Geotechnical Infrastructure Asset Management, 2009. EIT-JSCE Joint International Symposium 2009, September 7-8, 2009, Imperial Queen's Park Hotel, Bangkok, Thailand, Organized by EIT, JSCE, Kyoto University, AIT

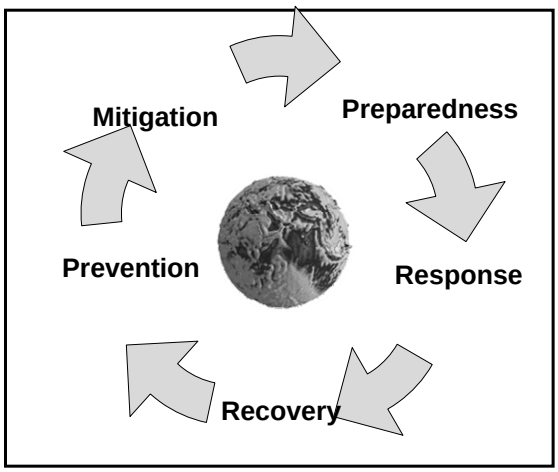
Landslide Risk Management in Thailand using API model

Suttisak Soralump (PhD)

7 September 2009

Geotechnical Research and Development Center (GERD)
Kasetsart University, Thailand

Disaster Management Cycle



Mitigation - Minimizing the effects of disaster.
Examples: building codes and zoning; vulnerability analyses; public education.

Preparedness - Planning how to respond.
Examples: preparedness plans; emergency exercises/training; warning systems.

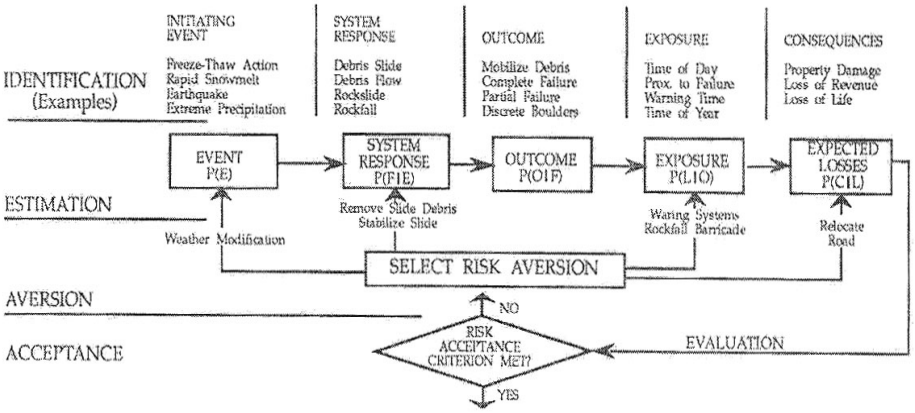
Response - Efforts to minimize the hazards created by a disaster.
Examples: search and rescue; emergency relief .

Recovery - Returning the community to normal.
Examples: temporary housing; grants; medical care.

http://www.gdrc.org/uem/disasters/1-dm_cycle.html

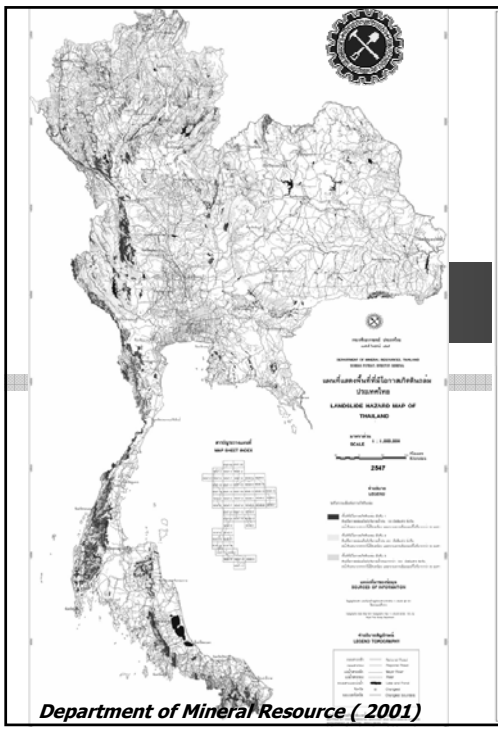
www.unisdr.org/wcdr/preparatory-process/ meetings/African-regional-consultation-2-3-jun-04/IWRM-and-DR.ppt

Landslide Risk Management Framework

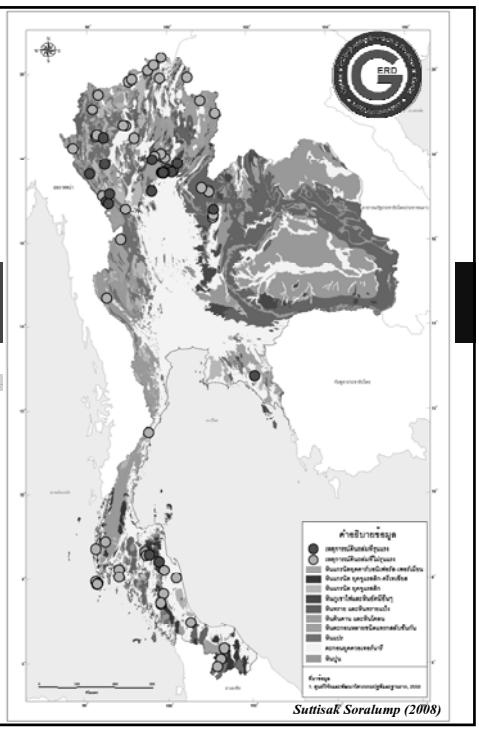


Anderson et al. (1996)

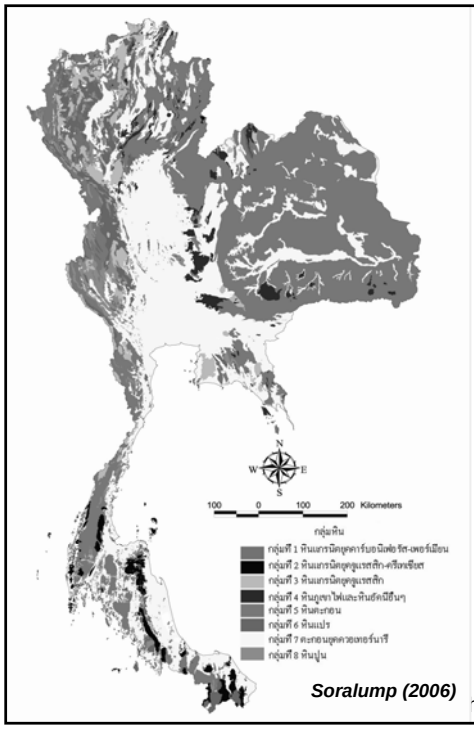
Risk Identification



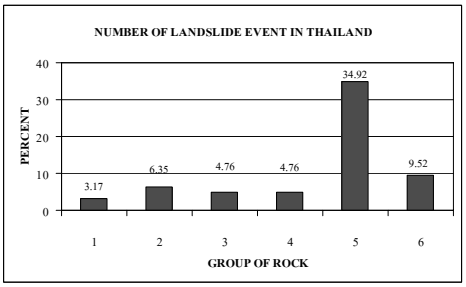
Department of Mineral Resource (2001)

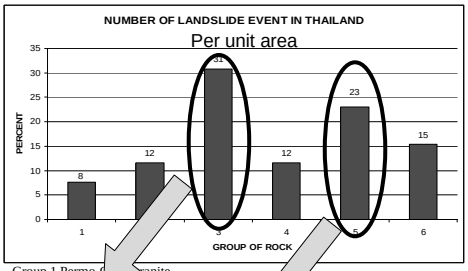


Suttisak Soralump (2008)



Soralump (2006)



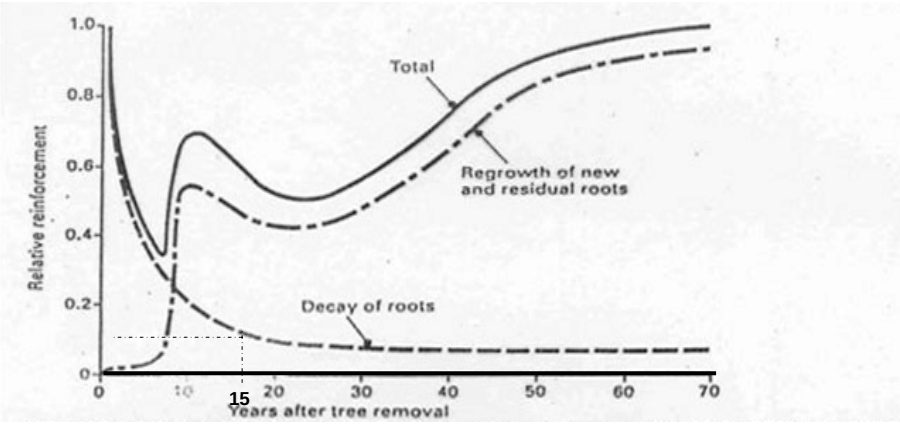


Group 1 Permo-C[illegible]granite
Group 2 Jurassic-Cretaceous granite
Group 3 Jurassic granite
Group 4 Volcanic and other plutonic rock
Group 5 Sandstone, shale, mudstone, conglomerate and chert
Group 6 Metamorphic rock

Soralump (2006)

[illegible]n and Development Center, Kasetsart University

Deforestation and Landslide

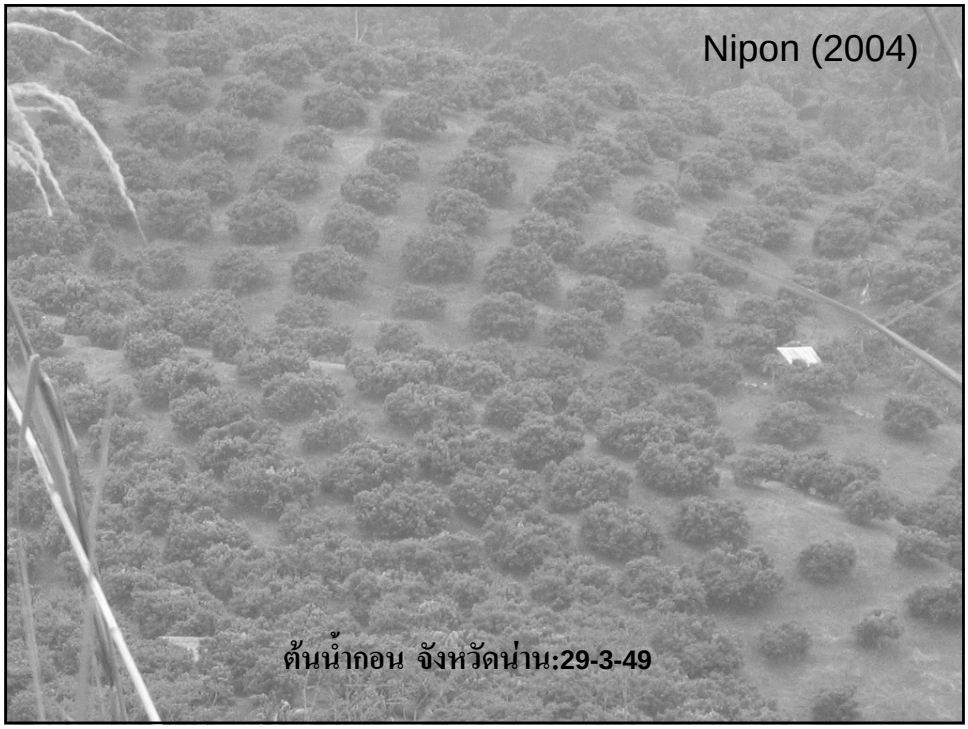


O'Loughlin and Ziemer,1982

Nipon (2004)

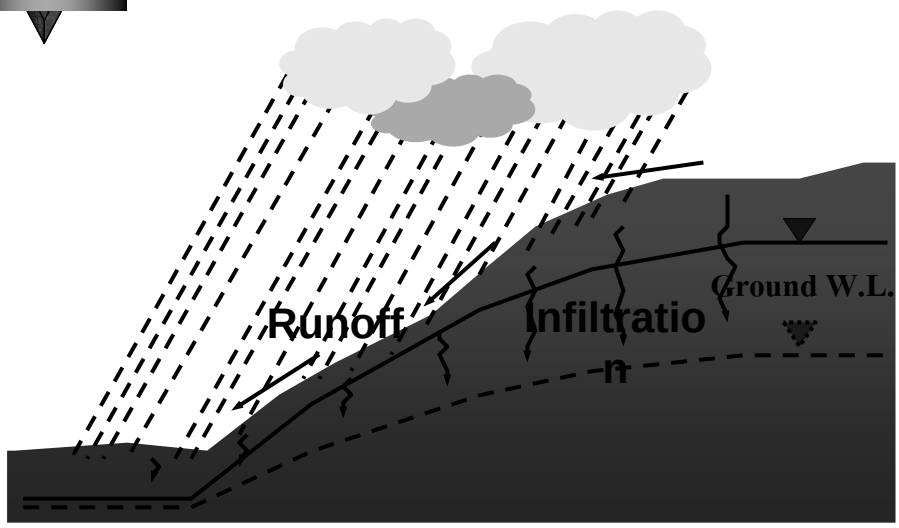
ภาพ: ศูนย์ภูมิสารสนเทศเพื่อการจัดการลุ่มน้ำ
สำนักอนุรักษ์และการจัดการต้นน้ำ สำนักบริหารจัดการพื้นที่ป่าอนุรักษ์ที่ 16

อมก๋อย, 2547



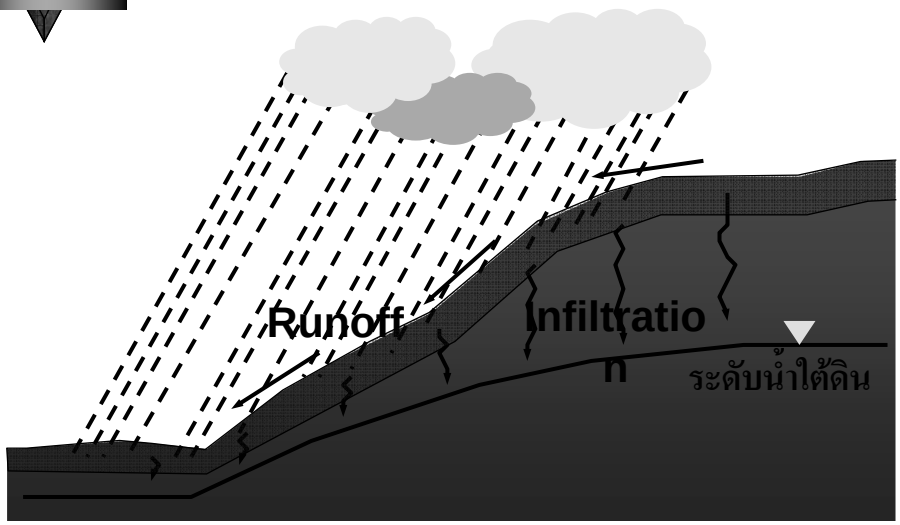
System Response

1 Ground Water Level Rising



Mairaing (2008)

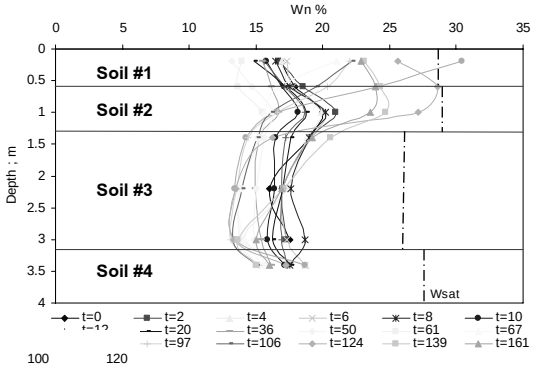
2. Increase Degree of Saturation or Perch water table

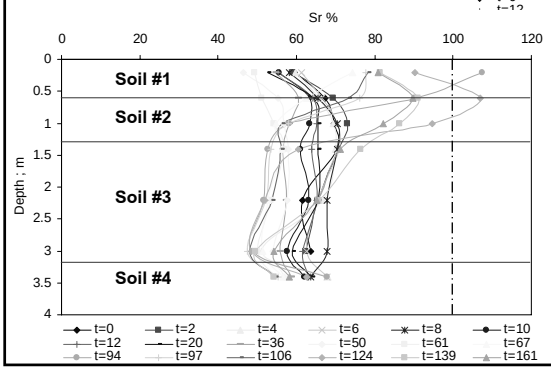


Mairaing (2008)

Variation of Water Content and Degree of Saturation with Time

Field Water content





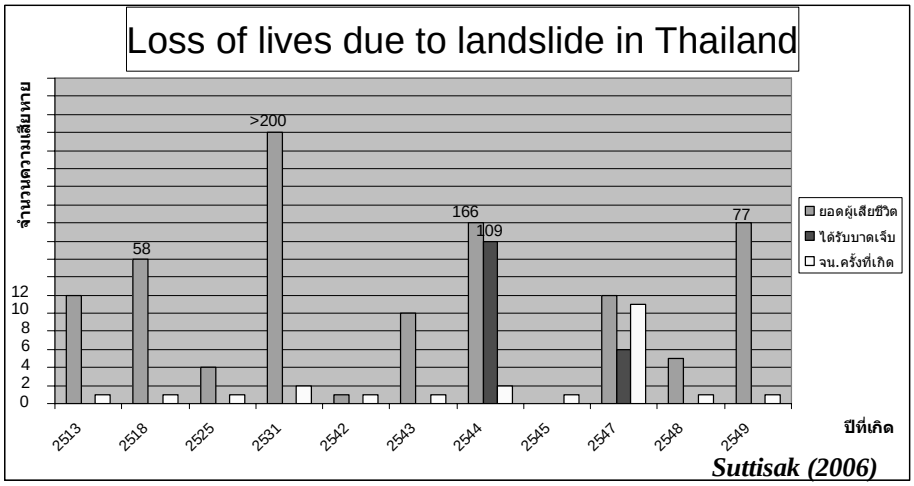
Degree of Saturation

Mairaing (2008)

Risk Estimation

Area	1970-2006		Average lost (37 year)	
	Lives	**Economics**	**Lives**	**Economics**
North	286	2,575,600,000.00	**8**	**69,610,810.81**
Central	1	300,000,000.00	**0**	**8,108,108.11**
South	247	1,010,000,000.00	**7**	**27,297,297.30**
Total	**534**	**3,885,600,000.00**	**14**	**105,016,216.22**

Suttisak Soralump (2007)



1970 2006

ผศ.ดร.สุทธิศักดิ์ ศรลัมพ์ ศูนย์วิจัยและพัฒนาวิศวกรรมปฐพีและฐานราก มหาวิทยาลัยเกษตรศาสตร์

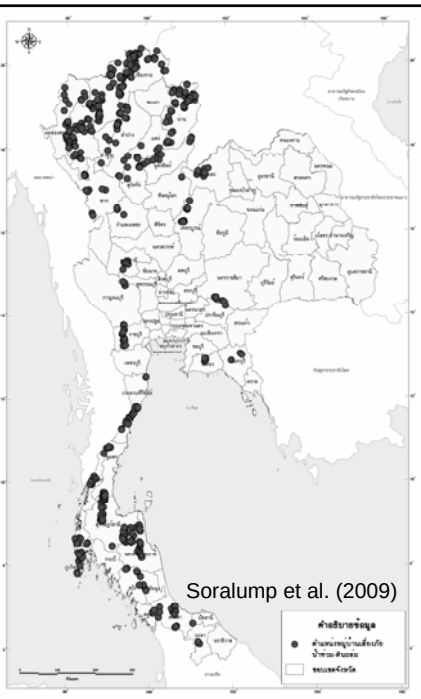
Landslide Hazard Mapping

Methods and factors for LS Hazard mapping in Thailand

WWW.GERD.ENG.KU.AC.TH

Method/ Organization	FACTORS RELATED TO LANDSLIDE															
	ROCK TYPE	LANDFORM (SLOPE)	RAINFALL	RAINFALL 5 return	LANDUSE / LAND COVER	ELEVATION	GEOLOGY	TOPOGRAPHIC	THERMALOGY	INVENTORY	WATERSHED	DRAINAGE	WETNESS	SOIL DEPTH	GROUNDWATER	ENGINEERING SOIL PROPERTIES
1. Weighting factor																
1.1 Wichai (1995)	✓	✓	✓		✓	✓										
1.2 DLD	✓	✓	✓		✓		✓									
1.3 Foresty R&D			✓				✓	✓	✓	✓						
1.4 DMR		✓	✓			✓	✓				✓	✓	✓			
1.5 Hathaitip (2001)	✓	✓	✓		✓	✓	✓					✓				
1.6 GERD	✓	✓	✓	✓	✓	✓	✓					✓				✓
2. Geotechnical																
2.1 GERD		✓	✓	✓	✓		✓						✓	✓	✓	

ผศ.ดร.สุทธิศักดิ์ ศรลัมพ์ ศูนย์วิจัยและพัฒนาวิศวกรรมปฐพีและฐานราก มหาวิทยาลัยเกษตรศาสตร์



Soralump et al. (2009)

ศูนย์วิจัยและพัฒนาวิศวกรรมปฐพีและฐานราก มหาวิทยาลัยเกษตรศาสตร์

Landslide Factors as GIS Layers

Static

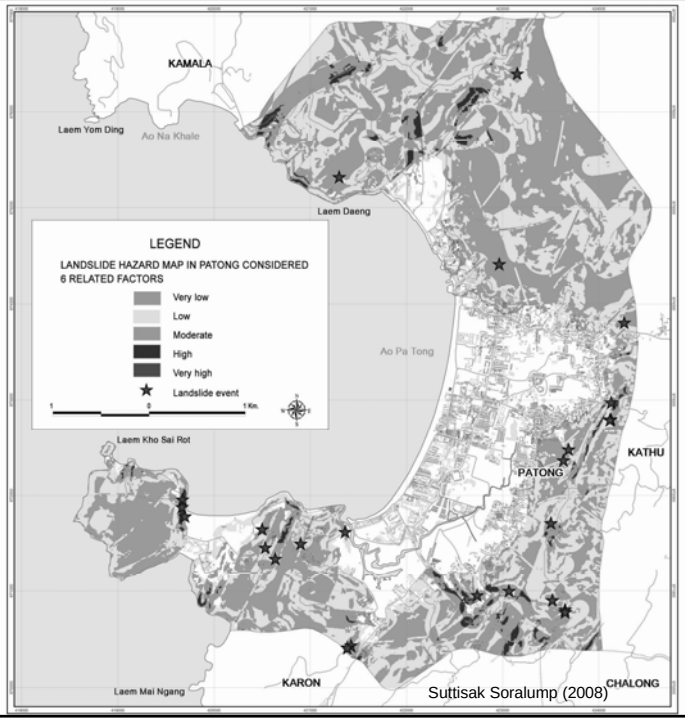
1. Geologic structure and Rock type
2. Slope and elevation
3. Surface water
4. Soil characteristics
5. Engineering soil properties-Strength reduction
6. Land use

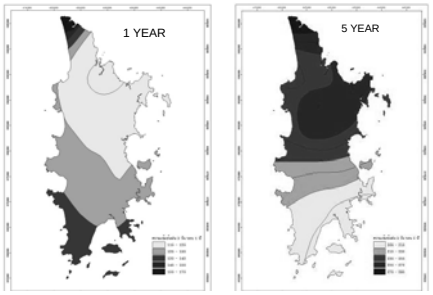
<u>Triggered Factors</u>

Dynamic

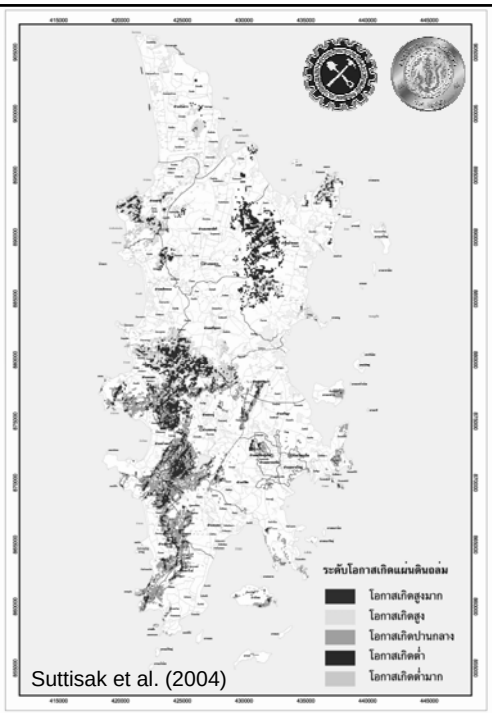
1. Accumulated rainfall

Suttisak Soralump (2008)





1 Year Return Period
5 Year Return Period
20 Year Return Period
50 Year Return Period
100 Year Return Period



Suttisak et al. (2004)

Risk Aversion

- Direct and indirect warning system

-Warning criteria

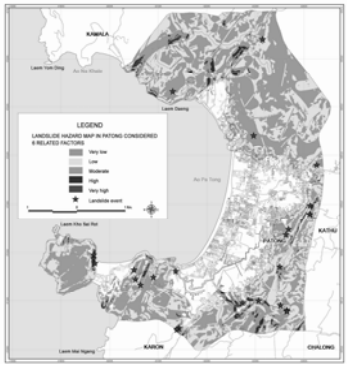
-Method of warning

-protection system

-relocation

Land use management

Recommendation for construction practice in hazard area



Actions	HIGH	MEDIUM	LOW	VERY LOW
Engineer	√	√		
Geologist	√			
Land cover	√	√		
Drainage management	√	√		
Control of cut slope angle	√	√	√	√

Suttisak (2007)

Landslide Risk Mapping

Vulnerability classes

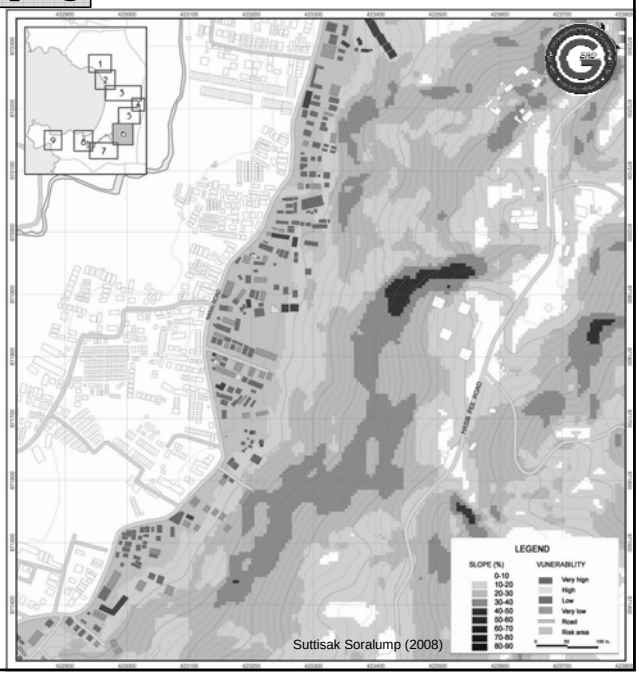
VH 1 story wooden buildings

H 1 story RC buildings

L > 1 story wooden buildings

VL > 1 story RC buildings

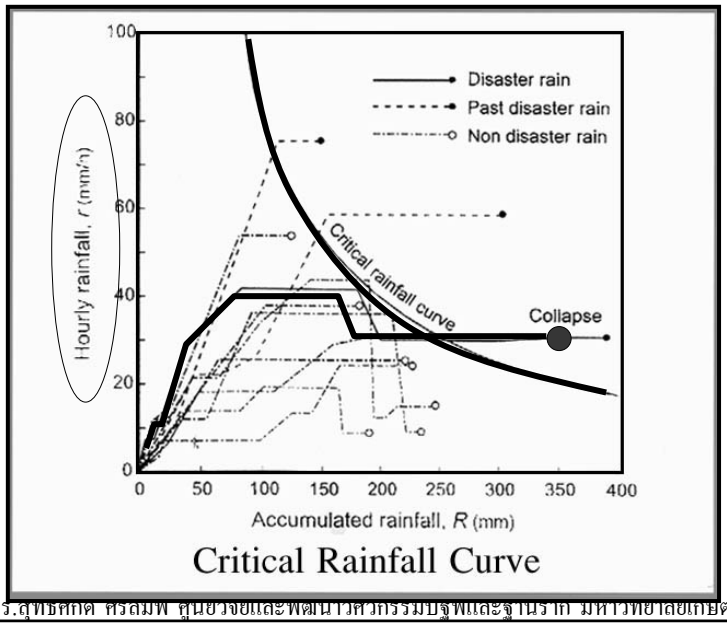
Suttisak (2007)



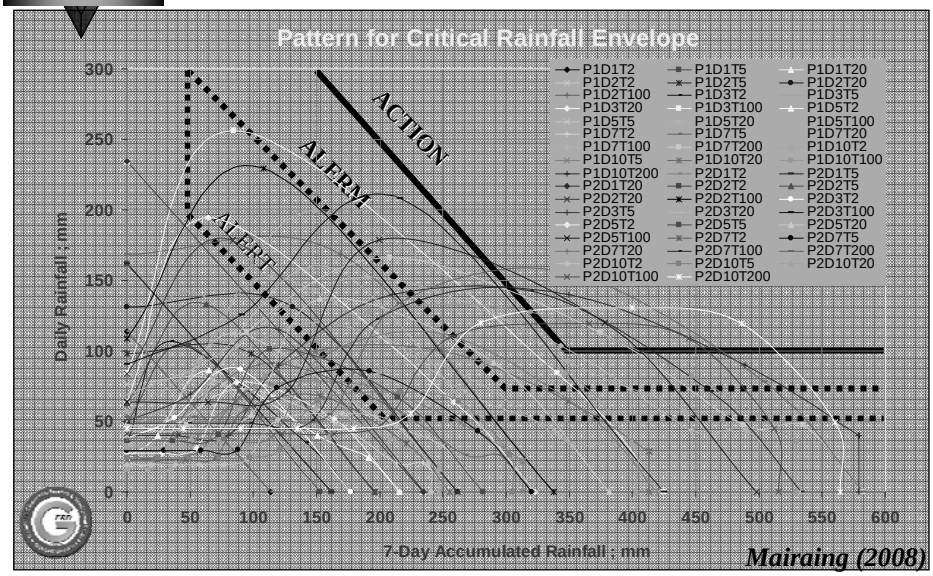
Suttisak Soralump (2008)

Critical rainfall envelop

การเตือนภัยจากปริมาณน้ำฝน

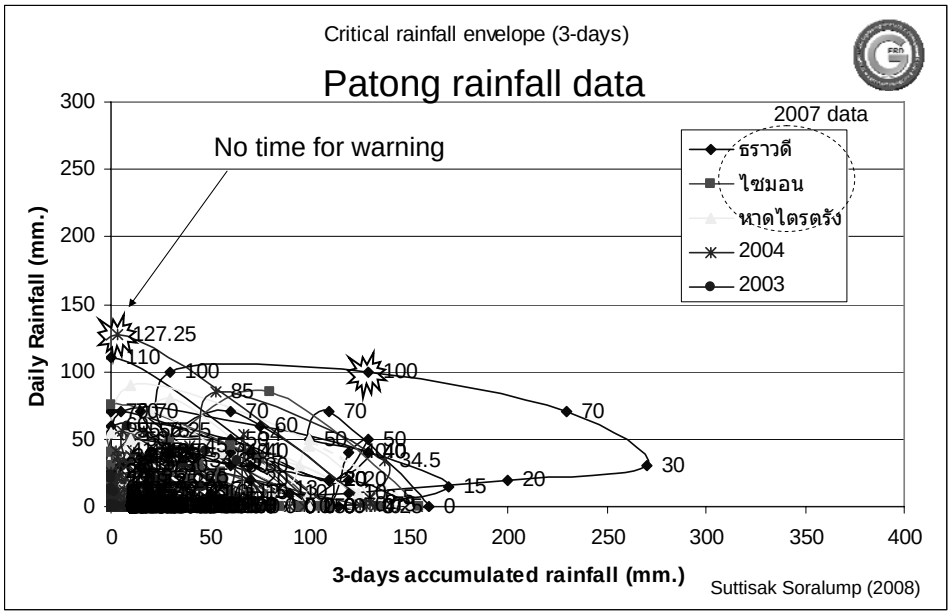


Rainfall Intensity Plot for Phuket

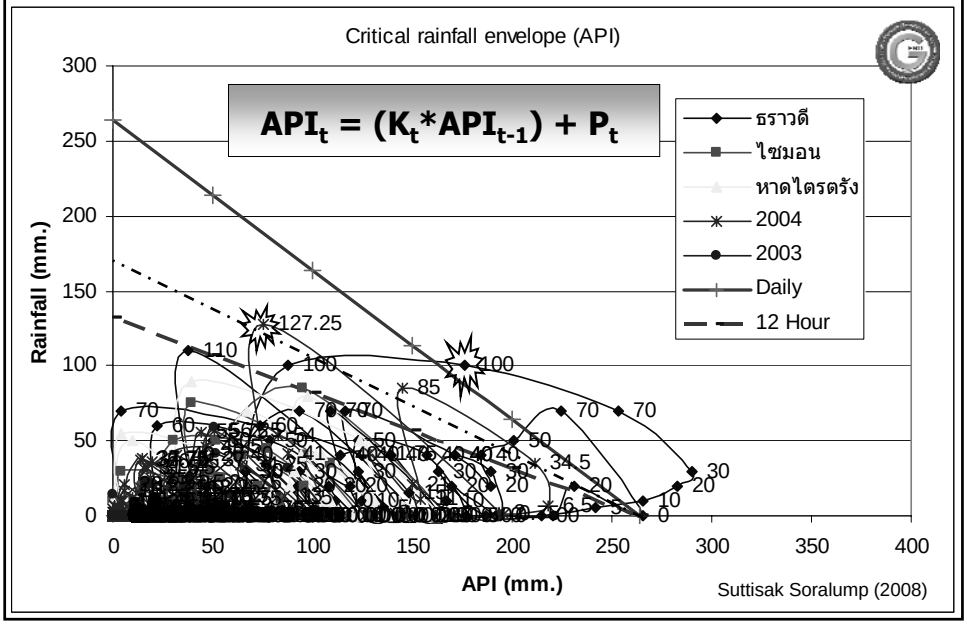


Mairaing (2008)

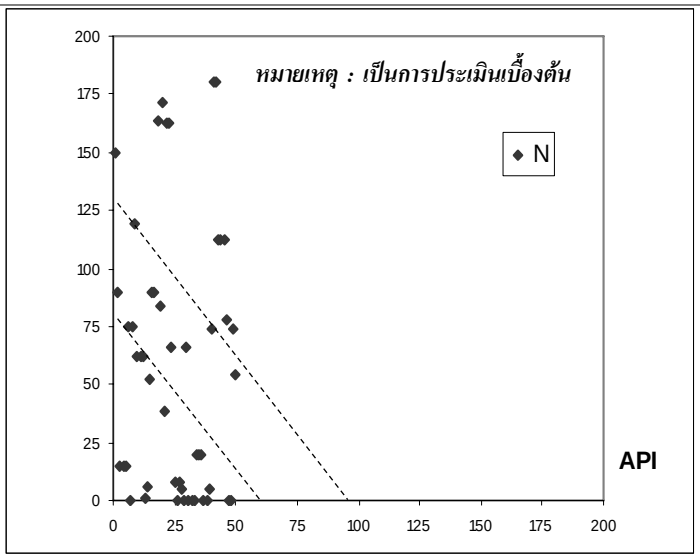
Drawback of using 3-day accumulated rainfall



Rainfall warning criteria



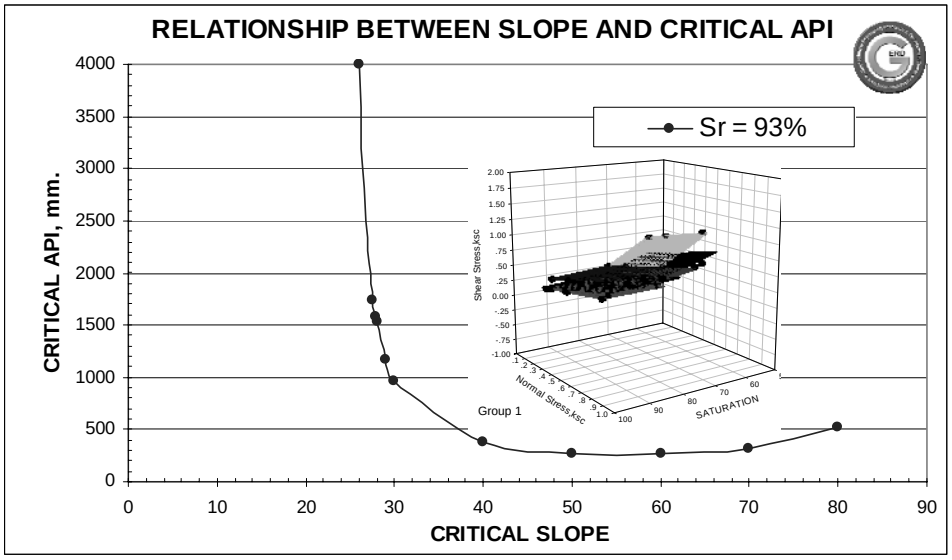
อิทธิพลของน้ำฝนต่อการเกิดอุทกภัยในเขตภาคเหนือของประเทศไทย



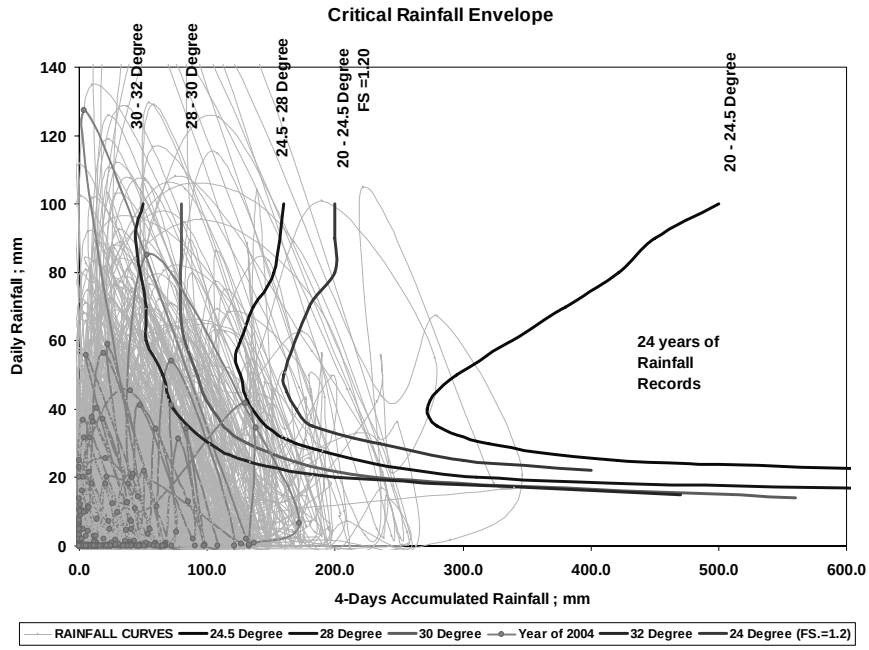
Nipon(2006)

Critical API Analysis

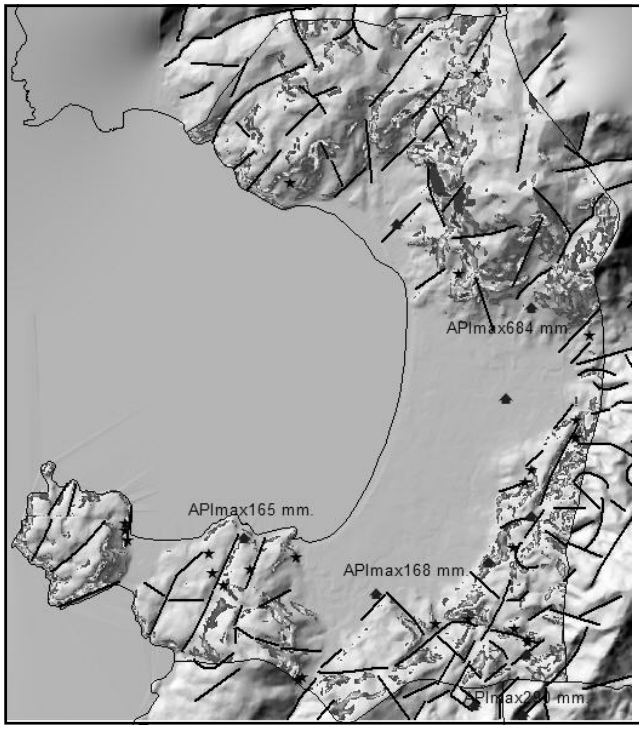
Worawat and Suttisak (2008)



Dr. Suttisak Soralump, Geotechnical Engineering Research and Development Center, Kasetsart University



Warakorn and Santi (2009)

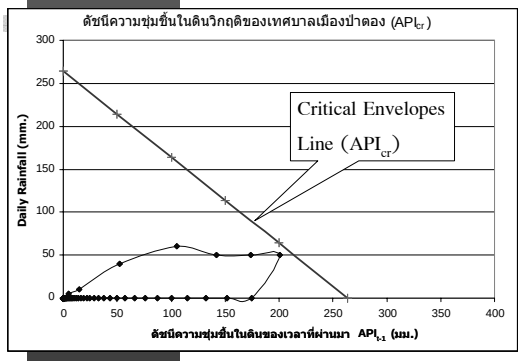


Critical API contour in Pathong

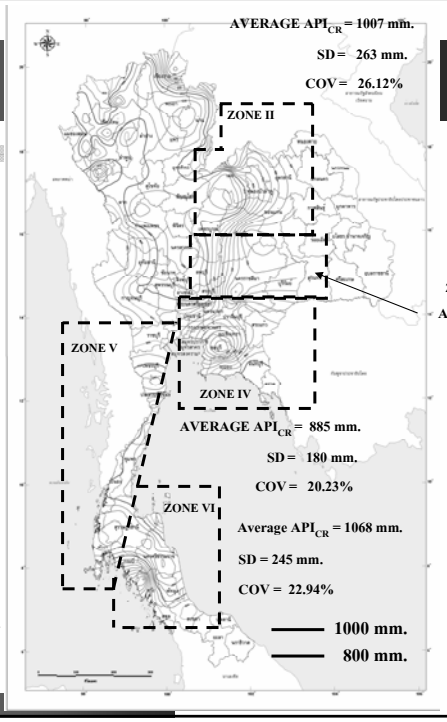
API $_{critical}$ > 265 mm.

Damrong and Suttisak (2007)

GERD Monitoring system



Critical API Contour



Worawat and Suttisak (2008)

Landslide Management Tools

- database development – preparation of inventory.
- landslide hazard zonation mapping and risk assessment-appropriate approach for diff geologic condition.
- monitoring of critical slopes-stability and infiltration behavior.
- geotechnical modeling.
- design of suitable control measures.
- development of early warning system and criteria-direct and indirect method.

Thank you

NRCT