Framework of Climate Change Risk Assessment:

Overview Climate Change Risk Assessment in Indonesia

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The Development of Climate Change Risk Assessment Framework

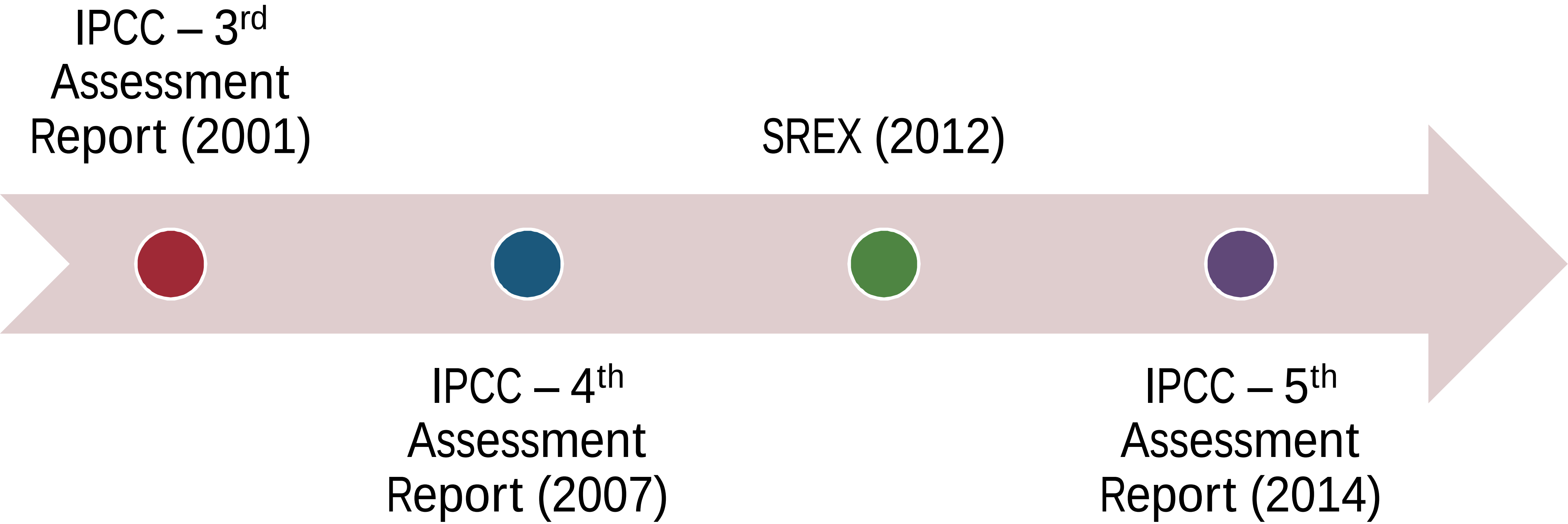
Framework of Climate Change Risk Assessment:
Overview in Indonesia

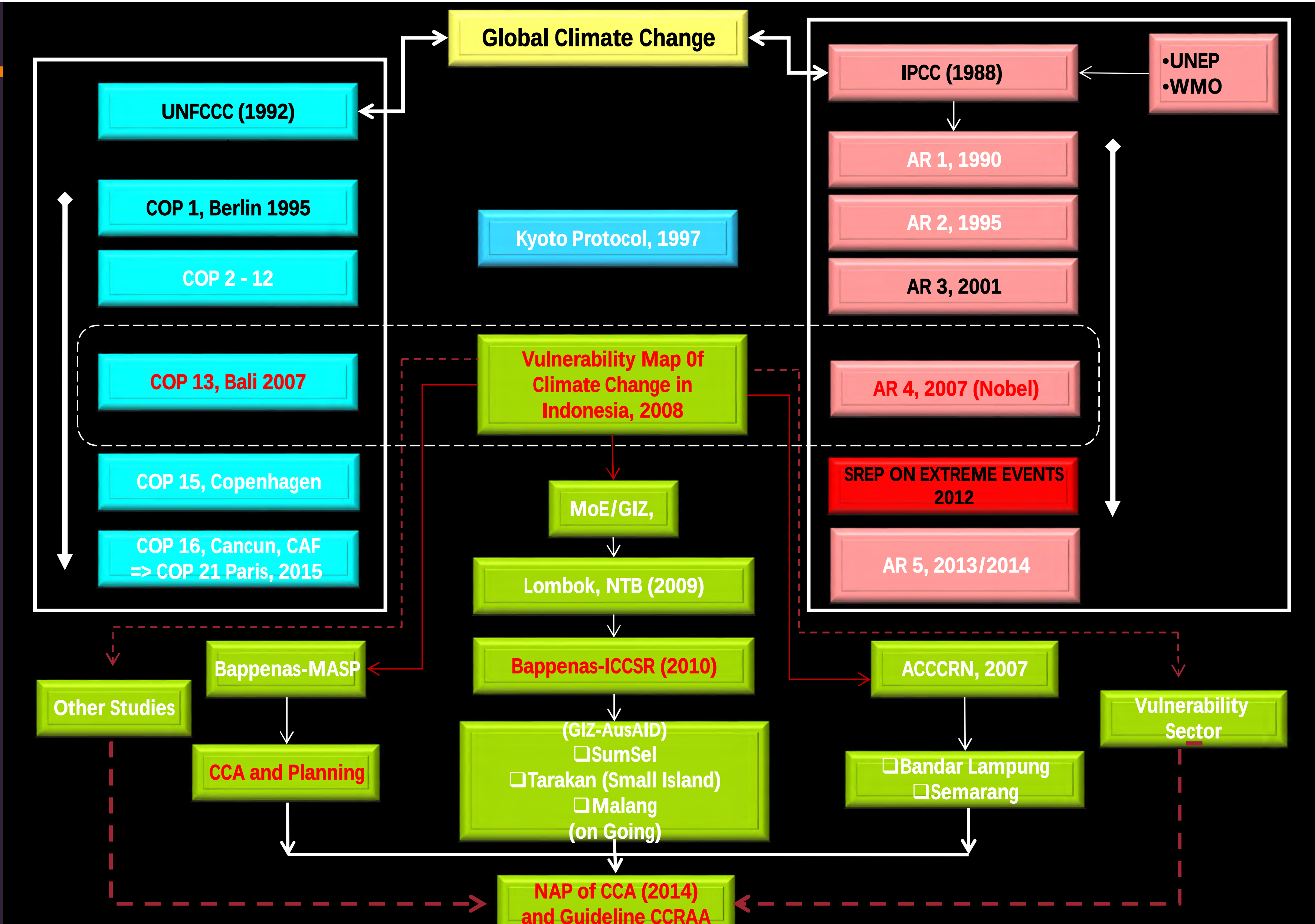
RISK ASSESSMENT

IN SEARCH FOR ASSESSMENT FRAMEWORK

- Since the Third Assessment Report, definition of VULNERABILITY based on IPCC has been confronted, both to account for social vulnerability *(O'Brien et al., 2004)* and to reconcile with risk assessment *(Downing and Patwardhan, 2005).*
- The risk assessment offers a framework for policy measures that focus on social aspects, including poverty alleviation reduction, diversification of food, protection of infrastructures and building of collective action *(Patwardhan, 2006)*
- The risk assessment framework has been well developed within the Natural Disaster Communities and has been increasingly adopted for vulnerability assessment to climate change *(Klein, 2004).*
- Five Approaches to CCIAV, the Four are Conventional Research Approaches: IA, AA, VA, Integrated A. The Fifth approach, risk management, has emerged as CCIAV studies have begun to be taken up in mainstream policy-making (WG II AR-4, 2007)
- **Adaptation is place- and context-specific, with no single approach for reducing risks appropriate across all settings (IPCC, 2014)**
- Climate Change adaptation is an opportunity for social reform, for the questioning of values that drive our unsustainable relationship with the environment => Adaptation is a social and political act; and with the possibility for re-shaping future, power relations in society (Pelling, 2011)
- Precise contribution of anthropocentric climate change to these events and trends may never be understood but climate change is certainly a decisive contributing factor and that vulnerability exists, demanding action (Pelling, 2011)

Development of Risk Assessment Framework





Source: CCC-ITB, 2015

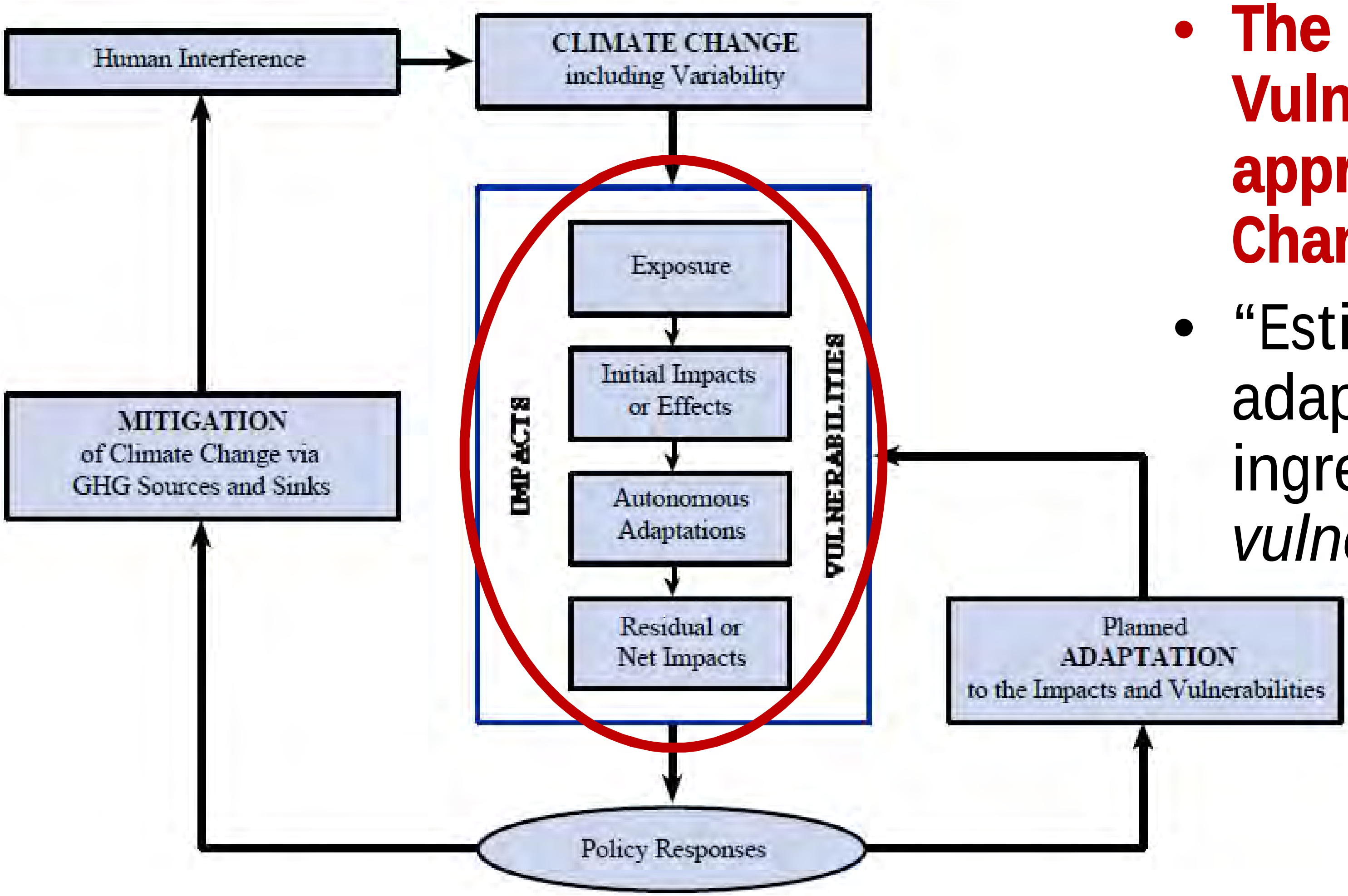
Evolution of Vulnerability Definition

VULNERABILITY

"Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its **sensitivity**, and its **adaptive capacity**" (AR-3, Synthesis Report, 2001)	"Vulnerability to climate change is the **degree to which systems are susceptible to, and unable to cope with, adverse impacts**" (AR-4, Synthesis Report, 2007:48)	"Vulnerability is the **propensity or predisposition to be adversely affected**. It encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt" (WG-II, AR5, SPM, 2014)

Impact, Adaptation, and Vulnerability Assessment (IPCC AR-3, 2001)

Places of Adaptation in the Climate Change Issue (Smit et al., 1999)



- **The Concept of Vulnerability is used as an approach for Climate Change Adaptation**
- "Estimates of likely future adaptations are an essential ingredient in *impact and vulnerability assessments*"

The Concept of Vulnerability (IPCC AR-3, 2001)

"*Vulnerability* is defined as the extent to which a natural or social system is susceptible to sustaining damage from climate change" (IPCC, 2001)

Vulnerability can then be said as a function of character, magnitude and level of climate variation to which a system is exposed, having sensitivity and adaptive capacity

- The *sensitivity* of a system to changes in climate (the degree to which a system will respond to a given change in climate, including beneficial and harmful effects)
- *Adaptive capacity* (the degree to which adjustments in practices, processes, or structures can moderate or offset the potential for damage or take advantage of opportunities created by a given change in climate
- The degree of *exposure* of the system to climatic hazards

Source: IPCC, 2001

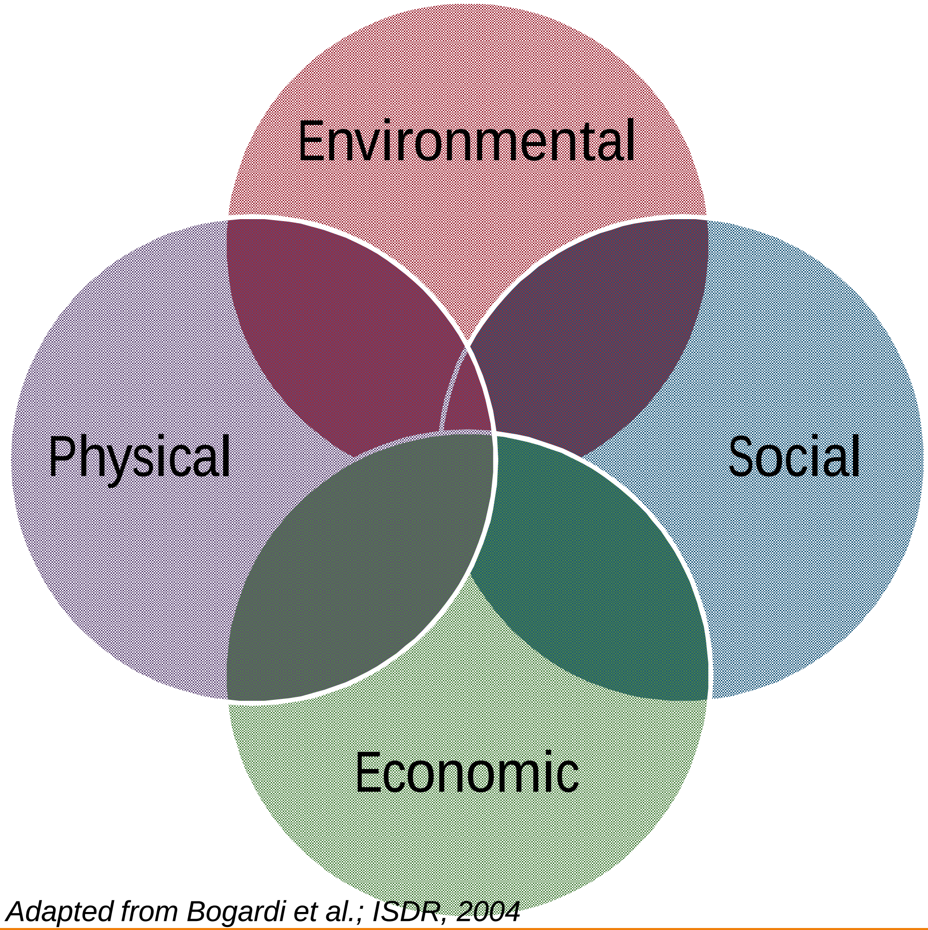
Pseudo -Equation

$$V = \frac{E \times S}{AC}$$

Overview: The Concept of Vulnerability (ISDR, 2004)

"***Vulnerability*** **is defined as the set of conditions and processes resulting from physical, social, economic, and environmental factors, which increase the susceptibility of a community to the impact of hazard" (ISDR, 2004)**

Vulnerability Factors



Source: Adapted from Bogardi et al.; ISDR, 2004

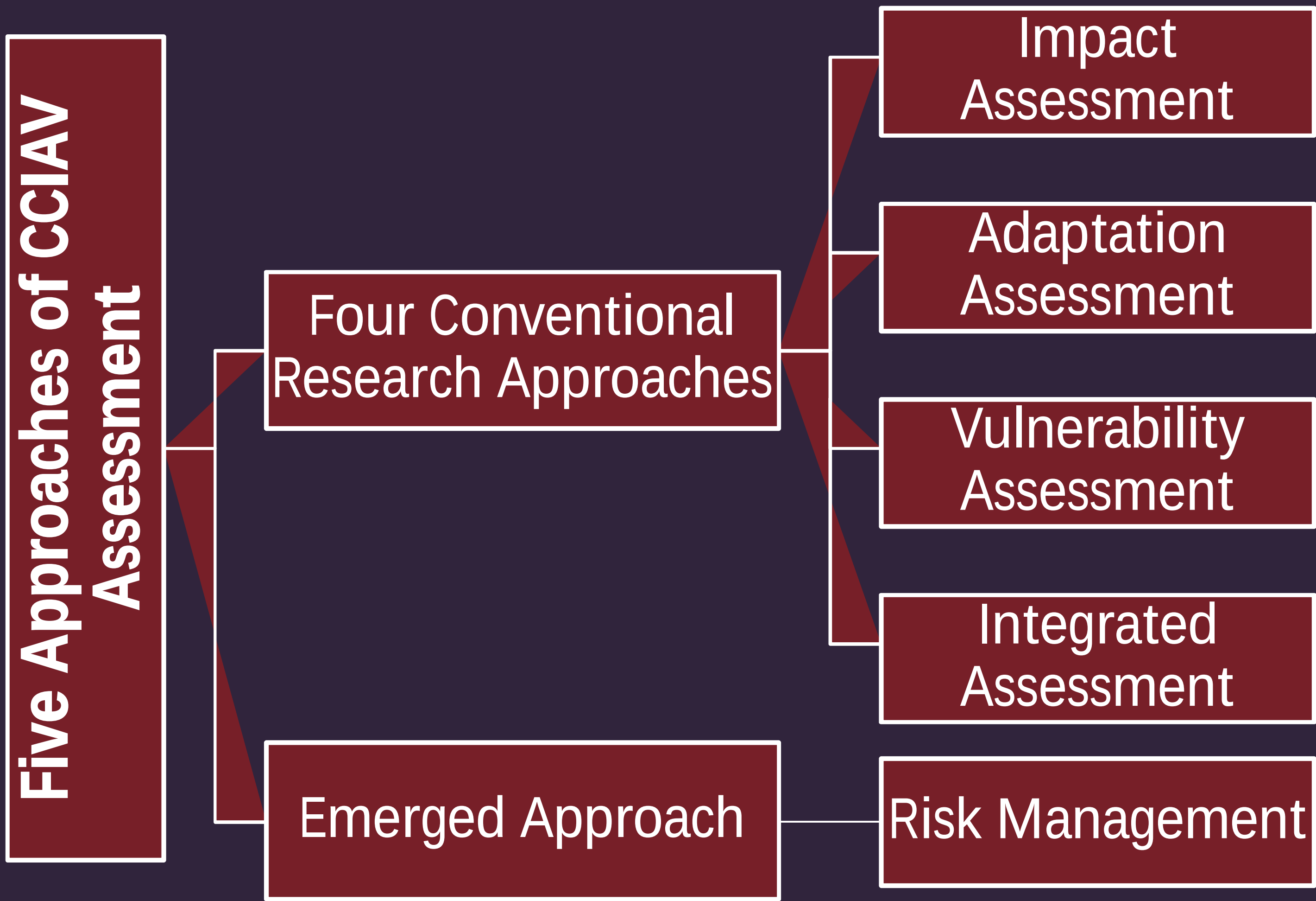
Some characteristics of different approaches to CCIAV assessment (IPCC, 2007)

*Note that vulnerability and adaptation-based approaches are highly complementary.

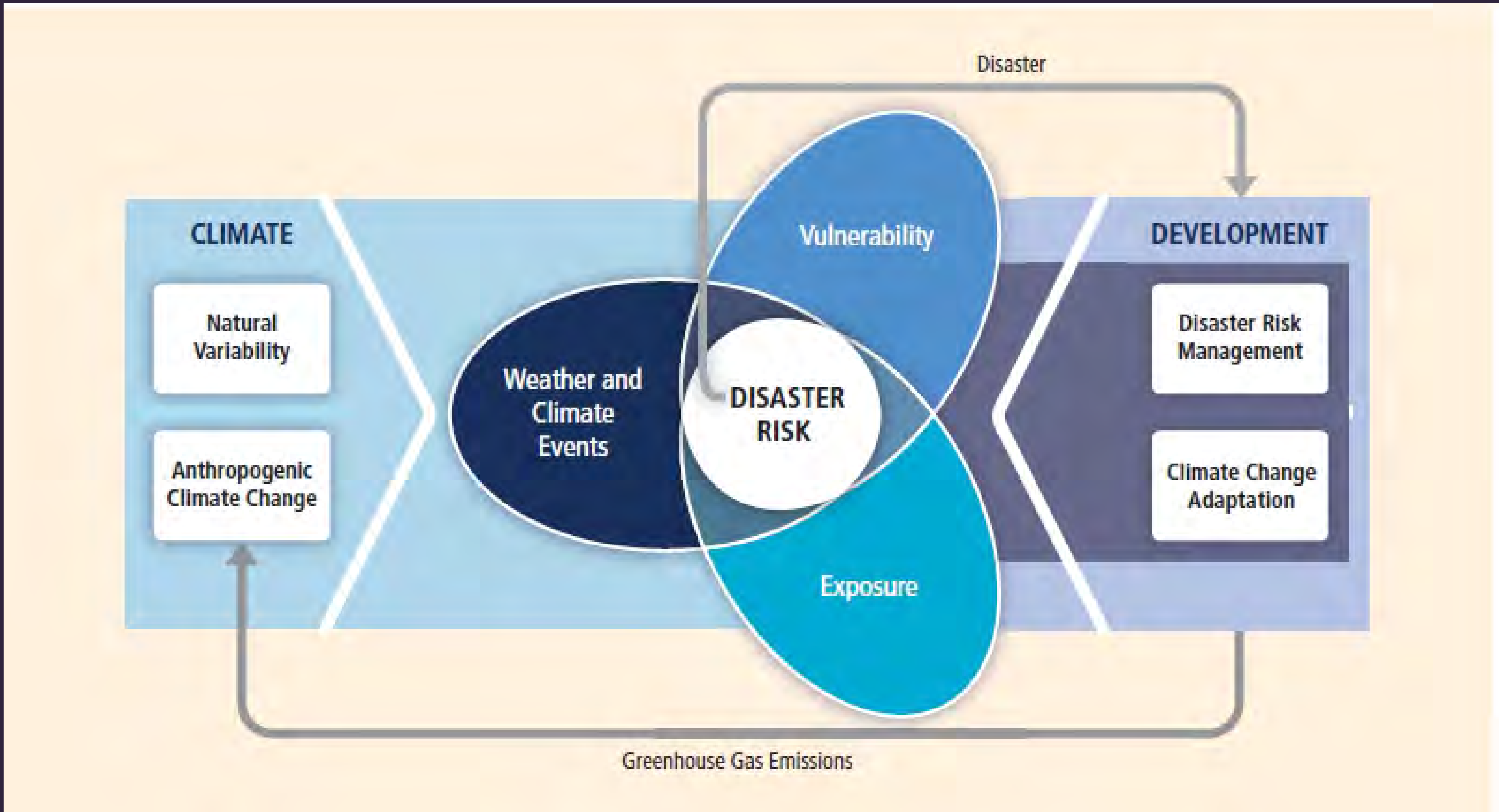
	Approach			
	Impact	**Vulnerability**	**Adaptation**	**Integrated**
Scientific objectives	Impacts and risks under future climate	Processes affecting vulnerability to climate change	Processes affecting adaptation and adaptive capacity	Interactions and feedbacks between multiple drivers and impacts
Practical aims	Actions to reduce risks	Actions to reduce vulnerability	Actions to improve adaptation	Global policy options and costs
Research methods	Standard approach to CCIAV Drivers-pressure-state-impact-response (DPSIR) methods Hazard-driven risk assessment	Vulnerability indicators and profiles Past and present climate risks Livelihood analysis Agent-based methods Narrative methods Risk perception including critical thresholds Development/sustainability policy performance Relationship of adaptive capacity to sustainable development		Integrated assessment modelling Cross-sectoral interactions Integration of climate with other drivers Stakeholder discussions Linking models across types and scales Combining assessment approaches/methods
Spatial domains	Top-down Global → Local	Bottom-up Local → Regional (macro-economic approaches are top-down)		Linking scales Commonly global/regional Often grid-based
Scenario types	Exploratory scenarios of climate and other factors (e.g., SRES) Normative scenarios (e.g., stabilisation)	Socio-economic conditions Scenarios or inverse methods	Baseline adaptation Adaptation analogues from history, other locations, other activities	Exploratory scenarios: exogenous and often endogenous (including feedbacks) Normative pathways
Motivation	Research-driven	Research-/stakeholder-driven	Stakeholder-/research-driven	Research-/stakeholder-driven

Source: IPCC AR-4, 2007

Framework for CCIAV Assessment
(IPCC AR-4, 2007)

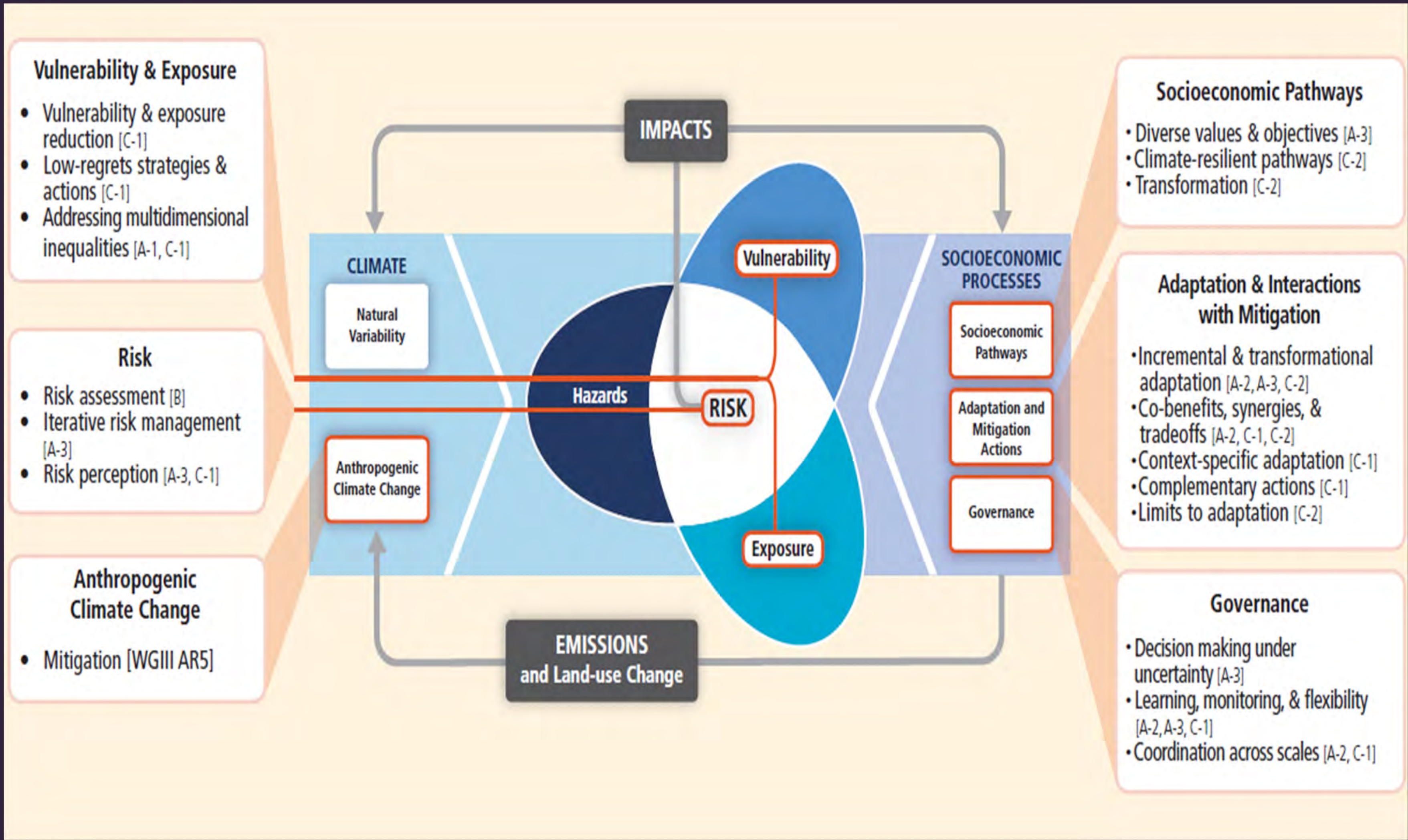


Key Concept and Scope of SREX (2012) Report



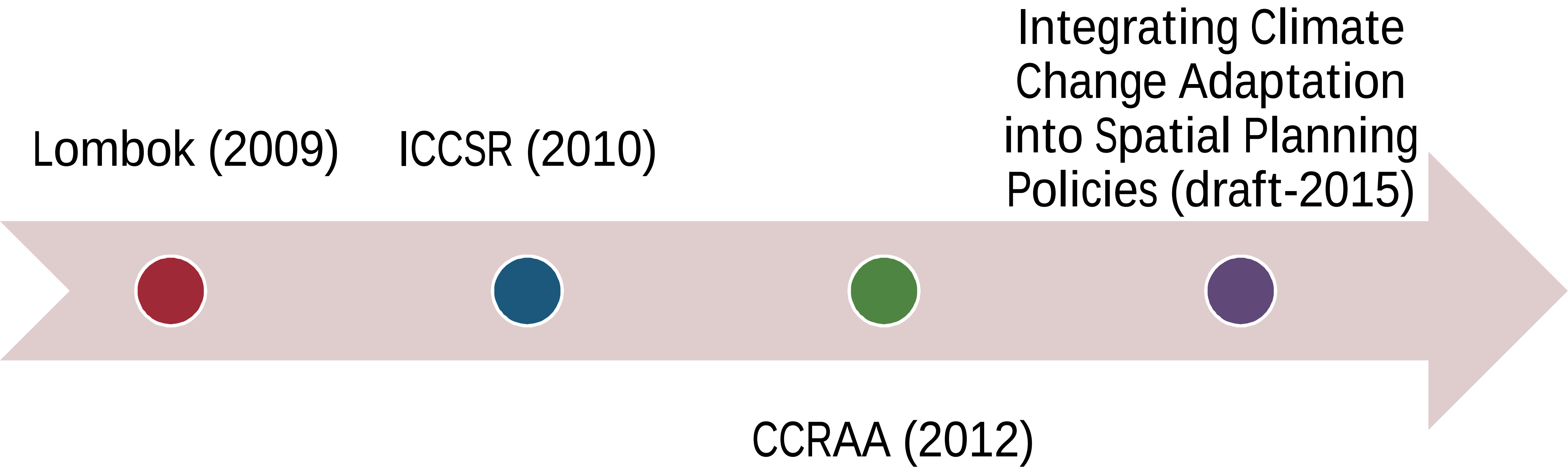
Source: IPCC, 2012

Risk Assessment – IPCC AR-5, 2014



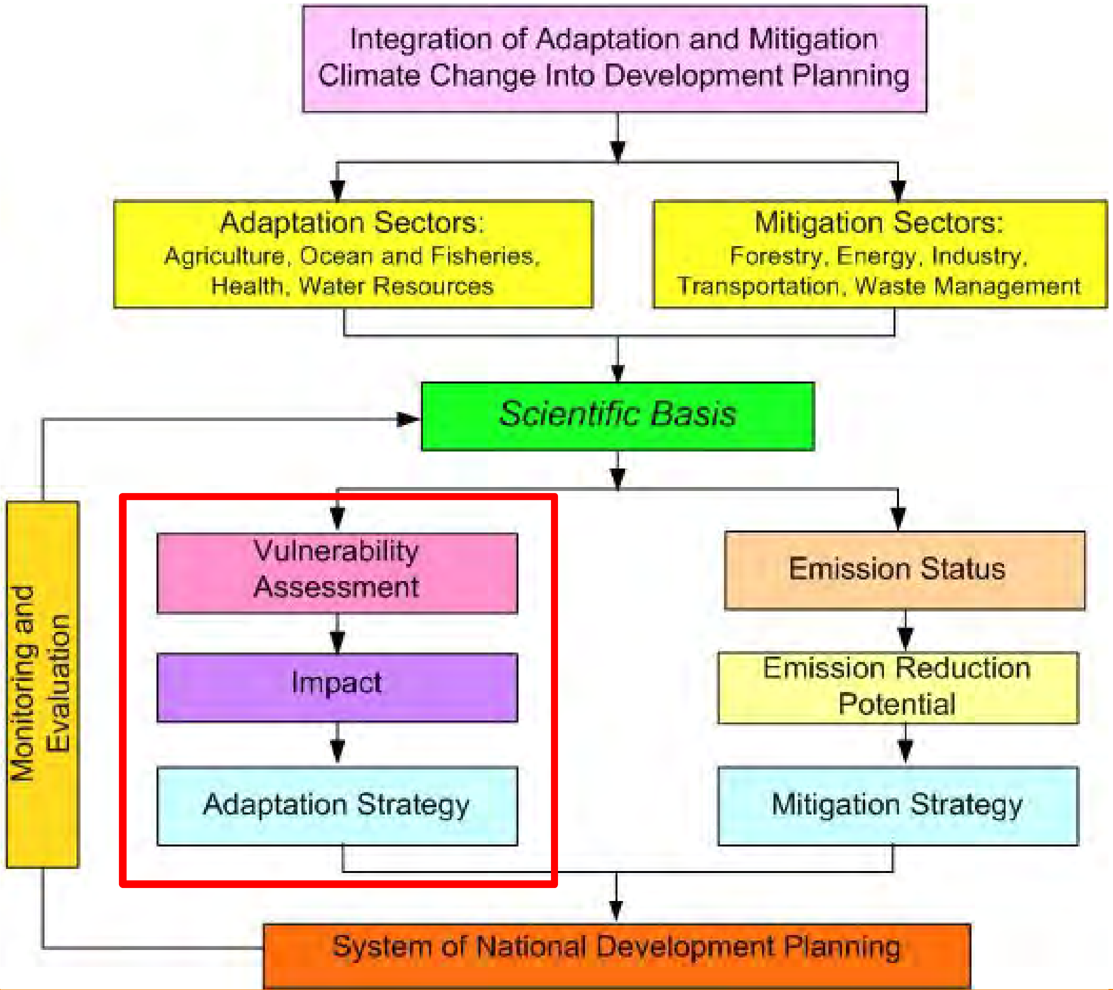
Source: IPCC AR-5, 2014

Development of Applied Risk Assessment Framework in Indonesia



Indonesia Climate Change Sectoral Roadmap (2010)

Roadmap Development Approach



- The ICCSR serves as a detailed policy **guidance** and **mainstreaming tool** for the sectoral and cross-sectoral development programs in order to take up considerations of **climate change** into all aspects of **development planning**
- The Development of Roadmap has applied a **Risk Assessment Framework**

$$\boxed{R = H \times V}$$

Where:

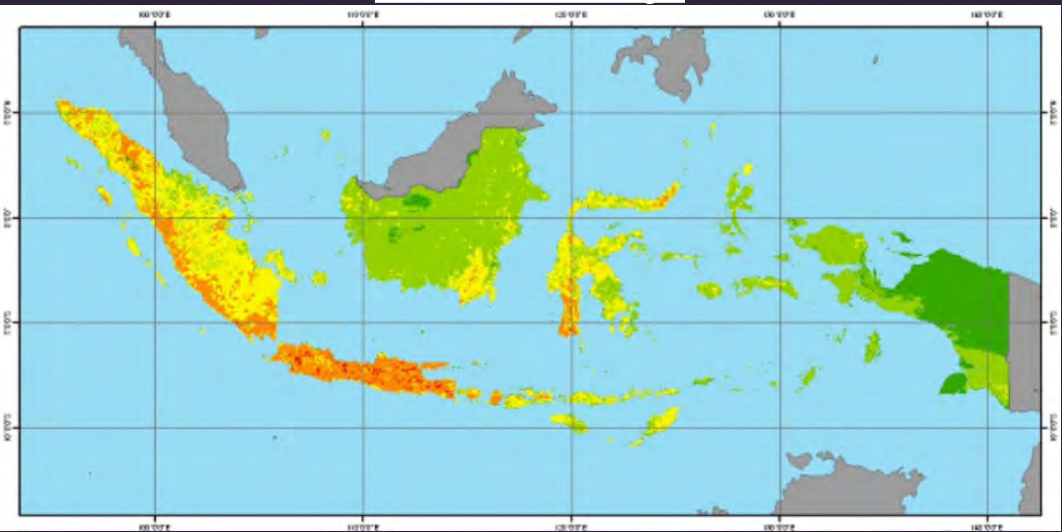
H = Hazard

V = Vulnerability

- The project begin with the development of regional climate change projections, continued with analysis on the impact of climate change on each of priority sectors

Source: National Development Planning Agency (Bappenas), 2010 (adapted)

Water Shortage



Drought

Flood

1, Very Low
2, Low
3, Moderate
4, High
5, Very High

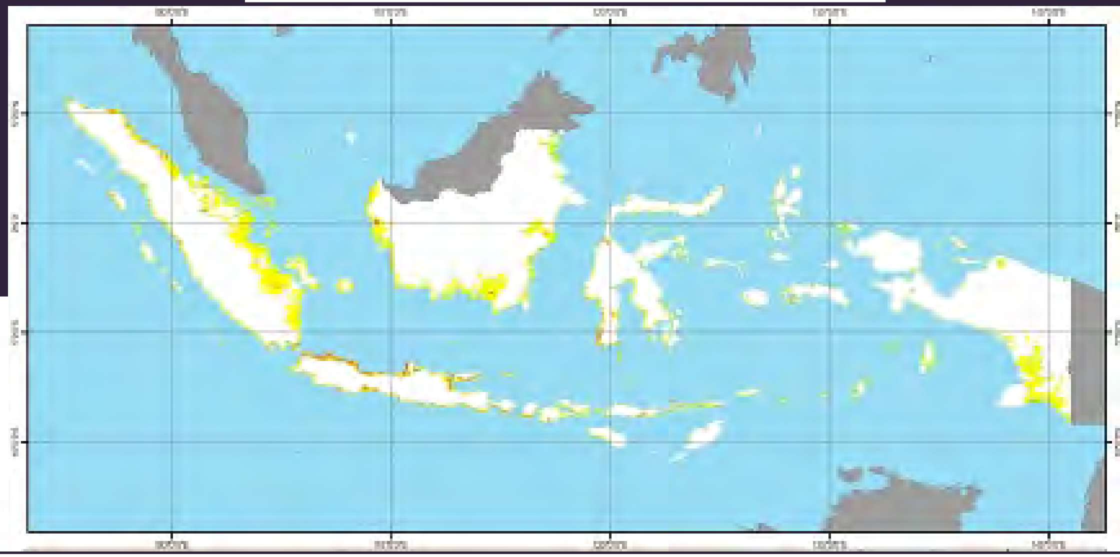
WATER SECTOR RISK MAP

Source: National Development Planning Agency (Bappenas), 2010

Scenario-1 HHWL+SLR

Scenario-2 HHWL+SLR+ENSO

Scenario-3 HHWL+SLR+ENSO+SS



MARINE & FISHERIES SECTOR RISK MAP

Source: National Development Planning Agency (Bappenas), 2010

AGRICULTURE SECTOR

Vulnerability of Paddy Field toward Flood/Inundation

Province	Highly Vulnerable	Vulnerable	Least Vulnerable	Non-Vulnerable	Total
West Java	27.654	205.304	324.734	409.984	967.676
Banten	7.509	53.472	89.291	42.259	192.531
Central Java	49.569	503.803	188.688	303.346	1.045.406
D.I. Yogyakarta	-	15.301	34.459	13.622	63.382
East Java	105.544	306.337	533.447	359.630	1.304.958
Total Area	162.622	1.084.217	1.170.619	1.128.841	3.573.953
Percentage	4,5	30,3	32,7	32,5	100,0

Vulnerability of Paddy Field toward Drought

Region/Province	Highly Vulnerable	Vulnerable	Total Area
West Java	-	30.863	971.474
Banten	-	26.588	192.904
Central Java	2.322	142.575	1.053.882
DI Yogyakarta	-	3.652	69.063
East Java	1.580	70.802	1.313.726
Bali	-	14.758	85.525
South East Nusa	38.546	105.687	214.576
Lampung	29.378	168.887	278.135
South Sumatera	-	184.993	439.668
North Sumatera	2.055	342.159	524.649
Total Area	73.881	1.090.964	5.143.602

Source: National Development Planning Agency (Bappenas), 2010

HEALTH SECTOR RISK MAP

Dengue Fever

1, Very Low
2, Low
3, Moderate
4, High
5, Very High

Malaria

Diarrhea

Source: National Development Planning Agency (Bappenas), 2010

Summary of Climate Change Risks by Region

Risks	Sumatra	Java-Bali	Kalimantan	Sulawesi	Nusa Tenggara	Moluccas	Papua
Water shortage	M, H, VH	H, VH	L, M	H, VH	H, VH	L, M	L
Flood	H, VH	H, VH	L, M, H	L, M, H	L	L	M, L
Drought	H, VH	H, VH	L	L, M	L, M, H	L	L
Coastal inundation	M, H	M, H, VH	M, H, VH	M, H	M, H	M, H	M, H
Paddy field drought	H, VH	H, VH	-	-	H, VH	-	-
Dengue fever	L, M, H	L, M, H	L, M	L, M	L, M	L, M	L, M, H
Malaria	L, M	L, M, H	L, M	L, M, H	L, M, H, VH	M, H	M, H, VH
Diarrhea	L, M, H	L, M, H	L, M, H	L, M, H	L, M, H	L, M, H	L, M, H VH

VH = Very High; H = High; M = Medium; L = Low; VL = Very Low

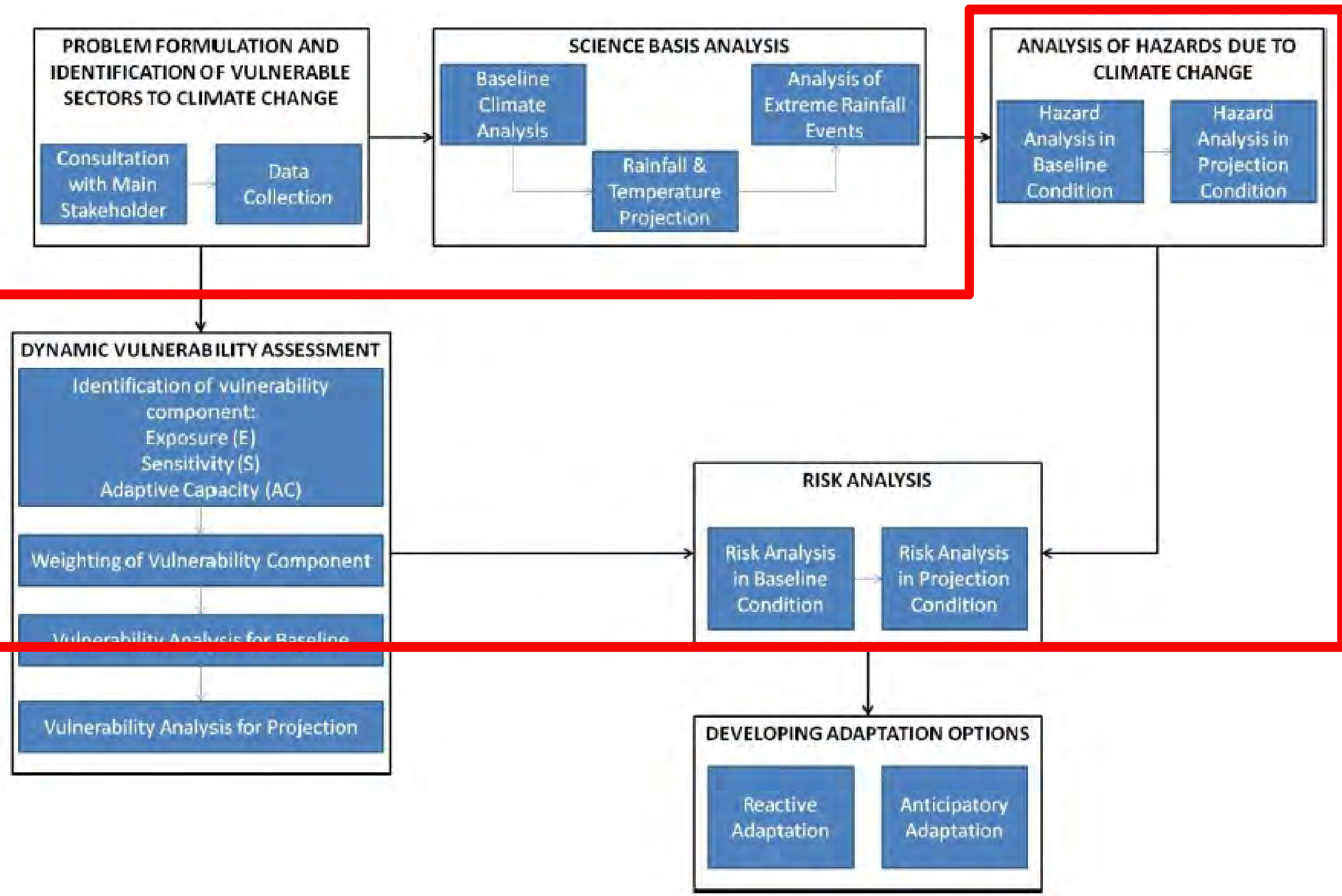
Source: National Development Planning Agency (Bappenas), 2010

Climate Change Risk and Adaptation Assessment (2012)

- The CCRAA was conducted in three selected sites: **Greater Malang**, **South Sumatera**, and **Tarakan**
- The risk assessment was conducted on four affected sectors, including **coastal**, **water**, **agriculture**, and **health** sectors
- As a comprehensive approach, the CCRAA covers activities to identify vulnerable sector toward climate change, formulate the solutions, as well as mainstream the adaptation strategy into development planning

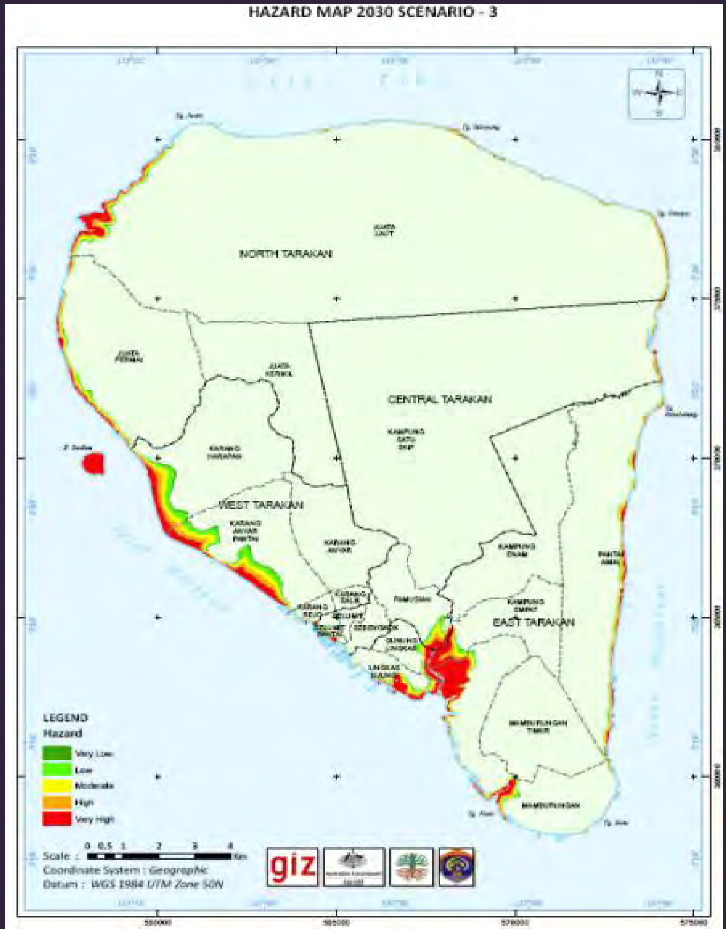
Source: Ministry of Environment, 2012

Climate Risk Assessment Process in KRAPI Approach

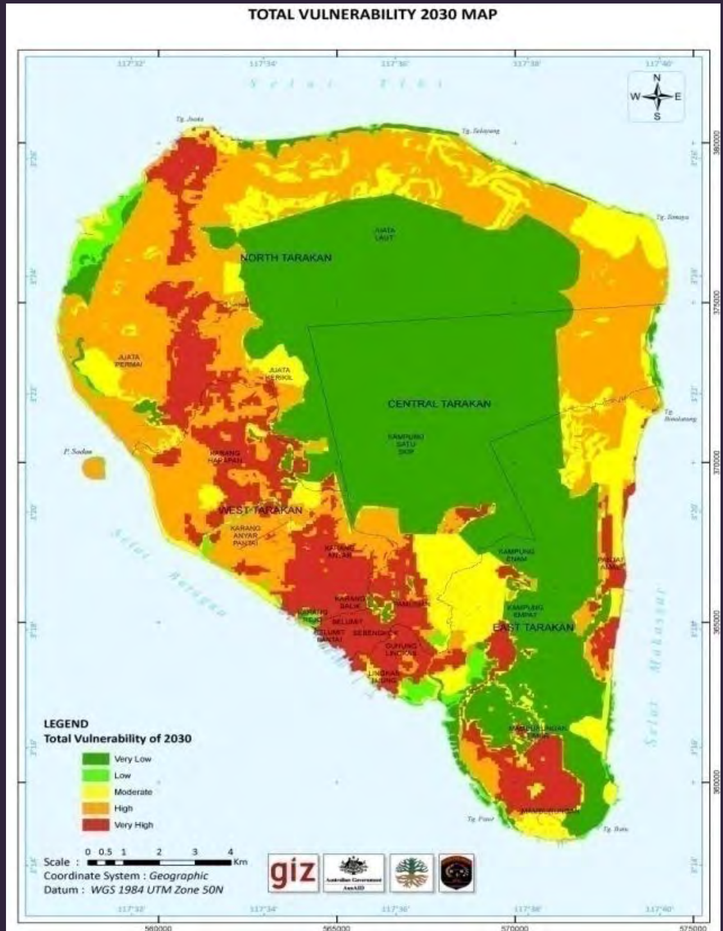


COASTAL SECTOR - Tarakan

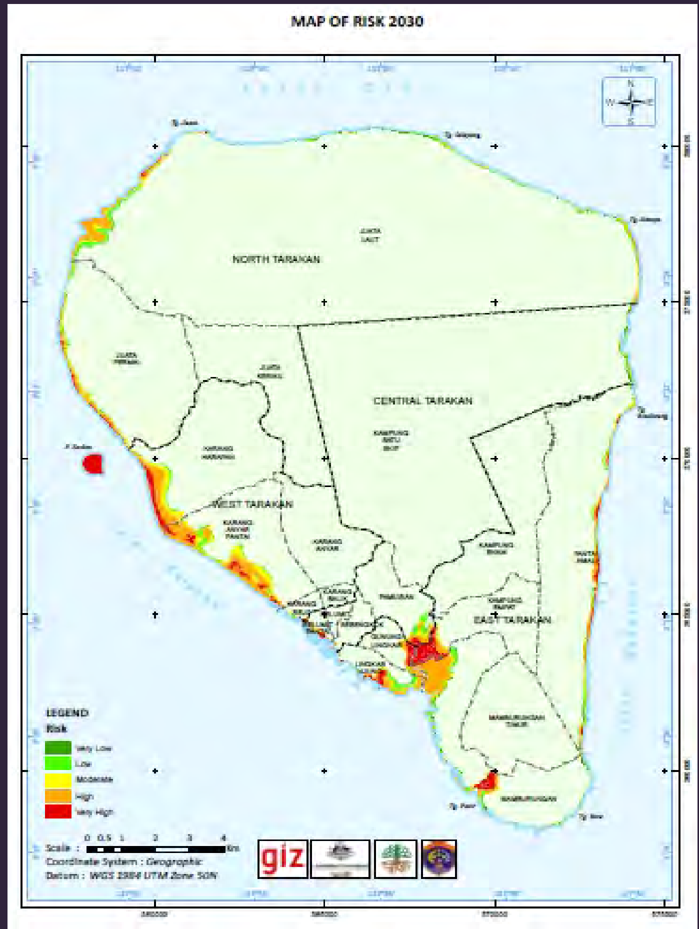
Hazard Map



Vulnerability Map



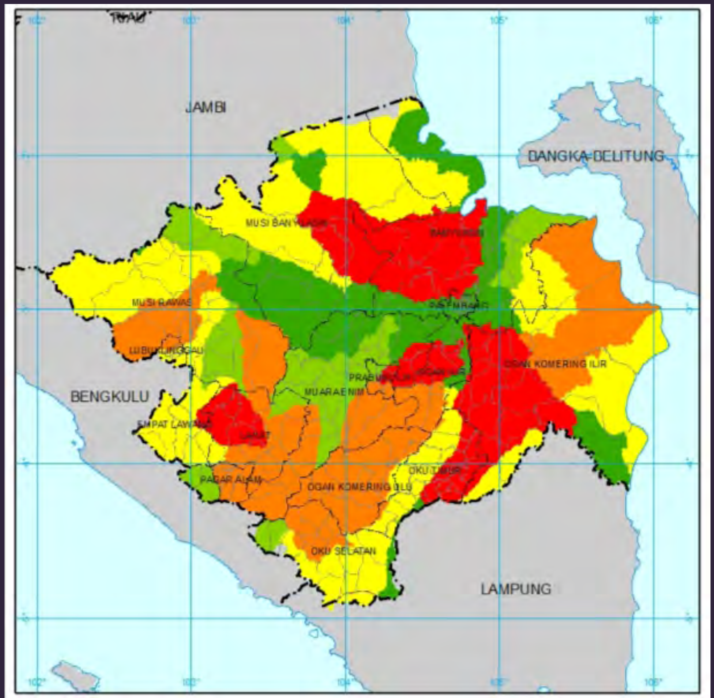
Risk Map



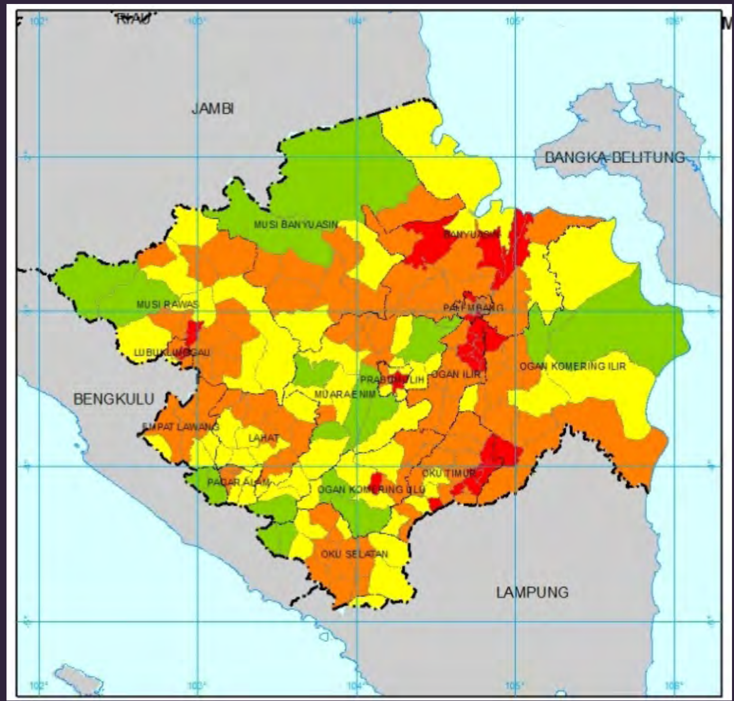
Source: Ministry of Environment, 2012

WATER SECTOR (WATER SHORTAGE) – South Sumatera

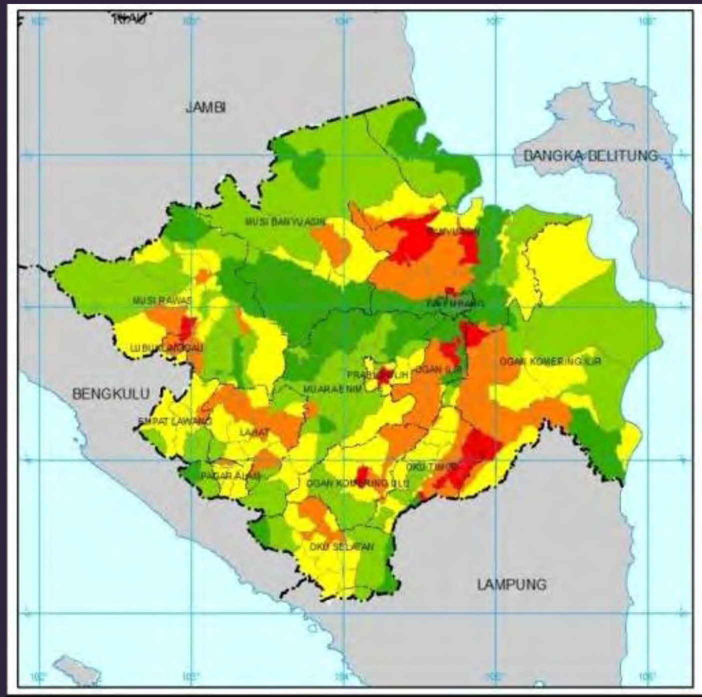
Hazard Map



Vulnerability Map



Risk Map

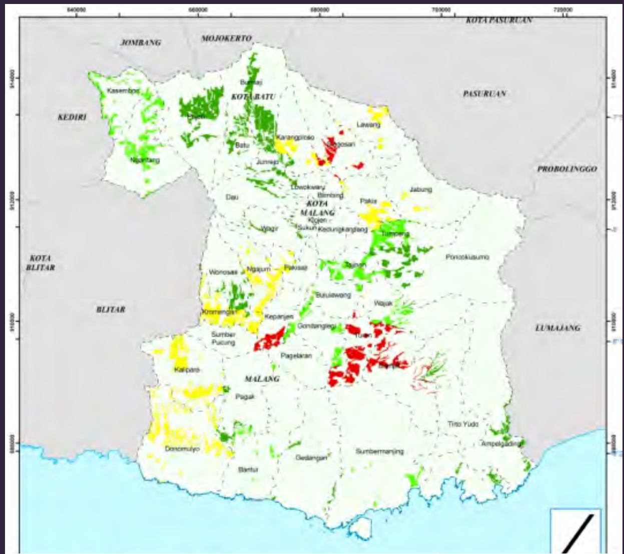
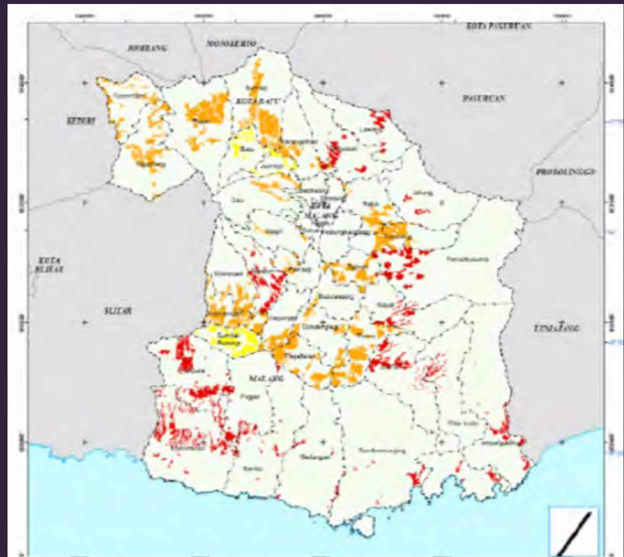
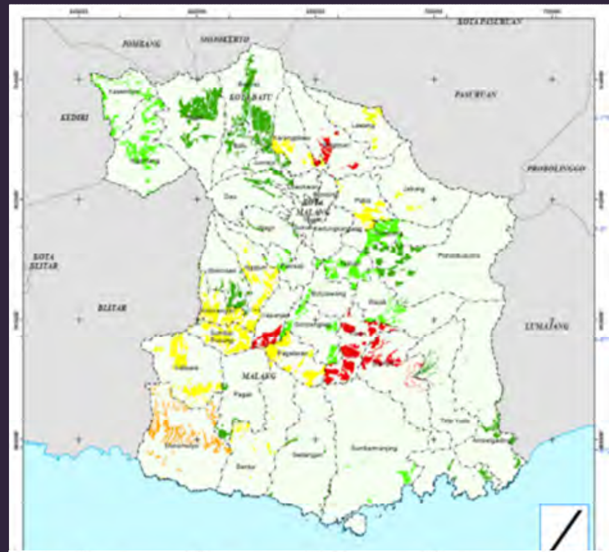
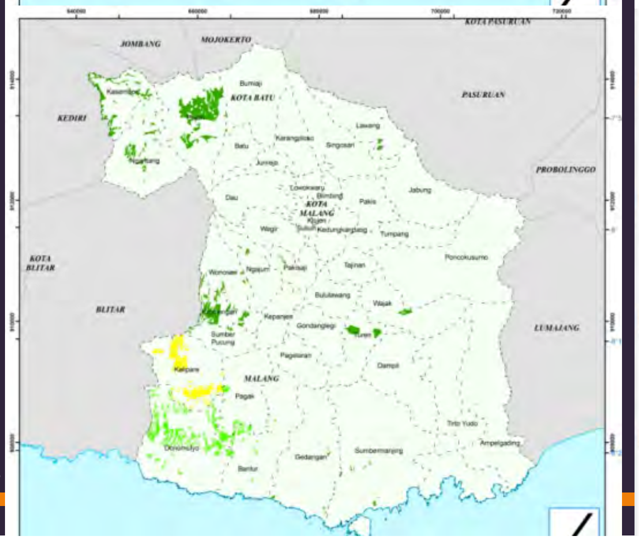
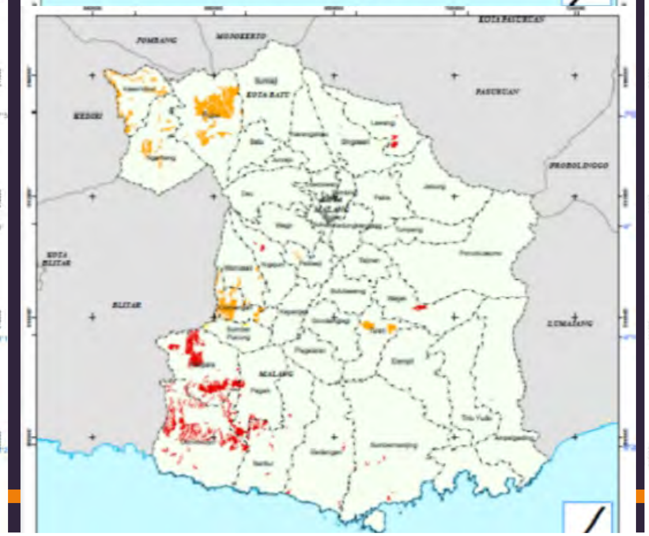
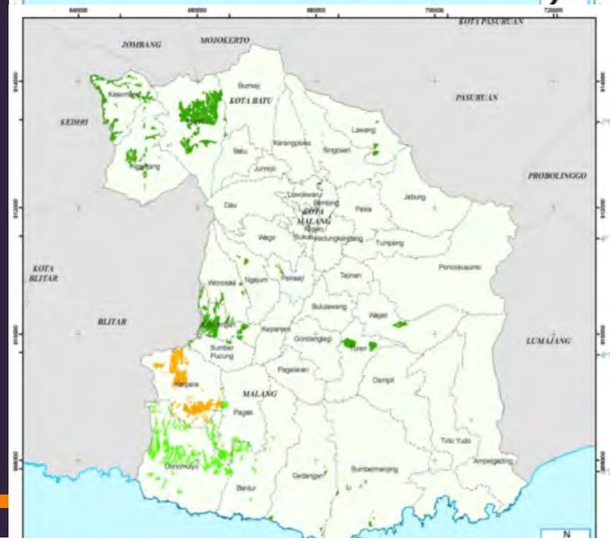


Projection

- 1, Very Low
- 2, Low
- 3, Moderate
- 4, High
- 5, Very High

Source: Ministry of Environment, 2012

AGRICULTURE SECTOR – Greater Malang

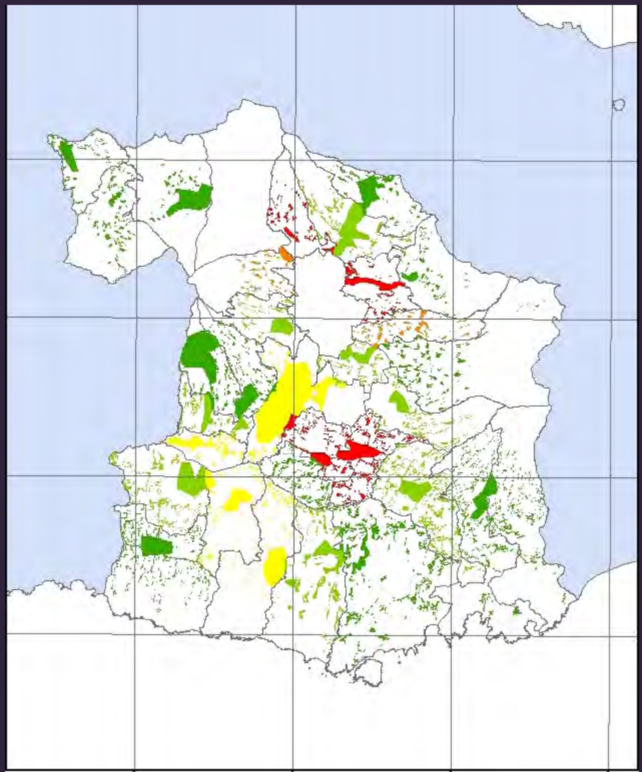
	Hazard Map	Vulnerability Map	Risk Map
Wetland Paddy Projection			
Dryland Paddy Projection			

- 1, Very Low
- 2, Low
- 3, Moderate
- 4, High
- 5, Very High

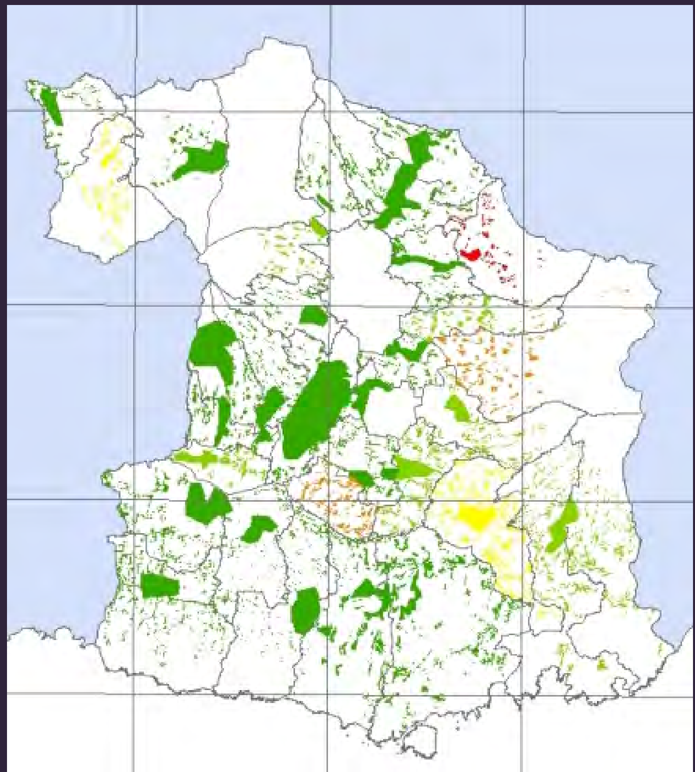
Source:
Ministry of Environment, 2012

HEALTH SECTOR (DHF) – Greater Malang

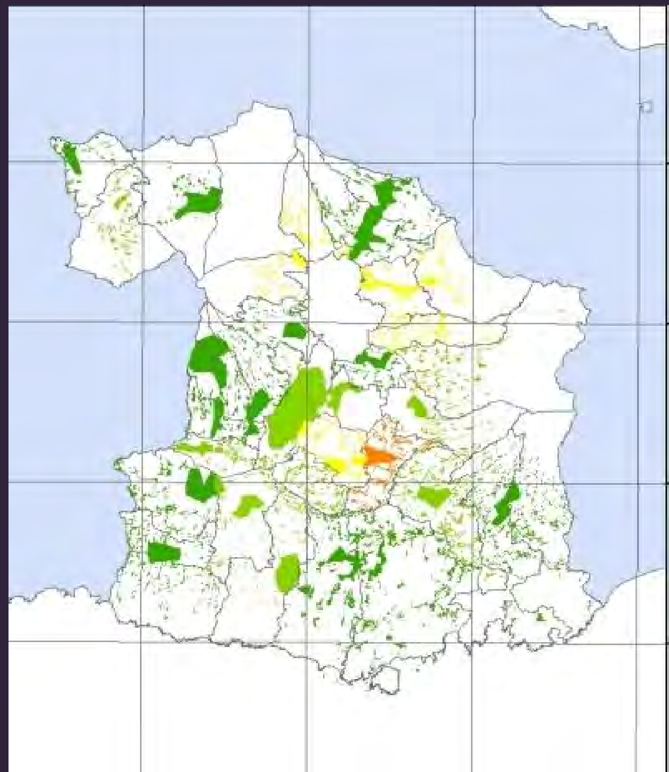
Hazard Map



Vulnerability Map



Risk Map



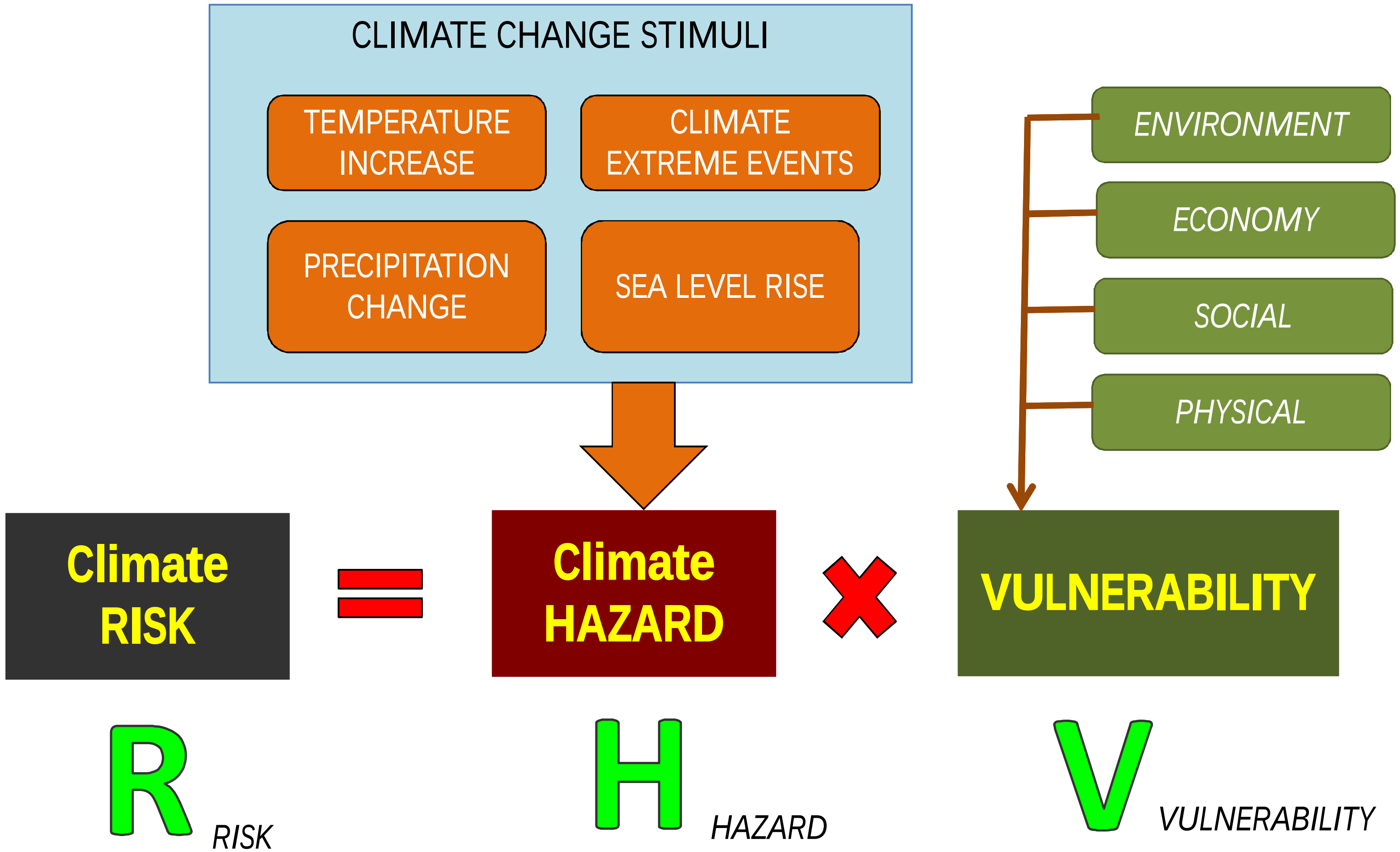
Projection

- 1, Very Low
- 2, Low
- 3, Moderate
- 4, High
- 5, Very High

Source: Ministry of Environment, 2012

Integrating Climate Change Adaptation into Spatial Planning Policies (draft-2015)

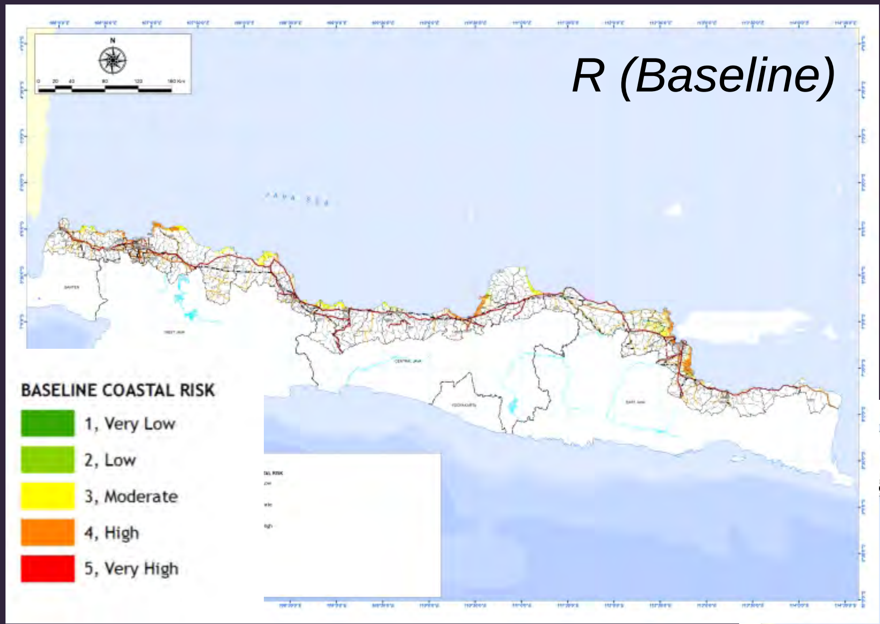
Concept of Risk Assessment

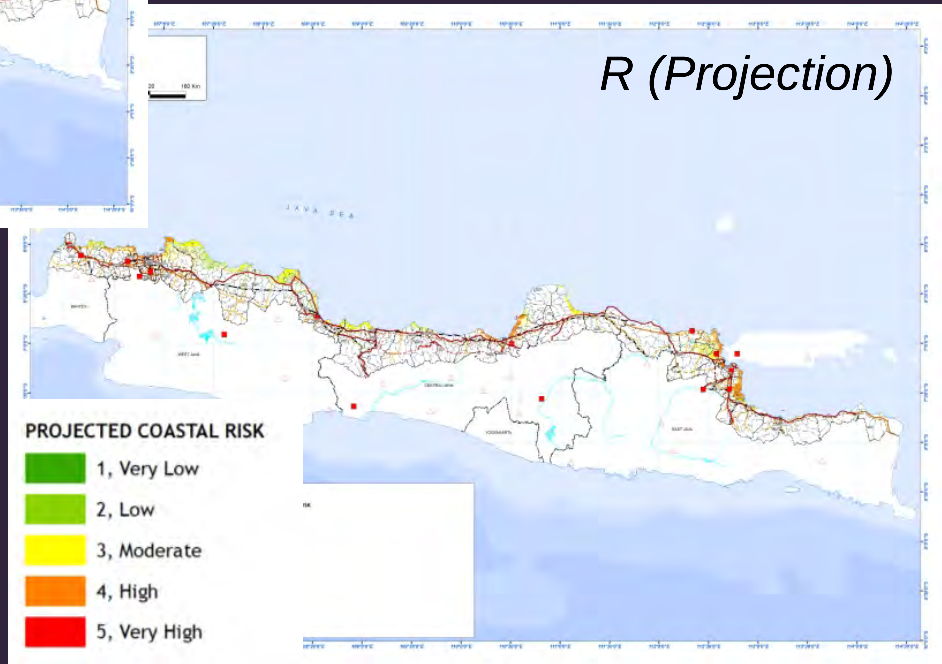


- Hazard Type: **Landslide, Drought, Flood, and Coastal**
- Selected Study Sites: Region 1 (Java Island) and Region 2 (East part of Indonesia: South Sulawesi)

Psedo Equation (Wisner, et.al, 2004)

Coastal Inundation Risk Assessment in North Coast of Java Island



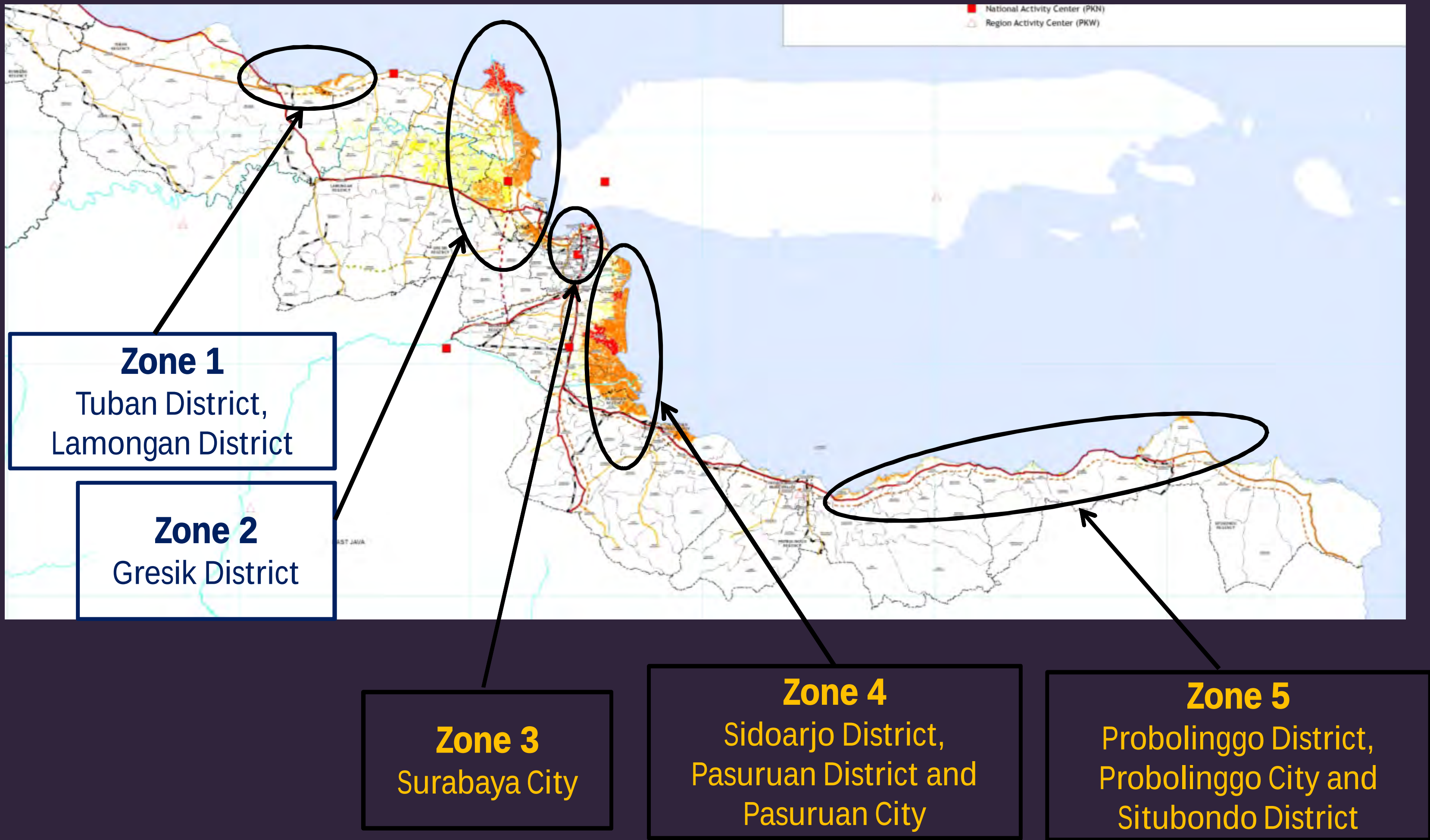


Source: Ministry of Agrarian and Spatial Planning, draft-2015


EMARANG GUDANG
+1M


Adaptation Zone in North Coast of East Java Province - Based on Risk Profile

COASTAL INUNDATION RISK ADAPTATION MAP IN EAST JAVA PROVINCE



Source: Ministry of Agrarian and Spatial Planning, draft-2015

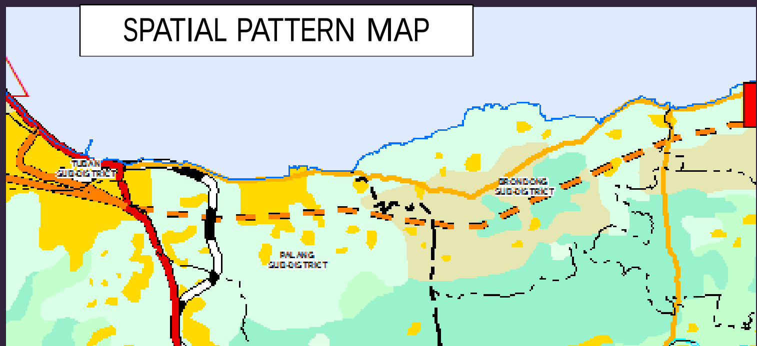
COASTAL INUNDATION RISK MAP IN NORTH COAST OF EAST JAVA

Zone 1 North Coast of East Java Province: (Tuban District and Lamongan District)

INUNDATION HAZARD MAP

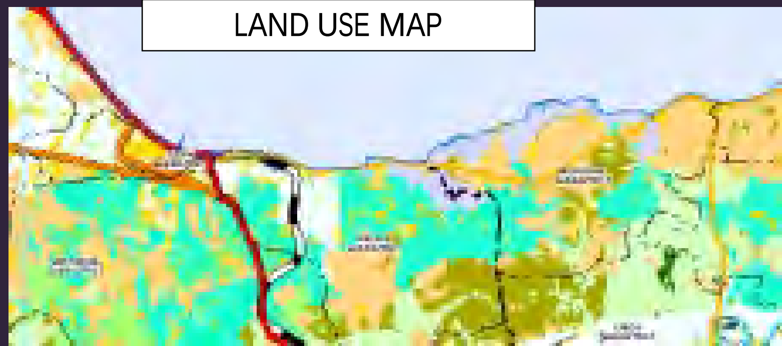
INUNDATION RISK MAP

SPATIAL PATTERN MAP



- Hutan Produksi
- Hutan Produksi Terbatas
- Pertanian
- Perkebunan
- Permukiman
- Permukiman perdesaan
- Permukiman perkotaan
- Industri

LAND USE MAP



- Permukiman
- Bandara Internasional
- Hutan Mangrove
- Hutan
- Sawah
- Sawah non-irigasi
- Perkebunan
- Pertanian
- Semak belukar
- Padang rumput
- Lahan berpasir
- Vegetasi Lainnya
- Perikanan
- Sungai
- Rawa
- Danau
- Bendungan

Source: Ministry of Agrarian and Spatial Planning, draft-2015

Adaptation Strategies to Spatial Pattern

Zone 1 North Coast of East Java

SPATIAL PATTERN	Area (Ha)	OBJECTIVE	ADAPTATION OPTIONS
Industrial Area	162,14	Accommodate	Restrict developed area at inundated area
		Protect	Structural protection at existing developed area
		Retreat	Encourage the development of new industry on the outside of inundated area
Settlement Area	133,03	Accommodate	Settlement control at inudated area
			Flood-proofing to residential buildings
		Protect	Structural protection at existing developed area
		Retreat	Encourage the development of new settlement on the outside of inundated area
Protected Area	34,41	Accommodate	Encourage the implementation of protected area spatial pattern
Agricultural Area	786,08	Accommodate	Agricultural adaptation sectoral policy (choosing the commodity)
			Tidal irrigation/ construct the reservoir (temporary saving water place)

Source: Ministry of Agrarian and Spatial Planning, draft-2015

THANK YOU!