

## Stocktaking on Socioeconomic Information and Approaches: Regional Scale

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## Overview

- Introduction to CIESIN
- Why information is needed to prepare for climate change
- The need for *spatial* data for global and regional analysis
- Sample types of data required
- Data sources
- Conclusions



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## Center for International Earth Science Information Network (CIESIN)

- Unit of The Earth Institute focusing on data development, management, distribution, and human dimensions research
- Runs the NASA-funded Socioeconomic Data and Applications Center (SEDAC)
- Under SEDAC:
  - IPCC Data Distribution Center for SE data
  - AIACC Data Methods and Synthesis Activity
  - Provide global spatial data on population, urban areas, poverty, "human footprint"
  - Provide national level sustainability indicators and estimates of pop and land area by climate class



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## Carbon emissions reduction requirements: A thought experiment

- Calculated the per capita gasoline allowance each person would have assuming:
  - Globally equitable fossil fuel consumption
  - A national allowance based on each country's share of 1990 global population distribution
  - An 80% reduction on current emissions in order to avoid potentially dangerous climate change\*

\* According to the UNFCCC (2006), "Emission reductions on the order of 60-80 per cent of 1990-level emissions would be necessary to stabilize concentrations of carbon dioxide in the atmosphere."



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**Table 1. Per Capita and Total Carbon Emission Allowances for the 25 Largest Countries (sorted by 2004 population)**

Country	Proportion of World Pop, 1990 (100%)	Population, 2004 (100%)	Carbon Emissions, 2004 (1000 Tons)	Carbon Allowance, 2004 (1000 Tons)	Total Carbon Emissions, 2004, as a % of Allowance	Actual Carbon Emissions Per Capita, 2004 (Tons)	Allowed Carbon Emissions Per Capita, 2004 (Tons)	Actual Gallons of Gasoline per Person Consumed, 2004	Allowed Annual Gallons of Gasoline per Person, 2004
1 China	0.21494	1,285,389	1,366,854	343,904	397.36	1.06	0.27	439.13	110.81
2 India	0.16090	1,087,124	366,301	287,432	142.29	0.34	0.24	139.18	87.81
3 USA	0.04840	295,410	1,650,020	77,446	2,130.54	5.59	0.26	2,307.10	108.29
4 Indonesia	0.03436	220,077	103,170	84,981	187.65	0.47	0.25	193.63	103.19
5 Brazil	0.02830	183,913	90,498	48,277	189.38	0.49	0.25	203.25	101.68
6 Pakistan	0.02116	154,794	34,277	33,883	101.25	0.23	0.22	91.46	90.33
7 Russian Fed.	0.02010	143,899	415,951	44,967	925.03	2.89	0.31	1,193.95	129.07
8 Bangladesh	0.01971	139,215	10,137	31,533	32.18	0.07	0.23	30.08	93.96
9 Nigeria	0.01715	128,709	31,101	27,445	113.32	0.24	0.21	99.81	88.08
10 Japan	0.02040	127,823	343,117	37,441	919.43	2.68	0.29	1,107.88	120.89
11 Mexico	0.01597	105,699	119,473	25,548	467.65	1.13	0.24	466.88	99.83
12 Viet Nam	0.01254	83,123	26,911	20,066	134.12	0.30	0.24	133.72	99.71
13 Germany	0.01505	82,645	220,596	24,074	916.32	2.67	0.29	1,102.81	120.32
14 Philippines	0.01157	81,817	21,905	18,519	118.28	0.27	0.23	111.14	93.72
15 Ethiopia	0.00987	75,600	2,177	18,489	14.07	0.03	0.30	11.89	84.82
16 Egypt	0.01055	72,842	43,160	16,873	255.79	0.59	0.23	245.41	95.94
17 Turkey	0.01085	72,220	61,877	17,366	356.16	0.85	0.24	352.75	99.32
18 Iran	0.01074	68,803	118,259	17,176	688.51	1.72	0.25	709.96	103.11
19 Thailand	0.01035	63,684	73,121	16,589	441.97	1.15	0.26	474.19	107.39
20 France	0.01075	60,287	101,927	17,196	592.78	1.69	0.29	698.69	117.87
21 United Kingdom	0.01075	59,479	160,179	17,203	931.13	2.69	0.29	1,112.35	119.46
22 Italy	0.01074	58,033	122,726	17,190	713.94	2.11	0.30	873.81	122.35
23 DR Congo	0.00719	55,893	874	11,445	8.02	0.01	0.20	4.24	84.64
24 Myanmar	0.00772	50,004	2,662	12,381	21.56	0.06	0.29	21.99	102.02
25 Republic of Korea	0.00812	47,645	127,007	12,990	977.55	2.67	0.27	1,101.08	112.64

## Socioeconomic data for impacts, vulnerability and adaptation assessment

The view from 35,000 feet

## Spatial data are needed for V&A assessments

$$\text{Risk} = \frac{\text{Exposure to Hazard} \times \text{Vulnerability}}{\text{Coping Capacity}}$$

- Climate change impacts are spatially differentiated
- Vulnerabilities are spatially differentiated
- Adaptive/coping capacities are spatially differentiated

## Hazard distribution

The data set comes from the Dartmouth Flood Observatory's global listing of extreme flood events compiled from various sources for the 20-year period from 1985 - 2005. Some flooding is evident in more than one-third of the world's land area.

Source: Dilley, M., R.S.Chen, U. Deichmann, A. Lerner-Lam and M. Arnold (2005). *Natural Disaster Hotspots: A Global Risk Analysis*, World Bank, Washington DC.

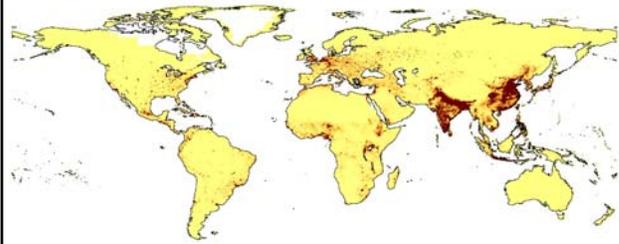
# Exposure to hazards

## Global Cities in Relation to Current Climate Related Hazards

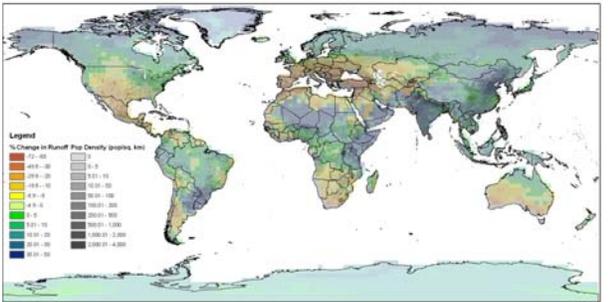


Hazard risk represents a cumulative score based on risk of cyclones, flooding, landslides and drought.  
 Source: de Sherbinin *et al.* (2007). The vulnerability of global cities to climate hazards. *Environment & Urbanization*. 19(1): 39-64.

# Knowing where people are...



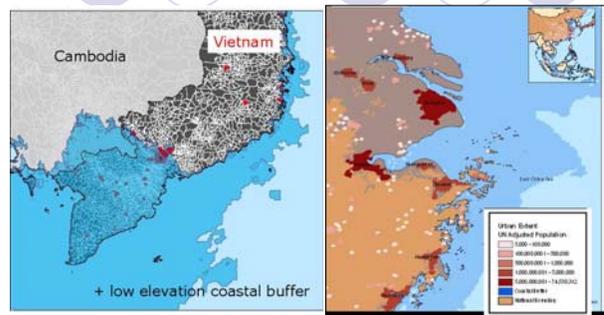
# in relation to future climate hazards: (a) prolonged drying, drought, and floods



Source: Adamo and de Sherbinin based on Nohara *et al.* (2006) and CIESIN (2005)



# (b) sea level rise of 10 meters



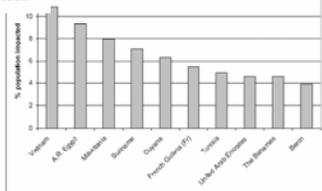
Source: Balk, D., G. McGranahan, and B. Anderson. 2006. *Population and Land Area in Distribution in Urban Coastal Zones A Systematic Assessment*. Earth System Science Partnership Open Science Meeting, Nov 2006, Beijing.



## Varying levels of sea level rise can be assessed

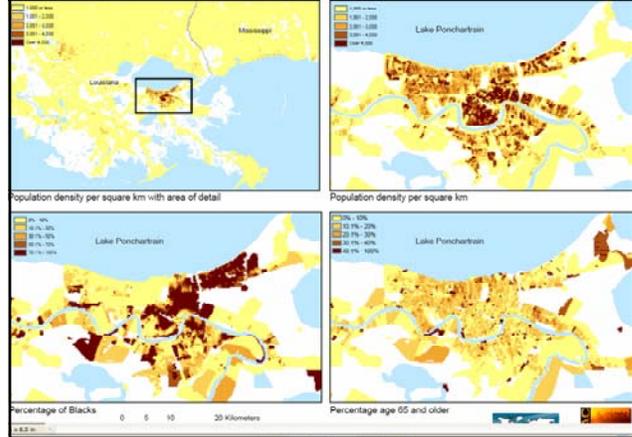
	World	LA	MENA	SSA	EA	SA
<b>Indicators</b>						
1m SLR						
Area	0.31	0.34	0.20	0.12	0.32	0.29
Population	1.28	0.57	2.20	0.45	1.97	0.45
GDP	1.30	0.64	1.49	0.23	2.09	0.85
Urban extent	1.02	0.61	1.94	0.39	1.71	0.33
Ag. extent	0.39	0.33	1.16	0.24	0.83	0.11
Wetlands	1.86	1.35	3.32	1.11	2.67	1.59
5m SLR						
Area	1.21	1.24	0.63	0.48	2.30	1.65
Population	6.57	2.69	7.49	2.38	8.63	3.02
GDP	6.06	2.38	3.91	1.42	10.2	2.86
Urban extent	4.68	3.03	4.94	2.24	6.99	2.72
Ag. extent	2.10	1.76	3.23	0.38	4.19	1.16
Wetlands	7.30	6.57	7.00	4.70	9.57	7.94

LA: Latin America and Caribbean; MENA: Middle East and North Africa; SSA: Sub-Saharan Africa; EA: East Asia; SA: South Asia.

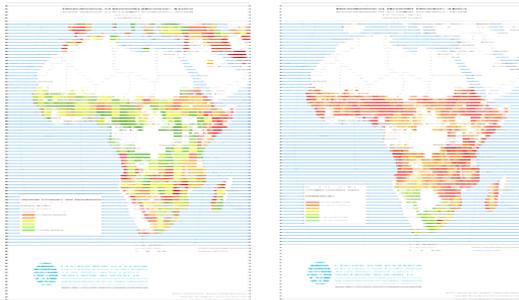


Source: Dasgupta et al. (2007). "The Impact of Sea Level Rise on Developing Countries: A Comparative Analysis" World Bank Working Paper No. 4136

## New Orleans Demographics



## Exposure vs. Vulnerability



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## Poverty as a proxy for vulnerability

- Poverty refers to lack of physical requirements, assets and income; while vulnerability focuses on the exposure to shocks, stress and risks, and on the lack of means to face the damage or loss.
- Poverty is a static concept, while vulnerability is more dynamic, multi-dimensional, and a better concept for measuring change.
- Poverty contributes to vulnerability through three mechanisms: (a) the narrowing of coping and resistance strategies, (b) the loss of diversification and the restriction of entitlements, and (c) the lack of empowerment.

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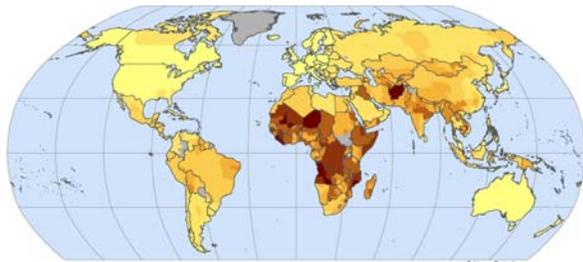
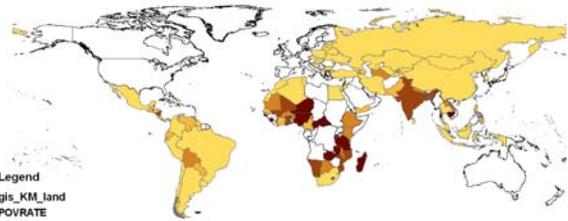
## Difficult to measure vulnerability at global/regional level

- Very place-specific and multi-dimensional
- Internal or intrinsic vulnerability a function of:
  - Socioeconomic status
  - Household characteristics
  - Gender and age
  - Social networks
  - Historic inequalities
  - Institutional inequalities
  - Building codes
  - National or local preparedness (e.g. early warning systems)



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## National Poverty Rate



The World  
By Subnational Administrative Level

### Measures of Poverty Infant Mortality Rates [IMR]

Subnational boundaries have been adjusted to 2010 using national-level data.  
Original data for 90% of countries are from 1991 or later. All data are from 1990 or later.

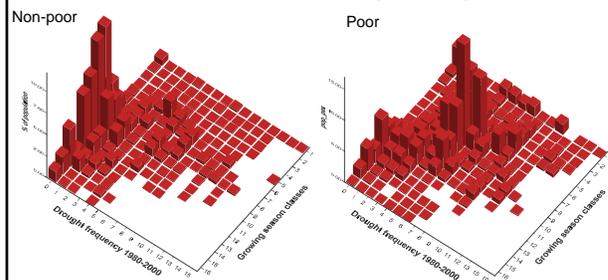


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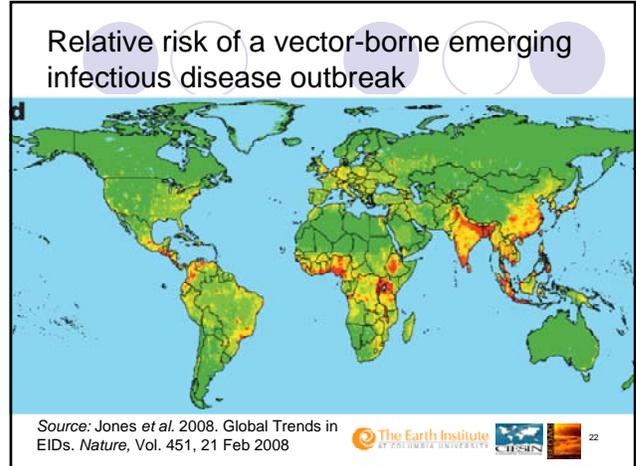
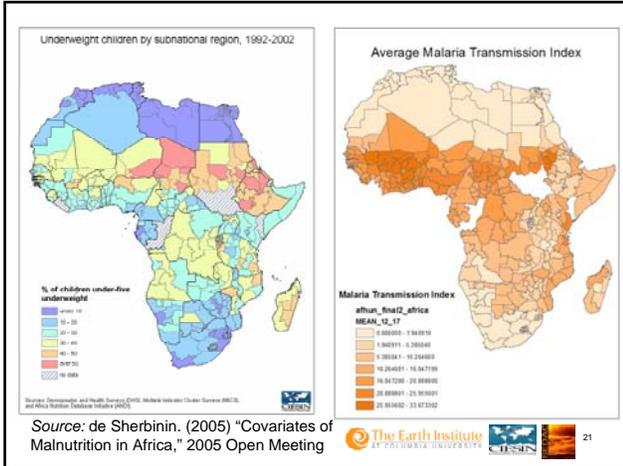
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## Compared with the non-poor, poor people are more likely to be found in drought-prone areas with shorter growing seasons



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Census vs. Survey

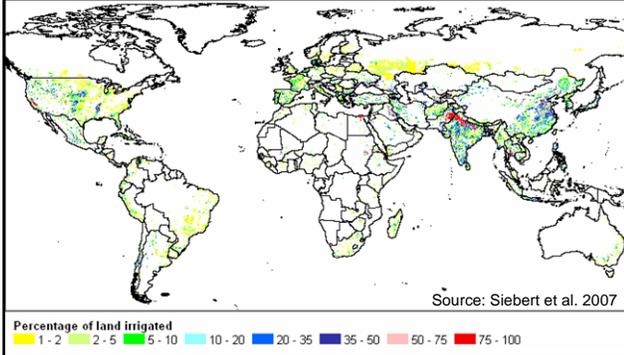
- PROS
  - Results can be representative for small geographic areas
- CONS
  - Costly to implement
  - Decennial
  - Limited number of questions
- PROS
  - Relatively lower costs
  - Annual / every few years
  - Can cover larger number or more focused set of issues
- CONS
  - Representative only for larger geographic areas

Adaptive capacity

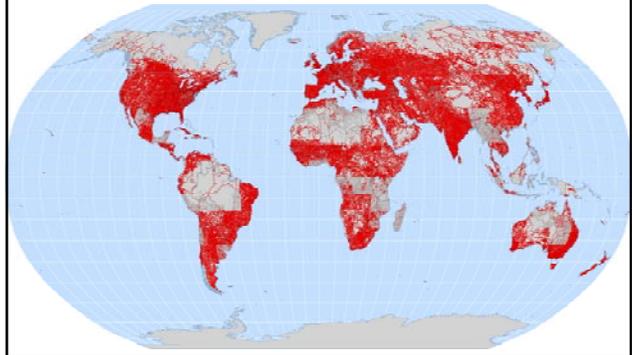
- A function of national income
- A function of human and social capital
- A function of past infrastructure development
- A function of good governance
- And many other issues...

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Water storage capacity an important indicator of drought resilience: Global Map of Irrigated Areas



Road networks



Spatial data on adaptive/coping capacities exist for the following

- Gridded income data (Nordhaus, Sutton)
- Water holding capacity of dams (UNH WSAG)
- Governance indicators at the national level (World Bank, Transparency Int'l, POLITY proj.)
- Conflict areas (PRIO, CIESIN)
- Refugee camps (UNHCR)
- Health infrastructure (WHO)
- Age structure (CIESIN forthcoming)

Other groups doing V&A assessment and data development at global/regional level

- World Resources Institute (WRI)
- Stockholm Environment Institute (SEI)
- Netherlands Environmental Assessment Agency (MNP)
- Potsdam Institute for Climate Impact Research (PIK)
- Center for Sustainability and the Global Environment (SAGE), U. of Wisconsin

## Conclusions

- Climate change of greater than 2° C is likely to happen: forewarned is fore armed
- Since impacts, vulnerability, and adaptive capacity are spatially differentiated, spatial data are vital
- There is an increasing amount of spatially disaggregated data on hazard exposure, aspects of vulnerability, and coping capacity

Thank you!

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