Sustainability of Land Use in Puerto Rico

Center for Sustainable Development Studies

School of Environmental Affairs

UNIVERSIDAD METROPOLITANA

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Grant # SD98228700

Sustainability of Land Use in Puerto Rico

Expected significant contribution:

- This project aims to develop and implement an easy to use GIS model with a land use sustainability index for municipalities in Puerto Rico that will help enhance the sustainability of their land use policies and plans.*
- The outcomes will be transferable to other municipalities as well as other islands.

* Note: There are 78 municipalities in Puerto Rico and the local Autonomous Municipalities Act requires them to have a land use plan.

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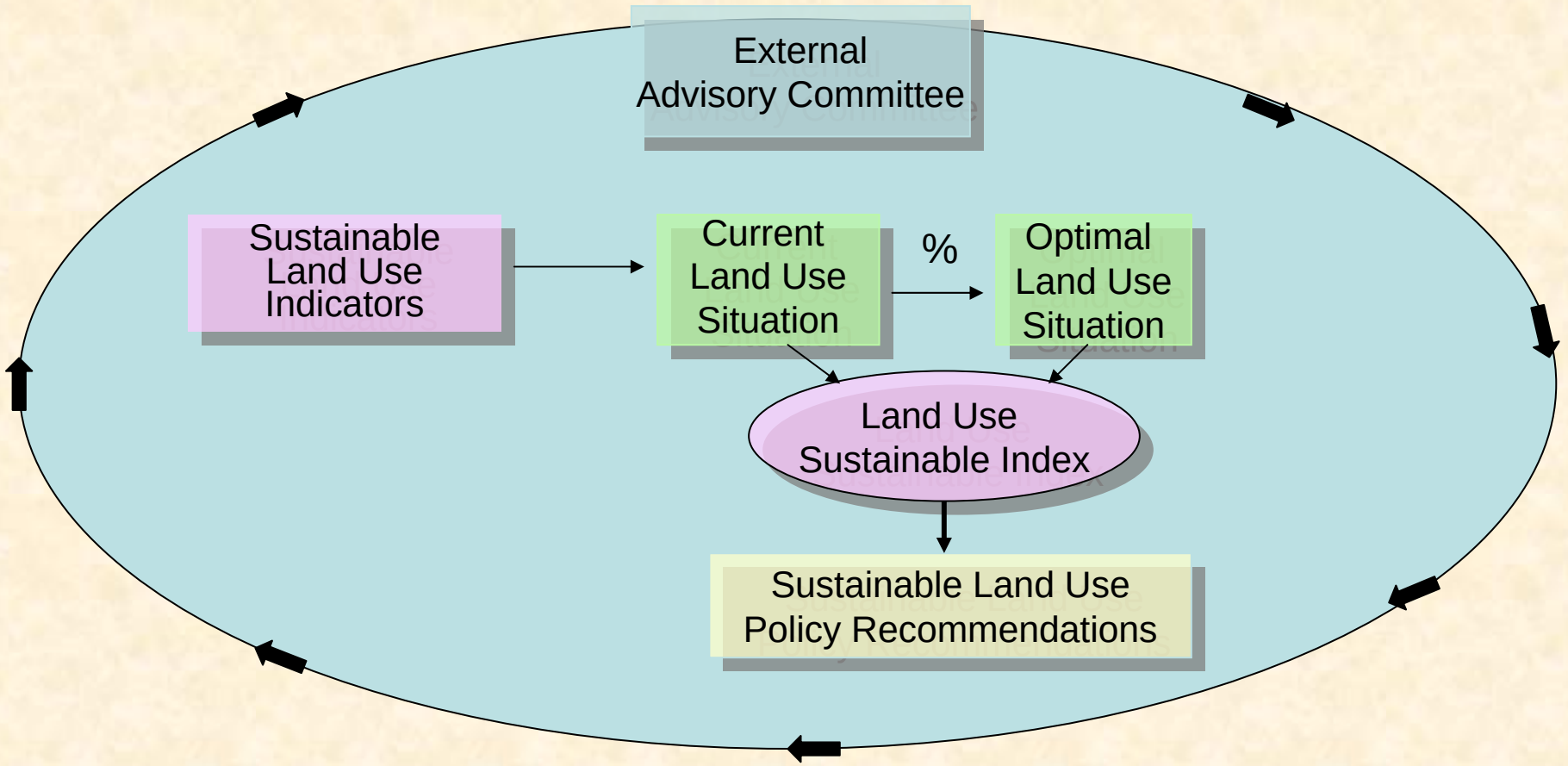
Schematic overview:



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Sustainability of Land Use in Puerto Rico

Schematic overview:

Goal

- Identify what activities should be modified at a municipal level to help drive land use towards sustainability.

Two primary components of the model:

- Describe the current land use based on specific indicators.
- Establish a base optimal land use based on minima and maxima developed from selected indicators.

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Challenges:
Surprises or lessons learned

- There are no data for some potential indicators (e.g. river pollution).
- Reliability of some existing data is a major challenge (there are no metadata for most of the datasets).
- Applying the model must consider dissimilar conditions across municipalities.
- Information is sometimes not available in digital form and is distributed across many agencies hence it is difficult to gather and analyze.
- The last land use inventory for Puerto Rico is over 25 years old.
- Municipalities have not developed a scientific method to calculate developable land for urban expansion plans.

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Collaborations – Advisory Committee and Potential Clients

- 13 municipalities have participated throughout the project.

- Collaboration with 6 local and federal government agencies.
  1. PR Dept. of Natural and Environmental Resources
  2. PR Dept. of Agriculture
  3. PR Environmental Quality Board
  4. PR Planning Board
  5. US Forrest Service
  6. NRCS USDA

- Puerto Rico Planning Society
- Estudios Técnicos Inc. (consulting firm)

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Other collaboration and spin-off efforts:

- Universidad Metropolitana (UMET) has been invited to be part of the Sustainable Indicators Committee for the Puerto Rico Planning Board's Land Use Plan.
- The Project Team presented at the Puerto Rico Social Forum at the University of Puerto Rico (November 19, 2006).
- The project enhances ongoing initiatives at UMET, especially the Puerto Rico version of ICMA and EPA's educational publication **Getting to Smart Growth: 100 Policies for Implementation.**

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Feedback is welcome:

- Since water quality data is scarce and unreliable for Puerto Rico, what models could help us develop a water quality indicator that could be used as proxy?

- Indicator optimality. What is the optimal sustainability value for each indicator?

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Population Trends (Background)

- In 2000 the Island had 3.8 millions, by 2020, Puerto Rico's population will level off at 4.1 millions
- Population density in 2000 was 1,112 persons per SqM by 2020 it will be 1,200
- Median age in 2000 was 32.1 by 2020 it will be 40.6

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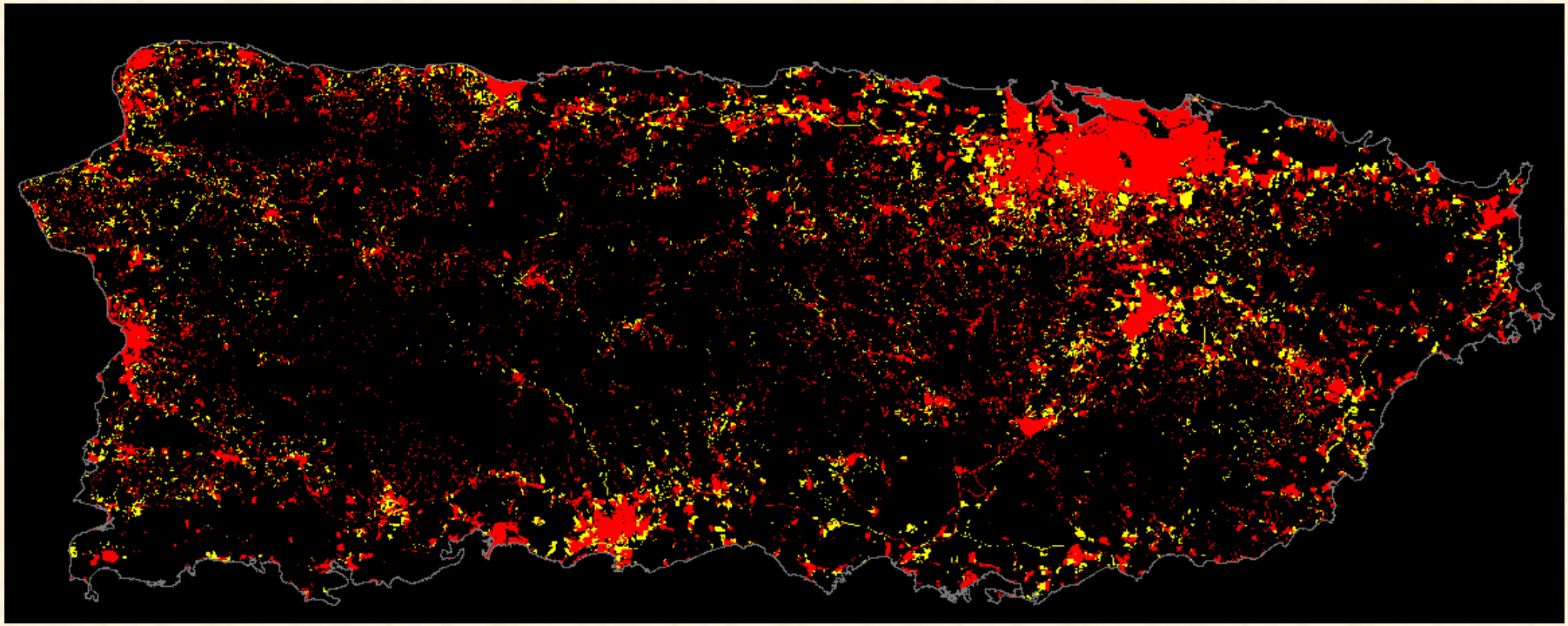
Urban Growth 1977- 2000



Source: US Forest Service, International Institute of Tropical Forestry (IITF)

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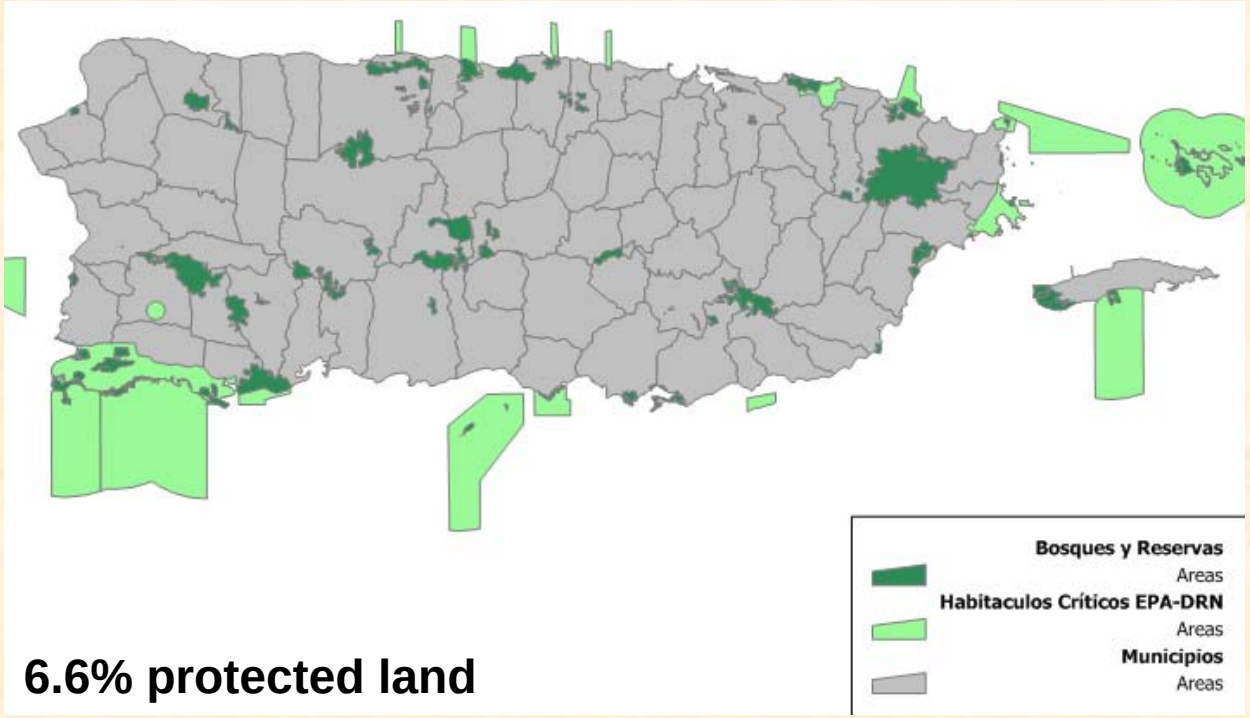
Protected Areas



6.6% protected land

Sources: US Forest Service – IITF
PR Department of Natural and Environmental Resources
PR Planning Board

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General Schema

- Analysis at various geographical scales:
  - ✓ Caribbean
  - ✓ Island
  - ✓ Regional
  - ✓ **Municipio**
  - ✓ **Barrio**

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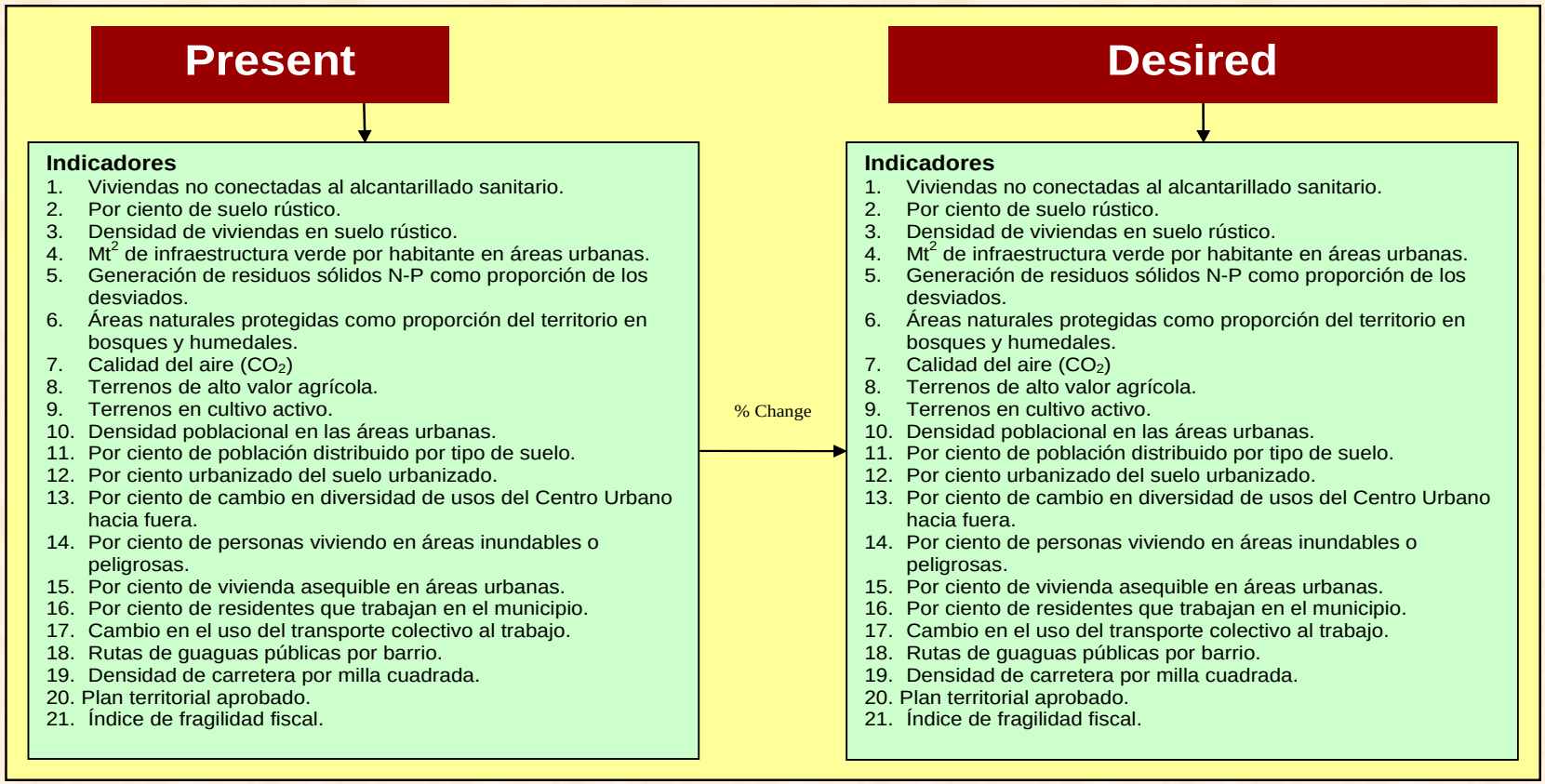
General Schema



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General Schema

Present Situation

- Evaluation of present situation based on an optimal land use situation.
- Product – Sustainability evaluation (how close or far is the municipality from sustainability of land use).

Desired Situation

- A function based on the ranking and weighing of selected indicators that will allow to measure percentage of change through time.
- Product: A series of recommendations to guide the municipality towards sustainability in land use.

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Indicators Selection

Each indicator will be weighted in low to high rankings to present sustainability:

Low in Sustainability --------High in Sustainability

The equation of the model to be developed will measure the combined behavior of the indicators.

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Model Continuity

- The model parameters will be revised to update the base year and to enhance or develop new objectives.
- The model should be re-run every 6 years (local land use plans have the same time frame).

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Indicator Optimality

For each indicator an optimality function will be developed. For example:

1. Population density in urban land should approach 2,000 persons per km^2;
2. Recycling should be 30% of all waste;
3. Green infrastructure in urban areas should be 50 m^2 per person or more.

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Indicator Selection

1. Maturity (used before, reliable)
2. Relevant and functional for land use planning
3. Adaptable to different scenarios
4. Must be able to evaluate current situation and future tendencies
5. Must have quantitative and qualitative value

A tentative group of indicators for the research work was selected by the Project Team with the input of the Advisory Committee composed of local and federal government agencies and municipal officials (informed stakeholders).

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Tentative Group of Indicators 1/3

Environmental

1. % of Housing with Sewer Connection
2. % Rustic Land (Non Urban Land / Agricultural / Unprotected)
3. Housing Density in Rustic Land
4. % Protected Areas
5. Green Infrastructure in Urban Areas
6. Solid Waste Generation (With % Recycled)
7. Air Quality (CO^2)

Economics

8. High Agricultural Value Land
9. Active Cultivation in Agricultural Land

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Tentative Group of Indicators 2/3

Urban

10. Population Density in Urban Area
11. Percentage of Population Per Land Use Type
12. Land Use Mix Index

Social

13. Percentage of People Living in Flood Prone Zones
14. Affordable Housing in Urban Areas
15. Percentage of People Living and Working in the Municipality

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Tentative Group of Indicators 3/3

Infrastructure

16. Percentage of People that use Public Transportation
17. Number of Public Car Routes per Municipality/ Accessibility to Public Transportation
18. Road Density as a Percentage of Municipal Area

Institutional

19. Approved Land Use Plan (Autonomous Municipalities Act)
20. Degree of Intervention by the Central Government in Land Use Decisions / Degree of Municipal Autonomy or "Jerarquía Municipal"
21. Municipal Land Use Planning and Environmental Office(s)

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