



## **Prevention and mitigation of geological hazards in Vietnam**

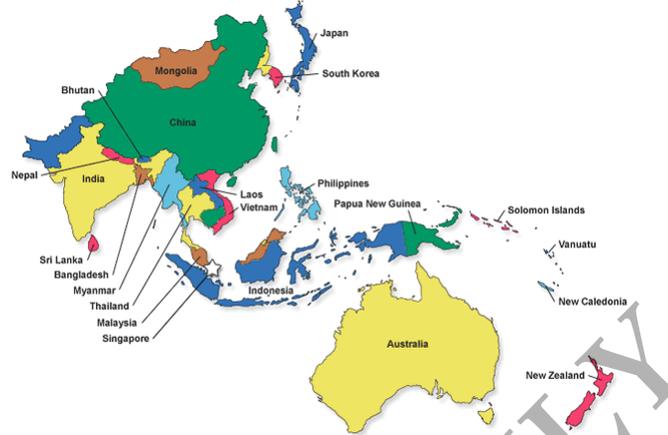
Vu Anh Thu - Hanoi University of Mining-Geology, Vietnam  
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## 1. Brief introduction on geological hazards in Vietnam



Vietnam is in the natural hazard region of the Asia-Pacific. It has experienced several geological hazards, including flood, drought, erosion, landslide, fire, polluted environment from mining, which effects on 60% of population of Vietnam (MARD, 2009).

### 1.1. Typhoon

- Vietnam normally suffers from 5-6 typhoons per year (scale from 9 to 13 degree).
- It causes averagely 120 of dead, 100 missing victims and damages about 50.219 of housing, infrastructure and construction), 200.000 ha of farming and \$20.000.000 per year (Ministry of Agriculal and Rural Development-MARD, 2012)

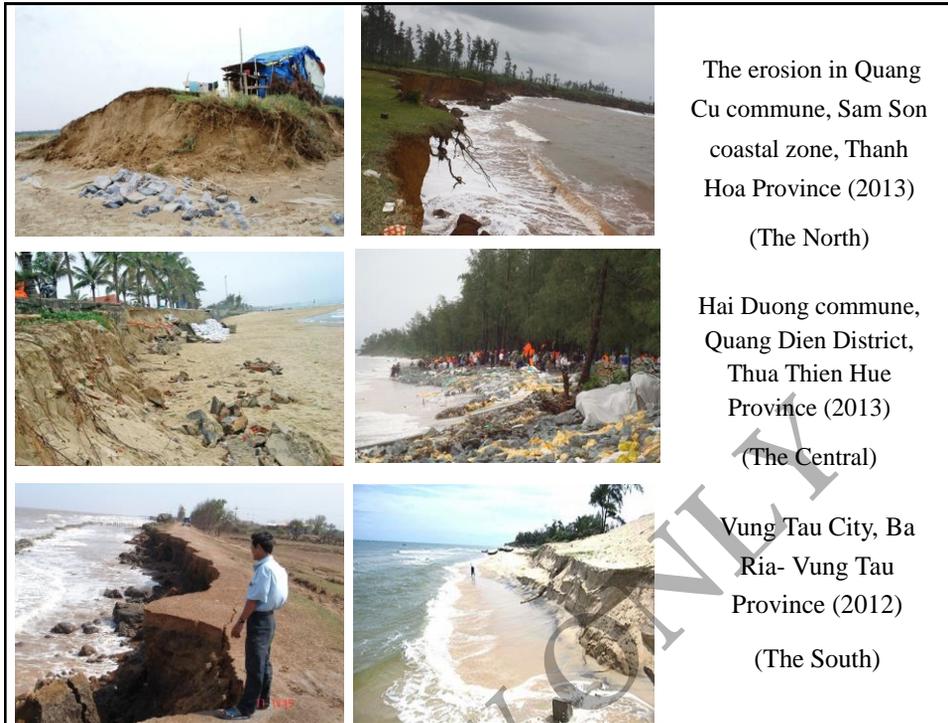


The Linda typhoon (150km/h) in Ca Mau and Kien Giang Province (1997): 4500 of dead, damaging 200000 housing and 325000 ha of farming



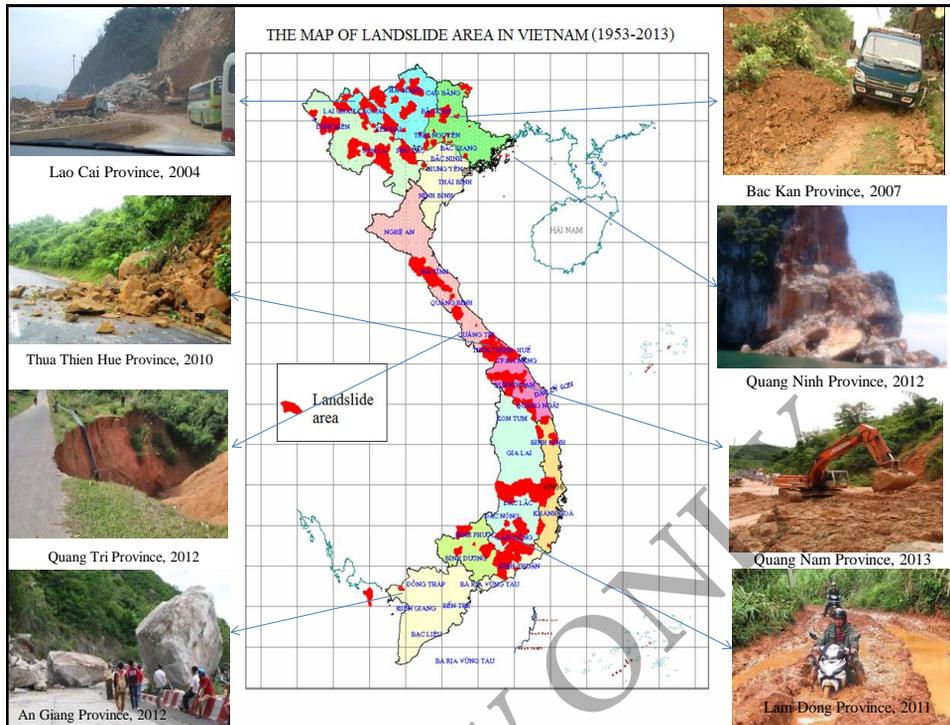
## 1.2. Erosion in coastal zone

- Erosion in coastal zone has changed complicatedly for 30 years in Vietnam.
- In the North (coastal zone with 750km length): there are 5 erosion areas (seriuos erosion happens in Cat Ba island, Hai Phong City) and Hai Hau District, Nam Dinh Province).
- In the Central (1960km length): seriously happens in coastal sand areas (accounting for 94% of erosion areas, about 160km.
- In the South (550km length): occurs at many areas during nearly 25 years at diffirent levels: Vung Tau (Ba Ria-Vung Tau Province, Dong Hai District (Tra Vinh Province) and Can Gio (Ho Chi Minh City).



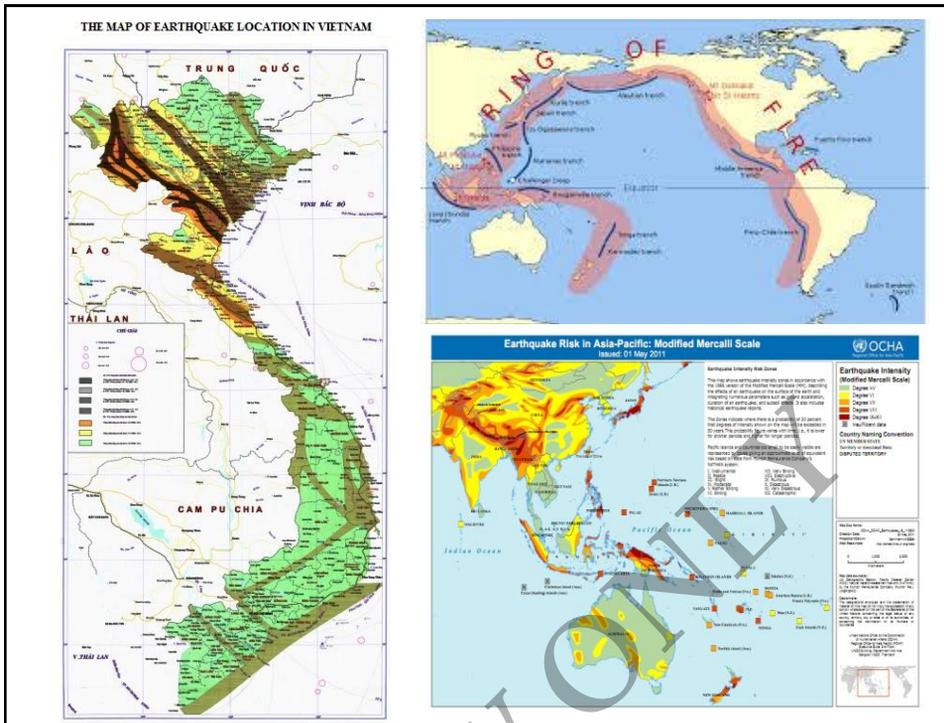
### 1.3. Landslide

- 75% of Vietnam area is slopehill topography and under tropical climate.
- There are about 200 landslides per year, mainly in East-West of Northern Mountainous area in Vietnam.
- It causes hundreds of dead and missing, damages housing, construction... And costs about \$5.000.000 per year.
- It occurs normally in rain season (from July to December), with rainfall from 300-700mm, at hillslope and thick weathering cover.
- Including: flashflooding, tuber flooding and 3 main types of mass movement (slide, flow and heave).



#### 1.4. Earthquake

- Vietnam is located in “ring of fire” region in the Pacific-Asia area, so there are many earthquake activities in this area.
- From 1989 to 2013, there are 20 earthquakes (above 5 Richter degree). Vietnam has recorded the two largest degree earthquakes: in Dien Bien Province, 1935 with 6.75 Richter Degree and in Lai Chau Province in June 1983 with 6.8 Richter Degree.
- In South Central Coastal area, there was an earthquake with 6.1 Richter Degree (Vung Tau, Phan Thiet). It accompanied with a Hon Tro volcano.
- In 2010, there were some earthquakes in Vietnam, the largest one was 5 Richter Degree. Smaller degree earthquakes occurred along large faults such as: Muong Lai-Bac Yen, Cao Bang-Tien Yen, Ma River, Ca River...



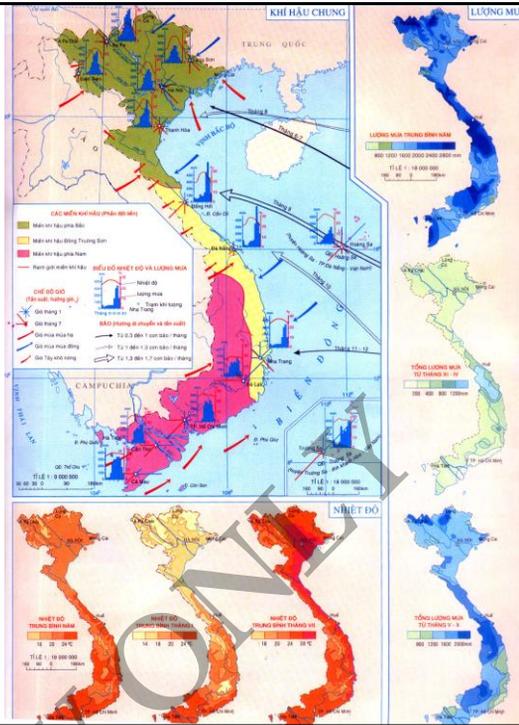
## 2. Causes and effects of natural hazards in Vietnam

### 2.1. Nature:

- Long coastal zone (>3260km): flooding, erosion in coastal zones.
- Special characteristics of neotectonic in Viet Nam: landslide, earthquake from electric power station and subsidence.
- Tropical climate zone: There 4 types of typical climate in Vietnam:



- In the North: **Subtropics climate**, with 4 seasons in a year
- In the South: **Tropical savanna climate**, with 2 seasons (dry and wet) in a year
- **Tropical monsoon climate**: Truong Son moutain.
- **South China Sea climate**:  
 ➔ It creates advantages to weather processing, erosion, landslide.

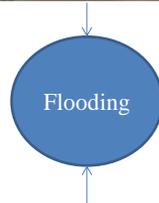


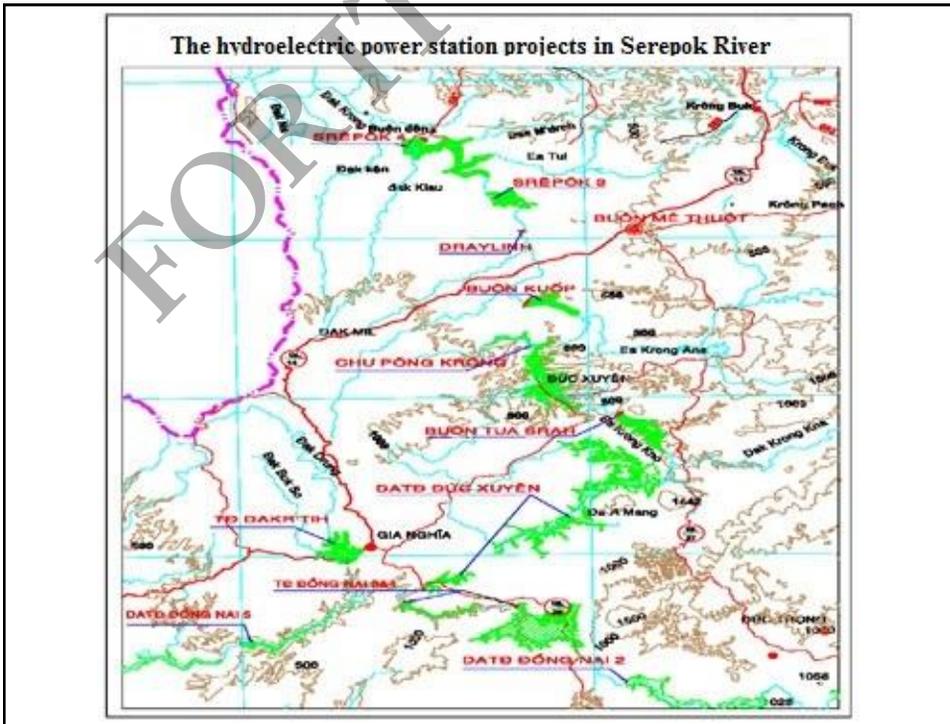
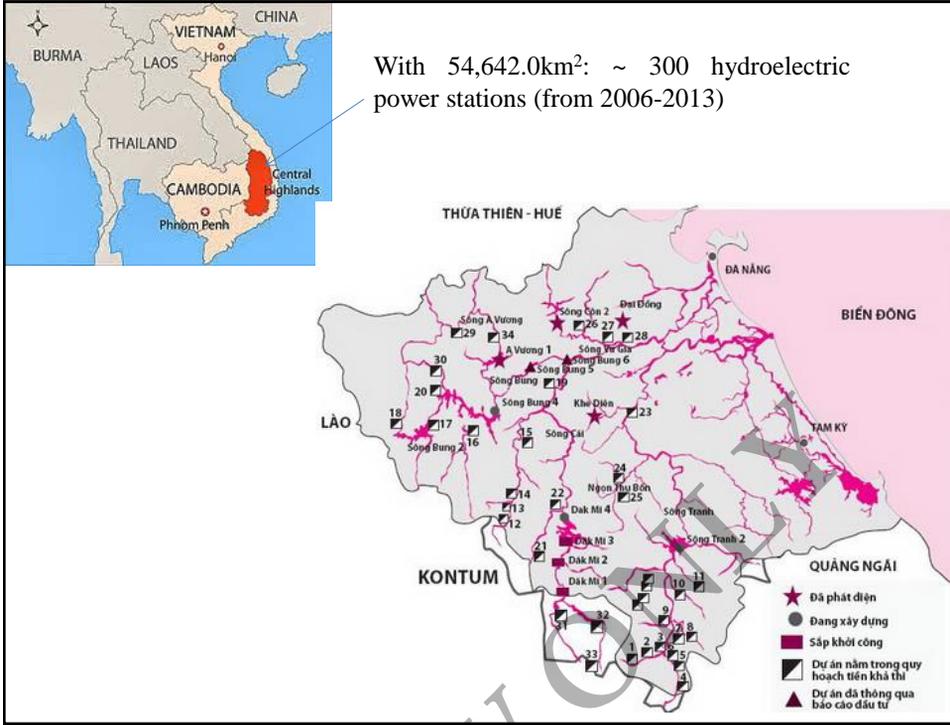
## 2. Causes and effects of natural hazards in Vietnam

### 2.2. Human:

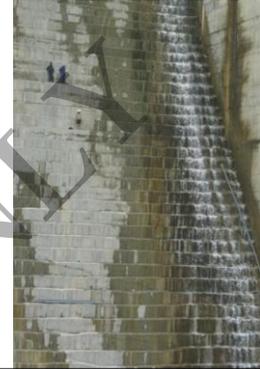
#### Flooding:

- Deforestation: 3,5 million ha. Natural forest area has decreased from 12 million ha to 10 million ha; the cover has decreased from 41,3% to 39.1%
- Infrastructure building: urbanization reaches the rate of 3.4%, which is highest speed in the South East Asia region.
- Hydroelectric power station building: has extremely increased in the number of hydroelectric power stations.



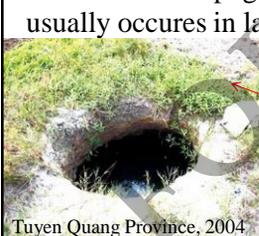


**Earthquake**: causes by hydroelectric power station, mainly in Central High Land (Lam Dong, Dak Lak, Gia Lai and Dak Nong Province): with 3-5 Richter Degree



Tranh River II hydroelectric power station, Quang Nam Province

**Earthquake causes by subsidence**: Vietnam has 50.000km<sup>2</sup> of carbonate and limistone topography area (accouting for 20% of total). Subsidence usually occurs in large area.

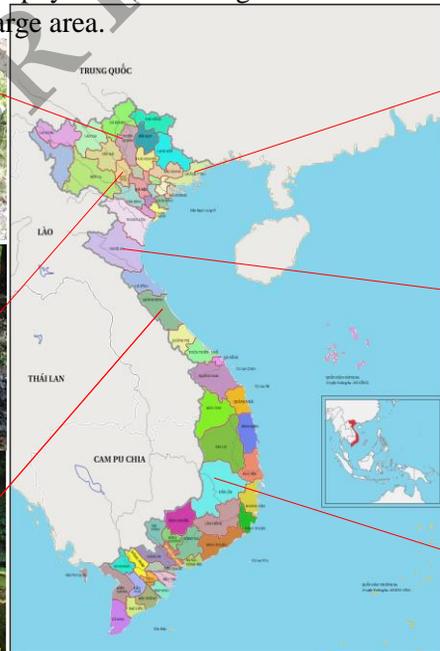


Tuyen Quang Province, 2004



Phu Tho Province, 2013

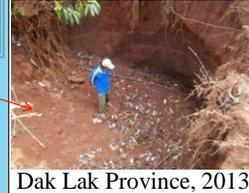
Quang Binh Province, 2012



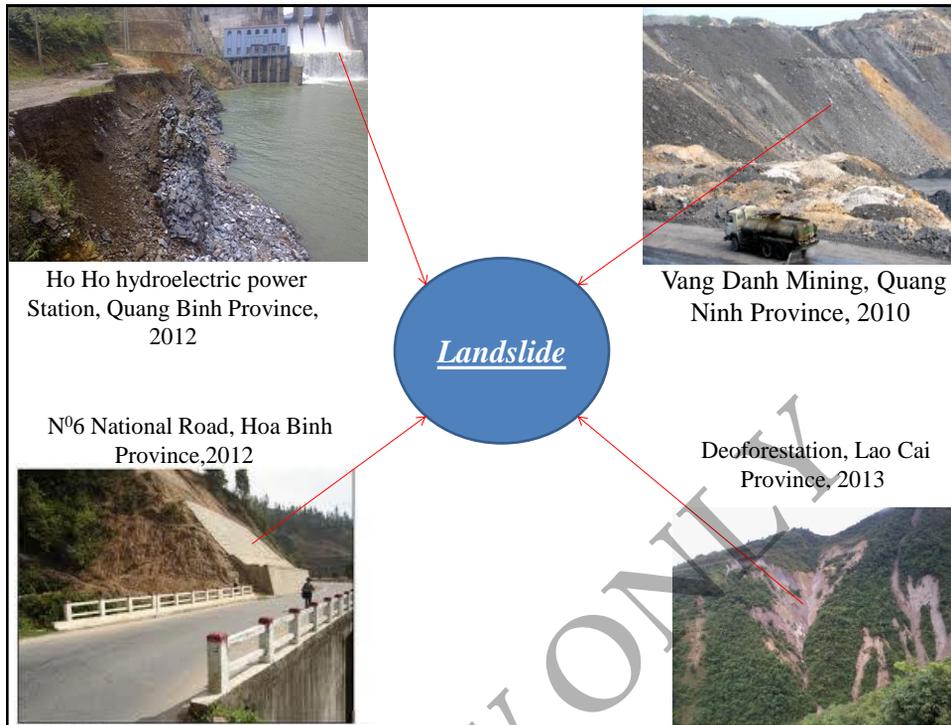
Quang Ninh Province, 2013



Nghe An Province, 2009



Dak Lak Province, 2013



### 3. Lessons from natural hazards mitigation in Vietnam

#### 3.1. Improve governance in preventing and mitigating hazards:

- Vietnamese Government has ratified the Law of Hazard Prevent (June-19, 2013).
- Frequently organize training and practising opportunities for staffs on hazard adaptation and mitigation.
- Learn experiences from other countries.

#### 3.2. Strengthening forecasting about hazards: early and exactly

- Early warning about hazards (in Vietnam, normally from 24 to 48hours)
- Transfer people to safe areas to mitigate impact from hazards

### 3.3. Building infrastructure and applying new technology to adapt with hazard

- Application *Stabiplate* technology at erosion coastal zones: In Vung Tau beach (Vung Tau-Ba Ria Province).
- Application new technology with stone embankment in deep sea level (Mekong Delta)
- Application new biotechnology to mitigate hazards in landslide areas: cultivate *Ficus racemosa* and *Ficus benjamina* tree.



Vung Tau coastal zone (Ba Ria- Vung Tau Province, 2012)



Ca Mau Province, 2011



*Ficus benjamina*



*Ficus racemosa*

### 3.3. Building infrastructure and applying new technology to adapt with hazard

- Using *Polyacrylamide (PAM)* to dissolve in water to irrigate at taluy to prevent erosion at strong weathering process.
- Building housing to adapt with hazards (co-operation with Japanese Government, 9/2013).
- Application GIS and Remote Sensing to forecast and warn about geological hazards



*Polyacrylamide (PAM)*



Before and after using PAM  
Tuyen Quang Province

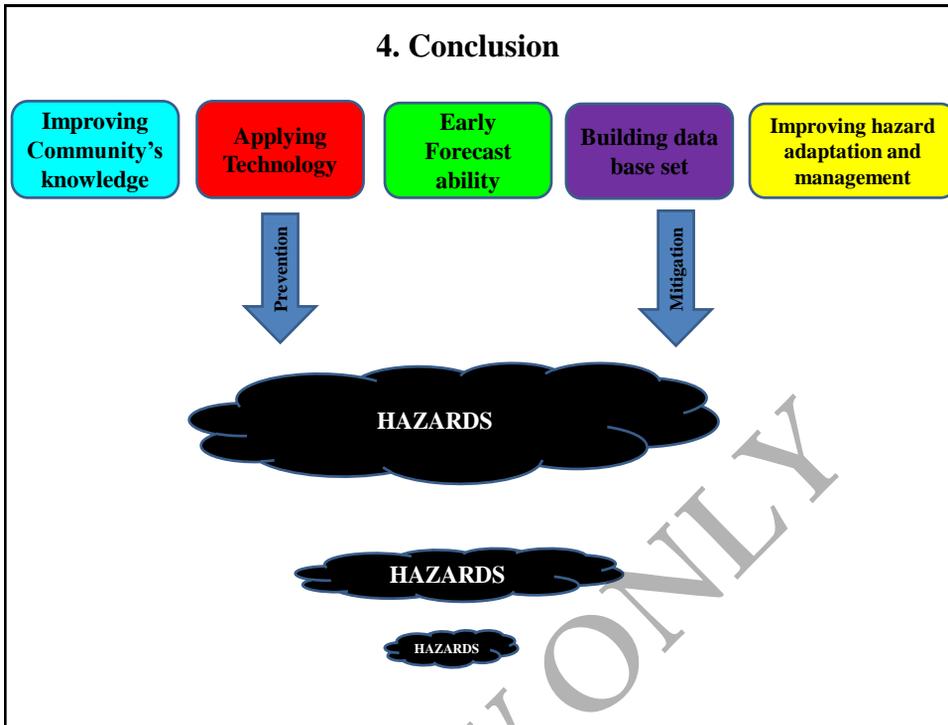


### 3.5. Increasing the role of community



### 3.5. Increasing the role of community

- There are about 100 training and workshops has organized in almost areas in Vietnam, particular in regions that usually suffer from natural hazards per year.
- Knowledge of community to prevent hazards has improved significantly.
- During 5 period year, from 2008-2013, preventing about natural hazards based on community has achieved many successes: decrease in the number of dead and missing and damaging of housing, construction, infrastructure and farming.



**THANK YOU FOR YOUR ATTENTION!**

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