RESILIENT SHORES

VIET NAM'S COASTAL DEVELOPMENT BETWEEN OPPORTUNITY AND DISASTER RISK

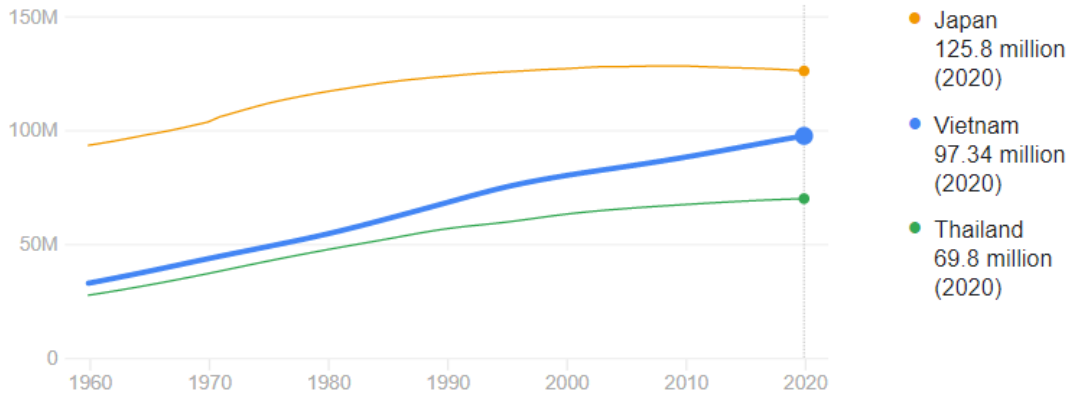
VIET NAM DISASTER AND DYKE MANAGEMENT AUTHORITY

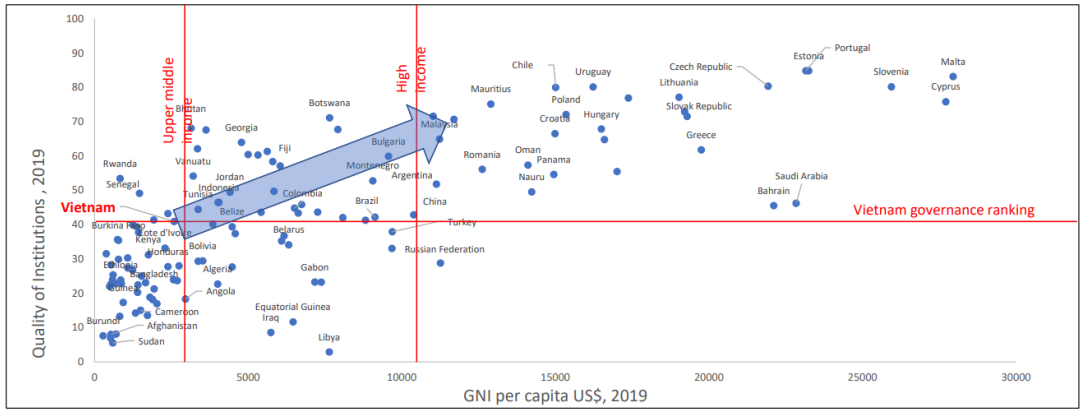
WORLD BANK GROUP
Climate Change

GFDRR
Global Facility for Disaster Reduction and Recovery

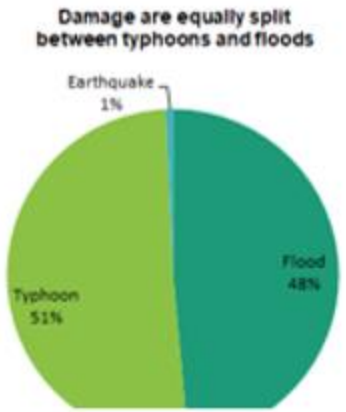
Vietnam at the glance

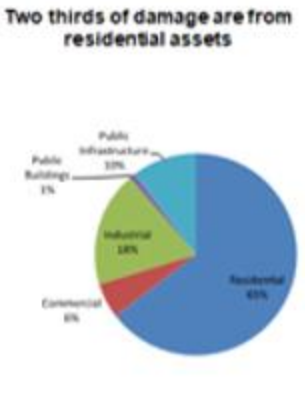
- Population: expected to expand to 120 million before tailing off around 2050.
- Low middle income country: Between 2002 and 2021, GDP per capita increased 3.6 times, reaching almost US$3,700.
- Expected to be a high-income country by 2045
- One of the largest countries in exporting rice and other agriculture products





Natural shocks





With a coastline of 3,260 kilometers

2007 – 2017 time period:

- Disaster Damage Cost: 288 trillion VND
- Total number of casualties: 3591
- Each year, on average, Vietnam experiences losses of $3.75 billion (1.5% GDP) due to floods and typhoons. **60% of these losses are concentrated along the coast**
- **Trending: more unusual and extreme**

Resilient Shores: Diagnosis and Solutions

Natural hazards

1 | Flooding, as a combination of:

- **Fluvial flooding**| 5, 10, 25, 50, 100, 250, and 500-year return periods
- **Pluvial flooding**| 5, 10, 25, 50, 100, 250, and 500-year return periods
- **Coastal flooding** | 5, 10, 25, 50, 100, 250, and 500-year return periods
- **Sea level rise** | Baseline (0cm), moderate (28cm) and high (60cm) scenarios for sea level rise in line with MONRE scenarios

- 2 | **Storms**, measured in wind speeds (50, 100, 250- year return periods)
- **3 | Coastal erosion (1990 to 2015 erosion extents)**
- 4 | **Saline intrusion**, caused by drought and sea level rise

Coastal Development

1 | **Coastal towns and urbanization**

2 | **Key economic sectors**

- **Agriculture**
- **Aquaculture and fisheries**
- **Industrial parks**
- **Tourism**

3 | **Essential public services**

- **Schools**
- **Healthcare facilities**

4 | **Lifeline infrastructure systems**

- **Energy** | Generation, transmission, distribution
- **Transport** | Ports, roads

See full report: https://www.worldbank.org/en/country/vietnam/brief/vietnam-resilient-shores

What is the level of risk?

Natural risks are substantial across all sectors

People

11.8 million people are directly exposed to the threat of intense flooding

Chapter 2 >>

Towns

Over **35%** of coastal settlements are located on eroding coastlines

Chapter 2 >>

Economy

Flood risks in high-growth areas are nearly **twice as high** as in low-growth areas

Chapter 2 >>

Agriculture

$1 billion of agricultural GDP and **1.5 million** workers are directly exposed to the threat of intense flooding

Chapter 3 >>

Aquaculture

1.1 million tons of aquaculture production is at risk of flooding each year, corresponding to $935 million in exports

Chapter 3 >>

Tourism

42% of coastal hotels are located near eroding beaches

Chapter 3 >>

Industry

Half of all industrial zones are directly exposed to the threat of intense flooding

Chapter 3 >>

Schools

22% of schools could be directly exposed to the threat of intense flooding

Chapter 4 >>

Health care

26% of health care facilities are directly exposed to the threat of intense flooding

Chapter 4 >>

Transport

A typhoon with wind speeds of up to 200 km/h can close roads, resulting in daily losses of **$114–324 million**

Chapter 5 >>

Energy

36% of transmission lines are in forested areas, exposed to falling trees in severe storms

Chapter 5 >>

Water

52 out of 63 provinces could depend on water-stressed river basins by 2030

Chapter 5 >>

Economic exposed to flooding each year

Province	Coastal flood risk	Riverine flood risk	Coastal flood risk	Riverine flood risk	Coastal flood risk	Riverine flood risk	Coastal flood risk	Riverine flood risk
NORTHEAST								
Quang Ninh	1.5	0.6	--	--	15.7	10.2	20.3	0.8
RED RIVER DELTA								
Hai Phong City	2.9	0.1	2.4	0.1	8.3	0.9	14.2	0.4
Thai Binh	4.9	0.3	5.5	0.3	1.1	0.1	1.1	0.1
Nam Dinh	5.6	0.3	4.1	0.2	0.8	0.0	1.4	1.4
Ninh Binh	3.0	0.1	1.5	0.1	25.3	0.9	2.4	2.0
NORTH CENTRAL COAST								
Thanh Hoa	2.7	2.2	--	--	4.0	3.3	5.9	7.7
Nghe An	2.1	1.8	--	--	3.2	2.6	3.8	9.0
Ha Tinh	1.9	0.9	--	--	1.1	1.5	6.5	11.6
Quang Binh	0.7	2.1	--	--	9.6	27.9	1.1	1.4
Quang Tri	0.2	1.8	--	--	0.7	7.3	0.2	0.1
Thua Thien-Hue	0.5	1.7	--	--	15.6	41.9	1.0	1.0
SOUTH CENTRAL COAST								
Da Nang City	0.0	0.3	--	--	7.2	22.5	4.6	2.4
Quang Nam	0.0	3.2	--	--	14.4	40.1	1.5	2.9
Quang Ngai	0.1	2.4	--	--	0.4	7.7	3.2	0.3
Binh Dinh	0.1	1.8	--	--	0.5	14.4	2.7	0.7
Phu Yen	0.0	0.9	--	--	1.1	7.8	0.3	0.0
Khanh Hoa	0.1	1.3	--	--	6.5	25.2	0.8	0.9
Ninh Thuan	0.0	0.8	--	--	0.8	5.6	0.2	0.1
Binh Thuan	0.0	2.7	--	--	12.1	41.0	0.4	0.8
SOUTHEAST								
Ba Ria-Vung Tau	0.1	0.3	--	--	14.7	25.7	2.4	0.1
Ho Chi Minh City	0.8	0.1	--	--	16.0	10.8	3.3	13.7
MEKONG RIVER DELTA								
Tien Giang	3.3	0.4	5.2	6.6	2.1	3.5	0.2	0.1
Ben Tre	5.9	0.5	24.7	11.9	2.9	2.5	0.1	0.0
Tra Vinh	5.2	0.7	7.9	4.7	1.1	0.7	0.0	0.0
Soc Trang	1.9	0.6	6.3	8.8	0.0	0.3	0.0	0.0
Bac Lieu	2.0	0.1	13.0	10.6	0.1	0.1	0.0	0.0
Ca Mau	0.6	0.1	4.6	15.5	0.2	1.1	0.0	0.1
Kien Giang	1.2	2.0	3.3	0.4	12.7	18.1	0.1	0.1
COASTAL VIETNAM	**47.2**	**30.0**	**78.5**	**59.1**	**178.2**	**323.7**	**77.6**	**57.9**

Number of people exposed to coastal flooding each year

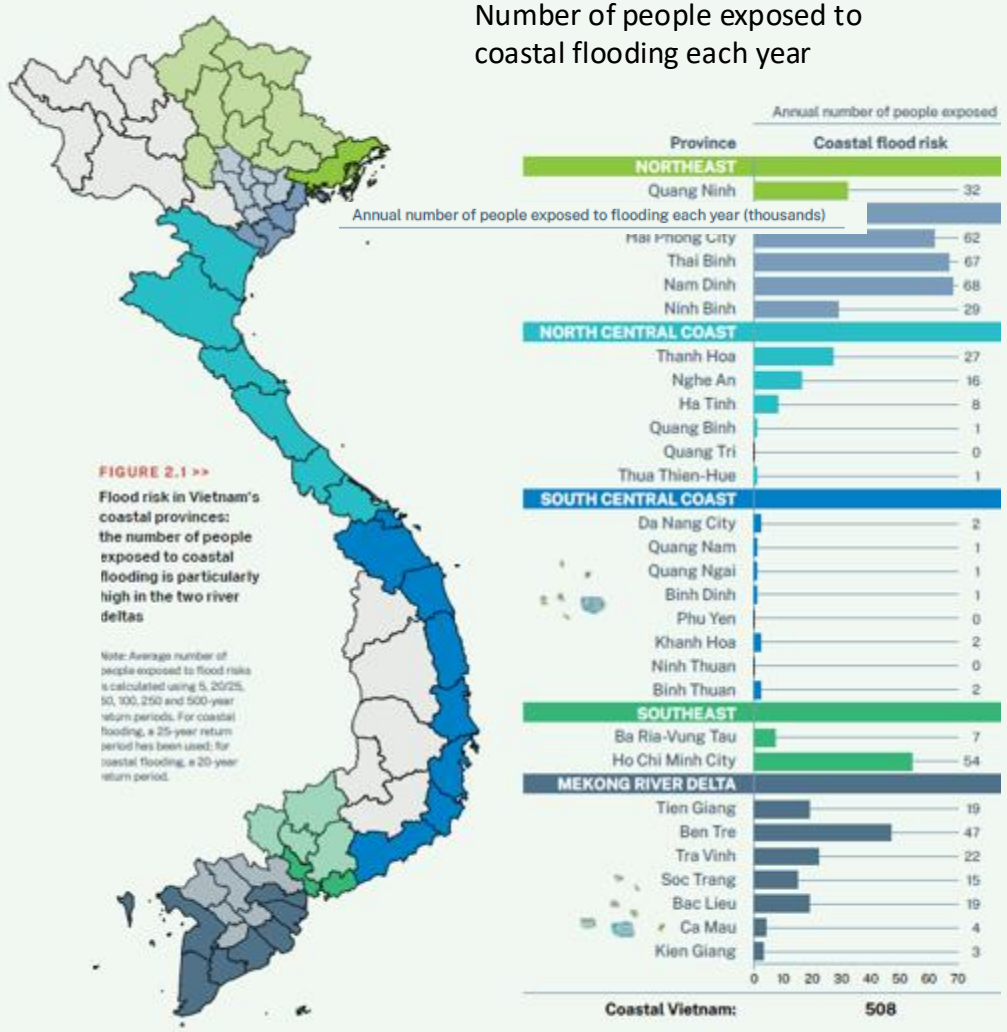


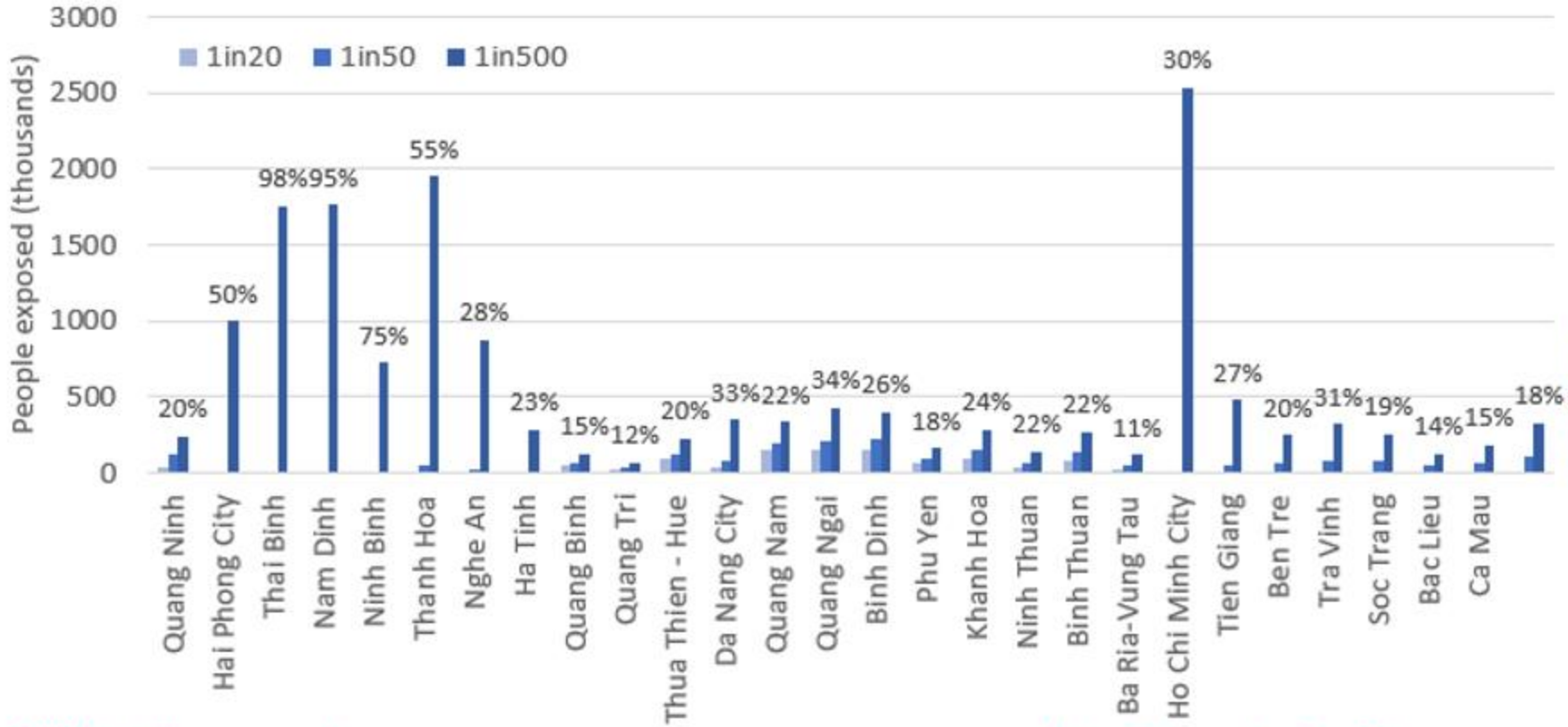
FIGURE 2.1 >>
Flood risk in Vietnam's coastal provinces: the number of people exposed to coastal flooding is particularly high in the two river deltas

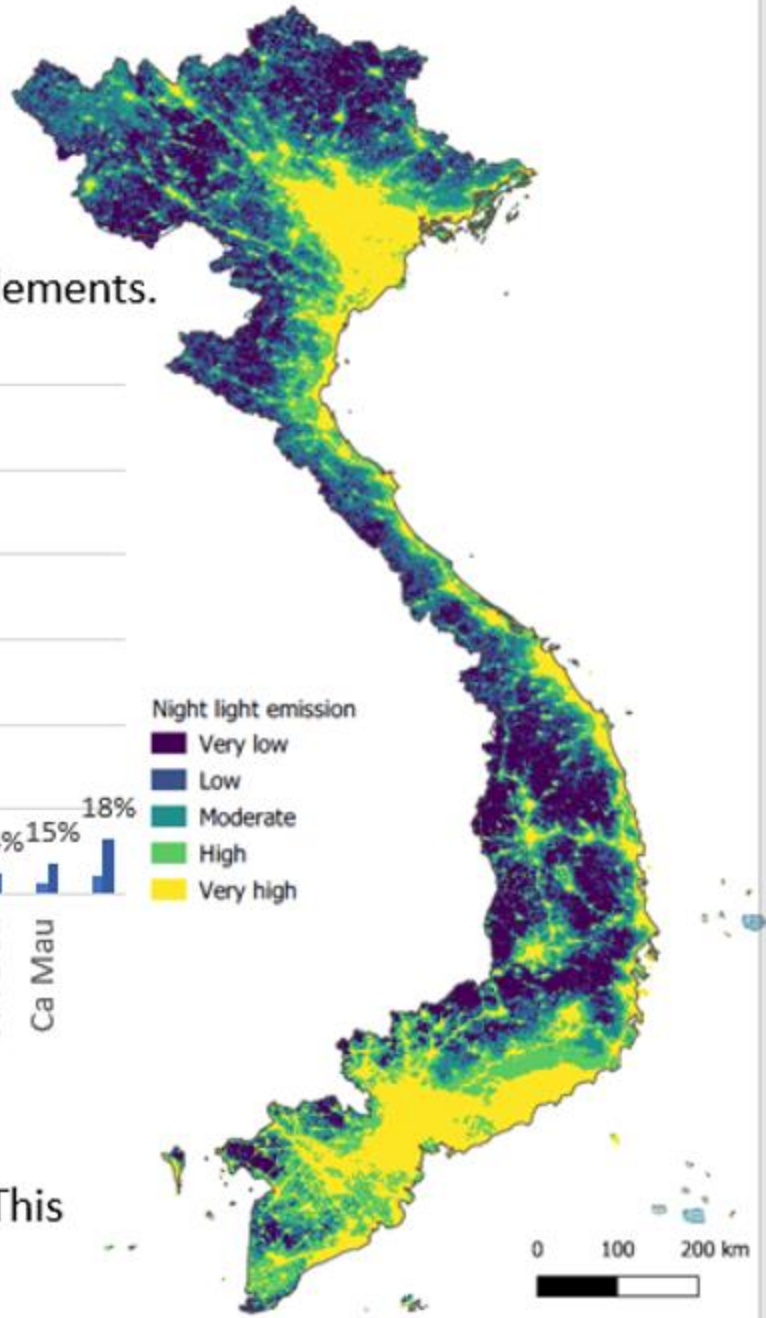
Note: Average number of people exposed to flood risks is calculated using 5, 20/25, 50, 100, 250 and 500-year return periods. For coastal flooding, a 25-year return period has been used; for coastal flooding, a 20-year return period.

The population, agriculture and urban in the river deltas are particularly at risk of flooding, tourism and industrial sectors are vulnerable along the central coast

Urbanization | flooding

→ At least 28% of Vietnam's 3,000 km of coastline is now built-up by cities and settlements.

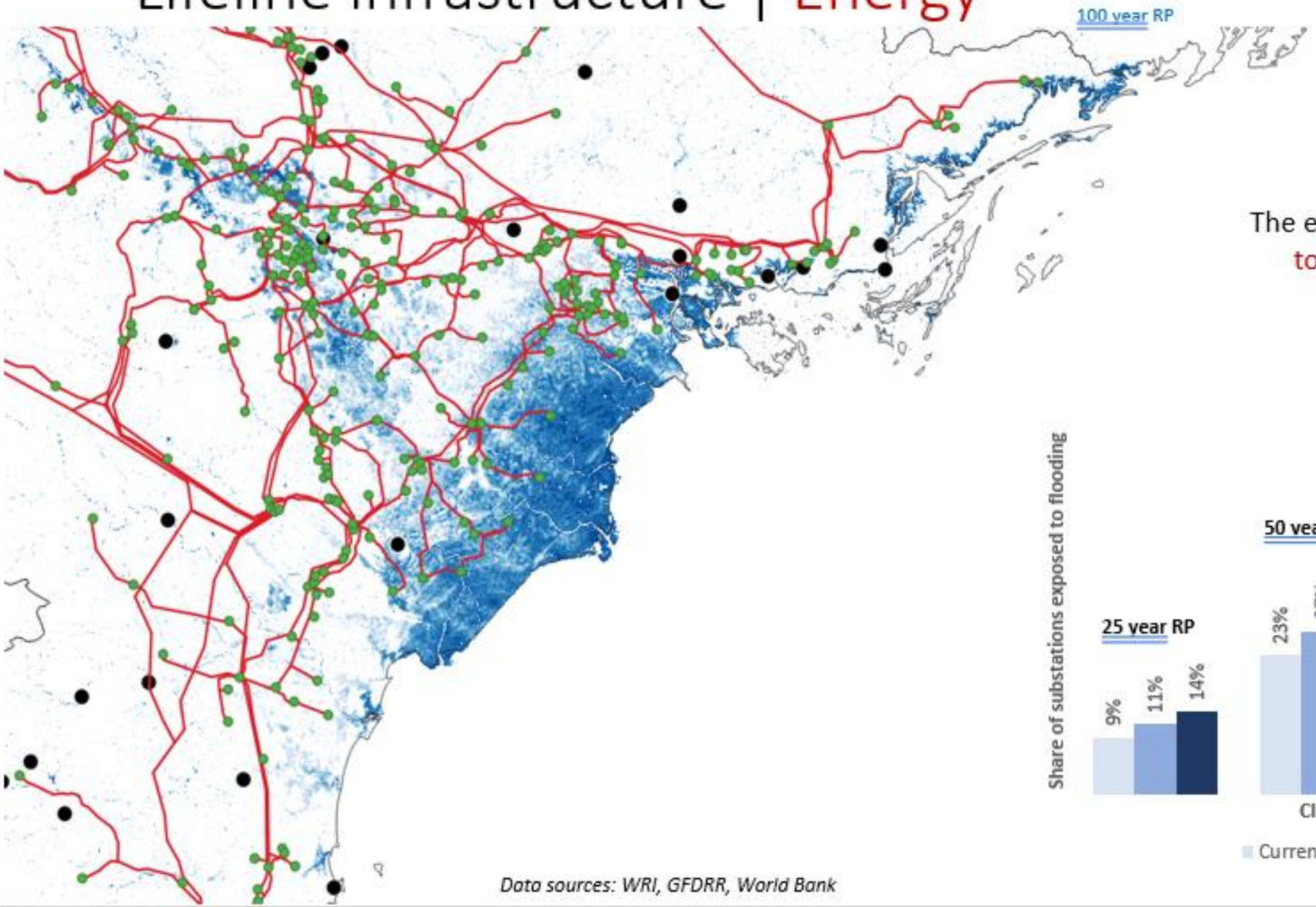




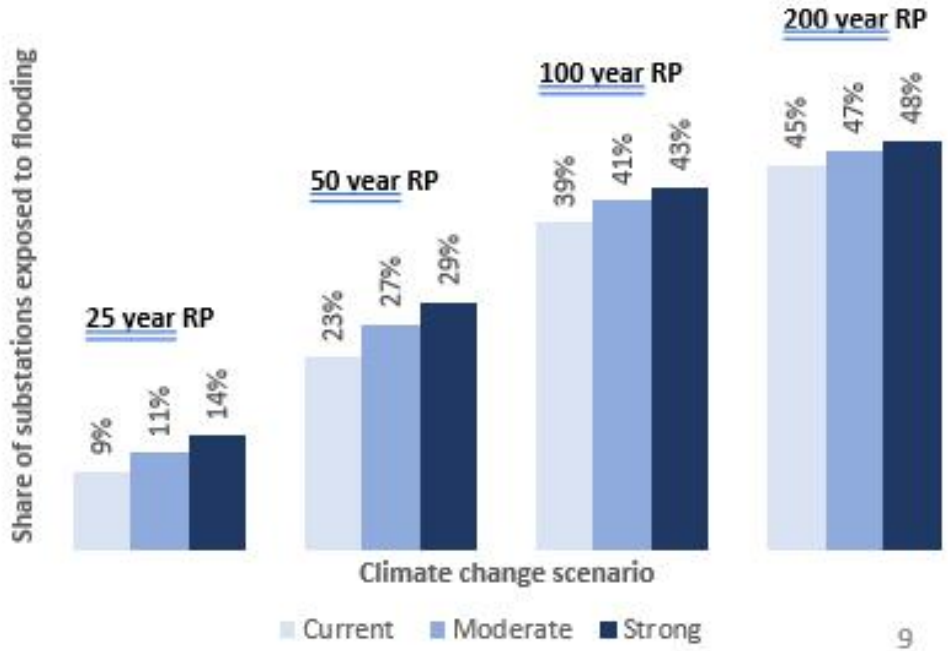
→ 5.8 million people are directly at risk from flooding with a 1 in 50 year intensity. This increases to 11.2 million people for a 1 in 100 year probability.

Data sources: GoV; Ottinger et al; DLR; GFDRR; Southern Institute of Water Resources Research

Lifeline infrastructure | Energy



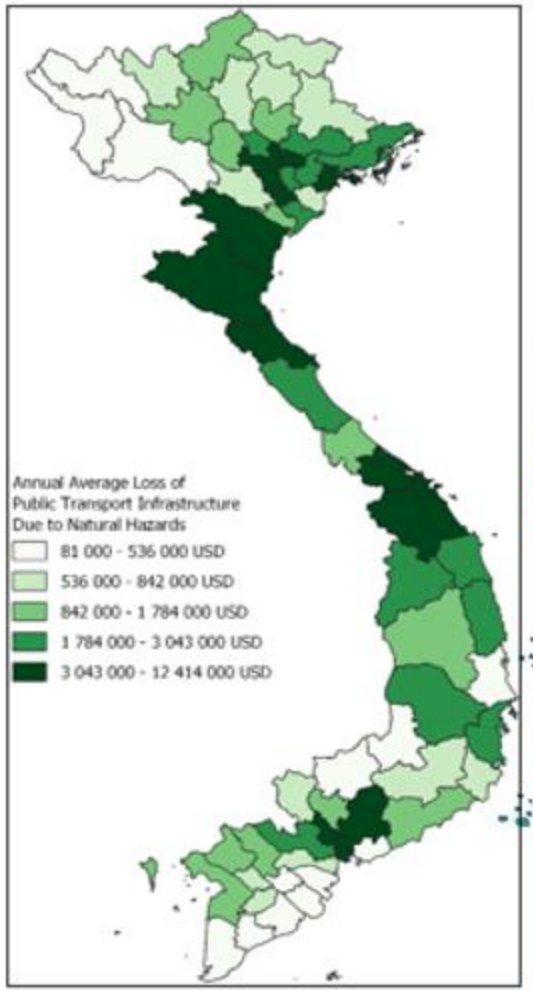
The energy system is highly exposed to floods, especially in the deltas and coastal regions.

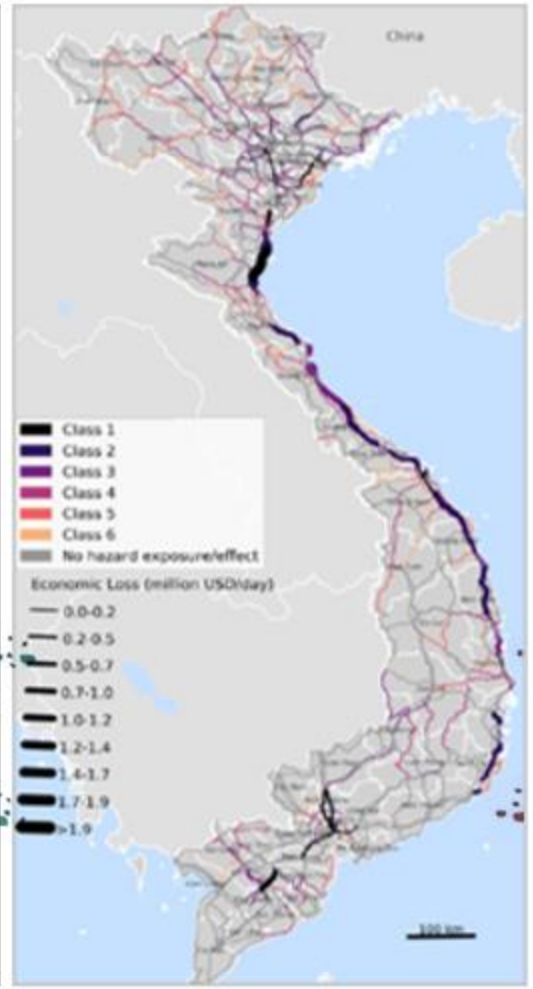


Data sources: WRI, GFDRR, World Bank

Lifeline infrastructure | Transport sector

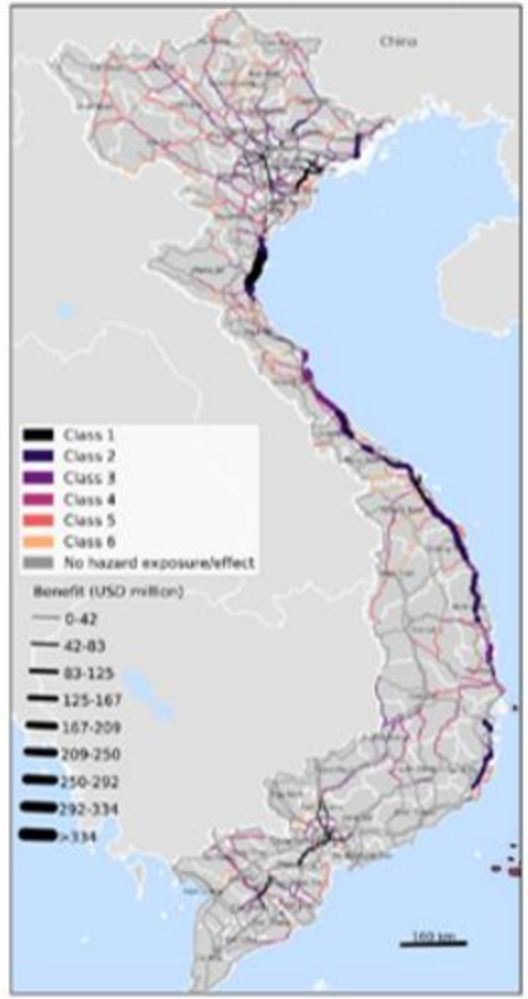
→ Disrupted transport infrastructure affects all economic activity





← Natural hazards cause substantial disruption of economic activity in coastal regions

Investing in resilient roads → can yield significant economic benefits



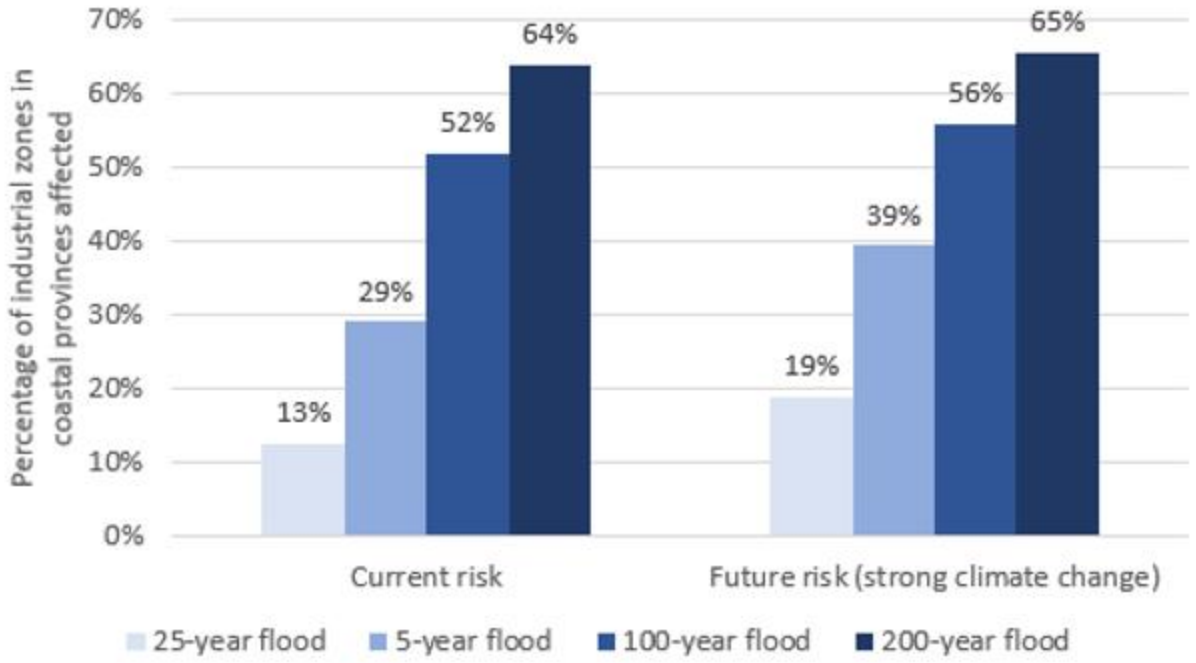
Source: Pant et al., 2019

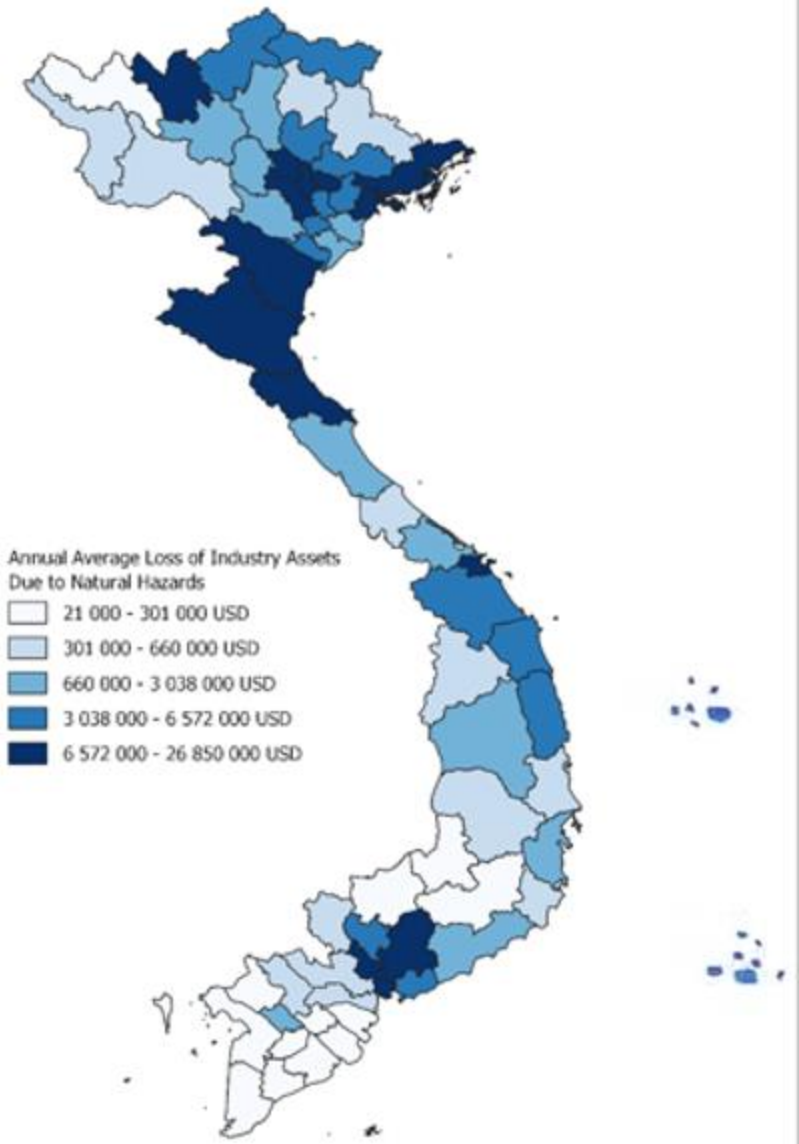
Key economic sectors| Industrial zones

→ Currently, country-wide average annual losses of industrial assets due to natural shocks amount to VND 5,992 bn, or about US$ 264 m

→ Industrial zones in coastal provinces are heavily affected by flooding

→ As industry is growing strongly along the coast, we are likely underestimating future risk

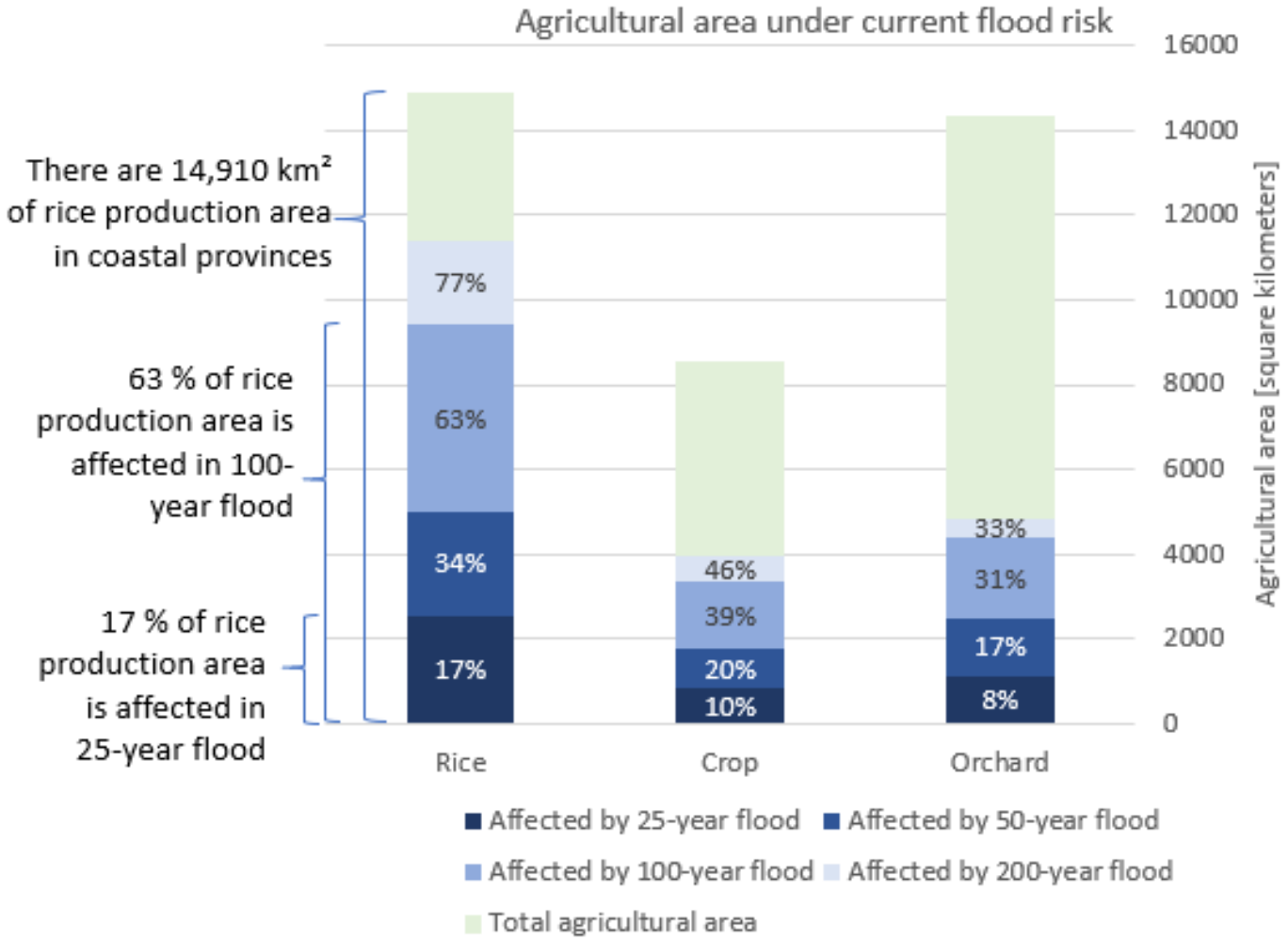


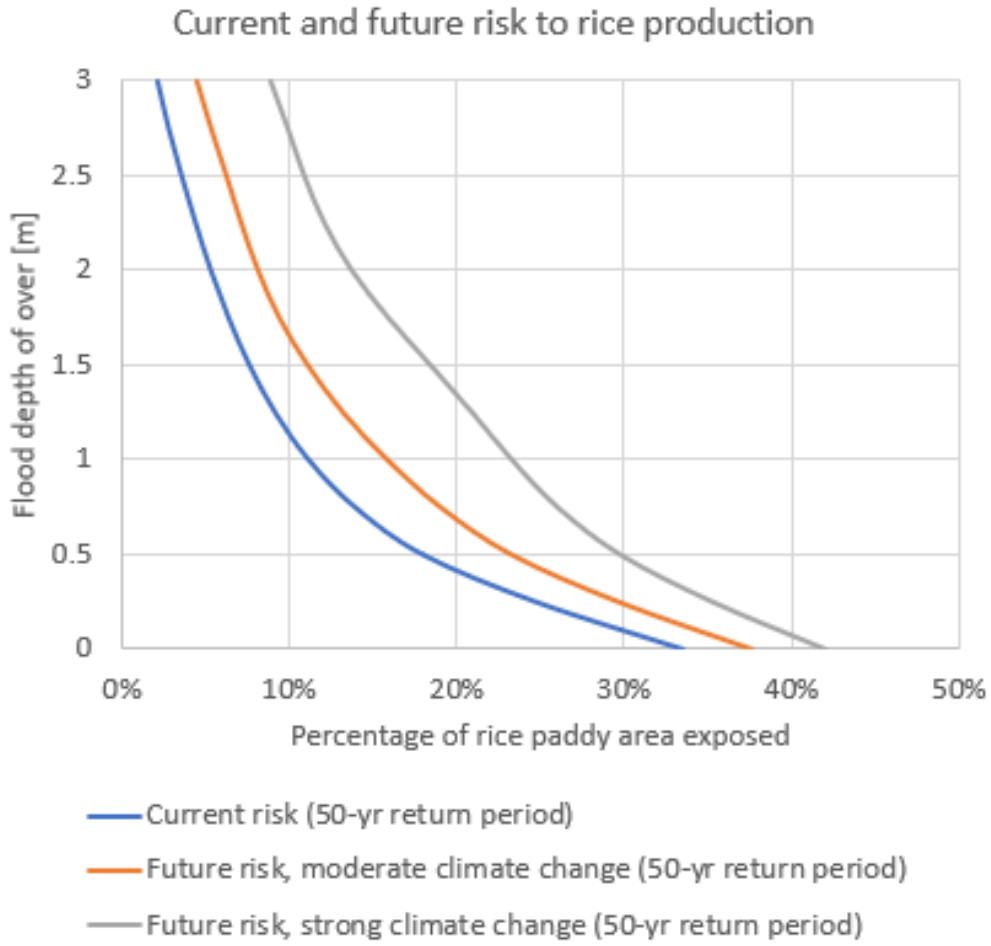


Data sources: World Bank; GFDRR; GoV

Key economic sectors| Agriculture

→ $1 billion would be lost and 1.5 million farmers would be affected by a 1 in 100 year probability flooding.

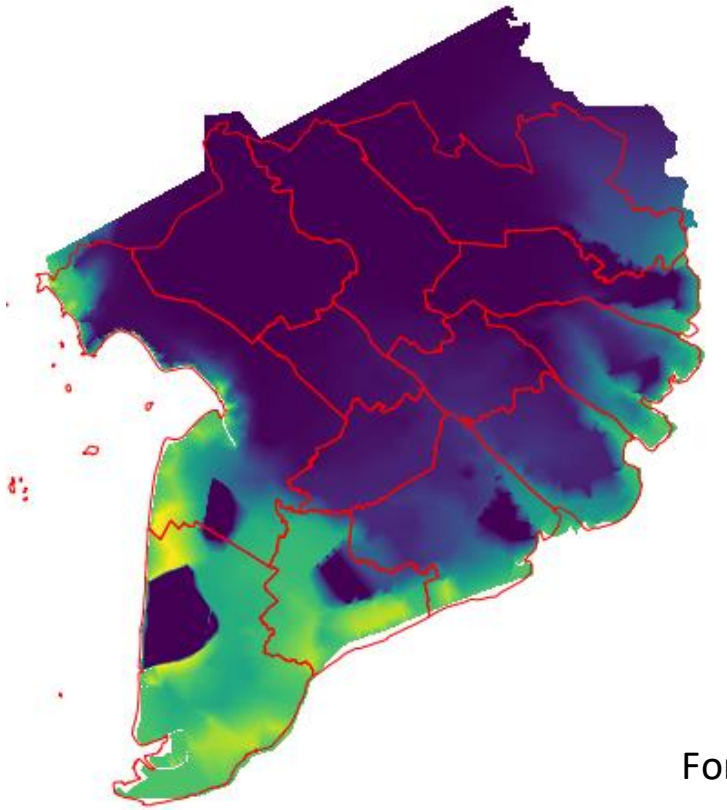




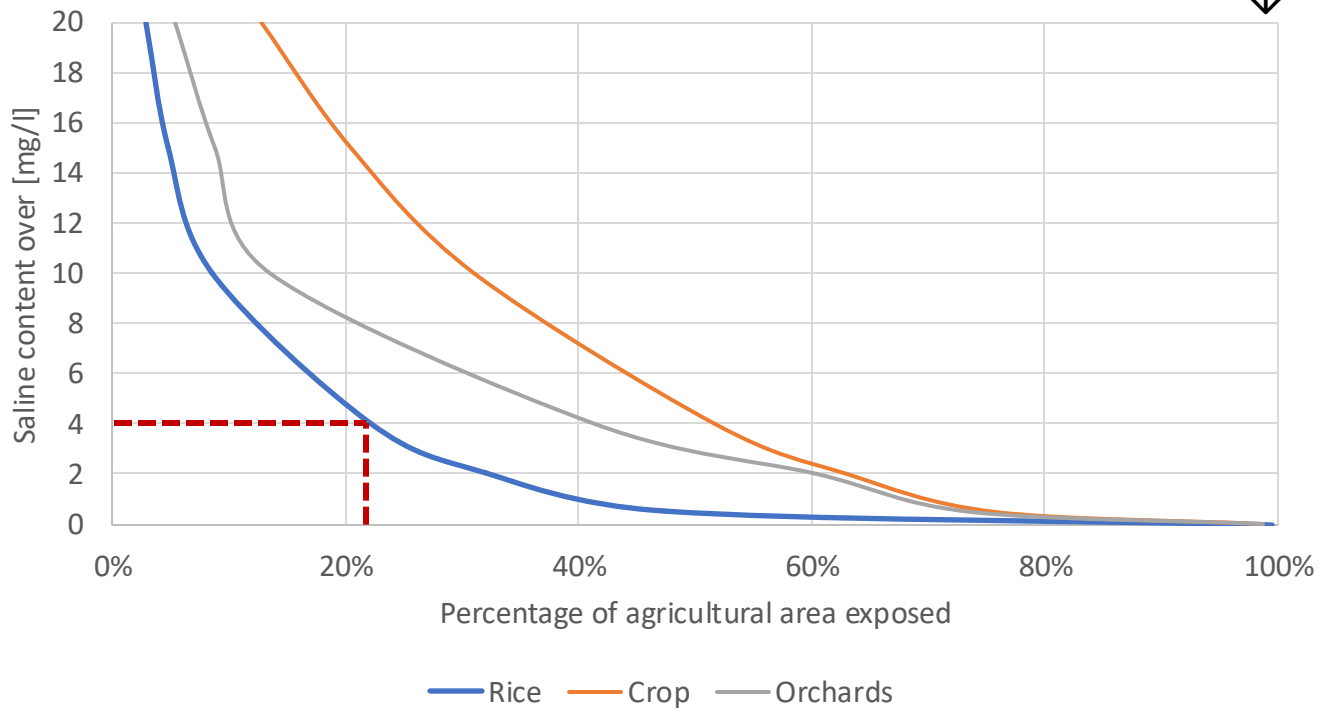
Data sources: Hashimoto et al.; JAXA EORC; GFDRR

Key economic sectors| Saline intrusion in the Mekong

→ Drought is increasing the risk of saline intrusion



Over 22% of rice paddies in the Mekong Delta can experience critically high salinity levels ↓



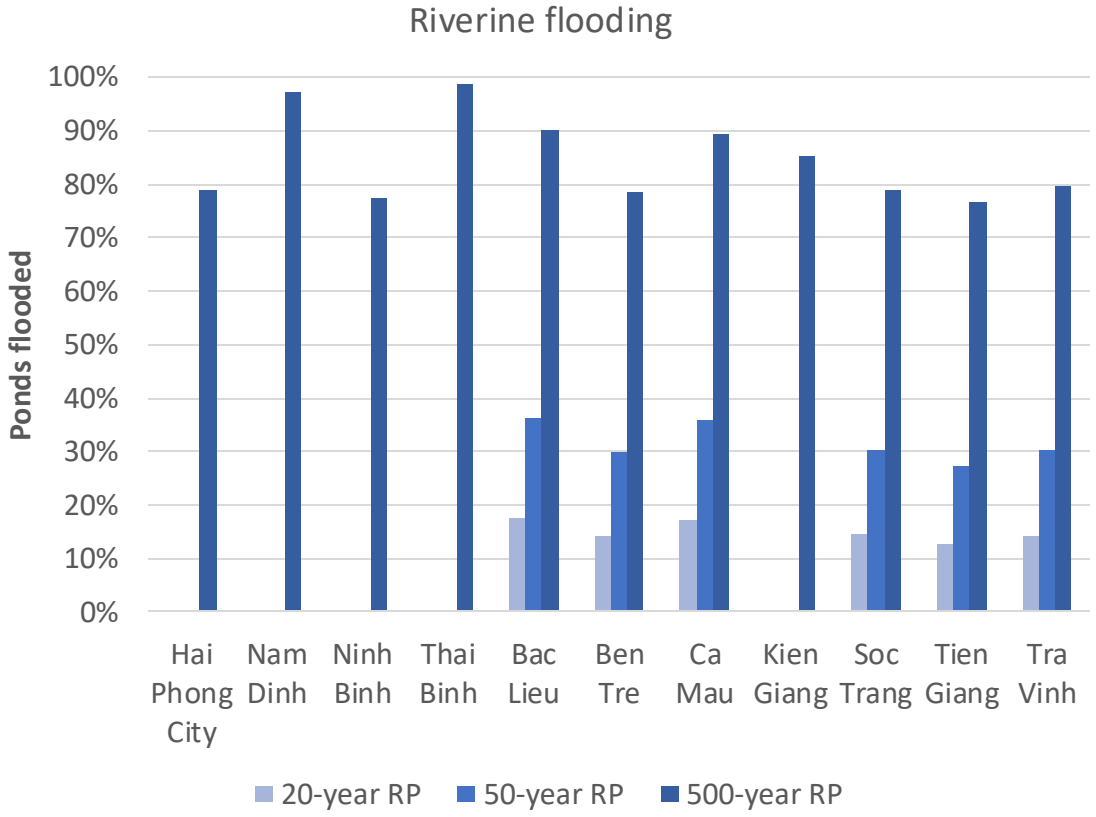
For saline contents over 4 mg/l, the monocultural production of rice starts becoming unviable.

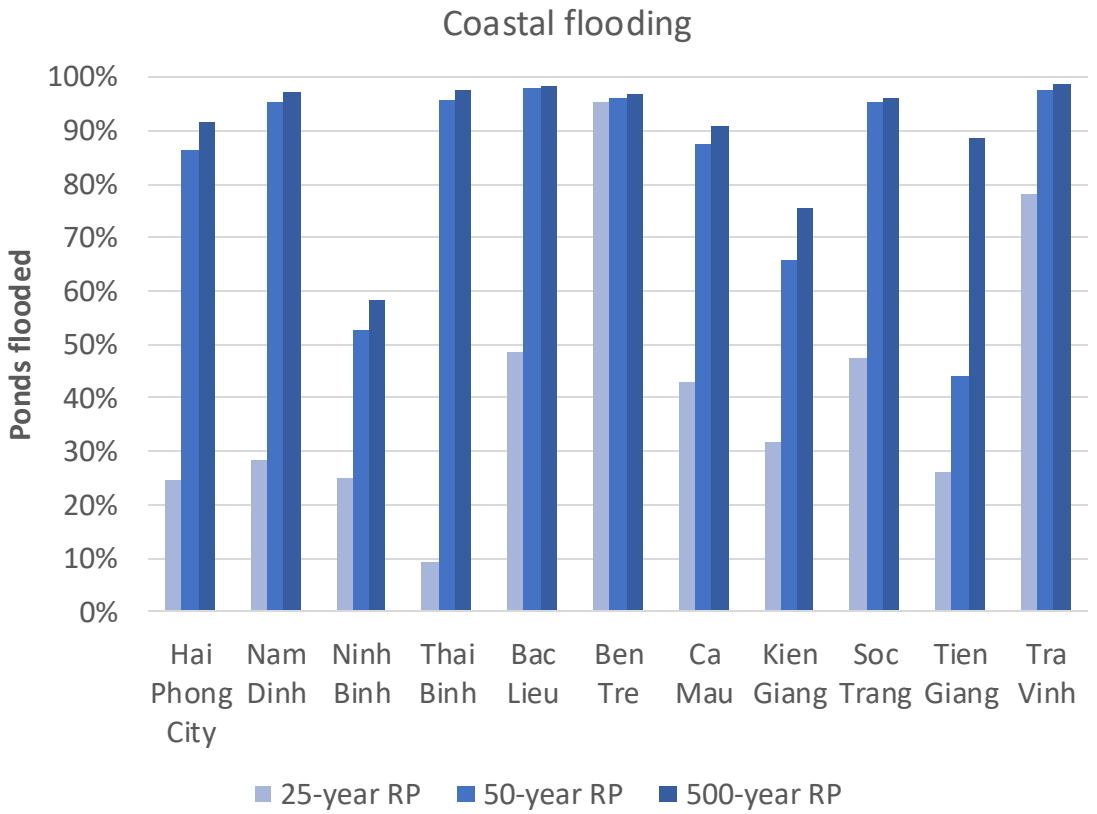
Such salinity levels can currently affect over 2900 km² of rice in the Mekong Delta.

Data sources: Hashimoto et al.; JAXA EORC; Nhan et al.; Southern Institute OF Water Resources Research

Key economic sectors| Aquaculture

→ A significant share of Vietnam's aquaculture sector is already exposed to natural hazards.





→ A 50-year flood in the two Deltas could destroy 1.5mil T of aquacultural production – corresponding to 1% of GDP, $1.1 bn in exports, and affecting 1.1 million workers.

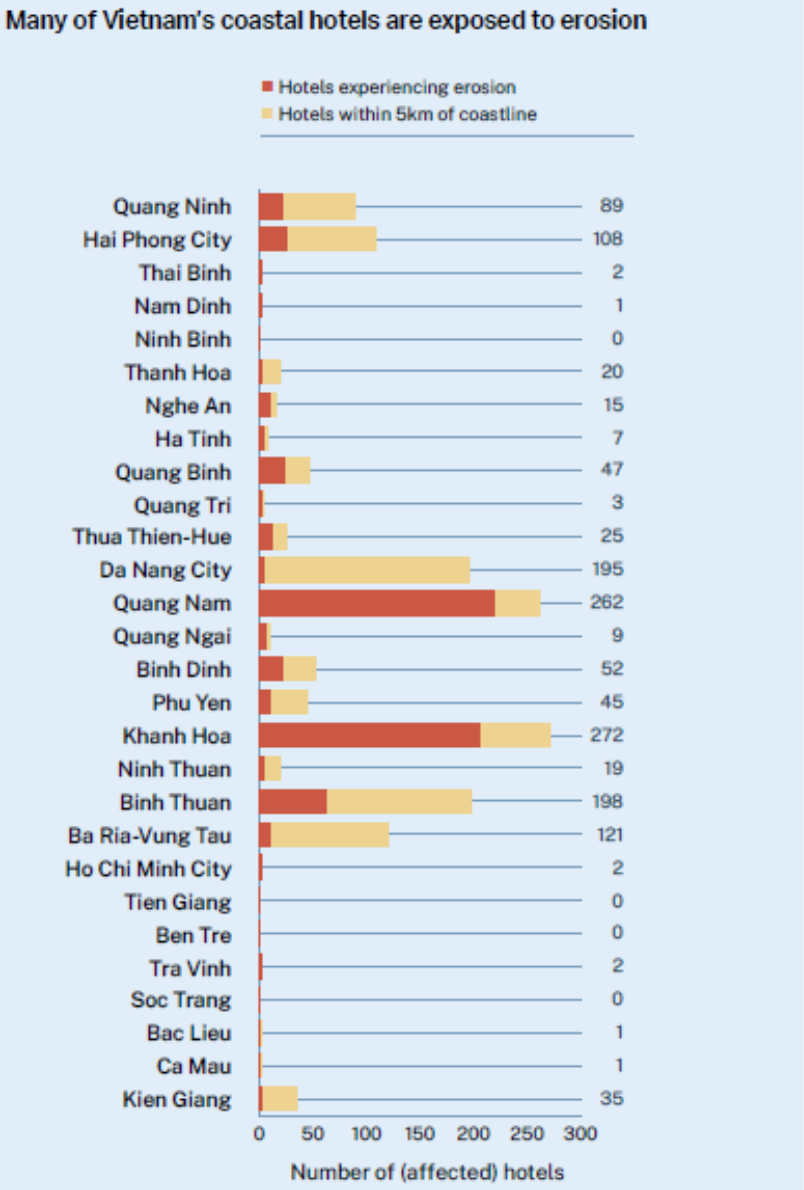
Data sources: GoV; Ottinger et al; DLR; GFDRR; Southern Institute of Water Resources Research

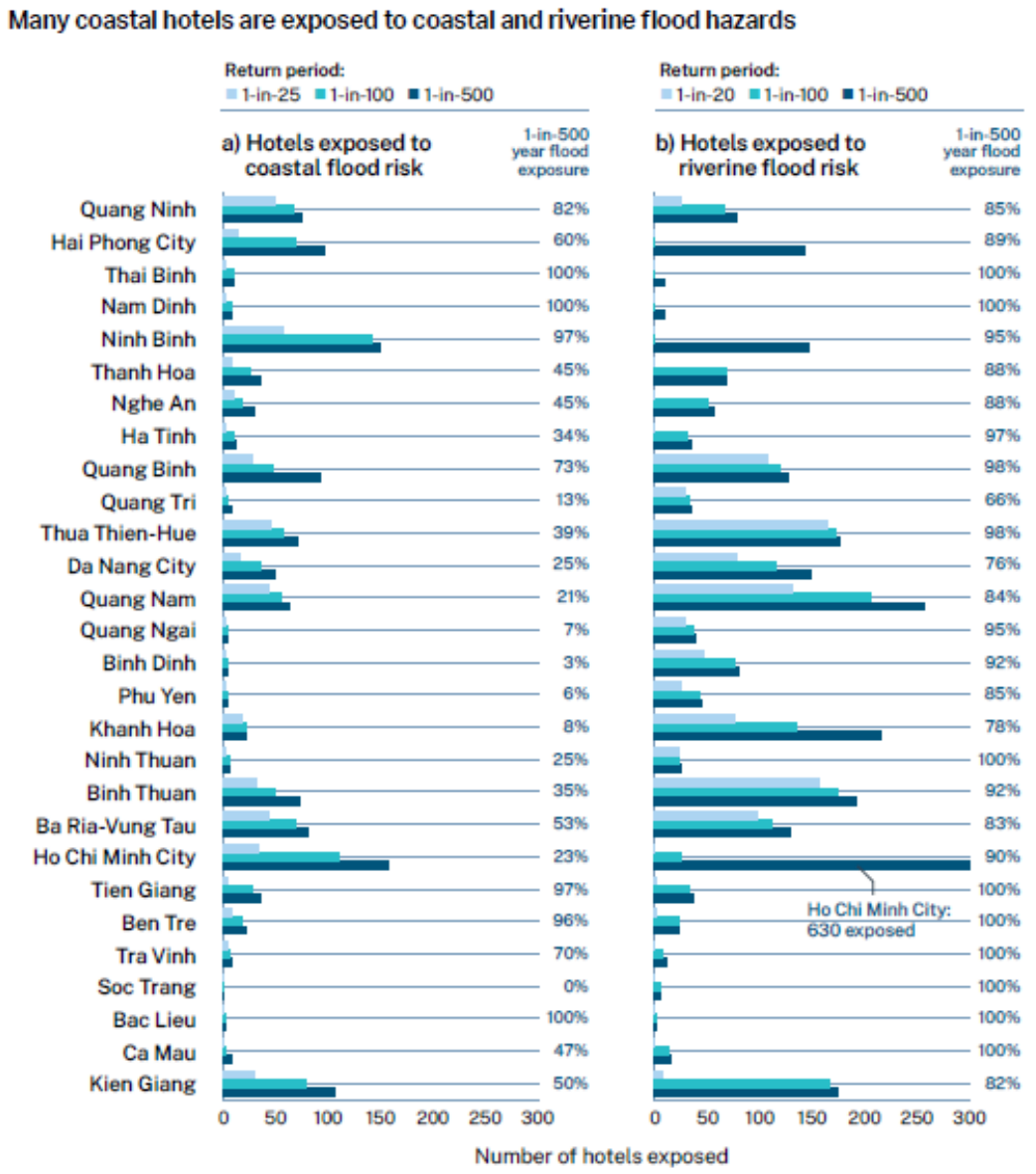
Key economic sectors| Tourism

→ A 100-year riverine flood could destroy $5 billion - corresponding to around 3% of GDP - and 753,000 workers unemployed

→ A 100-year coastal flood could destroy $2.7 billion - corresponding to around 1.6% of GDP - and 409,000 workers unemployed

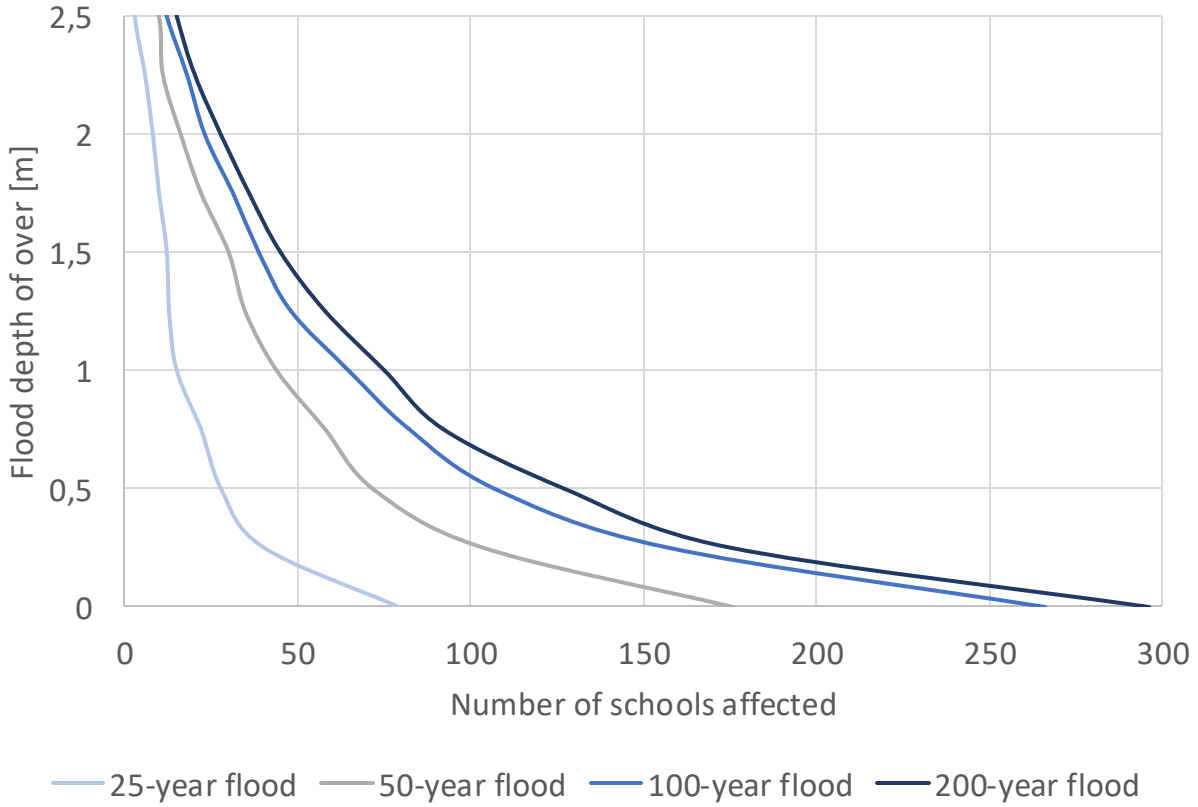
→ 22% of coastline are being eroded, and 35% of settlements located on eroding coastlines





Key socio-economic sectors| Education facilities

→ Using publicly sourced data, the team compiled a dataset with the locations of 864 schools in coastal provinces (about 10% of all schools in Vietnam)

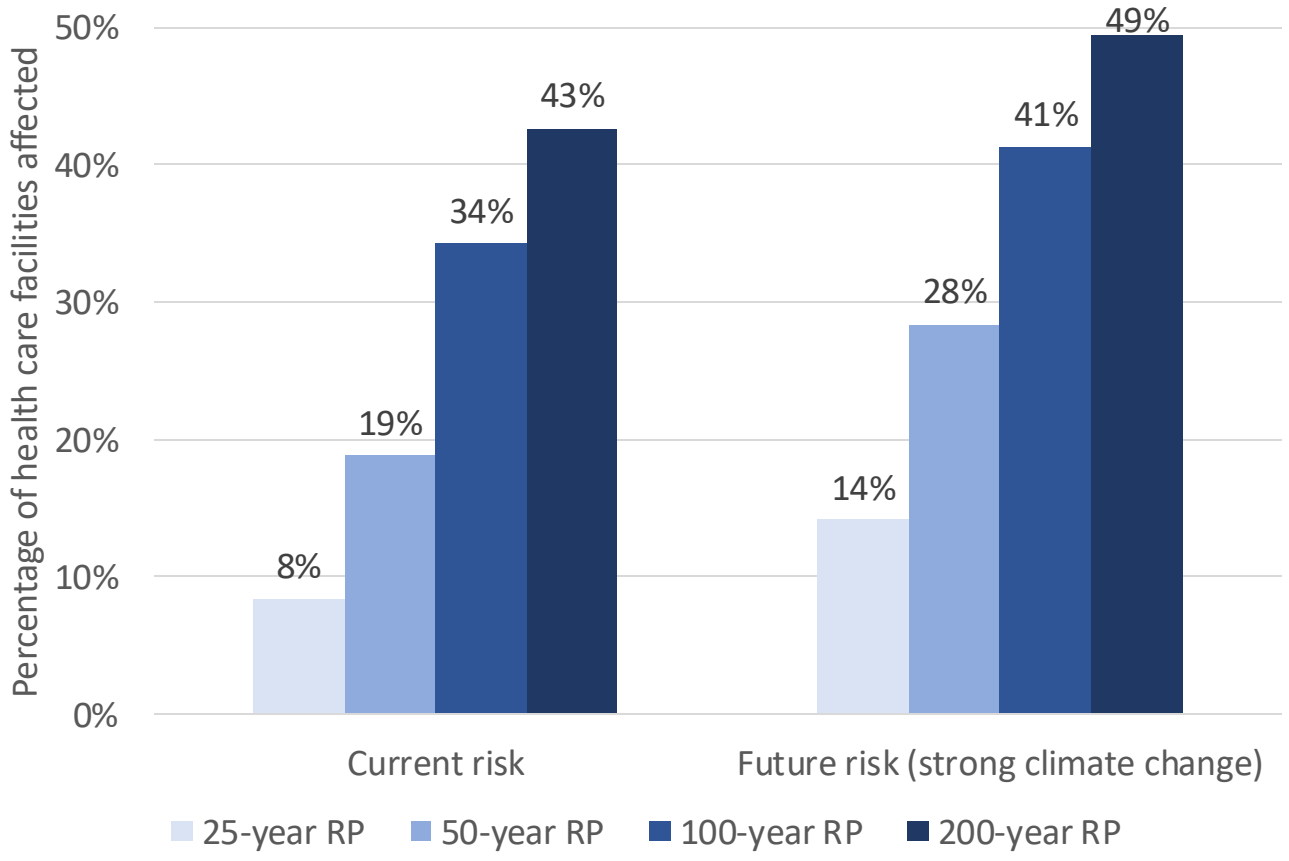


- In our dataset, 12% of schools affected by a flood with 100-year return period face flooding of over 0.5 m
- This has important implications for the usage of schools as emergency shelters: If schools in flood zones cannot withstand significant flood depths, they might end up endangering even more people when used as emergency shelters

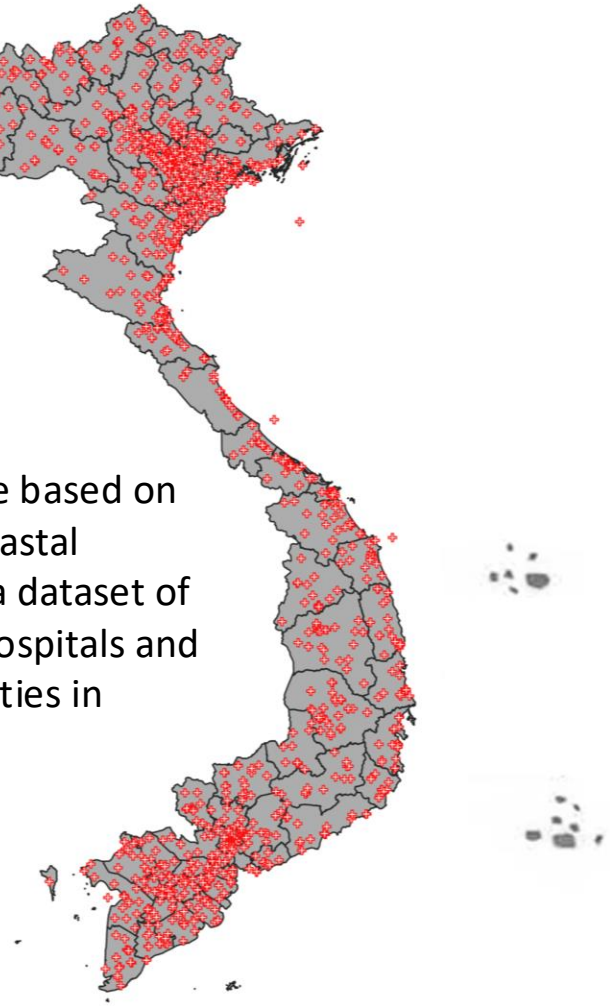
Data sources: Open Street Map; GFDRR

Key socio-economic sectors| Health care facilities

→Flooding poses a significant threat to health care facilities



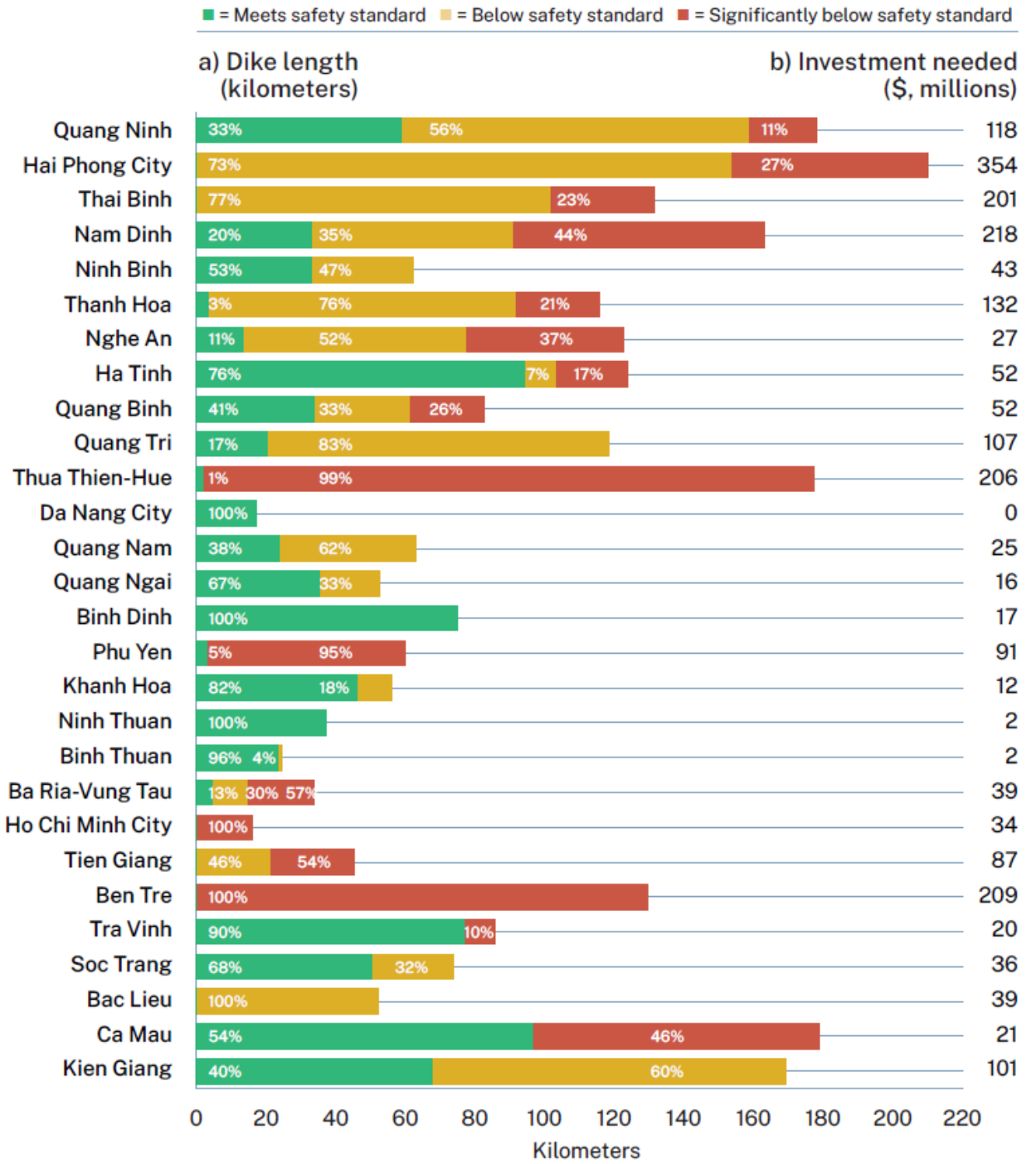
These results are based on an analysis of coastal provinces from a dataset of 750 geocoded hospitals and health care facilities in Vietnam



Data sources: Open Street Map; General Statistics Office

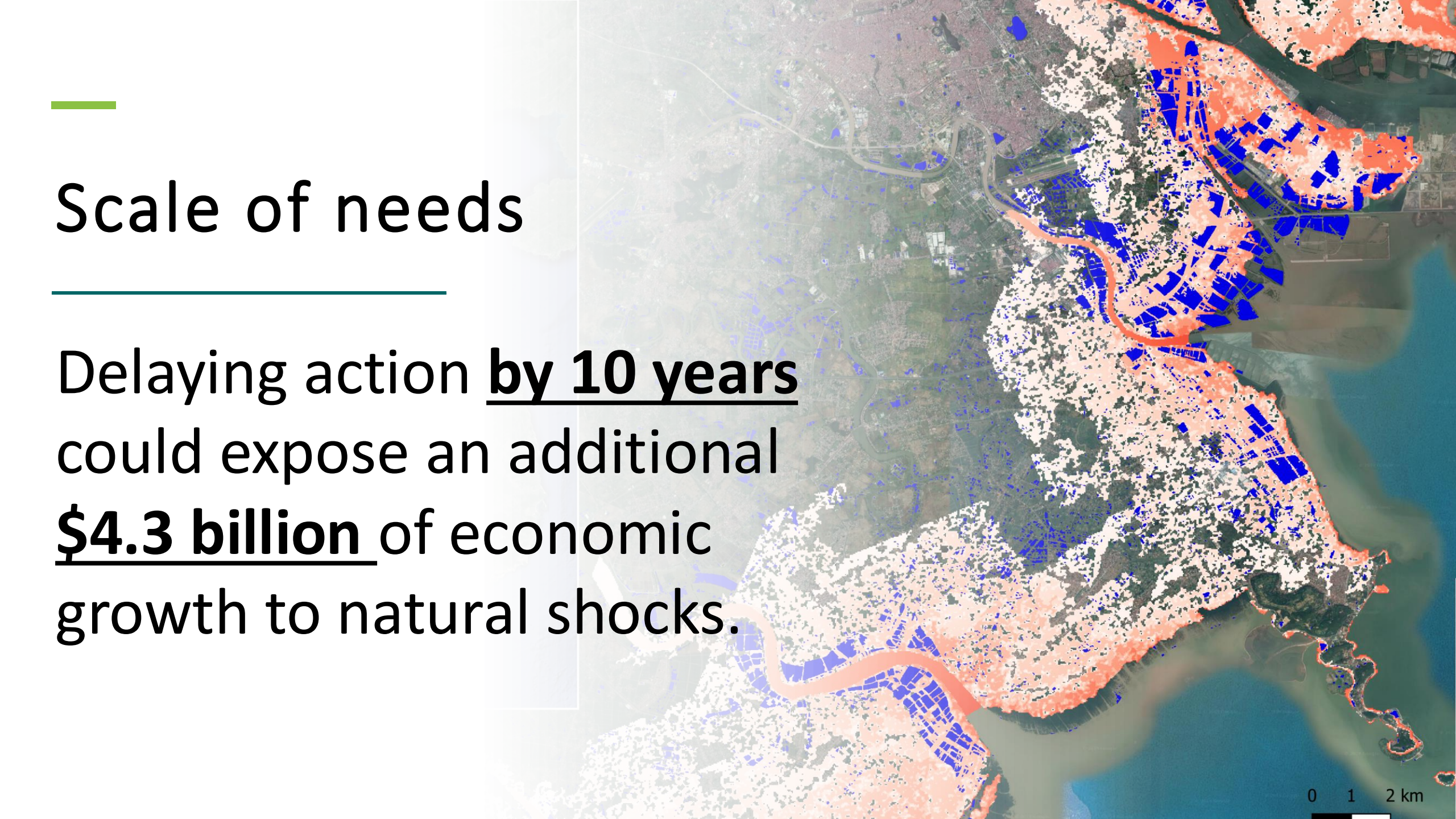
Why?


65% of Vietnam's dikes do not meet prescribed safety standards
Upgrades would require $2.3 bn in capital expenditure
= Grade I
= Grade II
= Grade III
= Grade IV
= Grade V
= Estuary dike
= Sea dike
= Sand dike
= Providence Boundary


= Meets safety standard
= Below safety standard
= Significantly below safety standard
a) Dike length (kilometers)
b) Investment needed ($, millions)
Quang Ninh 33% 56% 11% 118
Hai Phong City 73% 27% 354
Thai Binh 77% 23% 201
Nam Dinh 20% 35% 44% 218
Ninh Binh 53% 47% 43
Thanh Hoa 3% 76% 21% 132
Nghe An 11% 52% 37% 27
Ha Tinh 76% 7% 17% 52
Quang Binh 41% 33% 26% 52
Quang Tri 17% 83% 107
Thua Thien-Hue 1% 99% 206
Da Nang City 100% 0
Quang Nam 38% 62% 25
Quang Ngai 67% 33% 16
Binh Dinh 100% 17
Phu Yen 5% 95% 91
Khanh Hoa 82% 18% 12
Ninh Thuan 100% 2
Binh Thuan 96% 4% 2
Ba Ria-Vung Tau 13% 30% 57% 39
Ho Chi Minh City 100% 34
Tien Giang 46% 54% 87
Ben Tre 100% 209
Tra Vinh 90% 10% 20
Soc Trang 68% 32% 36
Bac Lieu 100% 39
Ca Mau 54% 46% 21
Kien Giang 40% 60% 101
0 20 40 60 80 100 120 140 160 180 200 220
Kilometers

Scale of needs

Delaying action **by 10 years** could expose an additional **$4.3 billion** of economic growth to natural shocks.



What strategy should be put in place to enhance the coastal resilience?

WB proposal for coastal resilience in Vietnam

Spatial planning

- Ensure availability of robust hazard data & analysis tools to facilitate the integration of risk information into development & investment planning
- Support provincial & city government planning processes to prioritize new infrastructure investments that incorporate localized & regional disaster & climate risks
- Establish a common donor platform for policy advocacy & financing to facilitate the coordination of investment from sectoral to spatial
- Increase public awareness on Disaster Risk

Resilient assets

- Support the upgrade of the coastal protection system while promoting risk-informed development of cities along the coast
- Strengthen the resilience of infrastructure systems & public services by integrating risk information into the planning, design, & maintenance stages of all infrastructure investments
- Update & enforce safety standards & technical guidelines for infra systems for prevention, responding and recovering

Disaster risk financing

- Formulate financing instruments & insurance models for DRM
- Mobilize loan for emergency response and post-disaster recovery, using improved social safety net & insurance markets
- Strengthen relevant laws & decrees regarding financing, DRM, asset management, & social safety net to improve financial inclusion

Emergency response

- Establish emergency command center & improve the risk-based forecast & early warning system
- Establish coastal disaster monitoring system & support the improvement of the national disaster shelter system
- Improve the coordination of response capacity across departments and authorities / committees through policies & tools

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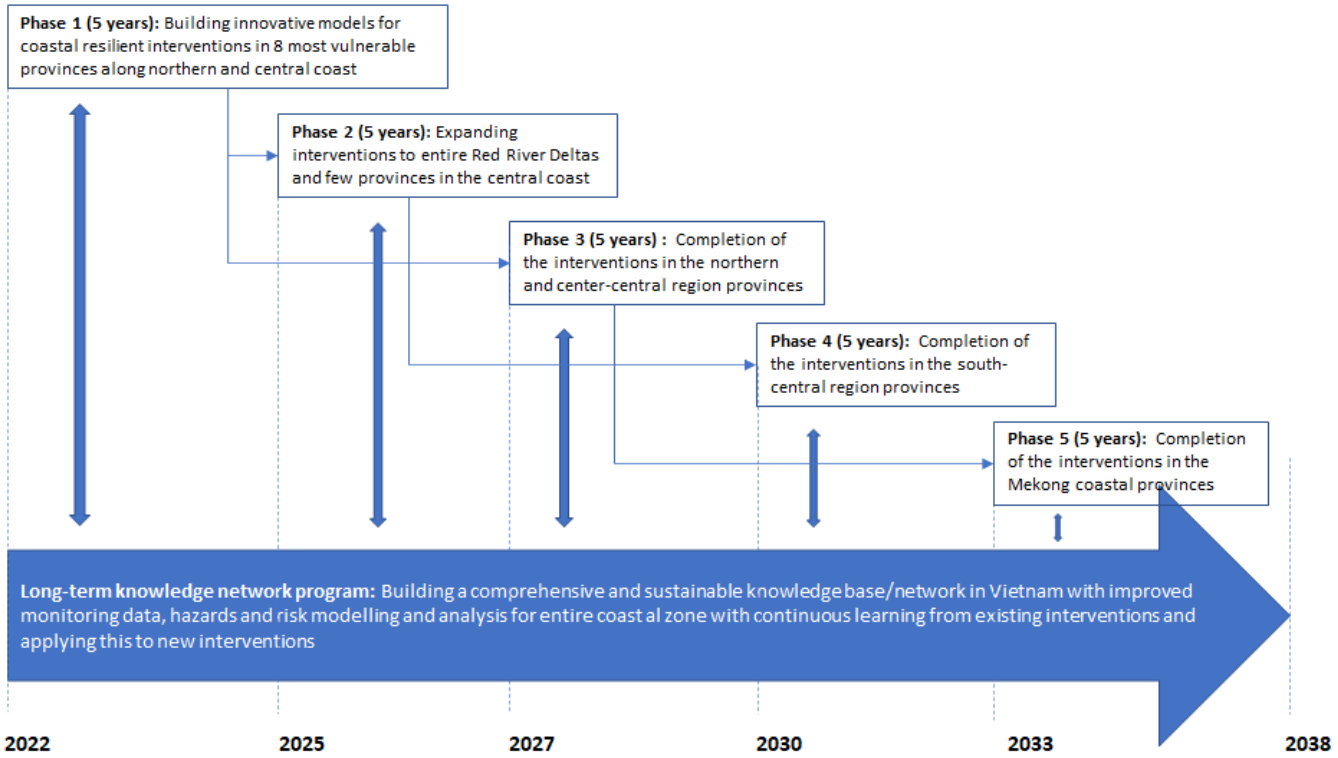
GoV's Vision and Proposed Plan

The long-term objective is to make the entire coastline more resilient against floods and erosion which is requiring a multi-phased approach program, with its focus on:

- supporting policies and establishing tools that integrate risk into investment planning
- strengthening the coastal protection systems; and
- establishing and functioning an investment platform that crows resources from development agencies



Long-term approach to build coastal resilience:

Start with most exposed provinces

Apply these recommendations

Do pilots and build innovative models

Learn from these interventions and expand to more areas

A multi-phase program with no-regret interventions but that would also allow for experimentation with innovative approaches to the protection and restoration of coastal ecosystem.

Thank you