BOLIVIA
PILOT ASSESSMENT

Marilyn Aparicio Effen
Ivar Arana Pardo
James Aparicio E
Rene Mollinedo
Cesareo Cuellar
Walter Santa Cruz
PART 1: BRIEF OVERVIEW OF ASSESSMENT CONDUCTED

Assessment Objective

Assess the climate change health vulnerability (including its variability), as the basis for design and implement adaptation measures, applying the PAHO / WHO Draft Guidance.

Specific Objectives

Assess, the current and future climate change health vulnerability, for prioritize diseases at subnational level in Yacuiba - Tarija, using qualitative and quantitative approach

Participatory and prioritize adaptation measures design (for selected diseases) at sub-national level, that help to generate experience, considering the lessons learned and achieved results.

Perform, advocacy, public awareness and capacity building for decision makers from different hierarchical levels, sector and intersectorial institutions, human health resources and community
**PART 1: BRIEF OVERVIEW OF ASSESSMENT CONDUCTED**

- **Approach to Organization**

  **National:** Ministry of Health, Epidemiologic Surveillance Director

  **Departmental:** sectoral, intersectoral, decision makers and representatives of social movements (including citizens, community associations and neighborhood associations).

  **Local:** Local Network of Health, National Health Fund and the Petroleum Insurance Fund, NGOs, local regional government (sub-prefecture) and local (municipality) and others. They area working, through a Coordination Council, which already are pursuing reactive adaptation

- **Process:**

  Meetings with decision makers to request assessment process authorization and participation

  Surveys for climate change issues identification

  Workshops: capacity building, define adaptation measures

  Presentation of results and define next steps
PART 1: BRIEF OVERVIEW OF ASSESSMENT CONDUCTED

- Technical Scope and Major Findings
  - Selection Criteria
    - References of high vulnerability to climate-sensitive diseases
    - Availability of epidemiological data series for climate change sensitive diseases
    - Represent a characteristic ecosystem type
    - Existence of systematic observation network for meteorological data series and current availability (AASANA)
    - Presence of an institution generating scientific evidence (University)
    - Skilled human resources
    - Previous sustainable experiences,
    - Local organization and cross-sectoral participatory willing to work in the field

- Diseases
  - Qualitative assessment: Dengue, Malaria, Chagas, Leptospirosis, Hanta, ADD, ARI, extreme events, others
  - Quantitative assessment: Dengue, Malaria, Chagas
  - Adaptation: CCANM and Dengue at subnational level

- Geographic Scale of the assessment YACUIBA – TARIJA DEPARTAMENT
  - Selection criteria
    - High vulnerability to climate-sensitive diseases
    - Meteorological data series availability (AASANA)
    - Presence of Public University (JMS)
    - Skilled human resources (Local Health Netw
    - Previous sustainable experiences,
    - Local organization and cross-sectoral participatory willing to work in the field
    - Represent a Chaco characteristic ecosystem
    - Option to expand the trinational area

- Time
  - 1950-1990 Baseline
  - 1991-2009 Current Climate
  - 2020 y 2030 Future
PART 1: BRIEF OVERVIEW OF ASSESSMENT CONDUCTED

➢ Technical Scope and Major Findings

1.031 DENGUE CASES
### Technical Scope and Major Findings

- **TN, OSC, HR and PP**
- **Seasonality**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>Dengue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>0.4</td>
<td>-0.2</td>
<td>-0.2</td>
<td>-0.3</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.3</td>
<td>-0.2</td>
<td>-0.2</td>
<td>-0.6</td>
<td>-0.8</td>
<td>-1.1</td>
<td>0.0</td>
</tr>
<tr>
<td>1985</td>
<td>1.1</td>
<td>-0.9</td>
<td>-0.8</td>
<td>-0.8</td>
<td>-0.8</td>
<td>-0.6</td>
<td>-0.6</td>
<td>-0.5</td>
<td>-0.6</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>1986</td>
<td>-0.5</td>
<td>-0.5</td>
<td>-0.3</td>
<td>-0.2</td>
<td>-0.1</td>
<td>0.0</td>
<td>0.2</td>
<td>0.4</td>
<td>0.6</td>
<td>0.9</td>
<td>1.1</td>
<td>1.2</td>
<td>0.0</td>
</tr>
<tr>
<td>1987</td>
<td>1.2</td>
<td>1.3</td>
<td>1.2</td>
<td>1.1</td>
<td>1.1</td>
<td>1.2</td>
<td>1.5</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>1.2</td>
<td>1.1</td>
<td>11.1</td>
</tr>
<tr>
<td>1988</td>
<td>0.7</td>
<td>0.5</td>
<td>0.1</td>
<td>-0.3</td>
<td>-0.9</td>
<td>-1.3</td>
<td>-1.4</td>
<td>-1.2</td>
<td>-1.3</td>
<td>-1.6</td>
<td>-2.2</td>
<td>-2.2</td>
<td>0.0</td>
</tr>
<tr>
<td>1989</td>
<td>-1.8</td>
<td>-1.6</td>
<td>-1.2</td>
<td>-0.9</td>
<td>-0.7</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.3</td>
<td>-0.2</td>
<td>-0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>1990</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>1991</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.0</td>
</tr>
<tr>
<td>1992</td>
<td>1.8</td>
<td>1.7</td>
<td>1.5</td>
<td>1.4</td>
<td>1.2</td>
<td>0.9</td>
<td>0.5</td>
<td>0.2</td>
<td>-0.1</td>
<td>-0.1</td>
<td>0.1</td>
<td>0.3</td>
<td>0.0</td>
</tr>
<tr>
<td>1993</td>
<td>0.4</td>
<td>0.4</td>
<td>0.5</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.0</td>
</tr>
<tr>
<td>1994</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
<td>0.4</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.0</td>
</tr>
<tr>
<td>1995</td>
<td>1.2</td>
<td>0.9</td>
<td>0.6</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
<td>-0.1</td>
<td>-0.2</td>
<td>-0.5</td>
<td>-0.6</td>
<td>-0.8</td>
<td>-0.8</td>
<td>0.0</td>
</tr>
<tr>
<td>1996</td>
<td>-0.8</td>
<td>-0.7</td>
<td>-0.5</td>
<td>-0.3</td>
<td>-0.2</td>
<td>-0.2</td>
<td>-0.1</td>
<td>-0.2</td>
<td>-0.4</td>
<td>-0.3</td>
<td>-0.4</td>
<td>-0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>1997</td>
<td>-0.4</td>
<td>-0.3</td>
<td>-0.1</td>
<td>0.3</td>
<td>0.8</td>
<td>1.3</td>
<td>1.7</td>
<td>2.2</td>
<td>2.2</td>
<td>2.4</td>
<td>2.5</td>
<td>2.7</td>
<td>2.9</td>
</tr>
<tr>
<td>1998</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>1999</td>
<td>-0.7</td>
<td>0.6</td>
<td>0.3</td>
<td>-0.6</td>
<td>-0.8</td>
<td>-0.8</td>
<td>-0.8</td>
<td>-0.8</td>
<td>-0.8</td>
<td>-0.8</td>
<td>-0.8</td>
<td>-0.8</td>
<td>0.0</td>
</tr>
<tr>
<td>2000</td>
<td>-0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.0</td>
</tr>
<tr>
<td>2001</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>2002</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>2003</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>2004</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>2005</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>2006</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>2007</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>12.2</td>
</tr>
<tr>
<td>2008</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Models and scenarios

- Emission Scenaries IPCC 2000 A2 y B2
- MAGICC SCENGEN as global model
- Earth Simulator
- PRESIS as regional model
- Base line 60-90 y 91-2007
- 2020 y 2030
2010-2020

Temperatura máxima media
Escenario A2, Años 2010 - 2020

Temperatura máxima media
Escenario B2, Años 2010 - 2020
Relative Humidity

Base line 1960-1990

Humedad relativa
Periodo base, Años 1961 - 1990

Humedad relativa
Escenario A2, Años 2010 - 2020
2020 Dengue Vulnerability
Burden of Dengue in relationship with climate change

Yacuiba Vulnerabilidad 1960-1990 y al 2030 del Dengue al Cambio Climático
PART 2: ASSESSMENT METHODS

Describe the steps followed in your methodology.

Documents and previous experiences in climate change and health as:
CCANM (Policies and adaptation strategies), Bol 3954 (Netherland Climate Assistance Project)
Develop Policy Framework UNDP-GEF 2007
PAHO-WHO Guidance
Compile and systematize previous experiences
Apply all steps of Draft Guidance, except point 6

- Selection of scenarios and analysis period
- Select an alternative range of possible futures, which correspond to the IPCC scenarios and the time series on which conduct the assessment
- Obtaining measures of exposure
Access to global climate models based on selected scenarios above
- Identify health outcomes for assessment
Include sensitive health outcomes CC
PART 2: ASSESSMENT METHODS

- To quantify the relationship between climate and each health outcome
  - Connecting the measure of exposure to climate modeling
  - Estimating the burden of disease in the absence of climate change
  - Calculate of the burden attributable to climate change for specific diseases

Next Steps

*The challenge to implement the early warning system for dengue outbreak, one of the climate change adaptation strategies of CCNMA; bioclimate surveillance systems in Yacuiba*
Temperature and rain Umbral values
Dengue Yacuiba - Bolivia

<table>
<thead>
<tr>
<th>AÑO</th>
<th>MES</th>
<th>SEMANA</th>
<th>T</th>
<th>TM</th>
<th>H</th>
<th>PP</th>
<th>VV</th>
<th>V</th>
<th>Dengue</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>8</td>
<td>31</td>
<td>16.07</td>
<td>23.19</td>
<td>5.94</td>
<td>548.96</td>
<td>3.81</td>
<td>23.89</td>
<td>16.39</td>
</tr>
<tr>
<td>2002</td>
<td>8</td>
<td>32</td>
<td>19.60</td>
<td>21.36</td>
<td>9.67</td>
<td>661.57</td>
<td>0.00</td>
<td>21.49</td>
<td>5.61</td>
</tr>
<tr>
<td>2002</td>
<td>8</td>
<td>35</td>
<td>23.40</td>
<td>30.86</td>
<td>13.37</td>
<td>640.00</td>
<td>0.00</td>
<td>15.99</td>
<td>10.53</td>
</tr>
<tr>
<td>2002</td>
<td>8</td>
<td>34</td>
<td>22.00</td>
<td>23.00</td>
<td>12.11</td>
<td>621.86</td>
<td>0.00</td>
<td>18.15</td>
<td>11.97</td>
</tr>
<tr>
<td>2002</td>
<td>8</td>
<td>35</td>
<td>24.67</td>
<td>31.67</td>
<td>14.69</td>
<td>624.65</td>
<td>5.08</td>
<td>18.11</td>
<td>16.91</td>
</tr>
<tr>
<td>2002</td>
<td>9</td>
<td>56</td>
<td>20.35</td>
<td>27.66</td>
<td>10.61</td>
<td>57.57</td>
<td>0.00</td>
<td>20.86</td>
<td>13.59</td>
</tr>
<tr>
<td>2002</td>
<td>9</td>
<td>57</td>
<td>21.94</td>
<td>28.07</td>
<td>12.39</td>
<td>62.45</td>
<td>0.00</td>
<td>17.05</td>
<td>11.20</td>
</tr>
<tr>
<td>2002</td>
<td>9</td>
<td>58</td>
<td>24.54</td>
<td>30.44</td>
<td>16.91</td>
<td>62.71</td>
<td>0.00</td>
<td>17.95</td>
<td>16.96</td>
</tr>
<tr>
<td>2002</td>
<td>9</td>
<td>59</td>
<td>26.66</td>
<td>30.67</td>
<td>12.49</td>
<td>49.86</td>
<td>0.00</td>
<td>17.80</td>
<td>14.90</td>
</tr>
<tr>
<td>2002</td>
<td>10</td>
<td>40</td>
<td>28.60</td>
<td>35.19</td>
<td>13.99</td>
<td>59.71</td>
<td>0.00</td>
<td>7.89</td>
<td>12.97</td>
</tr>
<tr>
<td>2002</td>
<td>10</td>
<td>41</td>
<td>36.57</td>
<td>47.10</td>
<td>11.57</td>
<td>52.97</td>
<td>14.22</td>
<td>8.17</td>
<td>11.86</td>
</tr>
<tr>
<td>2002</td>
<td>10</td>
<td>42</td>
<td>27.19</td>
<td>31.49</td>
<td>10.30</td>
<td>62.02</td>
<td>7.26</td>
<td>18.49</td>
<td>12.94</td>
</tr>
<tr>
<td>2002</td>
<td>10</td>
<td>43</td>
<td>26.76</td>
<td>33.30</td>
<td>12.06</td>
<td>54.14</td>
<td>0.00</td>
<td>20.37</td>
<td>12.87</td>
</tr>
<tr>
<td>2002</td>
<td>11</td>
<td>44</td>
<td>28.40</td>
<td>28.84</td>
<td>16.70</td>
<td>76.71</td>
<td>135.28</td>
<td>28.16</td>
<td>19.17</td>
</tr>
<tr>
<td>2002</td>
<td>11</td>
<td>45</td>
<td>25.93</td>
<td>31.71</td>
<td>13.87</td>
<td>59.40</td>
<td>0.00</td>
<td>26.94</td>
<td>18.41</td>
</tr>
<tr>
<td>2002</td>
<td>11</td>
<td>46</td>
<td>25.51</td>
<td>31.14</td>
<td>14.44</td>
<td>65.14</td>
<td>38.86</td>
<td>23.90</td>
<td>10.17</td>
</tr>
<tr>
<td>2002</td>
<td>11</td>
<td>47</td>
<td>28.67</td>
<td>34.56</td>
<td>20.10</td>
<td>70.14</td>
<td>12.46</td>
<td>19.20</td>
<td>8.94</td>
</tr>
<tr>
<td>2002</td>
<td>11</td>
<td>48</td>
<td>26.01</td>
<td>31.22</td>
<td>14.96</td>
<td>74.98</td>
<td>25.22</td>
<td>22.67</td>
<td>12.09</td>
</tr>
<tr>
<td>2002</td>
<td>12</td>
<td>49</td>
<td>24.14</td>
<td>29.89</td>
<td>10.24</td>
<td>84.16</td>
<td>14.00</td>
<td>22.34</td>
<td>7.29</td>
</tr>
<tr>
<td>2002</td>
<td>12</td>
<td>50</td>
<td>23.30</td>
<td>28.76</td>
<td>18.81</td>
<td>84.95</td>
<td>14.22</td>
<td>17.59</td>
<td>7.27</td>
</tr>
<tr>
<td>2002</td>
<td>12</td>
<td>51</td>
<td>26.28</td>
<td>31.31</td>
<td>19.67</td>
<td>77.71</td>
<td>60.55</td>
<td>23.34</td>
<td>9.06</td>
</tr>
<tr>
<td>2002</td>
<td>12</td>
<td>52</td>
<td>27.68</td>
<td>33.64</td>
<td>18.40</td>
<td>79.67</td>
<td>3.58</td>
<td>23.51</td>
<td>11.39</td>
</tr>
</tbody>
</table>

- **Temperature:** 24.15°C
- **Rainfall:** 37.83 mm
- **Rainfall on Dengue Days:** 15.82 mm
- **Rainfall in December:** 21.95°C
- **Rainfall in November:** 10.38 mm
- **Rainfall in October:** 26.08°C
BASE FOR BIOCLIMATE SURVEILLANCE
Yacuiba - Bolivia

- Dengue cases coincided with rainy season
  - 9 weeks before with 10mm of rain followed with increment 37mm, present dengue outbreak
    In the same period (9 week), if average temperature was 24ºC, followed by 2ºC increment.
- 25ºC, is excellent for *Aedes aegypti*, major temperatures can reduce its population
PART 3: MAJOR CHALLENGES & QUALITY OF ASSESSMENT

• Current Assessment of climate-sensitive diseases
  
  a) Qualitative assessment followed CC Guidance (countries without capacity building)
  
  b) Quantitative assessment. Variability identification and health index (IB1 al IB3)

• Future Scenarios of burden of climate change sensitive diseases

• A) Qualitative assessment followed CC Guidance (expert opinion)

• b) Quantitative assessment. (Downscaling, GIS, climate scenarios, future scenarios of burden sensitive diseases and climate change vulnerability index (countries with sectorial and intersectorial capacity building, formed and working practices communities and pilot experiences developed as bioclimate surveillance)

• The qualitative assessment maintain the suggestion of the PAHO/WHO guidance document

• The quantitative assessment propose methodologies using systematic observation networks data, as Human Developed Index, IPA, incomes level, isohyets and isotherms, etc.
Types of questions you might answer could include:

Did your assessment ask the right kind of questions needed to inform adaptation decisions?
   In order to generate adaptation decision, we have to combine science evidence, lesson learned of CCANM, NCAP and participatory, intersectorial and integrative adaptation measures

How useful do you believe the information you produced will be for decision makers in the development of public health and health care interventions to address the impacts of climate change?

- It will be very useful because produce: climate change health local impacts evidence
- Develop capacity building activities
- Develop public awareness in CC and health
- Permit to begin planned adaptation process
PART 4: UTILITY OF ASSESSMENT & MEETING DECISION NEEDS

Types of questions you might answer could include:

- What types of decisions do you think this assessment should or already has informed?
  Decision for action in order to prevent health compromise
  Did it provide the kind of information decision makers need, or not?
- The Guidelines provide information for technical personnel, more for decision makers, for this reason we suggest include more scientific evidence and international experiences.

What next steps or types of information needed to better support decision makers? (recommendations)

- Include capacity building activities
- Include public awareness information
- Include intersectorial tools and methodologies
THANKS