

# **Vulnerable Groups and Communities in The Context of Adaptation and Development Planning & Implementation:**

**Identification and Targeting at  
Different Scales, Best Available  
Methods and Data, Best Practices**

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# Outline

- Introduction
- Concepts: what is vulnerability?
- Geographic targeting vulnerability and geospatial tools
- Who is vulnerable? Methods
- Data for vulnerability mapping
- Emerging lessons
- Vulnerability analysis & geographic targeting and the NAPs: entry points
- Conclusion

# Introduction

- Development resources, including for adaptation are limited
- Among many competing priorities, climate change (CC) may not rank highly
- Must make a case for:
  - Enhancing adaptation as part of development needs/process
  - Targeting limited adaptation resources for cost effectiveness - *most bang for the buck*
- This requires identifying most vulnerable people, systems – hence, geographic targeting
- There are many methods and approaches to doing this, hence:
- **Objective: Present and discuss common methods, data, and best practices to guide identification of vulnerable groups and communities in the context of adaptation and development planning and implementation**
  - The NAP process offers a mechanisms for meeting this objective

# What is vulnerability?

- There are many definitions from different sources
- It is generally understood to be a function of exposure, sensitivity and adaptive capacity
- **Vulnerability = f (Exposure, Sensitivity, Adaptive Capacity)**

# Concepts

- **Exposure:** degree of climate stress upon a particular unit of analysis; it may be represented as either long-term changes in climate conditions, or by changes in climate variability, including the magnitude and frequency of extreme event (*IPCC, 2001*).
- **Sensitivity**
  - The degree to which a system will be affected by, or responsive to climate stimuli (*Smith et al., 2001*).
  - Sensitivity is basically the biophysical effect of climate change; but sensitivity can be altered by socio-economic changes.
- **Adaptive capacity:** the potential or capability of a system to adjust to climate change, including climate variability and extremes, so as to moderate potential damages, to take advantage of opportunities, or to cope with consequences (*Smit and Pilifosova, 2001*)

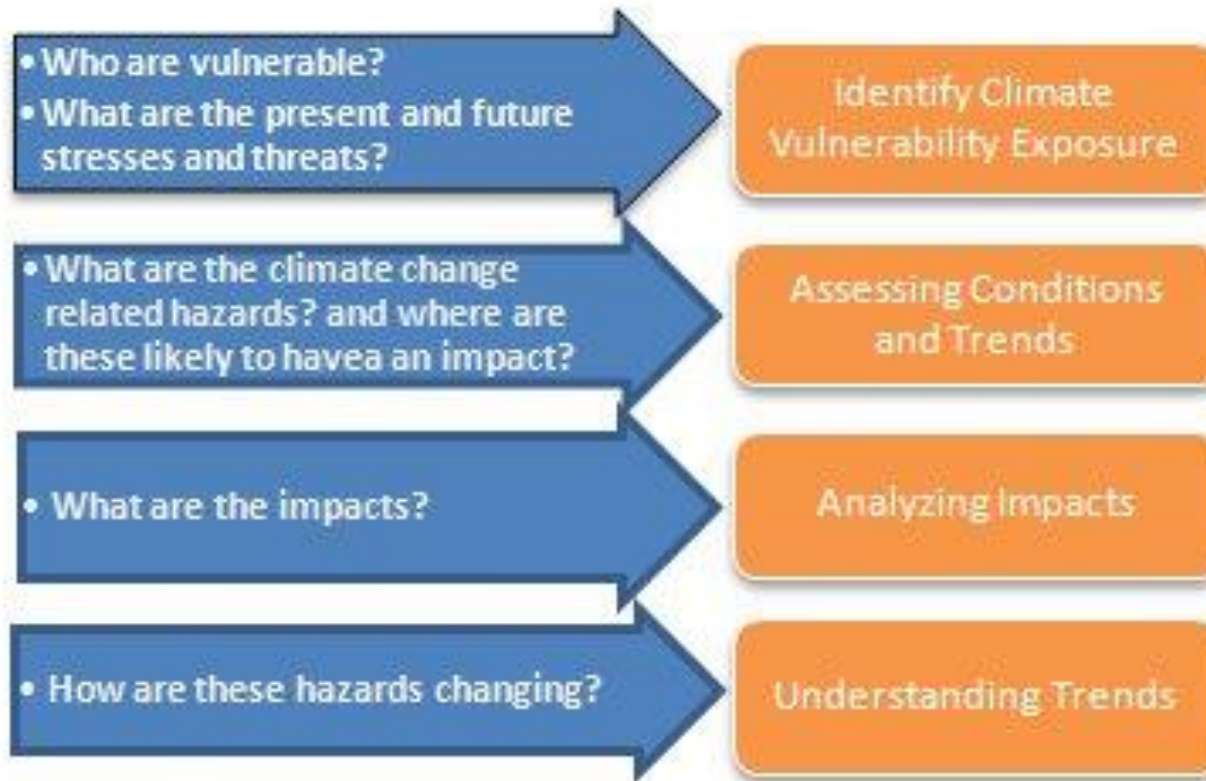
# Who are the vulnerable?

- The poor
- The food insecure
- Those living in fragile environments
  - Do vulnerable people create vulnerable spaces, which compound vulnerability?
- The marginalized – women, girls, youth, ill, handicapped, ethnic minorities, indigenous groups, urban poor, etc.
- Broader dimensions of vulnerability
  - Adding social to biophysical inequity
  - Qualitative analysis of vulnerability
  - Inequality
- What are the best methods to get to the poor, vulnerable?
- Do vulnerable people create vulnerable spaces, which further compound vulnerability?
- How well can we predict the next vulnerable places and people

# Dimensions of vulnerability

- Social
- Economic
- Ecological
- Demographic
- Also multiple characteristics
  - multiple contexts,
  - temporal variability,
  - multiple scales and scale interdependency
  - Many models of vulnerability

# Vulnerability assessment process





# Identifying and targeting vulnerable groups at multiple scales

## ■ Global scale

- The issue is identifying vulnerable global regions and countries to particular hazards
- Uses national or regional datasets/tools:
  - Climate Change Vulnerability Index
  - Famine Early Warning System (FEWS), USAID
  - Food Insecurity and Vulnerability Information Mapping System (FIVIMS ), FAO

## ■ National & sub-national scales

- Analysis disaggregated to local administrative units or small geography areas to capture fine spatial heterogeneity in vulnerability
- At least census data and survey data are often needed

# Various global CC vulnerability measures and rankings

## World Bank 12 most at risk countries to CC

Low Income		Middle Income		
Drought	Flood	Storm	Coastal 1m	Agriculture
Malawi	Bangladesh	Philippines	All low-lying Island states	Sudan
Ethiopia	China	Bangladesh	Vietnam	Senegal
Zimbabwe	India	Madagascar	Egypt	Zimbabwe
India	Cambodia	Vietnam	Tunisia	Mali
Mozambique	Mozambique	Moldova	Indonesia	Zambia
Niger	Laos	Mongolia	Mauritania	Morocco
Mauritania	Pakistan	Haiti	China	Niger
Eritrea	Sri Lanka	Samoa	Mexico	India
Sudan	Thailand	Tonga	Myanmar	Malawi
Chad	Vietnam	China	Bangladesh	Algeria
Kenya	Benin	Honduras	Senegal	Ethiopia
Iran	Rwanda	Fiji	Libya	Pakistan

Source: World Bank

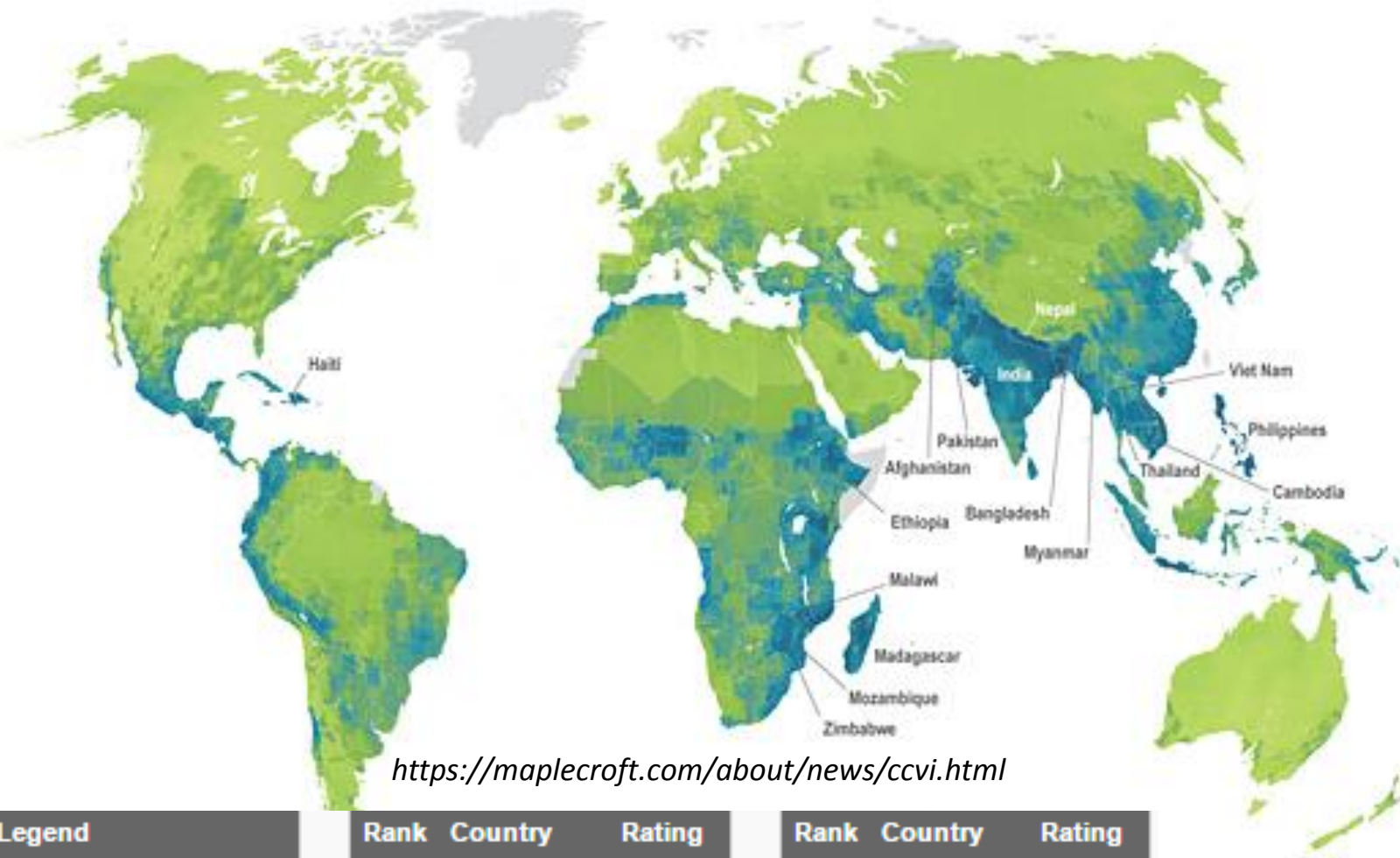
### Risk areas

1. Droughts
2. Floods
3. Storms
4. Rising sea levels, and
5. Agriculture.

### Also

- V20 group of countries vulnerable to climate change
- GermanWatch Global Climate Risk Index, top 10 1993-2013
- UNEP rankings, etc

# Climate Change Vulnerability Index 2011



<https://maplecroft.com/about/news/ccvi.html>

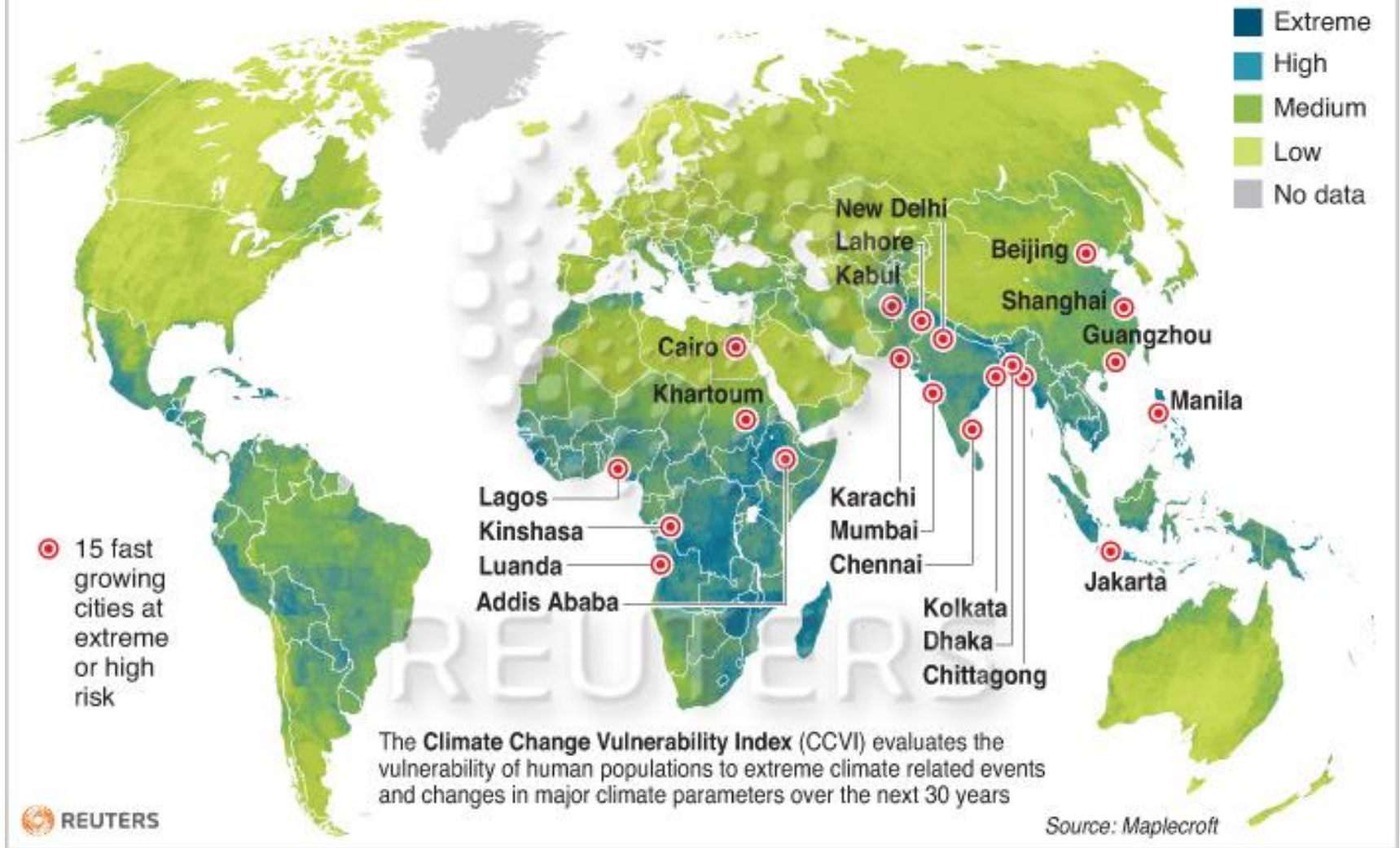
Legend	
Extreme risk	
High risk	
Medium risk	
Low risk	
No Data	

Rank	Country	Rating
1	Bangladesh	Extreme
2	India	Extreme
3	Madagascar	Extreme
4	Nepal	Extreme
5	Mozambique	Extreme

Rank	Country	Rating
6	Philippines	Extreme
7	Haiti	Extreme
8	Afghanistan	Extreme
9	Zimbabwe	Extreme
10	Myanmar	Extreme

Ethiopia (11),  
Cambodia (12),  
Thailand (14),  
Malawi (15) and  
Pakistan (16)

# CLIMATE CHANGE VUNERABILITY INDEX

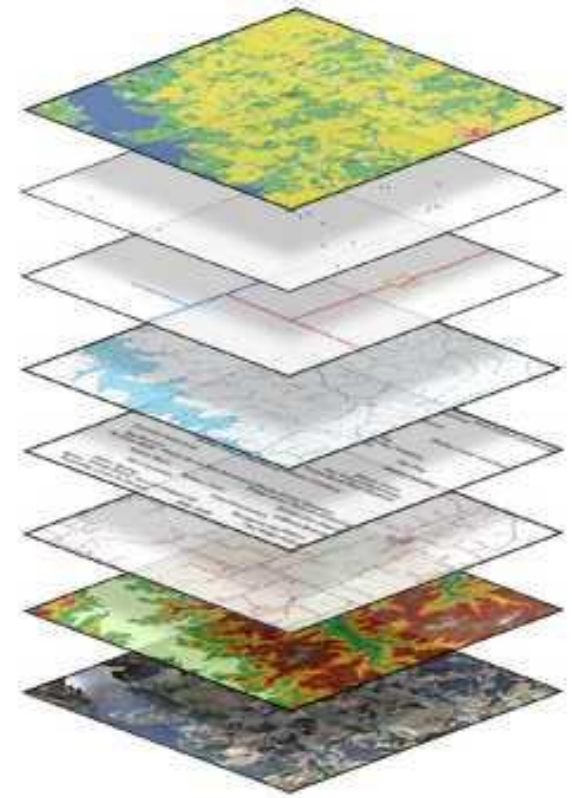


- CCVI evaluates the vulnerability of people in 170 countries to extreme climate related events & change in major climate measurements over the next 30 years.
- Used to assess national vulnerability
- Regions are indicated on the map: 42 social, economic and environmental factors
  - 16 countries and 15 fast growing cities all in Africa and Asia



# Role of geospatial analytical tools

- Geographic Information Systems (GIS), Remote Sensing Analysis, GPS technologies.
- Software programs for analysis of spatially located data.
- They use data on phenomena that can be tied to a particular location on the surface of the earth (geocoded).
- **The power of GIS is overlays:** ability to combine data from different sources so long as they have a shared location.
  - Census, HH or sector surveys, digital satellite data, aerial photos, biophysical data, etc.
- **GIS functions** include data storage, visual display, modeling and simulation analyses, and analysis of causal relationships or associations



# Role of GIS in Vulnerability/Poverty Mapping and Geographic Targeting

- Integration of data from diverse sources
- Analysis of spatial relationships among diverse social and biophysical variables
- Generating spatial data and inclusion of explanatory variables in multivariate statistical analyses of drivers of vulnerability or poverty and use of findings in other analyses.
- Policy comparison and development through dynamic mapping or monitoring.
- Further use in geographic targeting of interventions and visual displays of outcomes

# Geographic targeting can increase efficiency, reduce costs of service delivery

- Cost for optimal targeting at the third admin level were 42% - 7% lower than for non targeted cash transfers in three countries.

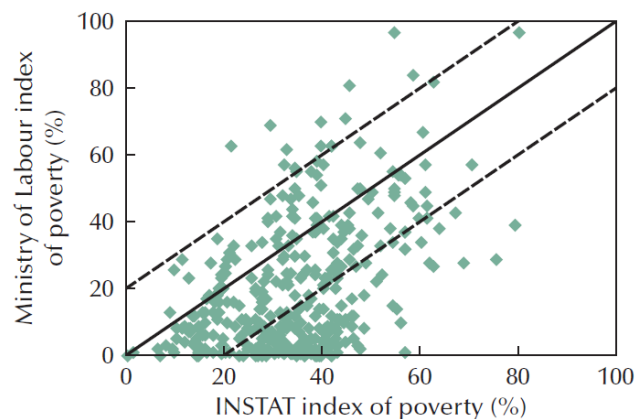
## Cost comparison: Uniform Transfer (Untargeted) Versus Optimal Targeting

Transfer type	Rural Ecuador %	Madagascar %	Cambodia %
Uniform transfer	100.0	100.0	100.0
Optimal targeting			
First administrative level	76.0	60.7	54.5
Second administrative level	66.7	46.4	41.4
Third administrative level	58.4	37.6	30.8

Source: Elbers et al. 2007.

Note: The administrative levels (first to third) refer to 21 provinces, 195 cantons, and 915 parishes in Ecuador; 6 faritany (provinces), 111 fivandrona (districts), and 1,248 firaisana (counties) in Madagascar; and 24 provinces, 180 districts, and 1,594 communes in Cambodia.

**Figure 3.2 Policy Impact Analysis: Distribution of Social Assistance Block Grants in Albania**



Source: MOLSA 2005.

*World Bank, 2007*

- In Albania, poverty map data were successfully used to target public spending through the Albanian Development Fund (ADF).
- Poverty maps have also been used to monitor MDGs at national and local levels

# Vulnerability/Poverty mapping methods

- Small area estimation
  - household (HH) or community data
- Multivariate weights basic-needs index
- Hybrid qualitative/secondary data methods
- Extrapolation
- Participatory approaches
- Direct measurement from HH data
- Direct measurement from census data

*(Baylis 2002; World Bank 2007)*



# Small area estimation method: Household data

- Needs both national census data and coincident socioeconomic survey data to get sub-national poverty estimates.
- Estimates are indirect and have a level of inherent statistical error, but are generally sound.
- **1st stage:** multiple regression analysis is conducted using consumption-based welfare variables from the survey shared by both census and survey datasets
- **2<sup>nd</sup> stage:** The regression model is applied to the census data with addition of a random disturbance term to better estimate consumption per capita (with SEs, confidence intervals); impute probability of being poor/food insecure using benchmarks
- Findings are presented in a GIS, aggregated to a chosen spatial resolution - province, state, district, sub-district, and municipality

*(Elbers, Lanjouw, and Lanjouw 2003)*

# HH small area estimation method...

- These are visual correlations maximizing identification of the poor, not causal relationships
- Despite computational and econometric complexities related to data types, reliability of estimates can easily be checked.
- Special software programs have been developed to conduct such analysis (e.g., PovMap, a World Bank poverty mapping software)  
<http://iresearch.worldbank.org> ( ver. 2.0, 2009)
- There is support for poverty mapping: World Bank, CGIR institutions, UNEP, FAO, etc
- Methods are extended to CC vulnerability applications:
  - Including Vulnerability Assessment Mapping (VAM)
- Other applications: nutrition, HIV prevalence, etc.
- Can scale to regional level, e.g. East Africa (Malawi, Mozambique, etc)

# Small area estimation method: Community-level data

- Uses aggregated community data averages instead of HH level data, e.g. small towns, community, district level
- Data are more easily available but level aggregation can undermine reliability of estimates.
- Scale of the predictive model is different but the method is the same as with HH data, with minor modifications
  - E.g., special headcount measure for groups (Taylor expansions); special assumptions on constant variation around mean and model behavior of poverty within and outside, and need to deal with higher incidence of missing data (limited data available at community level)
- Many countries have used this method
  - Vietnam, Burkina Faso, China and Kenya, others
- But, loss in precision of estimates increases with size of admin. Area – HH method is preferable if data are available

# Multivariate weights basic-needs index approaches

- Use different basic-needs indices and choices, and weighting schemes of variables to disaggregate poverty
- **Principal components analysis**
  - **Use:** Mexico, index of marginality to select eligible countries for a \$1 billion PROGRESA cash transfer program in 1990s
  - They used 7 variables, and the first component was used to derive weights for marginality index, and split into 5 classes.
  - Also used elsewhere: Costa Rica to link poverty with deforestation over time
- **Factor Analysis**
  - A data reduction technique based on some consistent underlying data construct.
  - **Use:** South Africa using 1996 data to determine allocation of development funds.
  - A household infrastructure and household circumstances factors explained 57% and 17% of the variance and were used in several steps to produce indices characterized into low, medium and high development at province level.

# Multivariate weights basic-needs index...

- **Ordinary Least squares**
  - Multiple regression analysis of drivers of extreme poverty using HH data to develop weights for an index developed from key variables
  - **Uses:** Nicaragua to develop poverty maps to identify census segments for intervention – cash transfer program linked to school attendance and health.
    - Used four variables: HH size and percent illiterate, without potable water, and without latrine

# Hybrid qualitative/secondary data methods for poverty mapping

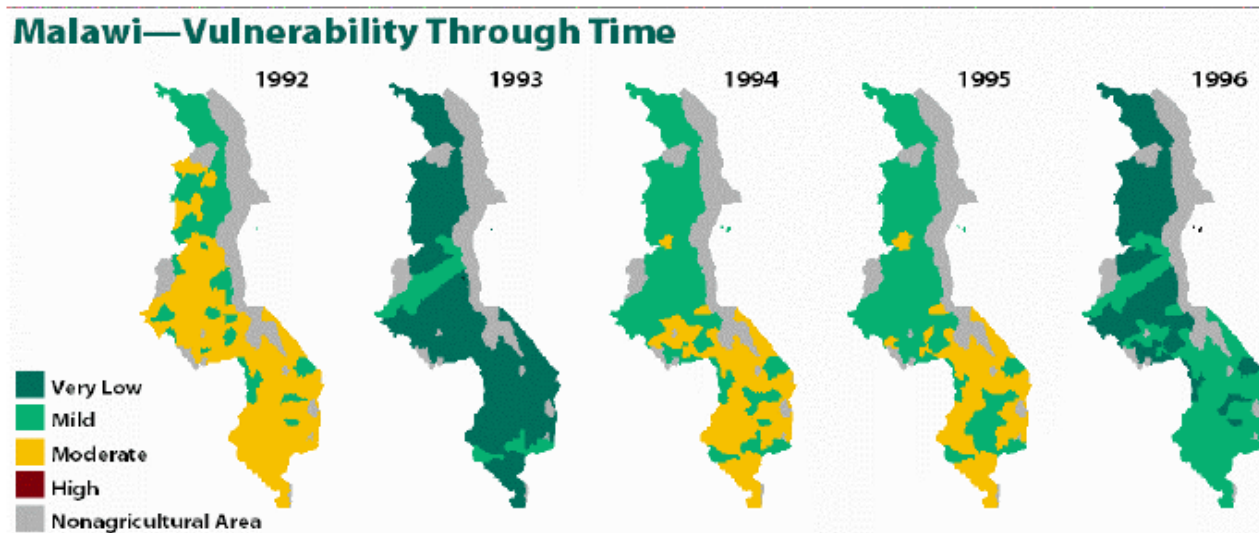
- Focus is often on food security determinants and livelihood strategies, and combine use of qualitative and secondary quantitative data
- Primarily qualitative data approaches
  - **Qualitative data collection:** Through RRA/PRA, focus groups, semi-structured interviews, key informants, supplemented by secondary data
  - **Household Economy Approach (HEA)** – by Save the Children Fund, FAO Global Information and Early Warning Systems (GIEWS) and used in WFP Vulnerability & Assessment Mapping
  - **FIVIMS:** FAO Food Insecurity and Vulnerability Information and Mapping Systems
    - Involves development of vulnerable-group profiles and mutually exclusive strategy groups based on key livelihoods strategies
- Primarily secondary data
  - **FEWS** (Famine Early Warning Systems approach) - indicator based
  - Approach assesses vulnerability with focus on identifying households mainly from secondary data with minor supplemental fieldwork
  - Multiple vulnerability indicators are often weighted using best judged and ranked into a single index to rank areas/groups, and mapped
- Statistical analysis of qualitative data combined with secondary data
  - E.g. FEWS, Malawi

# HEA hybrid qualitative/secondary data method – 5 steps

1. Define food economy zones for a region
2. For each zone, define different locally perceived wealth categories as indicators of wealth
3. For each category, collect livelihood information for a typical HH for a normal year.
4. Describe the economic context within which HH members live
5. Use collected information as baseline to determine potential impacts of economic change on HH income and food supply per zone
6. Produce vulnerability/risk maps
  - Because food economy zones are geographic

# Statistical analysis of qualitative data & secondary data: Malawi FEWS

Map 4. Malawi food security vulnerability over time, regression on expert opinion



Source: FEWS, 1997

- Secondary data collected were used to **produce indices of food insecurity**. These were grouped around **five expert-determined clusters or ‘spheres of influence’** through cluster analysis, then **reduced to three factor through PCA** – poverty, food deficiency for each of 154 extension planning areas, EPAs
- These were **then regressed against each of the clusters for associations**.
- Regression analysis was then used by cluster and opinion experts on evolution of vulnerability 1992-1996.



# Other poverty mapping methods

- **Extrapolation of Participatory approaches**
  - Local perceptions of poverty are identified, extrapolated and qualified to produce regional measures – a wellbeing index
  - Local definition is thought to produce more relevant/comprehensive measures; empowerment
  - Example Honduras – extrapolation can be sophisticated
- **Direct measurement from HH data**
  - Statistical analysis on large surveys: LMNS, DHS, HIS etc.
- **Direct measurement from census data**
  - Income data
  - Basic needs index, etc

*(Baylis 2003; World Bank 2007)*

# Choosing methods for vulnerability/poverty mapping

## ■ How to choose methods

- Objective of the vulnerability/poverty mapping
- Philosophy, worldviews, or professional prejudices
  - Economists, social scientists, statistical agencies, NGOs, etc.
- Data availability and access
  - A major challenge in developing world
- Available analytical capacity
- Cost (money, time, resources)

## ■ Complicating factors

- Type of indicators, alternatives
- Different levels of aggregation of spatial units can produce different results (MAUP)
- Different methods can produce different estimates from same data

# Data for vulnerability mapping

- Census data
- Survey data
  - Demographic Health Surveys (DHS)
  - Multiple Indicator Cluster Surveys (MICS)
  - Integrated HH surveys
  - Living Standards Measurement Study (LSMS)
- National Human Development Reports

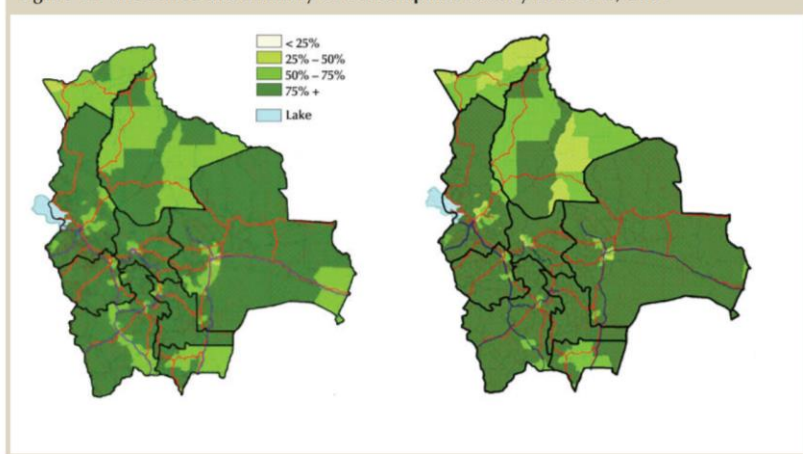
# Data for vulnerability mapping

- Secondary global/international geospatial databases:
  - **Biophysical** – climate, land use/cover, ecological, hydrology, etc
  - **Social** – vulnerability assessments, population, socio-economic indicators, etc
- **Methods & tools**, e.g., UNFCCC Compendium on methods and tools to evaluate impacts of, and vulnerability and adaptation to, climate change  
([http://unfccc.int/adaptation/nairobi\\_work\\_programme/knowledge\\_resources\\_and\\_publications/items/5457.php](http://unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_publications/items/5457.php))
- **Data quality: a major problem; a determining factor in method choices**

# Developing vulnerability maps does not automatically lead to their use

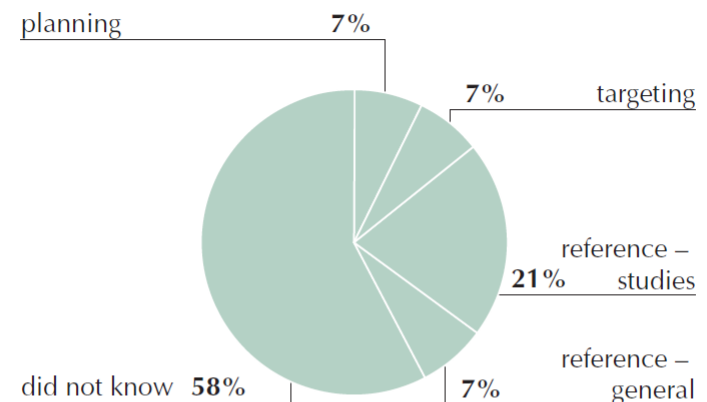
- Awareness and uses of Monetary Poverty Maps among Institutions, Bolivia
  - Awareness and use were much higher among international users than public institutions
  - (World Bank 2007)

Figure 4.1 Incidence and Intensity of Consumption Poverty in Bolivia, 2001

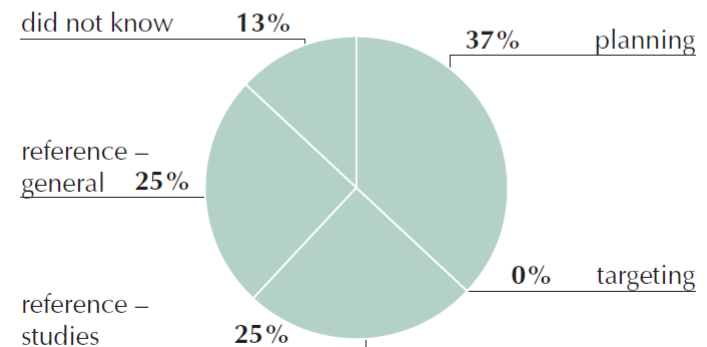


Source: INE and UDAPE 2003 using data from the 2001 census and household surveys in 1999–2001.  
Note: The intensity of poverty (poverty gap) is the total consumption shortfall (expressed in proportion to a poverty line) of those households showing consumption below the poverty threshold, divided by the total number of households.

a. Use of the maps by public institutions



b. Use of the maps by international institutions



Source: Based on field interviews described in Figueroa 2006.

# It requires effort to increasing the impact of vulnerability/poverty maps in policy

## The 10 Steps of the Poverty Mapping Process

1. Define the scope of the mapping exercise
2. Build support
3. Create demand
4. Overcome challenges, conflicts, and tensions
5. Establish institutional arrangements
6. Address data and software issues
7. Produce the poverty maps and test their validity
8. Distribute poverty mapping products
9. Support users and provide follow-up
10. Engage development partners

*(Case study Albania, CARLETTTO et al, in World Bank 2007)*

Preproduction

Production

Postproduction

# Integrating poverty mapping into development and CC planning

- The NAP Technical Guidelines for the National Adaptation Plan Process (*LEG 2012*) provide detailed guidelines and entry points for vulnerability assessments and geographic targeting:
- **Element A:** lay the groundwork and address gaps Part II, 4, Element A1
  - Stocktaking, Step A.2. - available information and gaps including vulnerability assessments
  - Comprehensively and iteratively assessing development needs and climate vulnerabilities, Step A4.
- **Element B:** Preparatory Elements – all sections,
  - Step B.2 is explicit on vulnerability analysis and adaptation option identification by sector
- **Element C:** Implementation Strategies – Steps C1-C3, including prioritizing CC adaptation in national planning
- **Element D:** Reporting , Monitoring and Review

# Selected emerging lessons

- Vulnerability/poverty mapping tools are important, but **choose critically, customize, and have a longer term view** (a process, not one-off event or just a map)
- **Integrate levels of local participation and decision making** in vulnerability/poverty assessments for enhance local relevance
- **Take proportionate affirmative action to creatively include marginalized groups:**
  - women & girls, ethnic minorities/indigenous communities, low caste groups, urban poor, youth, etc.
- **Small grants program at national level offer flexibility** for creative, vulnerability-/country-specific adaptation interventions that miss international funding streams.
- **Anticipate and integrate data collection needs** vulnerability/poverty mapping into national surveys and synchronize with census data collection
- **Build in-house capacity** for vulnerability/poverty mapping with national statistical services



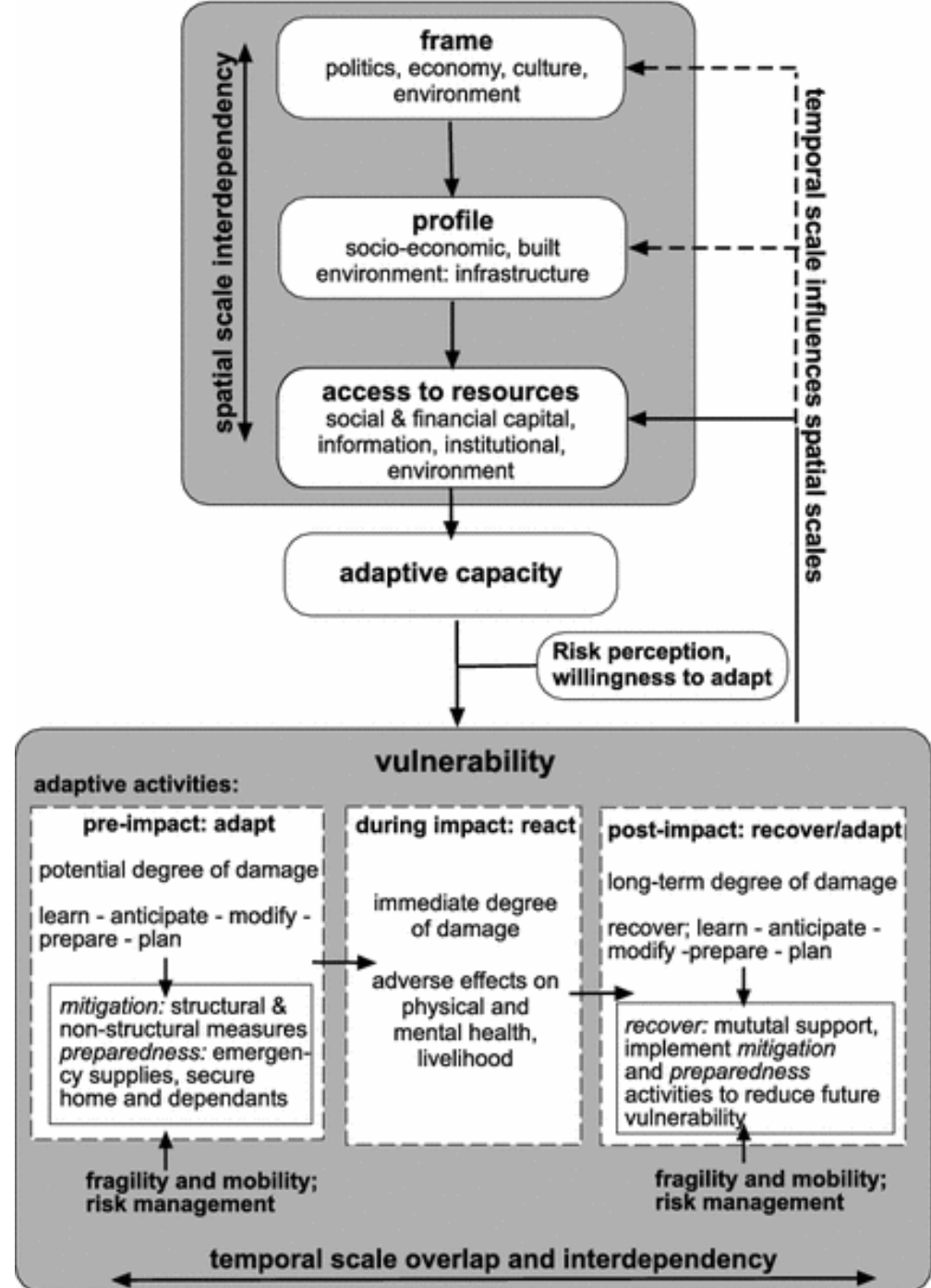
# Conclusions

- Inherent spatial heterogeneity in natural and social systems causes variation in vulnerability/poverty indicators
  - makes spatial tools essential for the geographic targeting of the vulnerable/poor for adaptation & development planning.
- Vulnerability/poverty mapping methods are diverse, from participatory poverty profiles to sophisticated econometric models & standalone programs; hence critical selection and use is key.
- All methods involve some error, hence require a balancing act:
  - Biophysical versus social indicators of vulnerability and goals
  - Quantitative versus qualitative methods or combines
  - Data scarcity versus reliability of vulnerability estimates
  - Objective versus political criteria e.g., the poorest or marginalized groups versus groups with best value for money/resources
- Broadening notion of vulnerability favor methods that integrate local power and decision-making in selecting the vulnerable and in targeting adaptation/development interventions.

**THANK YOU FOR YOUR  
ATTENTION?**

**QUESTIONS?  
COMMENTS?**

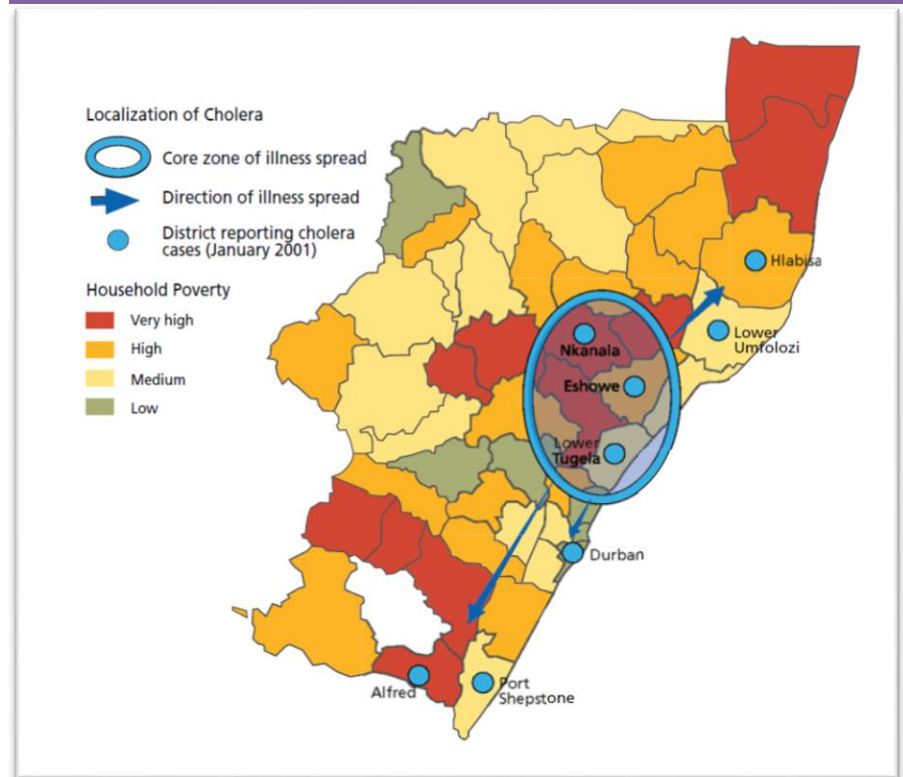
# Vulnerability: A summary



# Poverty mapping revealed the link between cholera spread and poverty in South Africa

An overlay of a poverty map and information on a cholera outbreak in the KwaZulu Natal province of South Africa in early 2001 shows that the outbreak originated in very high and high poverty areas and spread through and towards other poor areas.

## Mapping poverty and the spread of cholera in KwaZulu Natal, South Africa, January 2001



Henninger and Snel 2002)