

Adapting to Urban Climate Risk in Coastal Brazil

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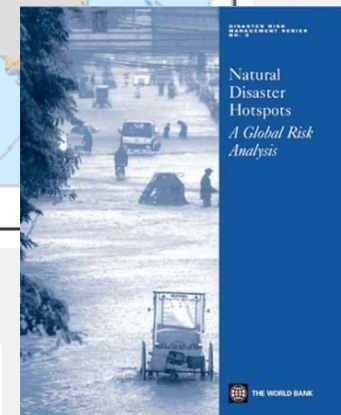
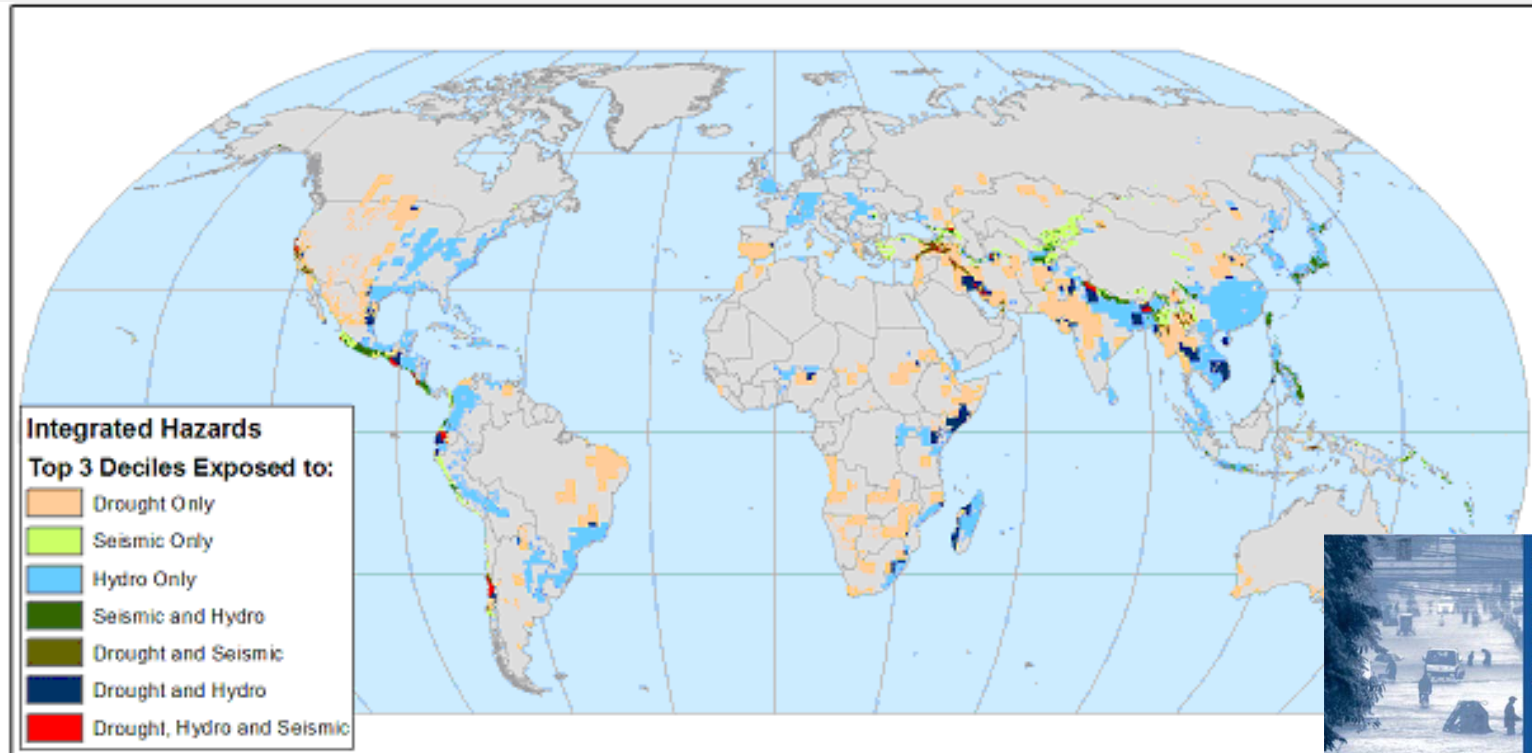
Greening the City I: Environment, Economy, and Urbanization

April 16, 2010



Natural Disasters Hotspots

Global analysis assessing the risks of mortality and economic losses
Combined hazard exposure and historical vulnerability



<http://www.ideo.columbia.edu/chrr/research/hotspots/>



“A growing chorus of expert voices warn that either we fight for ‘impossible’ solutions to the increasingly entangled crises of urban poverty and climate change, or become ourselves complicit in a *de facto* triage of humanity.”

Mike Davis. 2010. Who will build the ark? *New Left Review* 61: 29-46.

If the ark is built, who will be the passengers?

‘Urban Hazardscapes’ to ‘Climate Resilient Cities’

Vulnerability, resistance & resilience of interacting human & non-human systems

Consequences of Urbanization Pathways for Sustainability

- Ecological Integrity
- Human Health/Quality of life/Livability
- Economic Well-being
- Social Equity and Justice

Spatial heterogeneity & socio-spatial inequalities

Climate-related Hazards & Governance in Coastal Brazilian Cities

- Urban **Exposure** to Natural & Unnatural Hazards
- Analysis of Urban **Vulnerability** to Climate Variability & Climate Change
- **Impacts** of Extreme Climate Events
- **Adaptation** Decisions & Strategies
- Hazard **Mitigation** Options

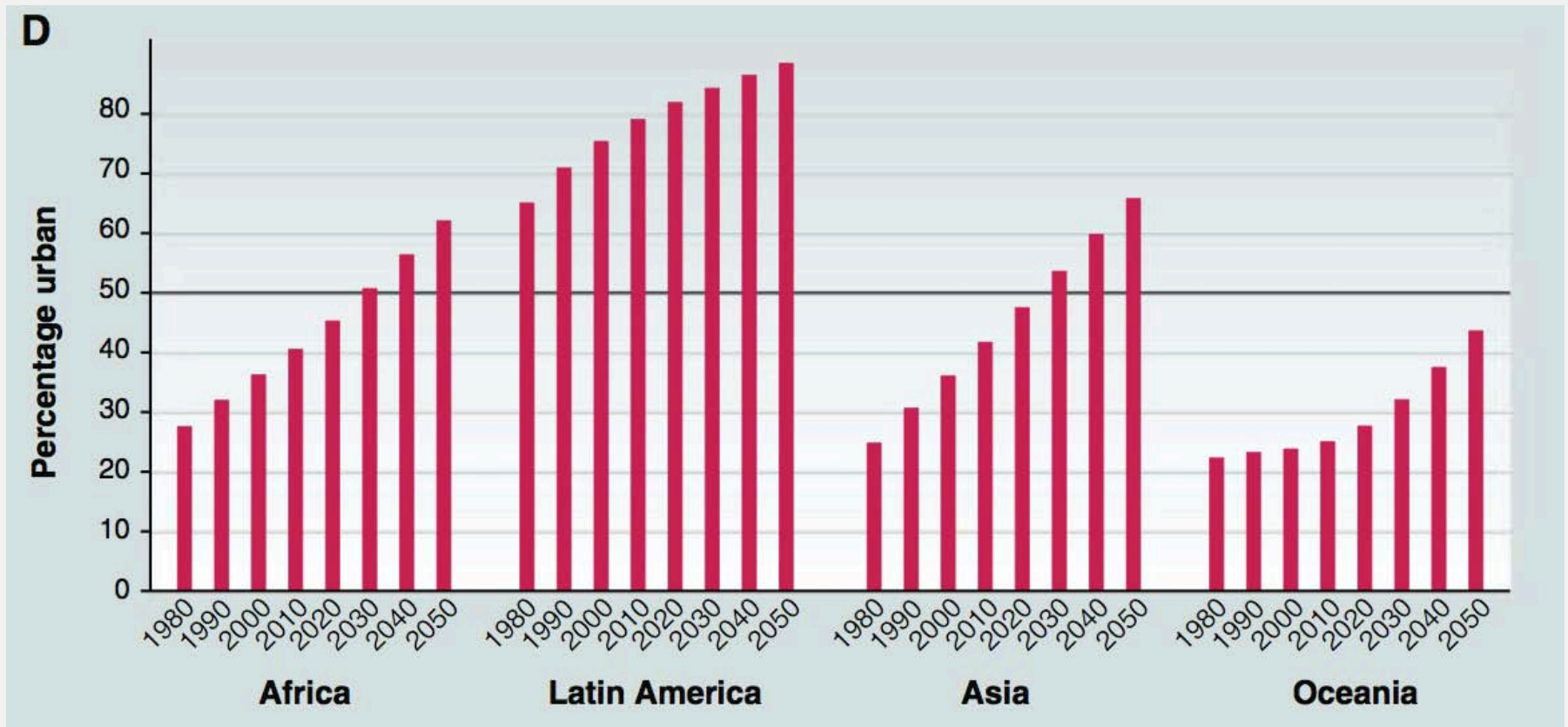
Multi-scale approach to support planning & action

| | |
|----------------------|--|
| Individual/household | Behaviors; decision-making; PPGIS & VGI |
| Local/neighborhood | Local risk assessments; community-based risk reduction & disaster response |
| City-region | Early-warning systems; evacuations plans; disease prevention; infrastructure & services (water supply, drainage, sanitation, transport) |
| Subnational | Weather forecasting capacity; coordination of rescue & relief operations |
| National | Climate change policies, plans, strategies |
| Regional | Regional-scale climate monitoring and modeling |
| Global | Global environmental change; global human population dynamics; atmospheric concentrations of greenhouse gases; global climate financing mechanisms |

Spatial Data Infrastructures to facilitate data collection/integration & democratic knowledge production

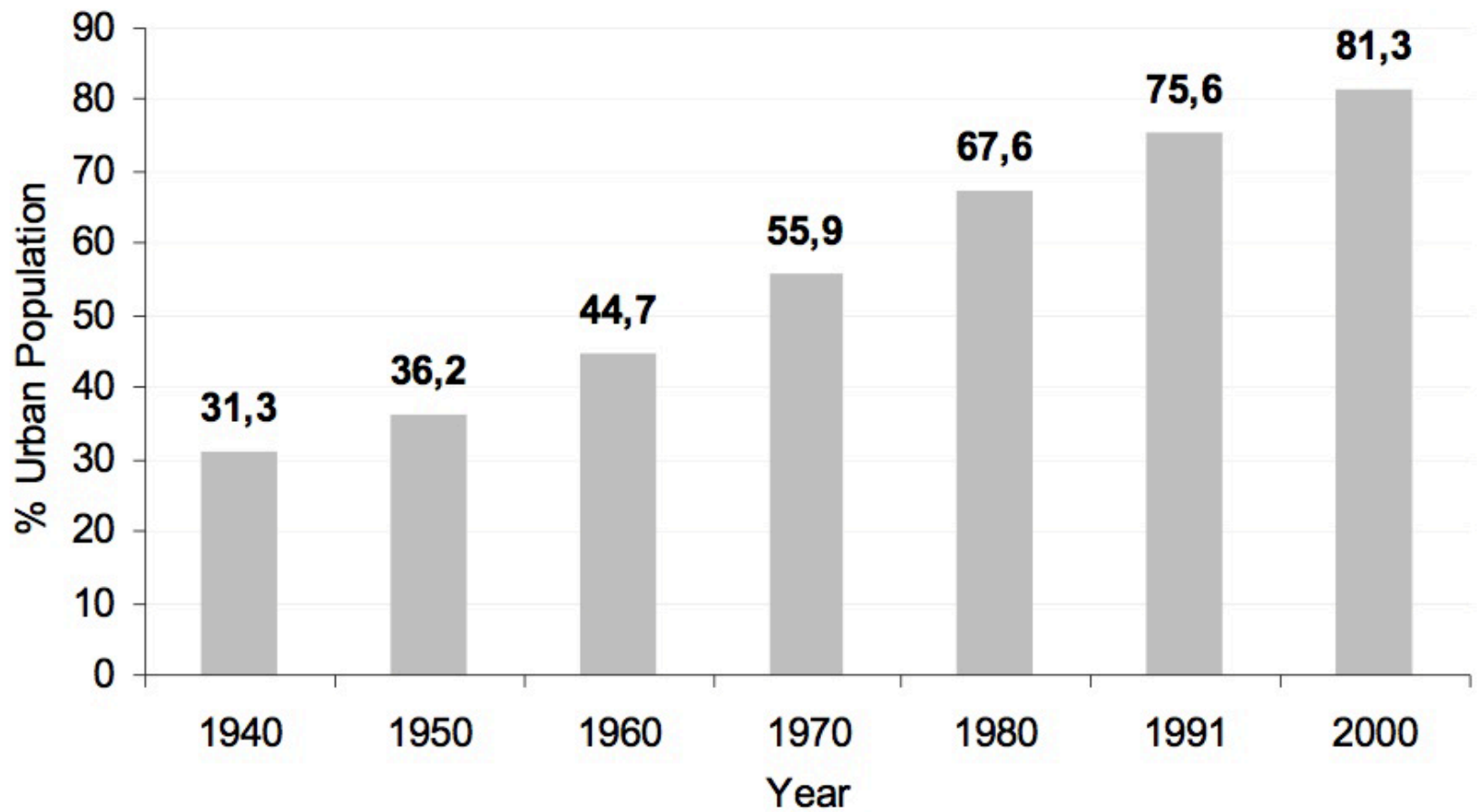
Global urbanization trends

Increasing percentage urban



Source: Montgomery, M.R. 2008. The urban transformation of the developing world. *Science* 319: 761–764.

Figure 1 – Urban population (%), Brazil (1940-2000)



Source: IBGE, Demographic censuses 1940-2000.

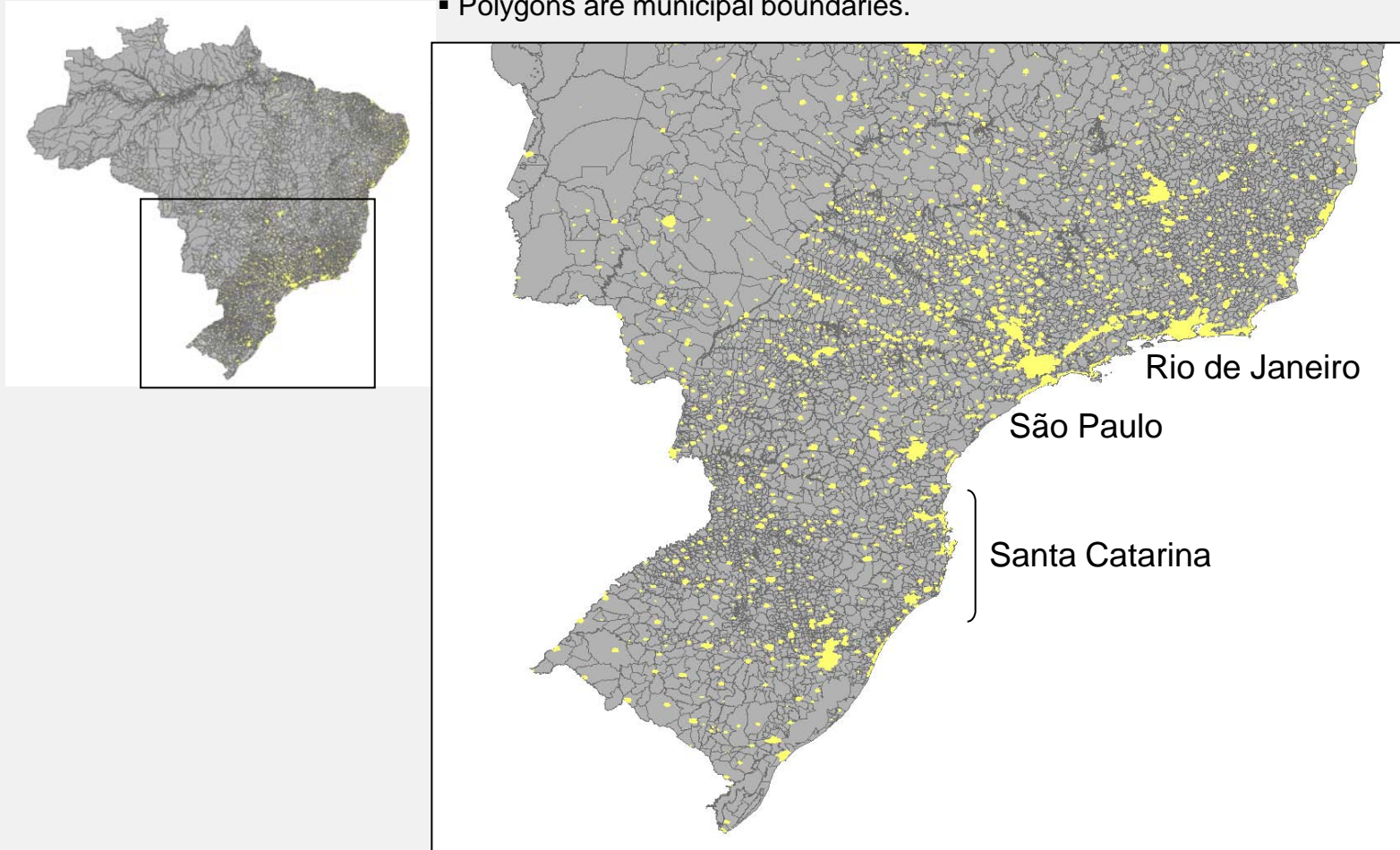
Florianópolis

Santa Catarina State, Brazil



Spatial distribution of urban populations in Brazil

- Areas displayed in yellow indicate urban extents (night-time lights).
- Polygons are municipal boundaries.



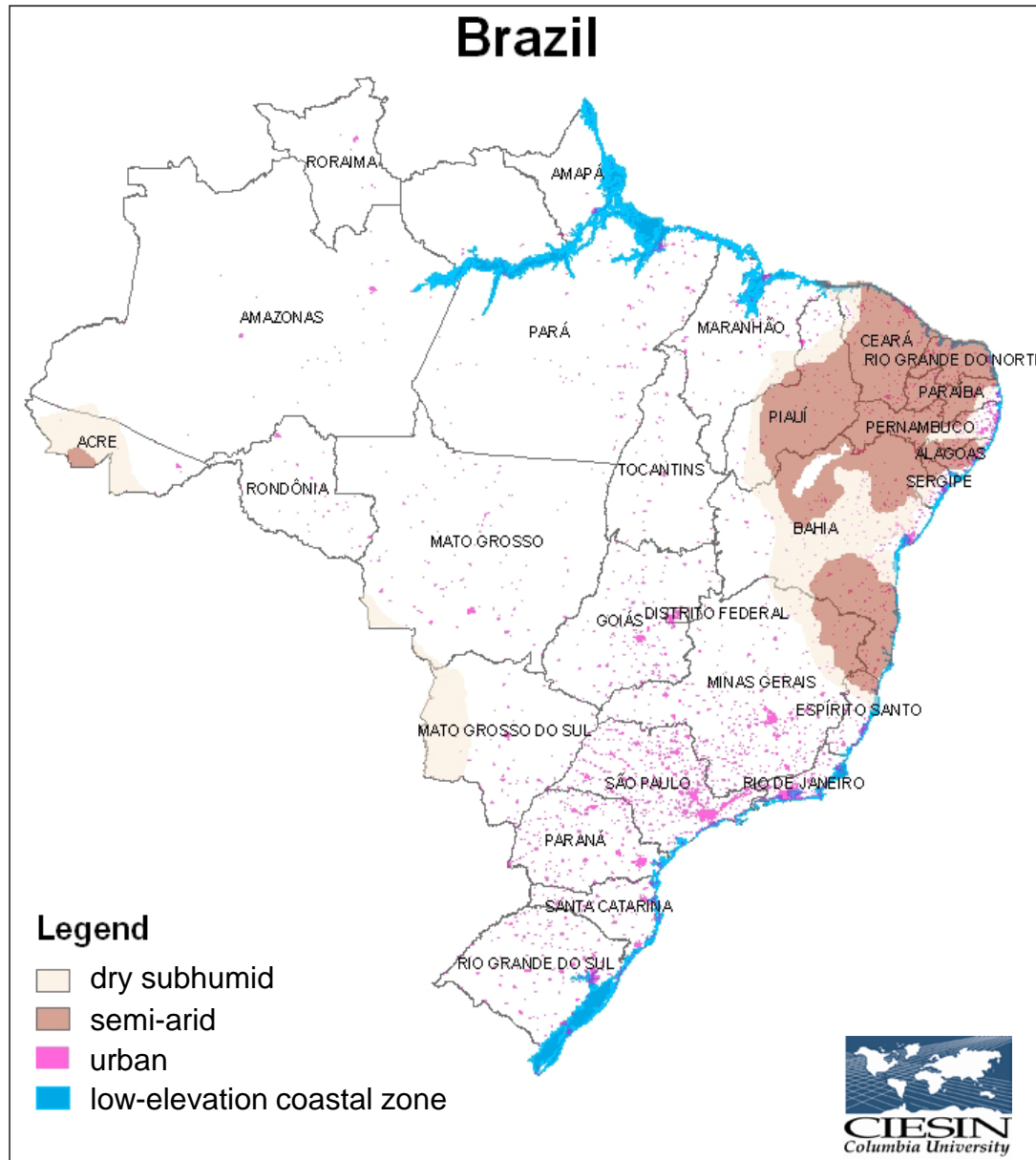
Gridded Population of the World, version 3 (GPWv3)
Global Rural-Urban Mapping Project (GRUMP)
<http://sedac.ciesin.columbia.edu/gpw/>

Collaborative Research

Mapping the Risks of Climate Change in Developing Countries

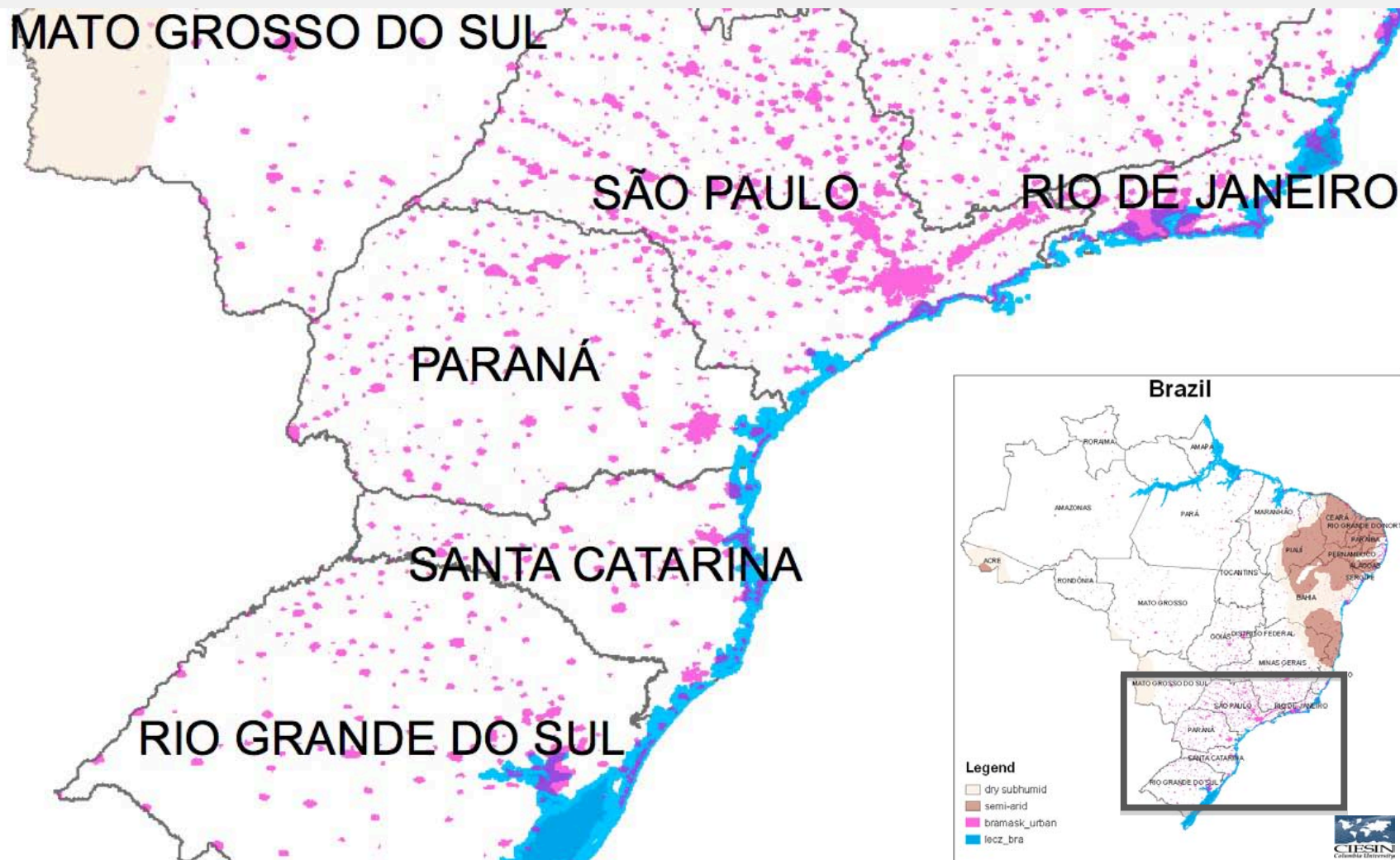
- **Deborah Balk & Megan Todd**, Baruch School of Public Affairs, CUNY Institute for Demographic Research (CIDR);
- **Mark Montgomery**, Stony Brook University & Population Council;
- **Gordon McGranahan**, International Institute for Environment & Development;
- **Donghwan Kim**, Stony Brook University
- **Thomas Buettner**, UN Population Division;
- **Christopher Small**, Lamont Doherty Earth Observatory, Columbia University;
- **S. Chandrasekhar**, Indira Gandhi Institute of Development Research, Mumbai;
- **Valentina Mara & Susana Adamo**, CIESIN.

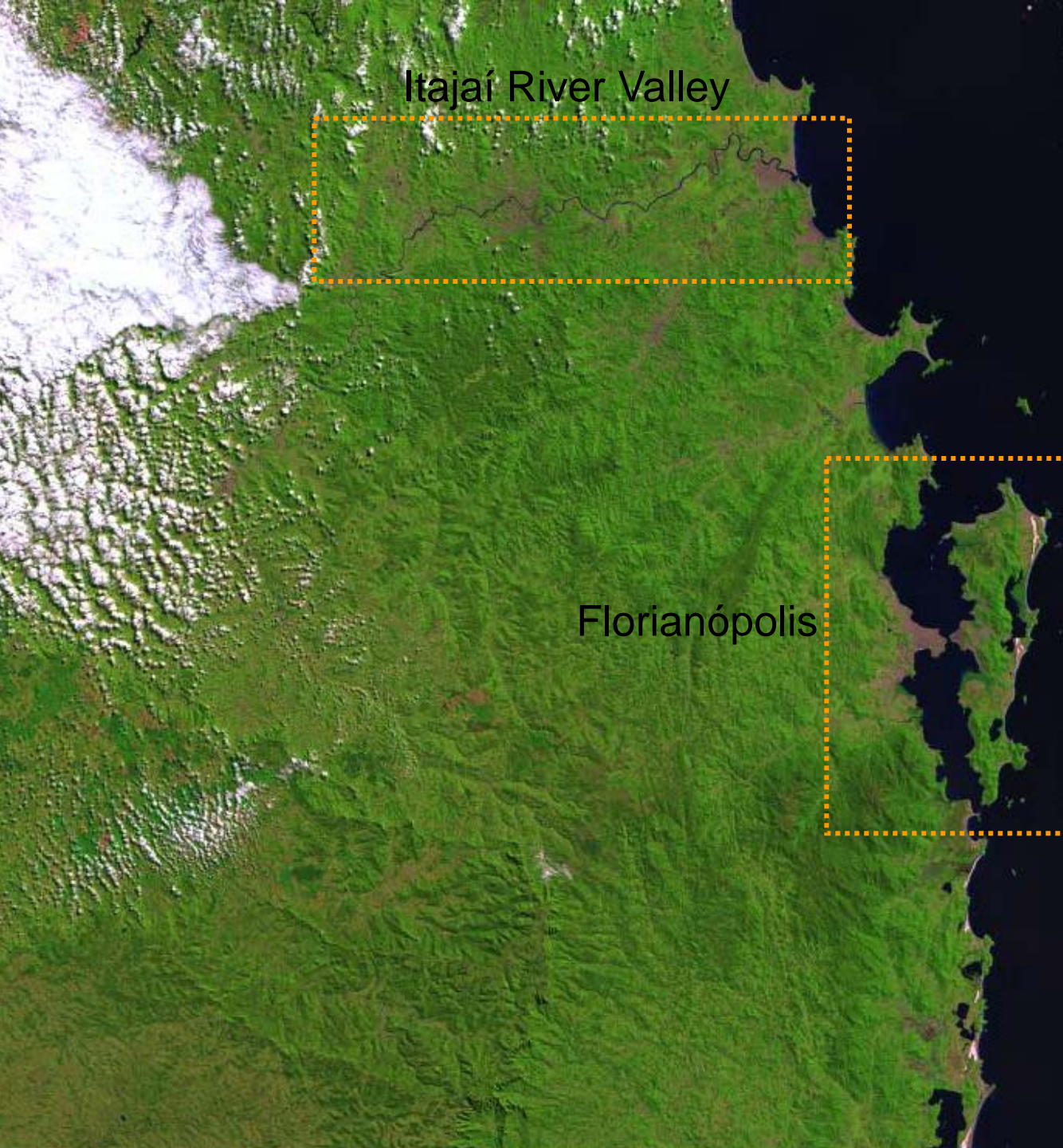
Mapping Urban Exposure & Vulnerability to Climate Variability & Change



Global Rural-Urban Mapping Project (GRUMP)

Urban Extents & Low-Elevation Coastal Zone in S & SE Brazil





Itajaí River Valley

Florianópolis

Santa Catarina State

Landsat 7
Path 220, Row 079
March 29, 2003

Source: <http://glovis.usgs.gov/>

Santa Catarina State Extreme rainfall event Began on Nov. 22, 2008

Nov. 22-23, 2008

Balneário Camboriú: 455 mm

Itajaí: 403 mm

São José: 254 mm

Florianópolis: 216 mm

Nov. 22-26, 2008

Blumenau: 600+ mm



Image taken 11:50 a.m. local time (13:30 UTC) on November 22, 2008
Source: <http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=36035>

Tropical Rainfall Measuring Mission (TRMM) satellite
TRMM is a joint mission between NASA and the Japanese space agency, JAXA.

Landsat 7
Path 220, Row 079
March 29, 2003

Source: <http://glovis.usgs.gov/>

Extreme rainfall event in the Itajaí River Valley

November 2008

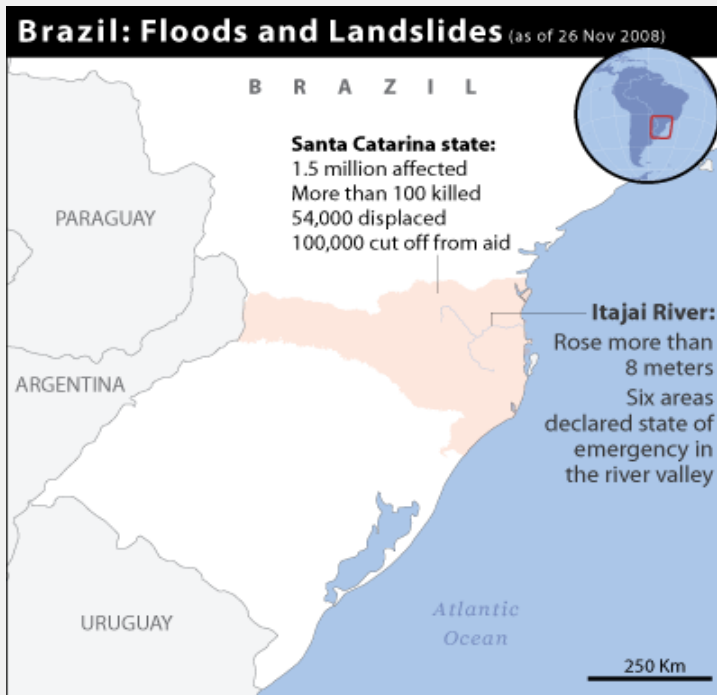
Affected an estimated 1.5 million people in the region.

Death toll of 135, mostly from landslides.

85 municipalities declared a state of emergency.

242 confirmed cases of leptospirosis.

Itajaí, Santa Catarina, Brazil on 24 Nov. 2008



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Narrative and statistical source: Reuters. Brazil Troops Quell Looting After Landslides. 26 Nov., 2008. . Data sources: UNCS, GAUL. Map created 26 Nov., 2008

Source: <http://reliefweb.int>



Itajaí é um dos municípios mais seriamente atingidos pelas chuvas - Itajaí, 24/11/2008 -

Foto: Neiva Daltrozo / Secretaria de Comunicação - Gov. Santa Catarina

<http://www.flickr.com/photos/capitania/sets/72157610162907768/>

Exposure, vulnerability, impacts, & responses at the local and household levels

Residents of Florianópolis were impacted by the same heavy rainfall event



23 Nov. 2008



27 Nov. 2008



Photos courtesy of K. Ferrão

28 Nov. 2008

Extreme rainfall event in Rio de Janeiro State

Began on April 5, 2010. Impacts: flooding, landslides, & storm surge.

288 mm (11.3 in) in 24 hours

Metro Rio de Janeiro

O GLOBO RIO

BUSCAR OK Edição digital No celular No e-mail

ASSINE

CAPA PLANTÃO MEU GLOBO BLOGS COLUNISTAS EU-REPORTER OPINIÃO MULTIMÍDIA GUIAS E SERVIÇOS O GLOBO SHOPPING EXTRA ONLINE AGÊNCIA O GLOBO

PAÍS RIO CIDADANIA ECONOMIA MUNDO CIÊNCIA ESPORTES CULTURA REGIONAL EDUCAÇÃO SAÚDE TECNOLOGIA VIAGEM O LIVREIRO CLASSIFICADOS ZAP

Veja o mapa da devastação no Rio e colabore



Dados cartográficos ©2010 MapLink/Tele Atlas - Todos os Direitos Reservados

Legenda

- Alagamento
- Lixo, lama e árvores
- Deslizamento
- Postos de doações

Colabore identificando no mapa pontos de destruição, alagamento, acúmulo de lixo, queda de árvore e postos para doações.

[Clique aqui para acrescentar informações e imagens](#)

Como fazer

- 1) Ao entrar no mapa, clique em editar
- 2) Selecione o ícone de adicionar um marcador
- 3) Posicione o marcador no mapa e insira as informações que desejar
- 4) O formato Rich Text permite que você acrescente também uma imagem que esteja na rede



Morro do Bumba, Niterói, RJ



Rio Disaster Death Toll At 355 As Rain Slacks

RIO DE JANEIRO, Brazil (AP) — The death toll in the Rio de Janeiro disaster climbed to 355 today and many more bodies were believed buried in the mud and debris left in the wake of the worst rains in the city's 400-year history.

A total of 185 deaths were confirmed in the city and another 170 in Rio de Janeiro state, including 100 in the mountain resort of Petropolis, 26 miles north of the city.

Many more were feared dead in isolated areas.

Doctors and attendants at the city morgue worked around the clock trying to identify bodies brought in.

"Most were suffocated in landslides," said Dr. Ivan Fer-

reira. "Many had broken spines and legs."

"The children were the hardest hit. The little ones drowned in as little as a few centimeters of water. Others were unable to withstand even minor slides and were dragged away."

Most of the dead came from the Favela shantytowns on Rio's hillsides. They were brought in by the truckload. Hampered by frequent power failures, doctors performed autopsies on each body.

Many families did not have the money to buy coffins or pay for burial. Radio and television stations broadcast frequent appeals to undertakers for donations of coffins and asked ceme-

tery officials to waive burial fees for the poor.

Authorities estimated at least 4,000 were homeless in the city and another 10,000 in the state.

An undetermined number of persons was killed Thursday when a huge mud slide roared off a hillside in Rio, buried two houses, two trucks and four floors of a seven-story apartment house.

Eight bodies were recovered, but many more were believed buried.

The rains, which started Monday, tapered off to a drizzle during the night.

A massive inoculation campaign was under way to prevent epidemics.

Extreme rainfall event in 1966:

- Fatalities mostly caused by landslides.
- Most of the deaths occurred in *favelas*.
- At least 4,000 left homeless in Rio city; 10,000 left homeless in Rio state.
- Efforts to prevent disease epidemics following the event.

What needs to happen for coastal Brazilian cities to adapt to existing climate variability & expected climate change?

- (1) **Build 'the ark' for all!** C.C. adaptation & development should be integrated in ways that reduce rather than exacerbate extreme socioeconomic inequalities.
 - extend & improve **basic urban infrastructure & services**
 - provide safe, affordable, low-carbon (low-impact) **housing** for population currently living in high risk areas
 - build, upgrade, prepare **multifunctional facilities** (i.e., health centers, schools, recreational centers) that can serve as hospitals & safe shelters
- (2) Enforcement of **land-use restrictions, zoning regulations & building codes.**
- (3) Strengthen **institutions & partnerships** that promote **good governance.**
 - governance systems need to be **inclusive** of the urban poor
- (4) Improve **systematic documentation & communication** of events, impacts & responses at multiple spatial scales; make data & information publicly accessible.
- (5) Advance **Spatial Data Infrastructures** to communicate knowledge & interactively shape behaviors & action; take advantage of social networking tools & services.

Thank you!

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