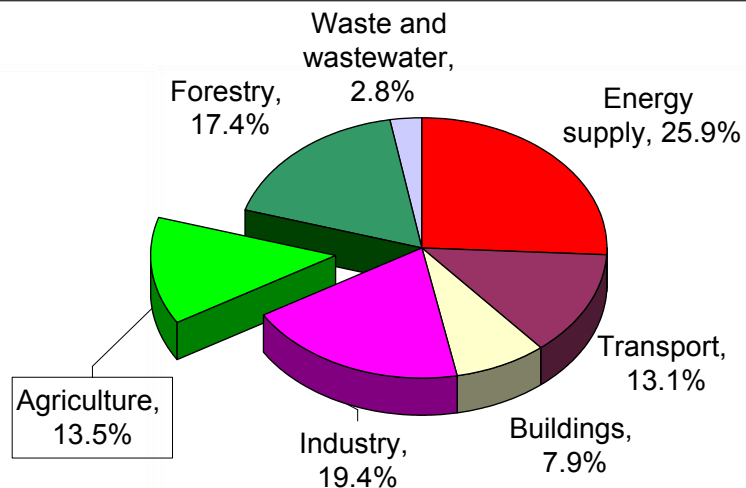


Greenhouse Gas Emission and Mitigation Potential of Agriculture: Highlighting Rice Production Systems

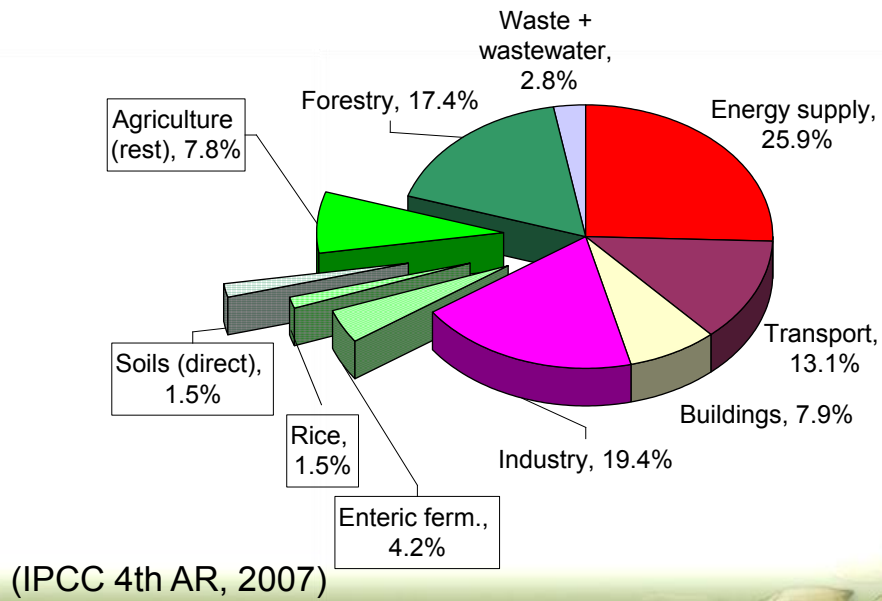
Reiner Wassmann
International Rice Research Institute

Global Sources of Greenhouse Gases



(IPCC 4th AR, 2007)

Global Sources of Greenhouse Gases



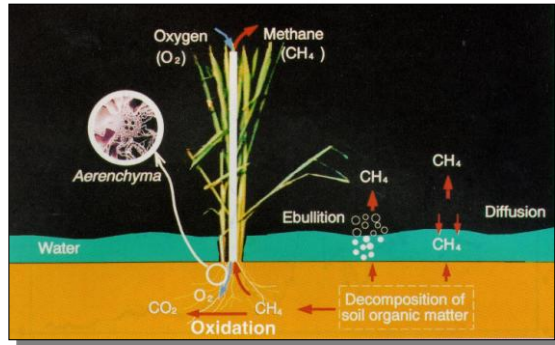
National Statistics in SE Asia/ Rice

Country	Emissions from rice production	
	(Mt CO ₂ eq)	
Cambodia	9.505	
Indonesia	53.856	
Lao PDR	2.308	
Myanmar	30.890	
Malaysia	3.445	
Philippines	21.706	
Thailand	44.156	
Timor-Leste	0.225	
Viet Nam	38.199	

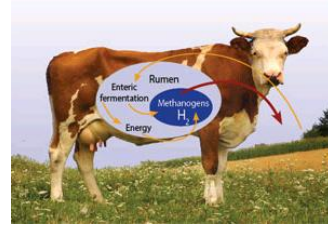
Data source: <http://edgar.jrc.ec.europa.eu/index.php>

Emissions from Agriculture

Methane from rice

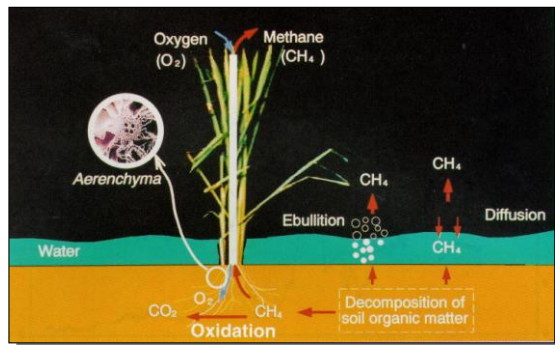


Methane from enteric fermentation

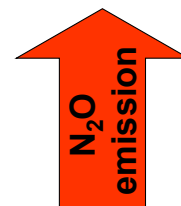


Emissions from Rice Fields

Methane



Nitrous oxide

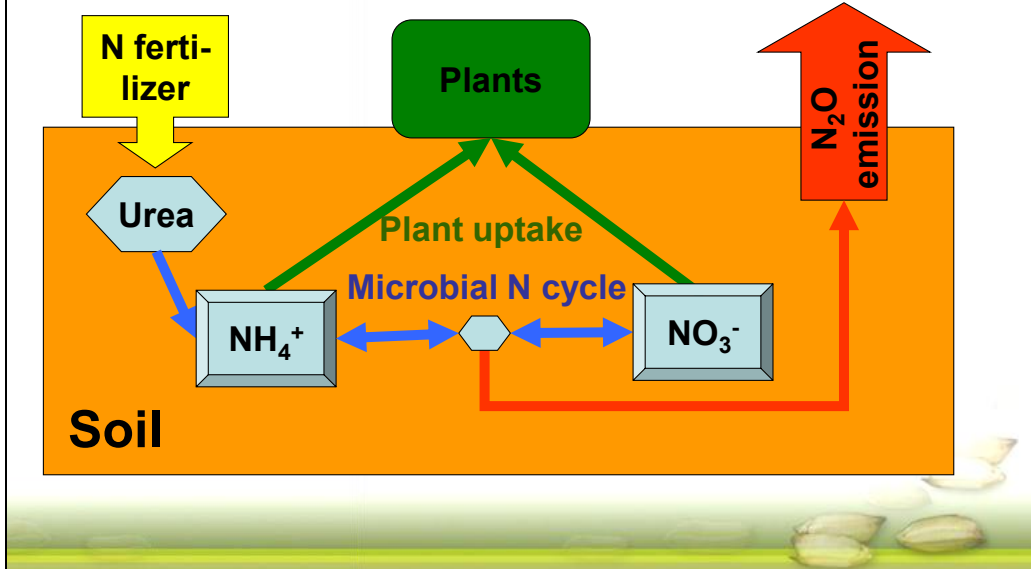


Soils

Global Warming Potential:

CH₄ = 21 CO₂eq
N₂O = 298 CO₂eq

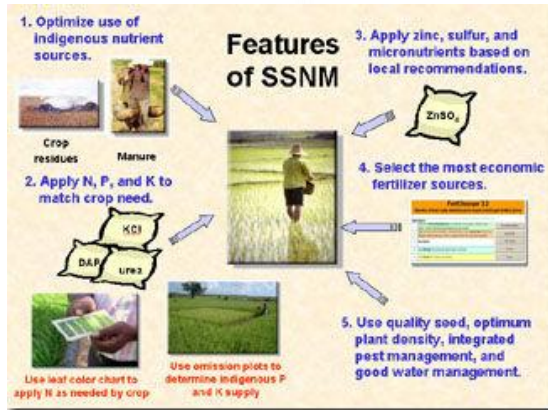
Nitrous Oxide Emissions from Soils



Alternate-Wetting-and-Drying (AWD)



„Site-Specific Nutrient Management’ (SSNM)



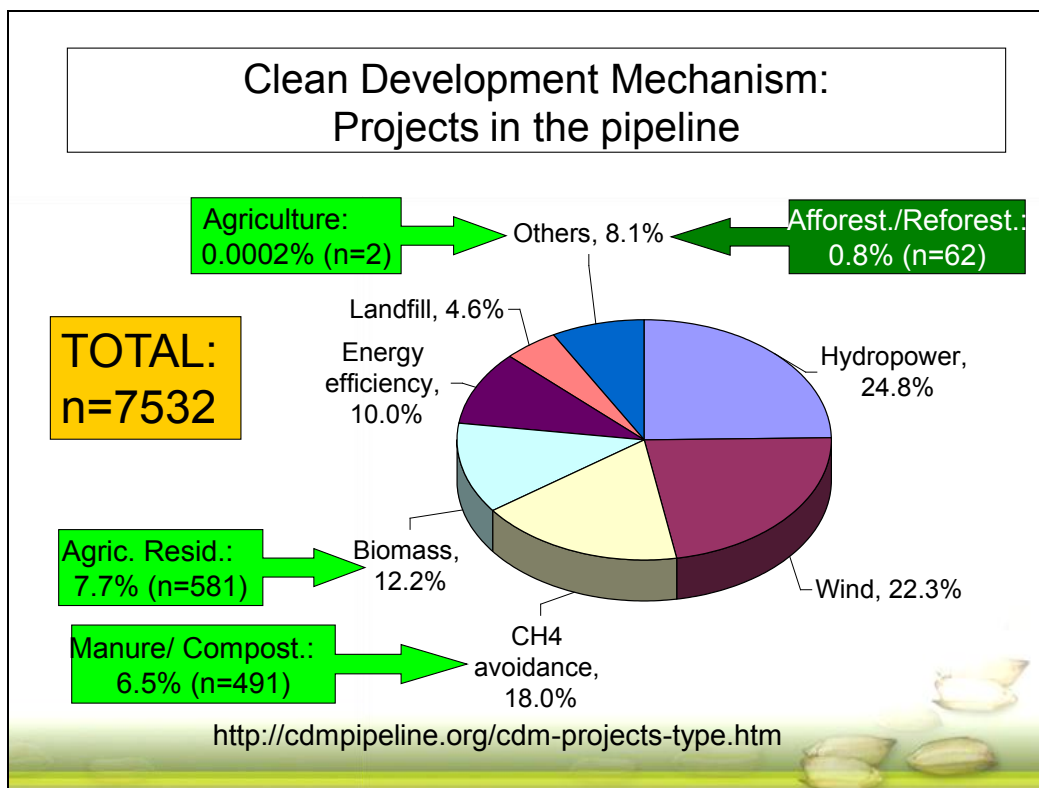
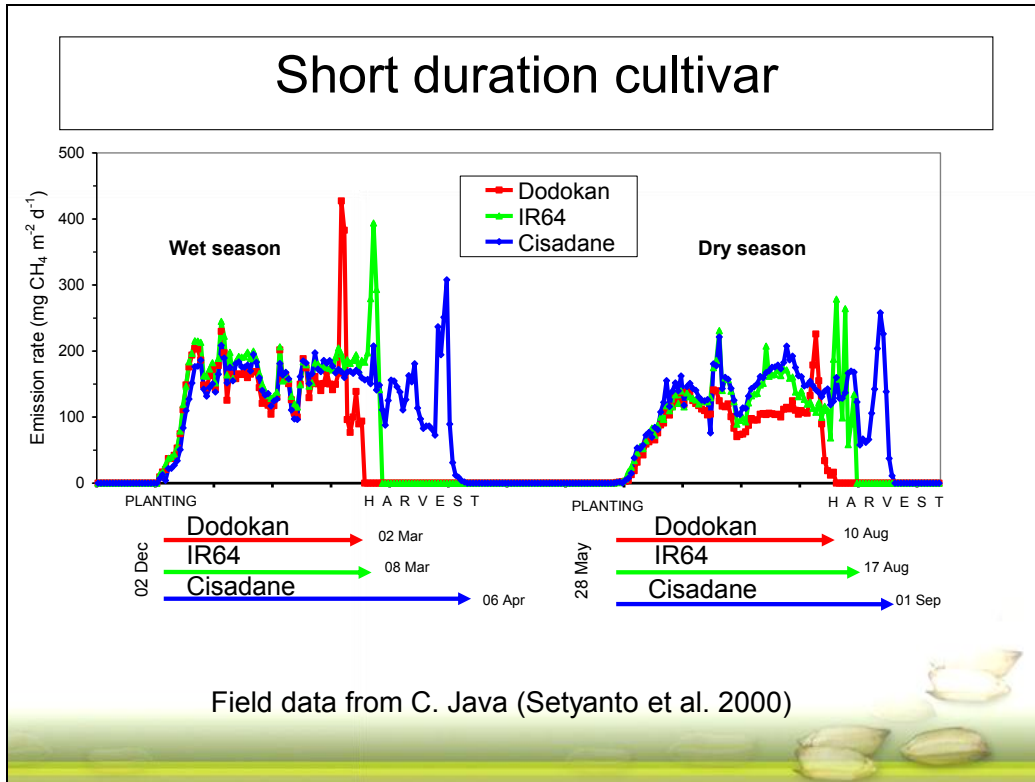
- Applying nutrients as and when needed
- Adjusting nutrient application to crop needs in given location and season

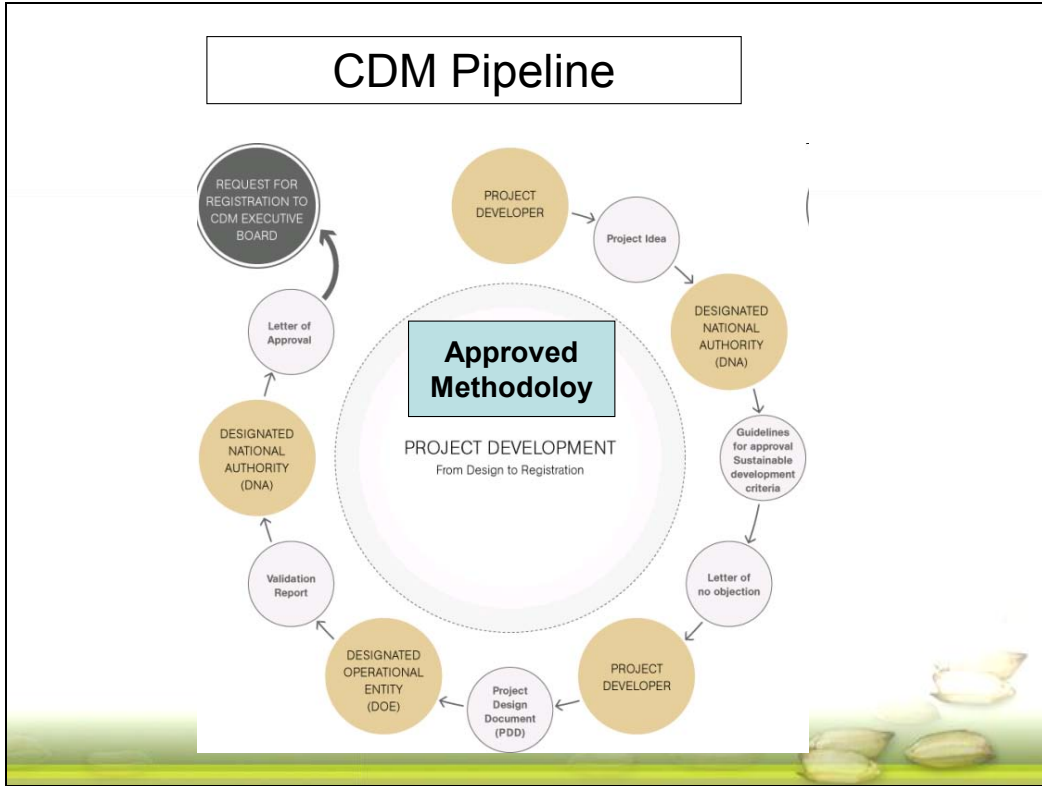
Preventing Straw Burning



Technological options for using rice straw as renewable energy:


- controlled combustion,
- biogas technology (in combination with animal husbandry),
- conversion of rice straw to ethanol,
- and ...





SSM – Small Scale Methodology Approved in May 2011

F-CDM-SSC-Subm ver 03.1

 CDM: Form for Submissions on Small Scale Methodologies and Procedures (version 03) <i>(To be used for presenting questions/proposals/amendments related to the simplified methodologies for small-scale CDM project activity categories)</i>	
Name:	Stephan Brunner Institution: Bayer CropScience
Affiliation ¹ :	<input type="checkbox"/> DNA <input type="checkbox"/> DOE <input checked="" type="checkbox"/> PP <input type="checkbox"/> Stakeholder
Title/Subject (max. 200 characters):	Reduction of methane emissions by switching from Transplanted to Direct Seeded Rice practice with adjusted water management
Purpose of the submission:	<input type="checkbox"/> Query on an approved SSC methodology or small scale procedures ² (Fill in field 1. below) <input type="checkbox"/> Request for Revision of an approved SSC methodology (Fill in fields 2. and 3. below) <input checked="" type="checkbox"/> Proposal for a new SSC methodology (Fill in fields 4. and 5. below)

<http://cdm.unfccc.int/UserManagement/FileStorage/4BTFS58C2AXGMPIVDOJEL3K1Y0UWRN>

Obstacles of CDM in agriculture

Involvement of many stakeholders/
transaction costs

Measurement/ Reporting/ Verification
(MRV)

Possible „leakages’

Emission savings based on area –
and not on grain production

NAMA

Nationally Appropriate Mitigation Actions

- NAMAs are voluntary country engagement proposals
- They are expected to become the main vehicle for mitigation action in developing countries in the future
- Funding should come from the newly established "Green Fund" (target: 100 bn USD by 2020)

Conclusion ...

... in terms of mitigation projects

Wishful thinking	
Realistic outlook	

Thank you

Rice
Science
for a Better
World



Climate change adaptation options with mitigation potential

- from FAO's work on climate change and food security -

Hideki KANAMARU
Climate, Energy and Tenure Division (NRC)
FAO
Rome
Hideki.Kanamaru@fao.org



Food and Agriculture Organization of the United Nations

www.fao.org/climatechange

Outline

- Climate change and food security
- Adaptation
- Mitigation
- Synergies
- Variability in estimates
- Climate-smart agriculture
- Constraints for adoption of adaptation/mitigation practices
- Conclusions

*Colleagues from various divisions of FAO contributed to this presentation



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Two Major Global Challenges

Achieving Food Security



- 1 billion people hungry
- The largest growth in projected populations is expected to occur in agricultural-based economies that already have high food insecurity
- Agriculture main source of livelihoods of most of the world's food insecure.
- Increased demand for food, feed and fibre



Coping with Climate Change

- "2 degree goal" requires major emission cuts, yet the goal may not be met
- Agriculture most climate sensitive/vulnerable



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Coping with Climate Change

Agriculture and climate change adaptation



- Negative climate change impacts projected for agricultural-based poor areas
- Urgent need to adapt
- Need for improved management of natural resources including water of the Pacific Rim countries

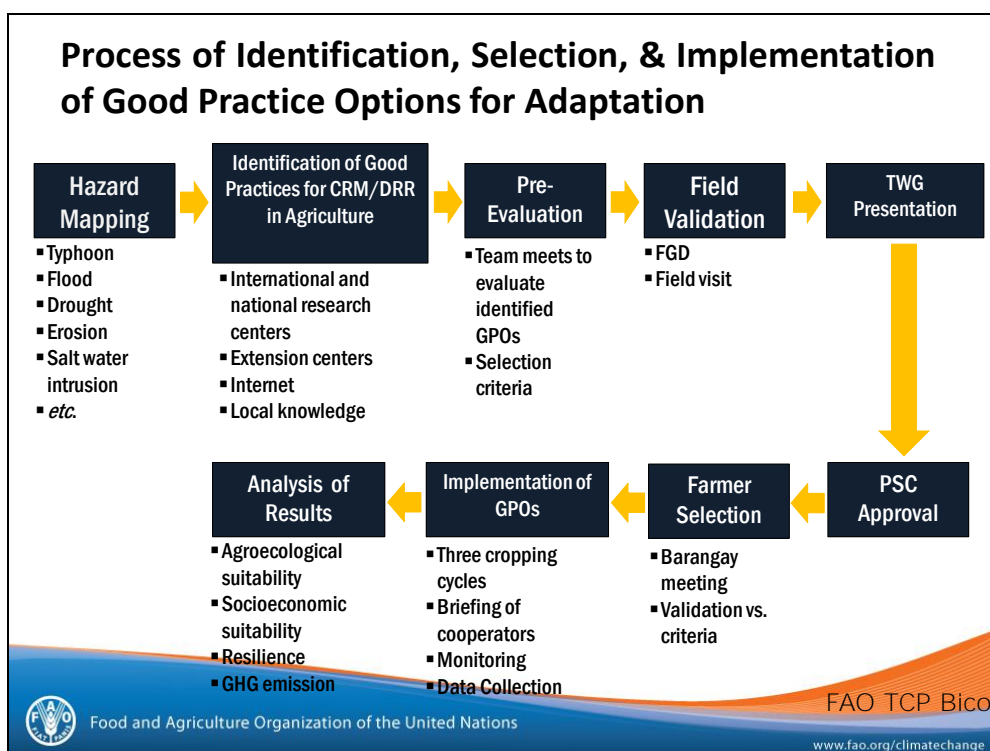
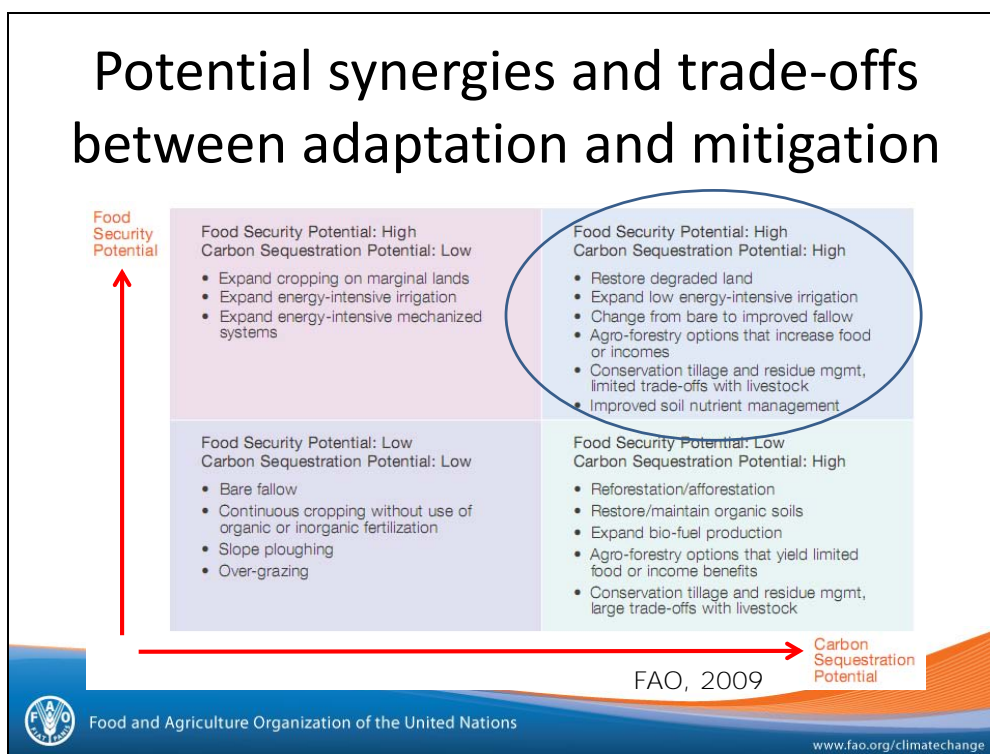
Agriculture and climate change mitigation

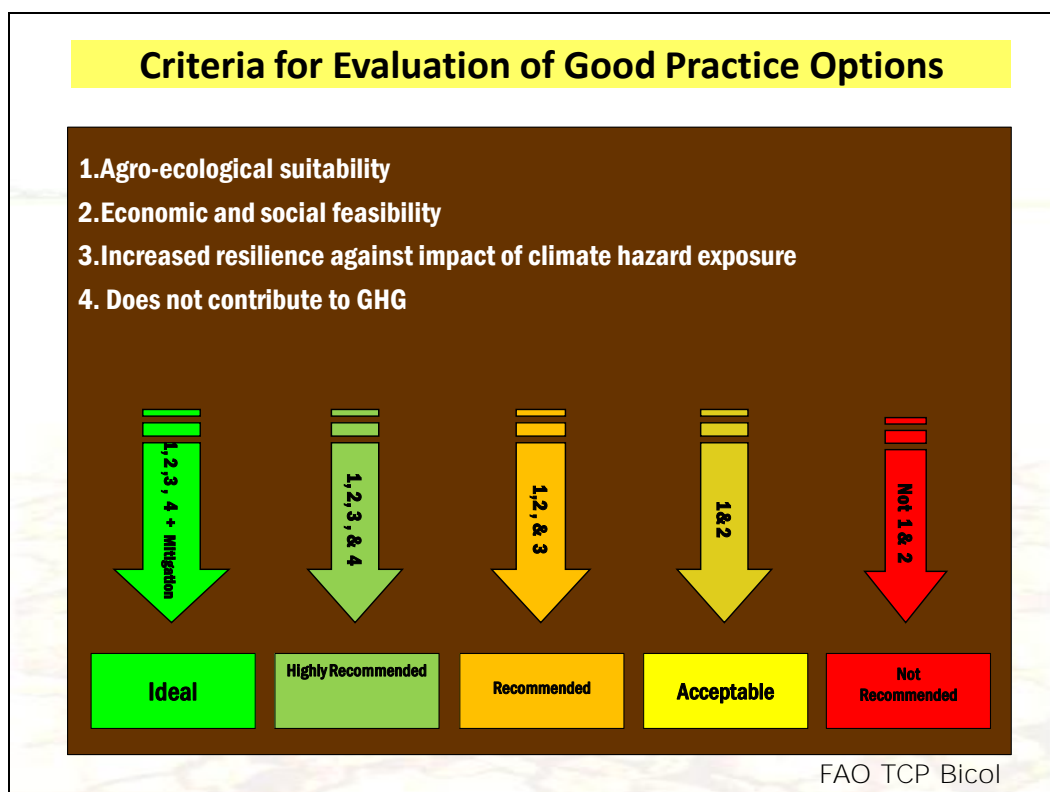
- Agriculture and Land use =1/3 of emissions
- Agriculture has big mitigation potential



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An example of evaluated GPO: Agro-forestry: Coffee for Forest Enrichment

Environmental Services Benefits from the Good Practice CCA				Economic Benefits from the Good Practice CCA	
Livelihood Protected from the GP CCA	Estimated Value of Environmental Services (in PhP)	Potential to increase and enhance soil stability	Potential to reduce GHG	Estimated annual streams of Income (in PhP)	Profit per annum
Riceland and swidden	35,000	Yes	Yes	55,000	15,000

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Recommended Good Practice Options for Climate Change Adaptation and Disaster Risk Reduction Upscaling

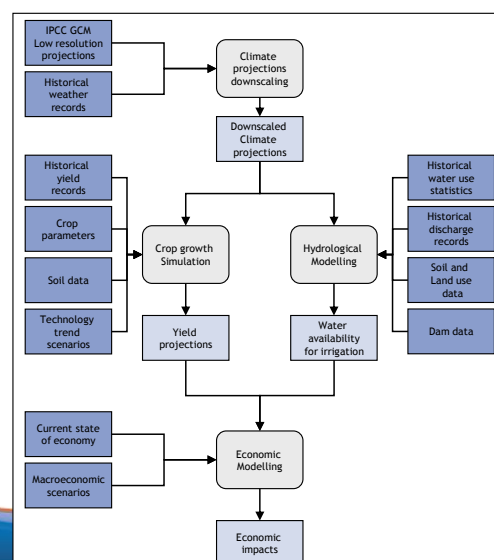
FAO TCP Bicol

Hazards	Upland	Lowland	Fishery
1. Typhoon	<ul style="list-style-type: none"> Long/medium duration crops + short duration crops Change root crop varieties Coconut leaf pruning 	<ul style="list-style-type: none"> Early maturing rice varieties Timing of planting/ratoon Rice + duck 	<ul style="list-style-type: none"> Tilapia farming Squid pot fishing Seaweed farming
2. Heavy rains	<ul style="list-style-type: none"> Water logged resistant long/ medium duration crops + short duration crops 	<ul style="list-style-type: none"> Timing of planting Use of submergence rice varieties 	<ul style="list-style-type: none"> Fish farming
3. Saline intrusion		<ul style="list-style-type: none"> Use of saline-tolerant varieties 	<ul style="list-style-type: none"> Tilapia farming


Impact assessment in support of adaptation planning



- MOSAICC – MOdeling System for Agricultural Impacts of Climate Change
- All impact models (climate downscaling, crops, hydrology, economy) in one package
- Software plus training
- Designed for nation-wide study at sub-national resolution, carried out by institutions of different disciplines, to *support adaptation planning and decision making*
- Fosters environment for multidisciplinary teamwork




AMICAF Project



- Improving *food security* of **vulnerable household groups** through **impact assessments** (step 1), development of an **information and mapping system** (step 2) for food security and climate change, and **livelihoods’ adaptation approaches** (step 3) plus **enhanced awareness and improved institutional mechanism** (step 4)

- Philippines and one Latin American country
- Started Oct 2011 for 3 years



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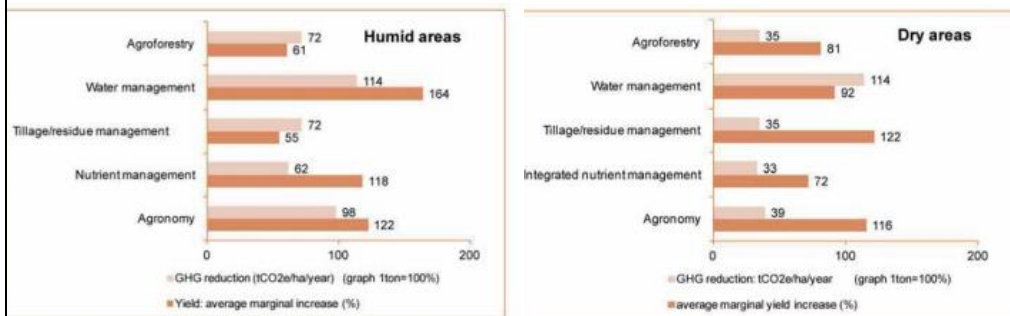
Review of synergies between adaptation and mitigation in major practices

Management	Details of the Practices
Agronomy	Cover crops
	Improved crop or fallow rotations
	Improved crop varieties
Nutrient management	Organic fertilization (use of compost, animal and green manure)
Tillage and residue management	Incorporation of crop residues, mulching
	Reduced/minimum/zero tillage
Water management	Terraces, contour farming
	Water harvesting
Agroforestry	Live barriers, fences
	Trees on cropland

FAO 2011a



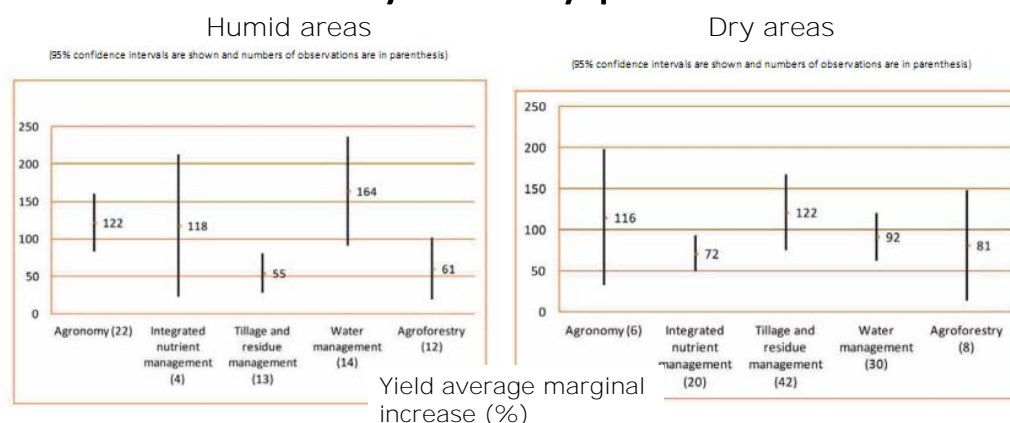
Synergies between productivity and climate change mitigation



- More synergies in humid areas than dry areas FAO 2011a
- In dry areas total potential benefits can be big if practices are implemented over a large enough scale.

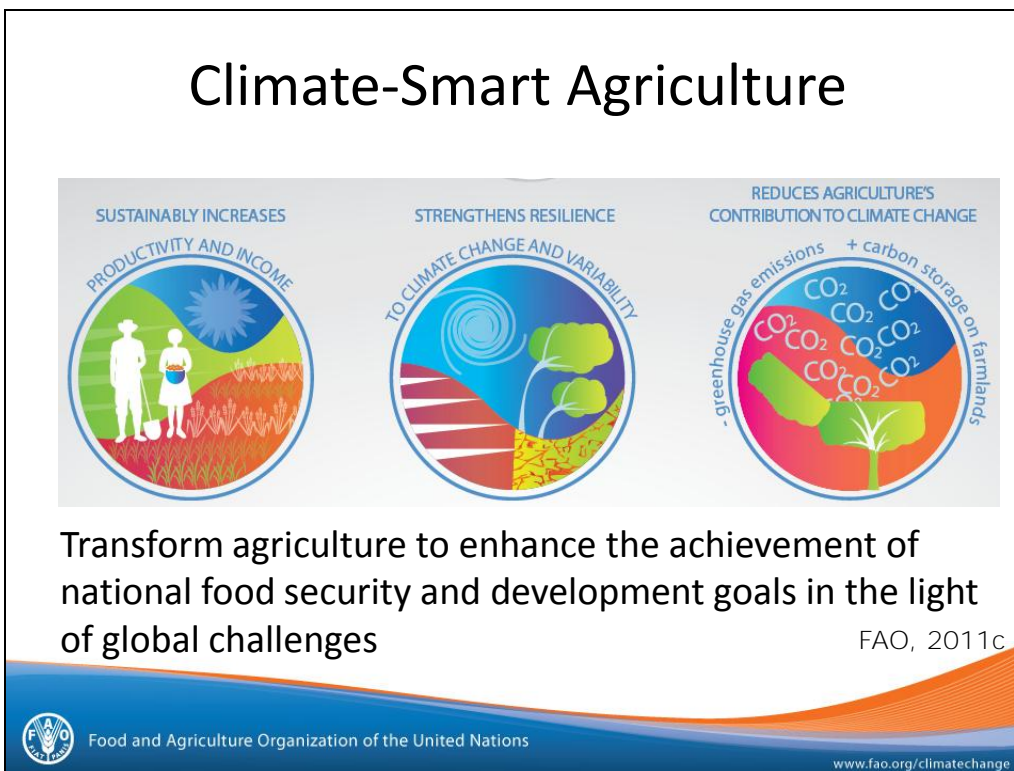
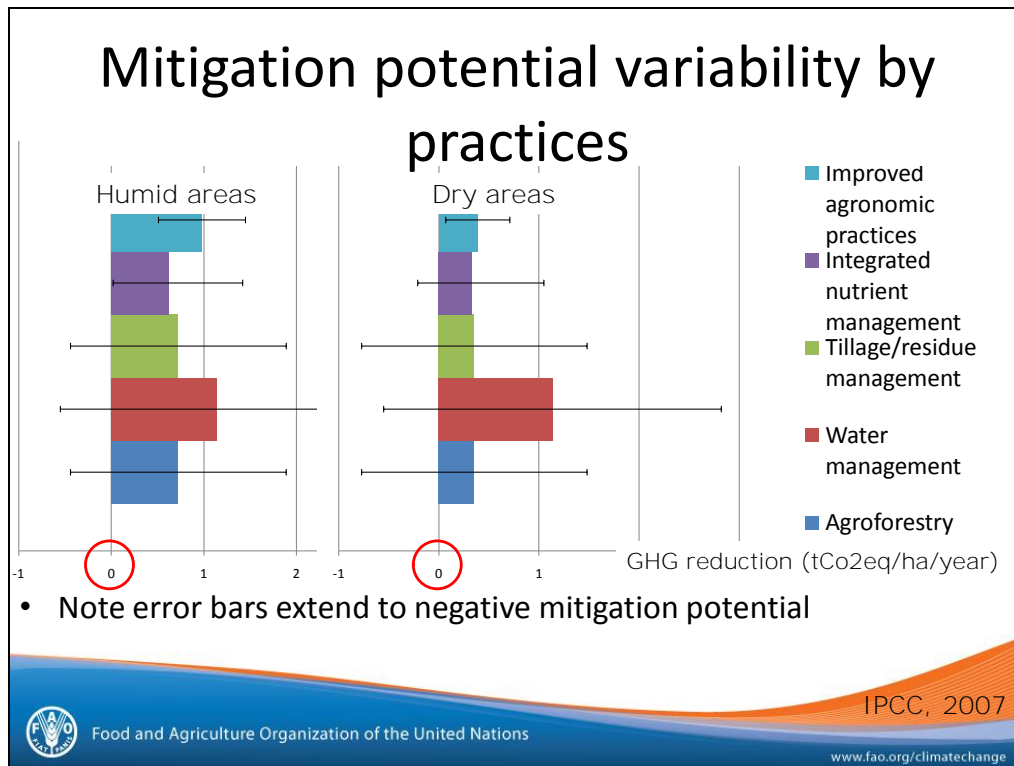


Adaptation: variability of % increase in cereal yields by practices



- Note large variability in estimates FAO 2011a
- Adaptation benefits are context specific.



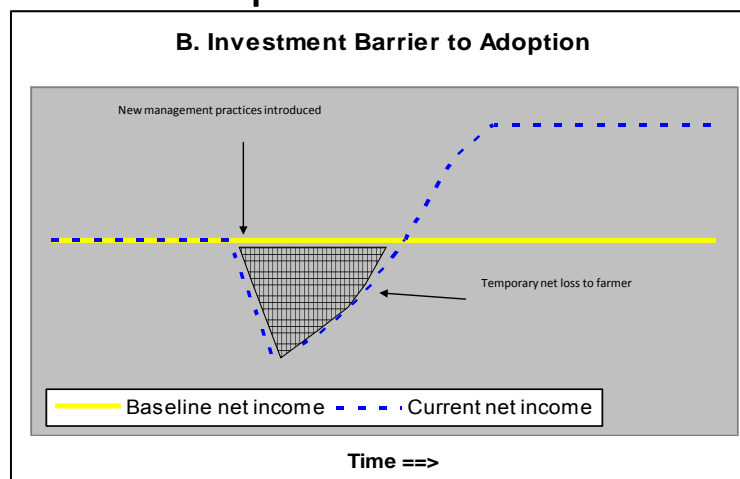


Classic barriers to technology adoption

- Tenure security: lack of tenure security and limited property rights, may hinder adoption of adaptation/mitigation practices
- Limited access to information, local experiences and capacity development, e.g. very low levels of investment/support for agriculture research and extension
- Up-front investment costs on the ground can be high, while on-farm benefits not realized until medium-long term



Up-front costs



- It takes time for net income to be positive
- Short run trade-offs even where long run is win-win

FAO, 2007



Examples of establishment and maintenance costs

Technology options	Practices	Case study	Establishment costs	Average maintenance costs
			US\$/ha	US\$/ha/year
Agro-forestry	Various agro-forestry practices	<i>Grevillea</i> agroforestry system, Kenya	160	90
		Shelterbelts, Togo	376	162
		Different agroforestry systems in Sumatra, Indonesia	1,159	80
		Intensive agroforestry system (high input, grass barriers, contour ridging), Colombia	1,285	145
Soil and water conservation	Conservation agriculture (CA)	Small-scale conservation tillage, Kenya	0	93
		Minimum tillage and direct planting, Ghana	220	212
		Medium-scale no-till technology for wheat and barley farming, Morocco	600	400
	Improved agronomic practices	Natural vegetative strips, The Philippines	84	36
		Grassed <i>Fanya juu</i> terraces, Kenya	380	30
		<i>Konso</i> bench terrace, Ethiopia	2,060	540
	Integrated nutrient management	Compost production and application, Burkina Faso	12	30
		<i>Tassa</i> planting pits, Niger	160	33
		Runoff and floodwater farming, Ethiopia	383	814
Improved pasture and grazing management	Improved pasture management	Grassland restoration and conservation, Qinghai province, China (1)	65	12
		Rotational grazing, South Africa	105	27
	Improved grazing management	Grazing land improvement, Ethiopia	1,052	126

Sources: Wocat 2007, Liniger et al. 2011, FAO 2009, Cacho et al. 2003

(1) Project estimates



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FAO, 2011b
www.fao.org/climatechange

Conclusions

- **Adaptation:** There are no “one fits all” adaptation practices; context-specific appropriate actions are necessary
- **Mitigation:** Mitigation potential is much larger in humid areas although estimates vary
- **Mitigation:** Per-unit mitigation potential may not be as large in dry areas -> need for large-scale implementation
- **Synergies:** Greater awareness of the potential synergies and trade-offs, and how they might be best managed to generate multiple benefits
- **CSA:** Adequate policy and institution support is needed to enable the transition to “Climate-smart” agriculture

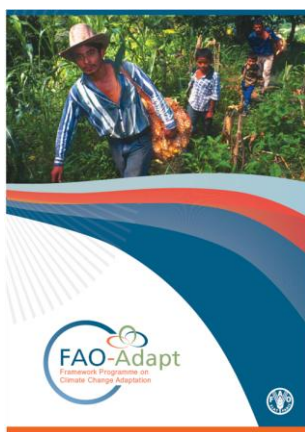


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Conclusions

- *Financing*: Need to better understand full costs of adaptation/mitigation practices adoption
- *Financing*: Climate financing needs to be designed to leverage agriculture investments and to value the synergies and provide farmers with incentives
- *Way forward*: A more holistic vision of food security, agricultural mitigation, adaptation and development is needed if synergies are to be maximized and trade-offs minimized. This needs to be mainstreamed into global agendas and national strategies for addressing climate change and food security



FAO-Adapt

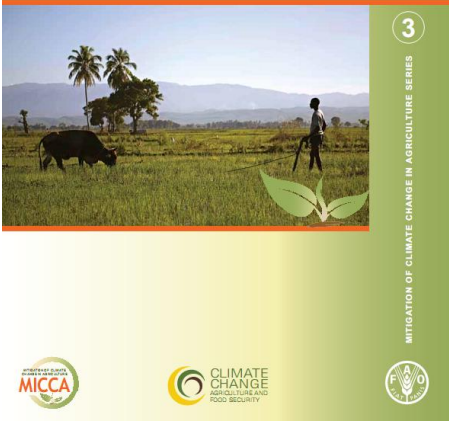


Climate-Smart Agriculture

(FAO, 2011c)

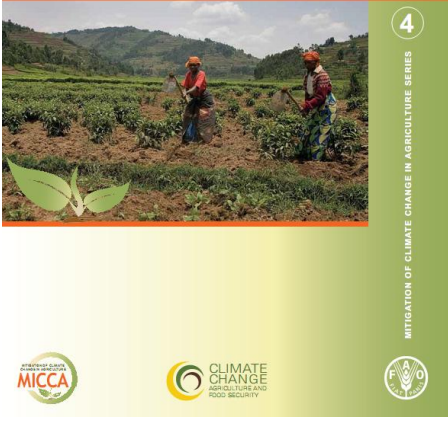


**Climate-Smart Agriculture:
A Synthesis of Empirical Evidence of
Food Security and Mitigation Benefits
from Improved Cropland Management**



(FAO, 2011a)

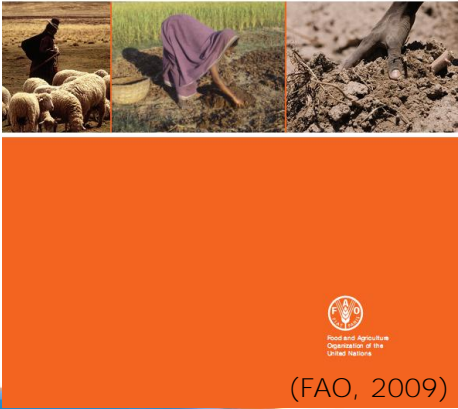
**Climate-Smart Agriculture:
Smallholder Adoption
and Implications for Climate Change
Adaptation and Mitigation**



(FAO, 2011b)

Food and Agriculture Organization of the United Nations www.fao.org/climatechange

**Food Security and Agricultural
Mitigation in Developing Countries:
Options for Capturing Synergies**



(FAO, 2009)

- **FAO Climate Change:**
<http://www.fao.org/climatechange>
- **Climate-Smart Agriculture:**
<http://www.fao.org/climatechange/climatesmart/>
- **EPIC:**
<http://www.fao.org/climatechange/73769/>
- **FAO-Adapt:**
<http://www.fao.org/climatechange/fao-adapt/>
- **Climpag:** <http://www.fao.org/nr/climpag/>
- **MOSAICC:**
<http://www.fao.org/climatechange/mosaicc>

Food and Agriculture Organization of the United Nations www.fao.org/climatechange



Adaptation and Mitigation Strategies in the Asia- Pacific Region: The Farmers Viewpoint

Raul Q. Montemayor
Past Chairman, IFAD-MTCP Farmers
Forum for Southeast Asia plus China



The Farmers Forum

- **A global initiative to strengthen farmer organizations and enhance their capacity to influence policy**
- **Supported by IFAD**
- **Started at the global, and now implemented at the regional and national, levels**
- **Sub-regional Farmers Forum covers China, Laos, Cambodia, Vietnam, Philippines, Indonesia and Myanmar**
 - **Currently involves 120 Farmer Organizations (FOs)**
 - **representing 16 million farmers in 7 countries**



Objectives of the Farmers Forum

- **Strengthen networks of farmer organizations**
- **Strengthen the involvement of farmers in policy processes**
- **Promote the involvement of farmer organizations in IFAD country programs**



Activities of the Farmers Forum

- **Mapping and profiling of FOs**
- **Platform-building (National and Sub-Regional Farmers Fora)**
- **Policy Research and Studies**
- **Policy dialogues at national and regional levels**
- **Capacity building**
- **Involvement in IFAD country programs**



Agriculture and Climate Change: Basic Principles

- **Agriculture is part of the problem**
- **Agriculture is a victim of climate change**
- **But, it is also part of the solution**
- **Climate change affects all, but responsibilities must be shared equitably and fairly**
- **Agriculture needs to be treated differently**
- **Farmers need to save themselves before they can help save the world**
- **Focus on the farmer, and not only on his crops**



Farmers' Adaptation to Climate Change: Basic Approaches

- **Build up the resilience of farmers**
- **Augment their capacity to cope with climate change**
- **Help them recover from disasters**



Building Up Farmers' Resiliency

- **Provide basic government support services**
- **Strengthen tenurial security of farmers**
- **Enhance farmers' productivity and profitability**
- **Promote biodiversified, integrated and sustainable farming**
- **Diversify income sources of farm families**



Helping Farmers Cope

- **Focus on risk, instead of crisis, management**
- **Adopt effective water and watershed resource management program**
- **Provide timely, accurate and useful meteorological, geological and other relevant information to farmers**
- **Develop stress tolerant crop varieties and adaptive tools, technologies and practices**
- **Provide extension and advisory services to farmers**



Disaster Relief and Rehabilitation

- **Put in place swift response disaster and relief assistance programs**
- **Provide credit and other support to enable farmers to recover swiftly**
- **Implement cost-effective and responsive crop, life and medical insurance programs for farmers**
- **Maintain buffer stocks of seeds and other critical farm inputs**



Agriculture and Mitigation: Basic Approaches

- **Educate farmers on climate change awareness and mitigation**
- **Segregate emissions due to natural causes and those caused by or controllable by man**
- **Provide incentives and rewards for farmers thru accessible carbon credit and trading systems**
- **Develop technologies and systems to accurately monitor GHG emissions from agriculture and mitigation efforts by farmers**



Farmers' Contribution to Mitigation Effort

- **Water Management**
- **Stewardship of forest lands**
- **Fertilizer usage and application**
- **Waste/biomass usage and management**
- **Climate friendly farming systems, technologies and practices**
- **Seeking divine intervention through prayers and offerings at local monasteries and shrines**



Concluding Remarks

- **Adaptation strategies need to be location and context-specific, integrated and flexible**
- **Need to mainstream climate change programs with overall developmental approaches and policies**
- **Small farmers can play a vital role, but they must be given a seat at the table**
 - participation of farmers and their organizations in negotiations at all levels
 - engage FOs in formulation of national climate change action plans and in the monitoring of activities
 - encourage R&D institutions to partner with FOs in technology development and dissemination



Adaptation Strategies with Mitigation Potential for Food and Water Security in Malaysia

Mario Valeriano
Department of Agriculture Malaysia



ASIA-PACIFIC ECONOMIC COOPERATION (APEC) SYMPOSIUM ON CLIMATE CHANGE
February 6-8, 2012
Manila, Philippines

OUTLINE OF THE PRESENTATION

1. INTRODUCTION

- Background of Malaysian Economy
- Scenario Climate Change in Malaysia

2. CLIMATE CHANGE VULNERABILITIES TO ECONOMY

3. ADAPTATION STRATEGIES

4. INSTITUTIONAL ARRANGEMENTS

5. POLICY OPTIONS

6. FINANCING OPTIONS

Introduction

➤ Presently, Land Resource of Malaysia & Land use type in Peninsular Malaysia show as statistically.

LAND RESOURCE OF MALAYSIA SITS ON THE LAND SURFACE WITH AN AREA OF 329,600 SQUARE KILOMETERS :

REGION	AREA		
	Sq.km	x 10 ⁶ ha	Percent
Peninsular Malaysia	131,500	13.15	39.9
Sarawak	124,600	12.46	37.8
Sabah	73,500	7.35	22.3
TOTAL	329,600	32.96	100

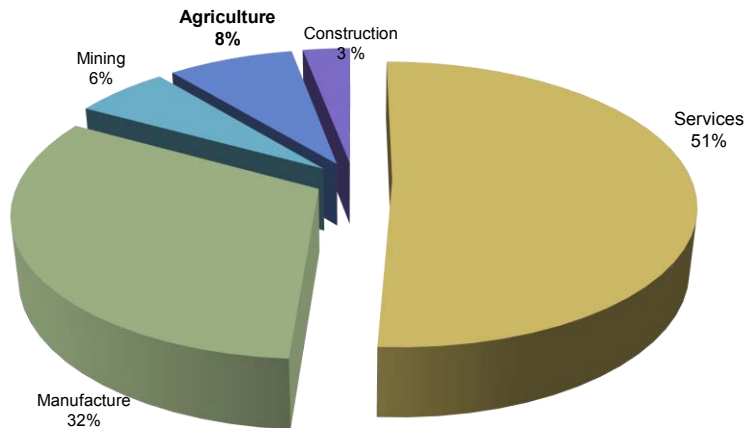
- Total population was 27.2 million in 2007.
- Temperature of between 26° C to 28° C
- Rainfall average 2000mm to 4000mm annually.

SUMMARY OF LAND USE TYPES PENINSULAR MALAYSIA YEAR 2008

LAND USE GROUP CATEGORY	TOTAL (Ha)	%
Urban	513,900	3.89
Mining	73,278	0.56
Horticulture Crop	359,651	2.72
Perrenial crops (oil palm,rubber,fruits)	4,504,311	34.12
Fields crop	410,795	3.11
Permanent Grazing Land	39,668	0.3
Busher	262,627	1.99
Forest	6,046,705	45.80
Mangrove & Peat Swamps	646,349	4.90
Others	85,526	0.65
Rivers and Canals	260,072	1.96
TOTAL (HA)	13,202,882	100

Background of Malaysian Economy

- Malaysia's economy is diversified in nature.
- Gross national income (GNI)/capita increased from RM 13,939 in 2000 to RM 17,773 in 2007 at constant prices.
- The average GDP growth rate for the same period was approximately 5.6 %.
- Unemployment rose to 3.2% in 2007 from 3% in 2000
- GDP for 2007 was made up as follows:-

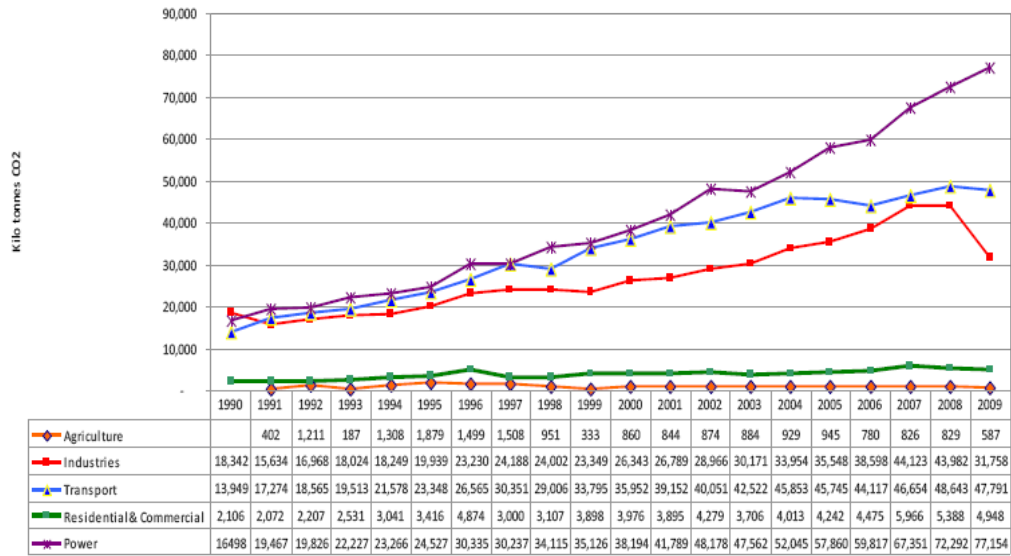


Scenario CC in Malaysia



Major Sources of CO₂ Emission

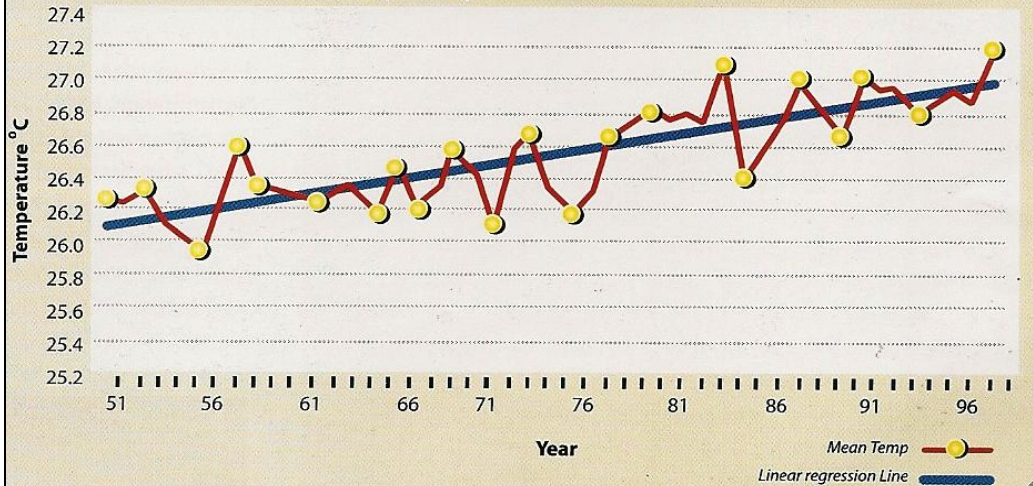
Trends of CO₂ Emissions



Feeling the heat in Malaysia

TIME SERIES OF MEAN ANNUAL TEMPERATURE

Slope of Regression Line: 0.18 °C/decade



Source: INC, 2000

Climate Change Vulnerabilities To Economy

- ▶ Losses in the agriculture sector in Malaysia, caused by El Nino were at least **RM3.4 billion** in 1997/98.
- ▶ **273,000 ha** of land or **15%** of current rubber land could be affected.
- ▶ Rise in sea level could force the abandoning of low-lying planted areas.
- ▶ Rice grain yields may decline by **9% to 10%** for each **1°C** rise Temperature.
- ▶ With more rains, crop could be exposed to diseases
- ▶ CC could affect supply of water for agricultural, domestic use and others.
- ▶ Jeopardizes agricultural production and food security.

Two Adaptation Strategies in Rice Production

- ▶ Research and Development
- ▶ Water Resource Management



Research and Development – Mitigation Potential on Rice Production

- ▶ Short maturing variety
 - Latest variety : 100 days (MR 211)
 - Less risky to water stress
- ▶ Development of drought resistant varieties
 - Drought tolerant varieties
 - Aerobic rice production
 - Develop high yielding varieties to suit different rice environments, inc. drought prone areas
- ▶ Water saving technologies
 - Optimize water use efficiency
 - Dry rotation and dry seeding
 - Improved irrigation techniques
 - Reduce water loss and wastage
- ▶ Precision farming; efficient utilization of production inputs including water
- ▶ Controlled production system

Water Resource Management- Mitigation Potential on Rice Production

- ▶ Continued improvement of irrigation infrastructures
 - Water recycling, efficient / timely distribution of water, conservation strategy
- ▶ Enhanced management support services
 - Storage system, delivery, distribution etc.
- ▶ Management & control system
 - Irrigation schedule
 - Telemetry System
- ▶ Indigenous water storage system (sugarcane plantation)
 - Man-made lakes as storage + mobile sprinkler system
 - Cheap and easy to maintain

Other Mitigation Options and Benefits

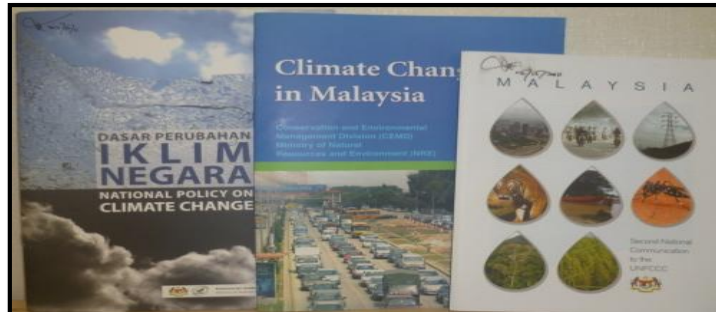
- a). Irrigated rice water management – Draining paddy fields will substantially reduce CH₄ emissions.
- b). Nitrogenous fertilizer management – N₂O emissions can be reduced by using alternative natural sources of nitrogen especially bio-fertilizers or soil microbes.
- c). Manure management – Use of organic fertilizer beside chemical fertilizer will help to maintain the fertility of the soil and at same time reducing GHG emission.

Institutional Arrangement

- The issues of CC covers many sectors and wide range of institutions within the country.
- The Ministry of Natural Resources and Environment (NRE) become a focal point in addressing climate change and environmental issues.
- This development has enabled better coordination as some of the key agencies which were previously in various ministries are now under NRE.
- Malaysia generally adopts a ‘precautionary principle’ approach and ‘no regret’ policy.
- Malaysian research institutional: MARDI – Agriculture
NAHRIM - Water
- Government, private sector and NGOs work harmoniously together through appropriate initiatives to address CC.

Policy Options

- ▶ Malaysia became a Non-Annex 1 Party to UNFCCC in 1994 and ratified Kyoto Protocol in 2002.
- ▶ Two recent policies, the National Policy on Climate Change & National Green Technology Policy were formulated towards addressing CC holistically, ensuring climate resilient development, development low carbon economy & promote green technology.



Financing Options

- ▶ Fund and Financing from government and private sector are limited addressing climate change.
- ▶ Other sources of fund comes from international organization such as UNDP, DANIDA and ADB.
- ▶ Malaysia in progress to create economic model in addressing climate change under Economic of Climate Change for Malaysia (ECCM)- in four sectors(Energy, Transportation, Water & Agriculture)
- ▶ The purposed of this studies are to assess economic costs and benefits of adaptation and mitigation measures for Malaysia.



Adaptation Strategies with Mitigation Potential for Food and Water Security in Brunei Darussalam

**Department of Agriculture and Agrifood,
Ministry of Industries and Primary Resources**

Introduction

- Brunei Darussalam has high dependency on importation of food commodities like rice (97%), fruits (76%), vegetables (37%), beef (99%) and dairy products (99%).
- Rice price fluctuations in the world trade in 2008 due to climate change and other unforeseen reasons has threaten food security of importing countries which include Brunei Darussalam



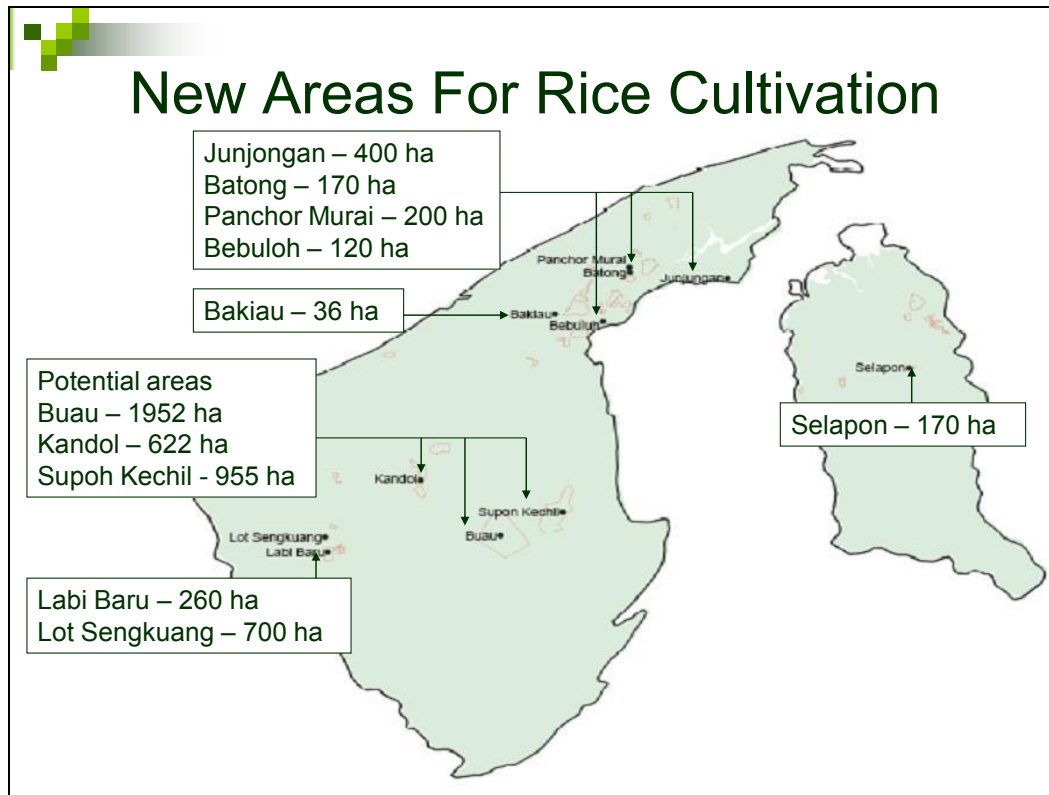
Existing Policy

- To ensure the national food security, the government has given priority to “increase and achieve self sufficiency in rice production in Brunei Darussalam”



Activities

- The project „Towards Self-sufficiency in National Rice Production” launched in April 2009 with the vision to raise the level of food security in the country through:-
 - Development of suitable area for rice production
 - Introducing high yielding rice varieties
 - Practice double cropping season in a year
 - Providing infrastructure such as drainage, irrigation and roads



Introduction of High Yielding Variety

- Under newly launched „Towards Self Sufficiency in National Rice Production” project in April 2009, improved rice variety “Laila” has been introduced to farmers which enable farmers to practice double cropping



Laila

- On going trail on varietals improvement using improved and local paddy varieties under local condition conducted by DAA



Relative performance between Laila and Laila x Pusu



Performance of Laila x Pusu

MOU and Bilateral Cooperation on Rice

- Collaboration with Republic of the Philippines on the purification of local varieties and establishment of Farmers Field School
- Research collaboration with a Singapore based company on development of hybrid rice in Brunei Darussalam



Hybrid Rice trial in Farmer's Field

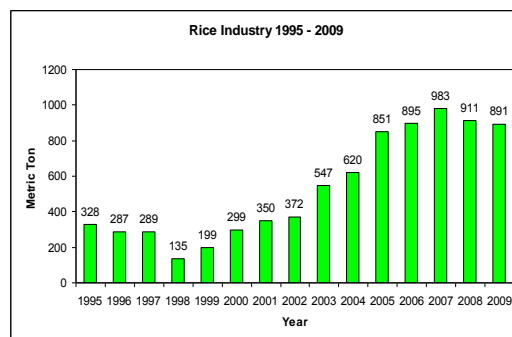
- Collaboration with a Korea on varietal trial and infrastructure development
- Research collaboration with Department of Agriculture, Guangxi Zhuang Autonomous Region, PR China on varietal trials and management practices.



Experiences from Climate Change

Rainfall: Intensity and frequency

- January 2009 with recorded highest precipitation (1175 mm) has caused flooding at agriculture development areas mainly cultivated with vegetables resulted in production loss in January and February worth B\$1,568,488.00 and \$467,000.00 of paddy.



- Increased incidence of diseases: leaf blast, neck rot, sheath blight caused significant yield loss in paddy
- Soil erosion on hilly areas with fruit plantation resulted in irreversible land degradation



Neck Rot

Sheath Blight



- High temperature with prolonged drought period
- Low productivity during off season paddy planting due to low precipitation during April – June 2009
- Fire hazard from peat land area
- Increased Incidence of pests: leaf folder, mole cricket, caseworm, brown plant hopper, rice bug in paddy



Damage by Leaf Folder



Damage by Mole Cricket



Mitigation Activities on Crop Production

- Introduction and implementation of ASEAN GAP
- Development of Horticultural Farm Accreditation System (HFAS) and Integrated Pest Management (IPM)
- Soil Fertility Evaluation/Advisory Service in Negara Brunei Darussalam
- Assessment and development of soil conservation techniques at hilly agricultural development areas
- Studies on heavy metals accumulation in vegetable growing areas
- Environmental impact assessment studies for commercial rice production at Buau, Supon Kechil and Kandol

- 
- Peat land conservation, the department involve in ASEAN –Australia Development Cooperation Program for Regional Partnerships Scheme on “Capacity Building to Improve Peatland Management and Reduce Land and Forest Fires and Associated Transboundary Haze Pollution in the ASEAN Region”

Mitigation Activities on Livestock Production

- Good Animal Husbandry Practice - GAHP
- Policy on closed house system for poultry production and feedlot system for goat and cattle production



Closed House System for Poultry Farm

- Farm Accreditation Scheme to ensure farms in Brunei produce quality, safe and environmentally friendly products
- Implement biosecurity programs in livestock farms by monitoring and providing consultation on how the farmers should implement and maintain the program.
- Implemented the Animal Health Program since 1997, which includes livestock / animal health monitoring, examination and treatment, farm hygiene / hygiene of farm premises, feeding management

Adaptation Practice

- **Paddy:** Peat land used for conventional paddy planting with local varieties
 - Planted under rain fed system
 - Zero tillage
 - Recycling of nutrients through decomposition of plant material and rice straw
- **Observation:** With minimum fertilizer, proper water and agronomic management practices, yield of local paddy 2 - 2.5 ton/ha annually



- **Vegetables:**
 - Water loving vegetables planted on raised bed at low laying areas prone to flooding
- **Protected Cultivation**
 - Vegetables sensitive to intensive rain



Water Spinach (*Ipomoea aquatica*)

Semi protected system



Challenge on Agriculture

- Lack of awareness among policy maker on the impact of climate change and usually ignore during agriculture planning
- Brunei Darussalam’s small population accounts for its limited expertise on climatic change studies and monitoring
- No clear policy on disaster management due to climate change specific to Agriculture

Cooperation Among ASEAN

1. Ensure sufficient production, accessibility and availability of food to minimize food security risk
2. Improving the accuracy and reliability of weather forecasting system
3. Adjusting agricultural research priorities toward climate change mitigation
4. Crop loss compensation or crop insurance scheme
5. Establishment of disaster management network among ASEAN countries
6. Strengthening capacity building, agricultural extension and communication system on climate change

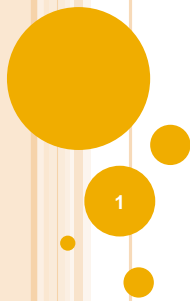
Conclusion

- The climate in Brunei Darussalam is generally considered uniform and favorable for tropical crops and the effect of climate change usually ignored by agriculture planner and policy maker
- Climatic change studies and observation on micro-climatic variation within the countries is vital to enhance maximum yield and ensure food security of the country
- With Brunei Darussalam aimed to achieve self sufficiency in rice production in the coming years, greater effort should be initiated to correlate between climate change and crop production

Thank you for your
attention

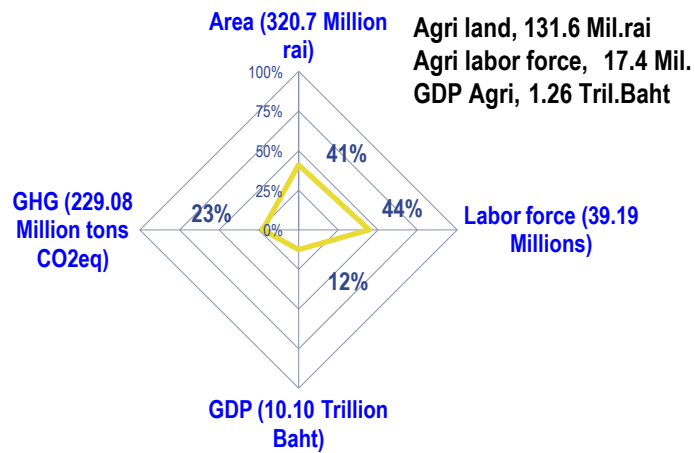


THAILAND REPORT



Prepare for:
Symposium on climate Change:
Adaptation Strategies with Mitigation Potential for
Food and Water Security

AGRICULTURE SECTOR IN THAI ECONOMY

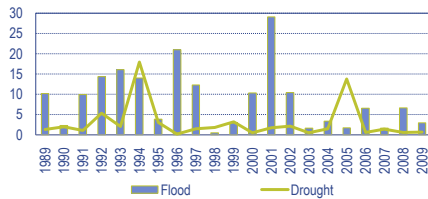


CLIMATE EXTREME , CLIMATE CHANGE, AND POTENTIAL IMPACT ON THAI AGRICULTURE SECTOR

3

NATURAL DISASTER AND AGRICULTURAL DAMAGE

Agriculture Areas Damaged from Flood and Drought

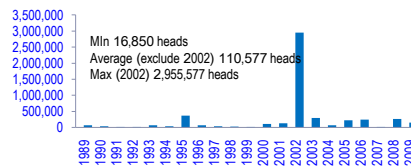


Source: Department of Disaster Prevention

Agricultural Areas Damaged from Natural Disaster (Mil.ra) :

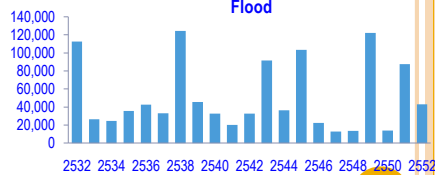
	Flood	Drought	Storm	Fire
Average	8.639	2.956	0.026	0.002
Minimum	0.466	0.102	0.001	0.000
Maximum	29.134	17.924	0.139	0.006

Numbers of livestock affected by Natural Disaster



Source: Department of Disaster

Numbers of Fish and Shrimp Ponds Affected by Flood



Source: Department of Disaster

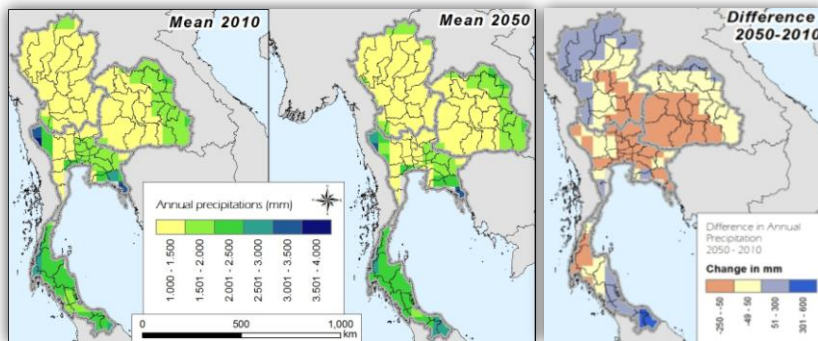
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FLOOD DAMAGE IN AGRICULTURE SECTOR IN 2011 (MAY-30 DEC)

- Crop:
 - 1.3 mil. farmers affected, cover 12.9 mil. Rai
 - out of 12.9 mil. Rai, 10.31 mil. Rai is rice
- Fisheries:
 - 135k farmers, 225k rai of fish pond
- Livestock:
 - 255k farmers, 30 mil. heads affected

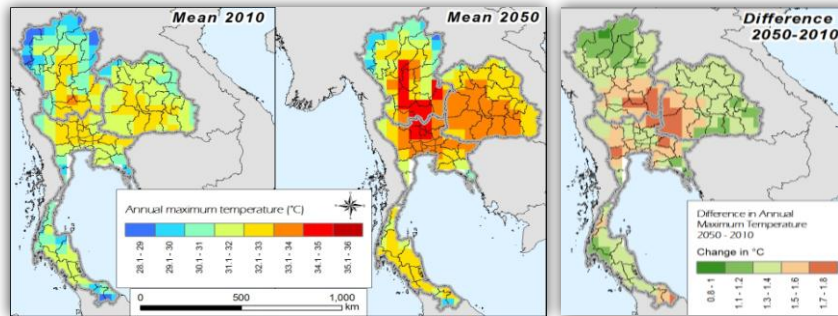
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RAINFALL PROJECTION



Rainfall in central area tend to decrease, while the rainfalls in Northern and the north of Northeastern Thailand tend to increase.

TEMPERATURE PROJECTION



Maximum temperature tend to increase between 0.8 – 1.8 C. The temperature of the northern area will increase about 1 C and more towards the southern part of northern region and the northeastern region.

POTENTIAL PHYSICAL IMPACT OF CLIMATE CHANGE ON MAJOR SECTOR



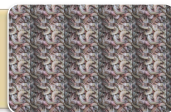
Exposure factors of crops: beginning day of rainy season, min daily temp, max daily temp, off season storm

- Major rice: uncertain rainfalls at the beginning of rainy season; second rice: uncertain rainfalls at the end of rainy season
- Cassava: root damage due to heavy rain
- Cane sugar: water shortage



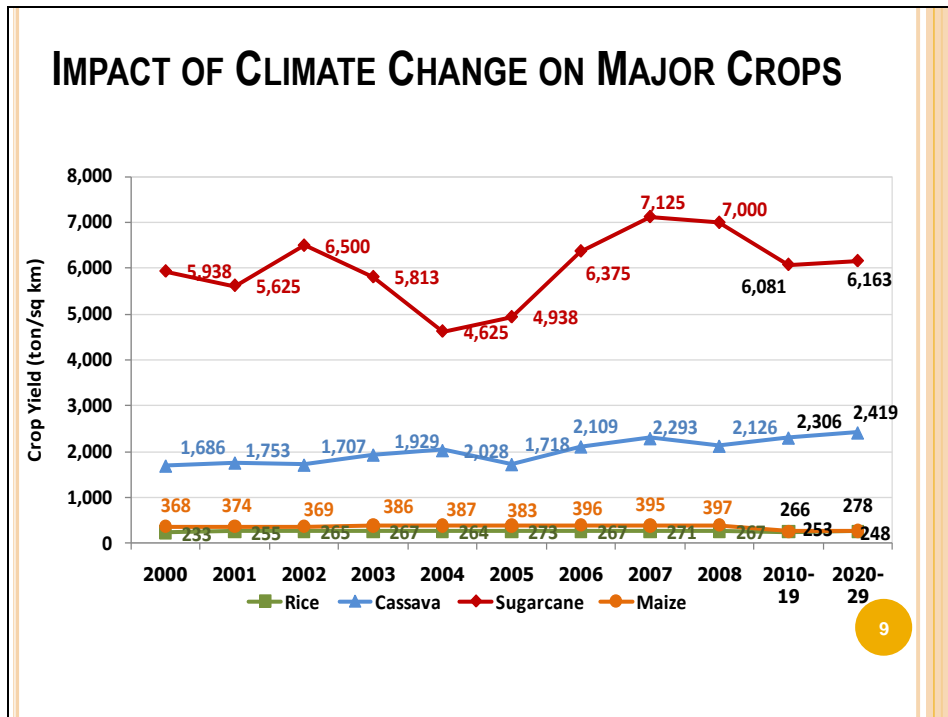
Exposure factors of livestock: temperature, quantity and quality of water

- Maize: beginning day of rainfall, and decrease
- Swine, cow, chicken: stress due to heat, affecting survival rate of babies, and immune system
- Quantity and quality of animal feed
- Risk to New Pathogen, parasite



• Low growth rate in production of plant and animal
Exposure factors of fisheries: temperature, saltiness, light

- Giant tiger prawn, fish, shell: higher death rate with rising temperature and many of them death at 37 C



CLIMATE CHANGE POLICIES, ADAPTATION POLICIES AND MEASURES

CLIMATE CHANGE POLICIES

- 1994: UNFCCC ; 2005: Kyoto Protocol
- 2007: Office of the Prime Minister Regulation on Climate Change Management (2007)
 - National Climate Change Policy Committee, chaired by PM
 - Set up Thailand Greenhouse Gas Management Organization (TGO)
- 2008: National Strategy for Climate Change Management (2008-2012)
 - Building adaptive capacity & reducing vulnerabilities to climate change impacts
 - Promoting GHG mitigation activity in harmony with sustainable development
 - Promoting climate change R&D
 - Raising awareness & encouraging public participation
 - Building capacity of relevant personnel & institution
 - Supporting international cooperation on climate change mitigation & sustainable development
- 2007: Climate Change Alleviation Plan for Agriculture (2007-2011)
 - Knowledge management; Prevention & correction; Public relation
- 2012: National Strategic Plan of Agriculture for Climate Change (2012 - 2016)
 - (Drafting process) : Adaptation, Mitigation, Awareness, Building Capacity, International Cooperation

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ADAPTATION STRATEGIES

- Adaptation in farm level:
 - Changing cropping pattern, adjust crop calendar
 - Diversifying crop and variety
 - Adopting sustainable agriculture
 - Increase soil nutrition: organic agriculture, tailor-made fertilizer
- Climate information management:
 - Improve early warning system: climate data collection, climate projection, the dissemination of climate data

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ADAPTATION STRATEGIES (2)

- **Impact assessment and risk management**
 - Impact assessment on crop, fisheries, and livestock
 - Improve varieties resistant to change in climate
 - Crop insurance and weather index insurance
- **Building climate resilience**
 - Raising awareness for local community
 - Rain harvesting in drought-prone area
 - Improving and expanding irrigation areas
 - Water and soil conservation

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Adaptation in livestock production

Production System

Genetics improvement



→ Adaptation



→ Mitigation



Feeding



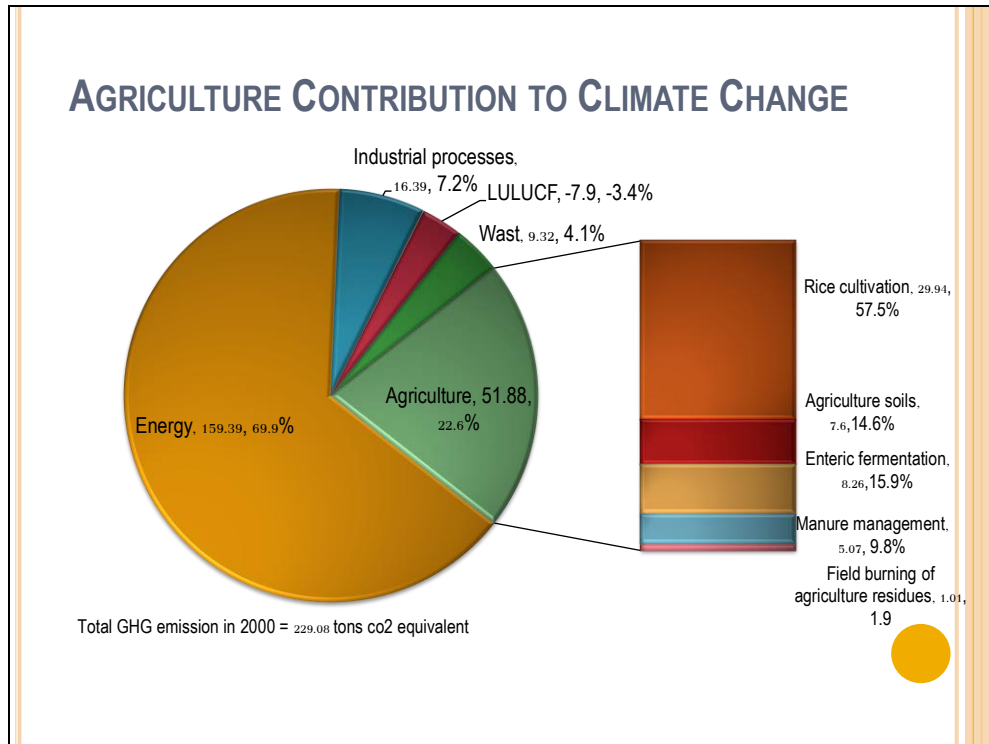
Optimised ratio



Housing



ADAPTATION AND MITIGATION OPTION



ADAPTATION WITH MITIGATION POTENTIAL

- **Enteric Fermentation and CH4 emissions**
 - **Increase production efficiency**
 - Decrease the number of animals
 - Decrease the time they are emitting methane
 - **Increase nutrition**
 - Decreases the amount of methane produced
- **Manure Management and CH4 and N2O emissions**
 - **Be mindful of temperature, moisture levels, time of storage, and other factors that lead to higher emissions**
 - **Give livestock easily digestible feed to control manure contents**

WASTE MANAGEMENT





DLD PROJECT FOR CLIMATE CHANGE

- CDM
- Mitigation by production system improvement
- Adaptation of livestock for high production, reproductive in CC
- Forage crop production in CC
- Carbon footprint

**INSTITUTION ARRANGEMENT, POLICY OPTIONS, AND
FINANCING OPTIONS**

SUSTAINABLE AGRICULTURE

Good Agriculture Practice (GAP)

- 2003: strategic plan for food safety
 - Promote quality of food and agriculture product in food supply chain
- Crop
 - 2004: set standard
 - 2011: GAP certified farmers about 90K (1.3% of farmers) and 767K rai (0.6%)
- Fisheries
 - 1999: Pilot project on farm CoC (code of conduct)
 - 2003: GAP for fisheries (shrimp and fish)
 - 2011: 32K GAP certified farms
- Livestock
 - 1999: GAP for livestock
 - 2010: 25K GAP certified farms
- **Problem:** lack of incentive, high cost, customer awareness

Organic agriculture

- 1992: pilot project for organic rice production (10k rai), later exported under the supervised and quality controlled by the IFOAM
- Private sectors play an important role persuading farmers and providing guidelines to meet international organic standards.
- 1997: The 8th National Economic Development plan (1997-2001): firstly mentioned the promotion of organic farming
- 2008: National Strategic Plan for Organic Agriculture Development (2008-2011), budget 4.826 billion baht
 - R&D, knowledge management, develop organic agriculture using traditional knowledge and practices
 - Promote commercial organic, organic fertilizer,
 - Subsistence vs. certified organic farming
- 2010: only 118k rai of organic agricultures
- **Problem:** Yield decrease in yr 1-3, diseconomy of scale, high cost of organic certificates

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CROP INSURANCE AND WEATHER INDEX INSURANCE

Crop insurance

- 1970: The Insurance Department studied different crop insurance models
- 1978-80:
 - Pilot project in cotton
 - Loss in 3rd year
- 1982-84: Department of Agriculture Extension implement crop insurance for 3 years, total loss 1.04 mil.Baht
 - Plan to continue on cotton and soybean but gov. was dissolved
- 1989-91: Crop insurance on maize, sorghum, soybean by private company,
 - Premium was 8% of sum insured (loss)

1996: Cabinets approved BAAC to implement crop insurance through “Mutual fund for damage mitigation”

- Cover rice and maize (flood, storm, and drought,)
- Premium: pay: gov 50 : farmer 50
- The Bureau of the Budget didn't approve

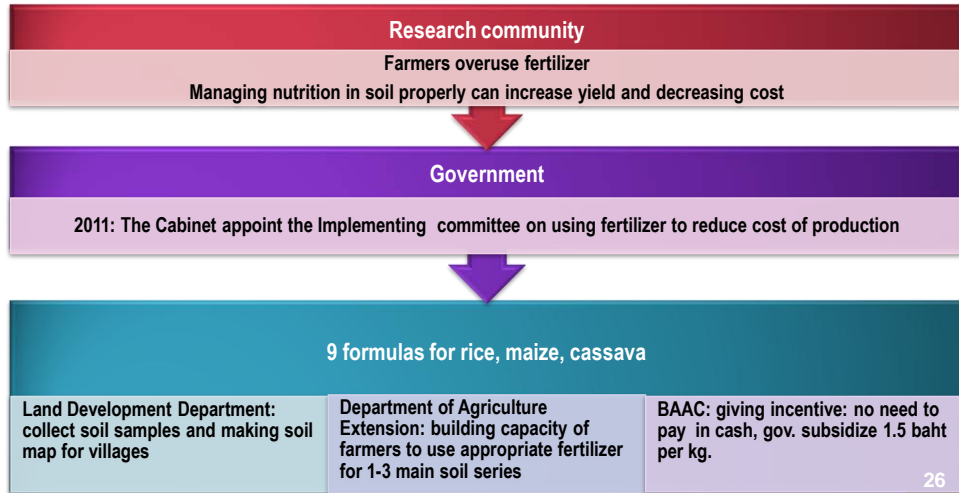
- 2001: BAAC proposed to est. a “Crop insurance Fund” to the Cabinets through MOAC
- 2003: Agenda did not reach the Cabinet

Weather index insurance

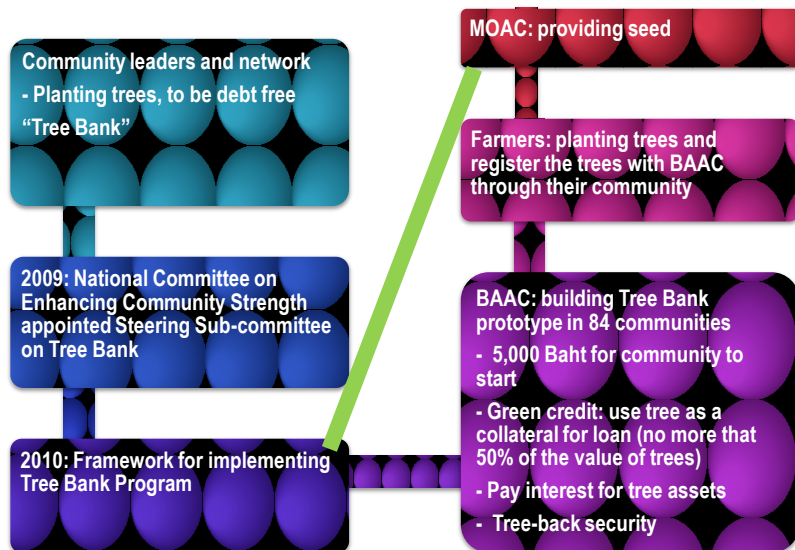
- 2005: Pilot project study supported by the WB (BAAC, The insurance Department, and the General Insurance Association)
 - Cover: maize (drought), rice (flood)
 - No. of farmers
 - Maize: 2007 – 10: 35->358->817->3,194 (about 60,668 rai)
 - Rice 2009 -10: 1,158 (8,040 rai)
- 2009: National Strategy on Crop Insurance Development
 - infrastructure dev: R&D, MIS, awareness, rain gauge expansion
 - market dev: demand and supply management
 - Project also include advancing weather index insurance to cover other crop

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TAILOR-MADE FERTILIZER



TREE BANK PROGRAM



SCALE OF ADOPTION

- GAP:
 - Crops (2011): 89,929 farmers (~1.3% of farmers), 767,450 rai (0.6% of farmland)
 - Fisheries (2010): 32,056 farmers
 - Livestock (1999): 25,783 farmers
- Organic agriculture: 118,091 rai
- Weather index insurance:
 - Maize: 35 ->388 ->817 ->3,194 (60,068 rai) (2007 -> -> ->2010)
 - Rice: start in 2011
- Tree bank: BAAC targeted 84 demonstration communities

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CHALLENGES

- Thailand’s agricultural practices are not uniform. The impact of climate change on agriculture are different from location to location.
- Currently there is no long range projection for extreme event
- Adaptation policies and measures need integrated approaches
- Limited knowledge of the impact of climate change on different varieties of crop and soil
- Limited capacity to adapt and adoption of a new technology and practice due to poverty of farmers
- Difficult to assess cost-benefit of adaptation measures due to high uncertainty
- Insufficient knowledge and technology
- Need creative policy tools to manage with climate change adaptation with mitigation potential

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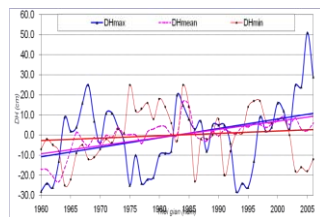
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CLIMATE CHANGE ON AGRICULTURE IN VIET NAM INTEGRATING CLIMATE CHANGE IN POLICY MAKING DECISION IN AGRICULTURE SECTOR

*Nguyen Vu Hoan and Pham Hong Hien,
Ministry of Agriculture and Rural Development of Vietnam
Manila, February 2011*



IN THIS PRESENTATION:

- BACKGROUND
- OVERVIEW OF CLIMATE CHANGE AND DISASTERS IN VIETNAM
- POTENTIAL IMPACTS OF CLIMATE CHANGE ON AGRICULTURE
- INTEGRATING CLIMATE CHANGE IN POLICY MAKING DECISION IN AGRICULTURE SECTOR
- CONCLUSIONS AND RECOMMENDATION



BACKGROUND

- Climate change is considered as a hot issue for Vietnam. It is important with comprehensive impacts on the sustainable development
- Agriculture suffers directly with the most severe impacts to rural area, products and farmers' life
- Vietnam government has issued national logical framework of responding program to climate change (Decision 158/2008/QĐ-TTg dated on 02/12/2008)
- MARD has issued logical framework of response action program to climate change in agriculture sector (Decision 2730/QĐ-BNN-KHCN dated on 5/9/2008 by Minister)



I. CLIMATE CHANGE IN VIETNAM

- *Temperature*: By the end of the 21st century, temperatures could additional increase to 3.3⁰C in the highest scenario 1.7⁰C in the lowest scenario. In winter, temperature goes down in the early months of the season and increase in the last months of season.
- *Rainfall*: Rainfall has trend to vary unevenly between regions, can increase (from 5% to 10%) in the rainy season; and decrease (from 3% to 22%) in the dry season; fluctuations of rain increases.
- *Sea level*: By the end of 21st century, the average of sea level in whole Vietnam can rise up from 34.6cm to 64.2cm in the lowest scenario and 59.3cm to 95.3cm in the highest scenario
- *Extreme disasters*: More typhoons with high intensive.

2.4. Disasters in Vietnam

Overview of disaster in Vietnam

- Many potential risks on arising types of natural disasters.
- Geographical, topographical features, climate, hydrology has contained many disaster occurs
- Population explosion, rapid urbanization rate; economic growth in the context of the backward production..... causes increased risk for arising disasters
- The main types of nature disasters are: storms, floods, droughts, desertification, whirlwind, earthquake and landslide.

Disaster impacts on social-economic development

- Natural disasters has reduced the achievements in poverty reduction and social - economic development.
- Directly affect to the economic, social development, degrade habitat, are agents of unsustainable development, increase poverty, are big obstacle in the process to achieve the Millennium Development Goals.
- Over 80% of the population influenced directly by natural disasters.

II. POTENTIAL IMPACTS OF CLIMATE CHANGE ON AGRICULTURE

2.1. Impacts climate change on agriculture

National scenario of climate change and SLR by MONRE, 2009, if sea level will rise at 1 m, 38.29% natural and 32.16% agricultural land areas will be submerged in the sea water in 10 provinces of Mekong River Delta

Rice quantity possibly reduces by 7.6 million tons of rice (40.52% of total regional rice quantity in Mekong River Delta and HCMC if sea level will rise at 1m in 2100.

Vietnam will be threatened to face to food insecurity in 2100, rice quantity will possibly reduce by 21.39% only changing in rice quantity of Mekong River Delta.

II. POTENTIAL IMPACTS OF CLIMATE CHANGE ON AGRICULTURE

2.2. Totalized changes in potential yield of main crops

Items	Forecasted up to 2030		Forecasted up to 2050	
	Quantity (1000 ton)	Rated (%)	Quantity (1000 ton)	Rate (%)
1. Rice	-2031.87	-8.37	-3699.97	-15.24
Reduced quantity due to natural disaster	-65.27	-0.18	- 65.27	-0.18
Reduced quantity due to potential yield reduction	-1966.6	-8.10	-3634.7	-14.97
- Spring rice	-1222.8	-7.93	-2159.3	-14.01
- Summer rice	-743.8	-8.40	-1475.4	-16.66
2. Maize	-500.4	-18.71	-880.4	-32.91
3. Soybean	- 14.38	-3.51	-37.01	-9.03

III. INTEGRATING CLIMATE CHANGE IN POLICY MAKING DECISION

3.1. Justification of integrated climate change in policy making decision

- Agricultural plans and strategies regarding to climate change should be based on the national policies and strategies on socioeconomic development to ensure modernization and industrialization.
- Recommended policies ensure feasible, supportive and effective. Selected policies ensure the achieve multipurpose to develop agriculture and related sectors.

3.2. Proposing policies to integrate climate change in agriculture and rural development

- Integrate survey, monitoring and short-term forecast of hydrograph and meteorology with agriculture
- Integrate climate change is multipurpose land master plan in medium and long term strategies;
- Integrate high technological and biotechnological research programs with genetic conservation and utilization;

III. INTEGRATING CLIMATE CHANGE IN POLICY MAKING DECISION

3.3. Proposing policies to integrate climate change in agriculture and rural development

- Integrate poverty alleviation and reduction programs with projects of responding to climate change, mitigation and adaptation strategies in island, remote areas;
- Cleaner production development, saving energy programs and reduce GHGs, waste disposals in crop and livestock production;
- Integrate science research and development programs, new technical advances in agriculture with mitigation and adaptation measures to climate change and GHGs, waste deposits reductions.
- To evaluate and propose policies and programs to cope with impacts of climate change and integrate climate change into plans of MARD in agricultural production.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

- 1 Vietnam agriculture will be affected seriously by climate change such as reduction in potential yield, agro-biodiversity, and losses in agricultural land, natural disasters, floods and drought consequences.
2. Due to consequence of climate change, agriculture lost for natural disasters (typhoon, storm, floods, chilly cold,...) 800 VND bil per year.
4. At 01 meter, in estimation, 38.9% natural land areas and 32.16% of agricultural land area will be threatened to be submerged, 40.52% of rice quantity will be reduced in 2100 in Mekong River Delta, Vietnam will face threaten of food insecurity.
5. Potential rice quantity will possibly reduce by 8.37% in 2030 and 15.24% in 2050. Natural disaster is included, total rice quantity of Vietnam will possibly reduce by 11.29 million ton (reduced 31.78%)
6. For other crops, potential maize quantity will possibly reduce
7. Each ecological region will be impacted particularly by climate variable change, different adaptation measures have been applied for different regions.

CONCLUSIONS AND RECOMMENDATIONS

RECOMMENDATIONS

1. MARD needs to issue and implement communication campaign of impacts of climate change on agriculture, considers climate change as conditional aspect to select and carry out of agricultural development program and direction;
2. Based on functions and tasks, MARD need to set up priority for different stages of adaptation programs (short term, medium and long-term) regarding to typical region, interregional and national level;
3. MARD needs to diversify financial sources from government, local authorities, NGO, INGO, domestic and international supports to strengthen capacity for agricultural network to response to climate change;
4. Strengthen capacity for agricultural research network regarding to climate change, unified managements of network in responding to climate change;
5. MARD needs to support for fully evaluating impacts of climate change on different crops, livestock, fishery, forestry,...and building databases on climate change and use it as longer term forecasted and support immediately for high vulnerable regions to climate change.



Thank you for your attention!