

Improving Regional /Local Sustainability & Resiliency Using GIS - based Planning Tools

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OIC-RD, NEDA Region 3

09 May 2018

Outline

I. Overview

II. RSDF

III. GIS-based Analytical Tools

IV. Case Studies

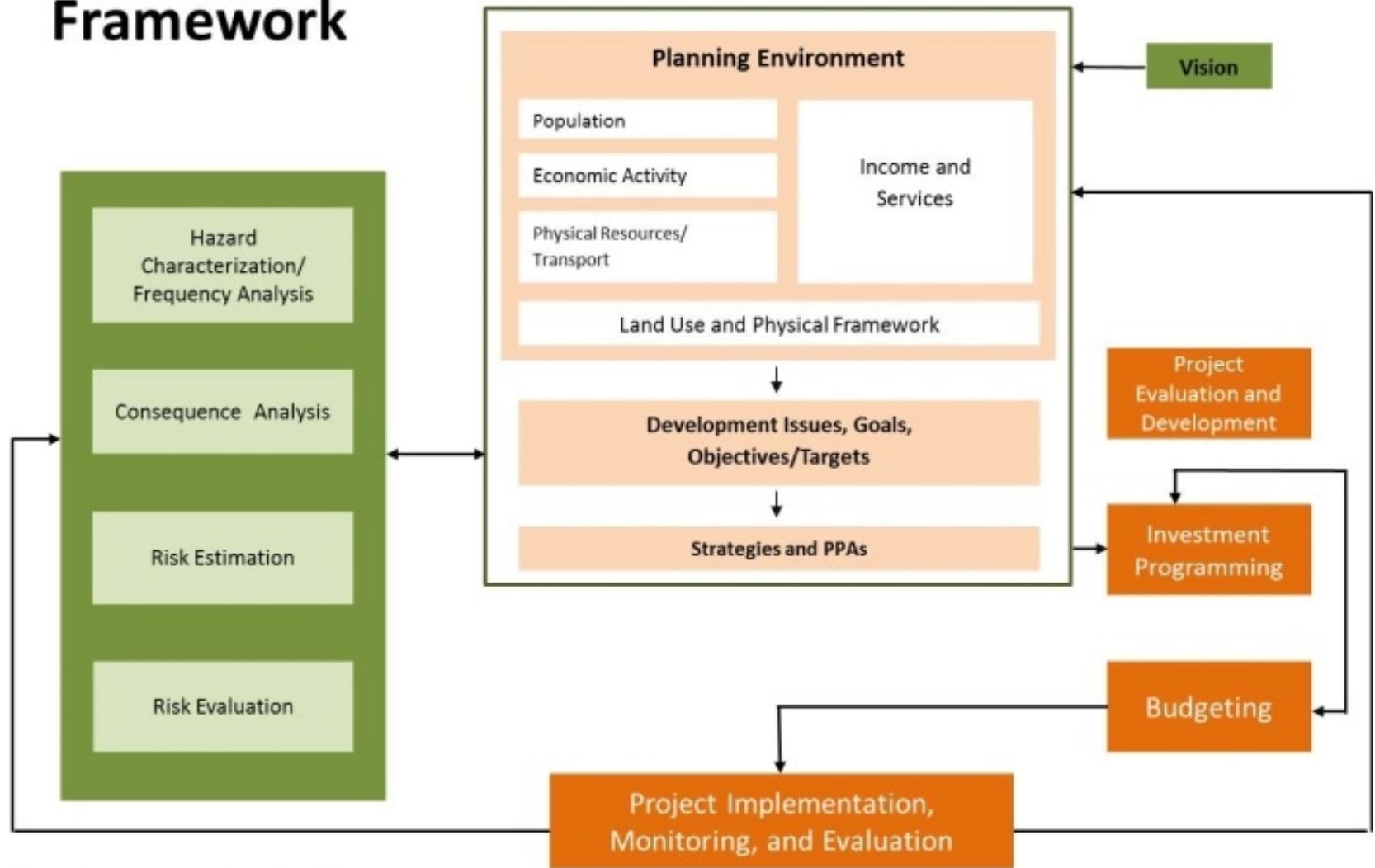
a) Pampanga River Basin Master
Plan

b) Guimba Spatial Framework

IV. Conclusion and Recommendations

I. Overview

DRR-CCA Enhanced PDPFP Mainstreaming Framework



Source: NEDA, UNDP, et al. 2008. Mainstreaming Disaster Risk Reduction in Subnational Development and Land Use/Physical Planning in the Philippines.

I. Overview

Planning Environment

Socio-economic & bio-physical profile (SEBP)

- Land Use
- Infrastructure
- Econ
- Social
- Environment
- Hazards
- Governance

Disaster Risk Reduction & Climate Change Mainstreaming

- Consequence analysis
- Climate vulnerability analysis
- Impact chain analysis
- Sieve Mapping

Integrated Land Use and Sectoral Development Plan

I. Vision, Goals, & Objectives

II. Spatial Strategy

- W-Corridor
- Metro Clark
- Grid & Multi-Nodal Urban Form

III. Physical Framework

- Settlement Land Use Policies
- Production Land Use Policies
- Protection Land Use Policies
- Infrastructure Land Use Policies

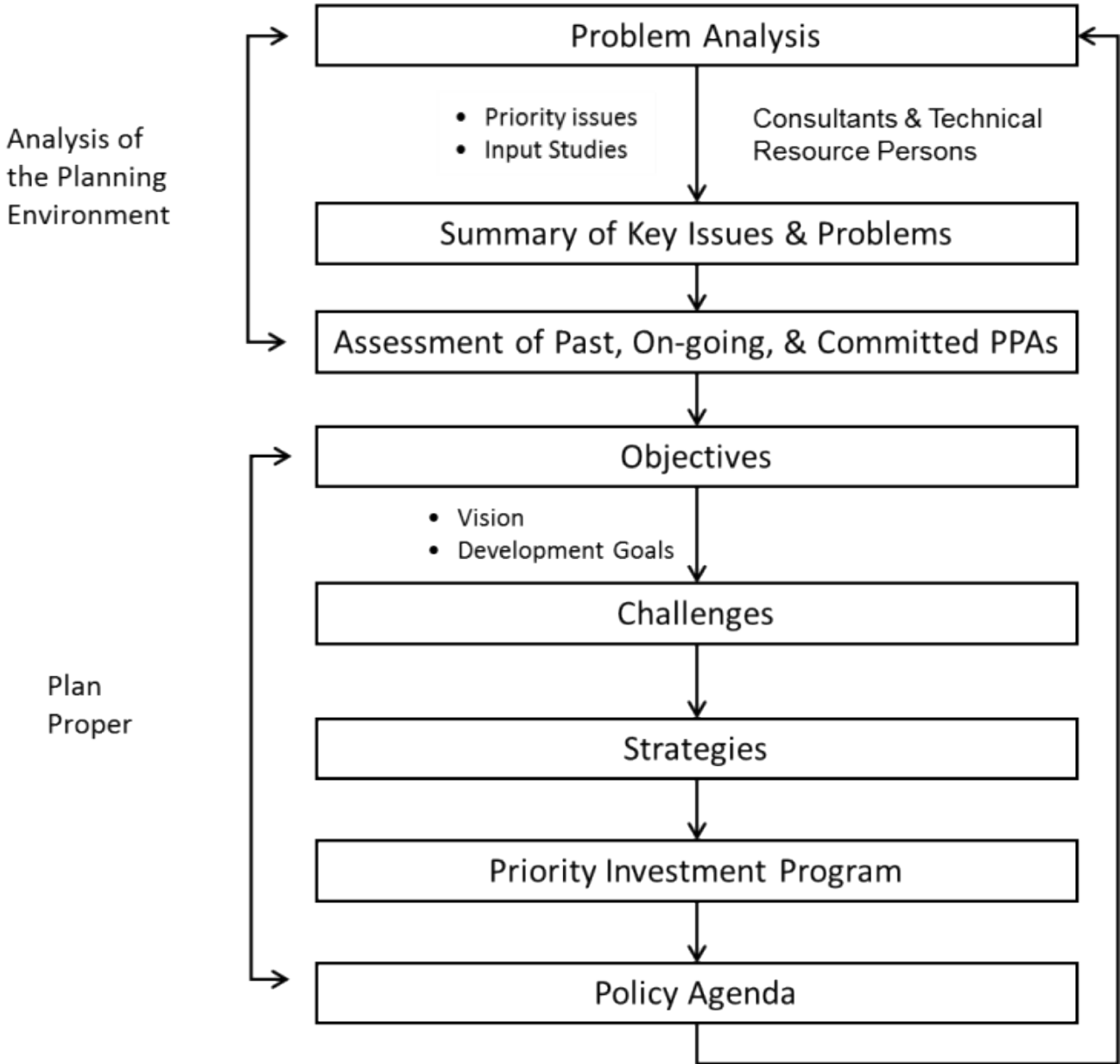
IV. Sectoral Development Plan

- Infrastructure & Physical Development
- Economic Development
- Social Development
- Environmental Management
- Disaster Risk Reduction & Climate Adaptation
- Development Administration

V. Local Development Investment Program



I. Overview

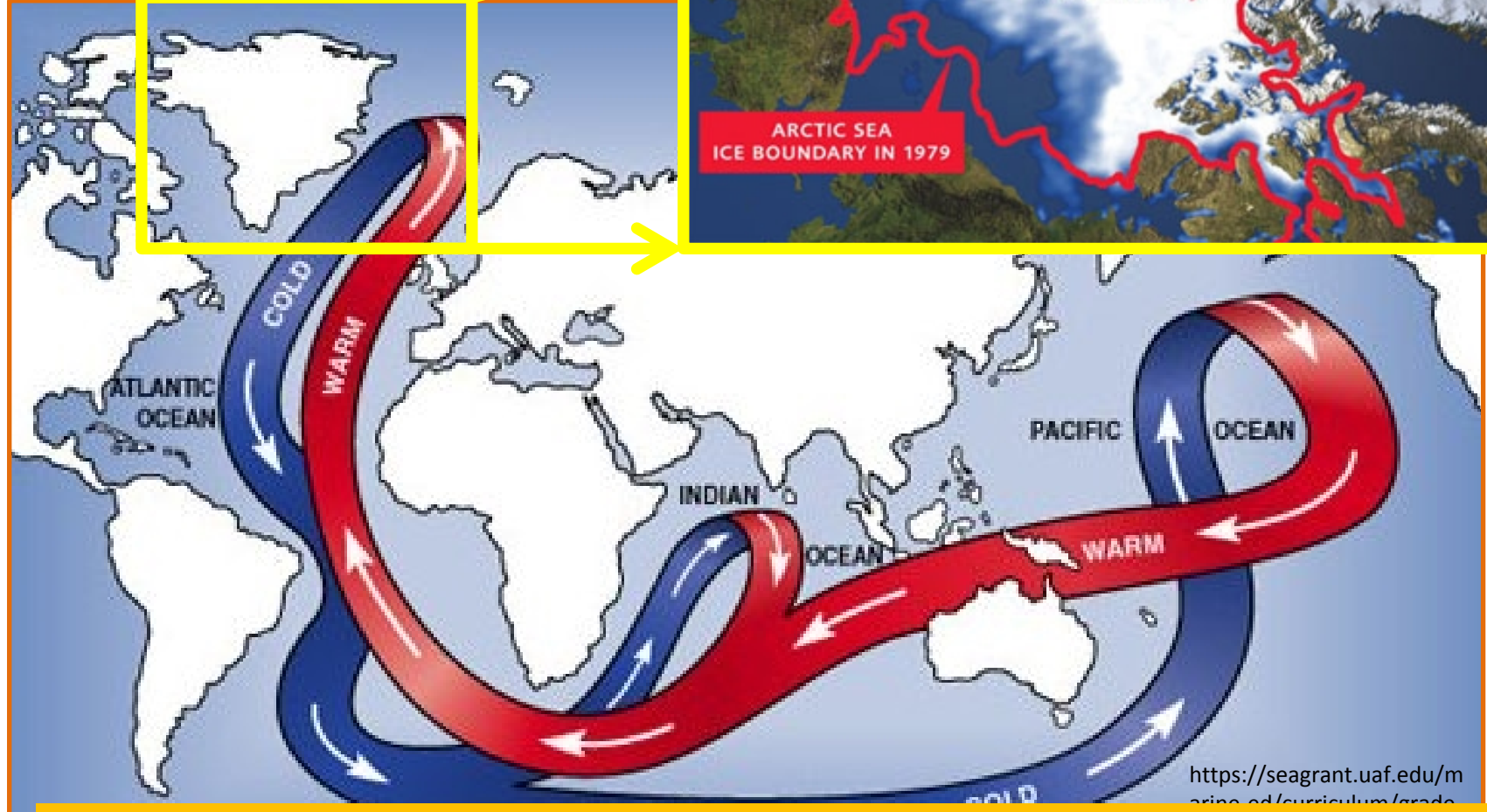
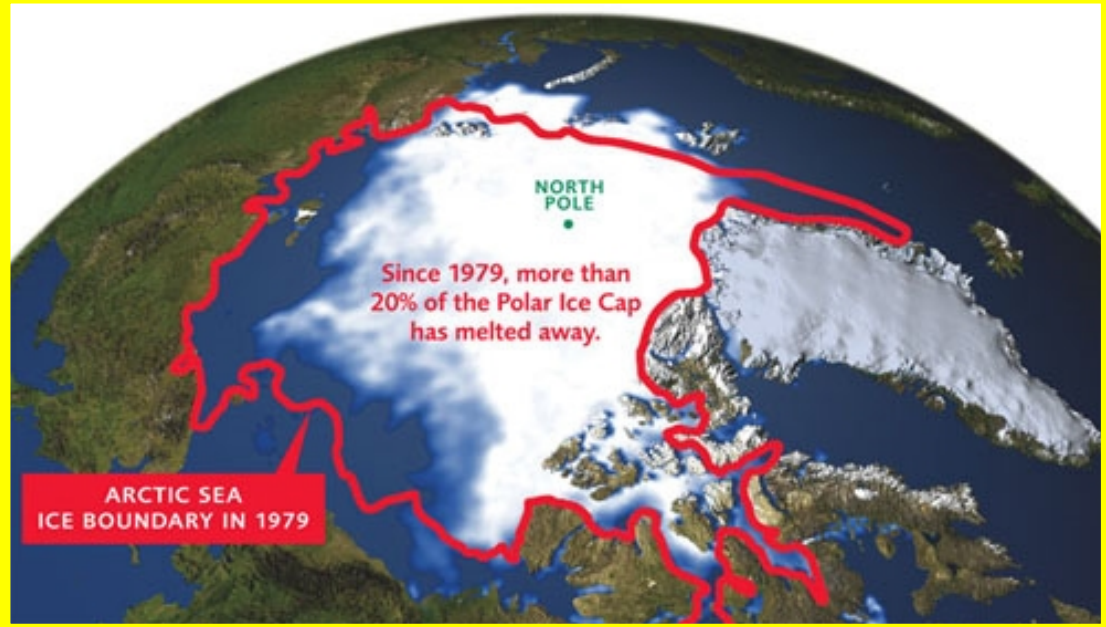


Planning process:

- The planning environment will be analyzed using evidenced-based planning tools
- The results will be inputted in the plan

I. Overview

Thermohaline circulation

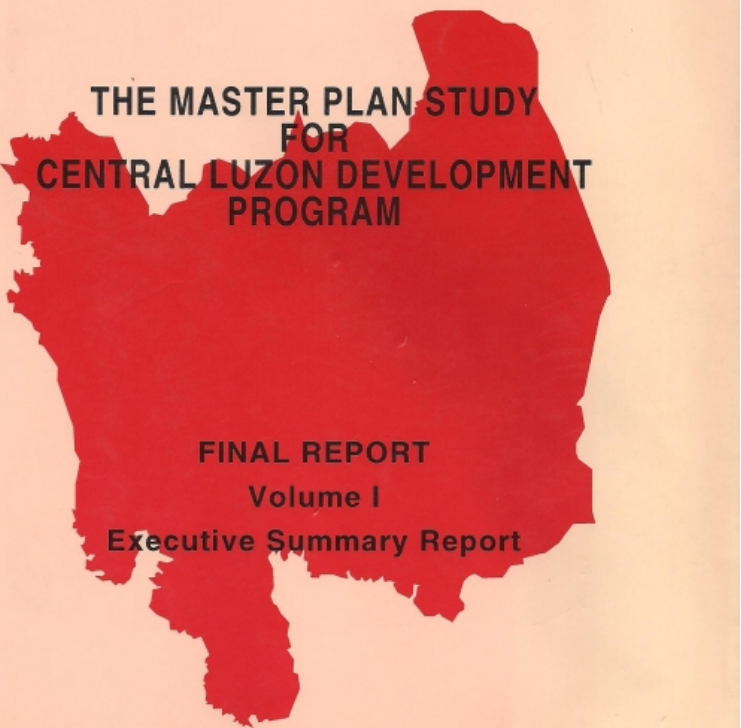


<https://seagrants.uaf.edu/marine-ed/curriculum/grade>

- The global conveyor belt breakdown can overheat the planet
- It could mean the extinction of civilization

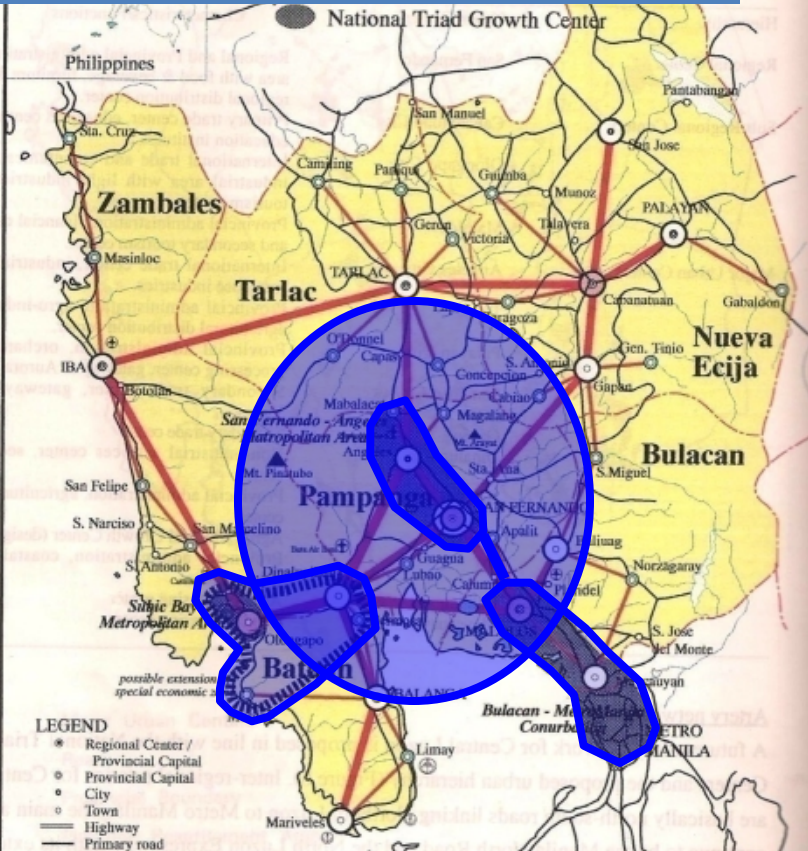
I. Overview

➤ This Plan was prepared in response to: i) The 1990 great Northern Luzon earthquake; ii) 1991 Mt. Pinatubo eruption, & iii) US military bases pullout



National Triad Growth Centers:

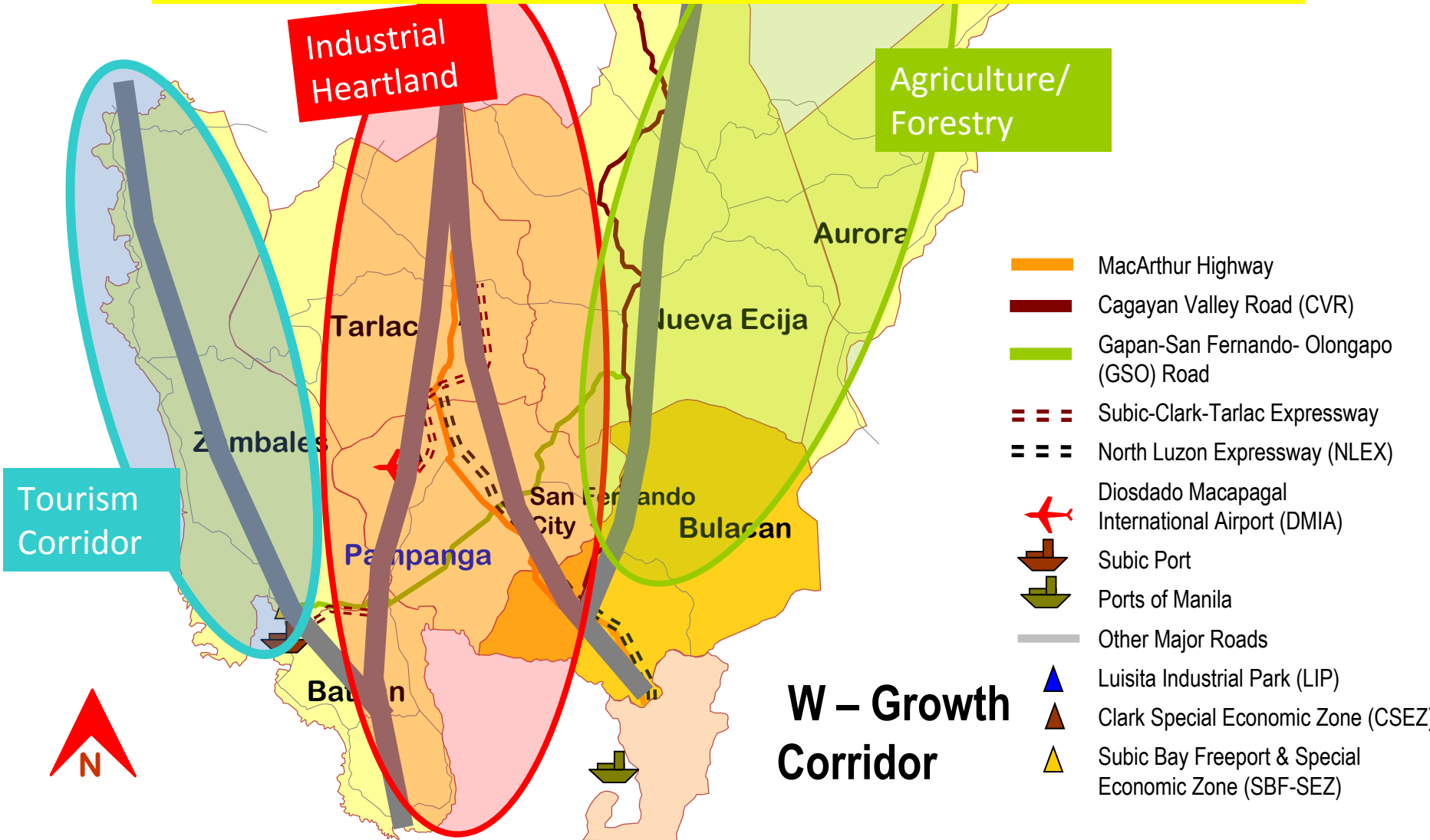
1. Bulacan-Manila Conurbation
2. San Fernando-Angeles Metro
3. Subic Metro



These growth centers were envisioned to ripple development across the region

I. Overview

Vision: A Sustainable and Caring Global Gateway through Public-Private Partnerships and Growth for All



II. Regional Spatial Development Framework

CENTRAL LUZON SPATIAL FRAMEWORK

i. Concentration – Distribution of population in existing urban areas and metropolitan centers according to urban hierarchy, and following the principles of densification, compaction and smart growth

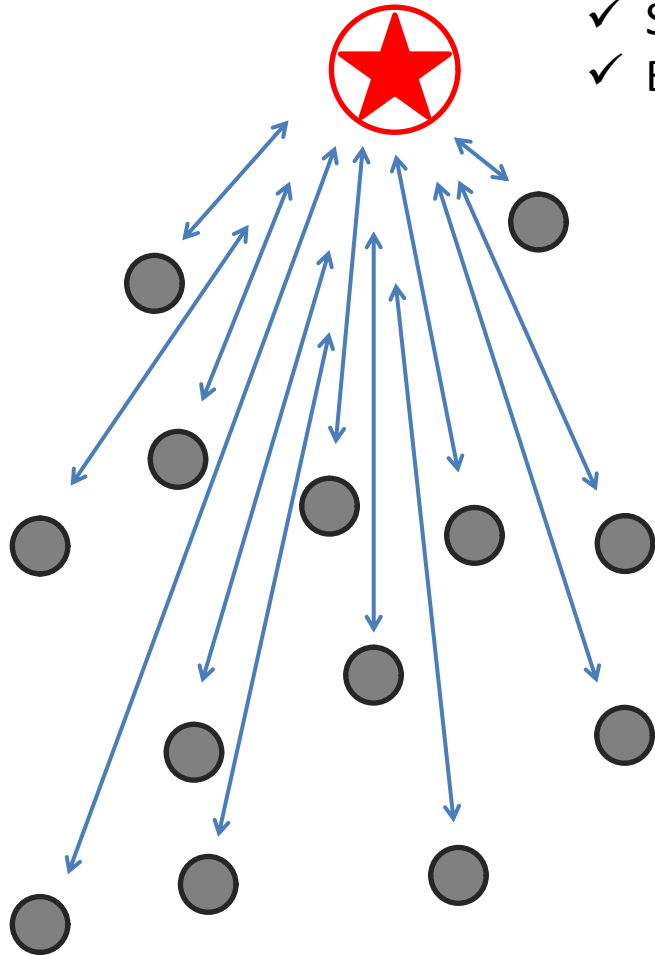
ii. Connectivity – Seamless integration of urban centers, production areas, and protection areas through infrastructure development

iii. Vulnerability Reduction – Hazard mitigation, exposure minimization, protection of elements at risk, and enhancement of adaptive capacity

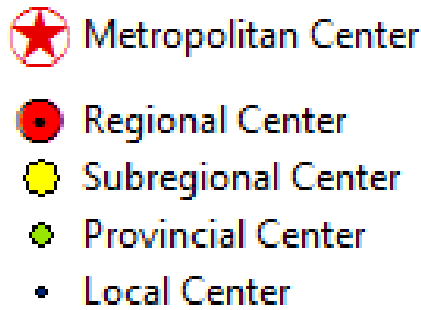
CENTRAL LUZON SPATIAL FRAMEWORK

i. Concentration

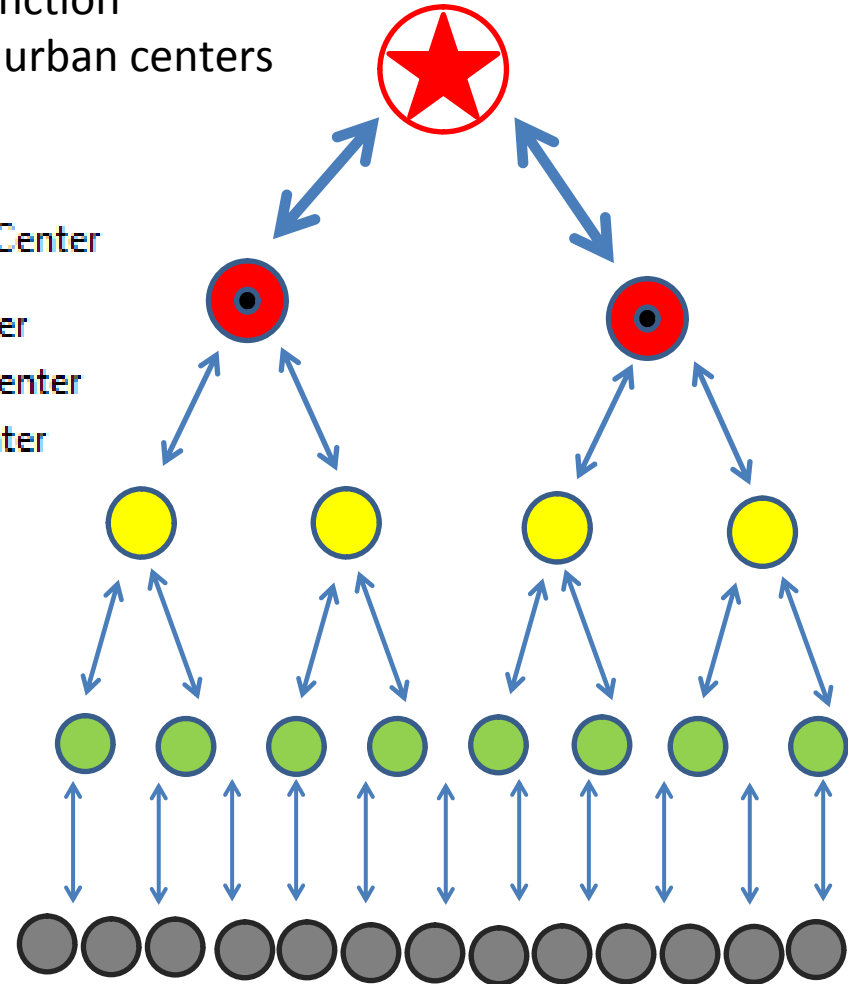
- ✓ Less congestion
- ✓ Specialization of function
- ✓ Emergence of new urban centers



2-Tiered Hierarchy of Settlements

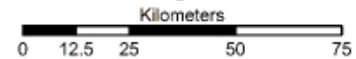
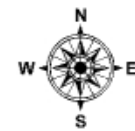
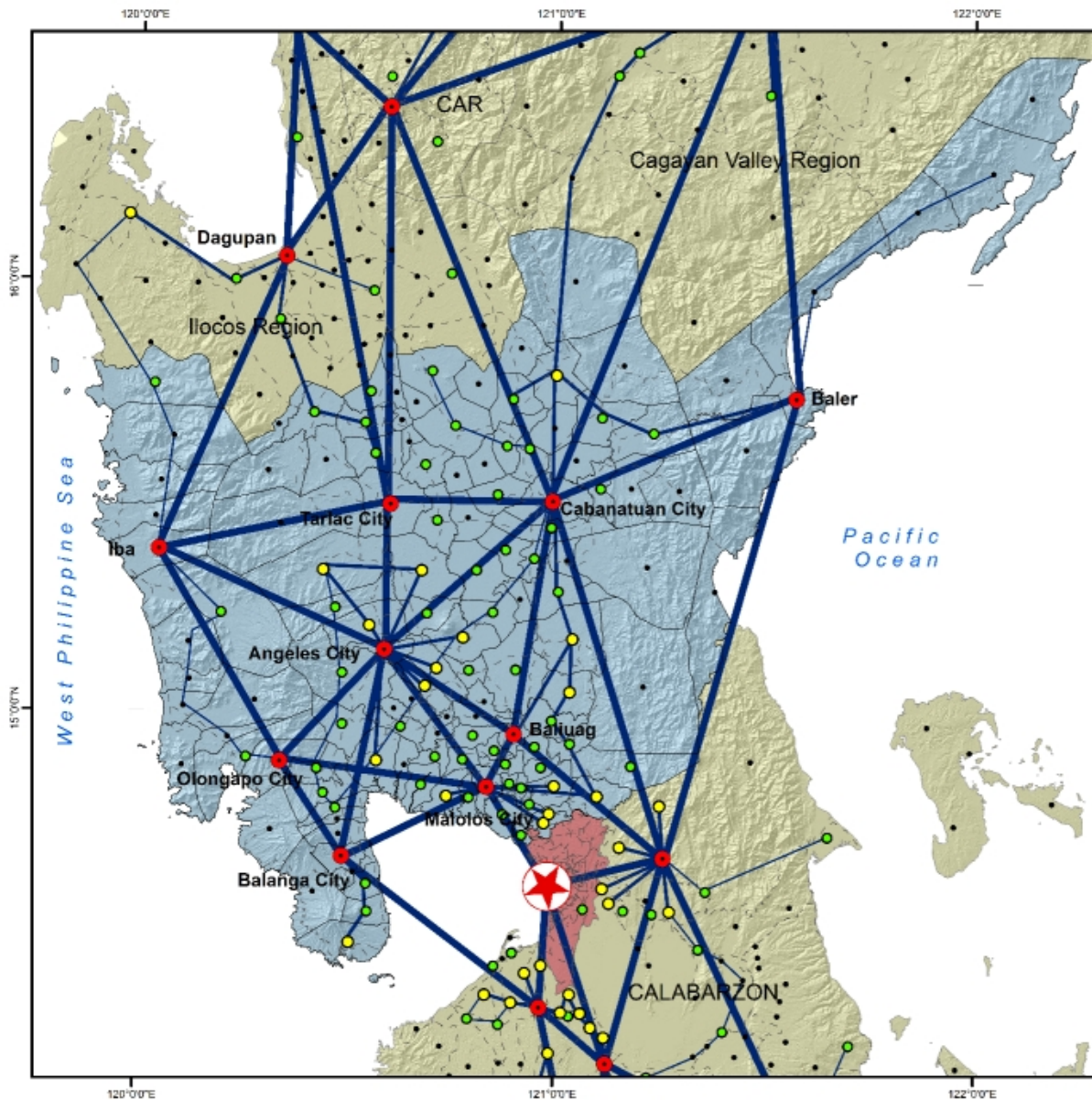


- Congestion
- Preservation of urban primacy



5-Tiered Hierarchy of Settlements

CENTRAL LUZON SPATIAL FRAMEWORK



1:1,350,000

Geographic Coordinate System:
GCS_WGS_1984

Source:
NAMRIA
DENR
Other NROs

Prepared by:
NEDA 3 GIS Team

Legend

- Metropolitan Center
- Regional Center
- Subregional Center
- Provincial Center
- Local Center
- National Roads
- Central Luzon Municipal Boundary

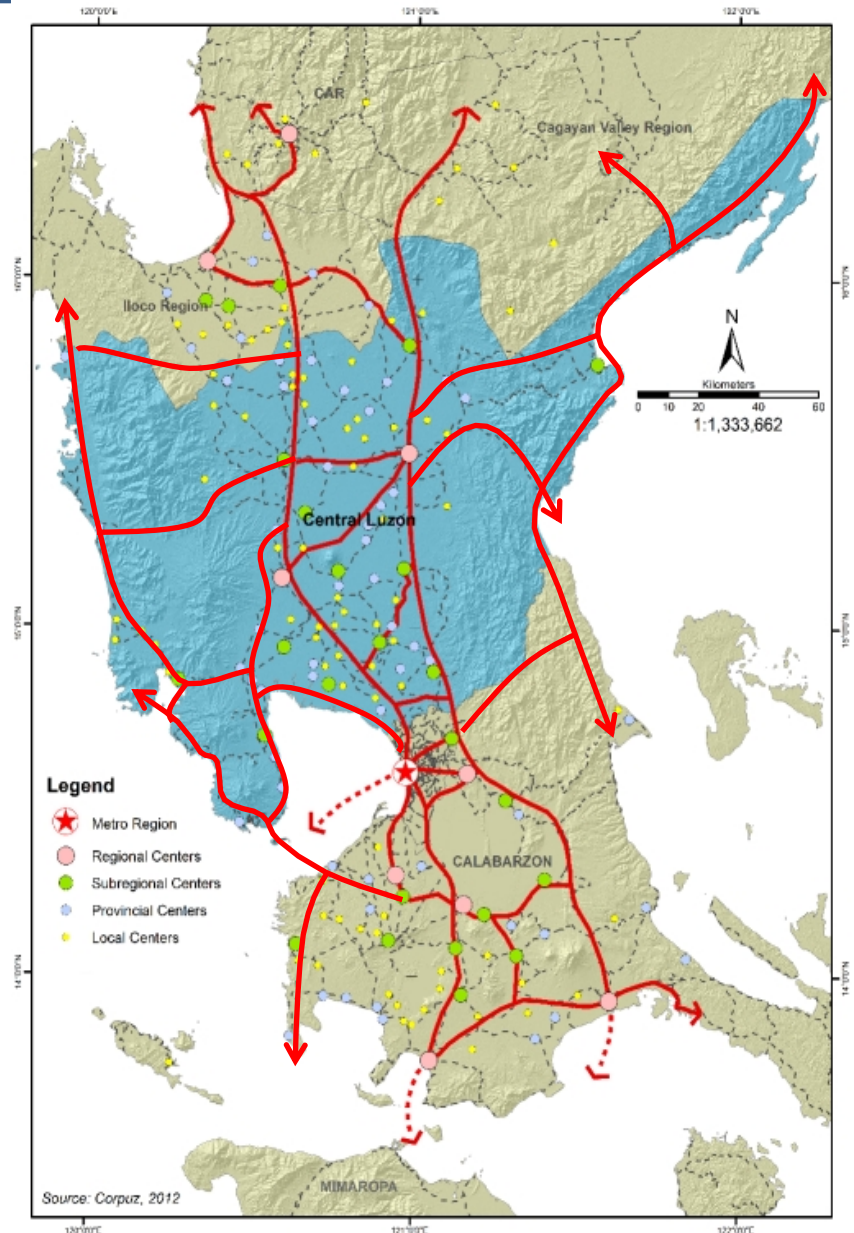
Map of Luzon



CENTRAL LUZON SPATIAL FRAMEWORK

ii. Connectivity

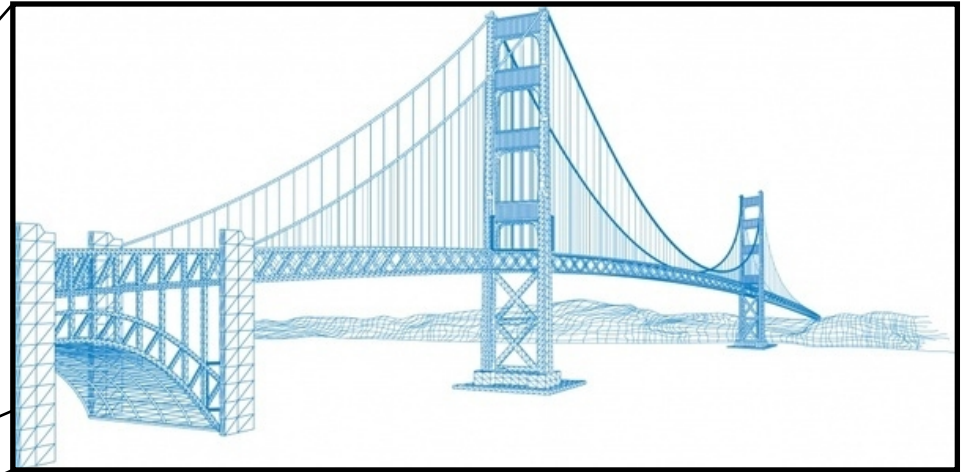
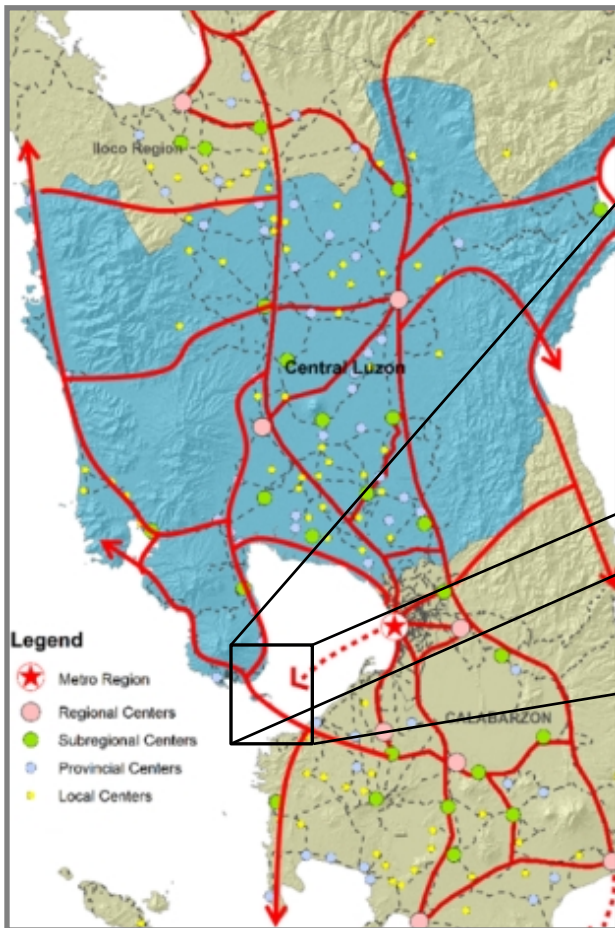
- ✓ Aims to improve transportation and communication (land, sea, air) linkages between and among settlements & production areas
- ✓ The twin-spine road network system will be adopted
- ✓ The High Standard Highway (HSH) system will be implemented



CENTRAL LUZON SPATIAL FRAMEWORK

Development Concept of the Bataan – Cavite Interlink Bridge Project

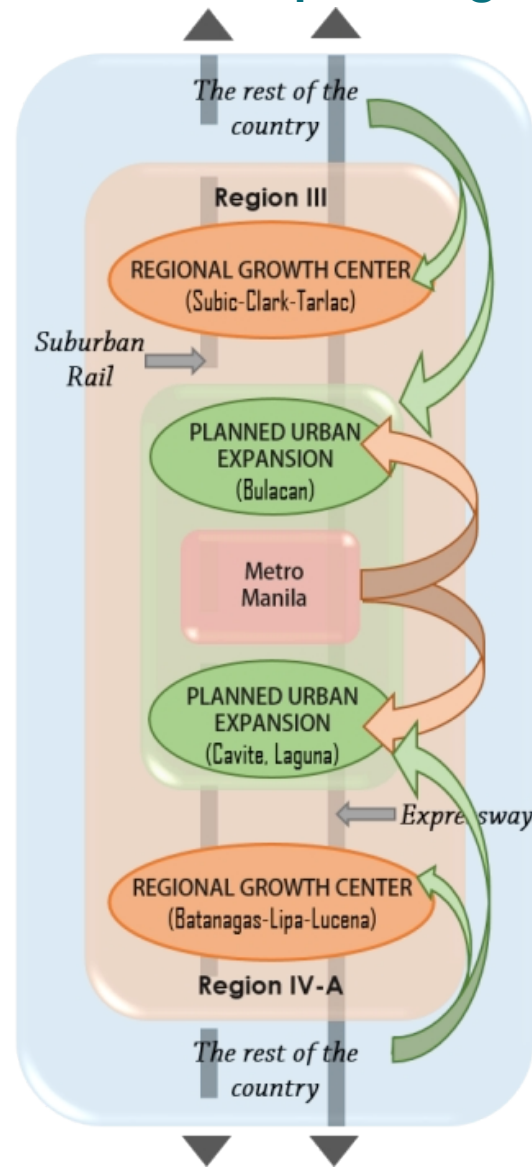
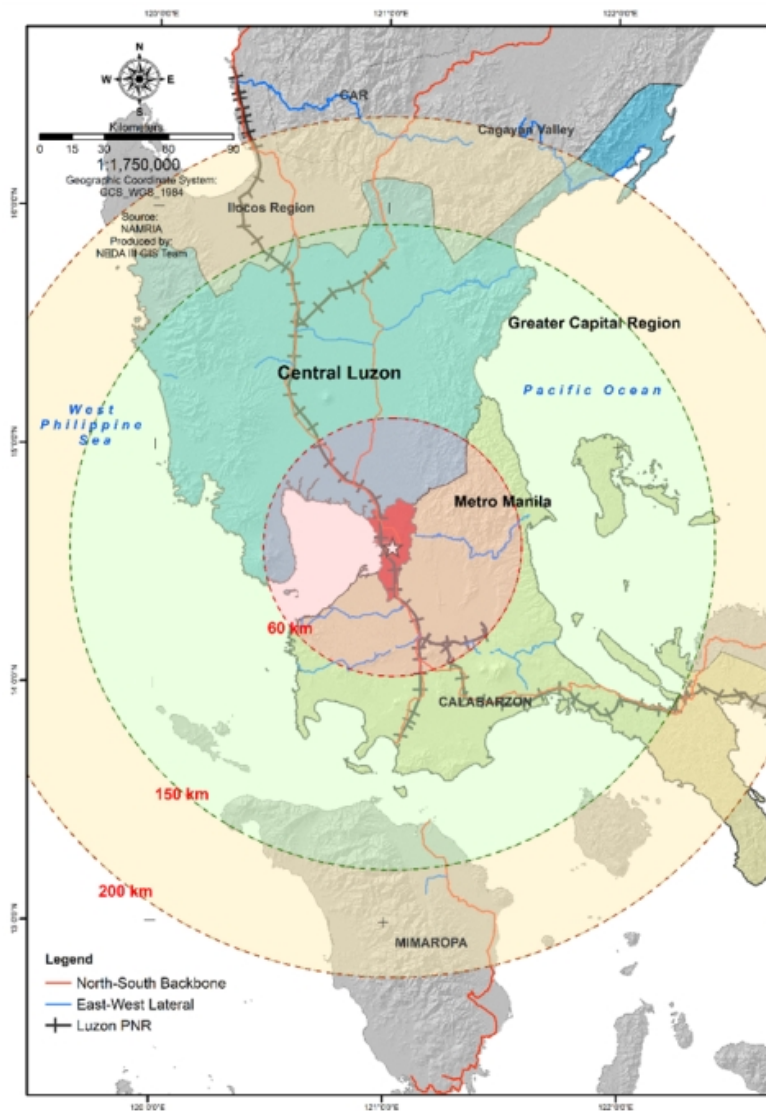
- A 20 km. Bridge from Mariveles, Bataan passing through Corregidor Island and going to Naic, Cavite



- The project is proposed for study under the Asian Development Bank (ADB) Infrastructure Preparation and Innovation Facility (IPIF).

CENTRAL LUZON SPATIAL FRAMEWORK

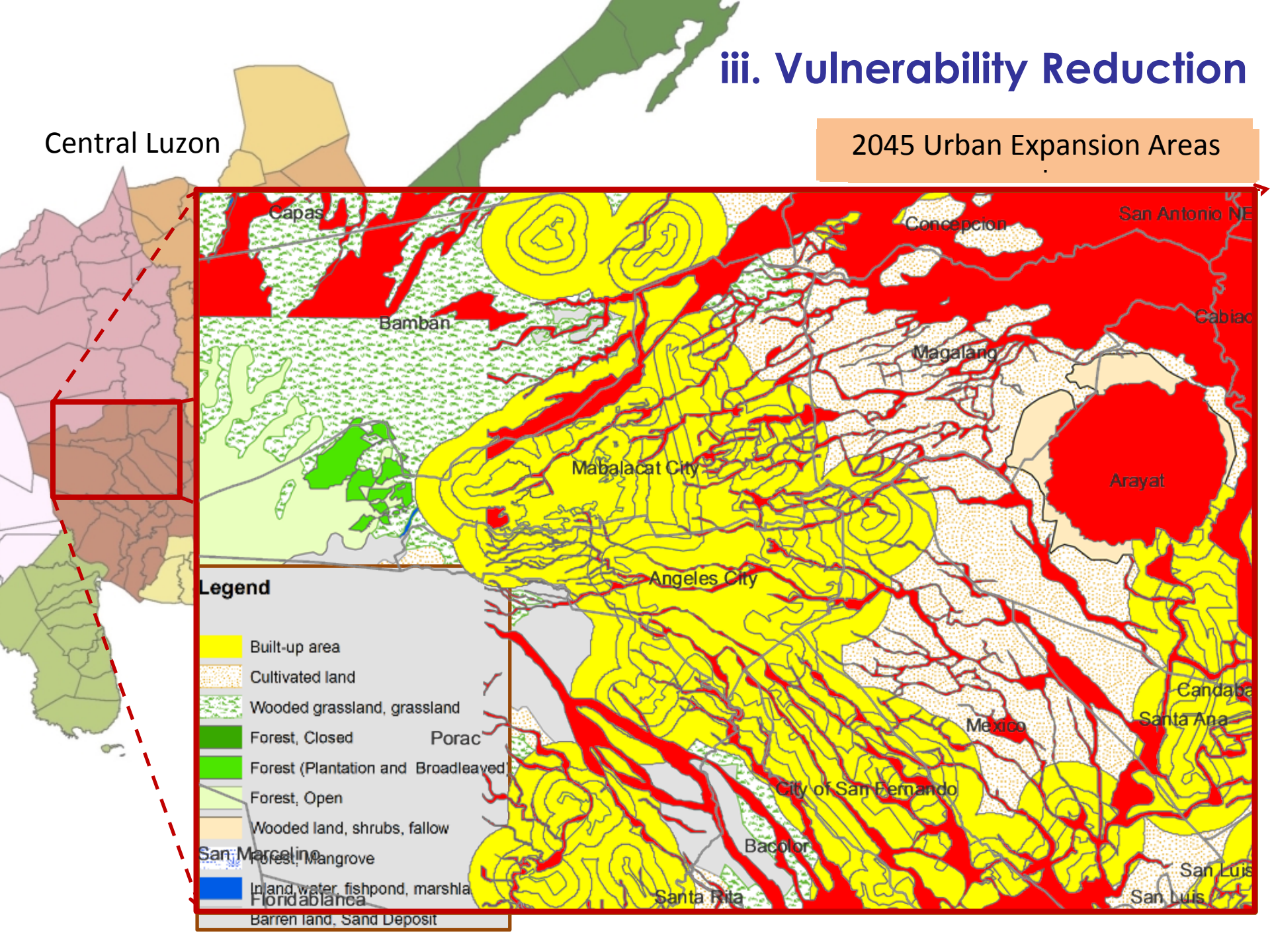
The integrated development concept of Greater Capital Region (GCR)



iii. Vulnerability Reduction

2045 Urban Expansion Areas

Central Luzon



III. GIS-based Analytical Tools

- Climate Change Vulnerability Assessment (CCVA)
- Consequence Analysis
- Land-Use/Land-Cover-Change (LULCC) Assessment
- Sieve Mapping

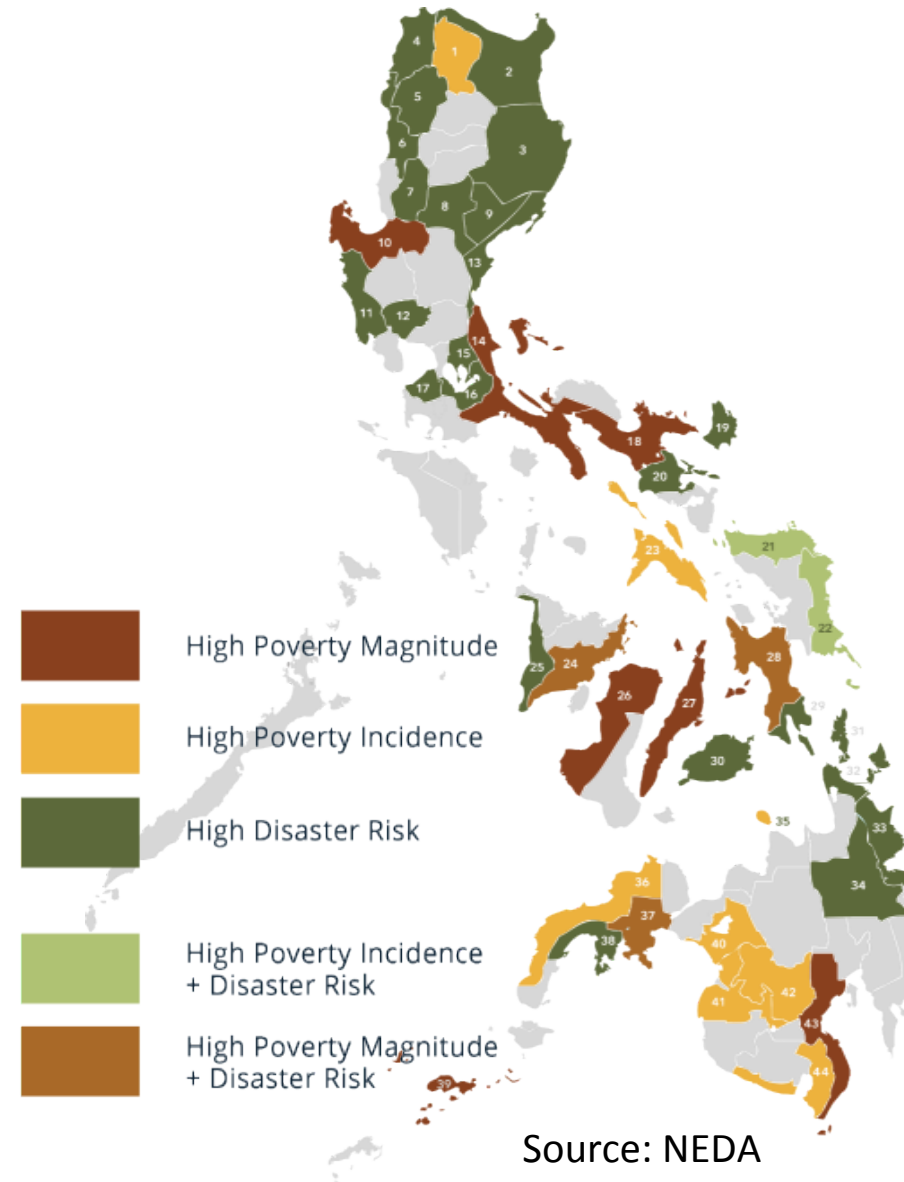
Climate Change Vulnerability Assessment (CCVA)

III. GIS-based Analytical Tools

■ CCVA

✓ FY 2017 Budget Priorities, Policy Directions, & Strategies:

- Two-Tier Budgeting Approach (2TBA)
- Geographical Focus of Budget to the poorest, lagging, and most climate vulnerable areas



III. GIS-based Analytical Tools

- **CCVA**

Hydrometeorologic Hazards
(Flood, Landslide, Sea Level Rise)

Measures/Conditions that reduce Sensitivity & or Exposure
(Infrastructures, Income)

Vulnerability
Assessment (VA)

= Sensitivity + Exposure + Addaptive Capacity

Elements at risk
(People, properties, Agri lands)

VA

=

S Ex AC

Weighted Sum

=

S(_%) + Ex(_%) + AC(_%)

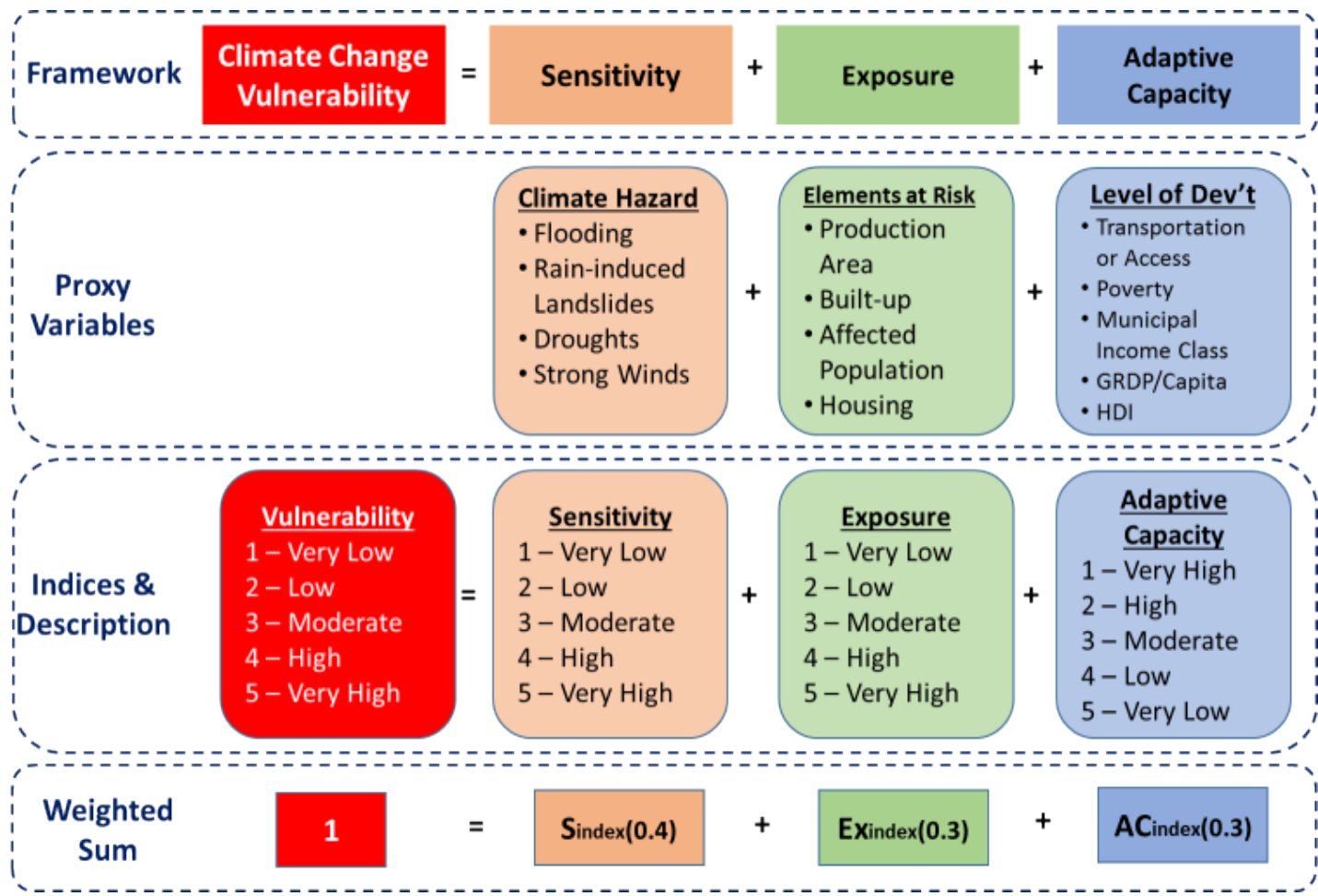
1

=

0.5 + 0.25 + 0.25

III. GIS-based Analytical Tools

- CCVA

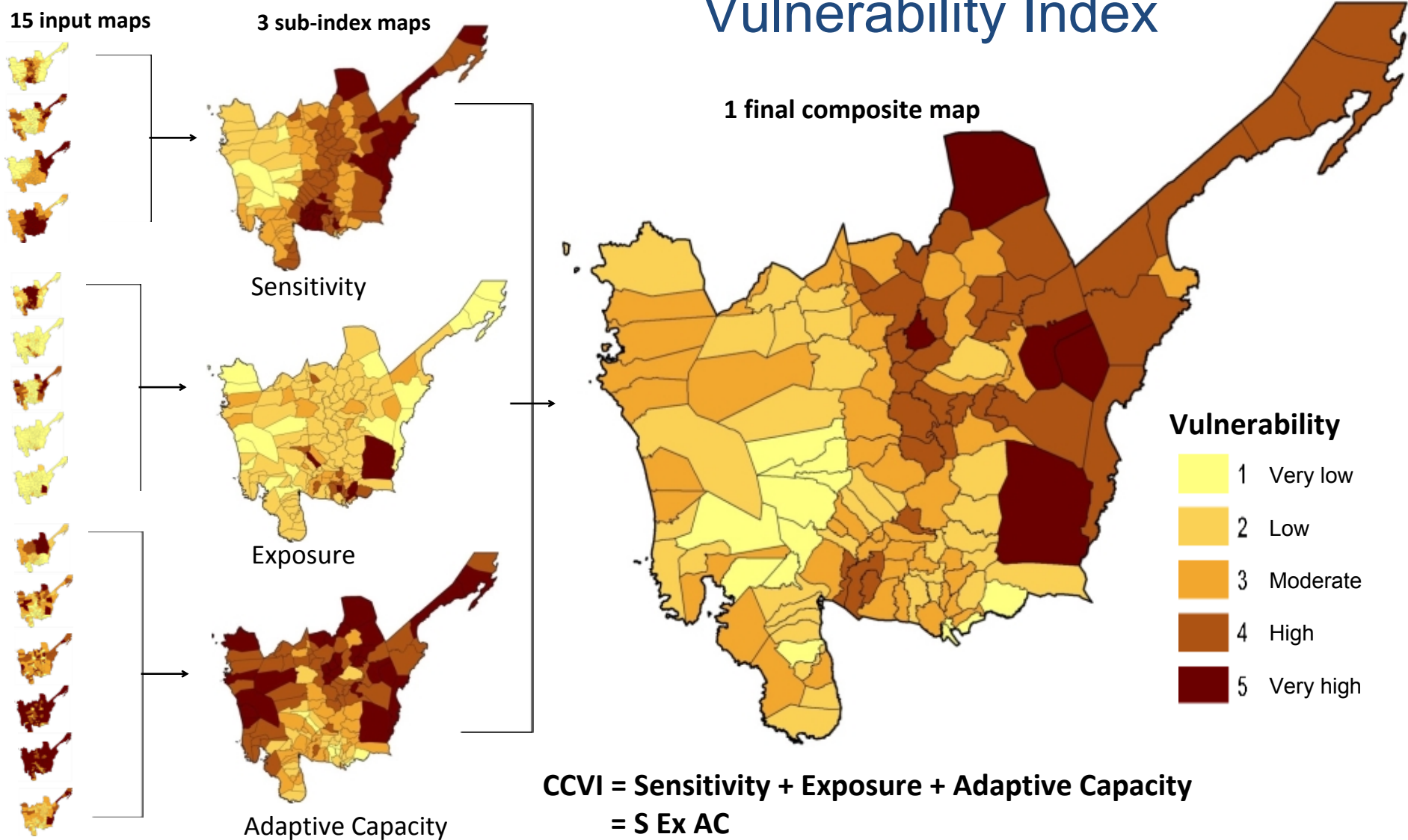


The IPCC Climate Change Vulnerability Assessment Framework

III. GIS-based Analytical Tools

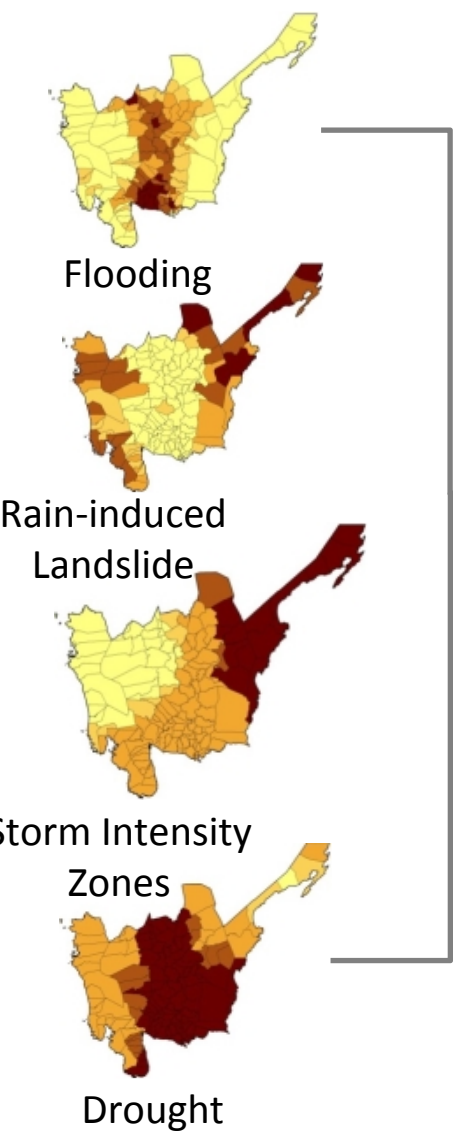
■ CCVA

Central Luzon Climate Vulnerability Index

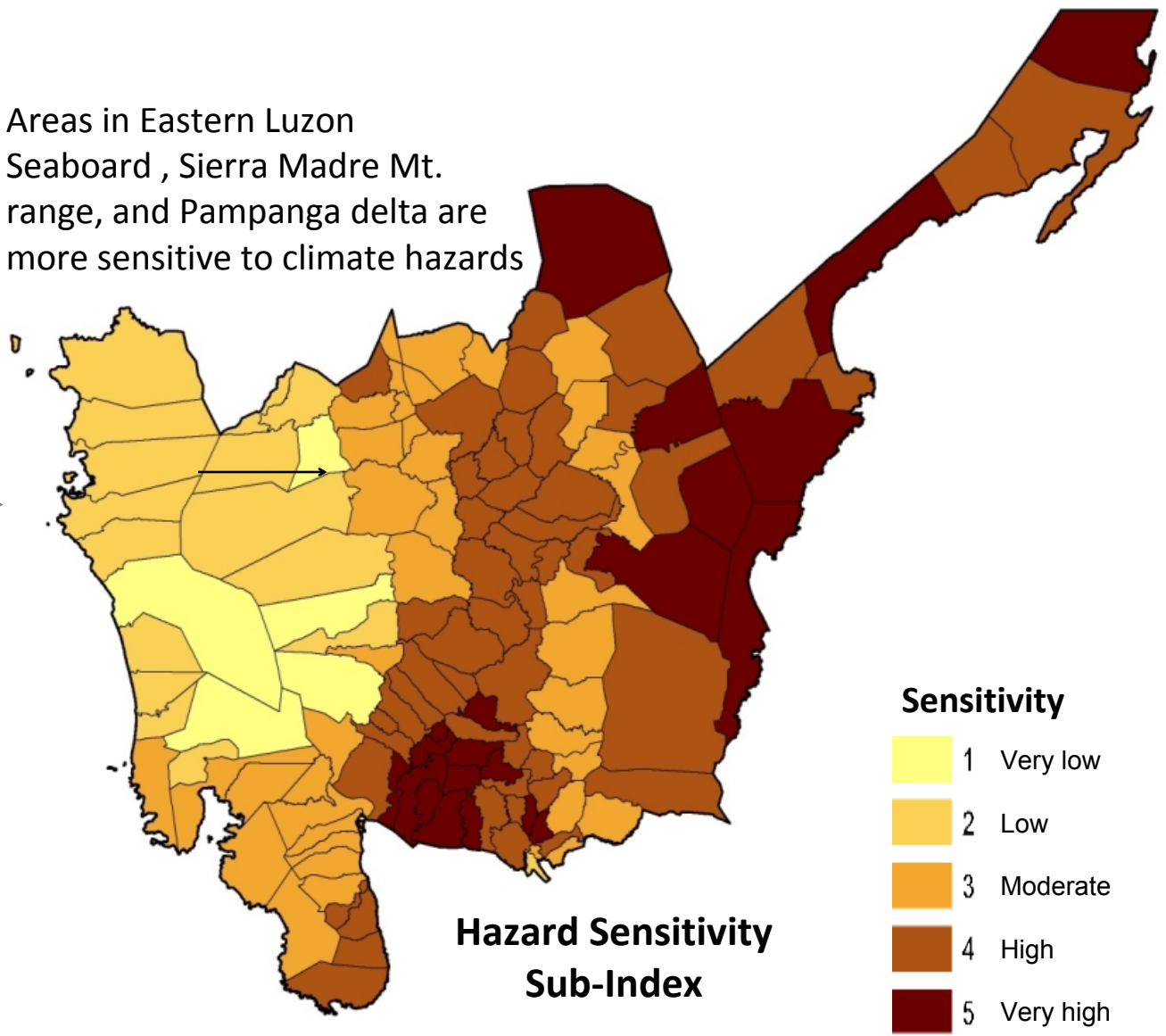


III. GIS-based Analytical Tools

■ CCVA



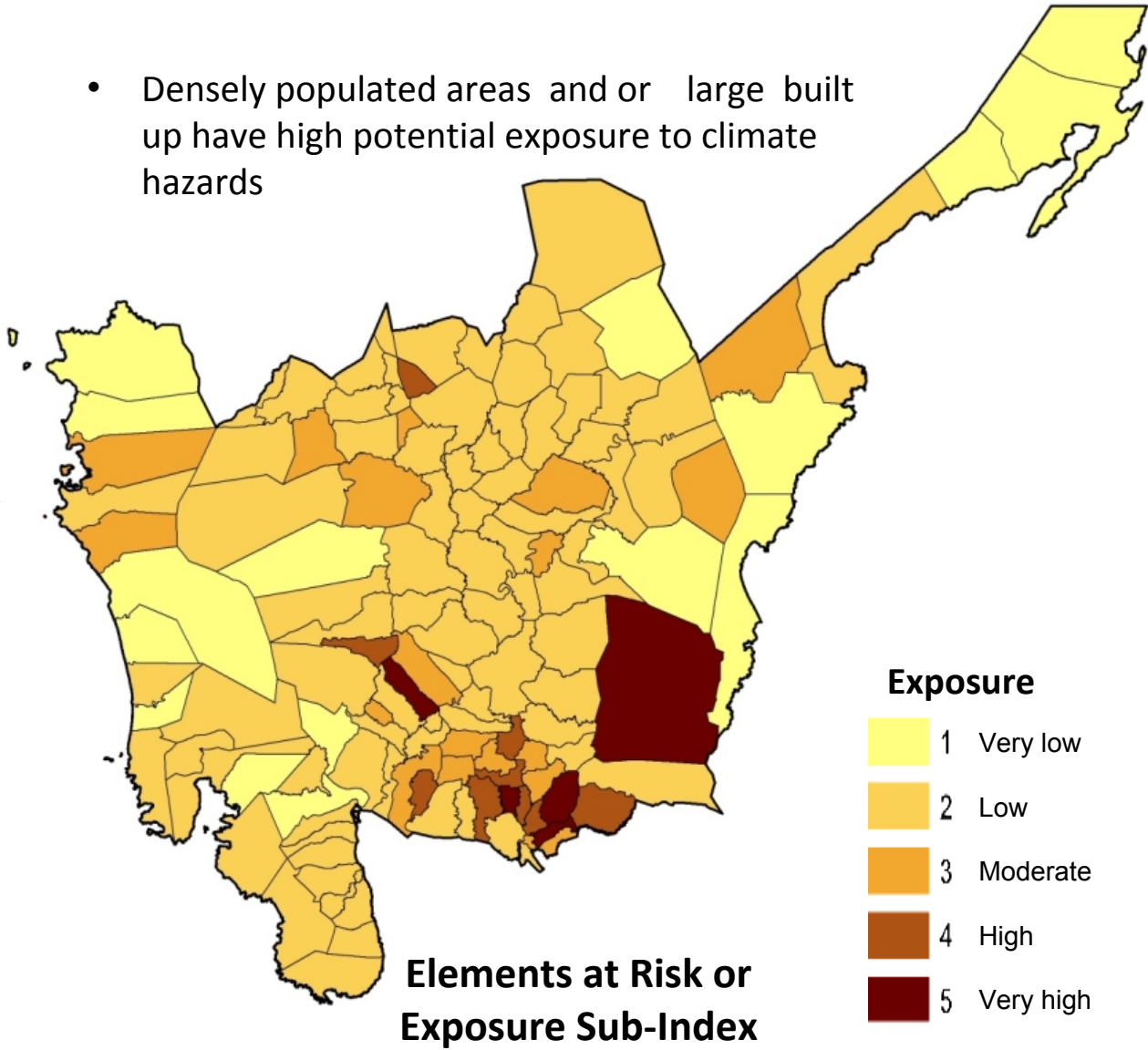
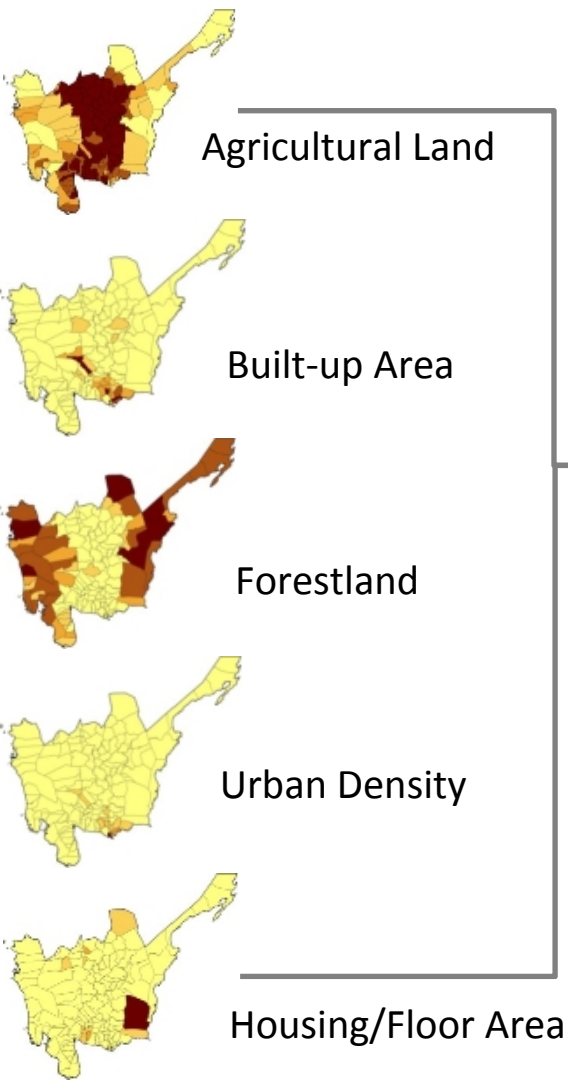
- Areas in Eastern Luzon Seaboard , Sierra Madre Mt. range, and Pampanga delta are more sensitive to climate hazards



III. GIS-based Analytical Tools

■ CCVA

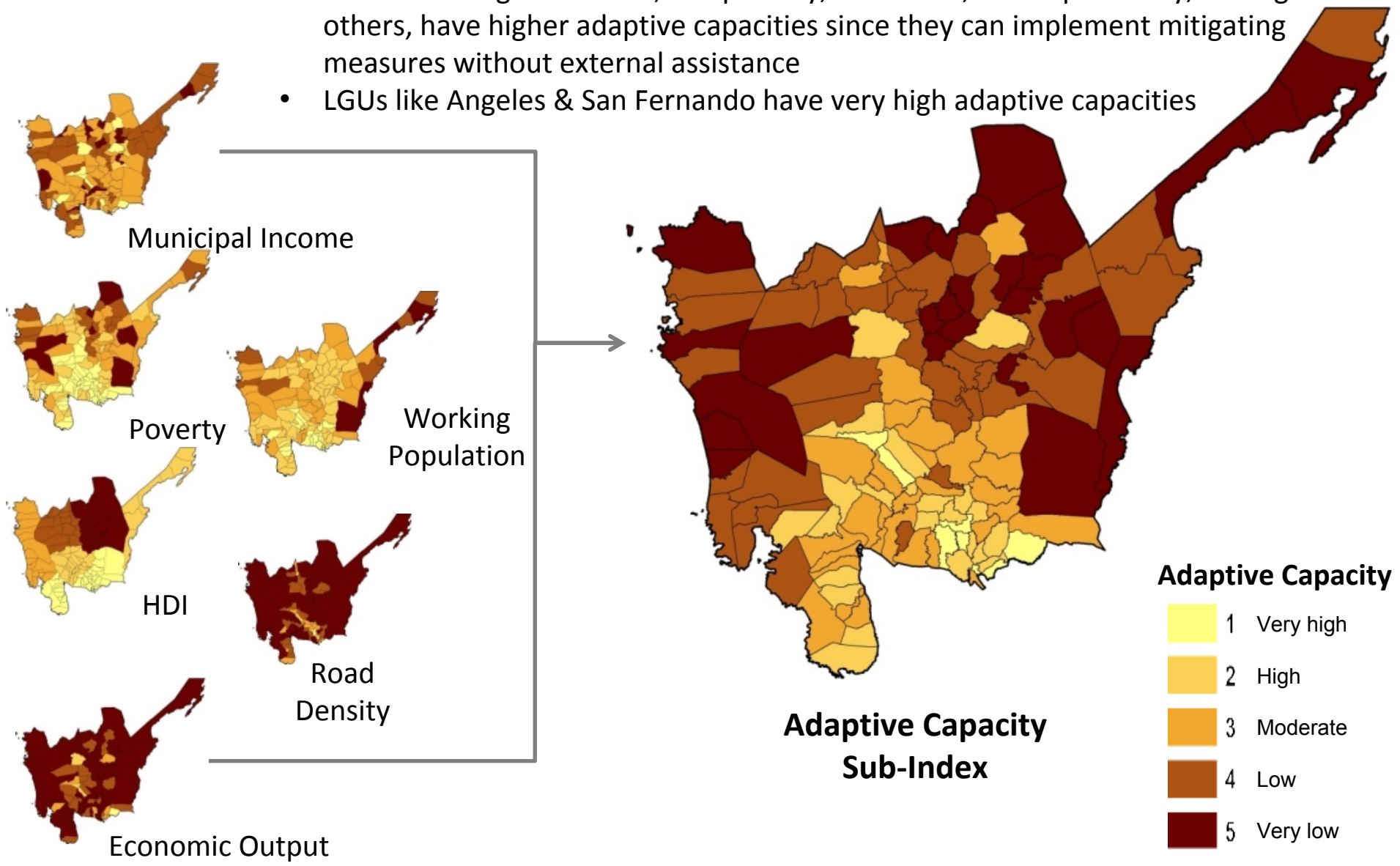
- Densely populated areas and or large built up have high potential exposure to climate hazards



III. GIS-based Analytical Tools

■ CCVA

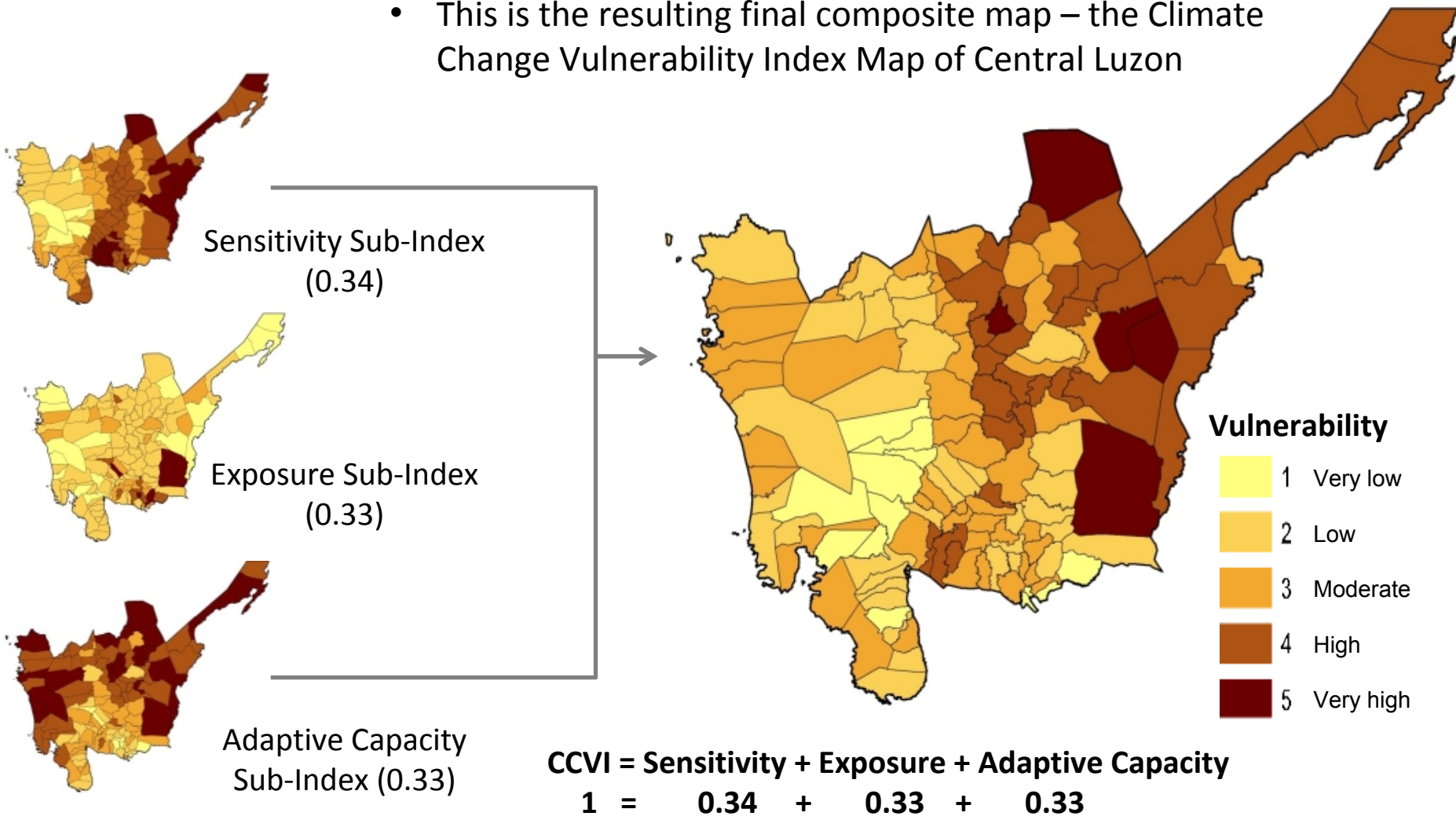
- Areas with higher income, low poverty, accessible, low dependency, among others, have higher adaptive capacities since they can implement mitigating measures without external assistance
- LGUs like Angeles & San Fernando have very high adaptive capacities



III. GIS-based Analytical Tools

■ CCVA

- This is the resulting final composite map – the Climate Change Vulnerability Index Map of Central Luzon

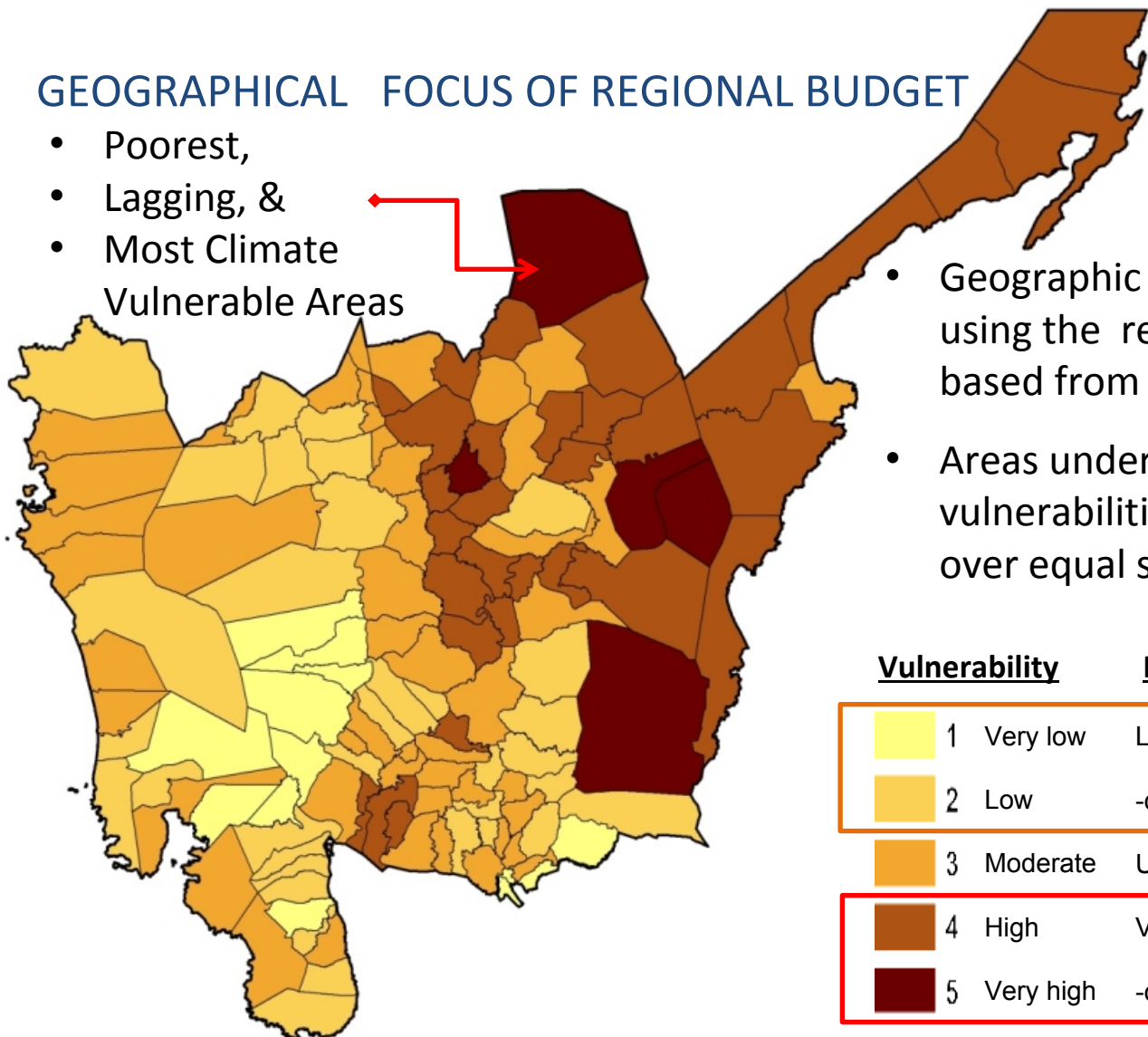
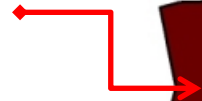


III. GIS-based Analytical Tools

■ CCVA

GEOGRAPHICAL FOCUS OF REGIONAL BUDGET

- Poorest,
- Lagging, &
- Most Climate Vulnerable Areas



- Geographic targeting may be facilitated using the recommended scheme below based from NEDA CCV study
- Areas under moderate to very high vulnerabilities may be given premium over equal sharing

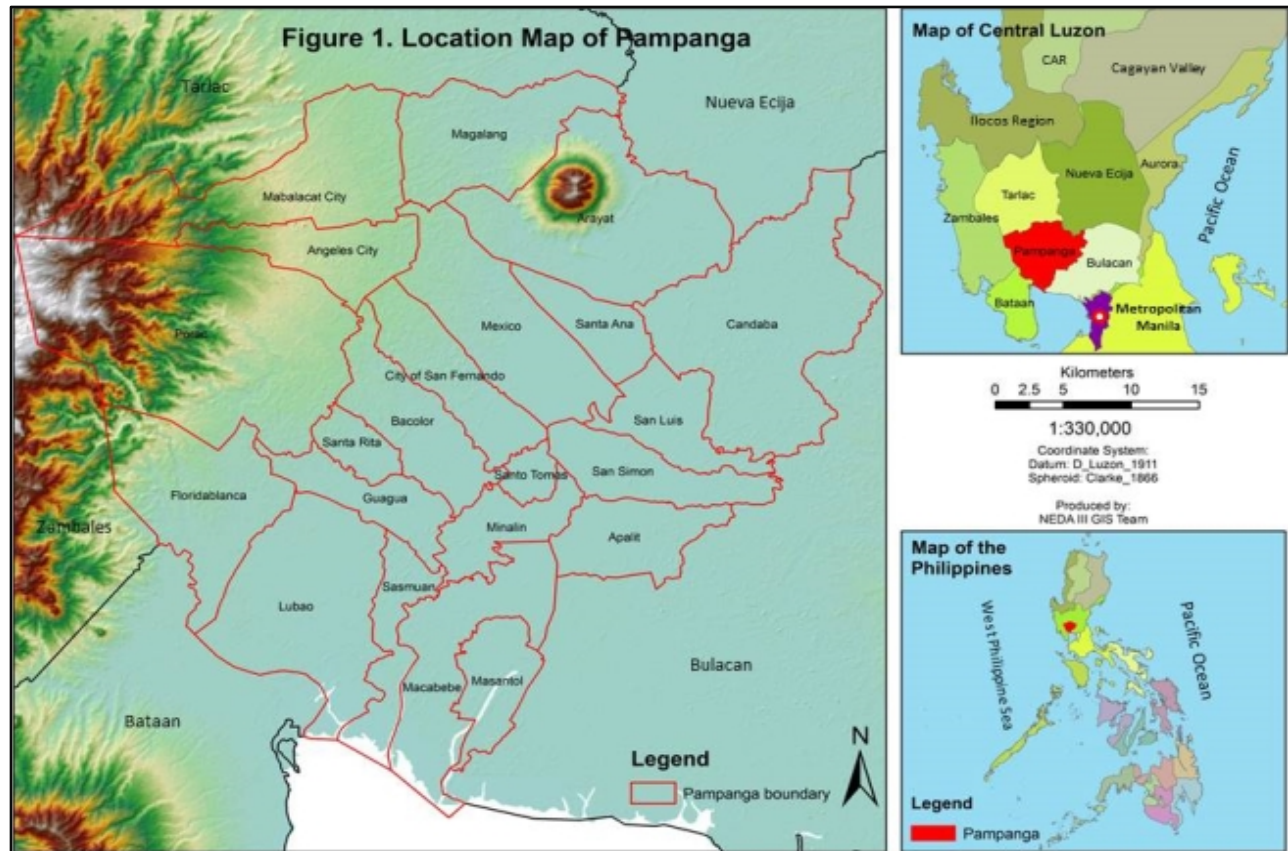
| <u>Vulnerability</u> | <u>Priority</u> | <u>Premium</u> |
|----------------------|-----------------|--------------------|
| 1 Very low | Less urgent | Equal sharing (ES) |
| 2 Low | -do- | -do- |
| 3 Moderate | Urgent | ES + 10% premium |
| 4 High | Very urgent | ES + 20% premium |
| 5 Very high | -do- | -do- |

Consequence Analysis

III. GIS-based Analytical Tools

■ Consequence Analysis

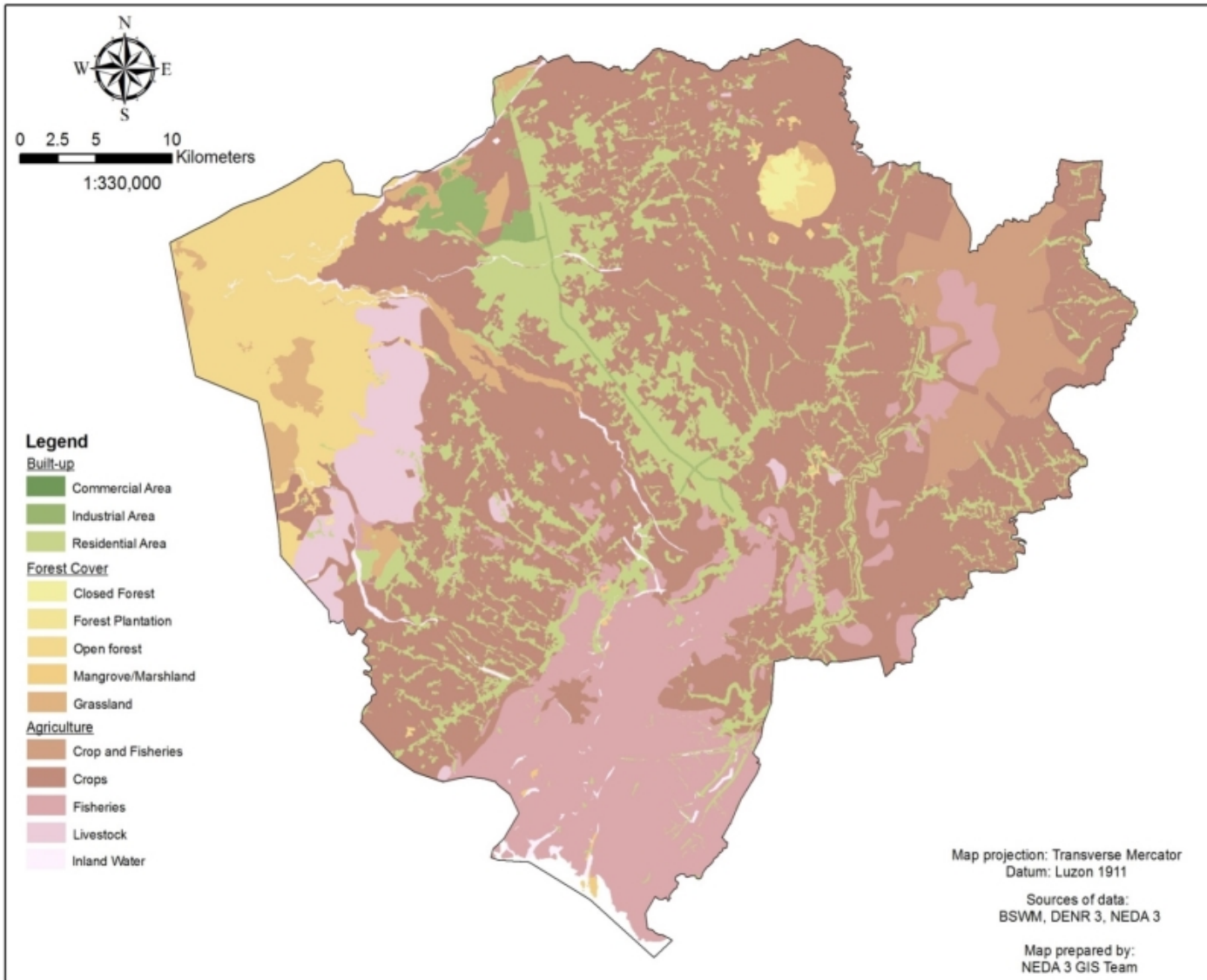
Consequence Analysis on Rain-Induced Land Slide (RIL) and Flooding Risks – Province of Pampanga, Central Luzon



Risk = Hazard x
Elements at Risk x
Vulnerability

III. GIS-based Analytical Tools

■ Consequence Analysis



Elements at Risk:

- Built-up areas
- Forest cover
- Agri/
Fisheries

III. GIS-based Analytical Tools

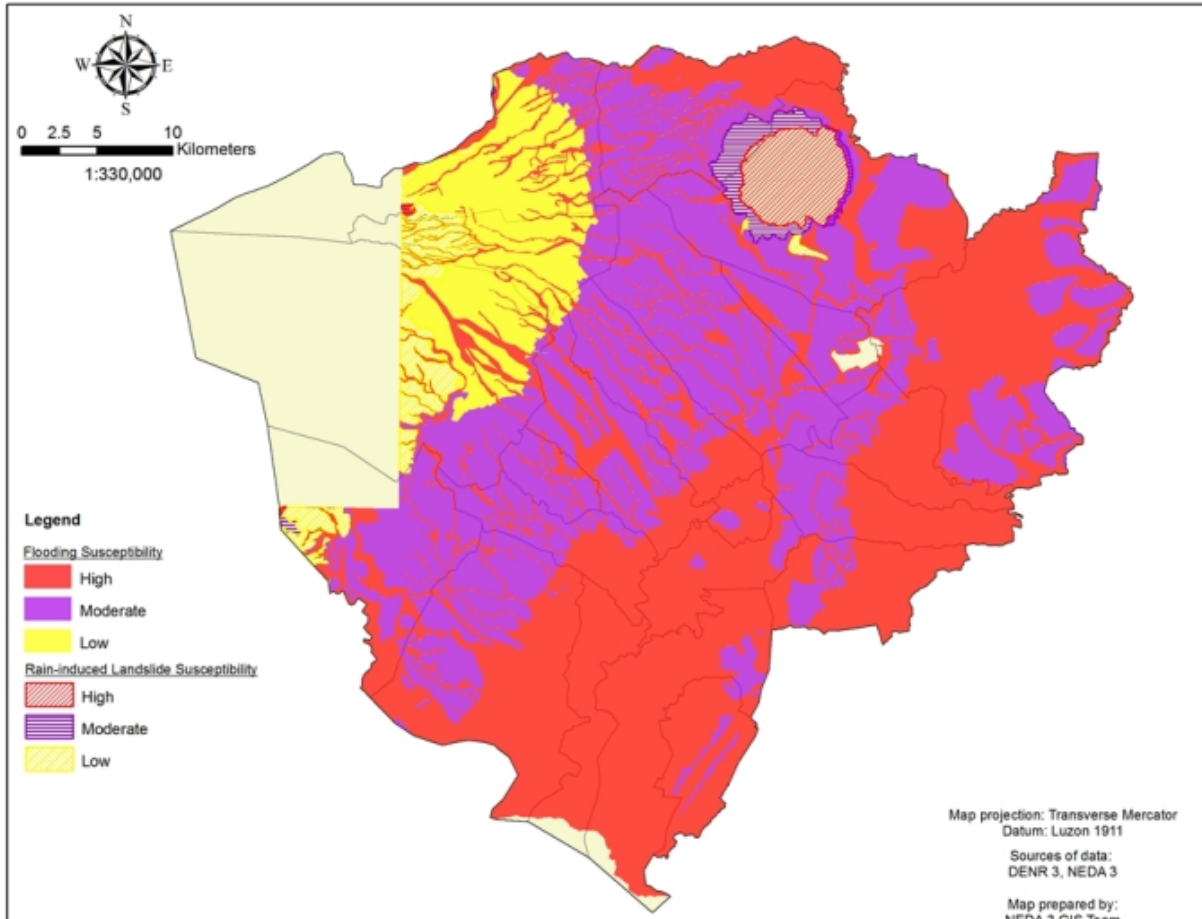
■ Consequence Analysis

Elements at Risk (Value, Php) – damage value

| Category | Area (ha) | Productivity/ Replacement Value (Php/Ha) |
|----------------------|------------|--|
| Built-up | | |
| -Commercial | 165.34 | 21,106,506 |
| -Industrial | 1,718.54 | 5,628,402 |
| -Residential | 29,907.12 | 21,106,506 |
| Forest Cover | | |
| -Closed Forest | 773.06 | 195,000 |
| -Forest Plantation | 44.59 | 195,000 |
| -Open Forest | 17,677.33 | 97,500 |
| -Mangrove/Marshland | 171.82 | 97,500 |
| -Grassland | 4,868.17 | 19,500 |
| Agriculture | | |
| -Crops and Fisheries | 9,582.97 | 195,000 |
| -Crops | 103,466.17 | 274,385 |
| -Fisheries | 30,399.30 | 274,385 |
| -Livestock | 7,675.22 | 411,577 |

III. GIS-based Analytical Tools

■ Consequence Analysis



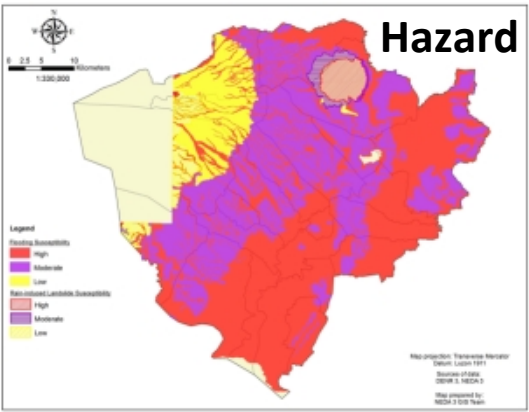
| Susceptibility | RIL | | Flooding | |
|----------------|---------------|-------------|---------------|-------------|
| | Return Period | Probability | Return Period | Probability |
| High | 5 | 0.20 | 5 | 0.20 |
| Moderate | 10 | 0.10 | 10 | 0.10 |
| Low | 20 | 0.05 | 20 | 0.05 |
| Debris Zone | 5 | 0.20 | - | - |

- Probability of occurrence of a hazard must be defined
- Hazard events happening more frequently should be given importance

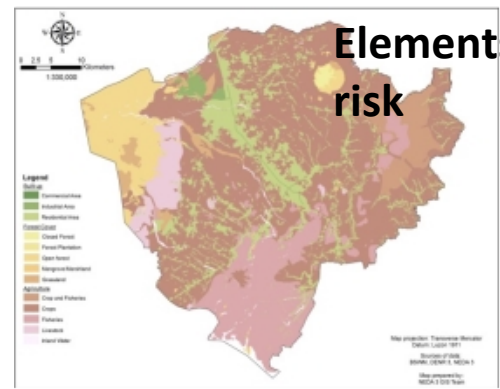
III. GIS-based Analytical Tools

■ Consequence Analysis

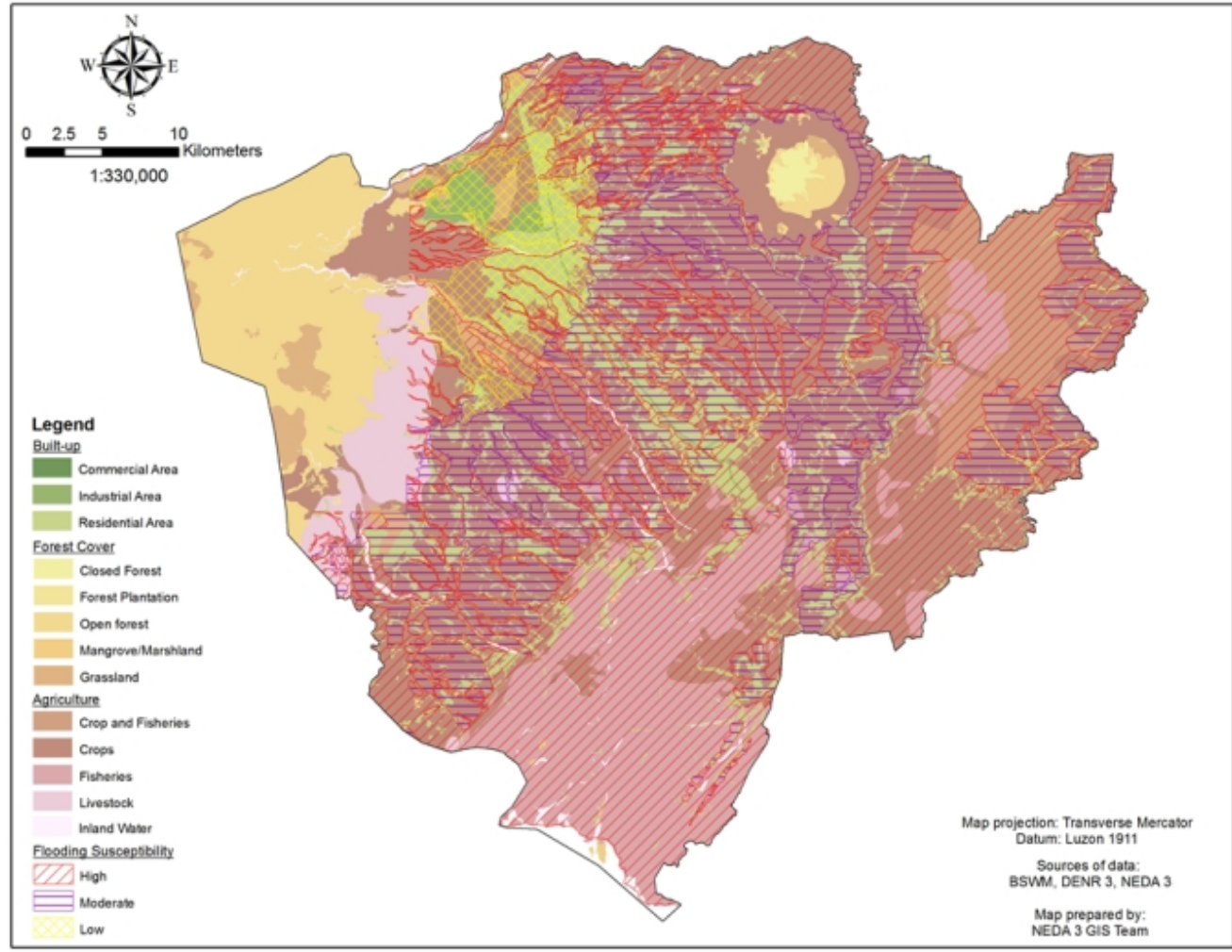
Elements Potentially Exposed to Flooding Risk



X



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III. GIS-based Analytical Tools

■ Consequence Analysis

| Land Use | Exposure (Ha) | | |
|----------------------|----------------------------------|------------------------------|-----------------------------------|
| | H S A (5-year return) | HSA, MSA (10-year return) | HSA, MSA, LSA (20-year return) |
| Built-up | | | |
| -Commercial | 32 | 124 | 165 |
| -Industrial | 56 | 56 | 1,538 |
| -Residential | 9,559 | 24,258 | 29,387 |
| Forest | | | |
| -Closed Forest | Exposure Table (Flooding) | | |
| -Forest Plantation | - | - | - |
| -Open Forest | 86 | 159 | 161 |
| -Mangrove/Marshland | 97 | 97 | 97 |
| -Grassland | 816 | 1,295 | 2,317 |
| Agriculture | | | |
| -Crops and Fisheries | 8,138 | 9,583 | 9,583 |
| -Crops | 38,723 | 88,394 | 94,657 |
| -Fisheries | 28,993 | 30,243 | 30,243 |
| -Livestock | 719 | 1,499 | 1,652 |

III. GIS-based Analytical Tools

- Consequence Analysis

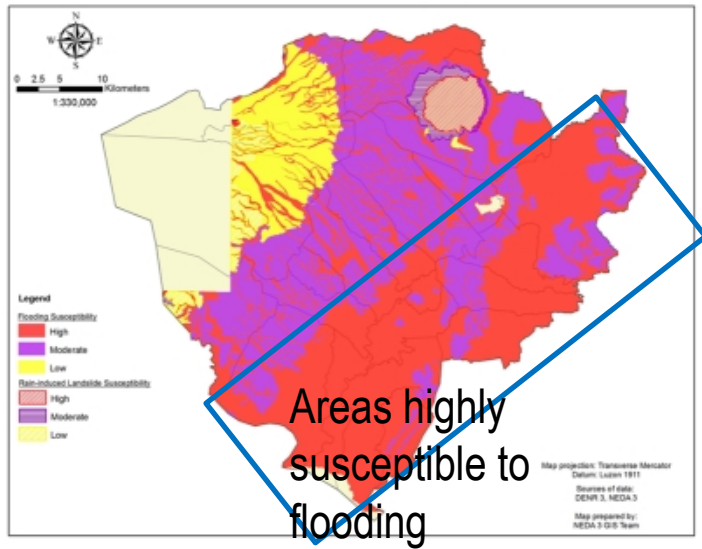
Estimating the Risk (Php)

| Land Use | Exposure (Ha) | | | Elements at Risk, E (Php millions/Ha) | Vulnerability, V | | | Value of Damages, R (Php millions) | | |
|----------------------|----------------|--------------------|-------------------------|---------------------------------------|------------------|--------------------|-------------------------|------------------------------------|--------------------|-------------------------|
| | H S A (5-year) | HSA, MSA (10-year) | HSA, MSA, LSA (20-year) | | H S A (5-year) | HSA, MSA (10-year) | HSA, MSA, LSA (20-year) | H S A (5-year) | HSA, MSA (10-year) | HSA, MSA, LSA (20-year) |
| Built-up | | | | | | | | | | |
| -Commercial | 32 | 124 | 165 | 21.10651 | 0.025 | 0.030 | 0.035 | 17 | 78 | 122 |
| -Industrial | 56 | 56 | 1,538 | 5.62840 | 0.020 | 0.040 | 0.050 | 6 | 13 | 433 |
| -Residential | 9,559 | 24,258 | 29,387 | 21.10651 | 0.025 | 0.030 | 0.035 | 5,044 | 15,360 | 21,709 |
| Forest | | | | | | | | | | |
| -Closed Forest | - | - | - | 0.19500 | 0.025 | 0.030 | 0.035 | - | - | - |
| -Forest Plantation | - | - | - | 0.19500 | 0.025 | 0.030 | 0.035 | - | - | - |
| -Open Forest | 86 | 159 | 161 | 0.09750 | 0.025 | 0.030 | 0.035 | 0 | 0 | 1 |
| -Mangrove/Marshland | 97 | 97 | 97 | 0.09750 | 0.025 | 0.030 | 0.035 | 0 | 0 | 0 |
| -Grassland | 816 | 1,295 | 2,317 | 0.01950 | 0.025 | 0.030 | 0.035 | 0 | 1 | 2 |
| Agriculture | | | | | | | | | | |
| -Crops and Fisheries | 8,138 | 9,583 | 9,583 | 0.19500 | 0.038 | 0.045 | 0.053 | 60 | 84 | 98 |
| -Crops | 38,723 | 88,394 | 94,657 | 0.27438 | 0.025 | 0.030 | 0.035 | 266 | 728 | 909 |
| -Fisheries | 28,993 | 30,243 | 30,243 | 0.27438 | 0.050 | 0.060 | 0.070 | 398 | 498 | 581 |
| -Livestock | 719 | 1,499 | 1,652 | 0.41158 | 0.025 | 0.030 | 0.035 | 7 | 19 | 24 |
| | | | | | | | Total | 5,798 | 16,781 | 23,878 |

III. GIS-based Analytical Tools

■ Cons. analysis

RIL & Flooding Risks Map



- The runs indicated that flood mitigating projects worth **Php6.8 billion** can be implemented in the province & still satisfy the economic viability thresholds

| Year | Investment | MOOE | Total Cost | Benefit | Net |
|------|-----------------|-----------------|------------|---------|-----------|
| 0 | 1,024 | | 1,024 | - | (1,024) |
| 1 | 1,707 | | 1,707 | - | (1,707) |
| 2 | 2,049 | | 2,049 | - | (2,049) |
| 3 | 1,366 | | 1,366 | - | (1,366) |
| 4 | 683 | | 683 | 644 | (39) |
| 5 | | 819 | 819 | 2,145 | 1,326 |
| 6 | | 819 | 819 | 2,145 | 1,326 |
| 7 | | 819 | 819 | 2,145 | 1,326 |
| 8 | | 819 | 819 | 2,145 | 1,326 |
| 9 | | 819 | 819 | 2,145 | 1,326 |
| 10 | | 819 | 819 | 2,145 | 1,326 |
| 11 | | 819 | 819 | 2,145 | 1,326 |
| 12 | | 819 | 819 | 2,145 | 1,326 |
| 13 | | 819 | 819 | 2,145 | 1,326 |
| 14 | | 819 | 819 | 2,145 | 1,326 |
| 15 | | 819 | 819 | 2,145 | 1,326 |
| 16 | | 819 | 819 | 2,145 | 1,326 |
| 17 | | 819 | 819 | 2,145 | 1,326 |
| 18 | | 819 | 819 | 2,145 | 1,326 |
| 19 | | 819 | 819 | 2,145 | 1,326 |
| 20 | | 819 | 819 | 2,145 | 1,326 |
| 21 | | 819 | 819 | 2,145 | 1,326 |
| 22 | | 819 | 819 | 2,145 | 1,326 |
| 23 | | 819 | 819 | 2,145 | 1,326 |
| 24 | | 819 | 819 | 2,145 | 1,326 |
| 25 | | 819 | 819 | 2,145 | 1,326 |
| 26 | | 819 | 819 | 2,145 | 1,326 |
| 27 | | 819 | 819 | 2,145 | 1,326 |
| 28 | | 819 | 819 | 2,145 | 1,326 |
| 29 | | 819 | 819 | 2,145 | 1,326 |
| 30 | | 819 | 819 | 2,145 | 1,326 |
| 31 | | 819 | 819 | 2,145 | 1,326 |
| 32 | | 819 | 819 | 2,145 | 1,326 |
| 33 | | 819 | 819 | 2,145 | 1,326 |
| 34 | | 819 | 819 | 2,145 | 1,326 |
| | MOOE | 12% | | IRR | 15.00% |
| | Investment Cost | Php6,828 | | NPV | (Php0.00) |
| | | | | B/C | Php1.00 |

Benefit-Cost Analysis

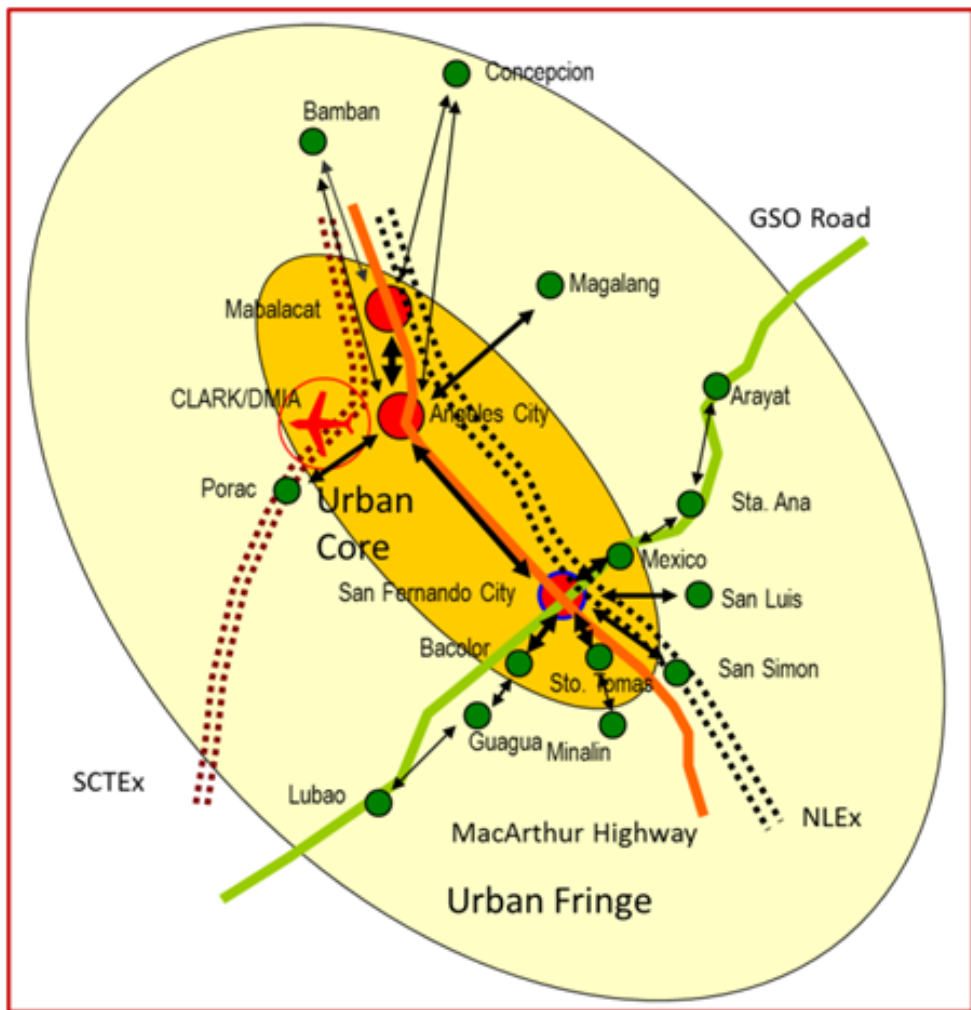
Php6.8 billion

Php6,828

Land-Use/Land-Cover-Change (LULCC) Assessment

III. GIS-based Analytical Tools

- **LU/LCC Assessment**



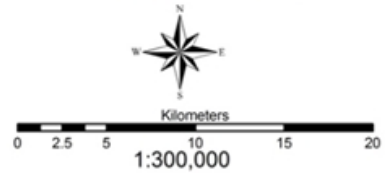
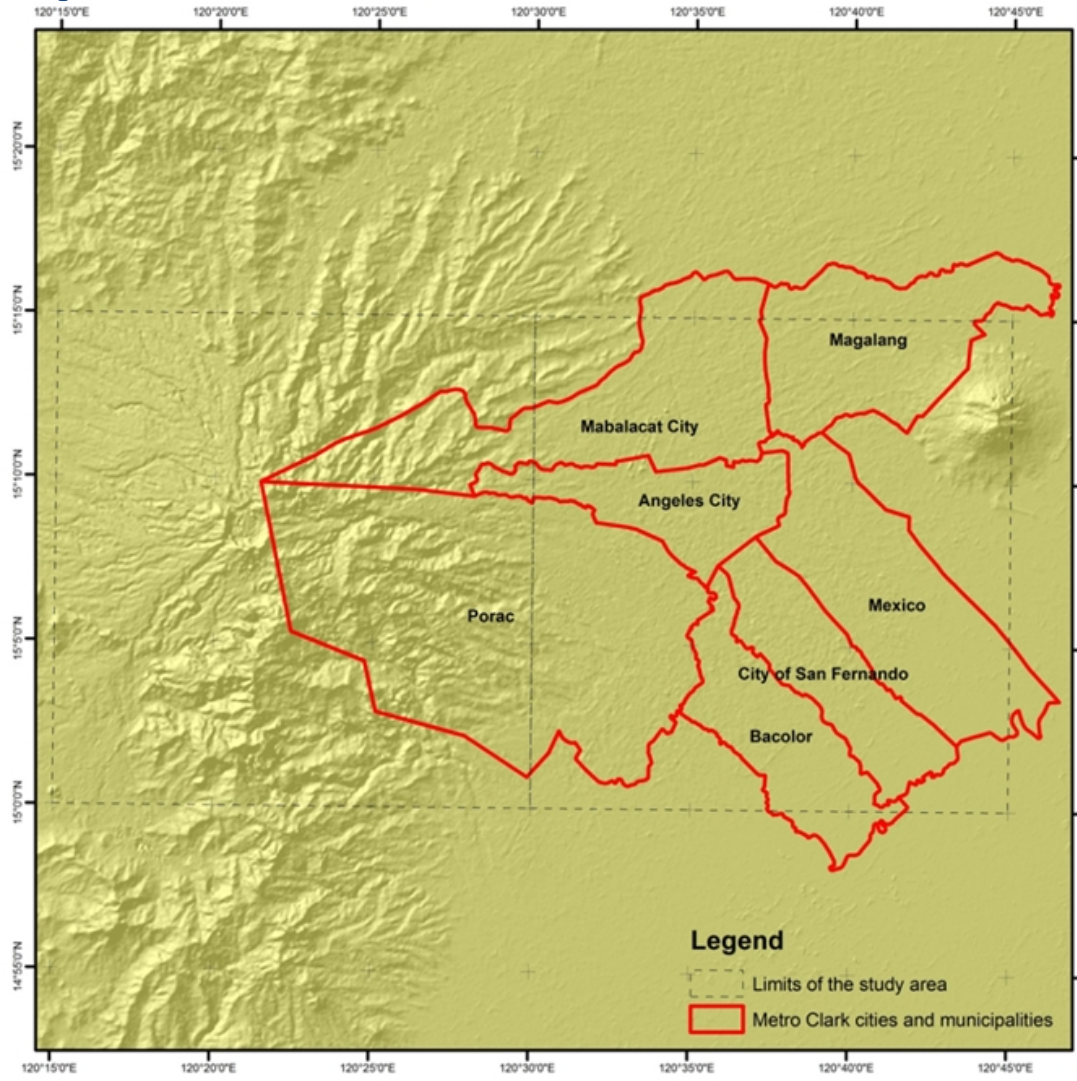
Schematic Diagram of the Urban Core and Urban Fringe of Metro Clark Area



Map of Region III

III. GIS-based Analytical Tools

- **LU/LCC Assessment**



Universal Transverse Mercator
Spheroid: Clark 1866
Datum: Luzon 1911

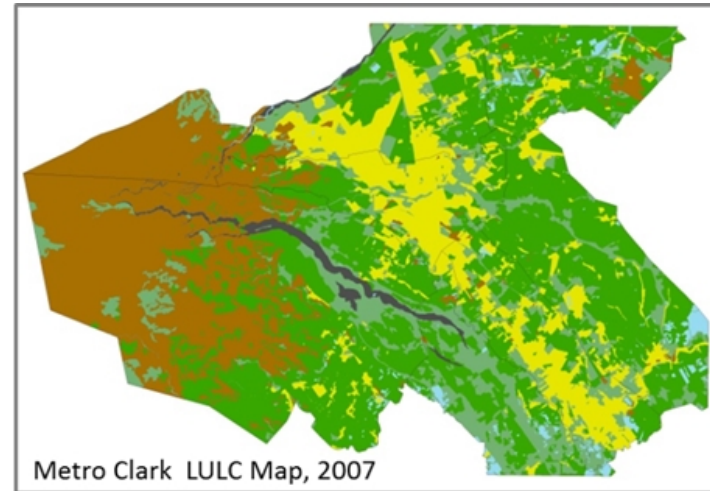
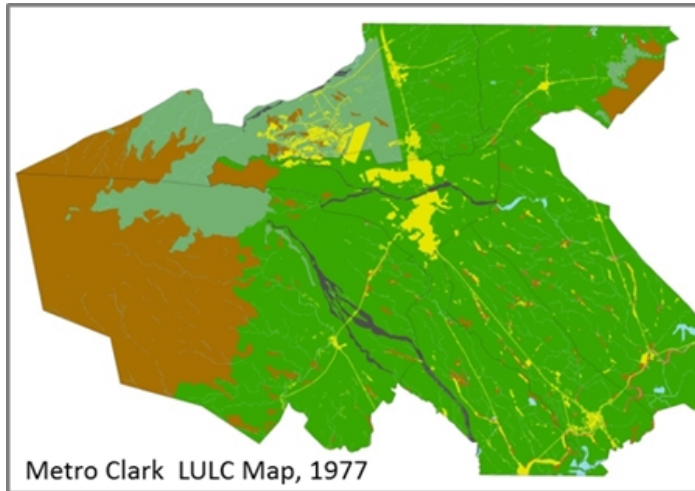
Produced by:
NEDA III GIS Team



The Study Area: Metropolitan Clark

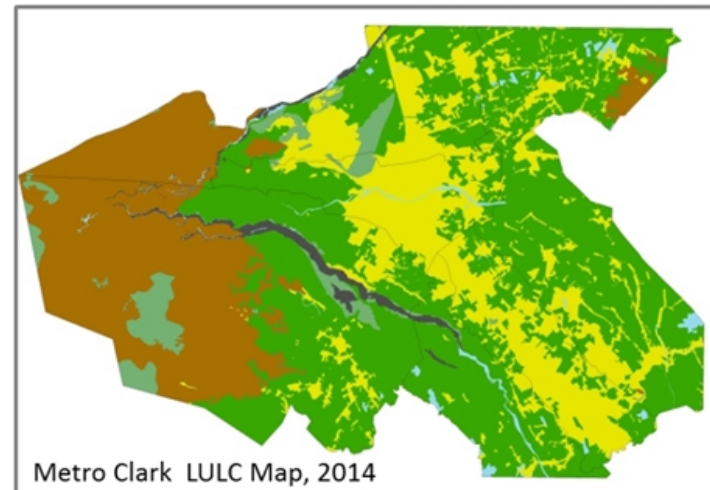
III. GIS-based Analytical Tools

■ LU/LCC Assessment



Legend

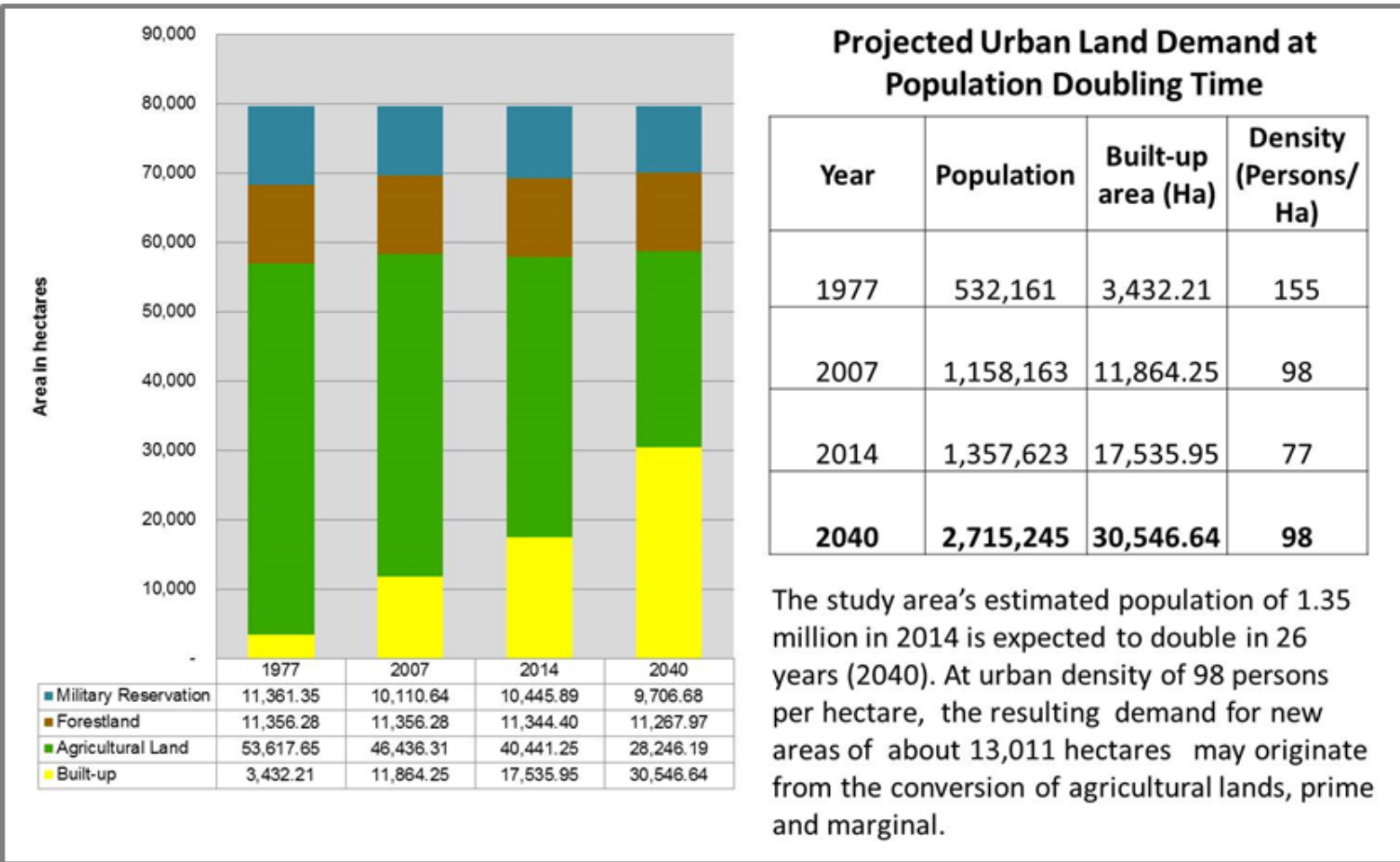
-  Agri/cropland
-  Built-up
-  Inland water/fishpond
-  Sand/lahar deposit
-  Tropical grass/ Clearing
-  Wood/ Shrub



Progression of Land Use and Land Cover in Metro Clark from 1977-2014

III. GIS-based Analytical Tools

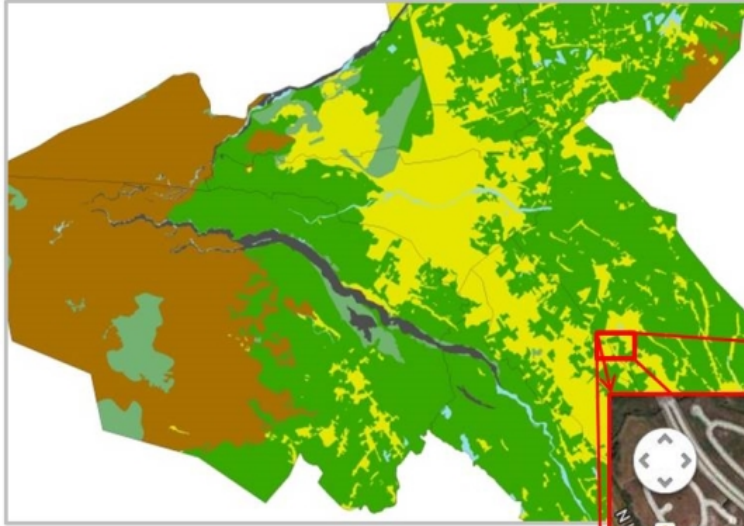
■ LU/LCC Assessment



- This may displace the production 65,000 metric tons of rice annually, enough to supply the rice requirements of 384,407 persons for one (1) year

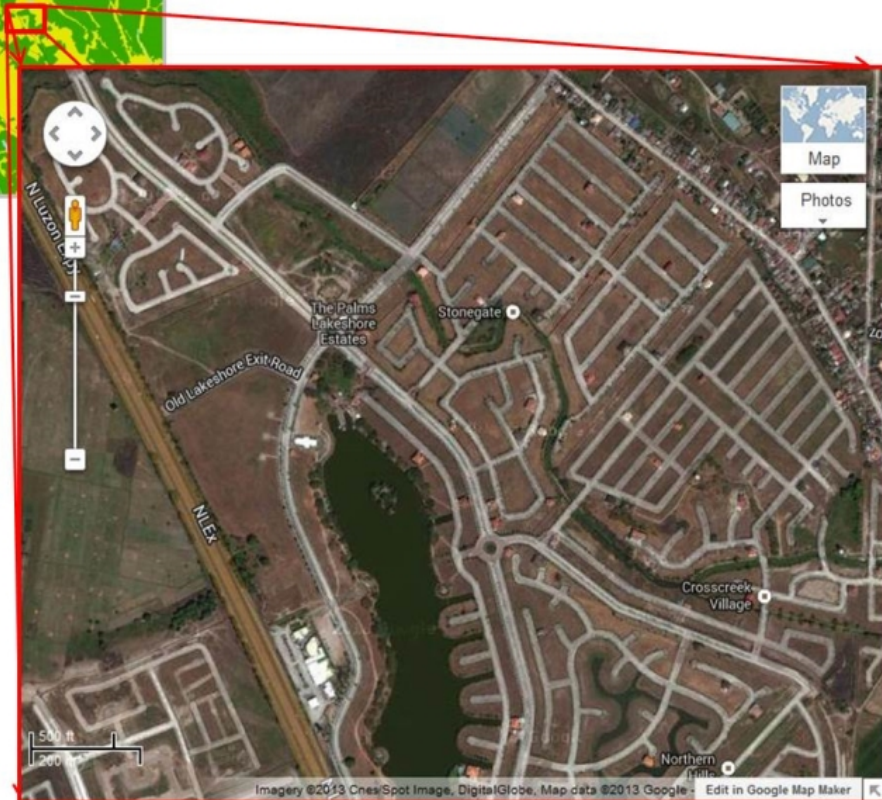
III. GIS-based Analytical Tools

■ LU/LCC Assessment



- A fully Serviced PUD With Very Few Dwelling Structures

- Decreasing urban land density can be explained by this Planned Unit Development (PUD) in Mexico, Pampanga
- Raw agricultural land is converted but with very few dwelling structures erected
- Formerly a sugarcane field



III. GIS-based Analytical Tools

- **LU/LCC Assessment**



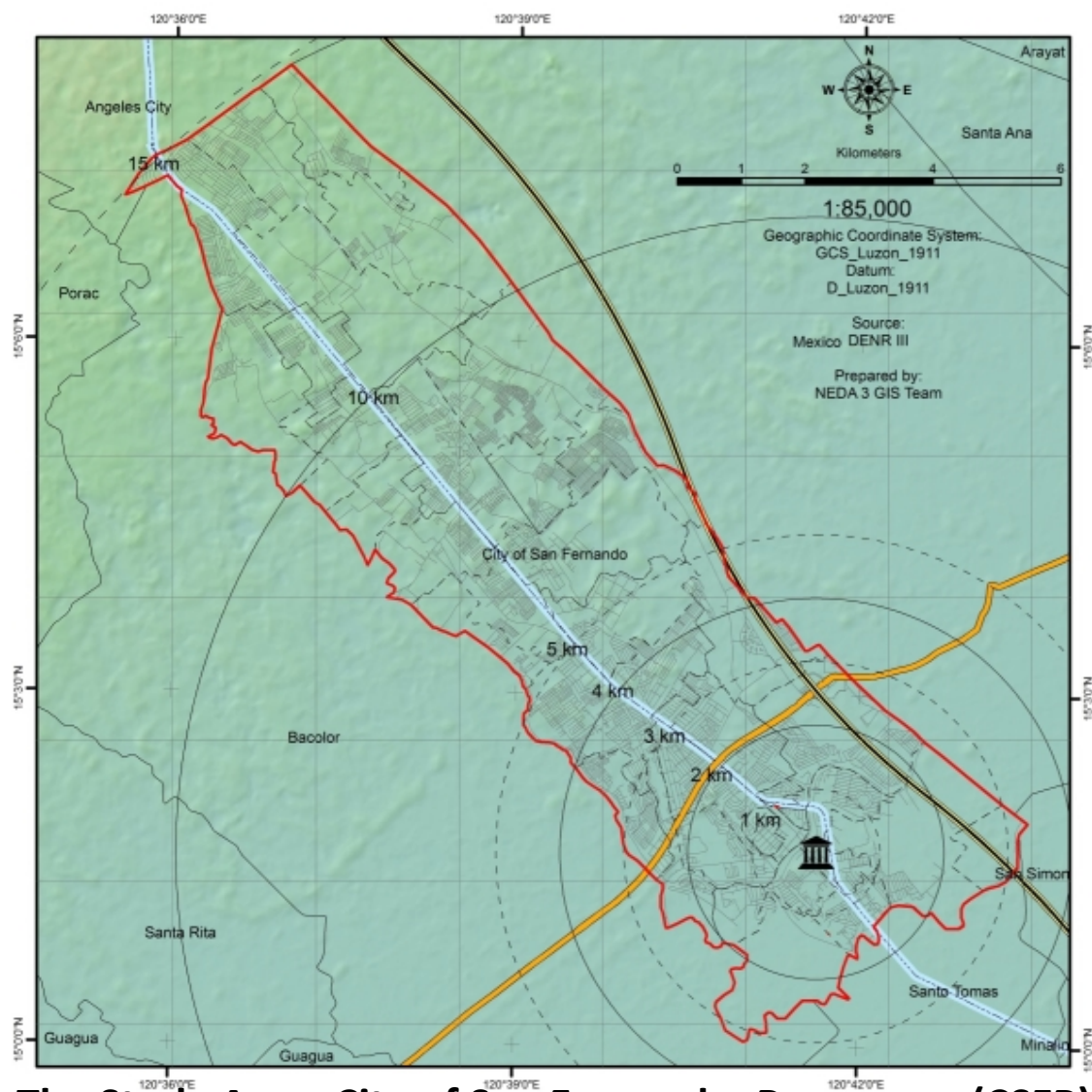
Images of idle lands in the vicinity of Angeles City Hall (top) and Marquee Mall (Right)



- Land Use and Settlement Framework
Sieve Mapping

III. GIS-based Analytical Tools

■ Sieve Mapping



Legend

- City Hall
- Barangay Boundary
- City Boundary
- Major Roads**
 - Jose Abad Santos Avenue
 - MacArthur Highway
 - North Luzon Expressway
 - Barangay Roads
- Grids**
 - 500 hectares



The Study Area: City of San Fernando, Pampanga (CSFP)

III. GIS-based Analytical Tools

■ Sieve Mapping

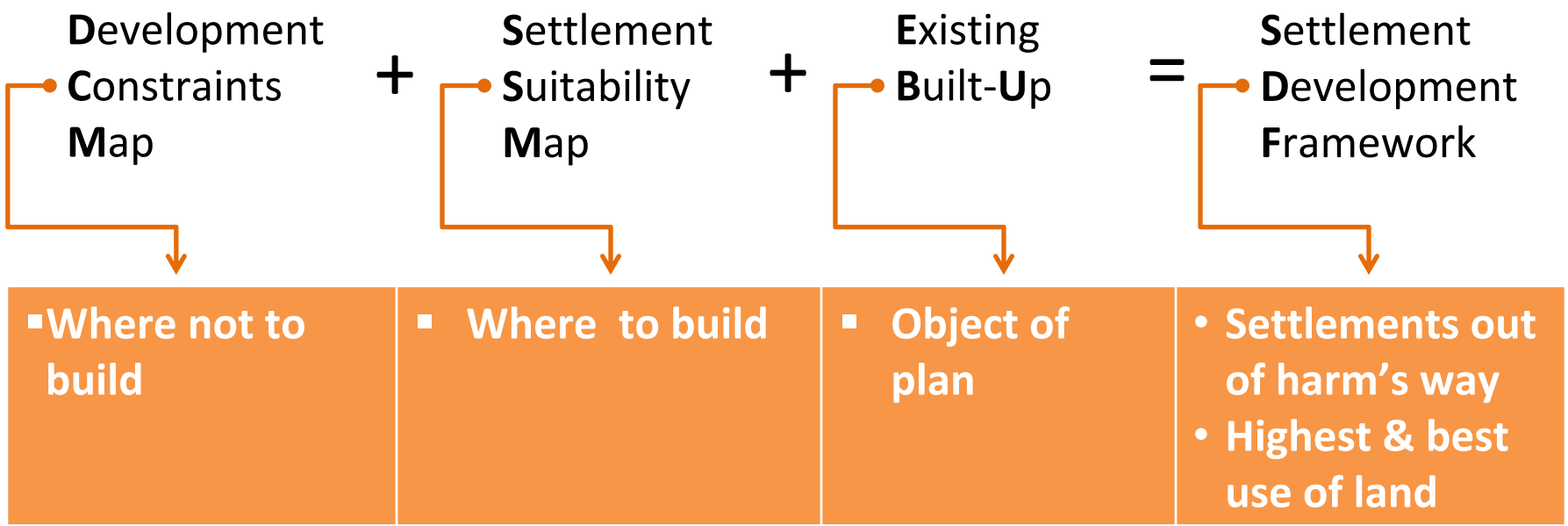
Goal

To establish settlements out of harm's way and achieve the highest and best use of land by identifying areas where to build and where not to build

Objectives

Prepare a development constraints map, identify areas suitable for urban expansion, prepare an existing built-up map, & come up with a settlement development framework

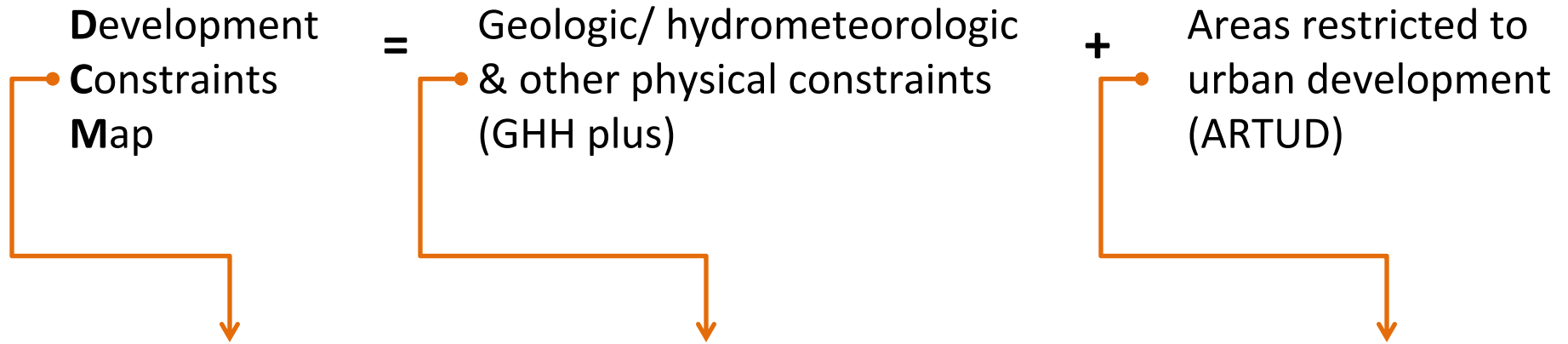
Sieve Mapping Framework



III. GIS-based Analytical Tools

■ Sieve Mapping

Required Maps



• Where not to build

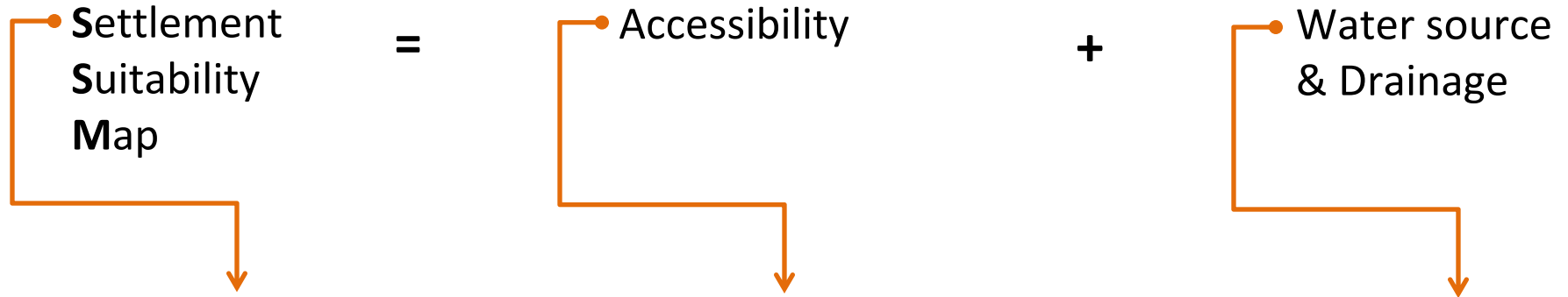
- Flood-prone
- Lahar/ Mudflow prone
- Liquefaction prone
- Steep slopes
- Other hazard and physical constraints

- Forest lands
- SAFDZs
- NIPAS areas
- ROWs
- Other restrictions

III. GIS-based Analytical Tools

■ Sieve Mapping

Required Maps



• Where to build

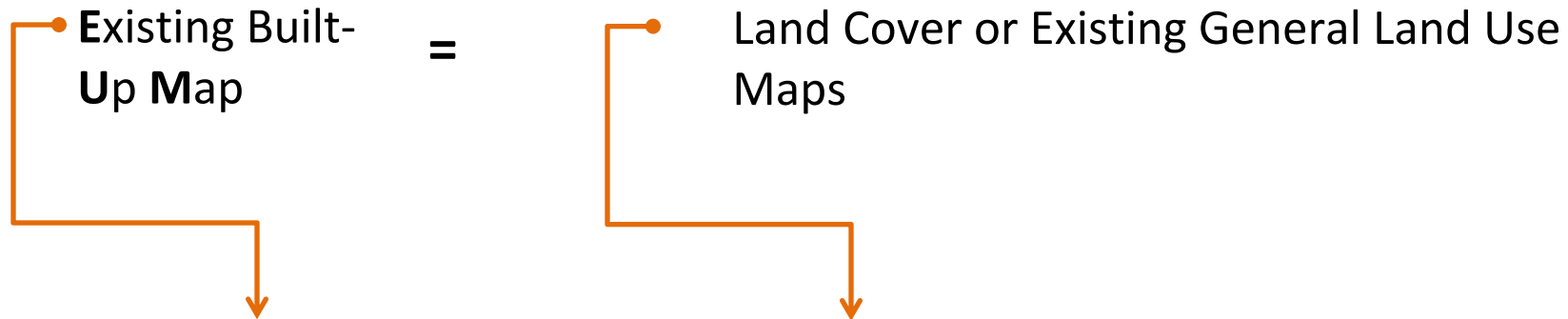
- Road and other infrastructure maps (Build accessible settlements)
- Settlements map (Build adjacent to existing settlements to avoid sprawl and to achieve agglomeration)

- Groundwater map (Build settlements where water table is low)
- Soils map (Build in areas with good internal drainage)

III. GIS-based Analytical Tools

■ Sieve Mapping

Required Maps

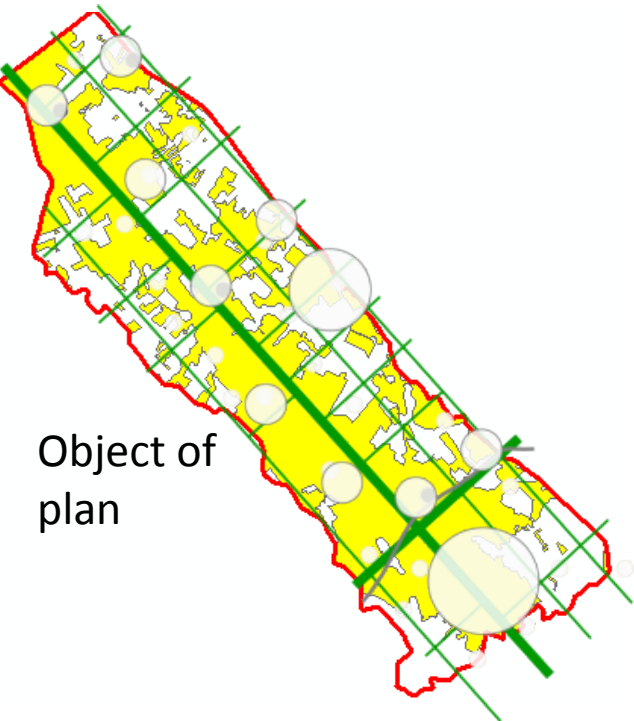
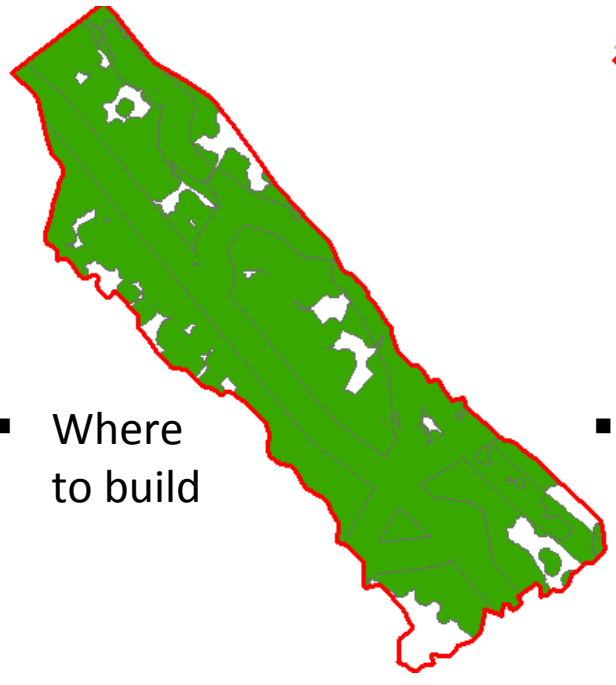
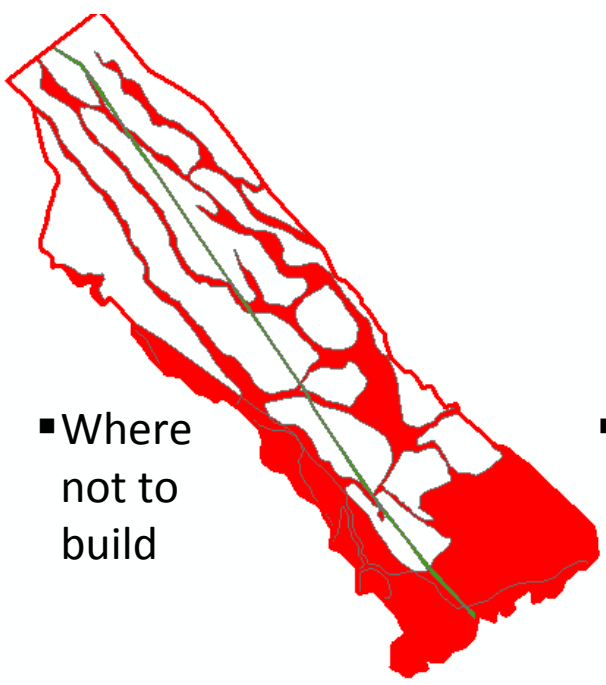
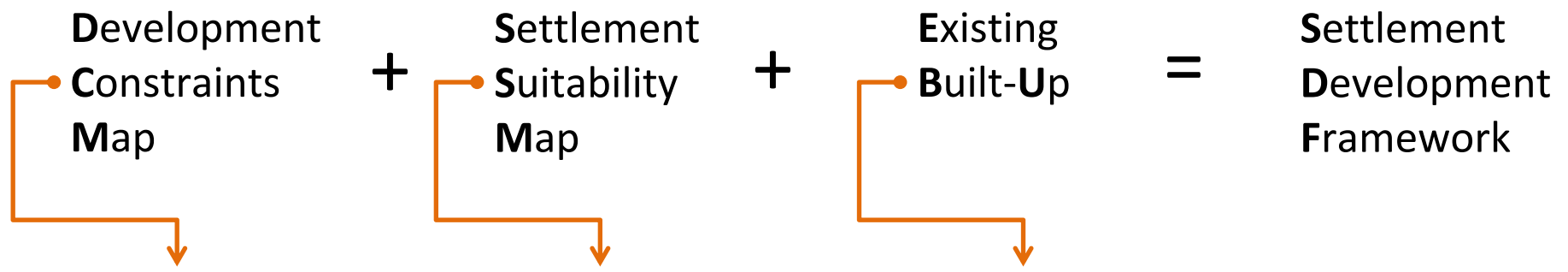


• Object of the Plan

- 1977 Land Cover / General Land Use Map, CSFP (NAMRIA topo map)
- 1997 Land Cover / General Land Use Map, CSFP (NAMRIA topo map)
- 2014 Land Cover / General Land Use Map, CSFP (Google Earth Satellite Image)

III. GIS-based Analytical Tools

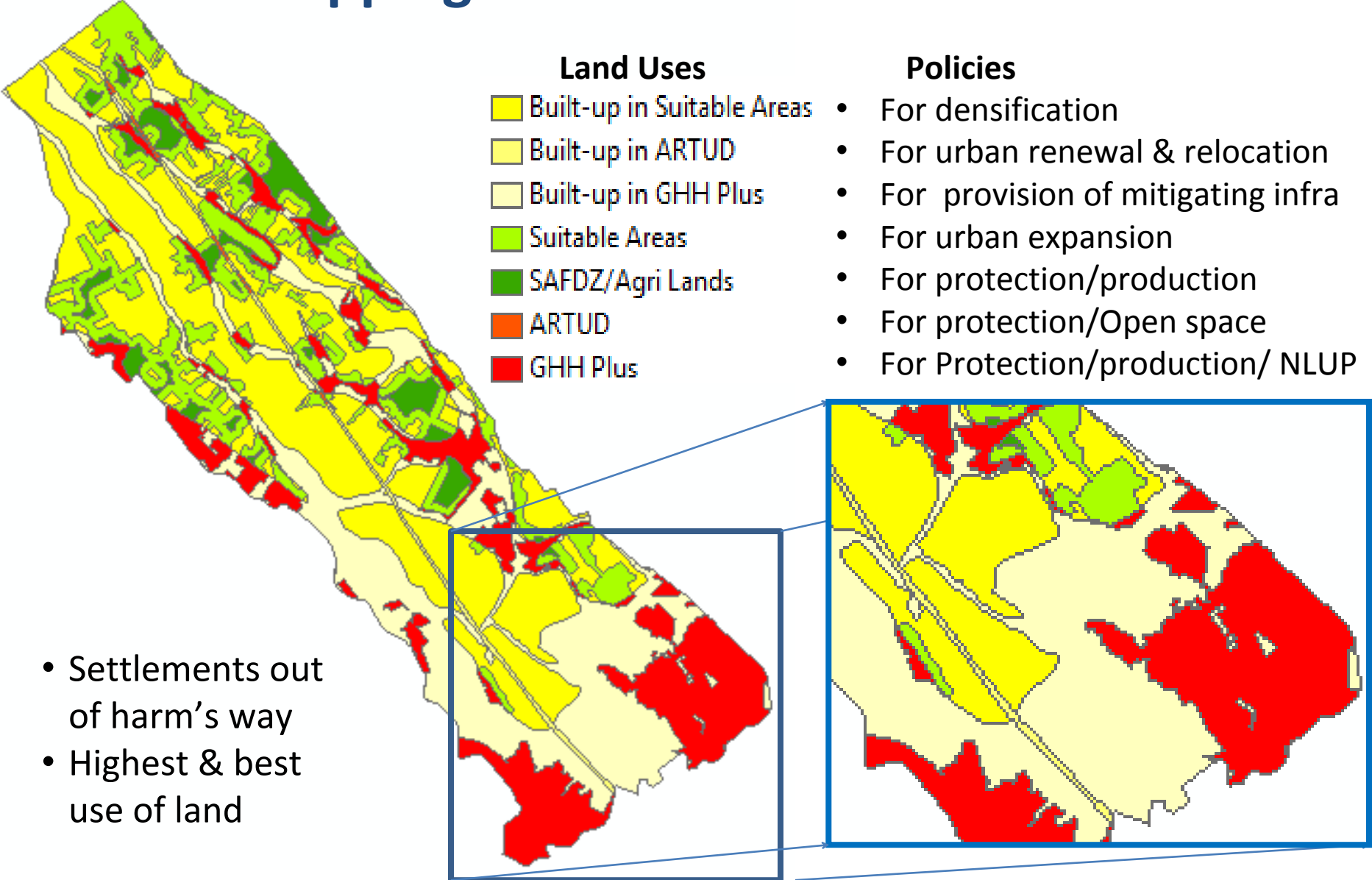
■ Sieve Mapping



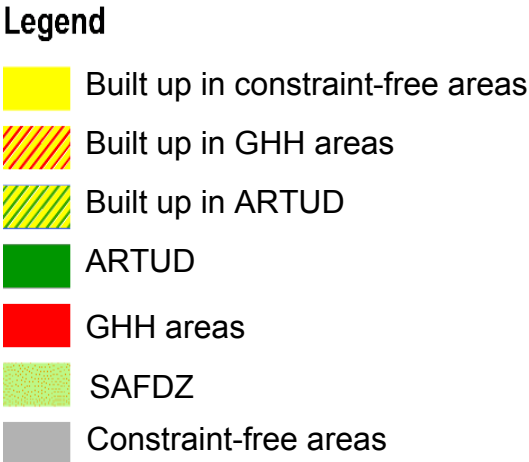
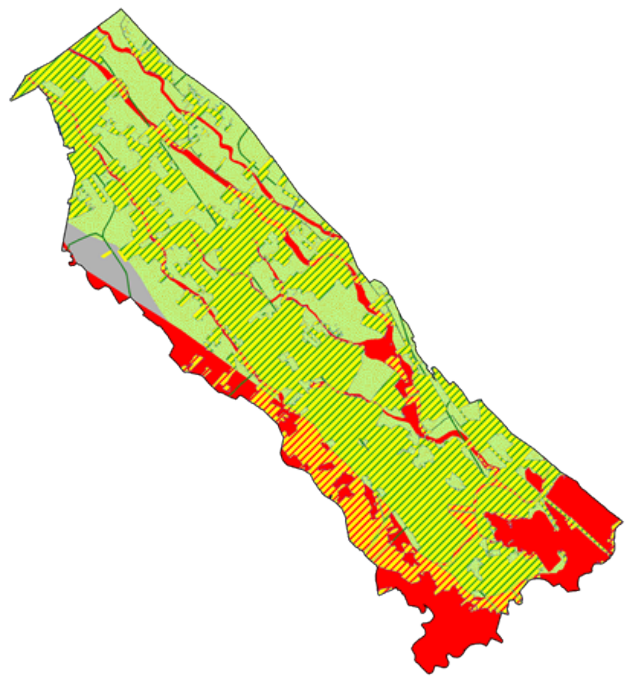
We can now run the final overlay to produce the CSFP Settlement Development Framework.

III. GIS-based Analytical Tools

■ Sieve Mapping The Initial Land Use/Settlement Framework



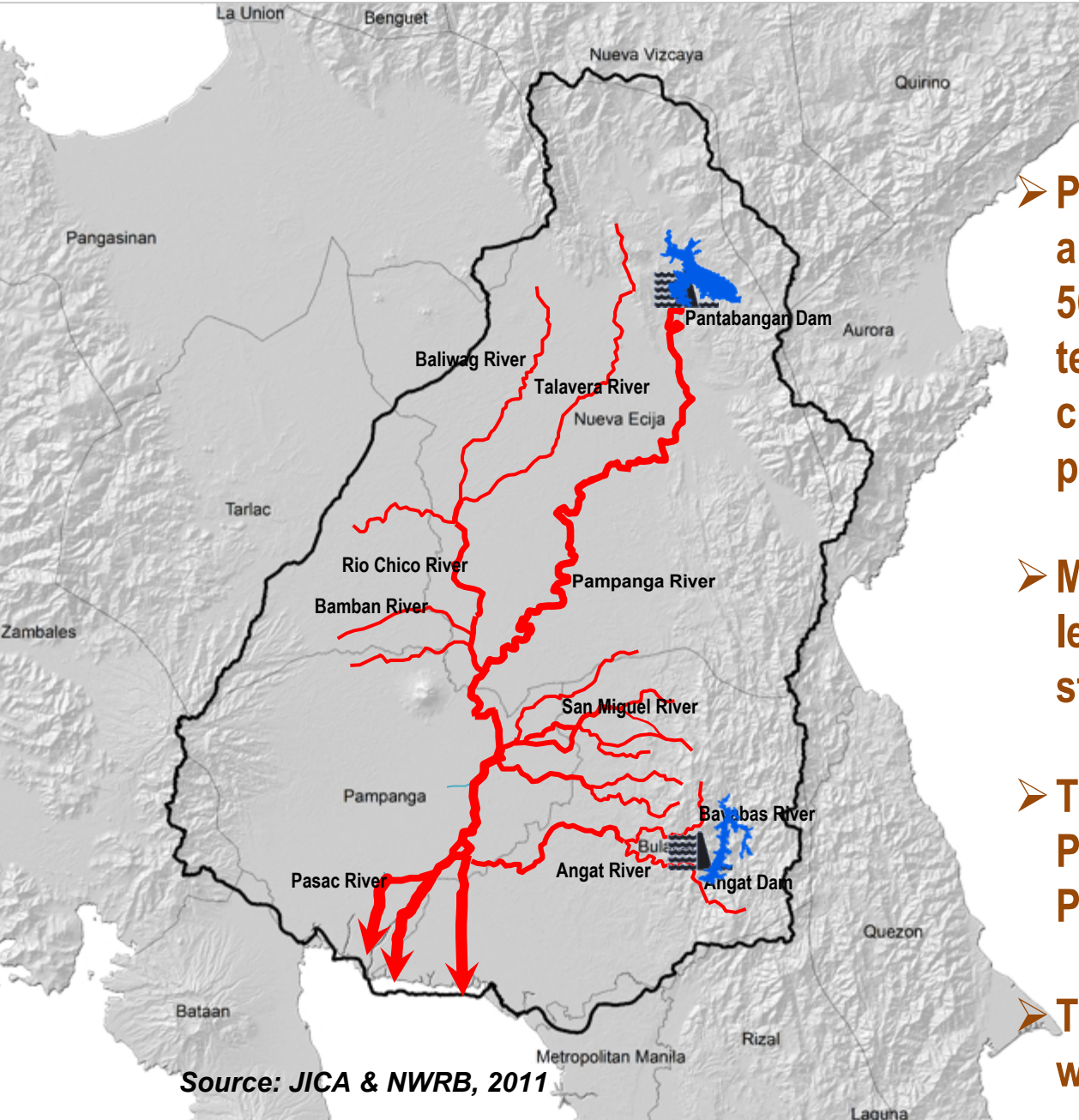
Finalized Land Use & Settlement Development Framework of CSFP



| Land Use Category | Development and Policy Option |
|---|--|
| Built – up in constraint free/ suitable areas | Urban density may be increased through vertical constructions and mixed-use developments. |
| Built – up in GHH areas | Built-up located in areas highly susceptible to flooding or lahar flows may be relocated or provided with mitigating infrastructures. |
| Built – up in ARTUD | Settlements nested in road ROWs or located in protected parks and open spaces will be relocated. |
| Areas Restricted to Urban Development (ARTUD) | For inclusion in the protection land use category or zoned as part of the parks and open spaces |
| Geologic, Hydrometeorologic Hazards (GHH) & Other Physical Restrictions | May be declared permanent danger zones and only non-permanent land use activities may be permitted; May also be included under the protection land use category. |
| SAFDZ/ Agricultural lands | CSFP’s remaining agricultural lands must be protected from conversion, land banking and speculation; Provide fiscal penalties for idle lands. |
| Constraint-free areas/ Suitable areas | Expansion area for built-up and other urban development activities under high density and mixed use intensities; Provide fiscal penalties for idle lands. |

Case Studies

IV. Case Studies - PRB



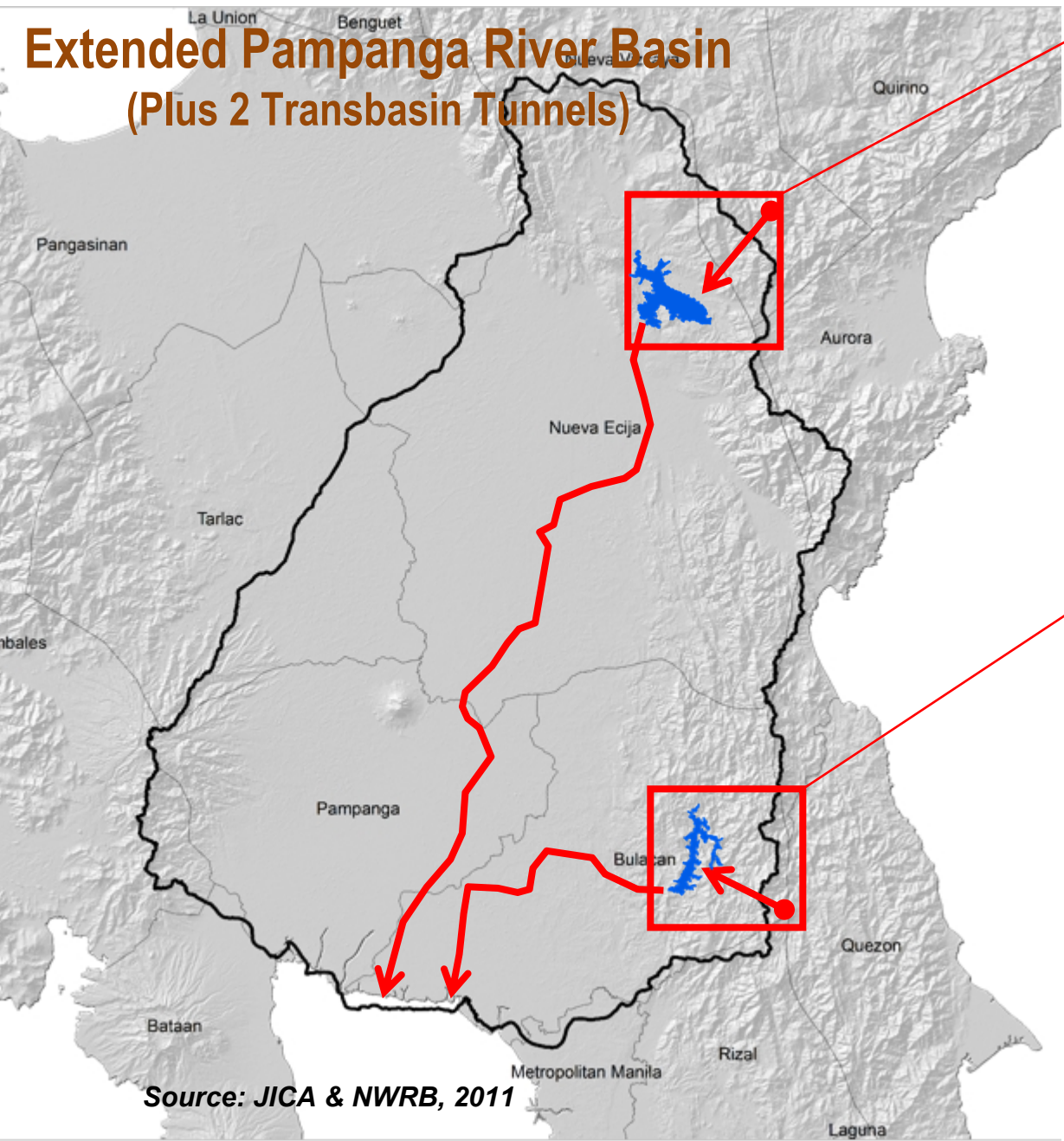
The Pampanga River basin (PRB) and the Central Luzon Floodplain

- PRB has a watershed area of about 1.04 million hectares and 56 tributaries under the territorial jurisdiction of 90 cities and municipalities in 6 provinces
- Meandering main channel length of 240 km versus straight distance of 122 km
- Two (2) major dams are also in PRB, namely: Angat and Pantabangan
- The population of PRB in 2015 was 8.54 million

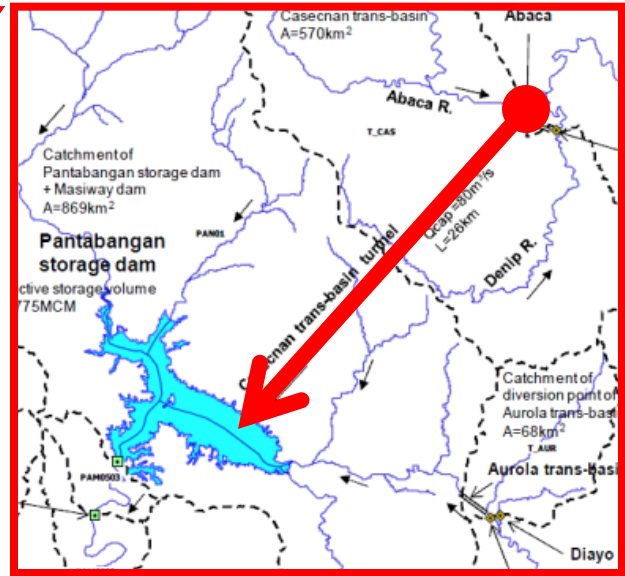
Source: JICA & NWRB, 2011

IV. Case Studies - PRB

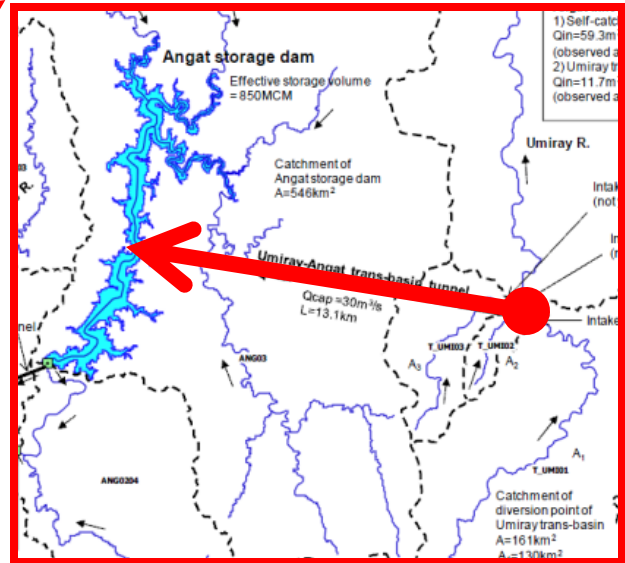
Extended Pampanga River Basin (Plus 2 Transbasin Tunnels)



Source: JICA & NWRB, 2011



Casecanan Transbasin Tunnel

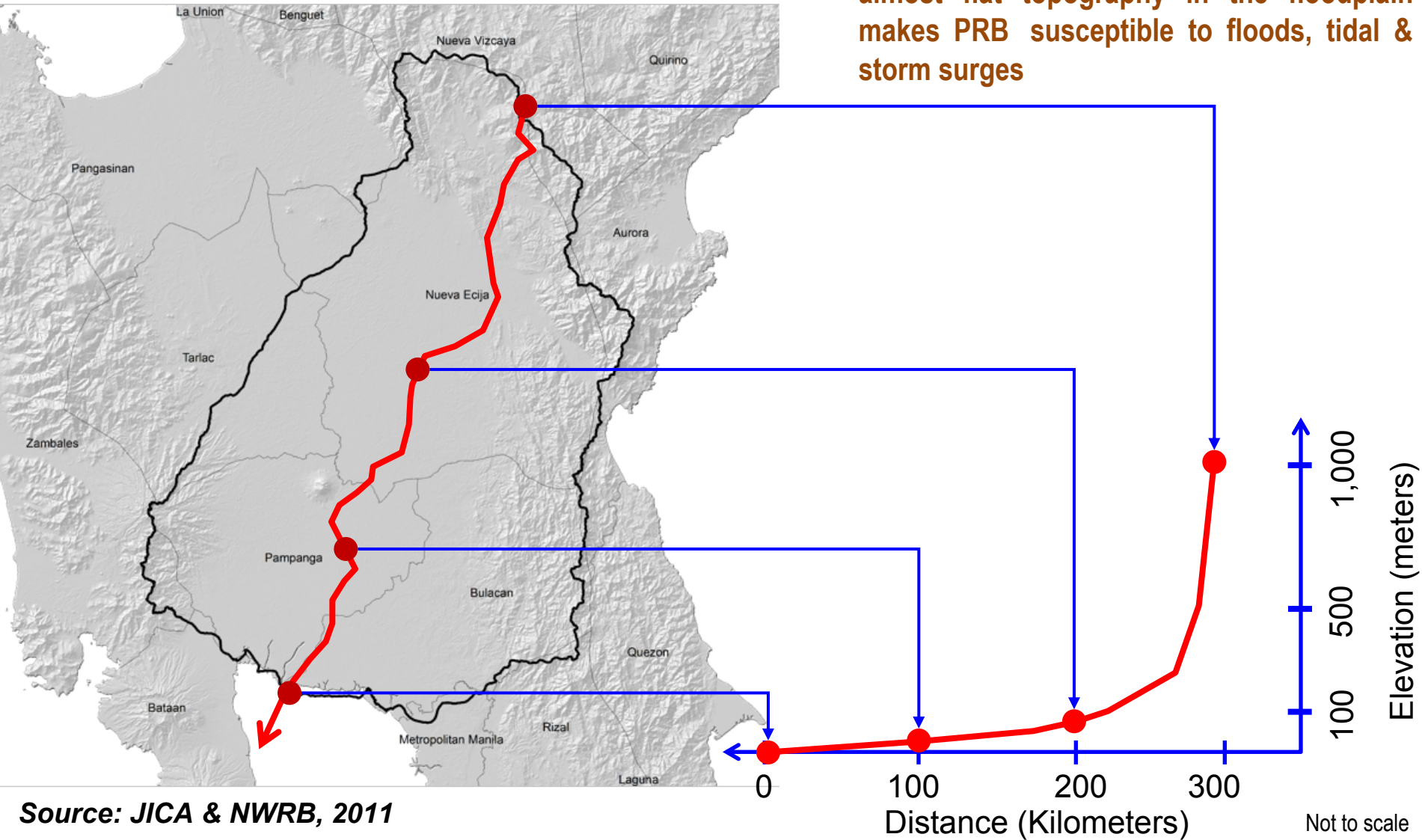


Umiray-Angat Transbasin Tunnel

IV. Case Studies - PRB

Longitudinal Profile of Pampanga River

- Huge catchment area (1,043,400 Has) with almost flat topography in the floodplain makes PRB susceptible to floods, tidal & storm surges

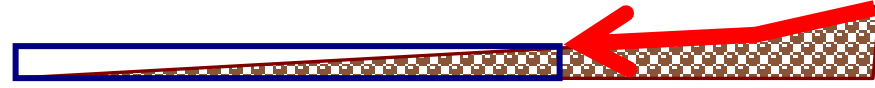
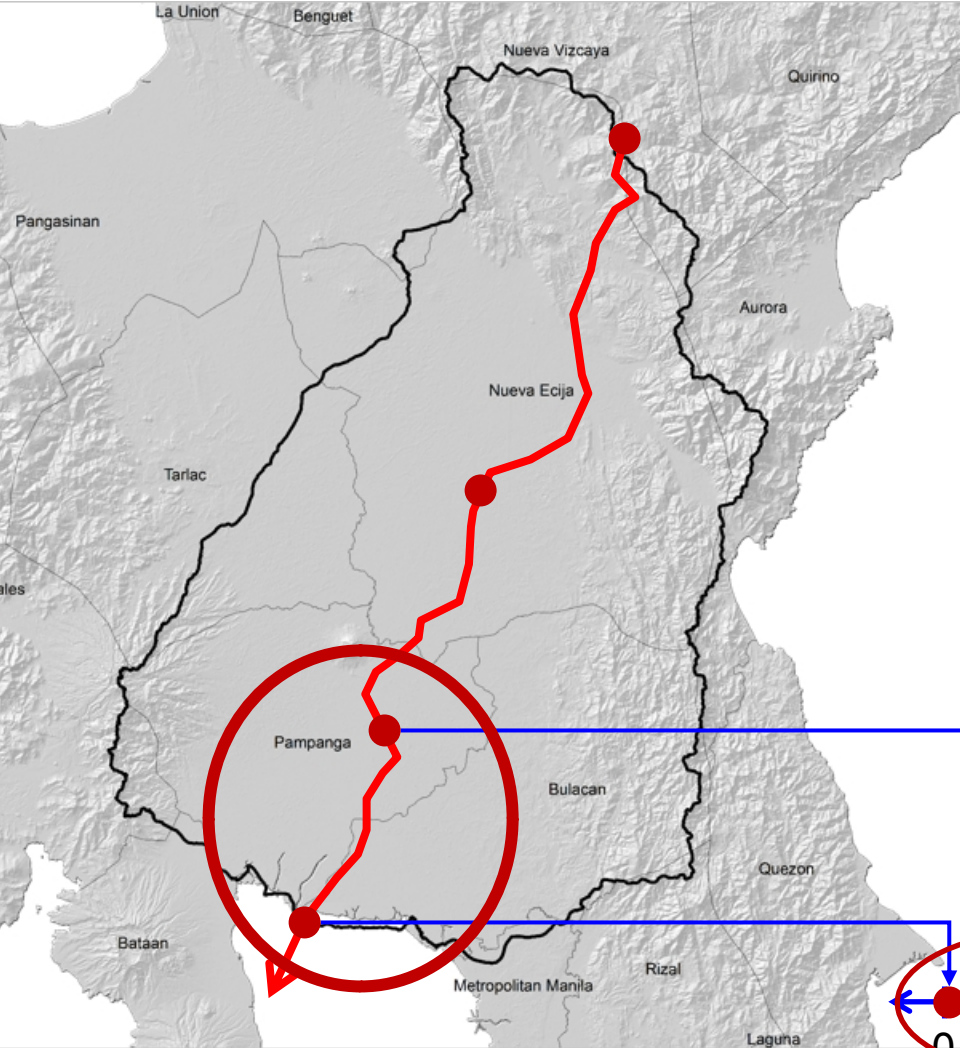


Source: JICA & NWRB, 2011

Not to scale

IV. Case Studies - PRB

Longitudinal Profile of Pampanga River

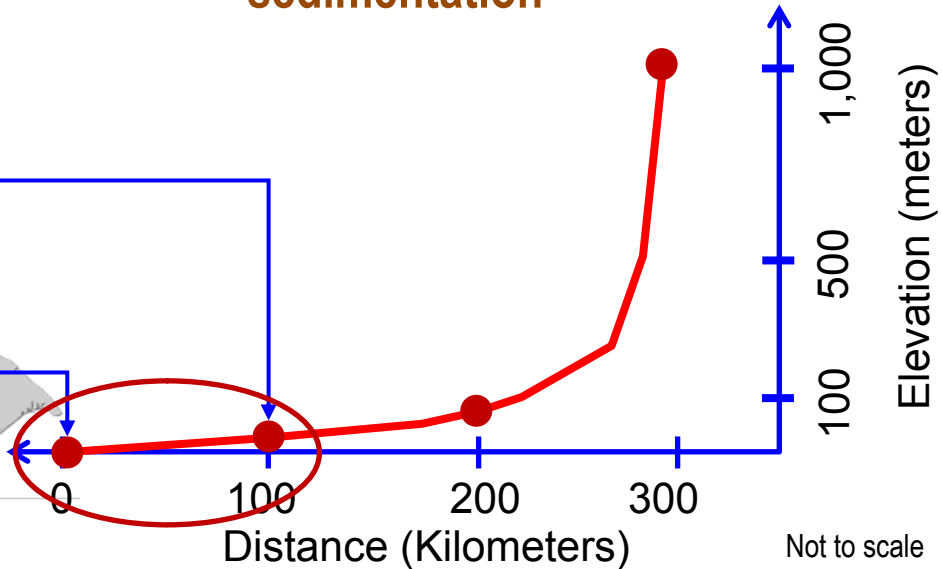


Huge flood flow at regular high tide level



Huge flood flow at extremely high tide level with storm surge

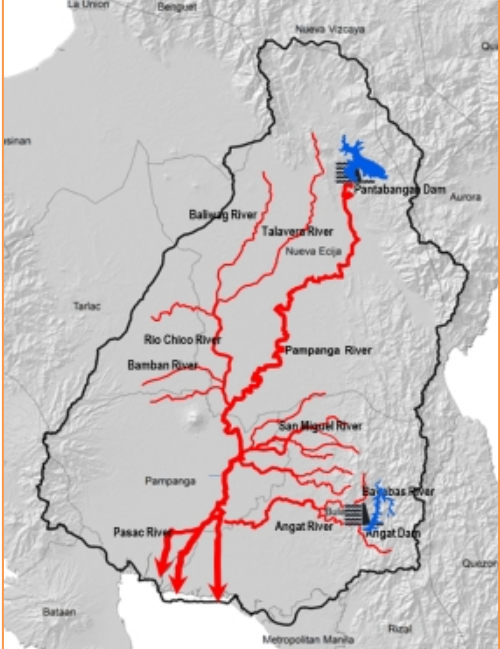
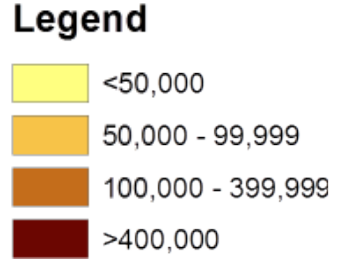
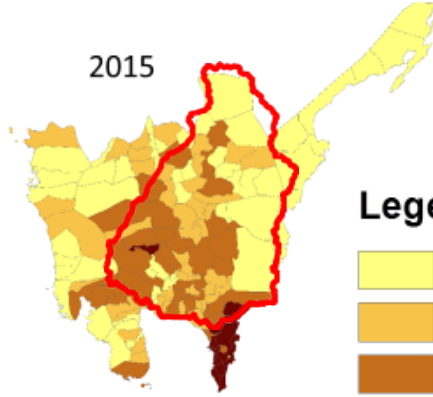
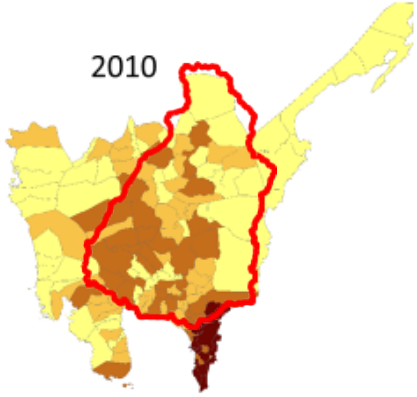
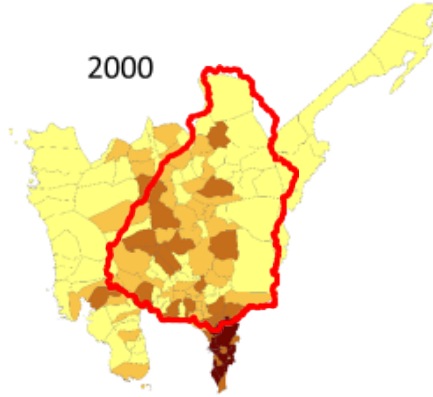
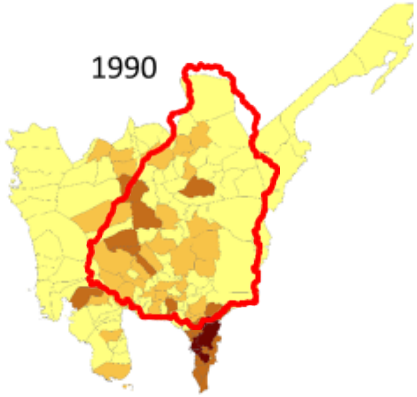
- Flooding can be aggravated by land subsidence, sea level rise, & lahar sedimentation



Source: JICA & NWRB, 2011

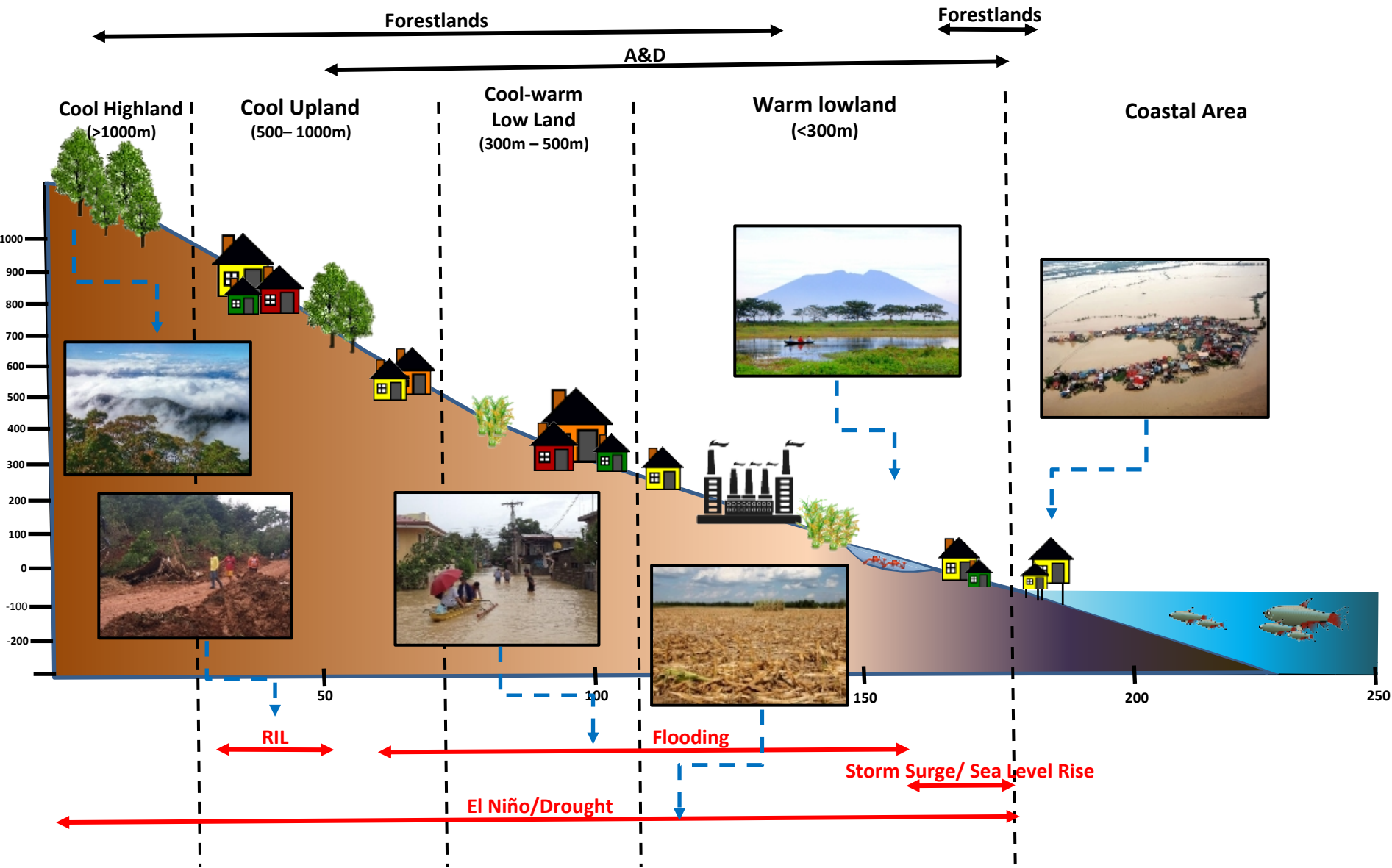
Not to scale

IV. Case Studies - PRB



- Population levels of cities /municipalities in PRB, Central Luzon, and Metro Manila in four (4) census years, 1990 – 2015
- Population of San Jose Del Monte which is the highest amongst cities/ municipalities in 2015 increased by 5.7 percent from 1990-2015
- Population tend to expand in areas prone to hazards

IV. Case Studies - PRB



The integrated ridge-to-reef watershed ecosystem framework - a holistic resource planning and management framework that links conservation and utilization actions across sub-watersheds and zones

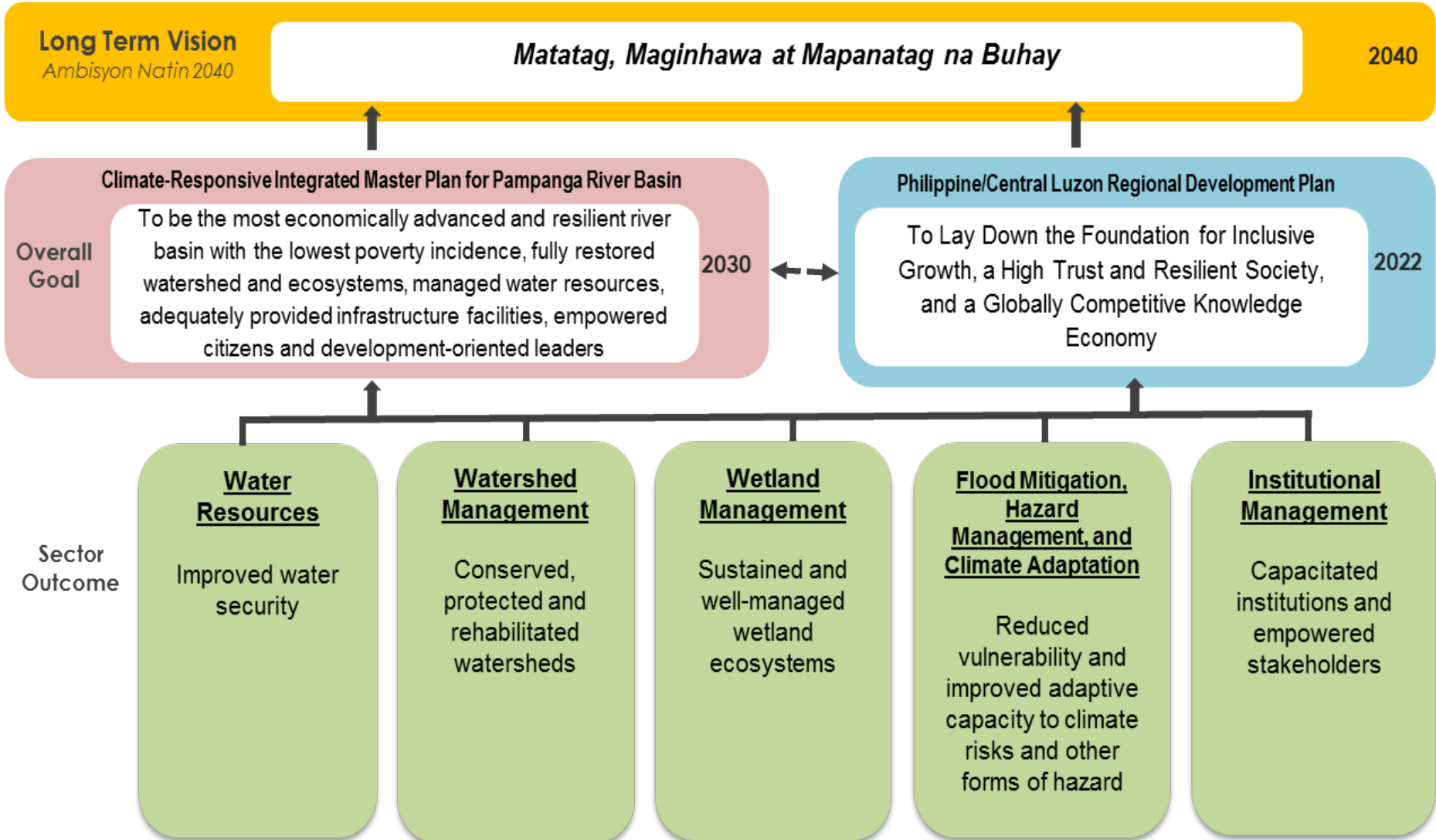
IV. Case Studies - PRB

PRB Vision

“The Pampanga River Basin (PRB) shall become the most economically advanced and resilient river basin in the country that shall attain the lowest incidence of poverty, fully restored watershed and ecosystems, properly utilized and managed water resources, adequately provided modern infrastructure facilities, and an empowered citizens in partnership with transparent, accountable, and development-oriented leaders.”

IV. Case Studies - PRB

Overall PRB Master Plan Framework



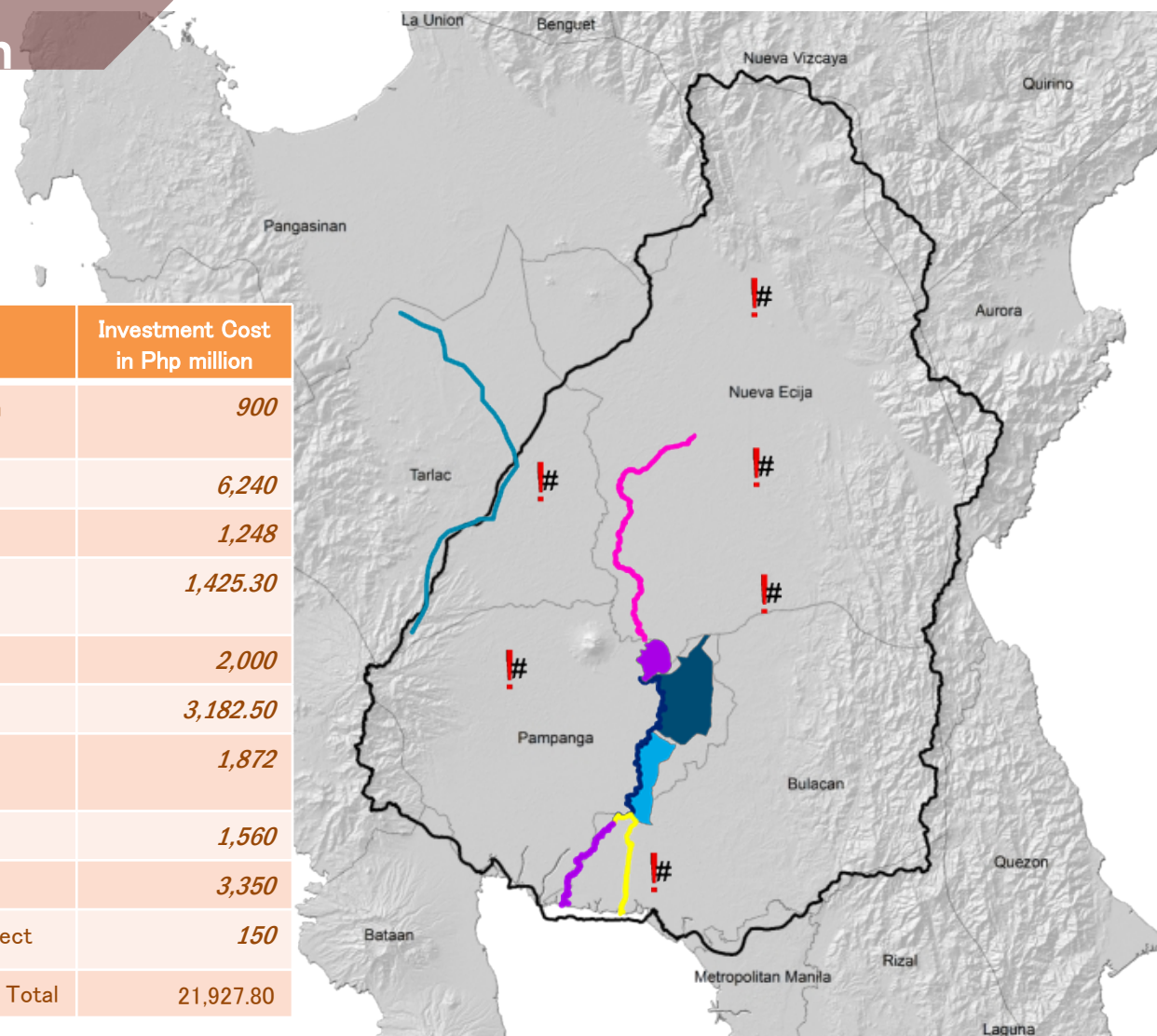
IV. INVESTMENT PROGRAM

D. Flood Mitigation, Hazard Management, and Climate Adaptation

Summary

*Priority Projects investment cost of
Php 21.9 billion*

| Project | Investment Cost in Php million |
|--|--------------------------------|
| 1. Integrated Command Center Project for Major Urban Center in PRB | 900 |
| 2. Flood Mitigation for Pampanga Delta Phase II | 6,240 |
| 3. Strengthening of Arayat-Cabiao Ring Levee | 1,248 |
| 4. Strengthening of Masantol-Macabebe-Arayat Setback Levee | 1,425.30 |
| 5. Rehabilitation Program for Pampanga Delta Phase I | 2,000 |
| 6. Rio Chico River Flood Control Project | 3,182.50 |
| 7. South Candaba Swamp Flood Control Project | 1,872 |
| 8. North Candaba Swamp Flood Control Project | 1,560 |
| 9. Tarlac River Overall Improvement Works | 3,350 |
| 10. Water-sensitive Urban Development Initiatives Project | 150 |
| Sub Total | 21,927.80 |



IV. Case Study

“Localizing LSDF in Comprehensive Land Use Plans (CLUPs) – The Case of Guimba, Nueva, Ecija”

IV. Case Studies - Guimba

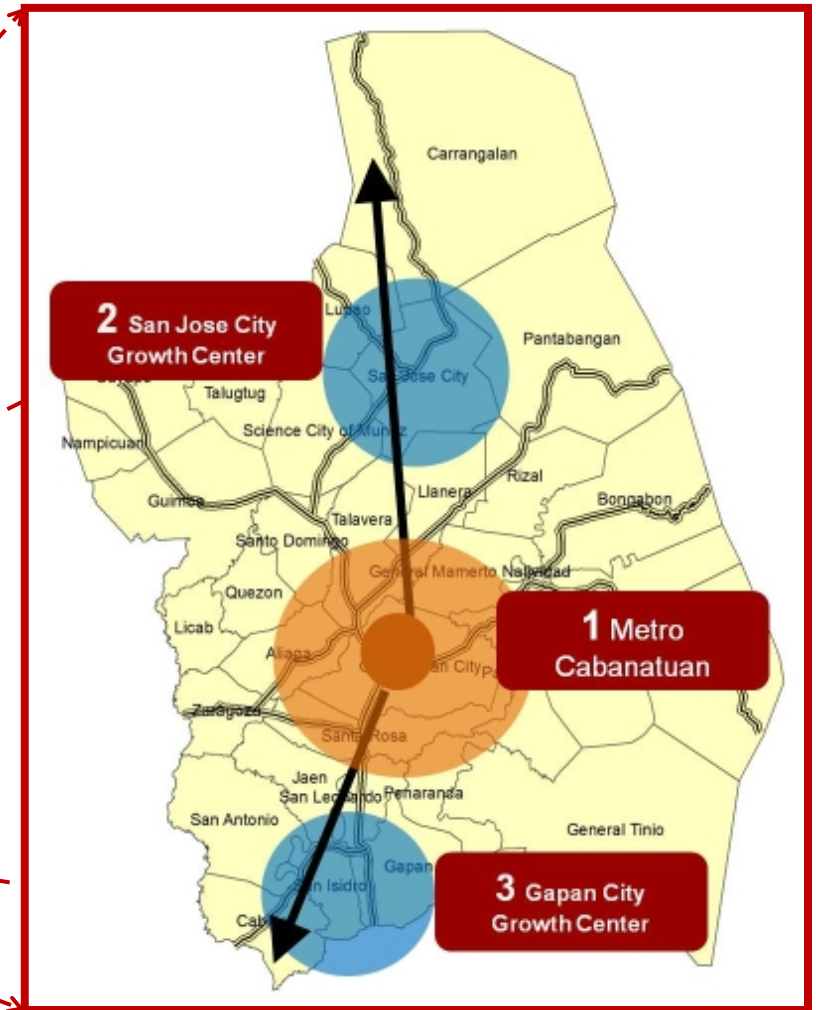
Spatial Strategy

The proposed spatial strategy of Nueva Ecija

- Spatial Strategy: The Central and Nodal Development Strategy

Growth Centers:

1. San Jose City Growth Center
2. Gapan City Growth Center
3. Cabanatuan-Palayan Regional Growth Center

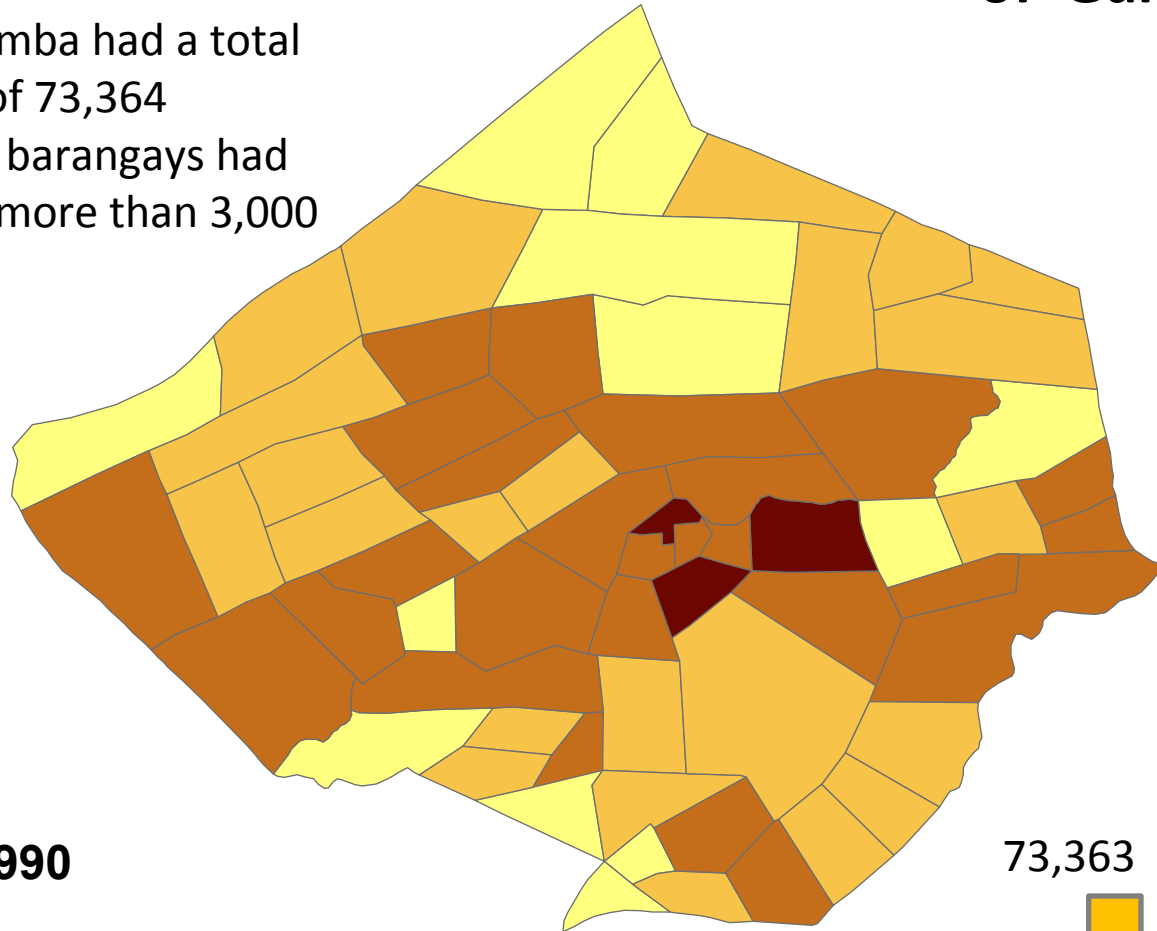


IV. Case Studies - Guimba

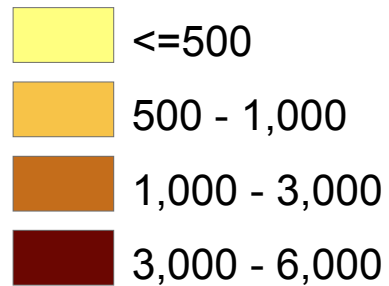
Spatial Strategy

- In 1990, Guimba had a total population of 73,364
- Only 3 of 64 barangays had population more than 3,000

Population Map of Guimba



Population 1990



No. of Barangays = 64

73,363



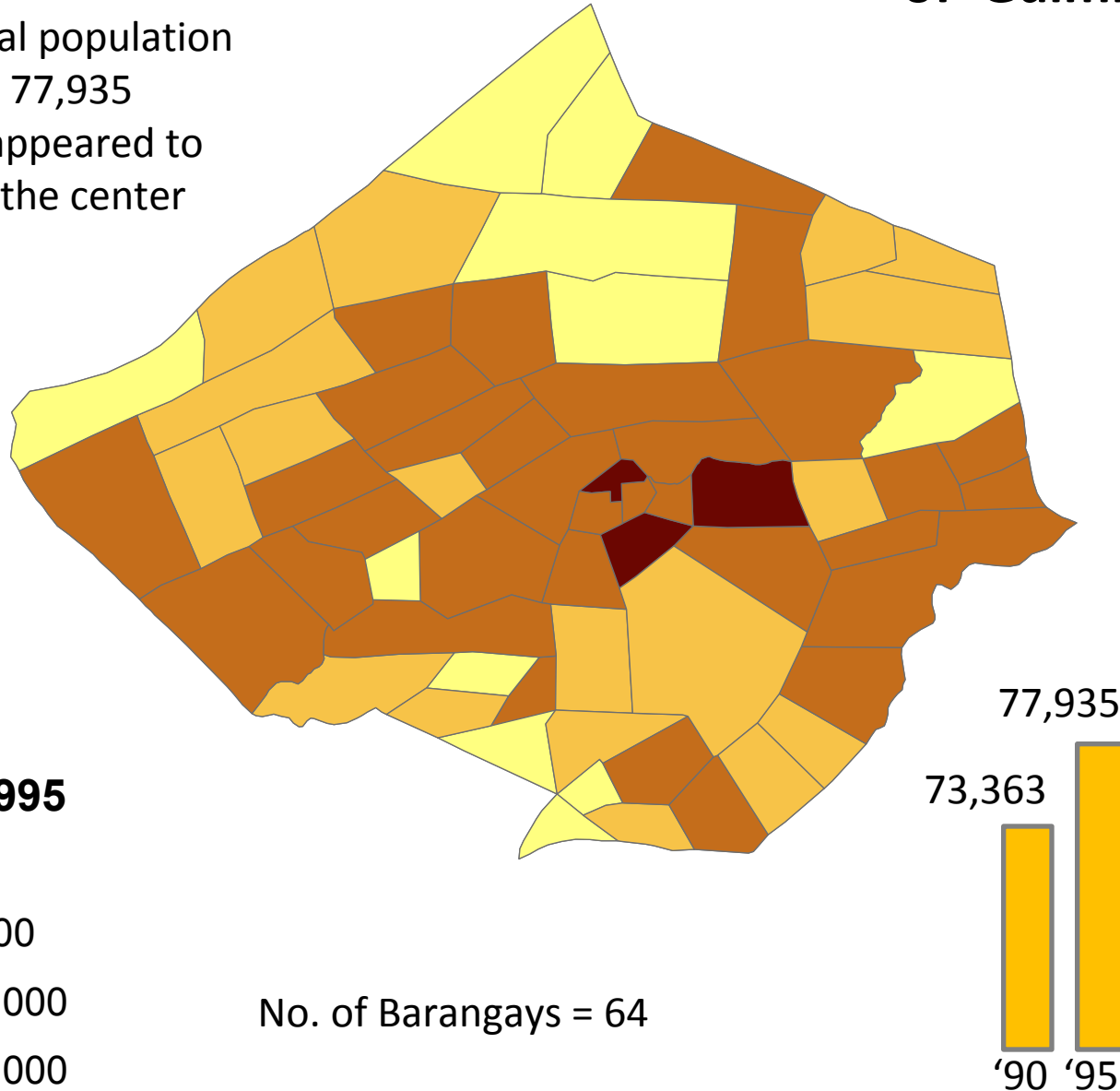
'90

IV. Case Studies - Guimba

Spatial Strategy

- In 1995, total population increased to 77,935
- Population appeared to converge at the center

Population Map of Guimba

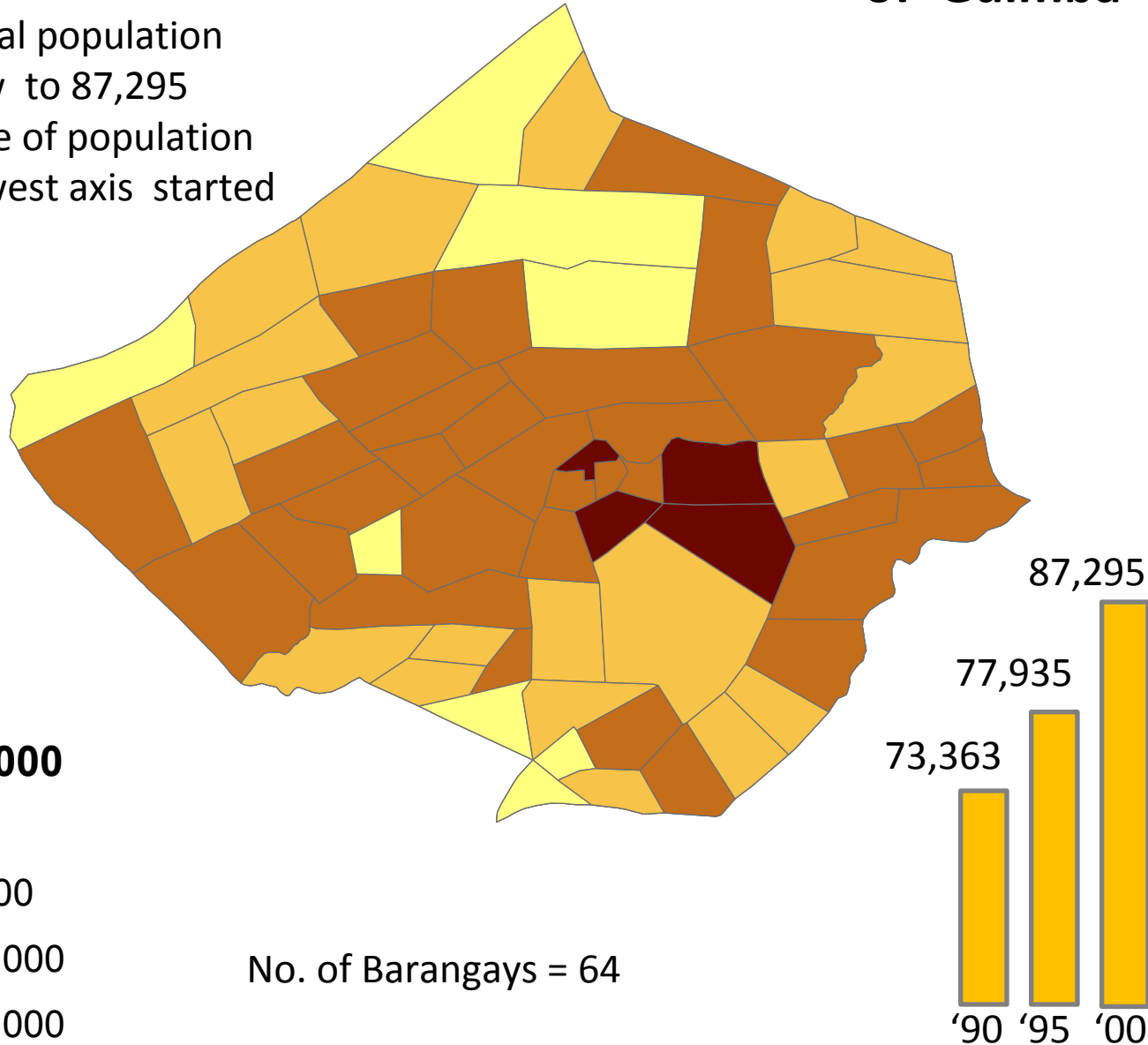


IV. Case Studies - Guimba

Spatial Strategy

- In 2000, total population further grew to 87,295
- Convergence of population along east-west axis started to emerge

Population Map of Guimba



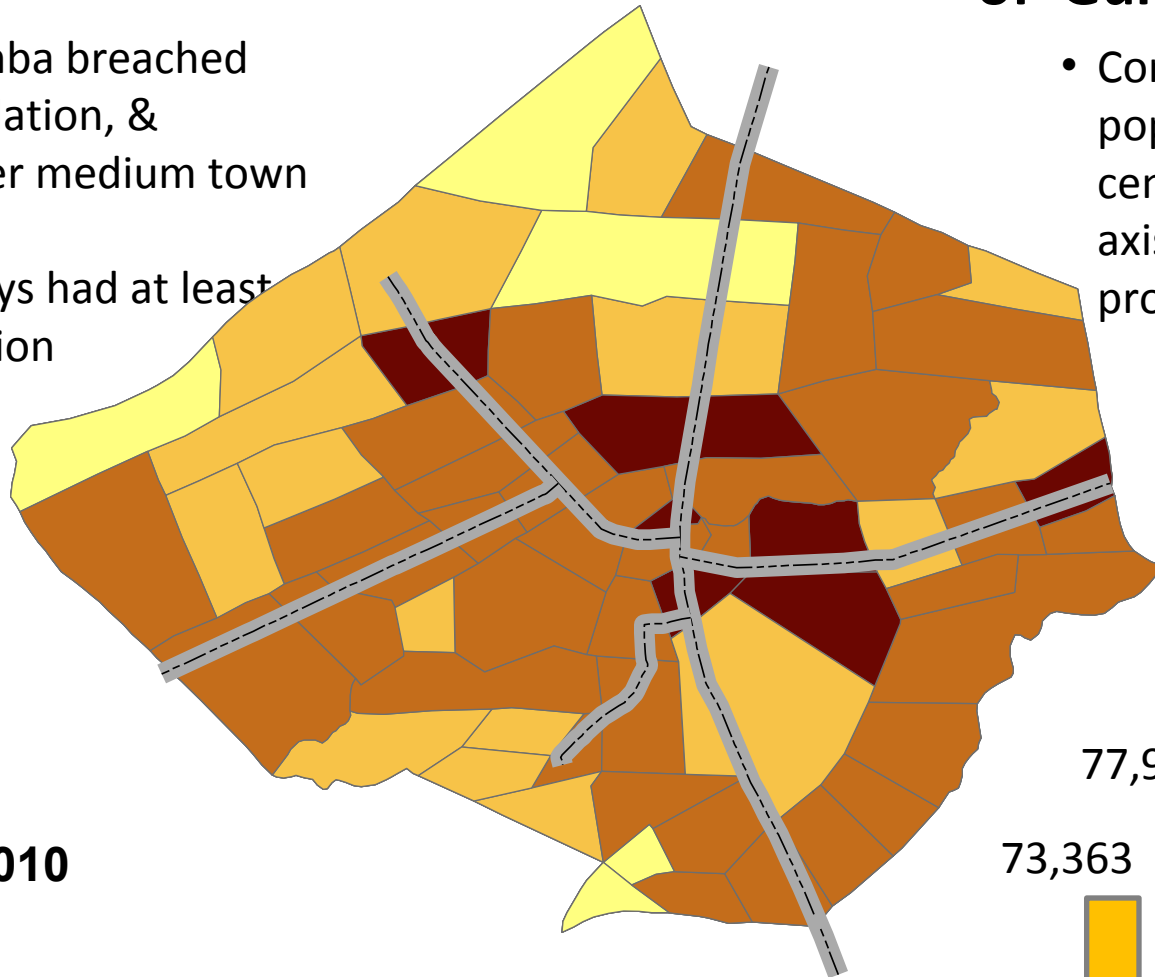
IV. Case Studies - Guimba

Spatial Strategy

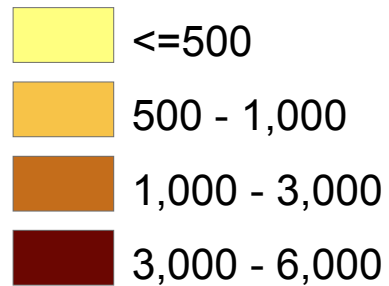
- In 2010, Guimba breached 100,000 population, & emerged under medium town category
- 6/64 barangays had at least 3,000 population

Population Map of Guimba

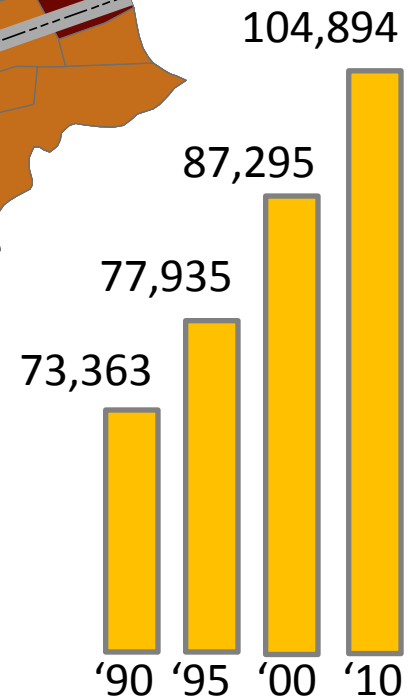
- Convergence of population in town center along east-west axis became more pronounced



Population 2010

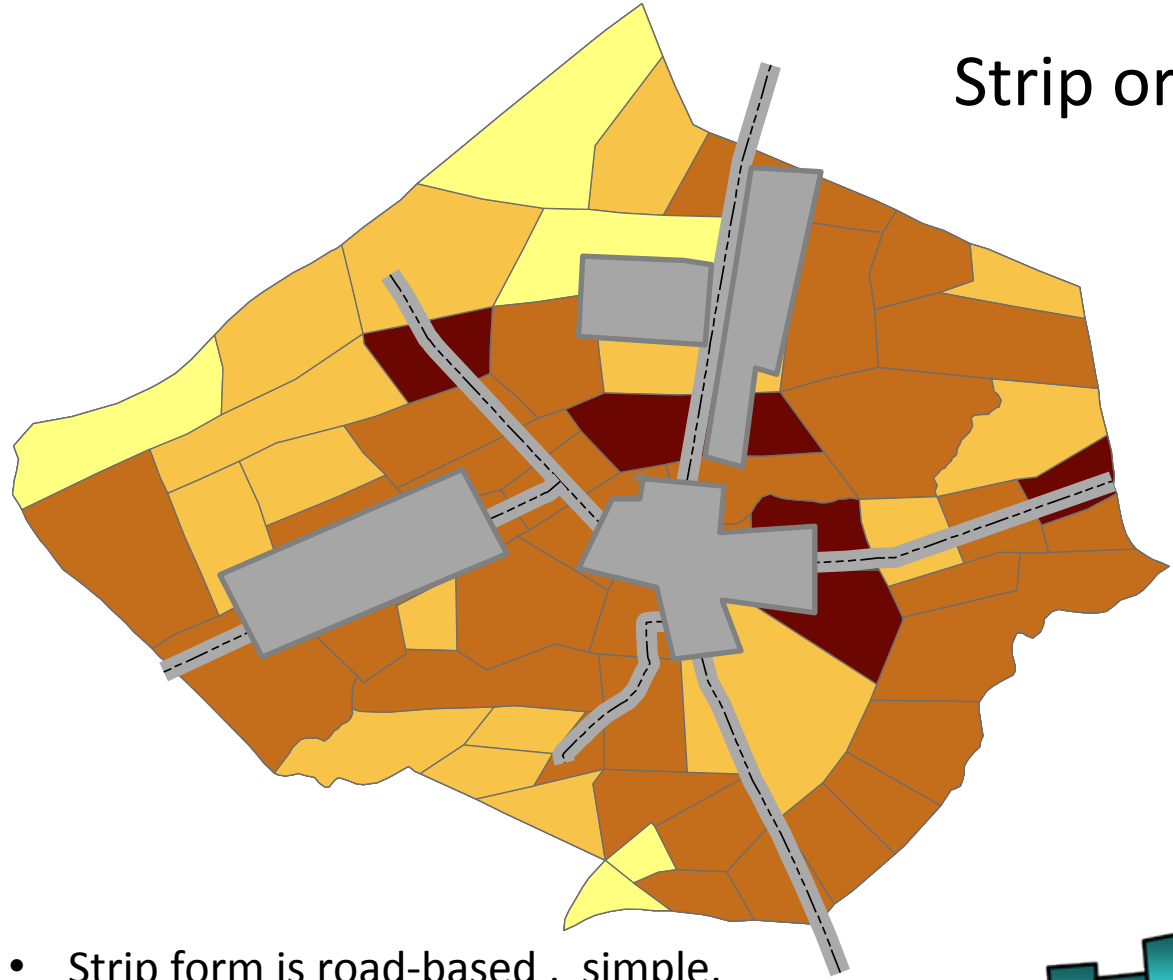


No. of Barangays = 64



IV. Case Studies - Guimba

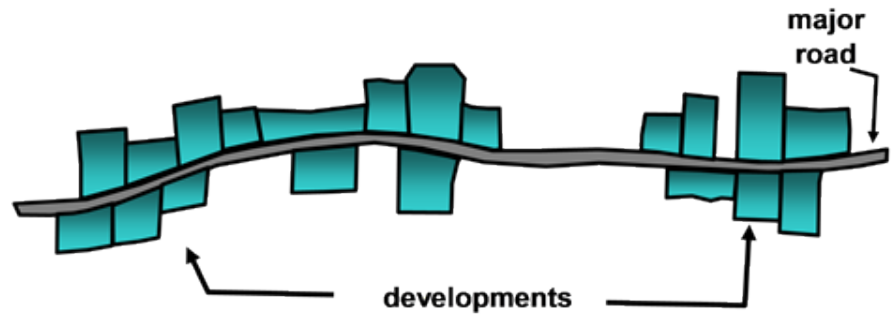
Spatial Strategy



Alternative 1: Strip or Linear Development

- Spatial strategy (a.k.a urban form) refers to the desired distribution of settlements and urban activities in a particular territory
- HLURB has a set of five urban forms LGUs can choose from

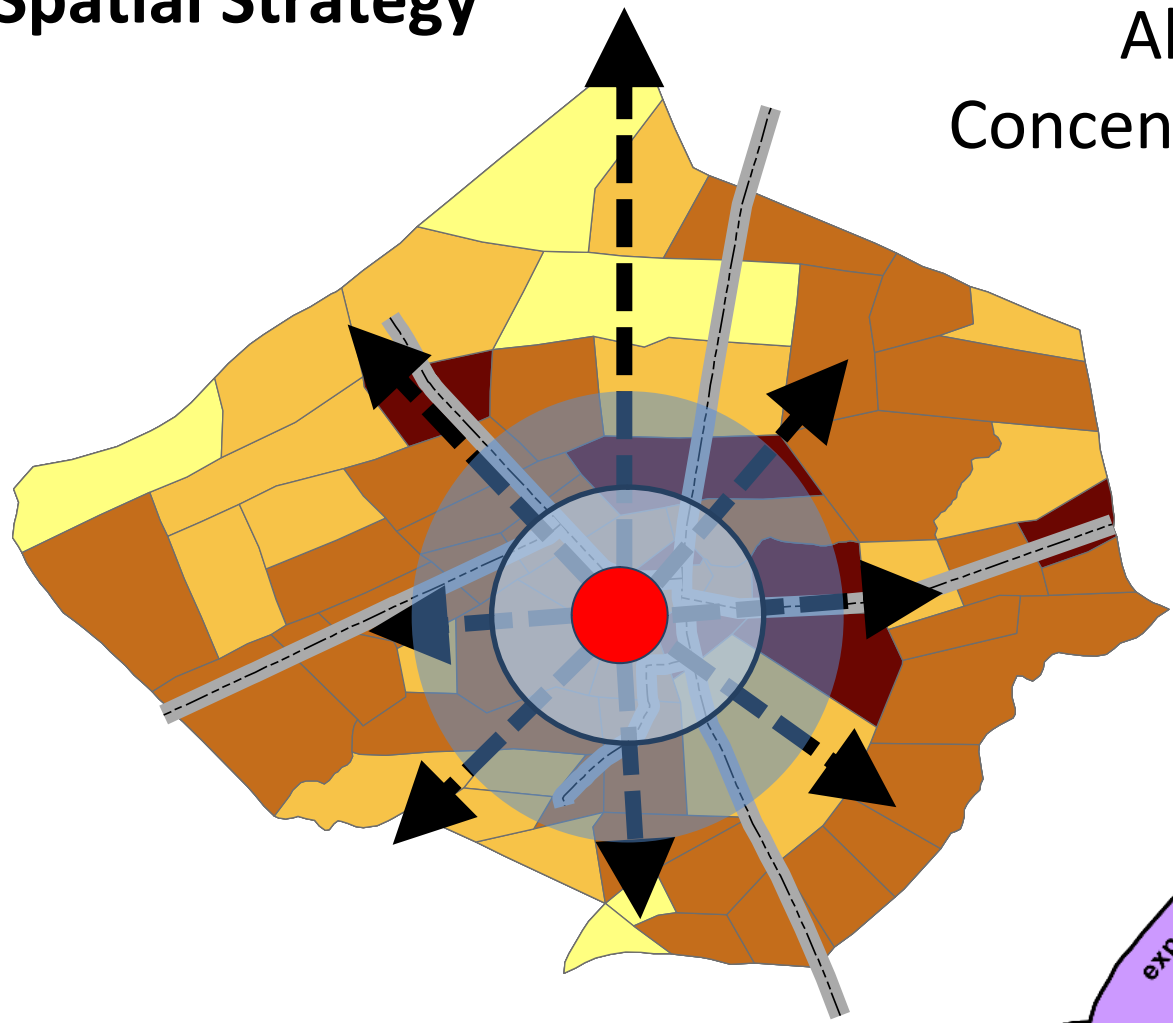
- Strip form is road-based , simple, and provides very high degree of accessibility but the most abused as regards easement and setback violations



Source: HLURB, Planning Guidelines 1997

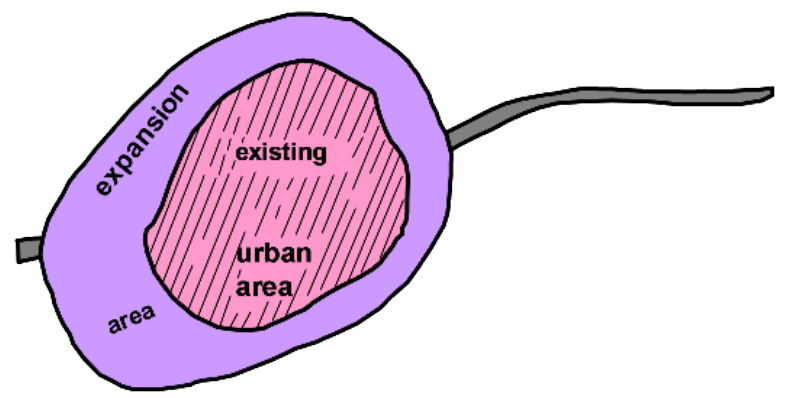
IV. Case Studies - Guimba

Spatial Strategy



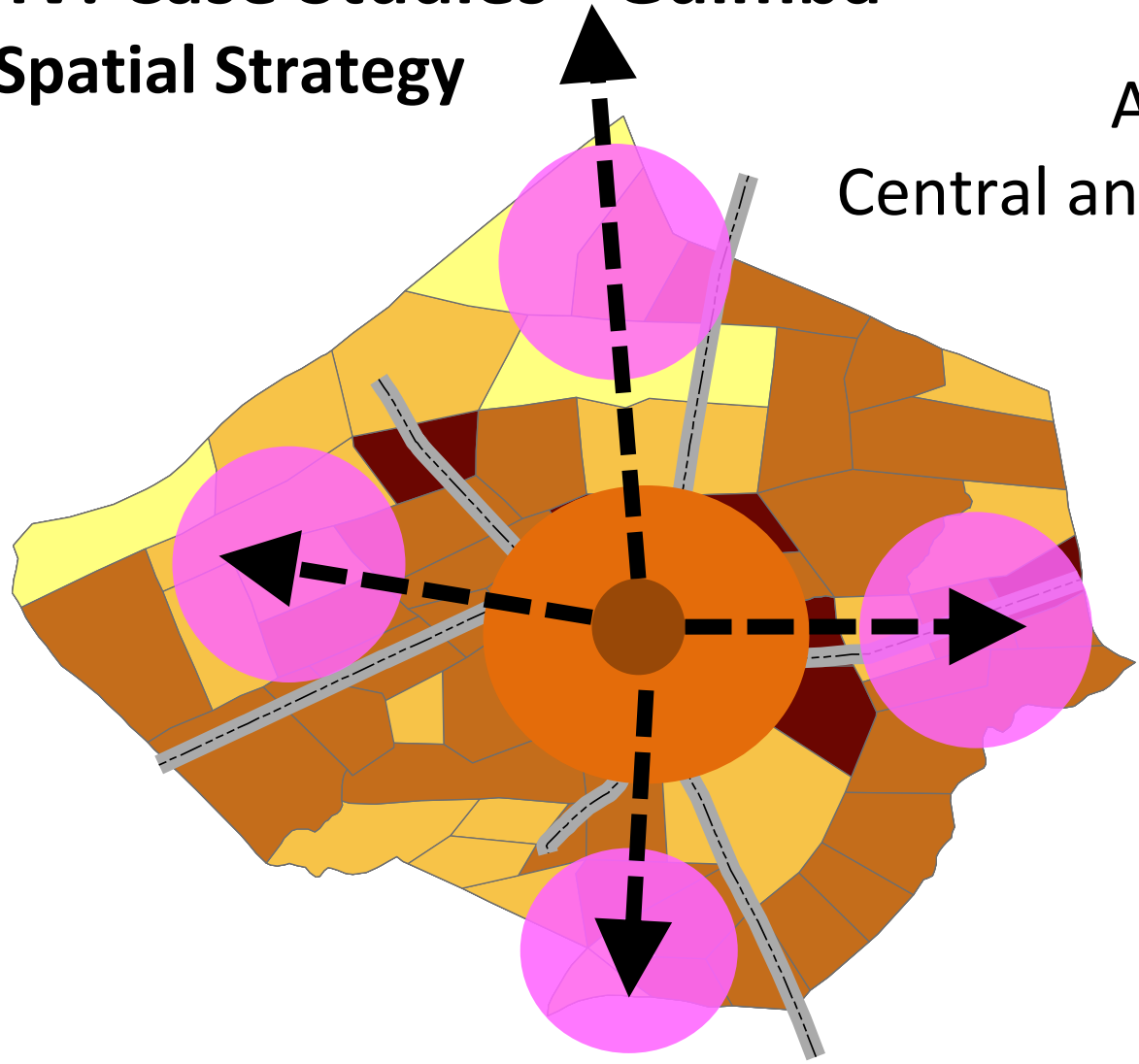
Alternative 2: Concentric Development

- Concentric form is one of the more practical approaches to direct urban expansion based on proximity
- It may limit growth only in one center
- Ideal for small towns
- Growth in fringes is discouraged



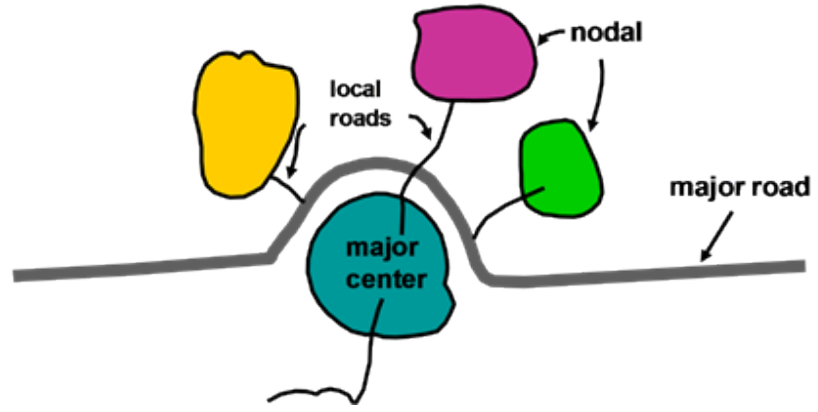
IV. Case Studies - Guimba

Spatial Strategy



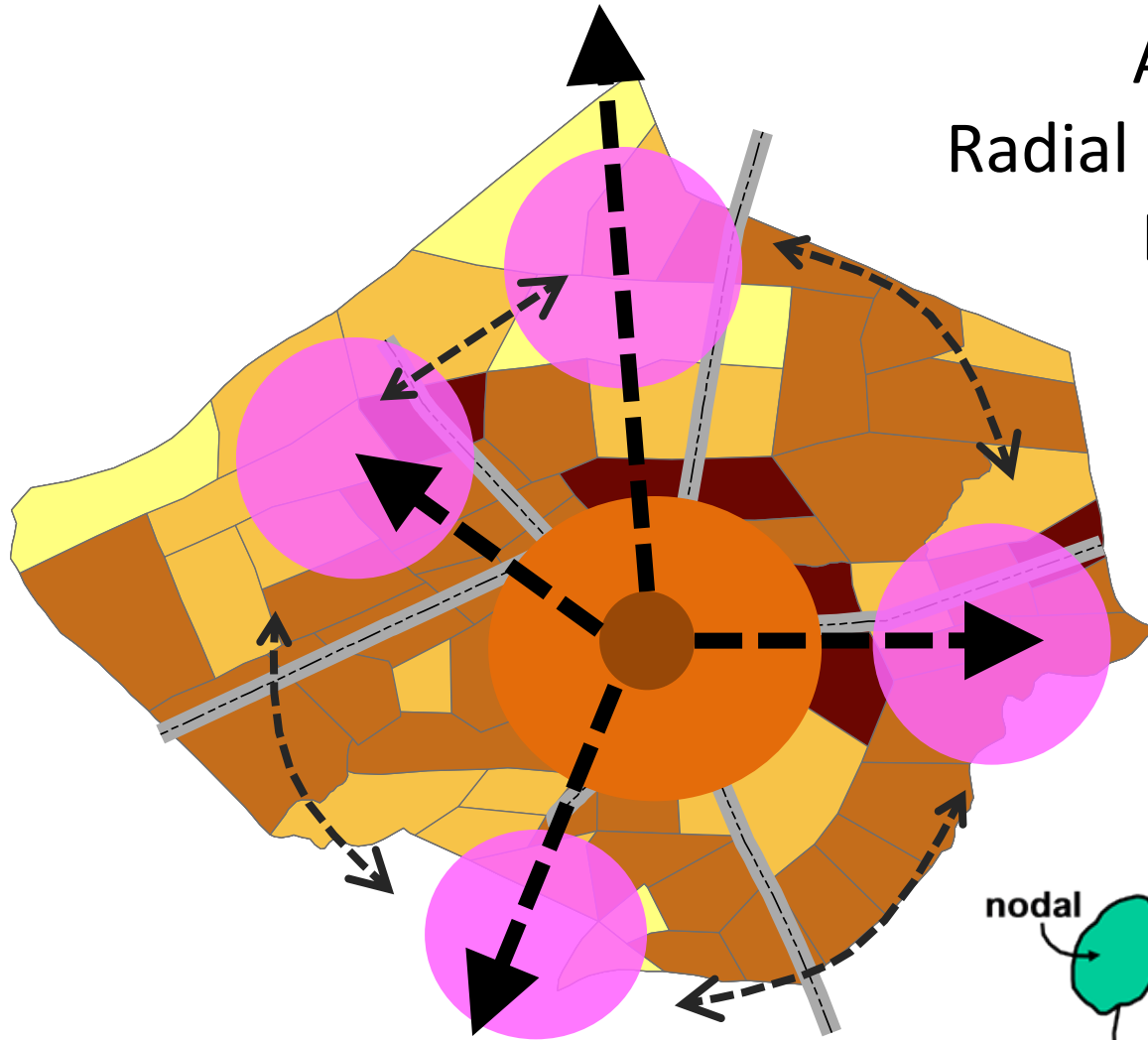
Alternative 3: Central and Nodal Development

- Central nodal is an evolution of concentric form
- Growth is emphasized at the core and to the fringes
- This hub-and-spoke system is ideal in towns with a dominant core with a handful of emerging service hinterlands



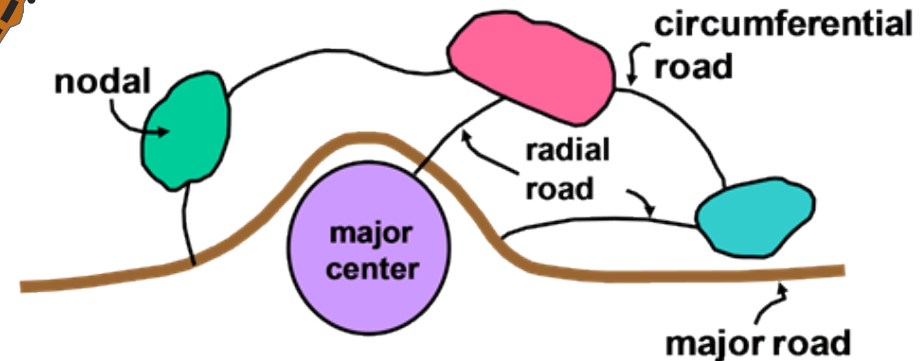
Source: HLURB, Planning Guidelines 1997

II. Spatial Strategy

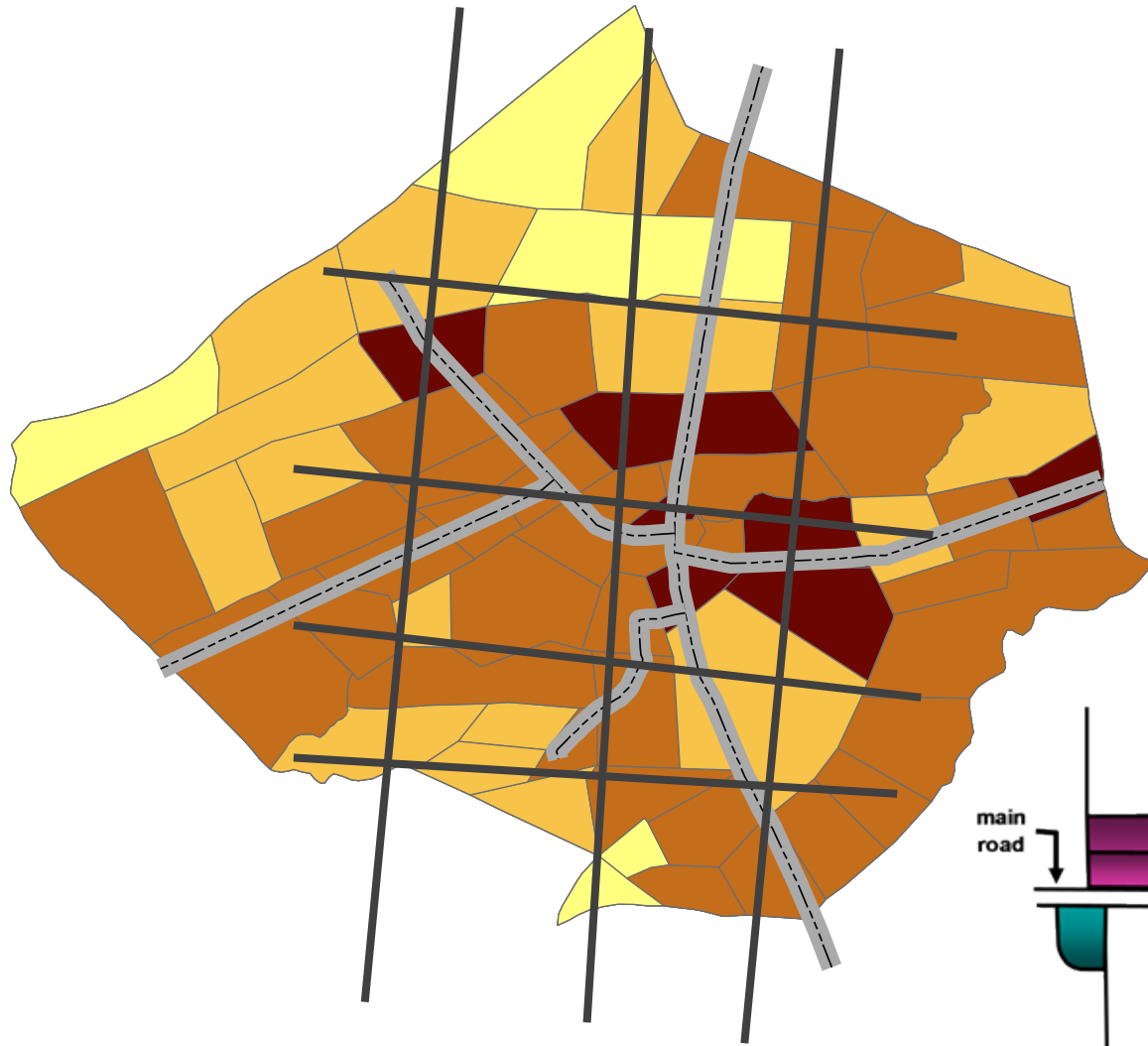


Alternative 4: Radial and Circumferential Development

- This spatial form is the natural evolution of central-nodal
- Urban centers are linked by a network of radial and circumferential roads
- Ideal for large towns and highly urbanized cities with several arrays of service hinterland

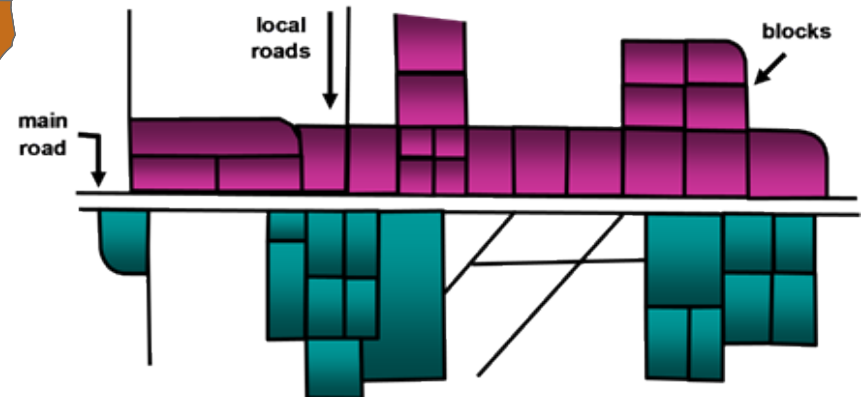


II. Spatial Strategy



Alternative 5: Grid Pattern

- Grid is a simple but an effective form suited for new settlements
- Common in planned unit developments (PUDs) e.g. subdivisions, industrial estates



IV. Case Studies - Guimba Spatial Strategy

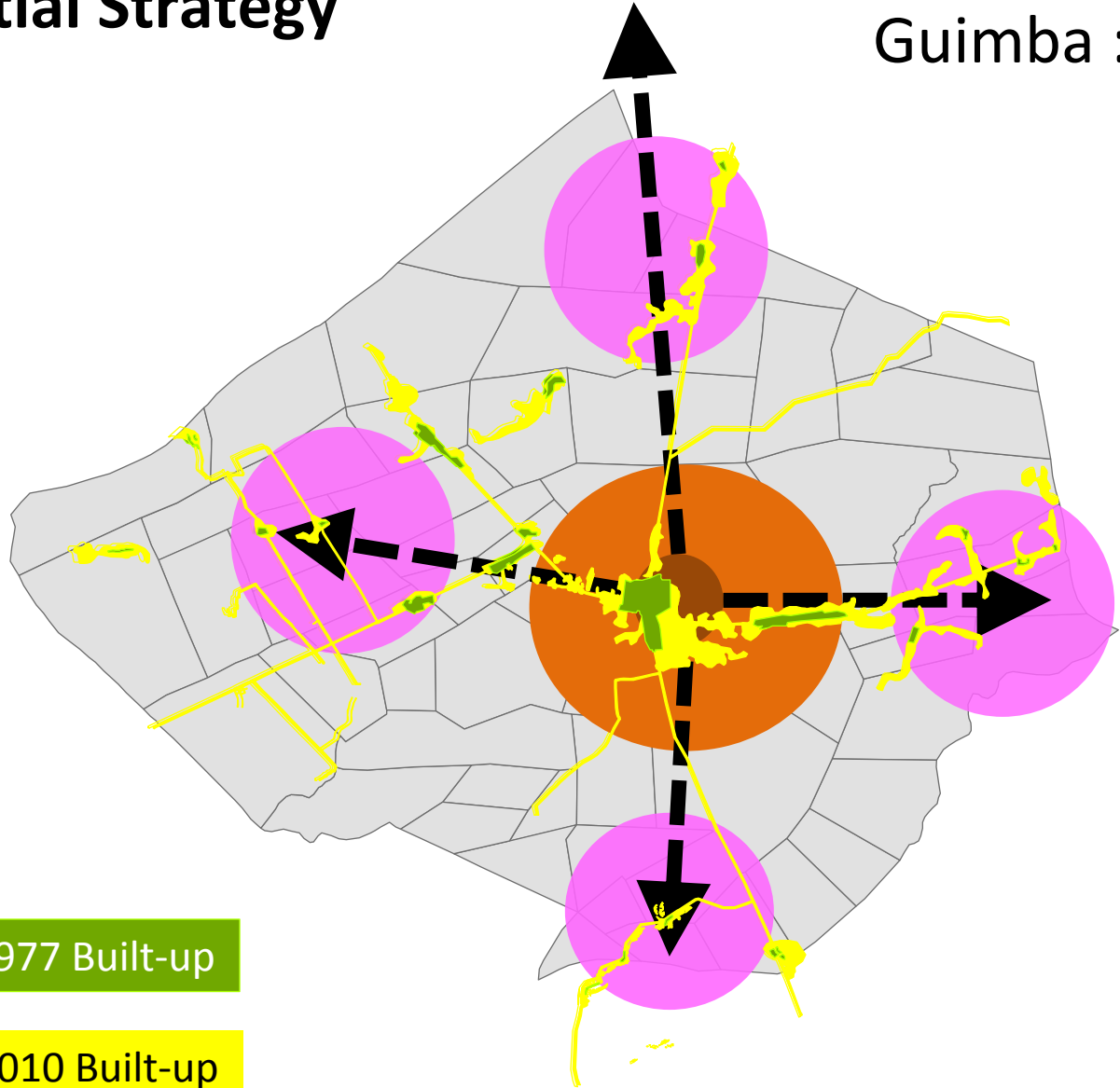
Evaluation & Selection of Preferred Spatial Strategy/ Urban Form

| Characteristics/ Criteria | Linear/ Strip ✓ | Grid | Concentric ✓ | Central/ Nodal | Radial/ Circumferential |
|---|--------------------|----------|--------------|-------------------|----------------------------|
| Infrastructure Cost | Low | High ✓ | Low | Medium ✓ | High ✓ |
| Improvement of Circulation/ Decongesting the Urban Core/ Provincial hub | Low | High | Low | High ✓ | High ✓ |
| Agglomeration and Economic Complementation | Low ✓ | Low | Medium ✓ | High ✓ | High |
| Food Security & Affordability | High | Low | High | High ✓ | Medium ✓ |
| Environmental Sustainability | Low | Low | Medium | High ✓ | High ✓ |
| Increased Investments / Employment/ LGU revenue | Low | Low | Medium | High ✓ | High ✓ |
| Attractiveness of the City | Low | Medium ✓ | Medium | High | High ✓ |
| Disaster Risk Reduction/ Climate Change Adaptation | Low | High | Medium | Medium | High |

IV. Case Studies - Guimba

Spatial Strategy

Preferred Urban Form for Guimba : Central-Nodal



1977 Built-up

2010 Built-up

- Actual expansion of built-up areas is consistent with the preferred urban form
- The settlement strategy and the general land use framework will be based from the central-nodal urban form
- The concentration, connectivity, & vulnerability reduction strategies of LSDF will also be considered

IV. Case Studies - Guimba

Localizing LSDF

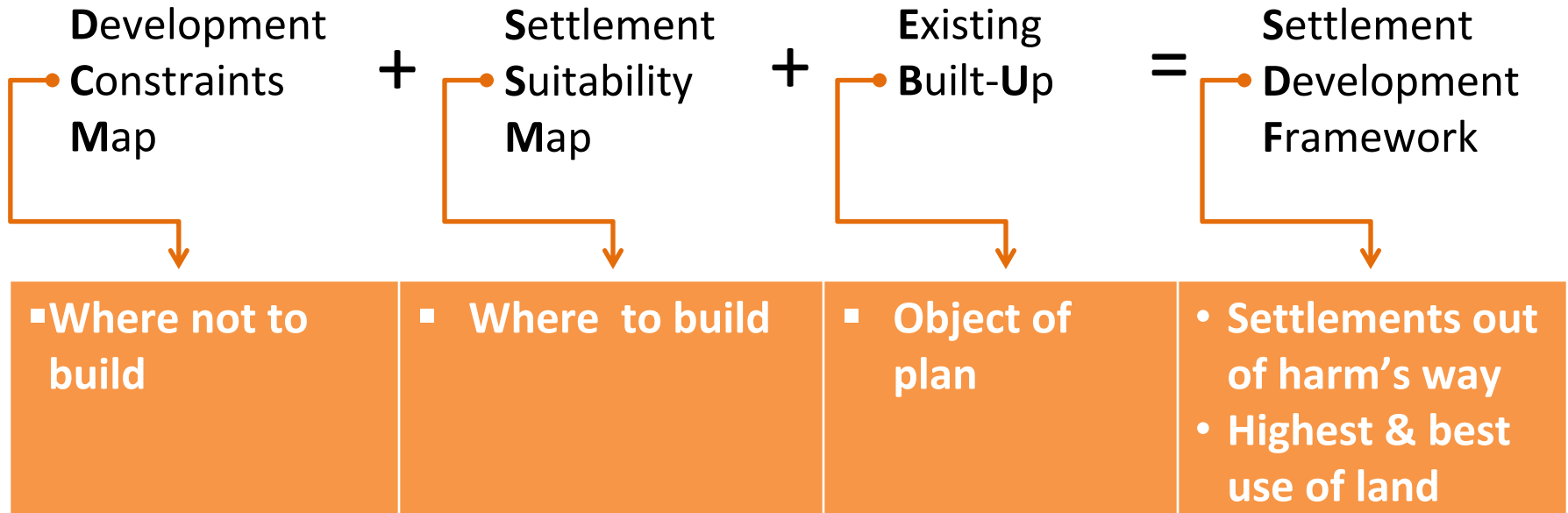
Goal

To establish settlements out of harm's way (where to build and where not to build) and achieve the highest and best use of land

Objectives

Prepare a development constraints map, identify areas suitable for urban expansion, prepare an existing built-up map, & come up with a settlement development framework

Sieve Mapping Framework



IV. Case Studies - Guimba Localizing LSDF

Evaluation criteria & selection parameters

Geologic/Hydromet hazards & other physical constraints (GHH plus)

| Flooding | Lahar | Liquefaction | Slope | Remarks |
|--------------------|--------------------------|--------------------|-----------------------|---|
| Not susceptible | Recurrent Flooding | Not susceptible | 0-9% | Buildable |
| Low | | Low | 9-15% | Buildable (Requires minor mitigation) |
| Medium | | Medium | 15-18% | Buildable (Requires moderate mitigation) |
| | | | 18-30% | Buildable (Requires significant mitigation) |
| <u>High</u> | <u>Lahar Zone</u> | <u>High</u> | <u>>30%</u> | Not buildable |

IV. Case Studies - Guimba

Localizing LSDF

Evaluation criteria & selection parameters

Areas Restricted To Urban Development (ARTUD)

| Land Classification | Infrastructure ROW | Agri-lands | Remarks |
|------------------------------|----------------------------|-------------------|--------------------------------------|
| A & D | Non-row areas | Non-SAFDZ areas | Buildable |
| Forest & other non-A&D areas | RRROW + required easements | SAFDZs | Not buildable/ Restricted |

III. Localizing LSDF

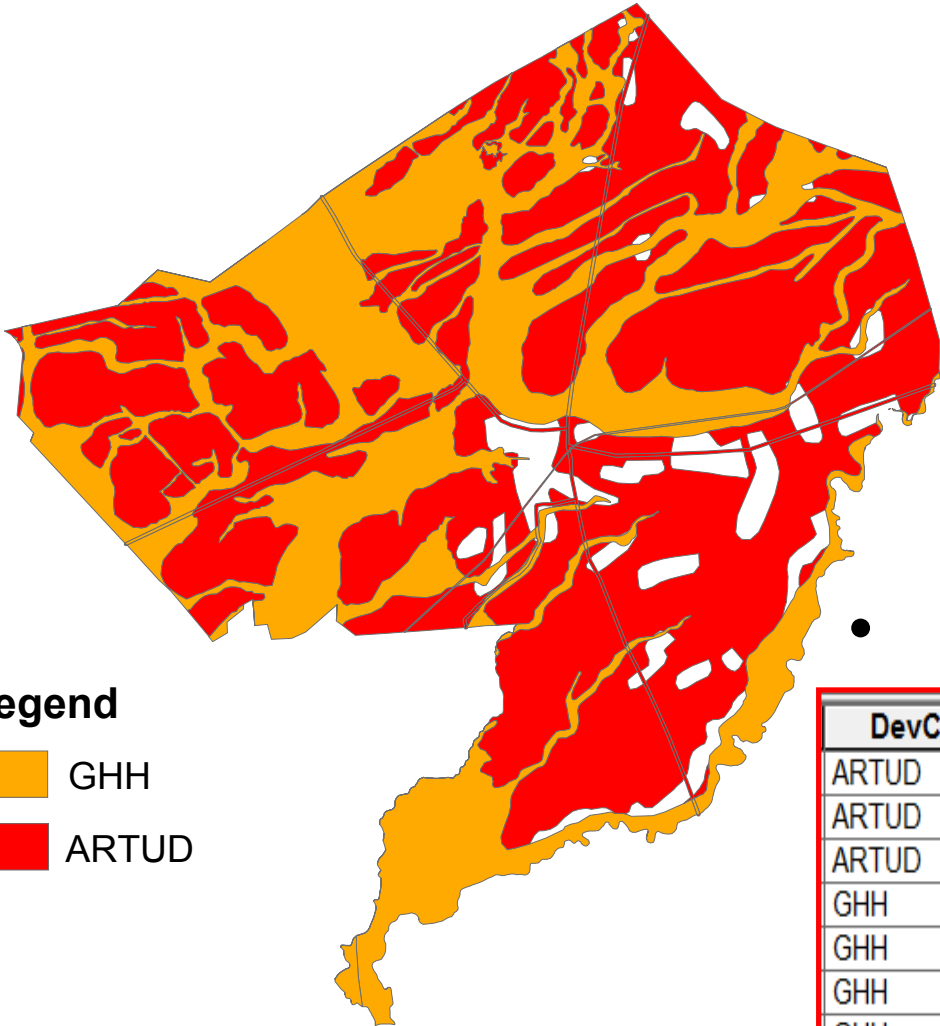
Evaluation criteria & selection parameters

Settlement Suitability

| Road | Soil | Existing Built-up | Remarks |
|-------------------|---------------|-------------------|------------------------|
| Within 350 meters | Sandy to loam | Within 150 meters | <u>Highly Suitable</u> |
| Above 350 meters | Heavy Clay | Beyond 150 meters | Not Suitable |

IV. Case Studies - Guimba Localizing LSDF

Development Constraints Map



- Where not to build

Legend

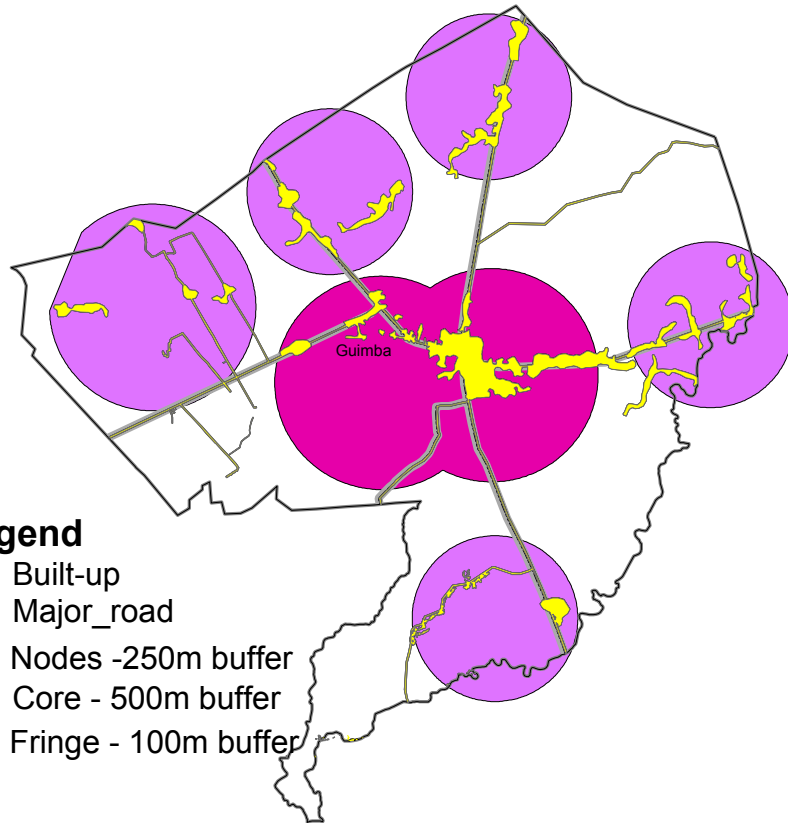
- GHH
- ARTUD

| DevConType | Constraint | Remarks |
|------------|-------------------------|---------------------------|
| ARTUD | RROW | Not buildable |
| ARTUD | PNR ROW | Not buildable |
| ARTUD | NPAAAD/SAFDZ Areas | Not buildable/ Restricted |
| GHH | Flooding | Not buildable |
| GHH | Flooding + RROW | Not buildable |
| GHH | Flooding + PNR ROW | Not buildable |
| GHH | Flooding + Liquefaction | Not buildable |

IV. Case Studies - Guimba Localizing LSDF

Suitability Parameters

- Near roads
- Near existing built up
- Consistent with spatial strategy



Legend

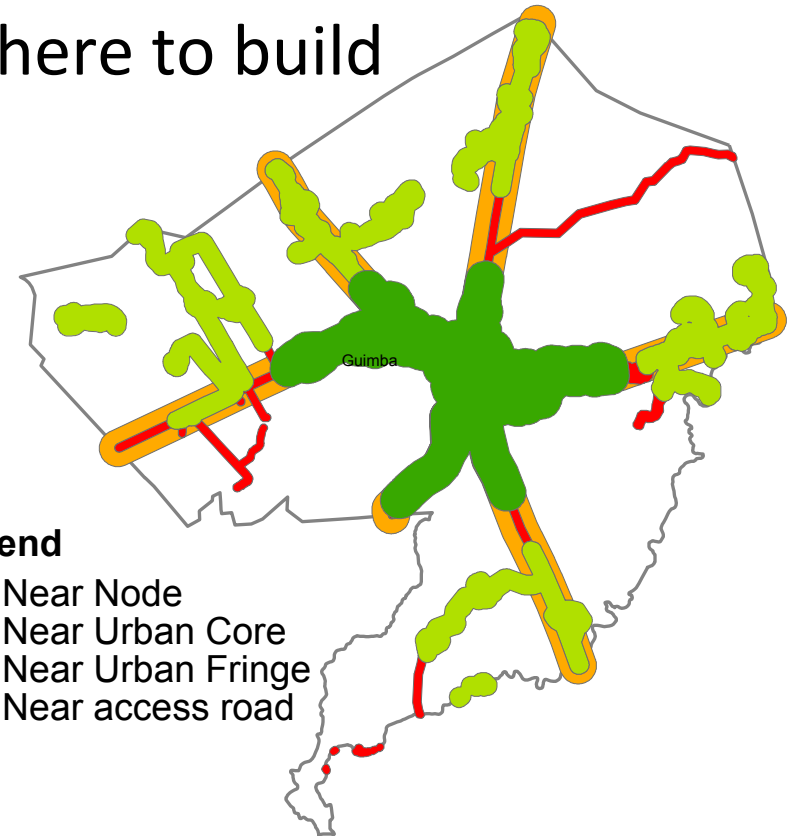
- Built-up
- Major_road
- Nodes -250m buffer
- Core - 500m buffer
- Fringe - 100m buffer

➤ Input maps for buffering

Settlement Suitability Map

| Suitability | Remarks |
|-------------------|----------|
| Near access road | Suitable |
| Near Node | Suitable |
| Near Urban Core | Suitable |
| Near Urban Fringe | Suitable |

- Where to build



Legend

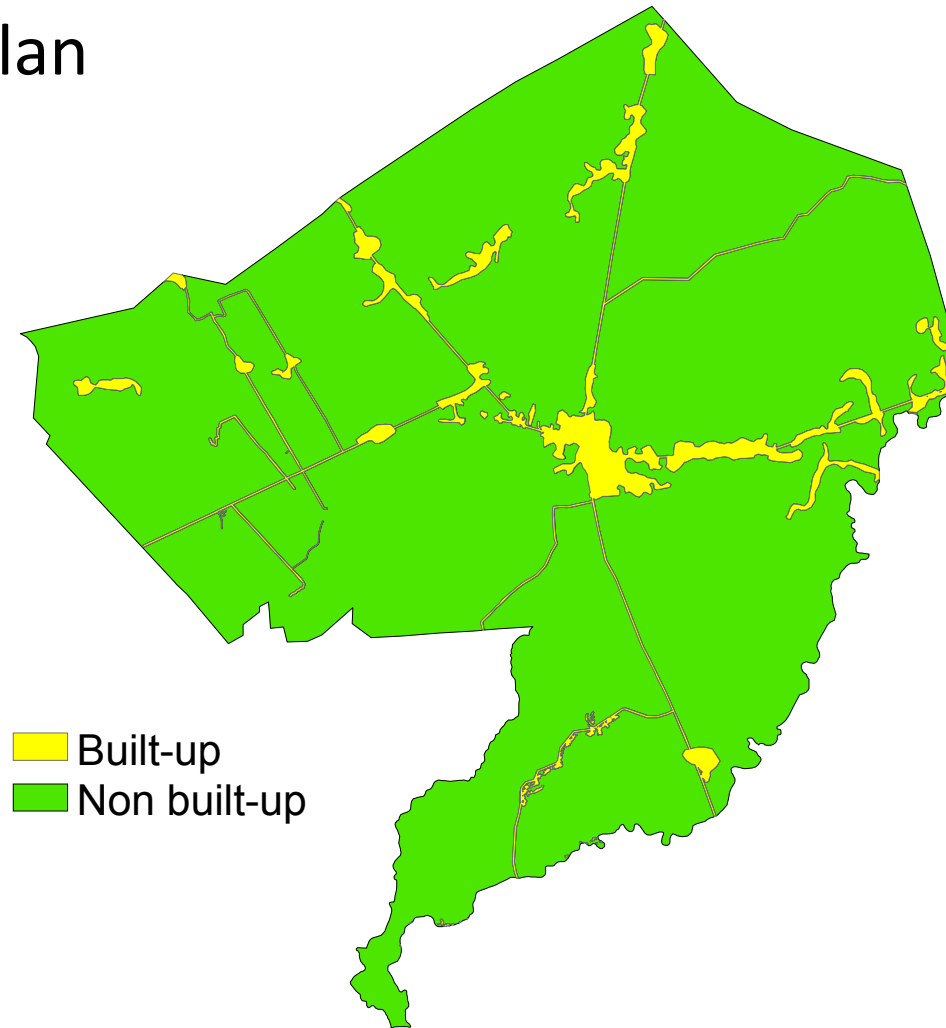
- Near Node
- Near Urban Core
- Near Urban Fringe
- Near access road

➤ Resulting buffer map

IV. Case Studies - Guimba Localizing LSDF

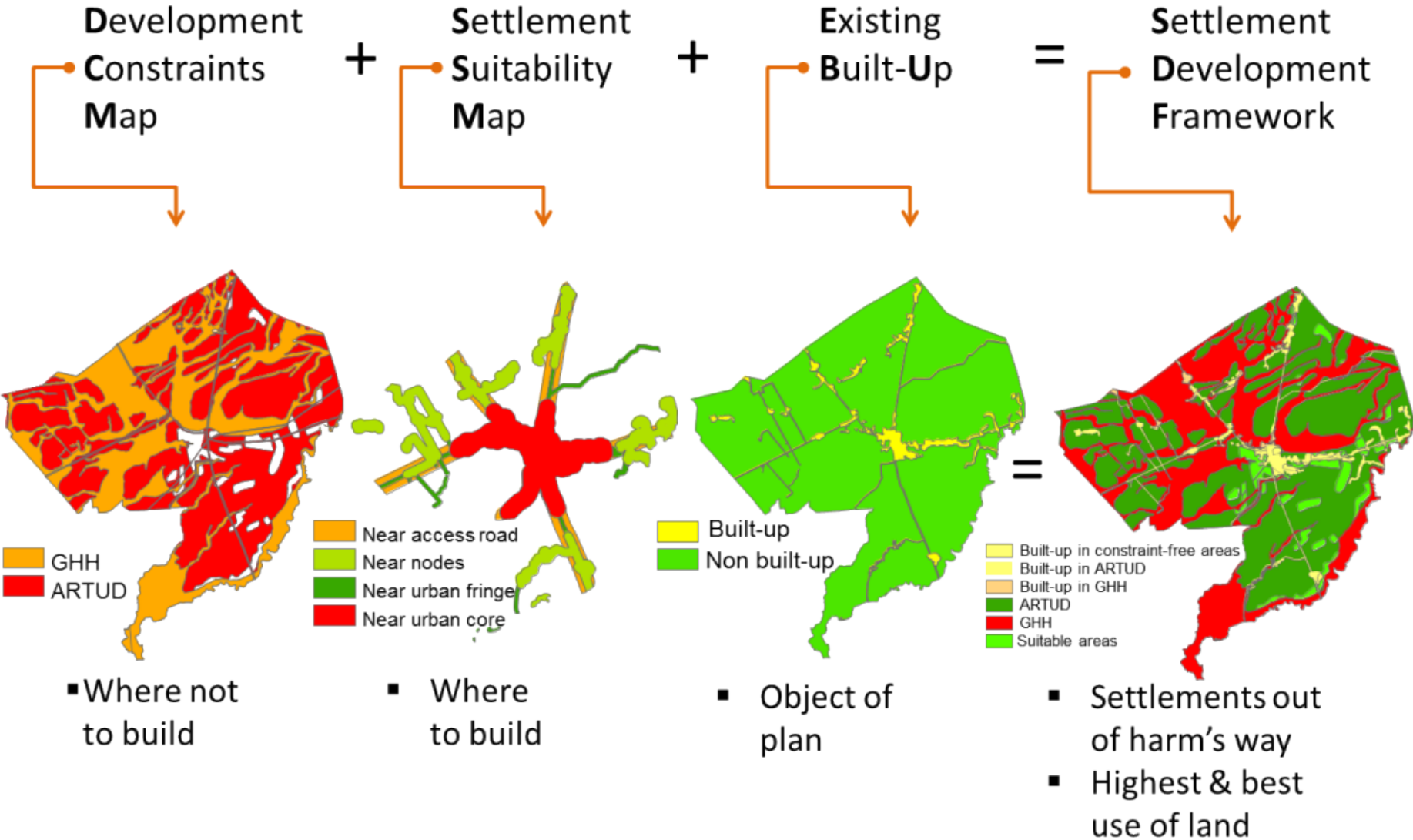
Existing Built - Up

- Object of Plan



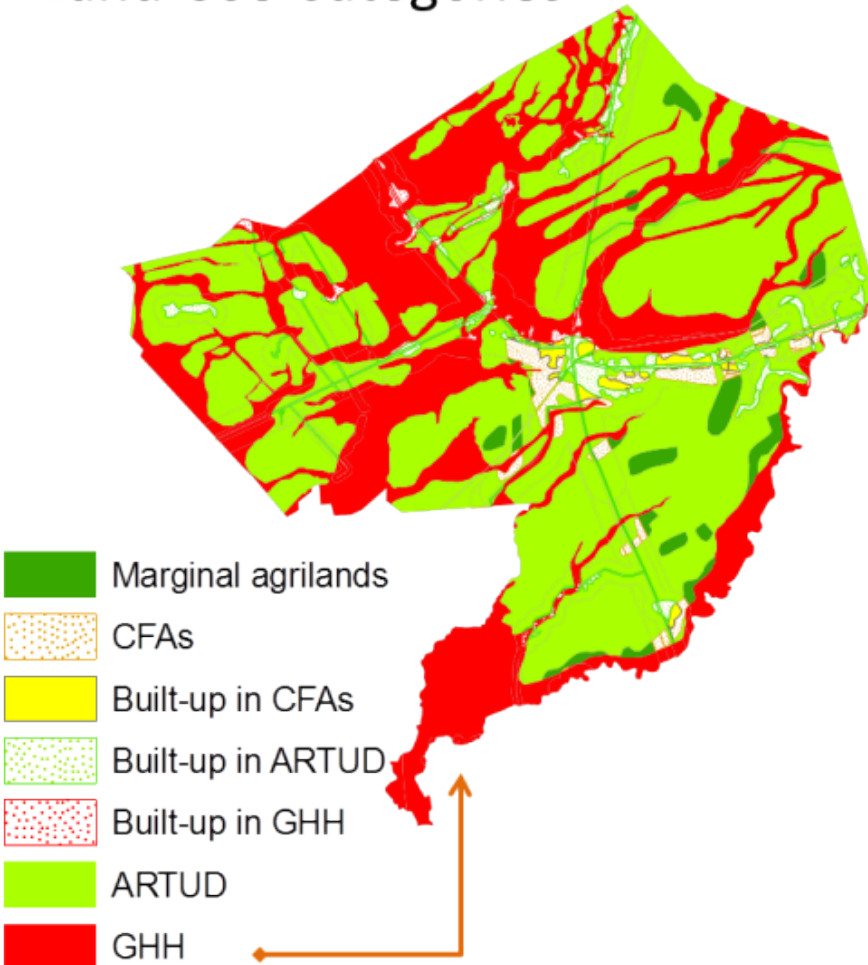
III. Localizing LSDF

Initiating the final overlay

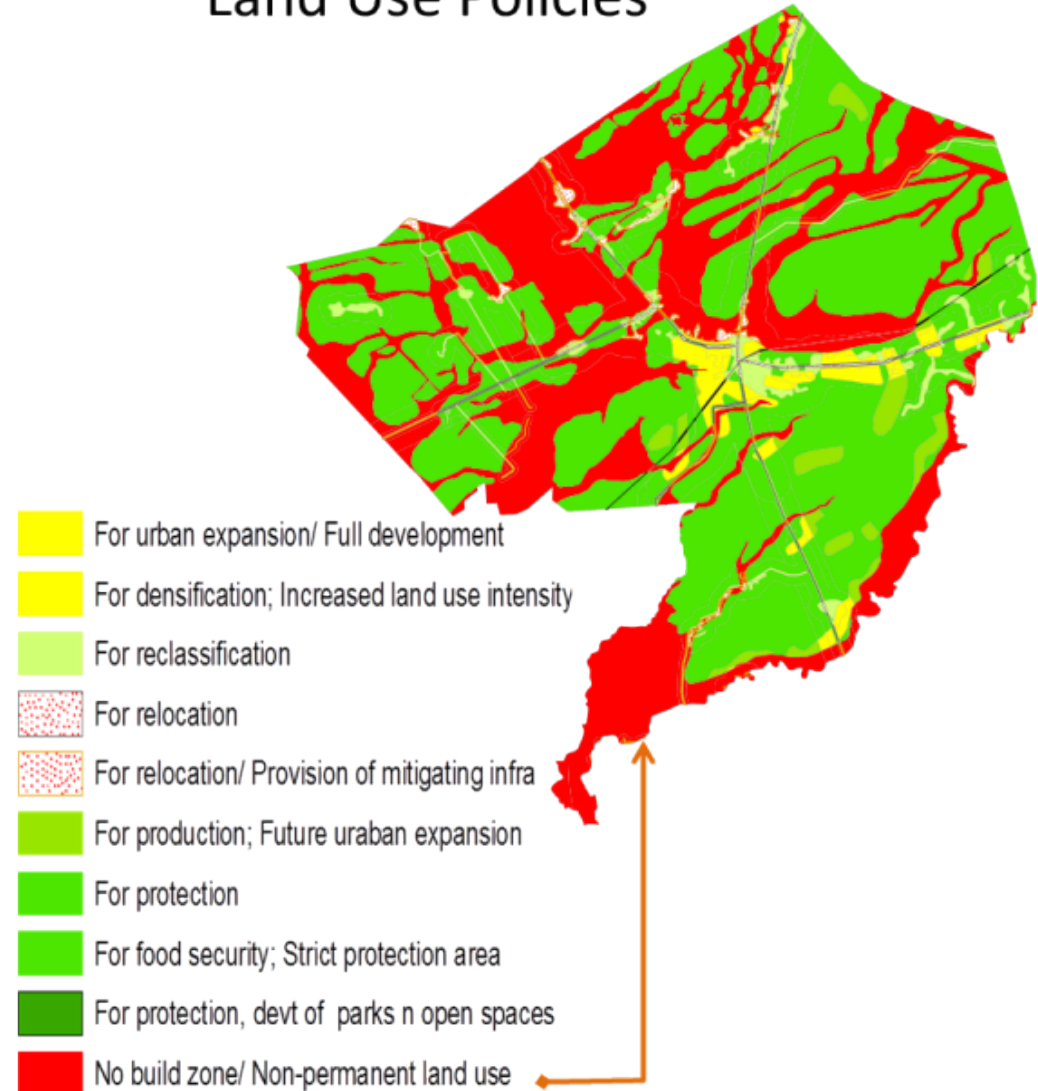


IV. Case Study - The LSDF-enhanced Settlement & Land Use Framework Framework of Guimba, Nueva Ecija

Land Use Categories



Land Use Policies



IV. Conclusion & Recommendation

- Now is the era of science and evidence-based decisions in governance
- ICT-based planning and decision-making tools and models are within the reach of technocrats
- These should be shared to the stakeholders for optimization of use and further development
- NEDA 3, in pursuit of regional/local sustainability and resilience, is sharing these tools to achieve social inclusion and development through planning

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Thank You 😊