Resilience towards hurricane in coastal communities in Oaxaca Mexico

ISEE, 2016
Washington DC

Dra. Sophie Ávila Foucat and F. Martínez

SEP-CONACYT

^ Full time Researcher
Instituto de Investigaciones Economicas UNAM
savila_1@yahoo.com.mx; savila@iiec.unam.mx
Framework

Socio-ecological system
Multilevel systems that provide essential services to society (Berkes and Folke, 1998). It is recognized that socio-ecological systems are dynamic and complex since their components interact within a diversity of spatial and temporal scales.

Livelihood Assets

Principles for enhancing resilience
Livelihood Assets

**Physical Assets**
- Infrastructure for production or for livelihood

**Human Assets**
- Education, capacities, working force, health

**Natural Assets**
- Agricultural land, access to water, and extractive or non-extractive use of natural resources

**Financial Assets**
- Monetarian resources for production or consumption

**Social Assets**
- Networks, norms, rules, sanctions, reciprocity etc..

*(Ellis, 2000)*

*Note: The diagram illustrates the interdependence of different types of assets in livelihood.*
Principles for enhancing resilience

- Mantain diversity and redundancy
- Connectivity
- Slow variables and feedbacks
- Adaptative management
- Learning and participation
- Policentric governance
Socio-ecological resilience
Definition

The possibility of the system to recover from a stress or shock, maintaining and arranging assets (capitals) for securing sustainable livelihoods (Plummer R. and D. Armitage 2007).
Research aims

Resilience assessment using households perception on capitals recovery and their interaction after a hurricane in coastal communities in Oaxaca Mexico to build an index and discuss connectivity, diversity, slow variables and feedbacks within the system.
Study area: Oaxaca coast

- Area with high hurricane intensity and frequency (World Bank, 2013).
- **61.9 %** of population on poverty conditions from which **29.9%** on extreme poverty (CONEVAL, 2012), vulnerable.
- **47.3 %** of population is in rural communities of 2500 habitants, the national statistic is **76.8%**. (NEGI, 2010).
Shock: Huracan Carlota 2012

14 of June 2012, winds 205 km/hr, category II.

Fuente: CNA-CGSMN GOES 13 IR4 15/Jun/2012 2:45 GMT
Methods

- In depth interview to key informants for describing the context

- Survey

A total of 212 households were surveyed in January 2014, representing 73% of total households of four rural coastal communities.
## VARIABLES

<table>
<thead>
<tr>
<th><strong>FINANCIAL</strong></th>
<th><strong>PHYSICAL</strong></th>
<th><strong>HUMAN</strong></th>
<th><strong>SOCIAL</strong></th>
<th><strong>NATURAL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of income for</td>
<td>House damage</td>
<td>Health</td>
<td>Cohesion</td>
<td>Mangrove</td>
</tr>
<tr>
<td>damage in crops</td>
<td></td>
<td></td>
<td>Agreement and</td>
<td>Natural resource</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>accomplishment</td>
<td>(used by the household)</td>
</tr>
<tr>
<td>Loss in tourism</td>
<td>Infraestructure damage</td>
<td>Education</td>
<td>Links with external</td>
<td>Recreation landscape</td>
</tr>
<tr>
<td>Loss in sells in small</td>
<td>Livestock lost</td>
<td></td>
<td>organizations</td>
<td></td>
</tr>
<tr>
<td>business</td>
<td></td>
<td></td>
<td>Traditions</td>
<td></td>
</tr>
<tr>
<td>Loss for laboral</td>
<td>Boat damage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lost in ecoturistic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>infraestructure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Method

For each capital we asked:

- Damage (1,0), Intensity of damage, Recovery (1,0), Recovery level, Time for recovery
- Which variables from other capitals (we specified) helped you to recover?

Based on that we measured an index

Diversity is analyzed in terms of the number of assets they use to recover, and livelihood diversity (diversification),

Slow variables are considered in terms of the time of recovery of each capital,

Feedback and connectivity is the interaction between capitals.
4 different models were done changing the definition of resilience, but the closest to the socioecological perspective is:

if the household is recovered

\[ R = \sum_{i}^{n} \theta_i (\beta_i \alpha_i) \]

\begin{align*}
0 \leq R \leq 1 \\
0 \leq \beta_i \leq 1 \\
\theta_i = \frac{1}{5} \\
0 \leq \alpha_i \leq 1
\end{align*}

\[ \beta_i \text{ = Perception of the capital recovery} \]

\[ \alpha_i \text{ = perception of level of recovery} \]
RESULTS
Agregated damage and recovery

Damage
- Financiero
- Físico
- Social
- Humano
- Natural

Recovery
- Financiero
- Físico
- Social
- Humano
- Natural
Resilience measurement

<table>
<thead>
<tr>
<th>Community</th>
<th>Time of recovery for all assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vainilla</td>
<td>11.43</td>
</tr>
<tr>
<td>Escobilla</td>
<td>14.48</td>
</tr>
<tr>
<td>Ventanilla</td>
<td>25.22</td>
</tr>
<tr>
<td>Barra de Navidad</td>
<td>13.81</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Asset</th>
<th>Vainilla</th>
<th>Escobilla</th>
<th>Ventanilla</th>
<th>Barra de Navidad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovery time per asset (month)</td>
<td>11.43</td>
<td>14.48</td>
<td>25.22</td>
<td>13.81</td>
</tr>
</tbody>
</table>

- Financial: Vainilla, Escobilla, Social, Human, Natural
- Physical: Vainilla, Escobilla, Ventanilla, Barra de Navidad
- Social: Vainilla, Escobilla, Ventanilla, Barra de Navidad
- Human: Vainilla, Escobilla, Ventanilla, Barra de Navidad
- Natural: Vainilla, Escobilla, Ventanilla, Barra de Navidad
## Connectivity and feedbacks

<table>
<thead>
<tr>
<th></th>
<th>Financial</th>
<th>Physic</th>
<th>Social</th>
<th>Human</th>
<th>Natural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial</td>
<td>22%</td>
<td>16%</td>
<td>6%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Physic</td>
<td>6%</td>
<td>4%</td>
<td>0%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Social</td>
<td>30%</td>
<td>33%</td>
<td>34%</td>
<td>36%</td>
<td>34%</td>
</tr>
<tr>
<td>Natural</td>
<td>21%</td>
<td>26%</td>
<td>6%</td>
<td>8%</td>
<td>32%</td>
</tr>
<tr>
<td>Human</td>
<td>5%</td>
<td>5%</td>
<td>14%</td>
<td>4%</td>
<td>9%</td>
</tr>
<tr>
<td>External links</td>
<td>26%</td>
<td>31%</td>
<td>20%</td>
<td>29%</td>
<td>20%</td>
</tr>
</tbody>
</table>
DISCUSSION

- Differences on damage within the 4 communities and assets
- Differences on recovery within the 4 communities and assets
- Those differences are visible in the R measurement

**Diversity**

The diversity of assets is important for recovery. The most diversified community is the most resilient. But the ones more diversified on ecotourism spend more time on recovering and are less resilient.
Connectivity and positive feedbacks

The most interrelated capitals are the social, financial, and natural. The variables most connected are: help of the community members, savings, and natural resources use. Government transfer are important too, specially for physical, financial and human capitals. Communities more resilient have better perception of the role of social capital for recovery.

Slow variables

Social cohesion, agreements, enforcement, mangrove and natural resources are slow variables.
Conclusions

- Resilience can be assessed in a quantitatively and qualitatively using assets and resilience principles.

- Social capital and natural capital are slow variables and at the same time very important for connectivity. Crucial for the system structure and dynamic.

- Sustaining food and water are important for natural capital
Questions?
savila@iiec.unam.mx