

# Integrated environmental assessment and mapping:

## Municipalities planning adaptation strategies to limit climate change impacts

### Points to remember

1. Based on the DPSIR (Drivers, Pressures, State, Impact, and Response) analysis, IEA offers an effective perspective on the cause-effect relationship related to the state of the environment.
2. The integration of mapping in the IEA process enables decision makers to detect trends, possible scenarios and visualize changes over time in an accessible and effective way.
3. In the context of municipal IEA, mapping facilitates the localization of vulnerable sectors where adaptation strategies should focus on.

Climate change impacts affect cities unequally. Therefore, a decision maker's capacity to assess climate related risks and to understand where and why certain sectors are more vulnerable than others is essential for strategic urban planning. In this regard, integrated environmental assessment (IEA), a methodology used by UNEP, allows policy makers to detect pressures, impacts and possible responses in order to inform decision-making to address an uncertain future. This 'policy in practice' identifies key issues and lessons learned, policy makers should consider when implementing IEA and mapping their decision process.

### Why integrated environmental assessment in an urban policy context?

While climate change risks and vulnerability differ greatly between urban settlements worldwide, variation within city's limit is also a reality. Reasons for this inequality in the geographical distribution of climate change impacts between sectors of a same city are many. The most significant are:

- Physical conditions: steep slopes, flood prone areas, rocky ground, low-lying coastal zones, high altitudes;
- Failure of urban planning to adjust zoning and building codes and standards to the shifting reality of climate change;
- Lack of land use planning and/or of proper enforcement;
- Lack of rigorous data collection and analysis of the impact of disasters;
- Socioeconomic factors (e.g. gender, age, ethnicity, income, etc.).

One city alone cannot control the scope of climate change, but it can anticipate the effects and limit its vulnerability. Being able to identify the most vulnerable sectors in order to implement adequate adaptation strategies is essential for effective sustainable urban planning. But how can it be done? Which information is valuable and how can it be analyzed? Where can comparable and reliable data be found? Is there enough being done presently? Those decisive questions call for comprehensive answers.

Integrated environmental assessment (IEA) is a methodology used by UNEP to assess the state of environment in light of drivers and pressures in order to help policy makers

develop effective responses, as evidenced in the 46 city assessment reports produced in the Latin American and Caribbean region.

### What is integrated environmental assessment and how can it contribute to evaluate vulnerability to climate change?

Integrated assessment is the process by which environmental and climate change impacts and their implications for human well-being are evaluated so as to help decision makers to consider adequate policy options and response actions. In order to do so, the IEA process aims to answer five iterative questions:

1. What is happening to the city's environment on aspects relating to climate change vulnerabilities and why?
2. What are the consequences for the city's environment and population?
3. What is being done and how effective is it?
4. Where are we heading?
5. What actions or policy could be taken for helping build the resilience of cities?

### How are maps used in an integrated environmental assessment?

Policy makers need tools to help them understand human, environment and spatial interlinkages in an effective and accessible way. In this regard, spatial analysis and mapping, using Geographic Information Systems (GIS), should be included in the IEA process. Mapping and GIS can indeed be use to:

- Simulate and model possible scenarios;
- Perform spatial analysis and see trends by superimposing data layers;

- Anticipate impacts of a specific project on human and natural environment;
- Visualize changes over time and identify trends.

### What is being done?

The GEO-Cities<sup>1</sup> initiative, which has been conducted by UNEP since 2001, is a good example of implementation of IEA at the municipal level. While GEO-Cities first focused on assessing the urban environment (e.g. Rio de Janeiro, Mexico City, Buenos Aires,) some modifications over the years allow climate change issues and impacts to be integrated into the analysis through the ECCO-Cities process (e.g. Trujillo, Colonia del Sacramento, Distrito Metropolitano de Quito).

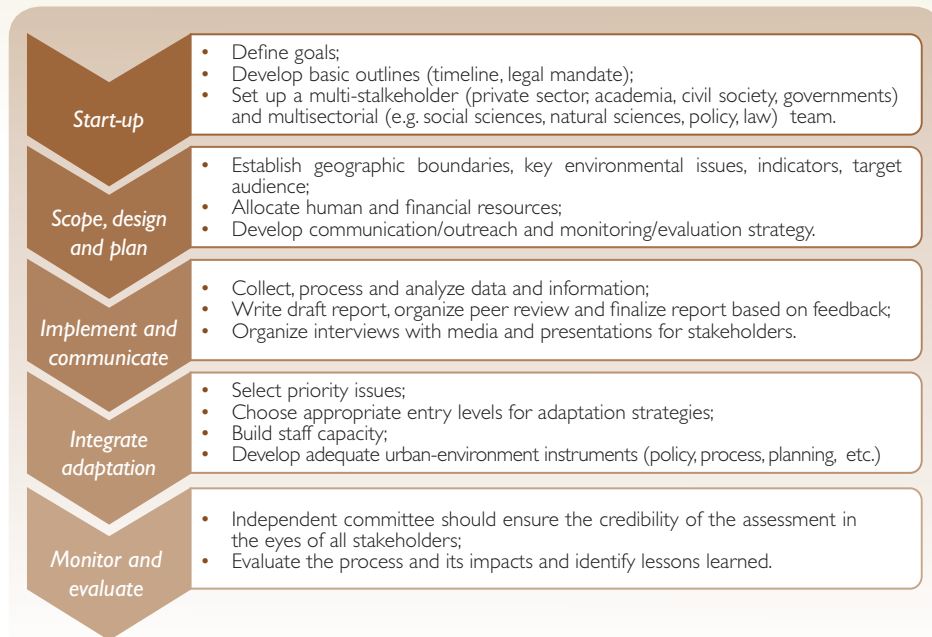
GEO and ECCO-Cities reports have brought to light that, local, regional and national stakeholders were already using environmental assessments punctually so as to facilitate policy making process. However, the focus of those assessments were usually less about urban ecosystems as a whole but were rather centered on a specific thematic (e.g. City of Puerto Montt's Assessment and visualization of environmental noise – *Evaluacion y Visualización del Ruido Ambiental de la Ciudad de Puerto Montt*) and/or perform on a larger scale (e.g. National Response Plan to Climate Change, Uruguay) thus making it hard to highlight critical urban specificities. A multisectoral approach centered on a city, as the one proposed by the GEO-Cities and ECCO-Cities methodologies, allows an extensive and thus more complete comprehension of the impact of climate change on urban ecosystem as well as the drivers and pressures in order to facilitate strategic decision making process at the city level.

<sup>1</sup> GEO-Cities: City reports based on the IEA methodology, as used for the Global Environment Outlook

## Constraints

- Availability of up to date data at the city level regarding extreme events and climate change (frequency, intensity, related deaths, injuries and costs) as well as neighborhood and informal settlements characteristics (demography, tenancy, quality of housing/infrastructure, access to basic services);
- Difficulty to appraise and measure direct and indirect impacts related to climate change hinders scenario making (e.g. work and school days lost, impossibility of carrying out informal activities to generate income, deaths, illnesses, etc.).

### How to integrate environmental assessment into the policy process at the municipal scale?



### Lessons learned through the GEO-Cities and ECCO-Cities processes:

**Include mapping into the IEA process** as it offers an effective and accessible way to visualize trends, changes over time and space as well as to simulate feasible scenarios;

**Put emphasis on participatory IEA** as it leads to more comprehensive, detailed and accurate data. Participatory processes foster greater engagement and appropriation of the topic by actors, increasing the possibility of further involvement and facilitating outputs for suited policy design;

**Provide capacity building** both in regard to IEA and more specifically to GIS;

**Monitor and evaluate** both the assessment and the policy process in order to improve policy responses.

#### Useful links and further reading:

- UNEP Geo data portal: <http://geodata.grid.unep.ch/>
- UNFCCC (2010), Adaptation assessment planning and practice :An overview from the Nairobi Work Programme: [http://unfccc.int/resource/docs/publications/10\\_nwp\\_adap\\_assess\\_en.pdf](http://unfccc.int/resource/docs/publications/10_nwp_adap_assess_en.pdf)

#### References:

- Adapting Cities to Climate Change: Understanding and Addressing the Development Challenges (2009), Earthscan, 397p.
- UNEP (2011), IEA Training Manual Volume Two, Climate Change Vulnerability and Impact Assessment in Cities: [http://www.pnuma.org/deat1/pdf/Manual\\_City\\_climatechange\\_assessment.pdf](http://www.pnuma.org/deat1/pdf/Manual_City_climatechange_assessment.pdf)
- UNEP (2010), GEO Puerto Montt - Perspectivas del Medio Ambiente Urbano: <http://www.pnuma.org/deat1/pdf/2010%20-%20GEO%20Puerto%20Montt.pdf>
- UNEP (2011), Vulnerabilidad y adaptación ante el cambio climático para GEO Ciudades: Colonia del Sacramento- Uruguay, 48p.

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- UNEP (2011), Perspectivas del ambiente y cambio climático en el medio urbano: ECCO Distrito Metropolitano de Quito: <http://www.pnuma.org/deat1/pdf/ECCO%20DM%20Quito.pdf>
- UNEP (2009), Perspectivas del Medio Ambiente Urbano: GEO Cartagena: <http://www.pnuma.org/deat1/pdf/2009%20-%20GEO%20Cartagena.pdf>

## CASE STUDY 1: SIMULATION

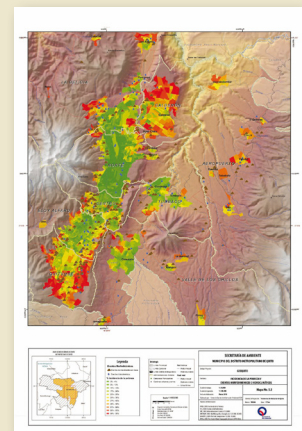
Colonia del Sacramento (Uruguay)  
Simulation of submerged coastal zone South of Zona Franca and Malvinas (3 meters)



How this map could help policy makers?  
This rising sea level simulation is effective as it shows policy makers vulnerable sectors where adaptation measures should be implemented. Urban planners could opt to restrict residential development in that sector or implement adaptation strategies to limit the impacts of rising sea level.

## CASE STUDY 2: SPATIAL ANALYSIS

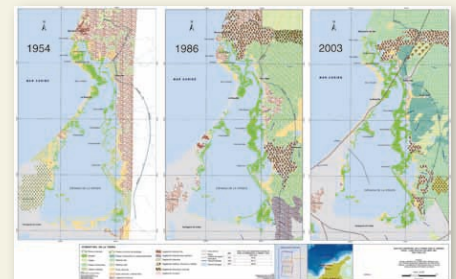
Quito Metropolitan District (Ecuador)  
Morphodynamic and hydrographic events in relation with incidence of poverty.



How this map could help policy makers?  
Mapping climate related events and the socio-economic situation makes it easier to locate vulnerable sectors. Policy makers could choose to implement adaptation strategies to reduce vulnerability (e.g. building codes).

## CASE STUDY 3: CHANGES OVER TIME

Cartagena (Colombia)  
Dynamics of change of the mangrove cover between 1954 and 2003



How this map could help policy makers?  
To map changes over time helps apprehend trends. In this particular case, the loss of mangrove cover increase risks of erosion and floods. In order to protect urban coast from climate related events, decision makers have chosen to restore the mangrove cover or at least secure what was left. Mangrove cover has indeed increased between 1954 and 2003.