Climate change vulnerability assessment and natural disaster management in the tropical area for sustainable development: case study of Vietnam

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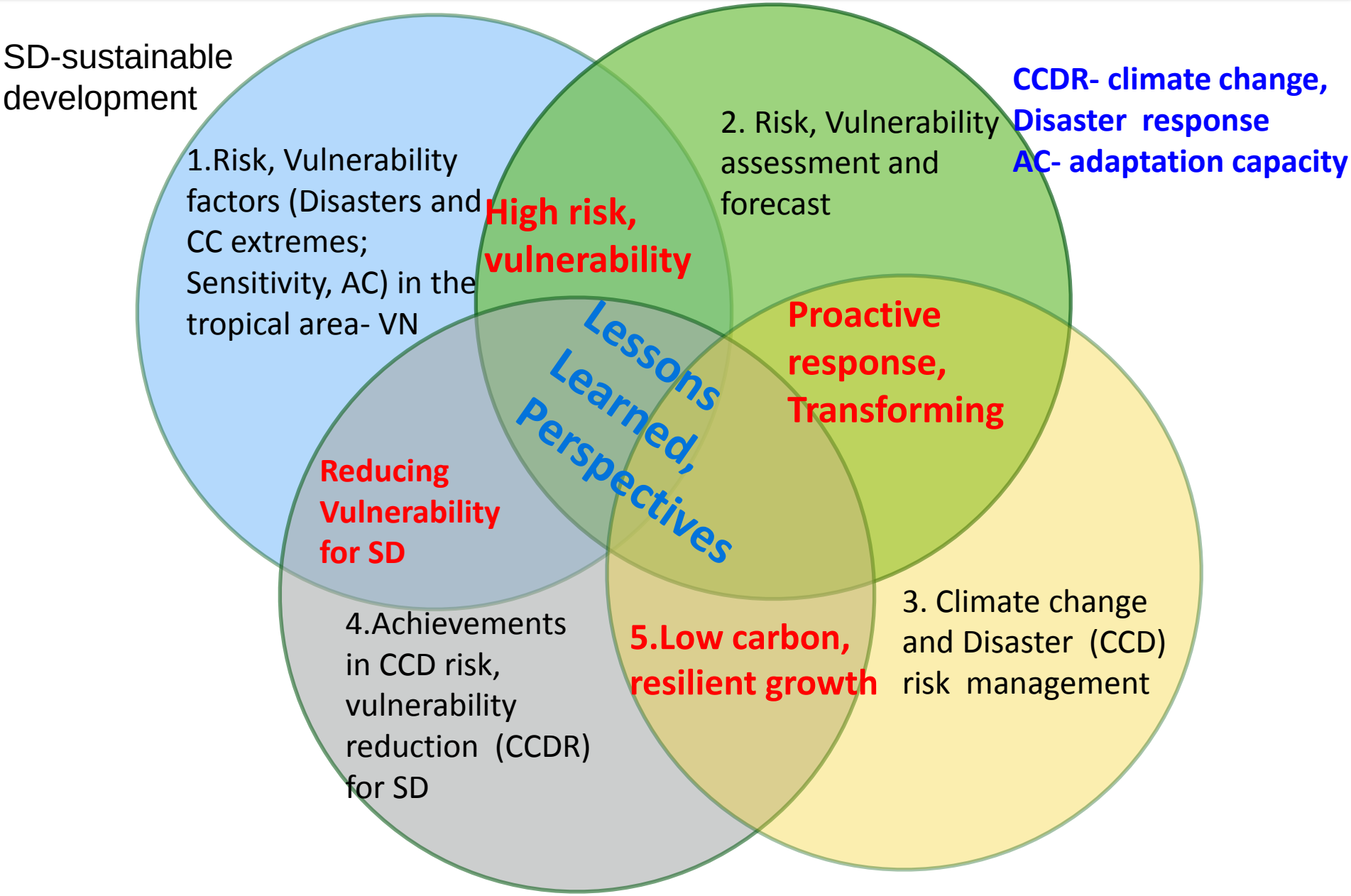
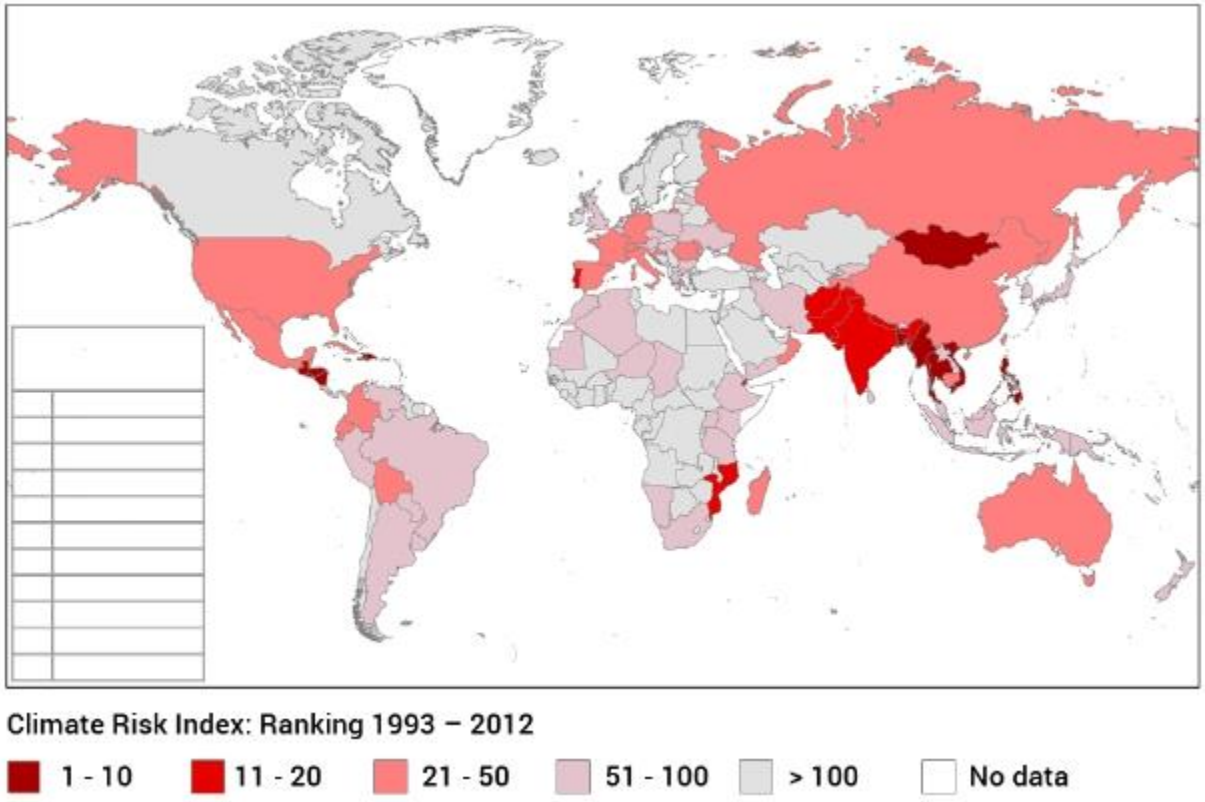
Main contents



1.Vietnam is one of the most CC vulnerable countries:

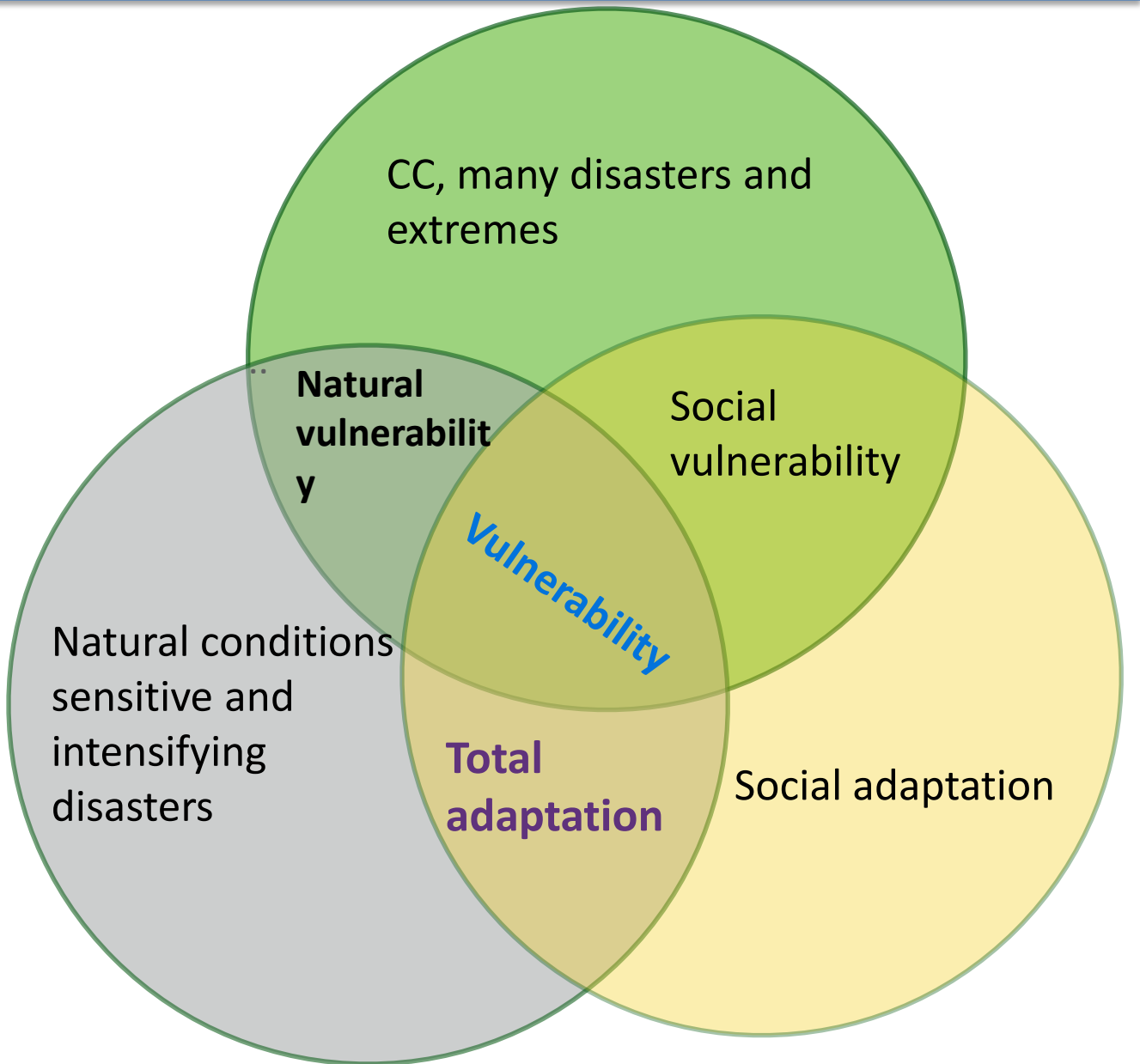


VN is in the top 10 according to Climate risk index, ranking 1993-2012

Sea Level Rise:

Mekong delta is in the top 3 most Vulnerable deltas

1.Vietnam is one of the most CC vulnerable countries: why?



I. Vietnam – one of the most vulnerable countries to climate change: Why?

1. Natural ,Socio-economic conditions
2. Impacted area, population, human and economic loss

There are all the CC disasters and extremes (typhoons, storm, flooding, debris flows; many disasters induced and/or intensified by CC, human activities (landslide, erosion, salt intrusion, inundation, …)

Main production sectors: agriculture, fisheries and forestry – much dependent and vulnerable to the impact of climate change, disaster (CCD)

Level development of science and technology, technical and socio-economic infrastructures - lower than requirements to respond to CCD

High population density; Low income, poor infrastructure

Fast urbanization

I. Natural and socioeconomic conditions of Vietnam are very sensitive to CC, extremes, disasters

1.1.Natural conditions

Natural conditions are **sensitive to CC negative impacts and disasters**:

+ 2/3 territory is mountainous; strongly dissected,
+ High differentiation of natural conditions
+ Abundant coastal lowlands, flooded areas arid regions,
+ Long Coastline, over 3260 km; every 10km one river mouth;
+ Nearly 65% of Vietnam's surface water resource from overseas
+ Water shortage: Has used approximately 40% of water source, approximately ecological safety threshold recommended by the FAO

1.1. Natural and socioeconomic conditions of Vietnam are very sensitive to CC, extremes, disaster: Unsustainable human activities

1.1. Natural and socioeconomic conditions of Vietnam are very sensitive to CC, extremes, disasters

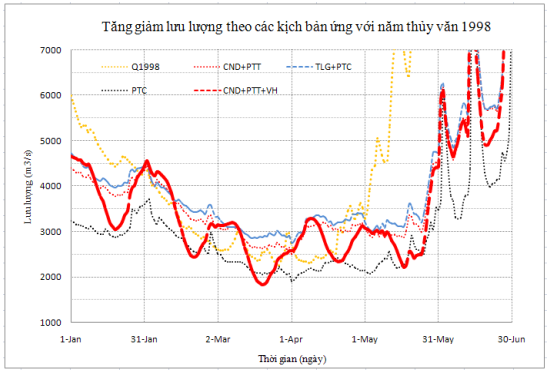
Map of hydropower projects on the Mekong basin

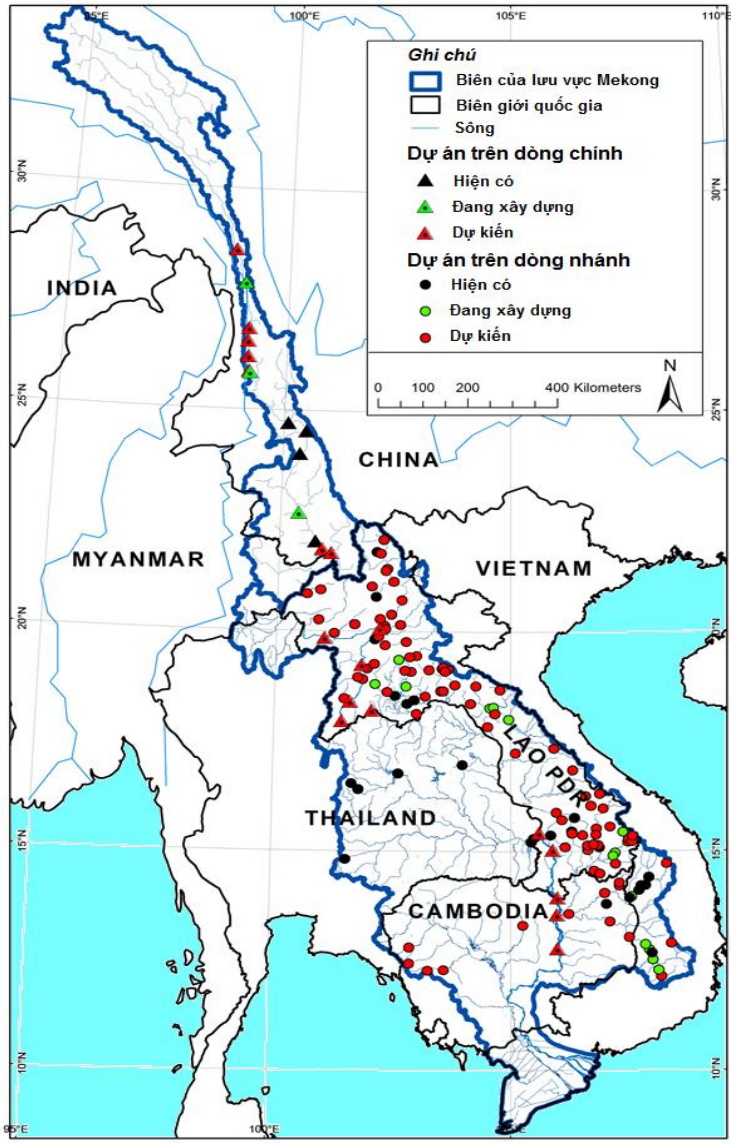
Legend:

Green spots: dam under construction

Red spots: the dam is about to be constructed.

Black spots: the dam is operating





Water Source in upstream Change results in:

-Fresh water decrease
-Flood regime change;
-Reduced downstream flow, sediment and nutrient load, especially in the dry season;
- Change the water quality (sediment, salt, alum, pollution);

Source: University of Canterbury, Data source: MRC Hydropower database, 2010a

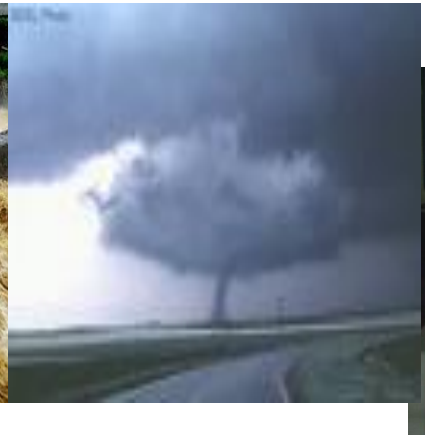
1.2. In Vietnam there are all the disasters and extremes related to climate change

Strong wind

Storm

Heavy rain

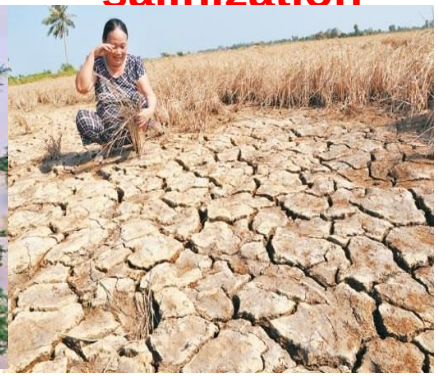
Cyclone



Debris flows

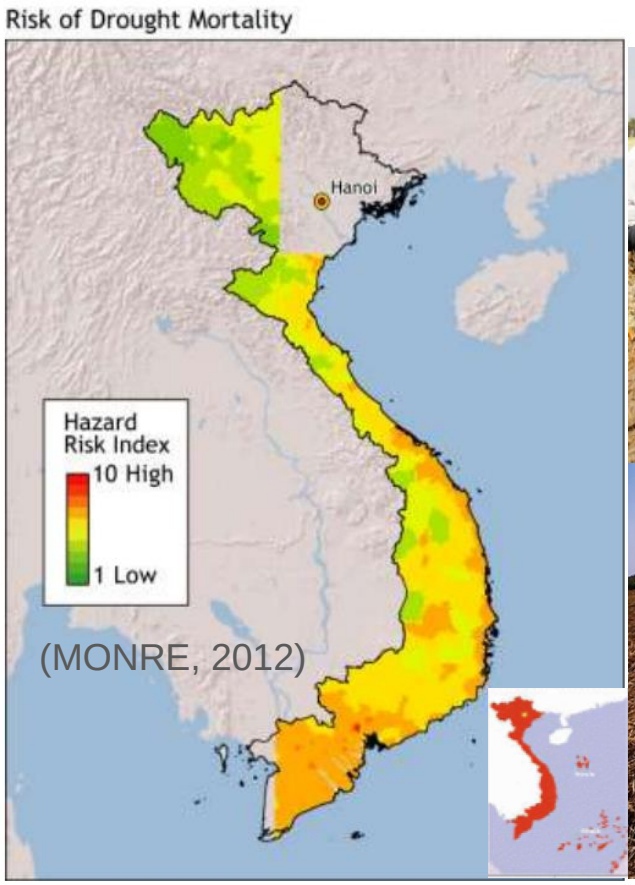
Flood (river, coastal)

Drought, salinization



Fire

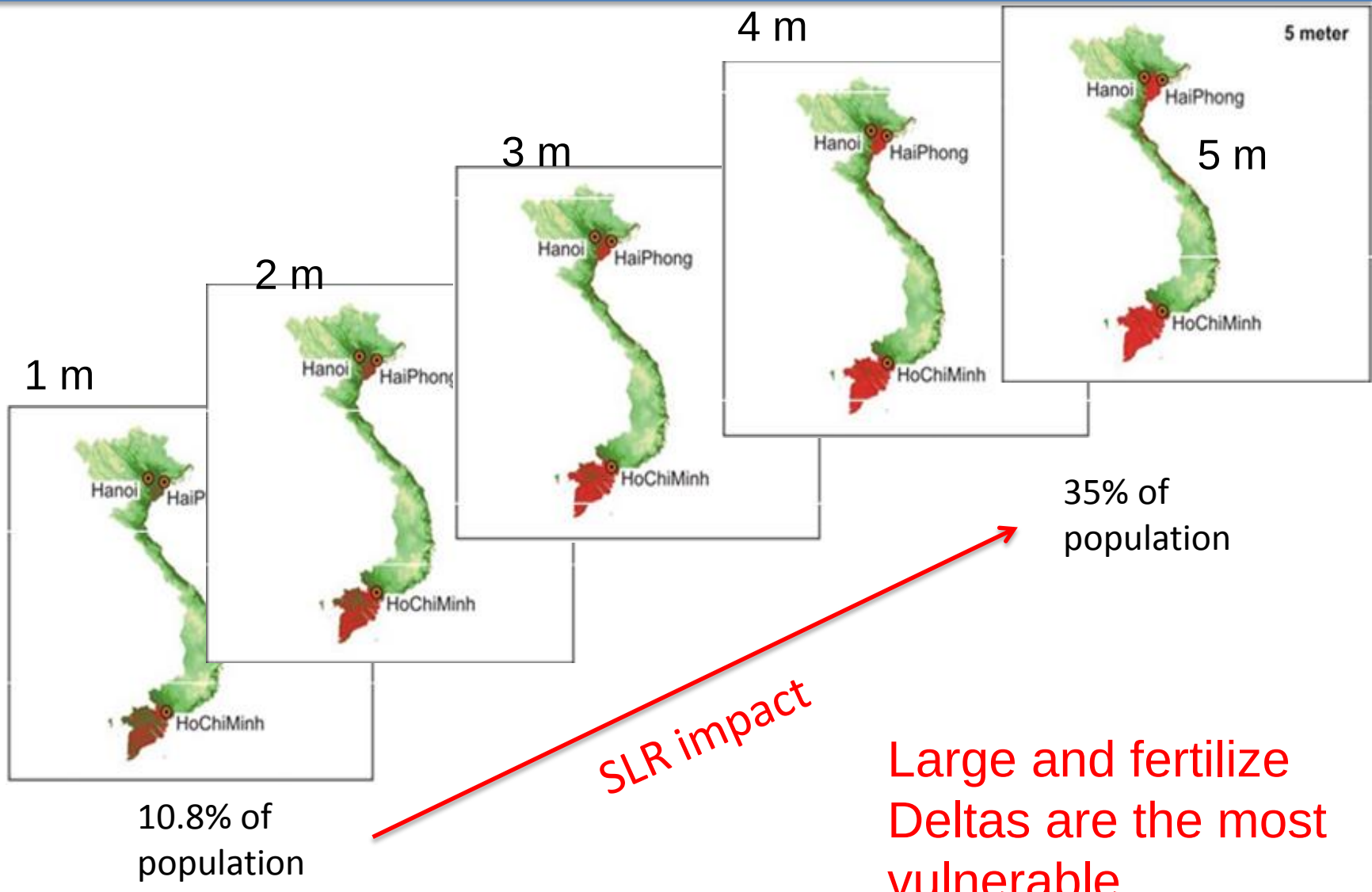
1.2. In Vietnam there are all the disasters and extremes related to climate change



Drought

- Increased in number and magnitude, particularly, Central, highland and Southern areas
- River water level quickly decreases

1.2. In Vietnam there are all the disasters and extremes related to climate change



Large and fertilize Deltas are the most vulnerable

Sea level rise

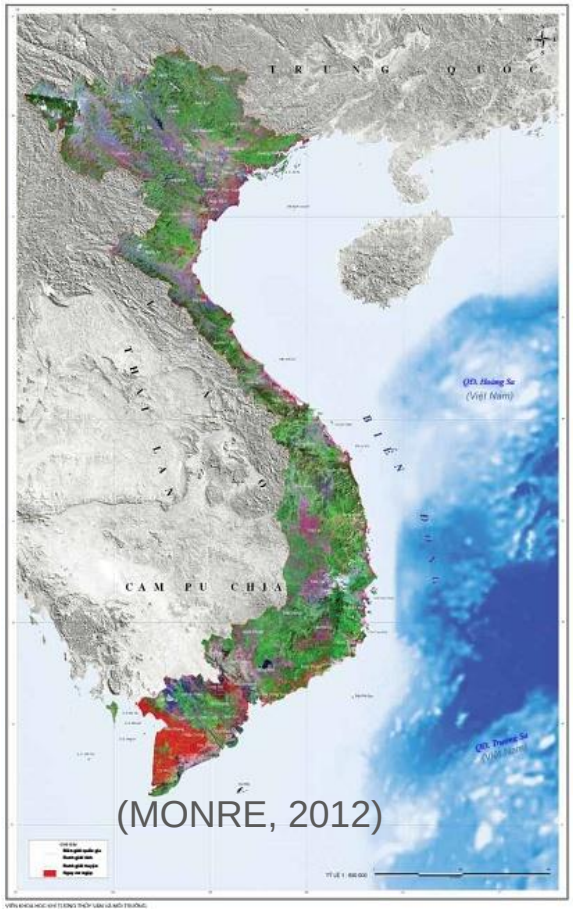
(MONRE, 2012)

1.2. In Vietnam there are all the disasters and extremes related to climate change

Flood

- **Red River delta:** Reduction of the annual flow, big floods occurred frequently in the upstream.
- **Mekong River delta**: witnessed many floods, especially in 2000, 2001, 2011, with the water level of over 4.5m.
- **The Central Vietnam:** Occurred very fast and dangerous

1.2. In Vietnam there are all the disasters and extremes related to climate change



(MONRE, 2012)


Vietnamnet


Internet


Internet


Internet

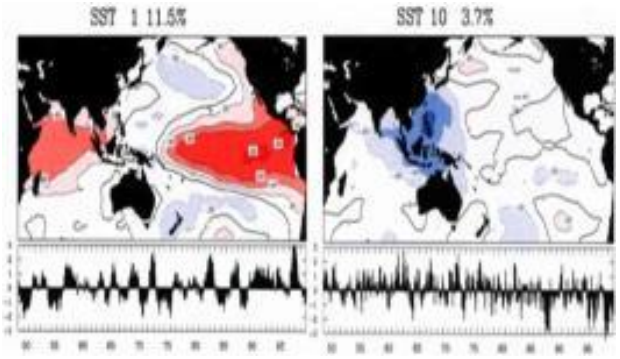
Floods

- Highly vulnerable areas: Red river delta, Mekong delta, Riverine estuaries of Central area

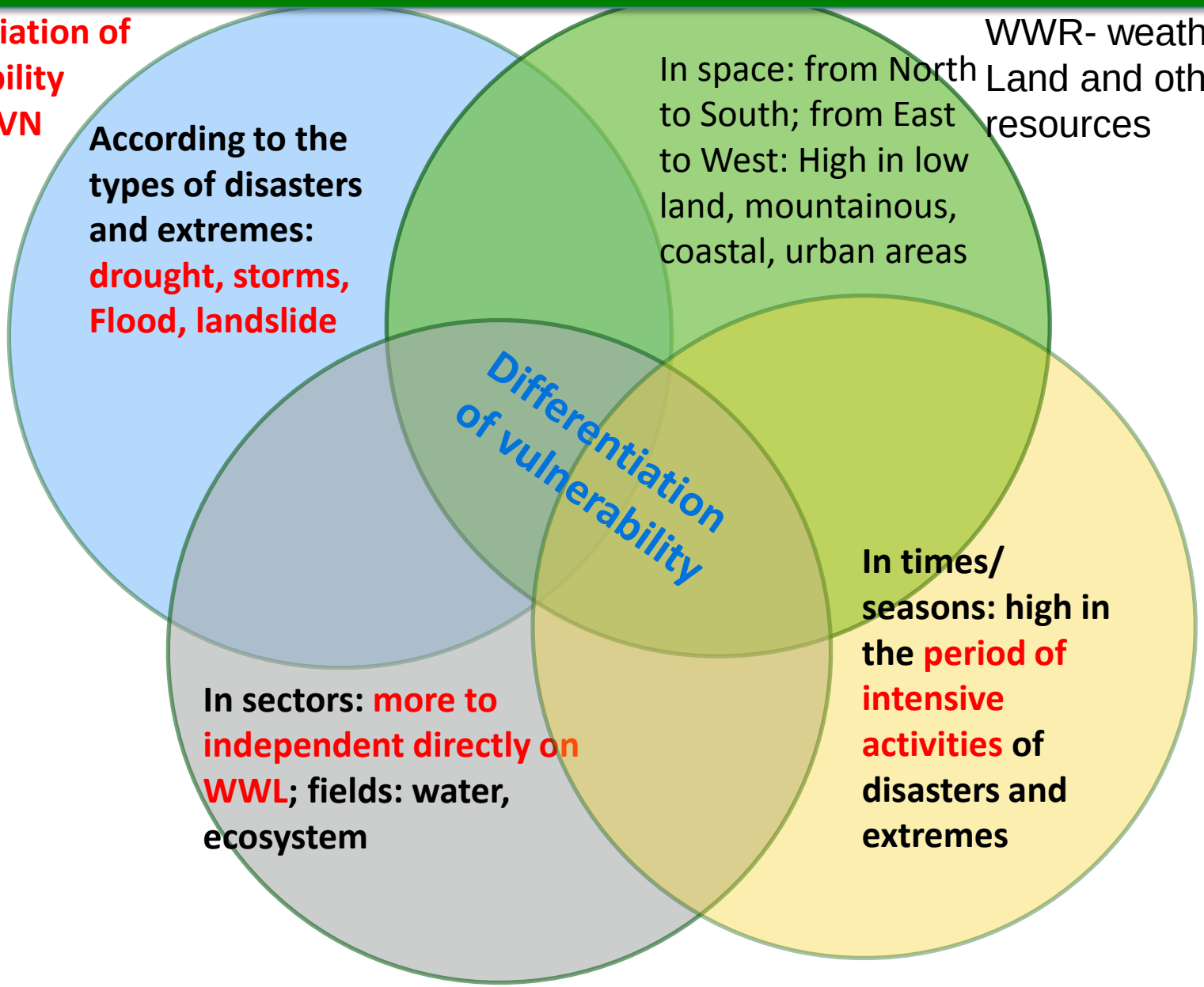
1.2. In Vietnam there are all the disasters and extremes related to climate change

Other extremes

- Cold days in the North decrease;
- More extreme cold days;
- Unseasonable rain and abnormal heavy rainfall more frequent;
- El Nino/ La Nina have impacted stronger.



I. Vietnam is one of the most CC vulnerable countries: Time and space differentiation of vulnerability



I. Vietnam is one of the most CC vulnerable countries

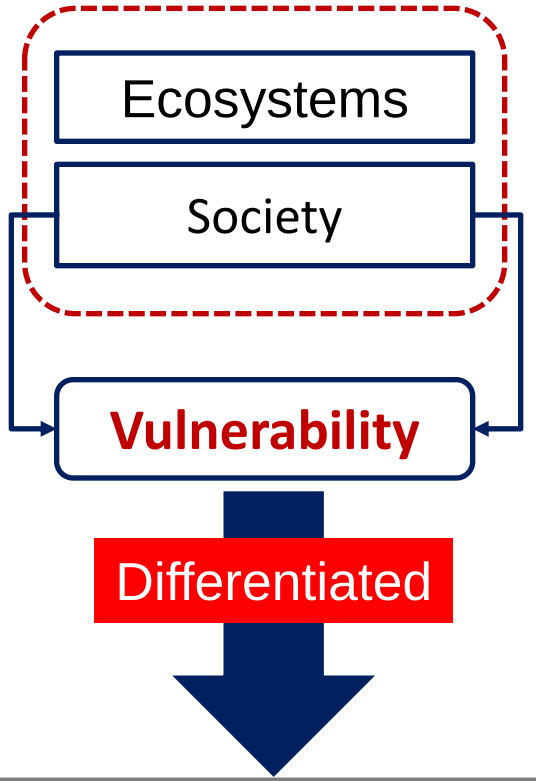
1.1. Space and time differentiation of Impact and Vulnerability to climate change, disasters:

Exposure

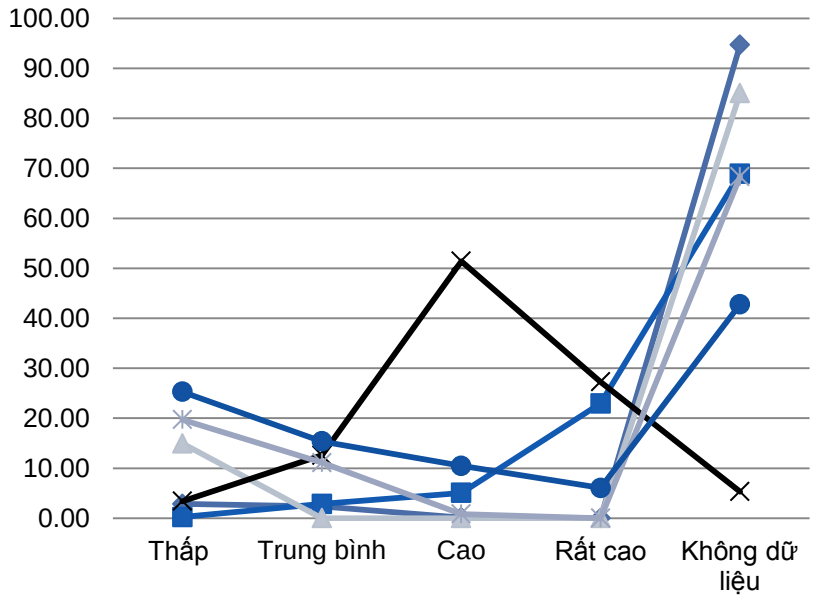
Weather hazards: typhoon, floods, heat waves, drought, frosts, etc.

Other hazards: landslides, erosions, saline intrusion, etc.

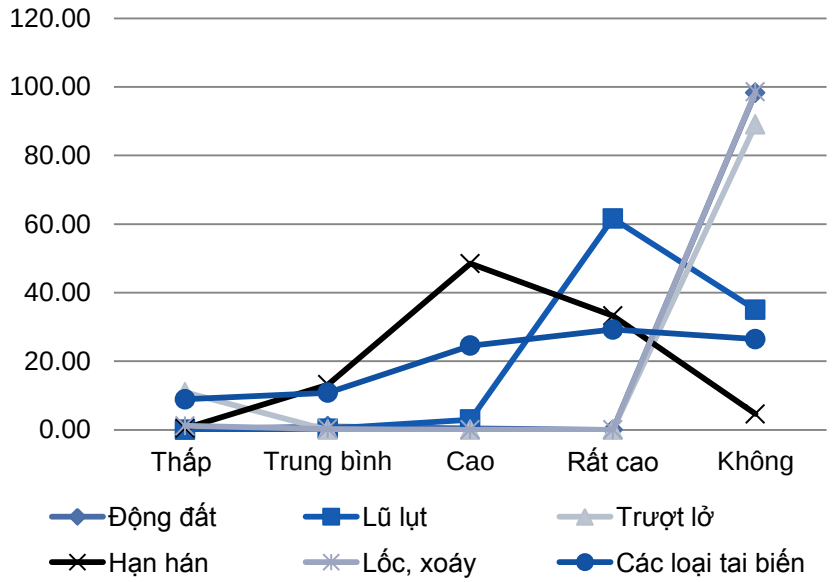
Impacts



I. Vietnam is one of the most CC vulnerable countries. 1.2. Most dangerous disasters



% impacted area by disasters in Vietnam



% impacted population by disasters in Vietnam

Reduction of the impacted area

Drought - integrated disasters- storm – flood - landslide- earthquake

Reduction of the impacted population

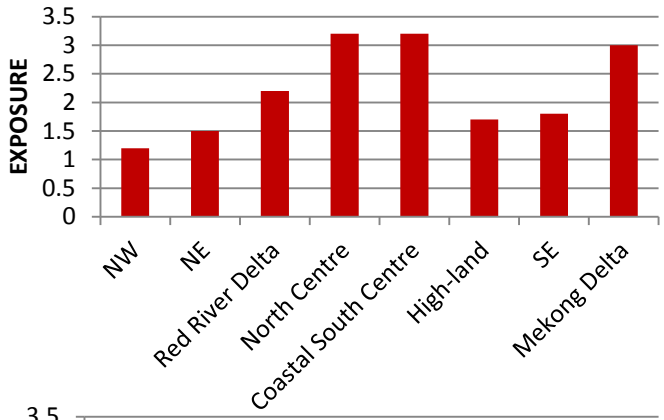
Drought - integrated disasters- storm – flood - landslide- earthquake

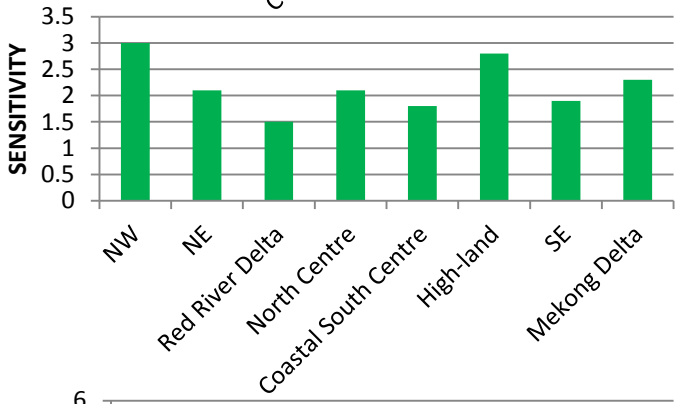
I. Vietnam is one of the most CC vulnerable countries. 1.3. Most vulnerable fields:

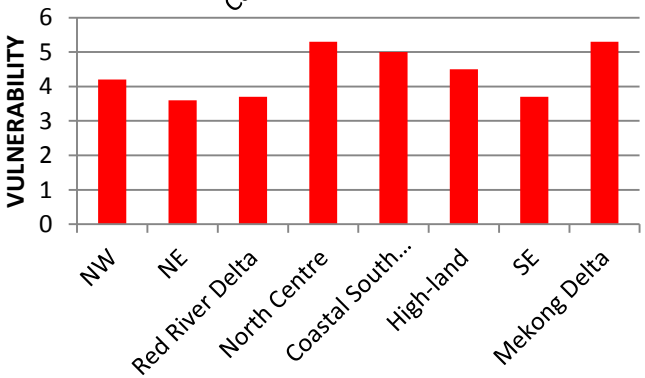
CC parameters/ disasters	Sensitive/vulnerable area	Vulnerable fields
Temperature rise	• Mountain regions: Northeast, Northwest and North Central • Northern Delta	• **Agriculture (farming, livestock, fisheries and fisheries)** • **Natural ecosystems, biodiversity** • **Energy (production and consumption)** • **Community health**
Sea level rise	• Coastal zone (including deltas and wetlands: Delta and the northern coast, the Mekong River Delta, Central Coast) • Islands	• **Agriculture (farming, livestock, fisheries and fisheries)** • **The marine ecosystems and coastal areas** • **Water resources (surface and groundwater)** • **Residence Place** • **Energy** • **Infrastructure, industrial parks** • **Community health**
Flooding, drainage and landslides	• Coastal zone (including deltas and wetlands: Delta and the northern coast, the Mekong River Delta, Central Coast) • Mountain regions: Northwest, Northeast, North Central and Central Highlands	• **Agriculture (farming, livestock, fisheries and fisheries)** • **Water resources (water and industrial catering)** • **The infrastructure** • **Residence Place** • **Transportation** • **Health and life**
Storms and tropical depressions	• Coastal zone (including deltas and wetlands: Delta and the northern coast, the Mekong River Delta, Central Coast) • Islands	• **Agriculture (farming, livestock, fisheries and fisheries)** • **The activities on marine and coastal** • **The infrastructure** • **Residence Place** • **Energy (Oil and Gas)** • **Transportation** • **Health and life**
Drought	• Central, especially South Central • Delta and the northern midland • Mekong Delta • Highlands	• **Agriculture (farming, livestock)** • **Energy (hydro)** • **Water transportation** • **Water Resources**

I. Vietnam is one of the most CC vulnerable countries. 1.4.Most vulnerable regions

	NW	NE	Red River Delta	North Centre	Coastal South Centre	High-land	SE	Mekong Delta
EXPOSURE								
Typhoon	1	3	4	4	4	2	2	3
Floods	1	1	4	4	4	2	2	4
Saline intrusion	0	0	1	2	2	0	1	4
SLR	0	0	2	2	2	0	3	4
Landslides	3	3	1	3	3	2	1	1
Drought	2	2	1	4	4	4	2	2
MEAN	1,2	1,5	2,2	3,2	3,2	1,7	1,8	3,0
SENSITIVITY								
Poverty	4	3	2	4	2	4	1	2
Economy	4	4	2	4	3	4	2	2
Education	4	3	1	2	2	2	1	3
Health and hygiene	4	1	2	1	1	1	1	3
Ethnic	4	3	0	1	1	4	1	2
Women & childrent	4	3	1	2	3	3	1	2
Migration	0	0	2	2	1	4	4	1
Urban households	0	0	2	1	1	0	4	3
MEAN	3,0	2,1	1,5	2,1	1,8	2,8	1,9	2,3
TOTAL	4,2	3,6	3,7	5,3	5,0	4,5	3,7	5,3



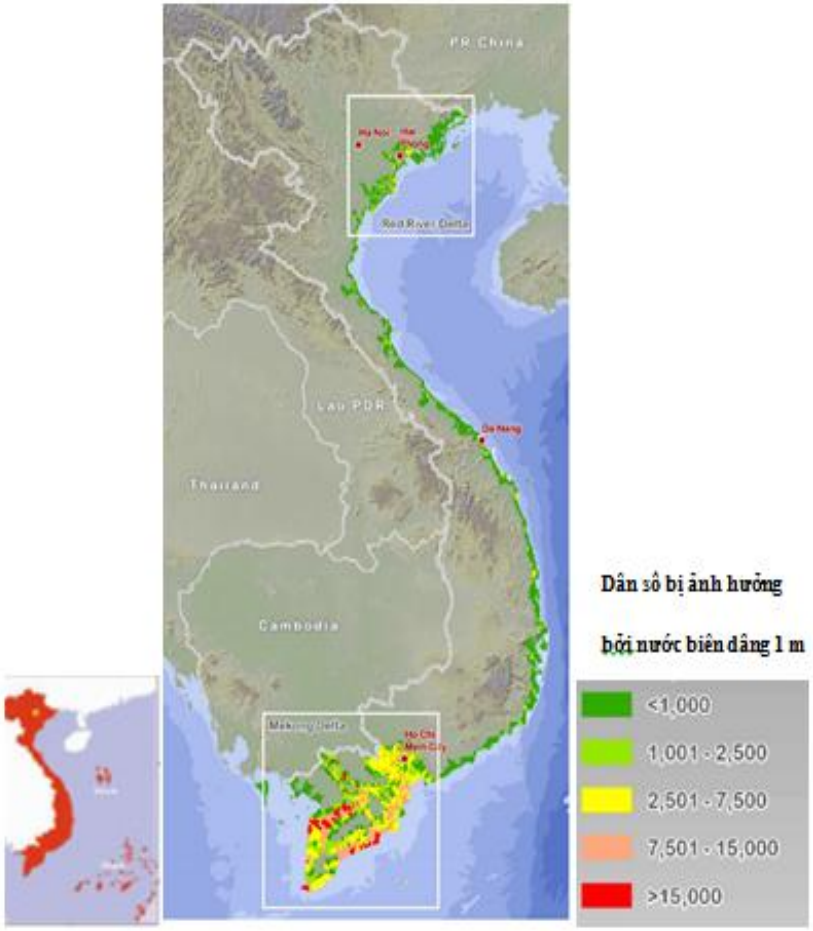




I. Vietnam is one of the most CC vulnerable countries. 1.4.Most vulnerable regions

Flooding due to sea level rise

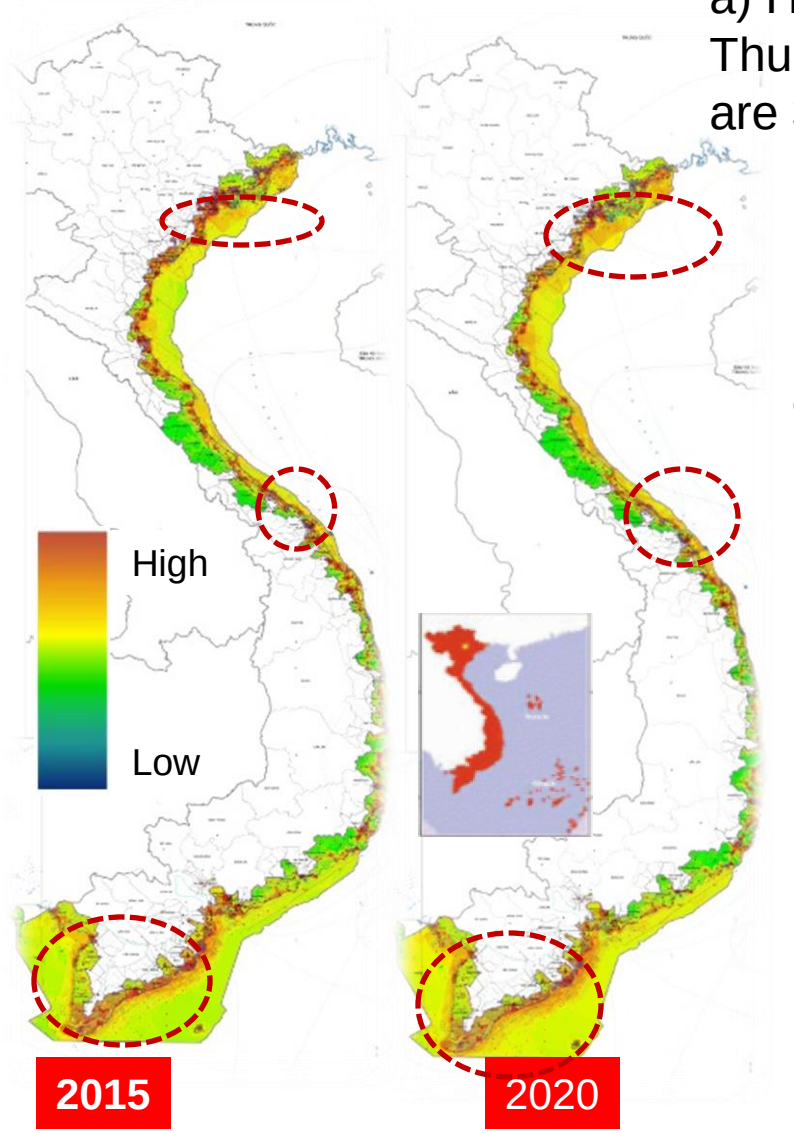
Note: The distance to the coast: red: 0-1 km; yellow: 1 - 20 km, blue:> 20 km

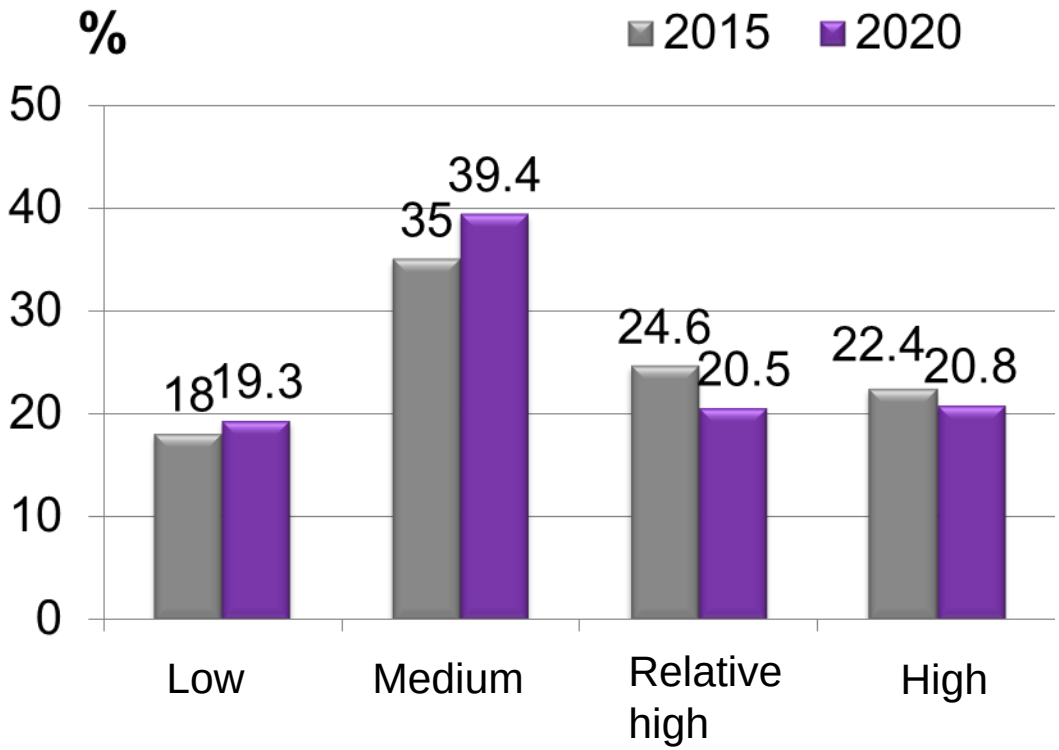


Industrial zone map (a) and population (b) affected by sea level rise of 1 m in Vietnam (Jeremy, 2008)

I. Vietnam is one of the most CC vulnerable countries. 1.4.Most vulnerable regions

a) High vulnerability in Mekong, Red river deltas, Thu Thien Hue; b) Areas of Vulnerability to SLR of 1m are 3 times more than one to SLR of 0,5m



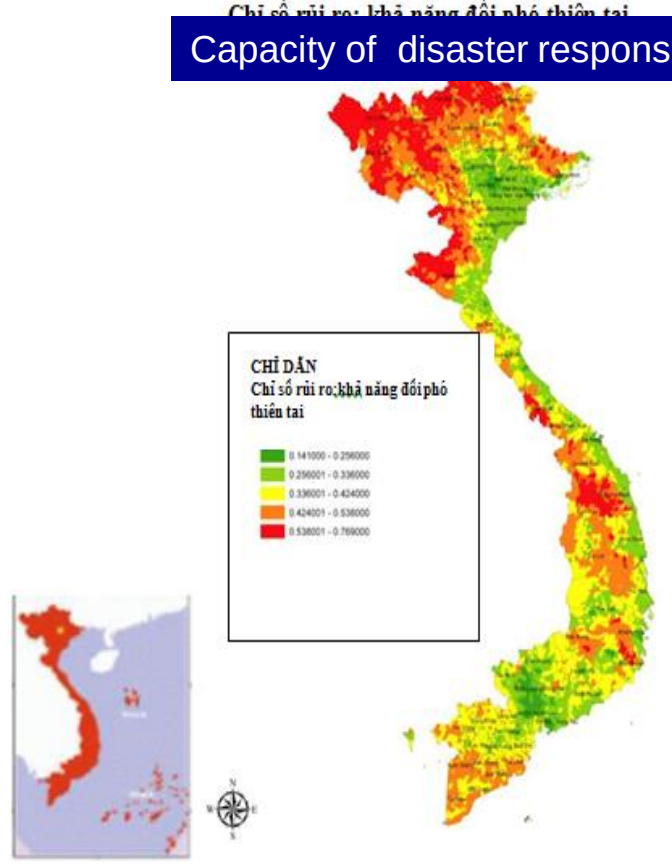


Vulnerability to SLR is highest for Mekong Delta.

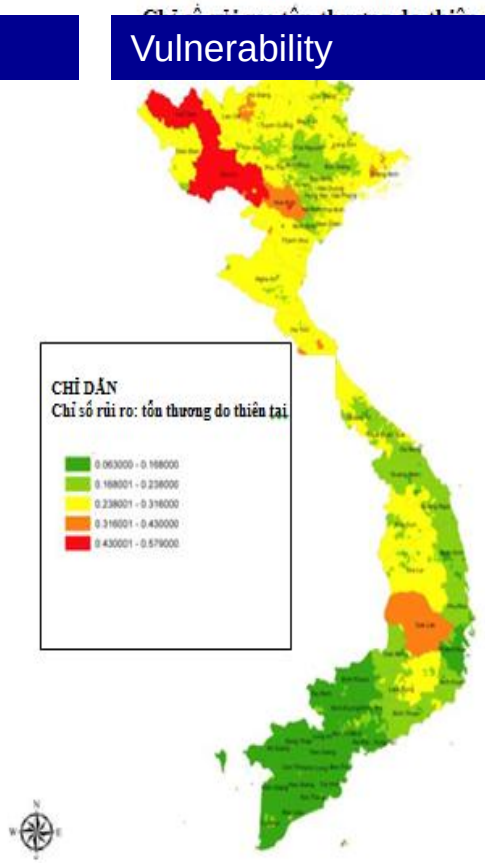
I. Vietnam is one of the most CC vulnerable countries. 1.5. Most vulnerable area of high poverty

Capacity of disaster response of North west, North east, High land are highest and rather similar with vulnerability distribution. Areas with high poverty among minorities are most vulnerable:

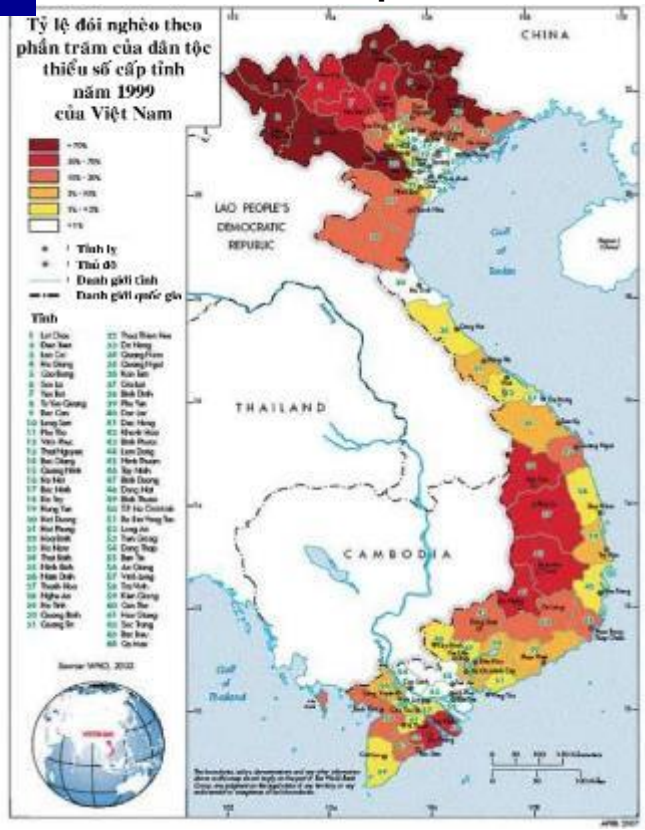
Capacity of disaster response



Vulnerability



Ratio of poverty among minorities of provinces



I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

Impact on Water Resources

River flow systems shortage

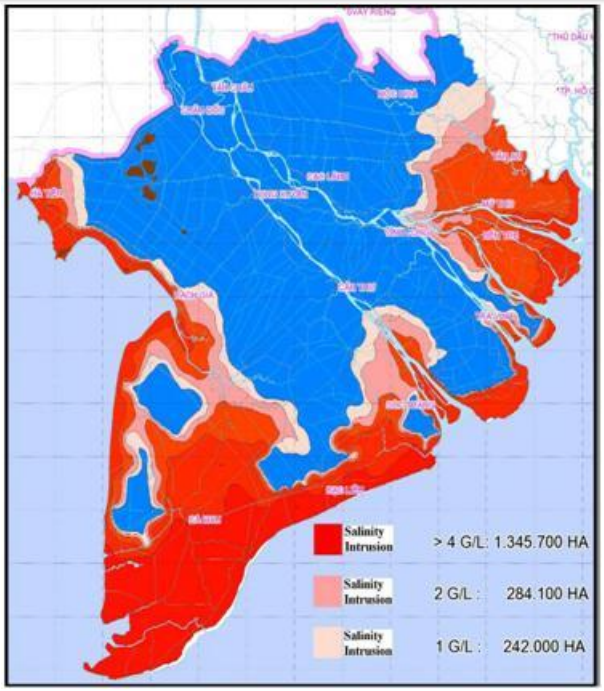
-The water level of many places reached the lowest historical level (Red River, Thai Binh, Ma, Ca, La, Tra Khuc, ...) has caused water shortages for agriculture, saltwater intrusion into estuaries
- Drought situation due to shortage of water in the future will increase in the river basin in VN

Significant decline in groundwater level

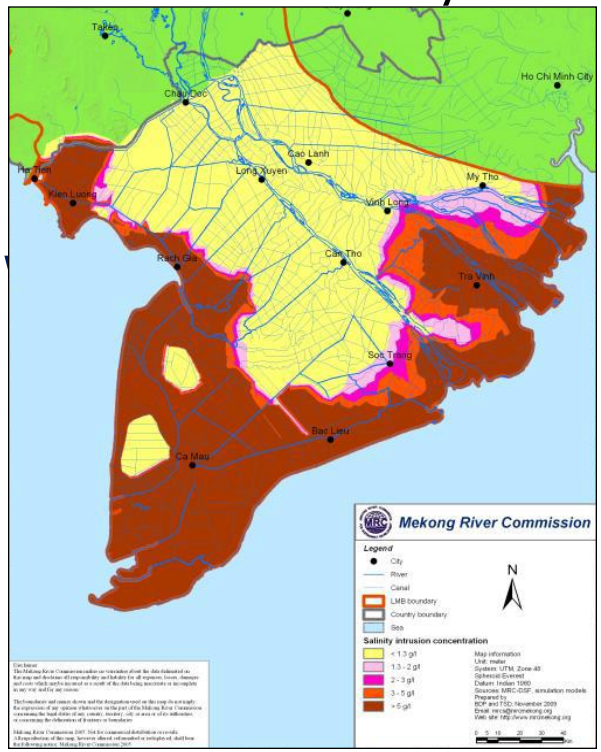
-Deterioration of water supply during the dry season runoff, lowering the water table
- In the dry season, the water table declined by less be supplemented by rainfall combined with rising sea levels lead to groundwater in the coastal plains salinization, reducing the amount of fresh water can be exploited, used true

I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

- Sea level rise will increase salinity in the river.
- A sea level rise of 1m would increase the area of 4 g/l salinity with 334,000 ha in relation to the benchmark year of 2004, a rise of 25%



Salinity in 2004



Salinity in 2024 (B2 scenario) with 20 cm sea level rise. *MRC, 2011*

- Water pressures drop by 2-5 m in the dry season,
- Groundwater use is depleting a limited aquifer and further intensification of groundwater use is unsustainable.

I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

Water resources, water resource security

The impact of CC on water resources and water resource security

Water shortage

+ Total of minimum one-month average water flow into the Mekong Delta is possible to decrease 3.5 billion m^3;
+ Total minimum three-month average water flow into the Mekong Delta is possible to reduce 13 billion m^3.
+ Total average dry season water flow in the Mekong Delta could total up to 30 billion m^3.

Increasing risk to drought, salinity

Flooding

+ Total maximum one-month average water flow into the Mekong Delta could rise to 3.6 billion m^3.
+ Total average water flow into the Mekong Delta in flood season may rise to 40 billion m^3

Directly impact on land use of economic sectors and daily life of people of the Mekong Delta.

I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

Water resources, water resource security (*MONRE, 2015*)

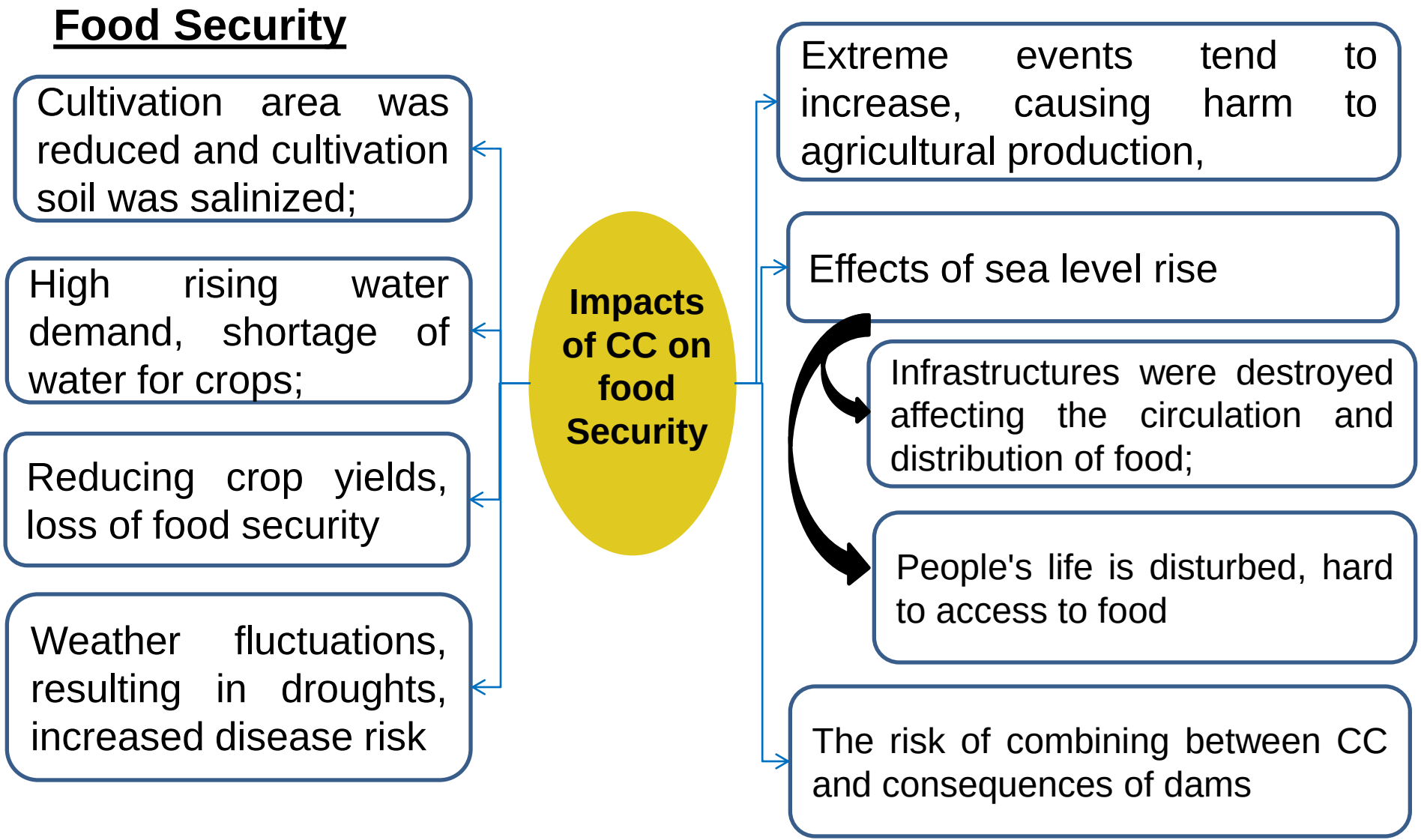
Water shortage

- At the end of 2015, the total area of crops damaged by water shortage is about 210,000 hectares; about 250,000 households with more than 1.3 million people lack domestic water.
- In Vam Co River, Tien River, Hau river, and Tay coast, saltwater intrusion 45-93 km inland; many places have the highest salinity 20,3-31,5g / l.

Flooding

- Flooding will rise in Dong Thap Muoi, Tu Giac Long Xuyen; especially much more serious areas are in the middle of Tien and Hau river.
- The cities / towns were flooded: Chau Doc Long Xuyen, Cao Lanh, Sa Dec, Vinh Long, Tan An, My Tho, Can Tho, Vi Thanh, Soc Trang, Rach Gia and Ha Tien flooded over 0.5 m. 50% of Ca Mau peninsula was flooded <0.5 m despite low-lying area.

I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields



I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

Impact on natural ecosystems

CC

increase

Human activities

- Land use conversion
- Fragmented distribution
- Overexploitation
- Pollution water

Temperatures will increase mangroves shifting north, erosion

Sea level rise: mangrove areas are at risk of narrowing

Increased frequency of storms, increased rainfall, sediment, salinity increase will reduce photosynthesis of trees in mangroves

FOREST degraded, reducing the area 3200 ha / year

Reducing people's livelihood; reduce the likelihood of waves, storms, filter and keep toxins cause seizures and pollution => Reduced adaptability

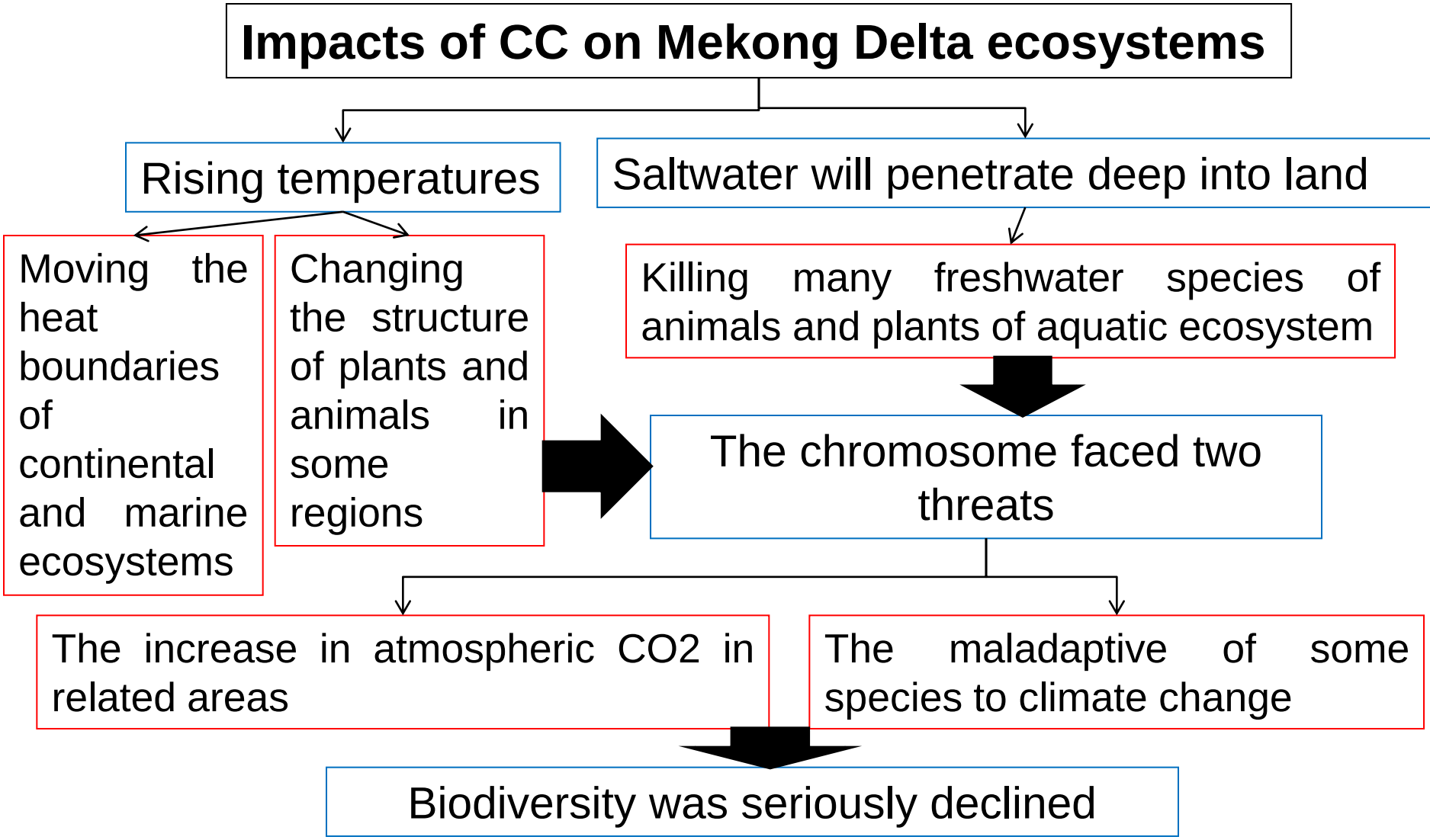
Increase the exposure and vulnerability of natural ecosystems

I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

Impact on natural ecosystems

Sea level rise, temperature rise	Marine and coastal ecosystems, causing threats to coral reefs and mangrove forests (mangroves shifted and reduced), the source seafood dispersed reduce the number and quality, adversely affecting the biological basisfor the mining operations and coastal aquaculture;
Increase the heat, the rain fell, storms, floods	High vulnerability for fish of Tor tambroides high mountainous areas and Clarias catfish, carp and hurt the average for black fish in Gia Lai
Storms,floods,erosion, landslides, forest fires	Area reduction, impaired quality of forest ecosystems, grasslands, ...

I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields



I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

2 ecosystems were mostly affected in the Mekong Delta, Coastal areas

Sea Ecosystem

- The coral reef is the rainforests of the sea, home to many important marine species;
- Tool against coastal erosion and mangroves protection;

Depression

Sea temperatures rise + □ rainy coastal water polluted sediment.

Mangrove ecosystem

The temperature rises, the tide changed ➔ species changed;

SLR ➔ Change the composition of the sediment, salinity and water pollution levels ➔ degradation of mangrove and biodiversity species;

Losing many species, changes drastically mangrove ecosystems

I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

The impact of CC on the Mekong Delta Ecosystem

1980 – 1995: Mekong Delta provinces lost 72 825 hectares (Le Anh Tuan, 2008). The forest coverage rate reached only 10% areas of the natural land;

Mangrove cover are barren, divided, fragmented into many small zones;

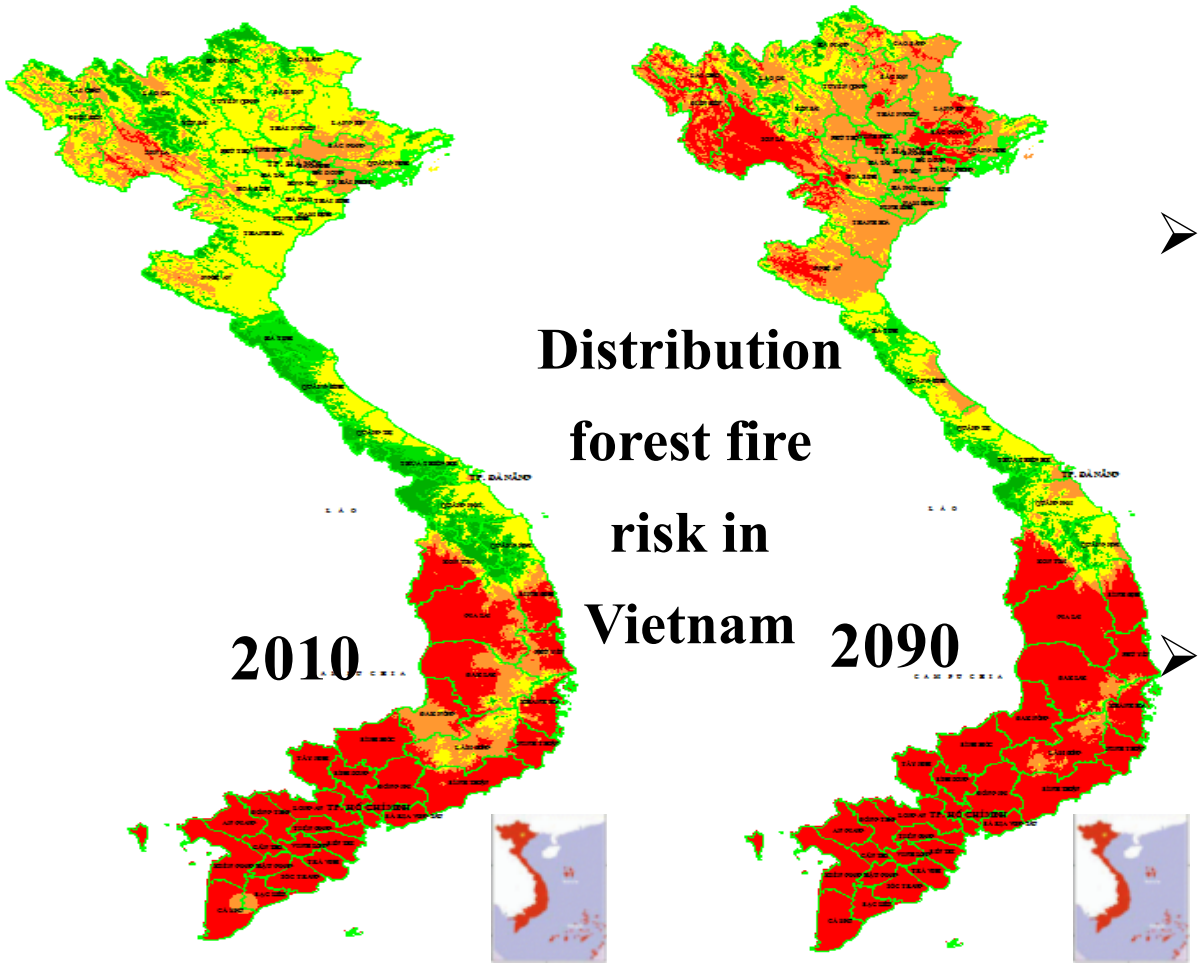
Soil was polluted by alkaline chemical processes in large-scale increases; soil was removed by land-cleared activities increasing washout process due to rain, the spread of alkaline in soil, water and ecosystems;

Biodiversity is declining due to no suitable conditions for living creatures and shelter. The environmental change microclimate, coastal erosion, and estuary has been increasing.

Ecological imbalance in the region.

I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

Impact on natural ecosystems



- Droughts facilitate forest fires in central highlands and the Mekong Delta
- Climate change increases the risk of forest fires across the country => The high exposure and vulnerability of forest
- Prolonged drought alters structure, as water levels in rivers and lakes are depleted

I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

Impact on residential areas, infrastructure and tourism

The system of roads in Vietnam

Impact on Traffic

- Storm floods, storm surges, landslides, erosion: damaged roads, bridges, dikes, breakwater; causing traffic jams, 2001-2005, billion 2571 loss
- Floods and landslide: annual damaged nearly 100 million dollars
- Sea level rise of 1m: affects 4% rail, 9% highway, 12% of provincial roads.
- Storms, sea waves: permanently flooded, destroying the coastal road, causing the accident paralyzes roads, affects aviation

I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

Impact on residential areas, infrastructure and tourism

Lengthen the tourist season

Tourism impact

- Transport does not work so travelers stranded at the point of disaster.
- Tourist sites were damaged by natural disasters and biodiversity degradation/pollution. Extreme events results in migration, distortion, mixing, a cultural characteristics, reducing the attractiveness, affect health and safety of visitors, reduced tourist attraction, reduced incomes, increased job loss.
- Adversely affecting the travel activities, tours, up time, increased costs when schedule changes, canceled programs abnormalities caused by natural disasters

I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

Impact on Health and human life, Social Welfare

Impact on health, human life, Social Welfare

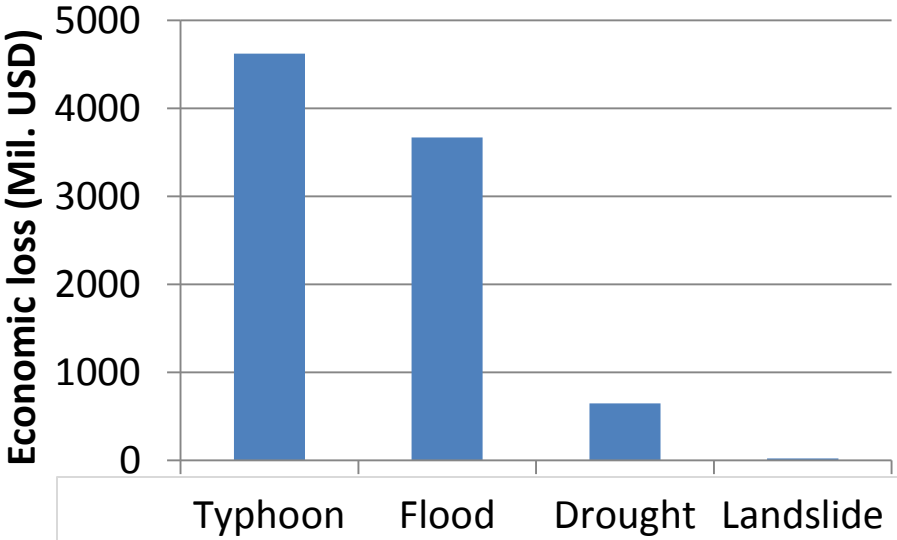
Climate change, floods, sea level rise, increased tropical diseases: malaria, dengue fever, diarrhea, skin, flu, allergies, defended spread from birds, poultry to humans

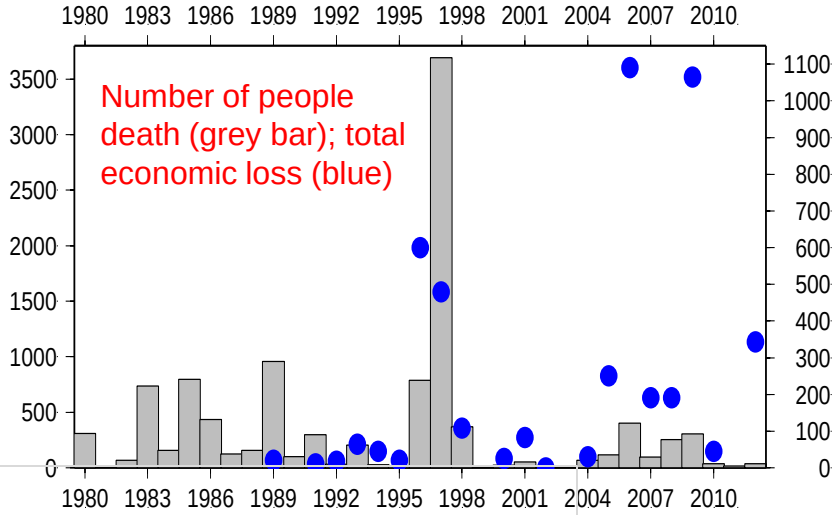
Temperature increase: increase the number of hospitalizations and deaths due to cardiovascular disease, respiratory failure ...

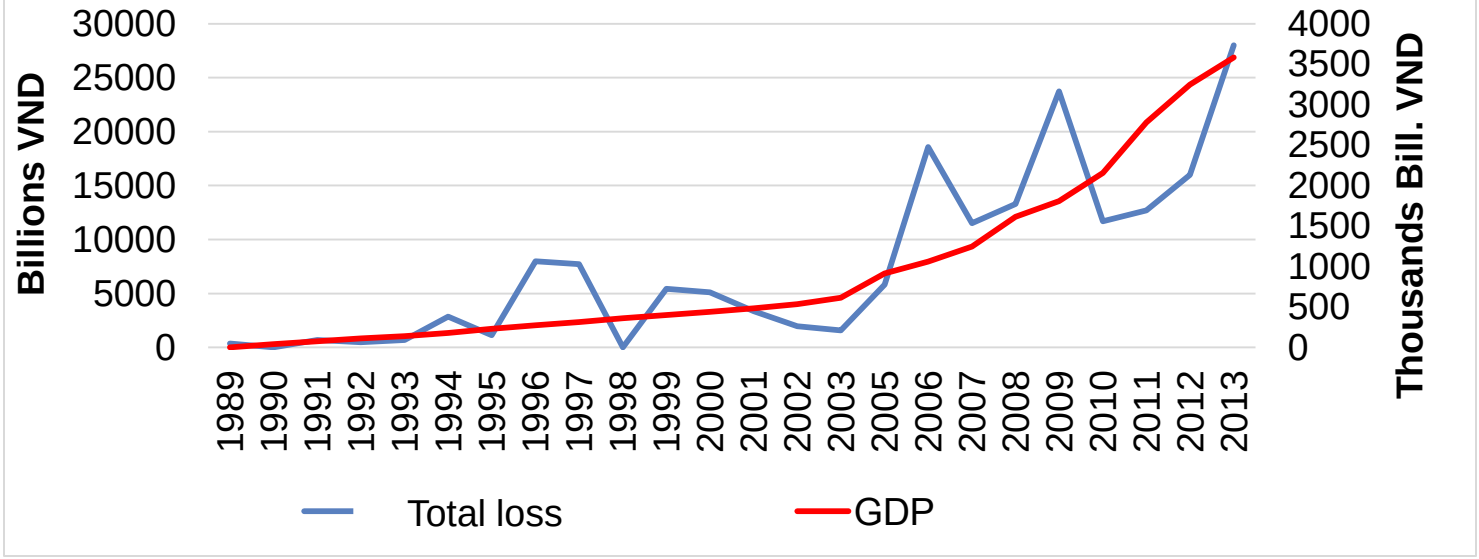
Extreme events increase the number of people killed through direct impact, pollution MT; destruction of medical facilities, reduced ability to provide services ...

I. Vietnam is one of the most CC vulnerable countries. 1.6.Most impacted fields

Economic loss by climate change







II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.1. Most important achievements

1. CCDR Science, technology achievements, CC scenarios based

2.Development, integration of policy and institution on climate change and disaster response (CCDR), including green growth strategies, NAMA, INDC into development policies, strategies

3. Promoting social power, innovation to CCDR: living with floods, drought, living with climate change; CC adaptation, CC mitigation

4. Proactively response to natural disasters & CC through resource sustainable use planning based on vulnerability assessment

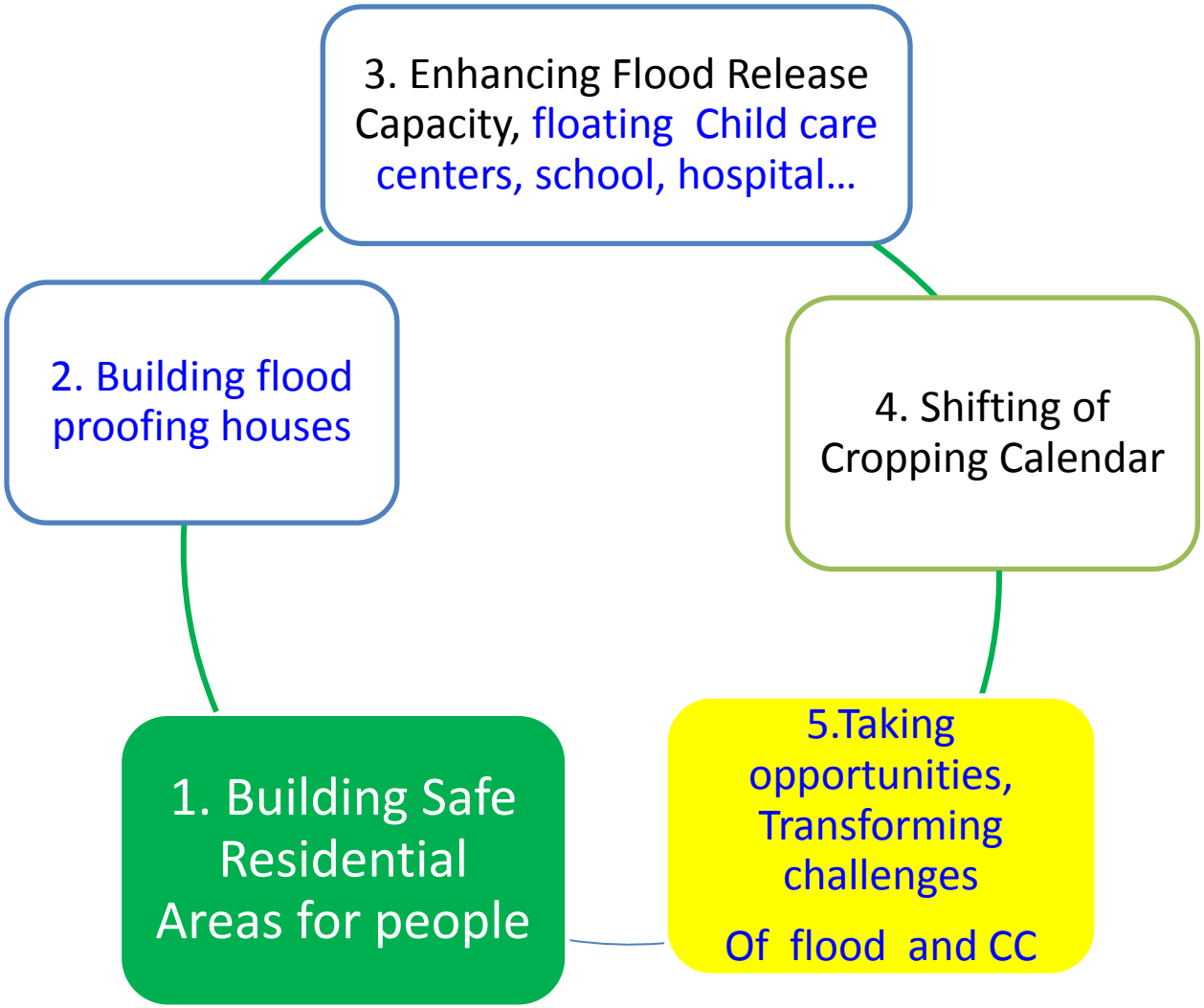
5. Effective development and improvement of international cooperation to climate change response

6. Development of human, financial resources for CCDR

7. Developing science and technology for CCR.

CCDR for SD

Living with flooding (Adaptation)



II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.2. Living with flooding

Living with flooding

Limiting negative impacts of flood; Solutions for different population groups

Engineering measures:
- Embankment in residential areas and flood drainage channels;
- floating houses, floating markets, medical boat, nursery flood, protection, ..

Mitigation measures:
- Seasonal schedule transfer, conversion of plant varieties and animal breeds;
- Teaching swimming lessons for children;
- Moving poultry to high location
- Upgrade forecasting system, flood warning.

Take advantage of opportunities from flood

Exploiting fisheries in flood season;
Waterway transport development;
Urban development, administrative centre along the canals, cavity 60km apart
Kill insects, mice, deacidification by flood water desalination ... prepare for next season;

2.2. Living with flooding

Smart housing design

Transportation

Smart agriculture

Smart aquaculture

Housing and transportation

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.2. Living with flooding

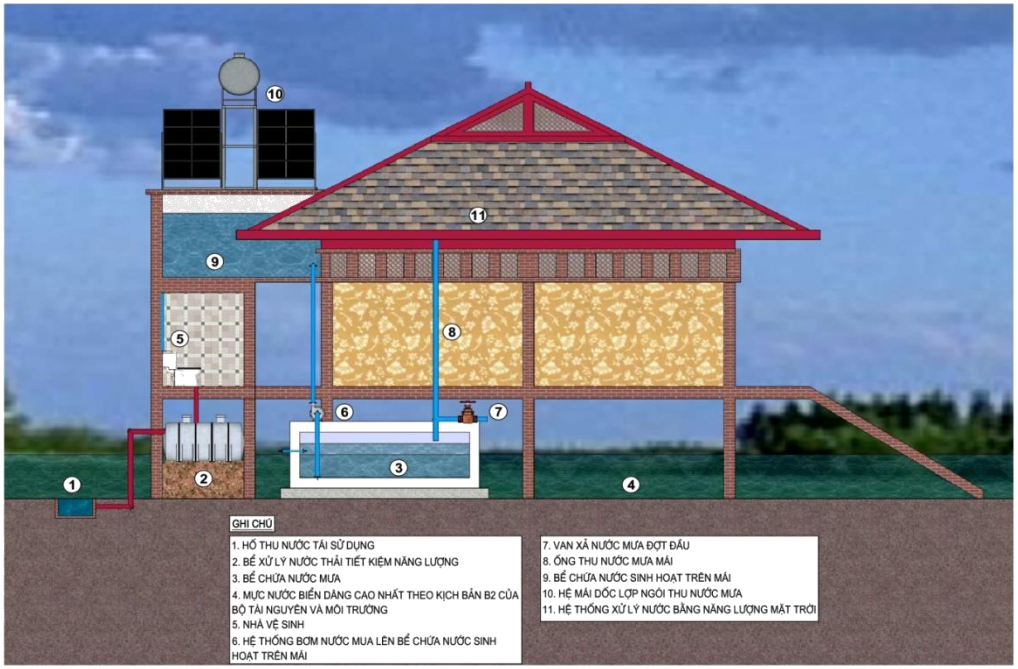
Flood in Mekong Delta

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.2. Living with flooding

Flood resilient and Energy saving Eco-house Model

1. Raising awareness from the central to the local level and the private sector;
2. Strengthening of research, development and application of science and technology in response to climate change.

The salinity water treatment system using solar energy



Energy saving Eco-house Model

A Product of National Scientific Program to Respond to Climate Change

Overcast weather, drought and salinity using advanced technology, experience and local knowledge to proactive response

-Adjustments, direction and use planning human activities within and outside the Mekong Delta, increase efficiency, ensure food security, livelihood: cota freshwater use

Switching to the economy, livelihoods rely on brackish and marine ecosystems; maintain economic rely on freshwater ecosystems at ensuring food security

-Development of experience, livelihood patterns, production, drought and salinity appropriate activities;
- Application of advanced science and technology to effectively adapt to drought and salinity

Recruiting, converting plant and animal to suitable term rise, salinity, lack of fresh water in the direction of increased efficiency, ensure food security, livelihood

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.3. Living with climate change

Adaptation

1. Development of weather, disaster, CC forecasting, warring systems
2. Improving natural (forest, mangrove, wetland,…) and social (infrastructure, HR, governance, land use planning…) resilience

- Adaptive economy and livelihood: change crop and season of agriculture; development of less vulnerable sectors
- Reservation of water, foods, medicals…for emergencies

Mitigation

1. Using water, wind, solar energy
2. Efficient use energy, water (VAC…)
3. Low GHG emission economy: agriculture, energy,…
4. 3R of waste for energy (biogas, making gas from agriculture waste…), …

Using CC opportunities

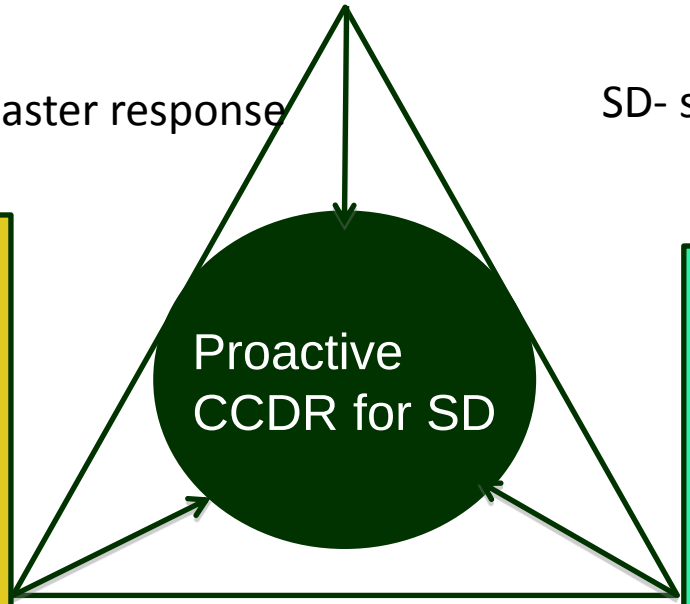
1. Living with flood, drought, CC
2. Increasing biological mass and productivity
3. Development of brackish ecosystem based economy and livelihood
4. Warming water from global warming
5. Climate smart models; new collaboration

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

I. Sustainable resource use, sustainable livelihood (e.g. Satomi model, climate smart aquaculture, sustainable use of wetland)

CCDR- climate change and disaster response

SD- sustainable development



II. Proactive Management (creating and implementing the SD, CC and disaster mitigation policies, institution; enhancing effectiveness of laws; sustainable ecology and community-based management,adaptive management)

III. Hazard, CCD mitigation (strategy, plan for proactive mitigation of disasters and change of natural factors: afforestation, coastline protection construction, social power enhancement…)

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

Disaster prevention and recovery measures

Strategy for disaster and climate change risk reduction:

- Non engineering measures:
- Increasing accuracy of disaster and climate extremes forecasting and warning;
- Integration of CC and disaster risk reduction (DRR) into development plan;
- Plan of disaster risk reduction: documents and map of disaster rick reduction: distribution hazards, vulnerability, prioritized measures including evacuation ways and areas for each location, forestation …); preparedness, response, rescue and recovery; …
- CC and disaster adaptation based on community in 6000 most vulnerable villages (implementing the PM decision 1002/QĐ-TTg dated 13/7/2009);
- Social network for DRR
- CC and disaster risk sharing/insurance;
- CC and disaster risk management: coordination mechanisms within and across sectors and stakeholders at all levels; human capacity!
- Engineering: general and disaster prevention infrastructures, …

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

CC and disaster forecasting and responding in future:

- Soft measures:

+ Developing and Improving CC and disaster forecasting and information systems;

CC and disaster risk communication and media;

+ Proactive response to CC and disasters;

+ Resources and ecosystem use and management and conservation for CC and disaster risk reduction and enhancing livelihoods : water, wetland, hydropower and irrigation reservoirs, forests …

+ Reservation and sharing of Food and basic need goods: the district Tây Giang, Quảng Nam province isolated 6 months by the flood related to the Ketsana typhoon in 2011 had enough food and basic need goods thanks to good reserve before.

- Engineering/hard measures: disaster prevention infrastructure, …

Response to disaster

- Assistance and disaster relief: Government supplied food and water to the people during drought in Tay Nguyen, Ninh Thuan, Mekong delta in 2015-2016; people in different provinces gathered and sent the good and money to the people impacted by typhoons and floods in Central Vietnam, by debris flows in the North west Vietnam in 2017

- Evacuation and Migration from the dangerous areas;

- Recovery and reconstruction.

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

Enhancing community capacity in disaster and climate change risk management:

- Social network and innovation for Proactive response to CC and disasters
- Ability of decision making in CC and disasters risk management: committees of disaster prevention control and rescue at all levels including ward and commune levels
- Development and effective use of social resources
- Using indigenous knowledge and modern engineering;
- Innovation and consolidating socio- political organizations for CCDR
- 4 in the place for disaster risk reduction: management, resources, facilities and logistics
- Community based CCDR models

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

1. Developing and maintaining integrated monitoring and warning systems

2. Sound scientific plan for disaster risk management and mitigation

- Basics for the plan:

  - Scientific fundamentals : disasters map, disasters risk map, vulnerability map, forecasting hazard map, weathering crust and soil map, forestry map, land use map, geological, engineering geology, hydrogeological, geomorphological, hydrological…maps

  - Policies, strategies, laws, socio-economic plans

  - Practical : experiences, lessons learned

- Main content of the plan:

  - Goals, objectives: The Disaster risk reduction (DRR) and poverty reduction, sustainable development

  - Non engineering measures: land use planning based on DRR, vulnerability maps, afforestation, education and training, awareness, monitoring systems, community based management, …

  - Engineering measures

  - Resources for DRR

  - Responsibilities of stakeholders…

  - Implementation

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

Carrying out project on researching and assessing vulnerability to climate change and disasters

- Carrying out the Projects in regional and location scales.
  - Some projects on disaster, vulnerability assessment have been carried by VNU Hanoi, the Institute of meteorology , hydrology and climate change and institute of Geology and Mineral Resources and MONRE; the Institute of Geological sciences, VAST;
  - More projects needed for disaster risk assessment, vulnerability

Forecasting landslide, debris flow and related disasters

- Traditional and modern methods
- f = -11,045 + 0,018d - 0,01/ + 0,003s + 0.0083n + 0,001M + 0,397T + 0,021P ; if f>o : landslide occurs, d- slope ; l- length of slope; s- relative height, n- total length of streams and rivers/1km2; M- rainfall/year; p- capacity of rock forming the weathering crust with potential landslide (Mai Trong Nhuan)

Sustainable land use planning including Road construction planning

- Research and sensitivity assessment of natural conditions, including geotechnical properties of WC, soil ….
- Choosing optimal options for opening new roads: high sustainability, less impact on environment and resources, less disasters…

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

Application of geo-technical measures preventing the disasters, in process of opening and maintaining the roads

- Building concrete wall and rock wall defending talus

- Controlling surface and ground water by oriented channel and pipes

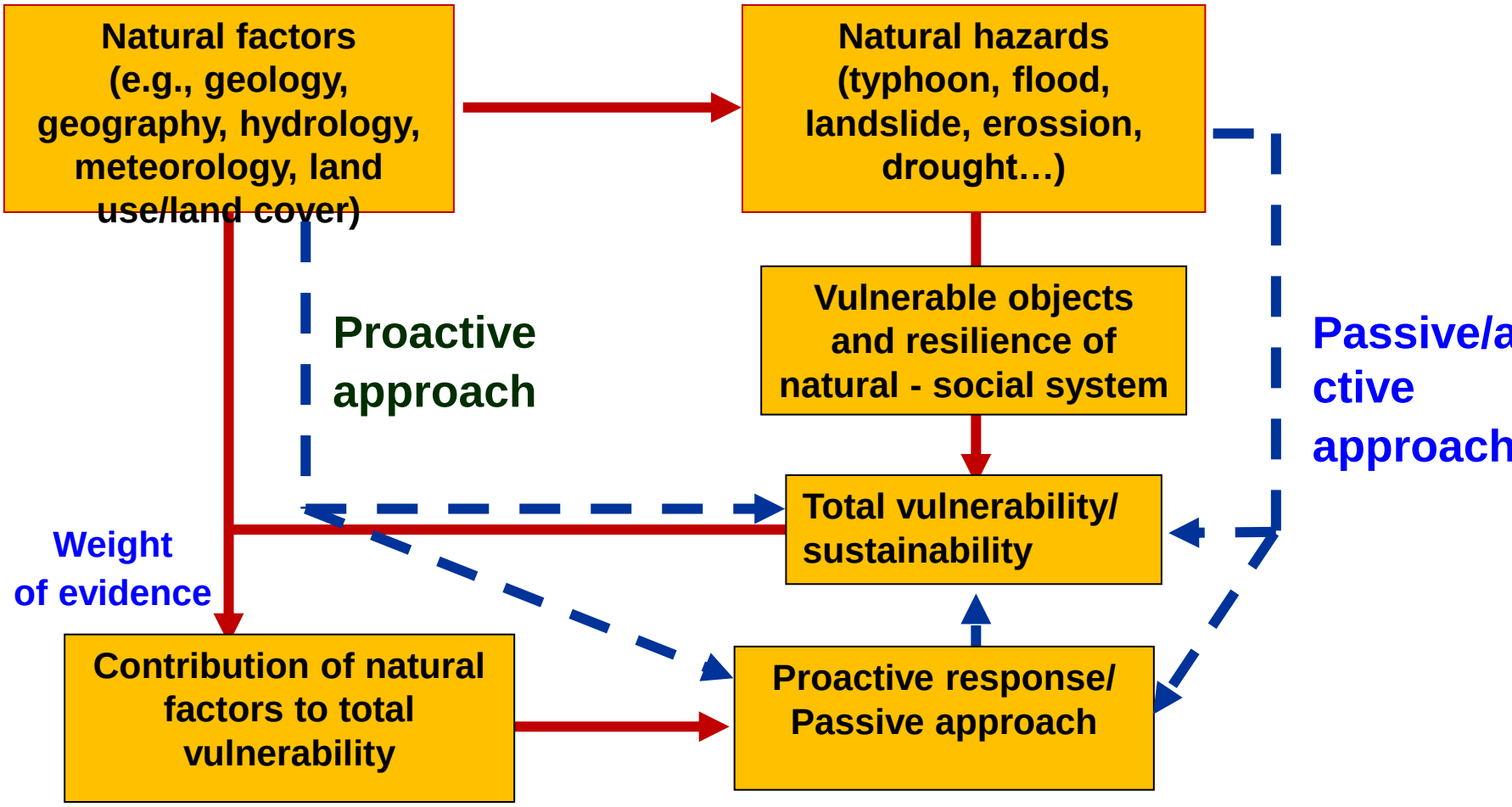
- Lowing height and steep degree of talus
- Cementation of soil and weathering crust on talus
- Defending talus by concrete stakes
- Defending talus by Vetiver grass

Capacity building, awareness for the DRR

- Education: professionals, experts,
- Training (hand on, learning by doing): necessary knowledge and skills
- Awareness

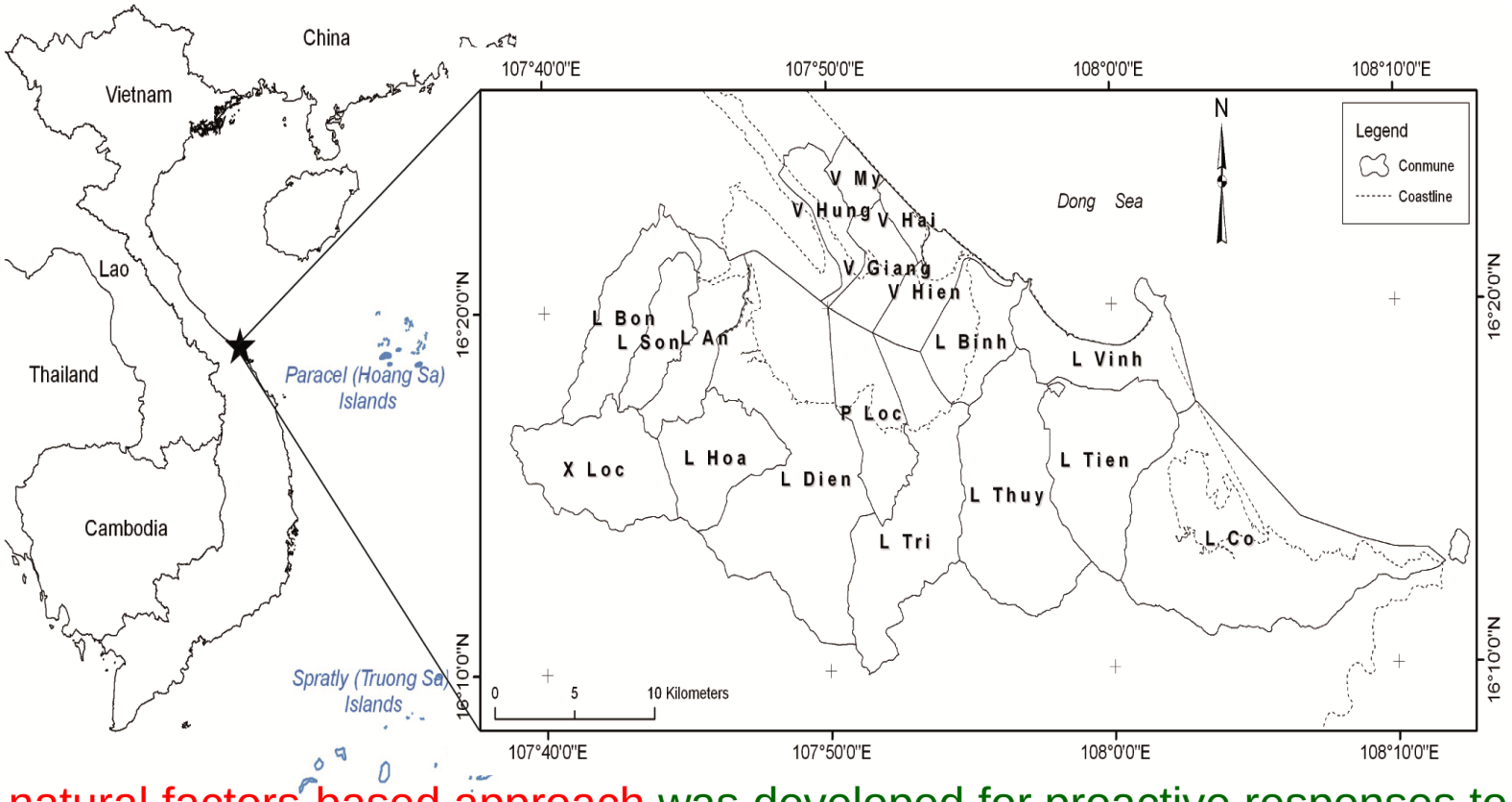
II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

Passive and proactive approaches in disaster and vulnerability assessment, reduction for sustainability



II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

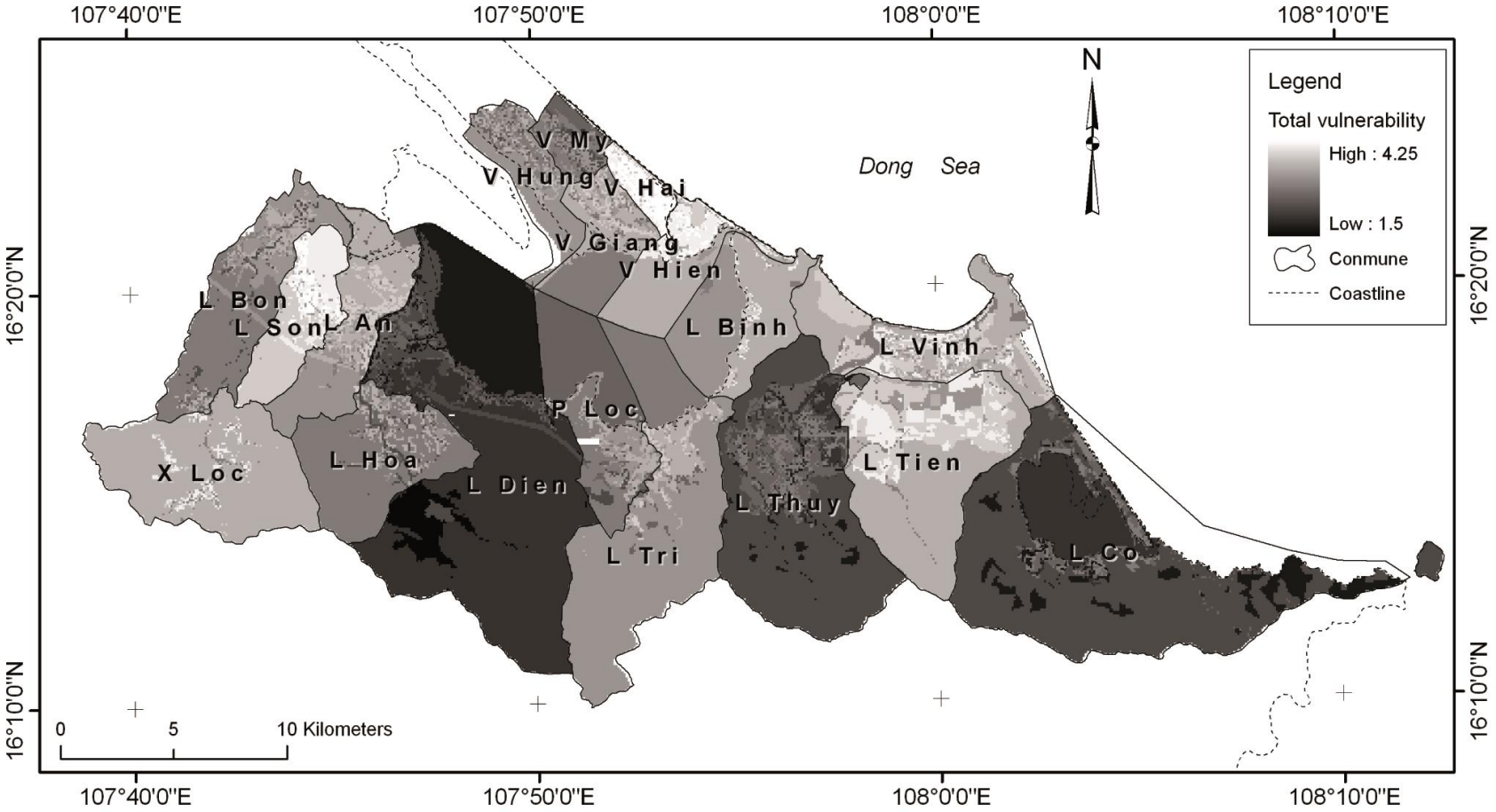
a) Proactive response to disaster based on vulnerability assessment according to natural factors



A natural factors-based approach was developed for proactive responses to hazards and improving sustainability in the Chan May – Lang Co Gulf area, Central Vietnam

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

a) Proactive response to disaster based on vulnerability assessment according to natural factors: 44.3% of the study area was high to very high total vulnerability by typhoon, floods, landslides, & erosion

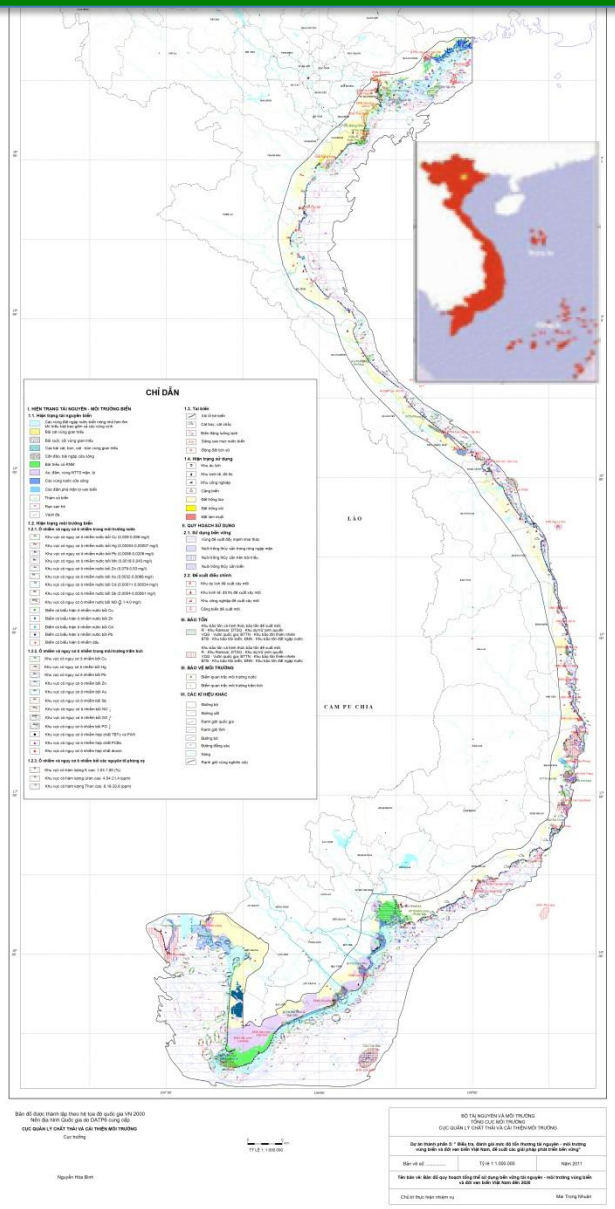


The total vulnerability in the period from 2004 to 2010 in the Chan May – Lang Co Gulf area is basic for Land use planning, disaster management plan

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

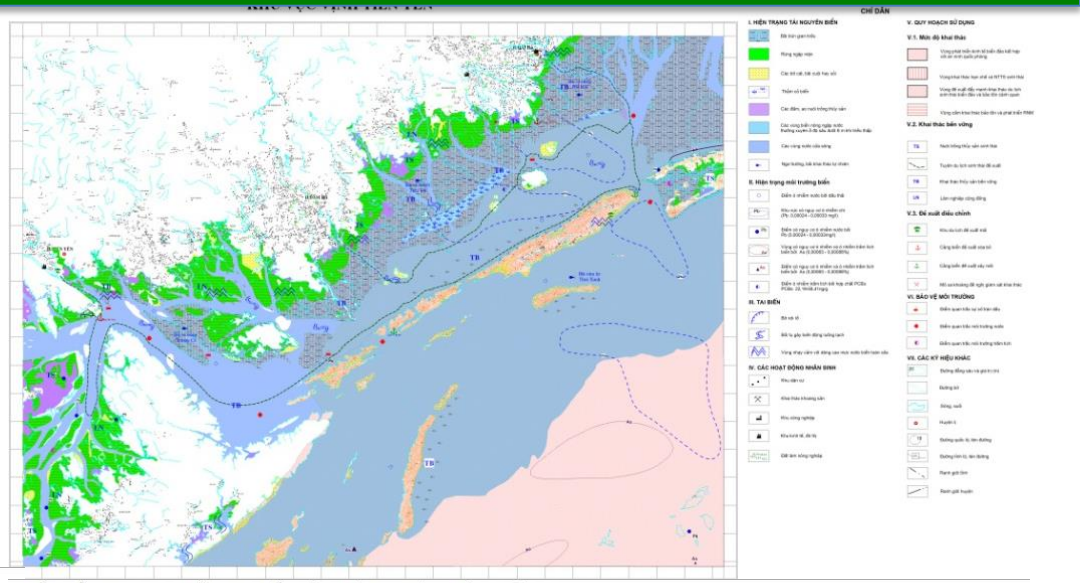
Proactive response to disaster based on sustainable natural resource use planning (SNRU)

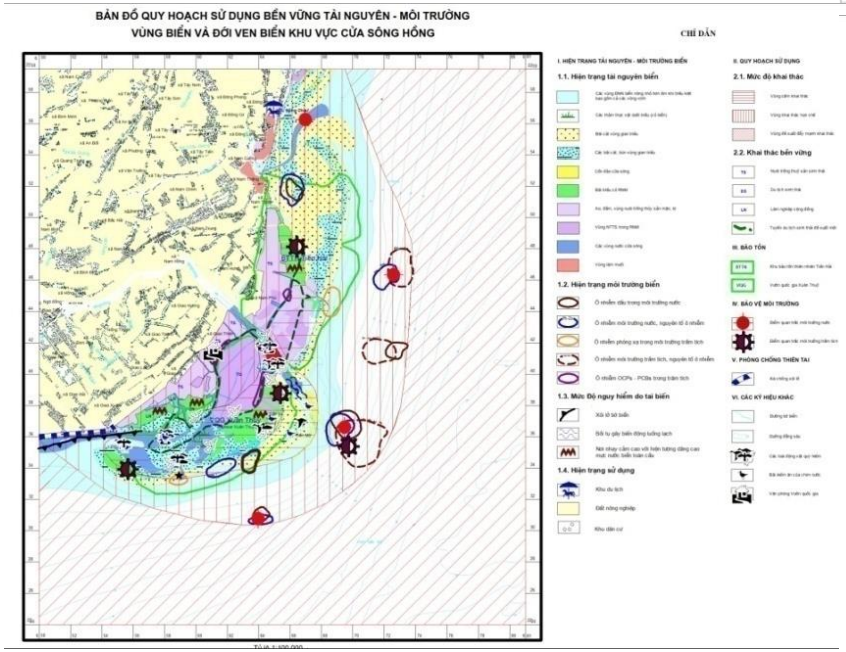
Master planning for sustainable use of natural resources and environment in Vietnam coastal zone, based on vulnerability assessment (1:1.000.000).

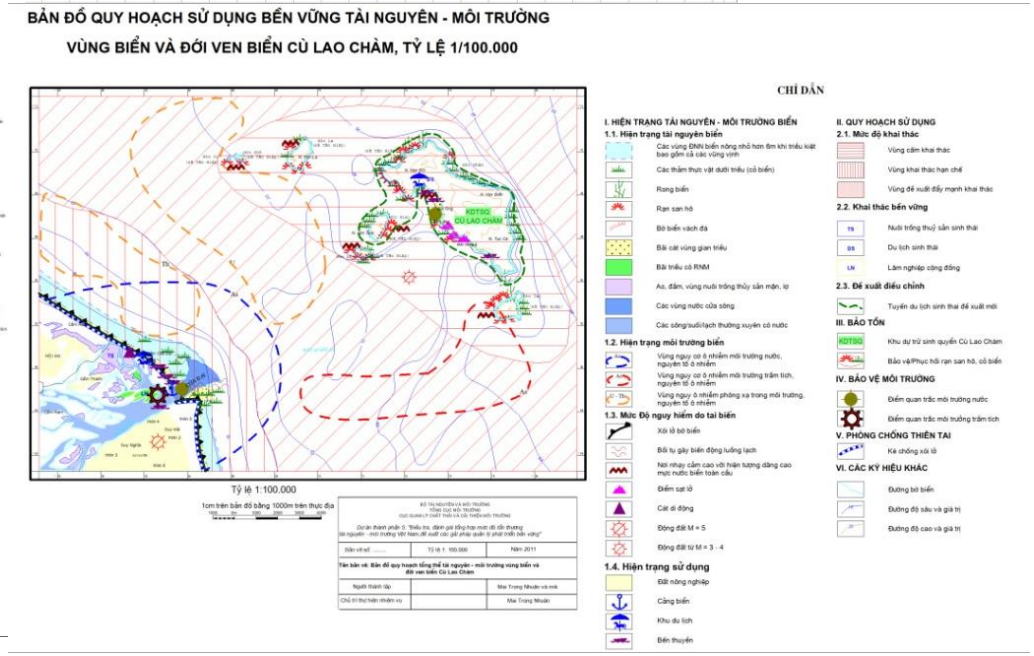


II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

Master planning for sustainable use of natural resources and environment in some areas of Vietnam coastal zone (scale of 1:100.000)



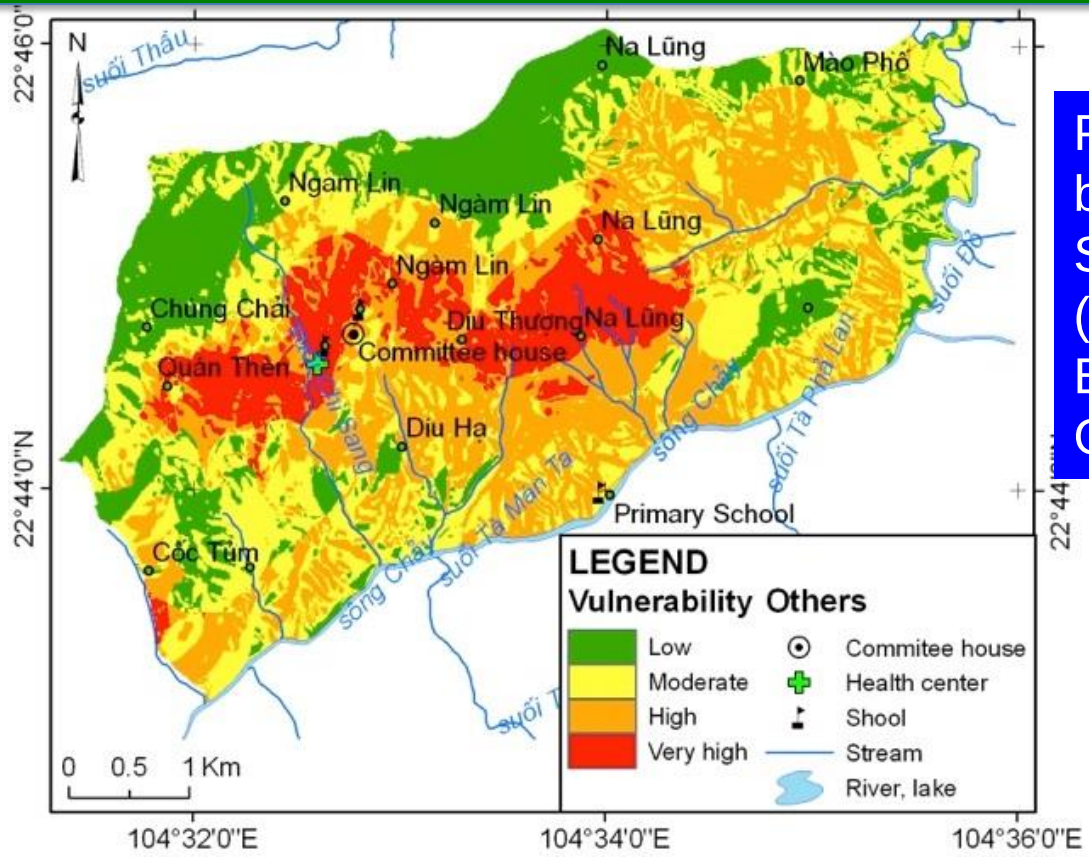




II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

Sustainable resource use (SRU) planning for CCA and SD: Ban Diu- landslide, Ha Giang Province , North Vietnam

II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters

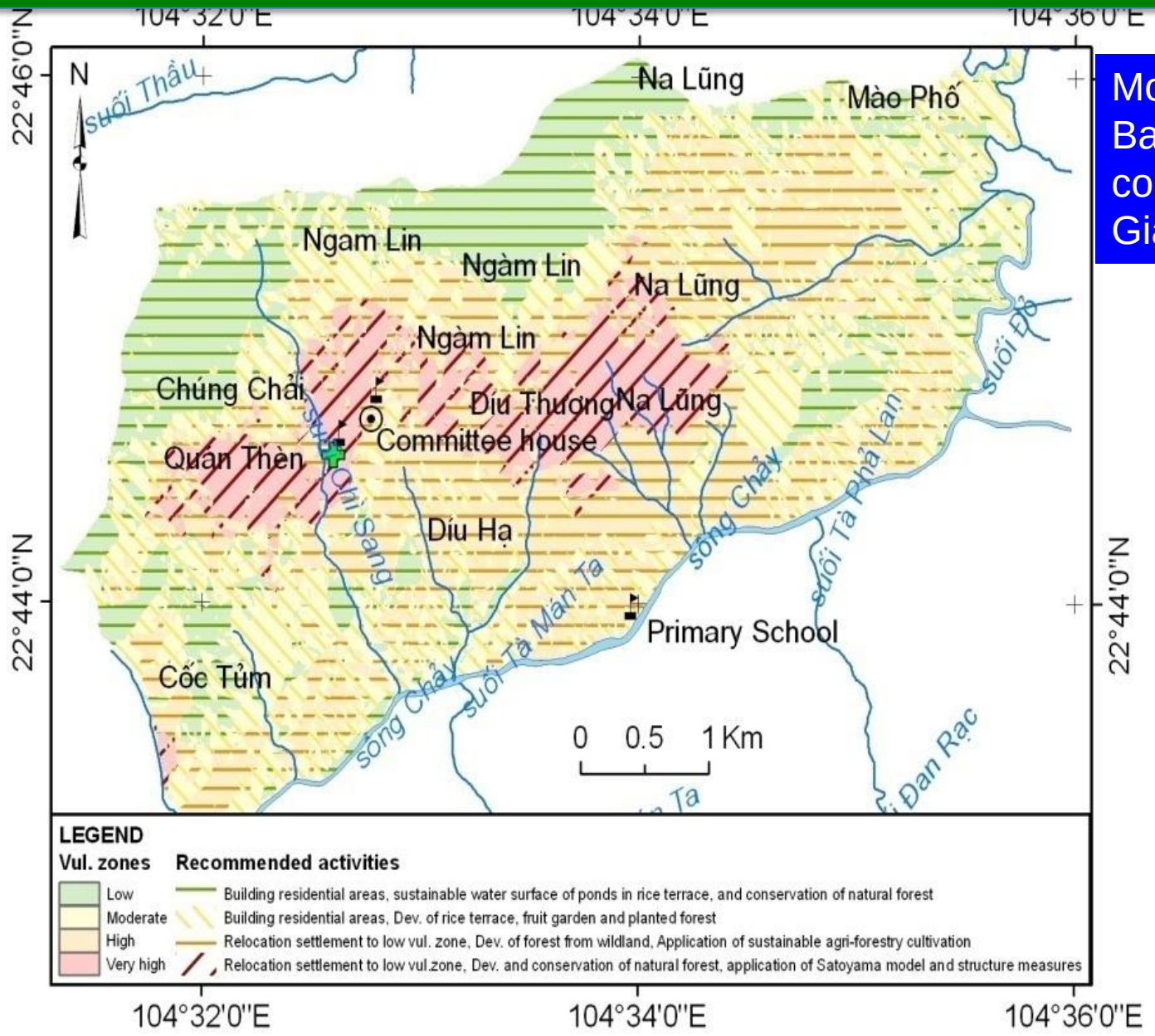


Proactive response to CC based on Natural resource Sustainable use planning (NRSU)-Mountain area- Ban Diu commune, Ha Giang Province

Maps of Vulnerability zoning to landslides of Ban Diu commune

- VA to landslides of Ban Diu communes divided into *four Vul. level zones*.
- *Very high and high Vul. zone* (mainly where occurred landslide) is located in Diu Thuong, Quan Then, Ngan Lin, Mao Pho and Diu Ha villages.

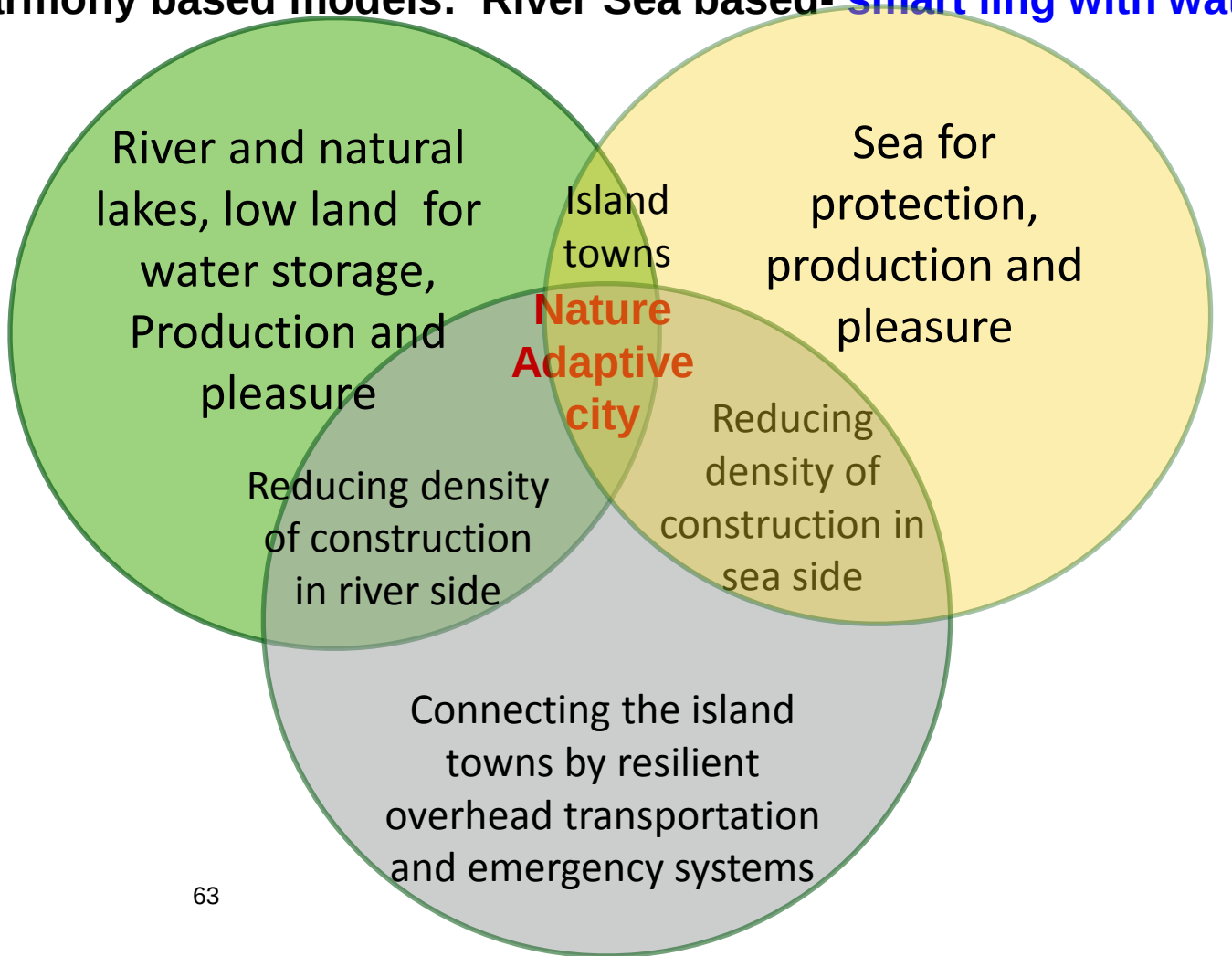
II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.4. Proactive response to CC, disasters



Mountain area- Ban Diu commune, Ha Giang Province

Models of Adaptive Coastal city to CCD in Vietnam

Nature harmony based models: River Sea based- smart ling with waters



Increasing resilience and adaptation based on CC response land use planning, Danang city

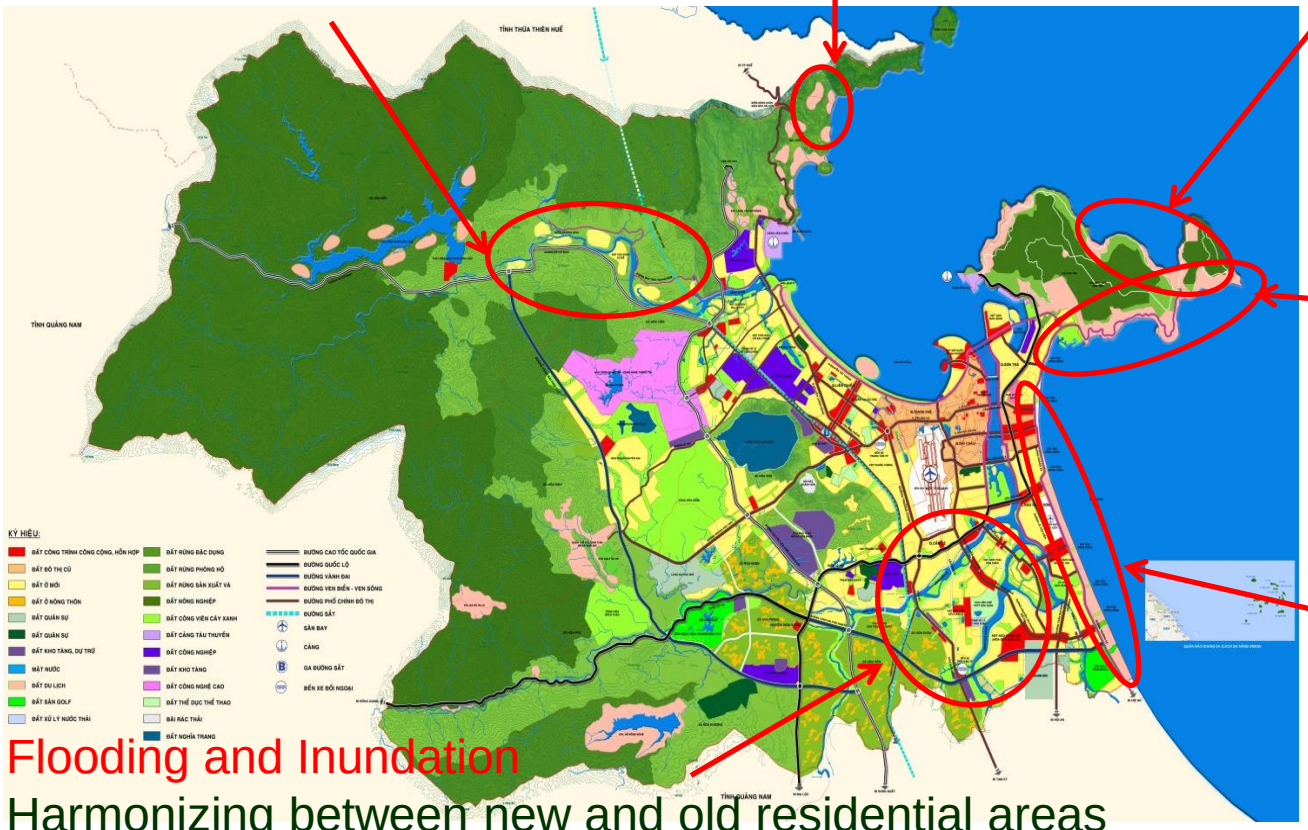
Climate change response land-use planning of Danang city

Flooding, flash flood Moving planned urban to the opposite riverside (higher position or hills

Typhoon, huge potential sliding block

Resorts → forest

Forest in the city and city in the forest



Annual typhoon

Resorts → seaside park or protection forest

Severe typhoon and storm surge

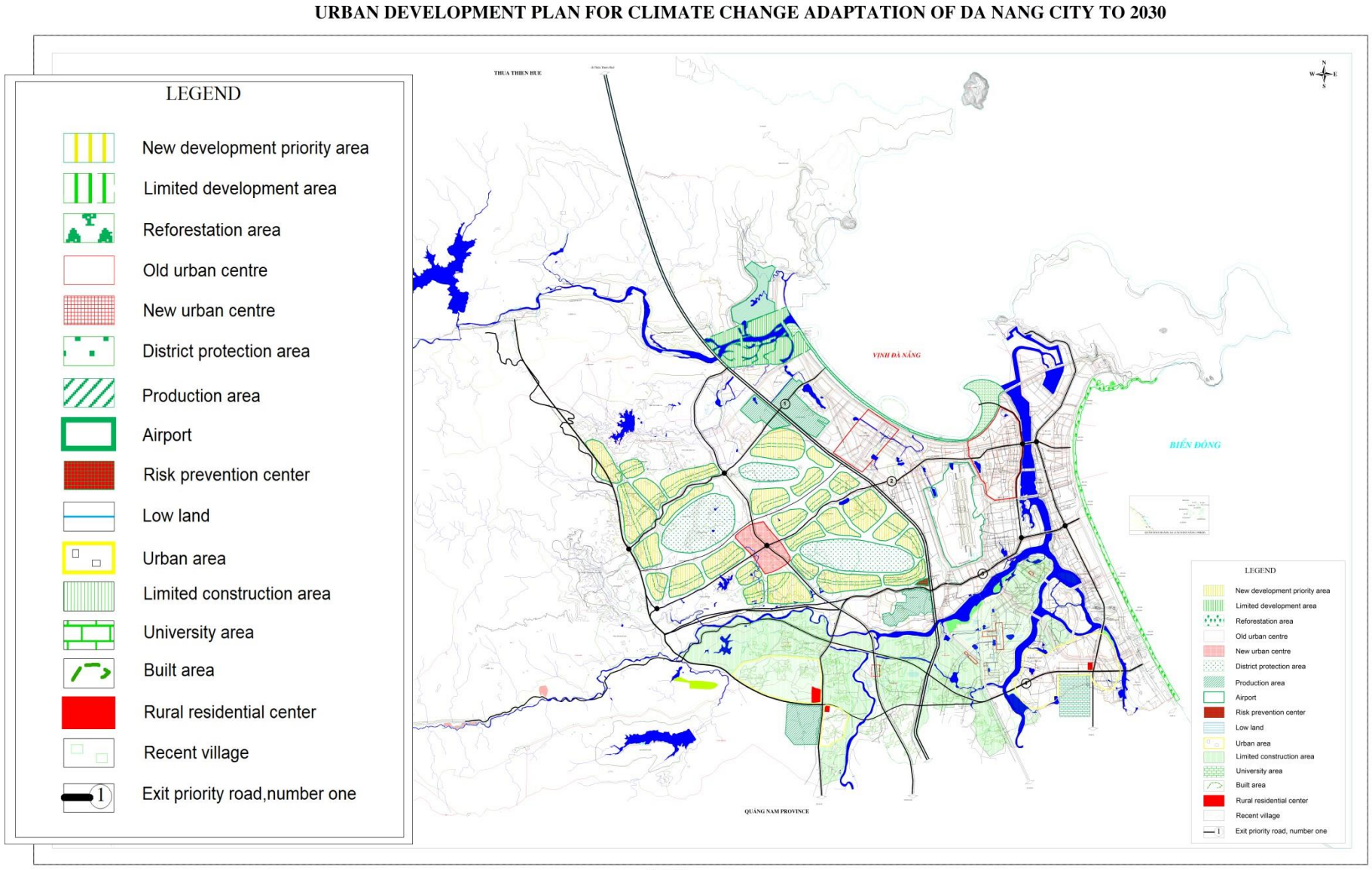
Tourism: arrangement of protection forest strips along the coast (Casuarina forest)

Flooding and Inundation

Harmonizing between new and old residential areas

Solving conflicts of supply - drainage

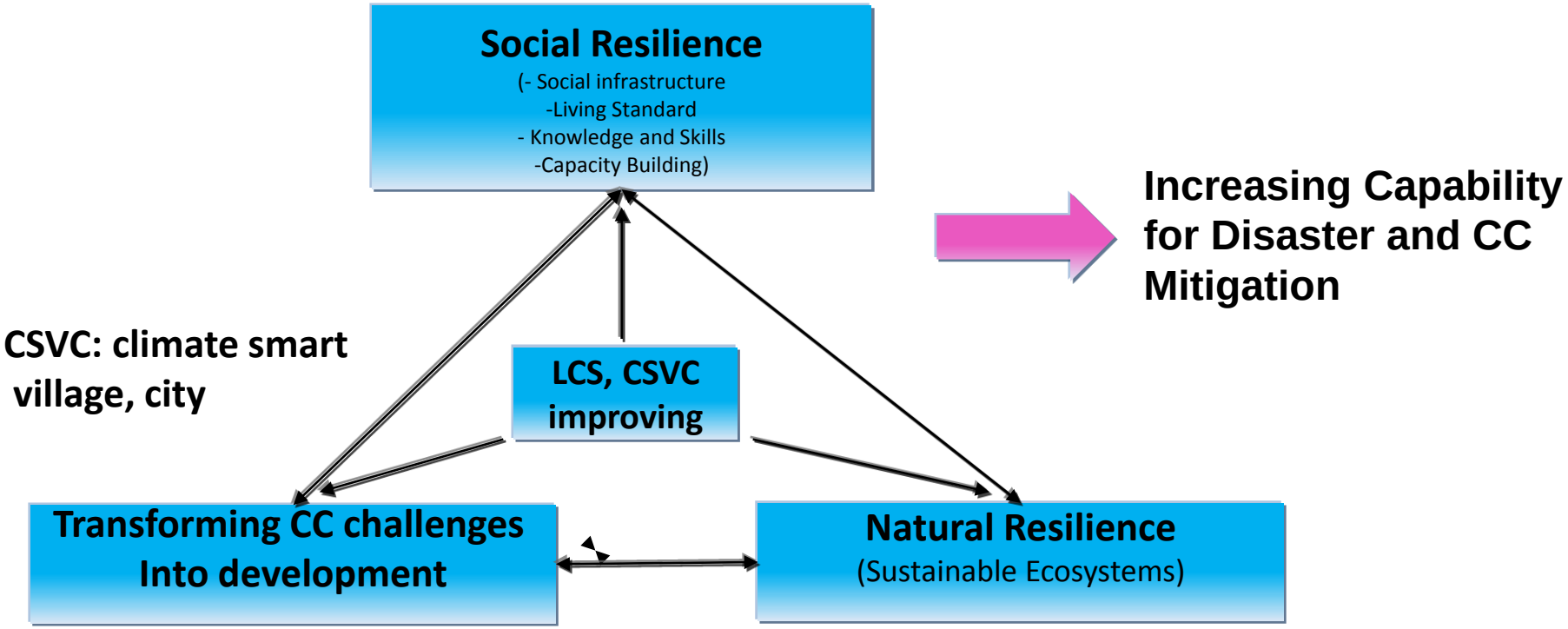
Model of coastal Adaptive to CC city for Da Nang: Development planning for CC Adaptation



II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.5. Sustainable Livelihood

- **Sustainable Livelihood is** Improving Social and nature Resilience and low carbon society (LCS)
  - Social infrastructure
  - Living standards
  - Knowledge and skills

} Increase Adaptive Capacity and Disaster Mitigation



II. Vietnam - pioneering in response to climate change, disaster response (CCDR) 2.5. Sustainable Livelihood

- **Diverse Sustainable Livelihoods (SL)**

Japan: Satoyama, Satoumi Models

China: Harmonious Society Development, eco-community,

Indonesia: community-based conservation

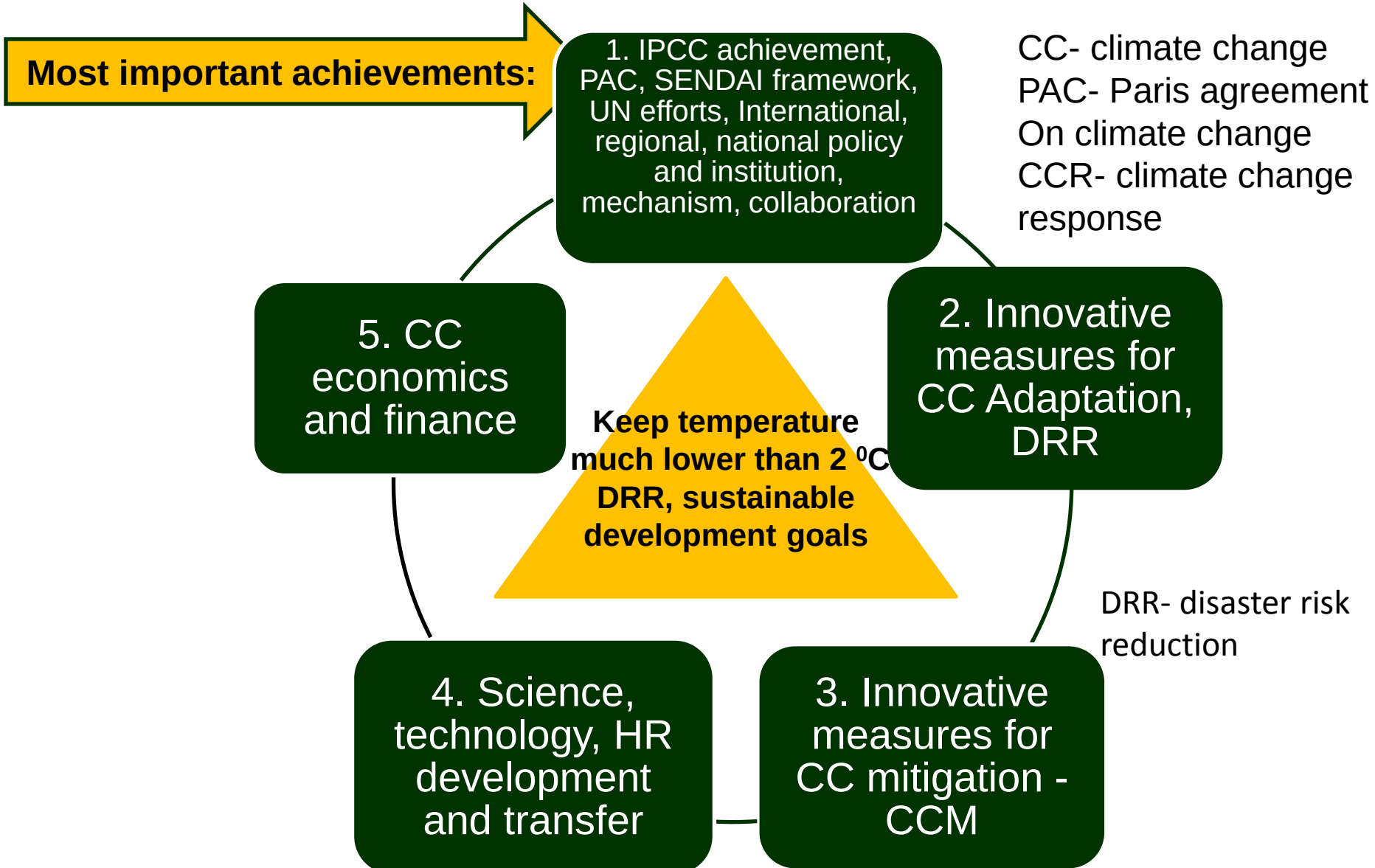
Vietnam: Traditional VAC, Modern VAC

- **Climate smart agriculture:**

Sustainable agriculture with improved production, clean food production, reduced CC and ecological change and enhanced resilience.

VAC= Garden + Aquaculture pond+ Breeding facility (for Livestock)

III. Building the new model of low carbon and resilient development, taking opportunities, transforming challenges. 3.1. Opportunities from global achievements in CCDR



III. Building the new model of low carbon and resilient development, taking opportunities, transforming challenges. 3.2. Challenges from PAC

- The followings are lower than requirements of PAC and SENDAI framework (SF) implementing:

- Knowledge, perception on PAC, SF;
- Policies & institutions;
- Human resources;
- Science and technology;
- Financial resource;
- Capacity of climate change response.

- Need more and greater efforts for:
  - Implementing PAC, SD
  - Building and implementing the models of low carbon and resilient development and society
- Challenges of loosing the above mentioned opportunities

III. Building the new model of low carbon and resilient development, taking opportunities, transforming challenges. 3.3. Challenges for SD in Vietnam

Challenges for SD in Vietnam

1. Disaters, CC risk, vulnerability
2. Environment pollution
3. Biodiversity, natural resources degradation
4. Poverty
5. Limited financial resources
6. Policy and and institution
7. Intersectorial collaboration, coordination limited
8. Science, technology not hightly developed
9. Weakness of VN people

III. Building the new model of low carbon and resilient development, taking opportunities, transforming challenges. 3.4. Objectives

To take advantage of opportunities, transform challenges from PA, SF, Building and implementing models of low carbon and resilient development with objectives:

Objectives

- Mitigating GHG emissions to achieve the objectives of the Paris Agreement on the climate (PAC);
- Minimizing impacts and losses due to natural disasters, CC, enhancing natural- social resilience, protection of environment and planet Earth;
- SD of economy, society, improving the living standards, safety prosperous, wealthy and strong country, social justice, democracy and civilization;
- Sustainable use of natural resources and environmental protection to develop a low carbon, high tolerance of climate change and natural disasters
- Developing the new growth models -low carbon, highly resilient to CC and natural disasters in the context global change

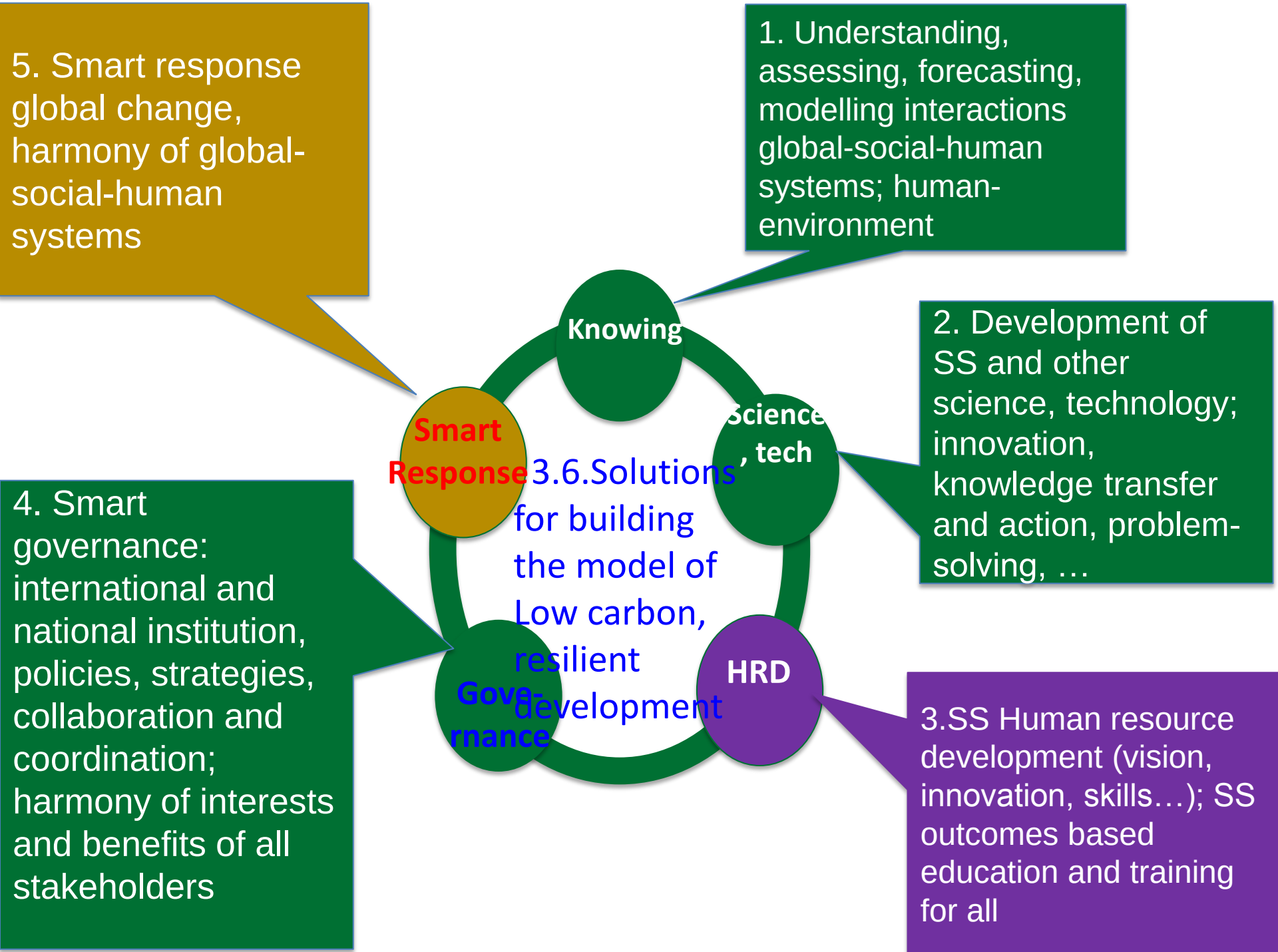
III. Building the new model of low carbon and resilient development, taking opportunities, transforming challenges. 3.5. Contents

CCDR: climate change and disaster (CCD) response

SD: sustainable development

Contents

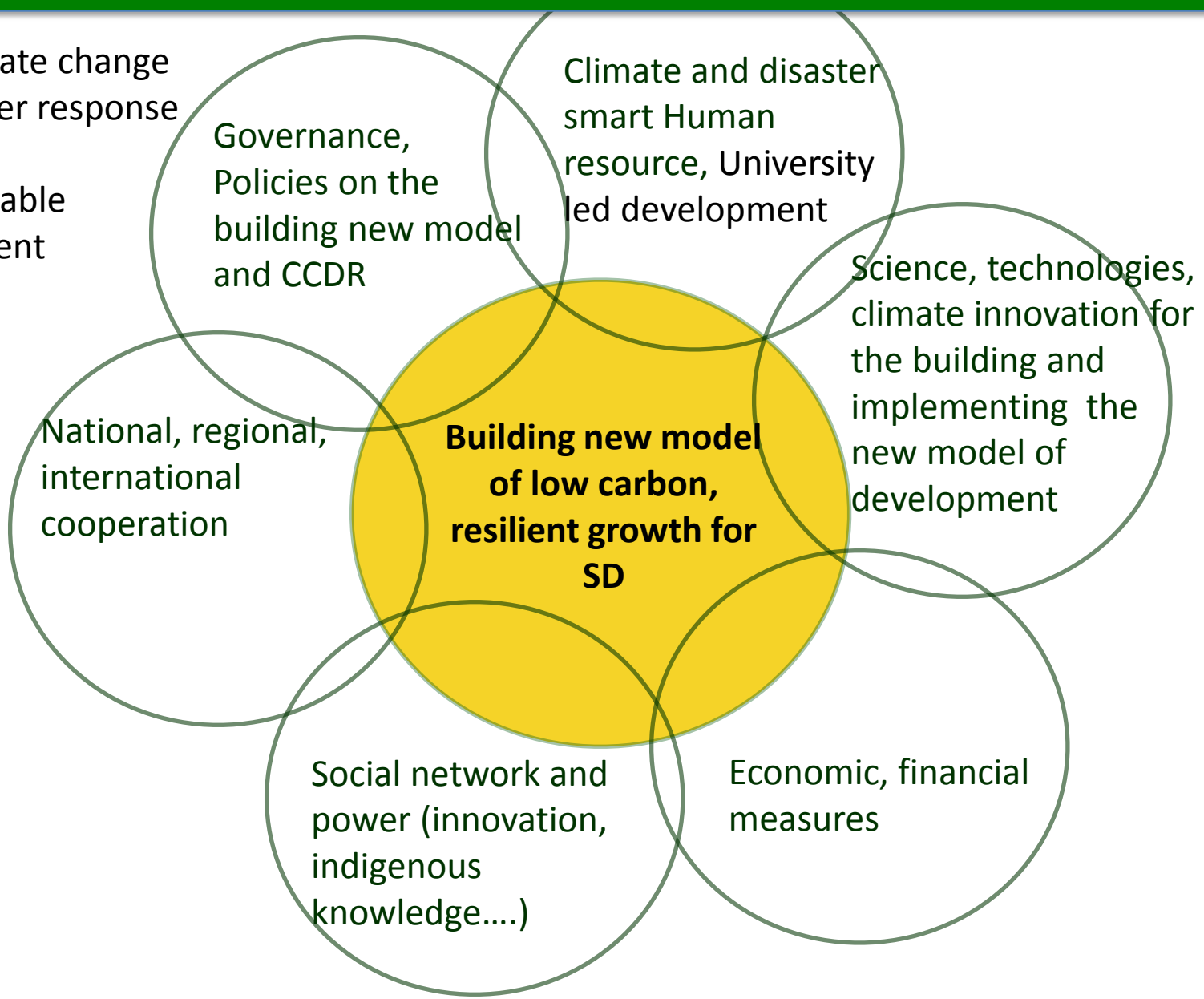
- a. CCD smart and resilient economics and infrastructure
- b. Society of democracy, justice , and smart to CCD, promoting core strengths, limiting weaknesses of natural conditions, natural resources, environment of Vietnam and Vietnamese people
- c. CCD smart science and technology, human resources, potentially transforming the challenges into opportunities for sustainable development
- d. Finance diversity, efficient use, meeting the requirements of CC and disasters response.
- e. CCD smart institutional, policy innovation; promoting innovation and achievements in disaster prevention and CC response in Vietnam and over the world.
- f. CCDR and SD international collaboration


5. Smart response global change, harmony of global-social-human systems
1. Understanding, assessing, forecasting, modelling interactions global-social-human systems; human-environment
Knowing
2. Development of SS and other science, technology; innovation, knowledge transfer and action, problem-solving, …
Science, tech
Smart Response
3.6.Solutions for building the model of Low carbon, resilient development
4. Smart governance: international and national institution, policies, strategies, collaboration and coordination; harmony of interests and benefits of all stakeholders
Gove-rnance
HRD
3.SS Human resource development (vision, innovation, skills…); SS outcomes based education and training for all

III. Building the new model of low carbon and resilient development, taking opportunities, transforming challenges. 3.6. Solutions

CCDR: climate change and disaster response

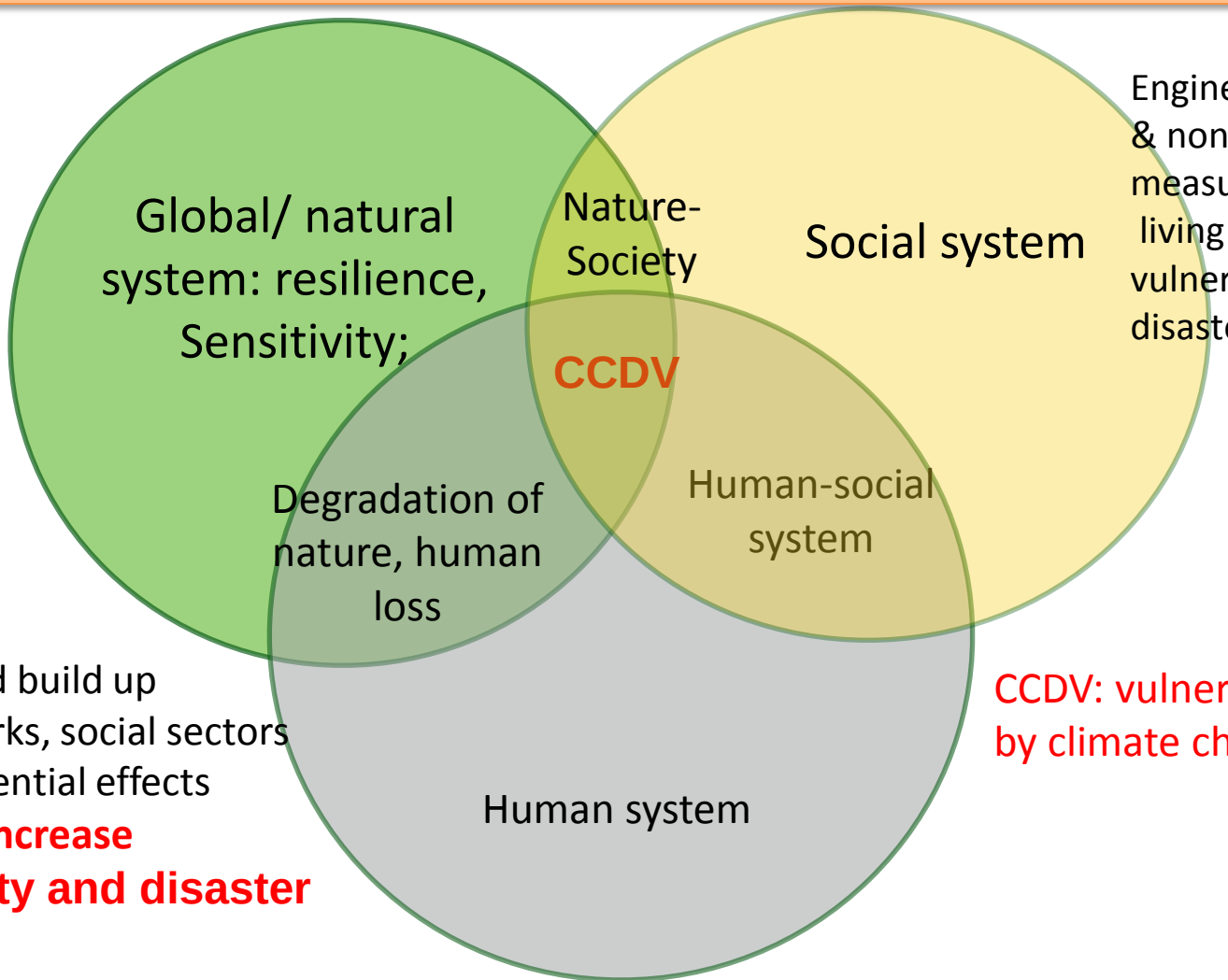
SD: sustainable development



IV. Lessons learned on climate change and disaster response

4.1. CCD and human activities Cause vulnerability of 3 systems –natural-social-human

Vulnerability to CC and disasters: higher in coastal, mountainous, low-land, fast urbanization areas, and in areas of multi hazard, **low natural resilience, high poverty communities and inappropriately anthropogenic activities**



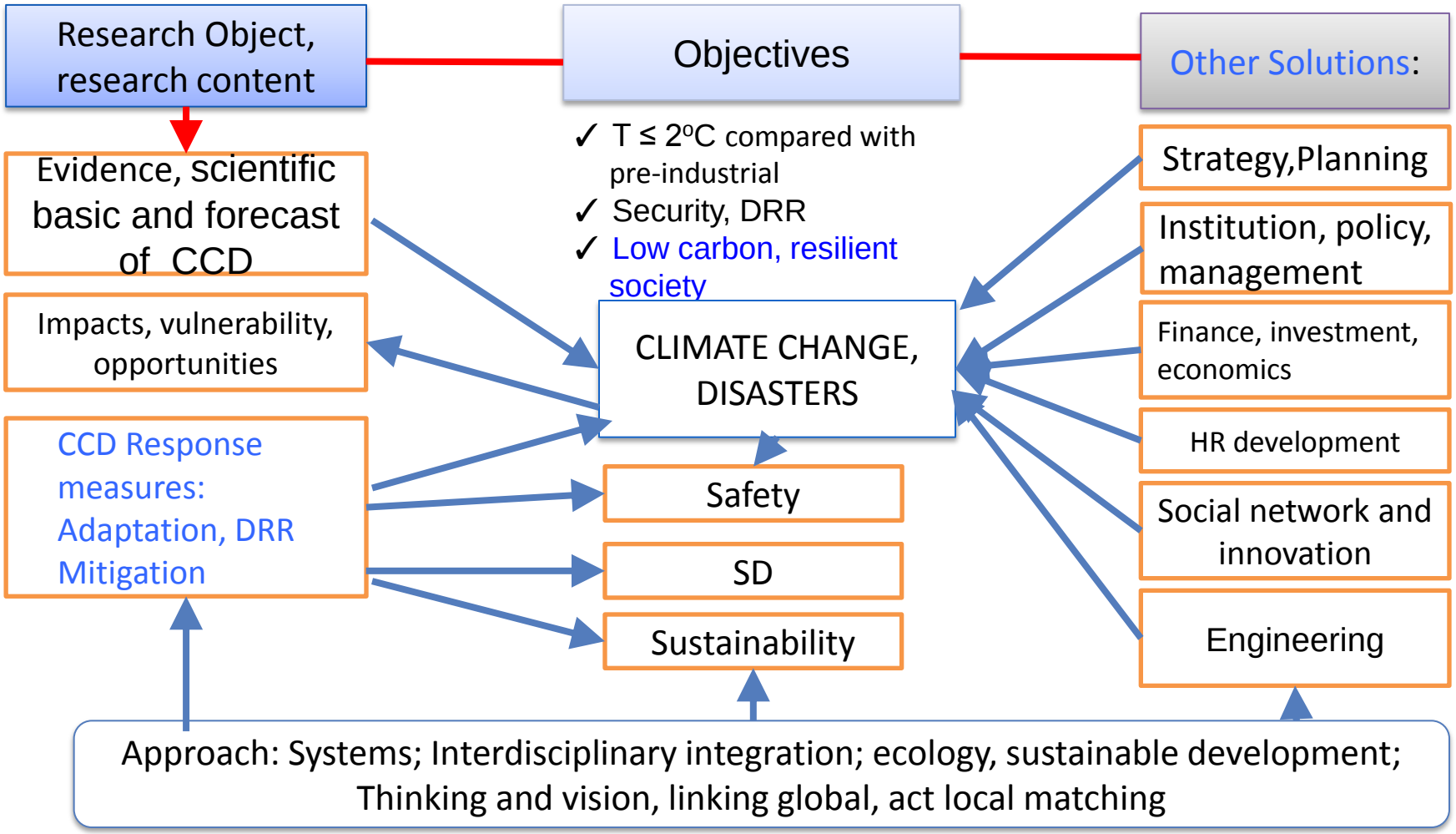
Engineering & non-engineering measures for CCDR, living with CCD reduce vulnerability and disaster risk

Urbanization, migration and build up industrial parks, social sectors in highly potential effects by disasters **Increase Vulnerability and disaster risk**

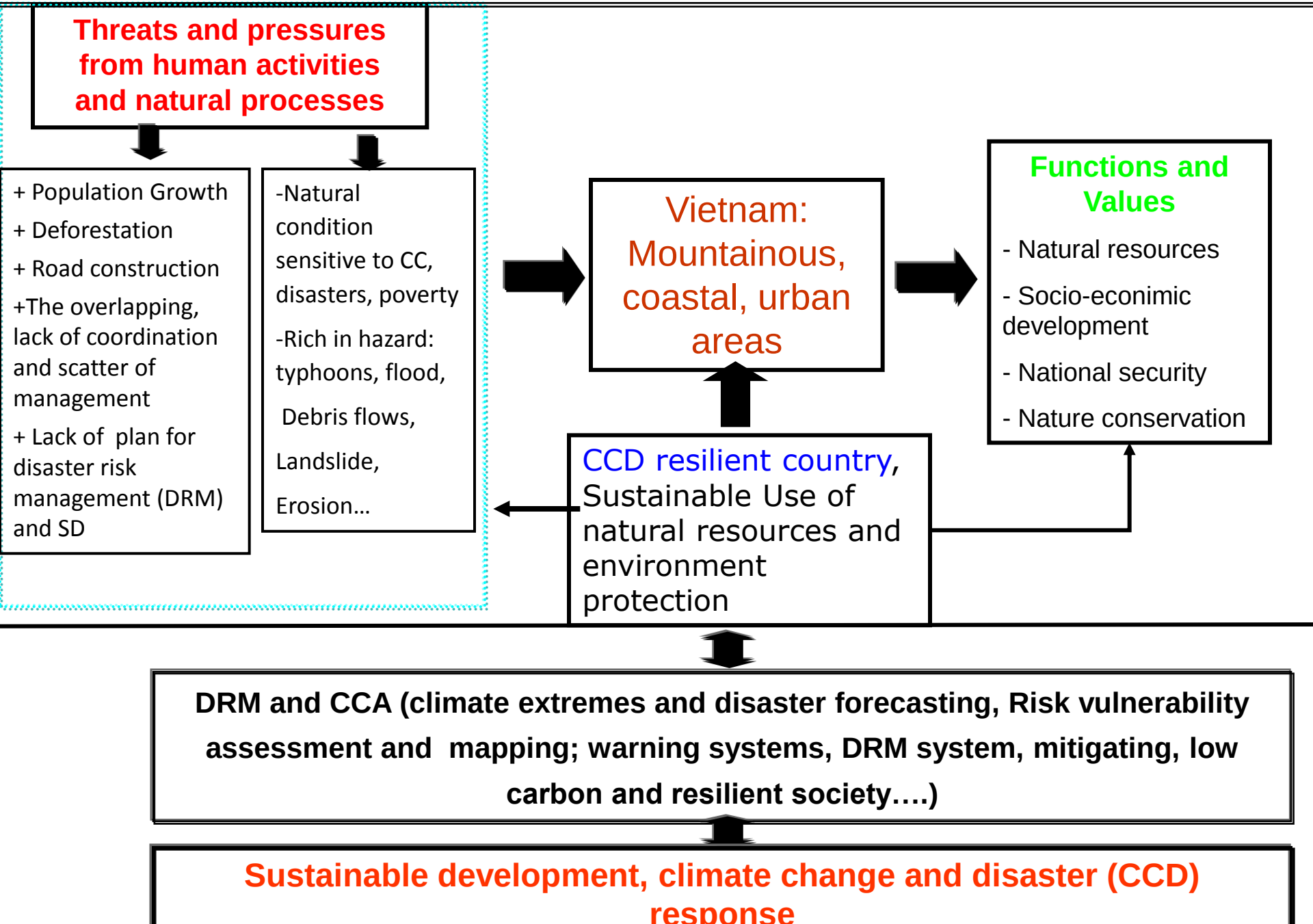
CCDV: vulnerability caused by climate change and disaste

IV. Lessons learned on climate change and disaster response (CCDR)
4.2 CCDR Framework for sustainable development

CCDR Framework for SD



DISATSER RISK REDUCTION F RAMEWORK



IV. Lessons learned on climate change and disaster response

4.4. Effective CCDR should be based on the Point of view of proactive response (better than active and passive ones) and:

Based on S&T, policies, institution, strategies, indigenous knowledge, social power

Harmonious benefit among stakeholders, between DDR and CC adaptation;

Integration, interdisciplinary, inter-sectorial bottom-up, top-down approaches

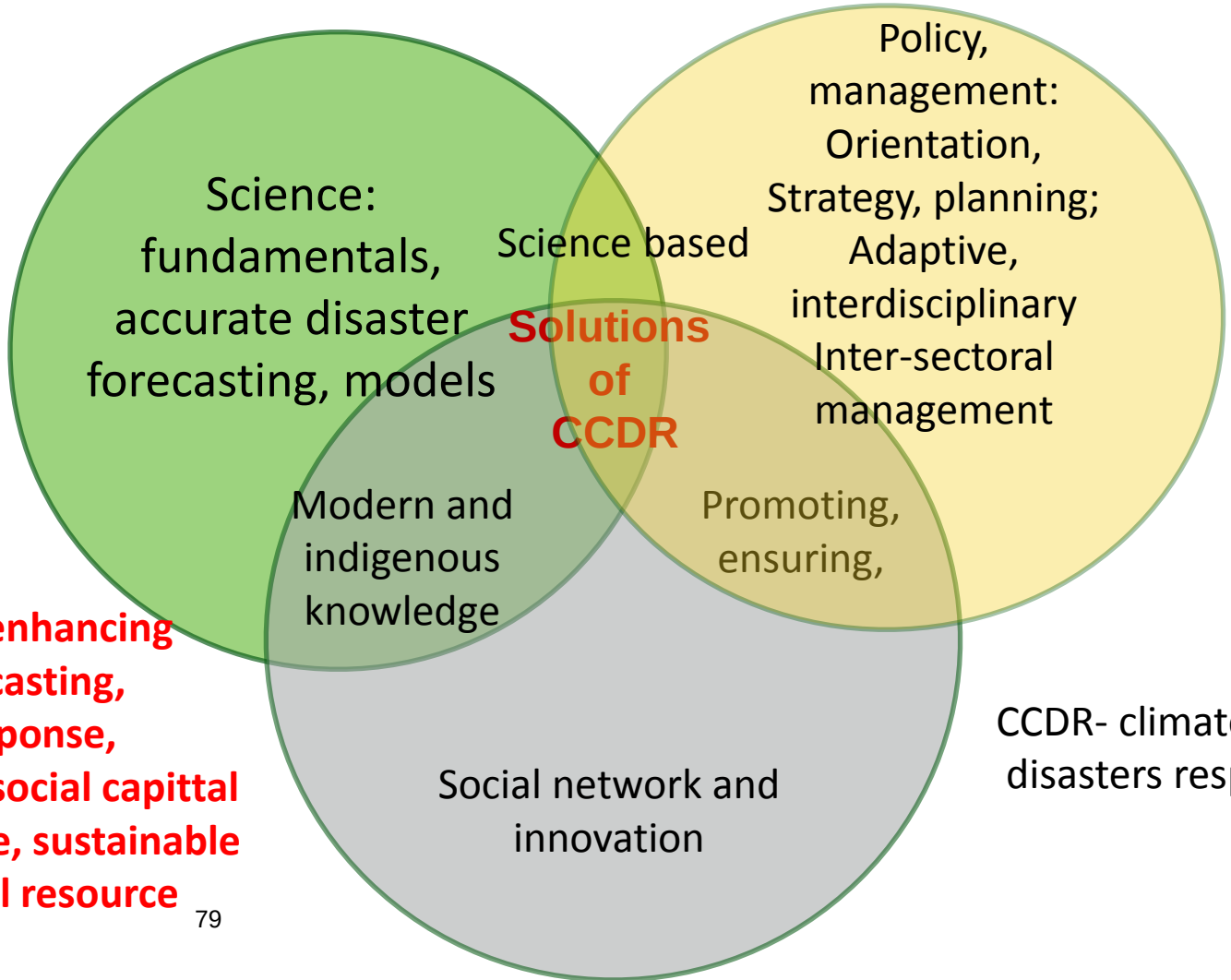
Integration of:
a) CCDR into development plan
b) natural and social resilience
c) Reducing bad impact and transforming challenges into opportunities

Think globally, regionally, action locally (fours in situ)
Proactive response first
International effort and cooperation (exp. Y F Tong, 2018)+VN efforts

IV. Lessons learned on climate change and disaster response

4.5. Science based policy, management+ social network and innovation for CCDR

Science based policy, management+ social network and innovation



Focusing on enhancing disaster forecasting, proactive response, natural and social capittal and resilience, sustainable use of natural resource

CCDR- climate change and disasters response

IV. Lessons learned on climate change and disaster response

4.5. Science based policy, management+ social network and innovation for CCDR

Determine and utilize CC opportunities for science and technology and social development, economic growth, human resources for SD

Highly Vulnerable Vietnam can be a pioneer in CCD response through:

Institutional and policy innovations, creating platform, framework, directions, promotion, finding resources for proposing and using the necessary measures aiming at climate change, disaster response (CCDR);

Using, promoting Social network, power and innovation, indigenous knowledge, water civilization, community-based which are very important for CCR in developing countries and turning the CCD challenges into opportunities of development

Living with floods, drought and climate change, creating Climate change and disaster smart models

Promoting proactive response to CC, disaster based on vulnerability assessment and forecasting (sustainable natural resource use planning, models- Satoyama, Satoumi,VAC models).

IV. Lessons learned on climate change and disaster response

4.5. Science based policy, management+ social network and innovation for CCDR

Science/technology-policy collaboration is important for CCDR through:

- Institutional and policy innovation: promoting effective CCDR, LC innovation (energy efficiency, renewable energy...; low carbon development)
- Integration of CCR and disaster risk reduction, overcoming challenges from CC, taking opportunities from CC
- Implementing sustainable natural resource use (Satoyama, Satomi,... models), climate smart models
- Energy innovation realization: solar energy, bio fuel, geothermal energy
- Development of LCS, climate smart models for CCDR and SD.

Transforming to a new growth model – sustainable, low carbon and resilient development is:

- Transformation of climate change challenges into opportunities, implementing PAC;
- Overcome the shortcoming of Vietnam natural and community characteristics for CCDR and sustainable development;
- Incorporated and best measures for climate change and disaster response

IV. Lessons learned on climate change and disaster response

4.6. More effective and sustainable response to CCD through new model of low carbon and resilient development

1. Improving the accuracy of forecast of CC, disaster, extreme events (Assessing, forecasting, quantifying impacts, vulnerability, adaptation of sectors, fields, areas, natural resources to CC, distinguishing the impacts by CC and non CC)

2. Change mindset of communities (leaders, managers) about the models of low carbon and resilience; considering CCD response is a smart business, dedication, safe and sustainable development

3. Developing and enhancing efficiency of institutional, policy, governance for promoting low carbon and resilient development models

4. Promote the better social power, innovation for breakthrough development

5. Development of original strength, reducing weakness of Vietnamese

6. Develop the human resources, fostering talents, science and technology about the sustainable development model, low carbon and resilient society, smart model for CCD response

7. Promoting financial mobilization through business and market mechanism

8. Promoting international cooperation and knowledge exchange

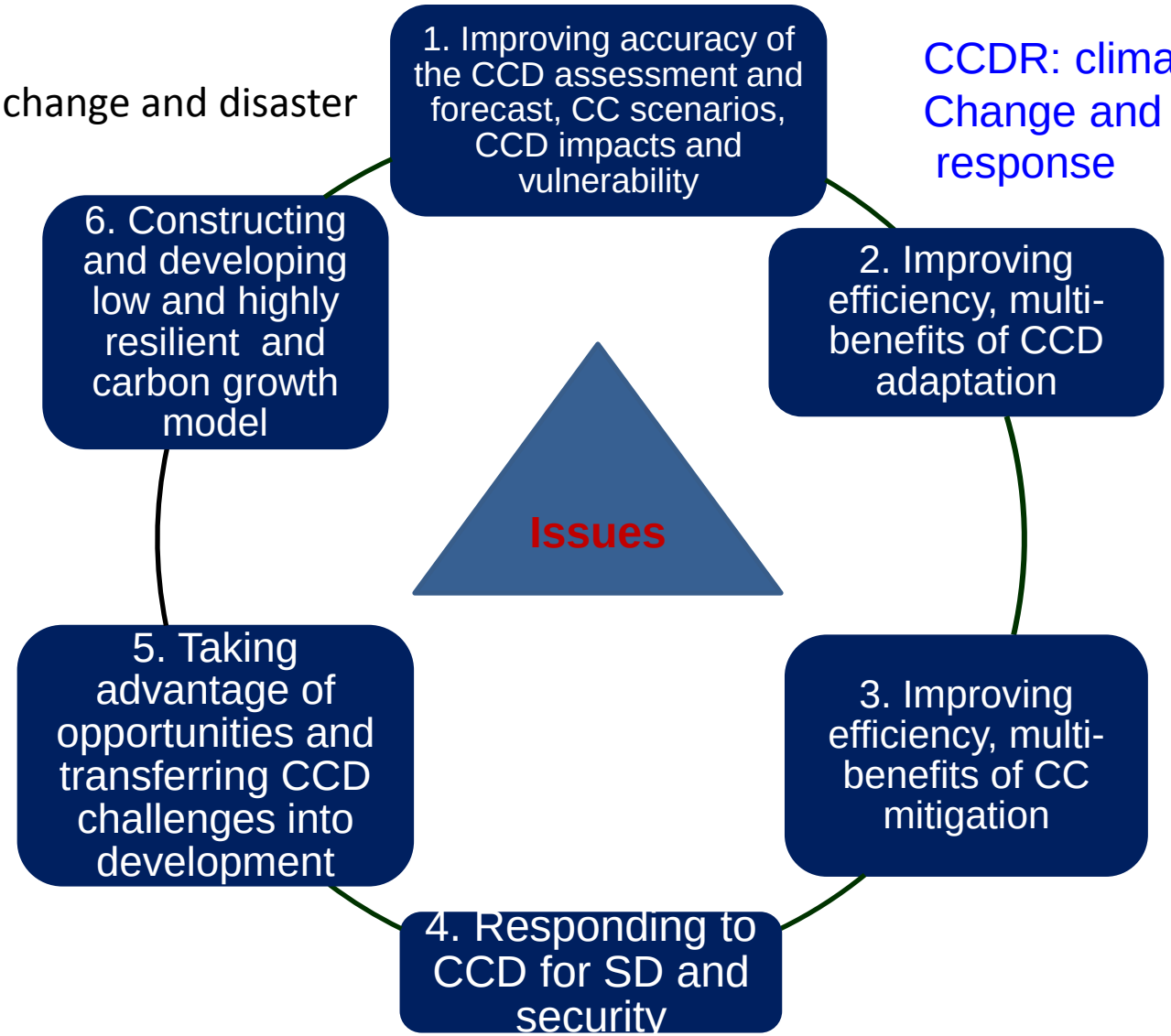
The most important conditions, solutions for building low carbon and resilient development model

V. Science and technology development for CCDR response

INNOVATION FOR EFFECTIVE CCDR AND SUSTAINABLE DEVELOPMENT (SD)

CCD: climate change and disaster

CCDR: climate Change and disaster response

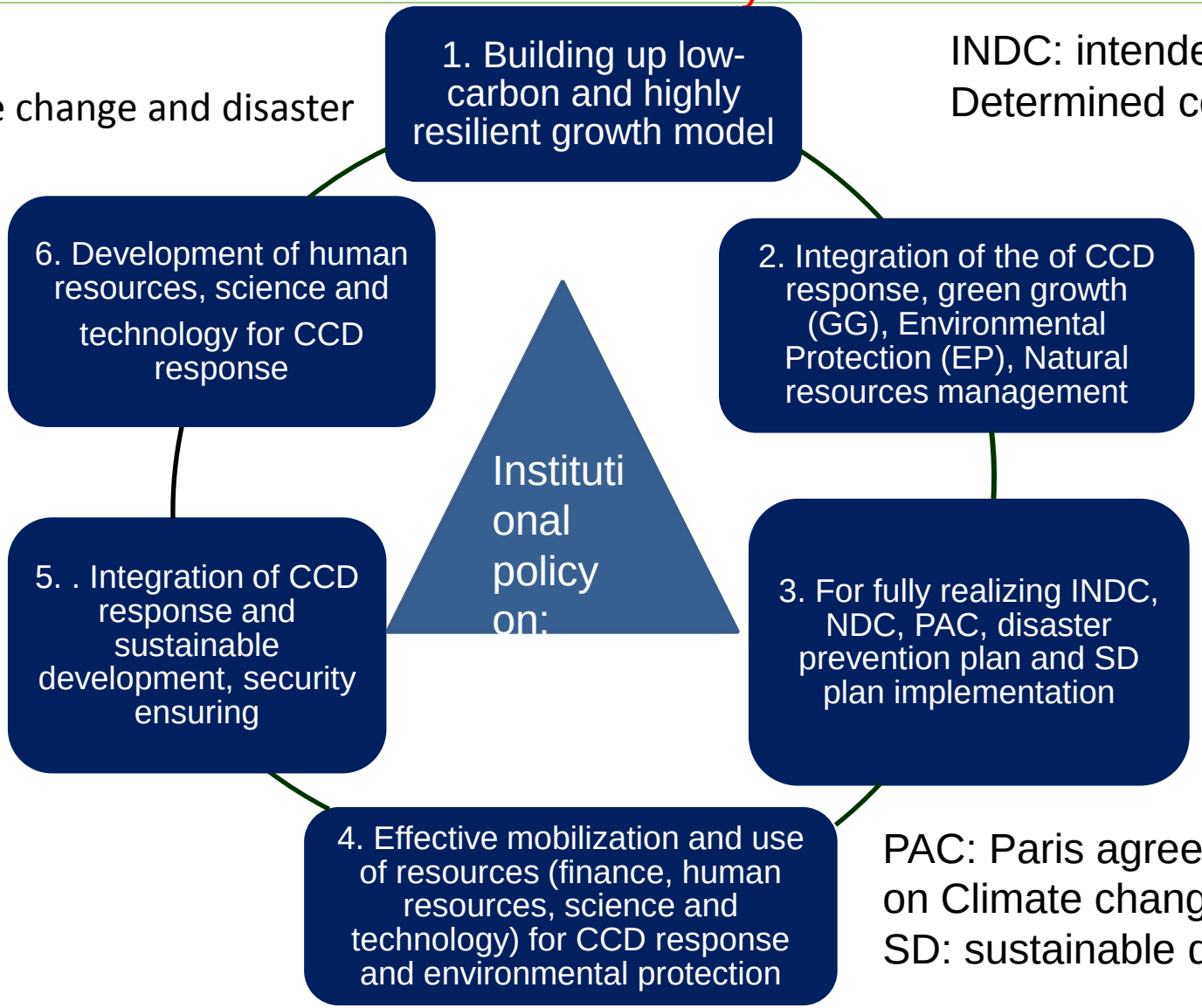


V. Institutional Policy Orientations for Proactive CC response, Resource Management, & Environment Protection

Focusing on proactive CCDR, building the sustainable, low carbon and resilient society

CCD: climate change and disaster

INDC: intended nationally Determined contributions



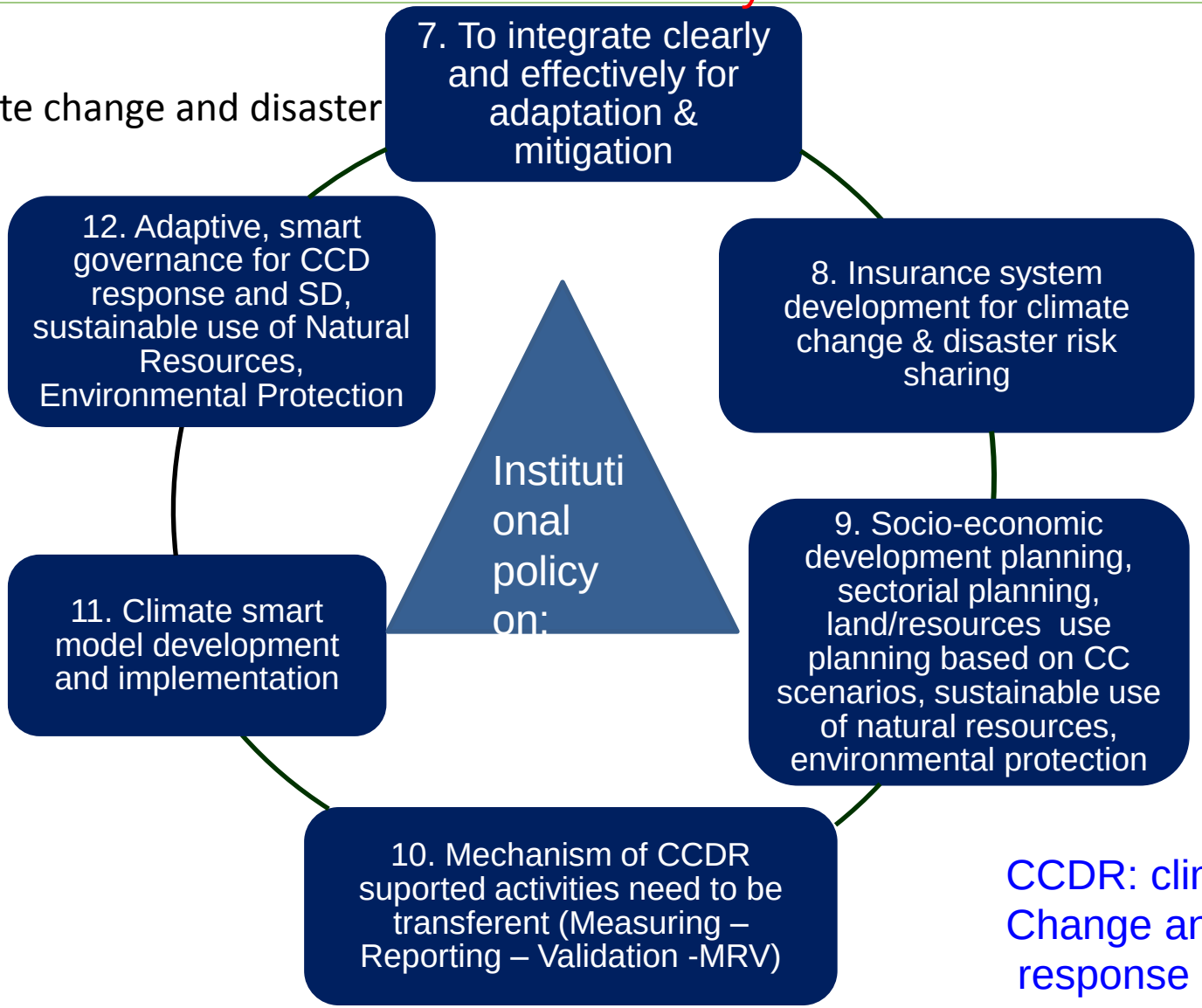
PAC: Paris agreement on Climate change

SD: sustainable development

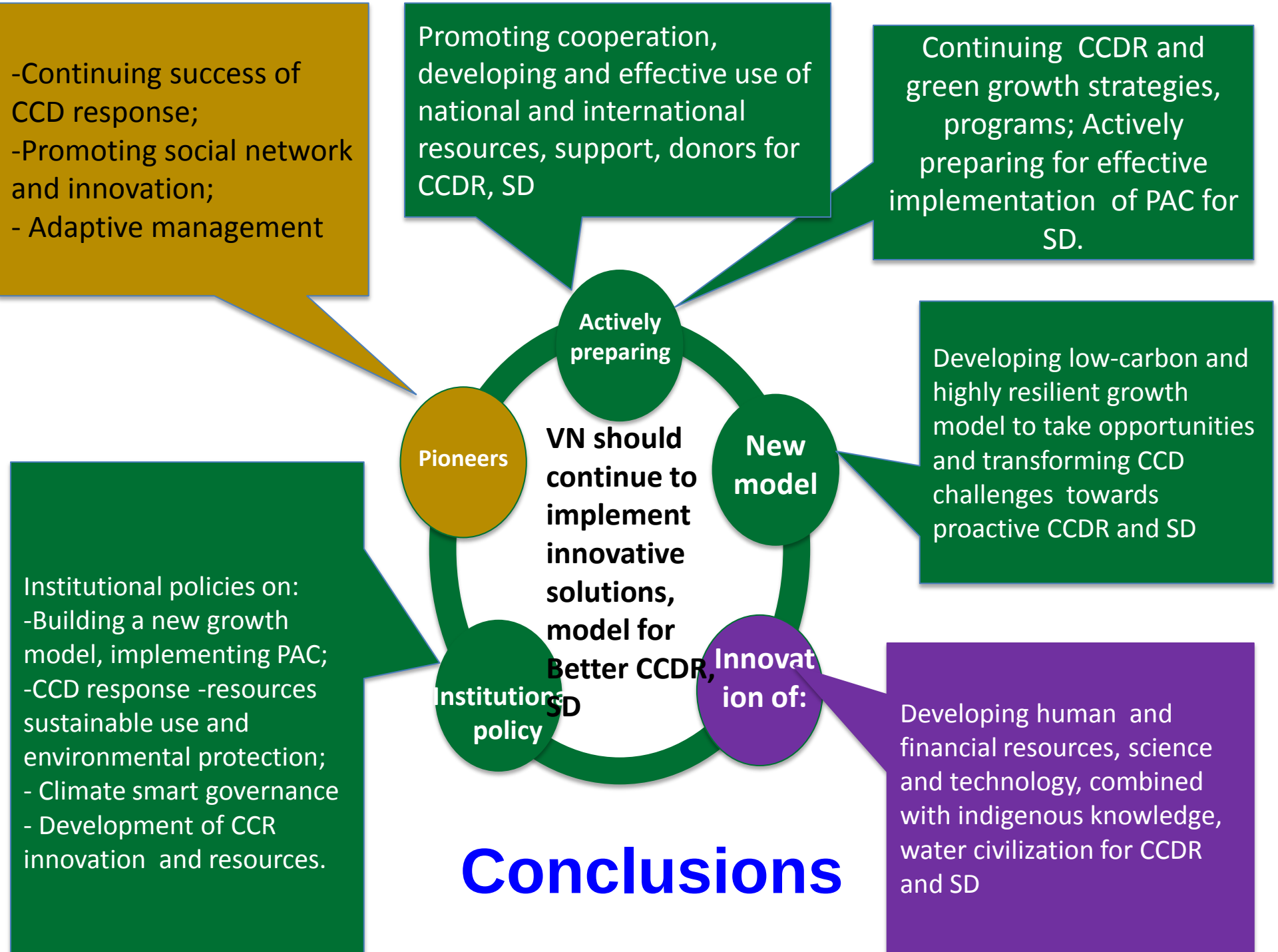
V. Institutional Policy Orientations for Proactive CC response, Resource Management, & Environment Protection

Focusing on proactive CCDR, building the sustainable, low carbon and resilient society

CCD: climate change and disaster



CCDR: climate Change and disaster response



Conclusions

Thank you for your attention!