



## INDIAN OCEAN RIM ASSOCIATION (IORA)

# The 3<sup>rd</sup> phase of workshop series on effects of Climate Change on the Indian Ocean Marine Environment

Topic 1; South African Climate Change Risk and Vulnerability Assessment  
Presentation  
21 February 2023



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164-238-438



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# Challenges faced by Coastal Towns and Cities

## Erosion



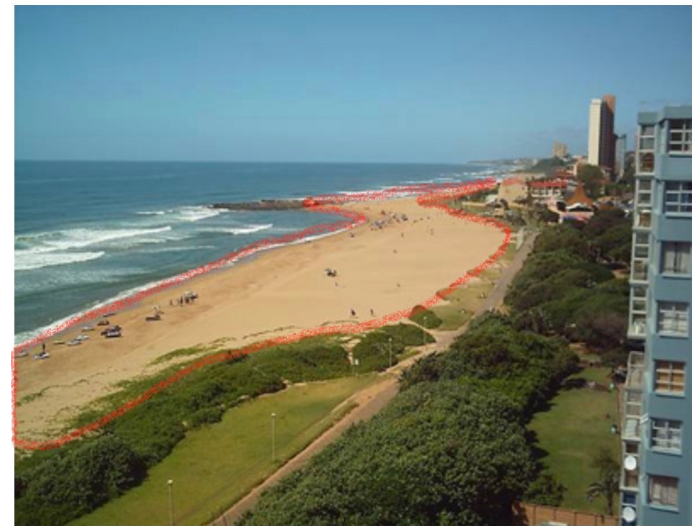
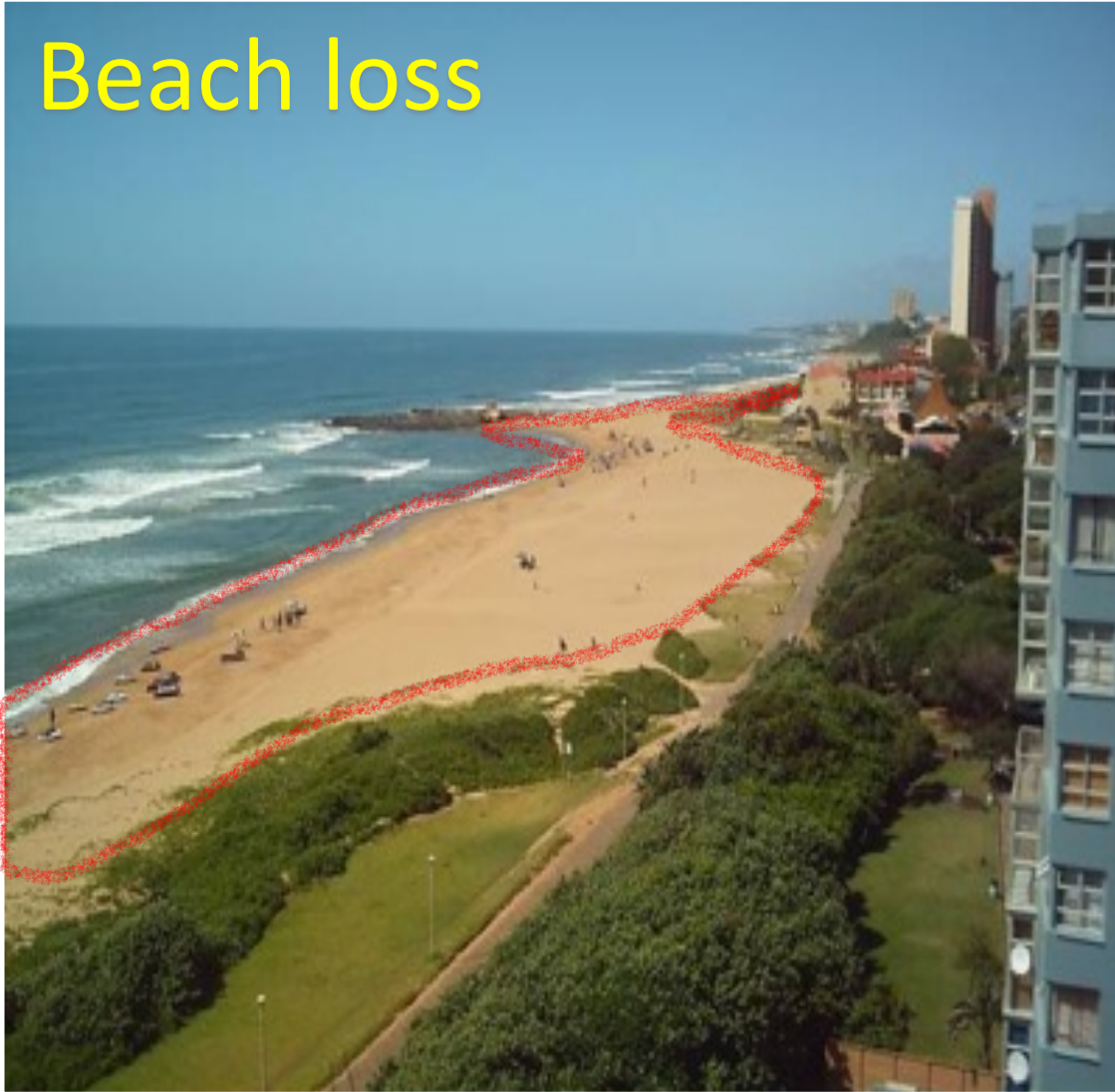
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# Beach loss



January 2007



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# Storm Tides



↑  
Inundation &  
Infrastructure Damages  
↓

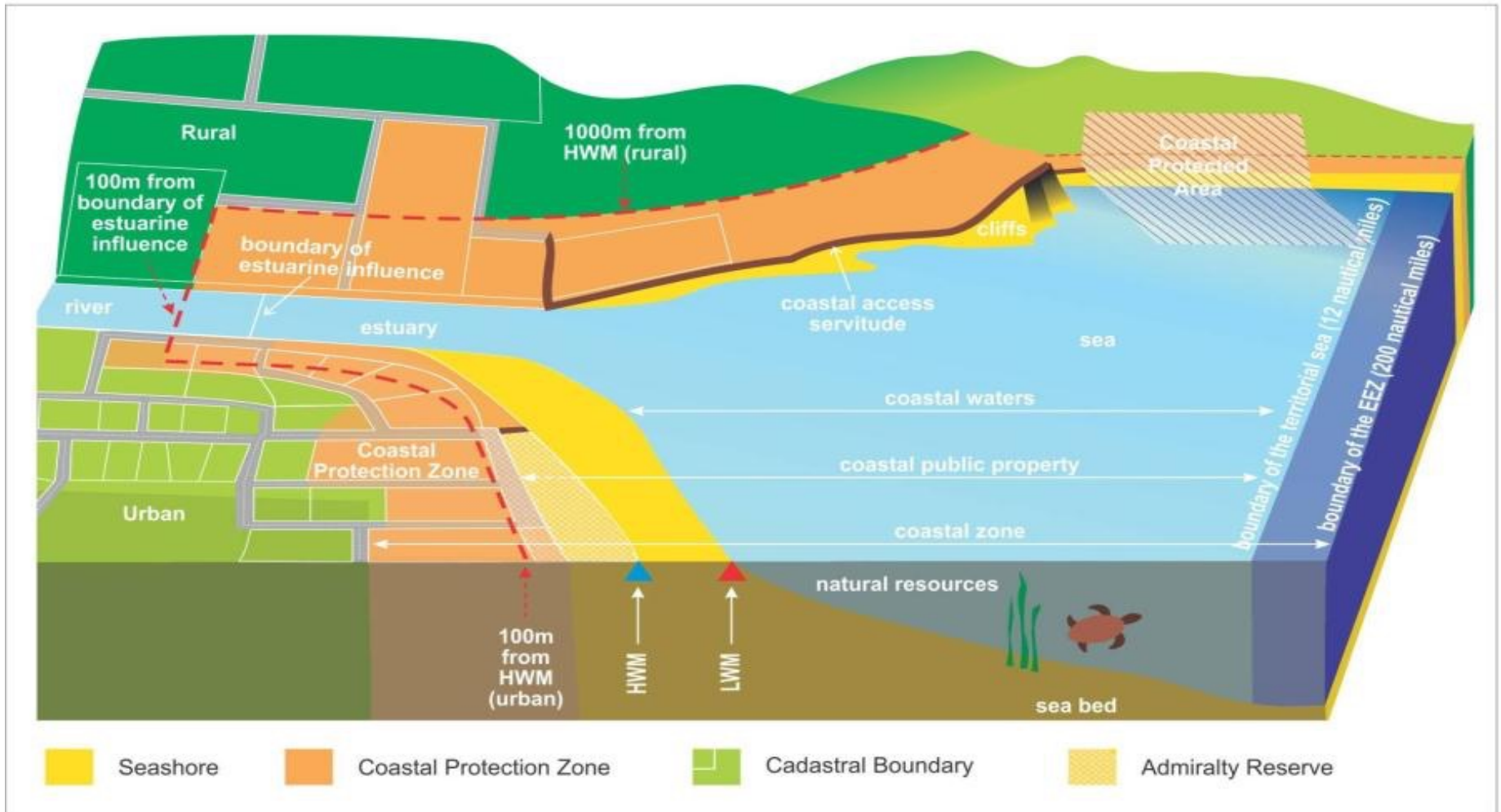


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# Geographical Boundaries (Marine and Coastal Space)



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# Integrated Coastal Management Law & SDG



<b>1 NO POVERTY</b> <p>End poverty in all its forms everywhere for all people</p>	<b>2 ZERO HUNGER</b> <p>End hunger, achieve food security and improved nutrition and promote sustainable agriculture</p>	<b>3 GOOD HEALTH AND WELL-BEING</b> <p>Ensure healthy lives and promote well-being for all at all ages</p>	<b>4 QUALITY EDUCATION</b> <p>Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all</p>
<b>5 GENDER EQUALITY</b> <p>Achieve gender equality and empower all women and girls</p>	<b>6 CLEAN WATER AND SANITATION</b> <p>Ensure availability and sustainable management of water and sanitation for all</p>	<b>7 AFFORDABLE AND CLEAN ENERGY</b> <p>Ensure access to affordable, reliable, sustainable and modern energy for all</p>	<b>8 DECENT WORK AND ECONOMIC GROWTH</b> <p>Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all</p>
<b>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</b> <p>Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation</p>	<b>10 REDUCE INEQUALITIES</b> <p>Reduce inequality within and among countries</p>	<b>11 SUSTAINABLE CITIES AND COMMUNITIES</b> <p>Make cities and human settlements inclusive, safe, resilient and sustainable</p>	<b>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</b> <p>Ensure sustainable consumption and production patterns</p>
<b>13 CLIMATE ACTION</b> <p>Take urgent action to combat climate change and its impacts*</p>	<b>14 LIFE BELOW WATER</b> <p>Conserve and sustainably use the oceans, seas and marine resources for sustainable development</p>	<b>15 LIFE ON LAND</b> <p>Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification</p>	<b>16 PEACE, JUSTICE AND STRONG INSTITUTIONS</b> <p>Promote peaceful and inclusive societies for sustainable development</p>
<b>17 PARTNERSHIPS FOR THE GOALS</b> <p>Strengthen the means of implementation and revitalize the global partnership for sustainable development</p>			

[social.un.org](http://social.un.org)

United Nations Department of Economic and Social Affairs - Division for Social Policy and Development

# National Climate change Adaptation Strategy (NAS)

- NAS is a strategic Framework for south Africa's climate adaptation programme.
- It has a VISION that seeks -

**To transition to a climate resilient South Africa,  
which will follow a sustainable development path,  
guided by  
anticipation,  
adaptation and  
recovery  
from a changing climate and  
environment to achieve our development aspirations.**



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# NAS Strategic Objectives

NAS was developed with the  
thinking of having  
four (4) broad Strategic Objectives

- **Strategic Objective 1:** Build climate resilience and adaptive capacity to respond to climate change risk and vulnerability
- **Strategic Objective 2:** Promote the integration of climate change adaptation response into development objectives, policy, planning and implementation
- **Strategic Objective 3:** Improve understanding of climate change impacts and capacity to respond to these impacts
- **Strategic Objective 4:** Ensure resources and systems are in place to enable implementation of climate changes responses



# NAS Strategic Interventions

Strategic  
Intervention 1.

Strategic  
Intervention 2.

Strategic  
Intervention 3.

Strategic  
Intervention 4.

Strategic  
Intervention 5.

Strategic  
Intervention 6.

Strategic  
Intervention 7.

Strategic  
Intervention 8.

Strategic  
Intervention 9.



- **Intervention 1:** Reduce human, economic, environmental, physical & ecological infrastructure vulnerability & build adaptive capacity
- **Intervention 2:** Develop a coordinated Climate Services System that provides climate products and services for key climate vulnerable sectors and geographic areas.
- **Intervention 3:** Develop a vulnerability and resilience methodology framework that integrates biophysical and socio-economic aspects of vulnerability and resilience.
- **Intervention 4:** Facilitate mainstreaming of adaptation responses into sectoral planning and implementation.
- **Intervention 5:** Promote research application, technology development, transfer and adoption to support planning and implementation.
- **Intervention 6:** Build the necessary capacity and awareness for climate change responses.
- **Intervention 7:** Establish effective governance and legislative processes to integrate climate change in development planning.
- **Intervention 8:** Enable substantial flows of climate change adaptation finance from various sources.
- **Intervention 9:** Develop and implement an M&E system that tracks implementation of adaptation actions and their effectiveness.



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# Adaptation & Response Sector Plans

## 12 Sectors

Energy

Health

Water

Human  
Settlements

Disaster Risk  
Reduction

Transportation &  
Infrastructure

Mining

Forestry

Agriculture

Fisheries

Biodiversity &  
Ecosystems

Oceans &  
Coasts



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# South Africa's coastal climate risk: a national assessment

Melanie Lück-Vogel<sup>1,2</sup>, Andre Theron<sup>2</sup>, Lauren Williams<sup>3</sup>, Alize Le Roux<sup>1</sup>, Elsona van Huyssteen<sup>1</sup>, Christiaan Theron<sup>2</sup>, Lara van Niekerk<sup>1</sup>, Ryan Peter<sup>3</sup>, Potlako Khathi<sup>3</sup>

<sup>1</sup> CSIR, South Africa; <sup>2</sup> Stellenbosch University, South Africa

<sup>3</sup> Department of Environment, Forestry & Fisheries, South Africa



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On behalf of:  
 Federal Ministry  
for the Environment, Nature Conservation  
and Nuclear Safety

of the Federal Republic of Germany

# NAS Strategic Interventions

- **Intervention 1:** Reduce human, economic, environmental, physical and ecological infrastructure vulnerability and build adaptive capacity

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- **Intervention 3:** Develop a vulnerability and resilience methodology framework that integrates biophysical and socio-economic aspects of vulnerability and resilience.

- **Intervention 4:** Facilitate mainstreaming of adaptation responses into sectoral planning and implementation.

- **Intervention 5:** Promote research application, technology development, transfer and adoption to support planning and implementation.

- **Intervention 6:** Build the necessary capacity and awareness for climate change responses.

- **Intervention 7:** Establish effective governance and legislative processes to integrate climate change in development planning.

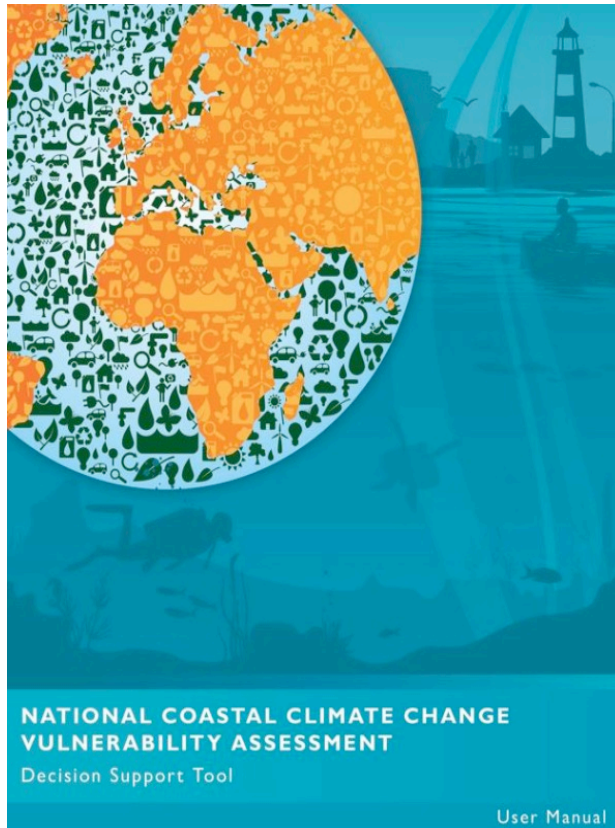
- **Intervention 8:** Enable substantial flows of climate change adaptation finance from various sources.

- **Intervention 9:** Develop and implement an M&E system that tracks implementation of adaptation actions and their effectiveness.





# National Coastal Climate Change Vulnerability Assessment



1. **Developed a geospatial index** for the vulnerability of SA's coasts in terms of climate change impacts. These are impacts primarily associated with flooding (through storm surge, wave runup and sea level rise) and shoreline erosion;
2. **Developed an interactive decision support tool (DeST)** that allows the users, primarily government officials in all spheres of government, to view and assess the various aspects of coastal risk and use of the spatially explicit information for spatial planning and climate change adaptation, and
3. **Integrated the Index and DeST with existing tools or platforms.**

**giz** Deutsche Gesellschaft  
für Internationale  
Zusammenarbeit (GIZ) GmbH

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**CSIR**  
our future through science

→ Respond to the urgent need for a National Coastal Spatial Vulnerability Index to inform coastal spatial management in response to the national climate change adaptation strategy.

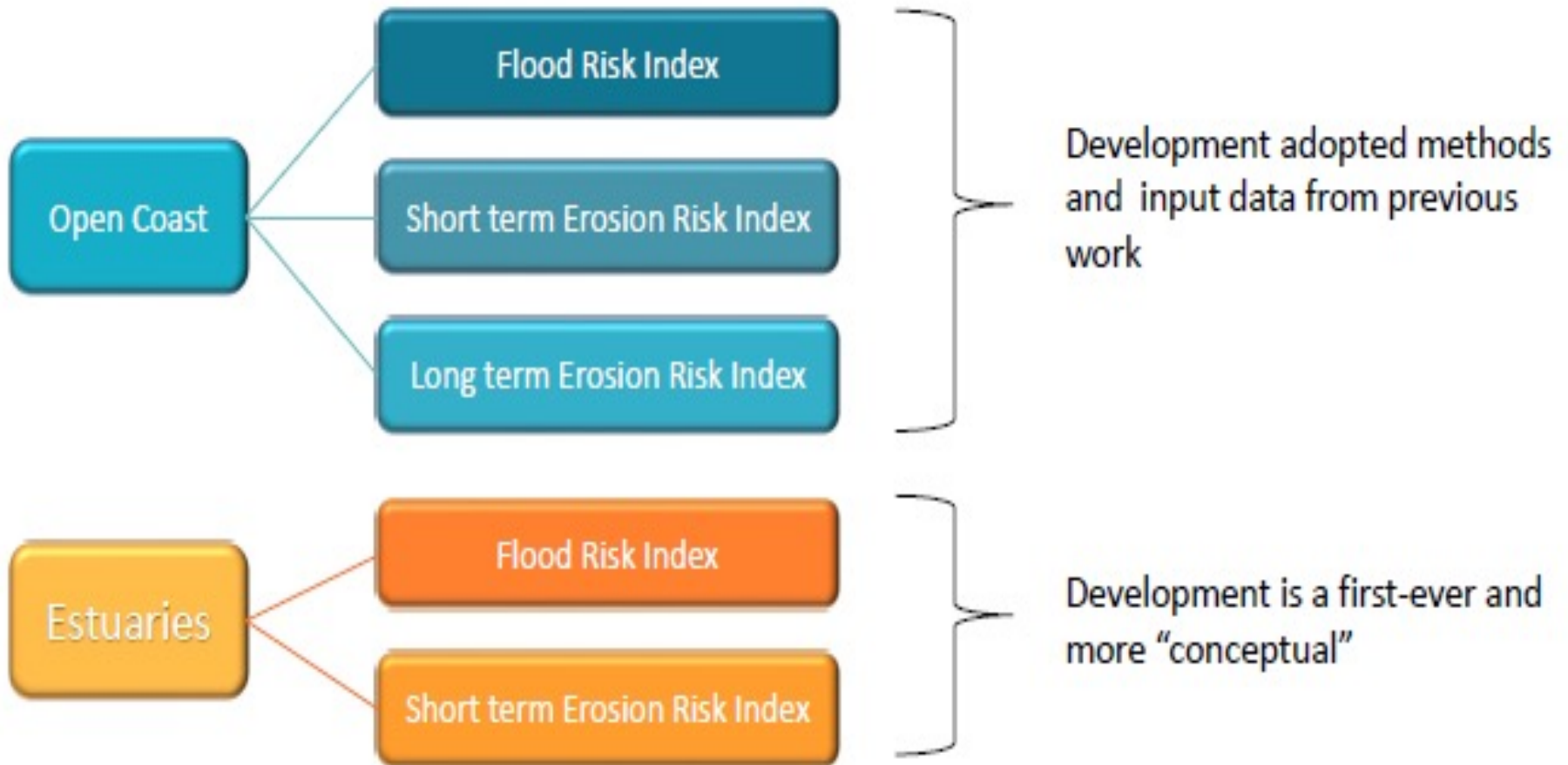


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# Introduction of the CoVu Indices



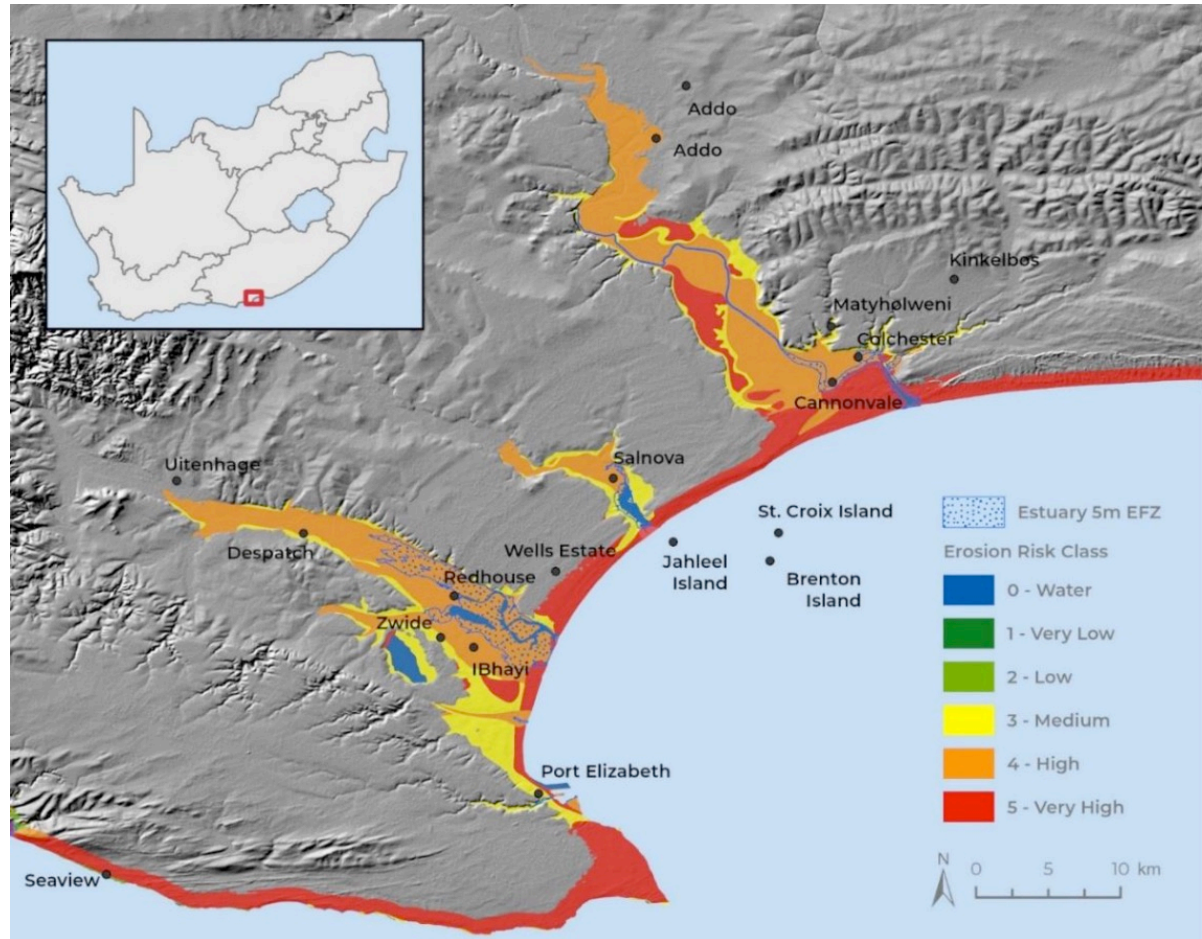
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# Key Inputs Parameters

Geology Index for Nelson Mandel Bay Municipality in the Eastern Cape.



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# Key Inputs Parameters

**Reference coastline**  
*National\_Coast\_Types.*  
*shp* from NBA 2011



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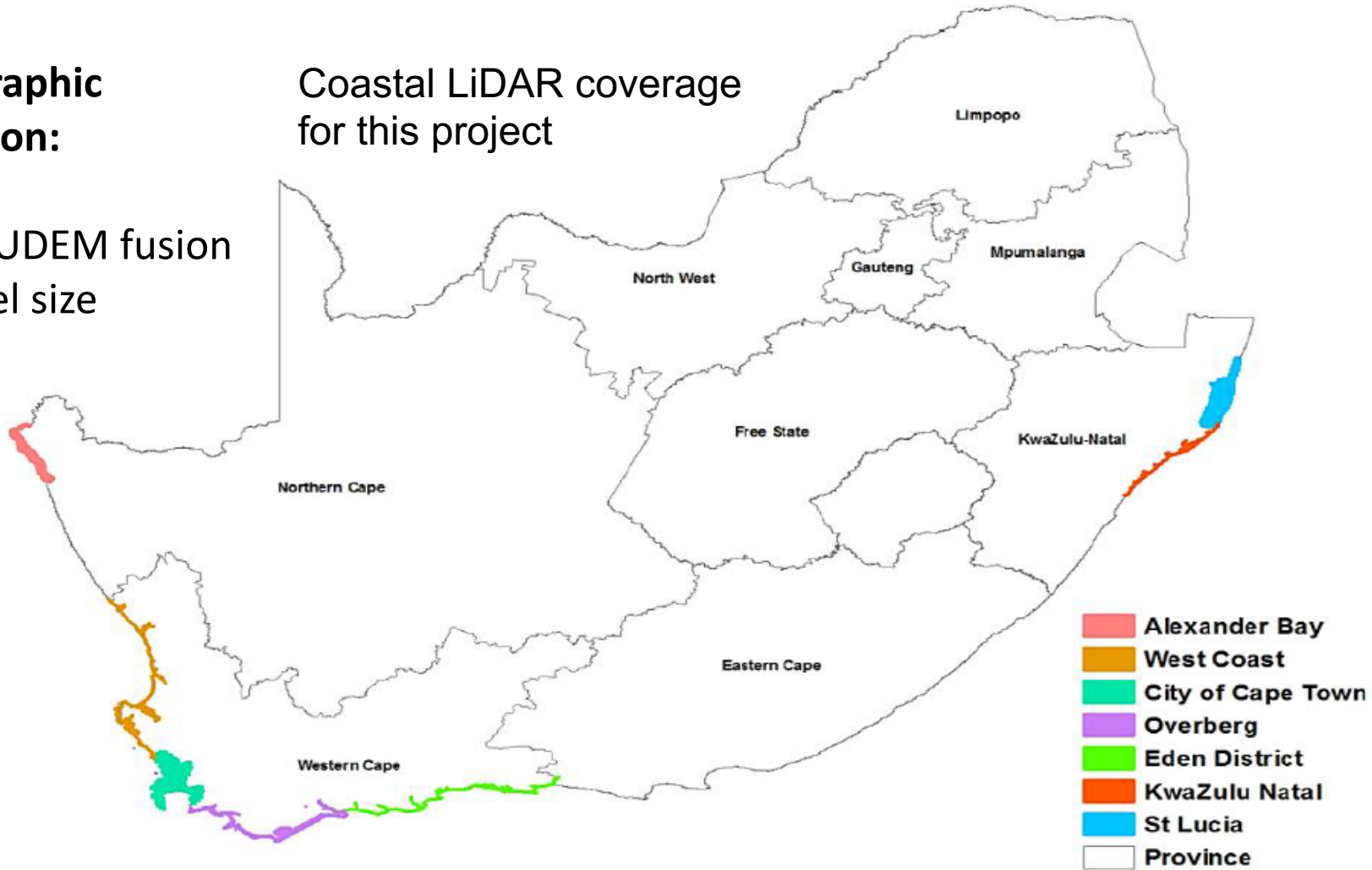


# Key Inputs Parameters

- **Topographic elevation:**

LiDAR & SUDEM fusion  
5x5 m pixel size

Coastal LiDAR coverage  
for this project



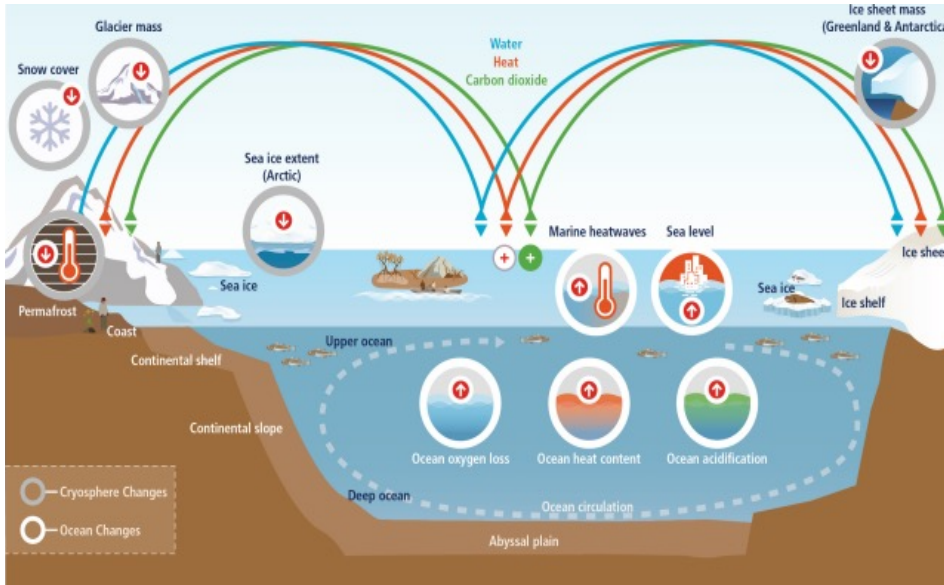
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# Key Inputs Parameters

- Sea level rise scenarios



**IPCC Special Report on Ocean and Cryosphere in a Changing Climate (SROCC)**

SLR scenario (m)	Expected by year*
0.15	2030
0.35	2050
0.5	2070
1.0	2100
2.0	2200

\*according to projections for RCP8.5 at 50%; Kopp et al. (2017).

Representative Concentration Pathways (RCP8.5)



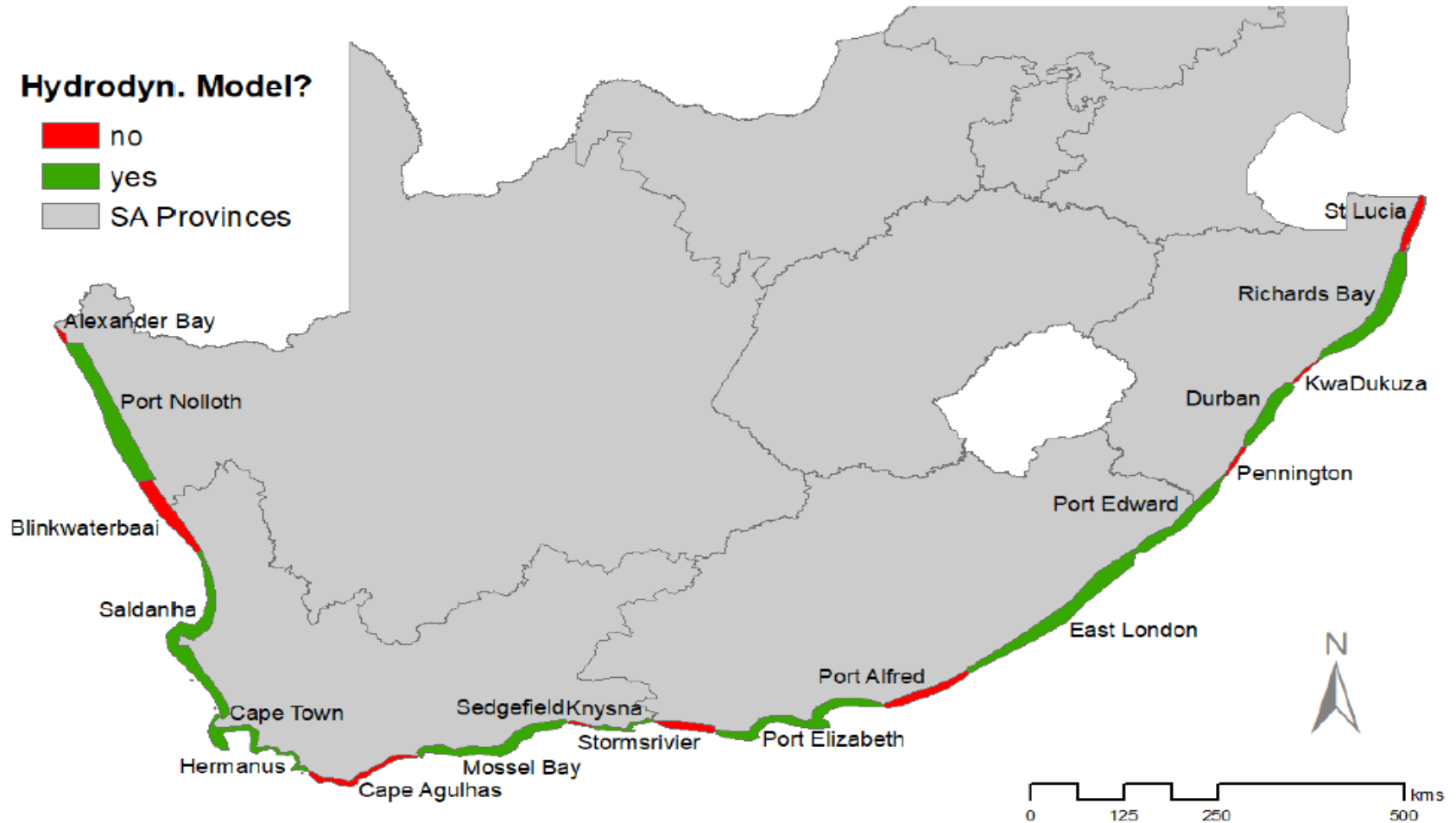
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# Key Inputs Parameters



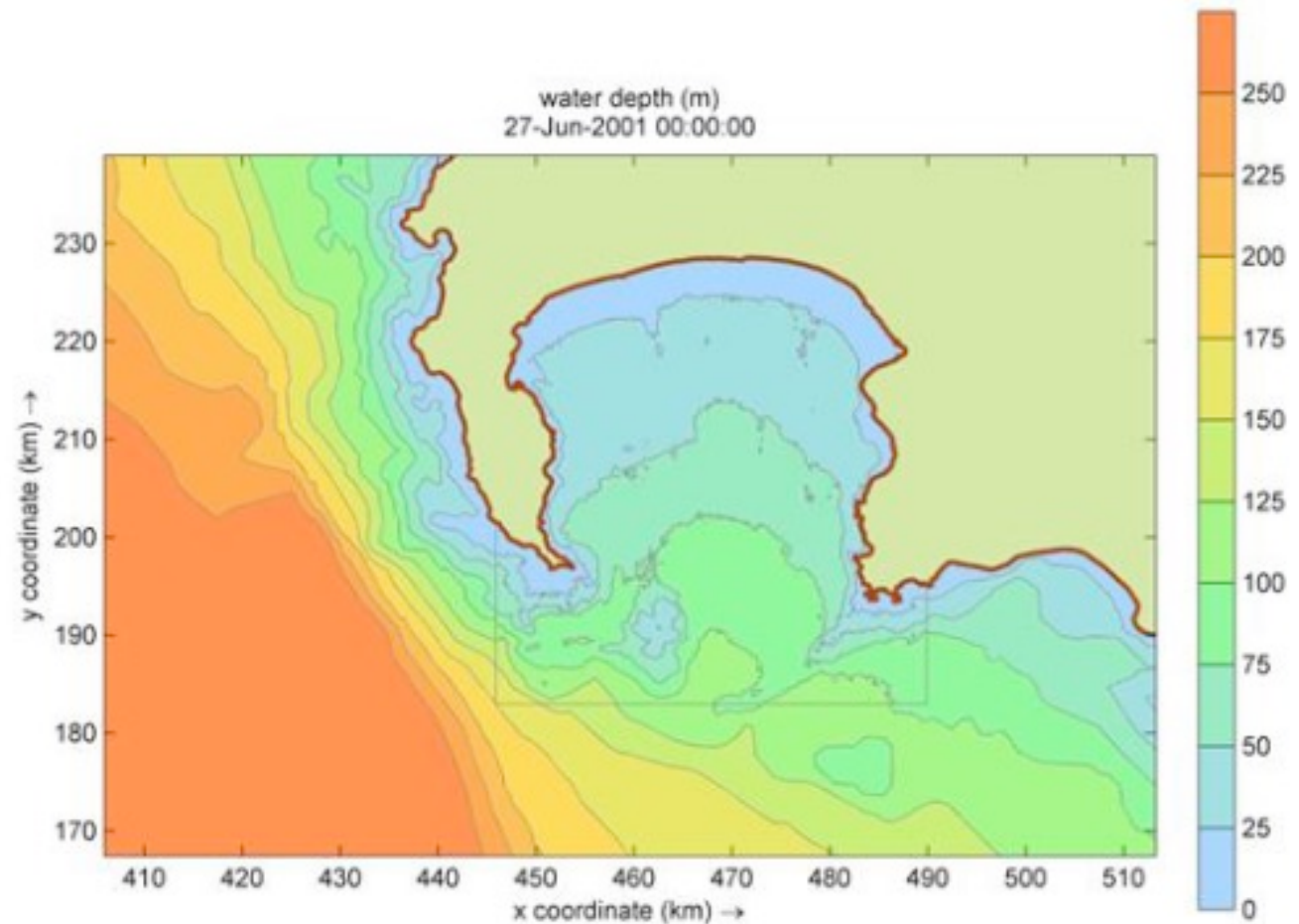
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# Key Inputs Parameters

**Bathymetry**  
nearshore bathy  
interpolated  
from 15 m bathy  
contour  
from nautical charts



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# Key Inputs Parameters

Wave modelling &  
return periods

## Extreme events

1:10 yrs, 0.3 m SLR

1:30 yrs, 0.3 m SLR

1:30 yrs, 1.0 m SLR

1:50 yrs, 1.0 m SLR

1:100yrs, 1.0 m SLR



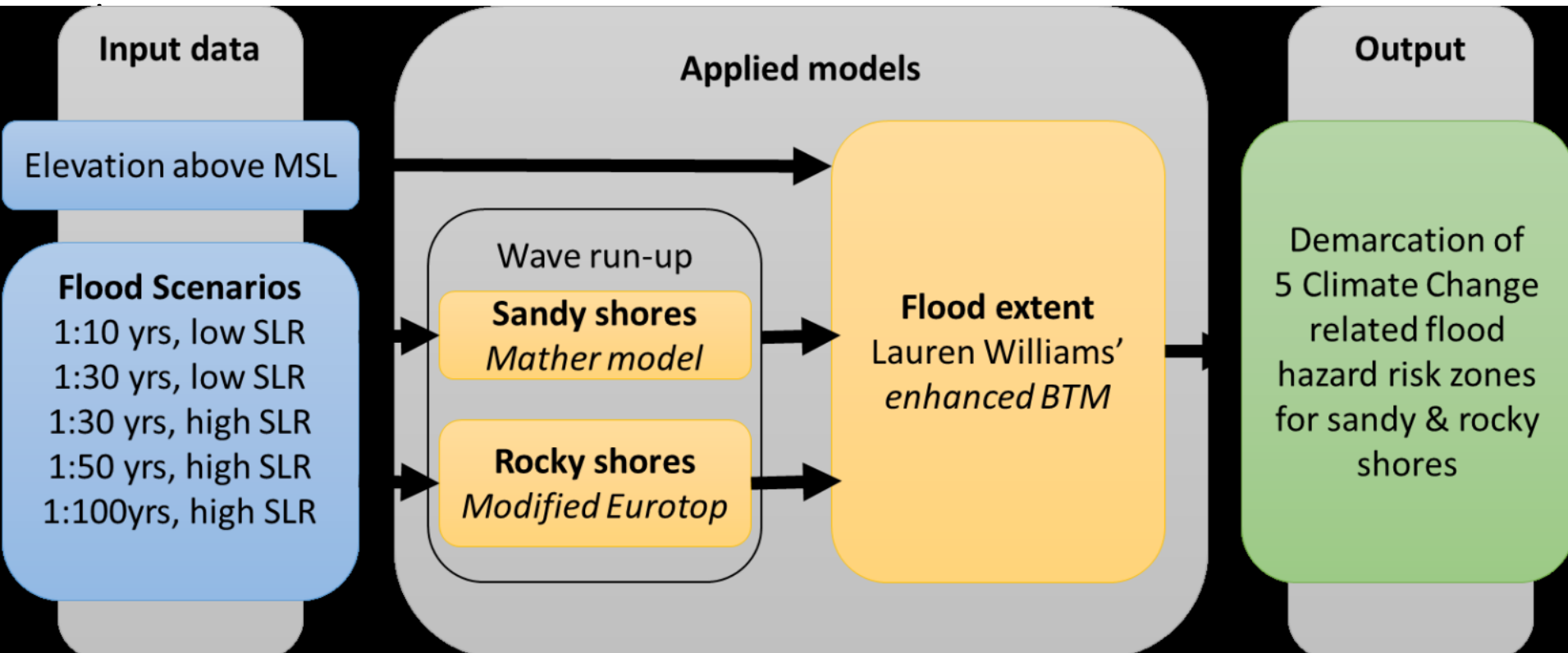
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# Open Coast Flood Risk Index

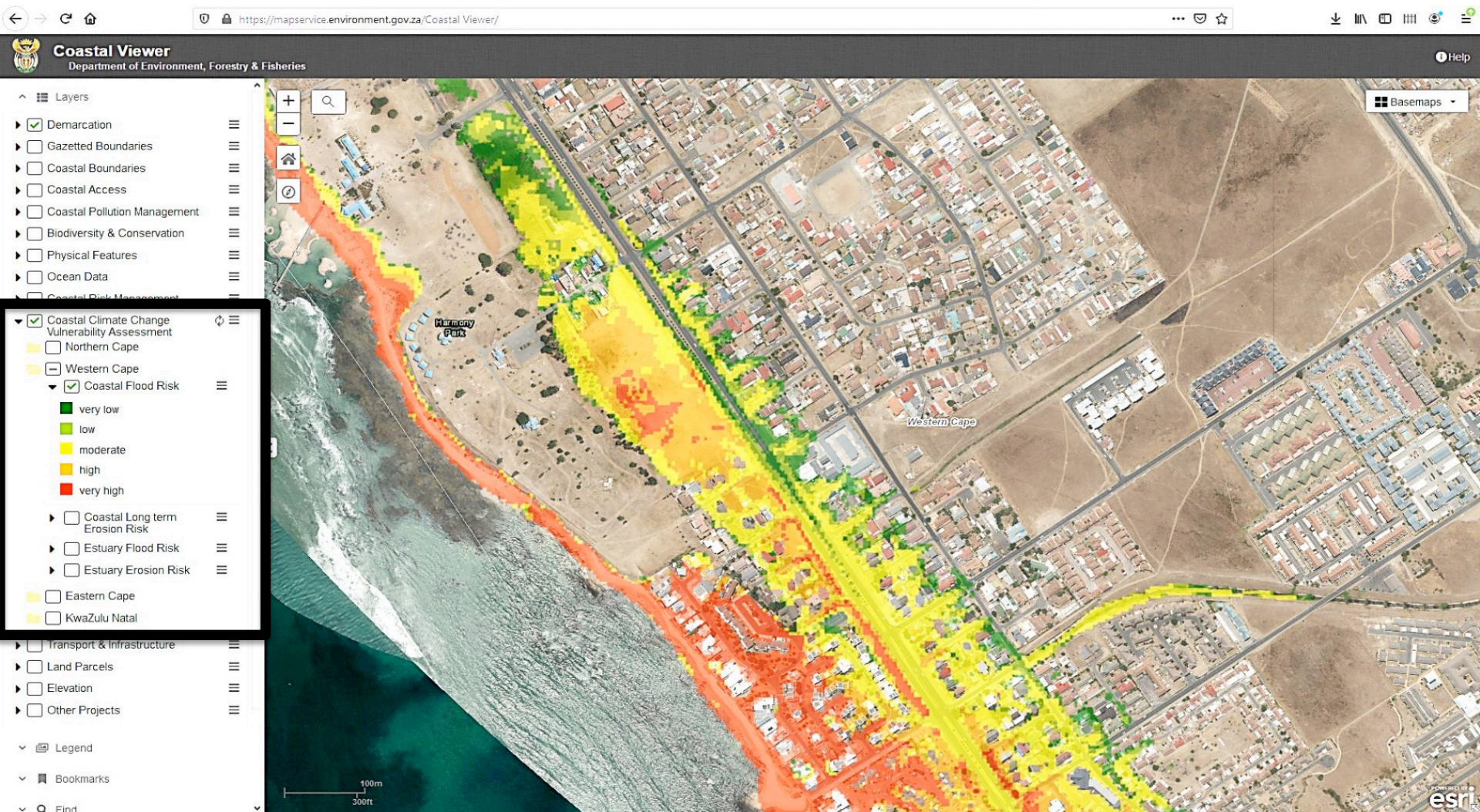


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# Open Coast Flood Risk Index



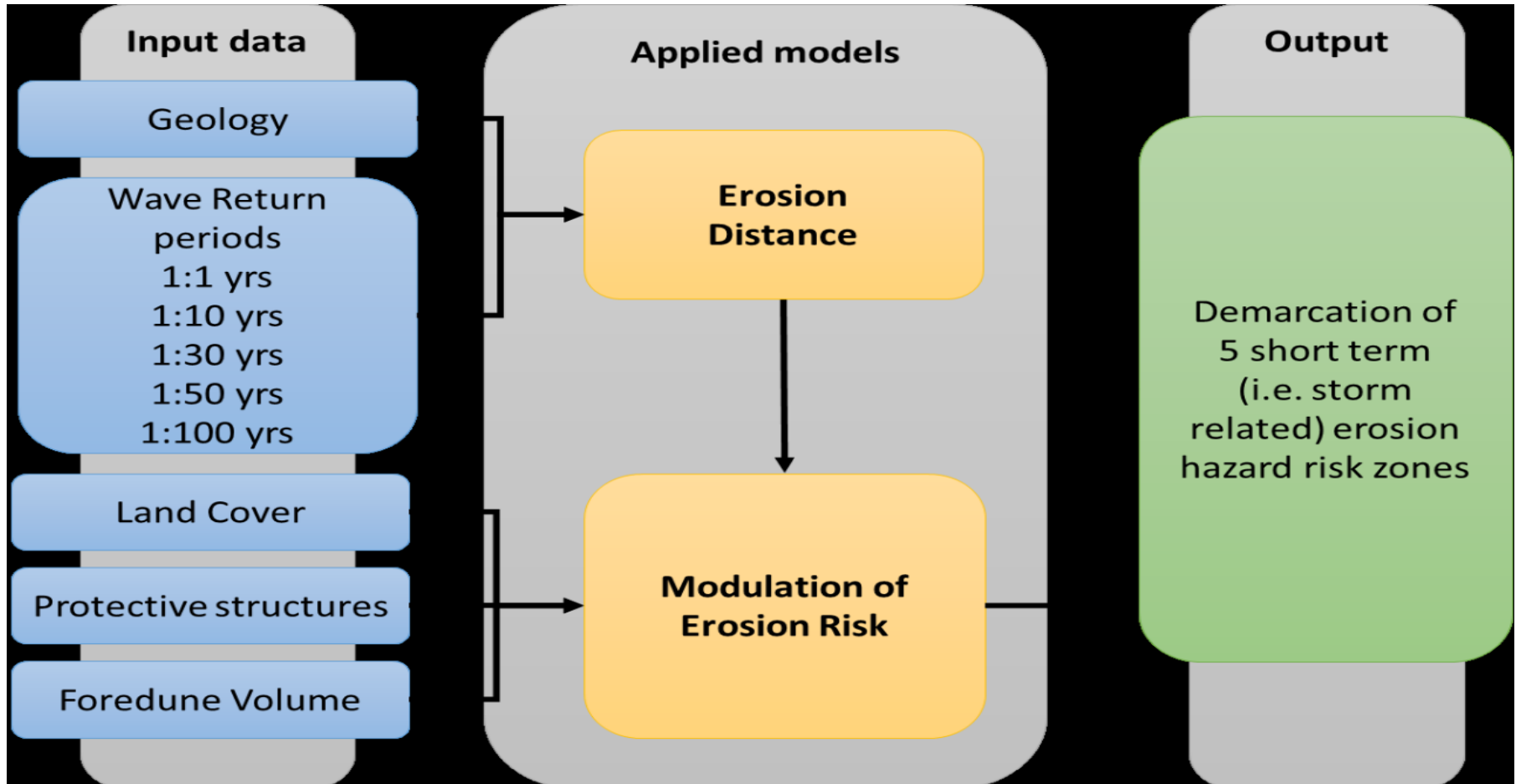
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# Open Coast Short term Erosion Risk Index

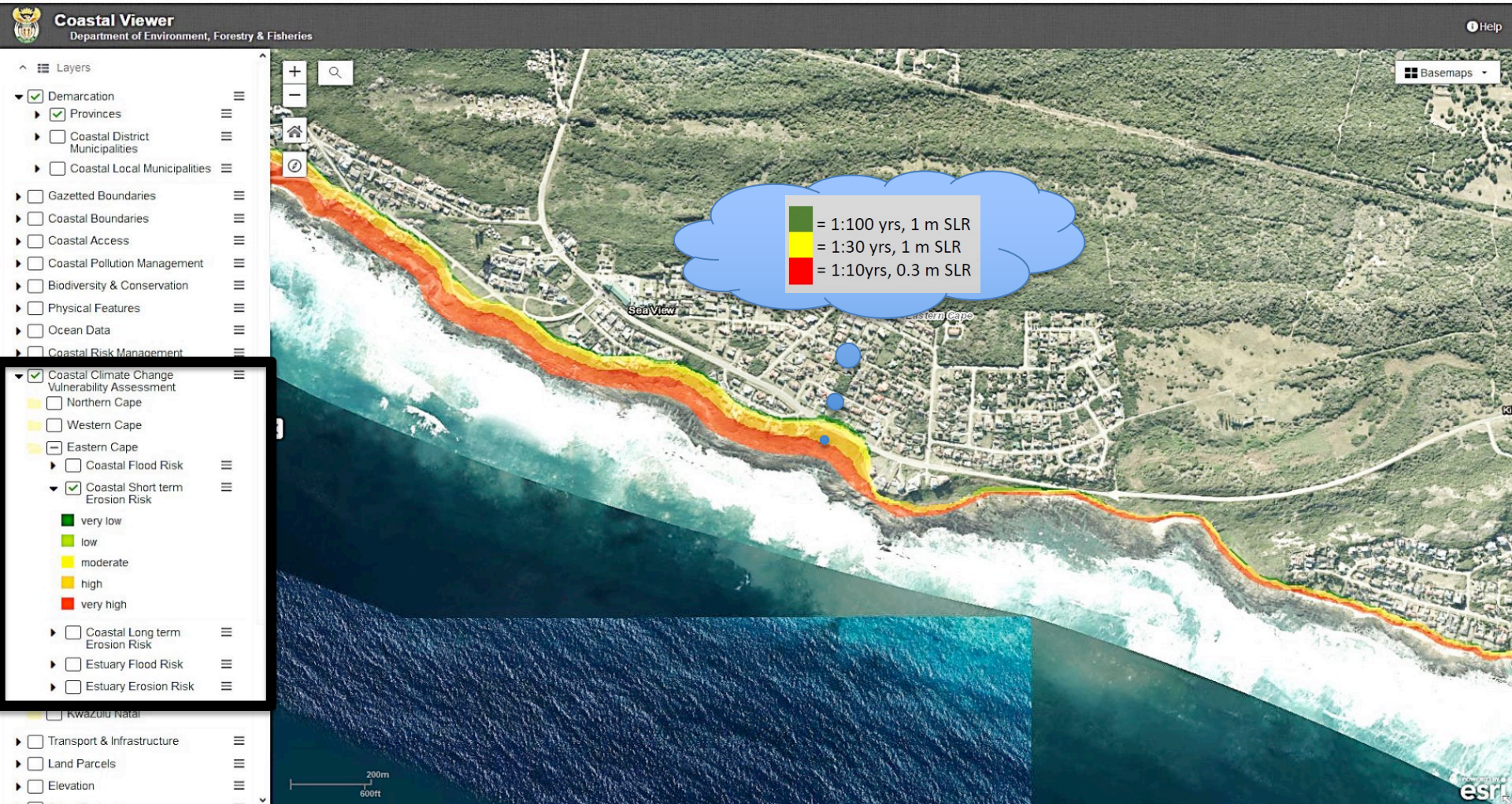


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# Open Coast Short term Erosion Risk Index



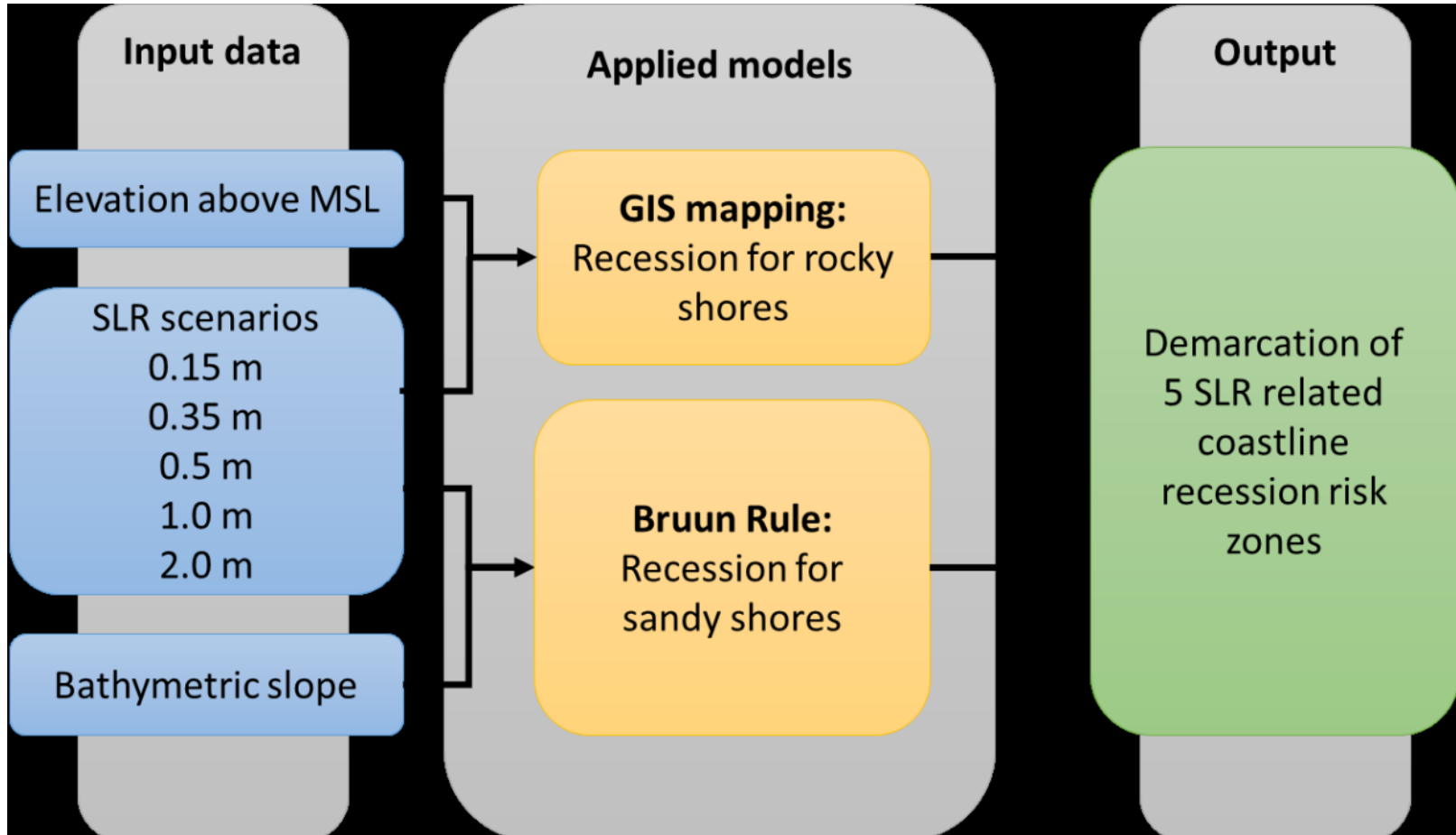
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# Open Coast Long term Erosion Risk Index

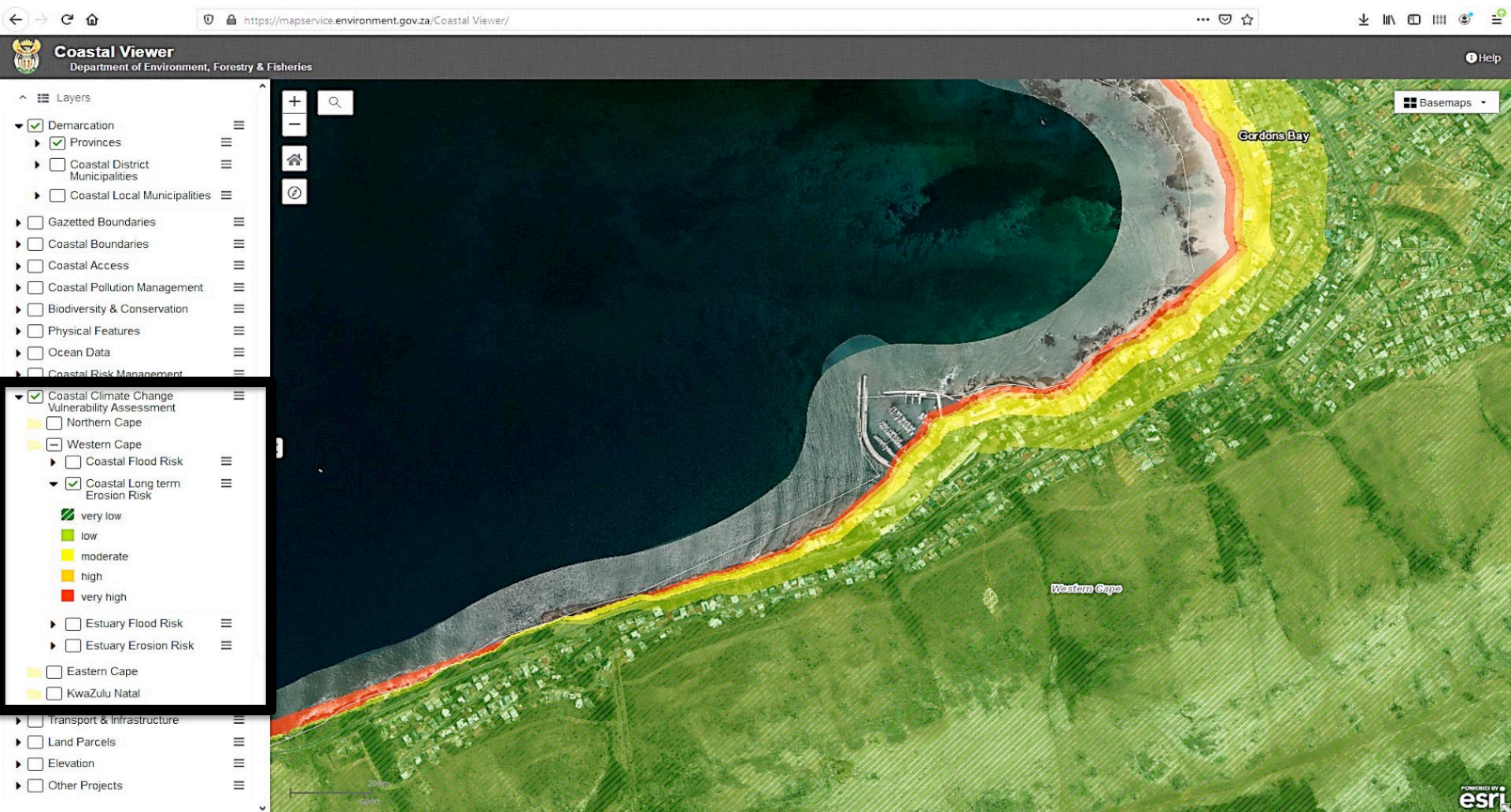


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# Open Coast Long term Erosion Risk Index



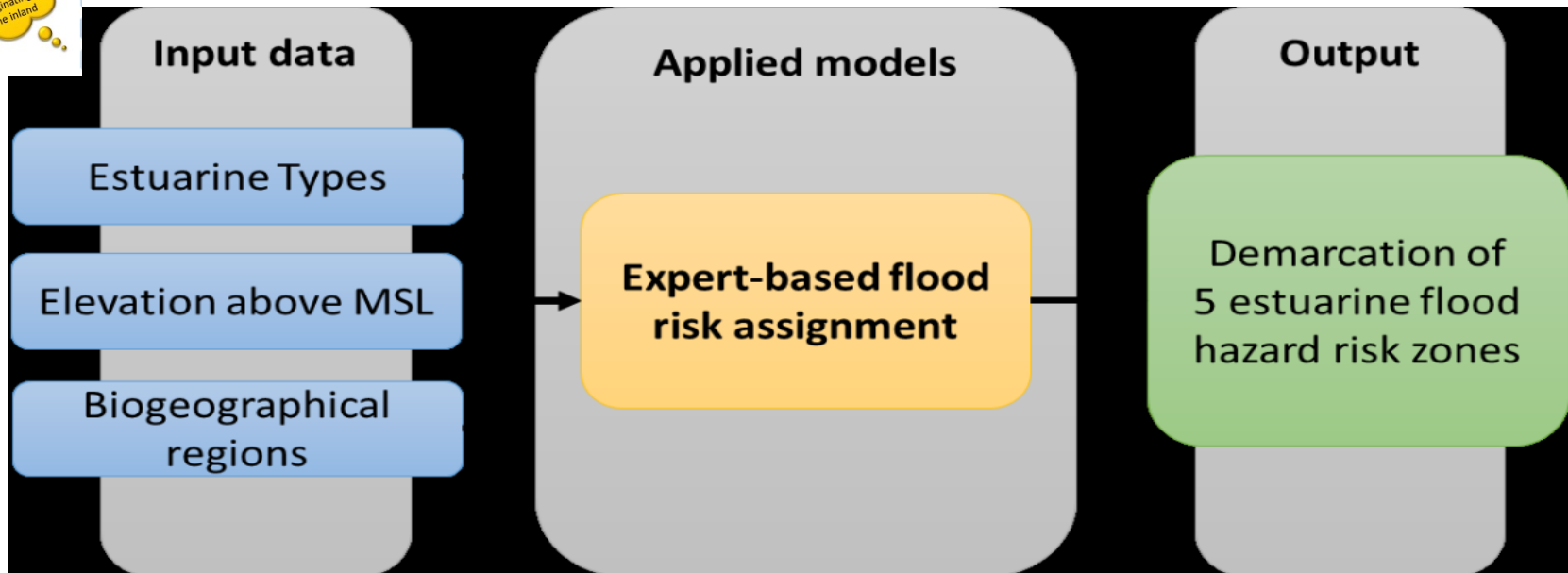
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# Estuaries Flood Risk Index

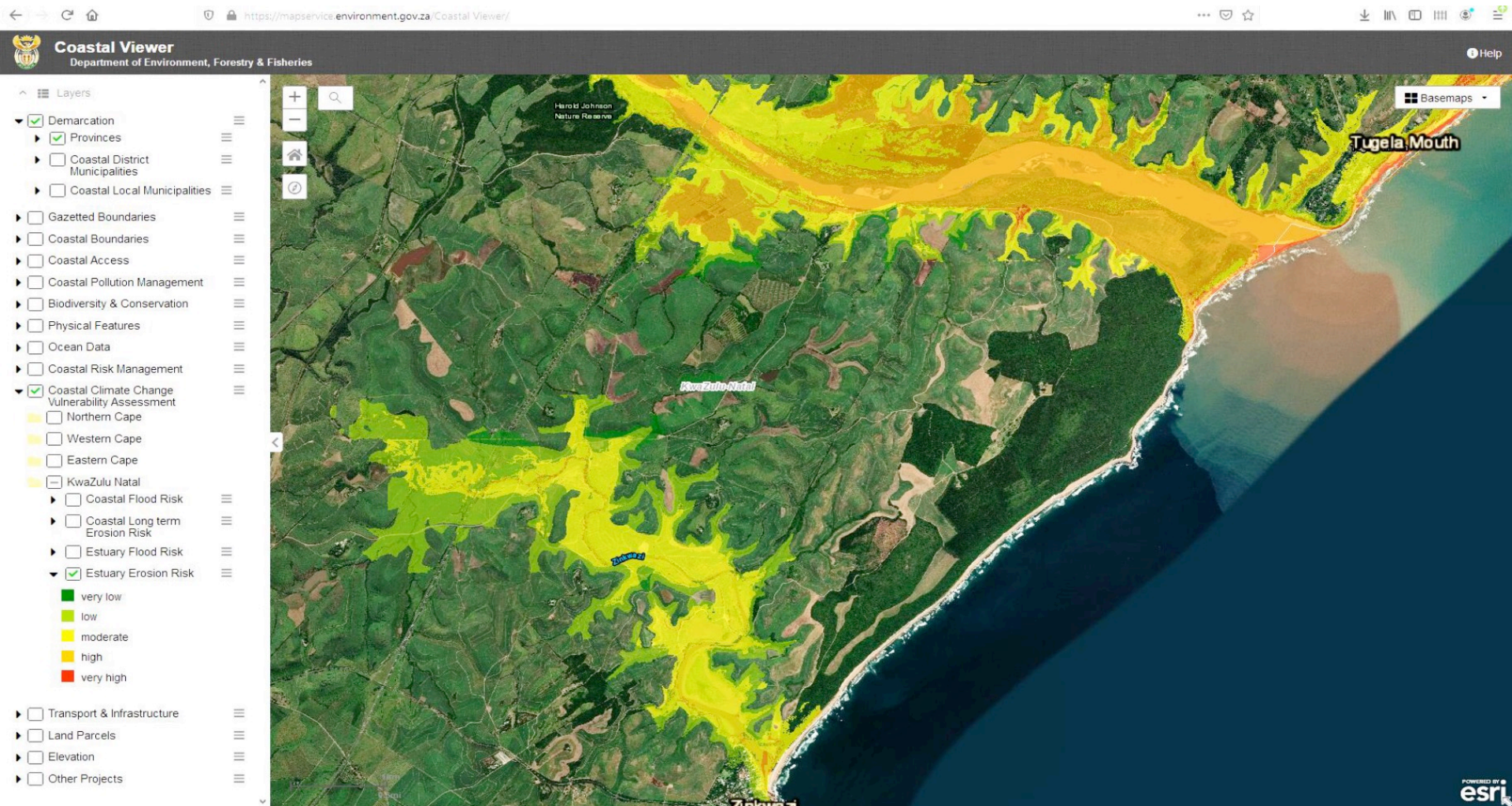
This index assesses flood risk originating from the inland



Flood Scouring Potential					
	Very low	Low	Medium	High	Very high
	1	2	3	4	5
Conceptual	Low MAR Large channel storage area	Low - moderate MAR Large - medium channel storage area	Moderate MAR Medium channel storage area	Moderate - high MAR Medium - small storage area	High MAR Small channel storage area
MAR (m <sup>3</sup> × 10 <sup>6</sup> ) Channel volume (m <sup>3</sup> )	0 - < 20	20 - < 50	50 - < 200	200 - < 400	400 - 10,000



# Estuaries Flood Risk Index



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# Coastal Flooding



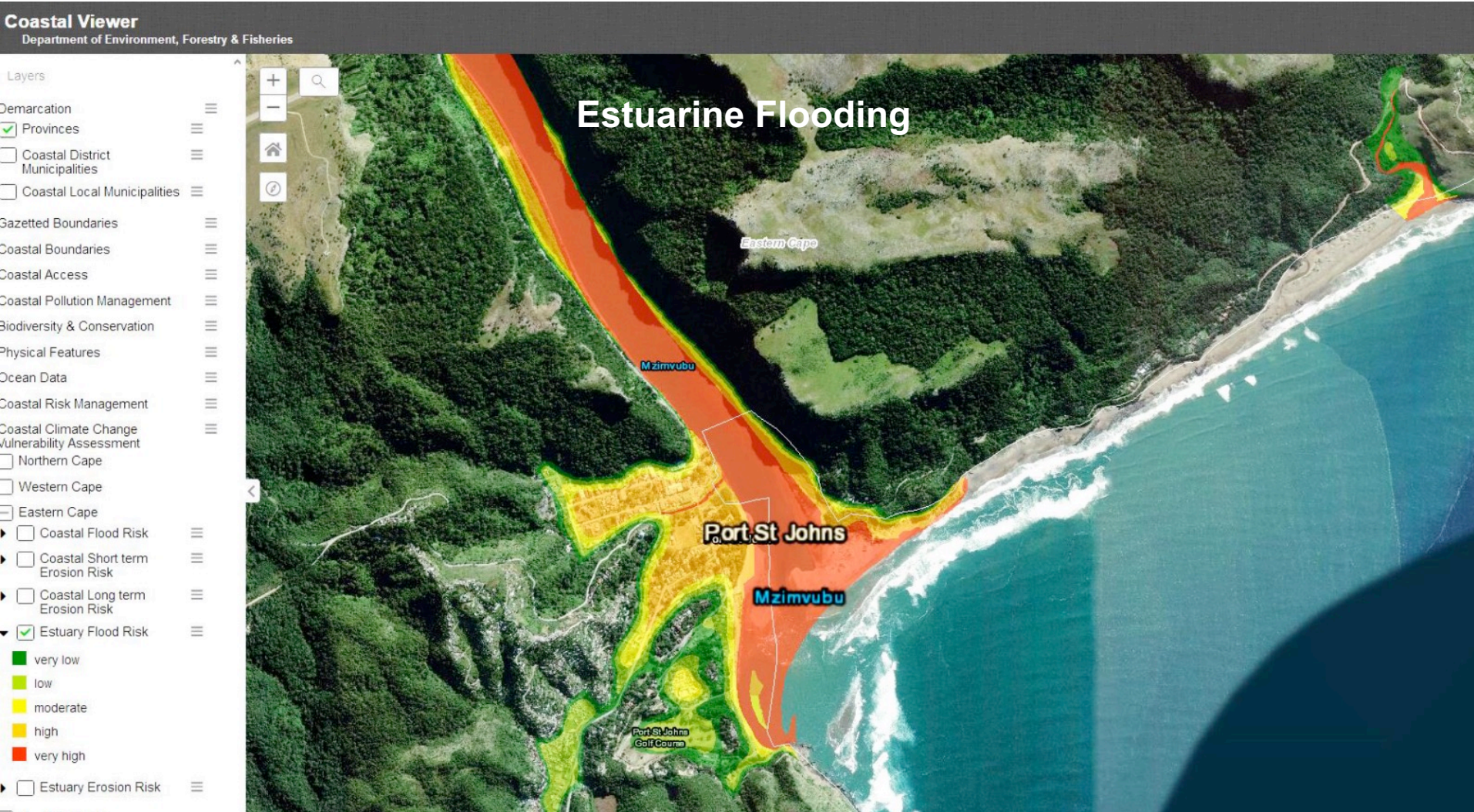
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# Estuarine Flooding



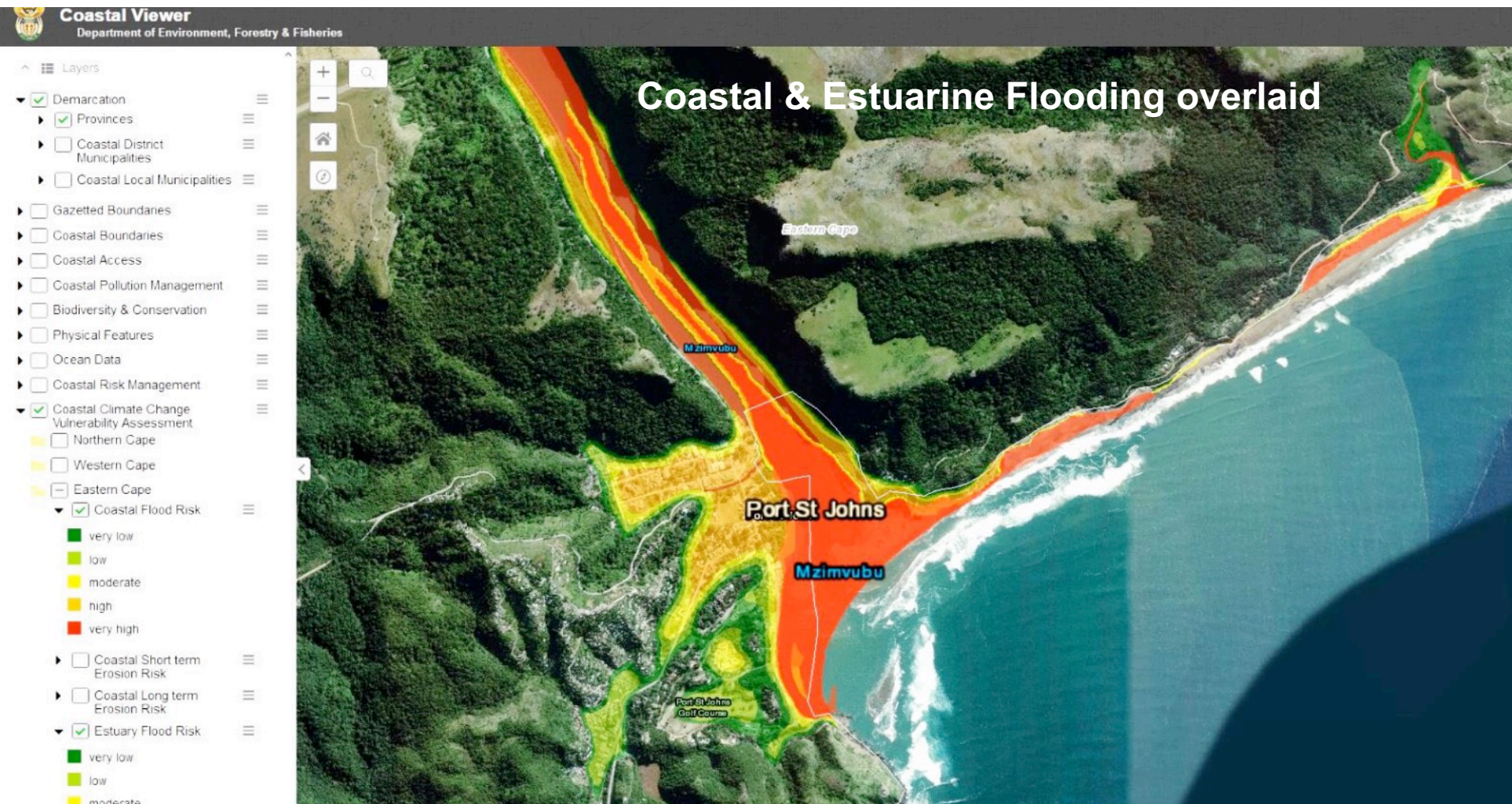
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# Combined use of layers in estuary areas



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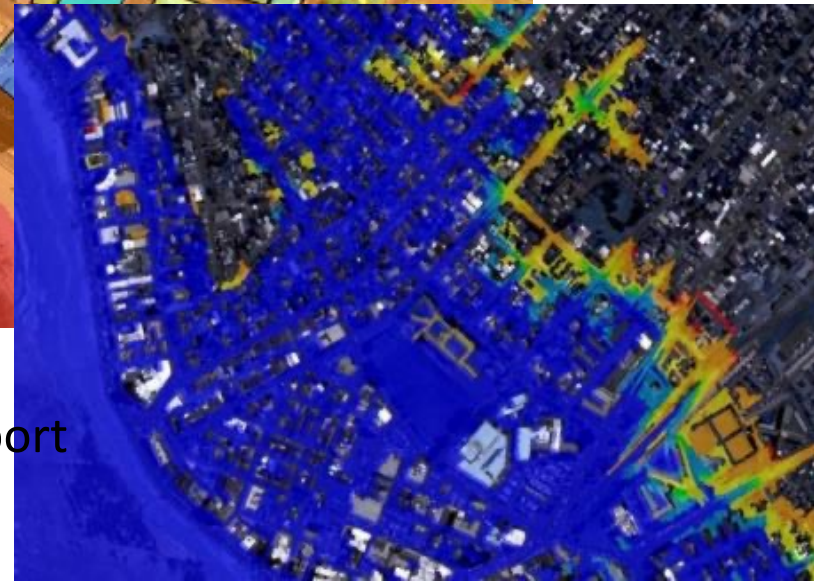
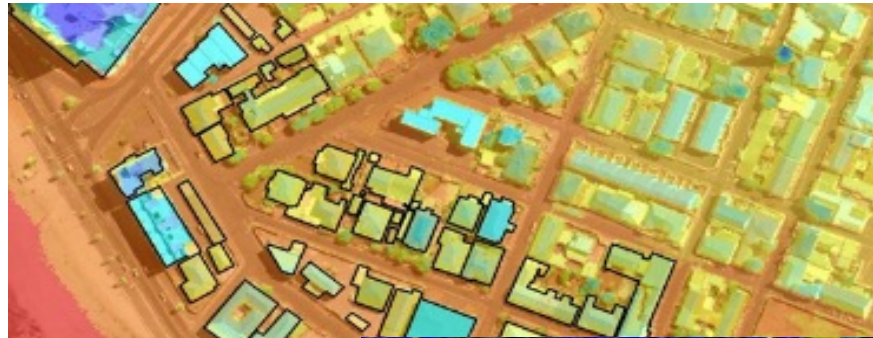


# Decision Support Process

## Determine Wave Climate



## Identify Coastal Infrastructure



Planning and  
decision support



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# Population Pressure

Massive population pressure in SA coastal flood risk zones

2011

Hazard risk	total	%	NC	WC	EC_urb	EC_trad	KZN_urb	KZN_trad
very high	15	0.002	2	13	-	-	-	-
high	738	0.1	102	585	33	4	14	-
medium	17 044	2.8	467	14 377	1 155	30	989	26
low	106 278	17.2	1 259	73 460	15 700	456	13 464	1 939
very low	494 308	79.9	1 476	353 103	52 343	758	58 116	28 512
<b>TOTAL</b>	<b>618 383</b>	<b>100</b>	<b>3 306</b>	<b>441 538</b>	<b>69 231</b>	<b>1 248</b>	<b>72 583</b>	<b>30 477</b>

2016

Hazard risk	TOTAL	%	NC	WC	EC_urb	EC_trad	KZN_urb	KZN_trad
Very high	55	0.01	1	52	1	-	1	-
high	1 158	0.1	100	983	60	4	11	-
medium	23 184	2.2	479	19 230	1 969	87	1 401	18
low	161 998	15.3	1 294	114 539	26 524	759	16 298	2 584
very low	873 550	82.4	1 511	655 959	103 347	1 466	69 435	41 832
<b>TOTAL</b>	<b>1 059 945</b>	<b>100</b>	<b>3 385</b>	<b>790 763</b>	<b>131 901</b>	<b>2 316</b>	<b>87 146</b>	<b>44 434</b>

Very high risk zone = Directly affected by SLR

Source: M. Luck-Vogel et al. 2020: NCA for South Africa: Situational Assessment Report.



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# The Offline GIS Viewer DeST

## DATA ACCESSIBILITY

The screenshot displays the 'Offline CoVu Decision Support Tool' interface. The main map shows the Northern Cape coastline with risk levels overlaid: 1 - Very low risk (green), 2 - Low risk (light green), 3 - Medium risk (yellow), 4 - High risk (orange), and 5 - Very high risk (red). The interface includes a legend, a 'Base Layer' section with 'Aerial Imagery' checked and 'Sentinel 2' unchecked, and a navigation bar at the bottom with tabs for OVERVIEW, NORTHERN CAPE, WESTERN CAPE, EASTERN CAPE, and KWAZULU-NATAL. Logos for environment, forestry & fisheries, CSIR, CGA, and giz are visible at the bottom left. A 'Powered by Esri' logo is at the bottom right.

The screenshot shows the title page of the 'User Guide for the Offline CoVu Decision Support Tool'. The text reads: 'User Guide for the Offline CoVu Decision Support Tool. Developed in the context of the National Coastal Climate Vulnerability Assessment 2020'. The page features a large globe graphic with various icons representing environmental and coastal elements. A cartoon character of a woman with glasses is on the right side. The footer includes logos for environment, forestry & fisheries, CSIR, and giz, along with the text 'Offline\_Covu\_tool\_user\_guide\_18Sept'.

*How can the CoVu Index be packaged for coastal managers to use?*

Main function requirements:

- Map Viewing & downloading
- Data download
- Not internet dependent



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# The Offline GIS Viewer DeST

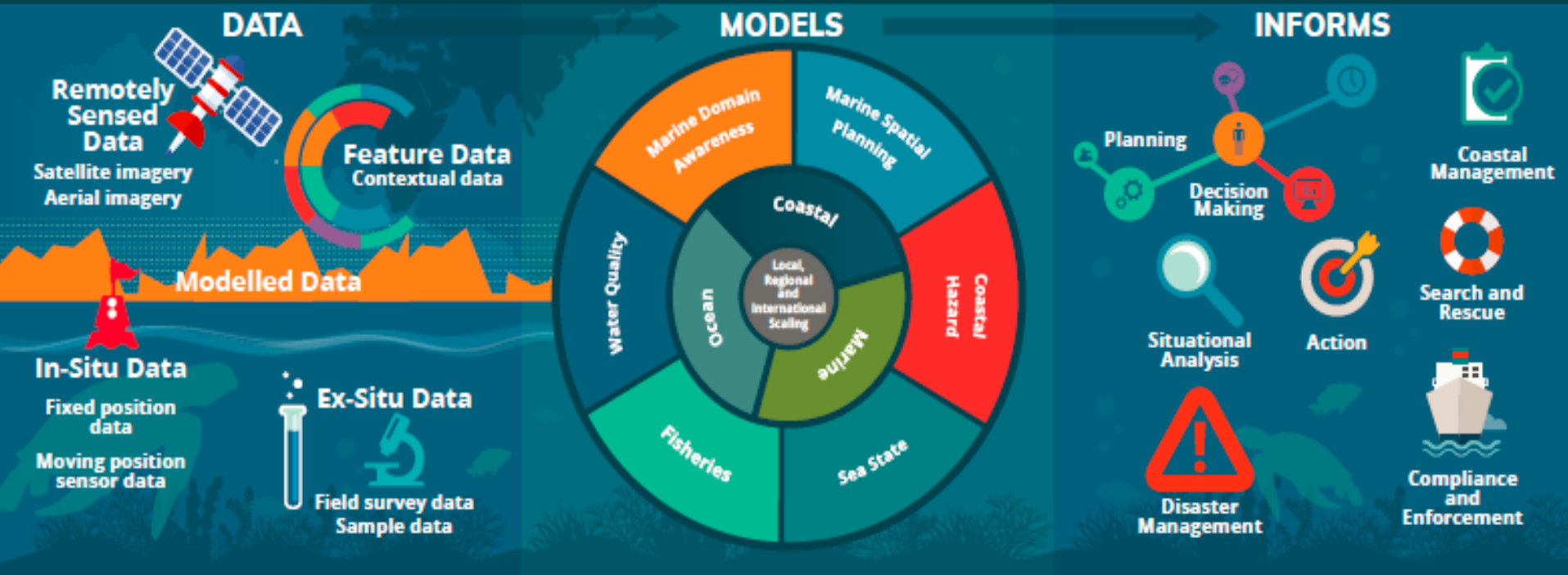
## User Guide for the Offline Covu Decision Support Tool

Developed in the context of the  
**National Coastal Climate  
Vulnerability Assessment**  
2020



# Incorporation of all GIS Decision Support Tools into the Oceans and Coasts Information Management System

## NATIONAL OCIMS



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# Incorporation of all GIS Decision Support Tools into the Oceans and Coasts Information Management System

Six (6) tools have been developed for OCIMS currently



## Harmful Algal Bloom

The South African west and south coasts suffer from the frequent occurrence of Harmful Algal Blooms (HABs). These blooms can have considerable negative impacts on commercial...  
1 Dataset



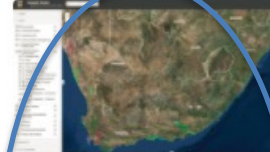
## Coastal Operations Viewer

South Africa's Exclusive Economic Zone (EEZ) encompasses the coastal ocean and shelf sea waters, which is home to one of the most energetic ocean systems, including the Agulhas...  
1 Dataset



## Marine Spatial Planning Support Viewer

The National Oceans and Coastal Information Management System (OCIMS) – Marine Spatial Planning (MSP) Support Viewer provides consolidated view of data sources that can inform...  
1 Dataset



## DEA Coastal Viewer

Information regarding the Coastal Public Property (CPP) and Coastal Protection Zone (CPZ) can be found in this viewer. This can support decision making processes by focussing...  
75 Datasets



## Integrated Vessel Tracking

Regular surveillance of territorial sea areas is increasingly important for coastal nations. Signatories to the United Nations Convention on the Law of the Sea (UNCLOS) can...  
1 Dataset



## Coastal Flood Hazard

In order to identify coastal areas at risk of flooding and to aid climate change adaptation, the South African Department of Environmental Affairs under the umbrella of...  
1 Dataset

Separate DST for CVI

Possible integration with CFH DST

Link with Provincial and Municipal GIS systems

Management and custodianship of data sets



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# THANK YOU!

Mr Potlako Khati

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Chief Directorate: Integrated Coastal Management  
Oceans and Coast Branch  
Department of Forestry, Fisheries and the Environment  
E-mail: [pkhati@environment.gov.za](mailto:pkhati@environment.gov.za)  
Contact: 083 263 9887  
Website: <http://www.environment.gov.za>

Thank You



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# INDIAN OCEAN RIM ASSOCIATION (IORA)

## The 3<sup>rd</sup> phase of workshop series on effects of Climate Change on the Indian Ocean Marine Environment

Topic 2; South Africa's Coastal and marine Climate Change Adaptation and Response Plan  
Presentation  
21 February 2023



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- **Intervention 6:** Build the necessary capacity and awareness for climate change responses.

- **Intervention 7:** Establish effective governance and legislative processes to integrate climate change in development planning.

- **Intervention 8:** Enable substantial flows of climate change adaptation finance from various sources.

- **Intervention 9:** Develop and implement an M&E system that tracks implementation of adaptation actions and their effectiveness.





# Background Information

- > **600 million** people (ca. **10%** of the world's population) live in coastal areas that are less than **10 meters** above sea level.
- Nearly **2.4 billion** people (ca. **40%** of the world's population) live within **100 km** of the coast.
- Ca. **40%** of South Africans are living within **60km** of the Oceans' coasts
- Ca. **10 million** people (about **20%**) of South African live in coastal areas
- Approximately **60%** of the South African economy depends on coastal natural resources and trade infrastructure such as ports.



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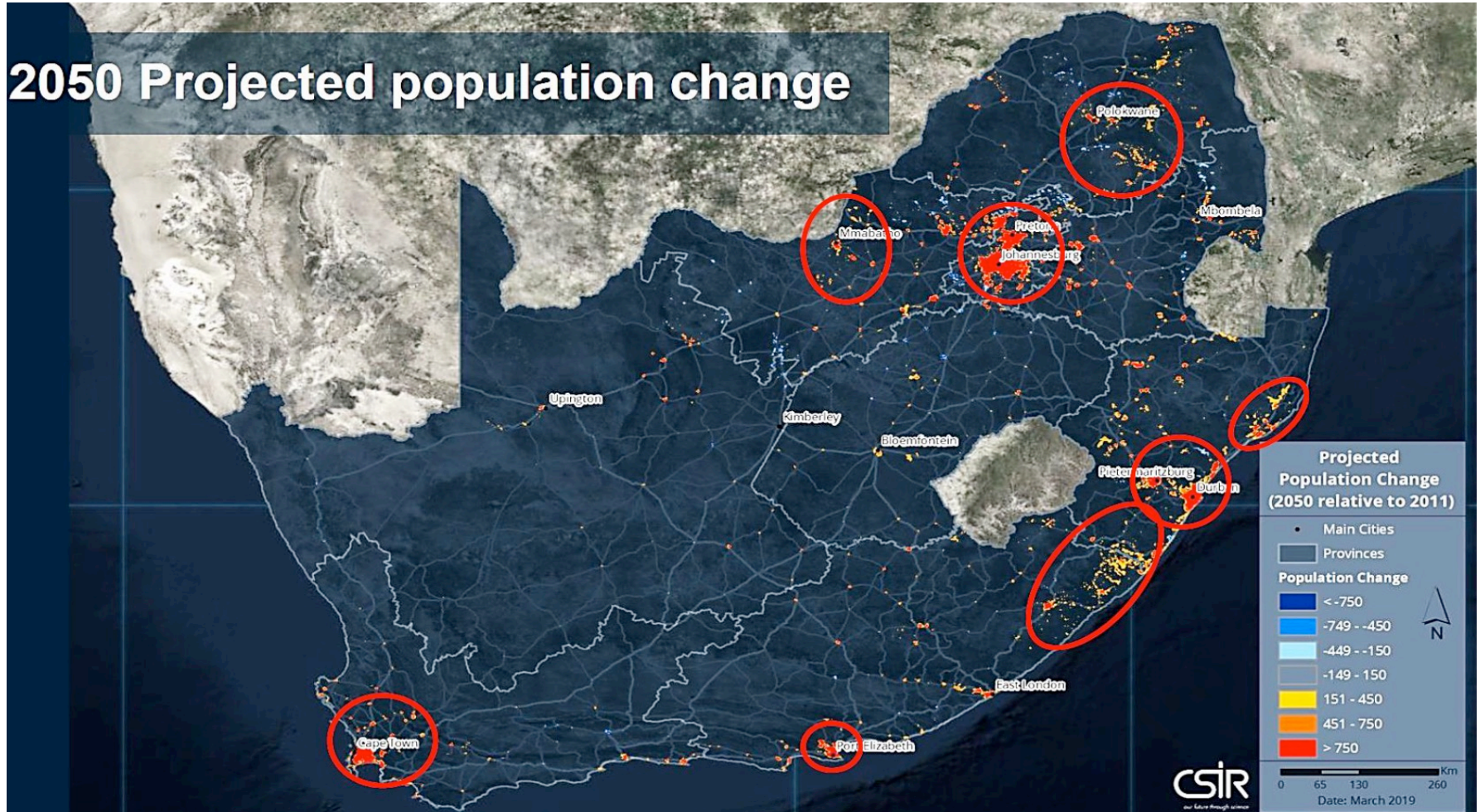
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# Projected Population Change

## 2050 Projected population change



→ Massive population pressure on coast to continue

Source: <https://Greenbook.co.za>



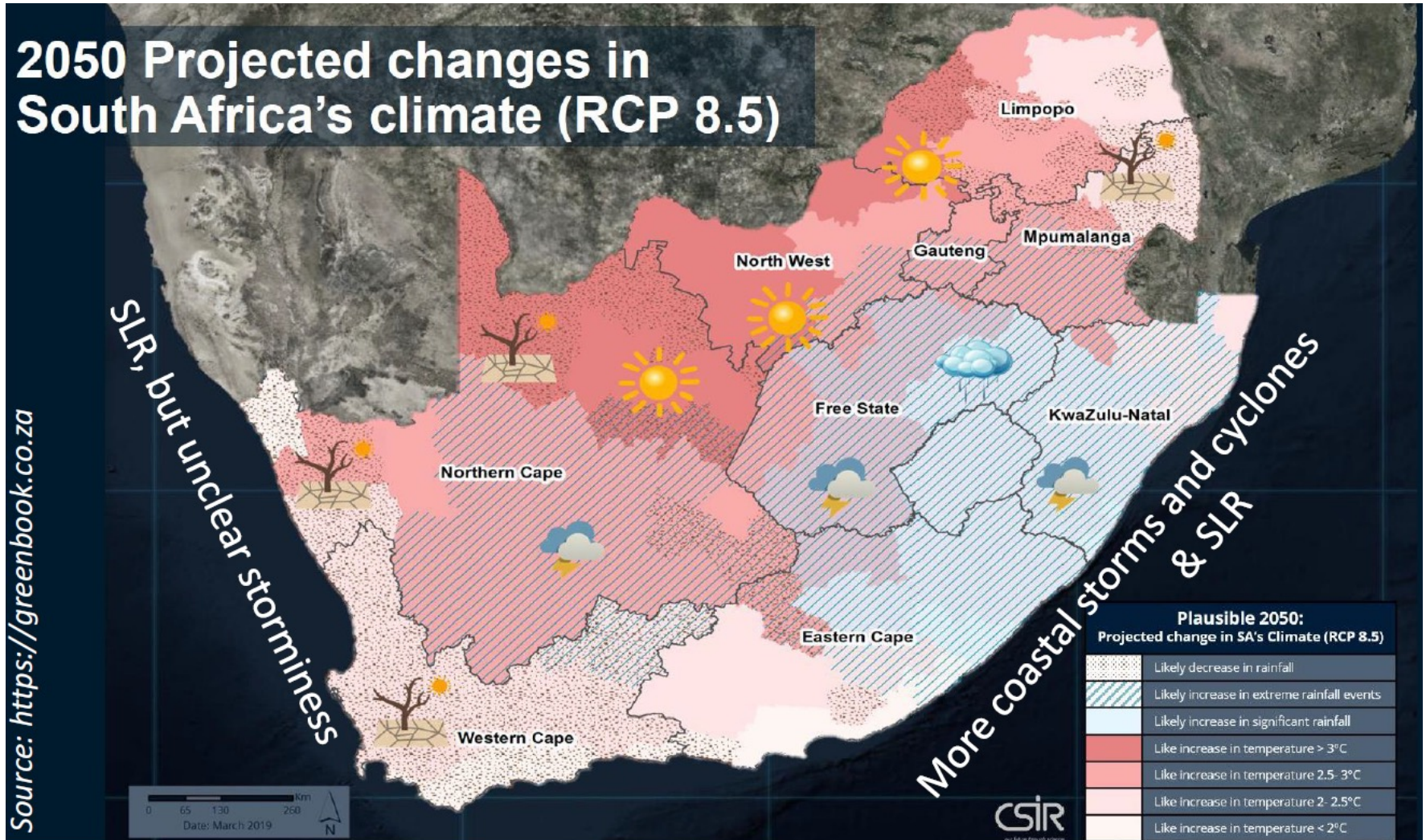
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# Projected Change in SA's Climate (RCP 8.5)



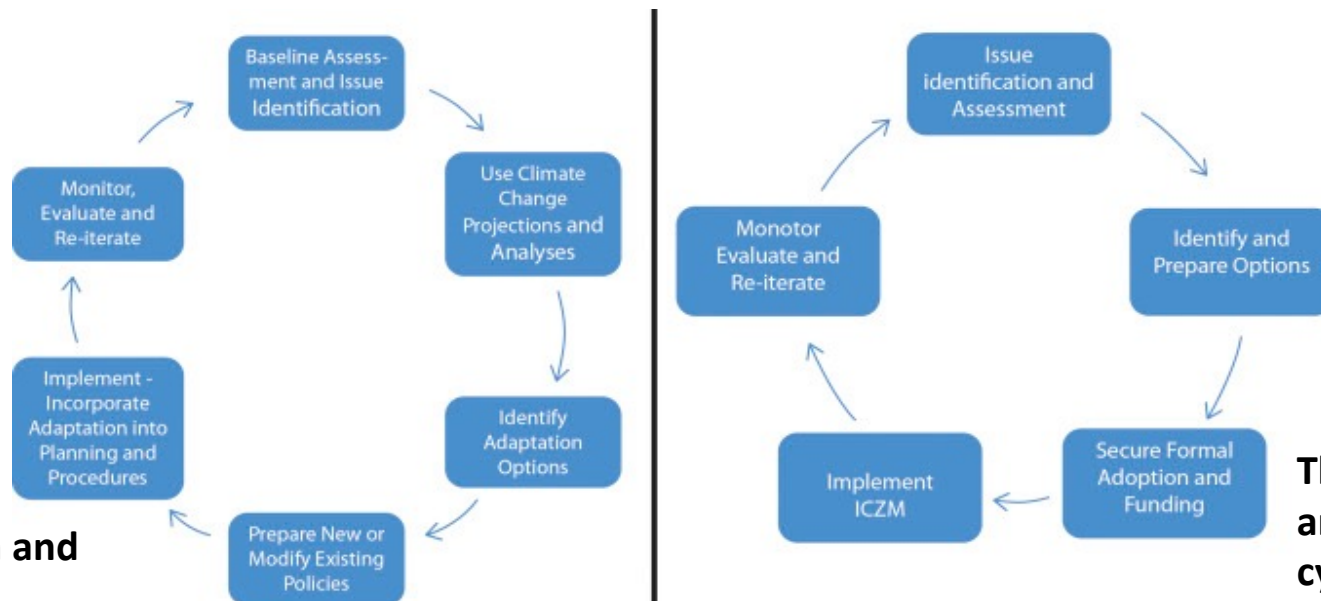
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# Sustainable Coastal Development Approach (SCDA)

1. Integrated Coastal Management as a framework for climate change adaptation action.
2. Coastal adaptation is not a one-time event but rather an adaptive and iterative process.



Marine Policy, Volume 111, January 2020, 102223

**The ICM policy and planning cycle (GESAMP 1996)**



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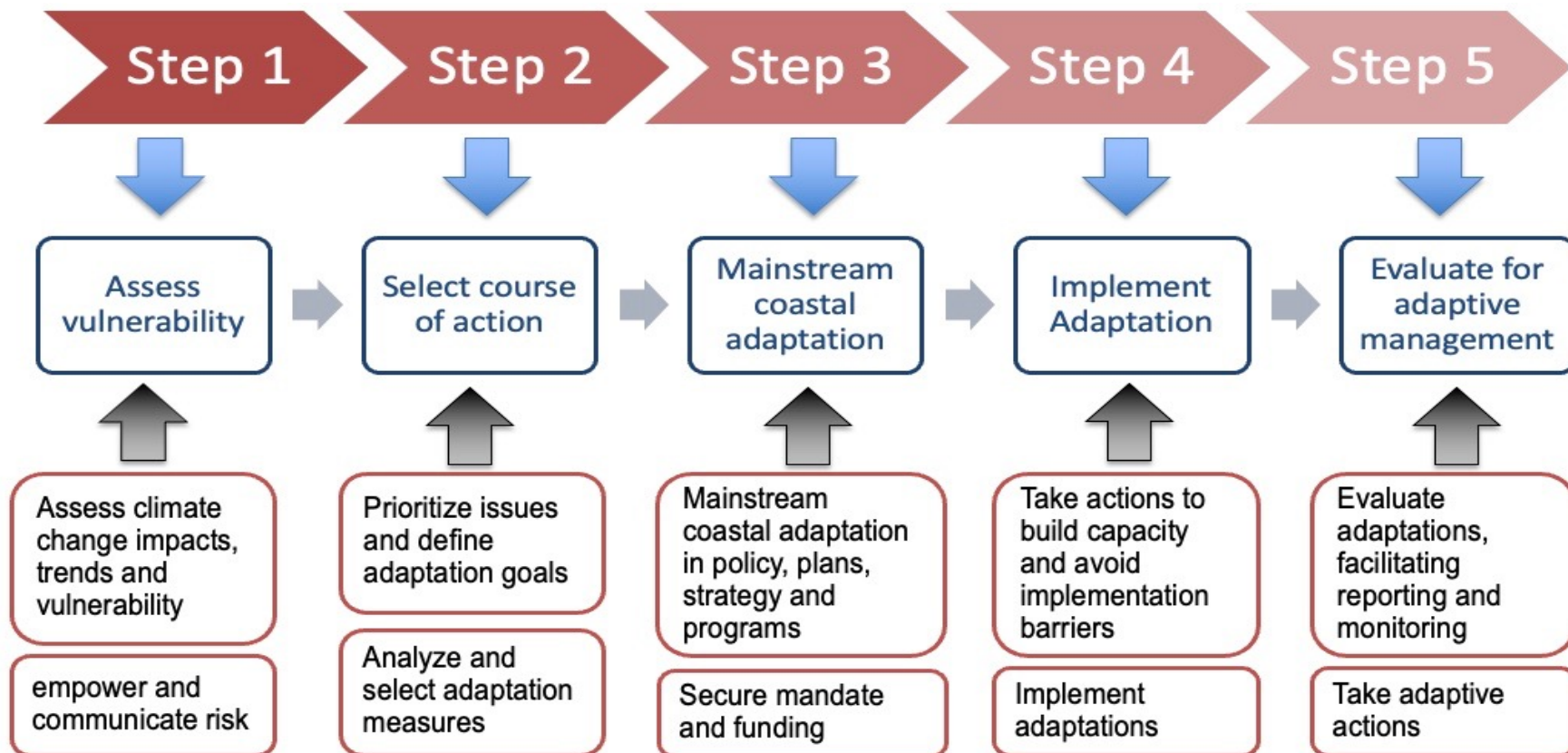
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# SCDA - Status update

Sustainable road map for climate actions has five (5) important steps to be undertaken to achieving sounds coastal management practice

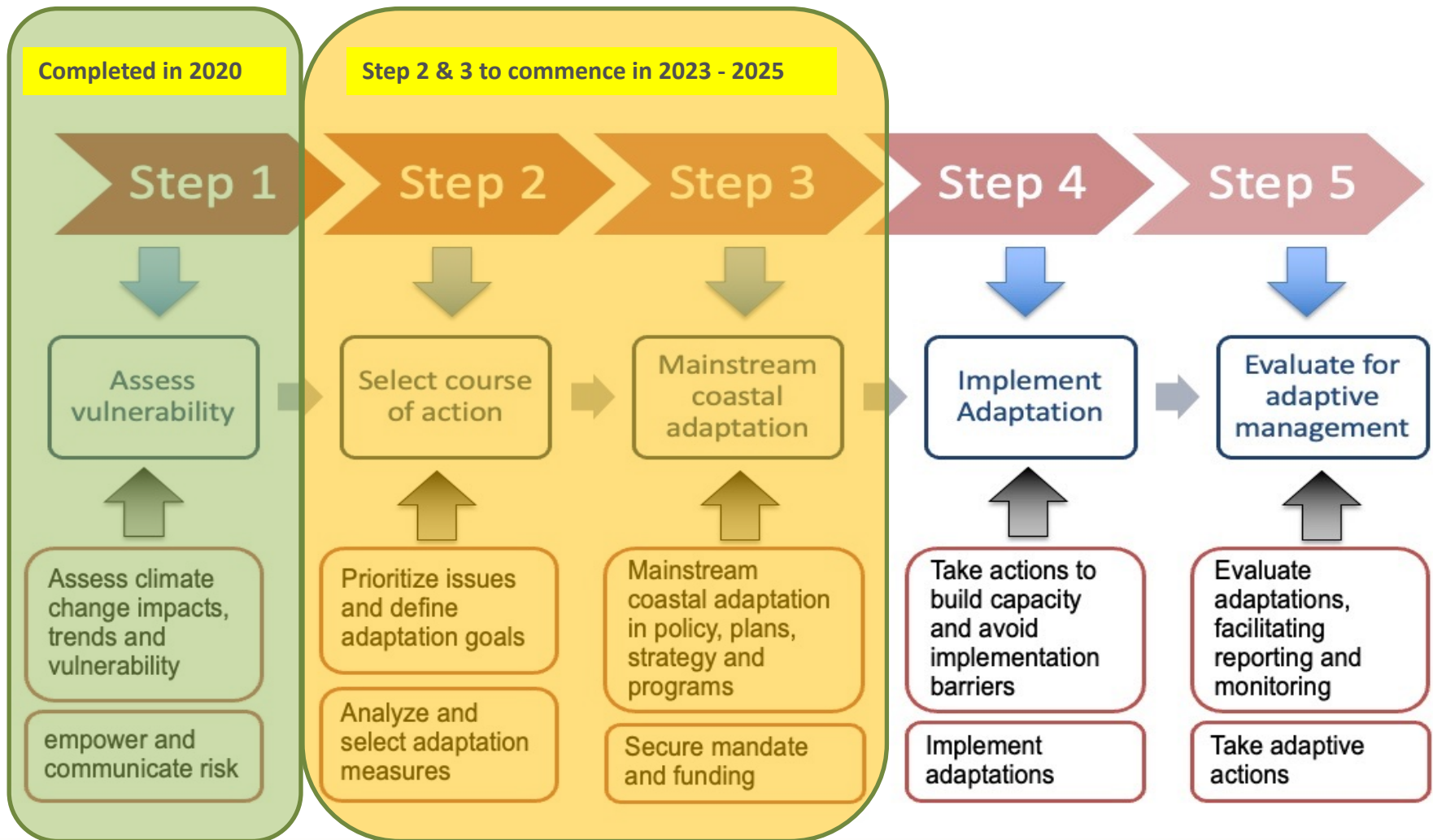


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# RoadMap



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# Step 2 & 3 Details – Development of CARP

## Stage 1

- Task 1: Project Inception
- Task 2: Assessment and Analysis

## Stage 2

- Task 3: Facilitation, Consultation and Stakeholder Engagement

## Stage 3

- Task 4: Development of Draft Coastal Adaptation Response Plan (CARP)

## Stage 4

- Task 5: Facilitation, Consultation and Stakeholder Engagement Phase

## Stage 5

- Task 6: Development of Final Coastal Adaptation Response Plan (CARP) and Project Launch

The development of CARP will be over a period of two (2) years from the year 2023 – 2025.



# Benefits of CARP

- The dev of CARP – Address climate change hazards in the Coastal Sector in line with the requirements of the ICM Act, NCMP, NAS and Draft Climate Change Bill.
- Vision Development
- Production of guidelines for mainstreaming climate change actions into coastal spatial planning
- Development of a new Agenda for research, science and innovation needs for marine and coastal environment
- Institutional Arrangement and Support Structures required for implementations
- Development of resource mobilisation strategy (funds etc).
- Implementation programme with M&E
- Awareness and Empowerment programme and information booklets / brochures





# THANK YOU!

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Thank You