STRENGTHENING CLIMATE CHANGE ADAPTATION PLANNING IN LATIN AMERICAN & CARIBBEAN CITIES

Center for Global Change Advisory Committee

Selection Criteria: Small and medium sized cities and climate change adaptation (Argentina, Chile, Paraguay, Uruguay).

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Introduction

Based on the initial survey targeted at all municipalities in the Southern Cone countries with small and medium-sized cities, with responses from 53 city-municipality representatives, the second phase of the project looks to select a small number of cities for further adaptation planning. The selection of criteria to reduce this long list of respondent municipalities to a short list of potential follow-up cases is the next step in the process.

Methodology

The respondent city-municipalities that filled in the survey, providing information on the preparedness of the authorities and the issues to be faced, are wide-ranging in many respects. In order to move forward with the selection, the criteria that are important for the World Bank project need to be clarified. There are many potential approaches that can be taken. One is a focus on those that have existing capacity and can then become 'demonstration effect' or 'best practice' examples of adaptation. Another is a focus on the weakest municipalities that have little or no awareness and have no specific measures in place, effectively those with most to gain. Clearly it is difficult to group city-municipalities given their considerable variation. Among the variables that one can consider are the following: population size; population trajectories (including migration, age, etc.); spatial extension; topography and geographical location; resource availability, quality and quality; composition of the local and regional economies; socio-economic typologies of resident groups; services coverage and quality; green spaces and environmental quality.

In view of this potential complexity, the purpose of this document is to provide a more basic, introductory approach based on available data sources in order to make specific distinctions that can support this selection process. Given the fact that different countries collect data on cities and municipalities in different ways, it is difficult to establish comparative data series for quantitative analysis. Consequently, the selection criteria are based on broad quantitative categorisations, also certain qualitative attributes.

The criteria that are used fall mainly into six categories:

1. National context
2. City size (according to population)
3. Climate change trends
4. Principal impacts
5. Adaptive capacity
6. Vulnerability of the local population

Given that each of the categories 3-6 involves numerous factors or variables, a suitable proxy has been used in order to reduce this complexity to a manageable level (avoiding the difficulties associated with creating indices and having to weight variables in this process, which is in itself problematic due to the data quality and comparability across countries).

Prior to filling out a matrix of respondent city-municipalities, these categories and the variables selected will be presented.

1. National context

Given that the World Bank project seeks to provide coverage of the region, it is important that each of these countries is represented. Although there may be justification for focusing on a country that has a specifically high level of potential climate change impact, or one that demonstrates higher levels of socio-economic vulnerability, or low levels of institutional adaptive capacity, the ambition of the project to provide a cross-section of experiences at the regional level mitigates against a national or even sub-national focus. This being said, clearly the use of national settings as a baseline, as opposed to specific risk factors (impacts or vulnerabilities), means that (with 3-5 potential follow-up cases) the selection will not be comparative by nature. A comparative study based on national settings would seek to select similar size, impact and vulnerability dimensions. Given the high diversity among city-municipalities and the specific nature of potential adaptation responses, a comparative study is neither necessary nor revealing at this early stage of regional urban adaptation.

Given the above, the criterion of national context will lead to the selection of at least case in each of the countries surveyed.

2. City size (according to population)

One of the most characteristics of urban development patterns is city size. City size can mean population size, city extension (surface area) or economic size (measured in GDP or employment variables). The most common understanding is that of population size. It is based on population size that the UN creates typologies of cities, from the smallest to megacities of over 10 million. Since each country is responsible for defining an urban settlement, this complicates more absolute measures for comparison. Another dimension is where one urban area ends and another begins, or how far into a rural setting an urban designation is extended (for sprawling cities in particular). The setting of urban limits through planning instruments is important in this respect since this limit can be legally changed and consequently the city extension and the urban population may change overnight.

To be able to compare the respondent city-municipalities, a simple criterion is established for city size. This is self-reported city size, where available, or national level urban data where the former is unavailable. For the purposes of the project, four different city sizes that correspond to small and medium-sized cities will be established: a. town <50.000 inhabitants; b. small sized city 50.000-100.000; c. medium sized city 100.000-250.000; d. intermediate city 250.000-500.000.

3. Climate change trends

Climate change trends, given their diverse nature and variability, pose considerable problems in terms of reducing this range to one index or variable. While accepting the complexity of the issue, for purposes of viability, climate change impacts (meaning the impacts expected in the longer-term from the conditions already known, according to the scenarios from the IPCC 4th report for the region) are simplified according to intensity. This intensity will be different in terms of the particular conditions that each city-municipality faces, however different exercises have provided broad-based introductions to this impact in the region. The climate changes identified in the IPCC (2007) report and using the climatewizard.org software (of The Nature Conservancy, University of Washington and University of Southern Mississippi) to identify current climate conditions provide a broad-brush approach to being able to establish diverse impacts in certain areas.

Given that the range and intensity of climatic events is likely to be more generalised, the more specific issues to be identified are gradations of temperature rise, and gradations of precipitation changes, also vulnerability to sea level rise (riverside and costal locations). These influence flooding, drought, urban heat island, disease distributions and a range of other factors. By using the maps provided in IPCC 2007 report and equating city-municipality locations to these maps it is possible to give broad overviews of total impacts. To this end, each of the 53 respondent city-municipalities is given a weighting according to temperature change, precipitation change and riverside or coastal location, using a simple traffic light scheme. The scenario that is used is A2, and the timeframe 2070-2100 (a longer-term projection). Flood risk from river (previous events) or coastal location (height above sea level) will be established according to each case. The traffic light will be red for extreme (according to other locations in the Southern Cone), i.e. high temperatures, decreasing precipitation, vulnerable location for flooding (extreme events). Green will reveal the inverse, with orange registering insignificant changes (according to the sub-regional norm).

4. Principal impacts

Based on the trends noted in the previous section, the principal impacts for each case are highlighted. Using a list of impacts: flooding (F), flash flooding (FF), heat island (H), drought (D) and sea level rise (SLR), each case is linked to a particular impact or combination where these appear to be likely. This column is important in the final selection since the case selection should provide an overview of different impacts that will be seen across the Southern Cone. In Annex 1 we present a series of maps that relate current conditions with future scenarios and associated potential impacts. This is the basis of the analysis performed at this stage.

5. Adaptive capacity

Adaptive capacity is a difficult variable to establish. Given the wide range of institutional capacities, financial structures, trained staff and formal powers, the role of local governments is difficult to establish. Rather than focusing on the adaptive capacity of the population at large, via income, educational levels or other criteria, the intention of focusing on institutional capacity is relevant given the central role that these local government institutions play in orienting local development and responses to major challenges, whether economic, social, or environmental in nature (and combinations thereof).

Bearing in mind that sizes and powers of local governments varies widely across the region, the intention is to focus on the planning attributes of these local governments since adaptation is a planning challenge that has to be inserted into most areas of government activity in order to shape local changes. The variable to be used is whether the local administration is aware and is planning for climate change. This is an indicator of their adaptive capacity. In Questions 11 and 12 of the survey, responses were provided in reference to current activities and awareness. Based on these qualitative responses the categories: Highly adaptive (HA); Adaptive (A); Unadaptive (UA) will be used.

6. Vulnerability of the local population

Vulnerability refers to the ability of individuals or groups of individuals to respond to a specific event or process. Low levels of adaptive capacity in the population will equate to high vulnerability. In this sense, vulnerability is a characteristic of the urban society in this sense. Bearing in mind that urban societies are diverse, with different socio-economic groups represented, the importance is to focus on the degree of vulnerability of the urban society at large. While poverty was most often used as a proxy for this vulnerability in previous decades, since the early 1990s the Human Development Index has provided a better tool since it brings in not only income poverty (or wealth) but also capacities based on health and education. The four variables that define the index are: longevity, schooling years, literacy, and income. By offsetting income with these other social variables, the emphasis on income poverty or wealth is tempered by these other educational and health considerations. Since the UNDP has been undertaking national and sub-national studies of the HDI over the past two decades, there is data available for the countries under discussion. Nevertheless, this information is not frequent therefore it is likely that each country will have data for a specific year during the last decade. As a photo of the experience at this time, we are provided with an indication of a situation. The advantage is that the methodology for the index is common therefore we are able to compare across countries. High HDI (H) is equivalent to low vulnerability, and vice versa.

Table for Comparison

The table for analysis of the respondent city-municipalities is as follows:

	Country	City size *a-d*	Trend *red-orange-green*	Principal Impacts *(F-FF-H-D-SLR)*	Adaptive capacity *HA-A-UA*	Vulnerability *HDI index*
City 1						
City n						

Based on this table (see filled table in separate file), 6 cities have been selected based on country and size, followed by an appreciation of the other three variables. The final selection will seek to represent cases that have high impact in all cases (red) and high vulnerability (low HDI). Cases with high and low adaptive capacity should be used for comparative purposes. Based on the cases, a definitive final number of cities will be selected depending on the World Bank criteria for the implementation phase.

Results

1. It is important to bear in mind that most climate change models do not operate at city or municipal scales. For these reasons, the selection results are imprecise, although they are based on IPCC meta-analysis (based on multiple models).

2. Some respondent cities are beyond the threshold of what may be considered small or medium size cities. These include: San Miguel de Tucuman; Rosario; Asunción.

3. Other municipalities are embedded within larger metropolitan conglomerations. For these reasons it is difficult for them to establish their own climate change adaptation strategies. These include Hualpén and Penco in the greater metropolitan area of Concepción, also San Lorenzo with the wider metropolitan area of Asunción. For these reasons these municipalities are excluded from selection.

4. Other municipalities excluded from final selection are those that have limited projected effects from temperature changes, precipitation and sea level rise associated with climate change and/or with not a minimum degree of accuracy on those projections. The more southern cities in Chile fulfil these criteria: Punta Arenas, Coyhaique. Other cities do not appear to have severe impacts to anticipate, e.g. in the province of San Luis, Argentina. Although these cities will be affected by the intensity of climate events, they will be less affected than other cities and municipalities. In the matrix under Principal Impacts, these cities are marked as 'NO', meaning that they should not be considered relative to others that have clearer, more severe impacts.

5. In order to compare between countries and not only use national studies, a general overview of main issues is provided. By highlighting more problematic issues in red, it is possible to identify cities that face important challenges over

coming decades. The main function of this matrix is to compare across municipalities in different countries rather than to focus on highly specific local issues. These will be raised in subsequent studies. For the most part there is inadequate information at local and regional levels in order to make clear affirmations relating to impacts and adaptation issues.

6. What is evident from the matrix and that is useful for selection is as follows:
    a. Many Chilean municipalities have falling precipitation and rising temperatures that is likely to generate an intensity of water stress. One of these would provide a good example to analyse water stress conditions and responses.
    b. Paraguay and Uruguay are likely to face moderate temperature increases but also increasing precipitation. The intensity and frequency of this precipitation is likely to generate important impacts. For this reason, one of these cases is appropriate to research this phenomenon.
    c. Sea level rise is a further hazard but one that is difficult to assess given local topographic conditions. Since salinisation and the loss of fertile land is a consequence of this rise, and is as important as direct flooding events associated with coastal storms, awareness and protection are vital. There are few clear examples where urban areas will be most affected by sea level rise, in Argentina, Uruguay and Chile, therefore the association of this issue with either precipitation/flooding or temperature rise/drought is made.
    d. Adaptation to climate change is related to the ability of people to react to known threats. These reactions also depend on financial capacity, as well as institutional capacity and awareness. For this reason, the levels of human development of the population – indicating poverty for example – are relevant. It is likely that poorer municipalities will be more affected by climate change due to broad-based capacity weaknesses. It is important to select one of these municipalities as a consequence. Adaptive capacity is likely to be related to this overall weakness, as in the cases of Caacupe and Concepción in Paraguay.
    e. City size is also relevant to this study, although in the case of Uruguay the cities are conflated with the Departamentos where local decision-making functions are concentrated. The ambition is to reflect different scales of city given their different challenges and potential opportunities.

7. Given the above, the following city-municipalities have been provisionally selected. A short-list of 6 is provided.

1. **CONCEPCIÓN, CONCEPCIÓN PARAGUAY**: a small city with low HDI (high vulnerability), unadaptive, and problems relating to increased precipitation and heat island problemas due to its already high temperatures and projections of even higher levels in the future. Concepcion is also a riverside city that faces potential flooding problems.
2. **OVALLE, COQUIMBO CHILE**: a small size city that is a hub of agriculture in a semi-arid environment. Problems relating to a heat island effect, as well as the problems of water supply for agriculture and residential uses, make this an interesting case since this scale of agricultural centre is common across the Southern Cone.

3. **CHILLAN, BIOBIO CHILE**: a medium size city that concentrates considerable several impacts. Given its watershed location (in the footsteps of the Andes), experiences of flash flooding are possible, as well as the ongoing impacts of rising temperatures that will lead to heat island problems and drought in the surrounding rural landscapes.
4. **COLONIA, COLONIA URUGUAY**: an intermediate size municipality since it covers different settlements, centred on the city of Colonia. Although the main city only has a population of 22.000, thus constituting a town in our context, the municipality covers several settlements that constitute an intermediate size regional authority. The municipality has a large extension of land that faces the River Plate, therefore it will be vulnerable to sea level rise, and will also face rising precipitation events leading to flooding.
5. **POSADAS, MISIONES ARGENTINA**: an intermediate city that faces challenges due to precipitation events, also median temperature rises (as with most other cities in the Southern Cone) that will lead to heat island consequences. It also faces potential flooding from intense events.
6. **SALTA, SALTA ARGENTINA**: an intermediate city, which is likely to experience the compounded impacts of rising temperatures and less water availability, but without the flooding that is likely in more northern provinces and further east. The heat island impact within this intermediate city will increase discomfort levels given the humidity component. Drought will pose challenges for agricultural activities, increasing residential versus productive water distribution pressures.

Annex I. Analysis of potential impacts associated with climate change

A. Actual conditions

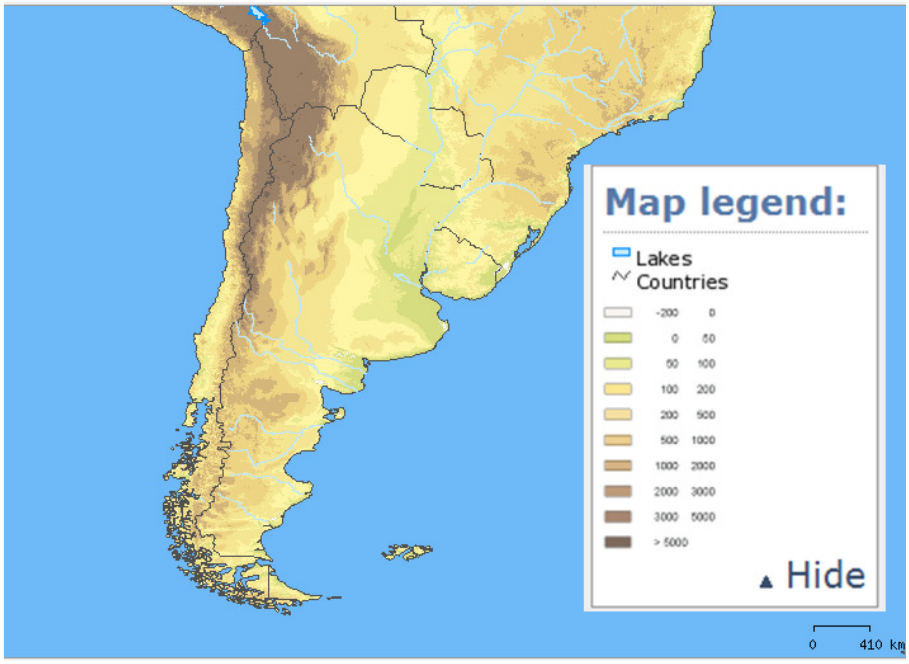

Figure 1. Topographic map

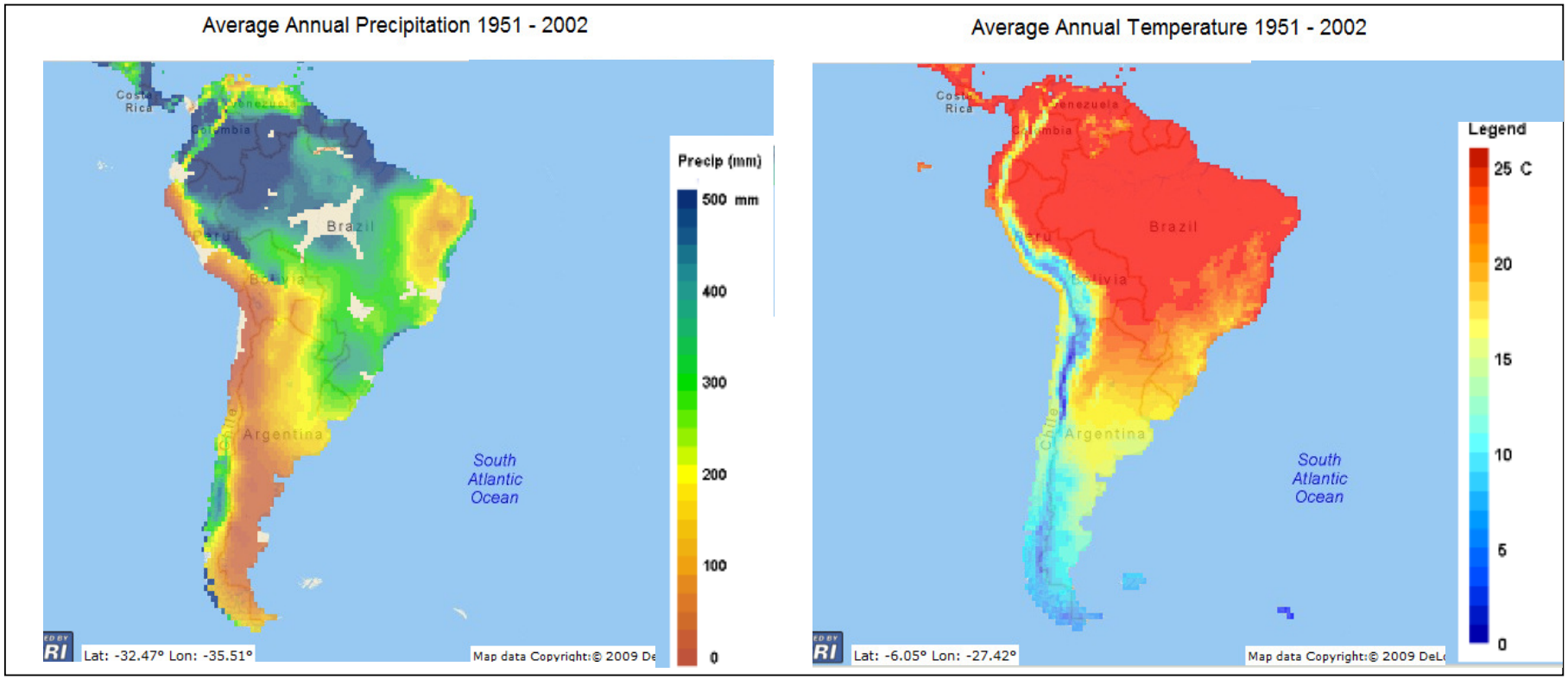

Figure 2. Historic precipitation and temperature conditions in South America (from http://www.climatewizard.org/)

B. Future scenarios

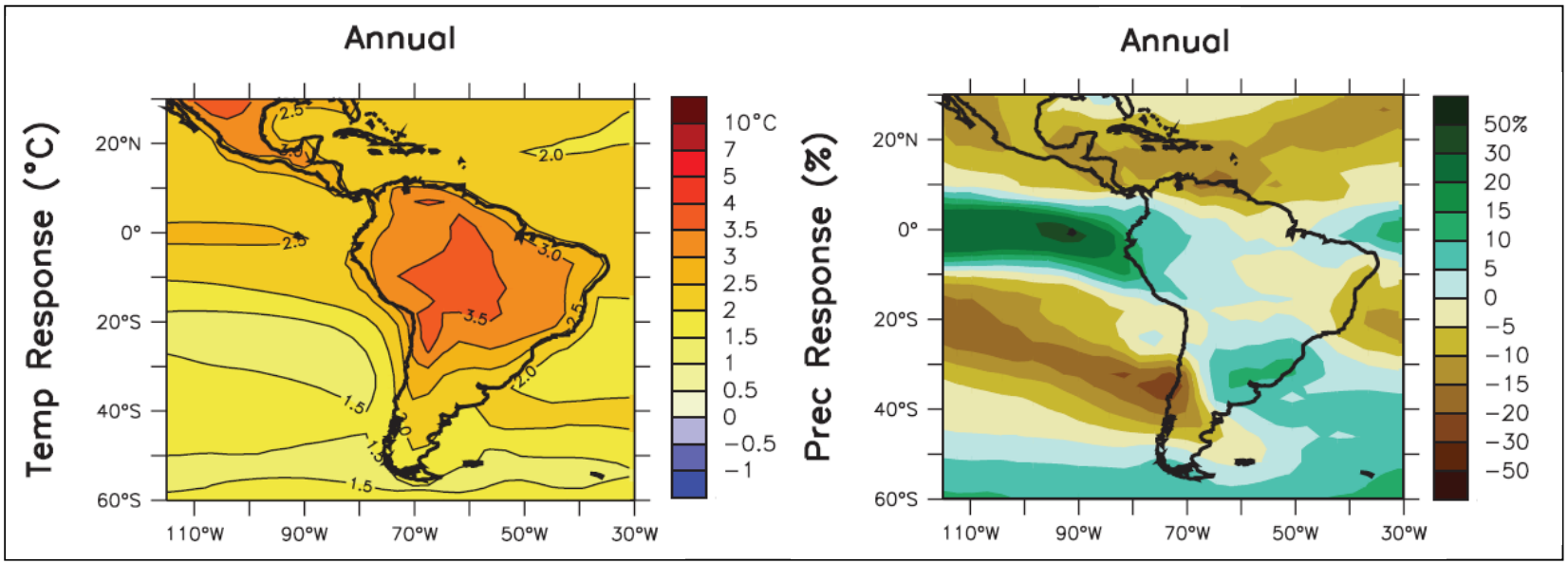

Figure 3. Future projected precipitation and temperature conditions in South America (IPCC, 2007)

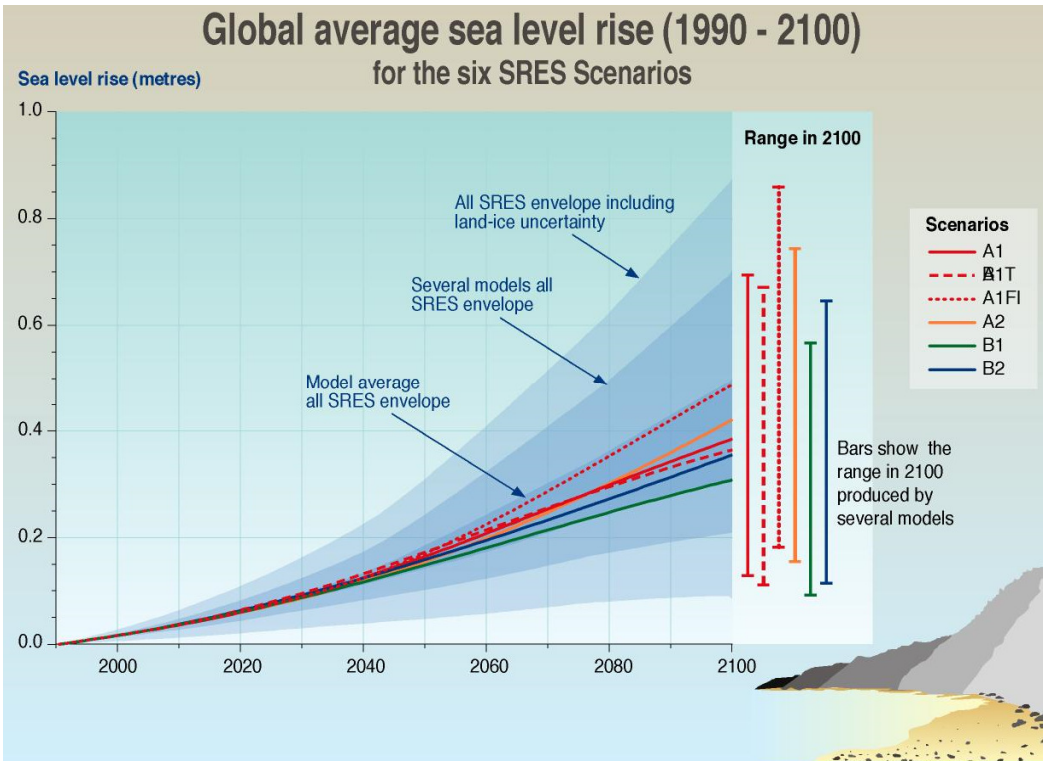

Figure 4. Sea level rise scenarios

C. Potential impacts