledge sharing for planning comprehensive strategy to CC

Under these Sub-Teams, a total of 16 Research Groups （i.e. 4 Groups, 11 Groups and 1 Group, respectively） will be formed to engage in the Project.

Sub-Team 2 is composed of Research Groups across six sectors: fresh water, rural, forest, urban, sedimentation, and coastal. Each group under Sub-Team 2 is expected to prepare adaptation measures and their impact assessment based on the research. Some member institutions of Sub-Team 3 are expected to utilize research results in the revision of the National Adaptation Plan.

These Research Groups formed by the participation of the Thai government organizations and research institutes, together with the Japanese research institutes, will be guided by shared Objectives, Results, Activities and Research Schedule. In order to ensure that the envisaged results from the Research Activities will turn into Project Outputs（shown in the figure）, leading to the achievement of Project Purpose by the end of the Project period, that is 5 years from its start, each Research Group is asked to prepare Research Plan as specified below.

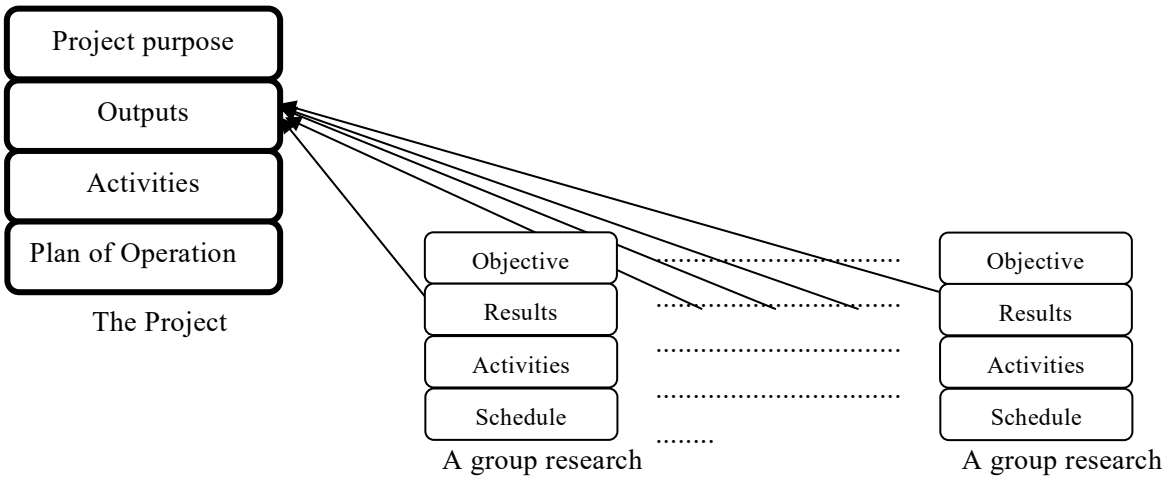


Fig. Project Outputs and Results of Researches

1. **Outline of Preliminary Research Plan**

   See attached.

2. **Preliminary Timeline**

   - Each Research Group prepares a Preliminary Research Plan by the end of October, 2015 and the Plan will be attached to the Minutes of Meeting to be signed as a result of the second detailed survey of the Project to be dispatched from November 16, 2015.
   - Each Research Group completes its Research Plan for the finalization at Joint Coordinating Committee（JCC), to be scheduled by the sixth month after the start（April 2016（planned））of the Project.
   - Research progress will be monitored against approved Research Plan by the Research Groups, and discussed and revised（if necessary）at JCC periodically.

End

Attachment

CONTENTS TO BE INCLUDED IN THE RESEARCH PLAN

I. Title of Research（Group category*1）

II. Organizations
  i. Thai and Japanese representatives, affiliated organization
  ii. Related organizations and type of their participation*2
    a. Collaborating organizations
    b. Organizations providing data for the research
    c. Organizations utilizing results of the research and their institutional role in Thailand

III. Research sites*3

IV. Societal Needs for the Research
  i. Issues and phenomena adversely affecting the society in relation with the research
  ii. Governmental policy and measures in relation with the research
  iii. Needs for the Research to solve i）and/or realize ii）

V. Challenges to the Research
  i. Availability of related research and project, its status as well as its relation to the planned research
  ii. Expected challenges to derive results from the research

VI. Expected Results
  i. Expected Research Results and contributions to the Project
  ii. Anticipated "social implementation"（i.e. application to societal needs）of research results and conditions/process required for application

VII. Major activities through research period, including exchange/sharing of intermediate findings with other Sub-Teams and/or other research groups

VIII. Research schedule*4

IX. Resource Input
  i. Input by the Thai side
  ii. Input by the Japanese side（Dispatch Japanese researchers, Receiving Thai counterparts to Japan, Procurement of equipment, Other cost to cover activities in Thailand）

REMARKS

*1: describe a category to which the research belongs as listed below

List of category:
- ST1...research under ST1
- ST2-W...research under ST2 water
- ST2-F...ST2 forest
- ST2-R...ST2 fural
- ST2-U...ST2 urban
- ST2-C...ST2 coast
- ST2-S...ST2 sedimentation
- ST3...research under ST3

*2: describe assumed participation of organizations such as providing information, comments and feedback to the Research, participating in workshops, being a member of co-design process, etc.

*3: describe research sites

*4: describe a period of total research and each major activity as "Research Team's Plan of Operation"

２．　研究チームに対するヒアリング実施時点の質問票（和文）

「タイ国における統合的な気候変動適応戦略の共創推進に関する研究」
第 1.5 次調査質問票（案）和文

第 1.5 次調査において、関係機関向けの質問票は、「I. 研究機関向け」、「II. 政府系機関向け」に分け、且つ、共通の質問項目と機関毎の個別の質問項目として、構成した。
第 1 次調査で既にコンタクトされている機関の場合、重複した質問事項もあることから、適宜、抽出をして質問を行う。

［研究機関向け　共通の質問項目］

1) プロジェクト・マネジャー

1) 研究計画概要（計画書に記載される内容の概要）

2) マイルストーンとなるべき成果・イベント

3) 他チームとの連携、調整事項

4) 政府機関への要望事項

5) 日本の研究機関への要望事項

6) JICA/JST への要望事項

［政府機関向け　共通の質問項目］

1) プロジェクト・マネジャー

2) 組織概要と気候変動適応策に関連する部署

3) インフラ等の将来開発計画

4) 気候変動適応策に関連する政策（CCMP に従って、現在実施中または計画・検討中の政策・施策があるか？）

5) 気候変動適応策に対する具体的なニーズ

6) 人材育成のニーズ

7) 研究機関からのアウトプットをどのように活用するのか？活用に向けた具体的なステップは？研究結果の活用にかかるスケジュール（マイルストーンはあるか？）

8) 研究機関への要望事項

9) 日本の研究機関への要望事項

10) JICA/JST への要望事項

３．研究チームに対するヒアリング実施時点の質問票（英文）

The Advancing Co-Design of Integrated Strategies with Adaptation to Climate Change in Thailand （ADAP-T）project

For Common Questionnaire for University/ Research Institute

(1) Outline main field and composition of the laboratory
(2) Who is Project Manager of the study in the ADAP-T Project?
(3) Outline of the study in the ADAP-T Project
(4) Milestones of the study
(5) Cooperation and coordination with other groups of ADAP-T Project
(6) Needs for human resources development
(7) Requests to Governmental organization of Thailand
(8) Requests to Japanese University/ Research Institute of Japan
(9) Requests to JICA/ JST

For Common Questionnaire for Governmental Organization

(1) Who is Project Manager of the study in the ADAP-T Project?
(2) Outline of the Organization （What are responsibilities in the government?）
(3) Relevance of measures of climate change adaptation; which department is in charge of CC adaptation?
(4) Policy for CC adaptation
(5) Needs for CC adaptation measures in your organization
(6) Needs for human resources development in your organization
(7) How to apply outcomes from universities/ research institutes in your organization? Implementation schedule and milestones
(8) Requests to universities/ research institute
(9) Requests to Japanese University/ Research Institute of Japan
(10) Requests to JICA/ JST

４． PDM/PO 作成に向けた Interview Guideline

Preparation date: 2015/10/14

INTERVIEW GUIDE FOR MEETING JICA EVALUATION ANALYSIS CONSULTANT ON RESEARCH PROJECT PREPARATION FOR "ADVANCING CO-DESIGN OF INTEGRATED STRATEGIES FOR[1] ADAPTATION TO CLIMATE CHANGE IN THAILAND"

Ahead of the full discussion between the Thai and Japanese parties to finalize project arrangement for the captioned （scheduled for November 16-20, 2015）, Dr. Maki will conduct scoping interviews with the select participants （individuals/organizations） in her capacity as JICA Evaluation and Analysis Member of the mission. She very much appreciates the time and attention extended by those asked for such interviews, to be coordinated by JICA Thai Office.

The preparation of the research project is expected to further mature between the time of this writing and her actual interviews. Thus, please consider the following "Indicative Topics for Interviews" as standard set of issues that come out from the evaluation and analysis perspective for JICA project. She will select, adjust and tailor the specific topics for each interviewee, depending on their association with the Project as well as preparation status for it.

While each interview will cover only a part of the points from the "Indicative Topics … ," please anticipate that each interview will star with the following big questions:

A. Where and in what ways will your intended research activities be conducted in the spirit of "co-designing"?

B. In the application, the Project's research activities are explained to progress in sequences, with the research results of Sub-Team （ST） 1 providing information for ST2 in order to evaluate adaptation options, and the results by ST2 in tern to inform the work of ST3. The ST provided research activity outlines （see attached table "Per Research Group Rough Sequences"） largely have not reflected such framework of the Project. Please explain how your intended Group work builds on the work of other Group（s）, or to be informed from the other Group（s）?

Thank you very much for your attention. Look forward to the opportunity to discussing so that the Project's scope will be finalized as scheduled.

[1] The original application used "with." During the course of upcoming discussions among the Project concerned parties, the author will promote the use of "for" instead for the more natural flow in English.

Attachment: Per Research Group Rough Sequences (Adapted from "ADAP-T PO 29Sep15.xlsx")

No	Name		Year 1	Year 2	Year 3	Year 4	Year 5
ST1: Development of knowledge base for climate change							
1	ST1-1IT	Information Technology (data portal)	Needs Survey	System Design	Programming	Testing	Training
2	ST1-2SF	Seasonal Forecast	Information to be received				
3	ST1-3FS	Future Scenario	Information to be received				
4	ST1-4GW	Groundwater	Mapping				Publication
ST2: Assessment of adaptation measures to CC and development of co-design method							
5	ST2-F	Forestry	Mapping			Adaptation Implementation	Evaluate Implementation
6	ST2-R1	Rural	Adaptation Technique Experimentation		Technique Improvement		(time reserved - for what?)
7	ST2-R2	Rural	Mapping		Development of Adaptation Approach	Development of Adaptation Approaches	
8	ST2-R3	Rural	Mapping/Analysis		Development of Adaptation Approach	Development of Adaptation Models	
9	ST2-W1	Water	Data Collection	Analysis	Mapping	Risk Assessment	Development of Adaptation Approaches
10	ST2-W2	Water	Model Update	Analysis and Estimation		Development of Adaptation Measures	
11	ST2-W3	Fresh Water	Data Update	Forecasting/Mapping		Development of Adaptation Measures	
12	ST2-U1	Urban	Data Update	Data into Model	Development of Adaptation Measures		Technology Transfer to BMA
13	ST2-U2	Urban	Data Update	Data into Model	Development of Adaptation Measures		Technology Transfer to BMA
14	ST2-C	Coastal	Data Update	Forecasting/Mapping		Development of Adaptation Measures	
15	ST2-S	Sedimentation	Data Update	Model Update		Development of Adaptation Measures	
ST3: Knowledge sharing for planning comprehensive strategy to Climate Change							
16	ST3	(To be named?)	Information to be received				

INDICATIVE TOPICS FOR INTERVIEWS WITH JICA EVALUATION ANALYSIS CONSULTANT

1) RELEVANCE OF THE PROJECT

a. Project's relevance with the strategic plan of Thailand toward climate change
b. Relevance with the needs of beneficiaries
c. Comparative empirical and technological advantage of Japan's cooperation
d. Are the method/approaches of the project appropriate?
e. Is the draft Project Design Matrix（PDM）[2] appropriate to address the needs?

2) ANTICIPATED EFFECTIVENESS OF THE PROJECT（I.E. APPROPRIATENESS OF PDM/OUTPUTS/ACTIVITIES, AND PROSPECTS OF ACHIEVING PROJECT PURPOSE）

a. Is the Project Purpose appropriate?
b. Will the Project Purpose by derived as a result of Project Outputs?
c. Will the implementation of the Project produce appropriate benefits to the beneficiaries/target group(s)?
d. Are Outputs 1-3[3] appropriately formulated with the right set of indicators?
e. What are factors that will contribute to the achievement of the Project Purpose/Outputs?
f. What are factors that will hinder the achievement of the Project Purpose/Outputs?

3) ANTICIPATED IMPACT OF THE PROJECT（I.E. PROSPECTS FOR ACHIEVING PDM/OVERALL GOAL）

a. To what degree will the Overall Goal be achieved（and are indicators appropriate）?
b. What are the contributing factors for achieving the Overall Goal?
c. What are the hindering factors for achieving the Overall Goal?
d. Will the Project implementation affect development policies/institutions of Thailand, particularly those concerned with mitigation for/adaptation to climate change?
e. What are foreseeable positive and negative impacts outside the Project Purpose/Outputs that will derive from the Project?
f. Will the Project implementation produce negative impacts?

4) ANTICIPATED EFFICIENCY OF THE PROJECT

4）-1 Appropriateness/feasibility of PDM/Inputs

a. Are planned inputs and activities appropriate for achieving the Outputs?
b. Are inputs and activities to be appropriately implemented and managed to derive achievement of Outputs?

[2] She will bring a copy of the latest draft.
[3] She might propose the 4th Output, to be confirmed in the PDM draft to be shared at the interview.

c. What are external factors that affect the efficiency of the Project?
d. Provision of local budget by the Thai side（i.e. your organization）

4）-2 Implementation Structure

a. Overall structure of the implementation of Project – who are involved from the Thai side（i.e. your organization）？
b. On assignment of your organization's personnel（i.e. Counterpart Personnel – C/P） in terms of the number, placement（i.e. balance between their regular tasks and Project activities）, ownership and level of participation, including Project Director and Project Manager
c. On C/P training in Japan and in the third countries in terms of the number of participants, training contents, and the dispatched period and its timing
d. On provision of equipment by the Japanese side been in terms of quality, quantity and timing

5) ANTICIPATED SUSTAINABILITY OF THE PROJECT（I.E. PREPAREDNESS/SOUNDNESS OF INSTITUTIONS/ORGANIZATIONS THAT WILL SUPPORT THE ACHIEVEMENT OF THE OVERALL GOAL）

5）-1 Institutional Aspect

a. Will the policy of the Government of Thailand be expected to support and/or require the project produced research results?
b. Will respective agencies continue their institutional support for the further advancement of the research results as important agenda?

5）-2 Organizational Aspect

a. Will the implementation structure of the organization you are in continue to sustain?
b. Will respective agencies participating in this project continue to sustain its standing for responding to climate change agendas?
c. Are there no issues with regard to maintenance and management of the project provided equipment?
d. Are there prospects for securing further budget by the respective agencies?
e. Does each participating organization possess technical capacity to make use of the project produced research results, particularly in combination as a "co-designed portfolio"?
f. Are there any other issues to be noted in order to secure sustainability of the Project?

X．収集資料リスト

気候変動関係		
1	Thailand National Climate Change Master Plan and local authority	ONEP
2	Exective Summary of the Bangkok Master Plan on Climate Change	BMA
3	Climate Vulnerability and Capacity Analysis Report South of Thailand	BCR CC
4	タイ国 東南アジア地域気候変動緩和・ 適応能力強化プロジェクト	JICA
5	バンコク都気候変動マスタープラン（2013～2023)作成・実施能力向上プロジェクト	JICA
6	BMUB-IKI Support for integrating the agricultural sector into National Adaptation Plans (NAPs)	OAE
7	Thailand's Climate Change Research Strategy	NRCT
8	Climate Change Vulnerability Assessment in Thailand	NU
水資源関係		
1	Outlook on Water Governance in Thailand	MWA
2	Water Resources Manegement Strategy of Thailand (Draft,原文)	Policy Committee for Water Resource Management
3	タイの水資源管理戦略（案）	在タイ日本大使館
4	水資源法案 概念図	在タイ日本大使館
5	水資源法案 仮訳	在タイ日本大使館
6	タイにおける利水	在タイ日本大使館
7	METROPOLITAN WATERWORKS AUTHORITY (MWA) OF	MWA
8	BangkhenWater Treatment Plant	MWA
9	Provincial Waterworks Authority (PWA)	PWA
10	DWR組織概要	DWR
11	DDPM組織概要	DDPM
その他		
1	THE ELEVENTH NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT PLAN (2012-2016)	NESDB
2	TMD Meterological Data Service Form	TMD
2015年11月17日開催全体会合　資料		
1	Explanation of the Survey Result on ADAP-T	
2	Advancing co-Design of integrated strategies with AdaPtation to climate change in Thailand (ADAP-T)	
3	Study plan of ST3 Knowledge sharing for planning comprehensive strategy to climate change	
4	Thailand’s Climate Change Adaptation Planning & Progress	
5	Project Framework	
6	The Record of Discussions	
7	ADAP-T Outline(タイ語)	
8	Participants List	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