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## Catastrophic flood events, climate change and land use management: a case study in the Thua Thien Hue Province, Viet Nam

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# Socio-environmental context of Viet Nam

## Natural conditions

- Geographical location, topography, climate and hydrology create conditions for disasters to occur

## Socio-economic conditions

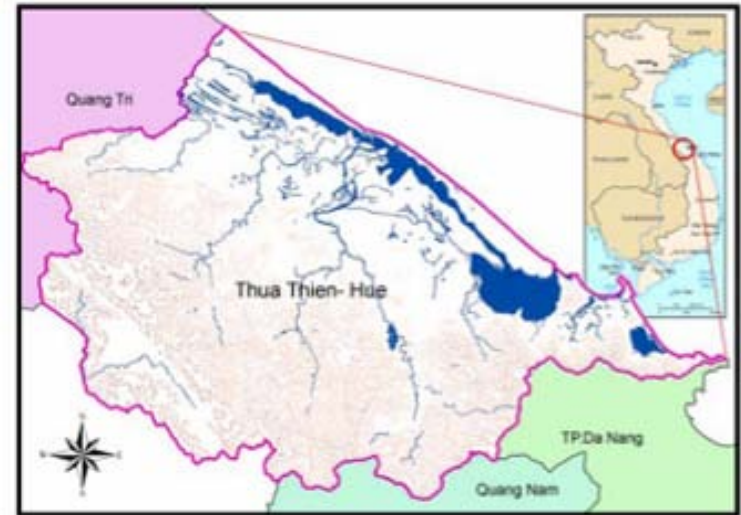
- Population growth and rapid urbanization
- Economic growth pressure (*Đổi mới* economic reforms)
- Unsuitable infrastructure development



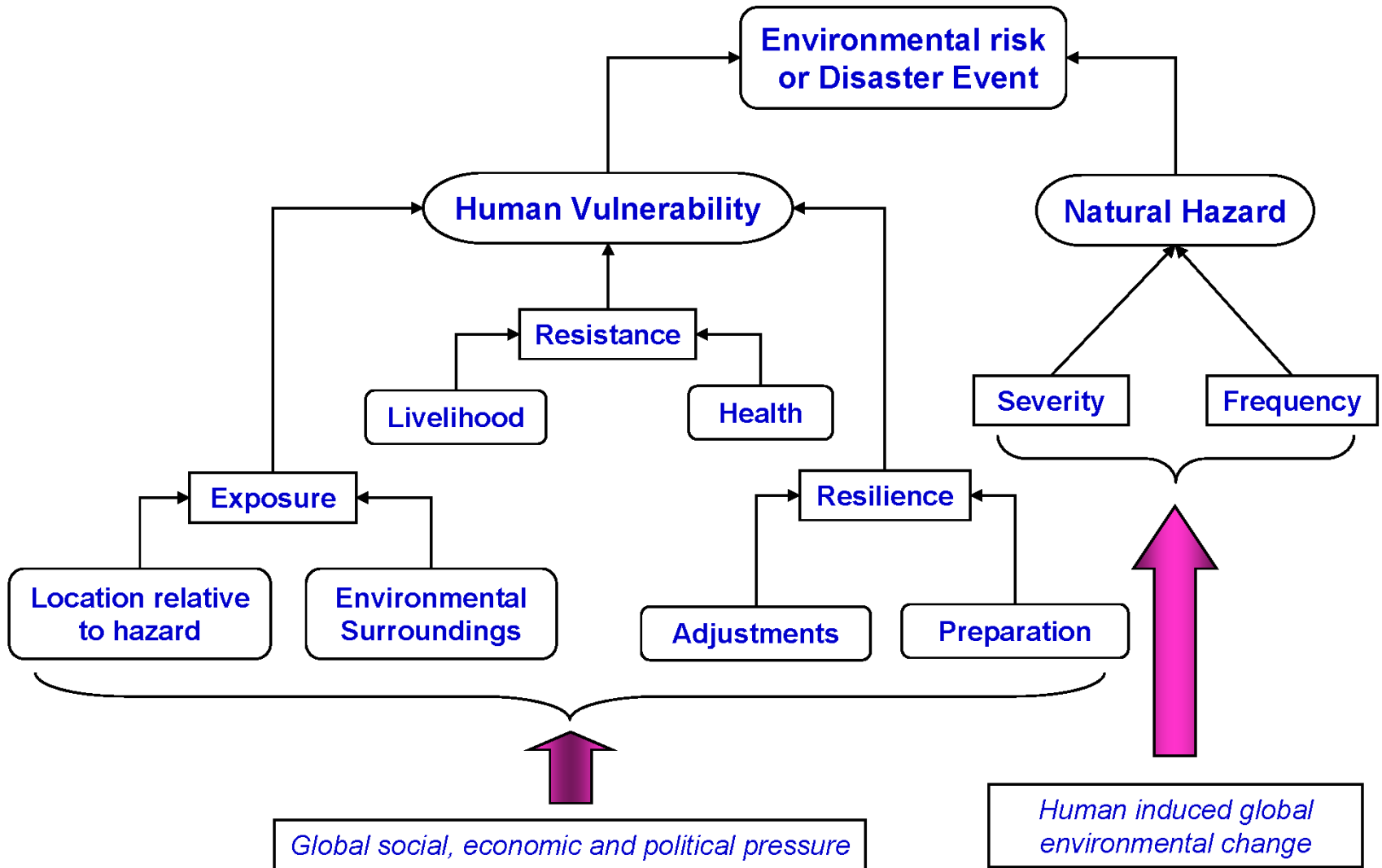


# Objectives and scope of study

- Studies carried out in *Thua Thien Hue*, Central Vietnam
- Clarify disaster-environment linkages at the local context
- Examine the gap between disasters and environmental management
- Promote integrated disaster-environment management

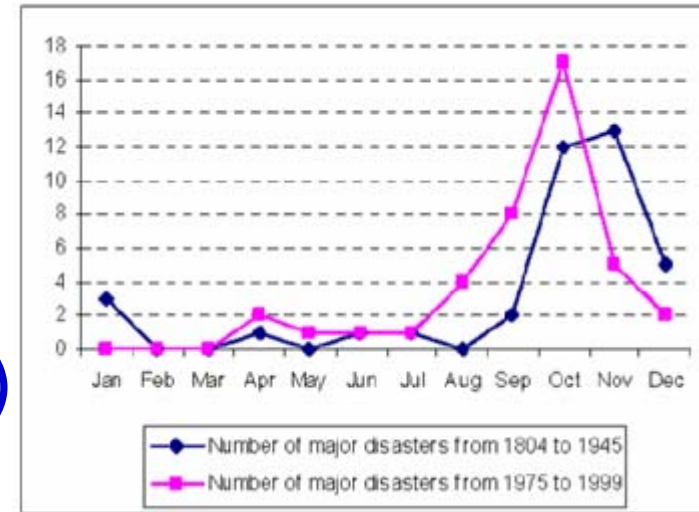


# Research framework

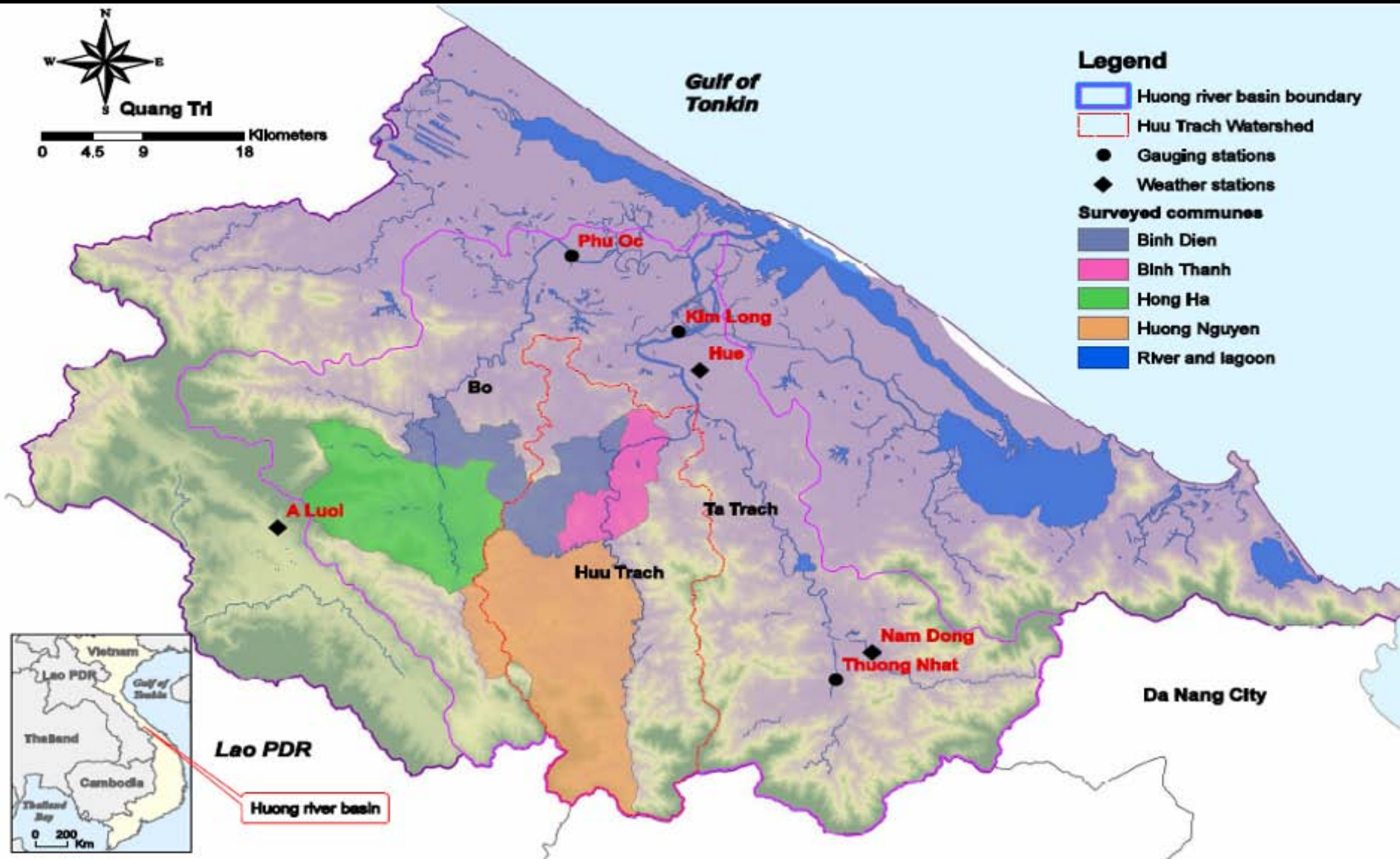


# Flood disaster patterns change

- Frequency and severity of floods are increasing
- Flood disasters last longer and are more erratic (unpredictable)
- The flood/storm season arrives earlier
- Climate change is contributing to worsening of local extreme meteorological events (IPCC, 2007)

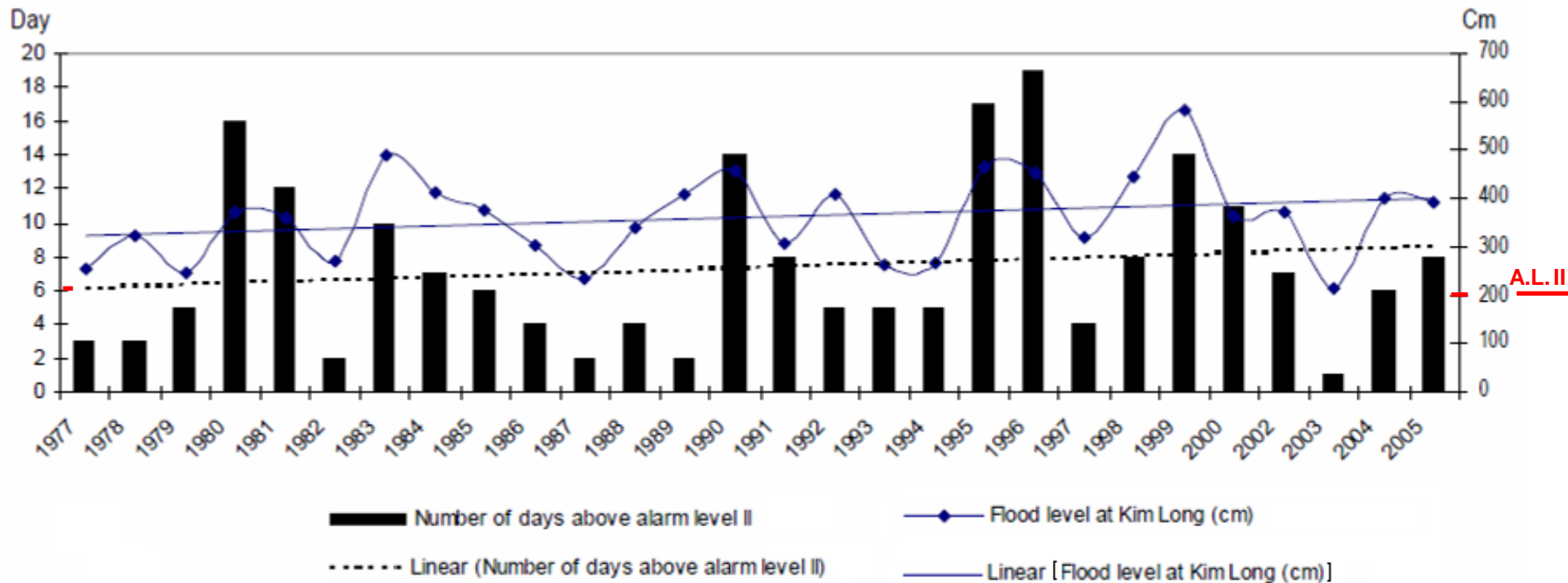


# Location of studied weather stations



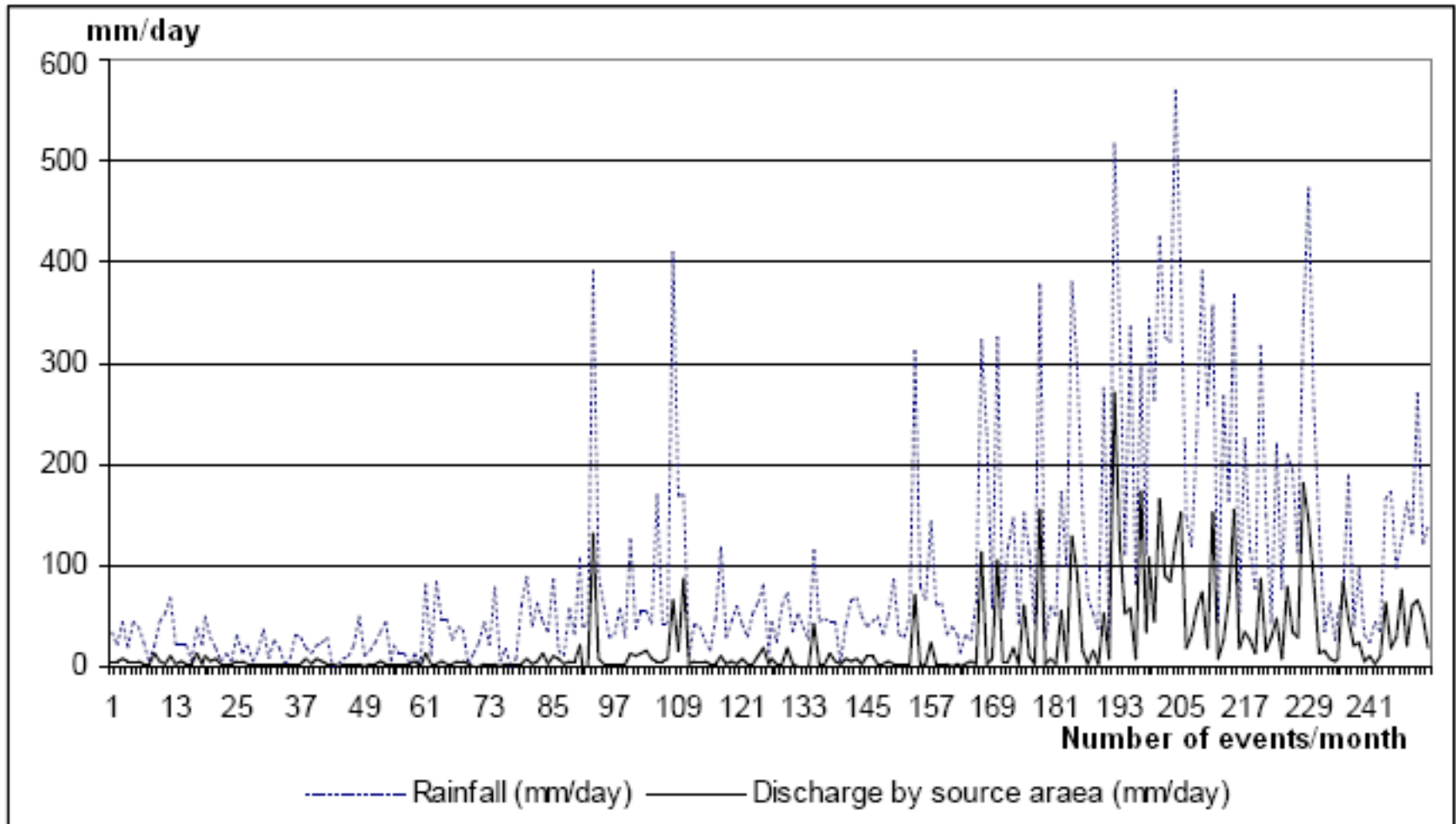


# Flood disaster patterns change



The increasing trend of flood peak and duration in the Huong river basin (Kim Long station)

# Rainfall and discharge at Thuong Nhat and Nam Dong stations



More than 77% variance of discharge accounted for by variance of rainfall (catastrophic floods appear linked to climate change/variability)



# Environment and disaster linkages



Cause and effect of environment degradation and disasters

# Impacts of environment degradation

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## Deforestation

- Change rainfall patterns and leads to drought, flood, flashflood, landslide, siltation, etc.
- Affects crops in the lowland areas increasing farmers vulnerability

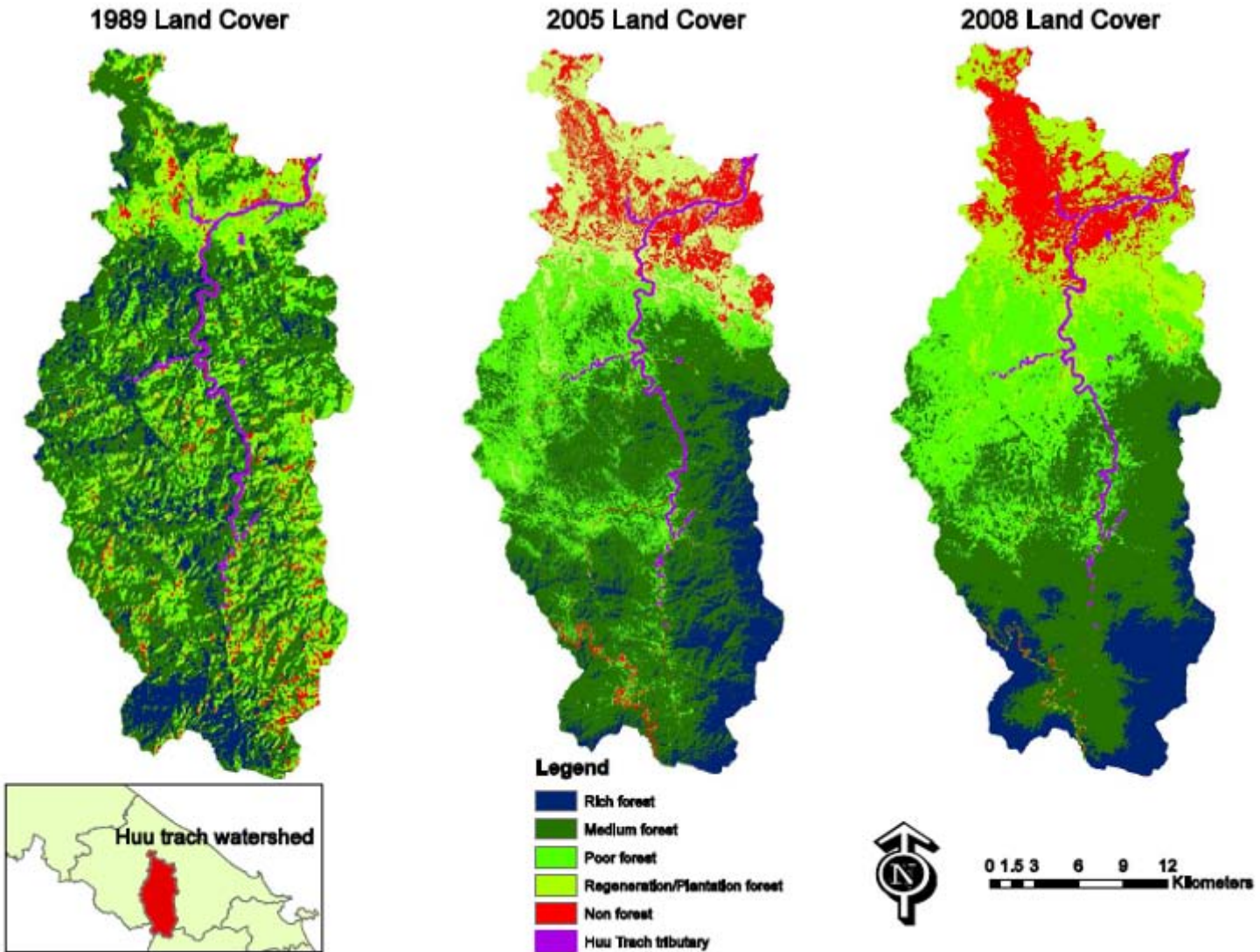
## Waste dumping (industrial waste, pesticides ...)

- Block the water flow and silt the reservoirs
- Chemical and biological risks exposure
- Reduces biodiversity

## Human infrastructures (road and dike systems)

- Modify the hydrology flow (infiltration & runoff)

# Land-cover in Huu Trach watershed in 1989, 2005 and 2008



(Calculated from Landsat, Spot-5 and Aster satellites images)



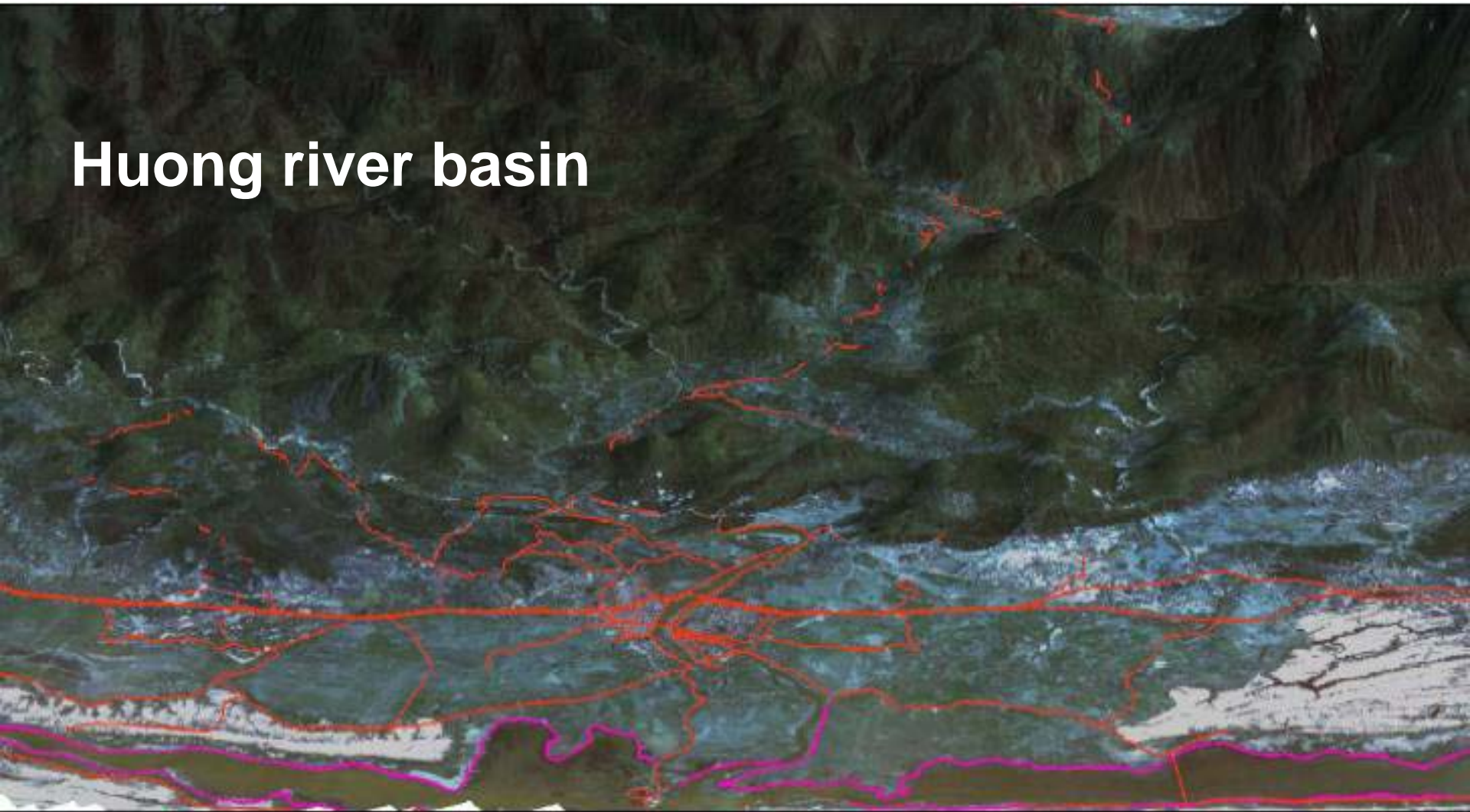
# Waste dumping



Waste dumping upstream and its effects downstream

# Topography, transportation and dyke systems

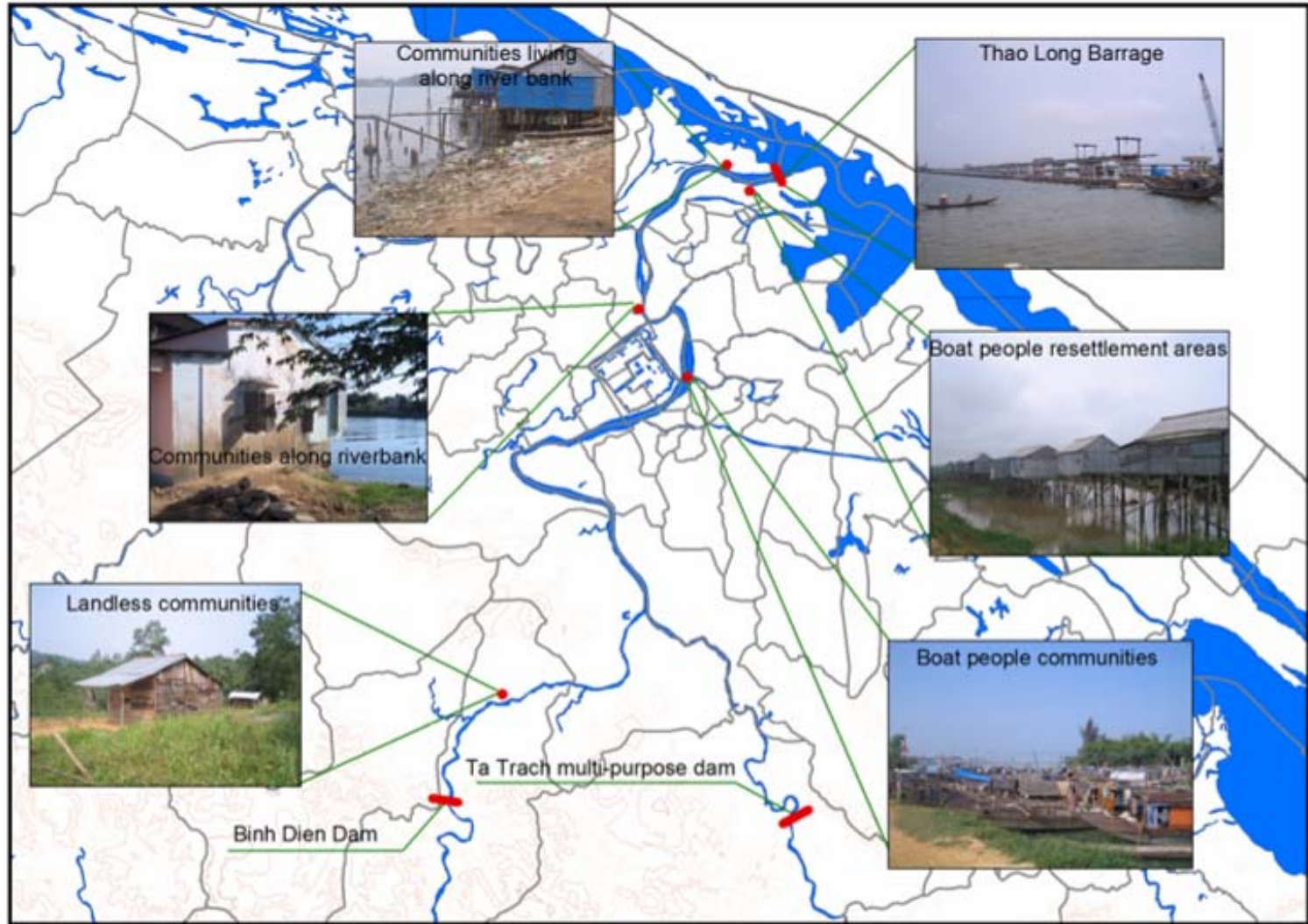
## Huong river basin



(Created from DEM, Landsat Image, main road and dyke systems of Thua Thien Hue)



# Dams and barrages



Dams, barrages and vulnerable communities



# Human vulnerability

## Root causes

- Population
- Globalization

pressure

## Dynamic pressures

- Slash/burn agriculture
- Sand/grave exploitation
- Overexploitation of natural resources
- Improper relocation

- Inappropriate protection measures
- Environmental degradation
- Migration
- Low level of education

## Unsafe conditions

### Physical environment

- Insecure houses
- People live on boat
- House in lowland, riverbank

### Public actions and Institutions

- Mainly focus on relive and emergency

### Fragile economy

- Main livelihood based on agriculture and aquaculture
- Limited wage work in rural areas

### Health

- Waste during the flood season
- Unhygienic condition

Disaster

## Hazards

- Flood
- Storm
- Drought
- Flash flood
- Landslides
- Coastal erosion
- Inundation
- Climate change

# Conclusions

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- Traditional practices of disaster and environmental management are under pressure
- New flood management (FDM) policies needed
- Flood disasters should be recognized as integral part of natural and societal processes
- FDM is **not just** a matter of:
  - *emergency aid*
  - *better monitoring and forecasting*
  - *safer building/infrastructures design*
  - *sustainable land use planning*
- FDM **should also be** integrated into:
  - *development programs* (poverty alleviation, relocation, etc.)
  - *capacity building programs* (public education/school programs)
  - *subsidiarity* (public and private, local and national)



