Support for Ambergris Caye Sustainable Development - Belize

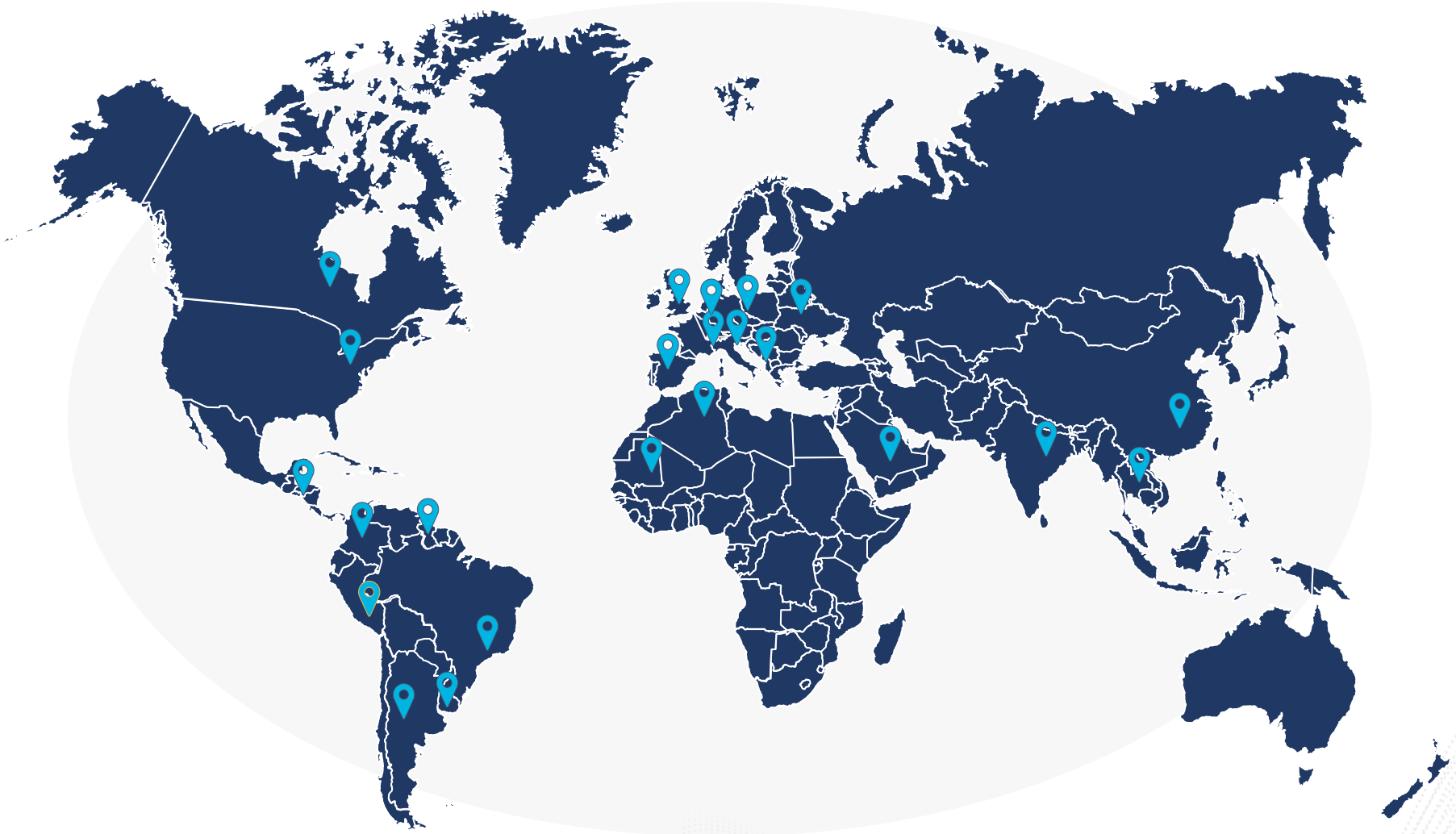
Comprehensive Multisector and Multiscale Diagnosis

Client

IDB
Inter-American Development Bank

IDOM
our commitment your success

IN THE PAST FEW YEARS, IDOM'S **ORGANIZATIONAL TRANSFORMATION AND GEOGRAPHIC EXPANSION** HAVE BEEN SUCH THAT WE CAN NOW CLAIM TO BE A TRULY **GLOBAL COMPANY.**



5.300
Professionals

66
Years of Experience

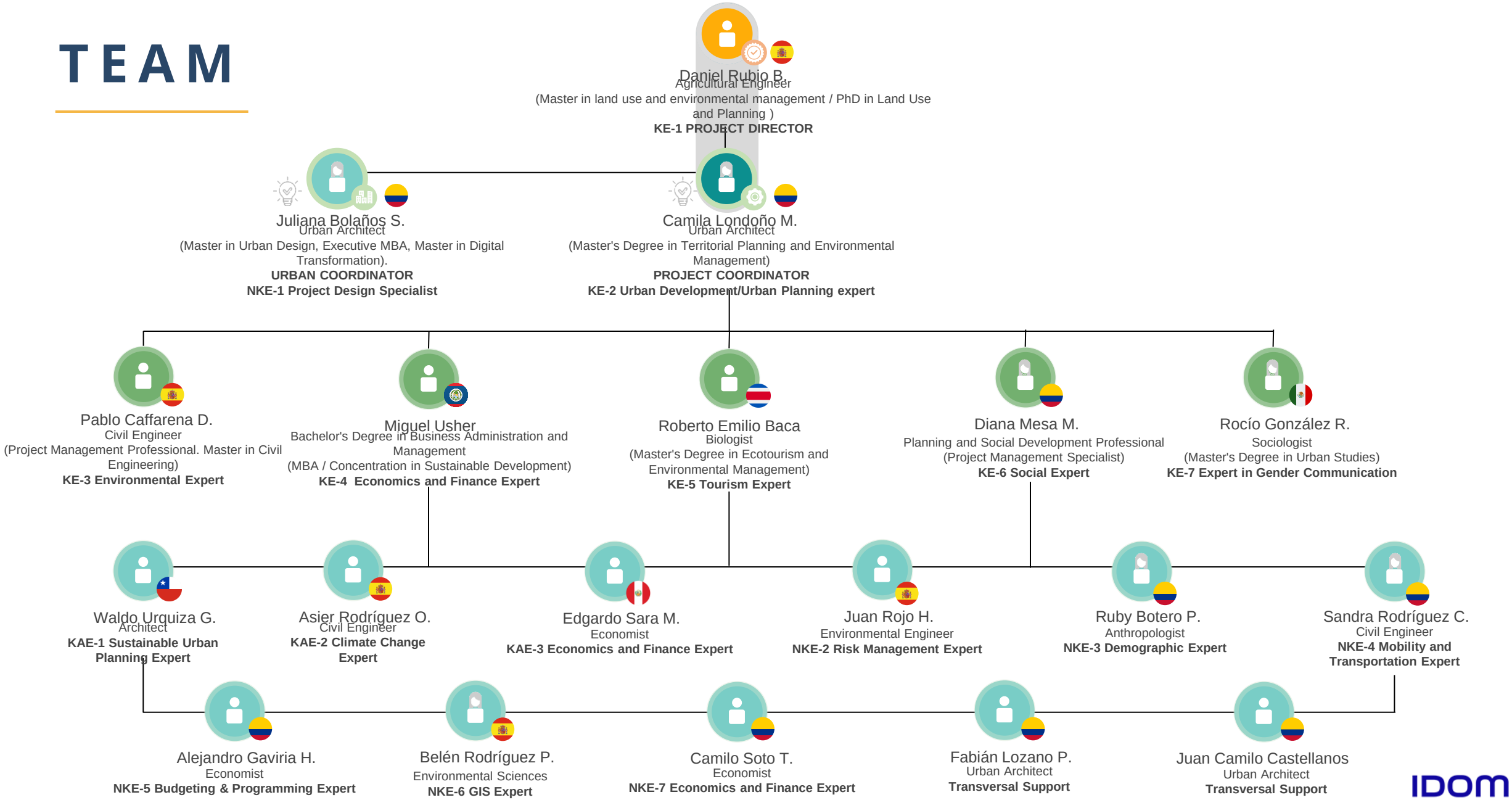
45
Offices

125
Countries

968
Partners

IDOM

TEAM


Daniel Rubio B.
Agricultural Engineer
(Master in land use and environmental management / PhD in Land Use and Planning)
KE-1 PROJECT DIRECTOR
Juliana Bolaños S.
Urban Architect
(Master in Urban Design, Executive MBA, Master in Digital Transformation).
URBAN COORDINATOR
NKE-1 Project Design Specialist
Camila Londoño M.
Urban Architect
(Master's Degree in Territorial Planning and Environmental Management)
PROJECT COORDINATOR
KE-2 Urban Development/Urban Planning expert
Pablo Caffarena D.
Civil Engineer
(Project Management Professional. Master in Civil Engineering)
KE-3 Environmental Expert
Miguel Usher
Bachelor's Degree in Business Administration and Management
(MBA / Concentration in Sustainable Development)
KE-4 Economics and Finance Expert
Roberto Emilio Baca
Biologist
(Master's Degree in Ecotourism and Environmental Management)
KE-5 Tourism Expert
Diana Mesa M.
Planning and Social Development Professional
(Project Management Specialist)
KE-6 Social Expert
Rocío González R.
Sociologist
(Master's Degree in Urban Studies)
KE-7 Expert in Gender Communication
Waldo Urquiza G.
Architect
KAE-1 Sustainable Urban Planning Expert
Asier Rodríguez O.
Civil Engineer
KAE-2 Climate Change Expert
Edgardo Sara M.
Economist
KAE-3 Economics and Finance Expert
Juan Rojo H.
Environmental Engineer
NKE-2 Risk Management Expert
Ruby Botero P.
Anthropologist
NKE-3 Demographic Expert
Sandra Rodríguez C.
Civil Engineer
NKE-4 Mobility and Transportation Expert
Alejandro Gaviria H.
Economist
NKE-5 Budgeting & Programming Expert
Belén Rodríguez P.
Environmental Sciences
NKE-6 GIS Expert
Camilo Soto T.
Economist
NKE-7 Economics and Finance Expert
Fabián Lozano P.
Urban Architect
Transversal Support
Juan Camilo Castellanos
Urban Architect
Transversal Support

SCOPE

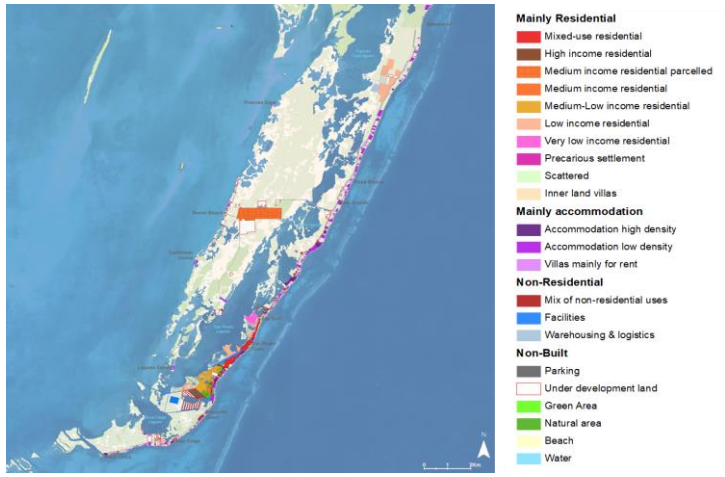
	0,5 month	2 months	2 months	2 months
PHASES	1 COMPREHENSION	2 MULTISECTORAL DIAGNOSIS	3 ACTION AND FINANCIAL PLAN	4 PRE-FEASIBILITY STUDIES & ZONING PLAN
TASKS	**1.1** Work plan, methodology and timeline **1.2** Identify and analyze relevant documents **1.3** Identify actors of key actors and Stakeholders **1.4** Identification and analysis of prioritized infrastructure projects	**2.1** Field work **2.2** General characterization **2.3** Sectorial characterization **2.4** Benchmark analysis of similar projects **2.5** Identification and characterization of vulnerable urban areas **2.6** Analysis of vulnerability to natural hazards. **2.7** Greenhouse gas emissions analysis **2.8** Definition, approach, variables and thresholds Carrying Capacity Model **2.9** Prospective population & urban footprint analysis in two development scenarios (20 years)	**3.1** Construction of a strategic development vision **3.3** Calculation of carrying capacity over the next 20 years **3.3** Estimated costs and required infrastructure **3.4** Preparation of action plan and financial plan	**4.1** Project prioritization **4.2** Field work **4.3**y **4.4** Pre-feasibility study of prioritized project 2 **4.5** Elaboration of Zoning Plan
	PARTICIPATION AND ENGAGEMENT STRATEGY			
	TERRITORIAL INFORMATION SYSTEM			
REPORTS	**REPORT 1.** - Work Plan - Executive Report of Findings	**REPORT 2.** - Comprehensive multisector and multiscale diagnostics	**REPORT 3.** - Development vision - Carrying capacity - Costs, action plan and financial plan	**REPORT 4.** - Project Prioritization - Project Prefeasibility - Zoning Plan

DIAGNOSTIC PRESENTATION AND VISION WORKSHOP

COMPONENTS OF THE WORKSHOP

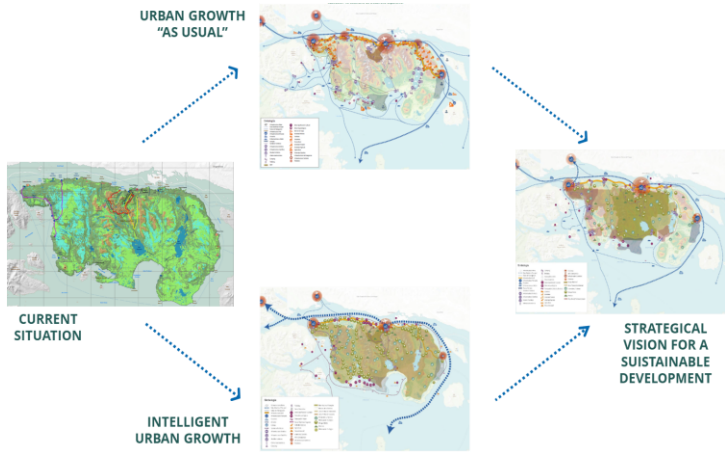
DIAGNOSTIC VALIDATION

Its objective is to present the advances and preliminary results of the diagnosis carried out by the consulting team and receive feedback from the attendees.



CONSTRUCTION OF A SHARED VISION

Its objective is to validate the progress of the scenarios (Urban growth "as usual" and Intelligent urban growth), and jointly build the sustainable Vision for Ambergris Caye.



01 Multisectoral diagnosis

02 Prospective analysis & carrying capacity

01

MULTISECTORAL DIAGNOSIS

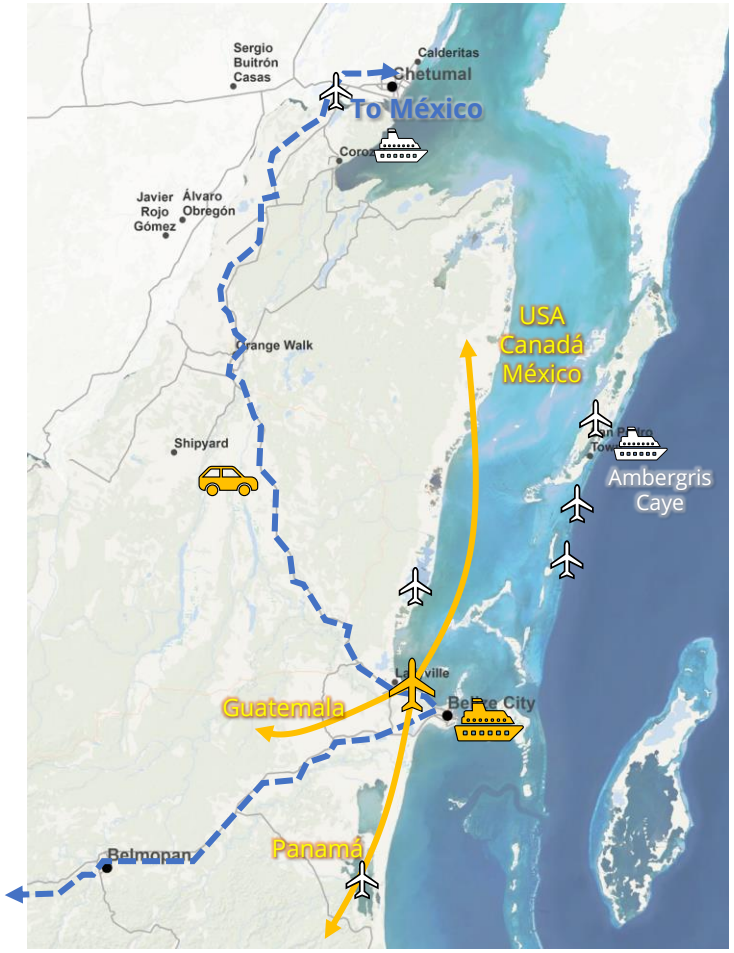
IDOM

TERRITORIAL FRAMEWORK

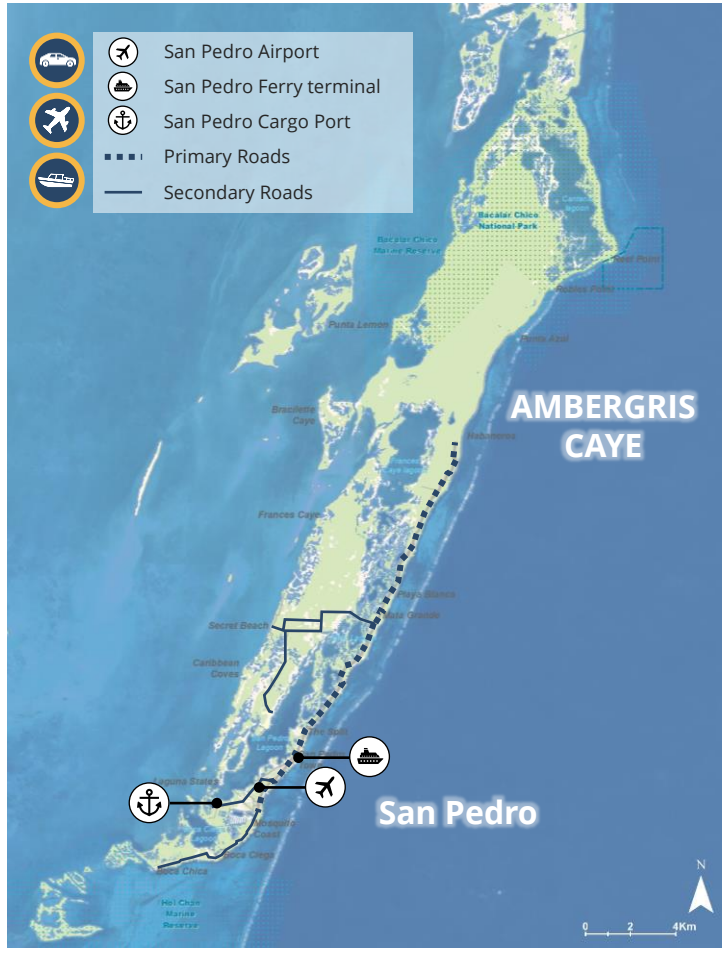
Surface **8.861** mi2 (2022)

Population **441.471** Inhabitants (2022)

Density **49.8** Inh./mi2 (2022)



Ambergris Caye is located on the **northeast side of the country** and represents the **largest island in Belize.** The connection of the island depend on the **connectivity with the inland part of the country.**



Surface **24.6** mi2 (2022)

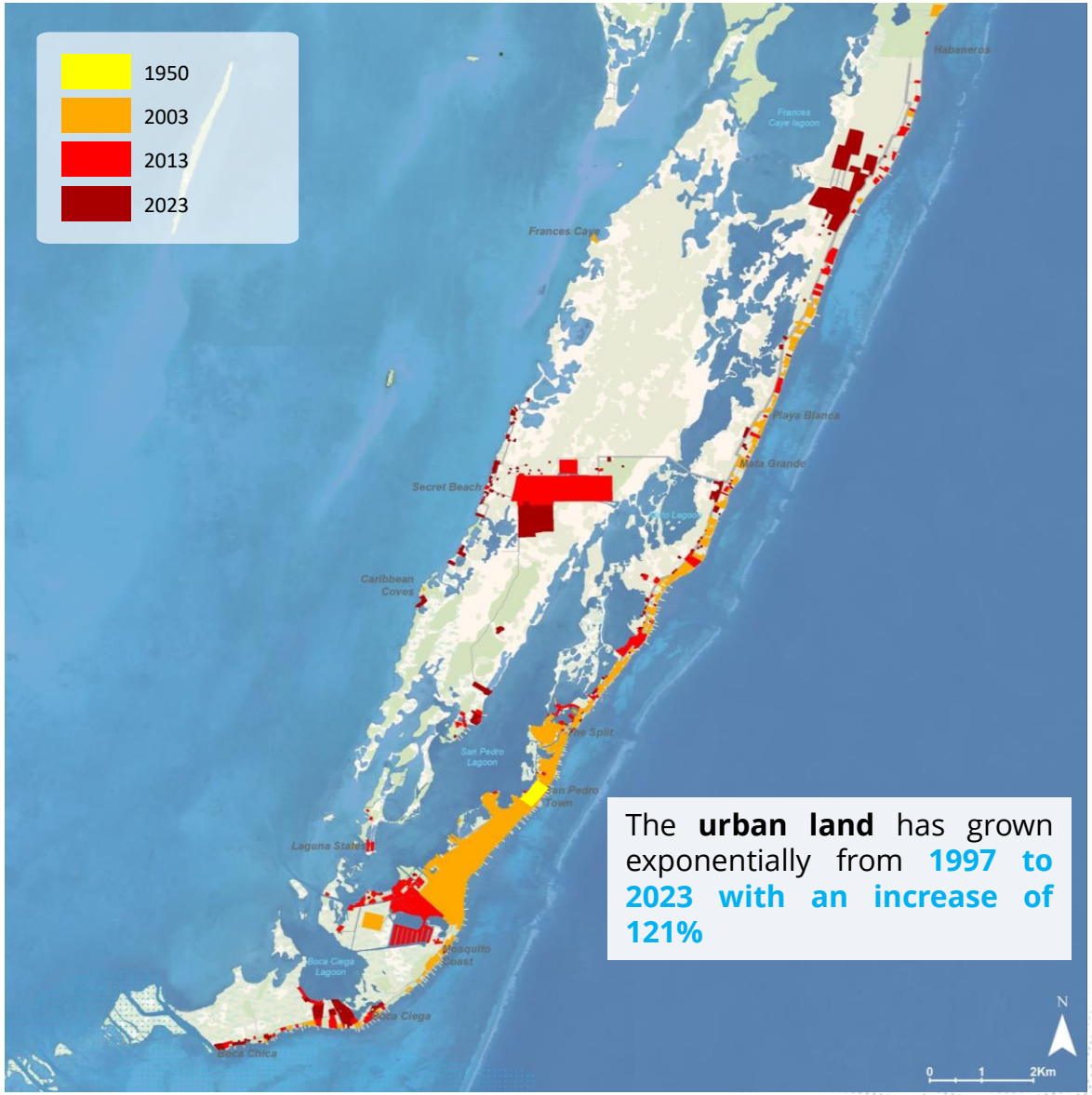
Population **18.319*** Inhabitants (2022)

Density **392** Inh./mi2 (2022)

***Preliminary estimated projection**

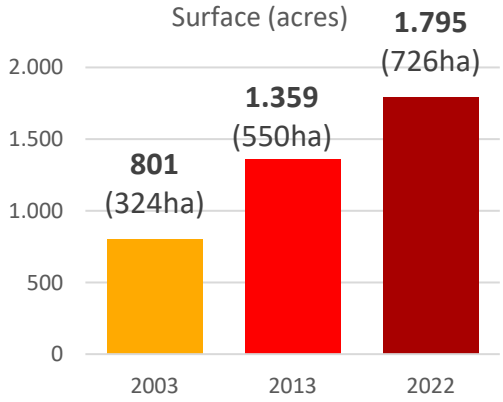
IDOM

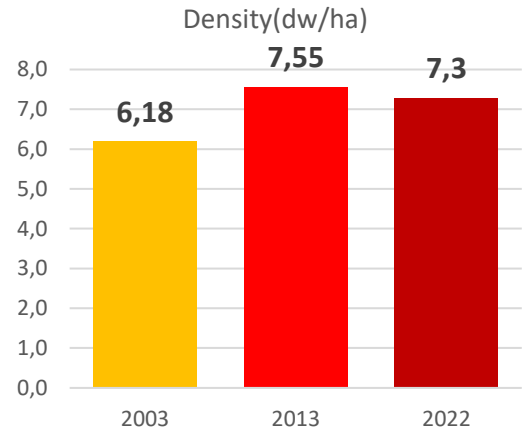
CURRENT AND HISTORICAL URBAN FOOTPRINT

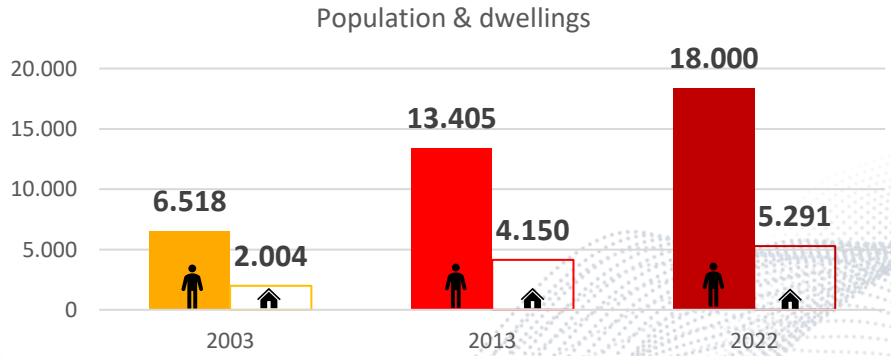


The **urban land** has grown exponentially from **1997 to 2023 with an increase of 121%**

Nowadays, the footprint spans nearly 1,800 acres, where **large pockets of developing land stabilize density**. Foremost growth is located more than 8 miles down the coastline and **reaches the west coast more than 7 miles** from the urban center.







ANALYSIS OF RECENT CHANGES

C1 - FILLS ON LAGOONS AND MANGROVES
MAHOGANY BAY

2014

ANALYSIS OF RECENT CHANGES

7% of mangrove degraded between 1980 and 2023.
A loss of 19 acres per year. ***Data WWF + IDOM***

Degradation affects 3% of Ambergris coral. ***Data WWF***

1 ANALYSIS OF RECENT CHANGES

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ANALYSIS OF RECENT CHANGES

C3 - HOTEL AND TOURIST DEVELOPMENTS
SECRET BEACH
2022

20.36 ACRES
OF BEACHFRONT TOURIST DEVELOPMENT

Vegetation cover has been reduced approximately **2,470 Acres from 1997 to 2023**, from a total cover of 80% to 70%

ANALYSIS OF RECENT CHANGES

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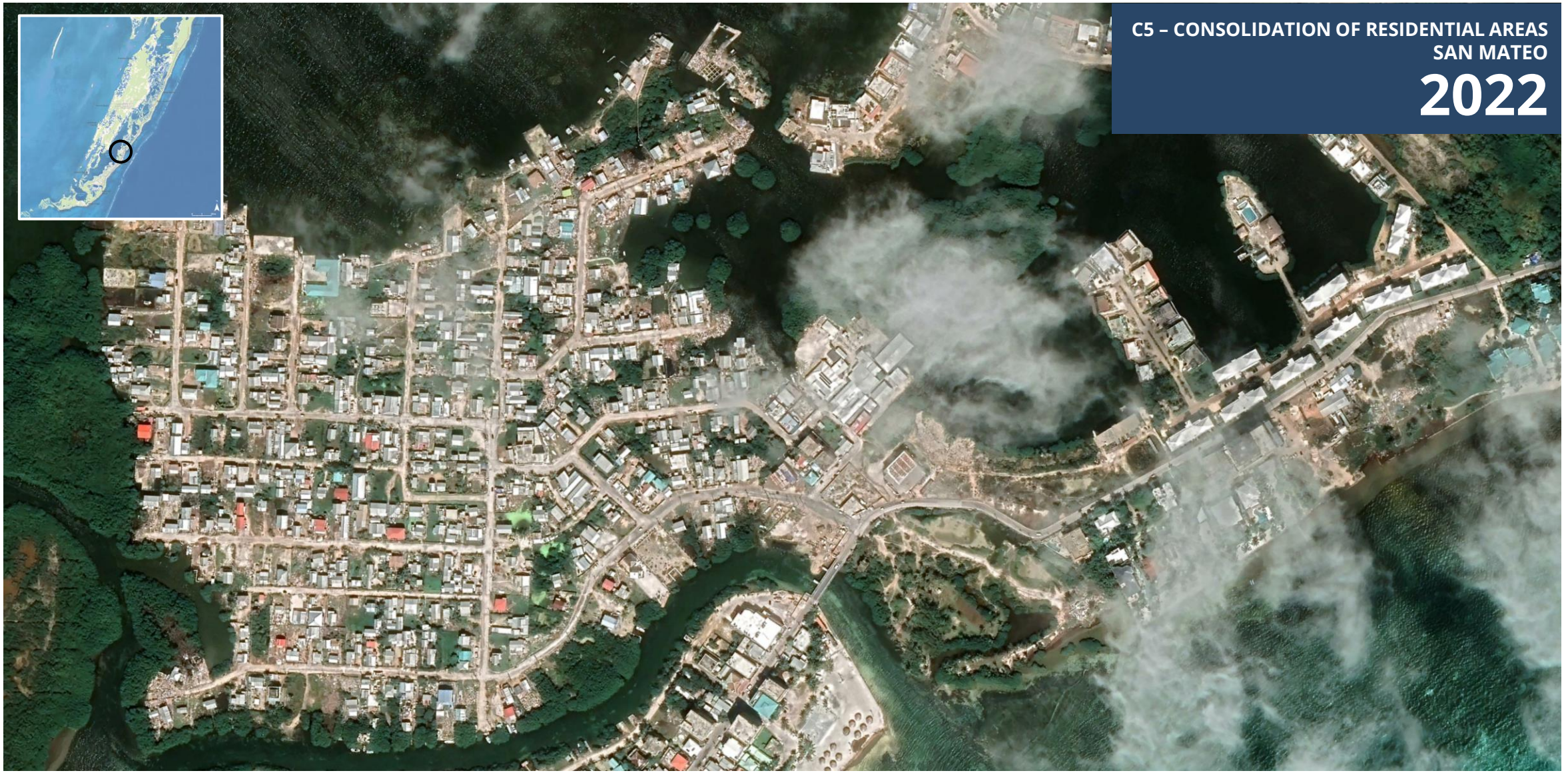

1 ANALYSIS OF RECENT CHANGES

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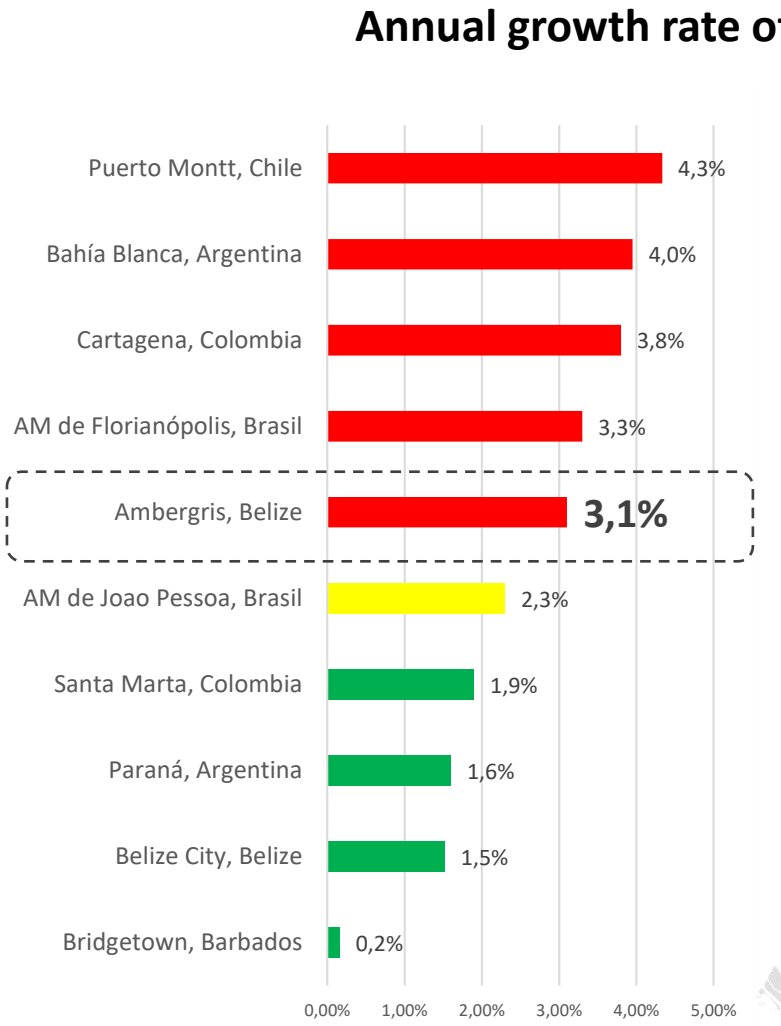
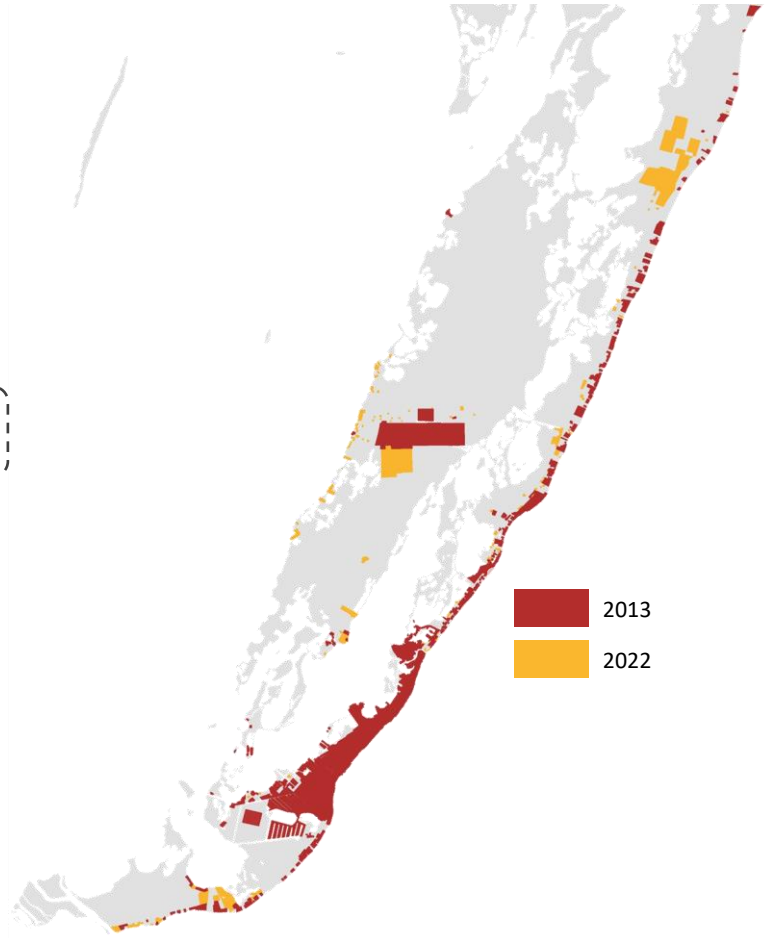
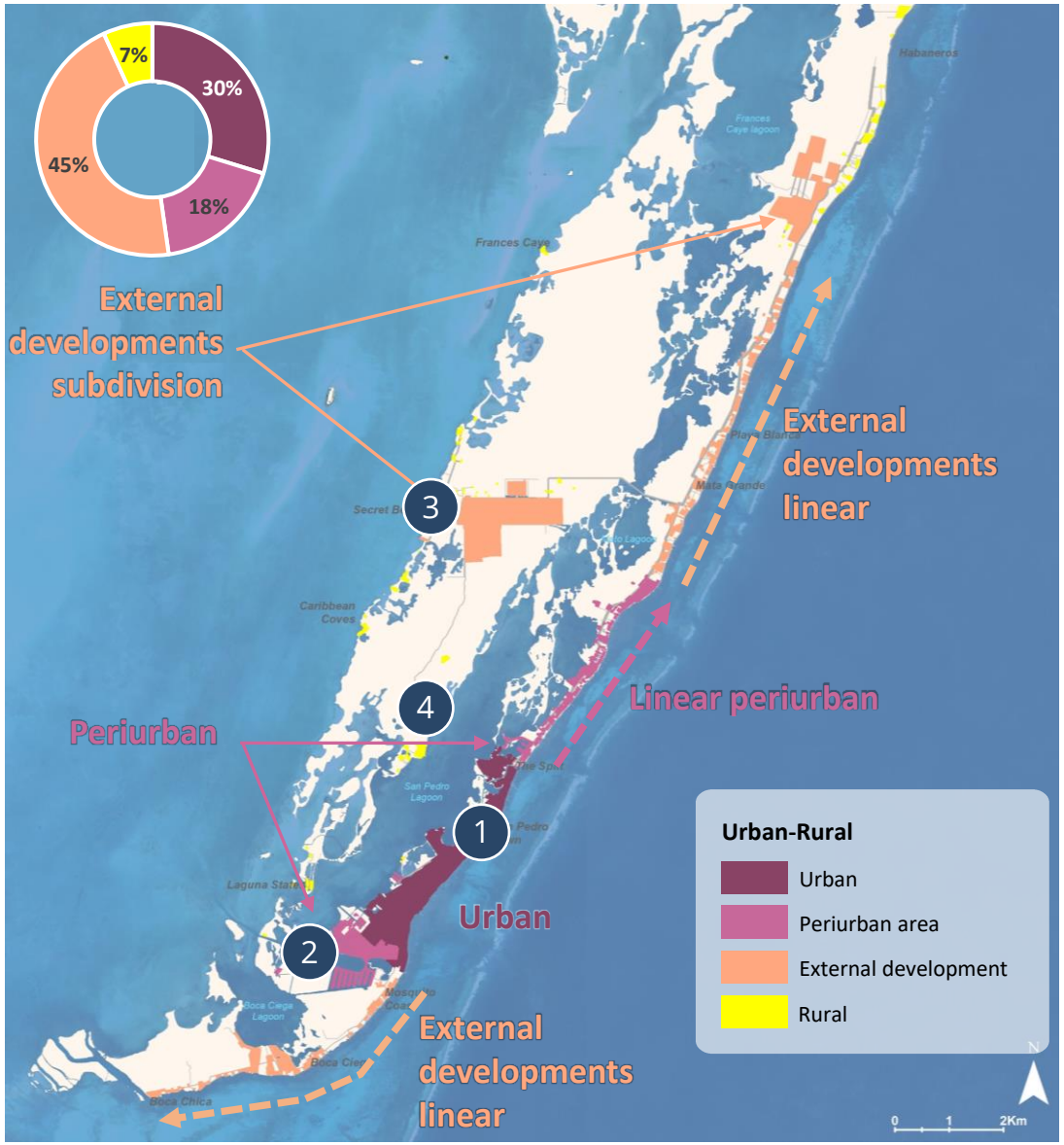
Annual growth rate of the urban footprint

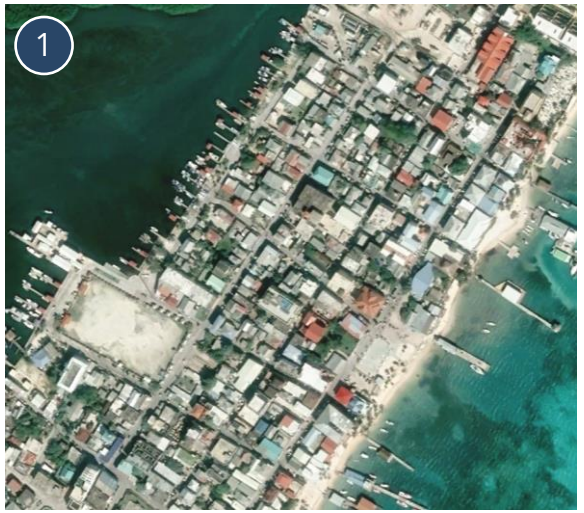
Annual growth rate of the footprint	3,1%
Annual growth rate of population/Annual growth rate of the footprint	1,13
Existence and implementation of urban planning tools approved by law and updated in recent years (10 years)	No
Existence and implementation of urban plan; urban regulatory rules	No
Presence of unplanned periurban space, generating lack of separation between urban and rural	5,10
Presence of unplanned periurban space, generating lack of separation between urban and rural	236,1%
Presence of a messy periurban space, generating lack of separation between urban and rural	70,2%
Urban population in the municipality or group of municipalities	78,2%





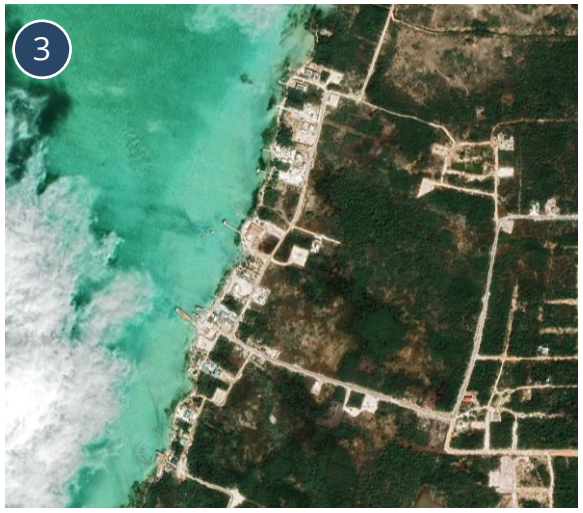
URBAN AND RURAL TRANSITION GROUPS



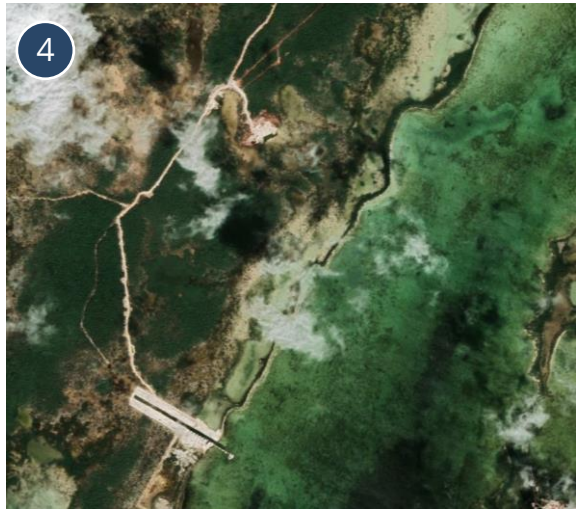


Urban (*Town Center*)

Periurban (*Ellis Subdivision*)



External development
(*Secret Beach*)



Rural
(*West Side of San Pedro Lagoon*)

GROWTH OF THE URBAN FOOTPRINT

1

PRESENCE OF UNPLANNED PERIURBAN SPACE

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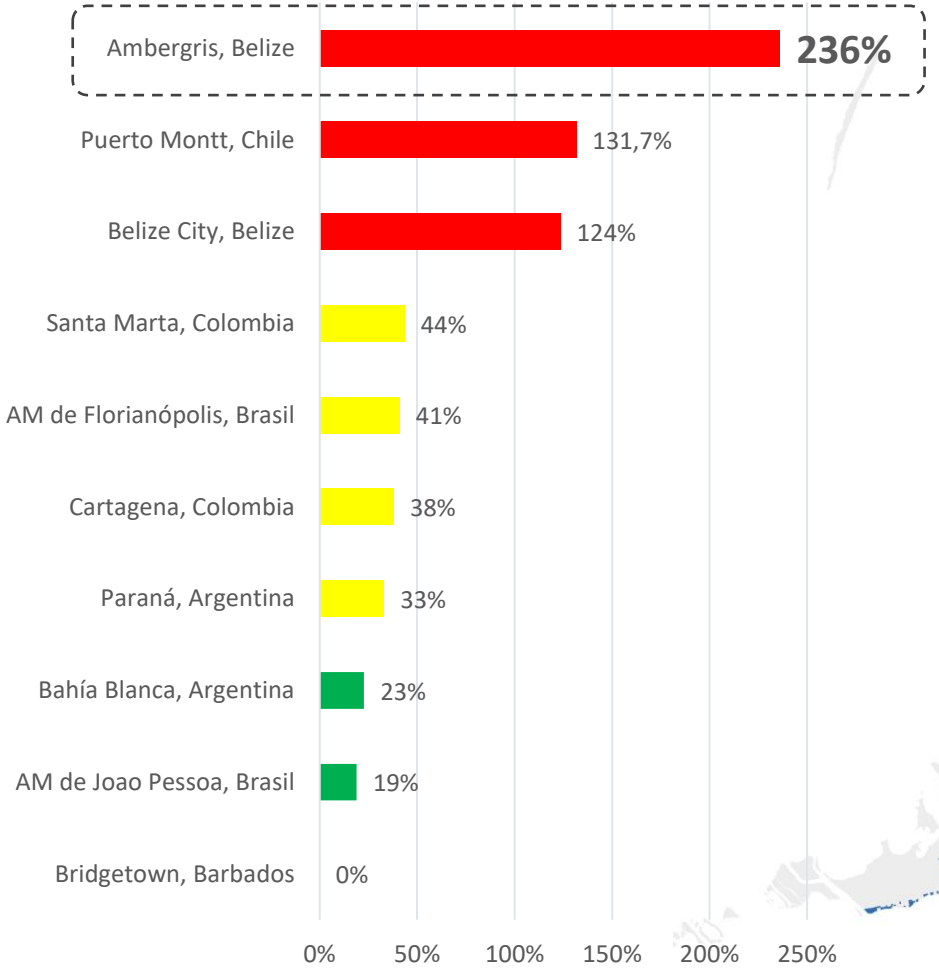
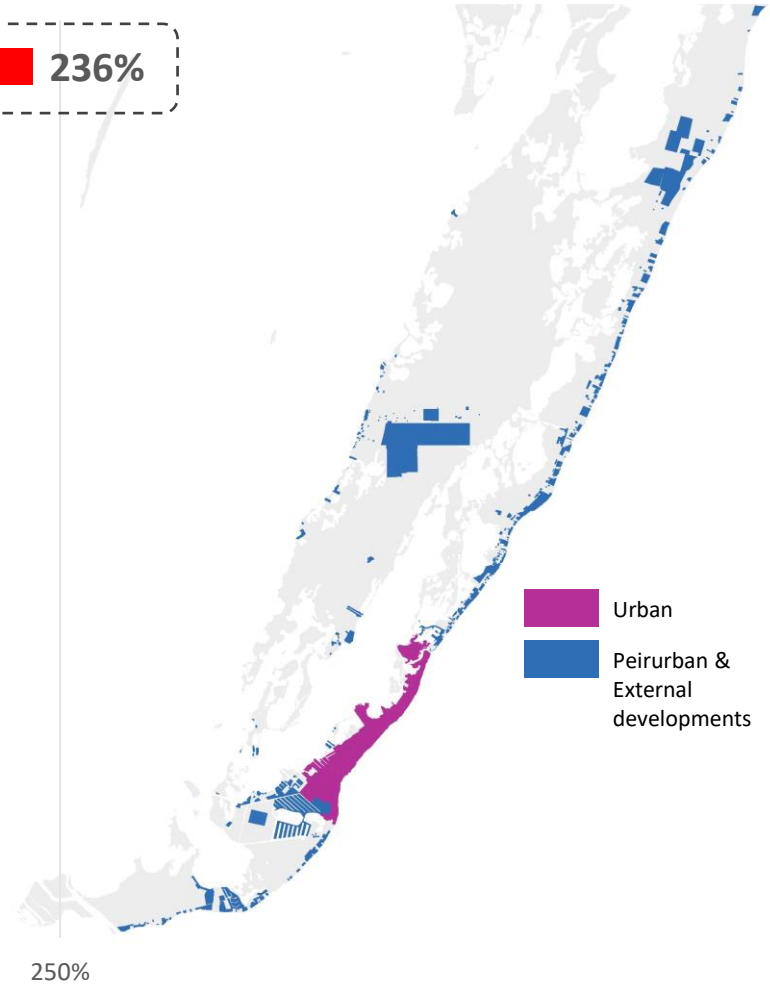
Presence of unplanned periurban space



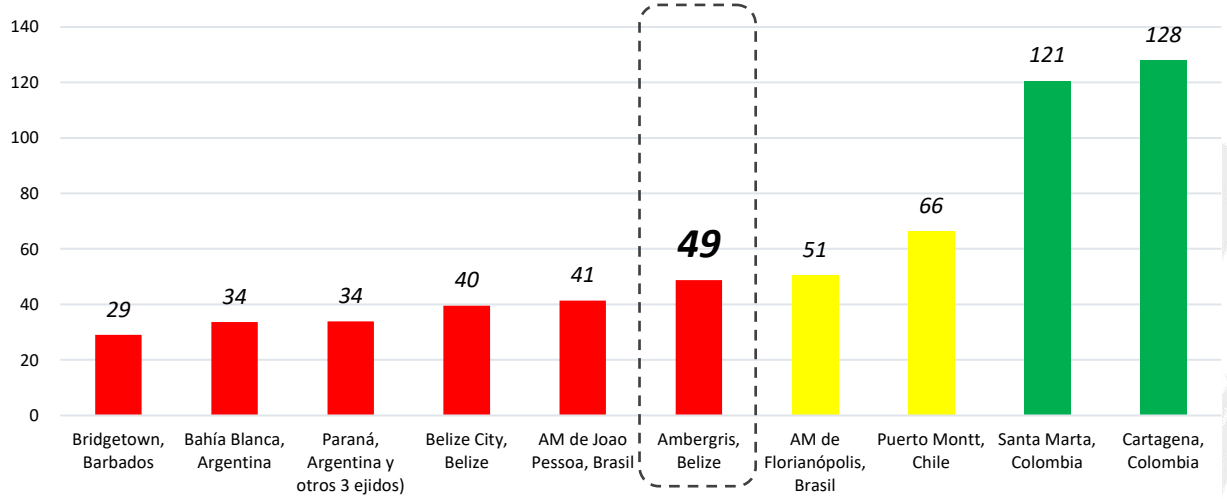


DENSITY INDICATORS

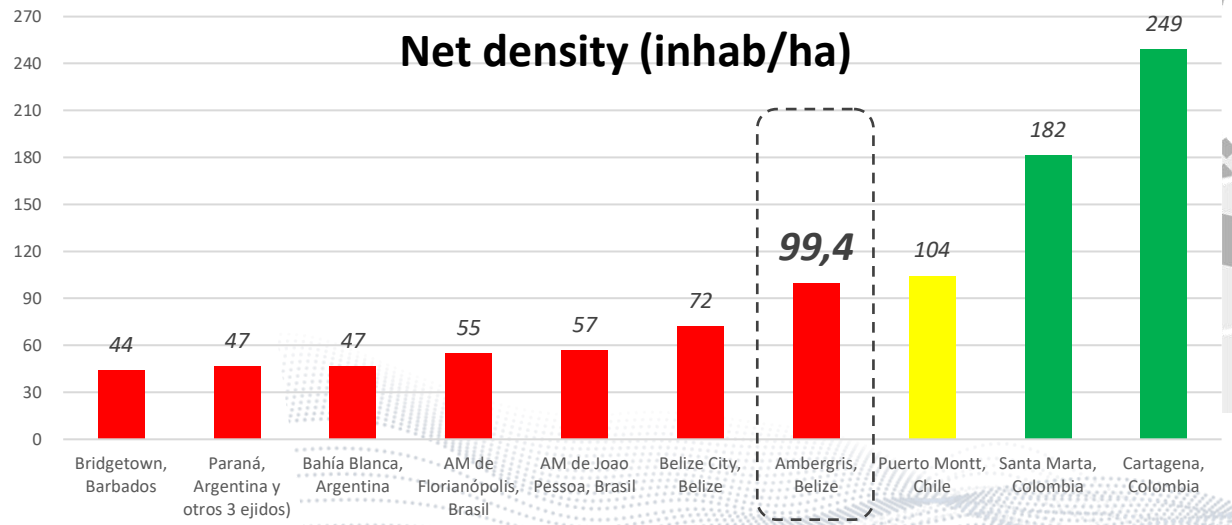
Net density of urban&periurban population*	99,4
Gross density of urban&periurban population*	48,8
Net density built urban&periurban*	28,7
Density distribution	Intermediate
Vacant spaces in the footprint	16,2%

**Urban & Periurban*

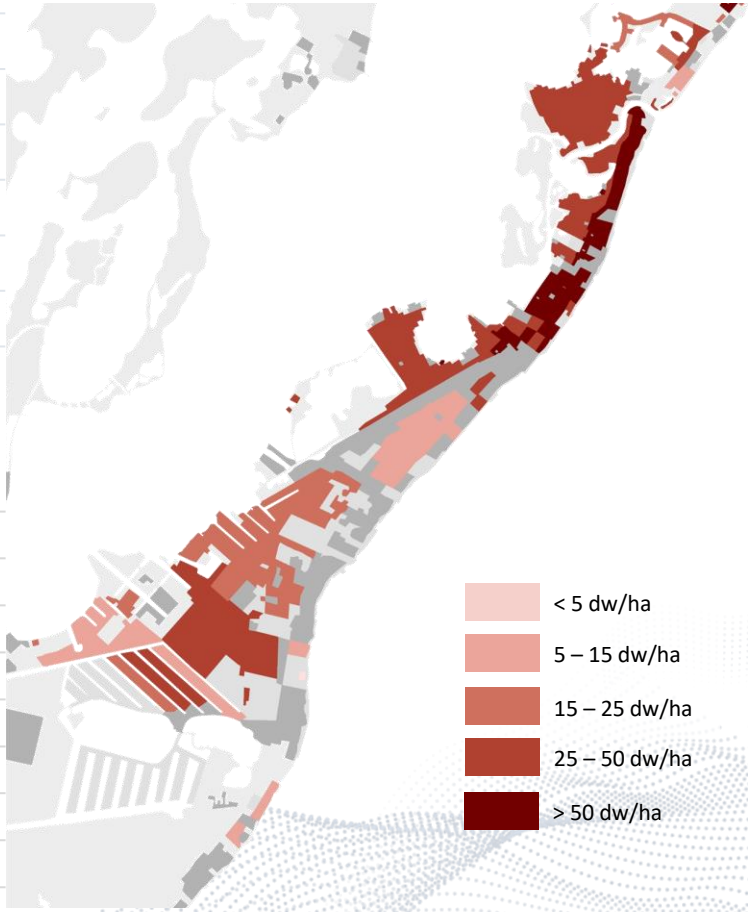
Gross density (inhab/ha)



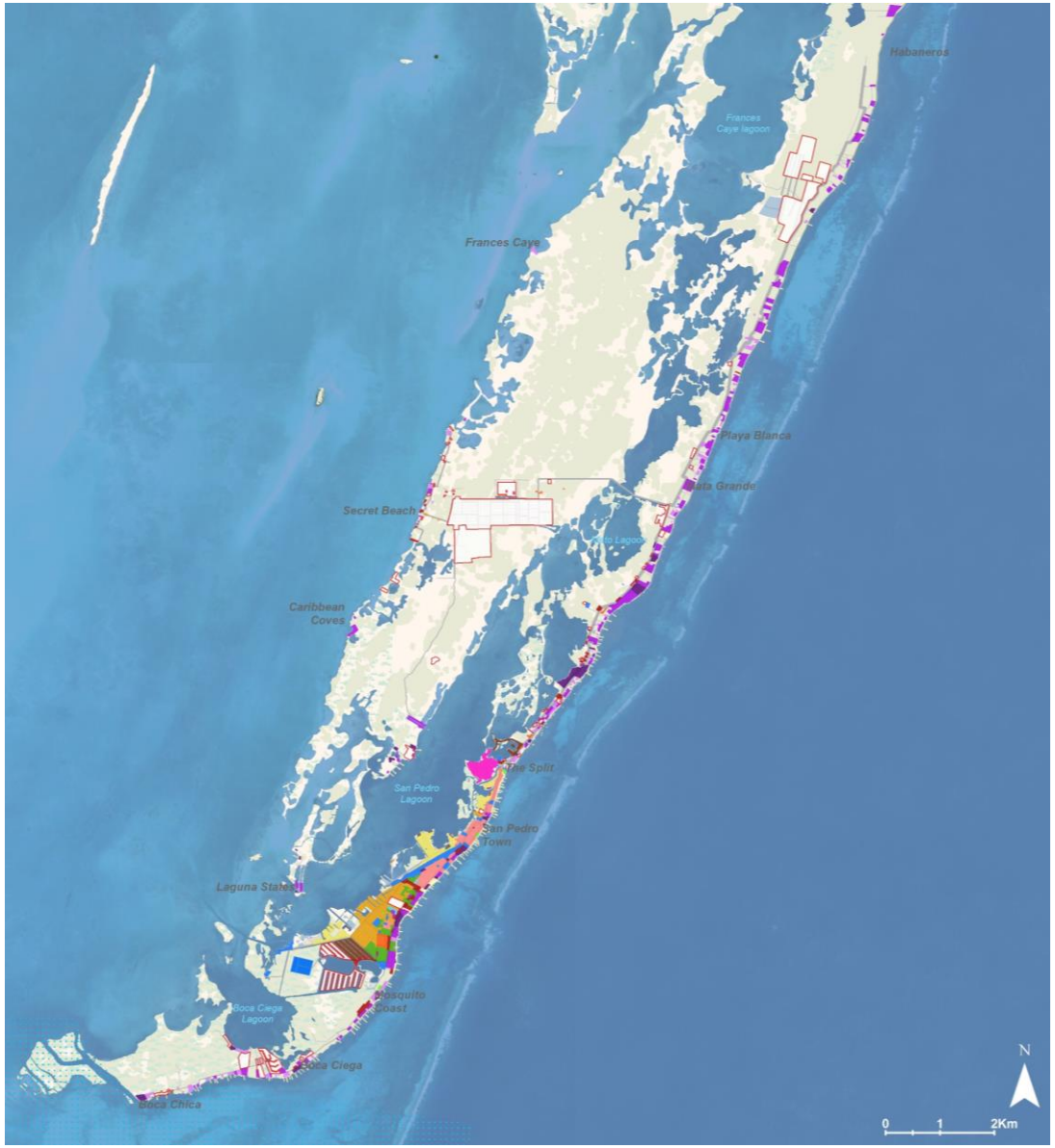
Net density (inhab/ha)



Net density built urban&periurban



DESCRIPTION OF HOMOGENEOUS UNITS



Mainly Residential

- Luxury housing
- Mixed-use residential
- Good quality housing
- Inner land villas
- Medium quality housing
- Low-to-medium quality housing
- Scattered
- Low quality housing
- Non-permanent housing

Mainly accommodation

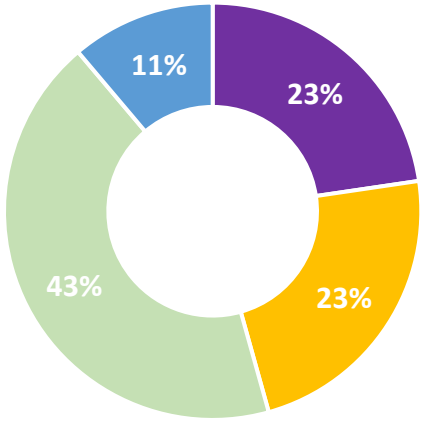
- Accommodation high density
- Accommodation low density
- Villas mainly for rent

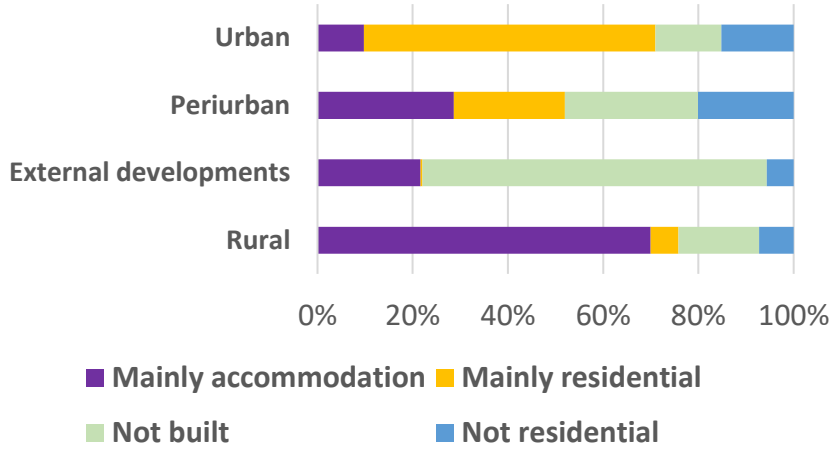
Non-Residential

- Mix of non-residential uses
- Facilities
- Warehousing & logistics

Non-Built

- Parking
- Land Under Development
- Green Area
- Natural area
- Beach
- Water





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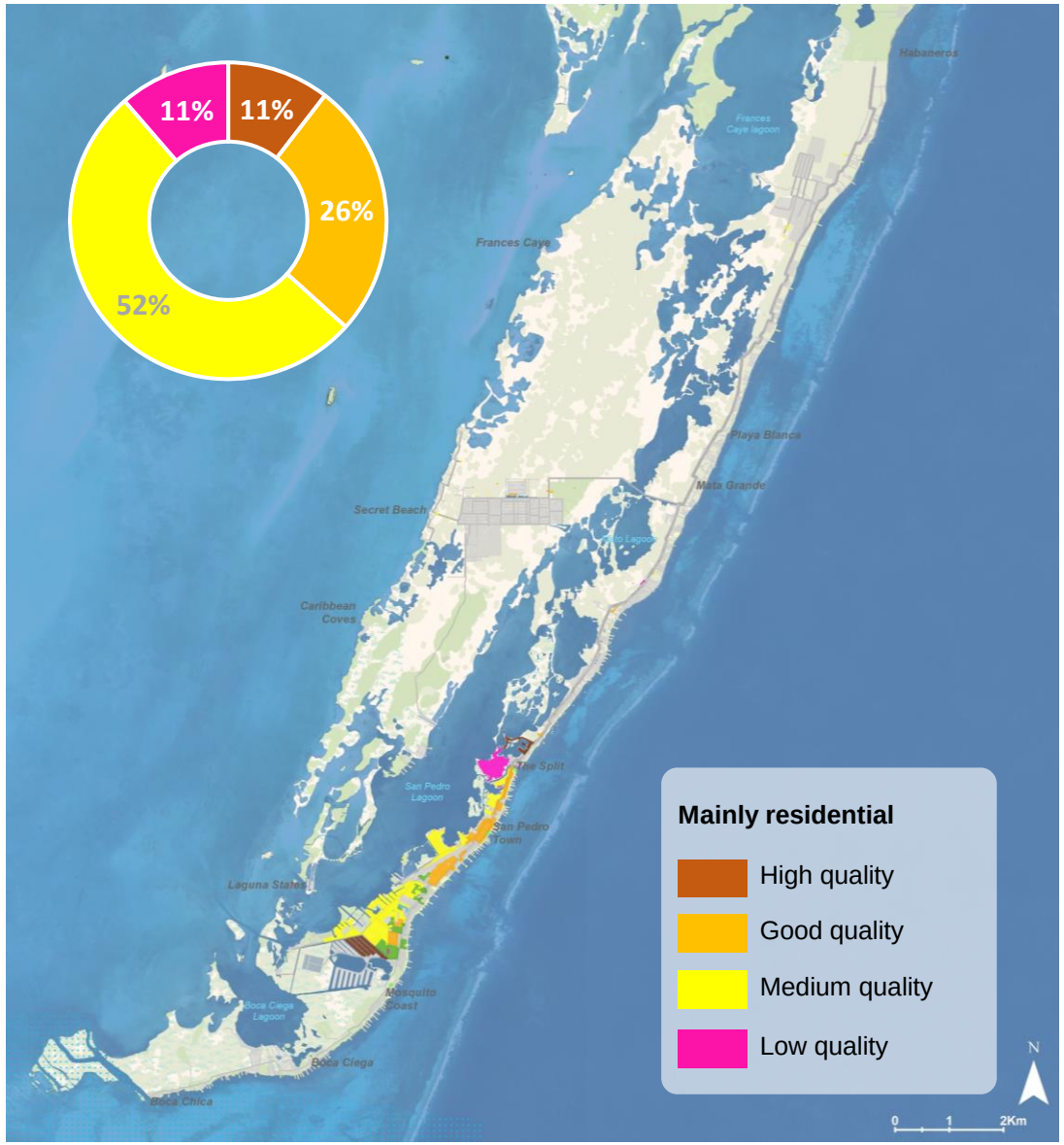
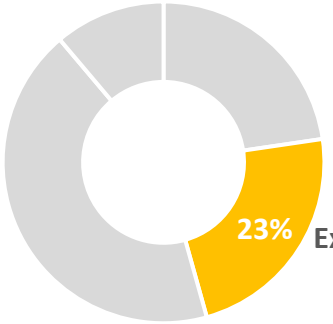
HOMOGENEOUS UNITS

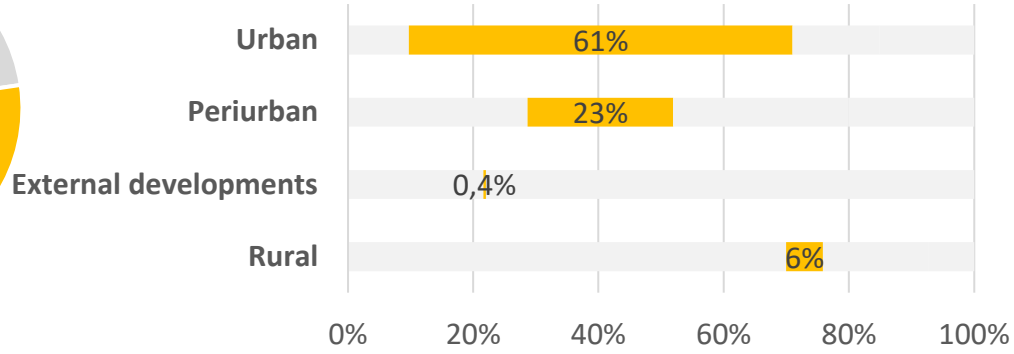
MAINLY RESIDENTIAL

29,1 dw/ha

17.600 inhabitants







Neighborhood quality	Mainly Residential	Description	Building quality	Material	Height
High	Luxury housing	Maralaguna & Mahogany Bay Village Complex	Good	Concrete	1-2 y 3
Good	Mixed-use residential	San Pedro Town Center	Good	*various	*various
	Good quality housing	Medium size, tidy, good quality of materials	Good	Concrete/Wood	*various
	Inner land villas	Offshore Villas	Good	No Data	1-2
Medium	Medium quality housing	< 25 precarious	75%Good 25%bad	Wood	1-2
	Low-to-medium quality housing	50% precarious	50%Good 50%bad	*various	1-2
	Scattered	Small <75m2 and isolated	Bad	Wood	1-2
Low	Low quality housing	> 75% precarious	Bad	Wood	1-2
	Non-permanent housing	Outside the urban structure, small, clustered	Very bad	Wood	1-2

1

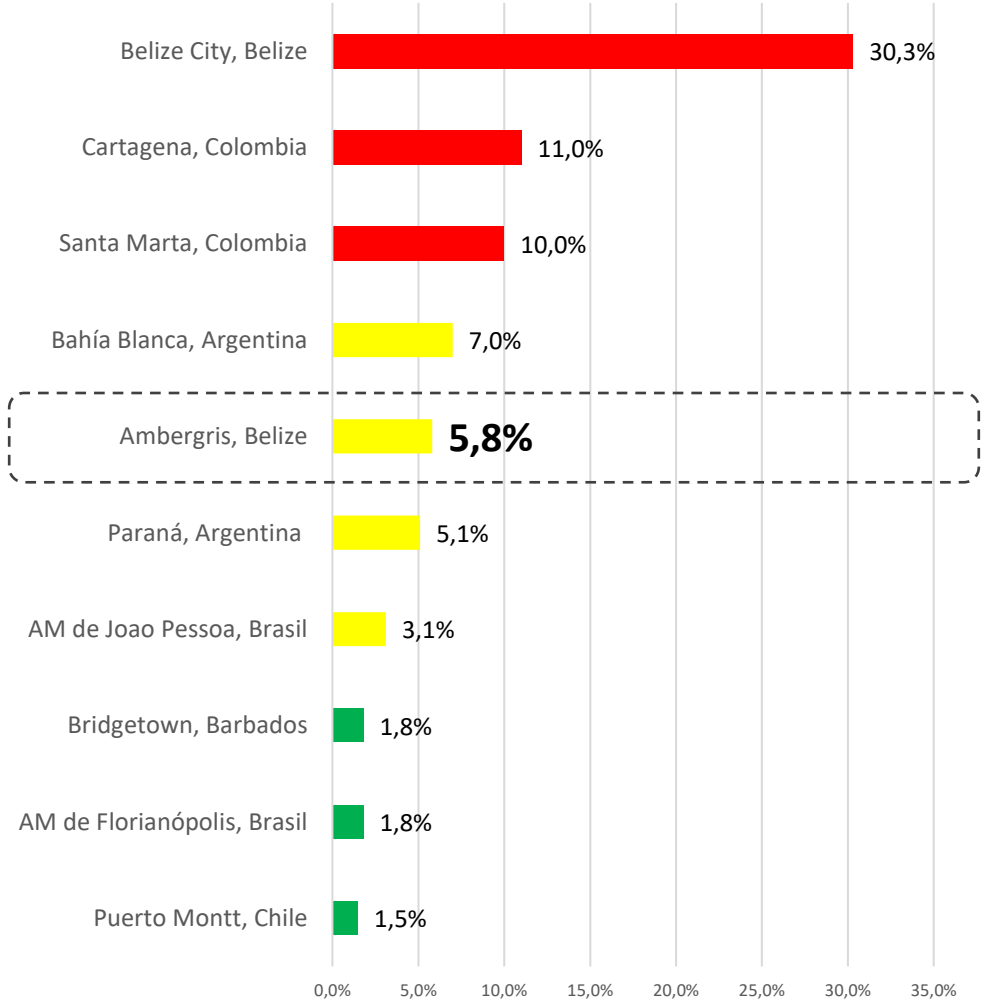
ICES COMPARATIVE

SEGREGATION & SOCIAL INJUSTICE INDICATORS

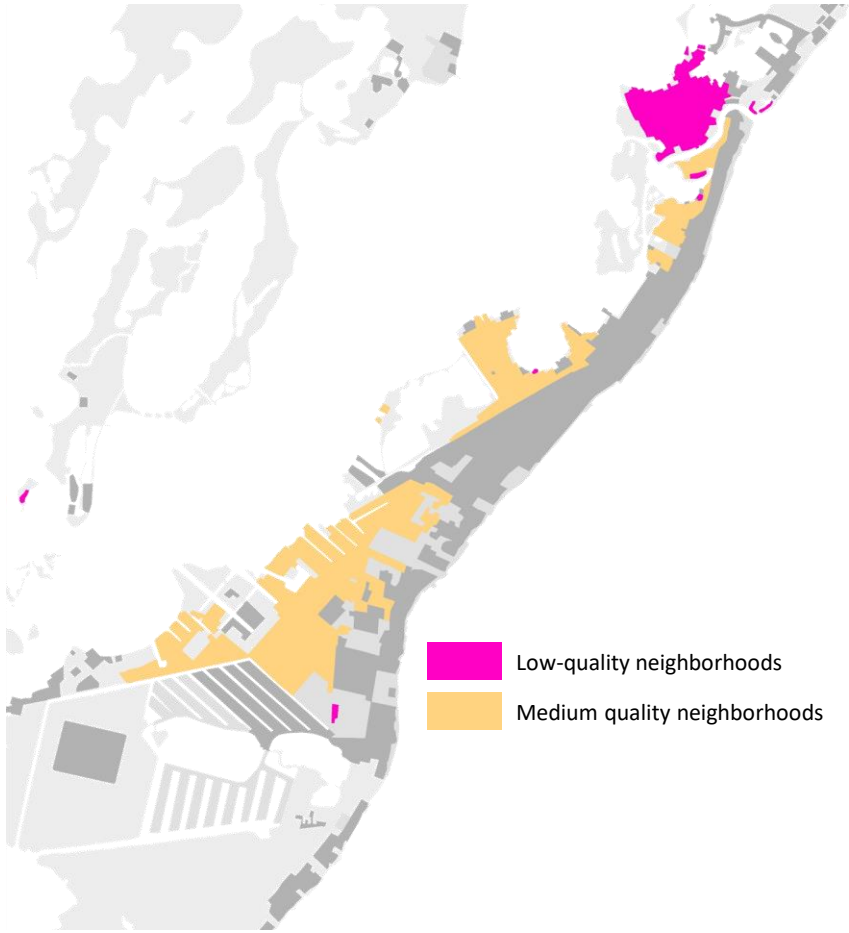
Percentage of houses that do not meet habitability standards defined by the country	29,6%
Percentage of houses located in slums (surface) *	5,8%
Percentage of houses located in slums (houses/dwellings) *	13,5%
Percentage of houses located in slums (population) *	13,5%
Residential area occupied by lower social strata (urban habitat unskilled)**	57%

*Low quality neighborhoods
** Low & medium quality neighborhoods

% houses in low quality neighborhoods



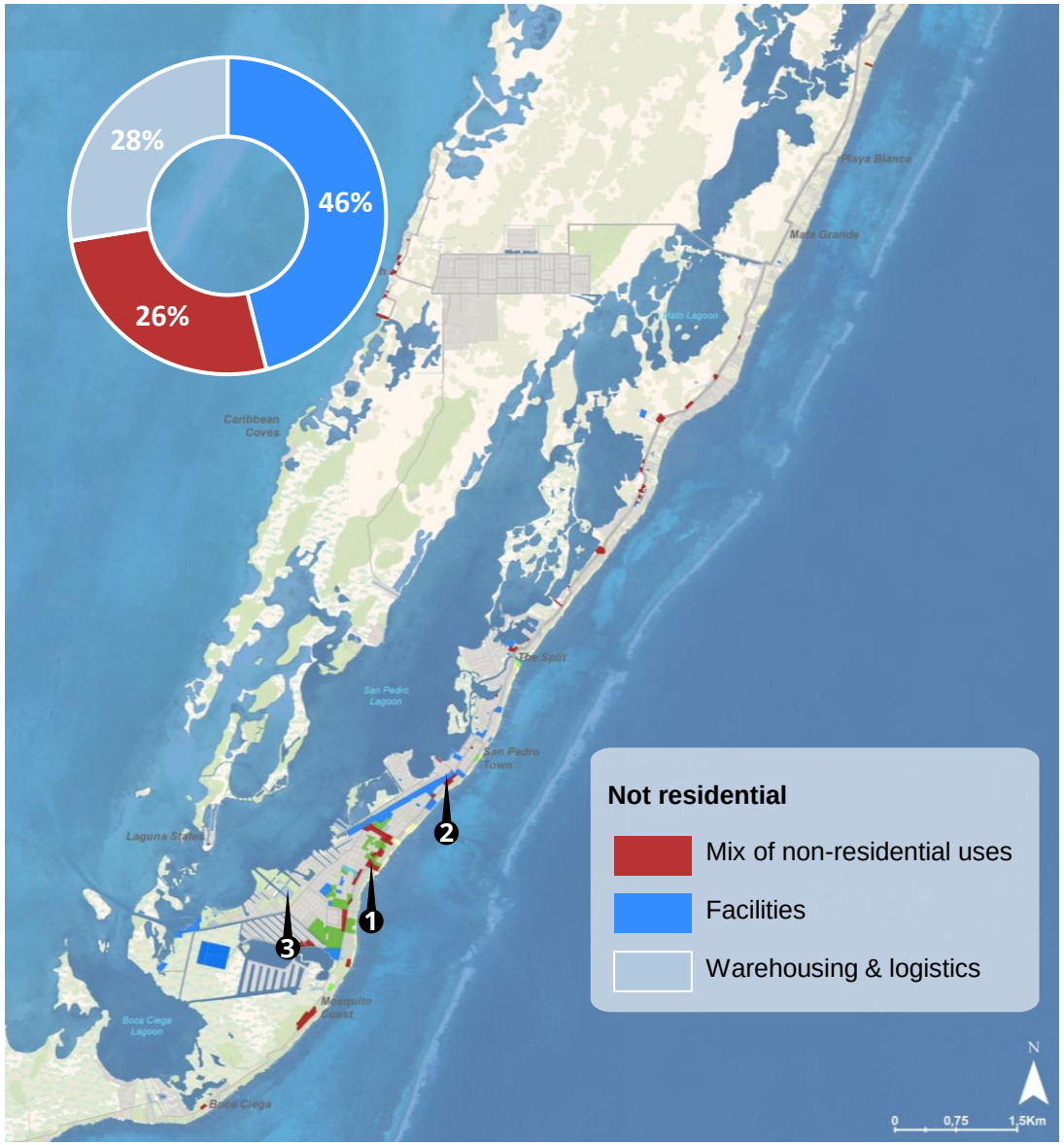
Low & medium quality neighborhoods

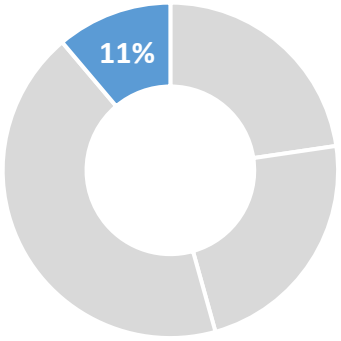


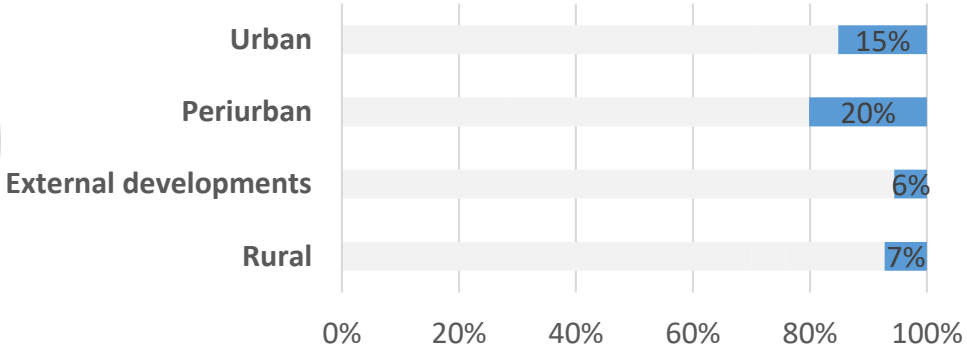
HOMOGENEOUS UNITS

1.3.2

NOT RESIDENTIAL







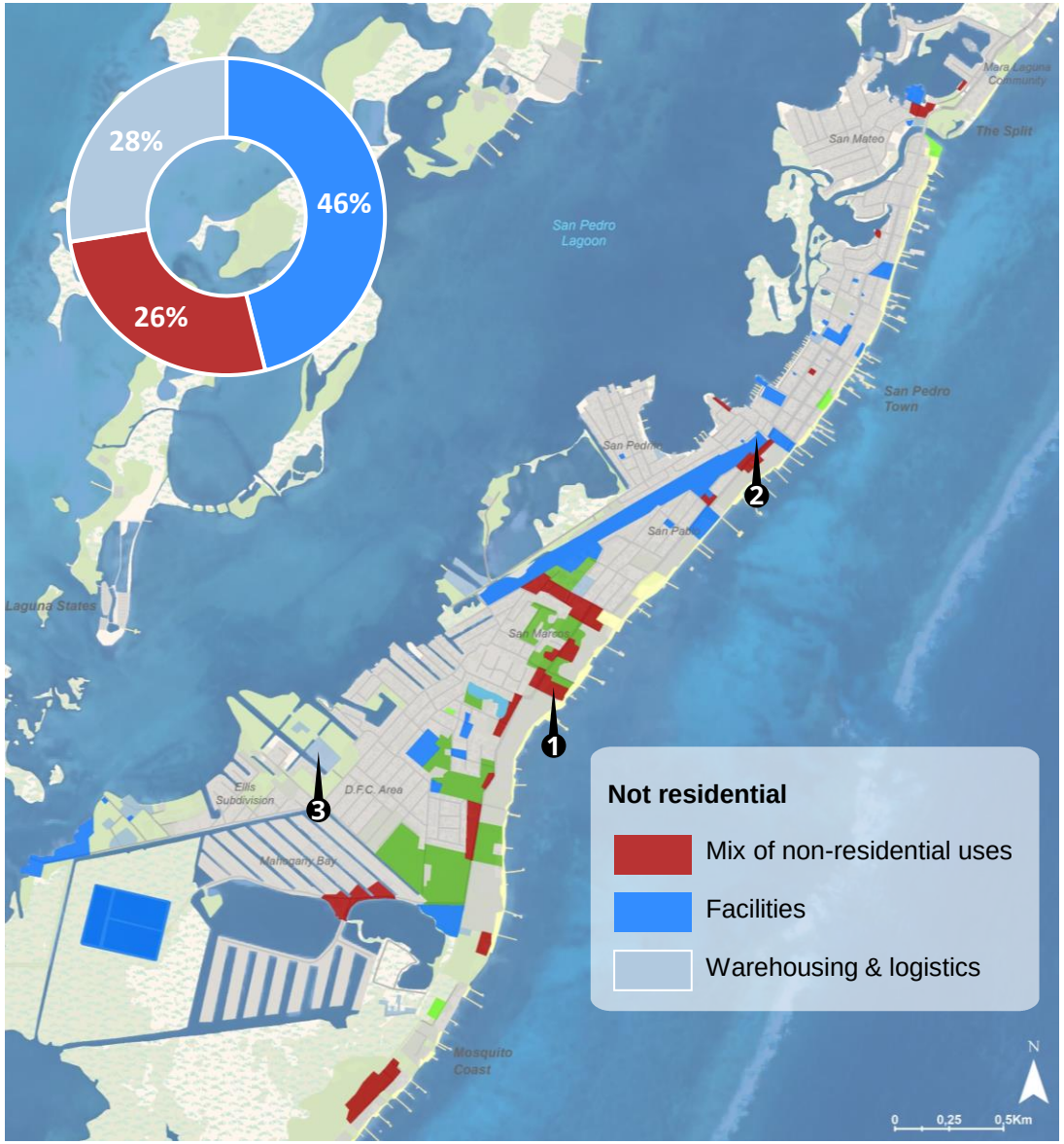
Distribution on north - south road and Secret beach

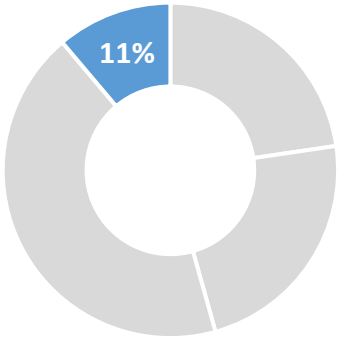
Facilities concentrated in the center

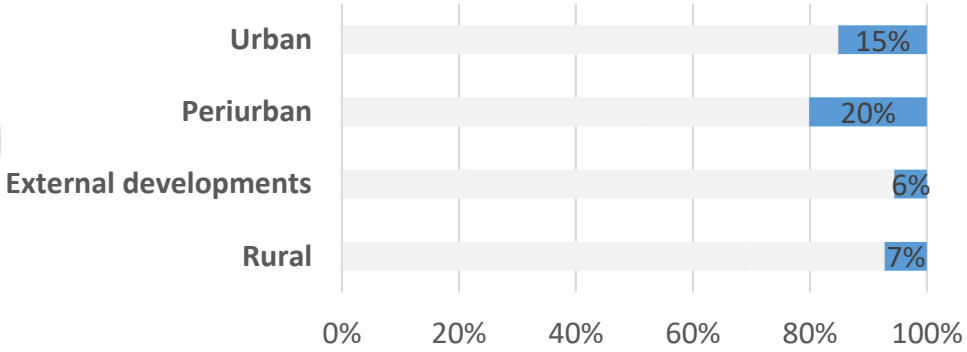
HOMOGENEOUS UNITS

1

NOT RESIDENTIAL- SAN PEDRO







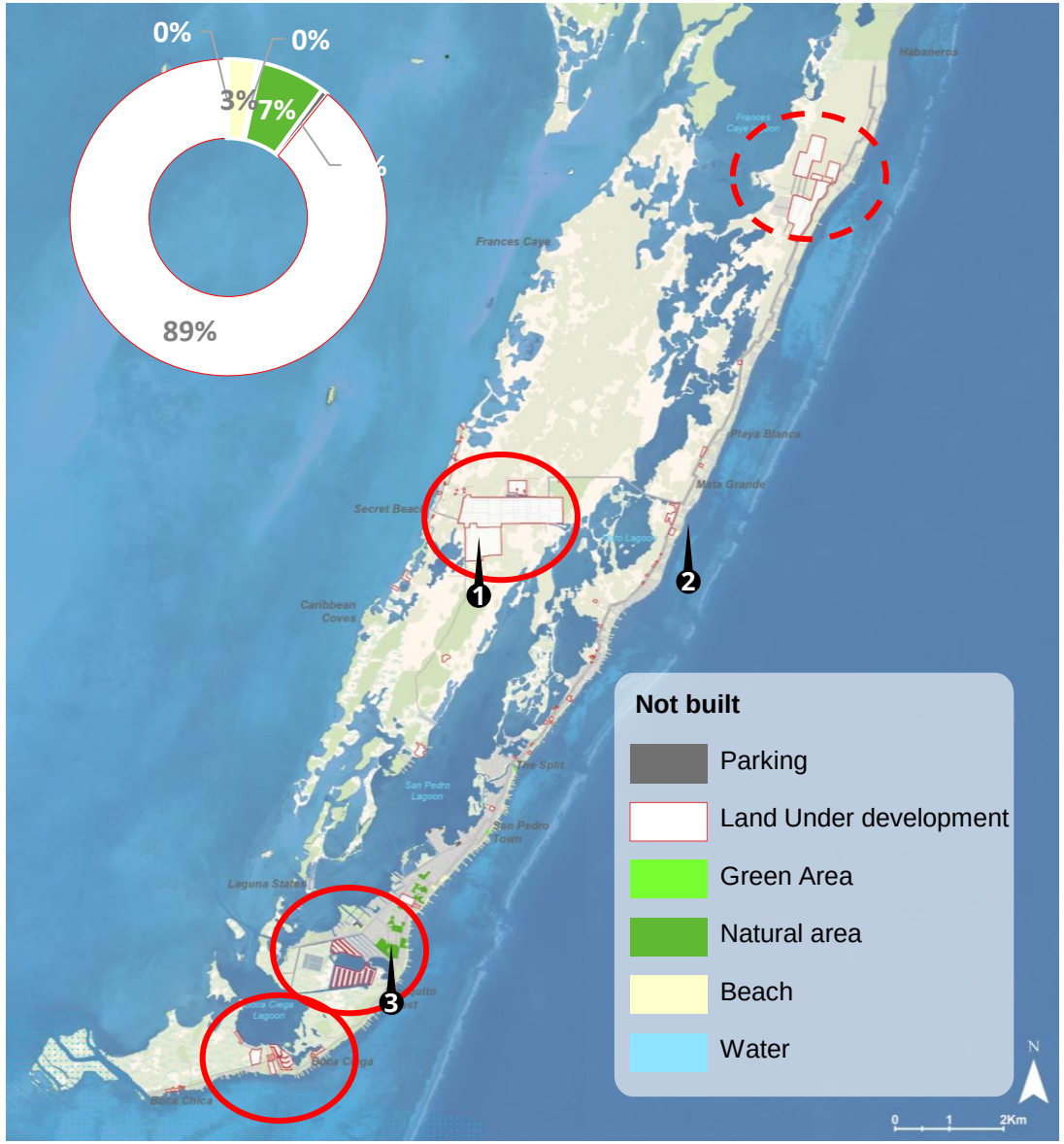
Distribution on north - south road and Secret beach

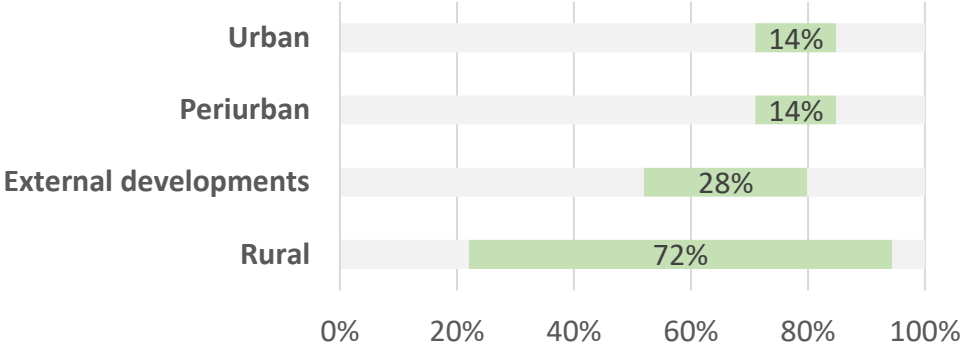
Facilities concentrated in the center

1

HOMOGENEOUS UNITS

NOT BUILT OR UNDER DEVELOPMENT





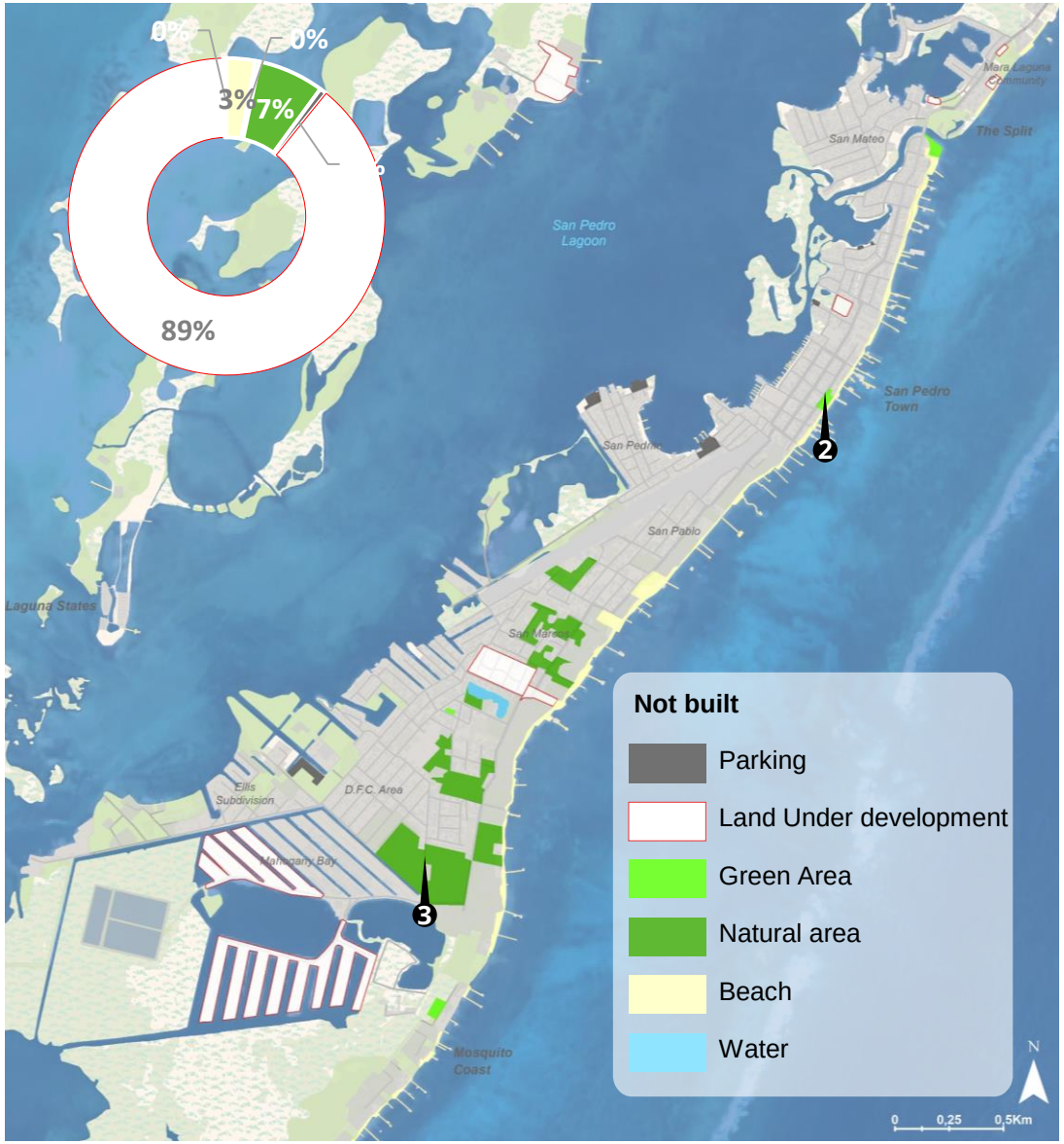
Three large pockets of land under and abandoned buildings and hotels .

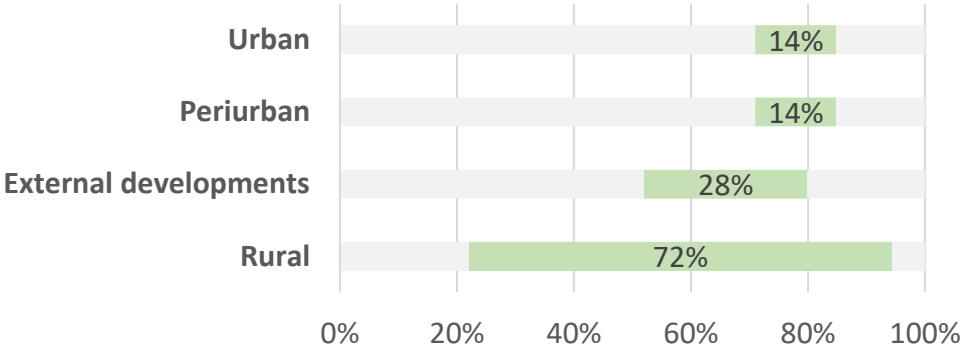
Only 55 acres of green areas, of which 3.3 qualified

1

HOMOGENEOUS UNITS

NOT BUILT OR UNDER DEVELOPMENT





Three large pockets of land under development and a fourth in the extreme northeast, already under development.

Only 55 acres of green areas, of which 3.3 qualified

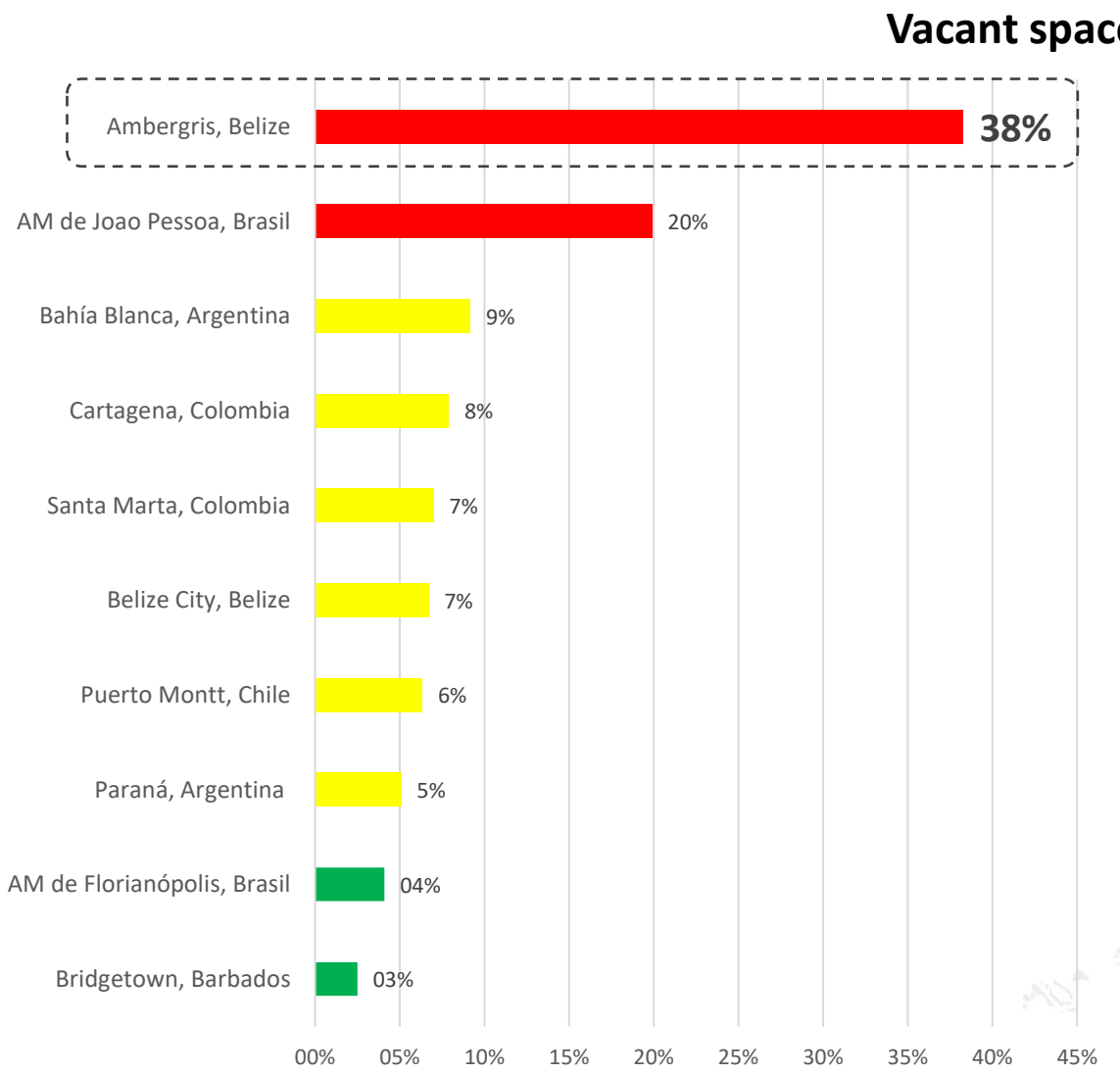
1

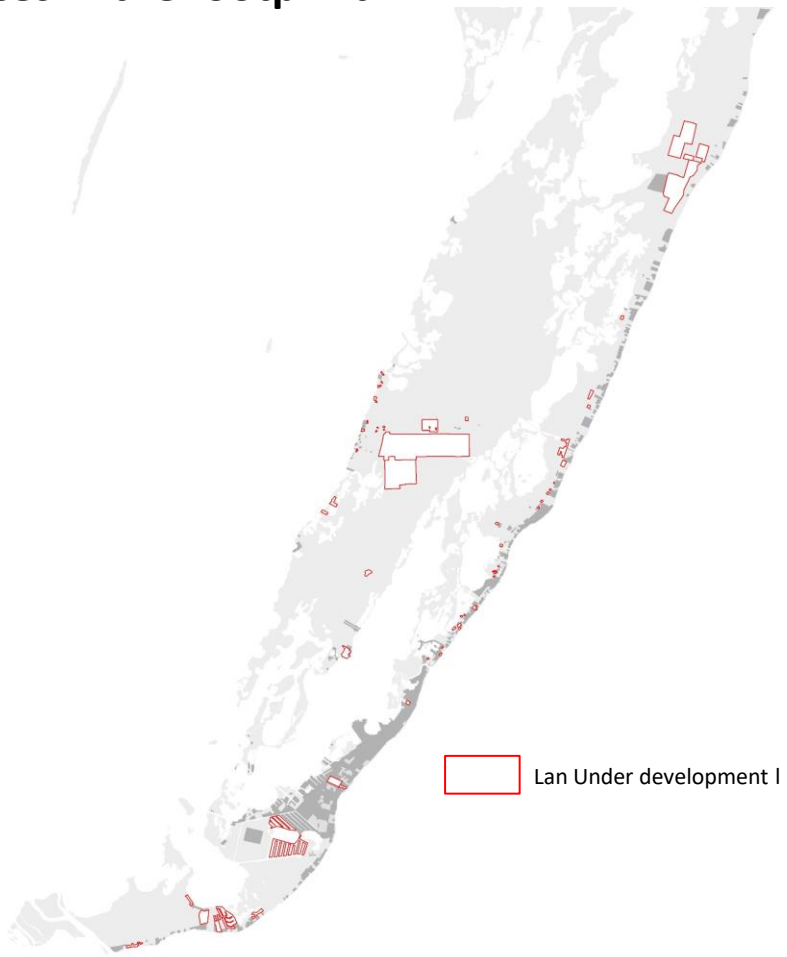
ICES COMPARATIVE

VACANT SPACES IN THE FOOTPRINT

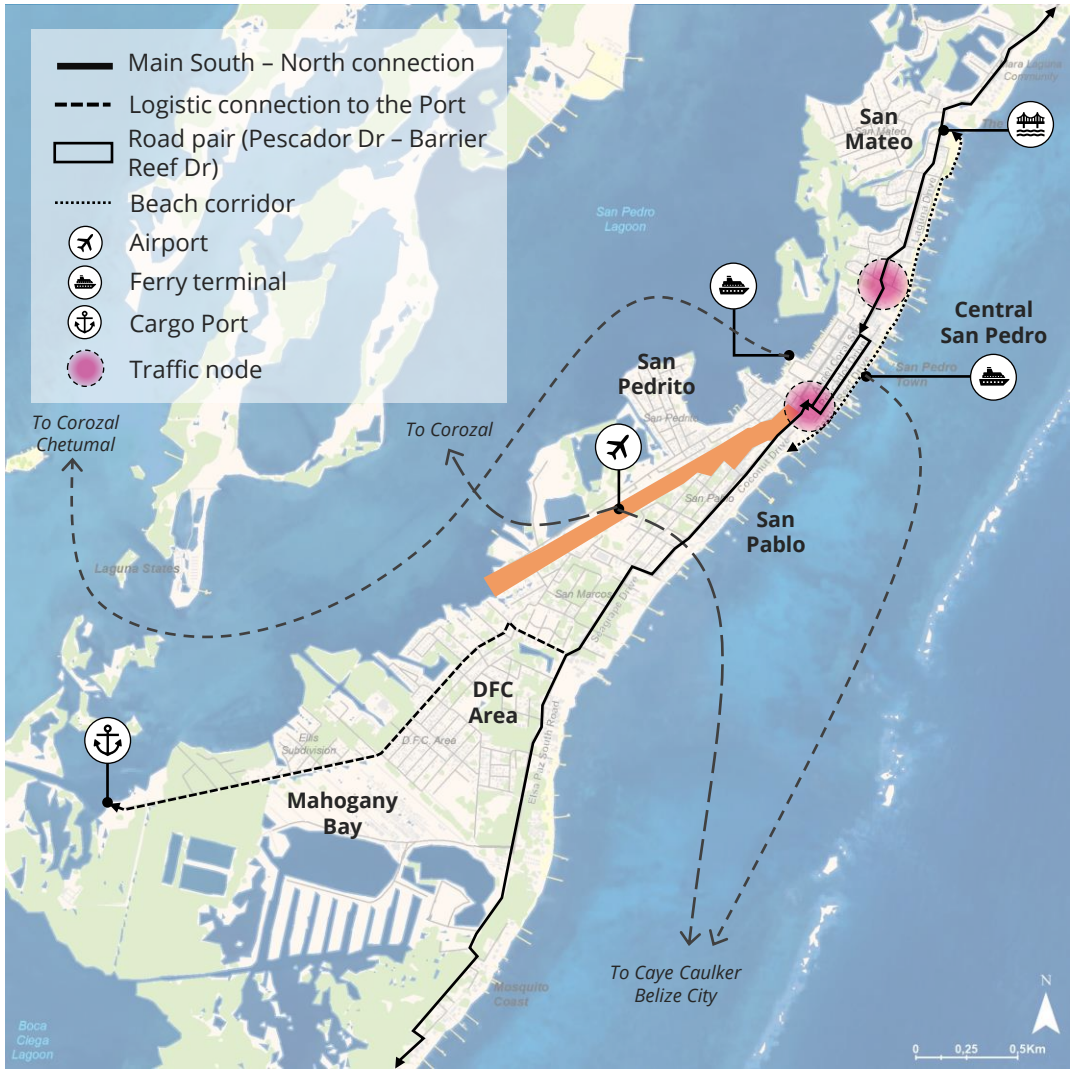
Net density of urban&periurban population*	99,4
Gross density of urban&periurban population*	48,8
Net density built urban&periurban*	28,7
Density distribution	Intermediate
Vacant spaces in the footprint	38,3%

**Urban & Periurban*





MOBILITY



Urban transportation

Golf Carts are the **primary mode of land transportation** used by residents and tourists in Ambergris Caye. However, **congestion problems** are generated on the streets of downtown San Pedro, which have primarily narrow road profiles.

There is no public transportation network (buses, minibuses) on the island.

Most of the roads do not have adequate sidewalks and spaces for pedestrian mobility.

Lack of infrastructure for bicycle mobility.

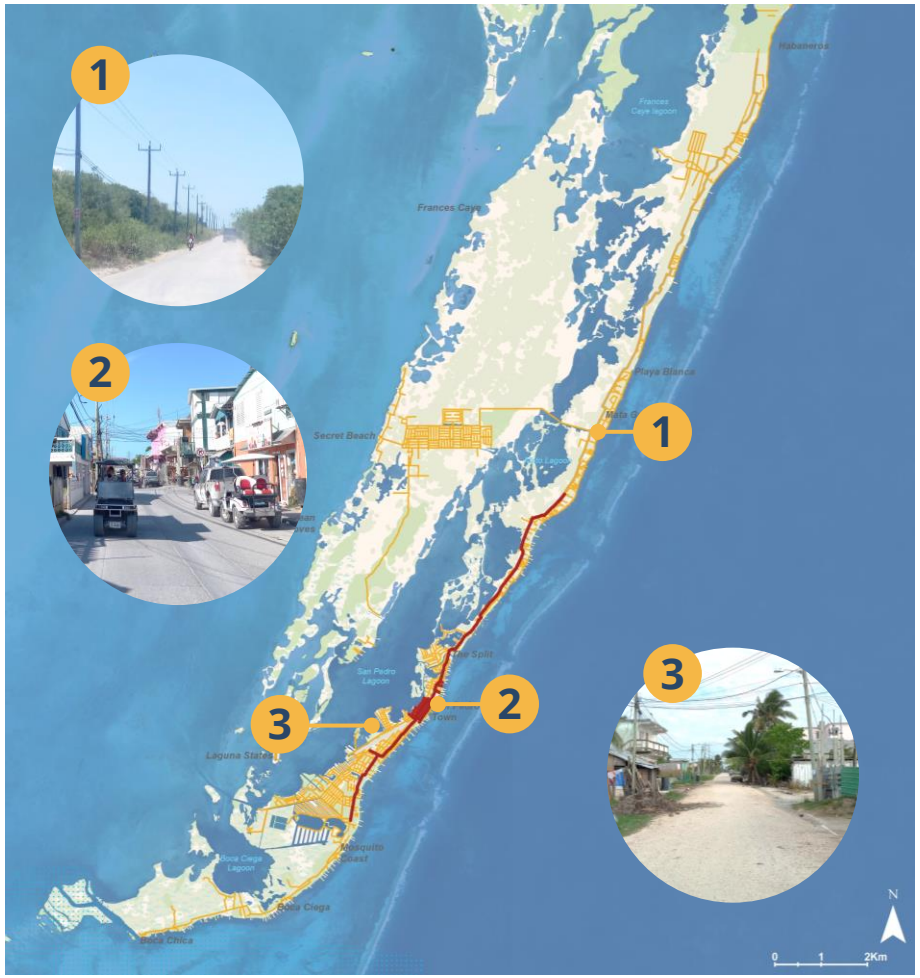
Lack of organization in the parking areas for vehicles.

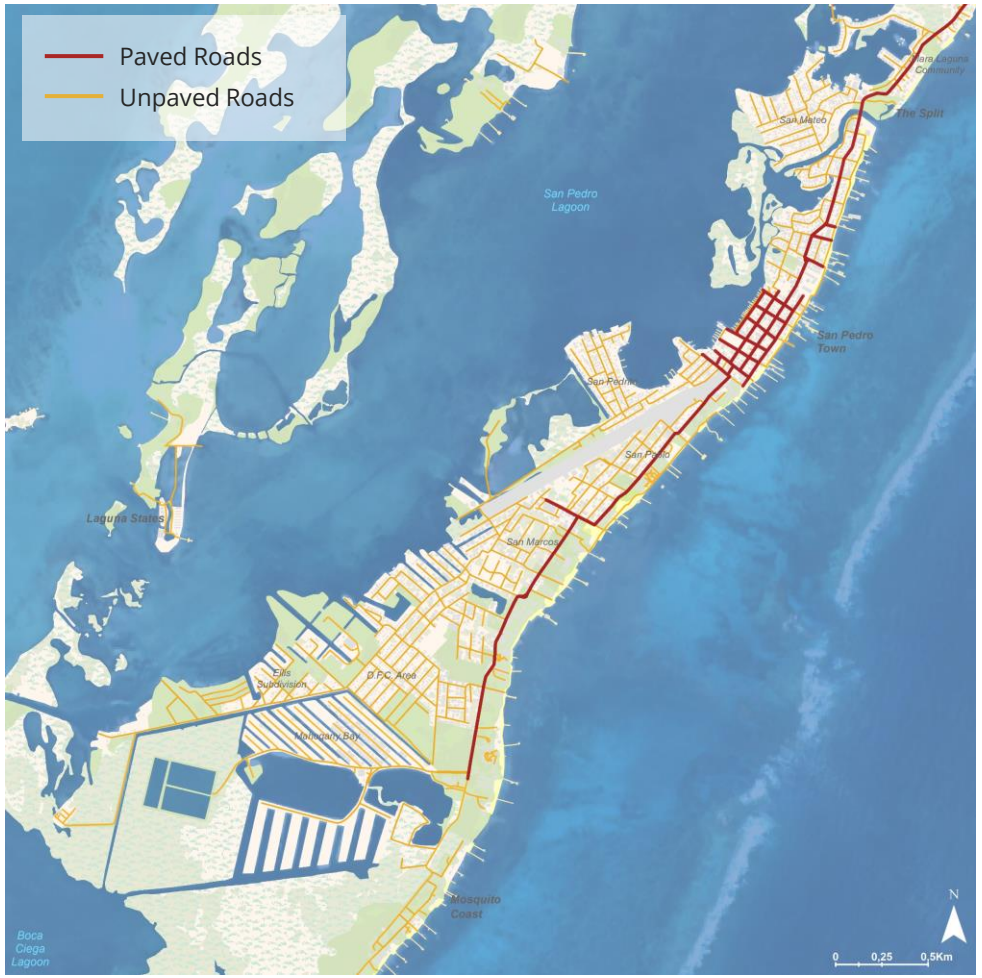
Lack of safe sidewalks and crosswalks for pedestrians

Parking on the road corridor

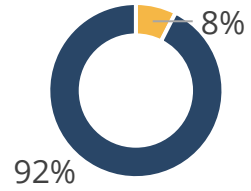
Road Network

Ambergris Caye's road network is made up of highways, local roads, and paths that connect the urban area of San Pedro and the different **residential and tourist developments to the north and south of the island.** Currently, only **8% of the road network is paved**, corresponding only to roads located in the center of San Pedro and the connecting road to the north and south, to the Belizean Shores Resort and Mahogany Bay sectors, respectively.





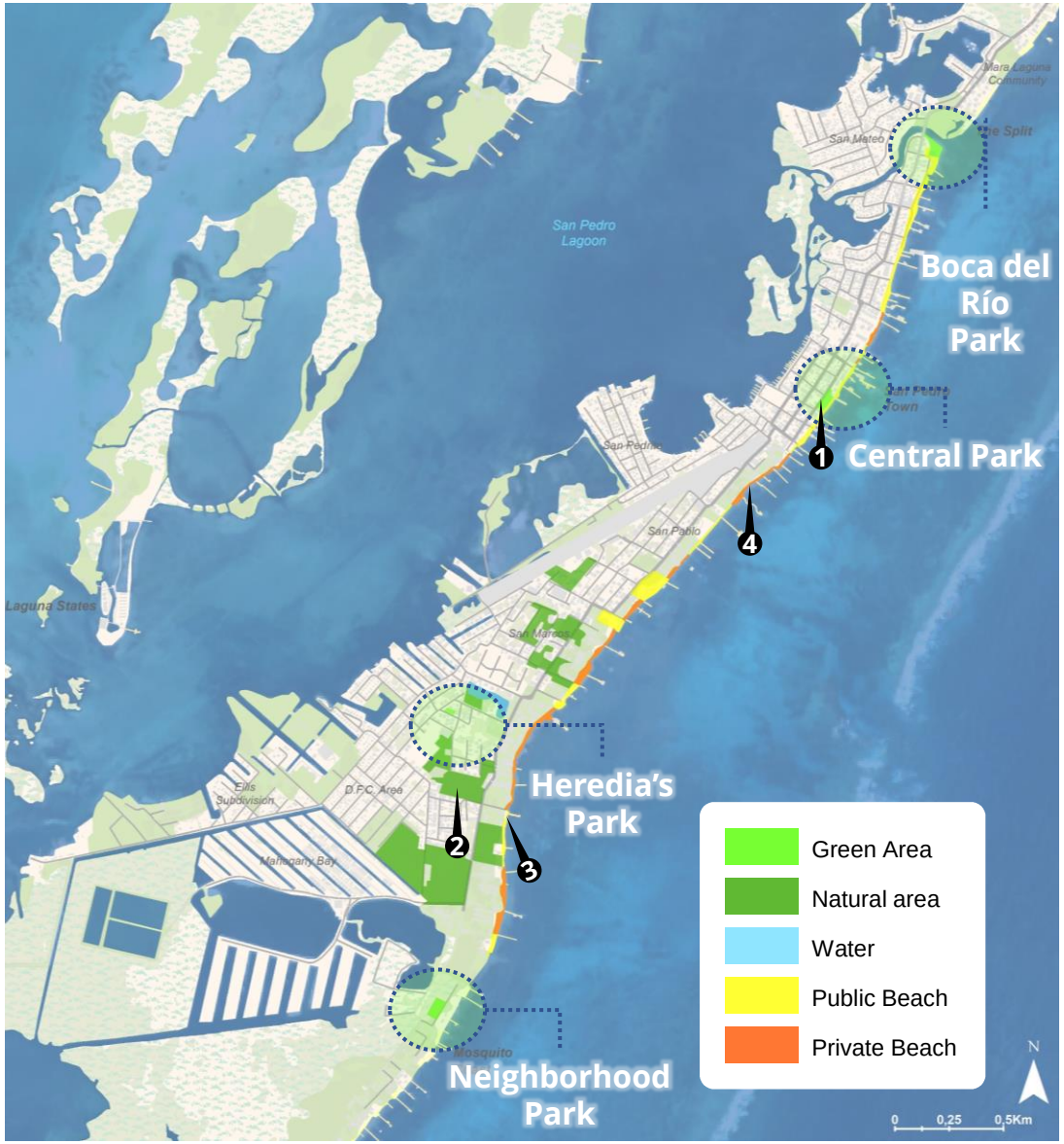
State of paving of the road network



- Paved roads
- Unpaved roads

1. **Unpaved road near Secret Beach**
2. **Paved road in downtown San Pedro**
3. **Unpaved road in the sector of San Pedrito**

PUBLIC SPACE



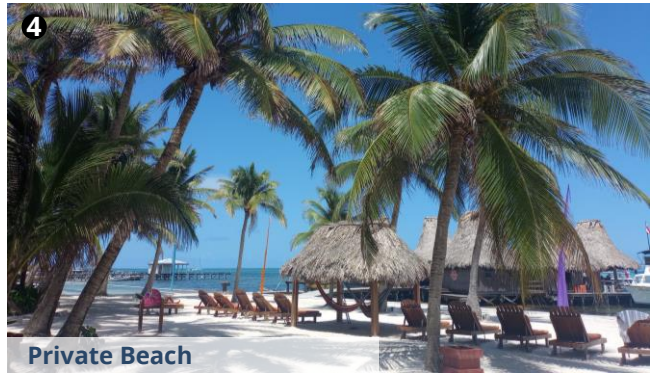
Types of Public Space

Public Space Indicator – 0.8 m2/inh. 86 ft2/inh.


Green Areas – Central Park

Natural Areas


Public Beach


Private Beach

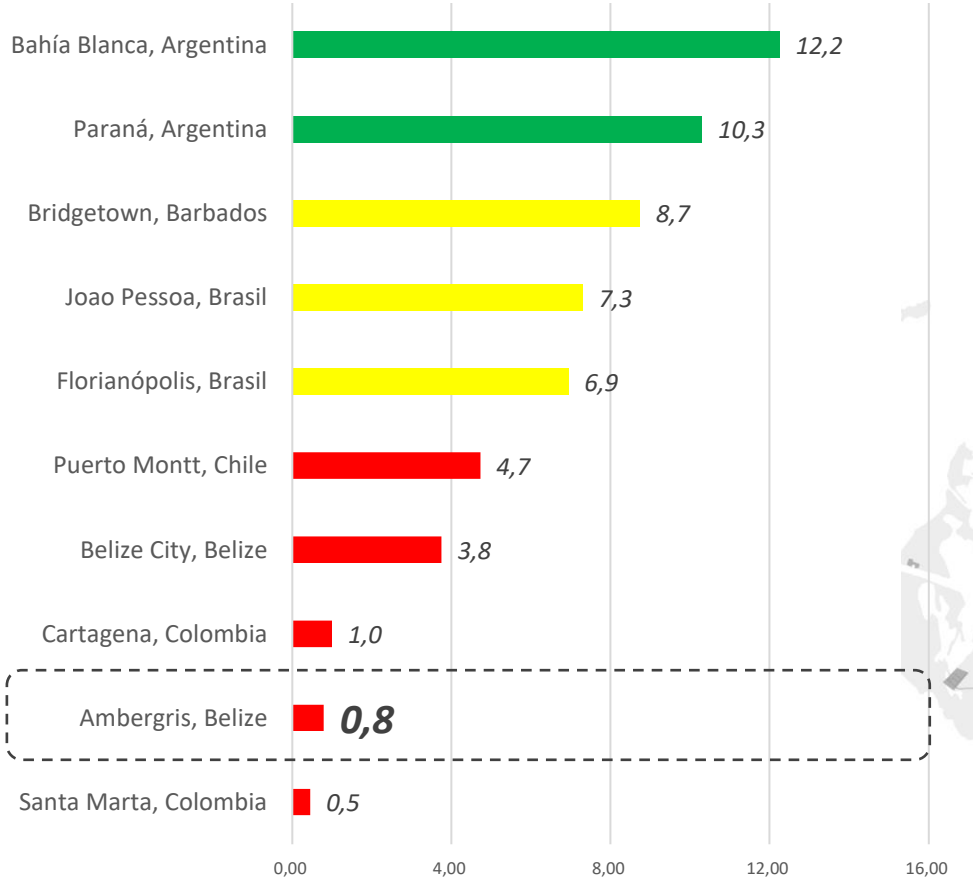
Public space	Acres
Green Area	3,3
Natural Area	52,2
Total Beach urban	22,7
Beach urban private (36,5%)	8,29
Total Beach (total Caye)	79
Total Beach private (total Caye) (45%)	35,9

GREEN AREAS & PUBLIC SPACE INDICATORS

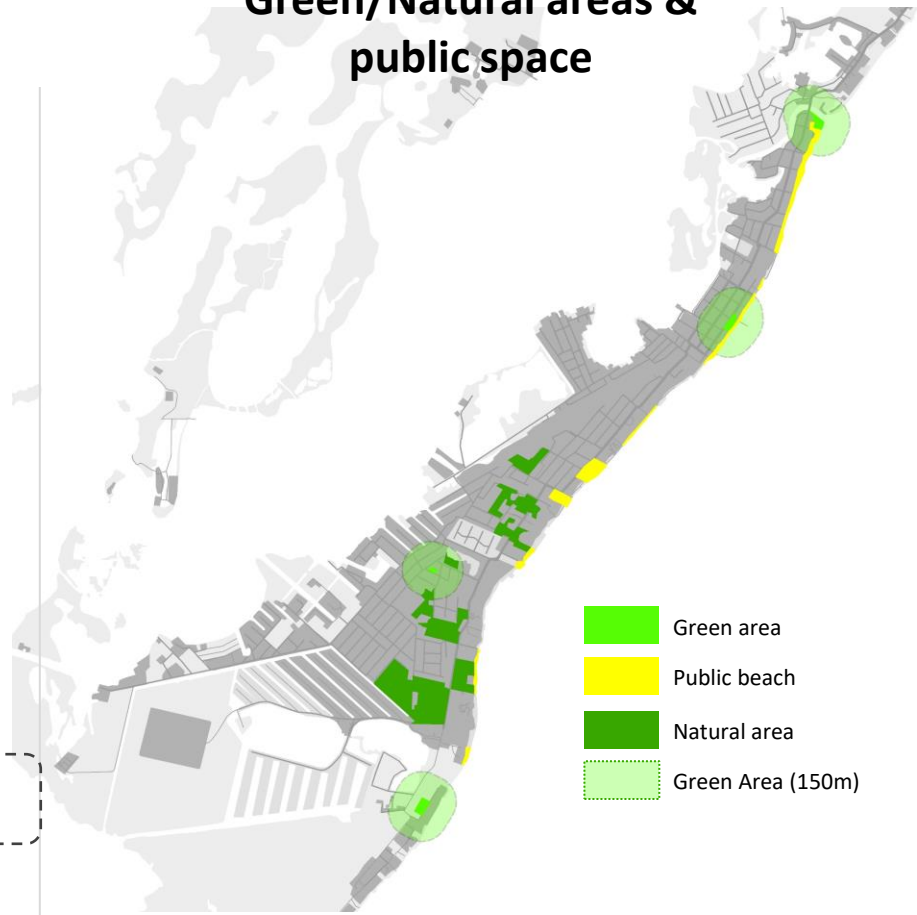
Qualified green areas (m2/hab)*	0,739
General green areas(m2/hab)*	12,27
Distribution of qualified green areas (% Population at less than ten minutes walking)*	13%
Public spaces (m2/hab)*	3,92

**Urban & Periurban*

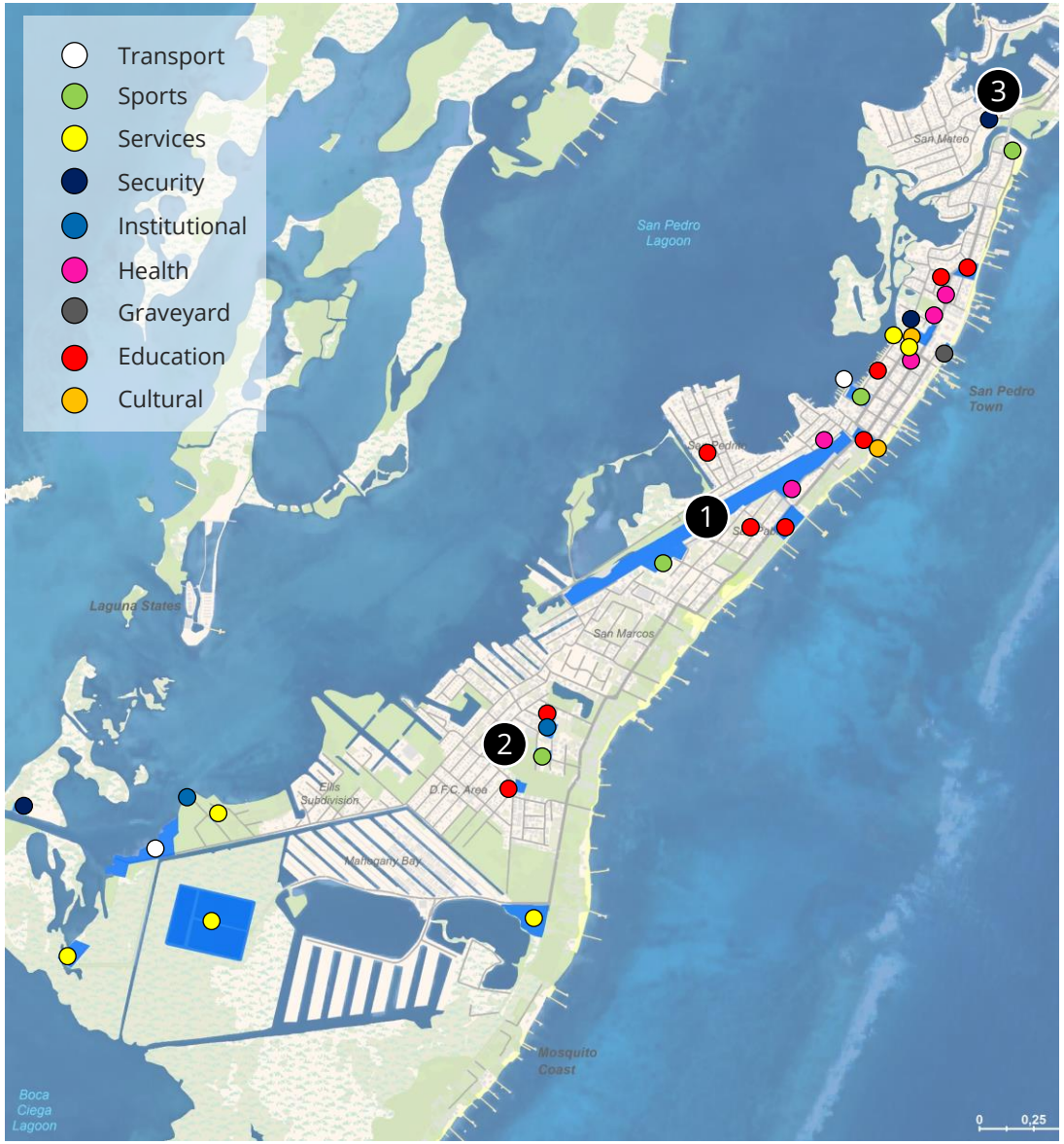
Qualified green areas (m2/hab)

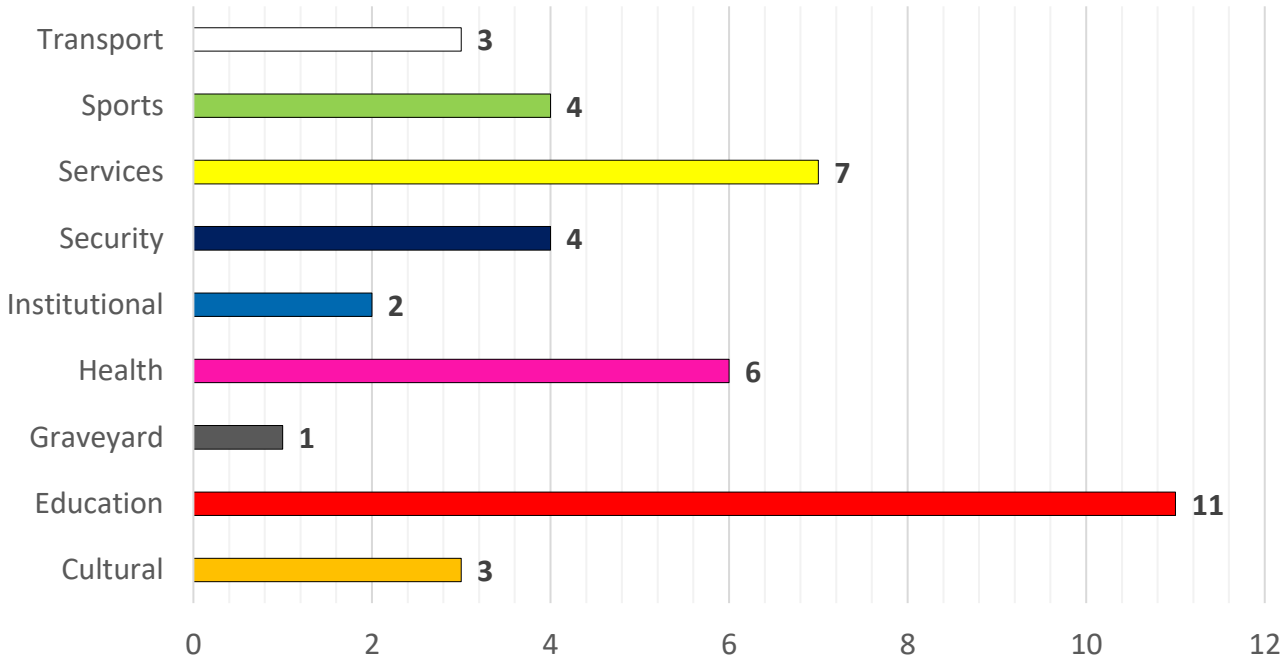


Green/Natural areas & public space



URBAN FACILITIES



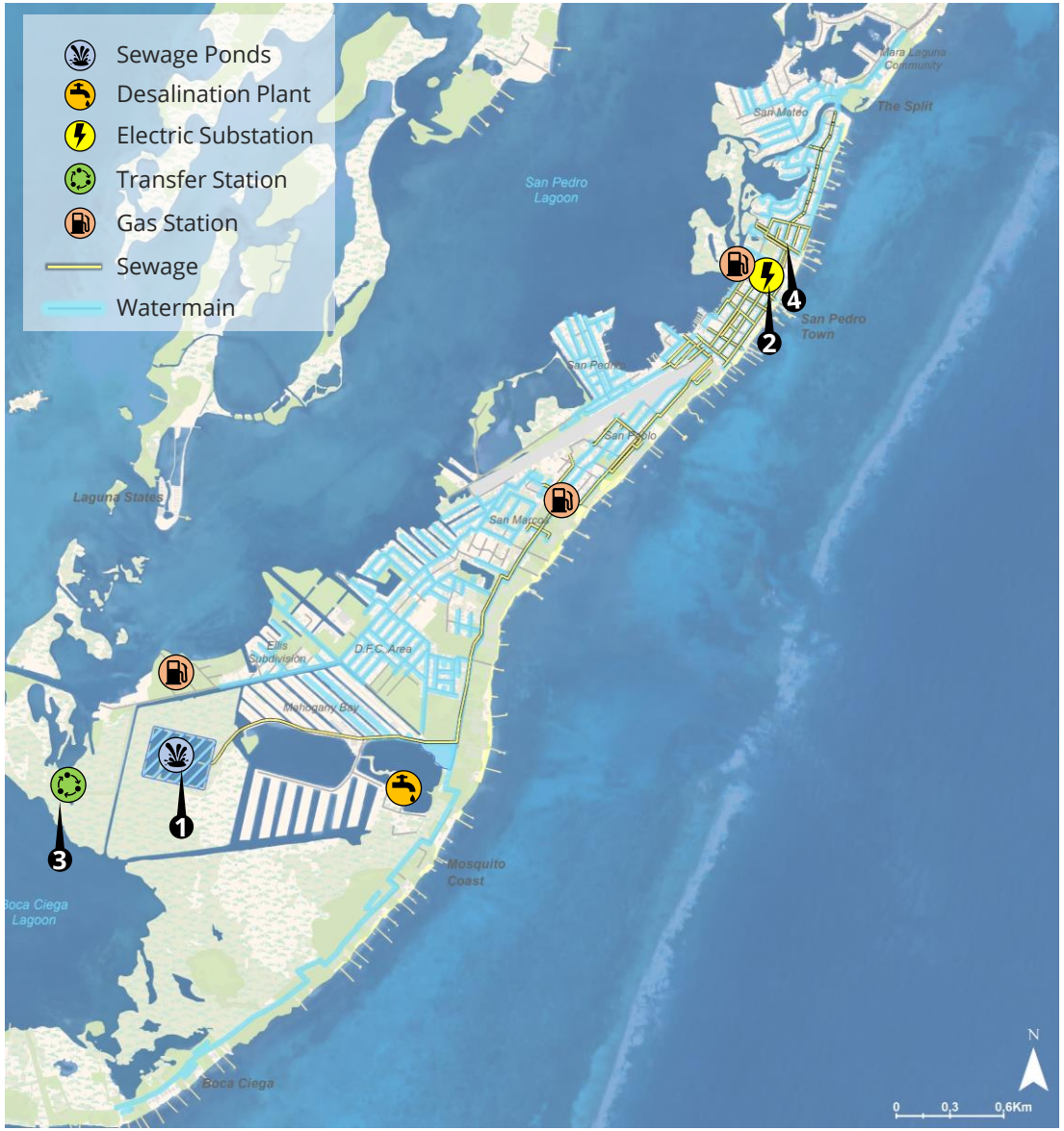


John Greif II Airport

Ambergris Stadium

Holy Cross Anglican Primary School

PUBLIC SERVICES

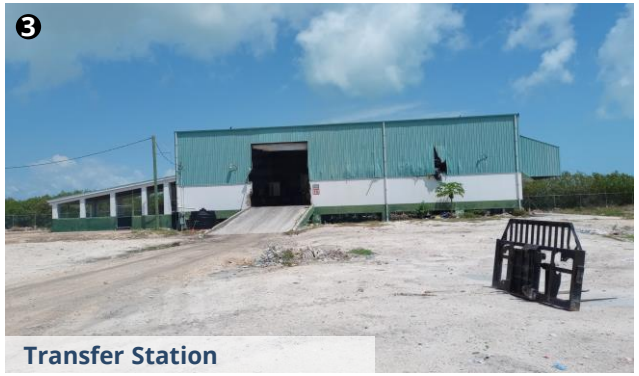


Existing Public Services

The island has **good coverage in general** and service machinery in the **central and southern areas.**

Sewage Pond

Electric Substation



Transfer Station

Sewage

83%

Of the population has access to Potable Water

29%

Of the inhabitants have access to Sewage

VULNERABILITY TO NATURAL HAZARDS.

1

PRIORITIZATION

Past, On-going and future Studies. Focused on M3

Use available and useful data

Information from key stakeholders a

Analysis of three main climate threats and its variation associated with climate change

Storm surge

- Related to hurricanes.
- The flood lasts two days and it flows out with no special risk.
- Well-defined hazard by the NHC and adapted for this specific study. Perfect base for a risk analysis that helps real state and sustainable development

Strong Winds

- Related to hurricanes.
- The wind impacts the most as per indicated by stakeholders.
- TR associated with Gumble distribution statistics and other statistical adjustments according to historic events.
- Comparison between Belize Meteorological Services of San Pedro Station and IBTrACS

Coastal Erosion

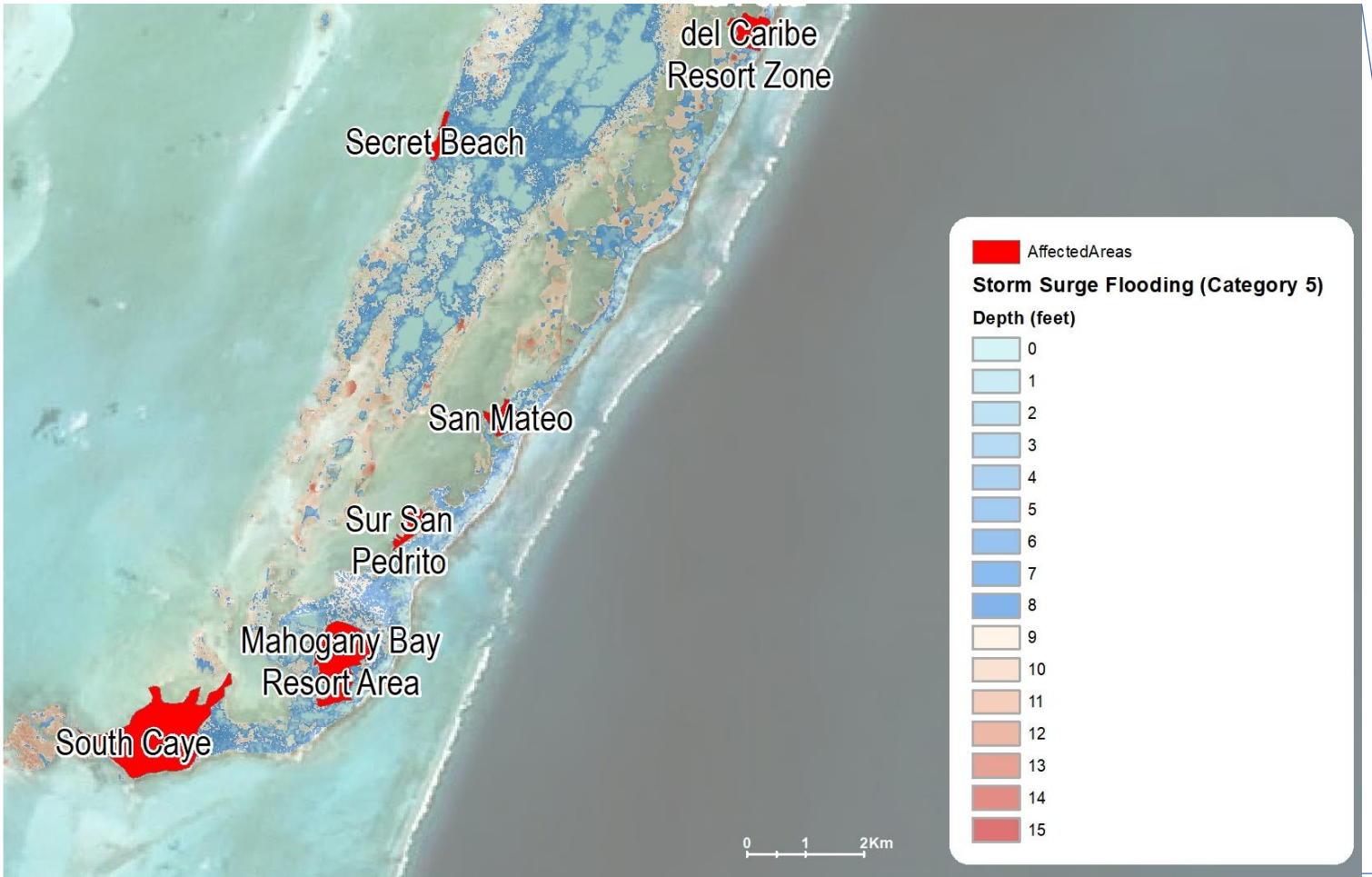
- The most identified hazard by the stakeholders.
- Adaptation measures identified in most of the private coastal properties: study of its influence in coastal dynamics
- Algorithm of shoreline change via satellite imagery
- Representative section study for illustrative results

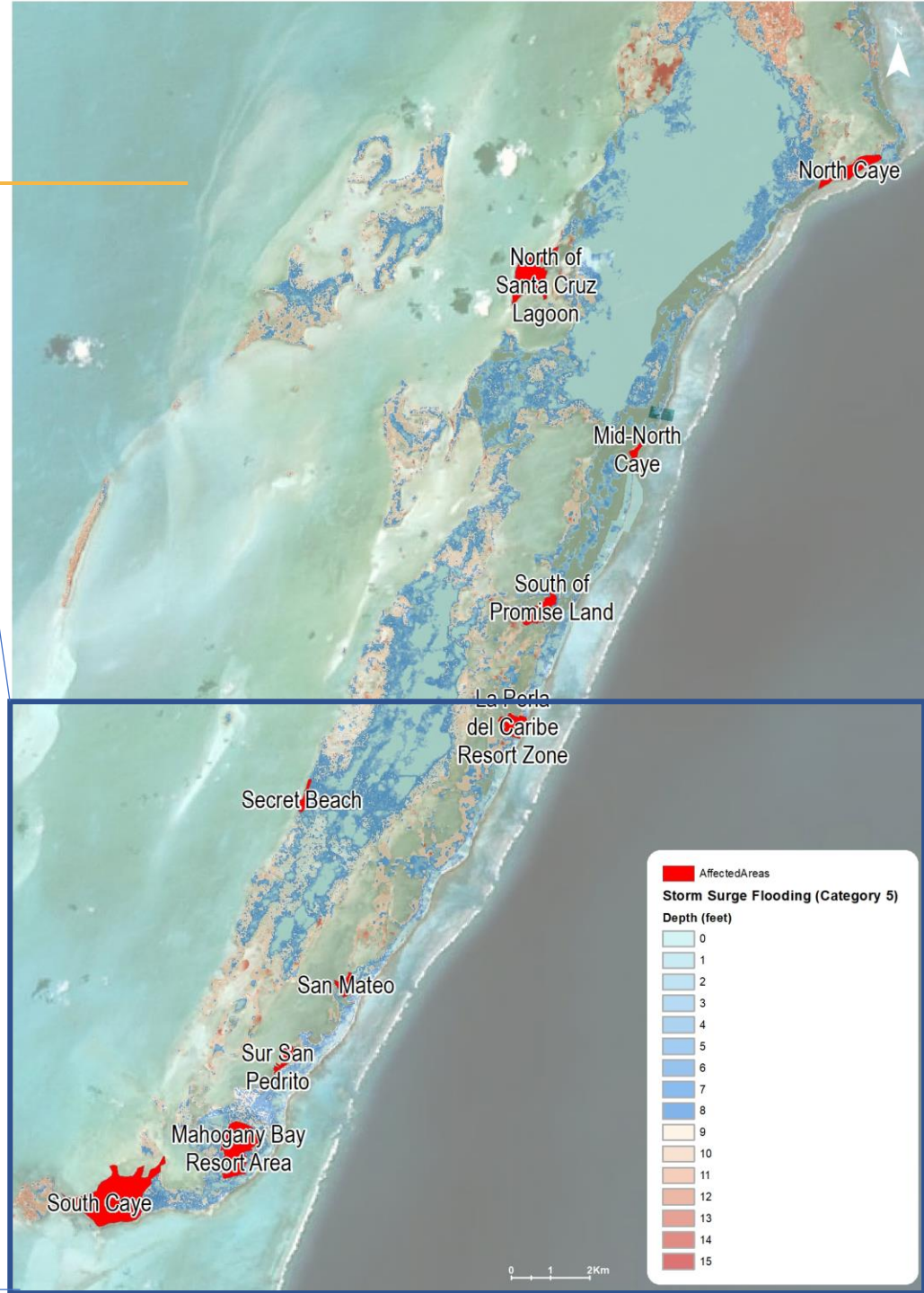
Storm Surge Flood

Hazard – Storm surge for each hurricane category

Hazard Definition

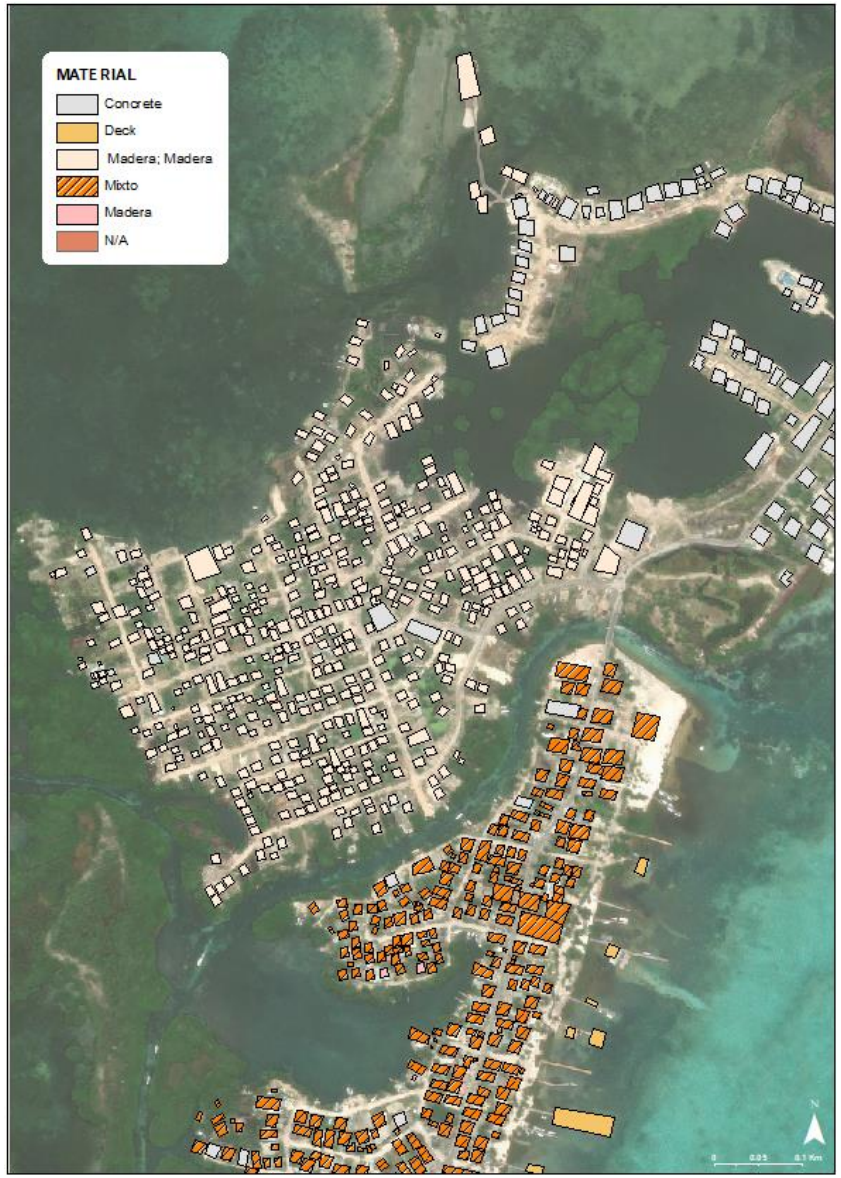
Flood hazard impacts, to varying degrees, the entirety of the cay





Storm Surge Flood

Vulnerability and Exposure



5,242 building infrastructures digitalized:

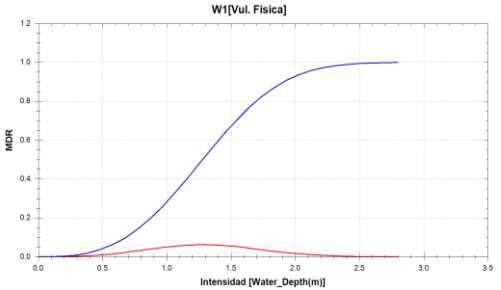
- Residential/ Housing Buildings
- Commercial Buildings
- Decks
- Accommodation Infrastructure: hotels, resorts, apartments

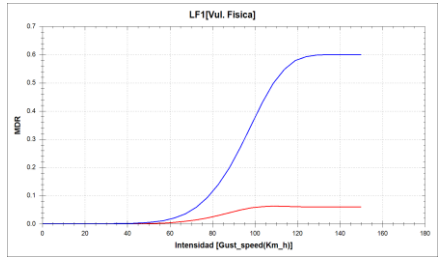
Information for vulnerability definition

- **Wall material:** wood, concrete, mixed concrete/wood, deck *Storm surge flood*
- **Roof Material:** Metal Sheet (aluminium, zinc**…), concrete,**

Strong winds

- Considered elevation from **piles**





VULNERABILITY TO NATURAL HAZARDS.

1

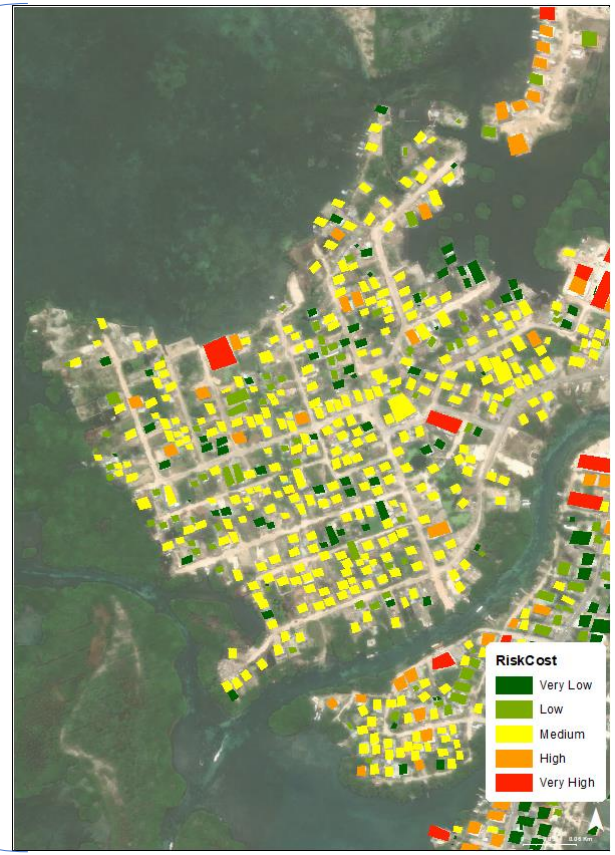
Storm Surge Flood

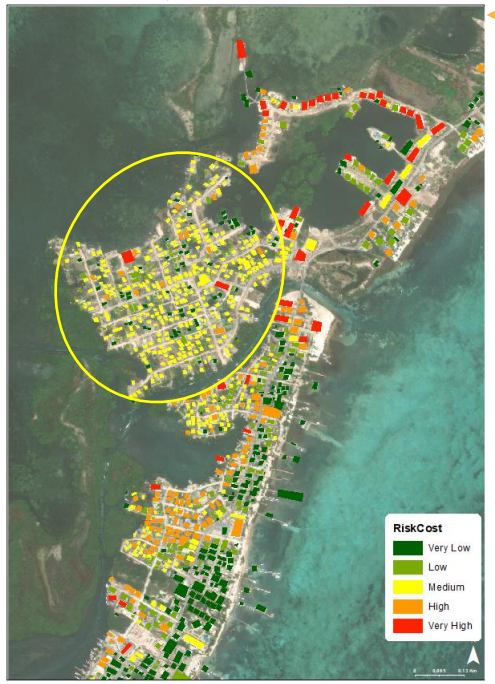
Risk → Damage and Losses

Risk calculated as expected losses

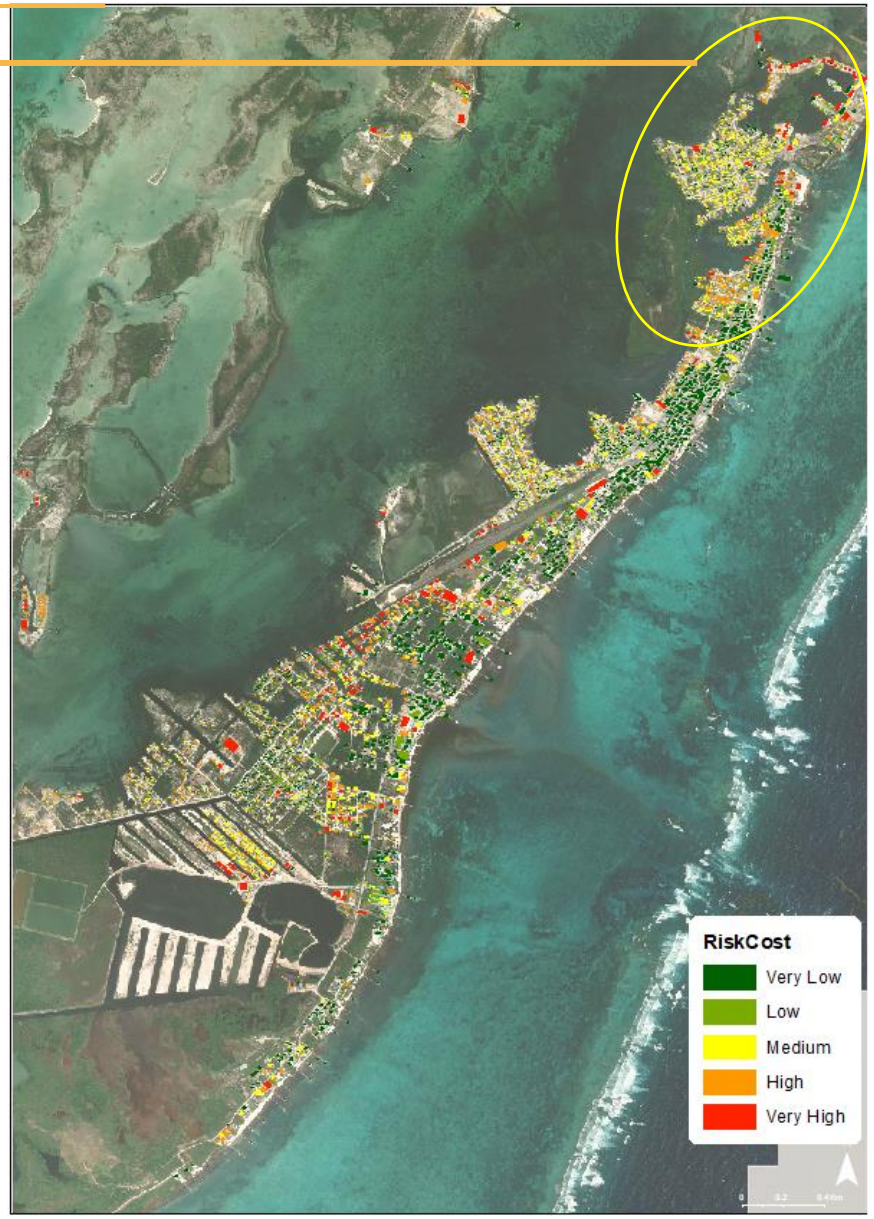
AAL (Average Annual Losses) may be calculated as well

Key factors:
Wall Material
Elevation (pilars)
Storm Surge Depth



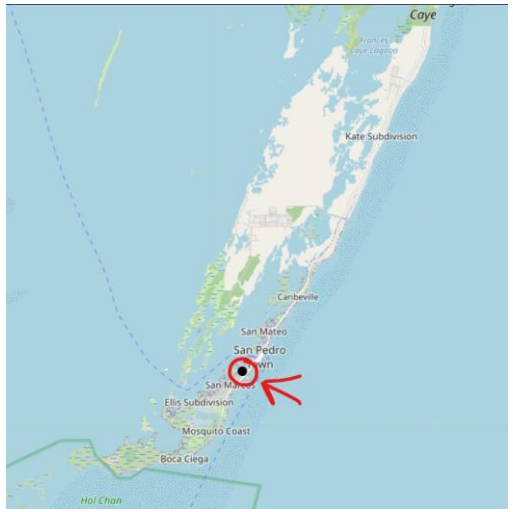


The risk cost is the result of the **infrastructure price** multiplied by the **MDR (Mean Damage Ratio)**



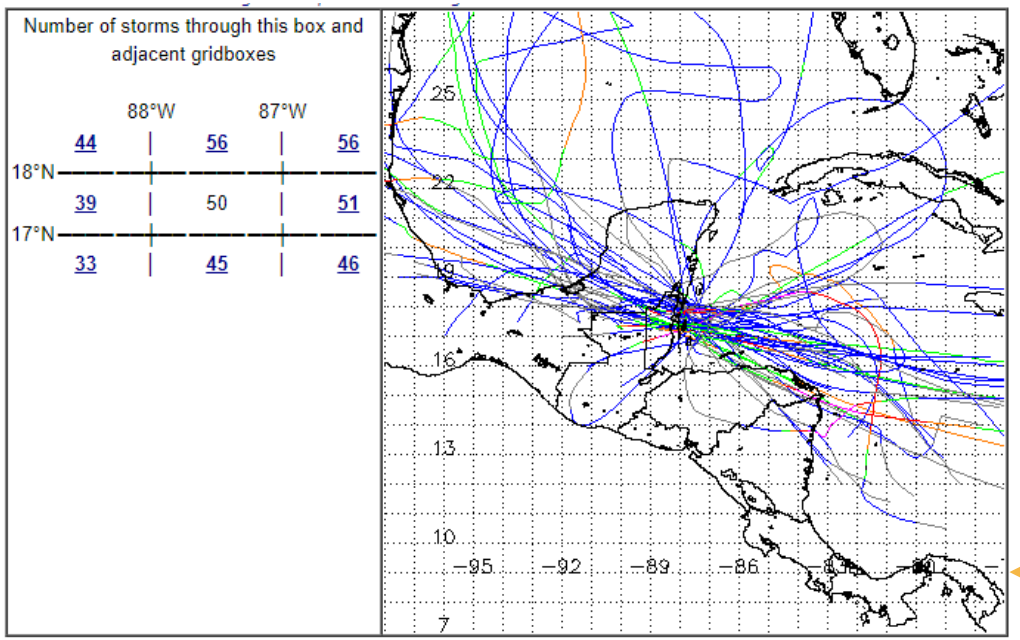
Strong Winds

Hazard Definition – Data Collection



5 minute data from 2016 to 2023. Data on:

PRECIP
T media
T min
T max Relative Humidity
Wind Speed (knots)
Wind Direction (Degrees)
Barometric Tendency (hPA)
Solar Radiation (W/m2)



Past Hurricanes events and intensity (velocity in knots)

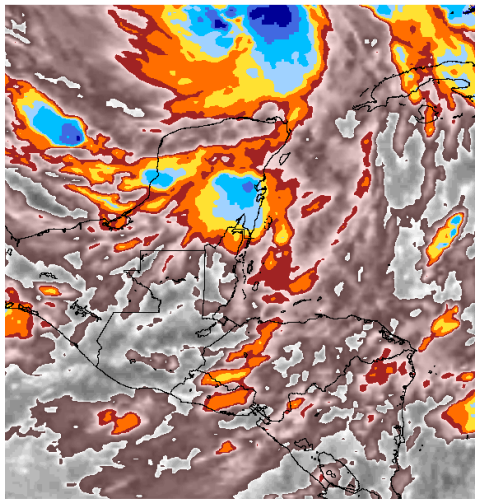
Belize Met Services

NAME	DATE	INTENSITY (knots)
NOT NAMED	1920	85
NOT NAMED	1921	80
NOT NAMED	1924	40
NOT NAMED	1931	115
NOT NAMED	1932	60
NOT NAMED	1933	95
NOT NAMED	1934	85
NOT NAMED	1938	50
NOT NAMED	1939	50
NOT NAMED	1940	40
NOT NAMED	1942	95
NOT NAMED	1943	40
NOT NAMED	1945	60
GERDA	1958	50
HATTIE	1961	145
AL12	1964	60
Chloe	1971	55
Edith	1971	140
Laura	1971	60
Al16	1975	60
Frieda	1977	50
AL17	1979	30
Hermine	1980	60
AL07	1986	30
Keith	2000	120
Chantal	2001	60
Arthur	2008	40
Alex	2010	95
Richard	2010	85
Earl	2016	75
ETA	2020	130
Lisa	2022	80

https://nms.gov.bz/tropical-weather/historical-storms/

IBTrACS

NAME	DATE	INTENSITY (knots)
UNAMED	1864	69.51808
UNAMED	1866	60.82832
UNAMED	1870	69.51808
UNAMED	1874	52.13856
UNAMED	1879	69.51808
UNAMED	1889	73.86296
UNAMED	1892	86.8976
UNAMED	1893	86.8976
UNAMED	1898	39.10392
UNAMED	1916	39.10392
UNAMED	1916	95.58736
UNAMED	1918	69.51808
UNAMED	1921	34.75904
UNAMED	1924	34.75904
UNAMED	1931	39.10392
UNAMED	1931	39.10392
UNAMED	1931	108.622
UNAMED	1931	60.82832
UNAMED	1932	39.10392
UNAMED	1932	39.10392
UNAMED	1933	69.51808
UNAMED	1933	34.75904
UNAMED	1934	39.10392
UNAMED	1936	34.75904
UNAMED	1938	39.10392
UNAMED	1939	30.41416
UNAMED	1940	39.10392
UNAMED	1941	78.20784
UNAMED	1942	34.75904
UNAMED	1942	86.8976
UNAMED	1943	34.75904
UNAMED	1945	34.75904
UNAMED	1945	86.8976
UNAMED	1946	30.41416
GILDA	1954	52.13856
JANET	1955	147.72592
ABBY	1960	69.51808
ANNA	1961	69.51808
HATTIE	1961	121.65664
FRANCELIA	1969	85.159648
EDITH	1971	60.82832
LAURA	1971	60.82832
CARMEN	1974	119.918688
FIFI	1974	91.24248
GRETA	1978	95.58736
HERMINE	1980	56.48344
GERT	1993	34.75904
KYLE	1996	43.4488
MITCH	1998	147.72592
KEITH	2000	108.622
CHANTAL	2001	52.13856
IRIS	2001	121.65664
DEAN	2007	147.72592
ARTHUR	2008	39.10392
ALEX	2010	52.13856
KARL	2010	52.13856
MATTHEW	2010	34.75904
RICHARD	2010	85.159648
HARVEY	2011	52.13856
RINA	2011	78.20784
ERNESTO	2012	73.86296
EARL	2016	73.86296
FRANKLIN	2017	47.79368
NATE	2017	39.10392


Satellite image near maximum intensity

Source: Knapp, K. R., H. J. Diamond, J. P. Kossin, M. C. Kruk, C. J. Schreck, 2018: International Best Track Archive for Climate Stewardship (IBTrACS) Project, Version 4. [indicate subset used]. NOAA National Centers for Environmental Information. doi:10.25921/82ty-9e16

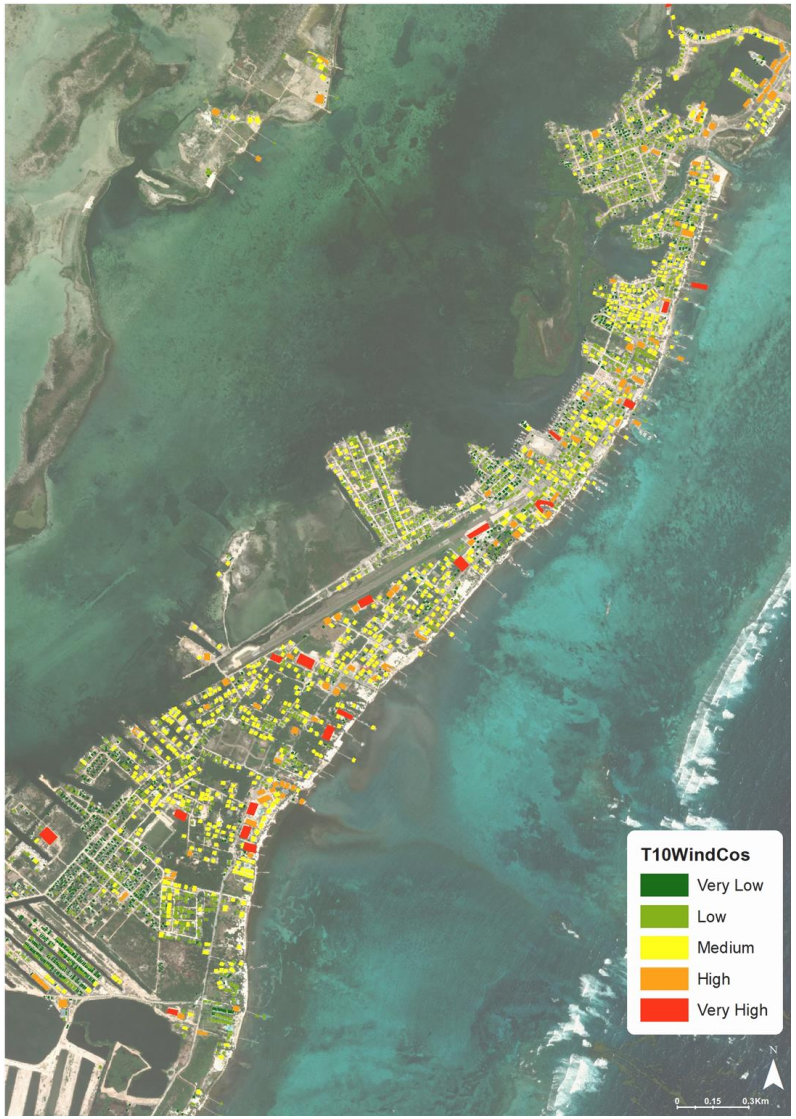
Strong Winds

Hazard Definition – Data Collection

Risk
calculated as damage in costs

A result associated to each frequency:

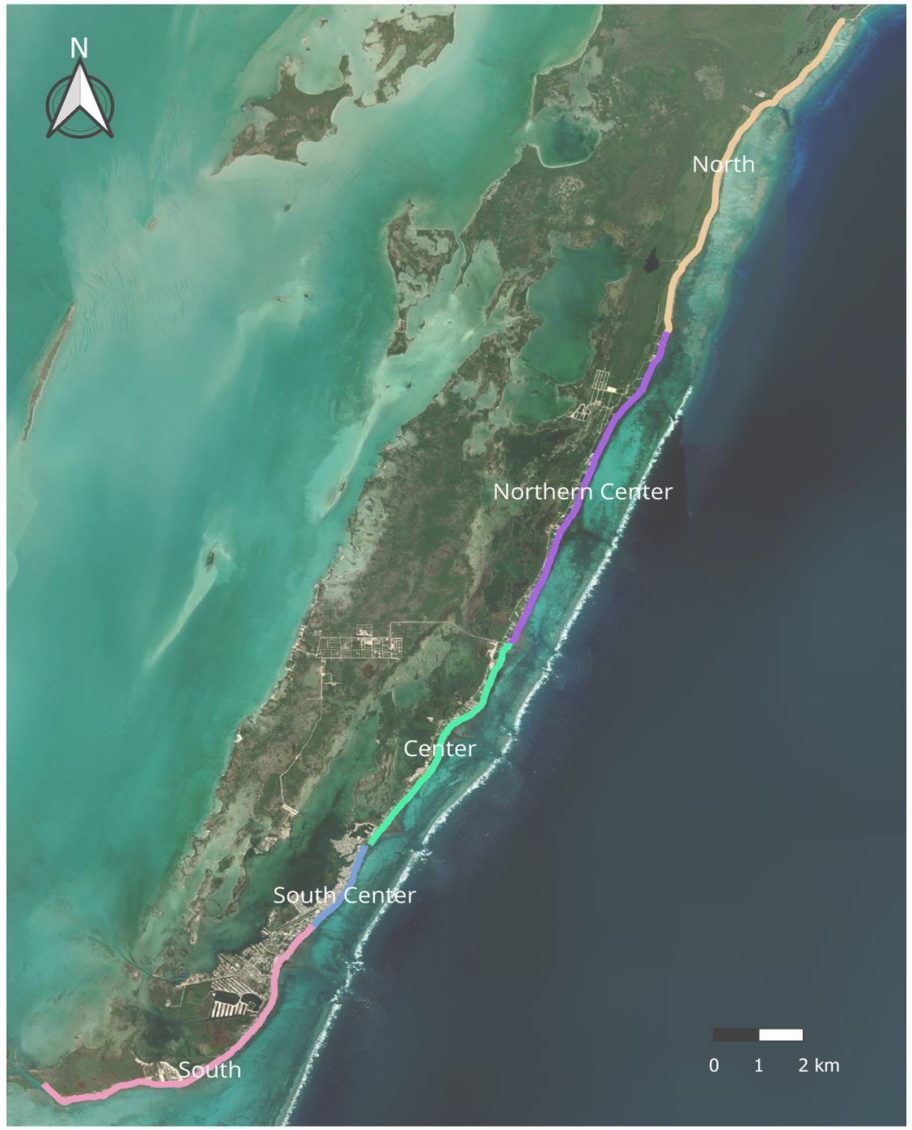
TR2.33
TR10
TR50,100,500



Coastal erosion Risk

Hazard Definition

Shoreline identification



In light of the diverse coastal dynamics arising from various infrastructural and natural interventions along the shoreline, a categorization into five distinct sectors has been undertaken for comprehensive analysis purposes.

- **North:** Low human intervention.
- **Northern center:** Few urbanizations and private resorts
- **Center and South center:** Higher population density.
- **South:** Hydro-morphological modification construction in private land

ShoreLine
- Center
- North
- Northern Center
- South
- South Center

Segment	Area (acres)	Length (mill)
Center	18.12	3.18
North Center	17.89	5.26
South Center	9.08	1.5
South	17.40	5.34
North	16.15	5.53

VULNERABILITY TO NATURAL HAZARDS.

1

Coastal erosion Risk

Automized identification – Python tool

2015-12-01 – 2023-01-01

The tools has been adapted to obtain photos from a large range of years to observe sedimentation or erosion processes → Function added to the code to extract a photo every 30 images

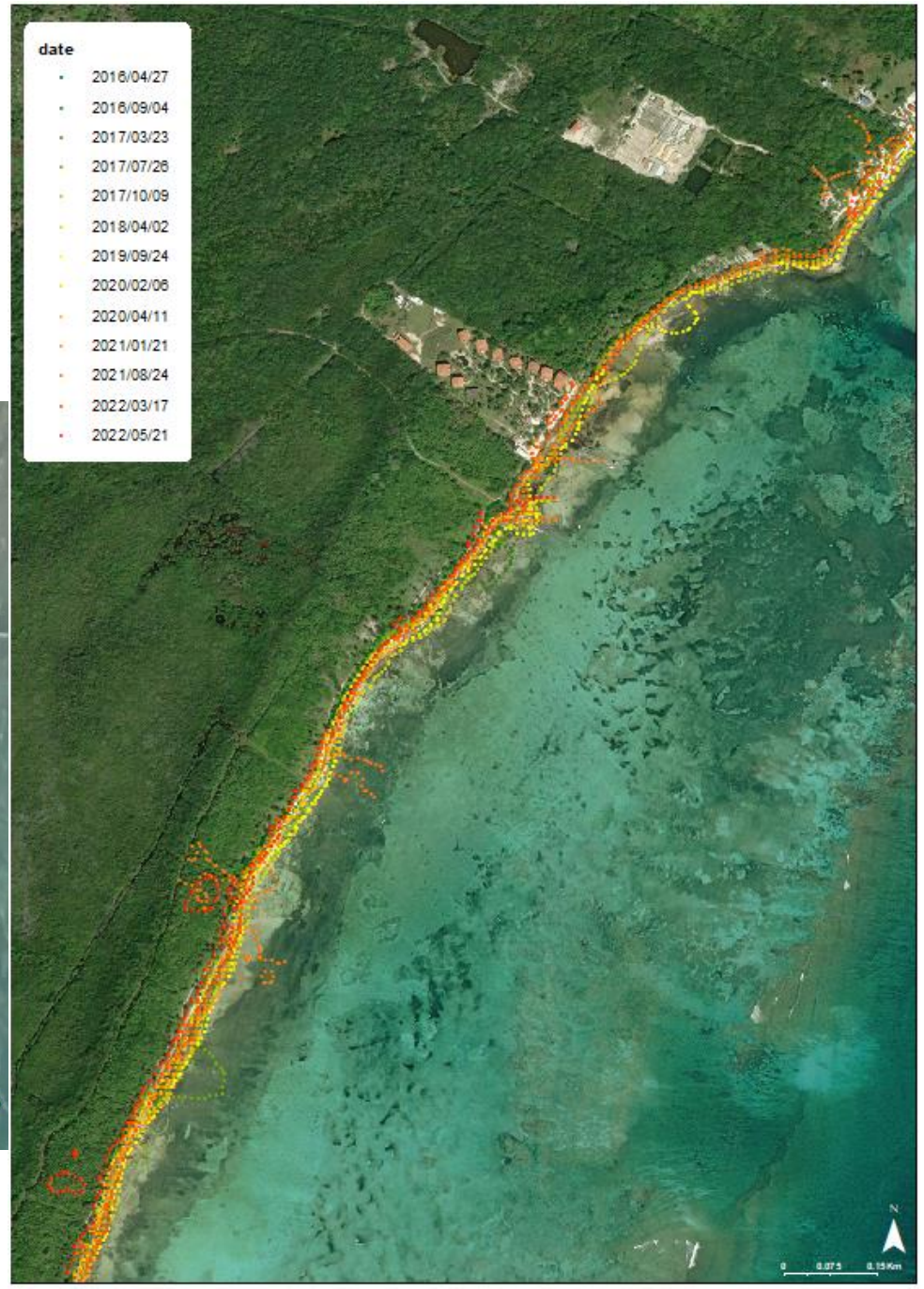
The shorelines are detected and drawn, using supervised classification and algorithm actions

Different parameters are considered, such as cloud threshold, minimum beach area (set as 20 feet), sand color, or validation for each shoreline

14 images with enough good quality (no clouds, no cuts, color…)

According to the high difference between shorelines there's is an evidence of tidal adjustment. Tide Data is needed for precision

25 meters difference



1 Coastal erosion Risk

Digitalization of representative Section

The dynamics of change have been computed within the central zone, where notable visual alterations are observed.

Sedimentation (feet)

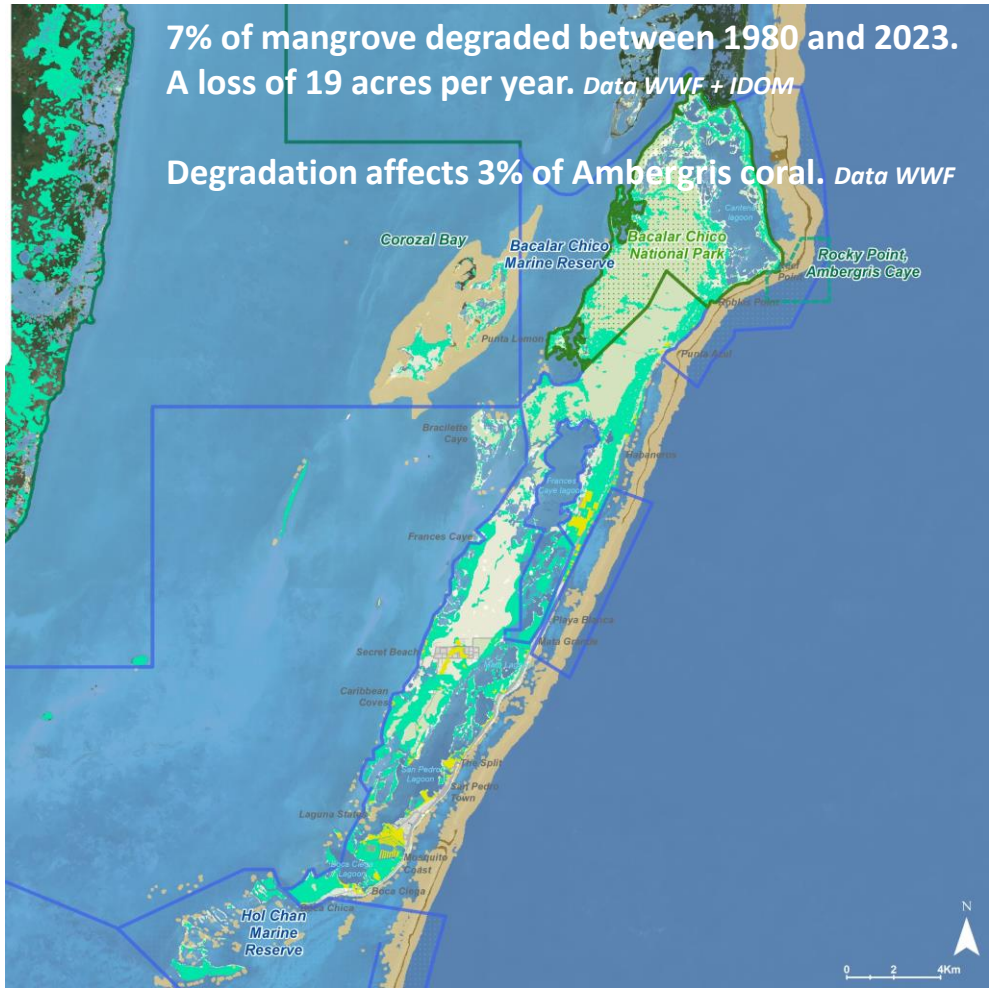
Erosion (feet)

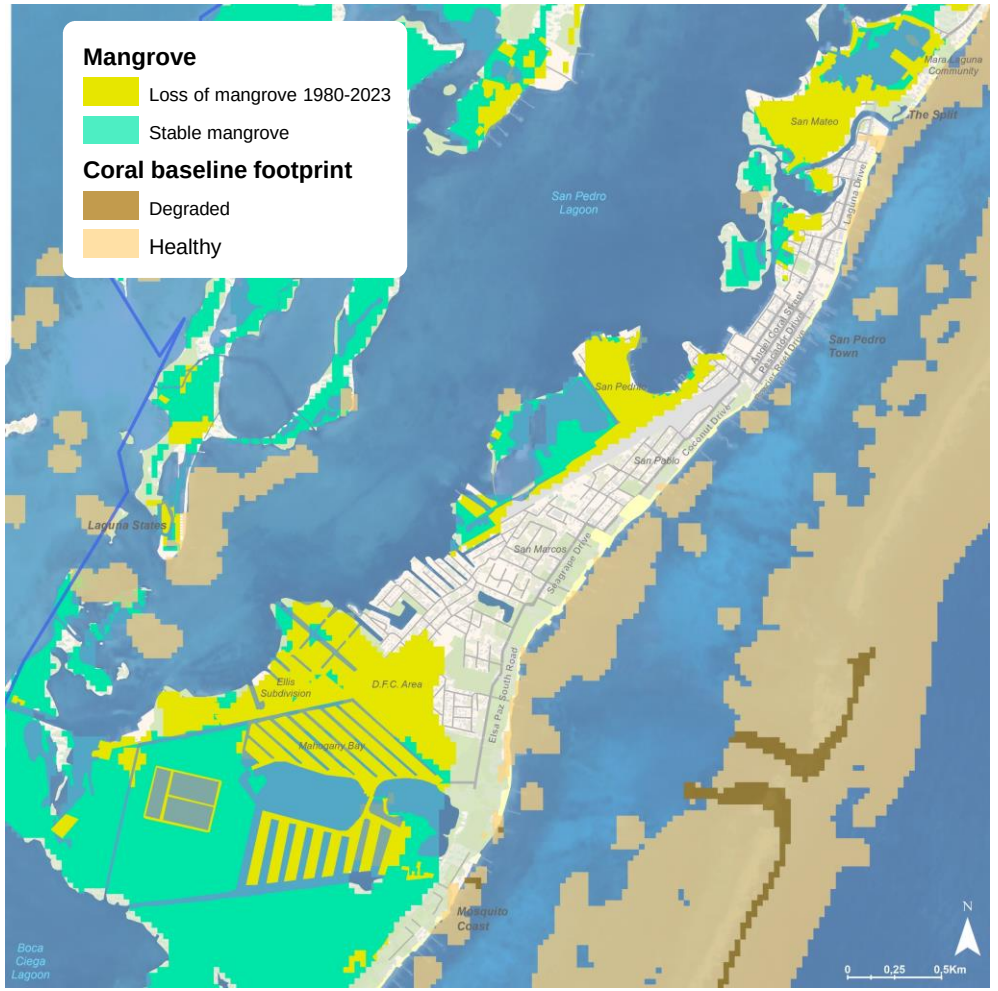
2002	2003	2010	2014	2016	2019	2021	2023
-	4.30	23.82	0.00	14.76	10.96	9.84	7.22

Based on this comprehensive analysis, which identifies the coastline and defines its variations, it can be inferred that there is no significant coastal erosion threat. Primarily, **the observed changes are attributed to the accumulation of beach sand and coastal dynamics influenced by the hurricane season**, as well as the impacts and effects of hurricanes along the coastline.

NATURAL SYSTEM AND PROTECTED AREAS

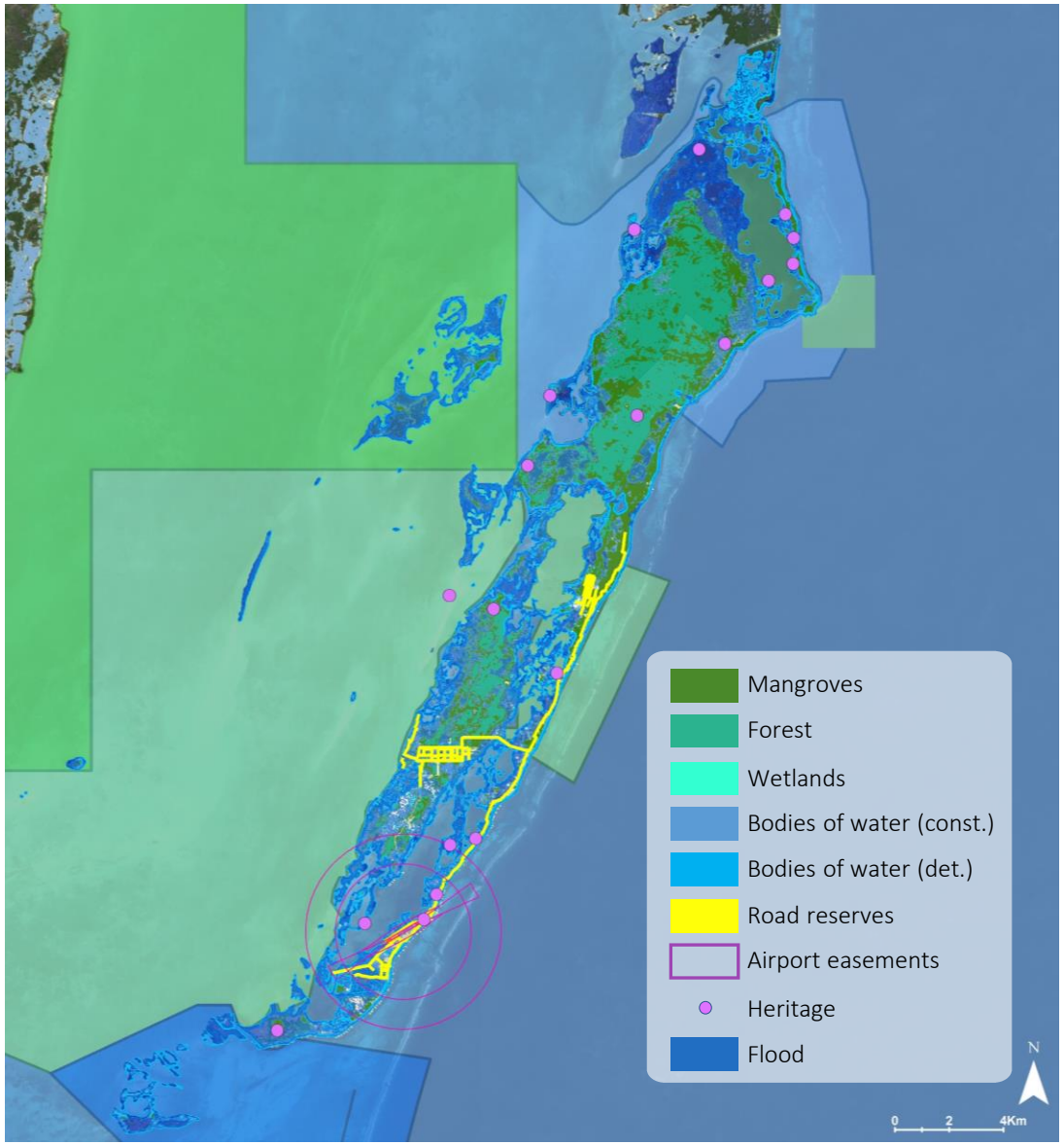
Mangroves are **one of the most relevant and extensive vegetation on the island.** They perform essential functions such as **protecting the coasts from wind and wave erosion.** Additionally, they have a **high productivity**, host a large number of **aquatic, amphibious and terrestrial organisms**; they are **life-generating engines**, among other things.





Mangrove removal

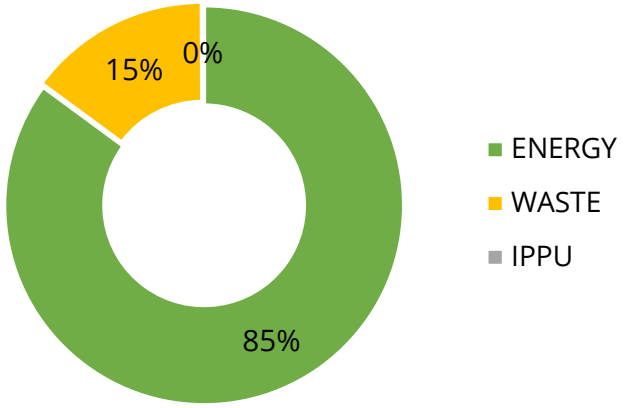
DETERMINANTS AND LIMITATIONS TO DEVELOPMENT



	Typology	% Caye affected	Affected built footprint (acres)	Affected vacational & residential footprint (acres)	Inhab
Protected Areas	Nature Reserves	43.1%	46.7	44.1	0
	Mangroves	47.6%	236.7	226.1	695
Natural Areas	Forest	23.4%	11.9	11.4	26
	Wetlands	4.5%	23.9	8.2	30
Bodies of water	Bodies of water (constraints)	10.9%	160.2	129.6	2,857
	Bodies of water (Determinant)	26.0%	509.3	441.6	8,508
Infrastructures	Road reserves	1.2%	187.7	169.4	3,623
	Airport easements	0.2%	38.3	24.3	792
Strategic areas of interest	Heritage	-	-	-	-
Natural Hazards	Flood prone areas	58.2%	942.5	793.5	12,821
TOTAL DETERMINANTS AND LIMITATIONS TO DEVELOPMENT		**98.5%**	**1,244.7**	**1,073.8**	**16,086**

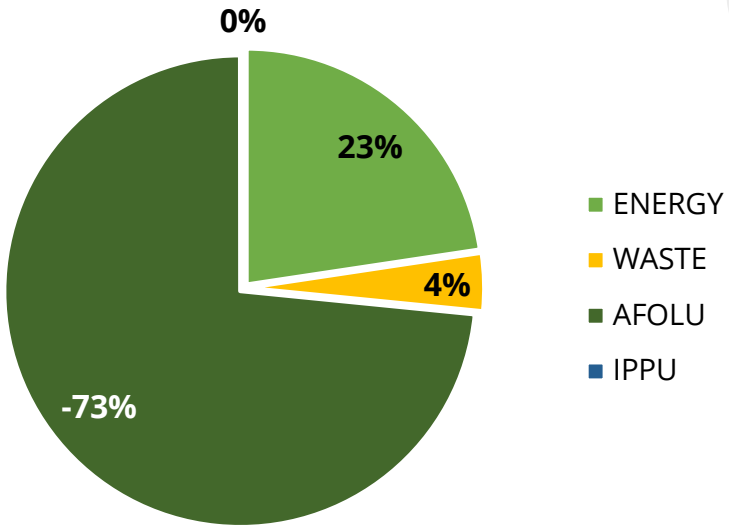
GHG Inventory

Ambergris Caye

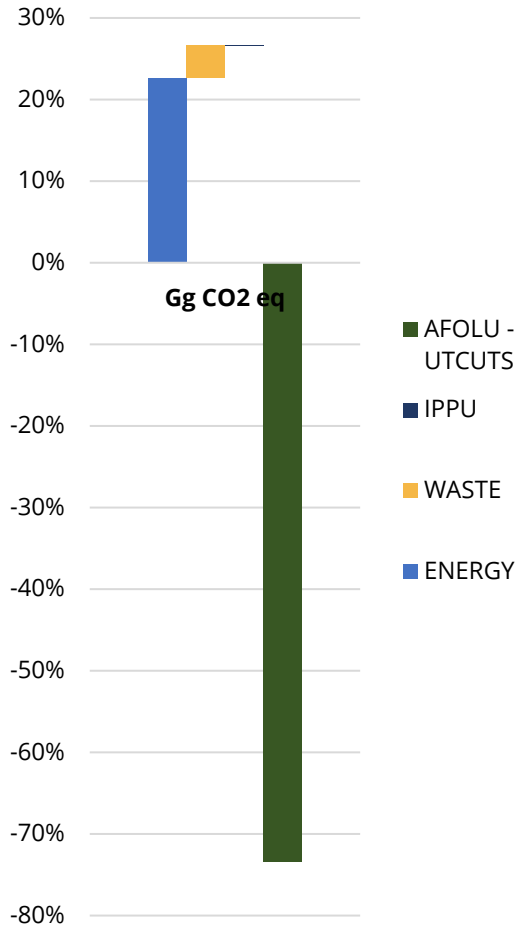


Total emissions
1,629 t CO_2eq per capita

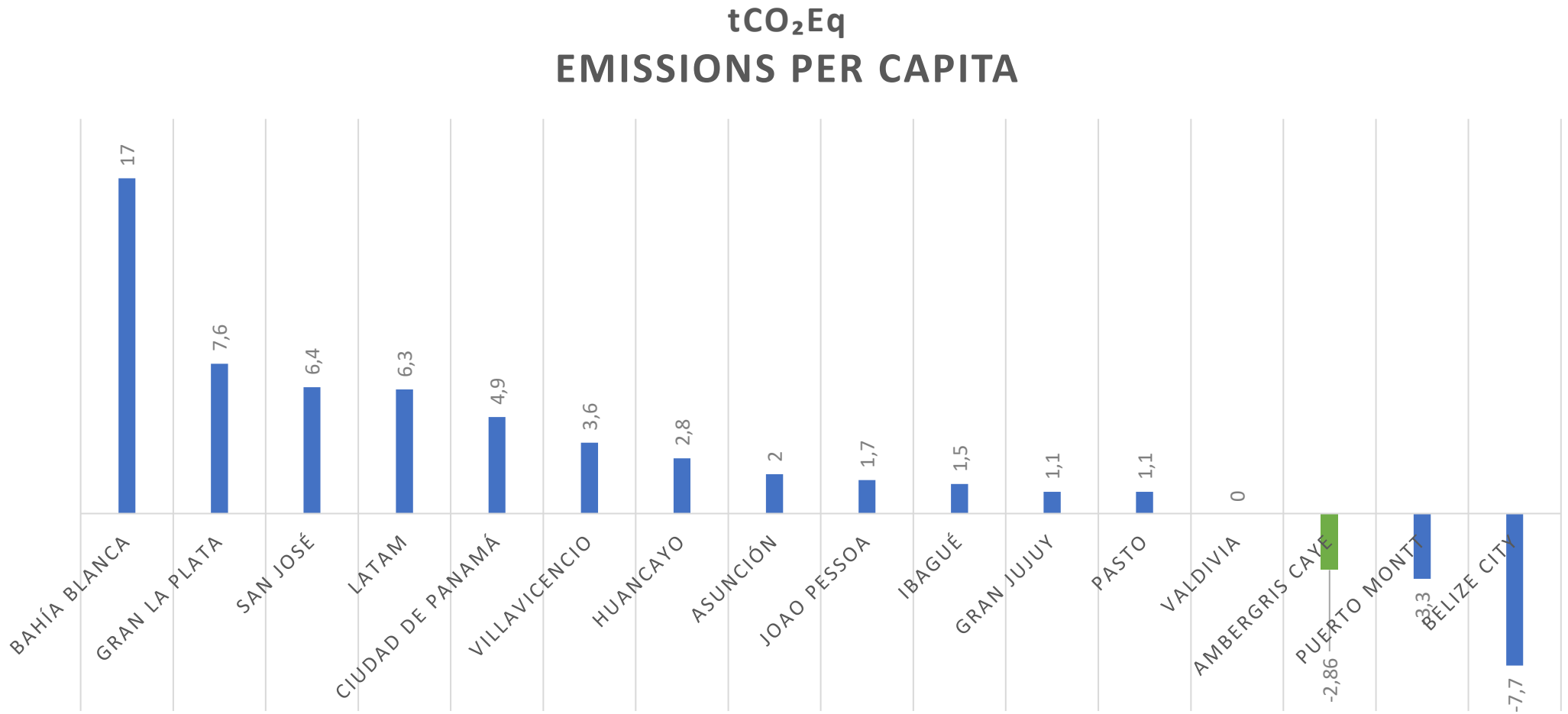
Net emissions
-2.86 t CO_2eq per capita



Emissions by sector



GHG Inventory



BACKGROUND INFORMATION ON TOURISM DEVELOPMENT

ECONOMIC IMPORTANCE OF TOURISM ACTIVITY FOR BELIZE

Tourism directly contributes to over 15% of GDP and directly supports over 21,000 jobs or 13.4% of total employment (NTP´s 2017).

NATIONAL SUSTAINABLE TOURISM MASTERPLAN FOR BELIZE 2030

BELIZE TOURISM BOARD

NSTMP 2011-2030 Vision Statement states that: **“Belize is an exclusive multicultural sustainable destination in the Central American Caribbean.”**

NTP's (2017), states in its vision that: **“Tourism should have an impact on Improving the quality of life of all Belizeans through a competitive and sustainable tourism sector that offers pleasant, unique and authentic experiences to visitors”.**

NSTMP Current Update: **"Grow Tourism in Belize ´holistically´to the benefits of its diverse peoples and with respects to its rare natural and cultural environment"**

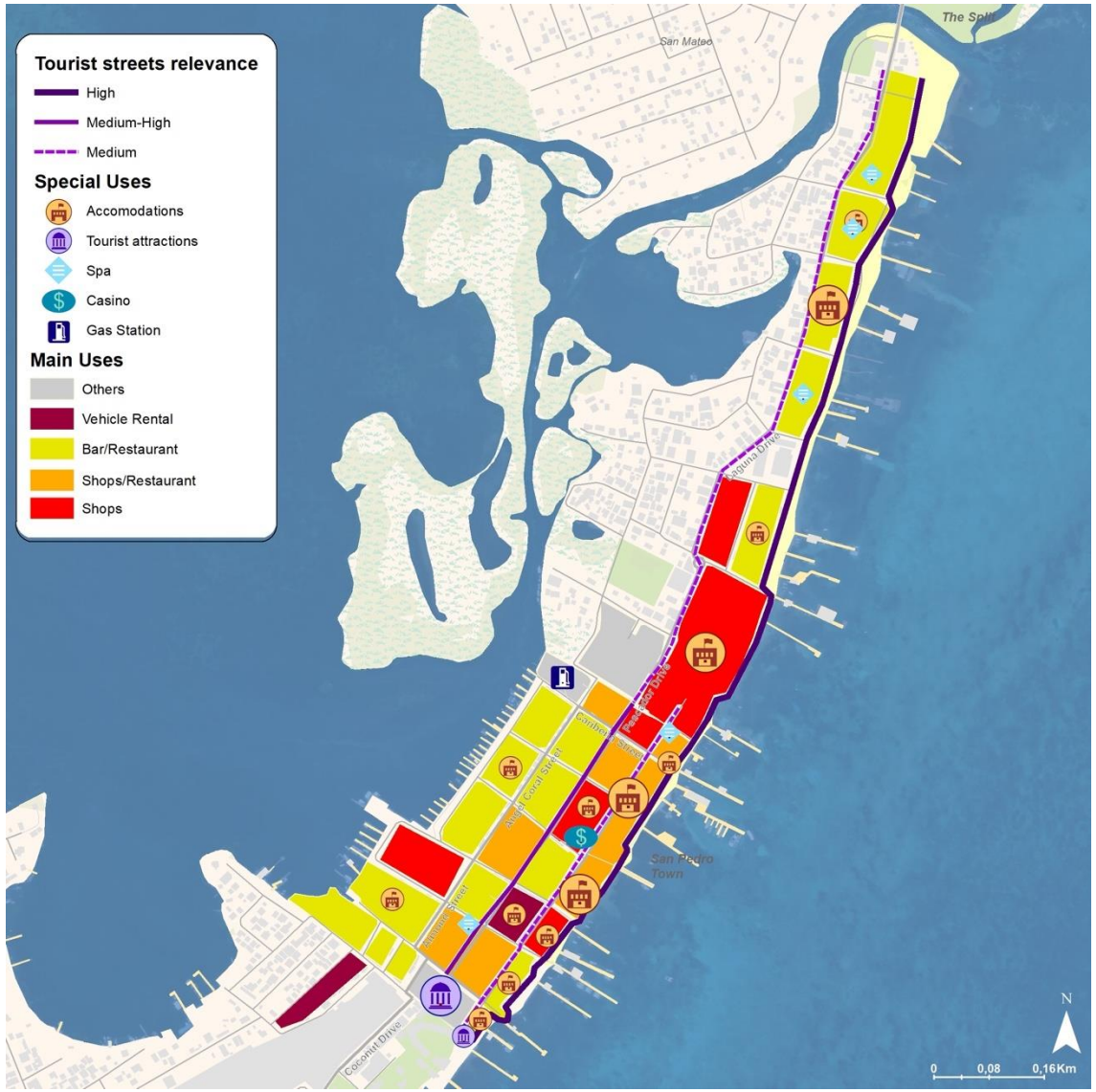
BACKGROUND INFORMATION ON TOURISM DEVELOPMENT

TOURIST PRODUCTS, REASONS FOR TRAVEL

- In July 1987, the Hol Chan Marine Reserve was granted reserve status under section 7 of the Fisheries – 172,037. (Amendment Act) of 1983. Section 9A-(1).
- Bacalar Chico National Park and Marine Insert Reserve, Statutory instrument 86 of 1996.
- In 1998, Belize Barrier Reef Reserve System (BBRRS) was inscribed on the UNESCO World Heritage List.
- Caye Caulker Marine Reserve. Declared under Statutory Instrument No. 35 of 1998

AMBERGRIS CAYE'S TOURISM VALUE CHAIN

- Tourists - 209,012 (ONTA+ONCTA, 2019)
- 13 Airlines (18 destinations, most from USA).
- 2 National (Mayan and Tropic Airlines).
- 5 Main Cruise Ships Lines.
- 271 excursions (Aprox, AirB&B).
- Tour Operators - 53 out of 368 national (14%).
- Tour Guides – 470 out of 2,164 (22%).
- 198 hotels out of 902 (22%).
- 3,104 beds in 2,412 rooms.
- 170 restaurants (Aprox. AirB&B).



BACKGROUND INFORMATION ON TOURISM DEVELOPMENT

TRENDS AND CHALLENGES FOR A SUISTANAIBLE TOURISM INDUSTRY

Trends:

- Big Airports – Different Destinations – Massified Tourism - All Inclusive / Punta Cana - 475 sqkm / Cancun – 1,065 sqkm / AC´s – 64 sqkm).
- Site degradation, less attractive, no cultural contact, no second world´s biggest coral reef.

Diversification:

- New products: Bacalar Chico, Archeological Sites
- Increase seasonally overnight stays
- Visits all year round

Competitiveness:

- **T&TCI (2019):** Specialized HR, ICT´s, Environmental Sustainability, T. Service Infrastructures and Cultural Resources and Bossiness Travel.

Sustainable Development

- **Global Sustainable Tourism Criteria for Destinations (2019).**

Sustainable Management (+)
Socioeconomic Sustainability (+/-)
Cultural Sustainability (-)
Environmental sustainability (-)

1 DIAGNOSTIC CONCLUSIONS

Urban growth

3.1% is the **annual growth rate** of the footprint

The main **Growing Vectors** are located in the **North and Secret Beach areas**

49 inhab/ha gross density of urban&periurban population*

5.8 % of houses are located in **low quality neighborhoods**

16% of the footprint are **vacant spaces**

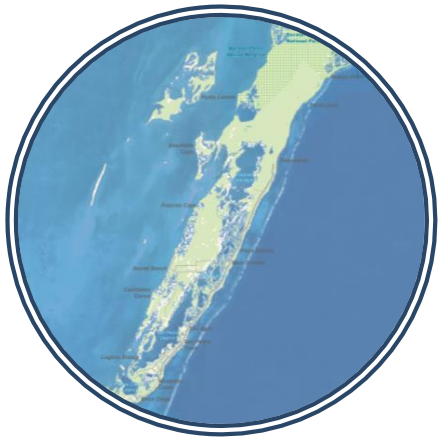
Limitations to development

43% of Ambergris Caye is classified as a **protected area**

47.6% of the Island is covered by **mangroves** and **26% by bodies of water**

58.2% of the of the Caye is **affected by flood prone areas**

85% of GHG emissions come from the energy sector



Quality of life

Very low indicator of Public Space – 0,8 m2/inh.

Only **13% of the population lives in a walking distance** (10 minutes) **of a Public Space**

Just **8**% of the **road network is** currently **paved**

The Island lacks a sustainable mobility system

83% of population has **access to potable water** and **only 29% has access to sawage**

Vacant land with a high economic value is focus at "Secret beach"

Condominiums are located mainly in San Pedro east part and north east part of the cay

Real estate market

1 DIAGNOSTIC CONCLUSIONS

Storm surge flood

Flood hazard impacts, to varying degrees, the entirety of the cay

Low vulnerability due to raised constructions or stilt houses

Related to hurricanes**.**

Constraint based on flood depth since the entirety cay is affected by this hazard.

Coastal erosion

Cyclic coastal dynamics

Slow and gradual sedimentation procces

Followed by a rapid erosion procces during hurricane events

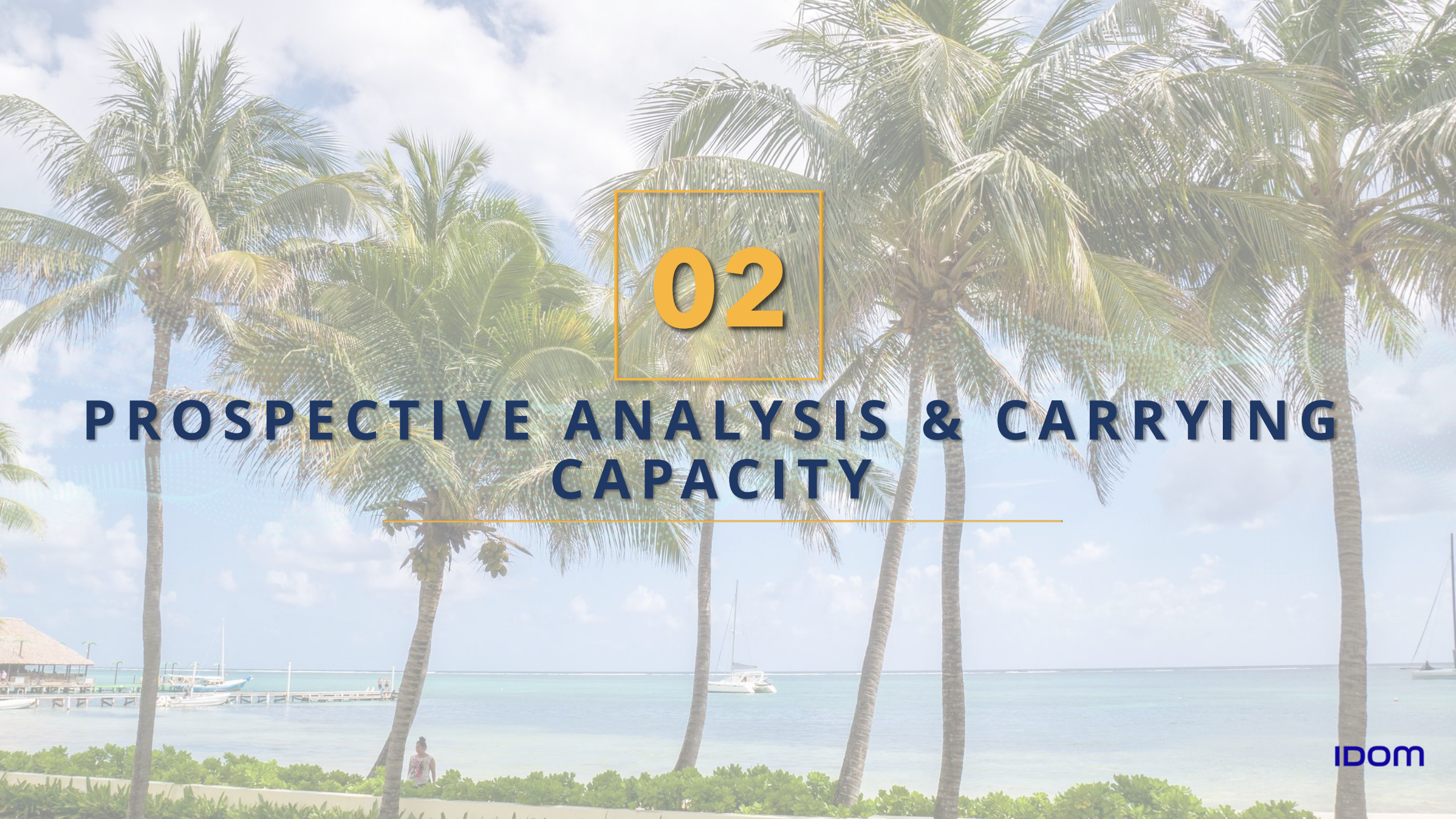
Without human intervention no net erosion process is expected.

Strong winds

Related to hurricanes**.**

The wind impacts the most as per indicated by stakeholders

High vulnerability: Roof made of Steel are very vulnerable (66% of total)

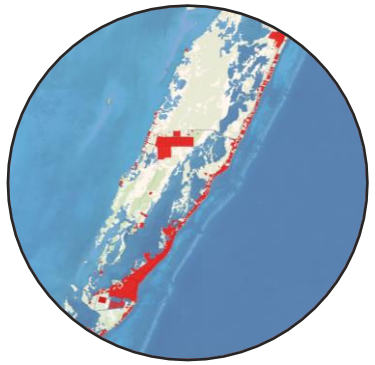


02

PROSPECTIVE ANALYSIS & CARRYING CAPACITY

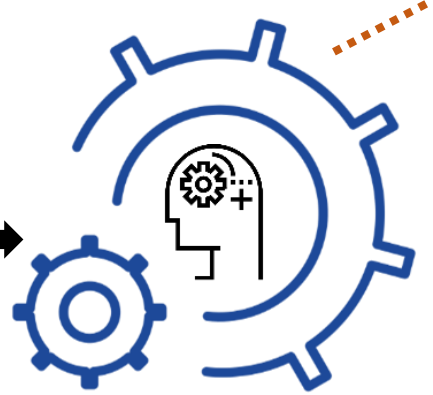
GROWTH SCENARIOS

CURRENT SITUATION



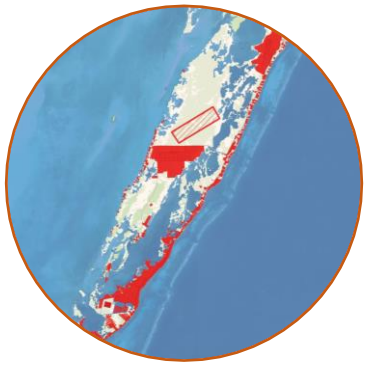
2023

VISION



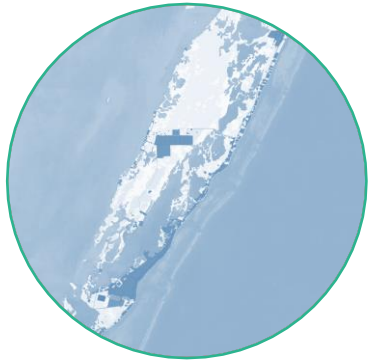
2045

TREND DEVELOPMENT (Business as usual)



How will the territory develop if the Current Dynamics of the Island continue?

SUSTAINABLE VISION



How will the territory develop if a balanced vision is implemented in terms of Risk Reduction, Urban Control and Land Planning?

EXTENSIVE, INSUSTANAIBLE EXPANSION MODEL

- High impact on **Protected Areas** and **Native Ecosystems**
- Low use of **Vacant Land**
- Growth without consideration of the **Island's Carrying Capacity**

COMPACT, PLANNED AND RESILIENT URBAN MODEL

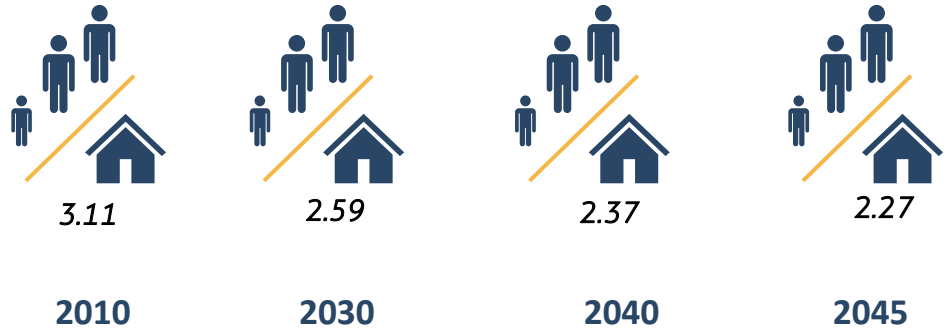
- Development **integrated with ecosystems**
- Efficient use of **urbanized areas served with infrastructure**
- Urban growth **considering areas at risk and resilient solutions**

POPULATION PROJECTIONS

POPULATION PROJECTION

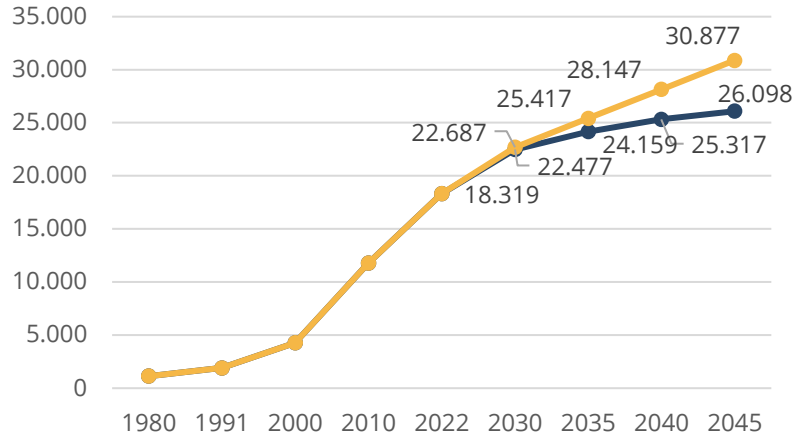
	2022	2030	2040	2045
Population	18,319*	22,687	28,147	30,877

Estimated to decrease the ratio of inhabitants per dwelling from 3.11 to 2.27.



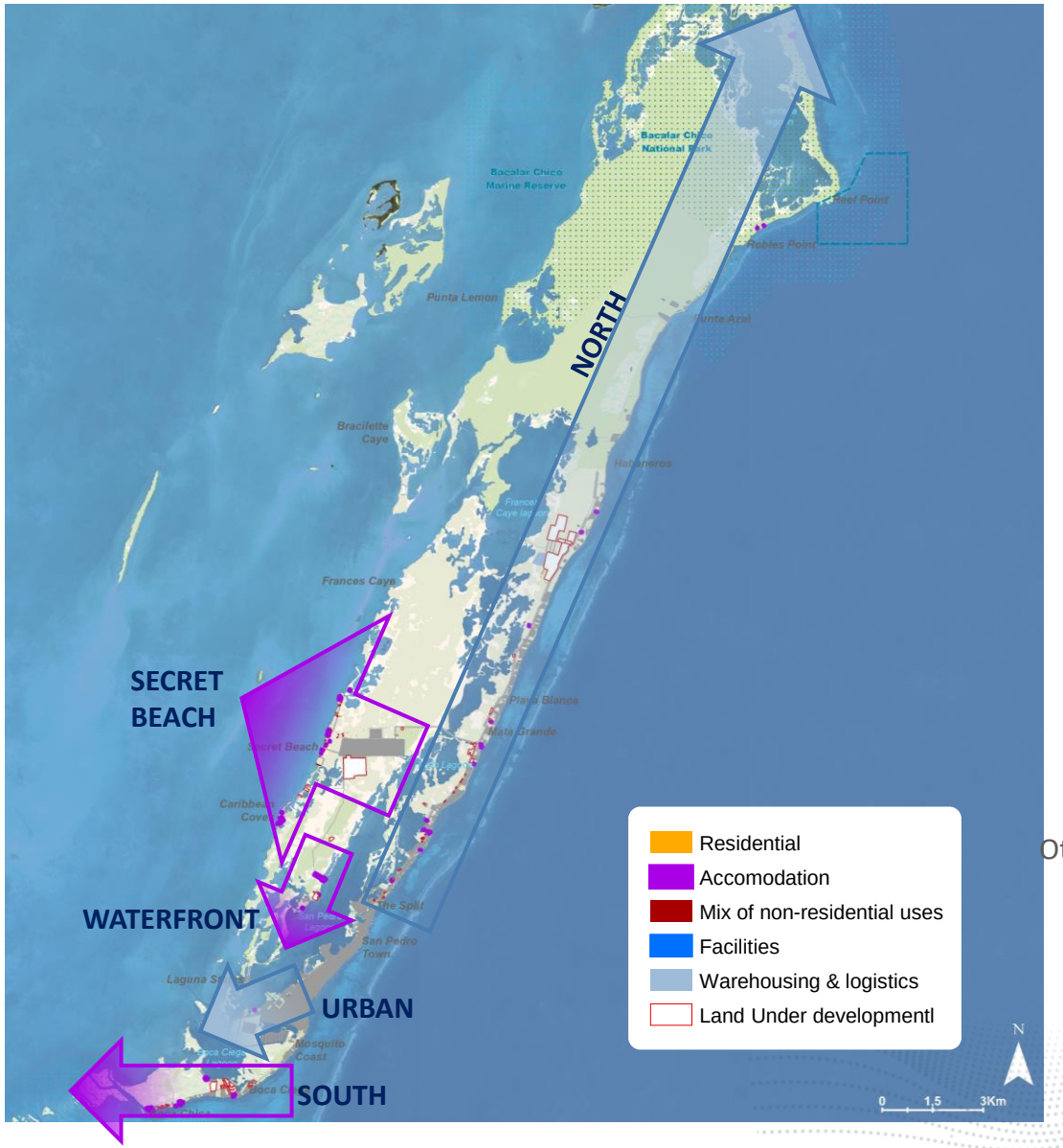
HOUSING PROJECTION

	2022	2030	2040	2045
Housing	5,291**	8,755	10,253	13,583



**Preliminary estimated projection*
***Preliminary housing count*

GROWTH VECTORS

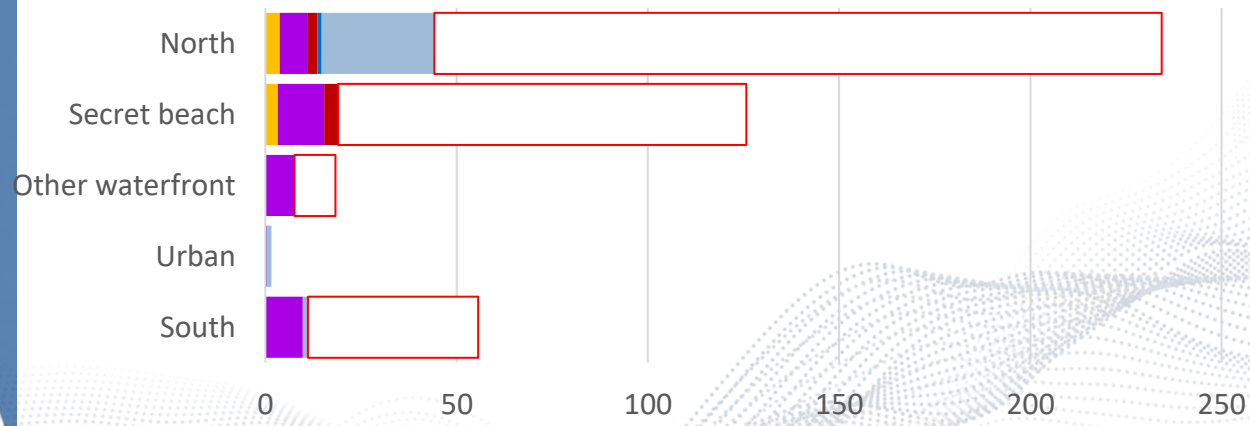


Between 2013 and 2022, the foremost area growth is to the **north (54%)** followed by the vector to **Secret Beach (30%).**
81% of the intervened surface still being Under development land.

Residential growth is mainly to the north, especially in medium and low quality housing. Of the total housing in this vector, **vacation homes represent 10%.**

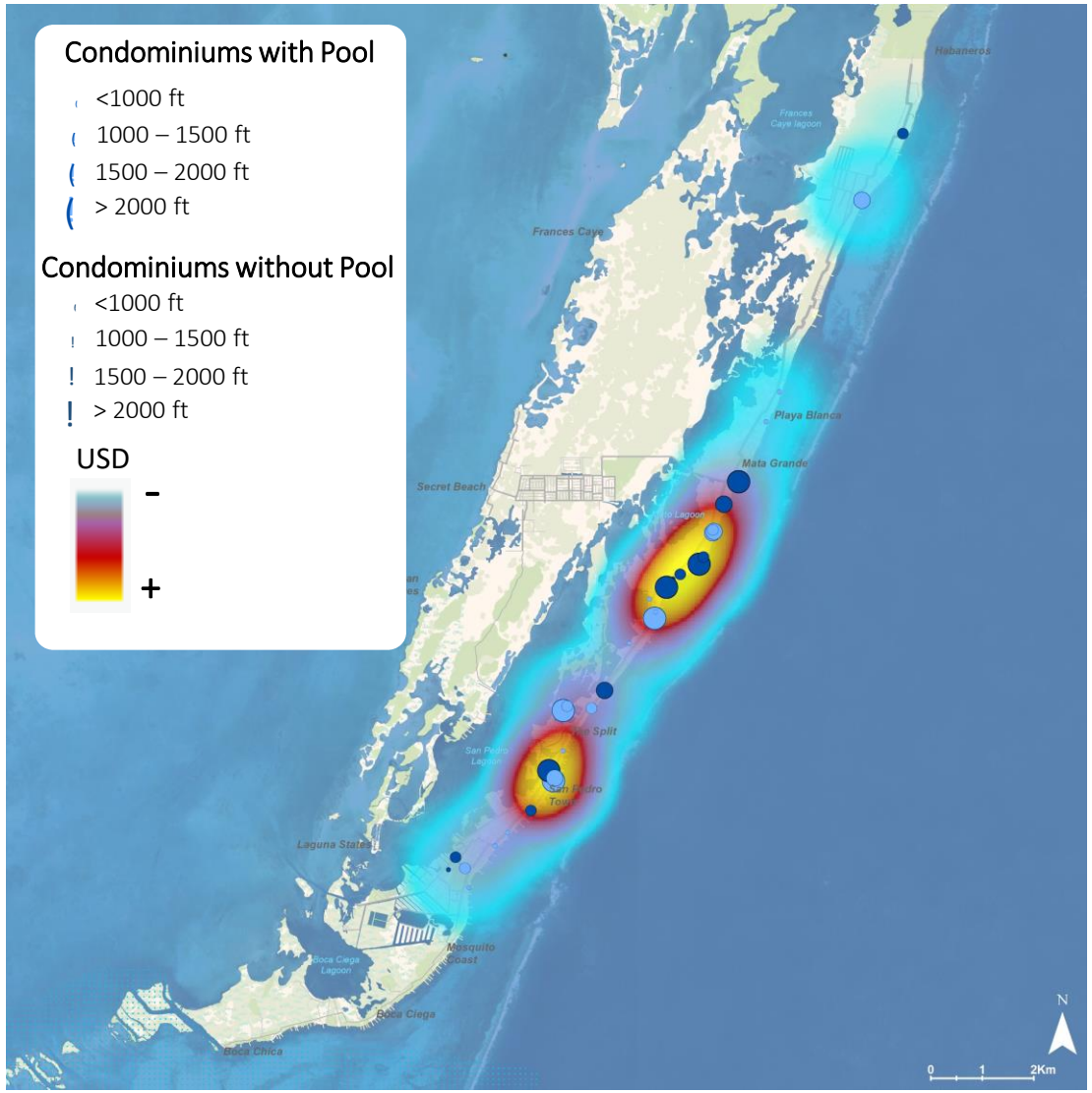
Secret beach, waterfront and south vectors are mostly under development land too, and **secondarily accomodations**, with no supply of facilities or mix of uses.

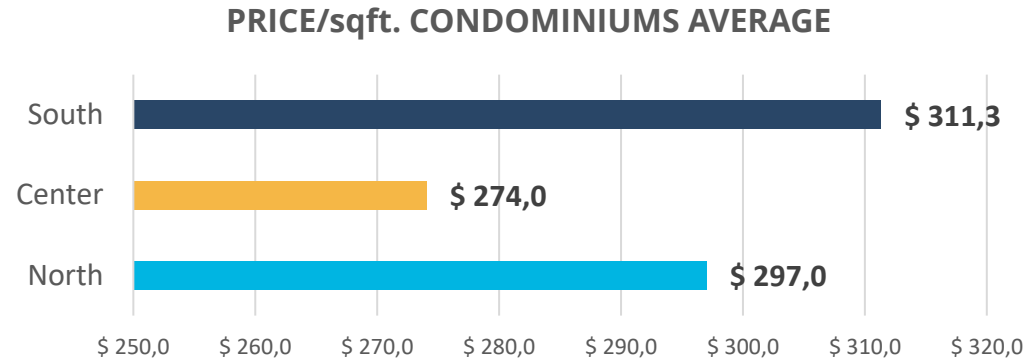
The urban vector is the least extensive, being mainly warehousing

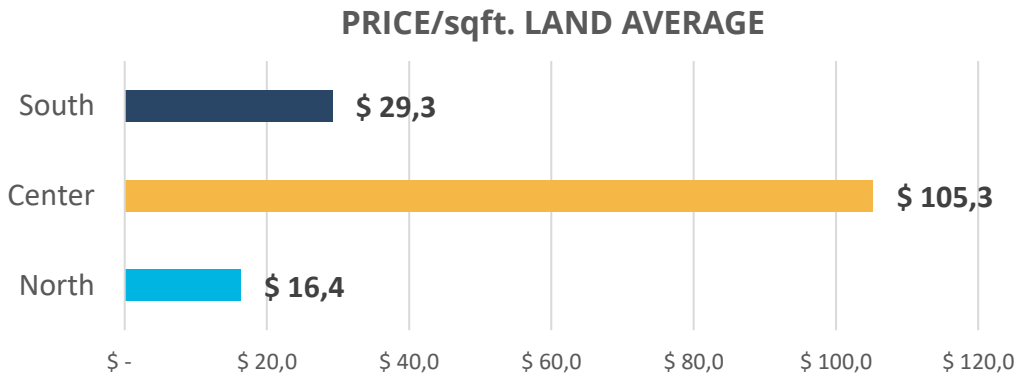


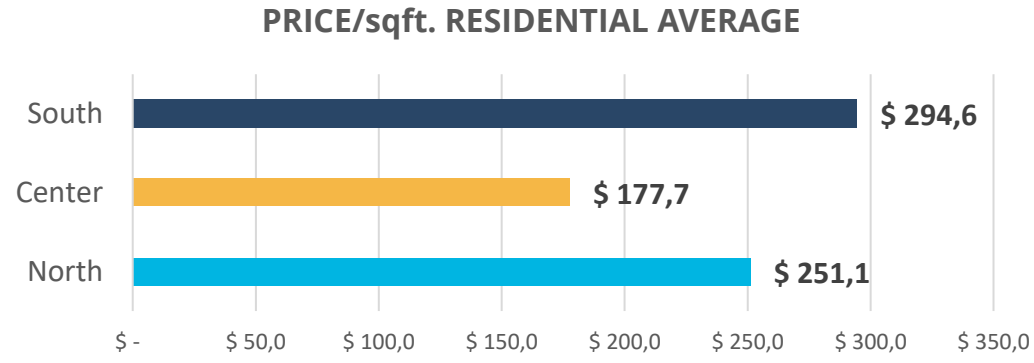
CURRENT REAL ESTATE OFFER

Condominiums Analysis

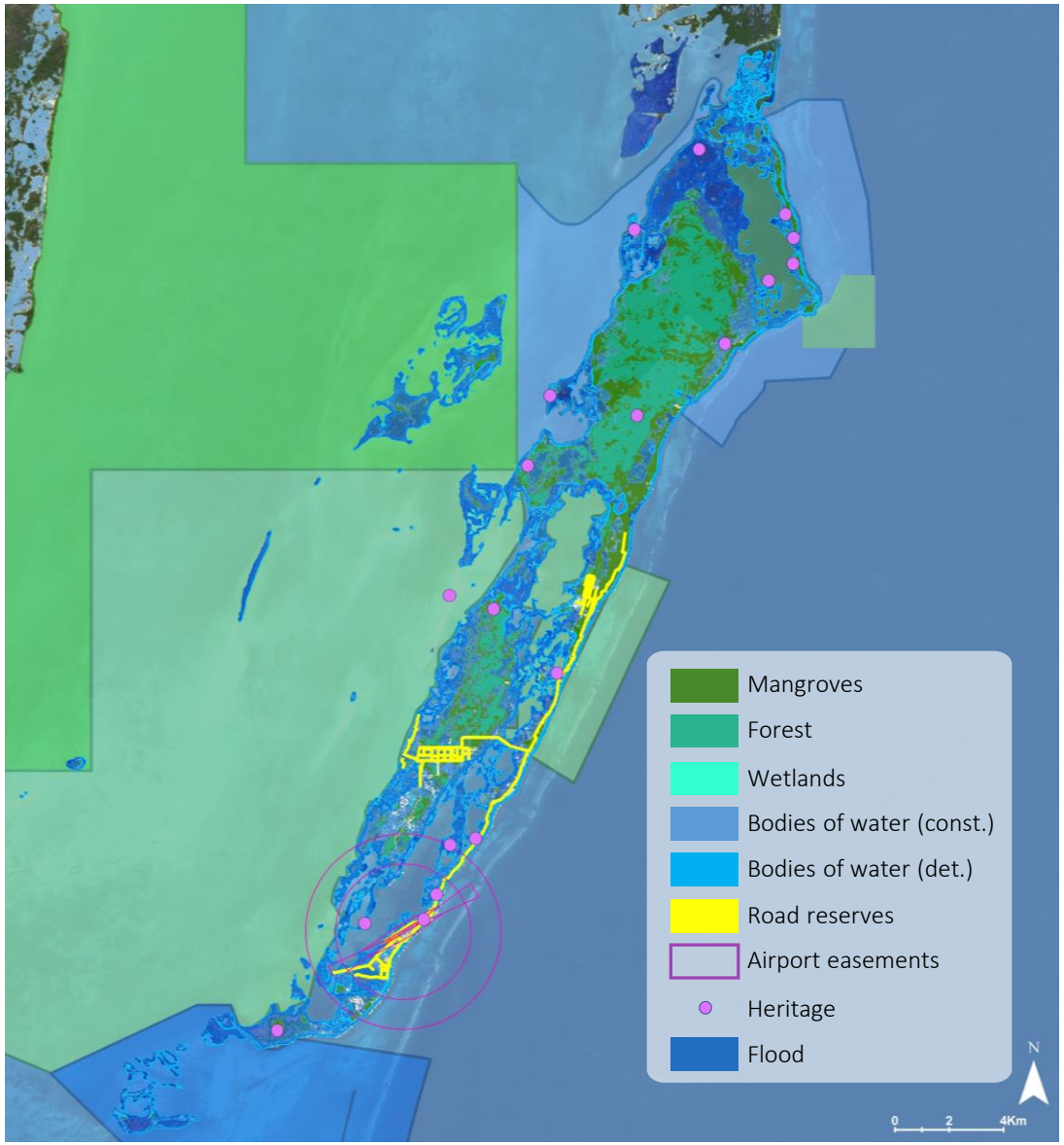








DETERMINANTS AND LIMITATIONS TO DEVELOPMENT

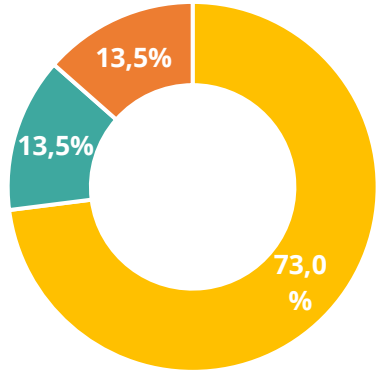


	Typology	% Caye affected	Affected built footprint (acres)	Affected vacational & residential footprint (acres)	Inhab
Protected Areas	Nature Reserves	43.1%	46.7	44.1	0
	Mangroves	47.6%	236.7	226.1	695
Natural Areas	Forest	23.4%	11.9	11.4	26
	Wetlands	4.5%	23.9	8.2	30
Bodies of water	Bodies of water (constraints)	10.9%	160.2	129.6	2,857
	Bodies of water (Determinant)	26.0%	509.3	441.6	8,508
Infrastructures	Road reserves	1.2%	187.7	169.4	3,623
	Airport easements	0.2%	38.3	24.3	792
Strategic areas of interest	Heritage	-	-	-	-
Natural Hazards	Flood prone areas	58.2%	942.5	793.5	12,821
TOTAL DETERMINANTS AND LIMITATIONS TO DEVELOPMENT		**98.5%**	**1,244.7**	**1,073.8**	**16,086**

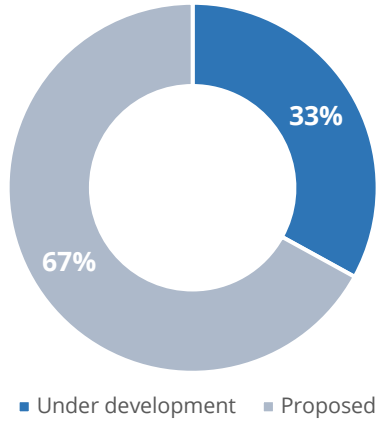
IDENTIFICATION OF PLANS AND PROJECTS

GROUP		NAME	STATUS
URBAN DEVELOPMENT AND TOURISM	1	Master Development Plan for northern Ambergris Caye	Under development
	2	Design and construction of San Pedro General Hospital	Preparation
	3	Develop adequate medical facilities in key tourist destinations such as Ambergris Caye and others	Proposed
	4	New Pre-primary, Primary and Secondary School Project	Proposed
	5	Relocation of San Pedro Airport	Proposed
	6	Water taxi services from Belize City Airport and Bomba	Proposed
	7	San Pedro - Caribbean Queen Depot	Proposed
	8	Urban road improvement	Under development
	9	Business street of San Pedro	Proposed
	10	New Cargo Port in the North	Proposed
	11	Improvement of road infrastructure in the North	Proposed
ENVIRONMENT	12	North Ambergris Caye Expansion (water & wastewater); Caye Caulker South and Placencia Peninsula WWTP and collection System	Proposed
	13	Support to Integrated Water Resources Management	Under development
NATURAL DISASTERS MANGAMENT	14	Water driven zoning mechanism	Proposed
	15	Development of innovative solutions to improve the resilience of homes in Belize to hurricane winds, considering the effect of climate change	Under development

Distribution of projects by Group

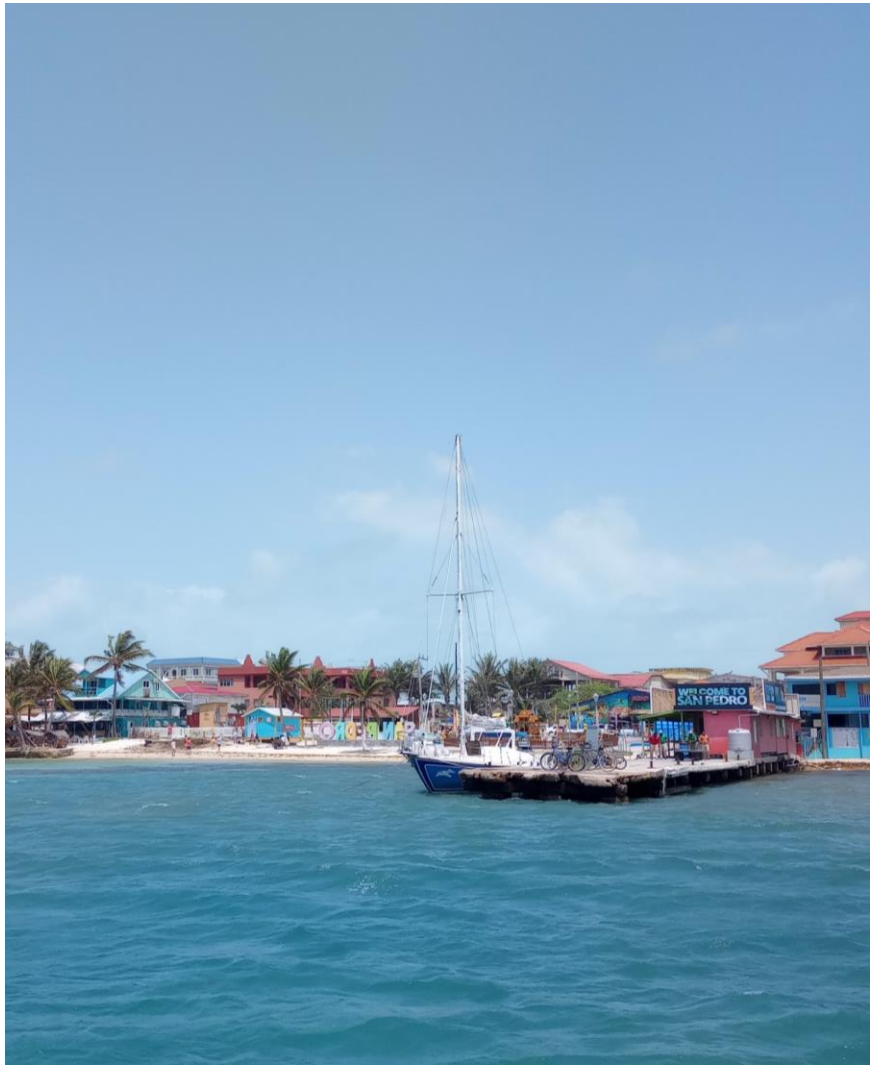


Distribution of projects by status



DEFINITION CARRYING CAPACITY MODEL

KEY CONCEPTS



- **The origin of the concept is related to the Capacity of the Territories to Produce Food** (Beginnings of the Ecology Concepts, XIX Century)
- **In the 1960s it began to be related to the number of visitors that a Protected Natural Area can receive** (e.g. Hol Chan Chan 2002).

CURRENT DEFINITION: **"NUMBER OF HUMAN BEINGS THAT CAN MAKE USE OF A SPACE WITHOUT DEGRADING ITS NATURAL, CULTURAL AND SOCIAL ENVIRONMENT, WITH THE ULTIMATE AIM OF MAINTAINING THE DESIRED QUALITY OF LIFE OVER THE LONG TERM"** (Abernethy, 2001).

Including the Carrying Capacity concepts in an Integral Planning allows :

- **Protect the environment**
- **Protect the Cultural Values**
- **Improve the Life Quality of the inhabitants**

DEFINITION CARRYING CAPACITY MODEL

KEY CONCEPTS

To determine the carrying capacity, it is necessary to identify variables and thresholds:

Variables can be of different types:

- **Environment Impacts:** Ecosystem Services, Biodiversity, Soil erosion.
- **Human needs:** Basic services provision, Housing, Health, Education, Security
- **Cultural Variables:** Language, Traditions, Landscape protection, Urban typology

Threshold Identification:

- **Investment Feasibility:** Financial, Technical, Environment, Social.
- **Laws, Regulations:** International regulations, Urban Planning, National Standards
- **Development Vision:** Language, Traditions, Landscape protection, Urban typologies

THE CARRYING CAPACITY IS DYNAMIC, IT COULD EVOLVE IF:

- **BASELINE FACTORS CHANGE (**Climate Change, Disasters, Inmigration, Regulation)
- **INFRASTRUCTURE INVESTMENTS**
- **CHANGES IN THE DEVELOPMENT VISION**

DEFINITION CARRYING CAPACITY MODEL

KEY CONCEPTS

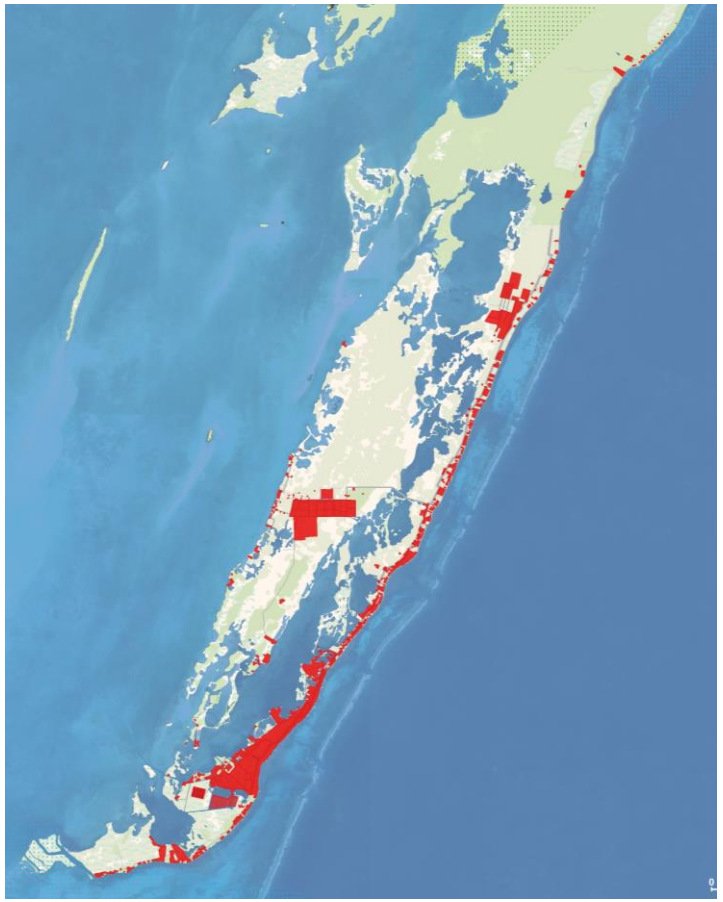
By considering a systemic view of the impacts, the analysis has become more complex, requiring the generation of analyses of different variables (Dynamic Simulation Models).

It should not be forgotten that **the carrying capacity should provide information for decision making.**
The key is to maintain a **practical approach, since it is a tool that must be functional and upgradeable.**

The analysis of carrying capacity must be related to management tools, investment and territorial planning.

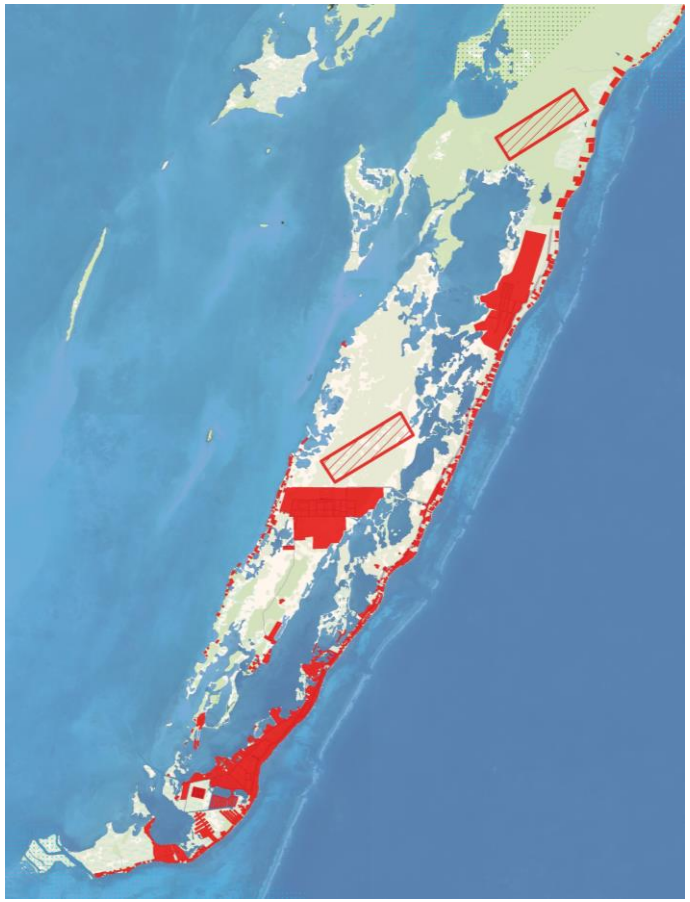
SCENARIO 1 – TREND DEVELOPMENT

Current model



1.795 acres (726 ha)
7,3 dw/ha (gross)
Green area 0,8 sqm/inhab
12.800 inhab flood area

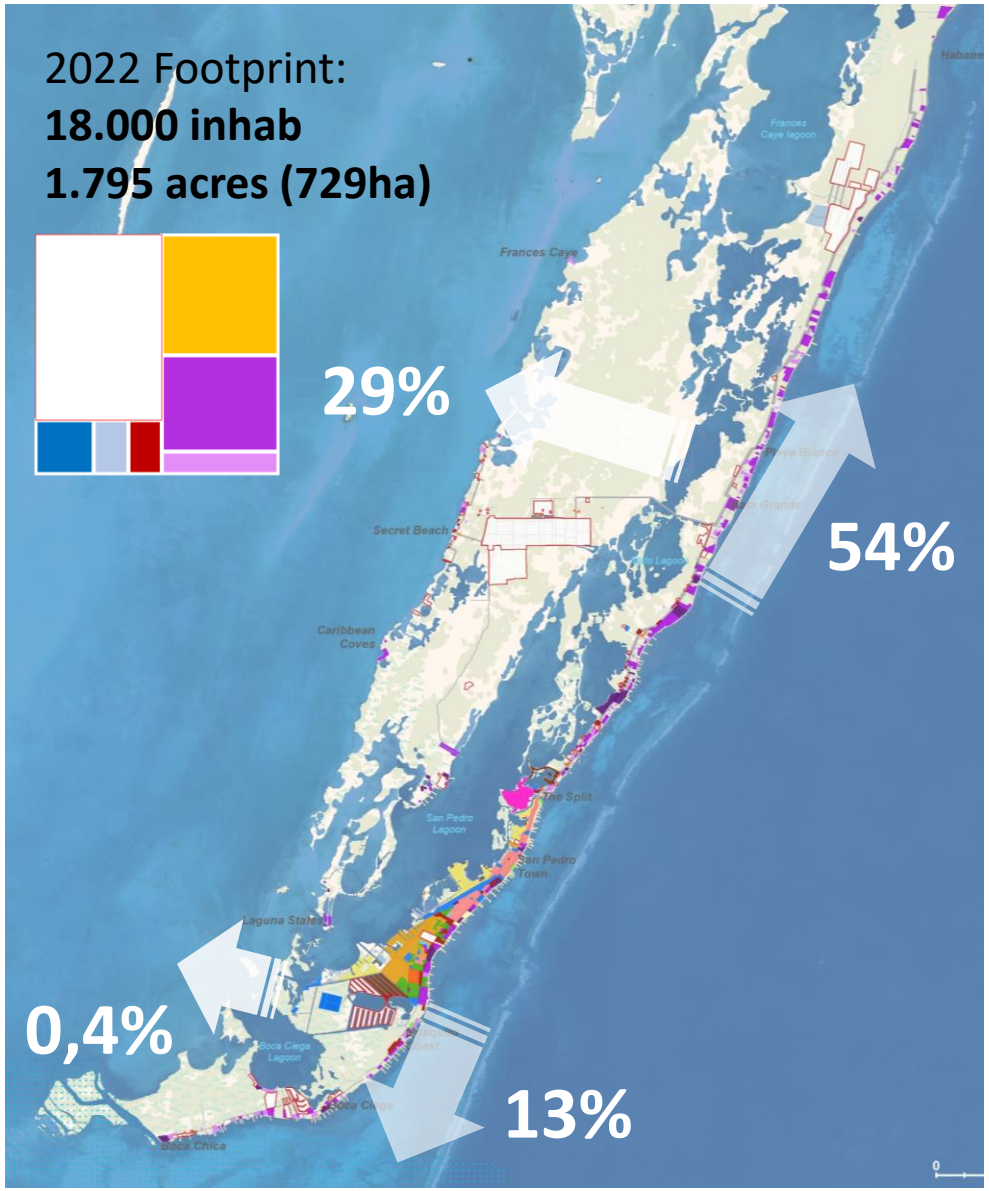
Trend development



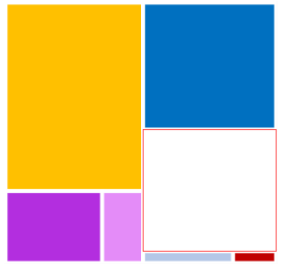
3.737 acres (1.510 ha)
9 dw/ha (gross)
Green area 0,4 sqm/inhab
20.000 inhab flood area

PROSPECTIVE POPULATION & URBAN FOOTPRINT

SCENARIO 1 – TREND DEVELOPMENT

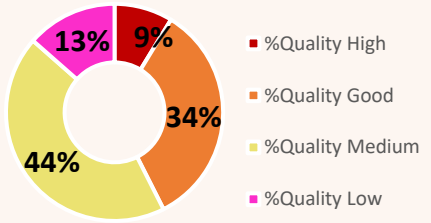


Theoric Land request
2022-2045:
12.600 inhab
2.124 acres (859ha)



782 acres (316 ha)

8.300 new dwellings
33% consolidation
5% vacational villas
62% vacant & new land



508 acres (206 ha)

1 new airport
1 new hospital
1 new school

Warehousing
33 acres (13 ha)

486 acres (197 ha)

Under development land

Mix-use
16 acres (6 ha)

210 (85)

49 new hotels/resorts

380 new vacational villas
89 acres (36 ha)

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F/ 968.21.22.31

07003 PALMA DE MALLORCA
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F/ 971.71.93.45

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F/ 943.39.08.45

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