Review reasearch

CLIMATE CHANGE ADAPTATION IN AGRICULTURE

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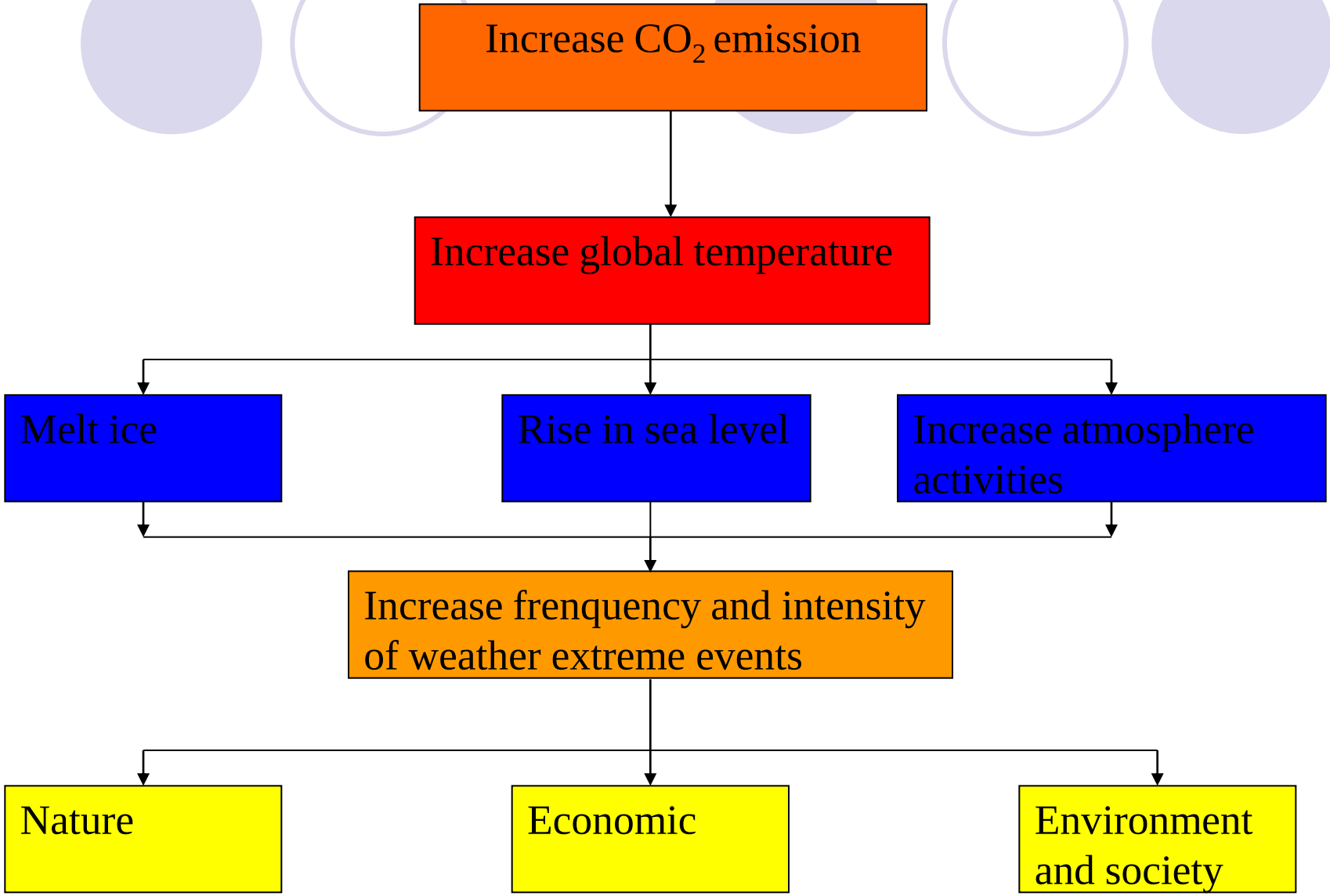
Introduction



Introduction

- Climate is both a significant resource for human activities and hazard
- Scholars agree that our climate is changing
- Viet Nam: the top 5 most affected countries in the study, considering all sea level rise impact indicators
- Many researches on adaptation and mitigation in agricultural production in the world as well as in Vietnam

Introduction (cont)

- In order to identify and evaluate:

(1) What are researches achieved?

(2) What are researches not achieved?

- Which researches have not conducted yet?

- Avoid overlap in researches in the future

- Find the gap in adaptation researches to climate change in agricultural production

Research objectives

- Provide basic knowledges about climate change
- Provide assessment approaches of climate change impact
- Provide information in adaptation to climate change on agriculutral production
- Propose the trend research to enhace adaptive capacity to climate change on agricultural production

Main contents

1. Causes and signs of climate changes

2. Assessment approaches of climate change impact

3. Climate changes in Vietnam

4. Impacts of climate changes on agriculture, fishing and aquaculture

5. Climate change adaptation in agriculture

6. Research trends in the future in agriculutural production

1. Causes of climate changes

Causes of climate change

There are two viewpoints:

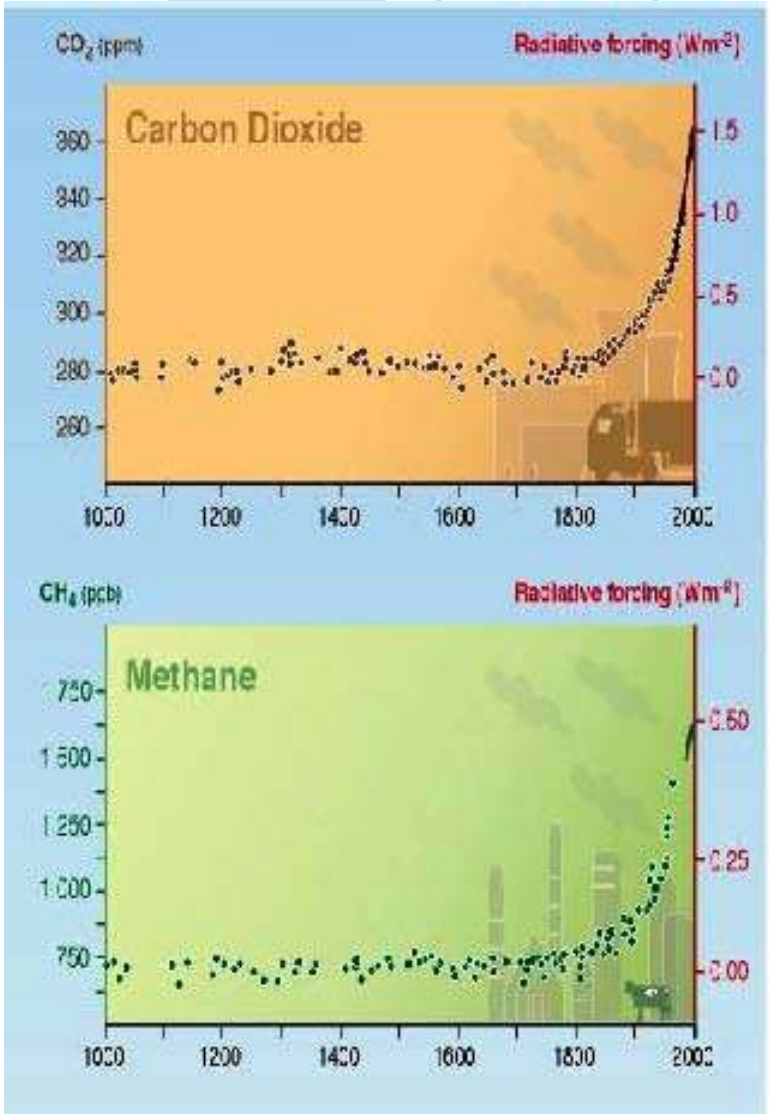
1. Increasing CO_2 in the asmosphere due to human activities
   - Human activities:
     - Industrial development
     - Overexploitation natural resources especially energy
     - Development mass transportation means
     - Lacking agricultural production management

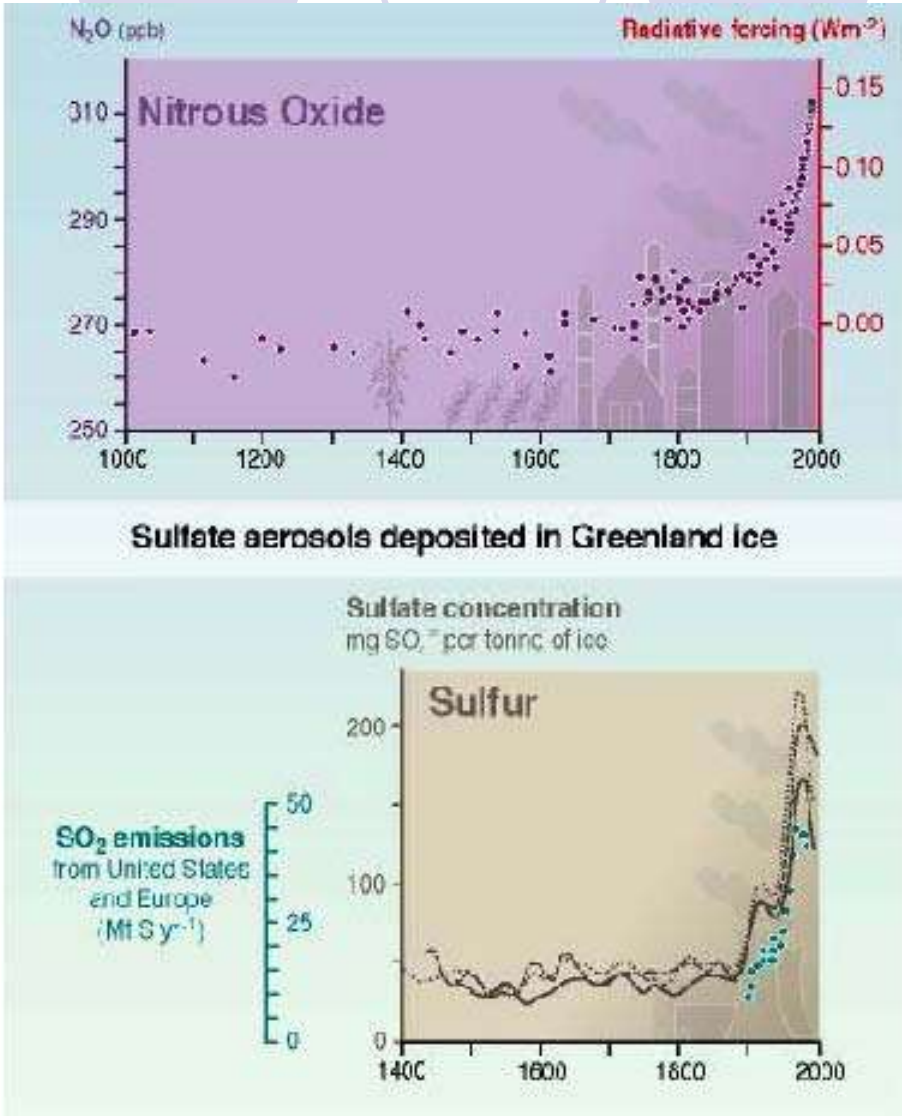
➔ Increasing CO_2 (280ppm lên 360 ppm), CH_4 ,N_2O, SO_2

2. Following the Earth cycle activity




The change the greenhouse gas in atmosphere





Source: IPCC (2007)

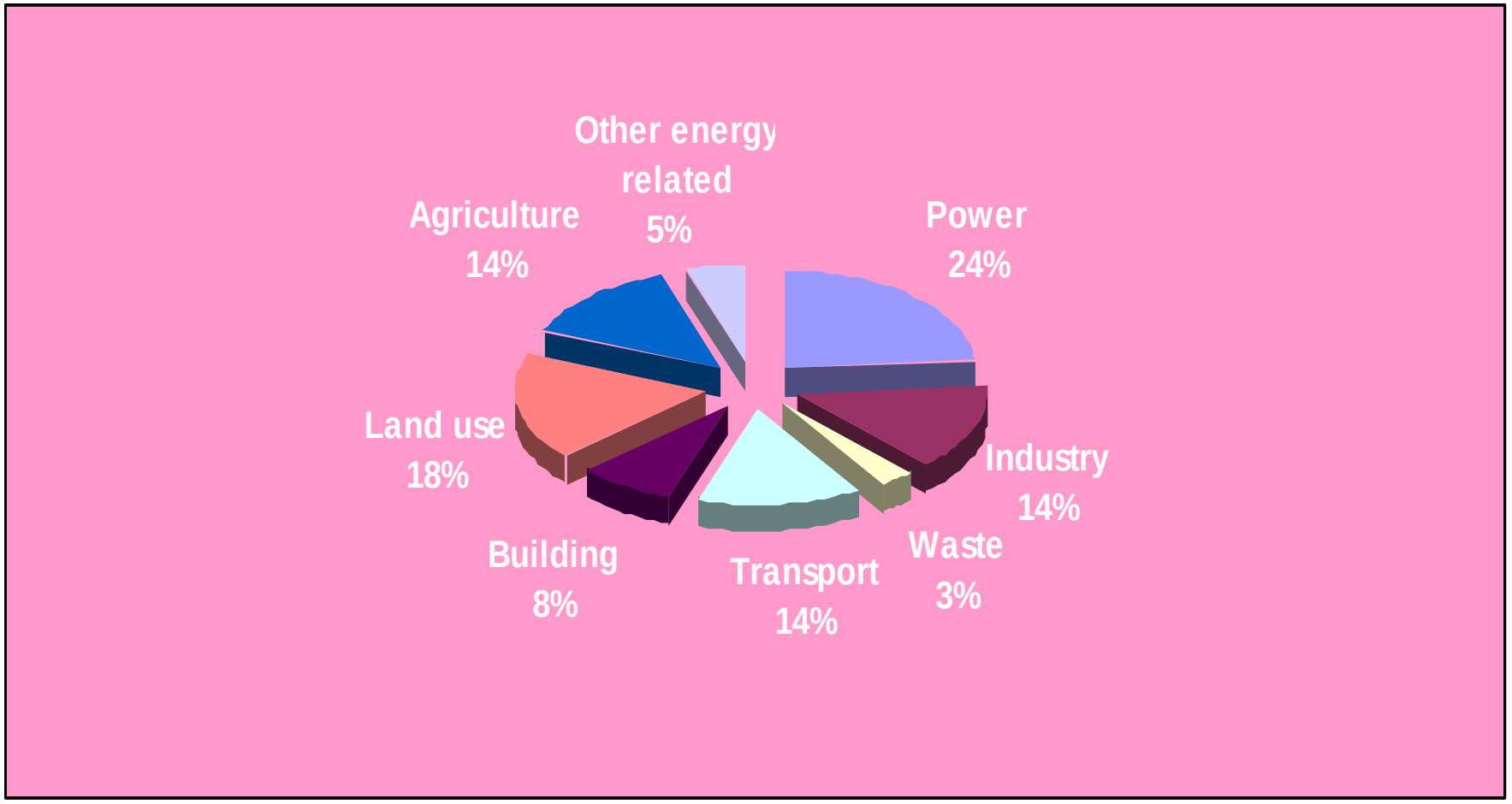


Figure 1: Global emissions by sector

Total emission in 2000

Livestock contribution GHG emission

Livestock currently contribute about 18% to the global warming effect

- 9 percent CO_2
- 37 percent CH_4
- 65 percent N_2O

(Source: Steinfeld and Hoofmann, 2008)

Table 1 Estimated GHG emissions to 2020 in Vietnam

Unit: million tons CO2

Year	*1994*	*2000*	*2010*	*2020*
Energy	25.64	45.92	105.17	196.98
Forestry and land use change	19.38	4.20	-21.70	-28.40
Agriculture	52.45	52.50	57.20	64.70
Total	**97.47***	**102.62**	**140.67**	**233.28**

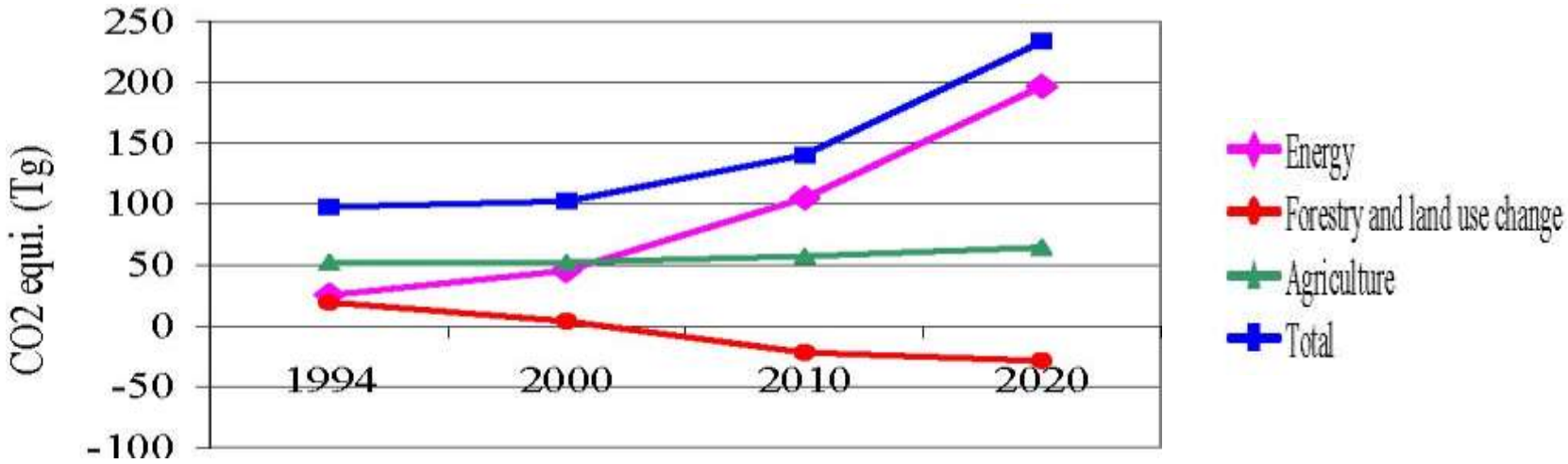


Figure 3: GHG emission projection to 2020

Source: ALGAS, 1997, Vietnam Initial NatCom, 2002.

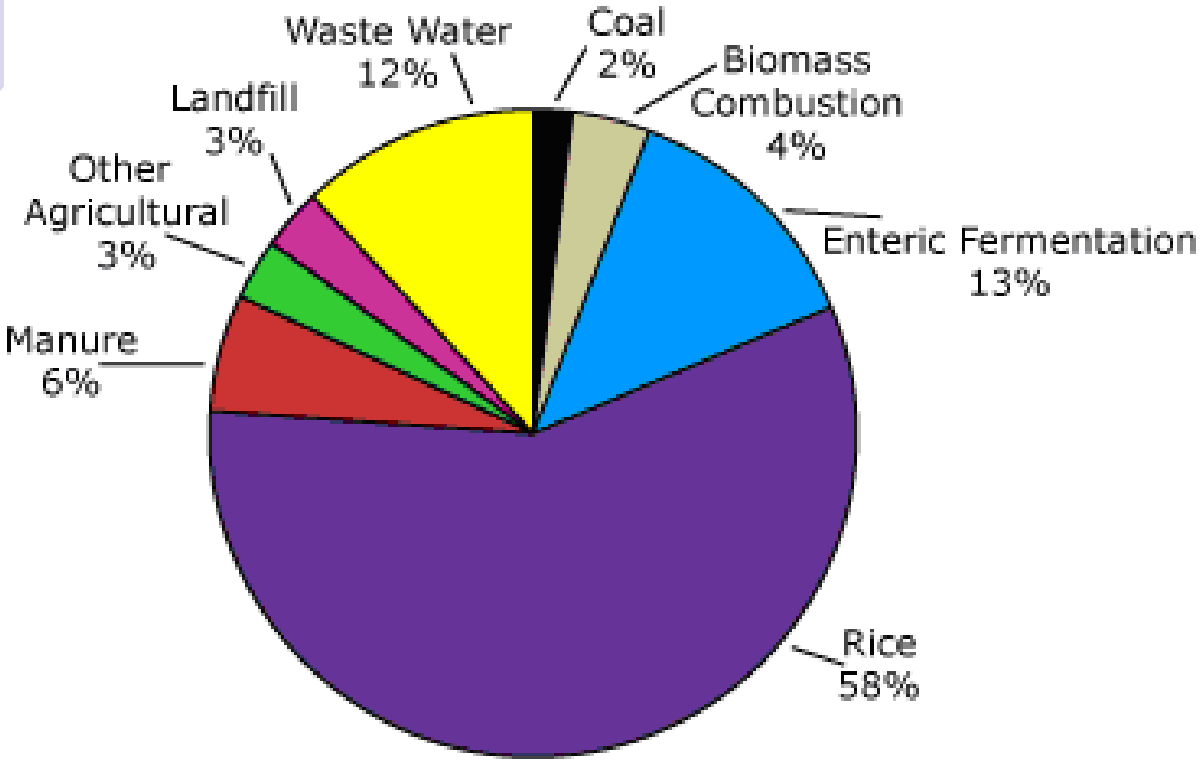


Figure 2: Vietnam 2005 methane emissions by source
Source: USEPA, 2006

Key consequences of climate change

- Increase of temperature
- Sea level rise
- Salt water intrusion
- More frequency/intense
  - floods, droughts, storms
  - landside, water drainage problems

2. Assessment approaches of climate change impact

Objectives of assessment approaches of climate change impact

1. Assess impacts of climate change on human activities and natural system
2. Assess vulnerability or thresholds to likely scenarios
3. Evaluate potential evironmental standards
4. Identify and evaluate adaptation options
5. Assess the costs of impacts of climate change and adaptation strategies implementation
6. Alert public awareness to issues of common cercern
7. Provide baseline for polices related to climate change

There are three approaches: impact approach, integrate approach and interaction approach

Source: *Carter et al.(1994)*

3. Climate changes in Vietnam

Observed information – climate change in VN

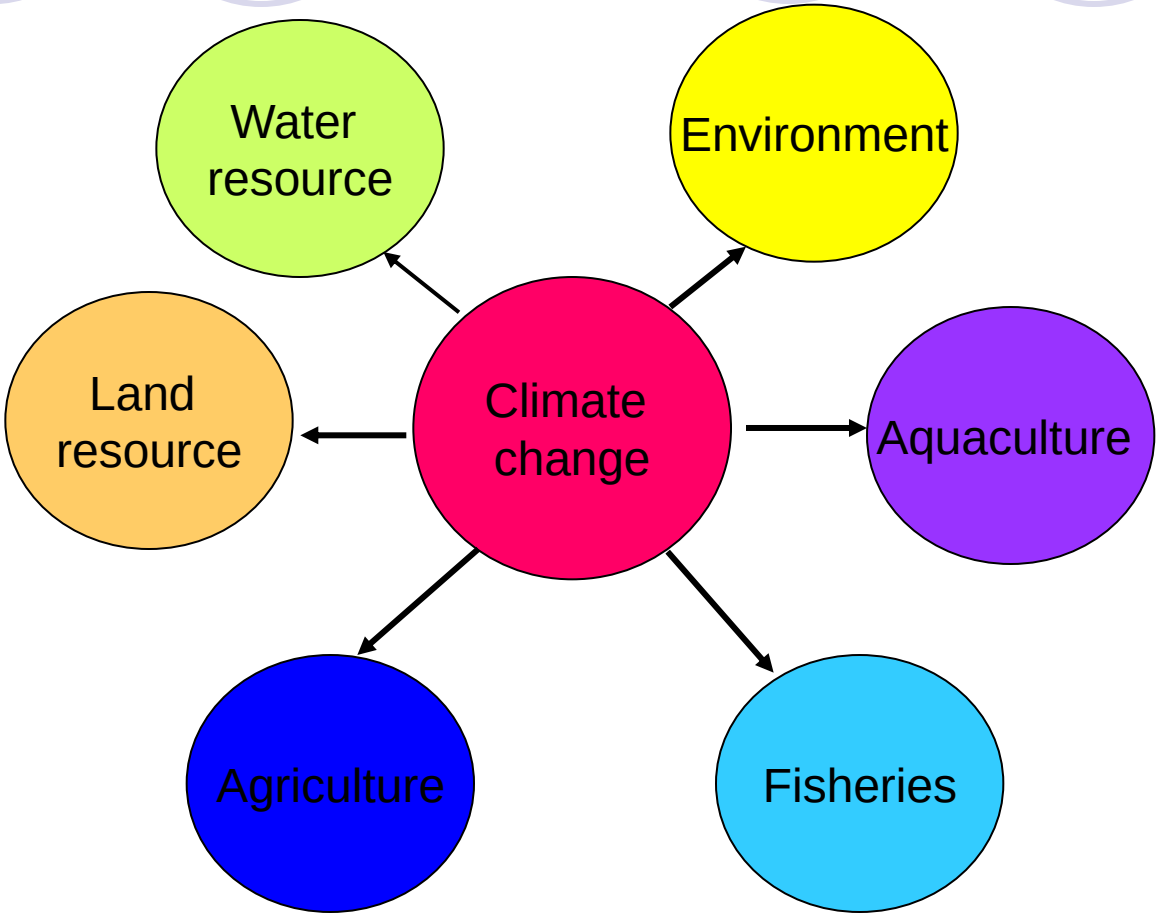
- A shilf of storms towards the South and towards the end of calendar year
- More special large floods in the central and southern parts of the country
- More droughts throughout the country
- ENSO has more impacts on climate regimes and characteristics of weather in various parts of Vietnam
- Sea level rises 2.5-3.0 cm/decade, over the 20th centry

Climate change in the future

- Temperature will go up by 2100:
  - about 3^0C in the NW and NE mountains, Red River delta and North central coastal
  - about 2^0C in the South central coastal; Central Highlands and Mekong Delta regions
- Rainfall will decrease on the dry season and increase from the June to November: flood risks and landsides
- Increase strongly drought risks on December to May: southern regions
- Typhoon: more frequency, stronger, landfall of a wider area
- Sea level rise and associated sline water intrusion will strongly affect:
  - Mekong and parts of the Red river delta
  - Coastal strip including small estuaries

4. Impacts of climate changes on agriculture, fishing and aquaculture

Climate change impacts



Sea level rise – posible impacts

- Viet Nam: the top 5 most affected countries in the study, considering all sea level rise impact indicators.
- In 2100, 1-metre rise in sea level would affect:
  - approximatey 5% of Vietnam's land area,
  - 11% of the population,
  - 7% of agriculture and
  - reduce GDP by 10%
  - water intrusion

Source: World Bank Policy Research Working Paper, 2007

Impacts on agricultural production

- Agricultural production is the target that is directly impacted of climate change:
  - Seasonal calendar
  - Disease
  - Investment cost
  - Yield
  - Agricultural product quality
  - Landloss
  - Soil erosion and degradation
  - Water resources

Crops

- Increase temperature ➔ Increase drought ➔ reduce yield and product quality of crops

  Positive crop yield responsees to temperature increases 2^0C rise but yield reductions at 4^0C temperature rise (Adams *et al.*, 1998)

- Increase local rainfall ➔ increase waterlogged area and flood ➔ reduce yield or failure of crops

- Sea level rise ➔ landloss and saline intrusion ➔ reduce yeild

  2007-2100: Vietnam has lost 7% agricultural area – reduce 12% productivity total

- Change incidence and distribution of pests and pathogens

- Change seasonal structure and distribution of crops

Livestock

- Livestock can be affected in 2 ways (Thornton *et al.*, 2007)

1. Quality and amount of forage from grasslands
   - changes in the productivity of rain-fed crops and forage
   - lack of feed
   - reduce number of animals
2. Directly effects on livestock due to higher temperature
   - reduced water availability
   - changing severity and distribution of livestock diseases

- Increase disease and harmful pest
- Reduce yield even yield loss
- Reduce quality of meat
- Low milk production
- Increase costs for investment

Livestock

- Feed source
- Productivity and reproduction capacity
- Resistance
- Scale and diversified level
- Profits

Fisheries and aquaculture

- Change environment life of many species (Rex *et al.*, 2007, Arnason, 2003)
  - Loss habitat of fresh aquatic
  - Narrow reproductive habitat of many aquatic species
  - Species in the brackish water have died
  - Migration fish species
- Change feed sources
- Change abundant of fish species
- Reproduction capacity has decrease
- Decline of fish catch
- Decline of shrimp productivity
- Disease has over broken in shrimp and fish ponds
- Reduce salt-marsh areas

➔ Strongly influence on aquaculturalists and fishers livelihood

Climate change and food security

- Climate change can lead more than 2 billion: food insecurity
- Increase poverty and unequal:

  - more than 850 million people, within

    - 300 million children need to relief
    - 184 million in Africa will die of hunger
- 1,2 billion people can often lack of food on 2025
- Vietnam, SLR-1m: an estimate productivity will decrease 12%, appromixately 5 million tan rice (without allow for saline intrusion areas)

5. Climate change adaptation in agriculture

Adaptation to climate change in agricultural prodcution has many options:

- Choice species or variety, breed and develop new varieties/breed
- Change mode of production
- Change/adjust seasonal calendar
- Improve water source and irrigation system
- Improve crop, livestock and aquacultural technique
- Adjust and manage in production inputs
- Enhance warning system
- Alternative livelihood

Varieties and breed

- Use of more heat/drought-tolerant in watter stress areas;
- disease and pest tolerant;
- salt-tolerant crop varieties
- Introduction higher yielding, earlier maturing crop varieties in cold regions
- Breeding livestock of greater tolerance and productivity
- Breeding fish tolerant to high water temperature

Mode of production

- Change monoculture production mode (Smit và Skinner, 2002
- Integrate several animals or crops in production
- Mode of production : combine indigenous/locally-adapted plants and animals
- Selection and multiplication of crop varieties and autochthonous races adapted or resistant to adverse conditions (FAO, 2007)
- Diversification crops or animals or crops and animals
- Incorporate crop rotations
- Agro-forestry (Rao *et al.*, 2007)
- Crop-livestock associations,
- Crop-fish systems and the use of hedges,
- Vegetative buffer strips

Seasonal calendar

- Warning system
- Forecasting weather (week, month)
- Adjusting planting and haversting date
- Change timing of farm operations to address the changing duration of growing seasons and associated changes in temperature and moisture

Cultivation techniques

- Technique for improving water resoure (FAO, 2007)
  - Improve irrigation systems
  - Technique for collecting surplus water
  - Plans for water management
  - Use mulching material

- Apply technique for cultivation in water

- Apply agro-foresrty and cultivation in slope soil technique

- Technique for improving soil: using residue mulching

- Techique for diversifying crop structure in terms of space and time (crop rotation, VAC, VACR)

Livestock techniques

- Increase stocks of forages for unfavorable time periods

- Improve pasture and garzing managment
- Improve management of stocking rates and roation pastures
- Increase quality of forages used to graze animals
- Increase plant coverage per hecta
- Provide local specific support in supplementary feed and veterinary service
- Adjust portion in feed (using crude protein)

6. Research trends in the future in agriculutural production

Table 2: Some polices relates to Risk management to climate change/disasters

• Policy about land and land use
• Policies about cultivation, protection, management and exploitation forestry
• Policy about management and use natural resources
• Policy about water management
• Policy relates to protection and management environment and sustainable development
• Particular policies for living with flood areas

Source: Bhujang và Huy (2006)

Research trends in the future in agriculutural production

- Varieties and breed for adaptation in climate change impacts
- Indigenous and practical knowlege in climate change adaptation in agriculutre to climate change impacts
- Crop and livestock technique, mode of production for adapting to climate change impacts
- Agricultural prodcution project for climate change scenario
- Crop and livestock technique, mode of production for mitigating greenhouse gas
- Water source management, especially water source in sandy land
- Technique for improving soil secondary impacts of climate change

Thank you very much for your attention!