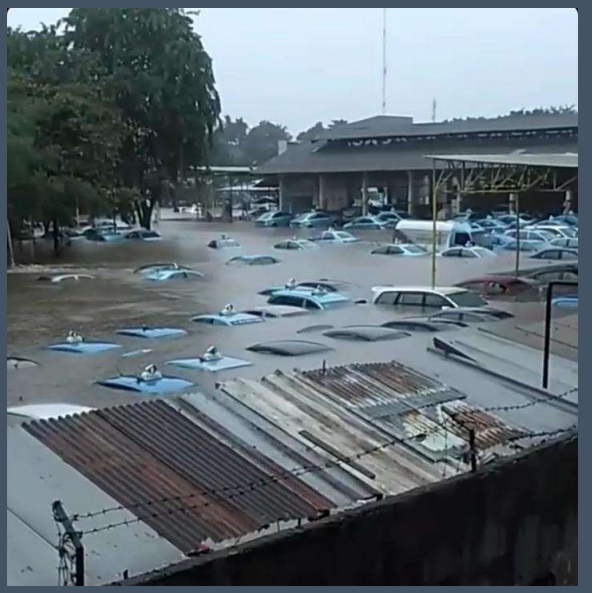
Webinar series: Challenges, Lessons, and Innovations for IFRM

Session 1: A country-scale view on IFRM and applications of global datasets

TA 9634-REG: Strengthening Integrated Flood Risk Management

Webinar Agenda

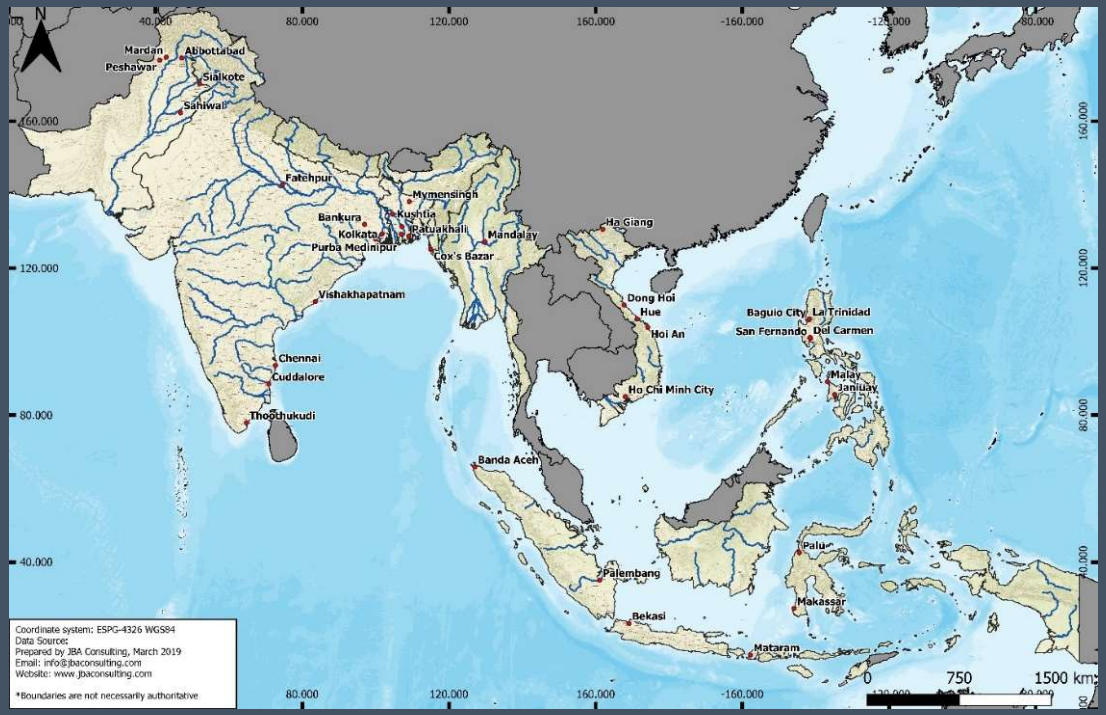
- **Welcome remarks** by Lorena Ramirez, Moderator and TA9634 Project Manager, Landell Mills
- **Opening remarks** by Chief of Urban Sector Group, Sustainable Development and Climate Change Department, ADB
- **Overview of TA9634 and intro to Webinar series** by Ian Wood, TA9634 Team Leader, Landell Mills
- **Comparative assessment of flood risk across eight countries** by Tony Green, IFRM Specialist, JBA Consulting
- **Application of NIRA Tool for Nepal, Pakistan & Indonesia** by Barry Hankin, Flood Modeler and Hazard Mapping Specialist, JBA Consulting
- **Using NIRA for the prioritization of IFRM investments in Indonesia** by Barry Hankin, Flood Modeler and Hazard Mapping Specialist, JBA Consulting
- **Discussion**
- **Closing remarks**



TA 9634 REG ‘Strengthening Integrated Flood Risk Management’

Overall objective:

Strengthen the design and implementation of IFRM solutions, enhancing knowledge and application of IFRM strategies



Commenced in February 2019, concludes in June 2022

8 Countries: Indonesia, Philippines, Viet Nam, Myanmar*, Bangladesh, India, Nepal and Pakistan

Webinar series

Session	Date	Title
1	March 9	A country-scale view on IFRM and applications of global datasets
2	March 15	Application of an IFRM Approach at a River Basin Level
3	March 22	Coastal Flood Risk Assessment
4	March 30	Economic and Finance for IFRM
5	April 5	Outlook for IFRM and Ways Forward

Objective:

To share our experiences from implementing the KSTA project and reflect on issues and lessons learned for applying IFRM in practical applications

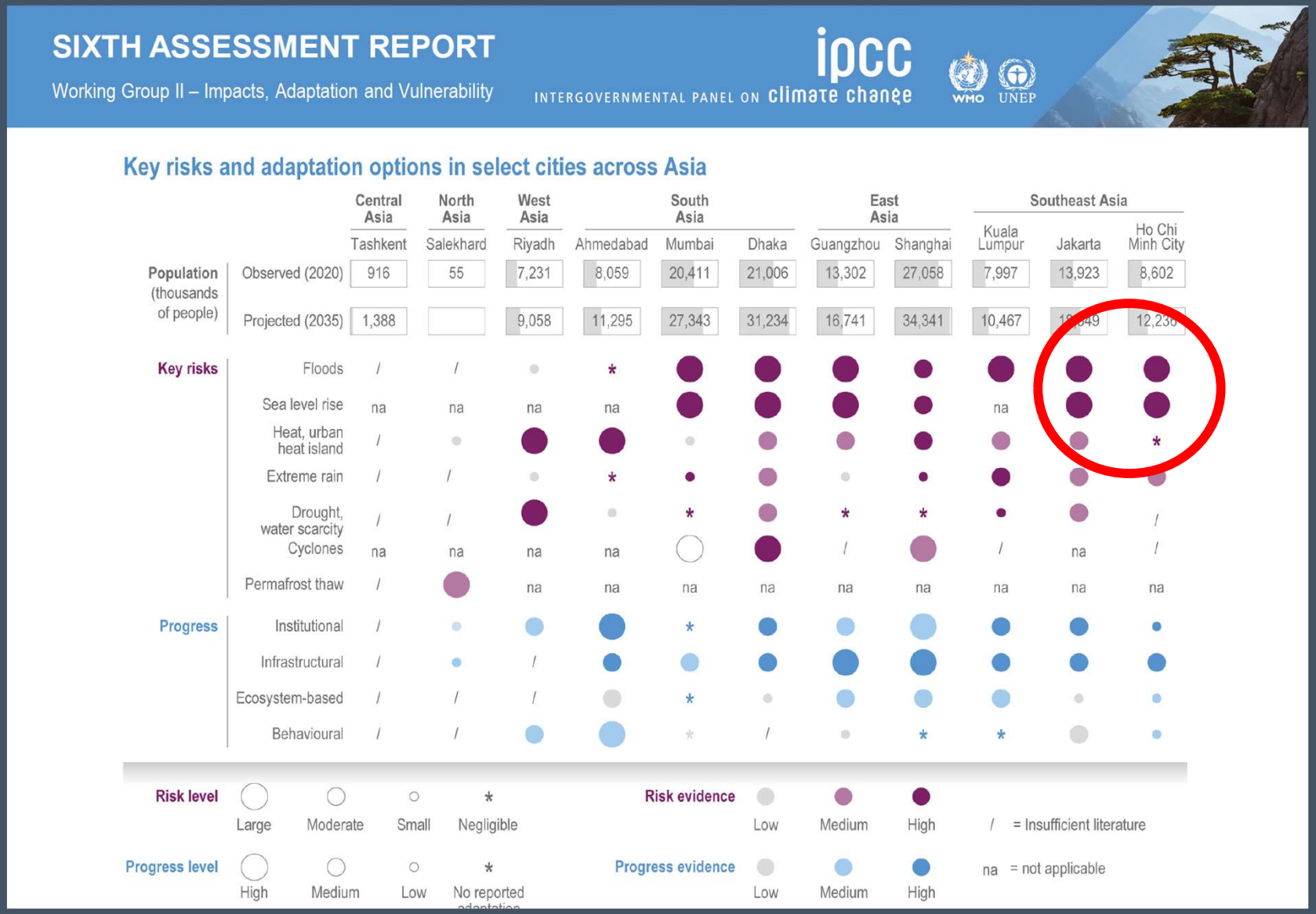
Integrated Flood Risk Management – National Scale 'Sector' Assessment

Heavy rainfall readily Integrates Impacts – but are the human systems integrated to respond?

Flood as a Sector
- Change
- Integration

Assessment Using Global Flood Mapping
- Features
- Institutions and Infrastructure Investments

Impacts of Climate Change - Projected Future Flood Risks including sea level rise critical for Asian Cities



Flood from Rivers and sea - Critical

- Source: IPCC Sixth Assessment Report – WGII – Fact Sheet Asia

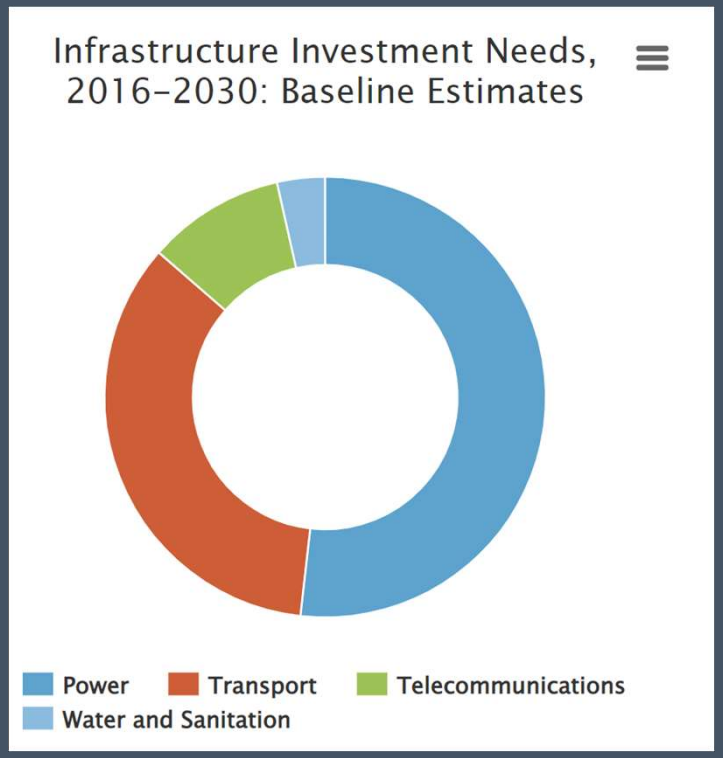
Integrated Flood Risk Management – Change

- Rising Frequency and Severity

- Rising Expectations with development
- Less tolerance as ‘possessions’ & capital stock increases.
- Insurance role residual
- Planning – economic benefit of risks and standards of service

Integrated Flood Risk Management – as a 'sector'

- Context of IFRM Infrastructure/Capex



Infrastructure 'Sectors'

- Power
- Transport
- Telecoms
- Water & Sanitation

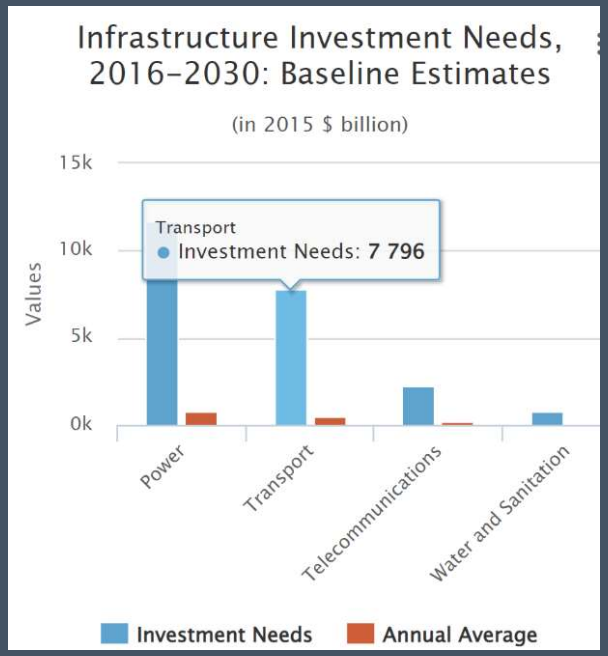
(Water is the smallest and flood is generally a small part of water)

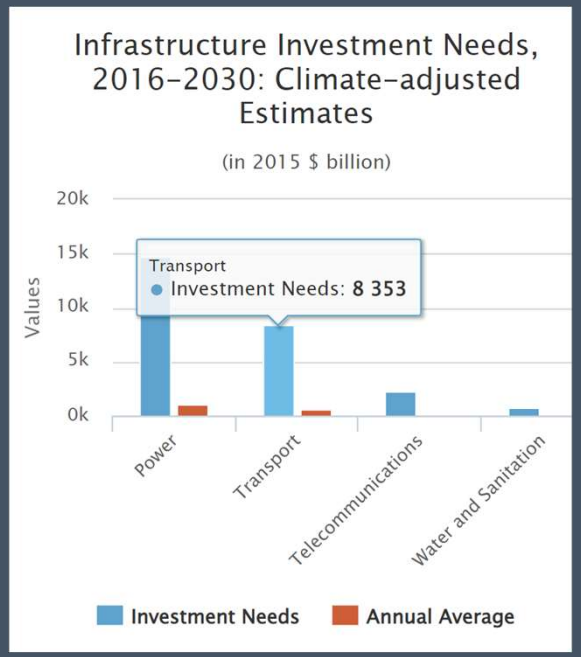
Source: ADB Meeting Asia's Infrastructure Needs (2017)

Context of IFRM Investment

Climate Change – Estimated Infrastructure investment needs in Asia

Climate has more impact on transport ($550b) infrastructure than total spend of the whole flood sector and most of the water sector ($802b)

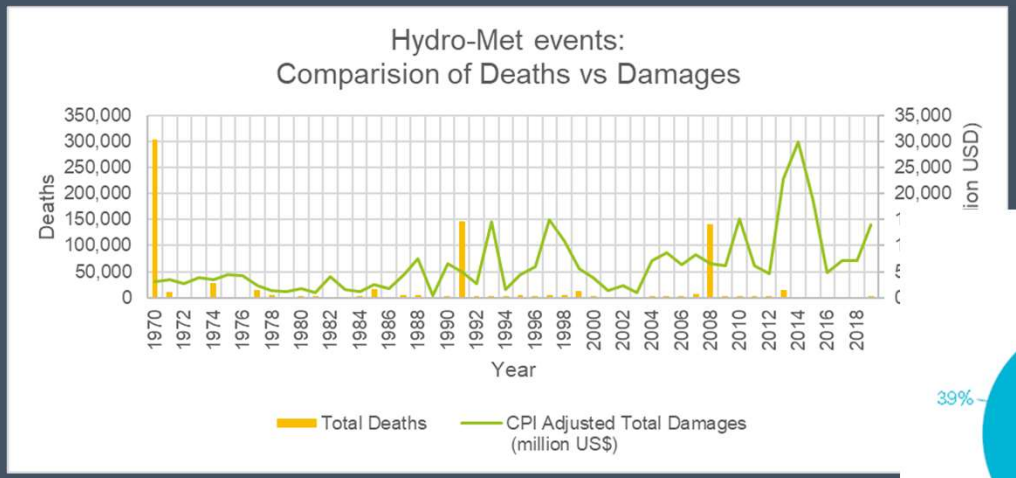


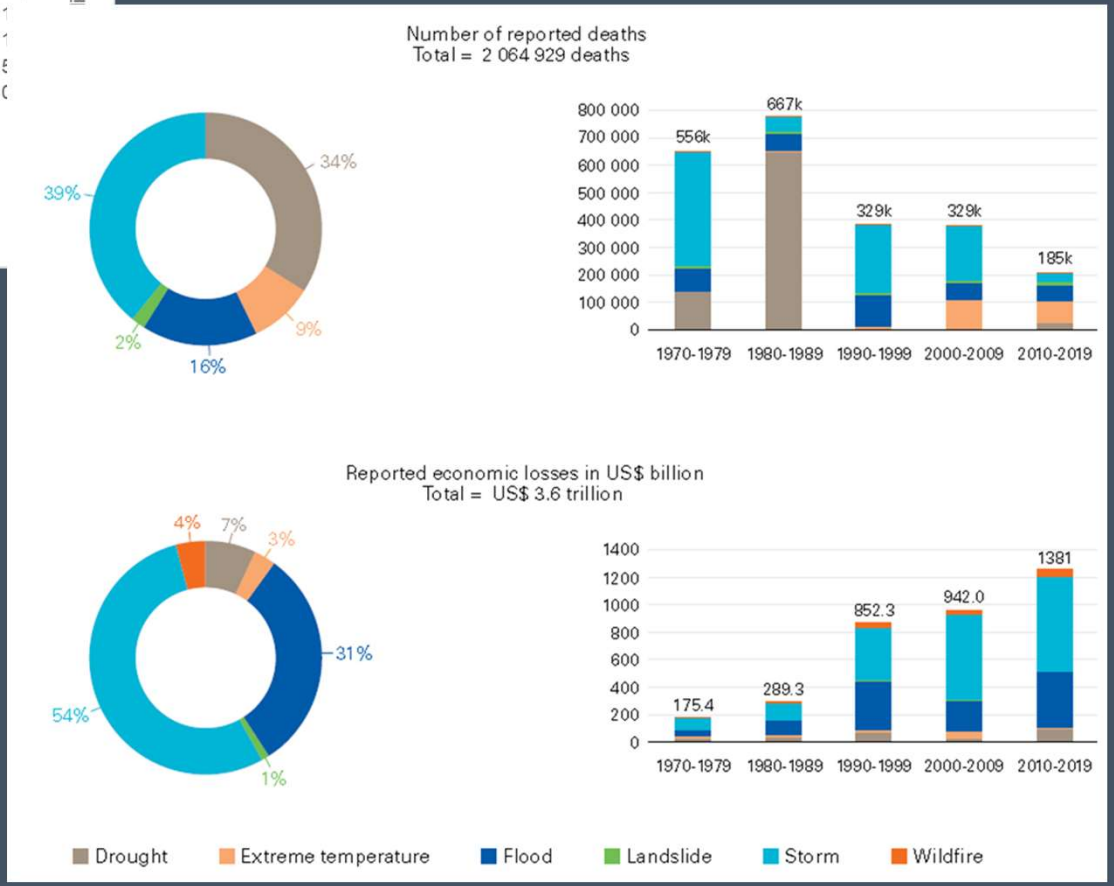


Source: ADB Meeting Asia's Infrastructure Needs (2017)

Integrated Flood Risk Management – Change

- Getting better at responding and disaster preparation

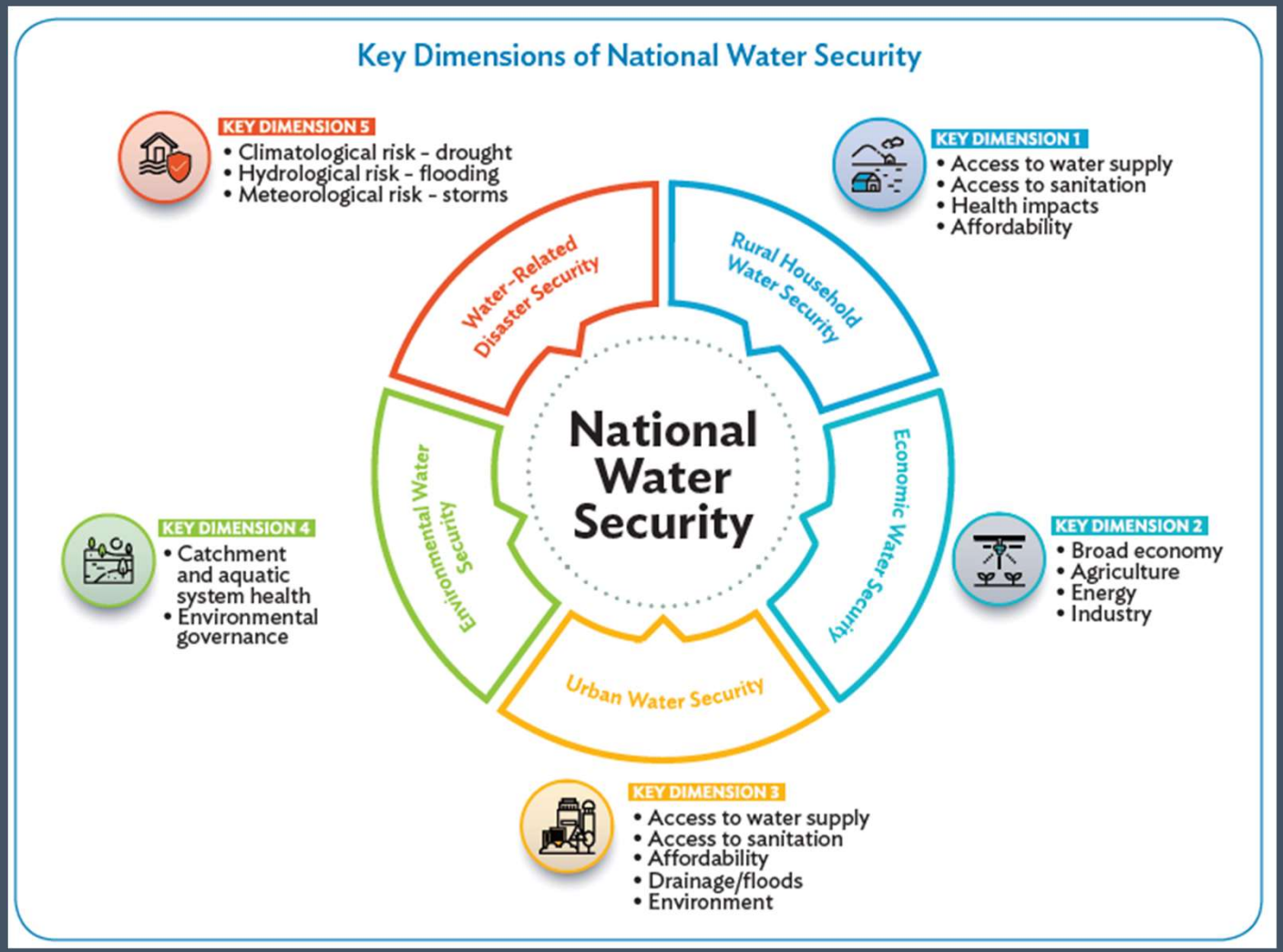




- But damages rising

Source: WMO Atlas of Mortality and economic losses from Weather , Climate and Water Extremes (1970-2019) WMO Publication 1267

Water Security
Asian Water Development Outlook (2020)



Source: ADB AWDO 2020

Integrating Are we ready for the coming storms?

Managing Rivers

Managing Cities

Managing Land

Coast and Sea

Weather Services

Disaster Response

National Scale 'Sector' Assessment Benchmarking

a) Magnitude of the flood issue *in each country - Flood Risks, Hazard and Exposure.*

b) Flood Management Status *– Hygo/Sendai Progress, Capital Expenditure, Levels of Protection achieved, balance between hard and soft approaches to risk reduction.*

c) Integration - Information and Governance

Clear responsibilities and coordination

To use flood data it must be easily available such as for land use or transport planning.

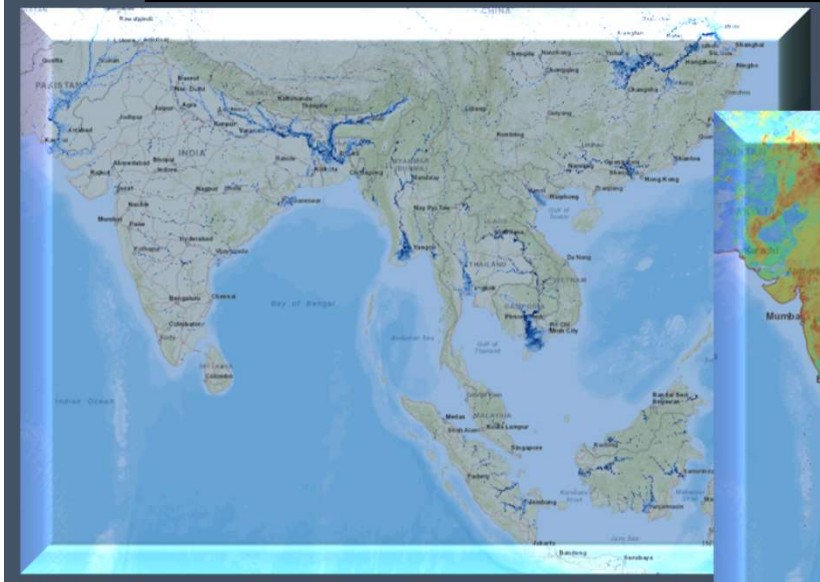
National Scale – Magnitude of Flood Issue

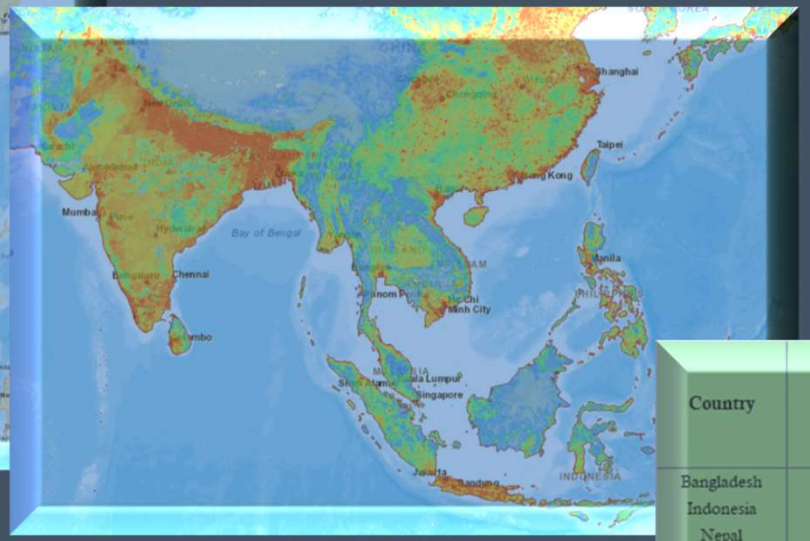
a) Flood Mapping

b) Defences

c) Population

→ ***GIS Analysis*** → ***Statistics***





Country	Total Area (km²)	Inundation Area (km²) (natural floodplain) 100yr Area	100yr % of total land mass	Extreme Flood (1500y) Area	Extreme Flood (1500y) % of total land mass
Bangladesh	130,170	58,849	45	73,151	56
Indonesia	1,811,570	265,873	15	423,202	23
Nepal	143,350	9,525	7	18,432	13
Pakistan	770,880	160,266	21	253,427	33
Philippines	298,170	51,128	17	79,933	27
Viet Nam	310,070	65,531	21	104,907	34
Total	3,464,210	611,173	15%	953,051	23%

JBA Global Data for flood envelope and Defences

a) GIS analysis – AREA OF NATURAL FLOODPLAIN

Country	Total Area (km^2)	Inundation Area (km^2) (natural floodplain)			
		100yr		Extreme Flood (1500y)	
		Area	% of total land mass	Area	% of total land mass
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Source of data: JBA Global Fluvial Flood and Defences Mapping 2021

JBA Global Data for flood envelope and Defences

b) People living in floodplains

Country	Total Population (million)	Population at risk of river flood (million) (people living in floodplains)			
		100yr		Extreme Flood (1500yr)	
		People (m)	% of Pop	People (m)	% of Pop
Bangladesh	165	67	41%	85	51%
Indonesia	274	69	25%	113	41%
Nepal	29	4	15%	7	24%
Pakistan	221	64	29%	97	44%
Philippines	110	35	32%	54	49%
Viet Nam	97	37	38%	51	52%
Total/Average	895	277	31%	406	43%

Source of data: JBA Global Fluvial Flood and Defences Mapping 2021

JBA Global Data for flood envelope and Defences

C) Areas and People Protected by Defences

Country	Defended Area Statistics						
	Area at Risk for 100yr (km2)	Total Protected Area >50 year (km^2)	Proportion of area at risk having defences >50 yr	Population with protection >50 year (million)	% of Population at risk having protection >50yr	Population with protection 100 year (million)	% of Population at risk having protection >100yr
Bangladesh	58,849	2251	4%	28	33%	13	19%
Indonesia	265,873	7761	3%	35	31%	20	29%
Nepal	9,525	2465	26%	7	100%	2	43%
Pakistan	160,266	12165	8%	48	49%	24	37%
Philippines	51,128	2456	5%	17	31%	11	30%
Viet Nam	65,531	8399	13%	27	54%	17	47%
Total	611,173	35,496		161	40%	86	31%

Source of data: JBA Global Fluvial Flood and Defences Mapping 2021

JBA Global Data for flood envelope and Defences

d) People at risk on the Coast

Country	Total Population (million)	Coastal Flood Statistics			
		Population At risk		Population Defended	
		No	% of Population	No	% of those at Risk
Bangladesh	165	36.1	21.9	7.8	21.7
Indonesia	274	3.8	2.3	0.7	18.7
Nepal	29				-
Pakistan	221	0.3	0.2	0.02	6.7
Philippines	110	3.4	2.1	0.1	3.8
Viet Nam	97	10.5	6.4	1.1	10.9
	895	54	6%	10	18%

Source of data: Consultant Analysis using GTSR 2016 and JBA Defences Mapping 2021

Flood Infrastructure

Different components

- Hard defenses – river embankments, flood channels/floodways
- Urban management – storm drains, storages, pump stations etc.
- Soft Measures – flood warning systems and dissemination, planning, land management & restoration and NBS
- Flood Response – evacuation, shelters, recovery & Insurance

Flood Infrastructure

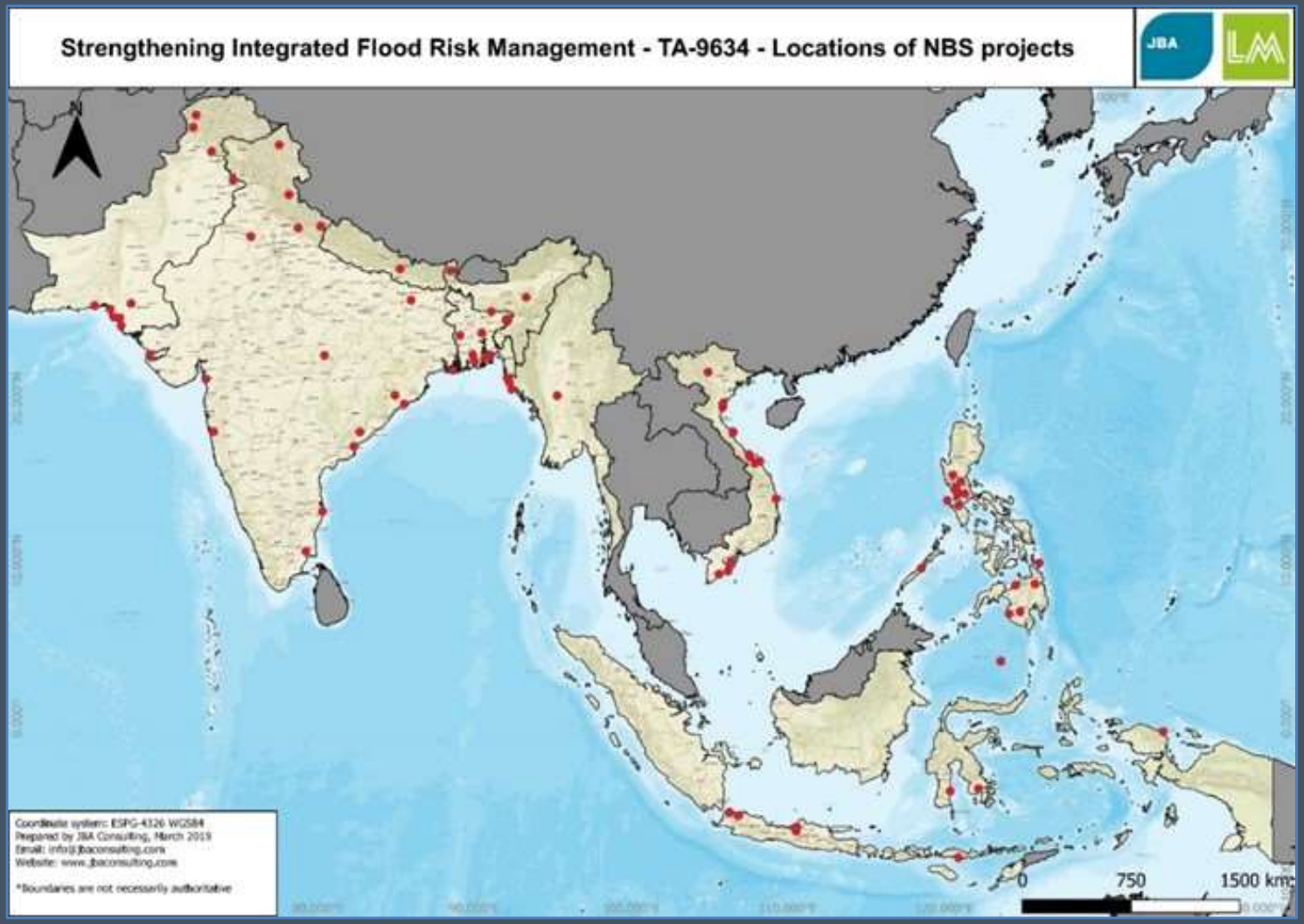
Expend relative to GDP and loss (AAL)

	CAPEX:GDP		CAPEX: AAL	
Country	CAPEX (US billions 2015)	Capex/GDP	Historic AAL	Capex/AAL
Bangladesh	0.007	0.00%	2,953	0.24%
India	1.5	0.05%	9,359	16.03%
Indonesia	0.5	0.04%	2,411	20.74%
Myanmar			2,039	
Nepal			143	
Pakistan	0.009	0.00%	1,055	0.85%
Philippines	1.1	0.29%	7,159	15.37%
Vietnam	0.1	0.04%	2,371	4.22%

Source of data: JICA RI (2020) Bridging the Gaps in Infrastructure Investment for Flood Protection in Asia. Paper 203 Mikio Ishiwatari and Daisuke Sasaki

Flood Infrastructure

Soft: NBS and Catchment Measures



Source of data: Consultant review of published project data

Flood Risks – Are we getting the balance right?

Source: Phare Cambodia

Integrated Flood Risk Management – Change

- Scope for improvement – sample of benchmarking

	Category	Bangladesh	India	Indonesia	Myanmar	Nepal	Pakistan	Phillipines	Vietnam
FLOOD INFRASTRUCTURE	Population with some defences (% of Population at Risk)								
	Population defended 50y+ (% of Population at Risk)								
	Application of NBS or similar soft solutions - rivers								
	Coastal NBS or similar soft solutions								
	CAPEX Index								
	OPEX Index								
	Storages Operated for Flood Risk Reduction								
	Flood Monitoring & Warning Systems								

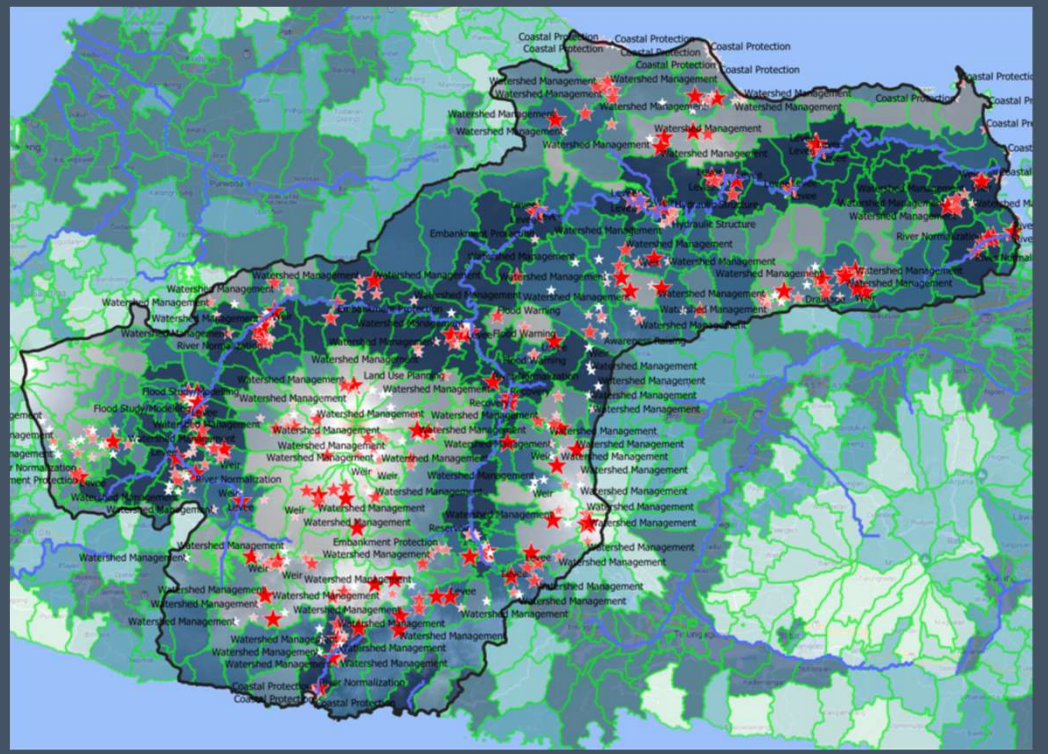
Source of data: Sector Assessment Benchmarking. Green= Best of Sample yellow is median performance Red = Low Achievement Black= Not available/applicable.

COUNTRY-WIDE PRIORITIZATION FOR FLOOD INVESTMENT

Development of a ***National Integrated Risk Analytics (NIRA) Tool*** for assessing flood risk and ranking solutions

Contents

- What is NIRA?
- NIRA at a national scale
- How it works
- Benchmarking
- Risk reduction scenarios
- Weighing-up strategic spatial IFRM scenarios

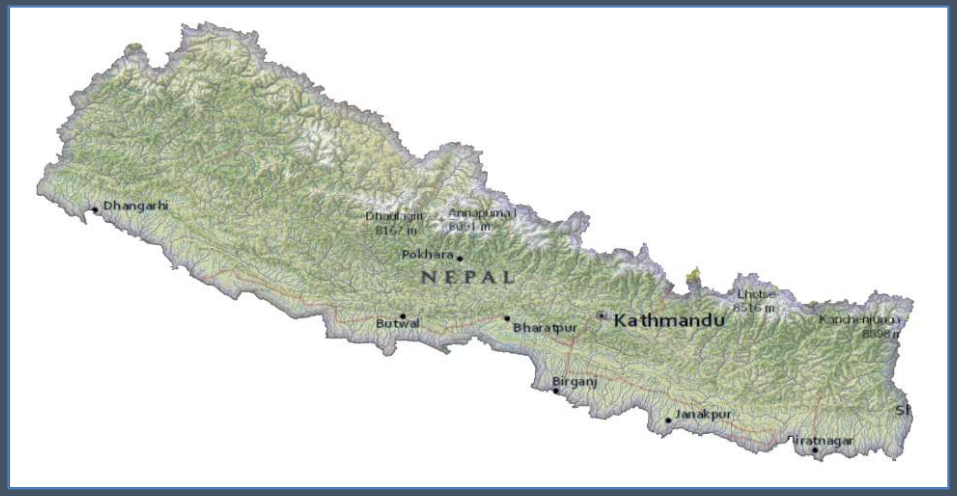


- Capacity building + National GIS Database
- Prioritising budgets with NIRA and other datasets including the Road Map
- Translates to the ground in Solo with the IFRM prioritisation recommendations
- The process helped Integrate NIRA with existing hazard data and local knowledge and made for a more informed prioritisation process

What is NIRA?

NIRA stands for National Integrated Risk Analytics, which we have used to:

- Understand **National** scale distribution of flood risk for Indonesia
- Understand the potential risk-reduction based on **Integrated** flood **Risk** management measures
- Provide **Analytics** of what-if scenarios at a strategic, birds-eye level



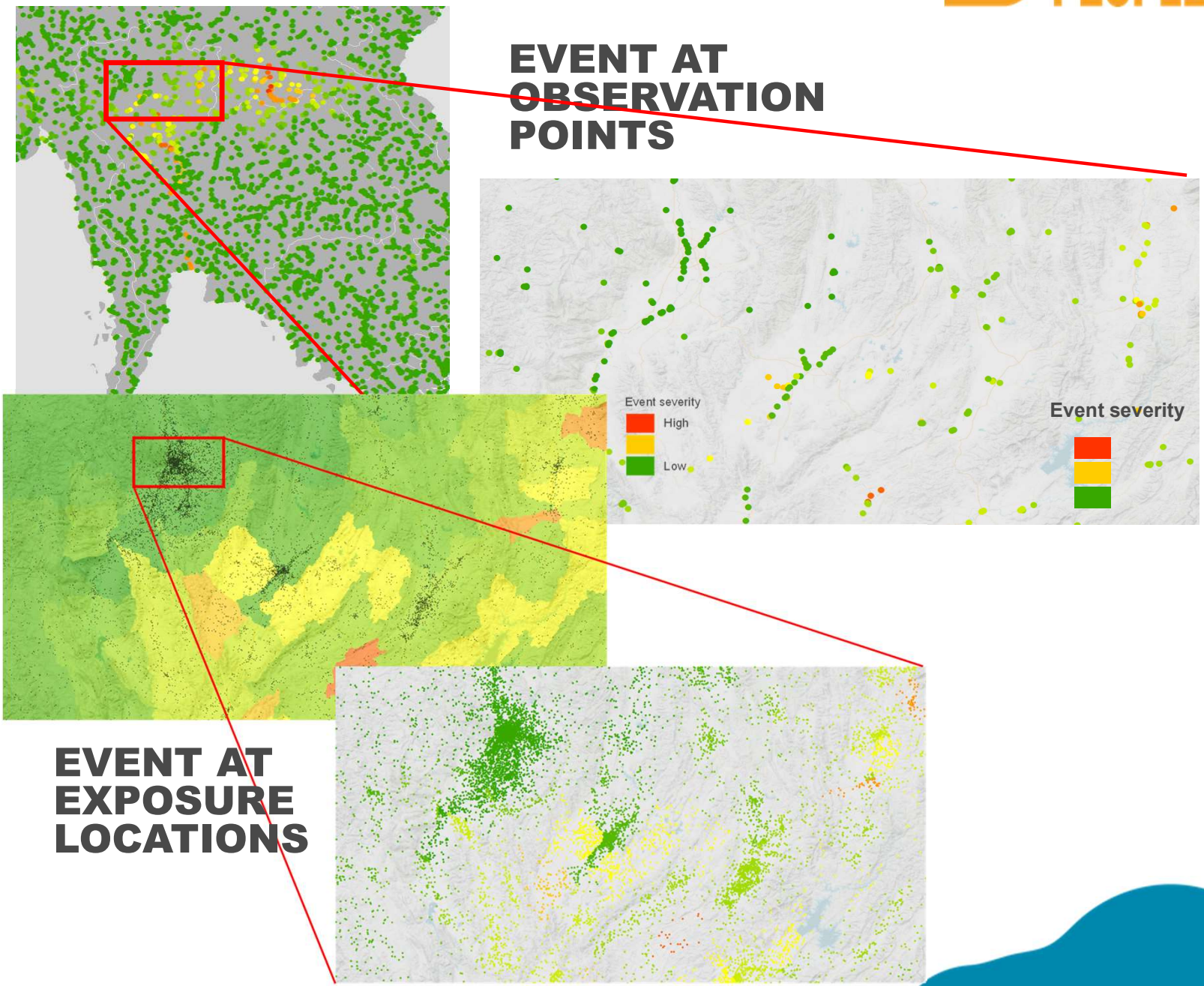
What Data does NIRA use?

- NIRA uses JBA software FLY to undertake probabilistic risk calculations with some key high-resolution datasets:
  - JBA's 30m resolution flood hazard library for 6 probabilities (5%, 2%, 1%, 0.5%, 0.2% and 0.07% AEP)
  - Covers both surface water and fluvial flooding
  - Facebook 30m resolution population data used for disaggregating different exposure data such as property and people
  - Census data at administrative levels 2 and 3
  - Vulnerability curves by census house-type based on JRC approach
  - JBA Global Event Set of tens of thousands of spatially realistic synthetic storms
- We then aggregate back up to the larger scale looking at national, river basin territory, district and sub-district scales

FLY TECHNOLOGY

JBA risk management THE FLOOD PEOPLE.

- Analyse each event from 10,000 events
- Find the distributed severity
- Apply severity to linked population
- Generate resulting Exposure
- Tabulate severity for each event
- Derive depth using GFM
- Translate to damage using vulnerability curve
- Derive average annual losses



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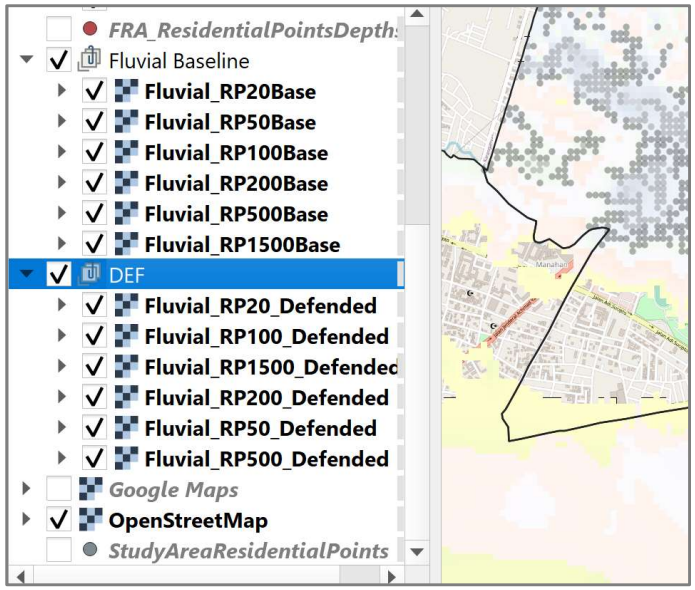
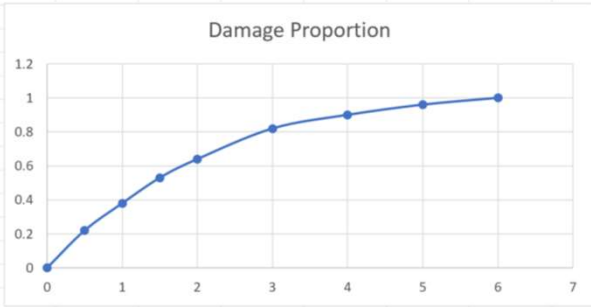
DERIVE DEPTH AT EACH PROPERTY



VULNERABILITY CURVES TRANSLATE TO DAMAGE

Depth	Damage Proportion
0	0
0.5	0.22
1	0.38
1.5	0.53
2	0.64
3	0.82
4	0.9
5	0.96
6	1

RP	Probability	Difference
2	0.5	
20	0.05	0.45
50	0.02	0.03
100	0.01	0.01
200	0.005	0.005
500	0.002	0.003
1500	0.00067	0.001333
∞	0	0.000667



Landell Mills

JBA consulting

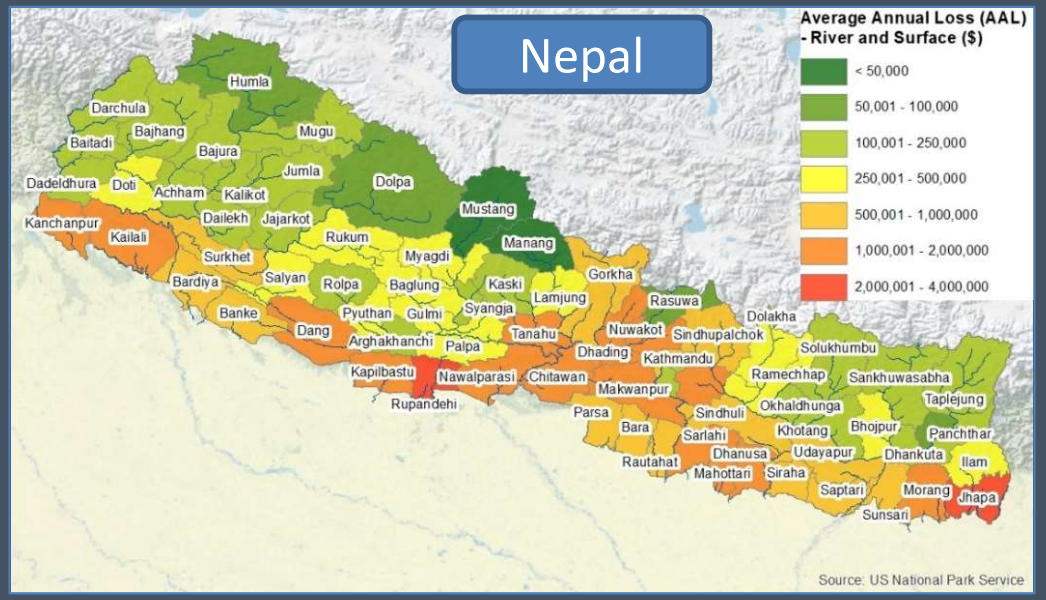
ADB
Asian Development Bank

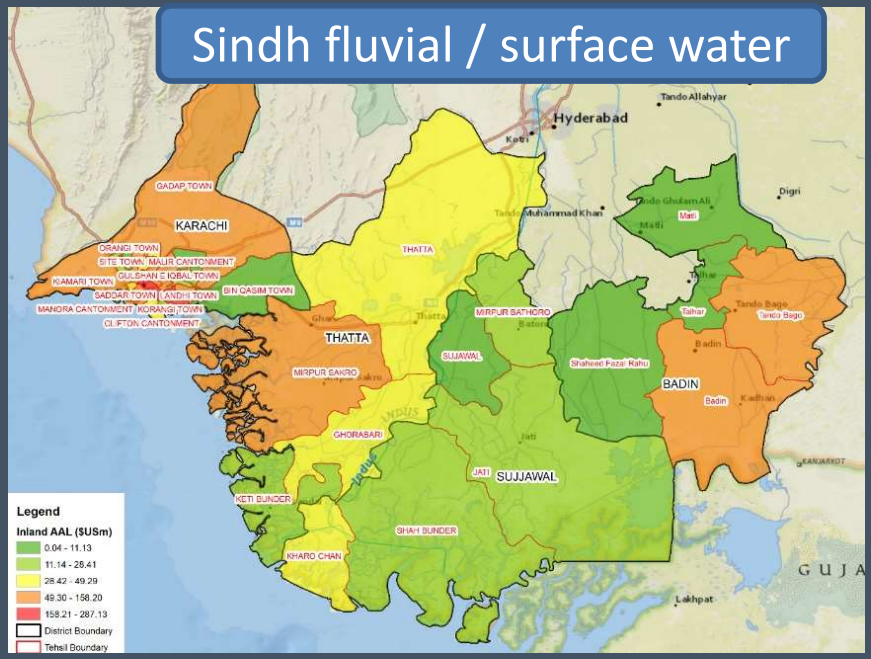
landell-mills.com

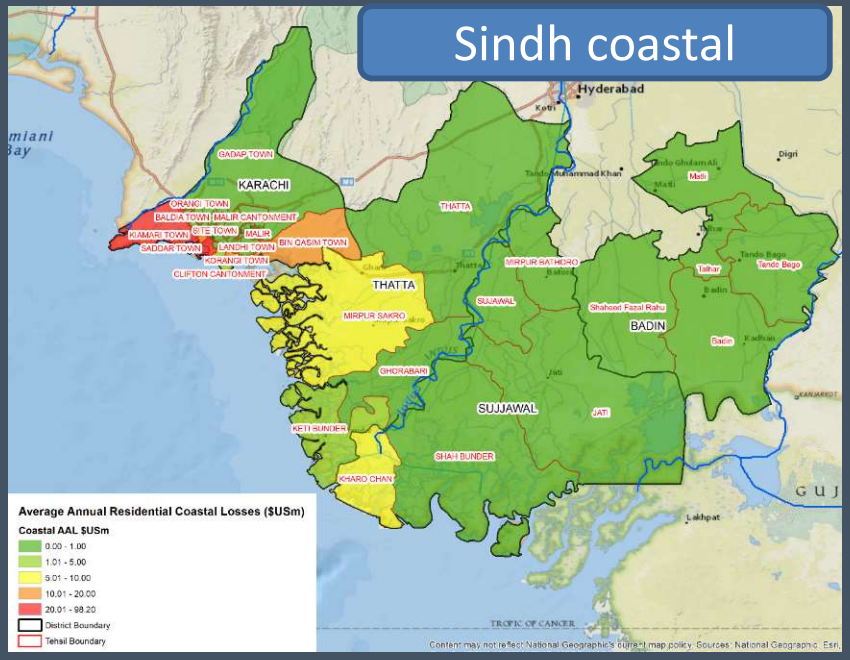
National Assessments of Risk

TA 9634-REG: Strengthening Integrated Flood Risk Management

Distribution of risk: Average Annual Losses (residential)







Comparisons with other national risk assessments

Useful comparisons - …But NIRA is "bottom-up" and the starting point is high resolution data (30m)

Indonesia

Source	Average Annual Losses from flooding (billion USD)	Assumptions
This study (residential losses)	*3.6*	*Residential undefended*
World Resources Institute / Aqueduct Global Flood Analyzer[1]	*3.7*	*All property, undefended (previous release)*
*World Resources Institute / Aqueduct **beta** Global Flood Analyzer[2]*	*4.9*	*All property, undefended new release of Aqueduct*
This study with JBA default defenses	*2.9*	*Using estimated areas benefitting from defenses*
GAR-15[3] from sector assessment report	*2.4*	*JBA Sector Assessment report (baseline defended)*

Nepal

Source	Average Annual Losses from flo
This study	***44.5****
World Resources Institute / Aqueduct Global Flood Analyzer[1]	***28.6**** Assuming a 2 year level **13.6** Assuming a 10 year leve
PreventionWeb, 2014[2]	**94.4** (National reports)
World Bank, 2016[3] EM-DAT estimates based on 30 years of data that includes hydrological and meteorological data that excludes cold snaps and avalanches	**38.5** (EM-DAT refined hazard) **36.7** (EM-DAT refined hazard)

Pakistan

Source	Average Annual Residential Direct Losses from fluvial / pluvial flooding (billion USD)	Assumptions
This study (residential losses, fluvial and pluvial) (2021).	4.22	Residential[1] undefended
This study with JBA default areas benefiting from defenses – these are approximate areas that considered to have some level of protection at a national scale based on JBA data	3.47	Using estimated areas benefitting from defenses (spatially varied standard of protection, JBA)
World Resources Institute / Aqueduct Global Flood Analyzer 2010 (**Error! Reference source not found.**)	1.6	Riverine / urban losses – estimated current flood protection 9 year Return Period
World Resources Institute / Aqueduct **beta** Global Flood Analyzer 2030 based on climate change projections (**Error! Reference source not found.**)	9.3	Riverine / urban losses – estimated future flood protection level 6.6 year Return Period

Prioritisation

Nepal

			er	Rank Based on Losses	Average Annual households (HH) at risk	AAHH at risk per km2	Rank based on households or people	Sum of Household and Losses Rank	Overall Priority based on households and losses (normalised by area)
Jalad	244.9	429134.71	1752.06	1	377	1.538	2	3	1
Budhi	340.5	317686.07	933.08	5	582	1.709	1	6	2
Aurhai	244.3	344906.09	1411.58	2	273	1.118	6	8	3
Lakhandeh	344.4	299311.28	869.08	7	418	1.215	5	12	4
Biring	369.3	338743.44	917.29	6	302	0.817	7	13	5
Ratuwa	380.9	375818.32	986.73	4	266				
Mohana	412.4	447274.14	1084.51	3	277				
Bakraha	398.0	326131.62	819.46	9	305				
Gagan	210.6	181018.70	859.56	8	160				
Khando	161.3	80507.35	499.25	15	240				
Lal Bakeya	849.0	401214.18	472.57	17	1075				
Jhim	206.6	133446.96	645.90	12	146				
Chisang	364.6	237746.77	652.14	11	249				
Chaudhar	362.6	271537.46	748.81	10	154				
East Rapti	3100.7	1894923.92	611.12	13	1686				
Kamal	119.3	63632.64	533.57	14	45				
Dodha	850.0	415062.18	488.28	16	325				
Banganga	956.7	411905.67	430.54	19	394				
Balan	471.8	213808.60	453.19	18	159				
Khutia	328.1	135321.94	412.43	20	77				
Kankai	1300.1	376528.59	289.63	21	259				
Kandra	473.1	123636.43	261.31	22	87				
West Rapti	6392.6	1505552.92	235.52	24	1046				
Narayani	28682.3	7243670.94	252.55	23	3746				
Karnal									

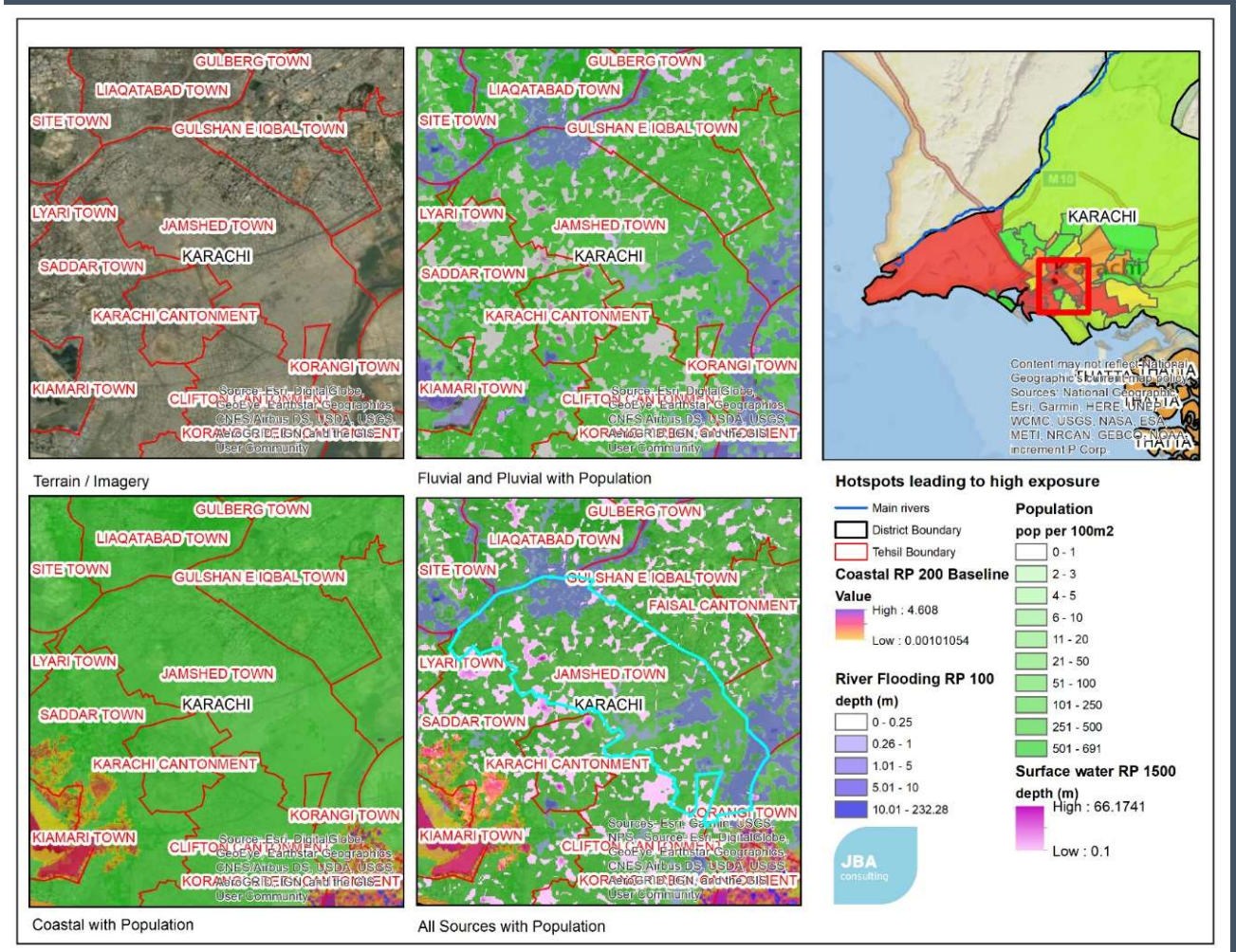
Sindh

PROVINCE	DISTRICT	TEHSIL	Average Annual Count of People flooded (Fluvial)	Average Annual Count of People flooded (Coastal)	Fluvial Baseline Undefended Average Annual Residential Losses (Per Capita)	Fluvial Defended (10 year) Average Annual Residential Losses (Per Capita)	Fluvial Defended (100 year) Average Annual Residential Losses (Per Capita)	Fluvial with PLR Average Annual Residential Losses (Per Capita)	Fluvial with EWS Average Annual Residential Losses (Per Capita)	Coastal Baseline Average Annual Residential Losses (Per Capita)	Coastal with Future Mangrove Average Annual Residential Losses (Per Capita)
SINDH	SUJAWAL	KHARO CHAN	1030	3188	$ 3,600.06	$ 3,600.06	$ 2,671.52	$ 3,515.37	$ 2,796.38	$ 2,689.95	$ 2,355.13
SINDH	THATTA	KETI BUNDER	838	706	$ 2,701.97	$ 2,701.97	$ 1,369.20	$ 2,577.01	$ 2,099.88	$ 2,736.13	$ 1,808.58
SINDH	KARACHI	JAMSHED TOWN	10824	40	$ 2,652.73	$ 130.96	$ 130.96	$ 2,475.65	$ 2,099.20	$ 4,695.10	$ 4,695.10
SINDH	KARACHI	KORANGI CREEK CANTONME	1096	2706	$ 2,592.22	$ 73.86	$ 73.86	$ 2,375.68	$ 2,061.40	$ 4,689.61	$ 2,214.02
SINDH	KARACHI	FAISAL CANTONMENT	5623	0	$ 2,519.11	$ 178.78	$ 178.78	$ 2,272.32	$ 1,979.83	$ -	$ -
SINDH	KARACHI	LANDHI TOWN	5313	0	$ 2,434.51	$ 55.95	$ 55.95	$ 2,209.30	$ 1,908.54	$ -	$ -
SINDH	KARACHI	LIAQATABAD TOWN	9062	0	$ 2,291.33	$ 188.84	$ 188.84	$ 2,001.15	$ 1,833.24	$ -	$ -
SINDH	KARACHI	SITE TOWN	6950	218	$ 2,276.33	$ 218.48	$ 218.48	$ 2,085.97	$ 1,822.39	$ 3,593.36	$ 855.24
SINDH	KARACHI	KORANGI TOWN	10850	178	$ 2,072.21	$ 147.89	$ 147.89	$ 1,860.76	$ 1,656.33	$ 4,440.93	$ 4,004.84
SINDH	SUJAWAL	SHAH BUNDER	1465	277	$ 1,805.11	$ 1,805.11	$ 118.86	$ 1,596.50	$ 1,434.08	$ 2,363.25	$ 1,944.41
SINDH	KARACHI	LYARI TOWN	2581	3214	$ 1,676.55	$ 87.72	$ 87.72	$ 1,525.62	$ 1,380.75	$ 4,183.42	$ 643.42
SINDH	KARACHI	GULBERG TOWN	6145	0	$ 1,604.13	$ 417.16	$ 417.16	$ 1,351.52	$ 1,362.19	$ -	$ -
SINDH	KARACHI	GULSHAN E IQBAL TOWN	9867	0	$ 1,482.96	$ 146.69	$ 146.69	$ 1,287.91	$ 1,201.07	$ -	$ -
SINDH	KARACHI	GADAP TOWN	5828	0	$ 1,475.89	$ 567.43	$ 567.43	$ 1,241.25	$ 1,169.49	$ -	$ -
SINDH	BADIN	Badin	6943	0	$ 1,454.86	$ 1,454.86	$ 1,454.86	$ 1,169.05	$ 1,133.69	$ -	$ -
SINDH	BADIN	Tando Bago	6527	0	$ 1,438.87	$ 1,438.87	$ 1,438.87	$ 1,129.99	$ 1,121.78	$ -	$ -
SINDH	KARACHI	KIAMARI TOWN	7313	22044	$ 1,404.33	$ 254.61	$ 254.61	$ 1,106.23	$ 1,127.90	$ 4,454.77	$ 1,840.00
SINDH	THATTA	MIRPUR SAKRO	5696	2237	$ 1,396.58	$ 1,396.58	$ 1,361.51	$ 992.45	$ 1,086.79	$ 2,491.81	$ 2,303.79
SINDH	KARACHI	KARACHI CANTONMENT	1505	7	$ 1,309.42	$ 442.18	$ 442.18	$ 1,298.07	$ 1,149.34	$ 6,989.09	$ 6,989.09
SINDH	THATTA	GHORABARI	3392	337	$ 1,281.46	$ 1,281.46	$ 641.37	$ 1,071.21	$ 1,000.18	$ 2,704.81	$ 1,262.57
								98.08	$ 999.40	$ -	$ -
								17.91	$ 1,121.48	$ 4,089.59	$ 3,564.99
								38.58	$ 960.84	$ -	$ -
								33.16	$ 847.32	$ -	$ -
								05.13	$ 793.20	$ -	$ -
								07.41	$ 785.69	$ -	$ -
								91.89	$ 675.80	$ -	$ -
								03.33	$ 661.88	$ 3,307.42	$ 3,206.34
								67.36	$ 579.74	$ -	$ -
								56.39	$ 586.03	$ -	$ -
								04.43	$ 518.34	$ -	$ -
								06.17	$ 402.65	$ -	$ -
								23.64	$ 358.13	$ -	$ -
								32.54	$ 320.06	$ 4,625.07	$ 4,625.07
								09.78	$ 159.90	$ -	$ -
								05.22	$ 144.77	$ -	$ -
								79.66	$ 106.50	$ -	$ -
								-	$ -	$ 5,186.40	$ 5,123.45

Indonesia

Name	Basin	AAL ($US)	Rank based on AAL	Average Annual Households at risk	Rank of Households at risk	Average Annual People at risk	Rank of People at risk	Overall Score
WS CILIWUNG-CISADANE	WS CILIWUNG-CISADANE	$392,443,887	1	89155	1	344157	1	3
WS BRANTAS	WS BRANTAS	$305,010,934	2	76300	2	280448	2	6
WS BENGAWAN SOLO	WS BENGAWAN SOLO	$213,044,890	4	52569	3	189726	4	11
WS CITARUM	WS CITARUM	$165,649,310	7	52353	4	195855	3	14
WS MUSI-SUGIHAN-BANYU	WS MUSI-SUGIHAN-BANYUASIN-I	$209,745,840	5	42786	5	172814	5	15
WS JRATUNSELUNA	WS JRATUNSELUNA	$99,914,337	11	36219	6	130748	6	23
WS CIMANUK-CISANGGARU	WS CIMANUK-CISANGGARUNG	$103,116,294	10	29769	7	108843	7	24
WS BARITO	WS BARITO	$115,509,315	8	28603	8	107862	8	24
WS KAPUAS	WS KAPUAS	$167,606,472	6	22899	10	97848	9	25
WS INDRAGIRI-AKUAMAN	WS INDRAGIRI-AKUAMAN	$242,606,272	3	16132	12	66976	12	27
WS PEMALI-COMAL	WS PEMALI-COMAL	$52,929,416	17	23991	9	95998	10	36
WS SERAYU-BOGOWONTO	WS SERAYU-BOGOWONTO	$77,527,615	14	22166	11	81932	11	36
WS MAHAKAM	WS MAHAKAM	$94,169,577	12	15997	13	63705	14	39
WS BATANGHARI	WS BATANGHARI	$106,850,411	9	13957	15	56064	15	39
WS BELAWAN-ULAR-PADAN	WS BELAWAN-ULAR-PADANG	$83,618,276	13	15521	14	65784	13	40
WS CITANDUY	WS CITANDUY	$60,427,801	16	12290	16	42750	16	48
WS PROGO-OPAK-SERANG	WS PROGO-OPAK-SERANG	$35,919,550	20	11596	17	40971	17	54
WS SEPUTIH-SEKAMPUNG	WS SEPUTIH-SEKAMPUNG	$33,880,075	21	9427	19	36844	19	59
WS SAMBAS	WS SAMBAS	$40,078,409	18	7527	22	32351	22	62
WS CIDANAU-CIUJUNG-CID	WS CIDANAU-CIUJUNG-CIDURIAN	$33,510,113	23	8633	20	36438	20	63
WS BONDOYUDO-BEDADU	WS BONDOYUDO-BEDADUNG	$32,476,399	24	10021	18	35265	21	63
WS SIAK	WS SIAK	$63,331,465	15	6571	24	27258	24	63
WS JENEBERANG	WS JENEBERANG	$27,147,846	25	8551	21	36928	18	64
WS ROKAN	WS ROKAN	$36,272,224	19	6047	25	25560	25	69

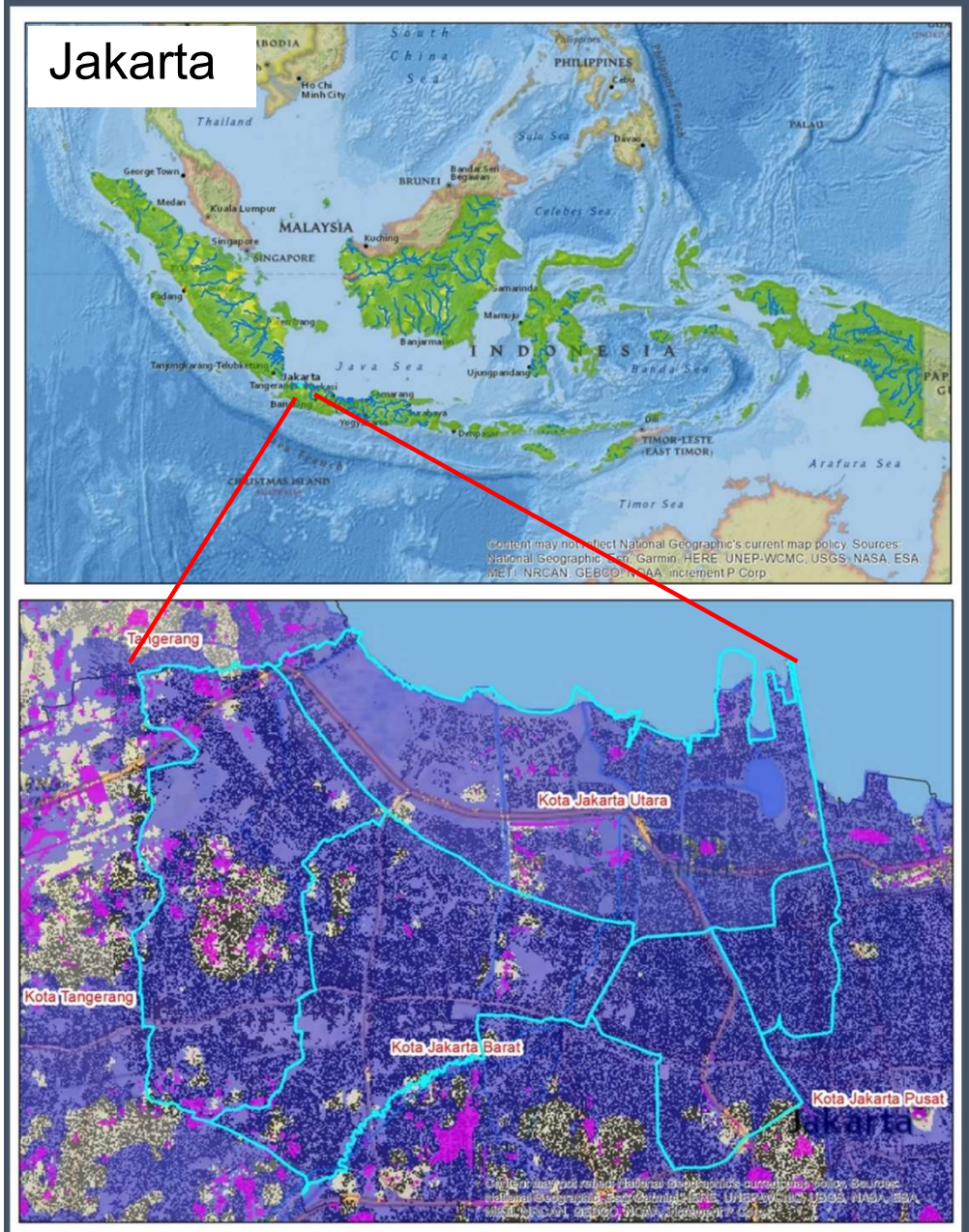
Exploring baseline risk - Sindh Province

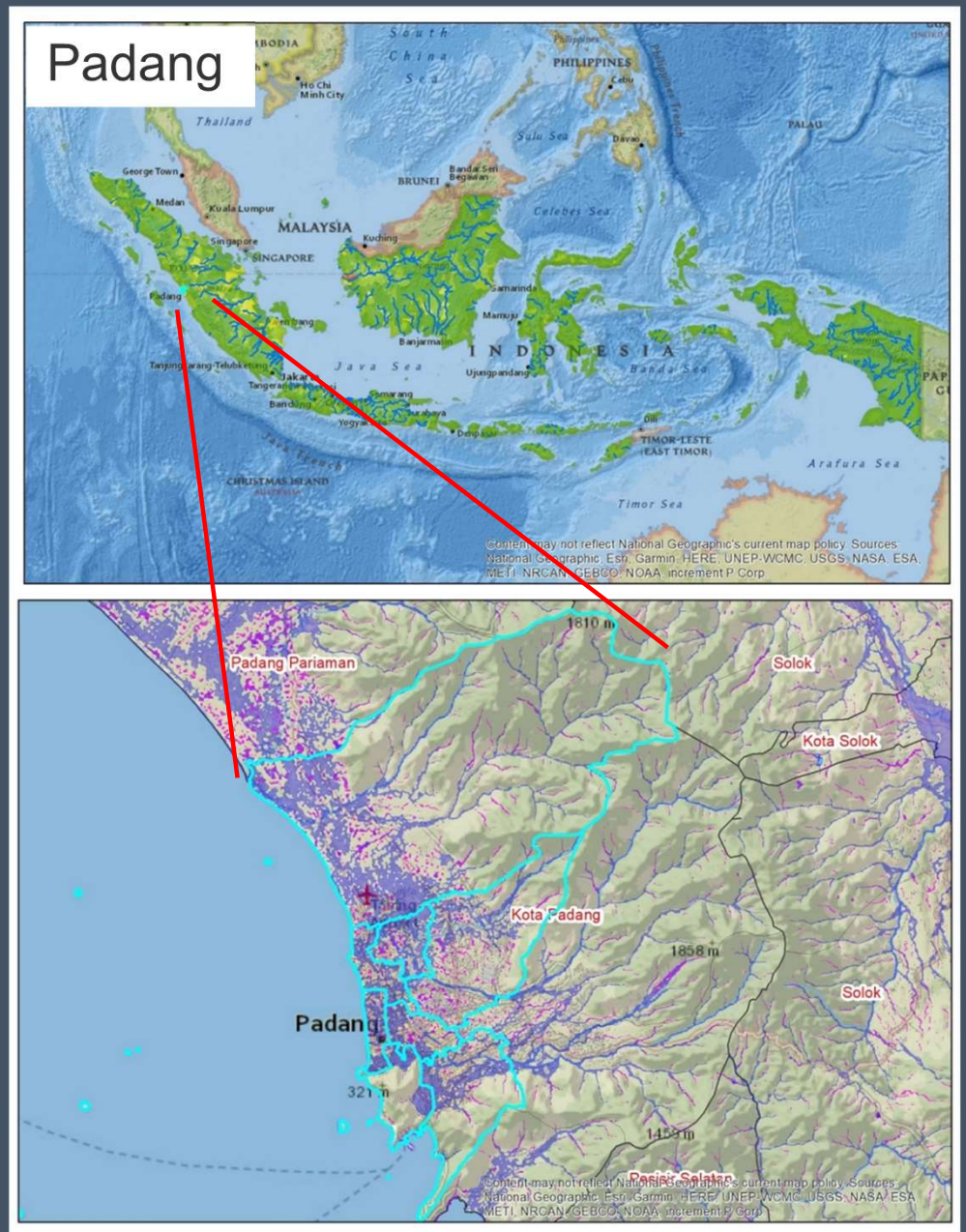


Jamshed town in Pakistan's southern port city of Karachi, in 2017

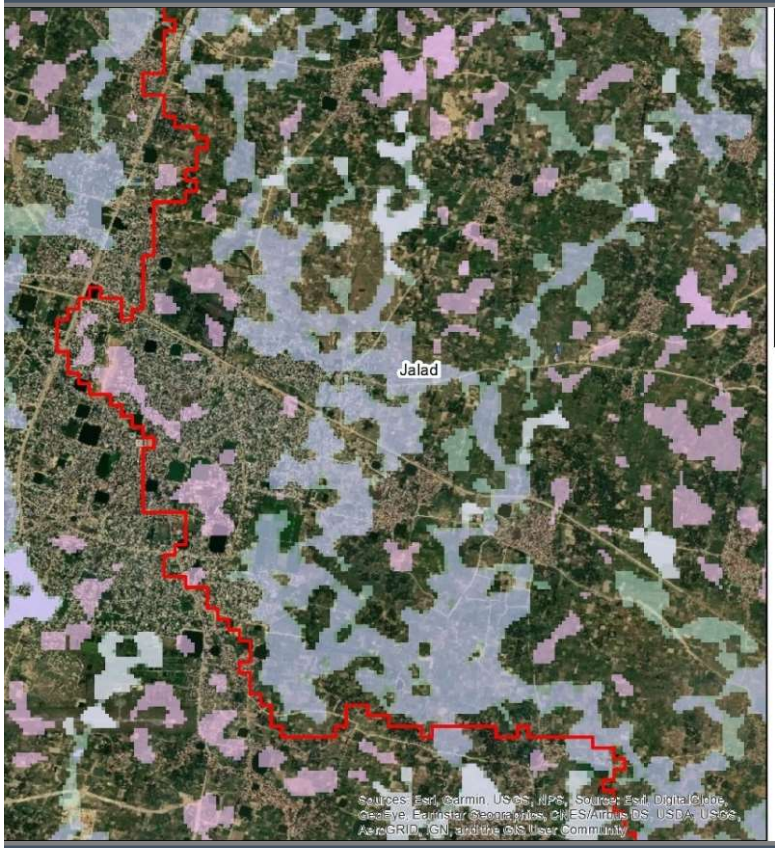
DISTRICT	TEHSIL	AA People Count (Inland)	AA People Count Coastal	AA People Count (Inland and Coastal)	Inland Baseline Undefended AA Residential Losses	Rank based on Inland Baseline Undefended AA Residential Losses	Coastal Baseline Average Annual Residential Losses	Rank based on Coastal Baseline AA Residential Losses	Overall Rank
KARACHI	JAMSHED TOWN	10824	40	10864	28713142	1	187804	15	3

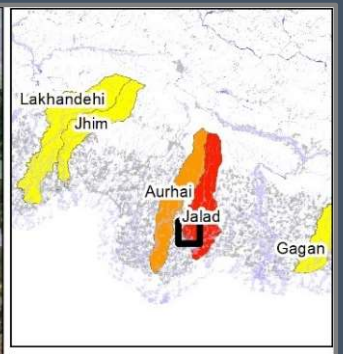
Exploring (baseline) risk - Indonesia

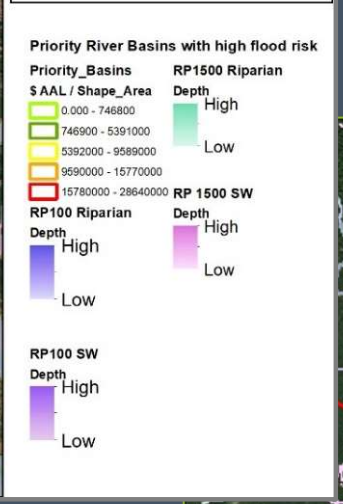


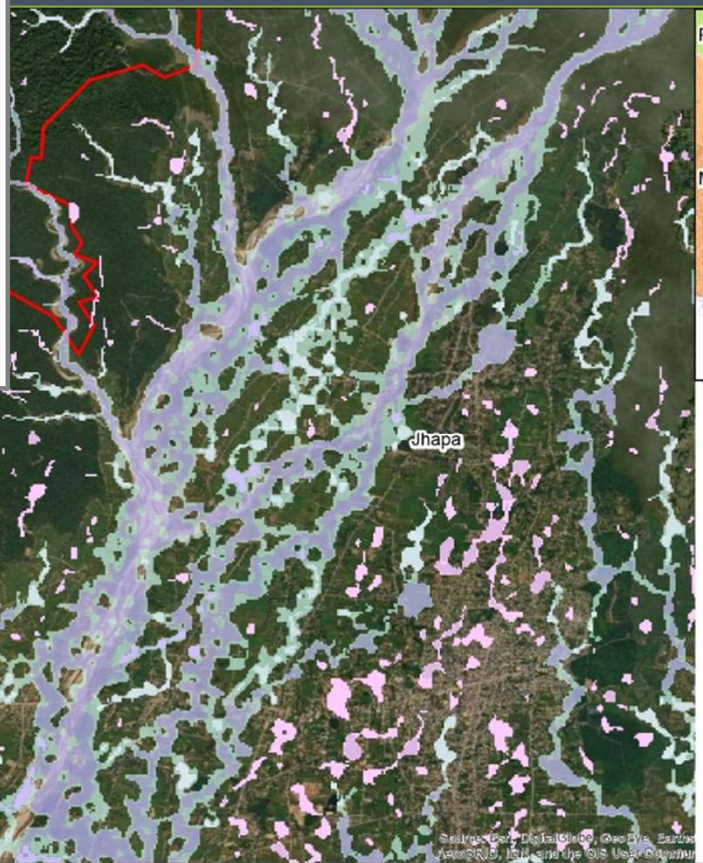


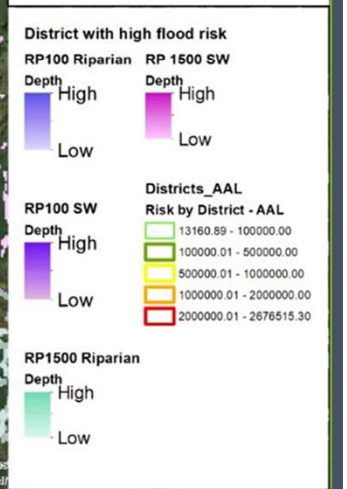
Exploring (baseline) risk - Nepal











Modelling residual risk
Potential areas for Integrated Flood Risk Management

- We modelled four kinds of IFRM nationally and computed the reduction in risk:
  - **New embankments or defences**
    - Areas of high risk have been identified
  - **Property Level Resilience**
    - Improved building type/flood-proofing
  - **Flood Warning Areas**
    - People are more prepared to rescue valuables or escape
  - **Nature Based Solutions**. These are split into:
    1. Floodplain reconnection (room for river, etc)
    2. Runoff interception through storage
    3. Runoff interception through riparian tree planting

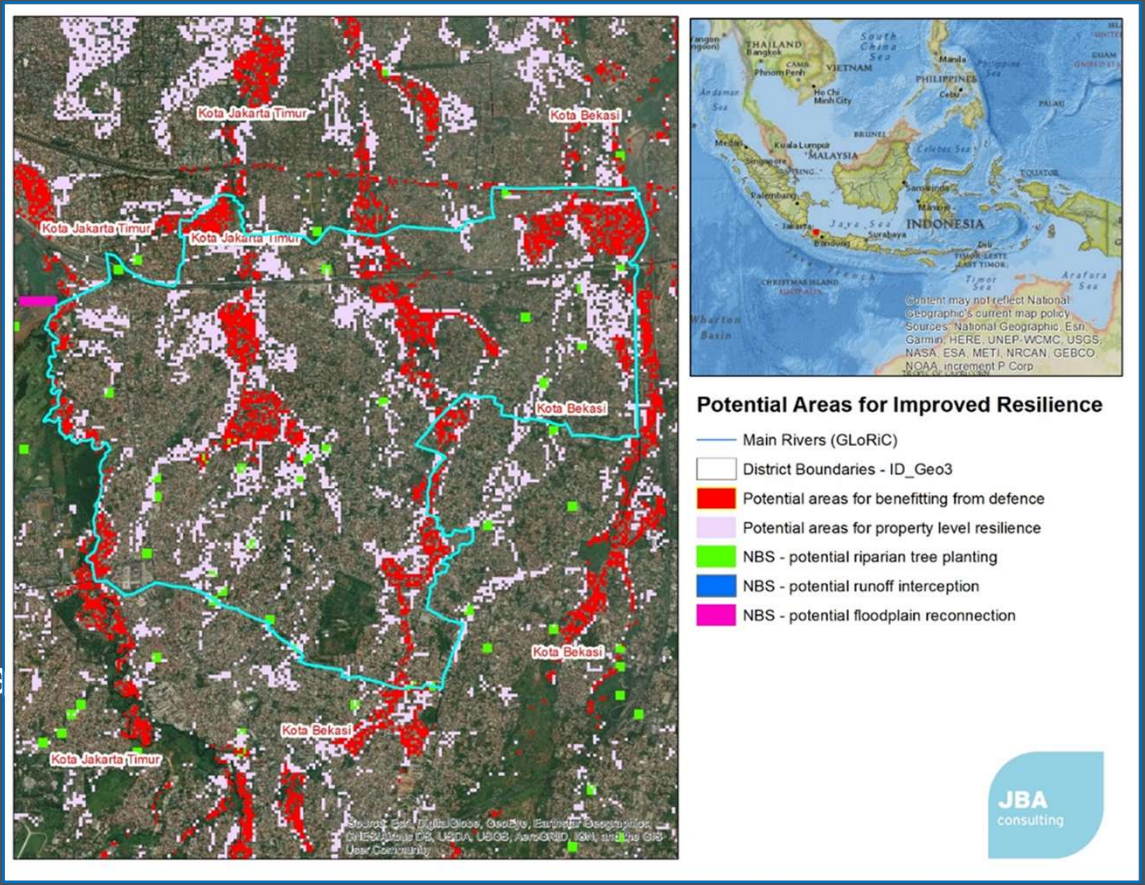
Integrated Flood Risk Management measure scenarios

- Each IFRM scenario required four steps:
  1. Conceptualisation
  2. Mapping potential areas (for IFRM) based on risk data
  3. Adjustment to risk calculation
  4. Re-run probabilistic calculation

- The next slide shows each of these steps for the one component of IFRM with maps and screenshots from the new national IFRM analysis tool

How have we created potential Areas (example uses defended areas)

- Conceptualise
  - Based on areas of high risk (>1% AEP fluvial), where there is a high population (>10 per 100m^2) density - good to prioritise!
- Mapping
  - Potential defended areas are shown in **Red**
- Adjust Risk
  - The DEF areas were given a *Standard of Protection* of 1% AEP in the risk calculation
- Re-compute
  - Adjust Risk



Baseline + adjusted risk (representing IFRM) are then compiled and stored spatially so strategies can be browsed interactively on the NIRA website…

NIRA - Indonesia

Adjust risk & re-run calculation

e.g. Threshold 1m depth since JRC curves with the 'no-damage until 0.5m.

50% reduction of all damages up to 1.5m

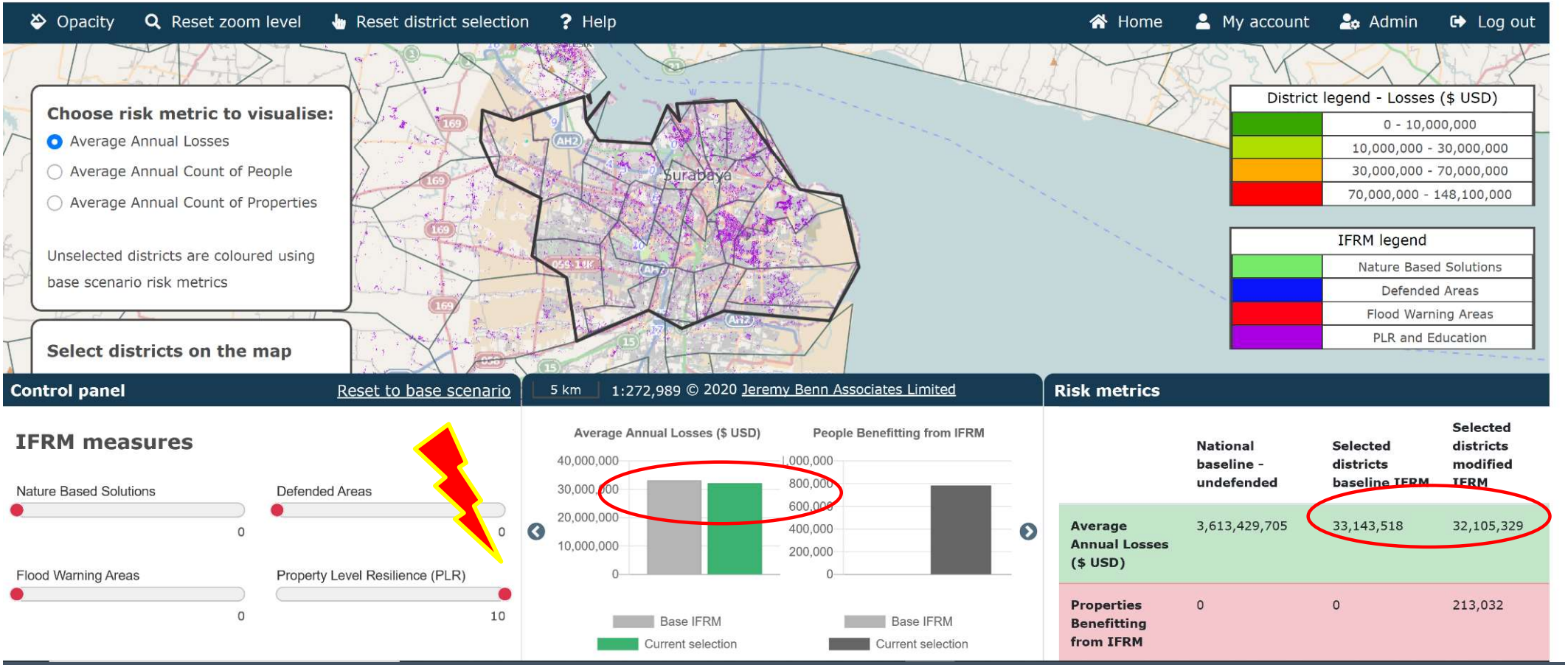
40% reduction up to 3m & then 20% above that

Risk Calculation:

This makes **a smaller** difference

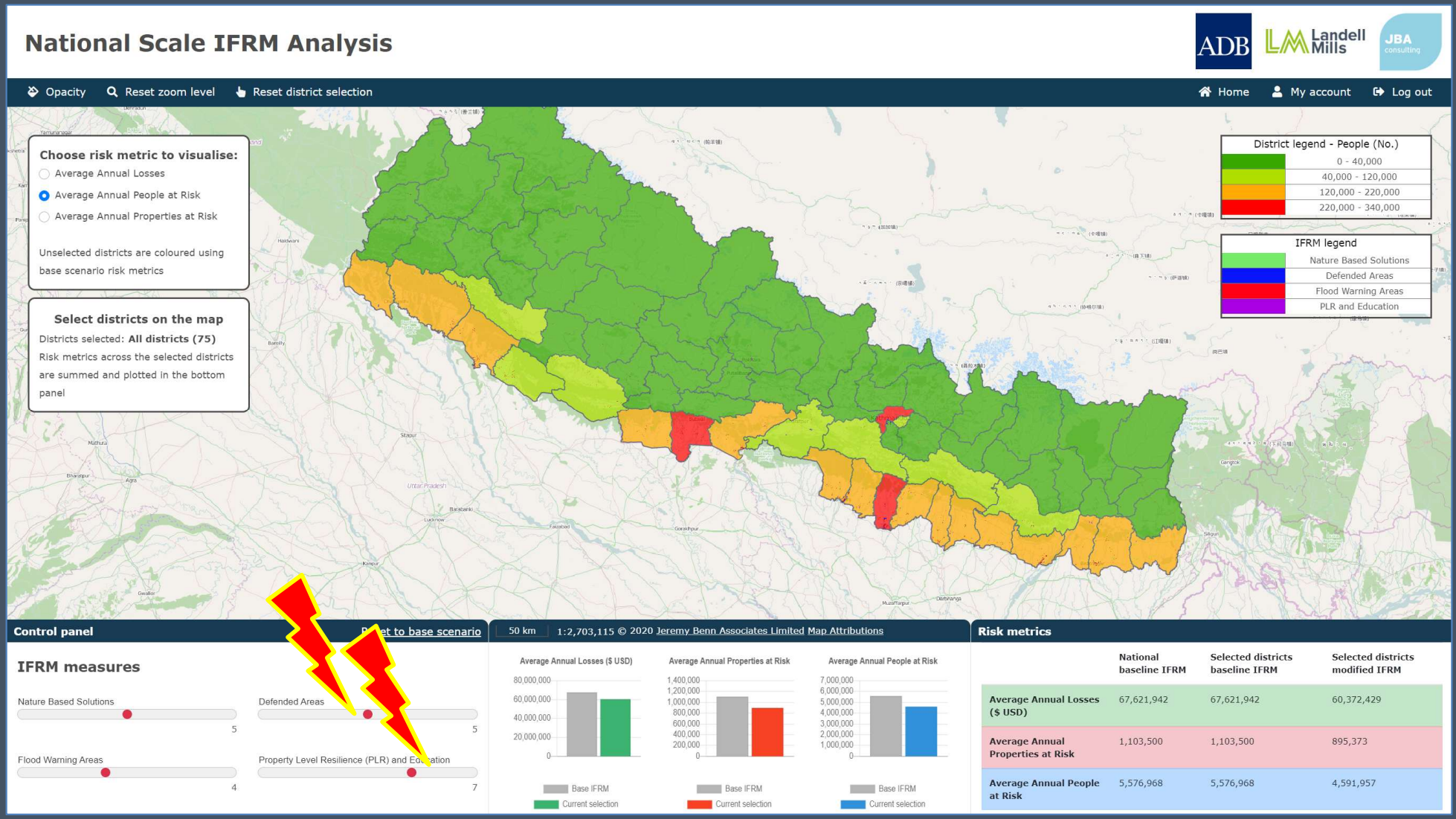
In places like Surabaya there is a 3% reduction in overall risk

National Scale IFRM Analysis - Indonesia

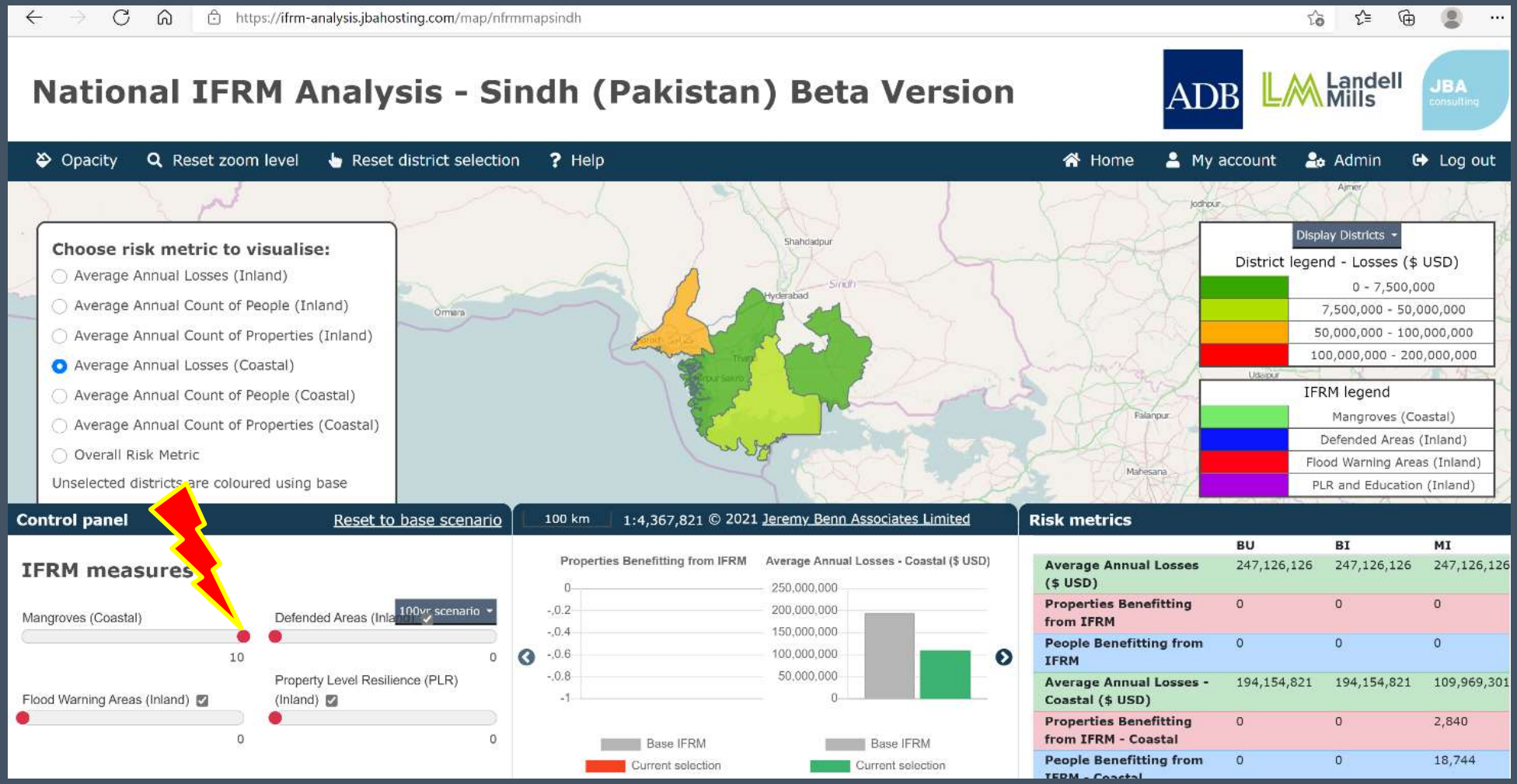


	National baseline - undefended	Selected districts baseline IFRM	Selected districts modified IFRM
Average Annual Losses ($ USD)	3,613,429,705	33,143,518	32,105,329
Properties Benefitting from IFRM	0	0	213,032

Exploring the NIRA portal: Nepal



NIRA – Sindh Province



Landell Mills

JBA consulting

ADB
Asian Development Bank

landell-mills.com

Using NIRA for the prioritization of IFRM investments

TA 9634-REG: Strengthening Integrated Flood Risk Management

Framework to prioritise FRM investments in Indonesia

- Developed for the Sub Directorate of Rivers and Coasts under Directorate General of Water Resources in the Ministry of Public Works and Housing in Indonesia.
- Prioritization method that integrates a range of tools and datasets to identify higher areas of flood risk, and shortlist proposed schemes based on available annual budget.
- Draft methodology has been handed over to the Sub directorate for testing in Solo catchment

Identifying priority for investments in FRM in Indonesia

National GIS database of proposed FRM investments (>7000 interventions)

National Integrated Risk Analytics **NIRA Tool**

Global datasets and local datasets

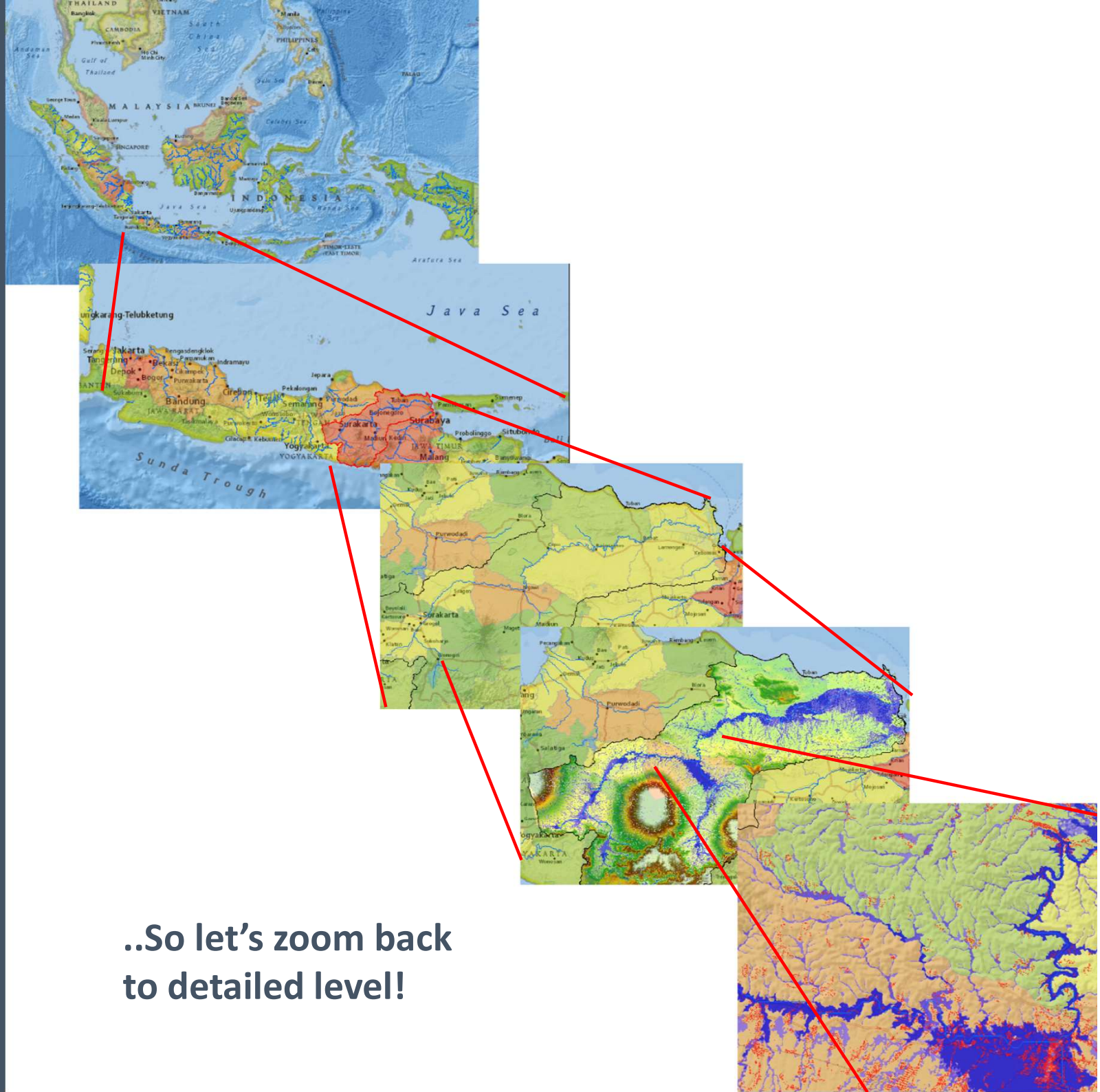
Needs assessment

Training program on range of tools and techniques for prioritization

Methodology for annual screening, establishing criteria and integration of data sources

Prioritization

National scale risk estimates are based on bottom-up, high resolution hazard and population data



..So let's zoom back to detailed level!

Integration of Road Map and Overall risk ranking across different flood risk metrics from NIRA

How does this compare with existing plans?

Name	Basin	AAL ($US)	Rank based on AAL	Average Annual Households at risk	Rank of Households at risk	Average Annual People at risk	Rank of People at risk	Overall Score
WS CILIWUNG-CISADANE	WS CILIWUNG-CISADANE	$392,443,887	1	89155	1	344157	1	**3**
WS BRANTAS	WS BRANTAS	$305,010,934	2	76300	2	280448	2	**6**
WS BENGAWAN SOLO	WS BENGAWAN SOLO	$213,044,890	4	52569	3	189726	4	**11**
WS CITARUM	WS CITARUM	$165,649,310	7	52353	4	195855	3	**14**
WS MUSI-SUGIHAN-BANYU	WS MUSI-SUGIHAN-BANYUASIN-	$209,745,840	5	42786	5	172814	5	**15**
WS JRATUNSELUNA	WS JRATUNSELUNA	$99,914,337	11	36219	6	130748	6	**23**
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WS KAPUAS	WS KAPUAS	$167,606,472	6	22899	10	97848	9	**25**
WS INDRAGIRI-AKUAMAN	WS INDRAGIRI-AKUAMAN	$242,606,272	3	16132	12	66976	12	**27**
WS PEMALI-COMAL	WS PEMALI-COMAL	$52,929,416	17	23991	9	95998	10	**36**
WS SERAYU-BOGOWONTO	WS SERAYU-BOGOWONTO	$77,527,615	14	22166	11	81932	11	**36**
WS MAHAKAM	WS MAHAKAM	$94,169,577	12	15997	13	63705	14	**39**
WS BATANGHARI	WS BATANGHARI	$106,850,411	9	13957	15	56064	15	**39**
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WS SEPUTIH-SEKAMPUNG	WS SEPUTIH-SEKAMPUNG	$33,880,075	21	9427	19	36844	19	**59**
WS SAMBAS	WS SAMBAS	$40,078,409	18	7527	22	32351	22	**62**
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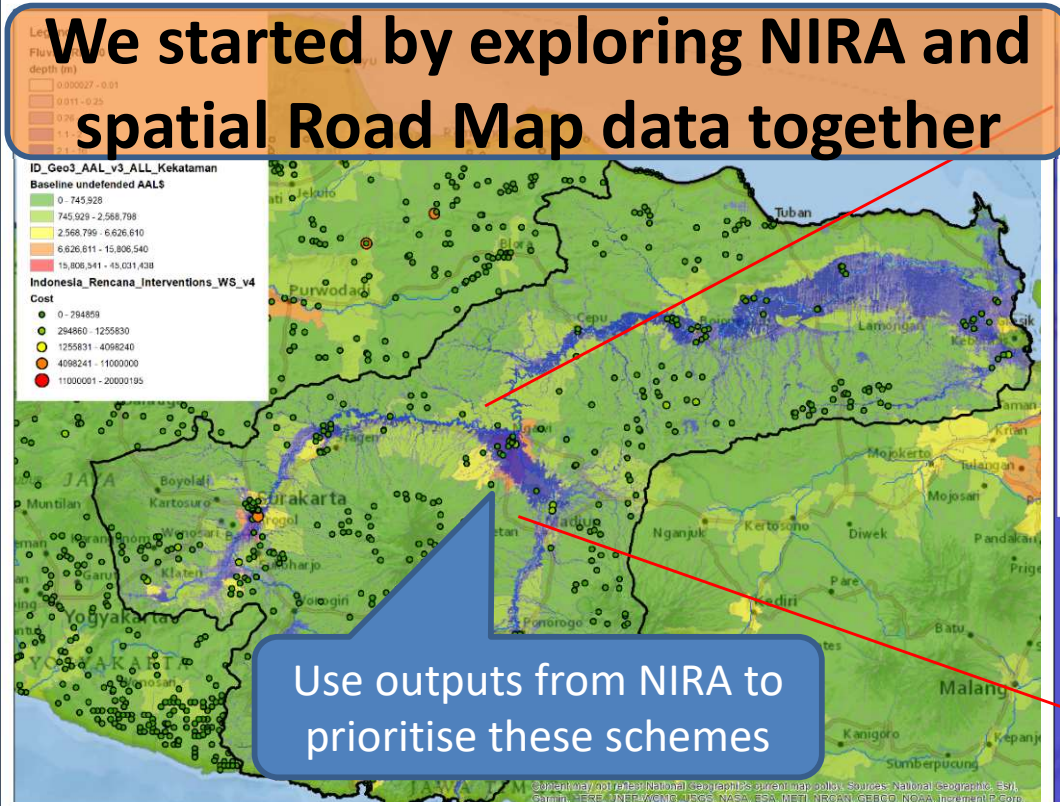
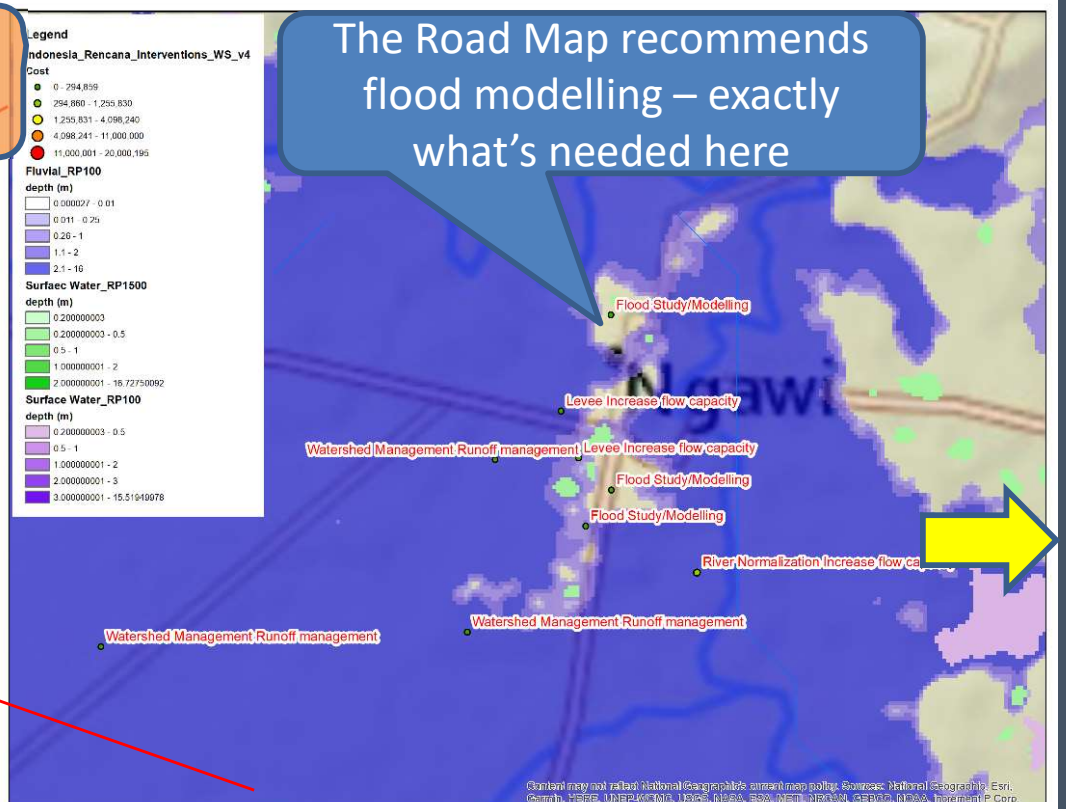
WS JENEBERANG	WS JENEBERANG	$27,147,846	25	8551	21	36928	18	**64**
WS ROKAN	WS ROKAN	$36,272,224	19	6047	25	25560	25	**69**

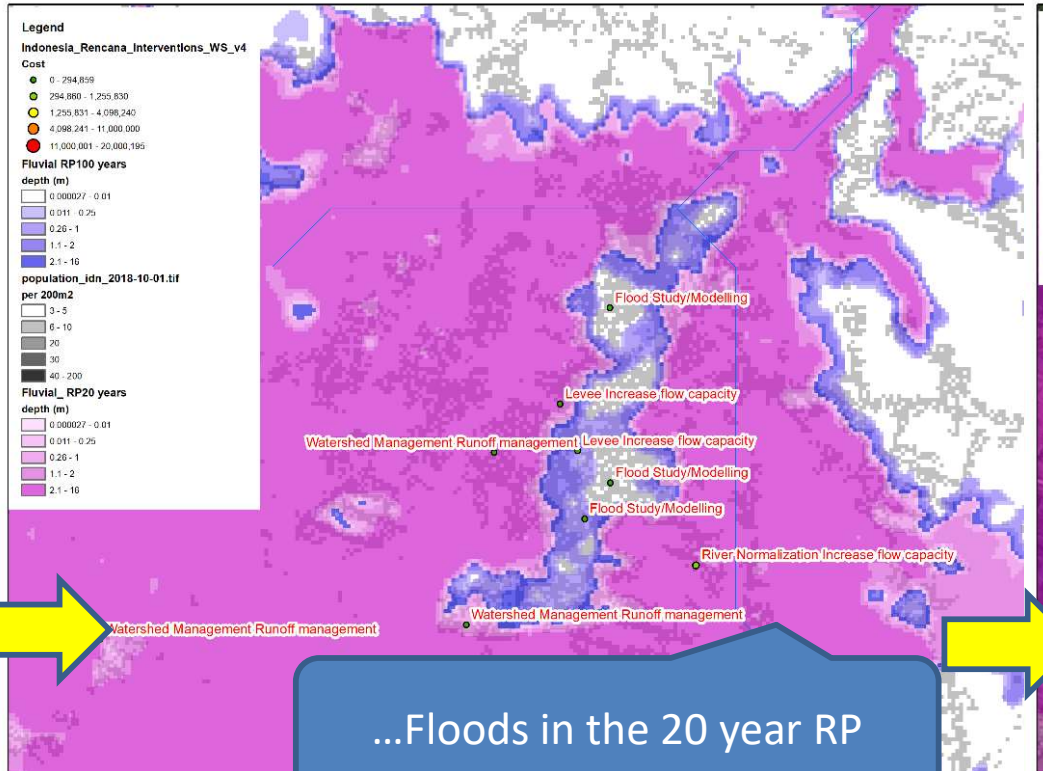
We started by exploring NIRA and spatial Road Map data together



Use outputs from NIRA to prioritise these schemes



The Road Map recommends flood modelling – exactly what's needed here



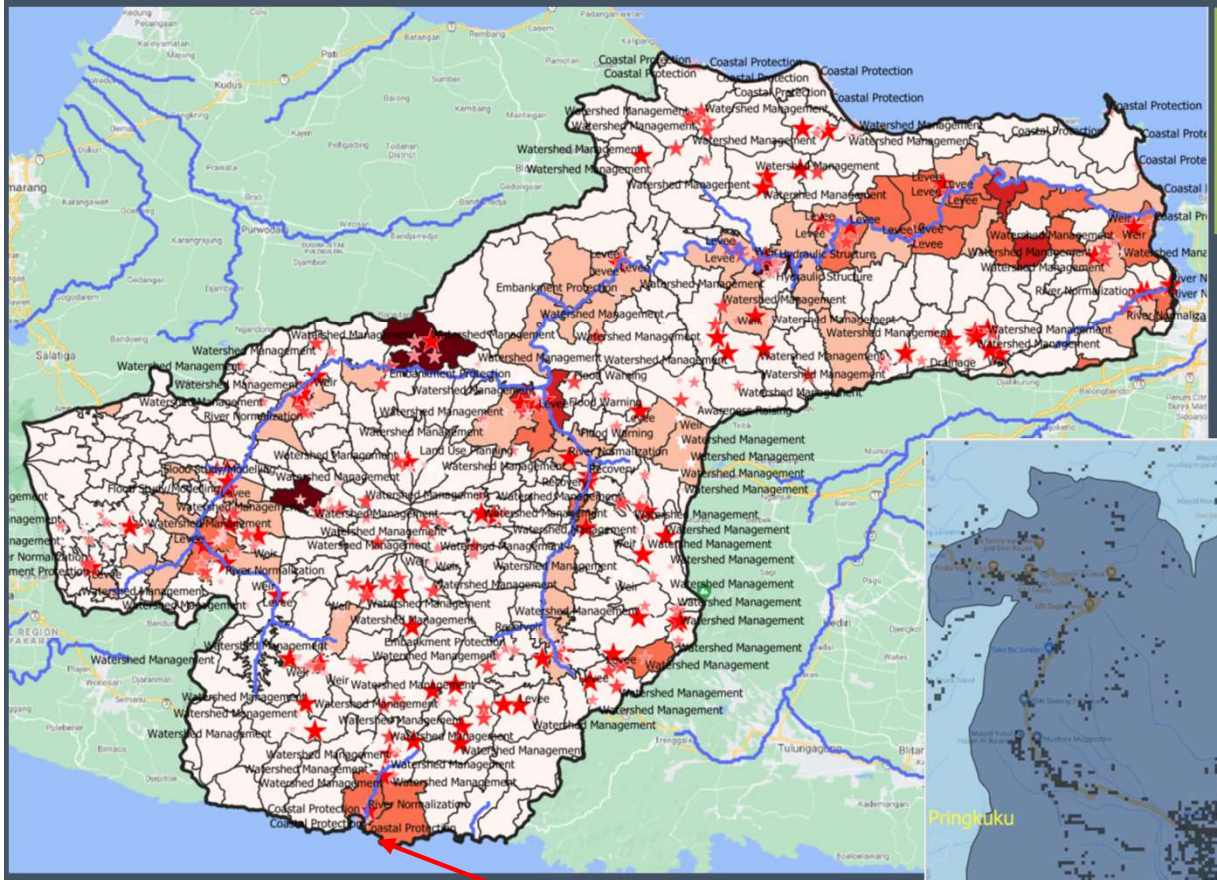
…Floods in the 20 year RP

…building is dense on the raised land but not all of it….

We also developed a set of exercises to explore residual risk with NIRA

Combining strengths

..Just using NIRA



..using NIRA + INARISK

Source / metric	residential losses	count of people	count of households	Key Services (hospitals)
Fluvial	NIRA	NIRA	NIRA	INARISK
Pluvial	NIRA	NIRA	NIRA	
Coastal			INARISK	INARISK
Tsunami			INARISK	INARISK

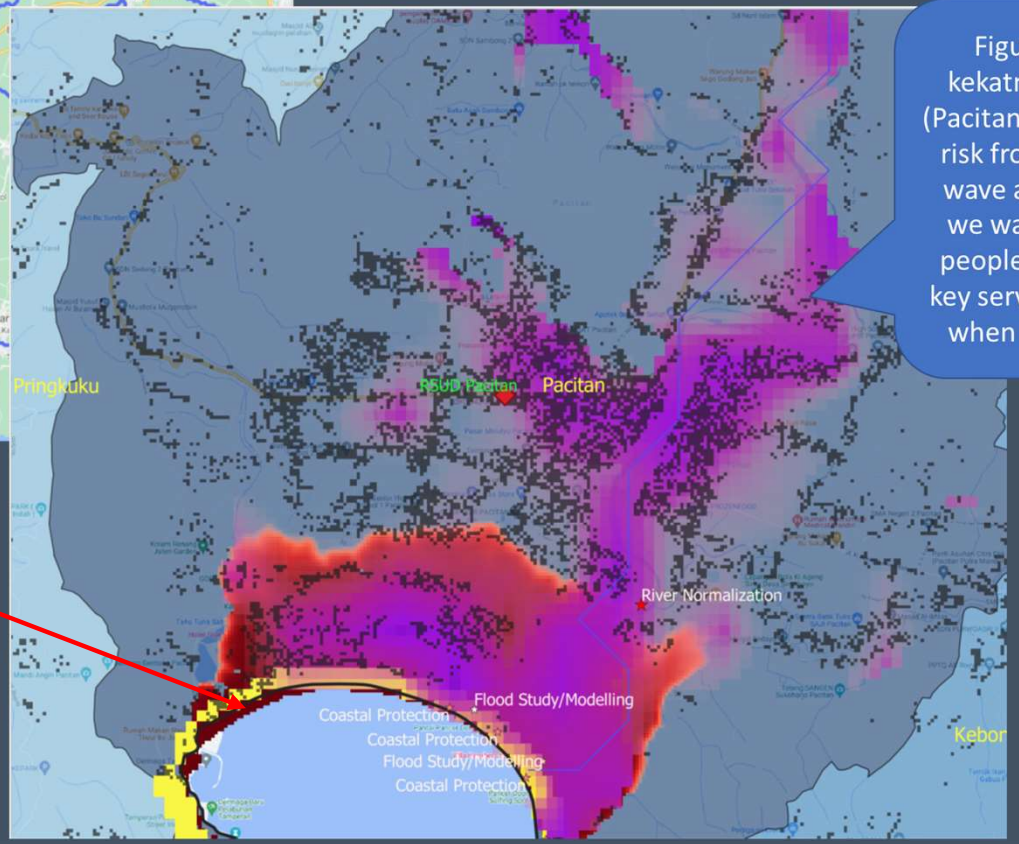


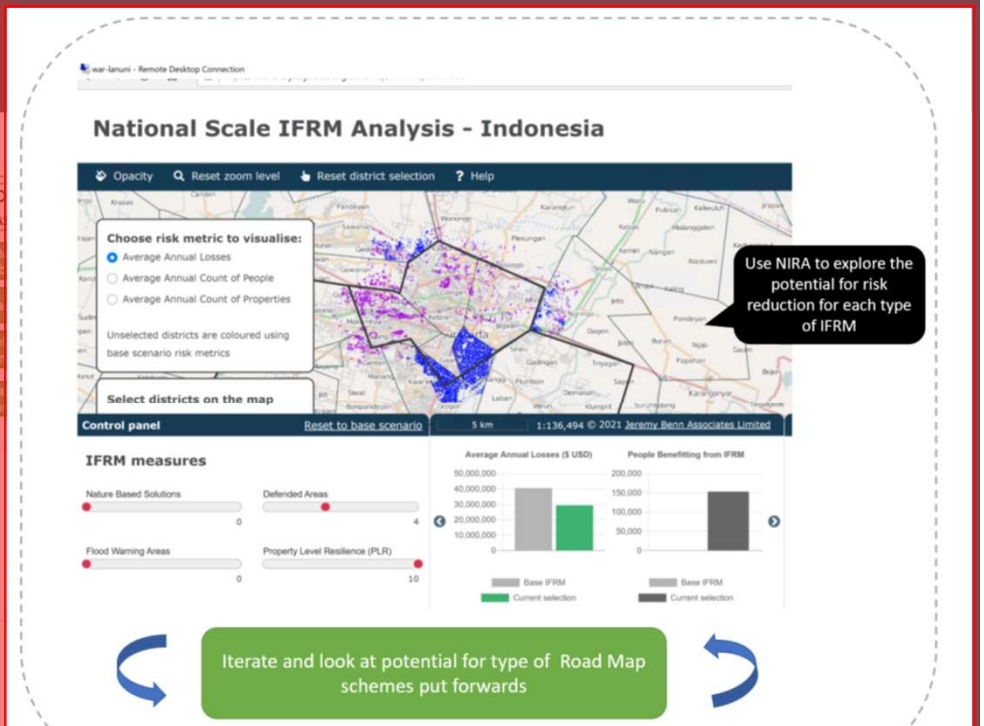
Figure 7 This kekatman in Solo (Pacitan) is very high risk from tsunami, wave and fluvial – we want to keep people, losses and key services in mind when prioritising

….We developed a range of ways of prioritising schemes

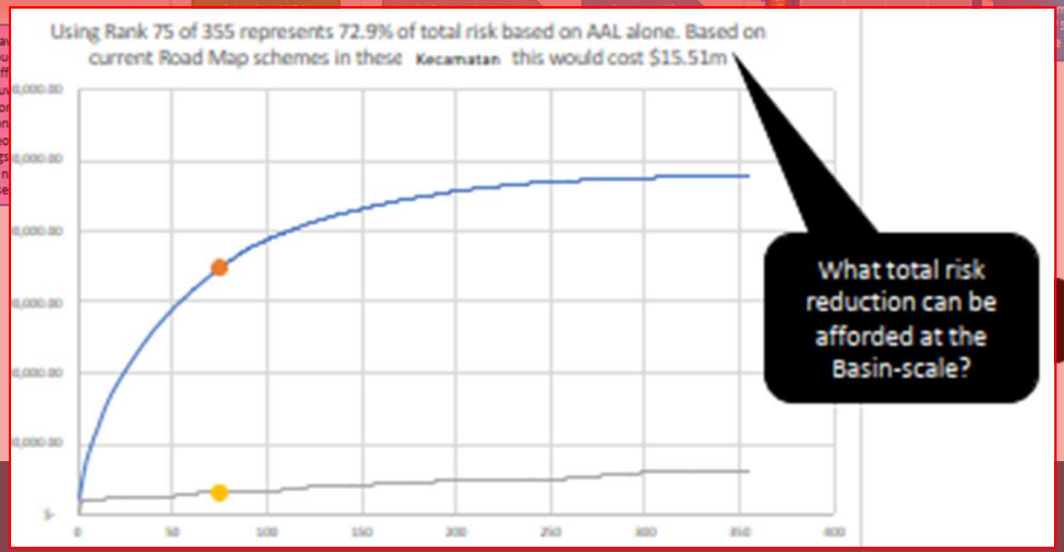
Prioritisation process

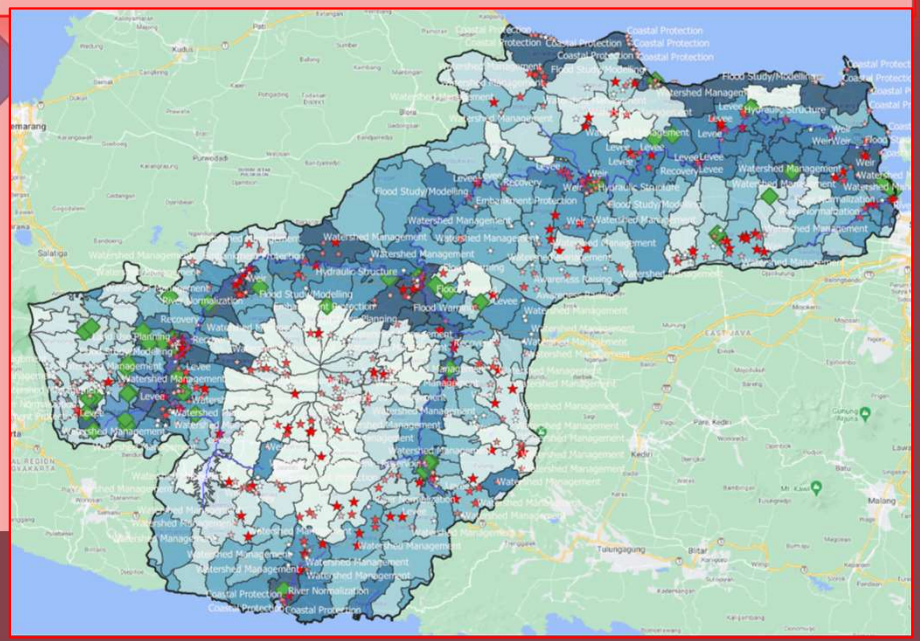
Question: Use NIRA and INARISK to prioritise IFRM schemes in Banagman Solo

Risk Datasets	NIRA	INARISK
Flood Sources	Fluvial Surface	Fluvial Coastal Flash flood Tsunami
Probabilities	6 Fluvial 6 Surface	Frequent flooding represents
Receptors/ metrics	Count of people Residential property count Residential property value	Key Services: Hospitals, schools, doctors? Population density
Residual risk (taking into account IFRM)	Defences Early Warning System	Property level resilience Nature Based Solutions



Prioritisation Approach 1





Summary

- Starting at the national scale we developed national estimates of baseline risk and residual risk assuming uptake of a range of IFRM
- We built a new tool, NIRA, to allow users to interactively assess this risk at the admin 2/3 level
- The Indonesian Government asked us to use this to help prioritise schemes using NIRA
- Following consultation and working with technical teams we undertook capacity building on a test catchment
- The final prioritisation process includes using NIRA, but also brings in other data and local knowledge
  - Without the consultation and technical knowledge aspects of risk, and local priorities would not have been captured


Thank you

Discussion questions

1. Does the comparison across countries help inform a sense of priority for IFRM issues?

2. How are areas within a country prioritized for investment in IFRM?

3. Does the NIRA tool developed in the project assist with making decisions on the location and type of investments?

SESSION 2

MAR 15 Tuesday
2022

Application of an IFRM approach at a River Basin Level

A Practical Guide on real-world issues for IFRM in urban and rural settings. Discussion on relevant issues for ADB projects.

16:00
Manila time
90 minutes

Ian Wood

TA9634 Team Leader and Climate Change Specialist
Landell Mills

Ian Munt

Urban Planning Specialist
Landell Mills

See you next week!

For recordings and any follow up questions, please access the event site at the ADB Knowledge Events in Development Asia

https://events.development.asia/learning-events/challenges-lessons-and-innovations-strengthening-integrated-flood-risk-management