Sustainable Infrastructure Programme in Asia

Incorporating Green Strategies Towards Sustainable Infrastructure Planning and Development: Mainstreaming Nature-based Solutions and Spatial Planning for a Resilient Butuan City

Supported by:

on the basis of a decision
by the German Bundestag

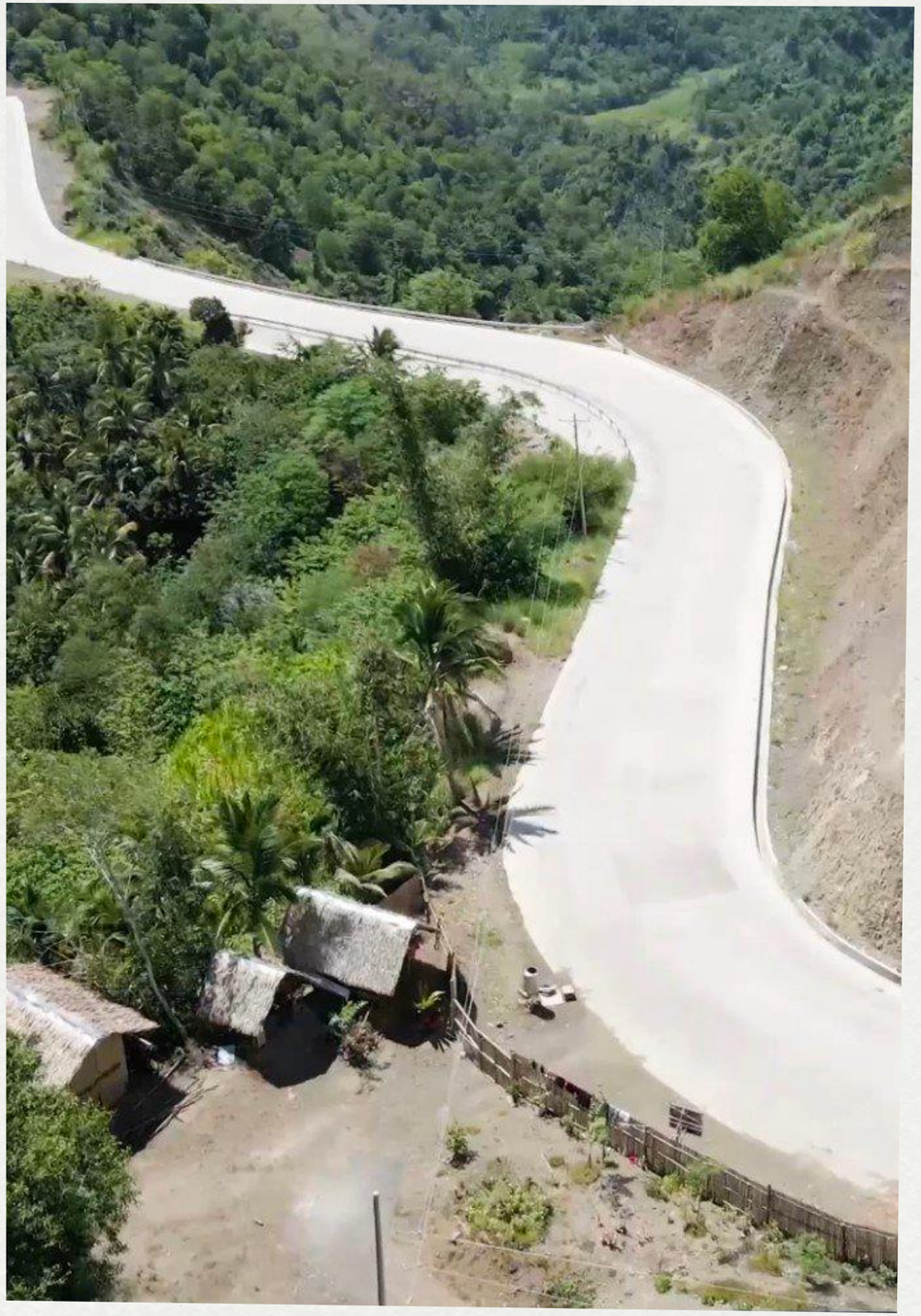
SUSTAINABLE INFRASTRUCTURE PROGRAMME IN ASIA (SIPA)

The initiative aimed to mainstream Nature-based Solutions (NbS) in infrastructure planning across the Philippines, using Butuan City, Agusan del Norte, as a case study to demonstrate its feasibility.

Incorporating Green Strategies towards Sustainable Infrastructure Planning and Development

RATIONALE

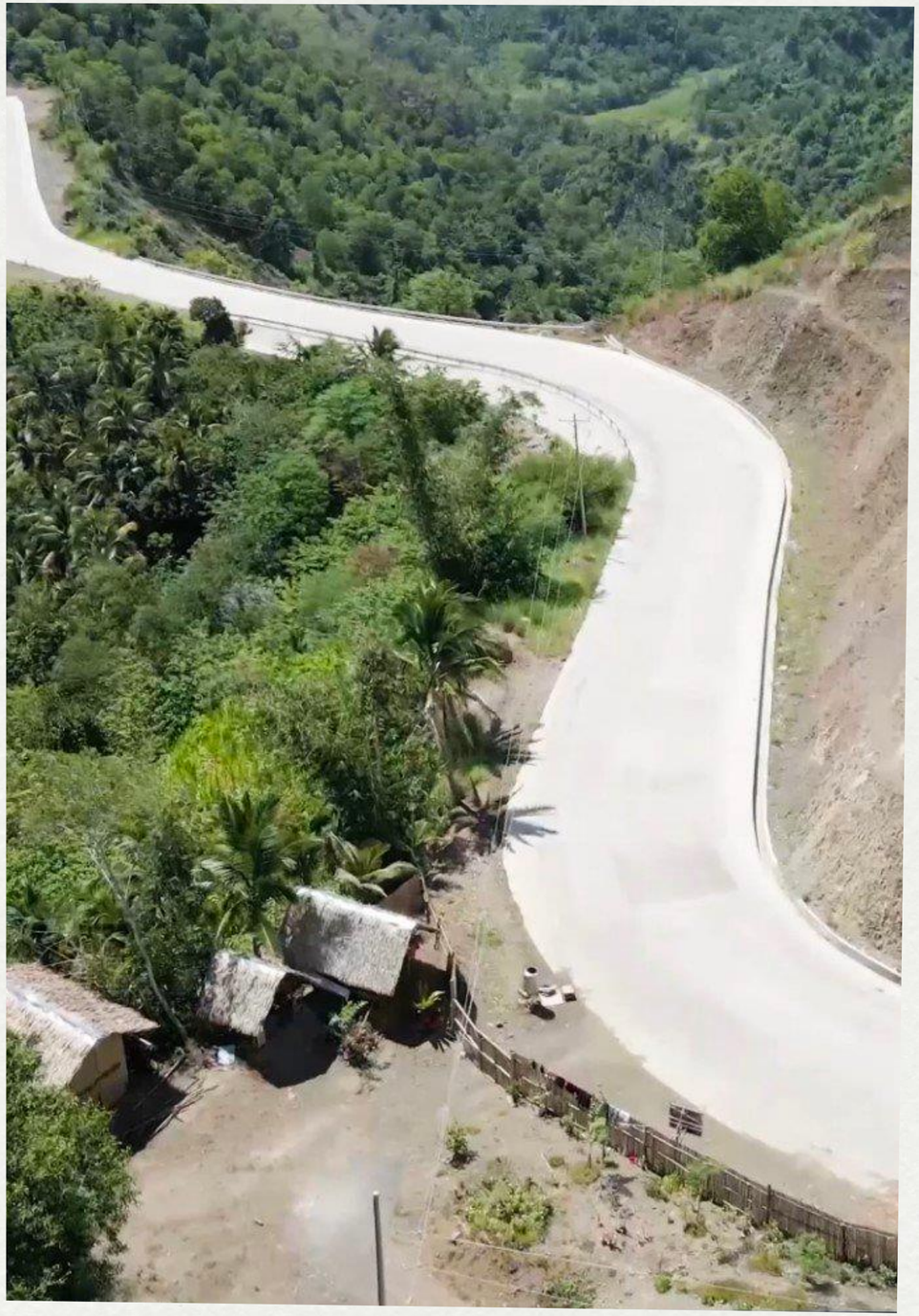
- **Infrastructure development, particularly the hard ones, often led to:**
  - Alteration of natural habitats and socio-ecological production landscapes and seascapes (SEPLS)
  - Habitat fragmentation and biodiversity loss (Bliss-Ketchum, 2019; Tian et al., 2020).
  - Exposure to agricultural crops to pests and diseases (Satoyama Initiative, 2010).



Incorporating Green Strategies towards Sustainable Infrastructure Planning and Development

RATIONALE

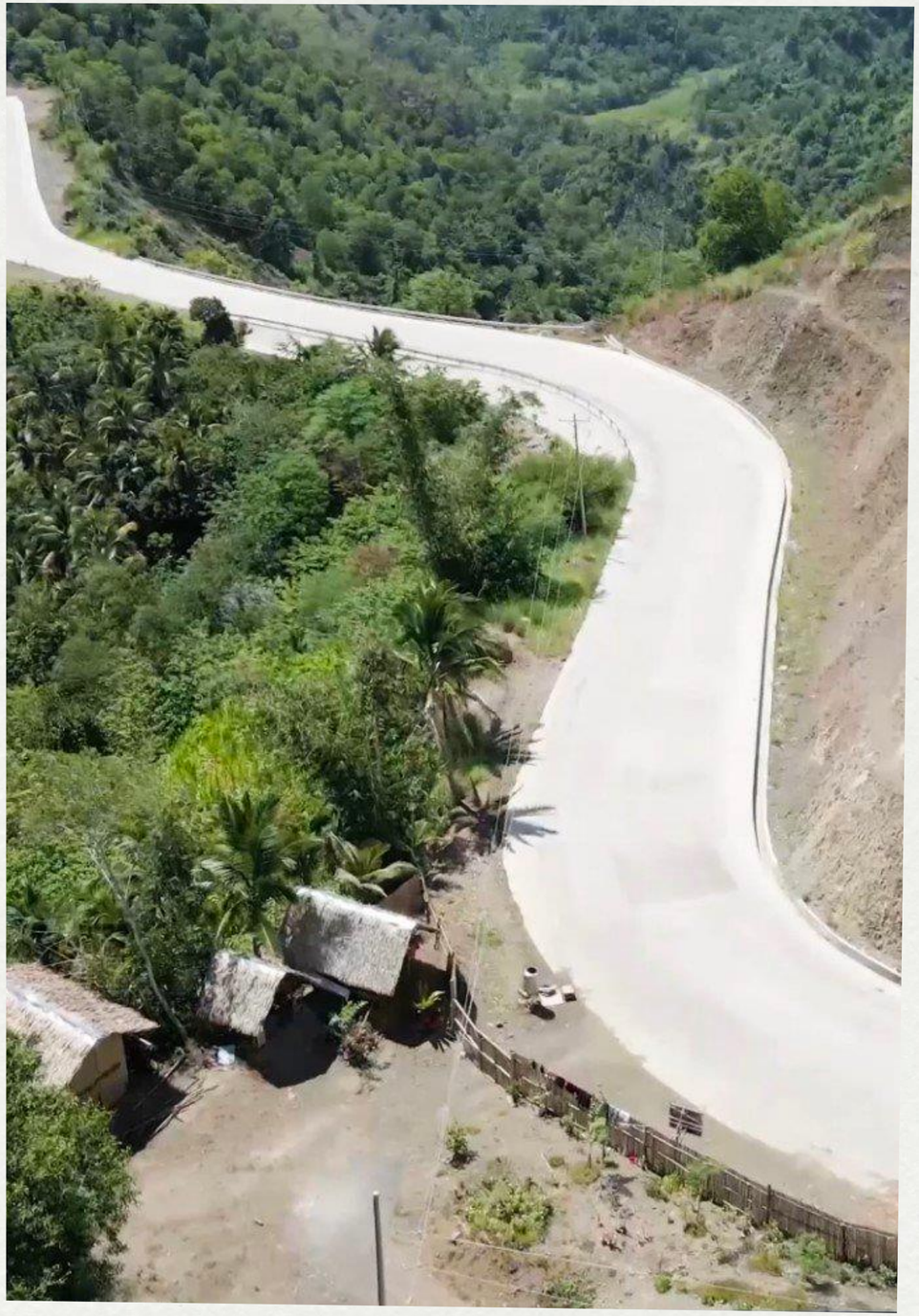
- **Infrastructures are essential inputs to economic development.**
  - directly affect the flow of goods and services in an economy.
  - Impacts logistics
  - Facilitates the mobility of human capital (Vagliasindi, 2022)
  - Eventually lead to large positive effects on the return to private investments (Aschauer, 1989, as cited in the Penn Wharton Budget Model, 2018).



Incorporating Green Strategies towards Sustainable Infrastructure Planning and Development

RATIONALE

- **Improves overall economic efficiency**
  - a top policy choice to develop the economic conditions in many countries (Adler, et al., 2020).
  - Build-Build-Build and Buildi-Better-More programs
  - Mindful mainstreaming of climate change adaptation and disaster risk reduction
  - CARBON-INTENSIVE INFRASTRUCTURE DEVELOPMENT - as it released approximately 60% of greenhouse gas emissions.

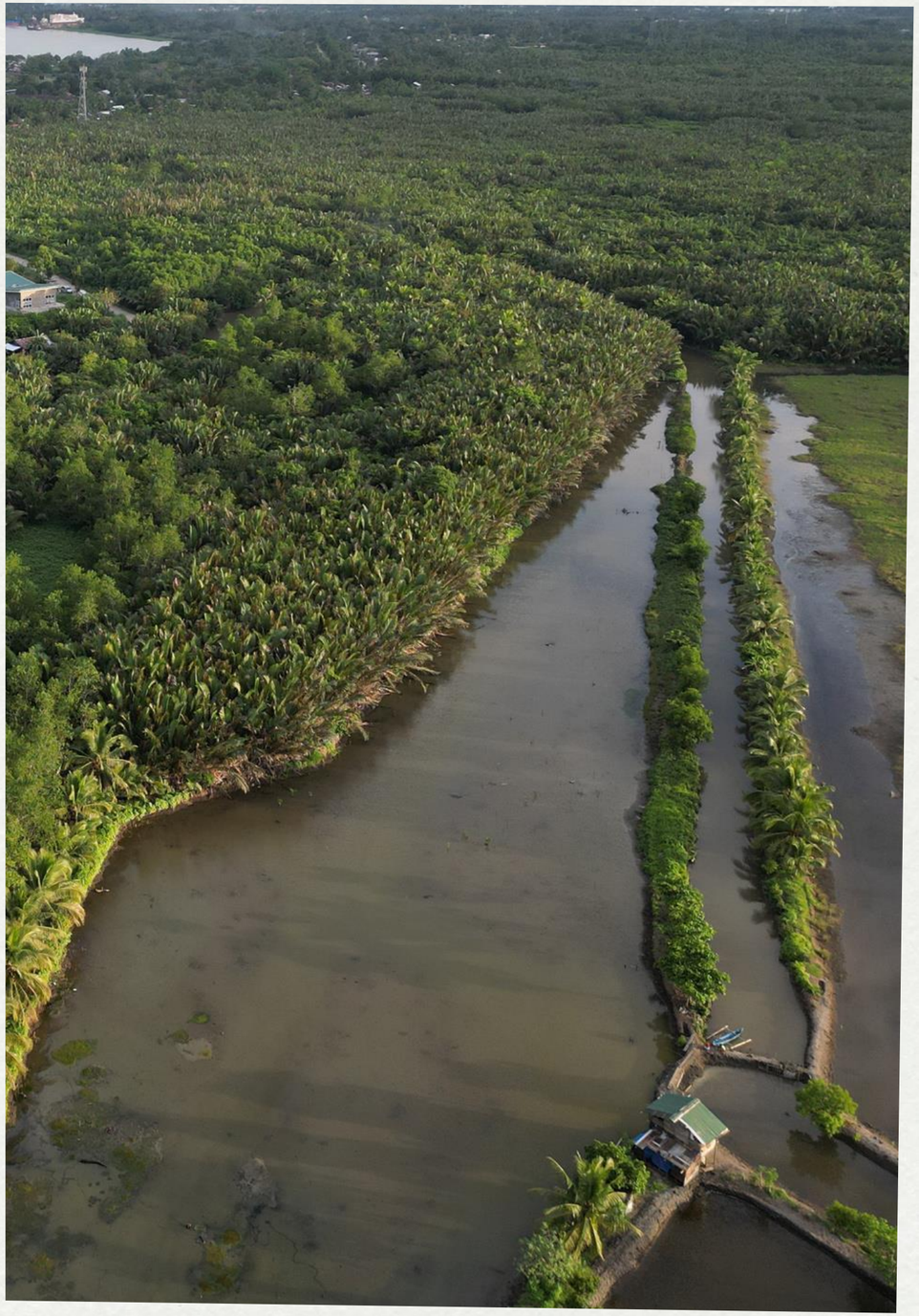


Incorporating Green Strategies towards Sustainable Infrastructure Planning and Development

RATIONALE

- **Nature-based Solutions (NbS) could be the strategy to address the challenges in achieving sustainable development.**


11
SUSTAINABLE CITIES
AND COMMUNITIES

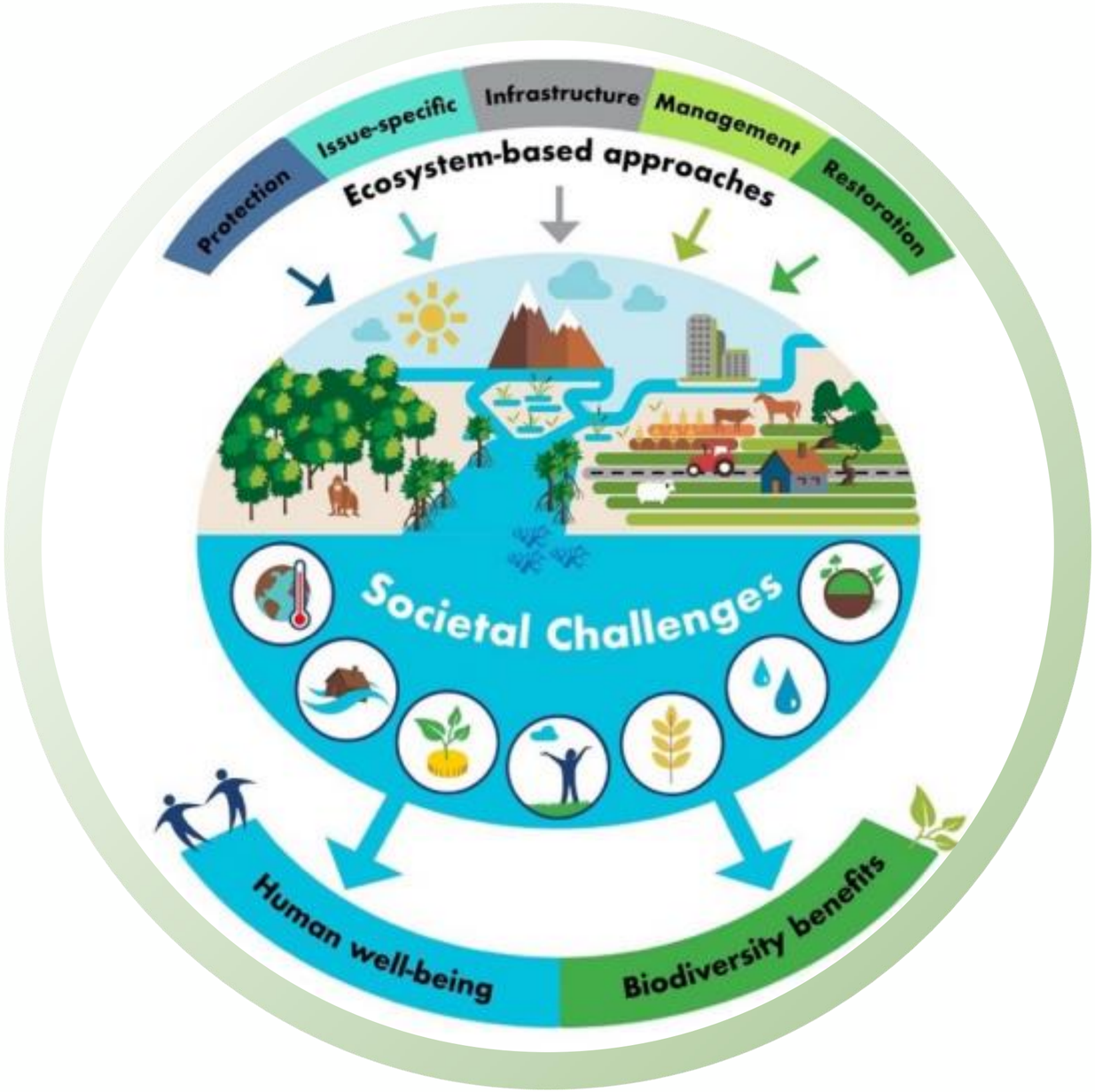


What is a Nature-based Solution?

A NbS is a solution to “address societal challenges through actions to protect, sustainably manage, and restore natural and modified ecosystems, benefiting people and nature at the same time”.

The IUCN NbS Framework

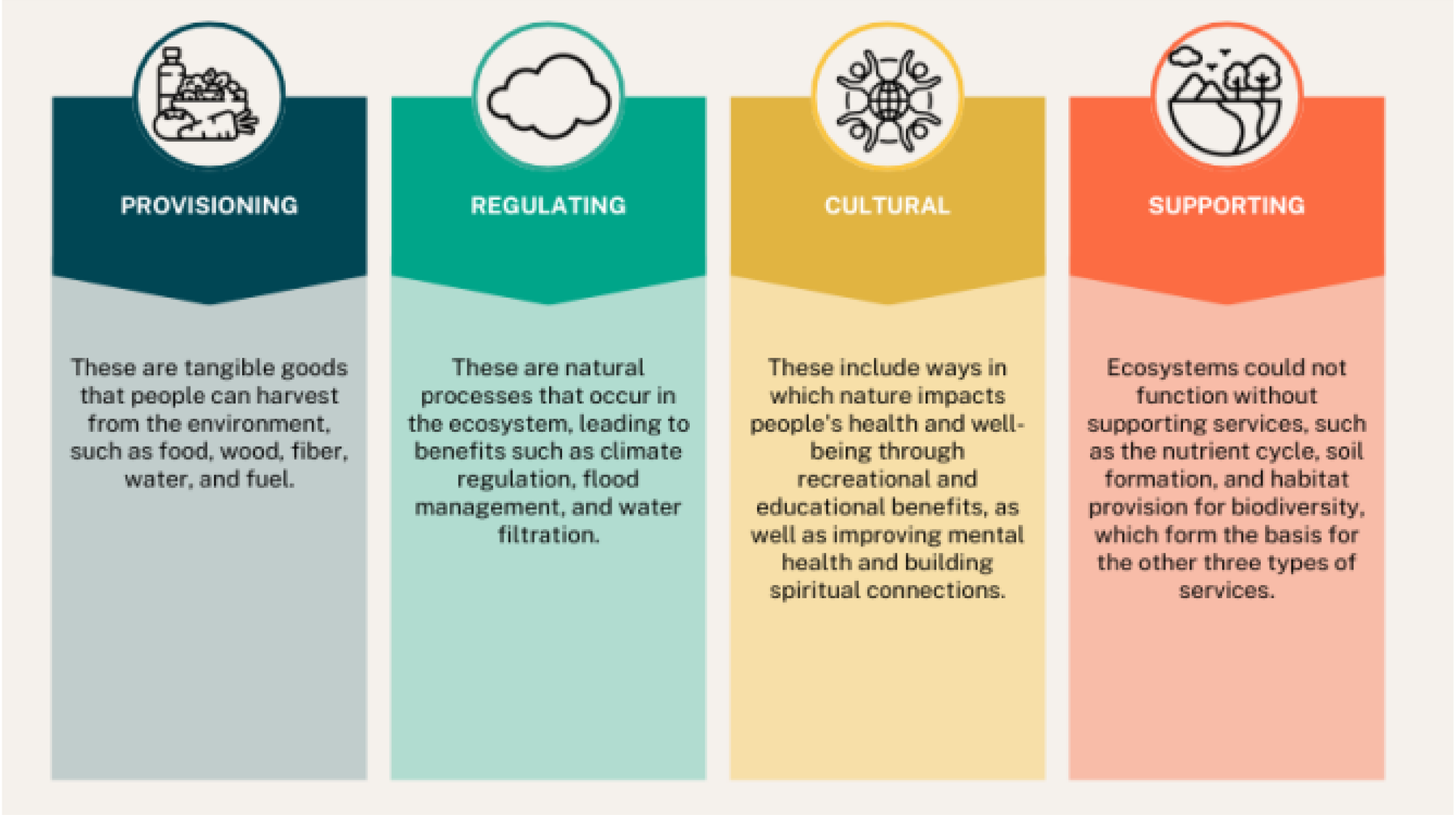
NbS can help **solve societal challenges through the protection, sustainable management, and restoration of ecosystems.**



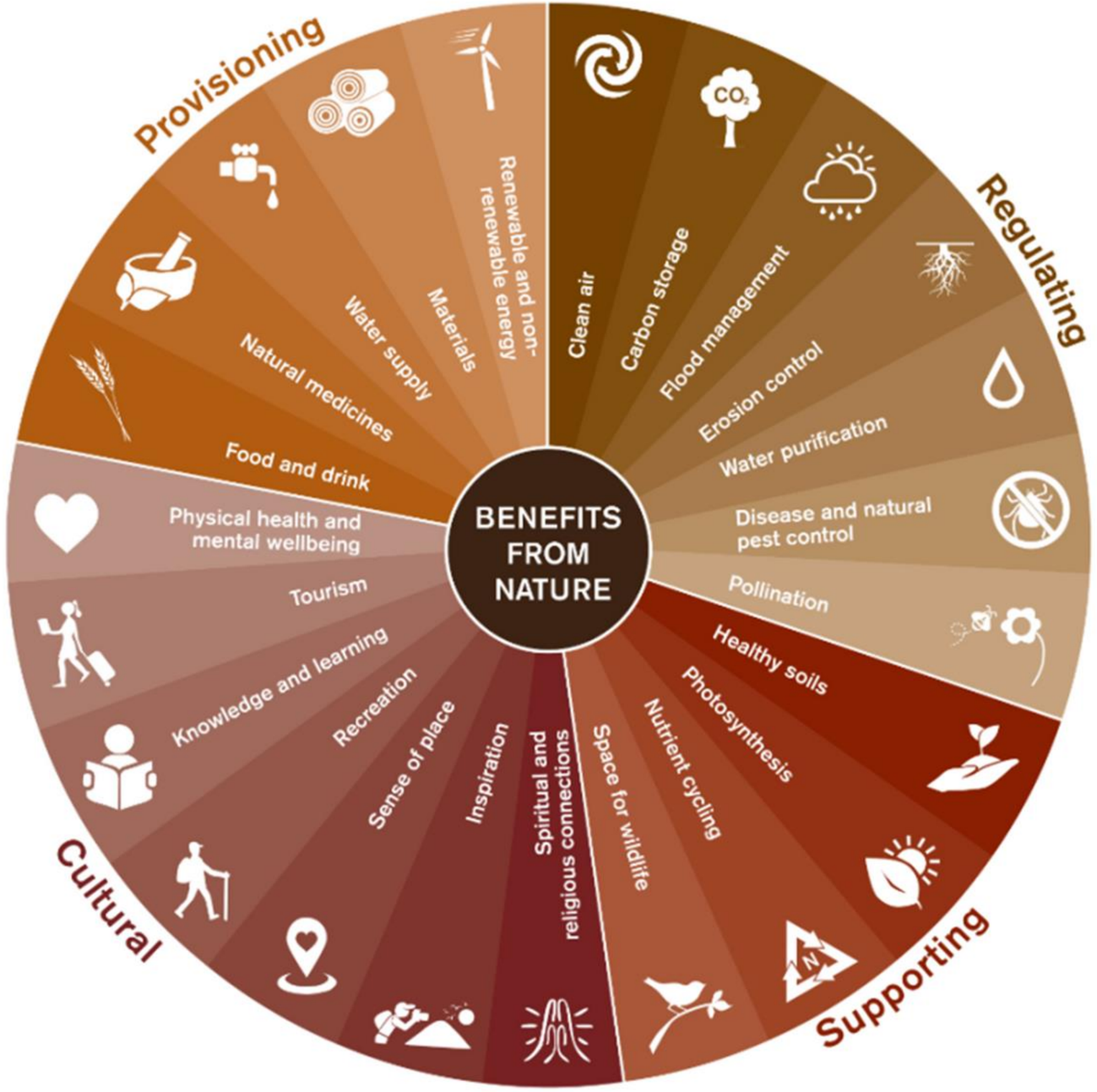
Seven societal challenges that NbS addresses

1. Climate change mitigation and adaptation
2. Disaster Risk Reduction
3. Economic and social development
4. Human health
5. Food security
6. Water security
7. Environmental degradation and biodiversity loss

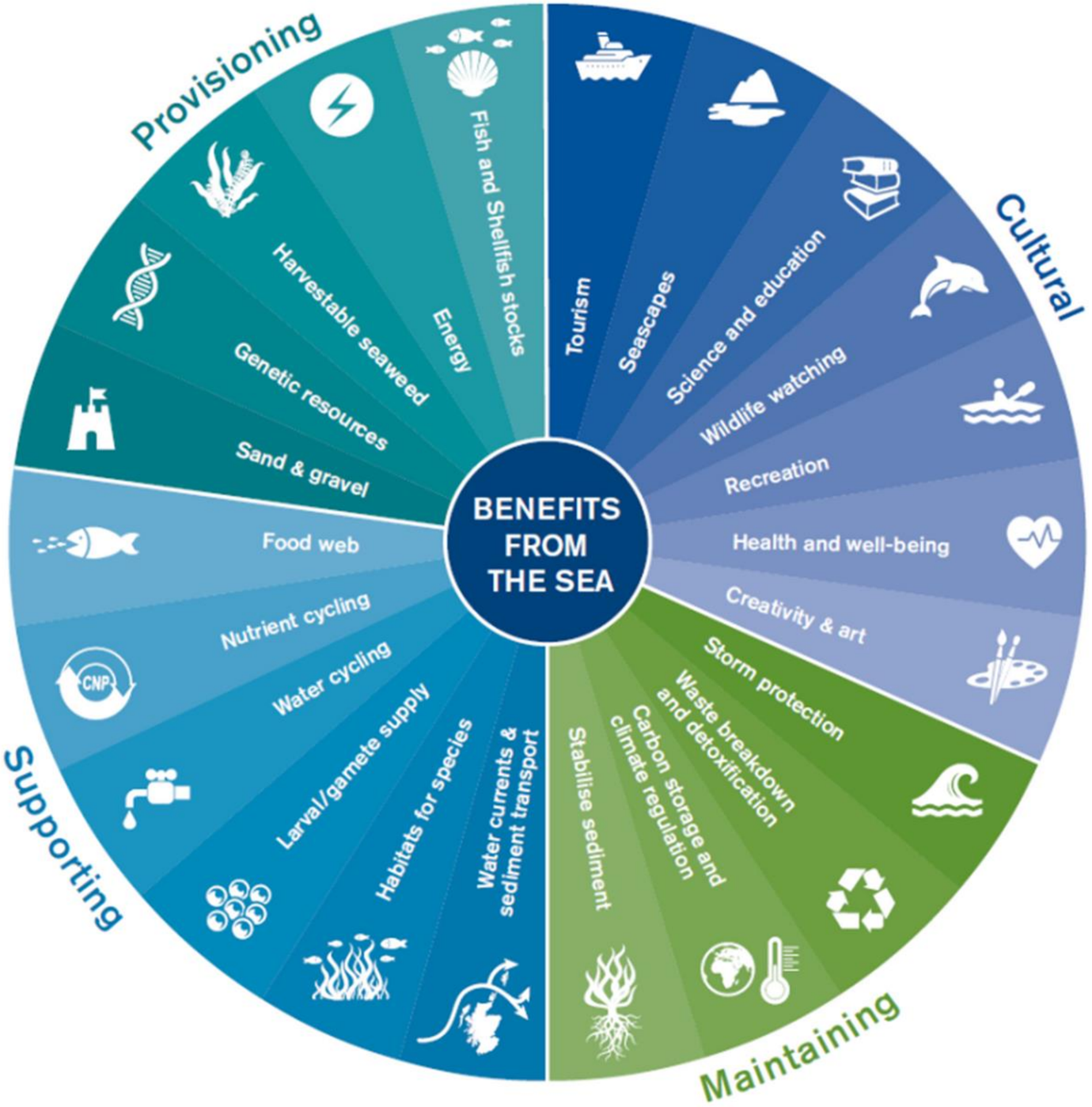
CATEGORIES OF ECOSYSTEM SERVICES



Source: NaturScot



Source: NatureScot



Source: NatureScot

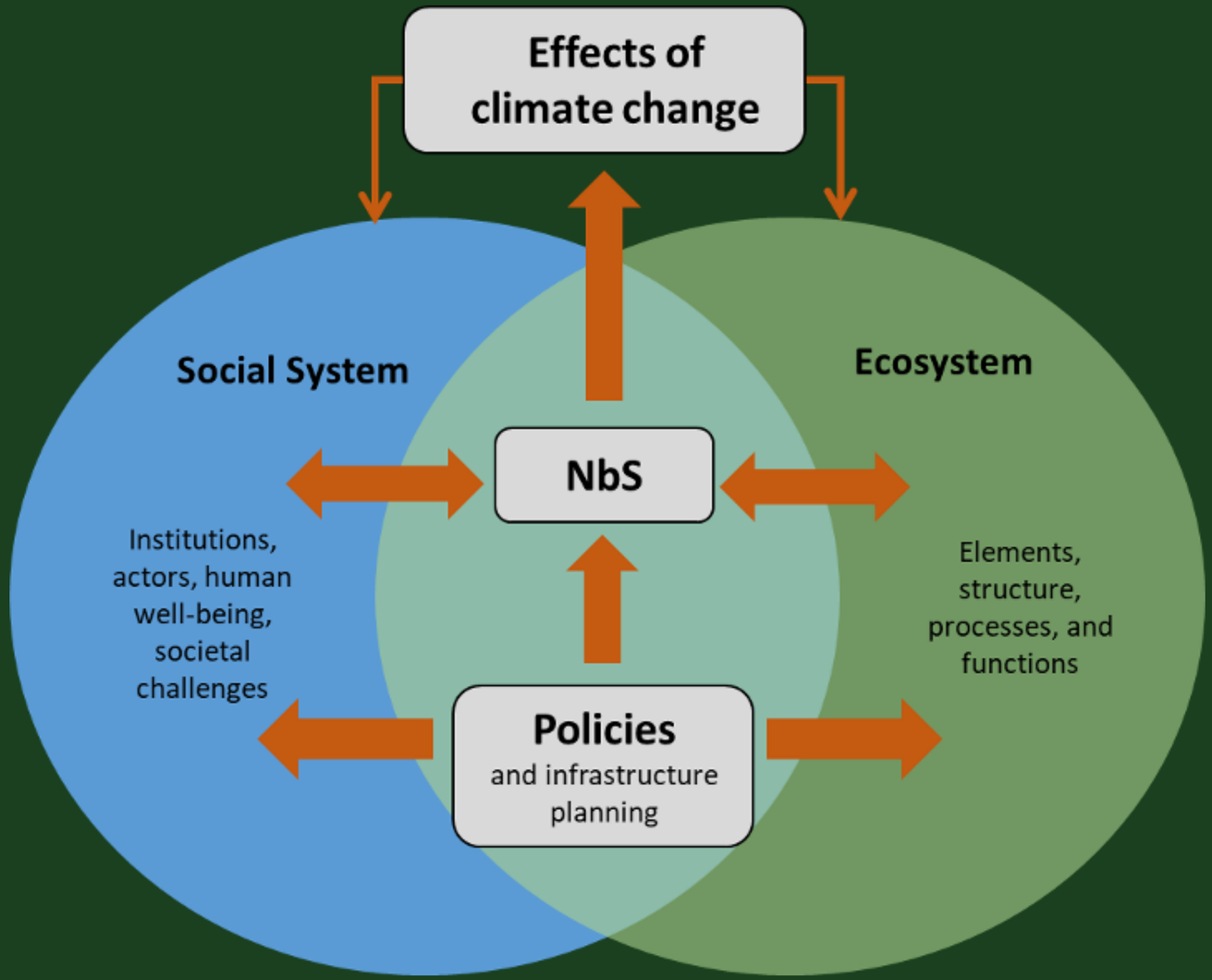
Incorporating Green Strategies towards Sustainable Infrastructure Planning and Development

OBJECTIVE: This project aims to mainstream Nature-Based solutions in infrastructure planning in the Philippines, particularly, Butuan City, Agusan Del Norte

Expected Outputs:

- **Training Manual and Guidelines** on Mainstreaming NbS to help decision-makers in determining appropriate nature-based solutions for linear infrastructure planning that can maintain or even enhance biodiversity and ecosystem services;
- Develop **a model to mainstream nature-based solutions** for sustainable and strategic linear infrastructure in Butuan City (Decision-Support).

CONCEPTUAL FRAMEWORK



Objectives - Data - Analysis Matrix

Objectives	Sources of Data	Analytical Method/Tools
1. Identify provisions in Philippine policy frameworks, from local to national legislation, that enable and/or mandate infrastructure planning, disaster risk reduction management, and environmental projects;	National Policies Butuan City Resolutions and Ordinances	Policy and Institutional Analytic Process Stakeholder analysis
2. Assess the condition of important social and ecological landscapes and seascapes in the context of local and national development plans;	Key Informant Interviews Focus Group Discussions Butuan City Local Plans (CLUP, FLUP, LCCAP, DRRM Plan)	Socio-Ecological Assessment (including Identification of Ecosystem Services) Cultural Consensus Analysis
3. Examine the interaction of climate-related hazards with socio-ecological factors in existing and planned infrastructure areas;	Key Informant Interviews Focus Group Discussions Butuan City Local Plans (CLUP, FLUP, LCCAP, DRRM Plan)	Socio-Ecological Assessment Risk Assessment
4. Analyze the impacts of climate change as key drivers for risks;	Key Informant Interviews Focus Group Discussions Butuan City Local Plans (CLUP, FLUP, LCCAP, DRRM Plan)	Socio-Ecological Assessment Risk Assessment Impact Chain Analysis
5. Develop an algorithm/model to mainstream nature-based solutions for sustainable and strategic linear infrastructure in Butuan City; and	Government Agencies (National, Regional, Provincial) Butuan City LGU	Spatial and Attribute Analysis Quantification of Ecosystem Services (ES)

Project Site: Butuan City

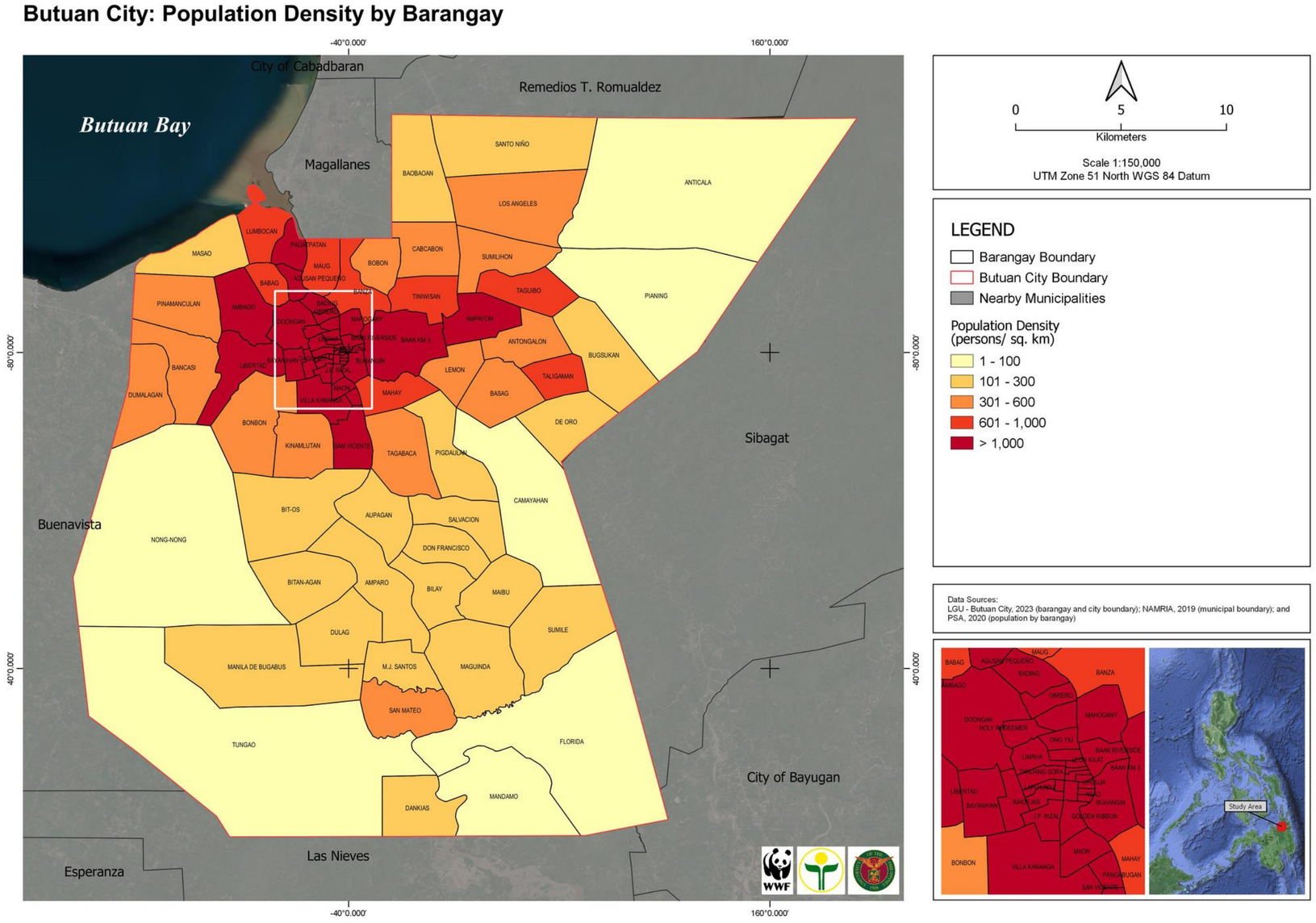
Barangays Visited:

<u>Category 1: Based on Population and Urban Development</u>

- San Vicente
- Villa Kananga
- Bancasi

<u>Category 2: Based on Land Use</u>

- Pagatpatan (Coastal/Riparian)
- Ampayon (Agricultural)
- Taguibo (Agri, Forest)
- Anticala (Forest)

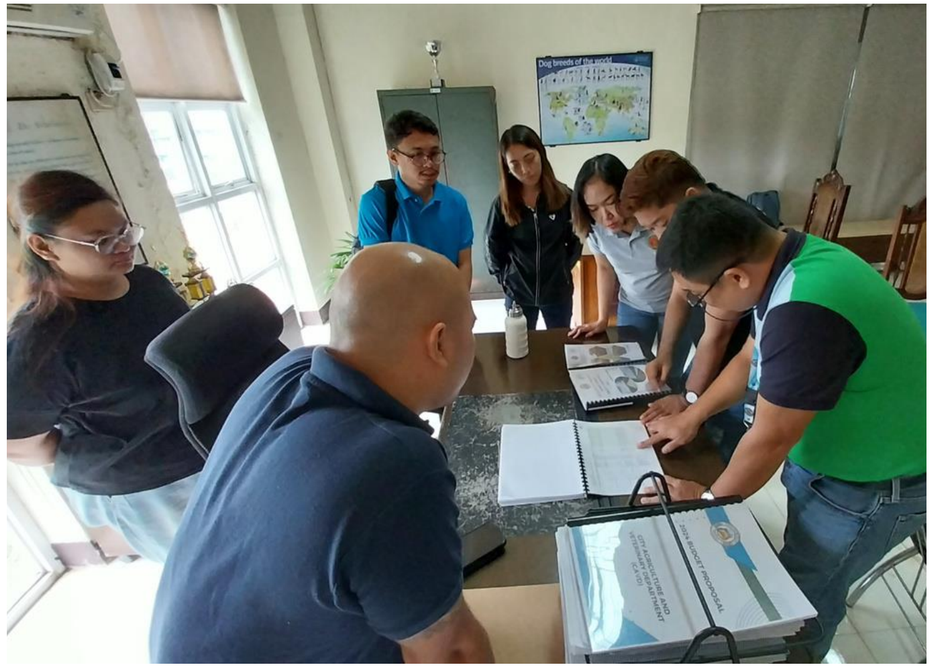


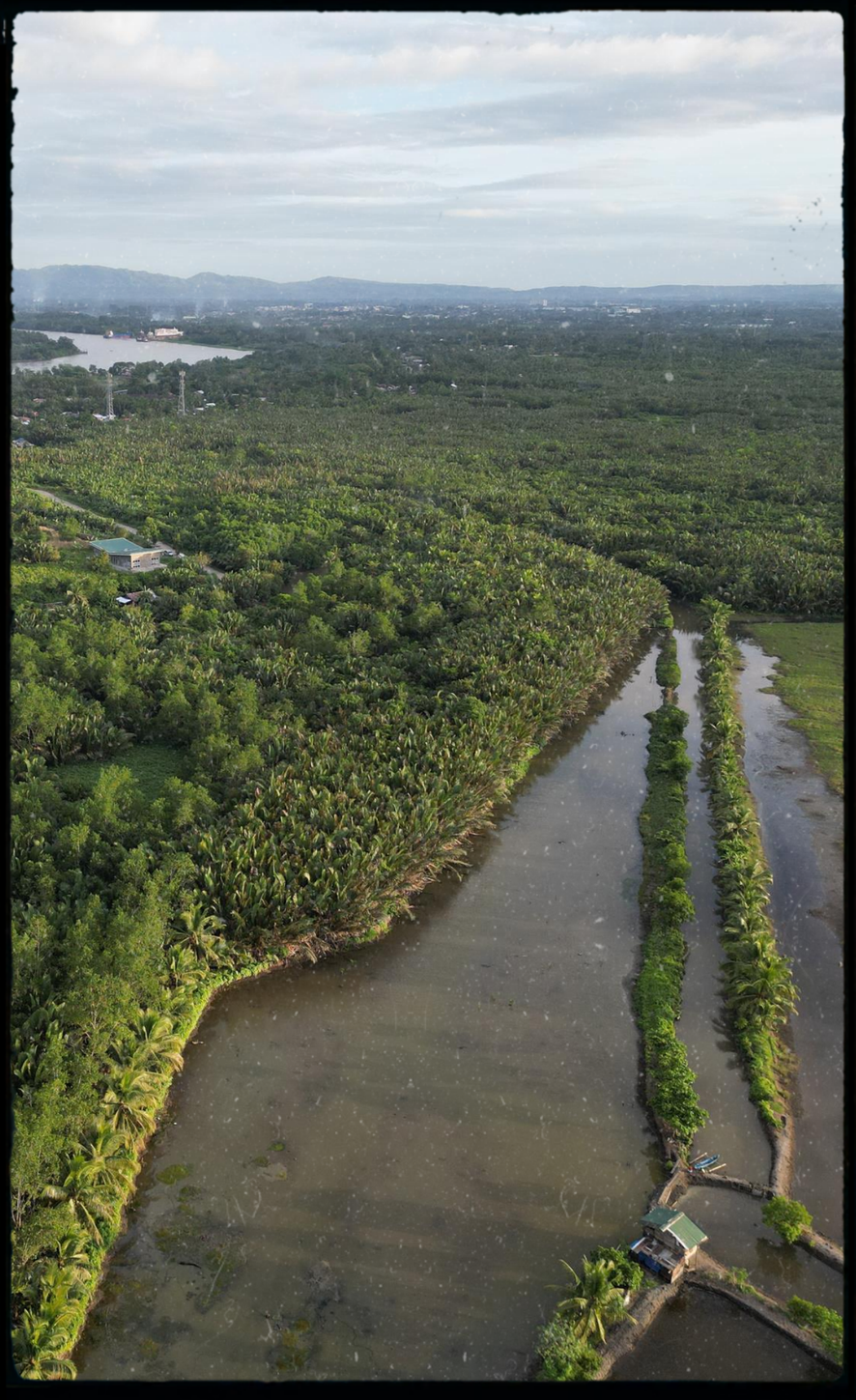

BARANGAY SAN VICENTE
VISION
A peaceful and progressive Barangay with empowered, educated, peace loving, law abiding, and God fearing citizenry living in harmony and unity.
MISSION
Effectively Implement Barangay justice system by increasing awareness and understanding in attaining Good Relationship by and between every individual in the community and improving economy by investing in education to produce professionals and entrepreneurs.


Alternative Learning System
K to 12 BEC
Learning Strands


Institute of Renewable Natural Resources
Mountains. Blue Waters. Healthy Soils.


PERFORMANCE


Dog breeds of the world



Relevant Plans and Policies

CLIMATE AND DISASTER RISK ASSESSMENT

Prepared by the City Planning and Development Office
Release Date: July 2023

BUTUAN ON
A City Ascending

BUTUAN CITY DISASTER RISK REDUCTION AND MANAGEMENT PLAN 2021-2026

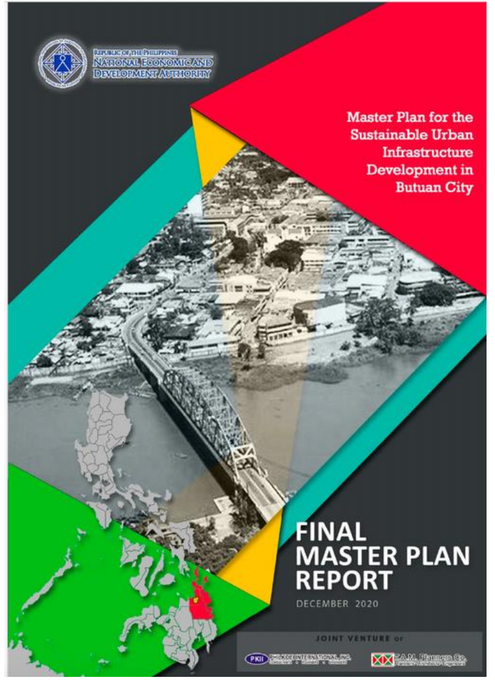
CDRRMC Proactive

BUTUAN ON
A City Ascending

BUTUAN CITY CLIMATE CHANGE ACTION PLAN 2022-2026

BUTUAN ON
A City Ascending

Master Plan for the Sustainable Urban Infrastructure Development in Butuan City

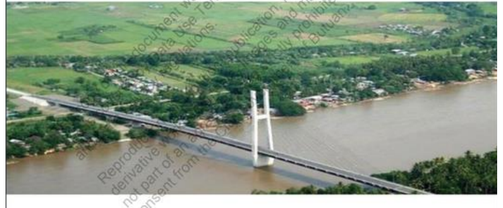


FINAL MASTER PLAN REPORT

DECEMBER 2020

JOINT VENTURE OF

Butuan City Energy Development Plan (2023-2050)



FARM TO MARKET ROAD (FMR) NETWORK DEVELOPMENT PLAN

(2020-2024)

June 2020

BUTUAN ON
A City Ascending

BUTUAN CITY IRRIGATION DEVELOPMENT PLAN

(2023-2032)

June 2022

BUTUAN ON
A City Ascending

BDC FUNCTIONALITY 2021

Cap Dev Agenda
Barangay Vision

VILLA KANANGA
BARANGAY

BUTUAN ON
A City Ascending

BARANGAY DEVELOPMENT PLAN

2023-2028

Barangay Pagapatan
Butuan City

NATIONAL POLICIES

- Climate Change Act of 2009 (RA 9729)
- Philippine Clean Air Act of 2004 (RA 8749)
- Philippine Green Building Code
- Philippine Disaster Risk Reduction and Management Act of 2010 (RA 10121)
- Fisheries Code of the Philippines (RA 8550 as amended by RA 10654)
- Environmental Impact Statement System of 1978 (PD 1586)
- Ecological Solid Waste Management Act of 2000 (RA 9003)
- NIPAS Act of 1992 (RA 7586) and E-NIPAS Act of 2018 (RA 11038)
- The Indigenous Peoples' Rights Act of 1997 (RA 8371)
- Philippine Water Code (PD 1067)
- Local Government Code of 1991 (RA 7160)
- Reorganization of Ministry of Public Works and highways, redefining its powers and functions (EO 124 s. 1987)
- Philippine Clean Water Act of 2004 (RA 9275)
- Philippine Building Code (PD 1096)
- **Philippine Ecosystem and Natural Capital Accounting System (PENCAS) law (RA 11995**

DEPARTMENT ORDERS

- Mandatory Tree Planting as Part of the Environmental Sustainability Program for DPWH Flood Control Projects. (DO 238 s. 2022)
- Implementation of the Social and Environmental Management System Operations Manual (DO 159 s. 2022)
- Environmental Impact Assessment (EIA) for DPWH Projects and Tree Cutting Permit Application (DO 57 s. 2016)
- Creation of the Social and Environmental Management Executive Committee (SEMEC) (DO 268 s. 2003)
- Creation of Regional Environmental Impact Assessment Offices (REIAOs) (DO 224 s. 2003)
- EIAPO to ESSO (DO 220 s. 1999 and DO 58 s. 2004)

LOCAL ORDINANCES

EWSM RELATED ORDINANCES

- EO No. 191 Series of 2016 Waste Segregation at Source
- EO No. 23 Series of 2017 (Reconstitutions on ESWM Board)
- SP Ordinance No. 5334-2017 Regulation of Plastics and Plastic By-Products
- SP Ordinance No. 4629-2015 Establishment of Septage Management System
- SP Ordinance No. 5445-2017 Penalties for illegal dumping of hazardous wastes.
- SP Ordinance No. 3589-2010 Adoption of the Butuan City SWM Code
- SP Ordinance No. 3623-2010 Sanitation Code
- EO No. 161 Series of 2007 Establish Residual Waste Collection Points

ENVIRONMENTAL PROTECTION RELATED ORDINANCES

- SP Ordinance No. 3617-2010 Establishment of Butuan City Environment Code of 2010
- SP Ordinance No. 3928-2012 Protection, Conservation, Rehabilitation, and Management of Watersheds

INFRASTRUCTURE RELATED ORDINANCES

?

Institutional Actors and Stakeholders

Initial Findings - Stakeholder Analysis

National Government Agencies (DPWH, DPWH Regional Planning & Design Division, DPWH Highway Section, DENR, DENR Office of the Assistant Secretary for Policy, Planning, and Foreign Assisted and Special Projects, DENR-EMB, DENR Planning & Management Division, DENR PENRO, DENR CENRO, NEDA, NEDA IS, NEDA RDC, DA, DA RAED, DA RPCO, DHSUD, DOST, DOST PAGASA, NCIP, DILG, AFP, DND-OCD

Initial Findings - Stakeholder Analysis

Local Government Unit: Provincial Level (Agusan del Norte) (PG, PGSP, PPDO, PG ENRO, PDRRMO, PEO, PAO,

Local Government Unit: City Level (City Government of Butuan) (OCM, CENRD, CDRRMD, CED, CAVD, IPMR, Barangays)

Initial Findings - Stakeholder Analysis

Educational Institutions (CarSU, FSUU)

Non-Government Organizations (NGOs) and Civil Society Organizations (CSOs) (WWF,PRC, FGSCBI, Farmers, Fisherfolks, Youth, Women, Senior Citizens)

Private and Business Sectors (BCWD, TASC, ANECO, Telecommunication Companies, Contractors)

Roles

ROLES	BRIEF DESCRIPTION
Funding (Fund Source)	Origin of funds for project implementation. Funds may come from private and public entities, as well as international financing organizations (i.e., World Bank, JICA).
Planning and design	Strategies and step-by-step action plans related to infrastructure development goal.
Regulation	Issuance of permits and other fees. Control and supervision based on existing national and local policies.
Implementation	Actual construction and execution of infrastructure projects

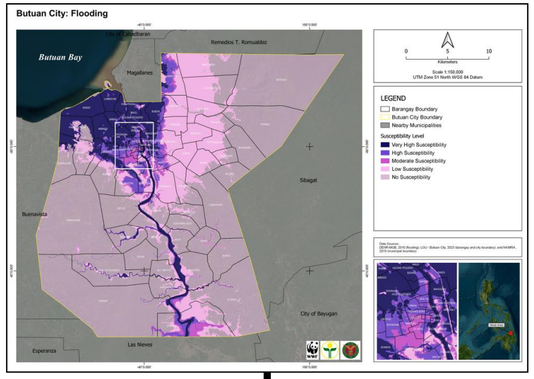
Roles

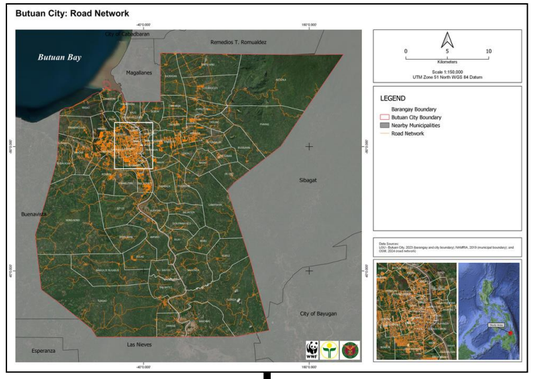
ROLES	BRIEF DESCRIPTION
Monitoring and Evaluation	post implementation activities, in understanding the project input-output-outcome.
Data generation	Collection of baseline information (quantitative and qualitative) to support the project design and implementation.
Others	Security (because of insurgency), others

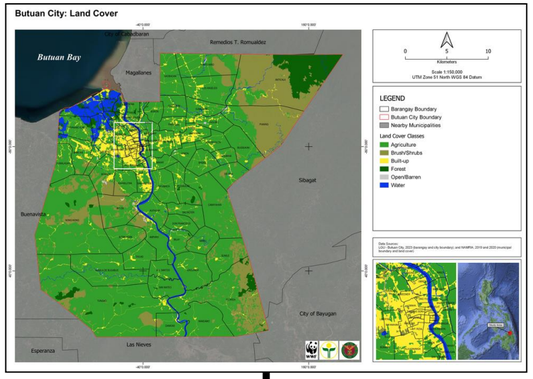
Hazard Mapping

RISK ASSESSMENT

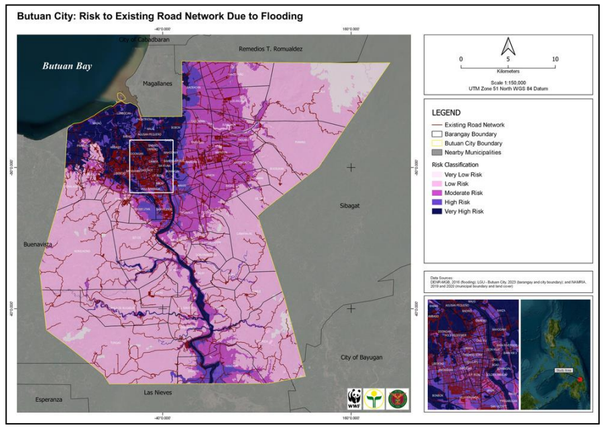
HEV Matching. Part of the risk mapping is the Hazard-Exposure-Vulnerability (HEV) matching. This process was conducted to determine the variables to be combined in generating risk maps.







Risk Mapping. Both hazard and vulnerability variables will be classified into 5 major classes (very low, low, moderate, high, and very high) using the defined interval classification process in QGIS.



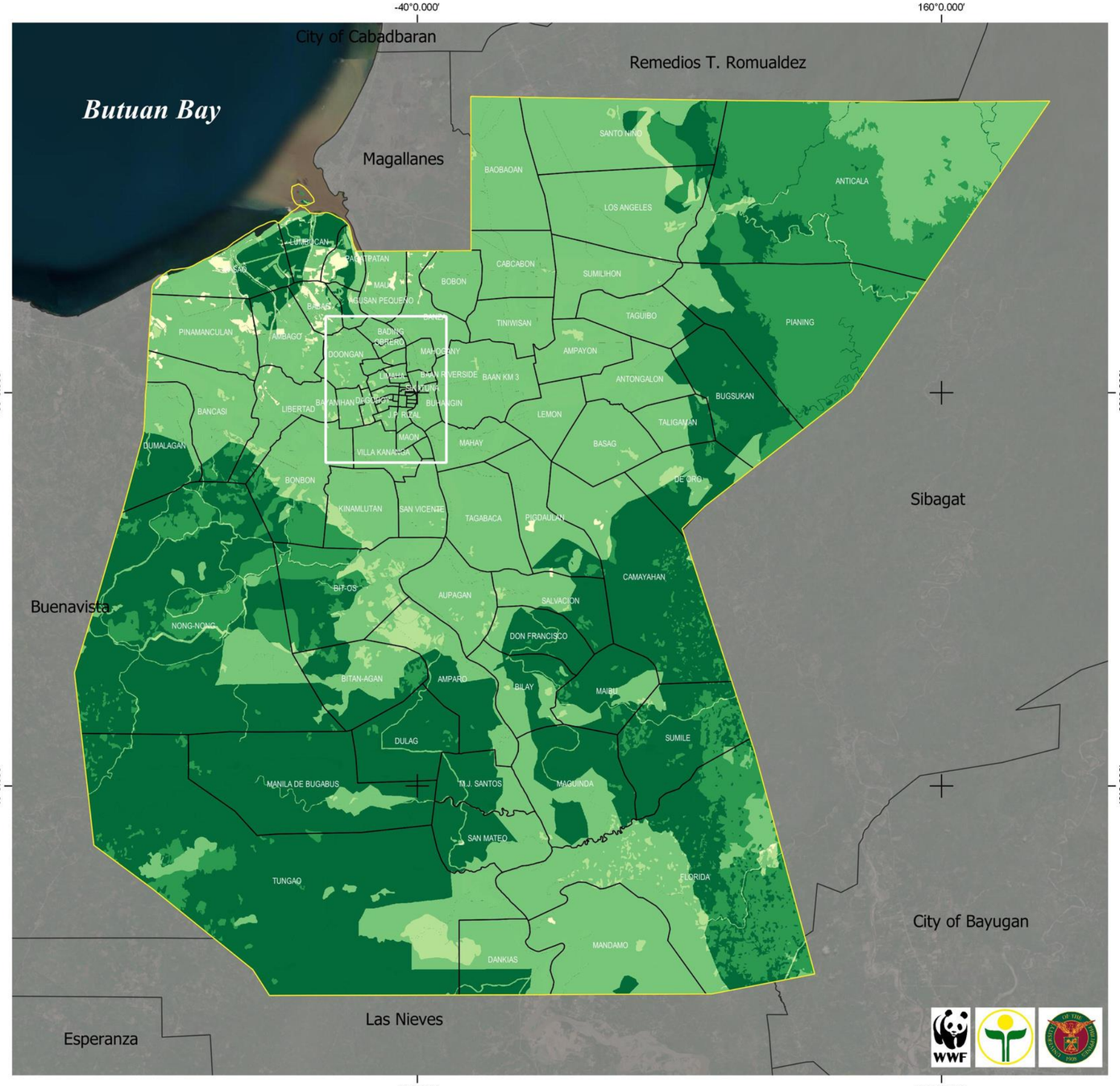
Maps of Priority Ecosystem Services

Carbon sequestration

The amount of carbon sequestered over time.

Source: InVEST: Integrated Valuation of Ecosystem Services and Tradeoffs¶

Butuan City: Carbon Storage Difference



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Kilometers

Scale 1:150,000

UTM Zone 51 North WGS 84 Datum

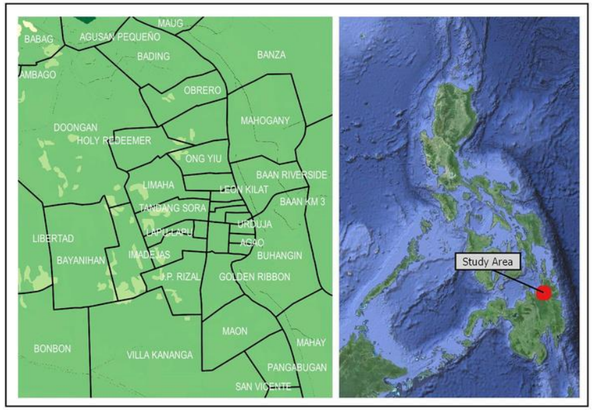
LEGEND

- Barangay Boundary
- Butuan City Boundary
- Nearby Municipalities

Carbon Stored Difference (metric tons per pixel)

- -1.25
- -0.62
- 0.00
- 0.62
- 1.25

Data Sources:
LGU - Butuan City, 2023 (barangay and city boundary); and NAMRIA, 2019 (municipal boundary)



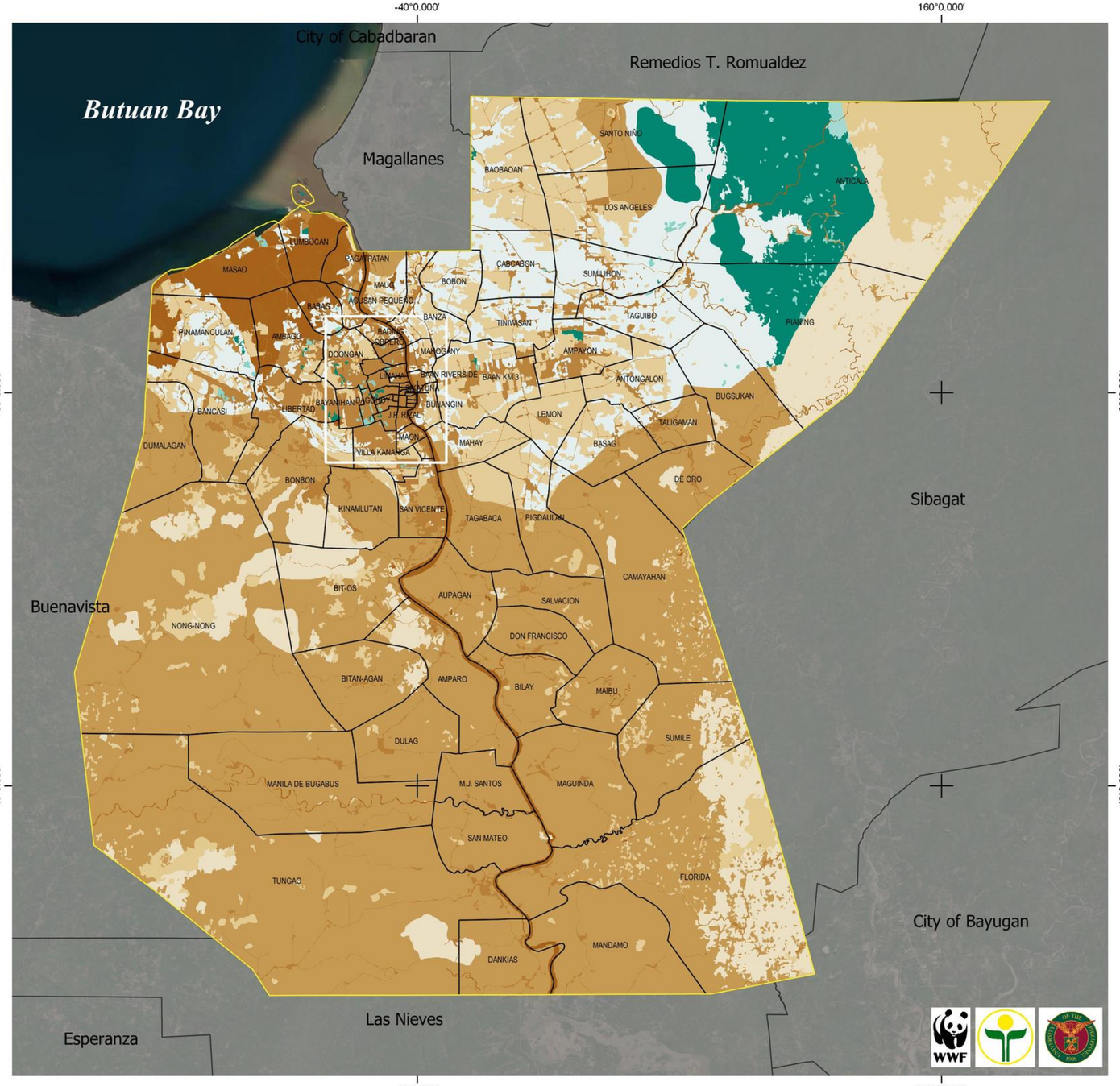
Urban Flood Risk Mitigation

The reduction of runoff production, slowing surface flows, and creation of space for water through natural infrastructure

Runoff retained (in mm)

Source: InVEST: Integrated Valuation of Ecosystem Services and Tradeoffs¶

Butuan City: Urban Flood Risk Mitigation



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Kilometers

Scale 1:150,000
UTM Zone 51 North WGS 84 Datum

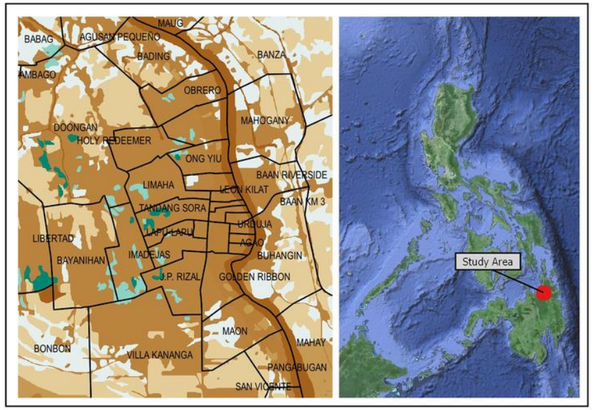
LEGEND

- Barangay Boundary
- Butuan City Boundary
- Nearby Municipalities

Runoff Retention (cubic meter)

- 0.07
- 1.63
- 3.18
- 4.74
- 6.29

Data Sources:
LGU - Butuan City, 2023 (barangay and city boundary); and NAMRIA, 2019 (municipal boundary)



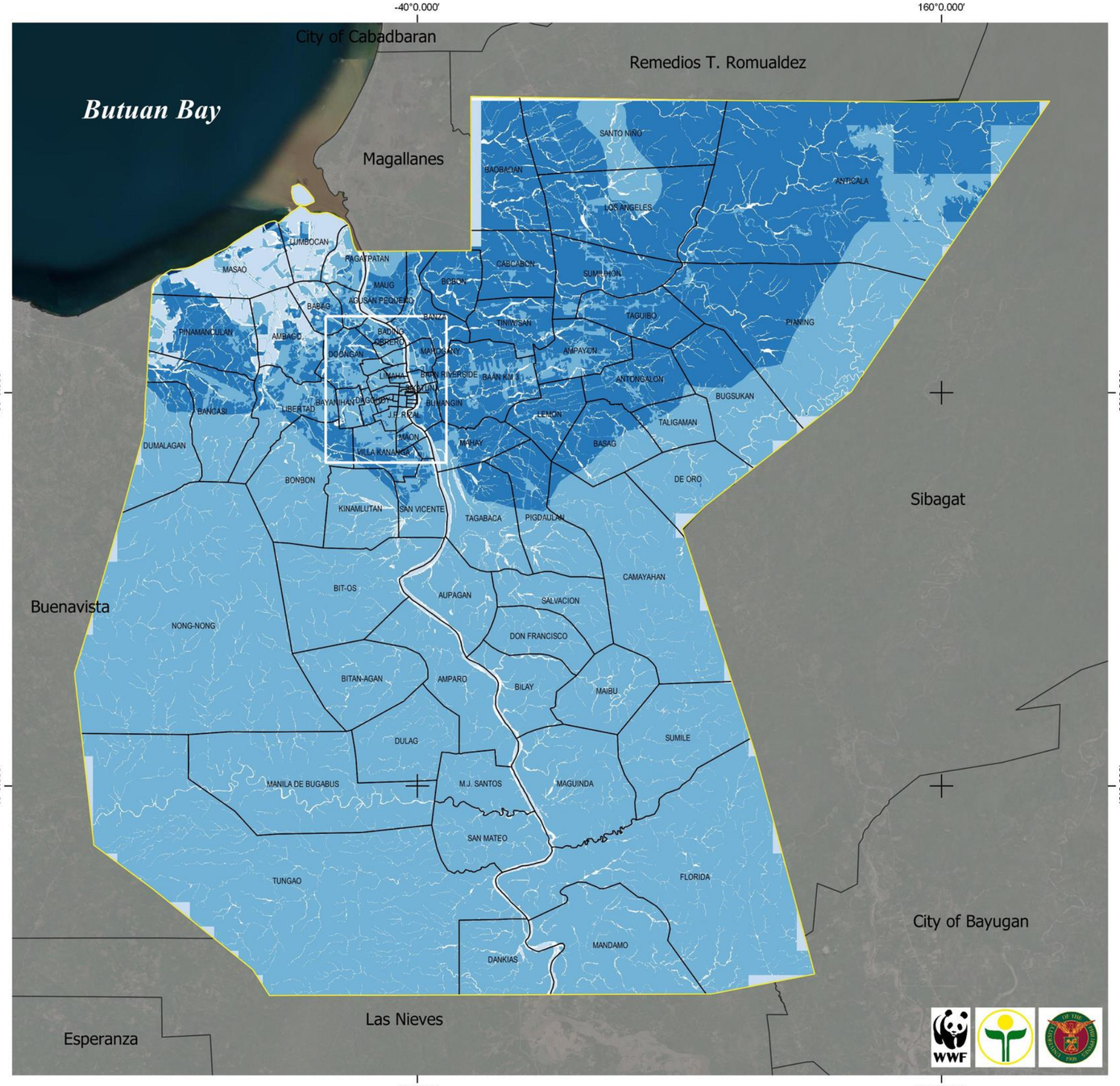
Seasonal water yield

Recharge contribution: Values of recharge to the total recharge.

Baseflow (to follow): Water that reaches the stream during dry season.

Source: InVEST: Integrated Valuation of Ecosystem Services and Tradeoffs¶

Butuan City: Recharge Contribution



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Kilometers

Scale 1:150,000
UTM Zone 51 North WGS 84 Datum

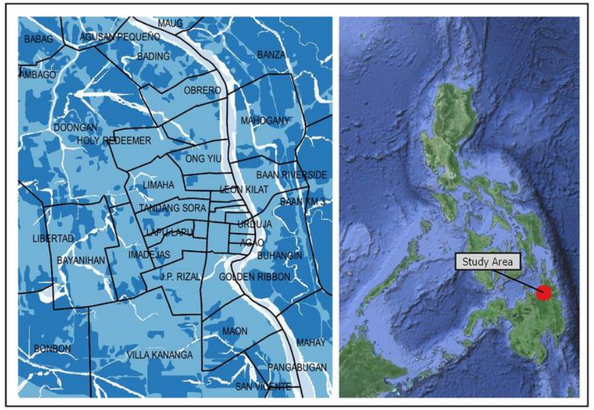
LEGEND

- Barangay Boundary
- Butuan City Boundary
- Nearby Municipalities

Recharge Contribution (mm)

- <= -1.25
- -1.26 - 1.30
- 1.31 - 3.86
- 3.87 - 6.42
- > 6.42

Data Sources:
LGU - Butuan City, 2023 (barangay and city boundary); and NAMRIA, 2019 (municipal boundary)

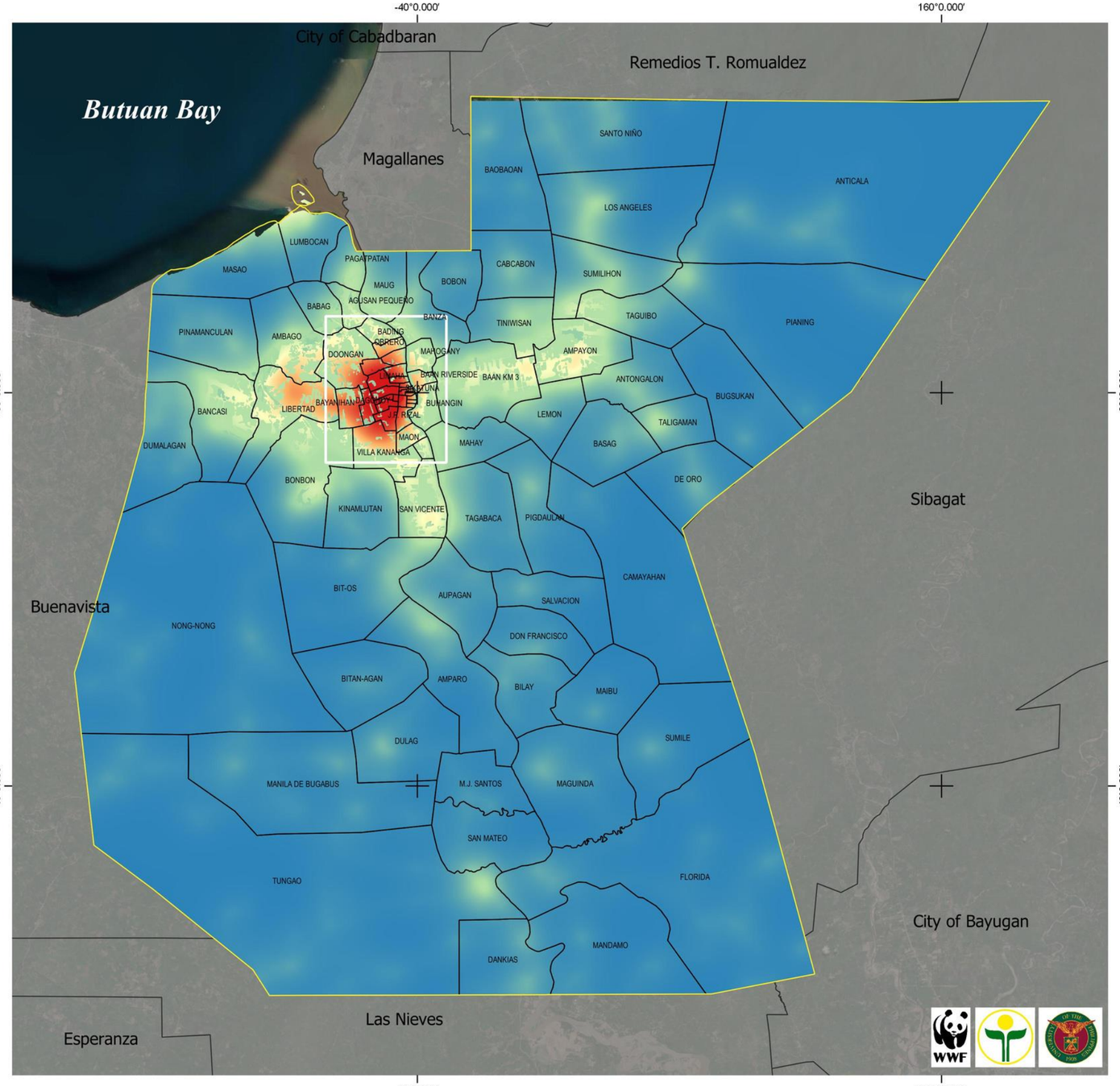


Urban cooling

Index of heat mitigation based on shade, evapotranspiration, and albedo, used to estimate a temperature reduction by vegetation.

Source: InVEST: Integrated Valuation of Ecosystem Services and Tradeoffs¶

Butuan City: Urban Cooling



0 5 10

Kilometers

Scale 1:150,000
UTM Zone 51 North WGS 84 Datum

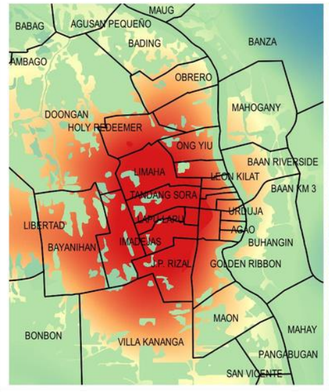
LEGEND

- Barangay Boundary
- Butuan City Boundary
- Nearby Municipalities

Heat Mitigation Index

- 0.22
- 0.41
- 0.61
- 0.80
- 1.00

Data Sources:
LGU - Butuan City, 2023 (barangay and city boundary); and NAMRIA, 2019 (municipal boundary)

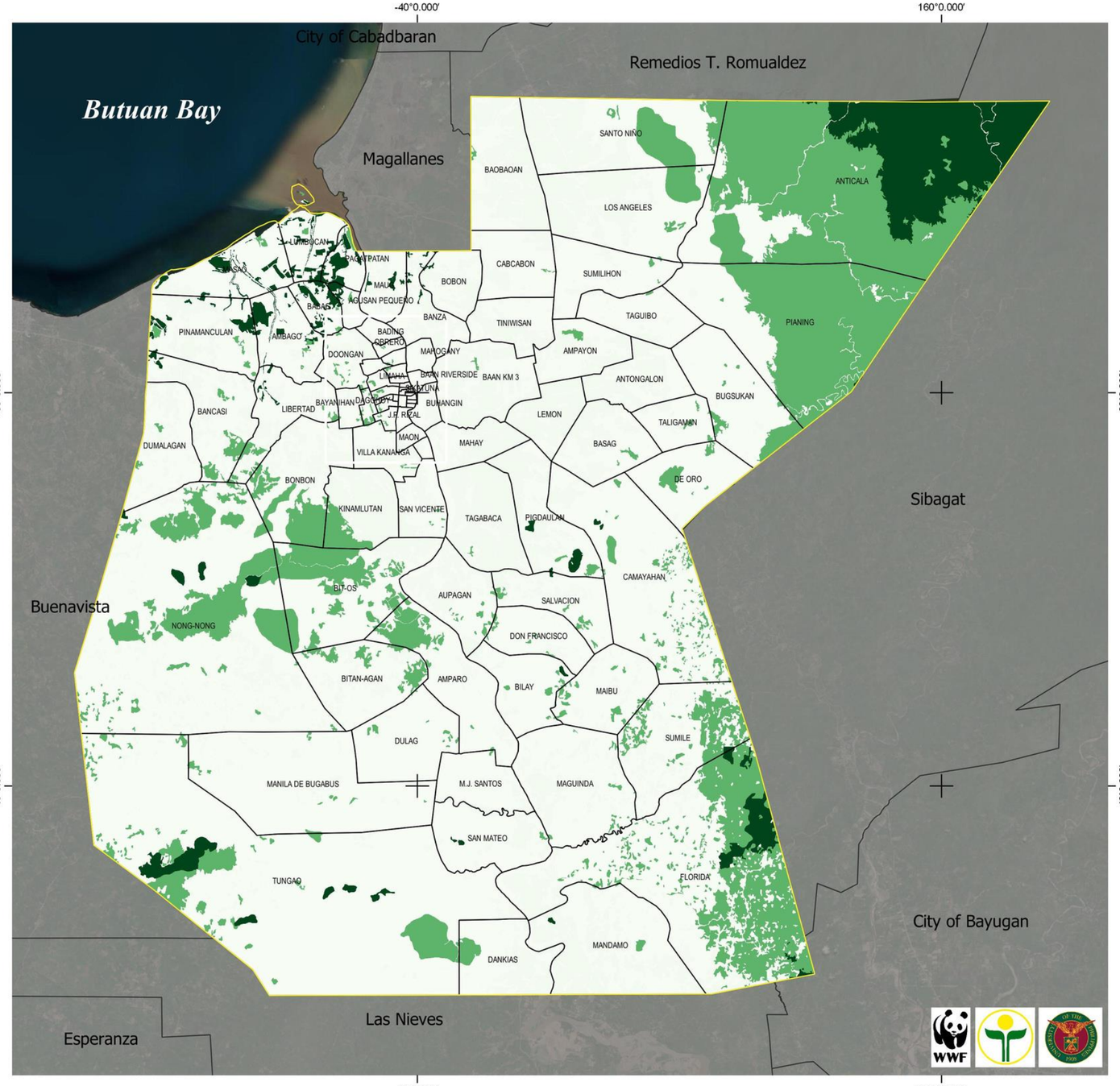


Forest edge carbon effect

Carbon stock change due to the creation of forest edges.

Source: InVEST: Integrated Valuation of Ecosystem Services and Tradeoffs¶

Butuan City: Forest Carbon Edge Effect



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Kilometers

Scale 1:150,000
UTM Zone 51 North WGS 84 Datum

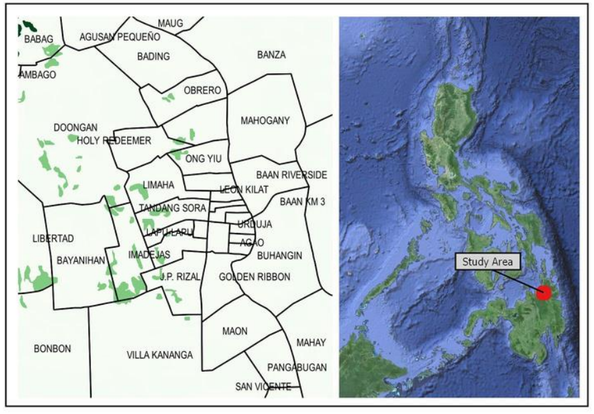
LEGEND

- Barangay Boundary
- Butuan City Boundary
- Nearby Municipalities

Forest Carbon Edge Effect
(metric tons per pixel)

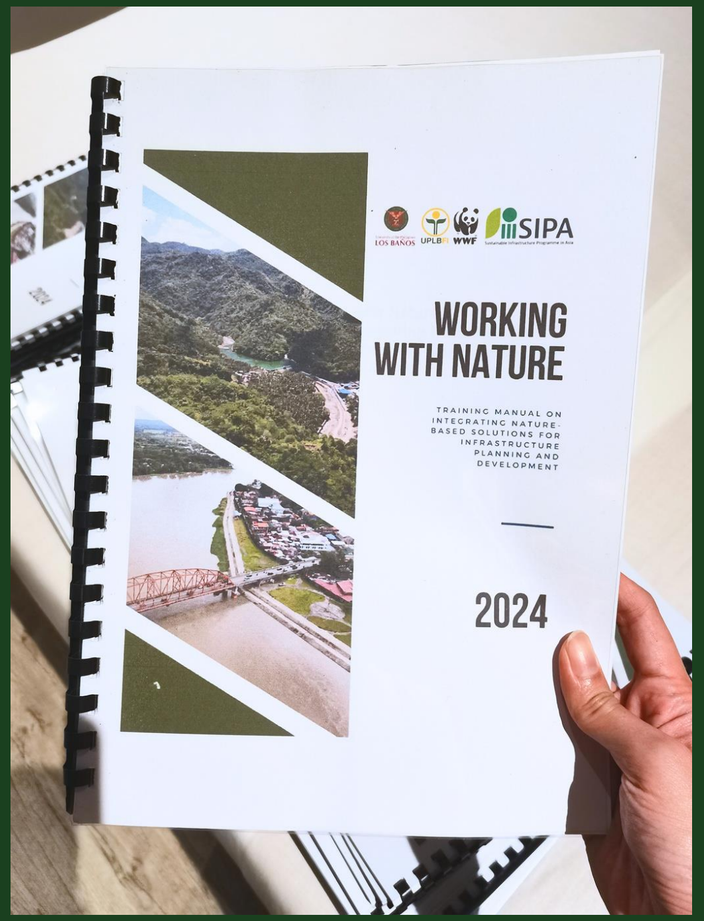
- 0.00
- 0.22
- 0.44
- 0.66
- 0.88

Data Sources:
LGU - Butuan City, 2023 (barangay and city boundary); and NAMRIA, 2019 (municipal boundary)



Sustainable Infrastructure Programme in Asia

Working with Nature: Integrating Nature-based Solutions for Infrastructure Planning and Development


LOS BAÑOS
UPLB
WWF
SIPA
WORKING WITH NATURE
TRAINING MANUAL ON INTEGRATING NATURE-BASED SOLUTIONS FOR INFRASTRUCTURE PLANNING AND DEVELOPMENT
2024


SIPA
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Working with Nature:
Integrating Nature-based Solutions for Infrastructure Planning & Development
What is a Nature-based Solution?
The International Union for the Conservation of Nature defines Nature-based Solutions or (NbS) as solutions to "address societal challenges through actions to protect, sustainably manage, and restore natural and modified ecosystems, benefiting people and nature at the same time".


SIPA

Ways Forward

Ways forward in mainstreaming NbS in Infrastructure Planning:

- NbS is a new concept in the Philippines, hence IEC activities are essential
- A whole-of-society approach is needed
  - Technical Working Committee
  - Ecosystem Service Prioritization of communities
  - Partnership with community beneficiaries
- NbS Entrypoint in planning: CLUP, MPSUID

Ways forward in mainstreaming NbS in Infrastructure Planning:

- RS/GIS and selection of appropriate NbS may seem too sophisticated for LGU officials, partnership with experts from the academe and mapping groups is needed
- Work on NbS facilitates work towards implementation of PENCAS (RA 11995)

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Thank you very much!
Daghang Salamat!