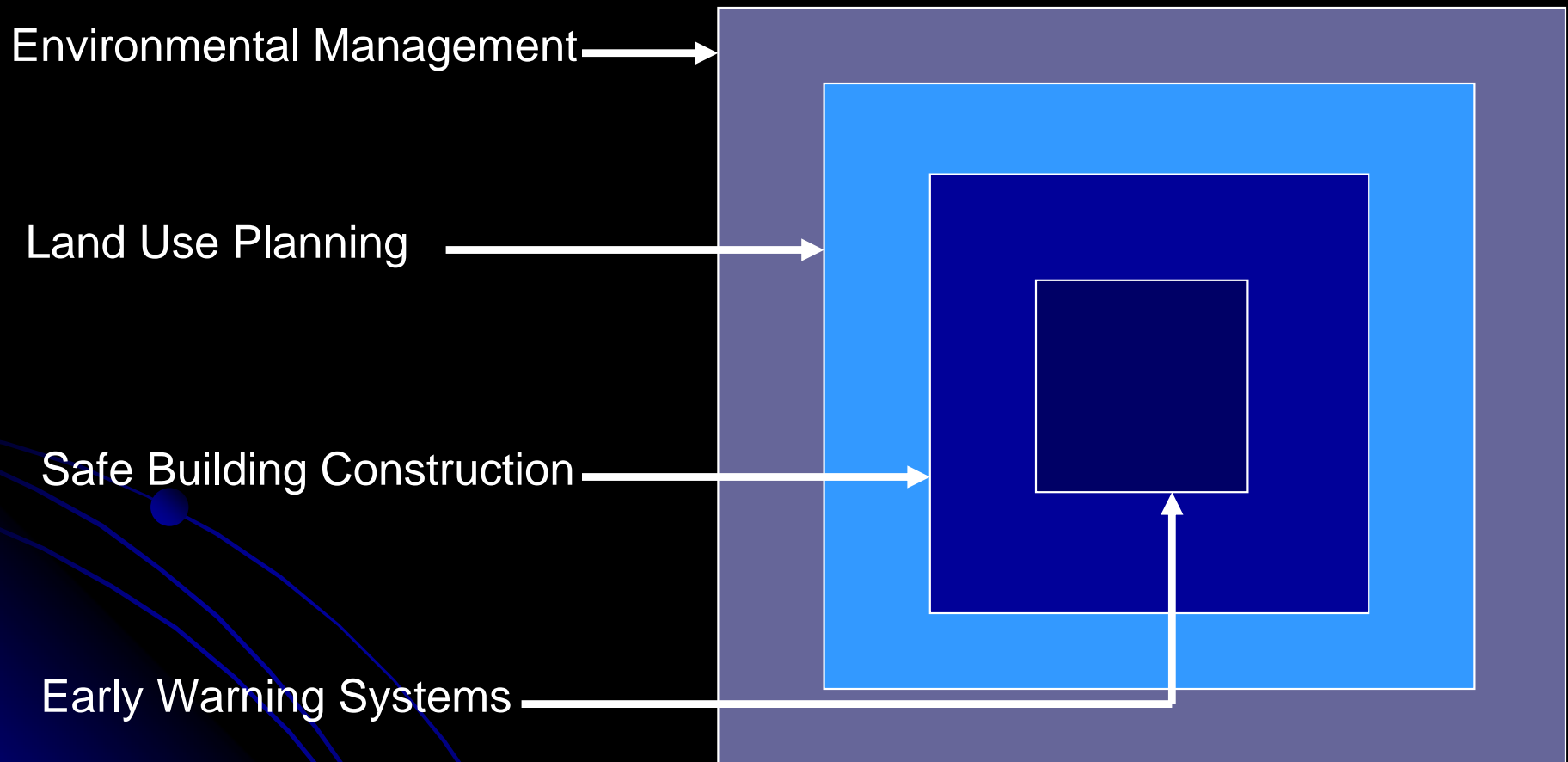


Land Use Planning for Disaster Risk Management

Ernesto M. Serote



Proactive Modes of Disaster Risk Reduction



Environmental Management

- Most global of DRR strategies
- Concerns include climate change, biodiversity, freshwater supply and quality, land and other natural resources utilization, among others
- Policy area of coverage follows natural boundaries, e.g. ecosystems, river basins, watersheds, coastal zones, etc.
- DRR concerns embedded in national agency policies and legislation
- Need to decentralize or devolve policy implementation

Land Use Planning

- A subset of environmental management
- Focused on land and other natural resources for human settlements, economic activities, and related needs
- DRR-sensitive LUP minimizes potential losses to physical assets, environmental capital, and human life
- Pursued at any scale but most effectively at local (city, municipal) levels

Safe Building Construction

- A subset of land use planning and management, concerned with safer private constructions and critical public infrastructure
- Application of standard engineering procedures that are disaster-resistant involving
 - reconstruction or repair of buildings damaged by hazardous events
 - construction of new buildings
 - retrofitting existing building stock
 - improving resistance of non-engineered buildings
- Enforced through national building codes adapted by local ordinances

Early Warning Systems

- Key element of DRR strategies aimed at protecting lives and property
- Consist of 3 basic components:
 - Detecting and forecasting impending extreme events using scientific data and native traditional knowledge
 - Disseminating warning information to political authorities and the threatened population
 - Responding to warnings by the people at risk and the local authorities
- Involves all levels of stakeholders from national (and possibly international) agencies to local authorities and local communities

Disaster Risk Reduction-Driven Land Use Planning: Rationale

- Land use planning at the local level is most effective in that, at this level:
 - National environmental issues can be addressed in greater detail with local legislation
 - Socially desired land use patterns can be regulated at the level of property parcels
 - Safe construction practices can be enforced at the project level
 - Community-level early warning systems can be coordinated and given resource support

Disaster Risk Reduction-Driven Land Use Planning: Benefits

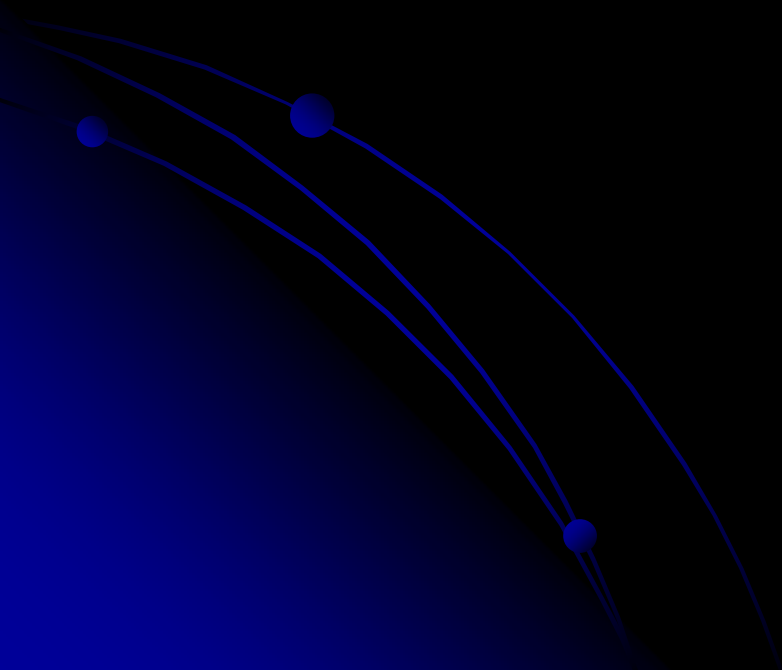
- Mainstreaming DRR in land use planning:
 - promotes urban growth without generating new risks
 - helps identify and mitigate the root causes of disaster like those entrenched in existing land development practices
 - modifies and reduces vulnerable conditions of people and places
 - preempts disaster damage before it happens rather than cleaning up after
 - reduces vulnerability and losses of people and increases their ability to recover and hasten the process of reconstruction and rehabilitation

Disaster Risk Reduction-Driven Land Use Planning: Scope

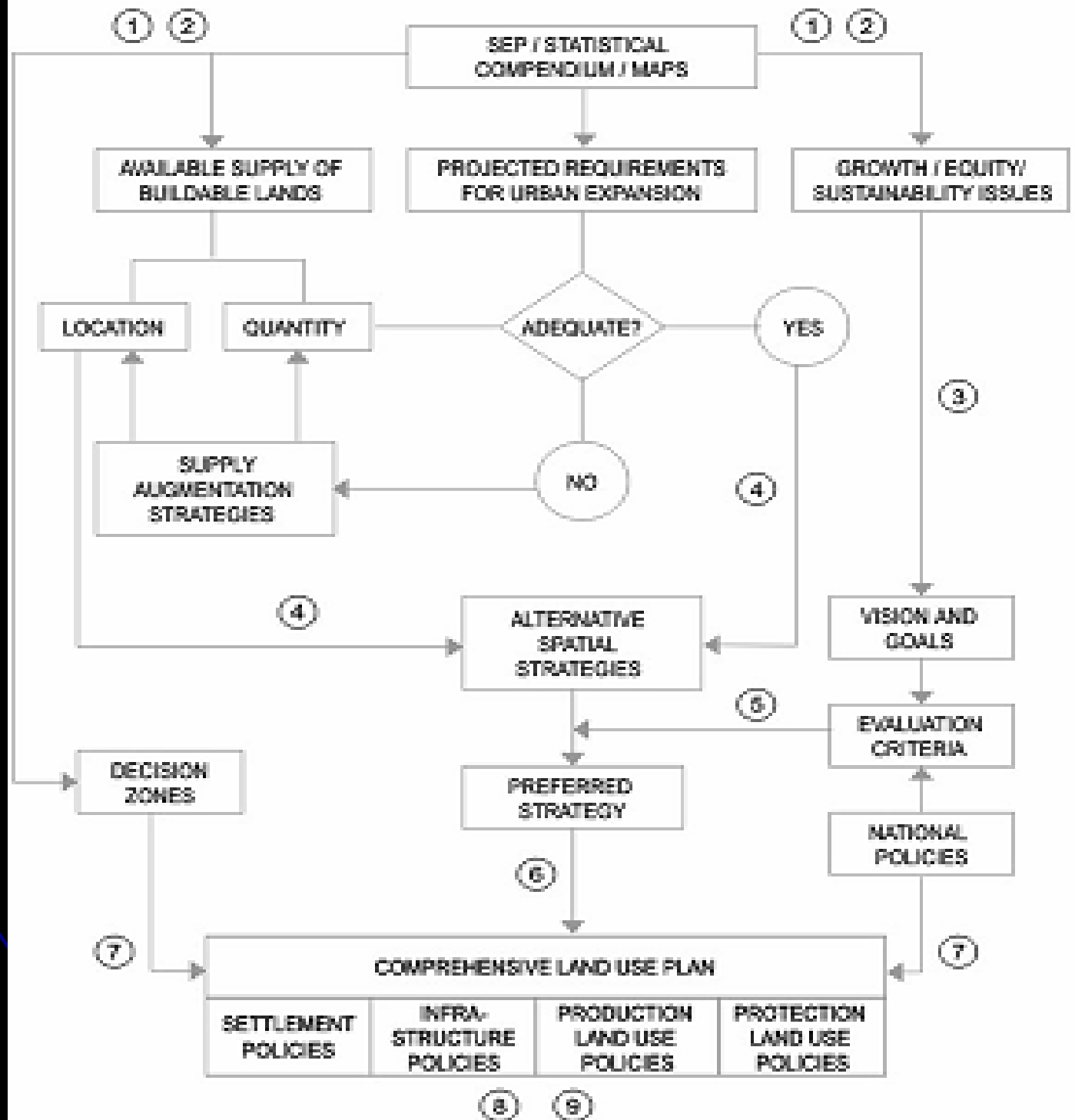
- Not a one-shot project but a continuing, cyclical function of local authorities
- Implemented through instruments derived from inherent powers of the state (e.g. zoning, special taxes, investment programs, etc.)
- Not targeted to specific hazard but includes all hazards known to threaten the local area
- Focus on the city/municipal level comprehensive land use plan

Integration of Disaster Risk Parameters in the CLUP Process

- Data Generation and Analysis
- Goal Formulation
- Strategy Generation
- Policy Formulation



LOCAL COMPREHENSIVE LAND USE PLANNING PROCESS



Data Generation and Analysis

- **Statistical data**
 - Development/underdevelopment indicators to incorporate vulnerability indicators
 - Complete inventory and taxonomy of hazards occurring in area
- **Mapped information**
 - Emphasis on geohydrological hazards
- **Decision zones**
 - Hazard-specific vulnerability maps
 - Existing settlements with varying degrees of exposure to geohazards
 - Anthropogenic hazards
 - Environmental degradation

Taxonomy of Natural Hazards in the Philippines

Triggering Phenomena	Associated Events	
Earthquakes	Ground shaking Ground rupture Liquefaction	Landslides Tsunami
Volcanic Eruption	Lava flows Pyroclastic flows Base surges Tephra falls Volcanic gases Earthquakes	Fissuring Tsunami Landslides Debris avalanche Lahars Seiches
Climatic Changes	Storm surges Landslides Floods Drought	Tropical cyclones Tidal fluctuations Sea level rise

Sources: DOST-PHIVOLCS, 1994
NEDA-NLUC, 2002

Selected Hazard/Vulnerability Indicators

CORE CONCERN	INDICATORS
1. Social Development Sector	
Access to health services	<ul style="list-style-type: none">▪ Percent of households without sanitary toilets▪ Prevalence rates of HIV/AIDS, malaria, TB and other diseases
Poverty	<ul style="list-style-type: none">▪ Proportion of households with members eating less than 3 meals daily
Security	<ul style="list-style-type: none">▪ Proportion of HHs with dwellings unable to protect them from the elements▪ Proportion of HHs without access to level II & level III water supply systems
2. Economic Development Sector	
Labor & Employment	<ul style="list-style-type: none">▪ Percent of labor force employed, by sex▪ Proportion of employed children below 15 years old to total numbers of employed persons
Food security	<ul style="list-style-type: none">▪ Food self-sufficiency index by food groups
Impact on environment	<ul style="list-style-type: none">▪ Ratio of mining & quarrying output to total industrial production

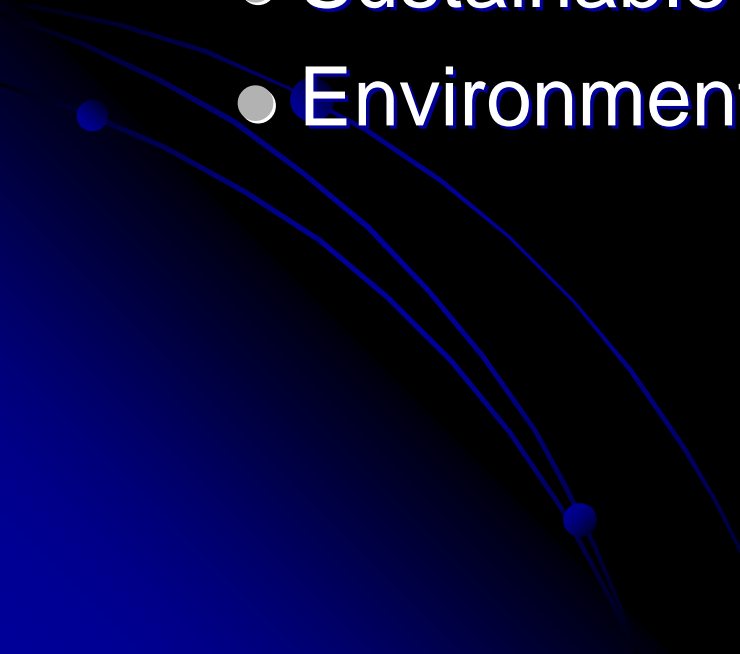
Selected Hazard/Vulnerability Indicators

CORE CONCERN	INDICATORS
3. Environmental Management Sector	
Resource base and land use	<ul style="list-style-type: none"> ▪ Soil erosion rate in upland areas (mm/yr) ▪ Ratio of forest to total forest land (%) ▪ Percentage of timberland proclaimed as protected forest ▪ Ratio of upland devoted to crop cultivation to total upland area (%)
Agricultural land conversion	<ul style="list-style-type: none"> ▪ Percentage of agricultural lands of all types converted to urban uses
Land degradation	<ul style="list-style-type: none"> ▪ Percent of land coverage of erosion prone areas by degree of erosion ▪ Pesticide used per unit of agricultural output (kg/mt) ▪ Inorganic fertilizer used per unit of crop area (kg/ha)
Air quality	<ul style="list-style-type: none"> ▪ Emissions levels of various pollutants per source (varying units)
Solid waste	<ul style="list-style-type: none"> ▪ Non-biodegradable waste generated per capita (mt or cu.m)
Water quality	<ul style="list-style-type: none"> ▪ Concentration of pollutants in selected water bodies (various units) ▪ Concentration of coliform in selected beaches (ppm)
Biodiversity	<ul style="list-style-type: none"> ▪ Proportion of protected areas with illegal settlements to total protected areas ▪ Critical habitats restored (ha/yr)

Selected Hazard/Vulnerability Indicators

CORE CONCERN	INDICATORS
4. Infrastructure Development Sector	
Utilities	<ul style="list-style-type: none">▪ Percent of HHs served by piped water systems
Health	<ul style="list-style-type: none">▪ Number of hospital beds per 1,000 population
Education	<ul style="list-style-type: none">▪ Classroom-to-pupil ratio in elementary and secondary levels
Roads	<ul style="list-style-type: none">▪ Total length of roads per 1,000 inhabitants (km)
Public Safety	<ul style="list-style-type: none">▪ Ratio of firetrucks to population▪ Percent of permanent bridges
5. Institutional Development Sector	
Fiscal management	<ul style="list-style-type: none">▪ Frequency of actual use of calamity fund reserve per year
Personnel	<ul style="list-style-type: none">▪ Ratio of public safety personnel (police and fire) to total population

Goal Formulation

- Generic physical planning goals
 - Rational distribution of population
 - Access of population to social services and economic opportunities
 - Sustainable utilization of natural resources
 - Environmental integrity maintained
- 

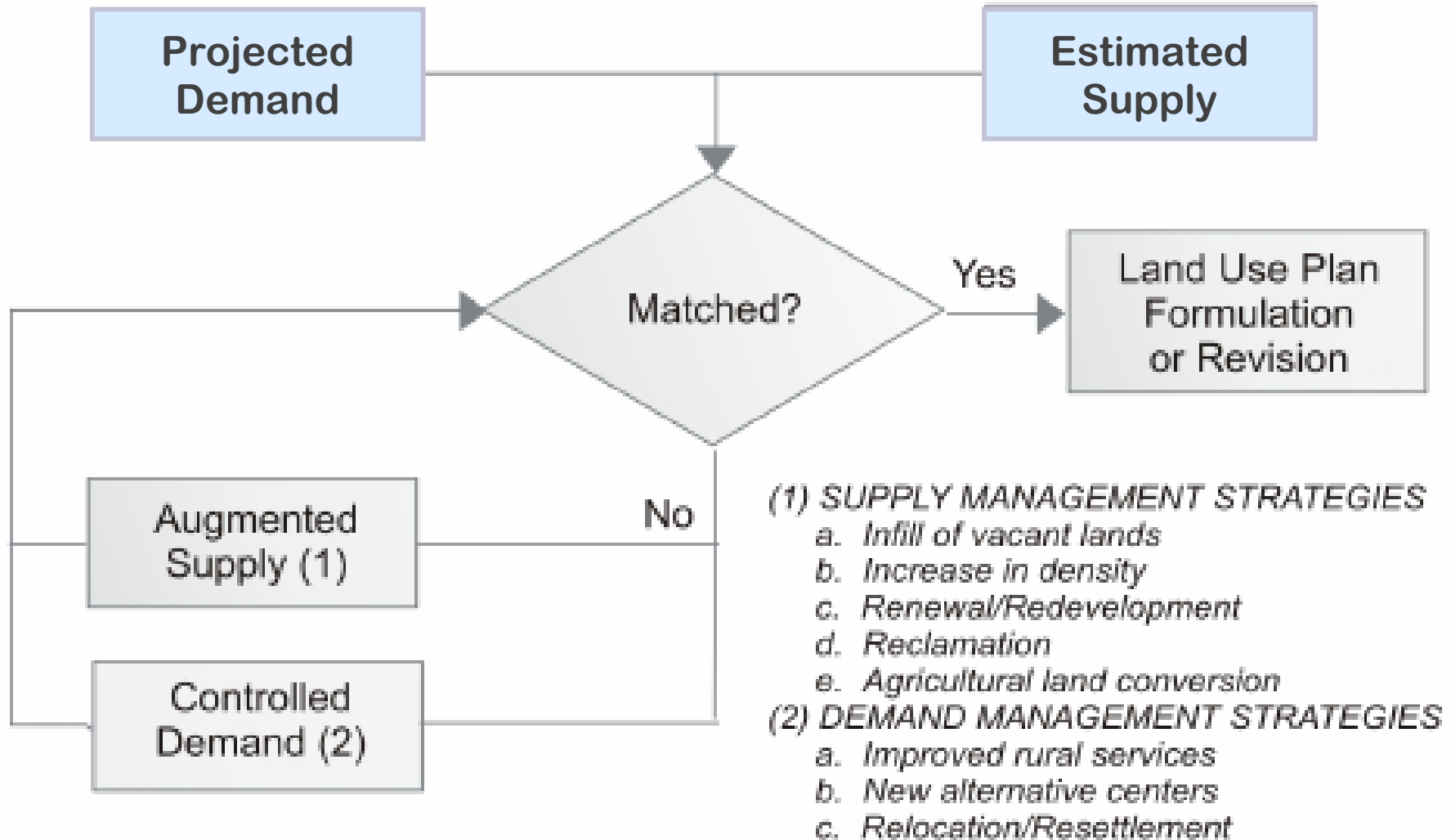
DRR Parameters in Goal Formulation

- Rational population distribution – to include hazard-free locations in definition of “rational”
- Access of population to social services and economic opportunities – “access” to also mean adequate, reliable, uninterrupted by hazard events
- Sustainable utilization of natural resources – with minimal vulnerabilities
- Environmental integrity as both ends and means of disaster risk reduction

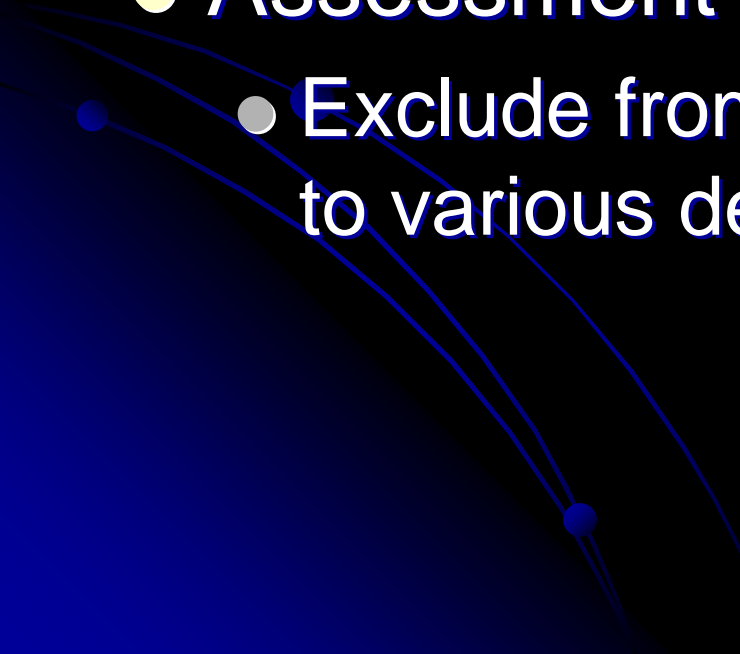
Steps in Strategy Generation

- Demand-supply balancing of land for future urban development
 - Projection of demand
 - Assessment of supply
 - Matching demand with supply
- Design of alternative urban forms
- Evaluation and selection of preferred urban form
- Detailing of comprehensive land use plan

Demand-Supply Balancing



DRR Parameters in Strategy Generation

- Projection of future demand for urban land:
 - Add to demand the estimated area needed to relocate existing vulnerable settlements
 - Assessment of supply of urbanizable land:
 - Exclude from consideration all lands exposed to various degrees of hazards
- 

Assessment of Land Supply

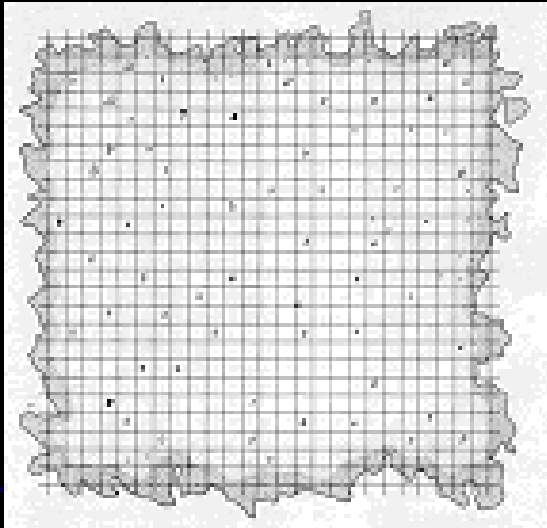
Total area of city/municipality	_____	ha
Subtract:	_____	ha
a. Protected areas		
i. NIPAS		
strict nature reserves		
national parks		
natural monuments		
wildlife sanctuaries		
protected landscapes/seascapes		
resource reserves		
other protected areas (e.g. virgin forests)		
ii. Non-NIPAS areas		
reserved second growth forests		
mangroves		
buffer strips/easements		
freshwater swamps/marshes		
critical watersheds		
b. Other reservations		
i. military and civil reservations		
ii. mineral and geothermal reserves		
iii. water courses and surface water		
c. Environmentally critical areas		
i. water-related hazards		
ii. earthquake-related hazards		
iii. volcanic-related hazards		
iv. erosion-hazards		
d. Protected agricultural areas		
highly restricted agricultural lands - SAFDZ		
e. Heritage sites		
Gross potential supply of urban land	_____	ha
Subtract:	_____	ha
a. existing built-up area		
b. production forests		
i. timber lands		
ii. industrial tree plantations		
iii. communal forest		
Net buildable area	_____	ha
Add: (When buildable area is insufficient to meet the projected demand)	_____	ha
a. vacant urban land		
b. urban renewal/redevelopment area		
c. areas for increased density		
d. new reclamation areas		
e. conditionally restricted agricultural areas		
f. moderately restricted agricultural areas (as a matter of last resort)		
Total land supply for urban use	_____	ha

DRR in the Design of Spatial Strategies

- Exclude hazard-exposed areas from consideration as urban expansion areas
- Depending on the location of hazard areas, give priority to compact urban forms through:
 - Infilling of vacant lands
 - Increasing densities in safe areas
 - Renewal/redevelopment of slums
- Adopt dispersed urban forms as a matter of low priority, through
 - Reclamation of foreshore lands
 - Agricultural land conversion
 - Relocation or resettlement to hazard-free sites

Urban Form Stereotypes

1. Dispersed Sheet

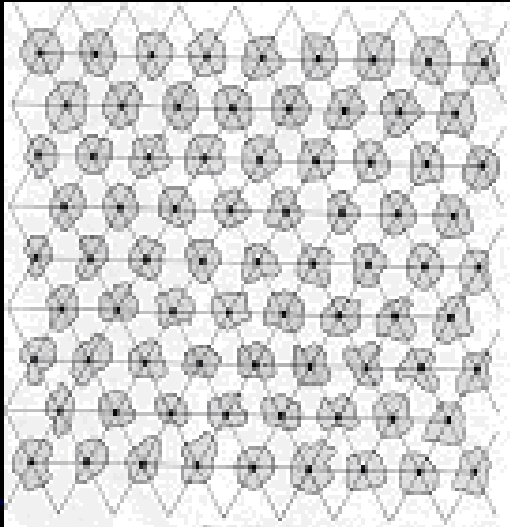


This pattern is similar to the native settlements prior to the coming of the Spanish colonizers – very small clusters of huts in widely scattered barangays.

- + New growth allowed to occur at the periphery at very low densities with substantial interstices of open lands kept in reserve.
- + Developments spread evenly over wide continuous tract; circulation carried out by individual vehicles.
- + Very high accessibility to open land; outdoor recreational possibilities plentiful.
- + Transport network a continuous grid designed for even movement in all directions. No road hierarchy, no major nodal points, no major terminals.
- + Activity areas evenly distributed.
- + Maximum flexibility, personal comfort, independence, local participation highly possible.
- + No traffic congestions, no multi-purpose trips, only single-purpose trips.
- + No vivid or memorable image of the city.
- + Public service provision is expensive.

Urban Form Stereotypes

2. Galaxy of Settlements

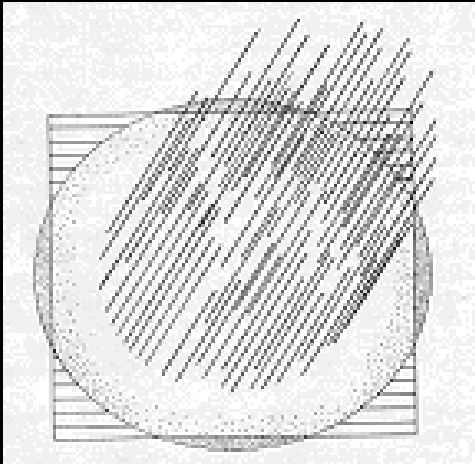


The Spaniards reduced the number of small scattered settlements into fewer but larger pueblos or towns. Later some barrios grew into large settlements that rivaled the old poblacion in population size and complexity of services.

- + Development clustered into relatively small units, each with an internal peak of density and separated from the next by a zone of low or zero density.
- + Each cluster is equal to the next in importance although specialization say, financial center, cultural center, etc. is possible.
- + Circulation mainly by private vehicle but supplementary public transport is possible.
- + All advantages of the dispersed sheet except flexibility are present.
- + If clusters are not too specialized, need for commuting is reduced.
- + Access to open country is assured if interstitial open spaces are maintained.
- + Visual image of local communities improved but not of the whole town.
- + Local centers may develop monotonous similarity unless deliberately made unique and different.

Urban Form Stereotypes

3. The Core City

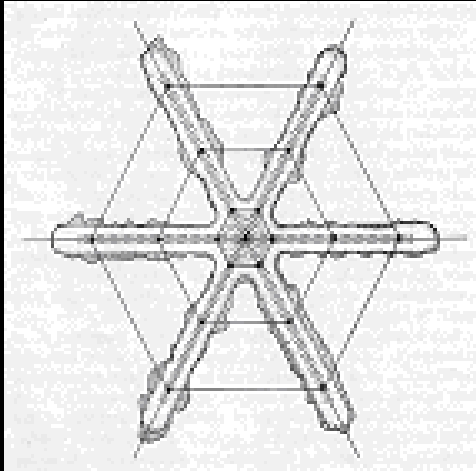


Some towns accommodate their urban growth in the poblacion because of physical and policy constraints to expanding sidewise or horizontally. Ex. Sampaloc and Lucban in Quezon province.

- + Development packed into one continuous body.
- + No single-detached single-family housing, only high-rise apartments available.
- + No private vehicles; movement is by pedestrian on foot or on mechanical devices like elevators, escalators, conveyor belts.
- + Accessibility is high both to activity centers and to open country at the edge of the city.
- + High density increases discomfort due to noise, pollution, and poor climate.
- + Narrow range of housing choice available.
- + Produces strong visual image for the whole town.
- + Initial investments are high but running costs may be low.
- + Highly rigid and inflexible; any change or rearrangement is very expensive.

Urban Form Stereotypes

4. The Urban Star

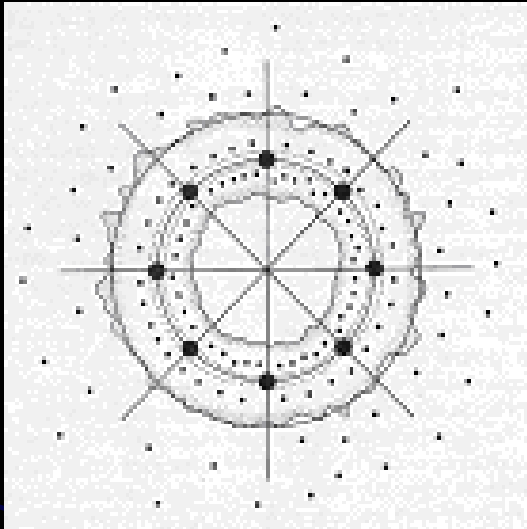


When more radial roads were built traversing the town center urban growth tended to follow along the roads thus preventing the town center from becoming very large. Thus the urban form resembles a star. Ex. Koronadal City or Tacurong City.

- + A dominant core surrounded by secondary centers distributed along main radials.
- + Tongues of open land incorporated in the design resulting in a pattern with a star shaped high-density core with fingers of moderate densities along lines of radial routes.
- + System of flow radial patterns; efficient public transport along radials and inside the core, supplementary concentric rings to connect secondary centers improves circulation in general.
- + Private vehicles allowed in the fringes but may have to be curtailed in the center.
- + Central core accommodates rapid communications & specialized services; offers wide variety of choice of habitat & activities.
- + Very strong visual image.
- + Flexible, could easily accommodate future growth.
- + Costly circumferential road network.
- + Congestion occurs at central core and main radials.

Urban Form Stereotypes

5. The Ring



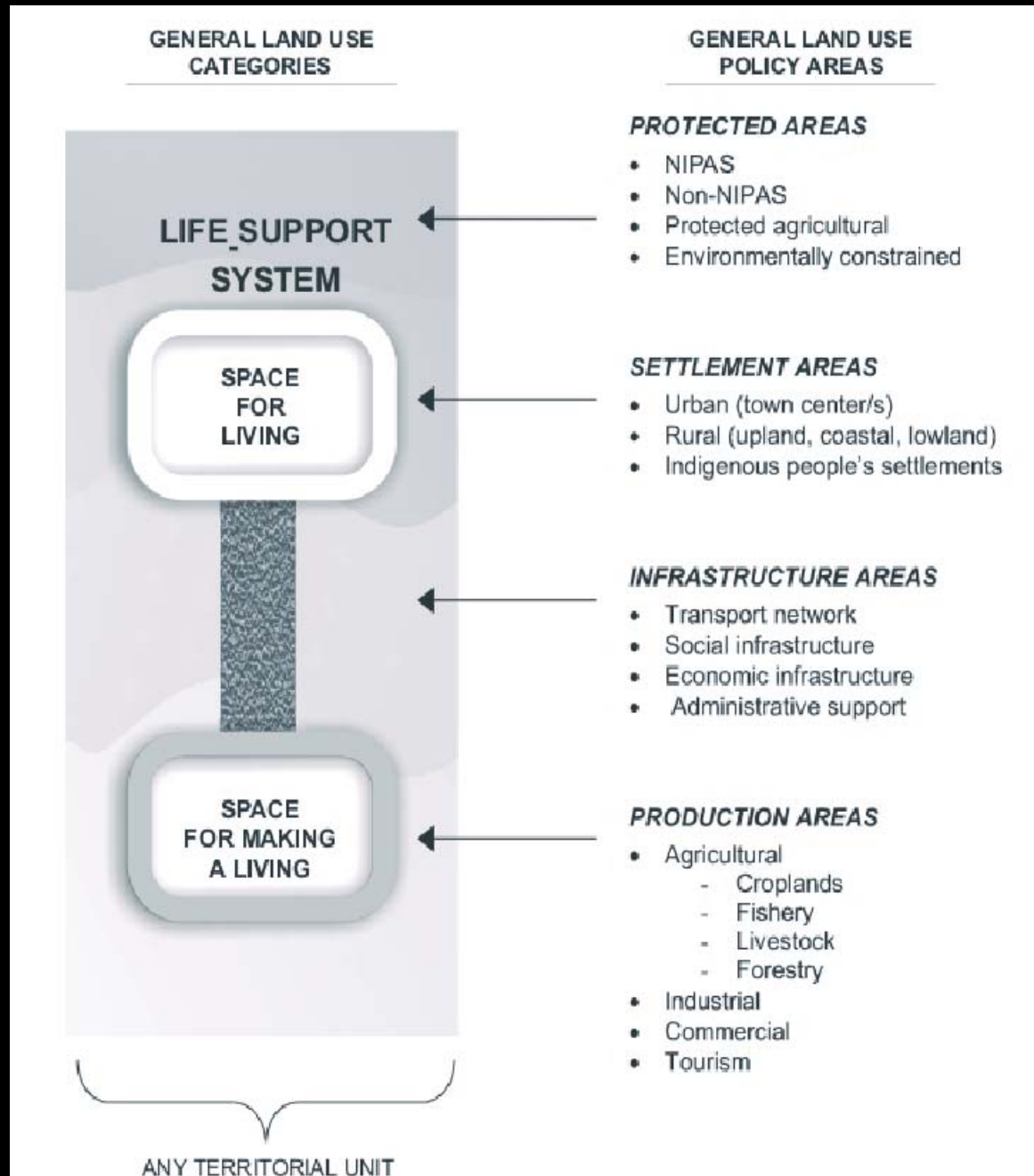
When there are constraints to urban expansion at the center settlements tend to go around like a ring. A good example is La Trinidad, Benguet.

- + Doughnut-like form; center kept open or at very low density surrounded by high-density developments & special activities.
- + Circulation is through a series of rings serving the rim supplemented by feeder radials converging at empty center.
- + No single dominant center but several centers which might be specialized. Other activities are distributed along ring roads.
- + High accessibility to services and open land.
- + Wide range of choice of housing and services.
- + Congestion avoided, circulation very efficient.
- + Strong visual image due to contrast provided by the empty core.
- + Rigid and inflexible as a form.
- + Preserving the open character of the core and the fringes of the built up ring entails very strong political will and very high civic consciousness.

Detailing the Comprehensive Land Use Plan

- Based on the chosen spatial strategy or urban form
- Must cover all areas within the corporate or political boundary of the local authority
- Land uses organized under the generic land use policy areas, namely, settlements, production, infrastructure and protection areas.

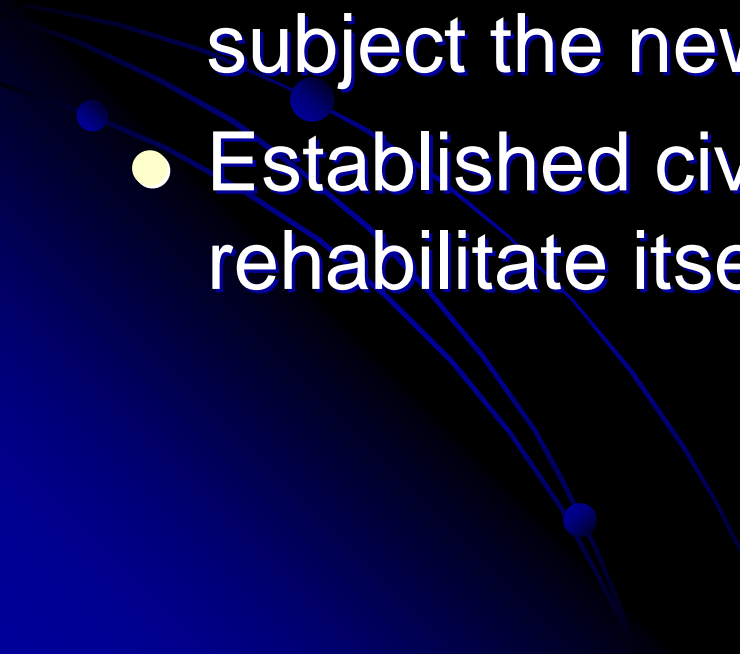
The 4 CLUP Policy Areas



DRR – Sensitive Land Use Policies: Settlements

- Residential use shall enjoy priority over all other uses in the allocation of hazard-free areas
- Hazard-exposed settlements, urban and rural, shall be relocated to safe areas
- Vulnerable settlements that cannot be relocated shall have an operational community-based disaster management plan
- Multi-storey dwellings shall be sited in areas determined to be safe by engineering geological studies.
- Regular monitoring and evaluation of structural quality of dwellings shall be established in all local authorities

DRR – Sensitive Land Use Policies: Infrastructures

- Properly sited and designed so as not to become a source of anthropogenic hazards themselves
 - Minimized exposure to geohydrological hazards
 - If local government center needs to be relocated subject the new site to intensive risk analysis
 - Established civil works that assist nature to rehabilitate itself or to maintain its integrity
- 

DRR – Sensitive Land Use Policies: Production

- Industrial and commercial land use should be properly located in consideration of their traffic generation potential and pollution impact
- Strict zoning regulation shall be enforced on livestock, poultry and piggery houses located in residential areas
- Contour tillage and similar sustainable practices shall be strictly enforced among sloping land cultivators
- The effects of agricultural chemical residues shall be monitored and regulated
- Environmental impact rather than potential revenue shall be the primary consideration in granting permits for small-scale mining and quarrying
- Tourism projects shall be evaluated equally for their income generation potential as for the environmental degradation, displacement of local native residents, and moral corruption that usually accompany these projects

DRR – Sensitive Land Use Policies: Protected Areas

- Liberal allocation of open space in heavily populated areas shall be used as a vulnerability-reduction measure
- Encourage the maintenance of greenery in public and private lots not only for amenity but for its carbon sequestration function
- Environmentally critical and hazardous areas shall be properly demarcated and buffered
- The ecological function shall be paramount over economic and other considerations when allowing the use of protected areas