Soil Erosion of Spatiotemporal Distribution Pattern and Factor Analysis on Teh-chi Reservoir watershed under Human-Environment Interactions (1956-2008)

Yan-ting Liau、Kuo-Chen Chang

廖彥婷、張國楨

Department of Geography, National Taiwan Normal University

Contents

1. Introduction

- Relationship between land use and disaster

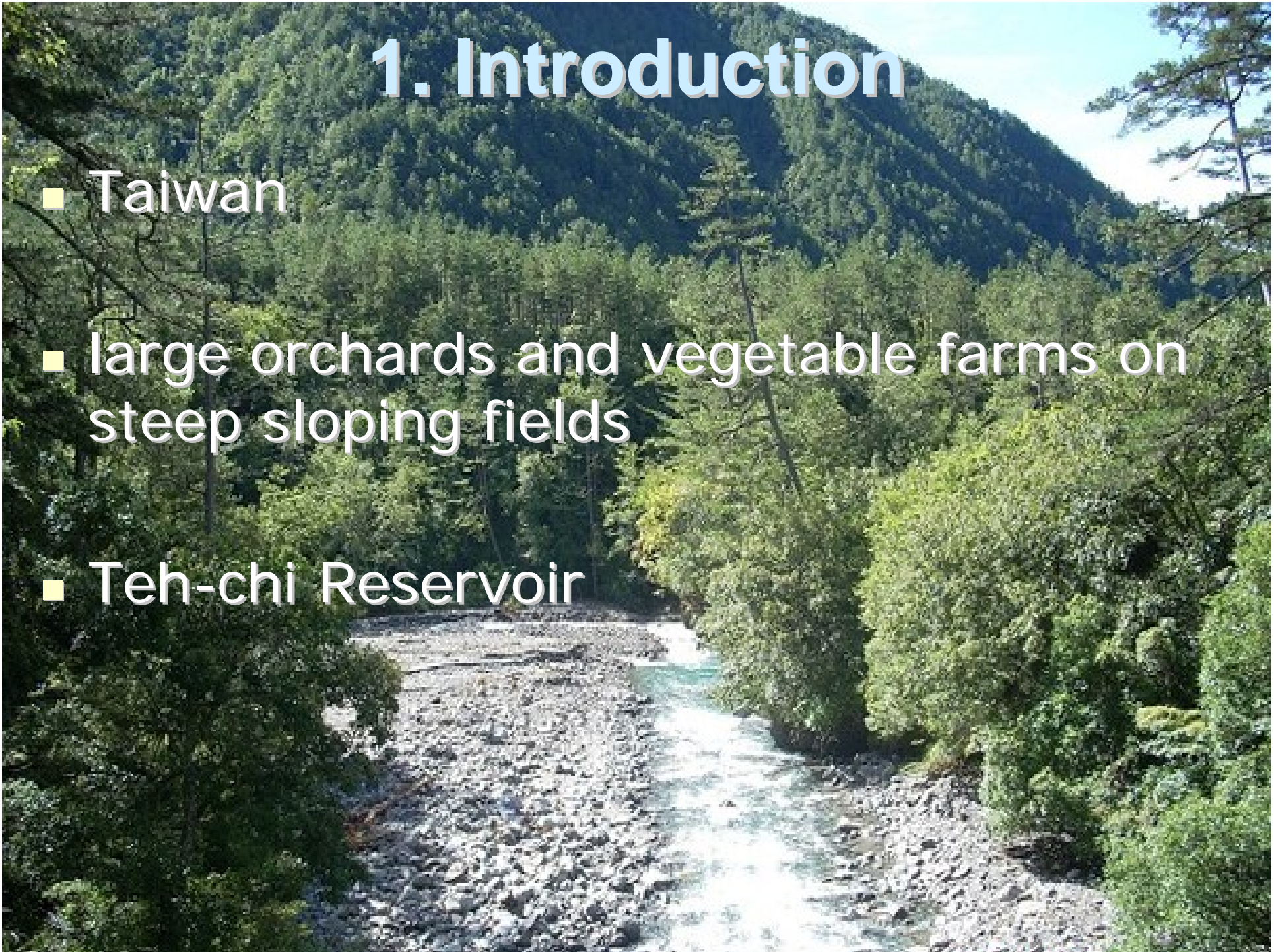- Food and Agriculture Organization (FAO) statistic

1. Introduction

- similar environment

- New Zealand, Japan, Italy

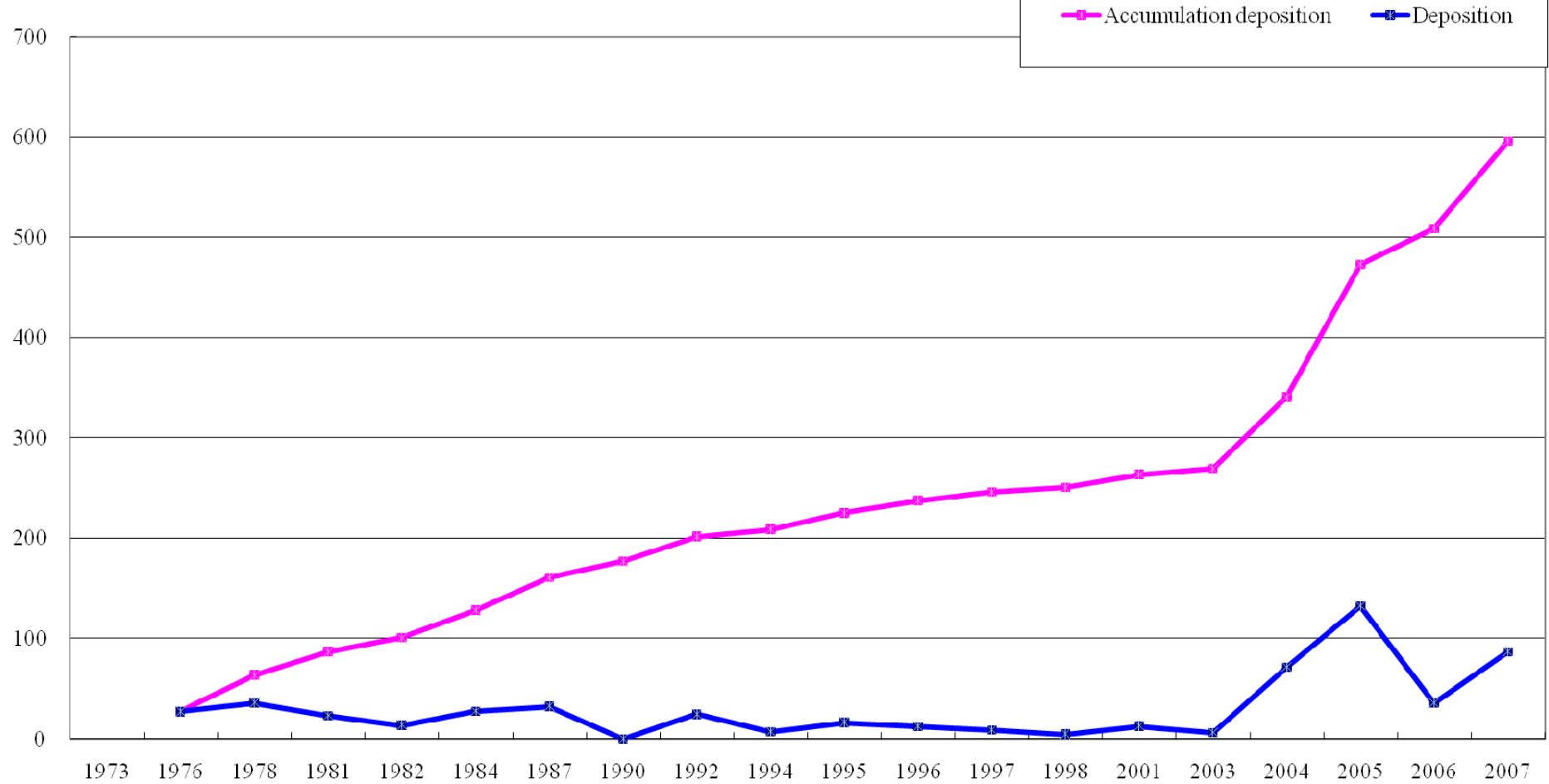- natural science aspects to explore the changes of landslide over time

1. Introduction

- Taiwan

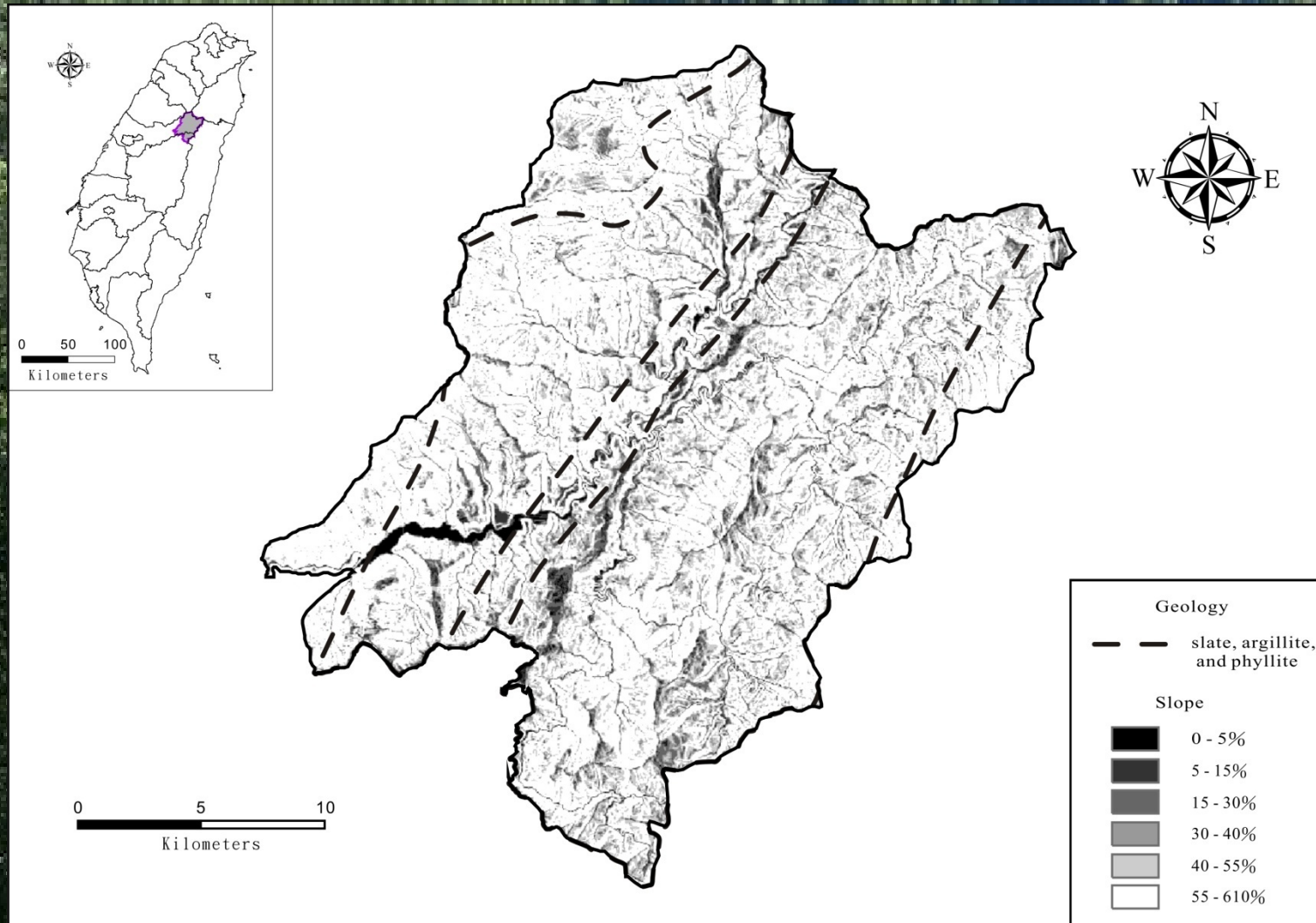- large orchards and vegetable farms on steep sloping fields

- Teh-chi Reservoir

1. Introduction

2. Materials and Methods

2.1. The Study Area

2. Materials and Methods

- **2.1. The Study Area**
- Atayal aborigines

- central cross-island highway

- new crops and new agriculture technique: market-oriented economy

- Chi-Chi earthquakes

2. Materials and Methods

- **2.2. Social Science on Disaster attributions**

- cultural ecology, environmental history, and political ecology etc.

- address the causes of disaster to human beings
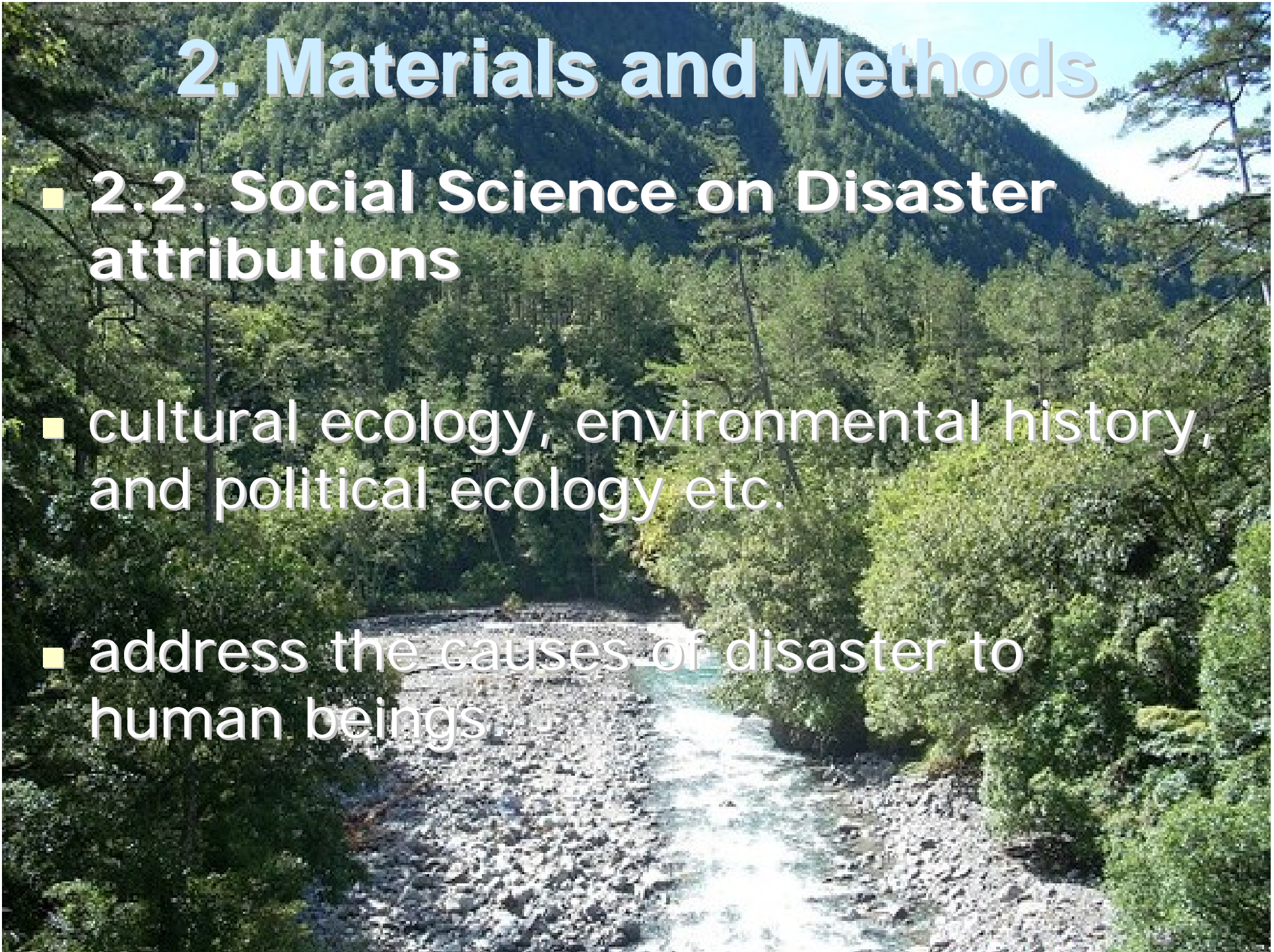
2. Materials and Methods

- **2.2. Social Science on Disaster attributions**

- changing and vulnerable environment

- environment factors may play key roles on local ecology systems

2. Materials and Methods

- 2.3.1. Acquirement of history Land use data
- land use survey maps and satellite imageries

- 1956、1967、1969、1973、1979、1990、1995、2008

- forest, grass, landslides, orchards, vegetables, and water

2. Materials and Methods

- 2.2.2. Value onset of USLE model
- $A = Rm \times Km \times L \times S \times C \times P$

- A: soil loss per unit area
- Rm: the rainfall factor
- Km: the soil-erodibility factor
- L & S: the slope-length and slope-gradient factor
- C: the cropping-management factor
- P: the erosion-control practice factor

2. Materials and Methods

- **2.4. Statistic Technique**

- 2.4.1. Principal component analysis and factor analysis

- 2.4.2. Standard Deviation Ellipse

- 2.4.3. Global Moran I

3. Results

- **3.1. Main Factors identification**
- 3.1.1. Principal component extracting

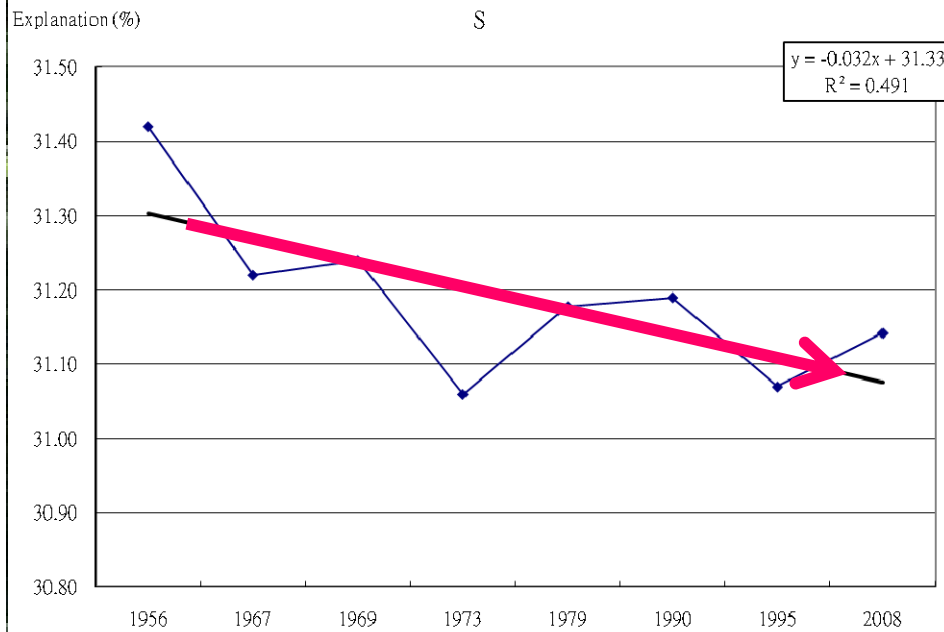- S_C, the L_C, the Rm_C, the Km_C, and the C_C

- S_{1987} factor, the L_{1956} factor, the Rm factor, the Soil FRI factor, and the C factor (high loadings)
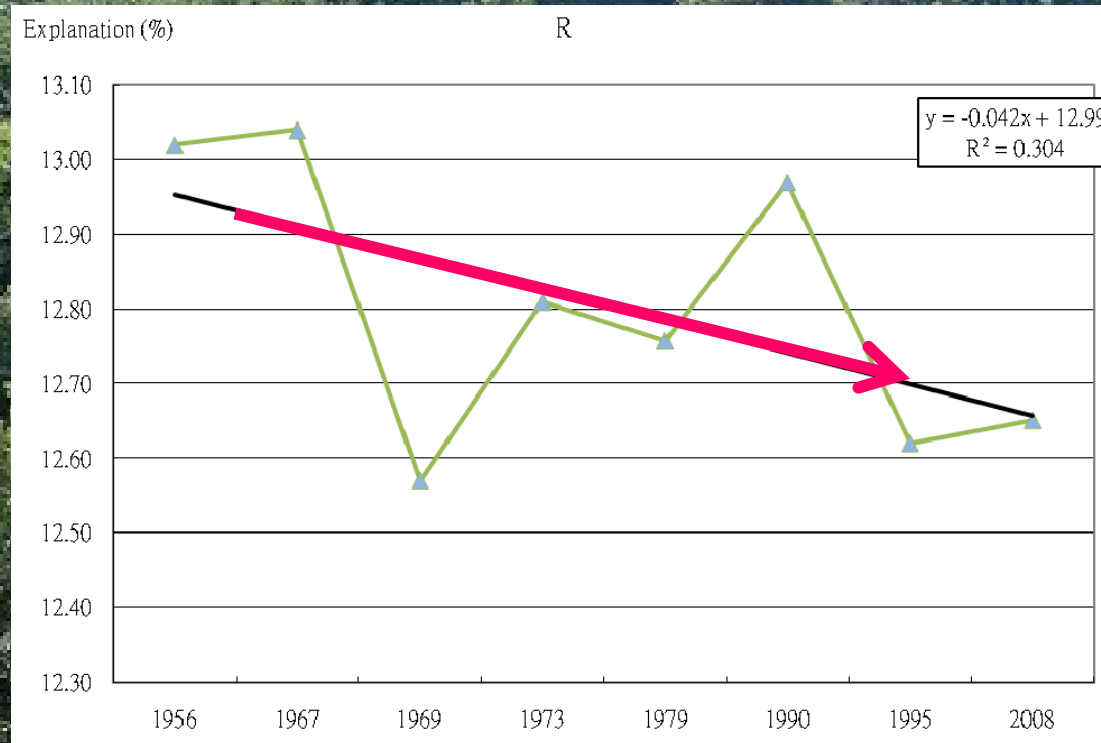
3. Results

- Based on the analysis of variations of major components through the time, we can divide the soil erosion into four different stages:

- before the completion of the highway
- after the completion of the highway
- late 60's, early 70's to Chi-Chi earthquake
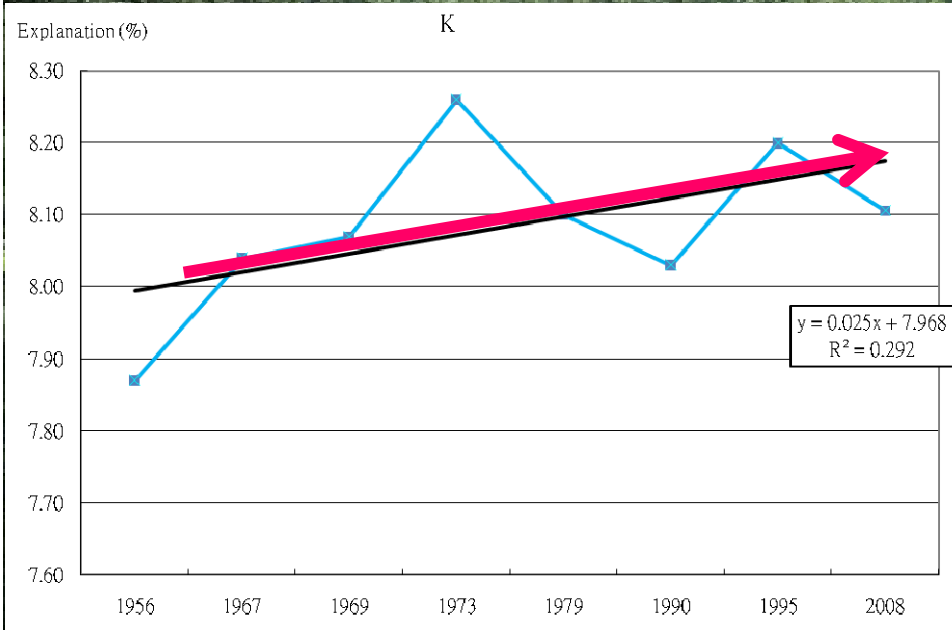- past the earthquake.

3. Results

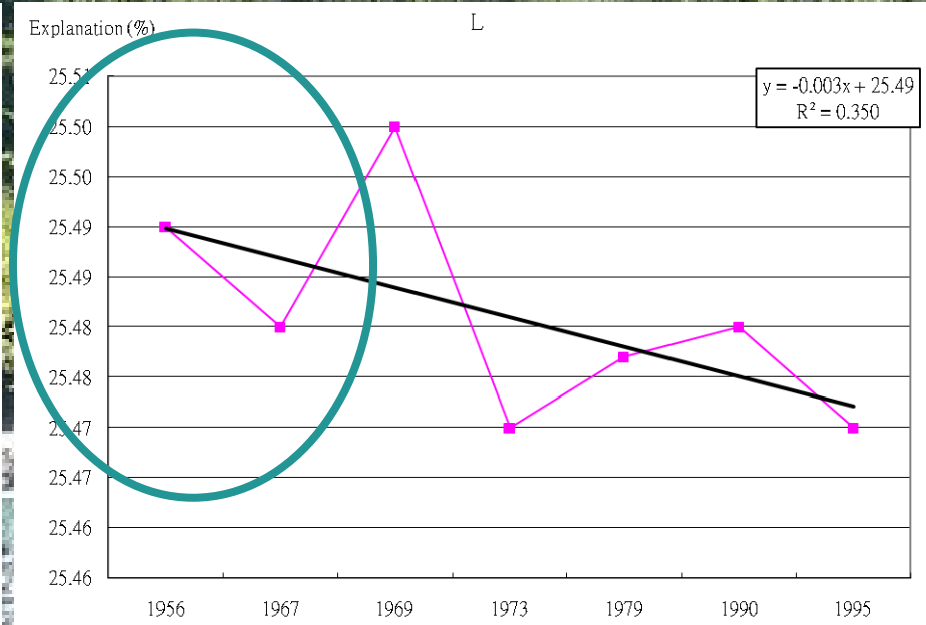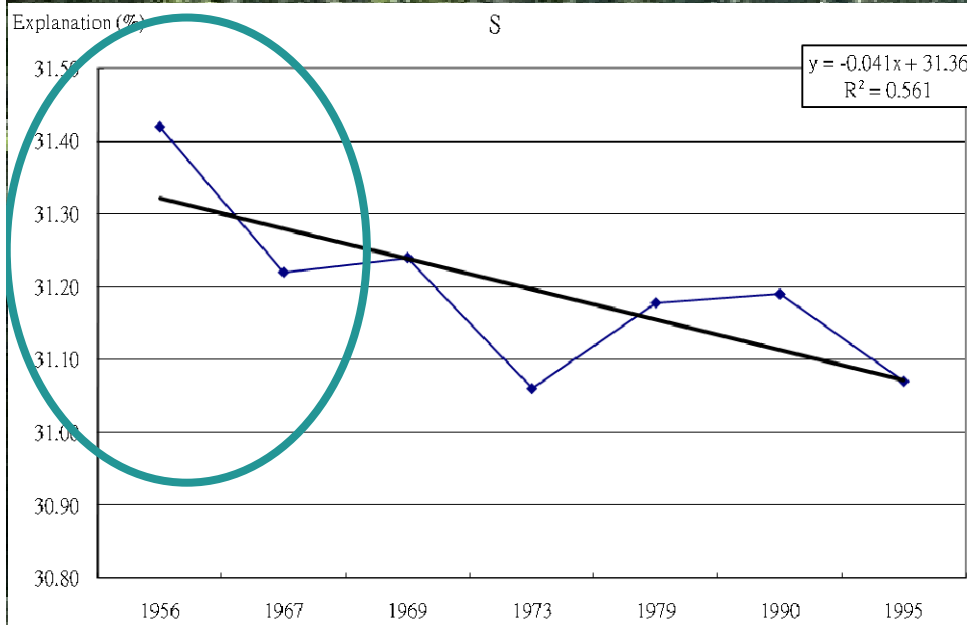- 3.1.2. The comparison of explanation ratio in four stages
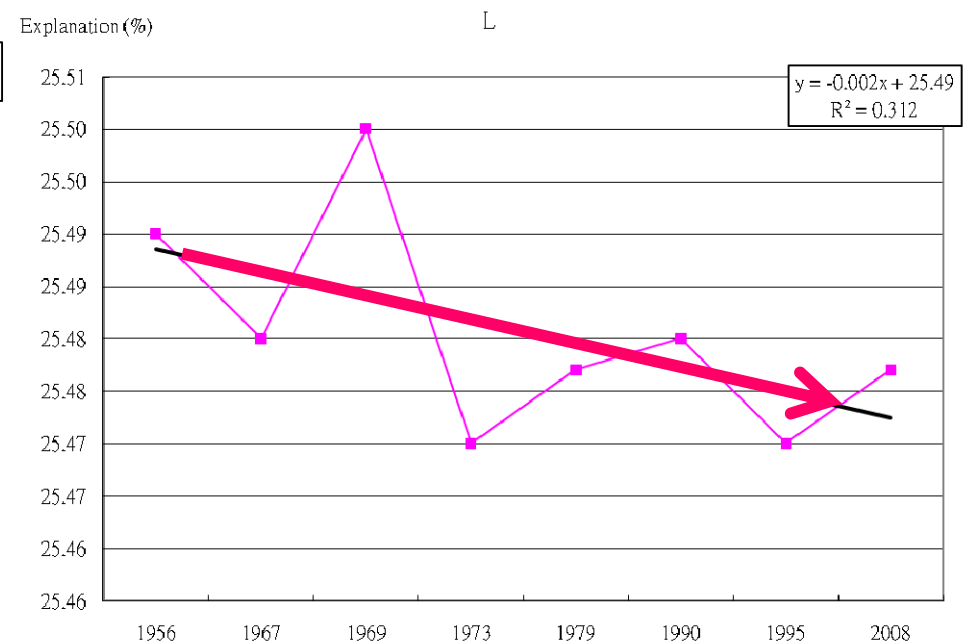
3. Results

3. Results
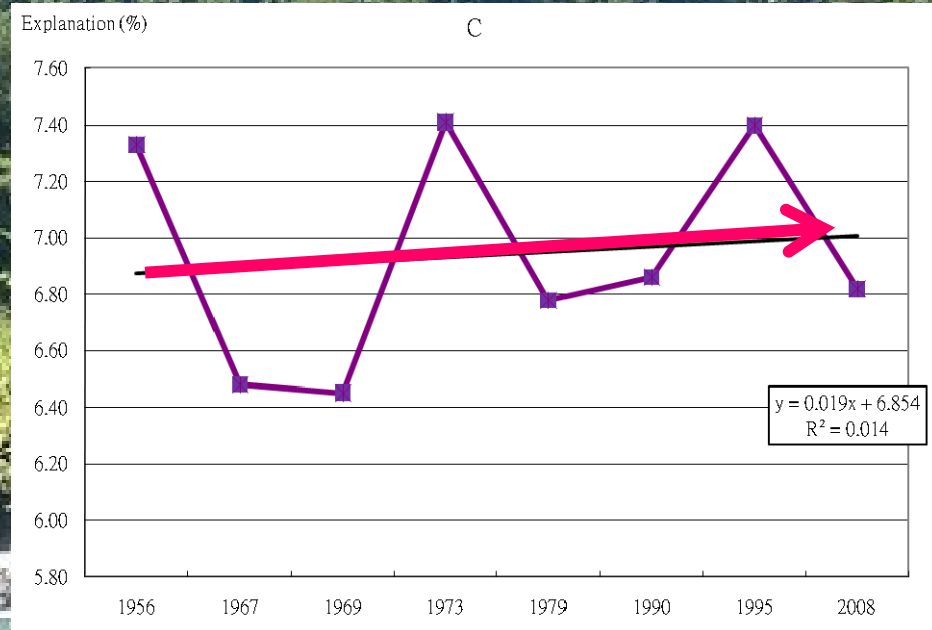
Explanation (%) — K

y = 0.025x + 7.968	R² = 0.292

Explanation (%) — C

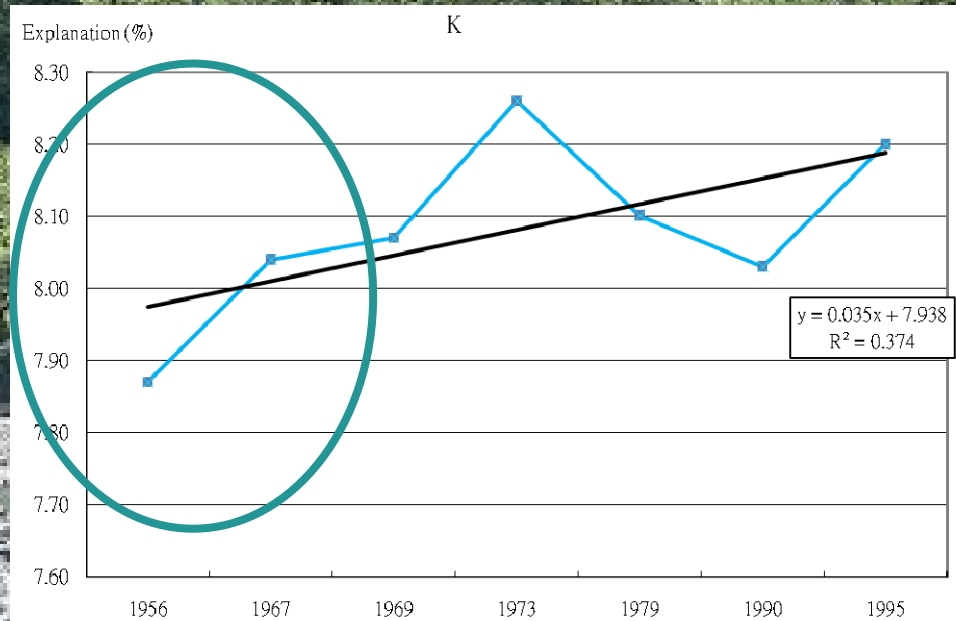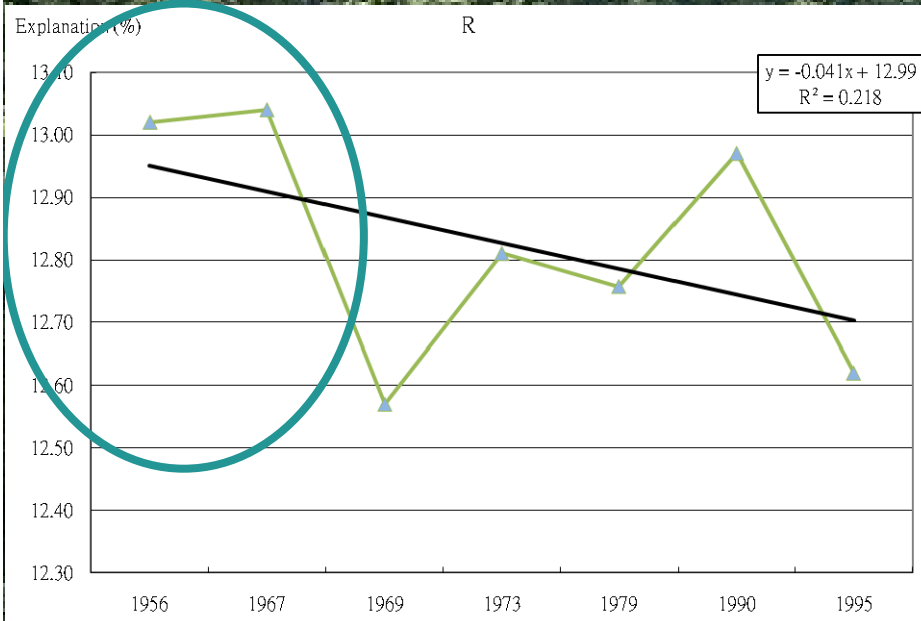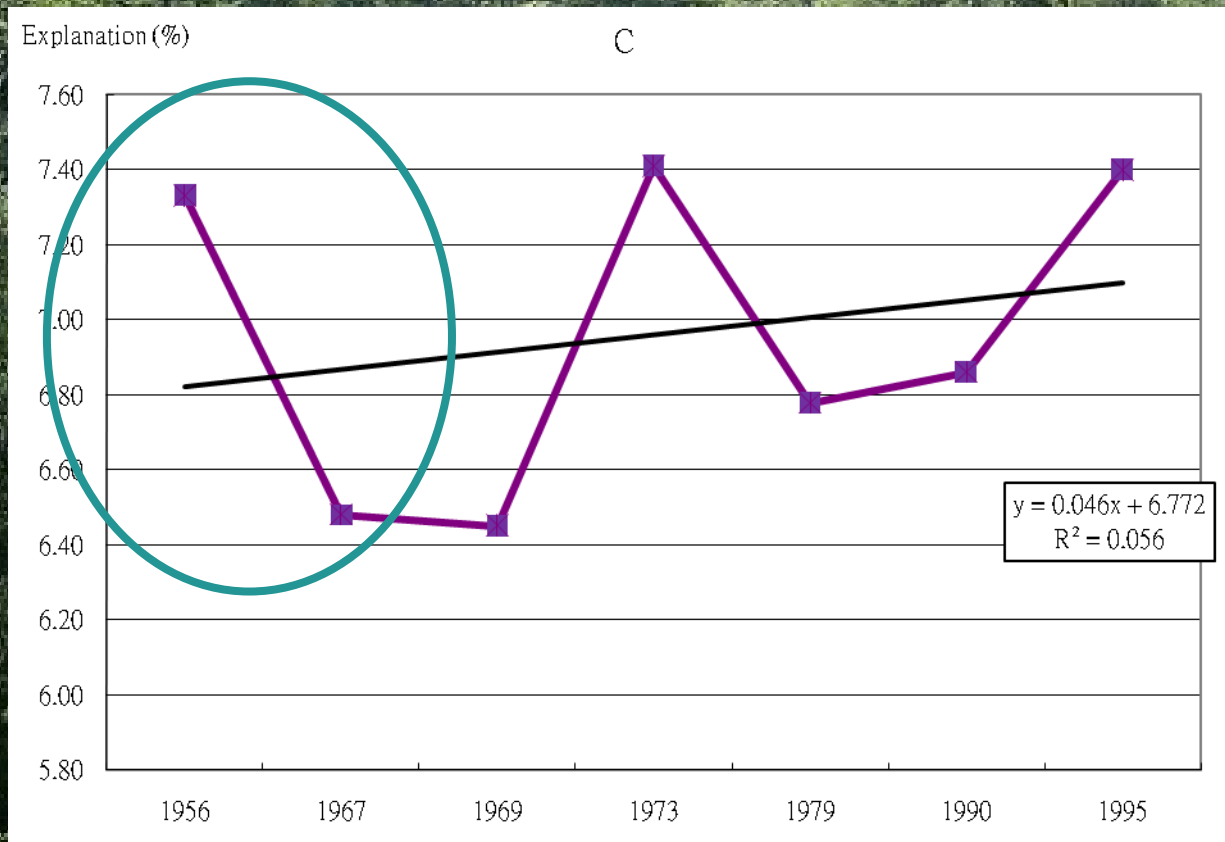|	
y = 0.019x + 6.854	R² = 0.014

3. Results

- central cross-island highway completion before and after

3. Results

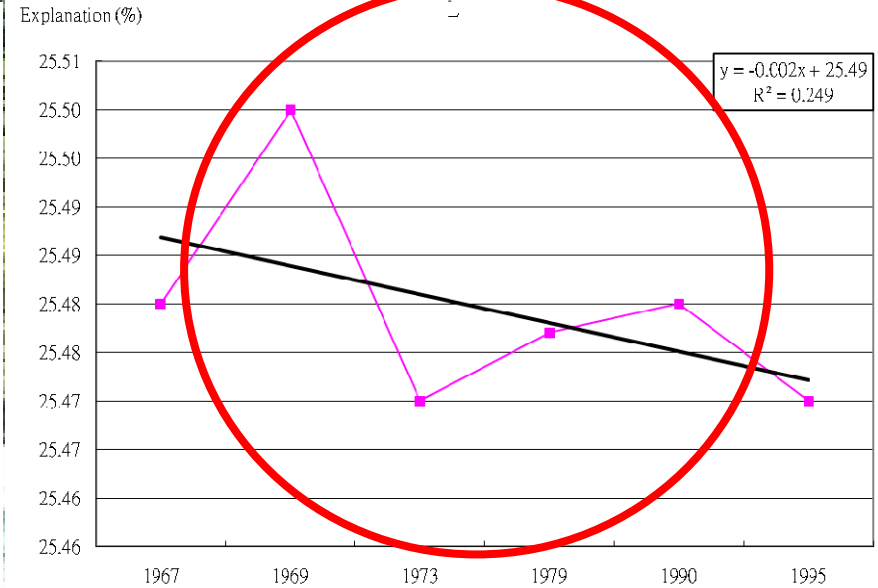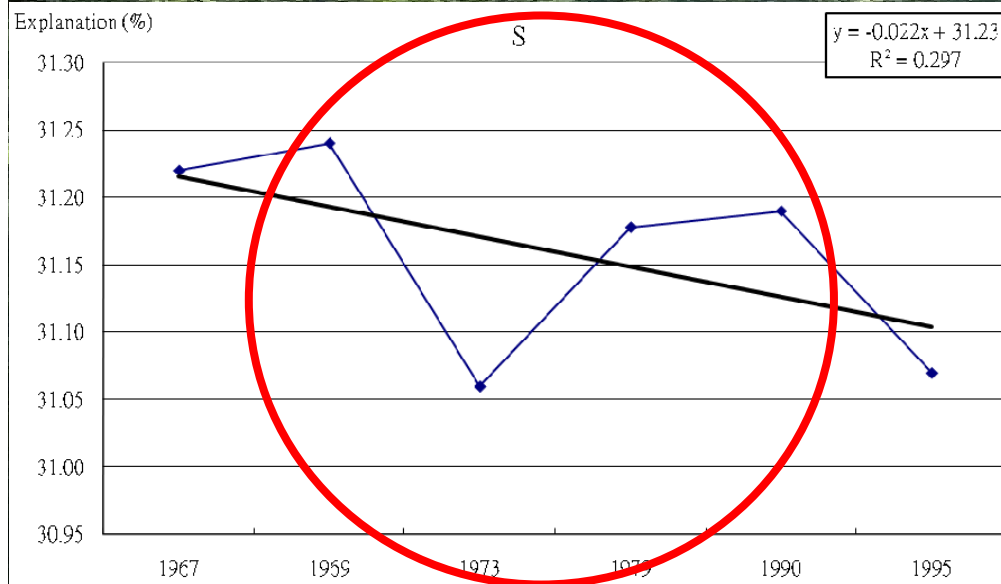- central cross-island highway completion before and after

3. Results

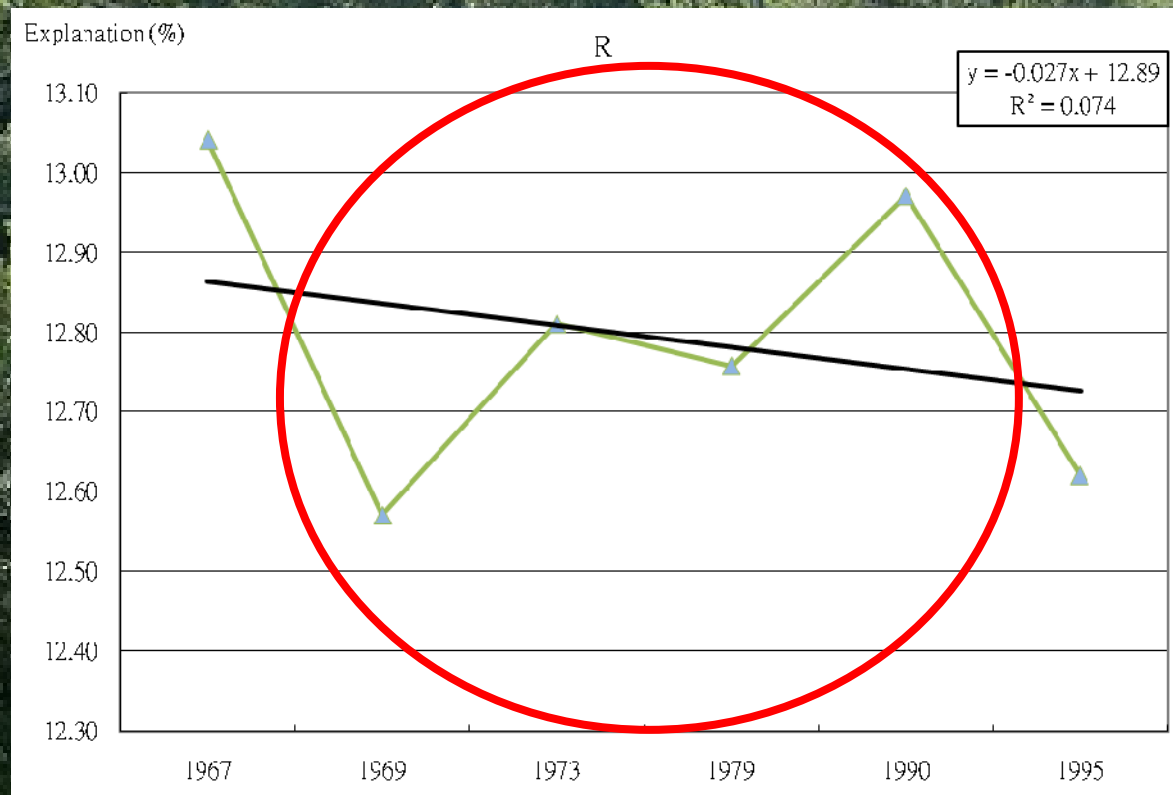- central cross-island highway completion before and after

3. Results

- late 60's, early 70's to Chi-Chi earthquake

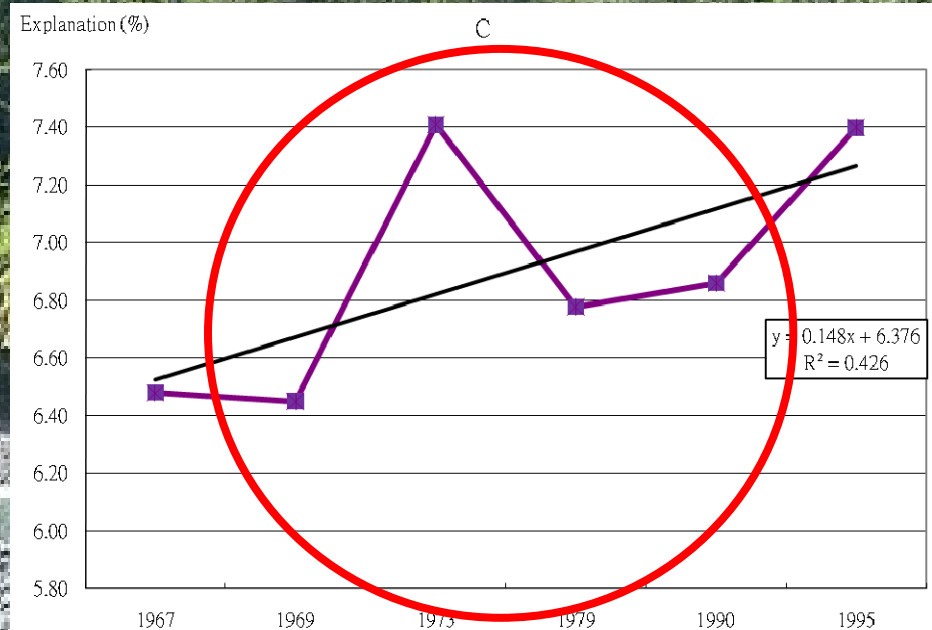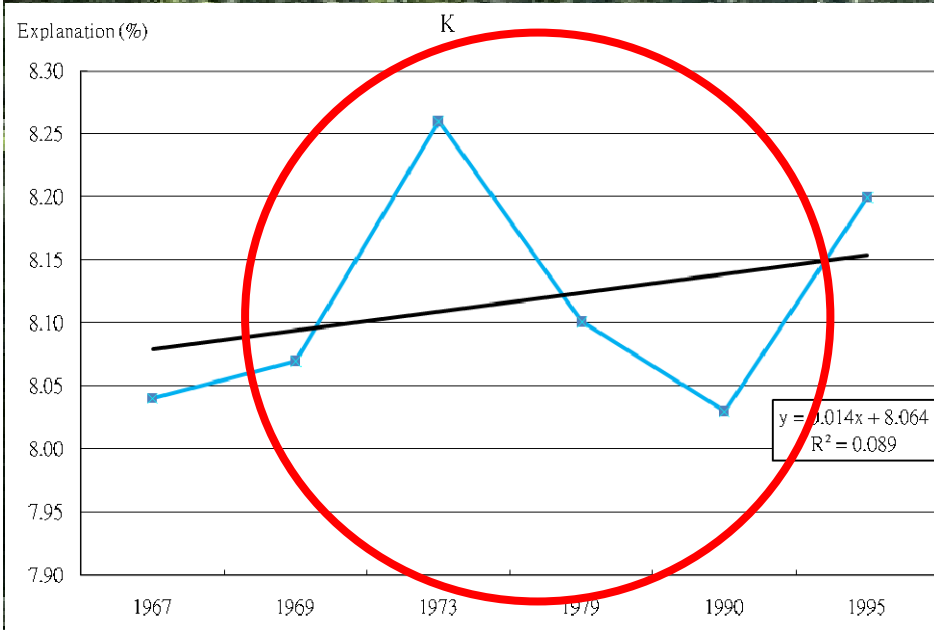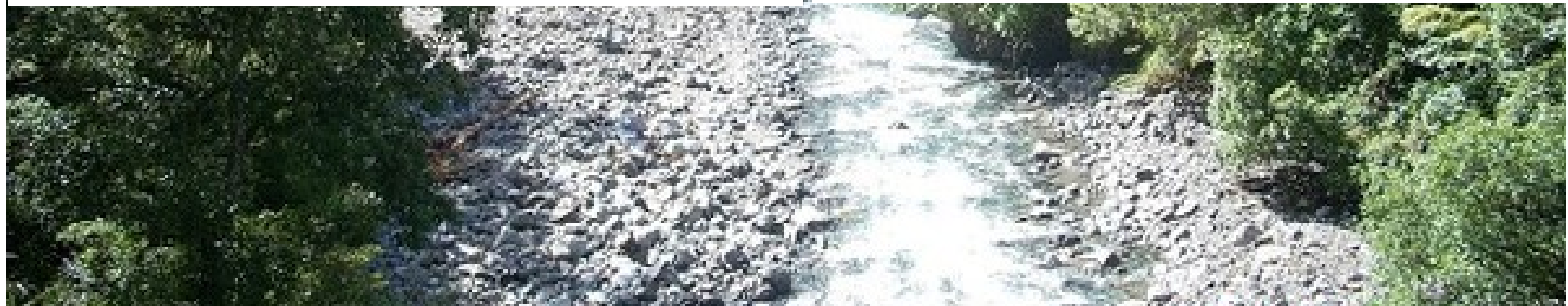# 3. Results
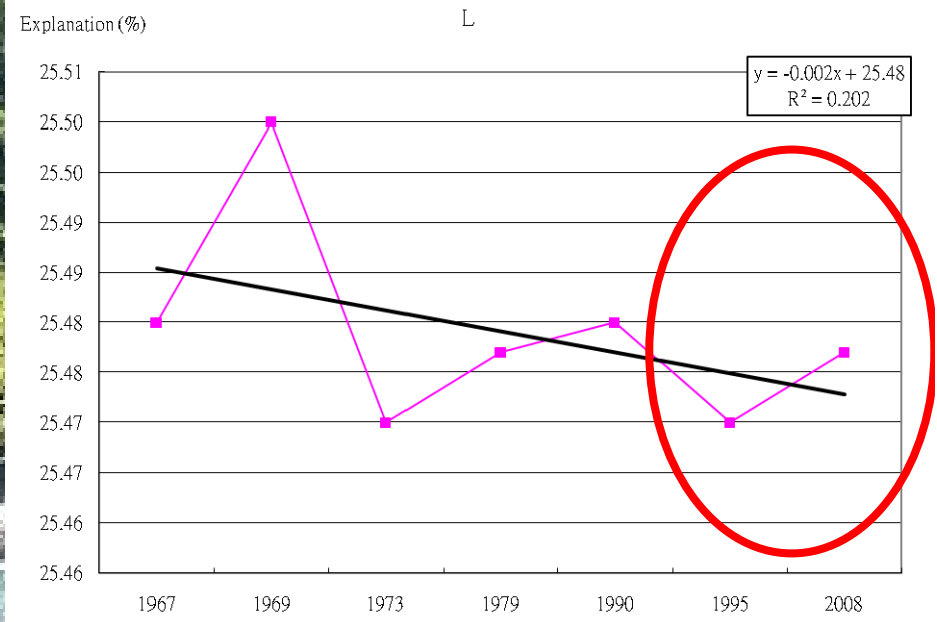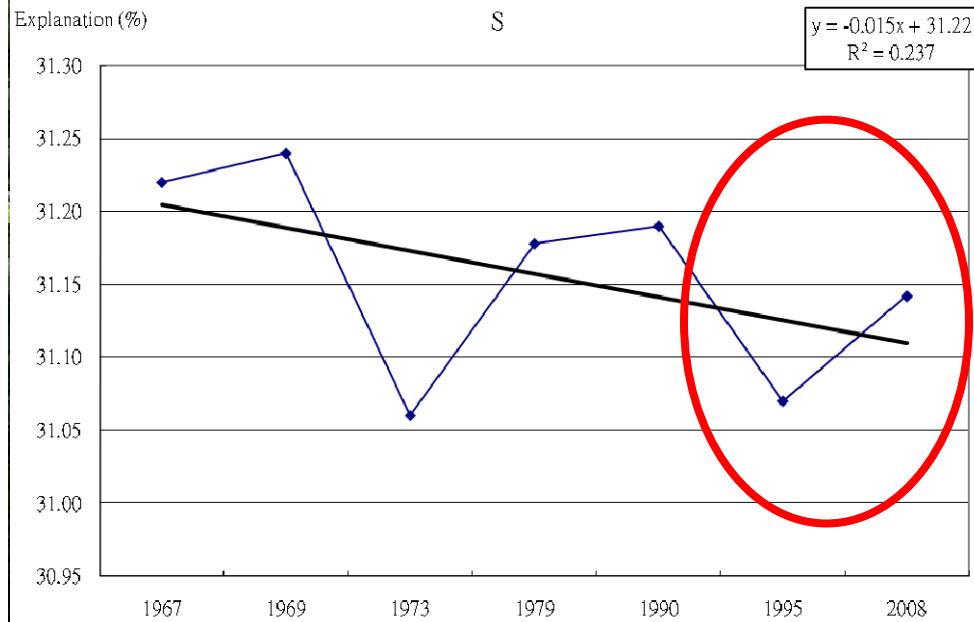
- late 60's, early 70's to Chi-Chi earthquake

3. Results

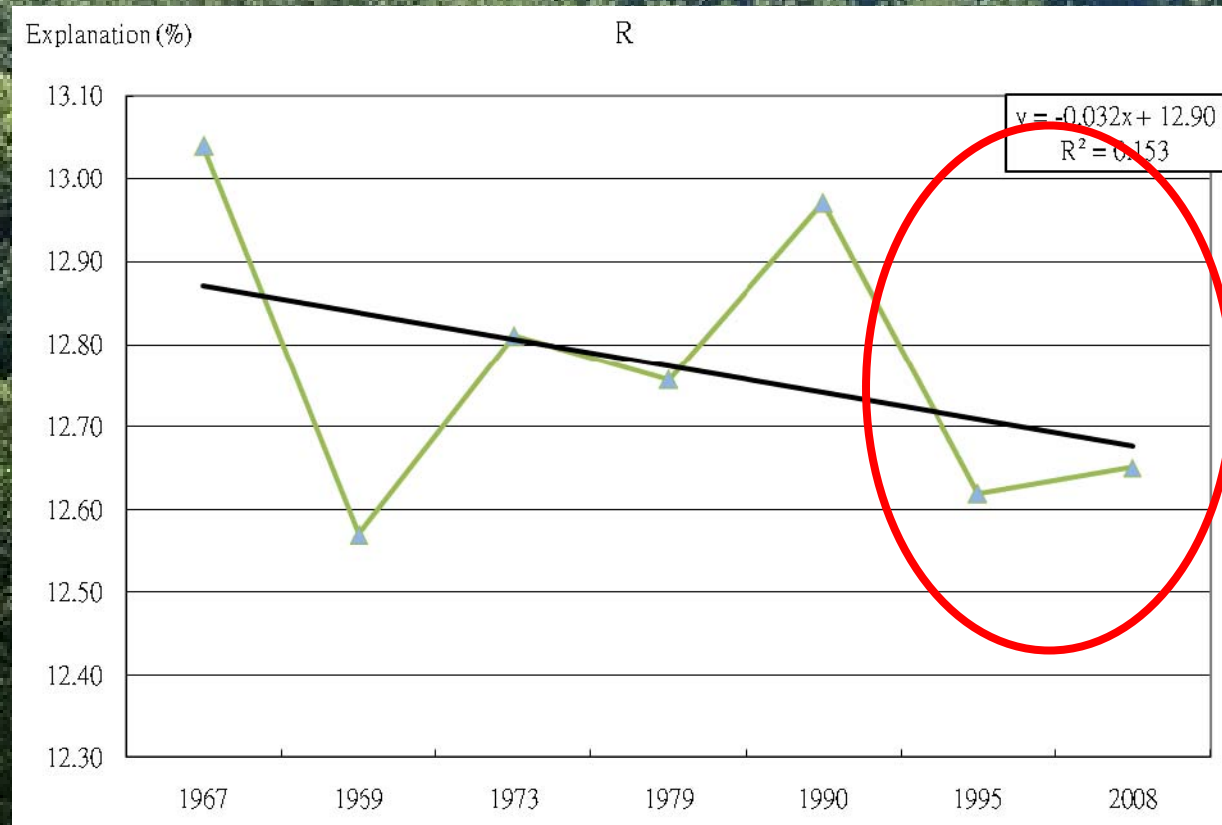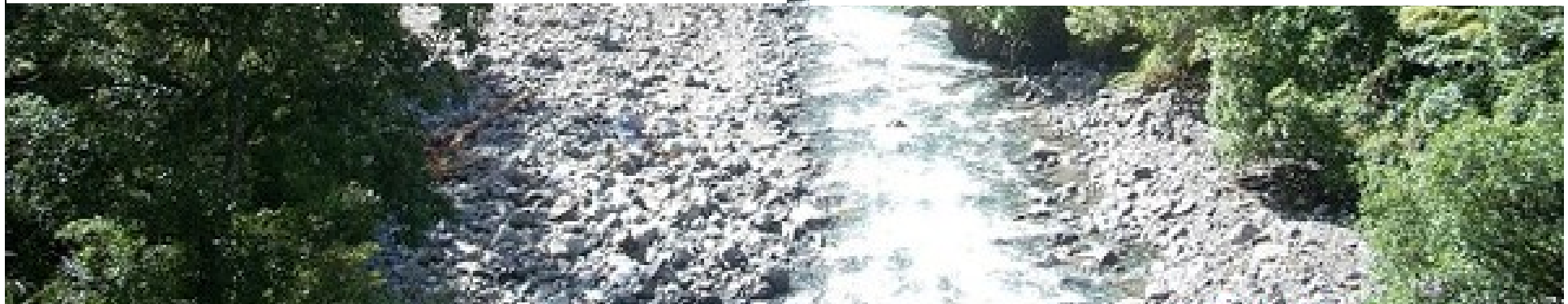- late 60's, early 70's to Chi-Chi earthquake

3. Results

■ past the earthquake

3. Results

- past the earthquake

3. Results
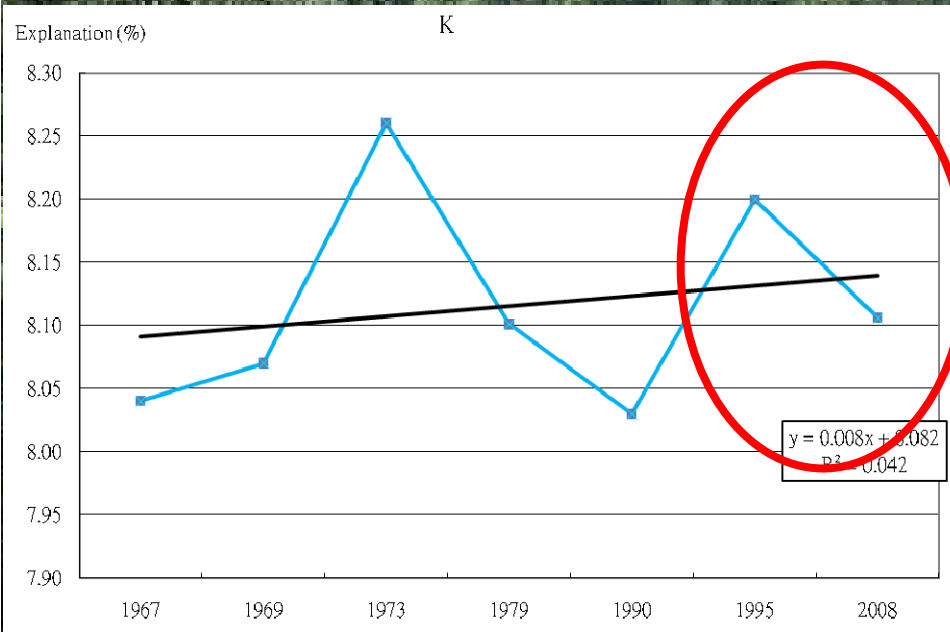
- past the earthquake

K

Explanation (%)

y = 0.008x + 8.082
R² = 0.042

C

Explanation (%)

y = 0.084x + 6.577
R² = 0.21
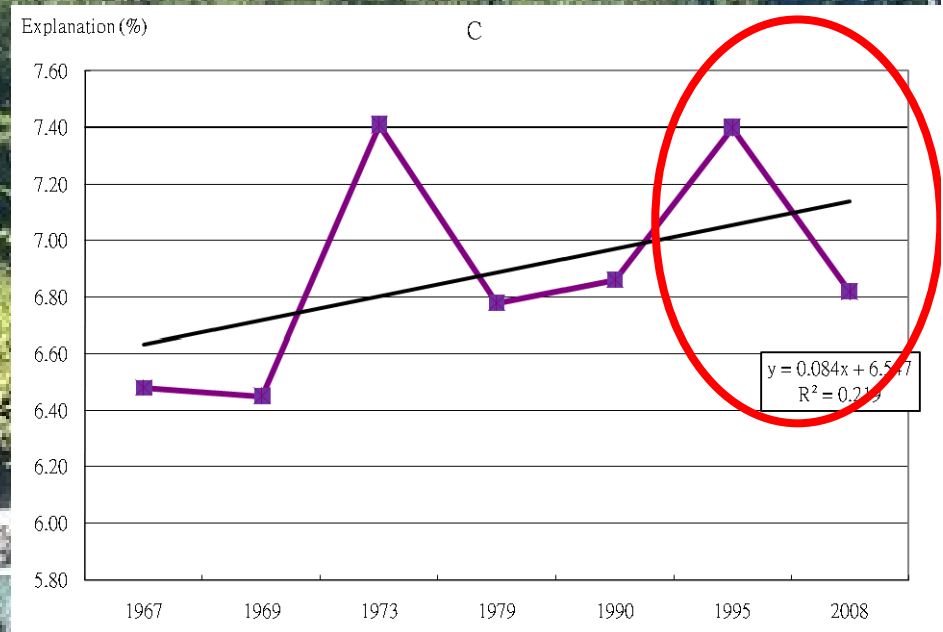
3. Results

- 3.2.1. Mean center and Standard Deviation Ellipse
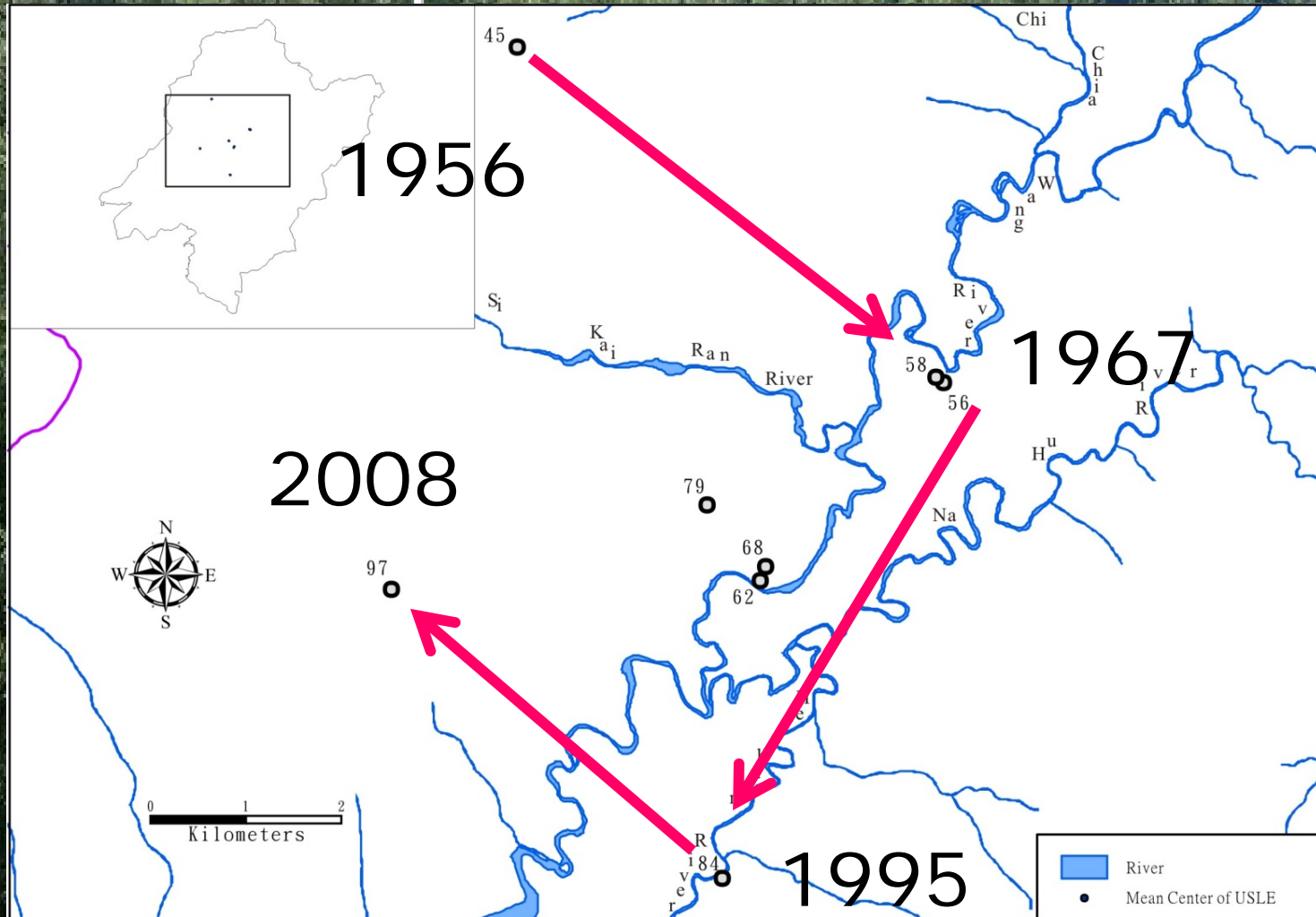
3. Results

- ## 3.2.2. Global Moran I

	1956	1967	1969	1973	1979	1990	1995	2008
C factor	0.9597	0.8988	0.8470	0.7204	0.6030	0.6035	0.3823	0.8471
USLE	0.6588	0.6192	0.5773	0.4534	0.4190	0.4833	0.2790	0.6359

3. Results

- Chi-Chi earthquakes

|	USLE Value		C factor	
	Before 921	After 921	Before 921	After 921
Regression equation	y = -0.056x + 0.722	y = -0.025x + 0.632	y = -0.091x + 1.083	y = -0.050x + 0.958
coefficient of determination	$R^2 = 0.852$	$R^2 = 0.235$	$R^2 = 0.953$	$R^2 = 0.404$

4. Conclusion

- In the former stage
- natural environment conditions

- with the increasing of human activities

- soil erosion to move southward from upstream to main stream

- accumulation sediment deposition

4. Conclusion

- The latter stage

- Chi-Chi earthquakes and the following typhoons
- natural environment factors

- natural disasters to westward downstream
- high quantity of deposition
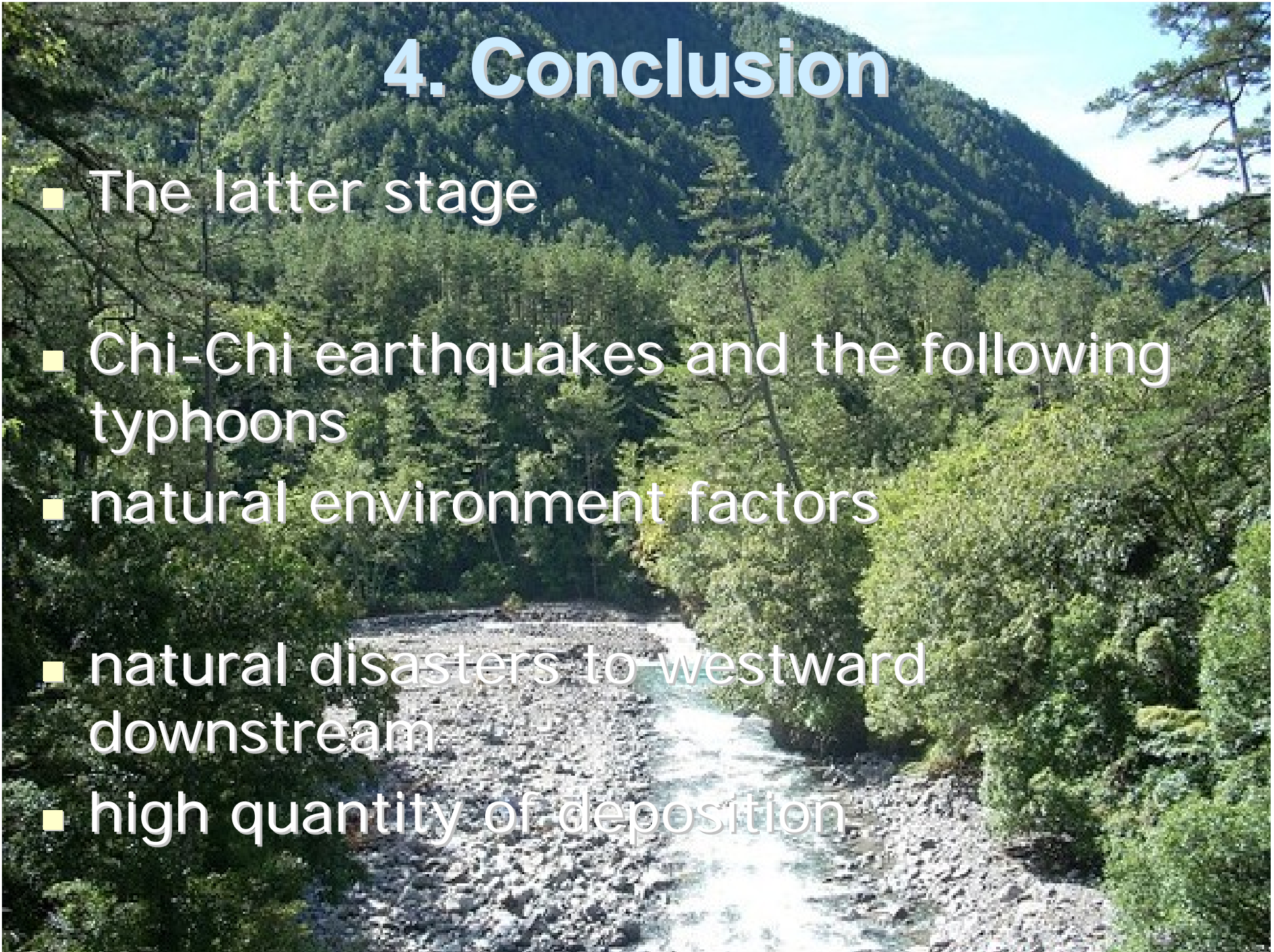
The END

Thank you for your listening!

Welcome to comment!