



POTSDAM INSTITUTE FOR
CLIMATE IMPACT RESEARCH

Impacts, adaptation and comparability: supporting decision processes in deltas

Deltas in Times of Climate Change
Session: Decision support instruments for climate adaptation policy

Prajal Pradhan, Till Sterzel, Hannah Förster and Jürgen Kropp

29 September - 1 October 2010, Rotterdam, the Netherlands



Content

- Introduction
- Deltas and comparability
- Sea-level rise and its impacts
- Decision support instrument: a novel approach
- Summary



Introduction

Both natural systems and socio-economic systems are affected (Paavola and Adger 2005)



Even with reductions in greenhouse gas emissions, it is largely irreversible (Soloman et al. 2008)

Adaptation is an important response option or strategy, along with mitigation (Smit and Pilifosova 2001).



3

Barriers

- accessibility of the available knowledge
- usability by decision makers



Need

- the processing of complex scientific knowledge
- comparatively assessment of climate change impacts
- prioritization of corresponding adaptation

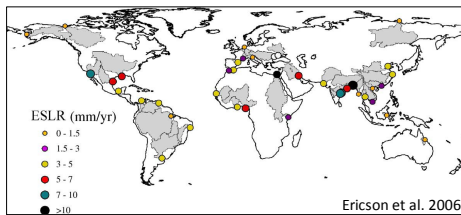
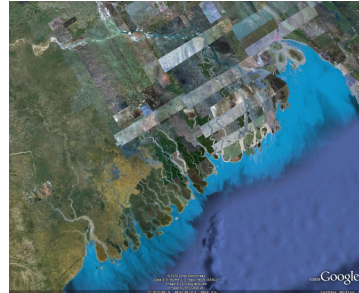
Decision support instruments regarding climate adaptation need to overcome these barriers and to address these needs



4

Deltas and comparability

- type of naturally dynamic coastal systems
- important in terms of social, economic and ecological value

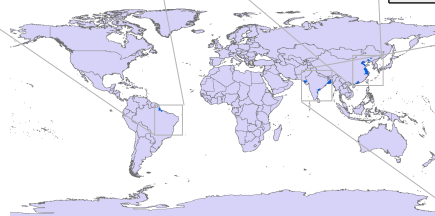


- major locations of population and agriculture
- sensitive to sea-level rise and other climate change impacts
- heterogeneous attributes in comparable systems (i.e. deltas)

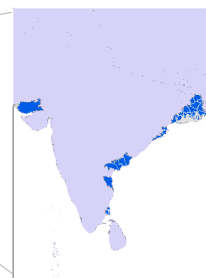


5

Selected delta regions for study



Country (4)	Delta (17)	No. of 2nd level admin units (92)
Bangladesh	Ganges-Brahmaputra	12
	Amazon	16
Brazil	Parnaiba	4
	Sao Francisco	6
China	Chang Jiang	14
	Hai Ho	4
	Huai	4
	Huang He	3
	Liao	4
	Zhujiang	8
	Cauvery	3
	Ganges-Brahmaputra	4
India	Godavari	2
	Indus	1
	Mahanadi	4
	Penner	1
	Krishna	2



based on focal countries in the ci:grasp project

www.ci-grasp.org

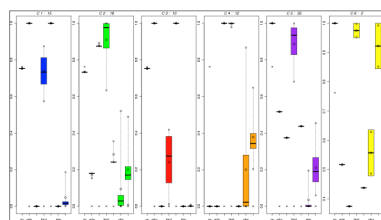
6

Indicators (17) used for comparability of deltas

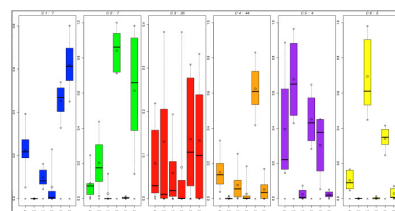
	Examples
Socio-economic indicators (7)	government effectiveness index
	national GDP/cap in 2008 in PPP\$ of constant 2005
	percent of agricultural GDP in 2008
	GINI Index 1992-2007
	population density admin unit level 2
Land use indicators (6)	area admin unit level 2 (m2)
	percent urban area of admin unit level 2
	protected area of admin unit level 2 in percent
	cropland area of admin unit level 2 in percent
Hazard indicators (6)	percent wetlands in admin unit level 2
	Effective sea level rise
	maximum storm surge height
	expected average number of event per 1000 years



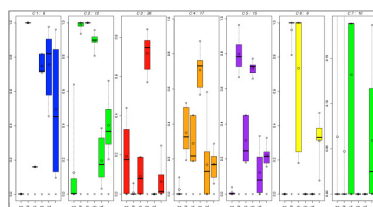
7



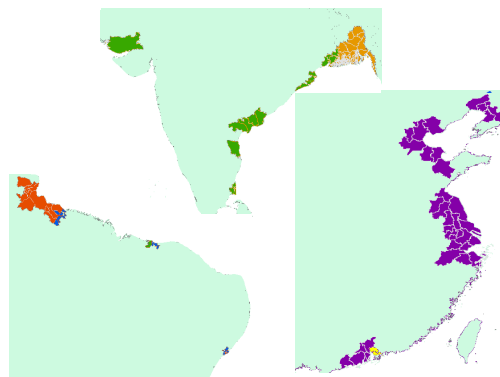
Socio-economic clusters (6)



Land use cluster (6)



Hazard cluster (7)

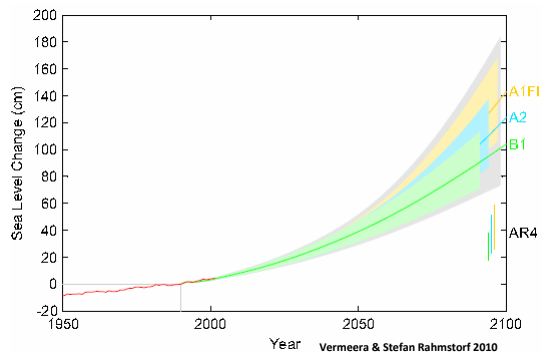


Socio-economic cluster map

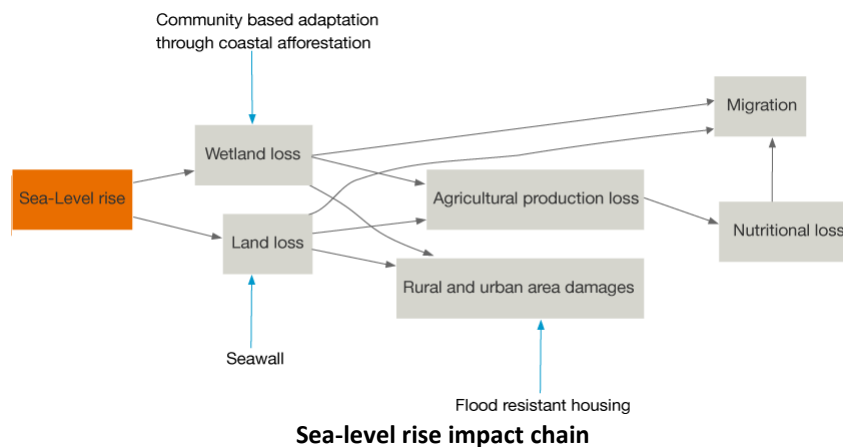
8

Sea level rise and its impacts

- uncertainty
- scenario analysis
- 1 m & 2 m SLR scenarios*
- various impacts
- cause and effect relationships
- *impact chain*

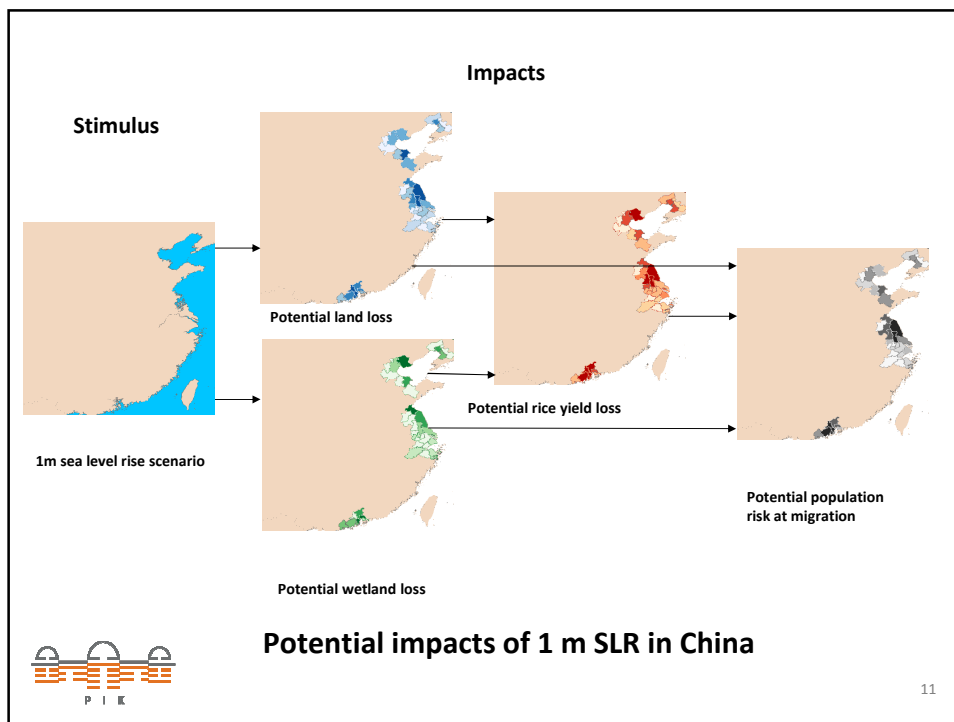


* Due to vertical resolution of appropriate DEMs 9



impact chain as such a structuring element to organize complex climate change content in a simpler and understandable concept





11

A novel approach

prioritization of adaptations

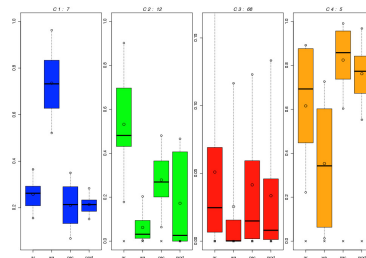
Admin level 2	Delta	Land loss %	Wetland loss %	Population at risk %	Yield loss %
Cangzhou	Hai Ho	0.41	0.00	0.11	0.00
Jiaxing	Chang Jiang	0.57	0.00	0.10	0.01
Hangzhou	Chang Jiang	0.46	0.78	0.00	0.07
Binzhou	Huang He	2.76	0.00	1.18	0.12
Ningbo	Chang Jiang	0.87	3.64	0.40	0.19
Anshan	Liao	0.05	0.00	0.04	0.20
Jinzhou	Liao	0.91	0.00	0.22	0.25
Shenzhen	Zhujiang	2.73	1.64	2.14	0.37
Changzhou	Chang Jiang	0.38	0.61	0.05	0.39
Yangjiang	Zhujiang	3.34	29.17	6.00	0.57
Suzhou	Chang Jiang	3.27	0.00	0.29	0.59
Wuxi	Chang Jiang	1.18	0.00	0.05	0.63
Weifang	Huang He	5.10	0.00	5.10	0.64
Nantong	Chang Jiang	3.85	7.65	4.19	0.84
Shanghai	Chang Jiang	1.56	5.14	1.48	0.90
Huai'an	Huai	2.07	0.00	7.14	2.42
Zhoushan	Chang Jiang	7.67	7.00	2.73	2.86
Zhenjiang	Chang Jiang	5.31	0.00	2.35	3.61
Tieling	Liao	2.00	38.49	3.01	6.75
Panjin	Liao	10.03	63.35	4.62	8.08
Dongying	Huang He	23.24	70.19	17.37	9.08
Lianyungang	Huai	15.63	75.86	10.41	11.38
Tianjin	Hai Ho	5.94	13.07	3.45	11.61
Dongguan	Zhujiang	18.35	95.84	11.94	11.82
Yangzhou	Chang Jiang	12.56	0.00	8.48	12.10
Tangshan	Hai Ho	8.92	83.95	2.74	12.45
Guangzhou	Zhujiang	14.85	46.98	16.39	13.41
Jiangmen	Zhujiang	13.30	23.49	17.95	14.84
Taizhou	Chang Jiang	27.28	14.32	23.39	22.73
Foshan	Zhujiang	26.71	0.00	36.01	28.98
Zhuhai	Zhujiang	41.34	32.86	27.82	42.89
Zhongshan	Zhujiang	53.46	72.64	41.90	46.71
Yancheng	Huai	52.30	57.76	48.81	55.44

PIK

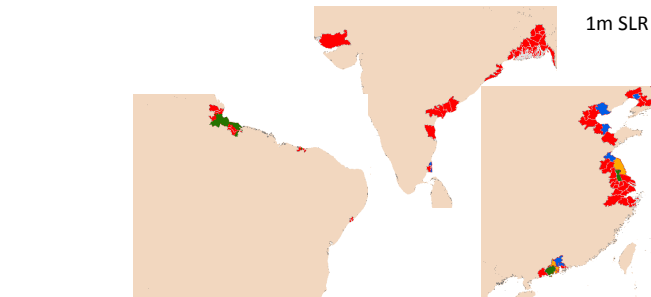
12

Prioritization of adaptation

- regions with similar impacts
- focal interest of decision-makers and stakeholders
- availability of resources



1m SLR impact cluster



1m SLR impact cluster map



13

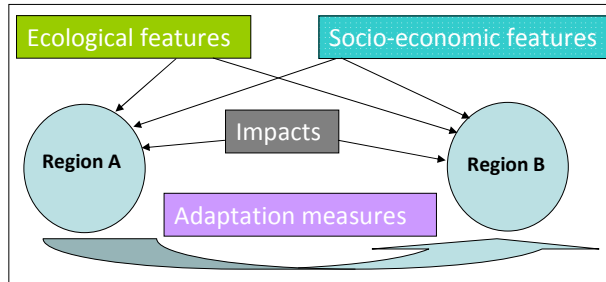
transferability of adaptation options



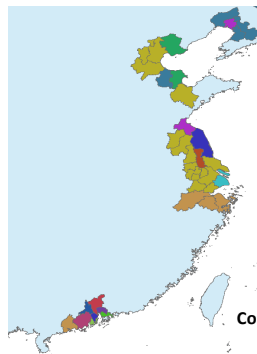
www.ci-grasp.org



Transferability of adaptation options



Admin 2 nd level	Socio-eco cluster	Land use cluster	Impacts cluster	
Tangshan	5	1	1	2
Dongying	5	1	1	
Jinshan	5	1	3	4
Jinzhou	5	1	3	
Tieling	5	1	3	
Binzhou	5	1	3	
Yangjiang	5	3	3	5
Hangzhou	5	3	3	
Ningbo	5	3	3	
Shaoxing	5	3	3	
Zhoushan	5	3	3	
Lianyungang	5	4	1	2
Panjin	5	4	1	
Cangzhou	5	4	3	14
Langfang	5	4	3	
Changzhou	5	4	3	
Huai'an	5	4	3	
Nantong	5	4	3	
Suzhou	5	4	3	
Suzhou	5	4	3	
Wuxi	5	4	3	
Yangzhou	5	4	3	
Zhenjiang	5	4	3	
Weifang	5	4	3	
Tianjin	5	4	3	
Huzhou	5	4	3	
Jiaxing	5	4	3	
Zhongshan	5	4	4	2
Yancheng	5	4	4	



Comparable regions for impacts of 1m SLR

15

Summary

- *impact chain* for communicating complex climate change knowledge to decision makers and stakeholders
- prioritization of adaptation options based on stakeholders' interest and looking at regions with similar impacts
- based on similarities of socio-economic and ecological features, and climate change impacts, we can identify locations from which adaptation experiences may be transferred to comparable locations

Thank you!

Prajal Pradhan: pradhan@pik-potsdam.de



16

Indicators (17) used for comparability of deltas

	Indicator	Source	Spatial resolution
Socio- economic indicators (7)	government effectiveness index	World Resources Institute	Country
	national GDP/cap in 2008 in PPP\$ of constant 2005	WDI	
	percent of agricultural GDP in 2008	WDI	
	flood mortality	Natural disaster hotspots, WB	2.5 lon x 2.5 lat
	GINI Index 1992-2007	HDI	country
	expected average annual population exposed to storm surge	UNEP/GRID	
	population density	GRUMP & GADM	Admin unit level 2
Land use indicators (6)	area (m2)	GADM	Admin unit level 2
	percent wetlands	Globcover 2.2	Admin unit level 2
	percent urban area	MODIS 500m	Admin unit level 2
	protected area in percent	WDPA 2010 (national + international)	Admin unit level 2
	cropland area in percent	http://www.geog.mcgill.ca/~nramankutty/Datasets/Datasets.html	Admin unit level 2
	pasture area in percent	http://www.geog.mcgill.ca/~nramankutty/Datasets/Datasets.html	Admin unit level 2
Hazard indicators (6)	percent wetlands	Globcover 2.2	Admin unit level 2
	flood frequency	Natural disaster hotspots, WB	2.5 lon x 2.5 lat
	Effective sea level rise	Ericson et al 2006	delta
	maximum storm surge height	DIVA database	
	expected average number of event per 1000 years	UNEP/GRID	
	population density	GRUMP & GADM	Admin unit level 2



17

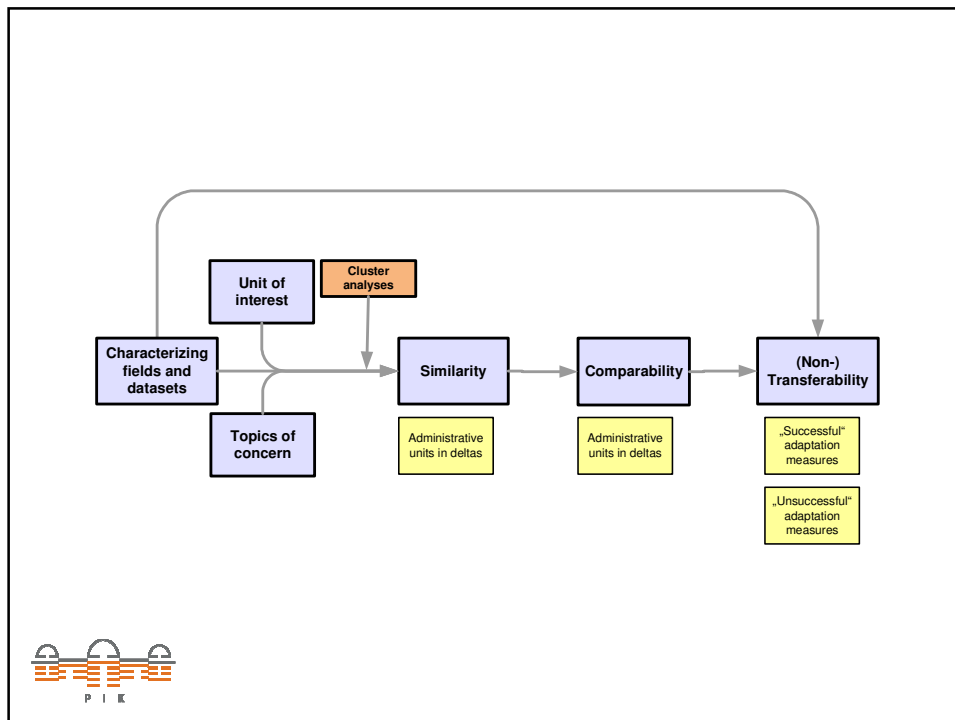
Glossary

Stimuli: Stimuli are climate-related variables that can cause impacts on human activities and the environment. Temperature, precipitation, sea level rise, etc. are examples of climate stimuli.

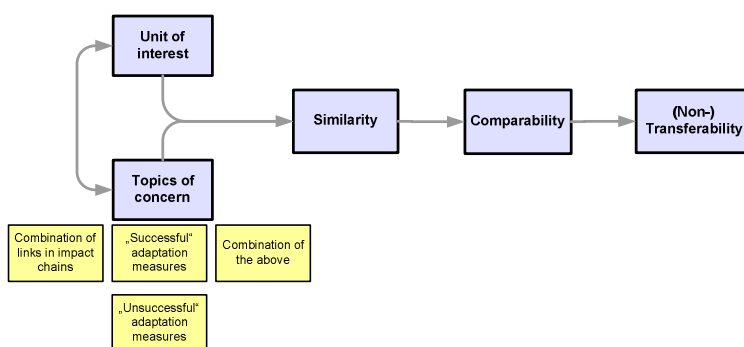
Impacts: Impacts are the effects of climate change on natural and human systems. Impacts can be distinguished into potential and residual impacts depending on the consideration of adaptation. (IPCC 2007).

Adaptation: Adaptation is adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC 2007).





Ci:grasp context: comparability

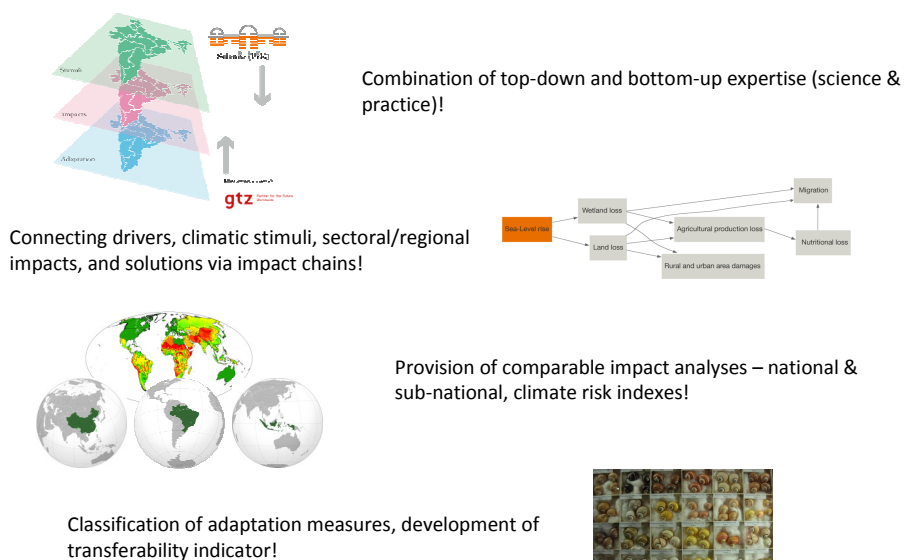


Aim: determine regions (e.g. admin units) to which successful adaptation measures may be transferrable to

Ci:grasp context: Comparability - example

Aim	Assumption	Basic common mechanism	Areas in clusters comparable with respect to
Determine areas adaptation measures may (not) be transferrable to	Adaptation measures can be implemented in areas with similar dynamics	Dynamics and contexts that raise need for adaptation measures	Values of parts of the impact chains the adaptation measures address

- Other fields addressed:**
- Categorization and proximity of adaptation measures
 - Areas with similar adaptation measures



ciograsp

Administration Log Out Contribute

Home World Map Stimuli Impacts Adaptations

Home > World Map

Explore impact chain

Grided drivers → Sea-Level rise → Wetland loss → Agricultural production loss → Nutritional loss

Land loss → People at risk of migration → Rural and urban area damages

drivers stimuli impacts

current map displayed

Impact chain as clickable navigational element to explore: drivers, stimuli, impacts and adaptation

Advanced Information

Legend Base Map ... Maximize Quick Help

PIK

23

ciograsp

Administration Log Out Contribute

Home World Map Stimuli Impacts Adaptations

Home > World Map

Explore impact chain

Advanced Information

SEARCH

Map Filter Adaptation Filter

Search for maps

Search Clear filters

Advanced options

Time period Please select

Temporal aggregation Please select

Model Please select

Scenario Please select

How to search for maps

Combine terms like location, impact or stimulus name or keywords.

Examples:

brazil land loss

brazil stimulus

brazil impact migration

RESULTS

Maps (143) Adaptations (40)

Sort by: relevance

Historical precipitation difference DJF Show info

People at risk of migration (Brazil, 1m SLR) Show info

People at risk of migration (Brazil, 2m SLR) Show info

People at risk of migration (Chile, 1m SLR) Show info

People at risk of migration (Chile, 2m SLR) Show info

People at risk of migration (China, 1m SLR) Show info

People at risk of migration (China, 2m SLR) Show info

Projected precipitation difference DJF Show info

Projected precipitation difference JJA Show info

Rural and urban GDP at risk (Brazil, 1m SLR) Show info

PIK

24

[Administration](#)
[Log Out](#)
[Contribute](#)

[Home](#)
[World Map](#)
[Stimuli](#)
[Impacts](#)
[Adaptations](#)

[Home > World Map](#)

☐ Explore impact chain
 ☐ Advanced information

SEARCH

Map Filter

Adaptation Filter

Advanced options

How to search for maps

RESULTS

Maps (4)

Adaptations (40)

Sort by: relevance

Potential land lost [ha] (Brazil, 1m SLR)

Show info

Potential land lost [ha] (Brazil, 2m SLR)

Show info

Potential land lost [%] (Brazil, 1m SLR)

Show info

Potential land lost [%] (Brazil, 2m SLR)

Show info

Base Map

Maximize

Quick Help

25

[Administration](#)
[Log Out](#)
[Contribute](#)

[Home](#)
[World Map](#)
[Stimuli](#)
[Impacts](#)
[Adaptations](#)

[Home > World Map](#)

☐ Explore impact chain
 ☐ Advanced information

SEARCH

Map Filter

Adaptation Filter

Advanced options

How to search for maps

RESULTS

Maps (143)

Adaptations (40)

Sort by: relevance

Farm-Dike Establishment

Show info

Coastal Resources Adaptation Project

Show info

Coral gardening

Show info

Conservancy Adaptation Project with integration of advanced mapping and engin...

Show info

Enhancing Coping and Adaptation Capacity of the Community to Reduce Vulnerabi...

Show info

Coast Protection constructing coastal structures

Show info

Coast Protection constructing revetment

Show info

Khazan technology

Show info

Adaptation to Coastal Erosion - relocation

Show info

Community-based Afforestation

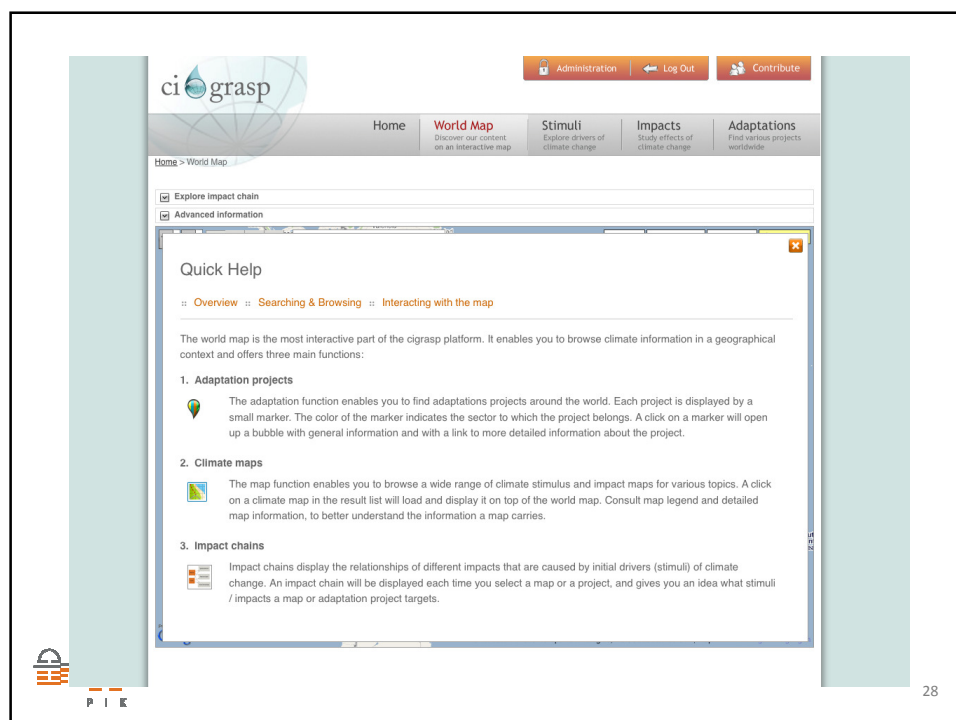
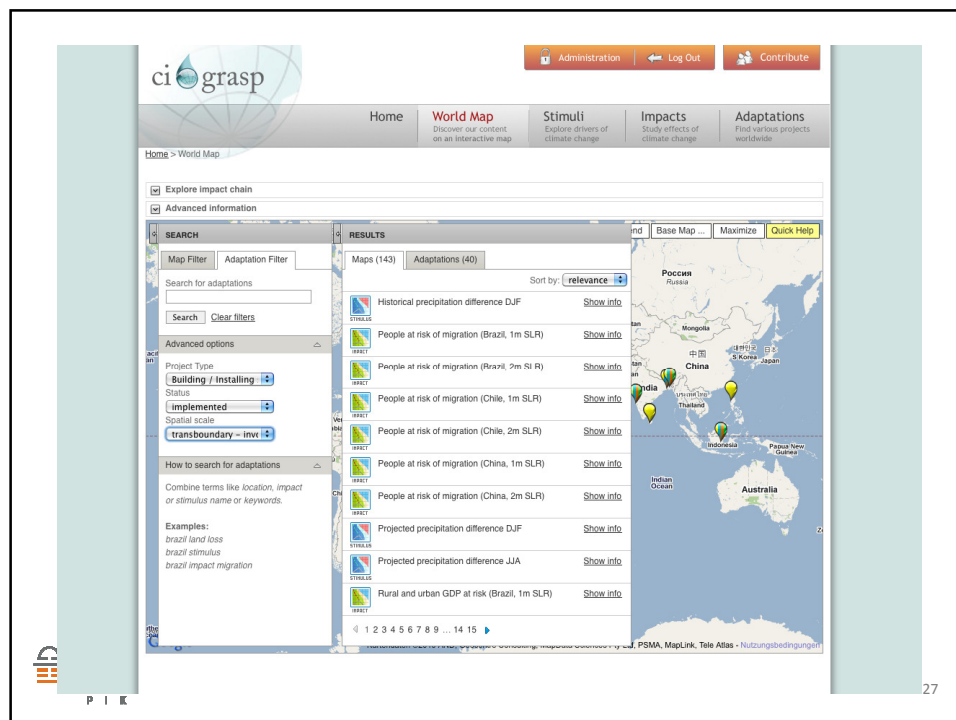
Show info


Base Map

Maximize

Quick Help

26





[Administration](#)
[Log Out](#)
[Contribute](#)

[Home](#)
[World Map
Discover and explore
on an interactive map](#)
[Stimuli
Human drivers of
climate change](#)
[Impacts
Ecological effects of
climate change](#)
[Adaptations
Find climate projects
worldwide](#)

[Home](#) > [List of adaptations](#) > Farm-Dike Establishment

Project details: Farm-Dike Establishment

State of this project: **accepted**


[Go to adaptation list](#)
[Print this page](#)

Building farm-dikes with flap-gates would be a cost efficient strategy to protect farmland from rising sea levels. It is thought that in South Kalimantan over 150,000 ha. of re-claimed coastal swampland, which is currently being farmed for rice and other food crops, are at risk. Farm-dikes with flap-gates have been shown to be successful in draining off excess surface and groundwater, providing flood protection, preventing salt intrusion, and controlling water quality. Each farm-dike can be used for 50 years, after which it should be replaced with a new one while the lifespan of a gate is 15 years.

Tagged with: [dike](#), [salt water intrusion](#)

Contact information
 Name: Akhmad R Saïdy & Yusuf Azis, Faculty of Agriculture
 Lambung Mangkurat University and Environmental
 Research Centre
 Address: Kampus Unlam Simpang Empat Jalan Ahmad
 Yani KM36, Banjarbaru 70714, Indonesia
 Tel: 62 511 4777540
 E-Mail: asaïdy@unlam.ac.id

Information source
 Economy and Environment Program For Southeast Asia,
<http://www.idrc.ca/eeepsea/>



Project location: **South Kalimantan, Indonesia**

