Climate changes and social inequalities

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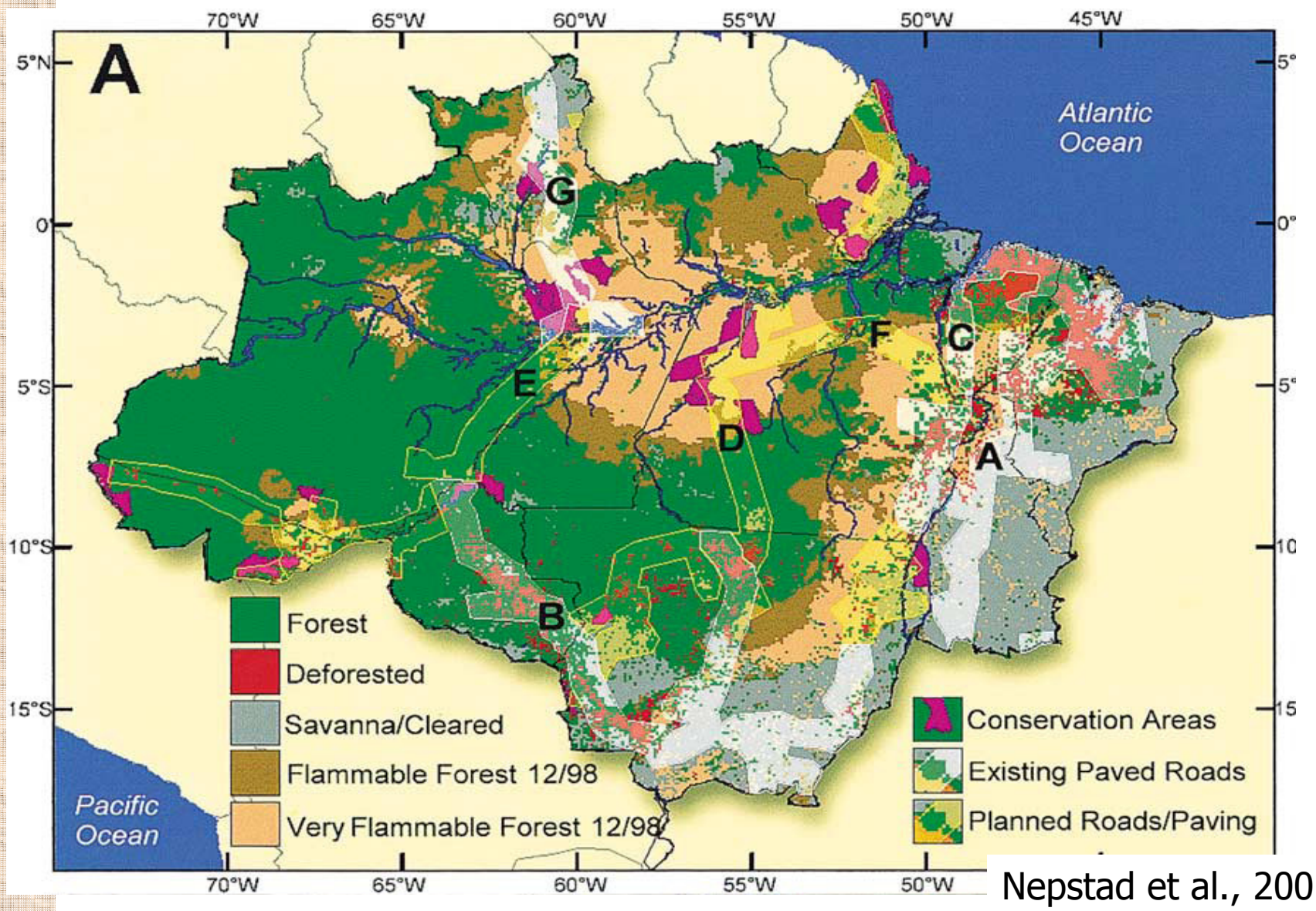
Land use, climate change and economic activities



Nepstad et al., 2001

Uma verdade inconveniente

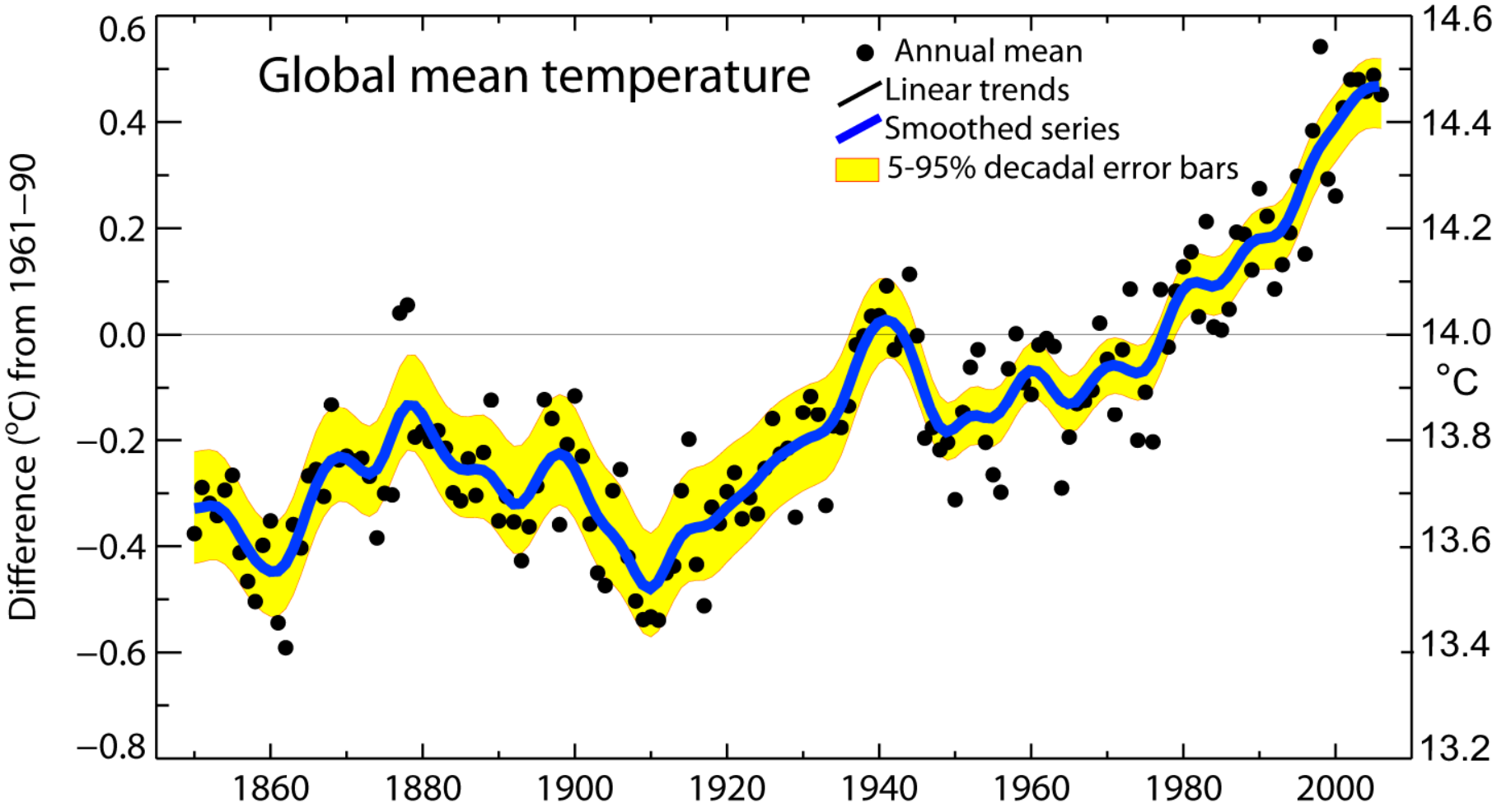
Katrina, 2005

O dia depois de amanhã

Relatório IPCC, 2007

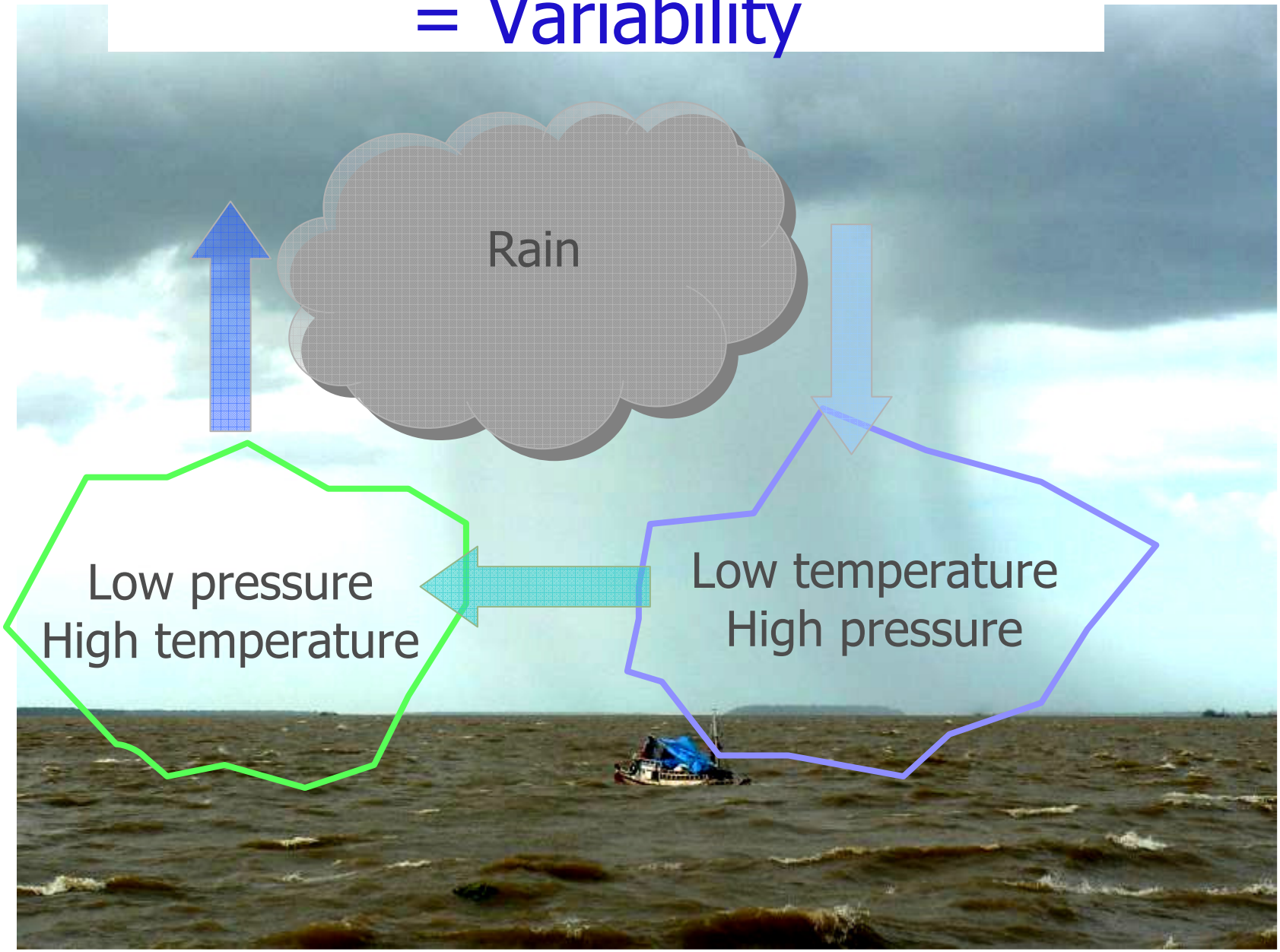
Ártico, 2006

Evolution of global mean temperature

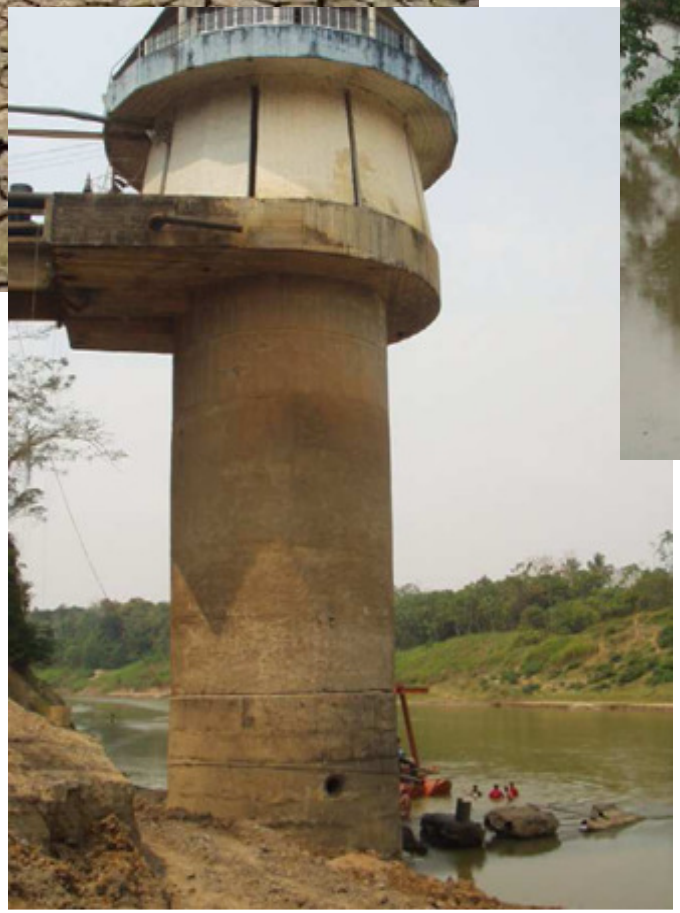


IPCC, 2007

Heating = Energy flow = Variability



Acre, western Amazon, 2005



www.map-amazonia.net

Variability

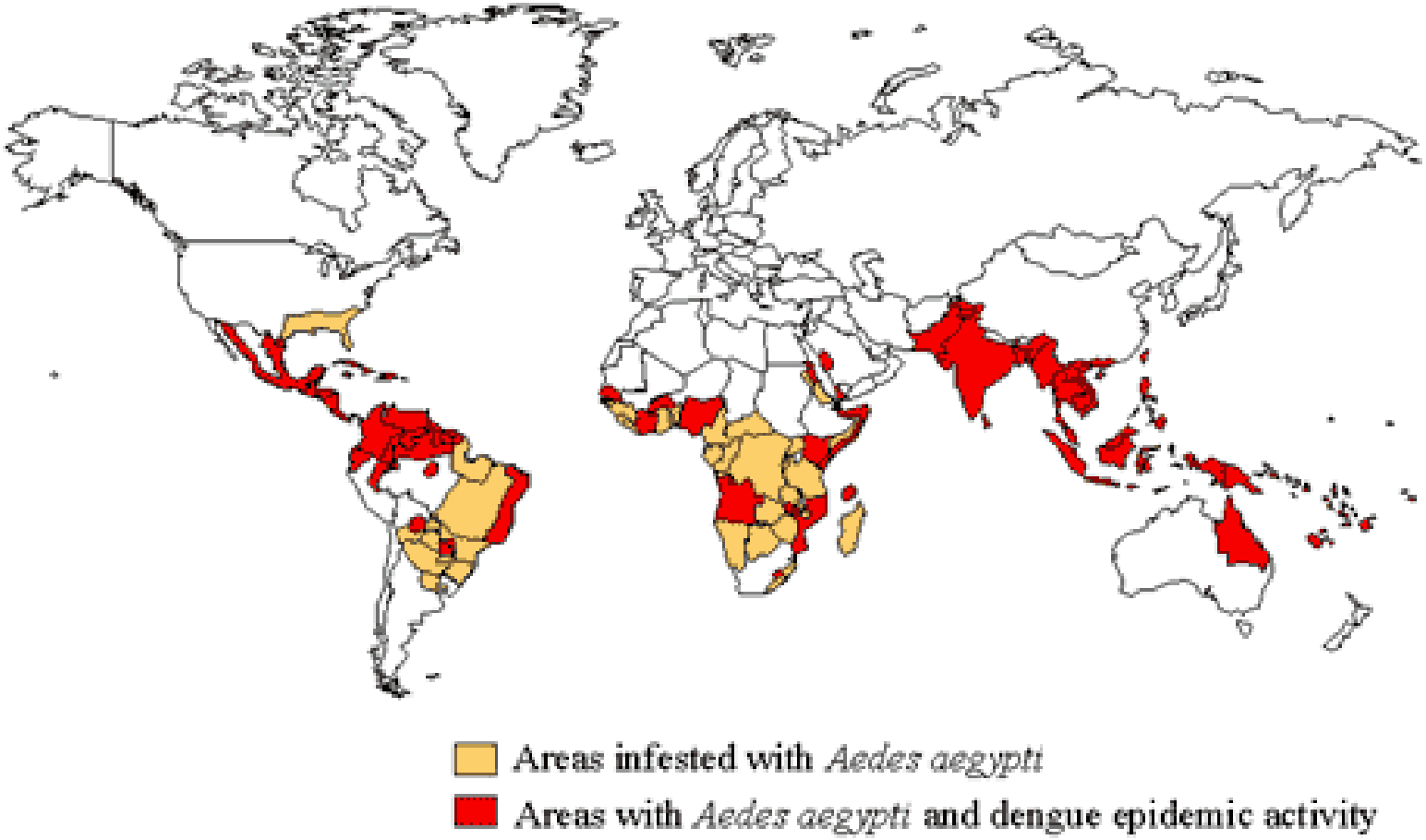
- Weather (shelter)
- Economy (agriculture, industries)
- Water and food (supply services)
- Migration (border control)
- Diseases outbreaks (epidemiologic surveillance)

Potential impacts of environmental and climate changes in health

- Expansion of vector borne disease transmission range
- Extreme climate events (floods, accidents, droughts)
- Atmospheric contamination
- Collapse of water & sanitation systems (water related diseases)

Dengue fever

World distribution

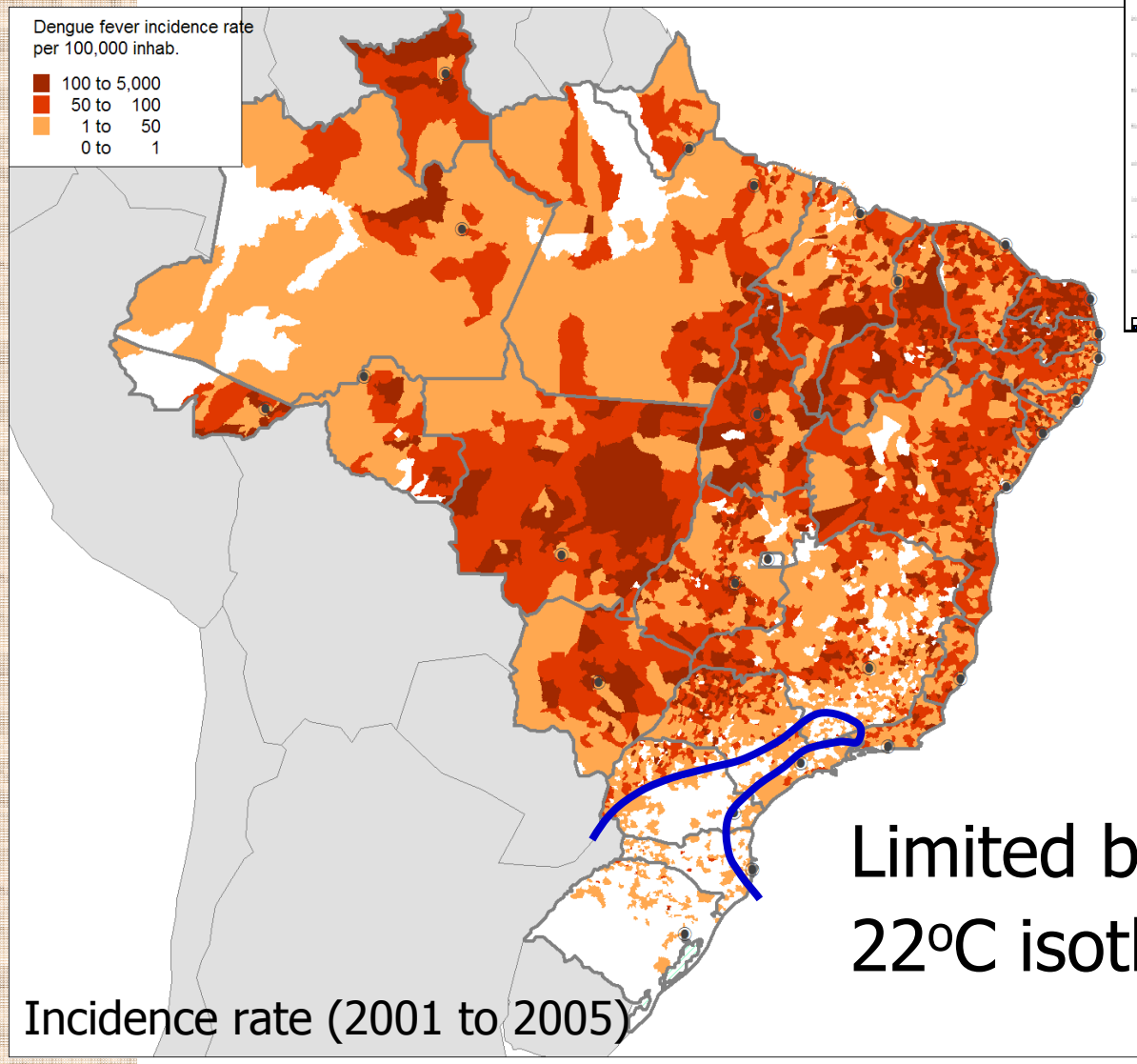


Dengue fever: A tropical disease?

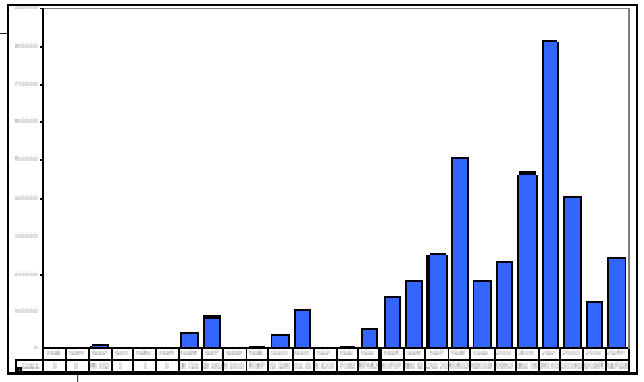
CDC

Will it expand?

Dengue fever distribution in Brazil



Incidence rate (2001 to 2005)

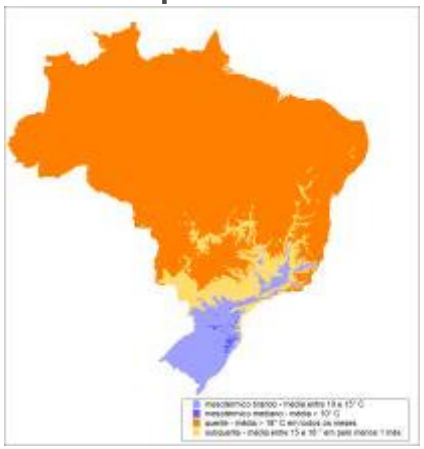


500.000 cases per year
40 deaths

Limited by the
22°C isotherm

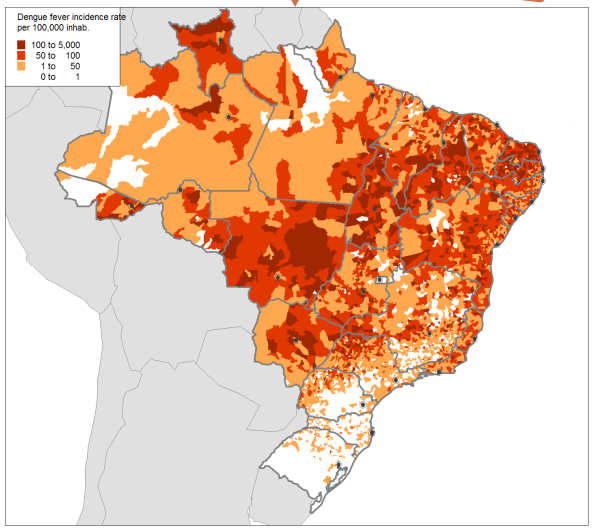
Factors affecting dengue distribution

Temperature

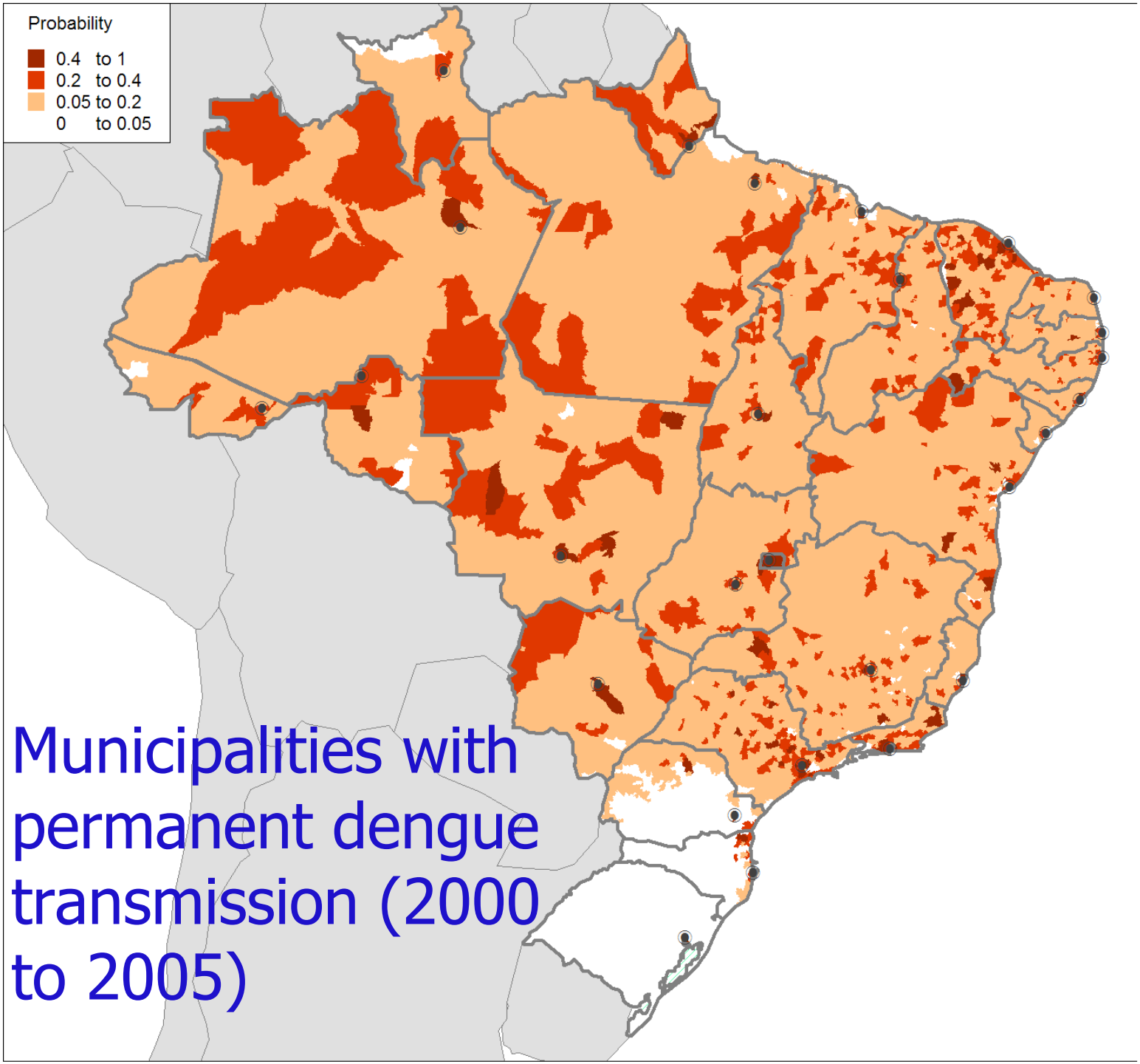


Rainfall

Sanitation



- GIS
- Logistic regression



Municipalities with permanent dengue transmission (2000 to 2005)

Regression coefficients

	B	S.E.	Wald	Partial cor.
Urban population	.018	.003	41.162	.303
Improvised water supply	.217	.072	9.207	.185
Total population	.000	.000	47.789	.380
Population growth	.103	.017	38.082	.296
No bathrooms	.012	.003	16.061	.134
Temperate climate	-3.116	.452	47.439	-.314
No water supply	.007	.003	6.055	.101
Constant	-3.544	.233	230.916	.000

- City characteristics
- Dwellings conditions
- Climate

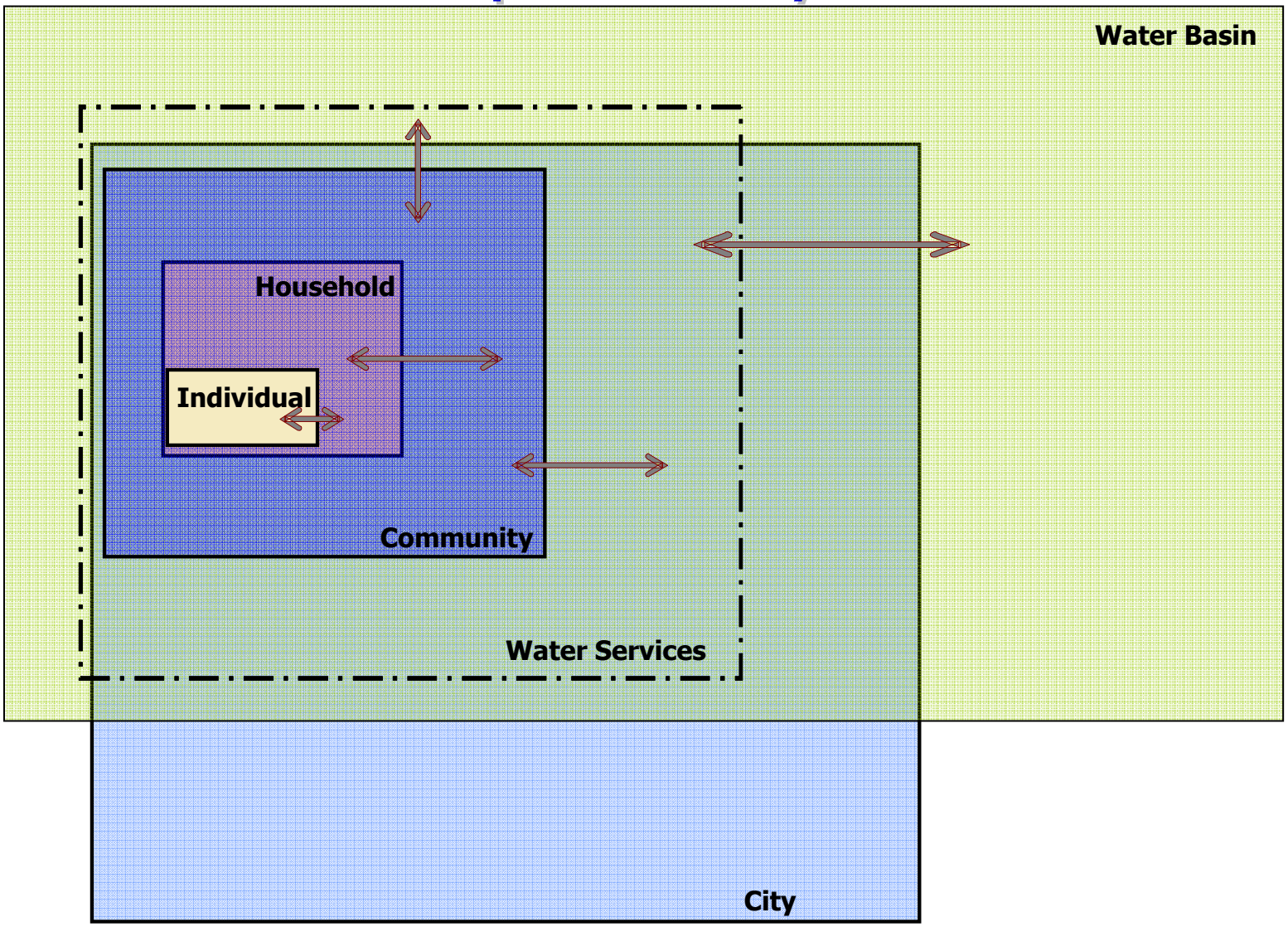
Risk

Risk = Harm * Vulnerability

- Nature
- Environment
- Event magnitude

- Society
- Adaptation
- Social inequalities

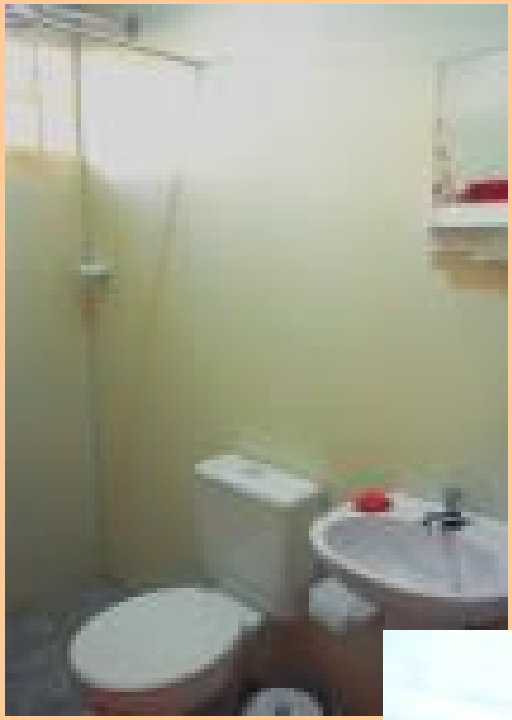
An Hierarchical Structure of Dependency



Individual

Nutritional status
Previous diseases
Cultural Habits/Behaviour

Household



Sanitary Installations
Income (Investment capacity)

Community

Political Organisation
Identity
Localisation

Water Services

Water Source
Distribution and Quality

City

Sanitation Public Policies
Environmental Enforcement Laws and Regulations

Water Basin

Rain Regimes
Vegetation
Climate

System of Dependencies

Individual

Household

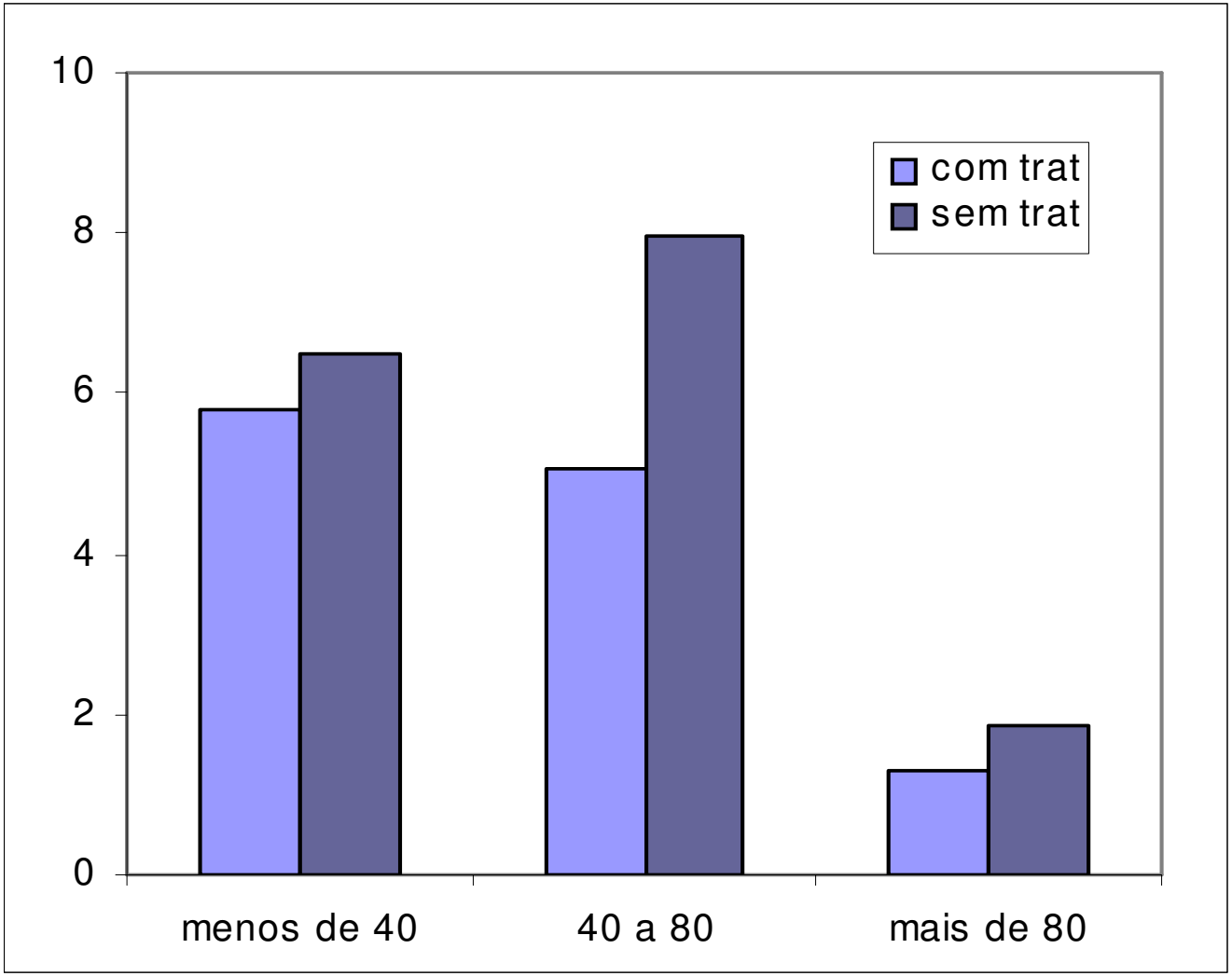
Comunity

Water Services

City

Water Basin

Mortality rate by diarrhoea in children for Municipalities with and without treated water



Fonte de dados: SIM/MS, PNSB/IBGE e Censo 2000/IBGE

The Angra dos Reis (RJ) water source during the drought of 2007

The flood of Rio de Janeiro, 1996

- Intensive rainfall (300 mm in few hours)
- 114 leptospirosis cases in the Rio de Janeiro western sector

Mapping leptospirosis risks after a severe flood in Rio de Janeiro, 1996

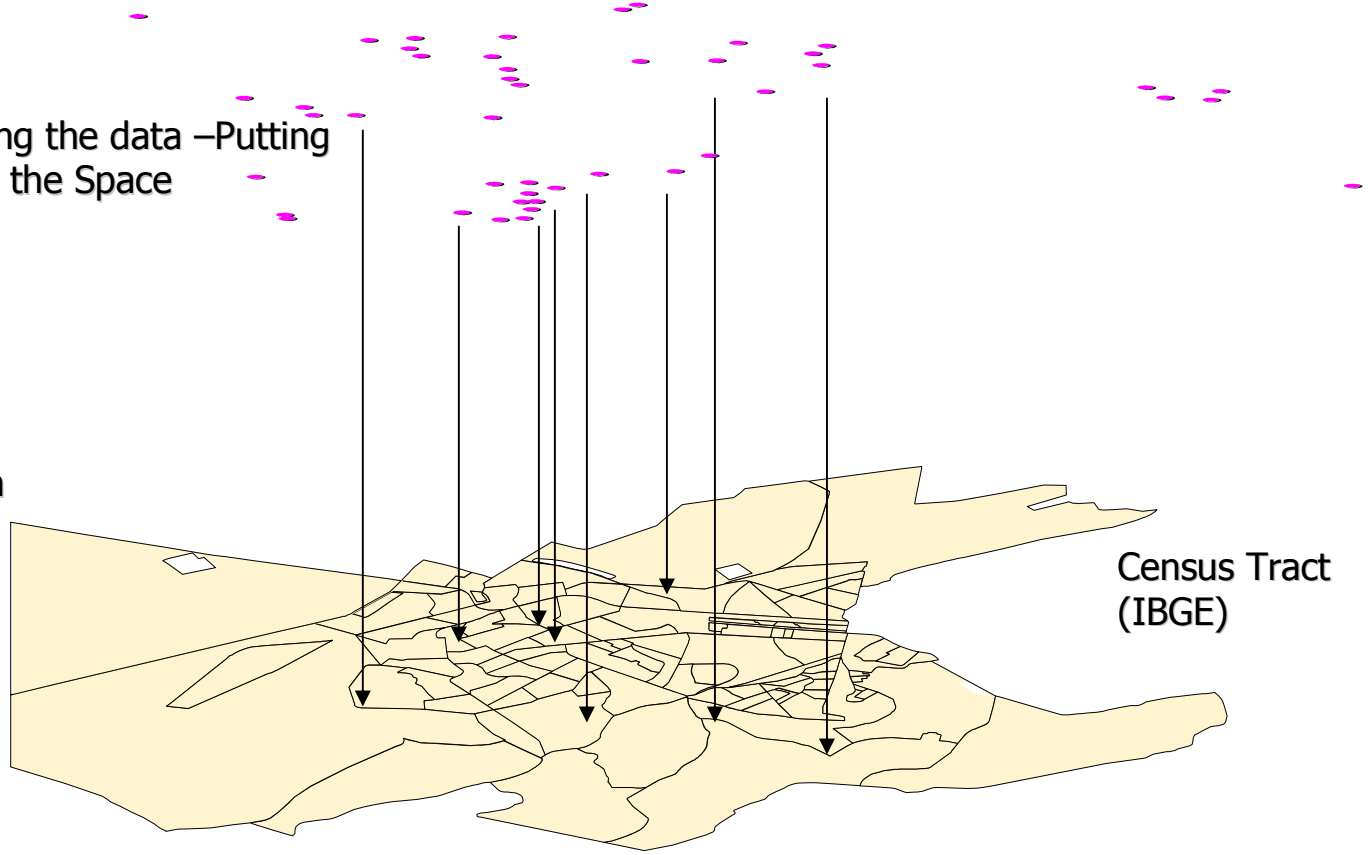
Data Collection

DT_ATEN	INICIAIS	BAIRRO	ENDERECO	PONTO DE REFERÊNCIA
18/03/96	AJO	148	TRAV. 8 C/05	ANTARES
28/02/96	AJR	148	TRAVESSA CAMERA 26	TRES PONTES
15/03/96	DRL	148	R. DEJI LAUDRA 175	
11/03/96	IDO	148	RUA NOVA JESUS S/N.	
07/03/96	IMO	148	R. NOVA JESSY S/N	ASSOCIACAO DE MORADORES
01/03/96	JVS	148	ESTR. SANTA EUGENIA, 552	
11/03/96	LRA	148	R. MONTE NOPOLIS QD. 90 LT.5	
08/03/96	LSS	148	R. IBIRACEMA 13	VENDA DE VARENDA
08/03/96	LSS	148	R. IBIRAREMA 13	VENDA DE VARANDA
11/03/96	PPO	148	RUA DA PAZ, 64	
13/03/96	VLS	148	ESTR. SAO GOMARIO R. G 34	
07/03/96	ACC	149	R. M. C/09 CONJ. MUCIMO DA SILVA	
01/03/96	AFR	149	RUA UM N.71 C.2	
05/03/96	ALS	149	R. AURISTELA 15 CASA 59	

Notification for leptospirosis (SES-RJ)

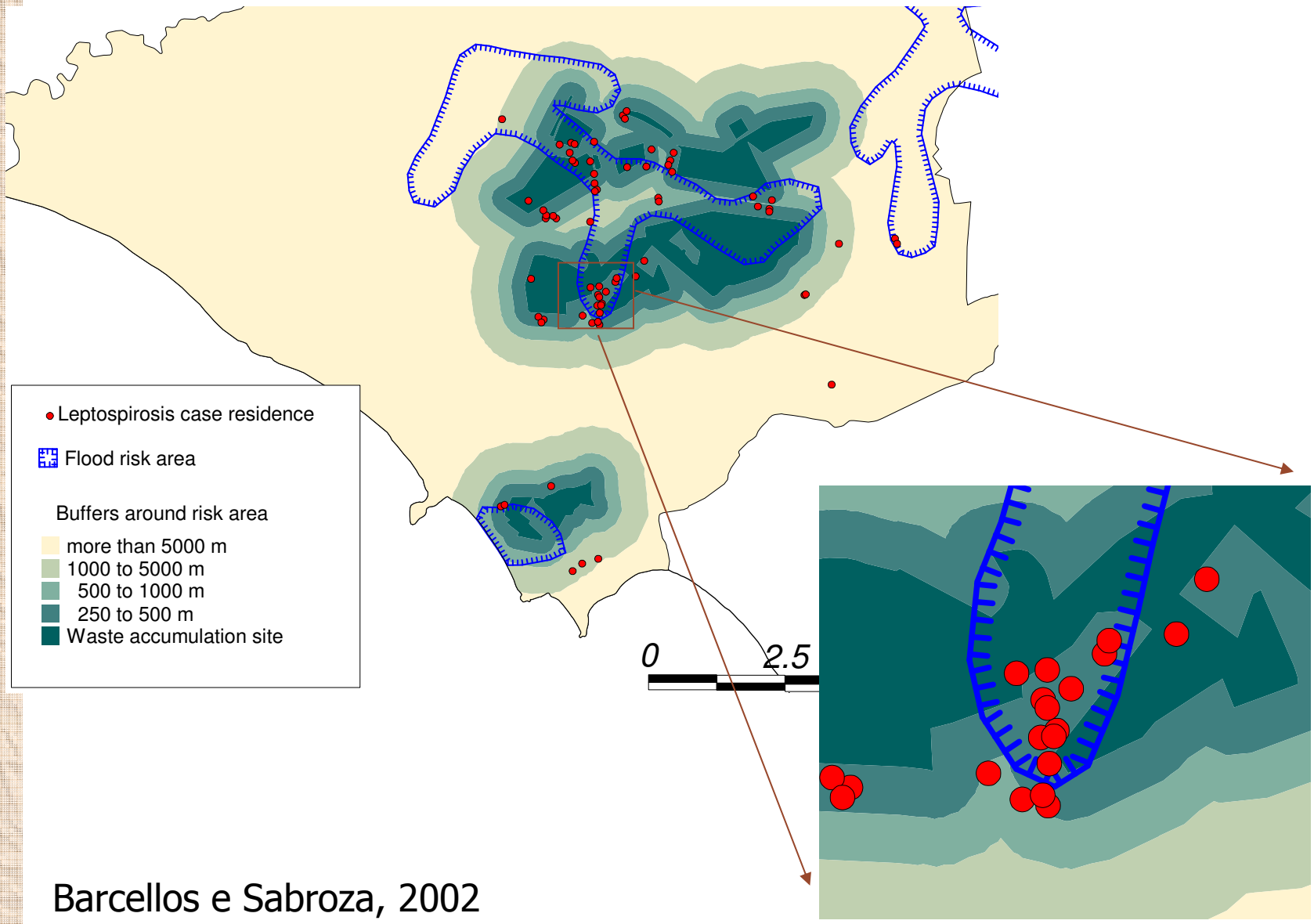
Georeferencing the data –Putting the Data into the Space

Integration



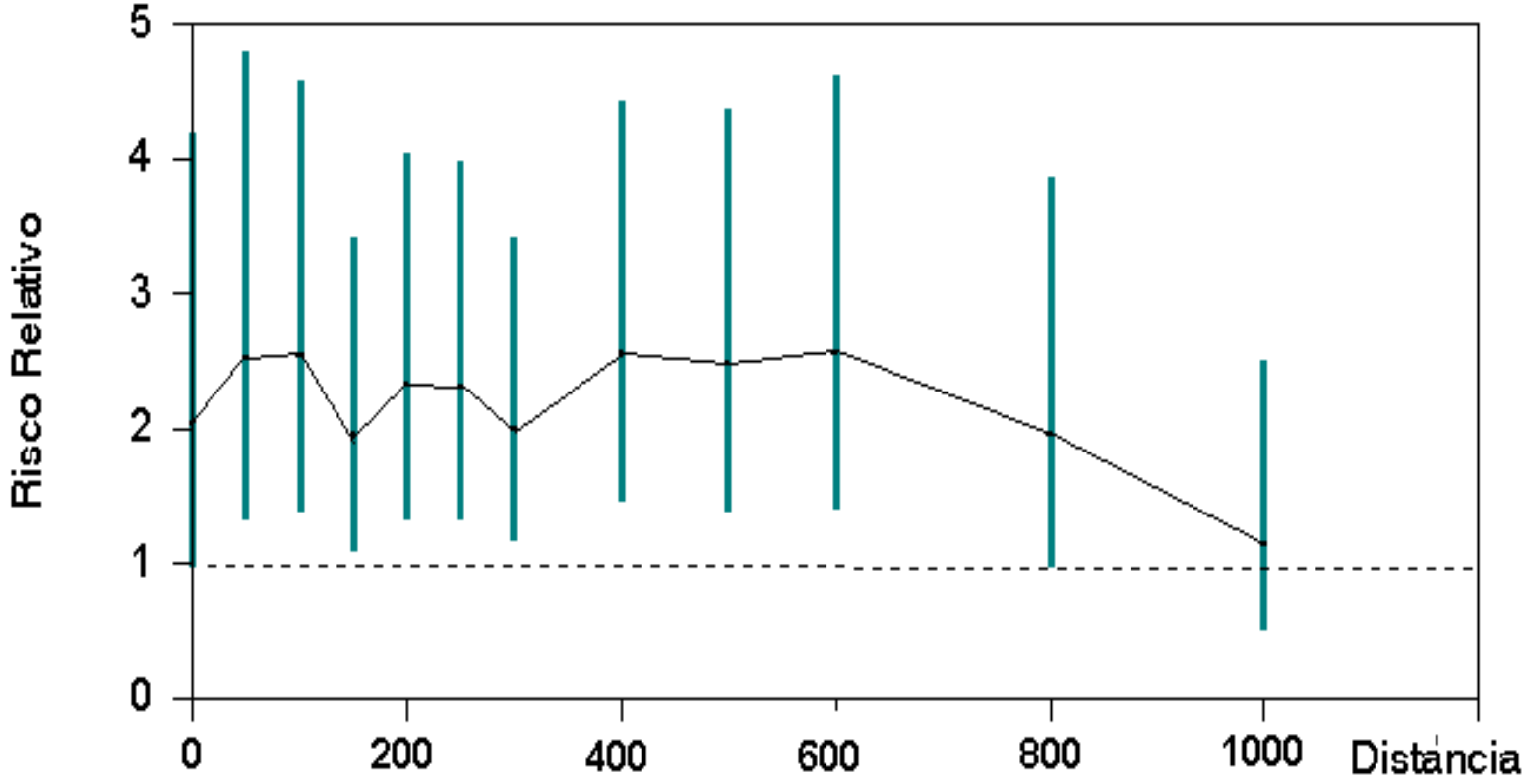
Census Tract (IBGE)

Leptospirosis, flooding and waste accumulation

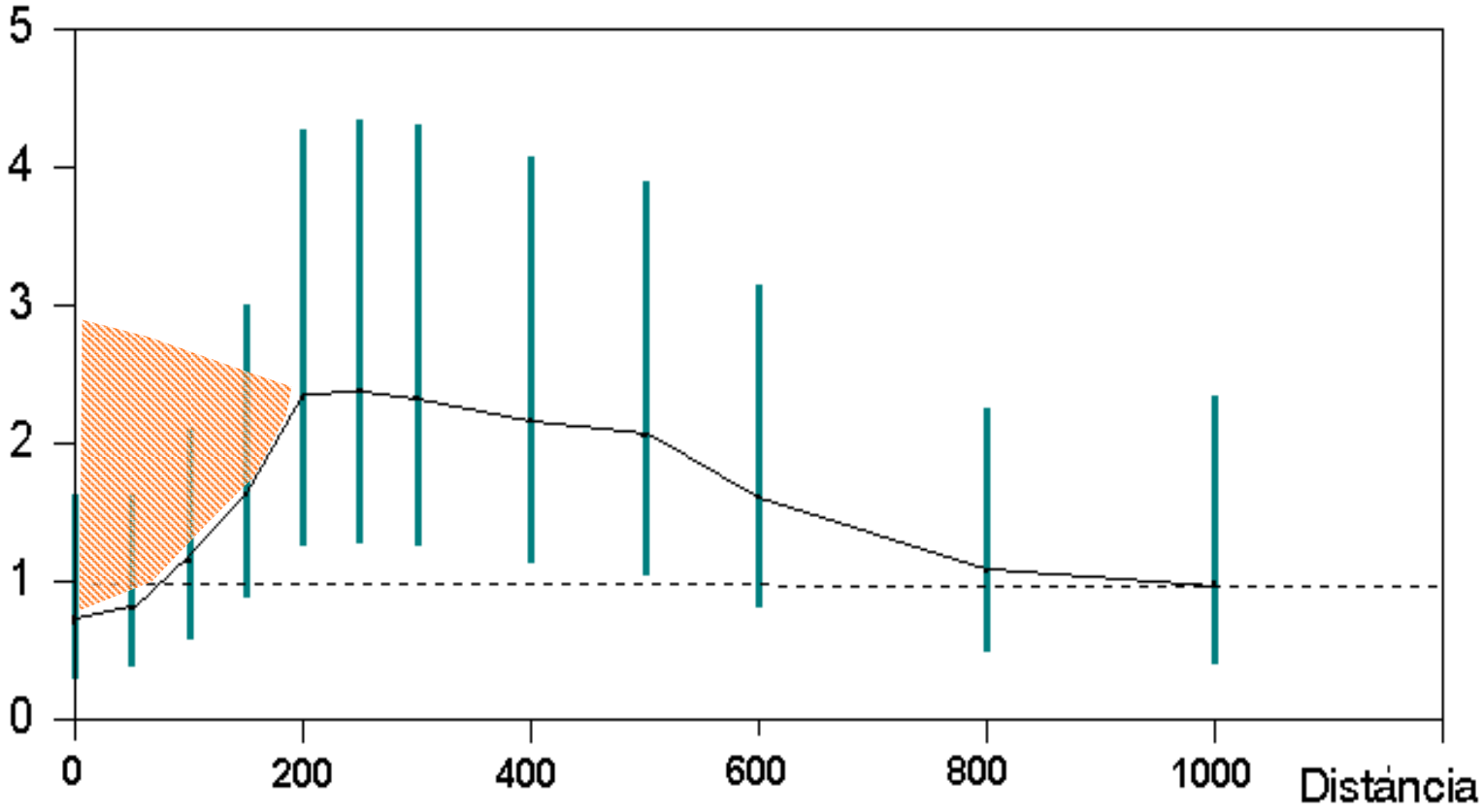


Barcellos e Sabroza, 2002

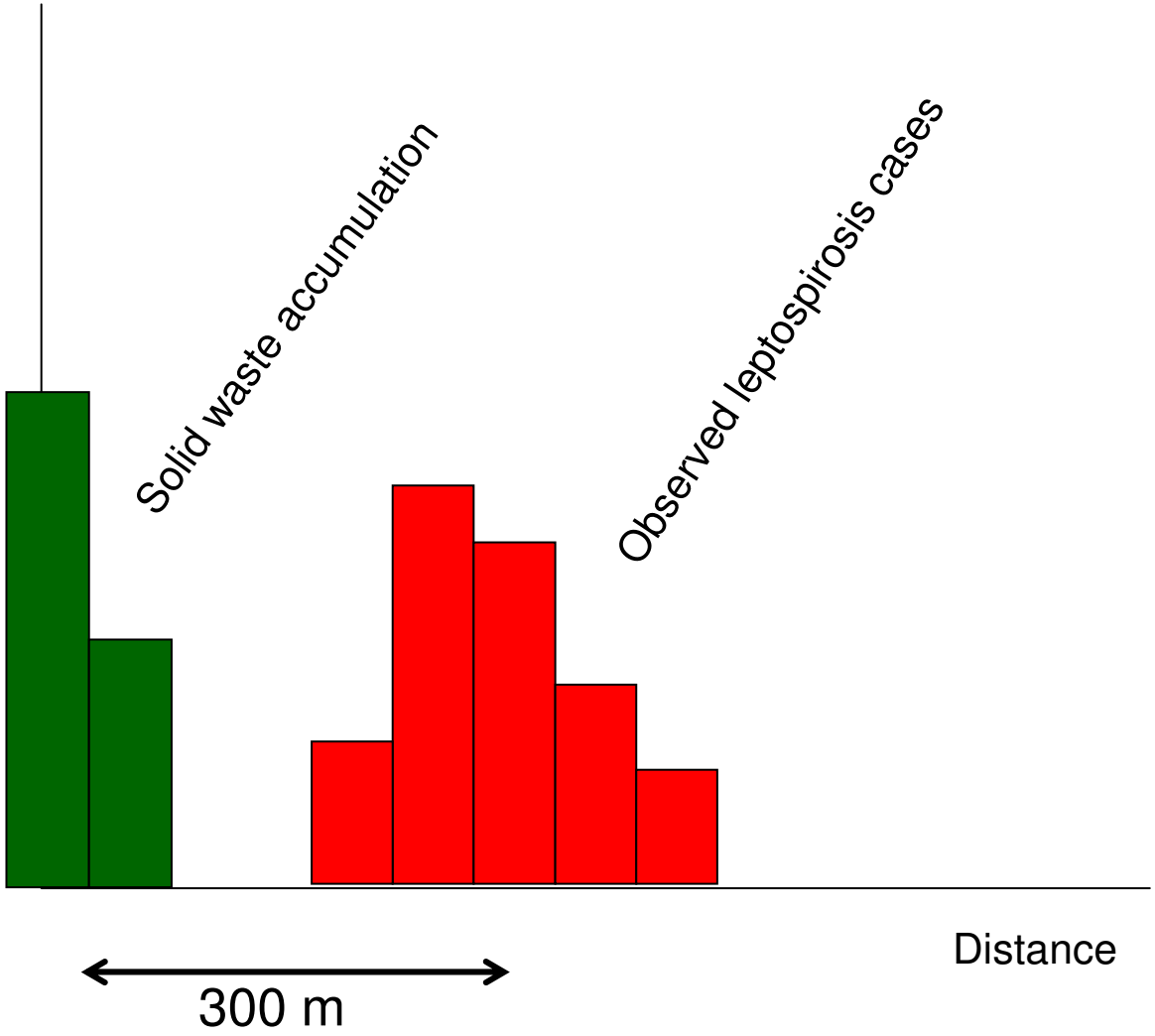
Relative risk of census tracts as a function of the distance to flooded area



Relative risk of census tracts as a function of the distance to waste accumulation sites



The distance between incidence and disease foci

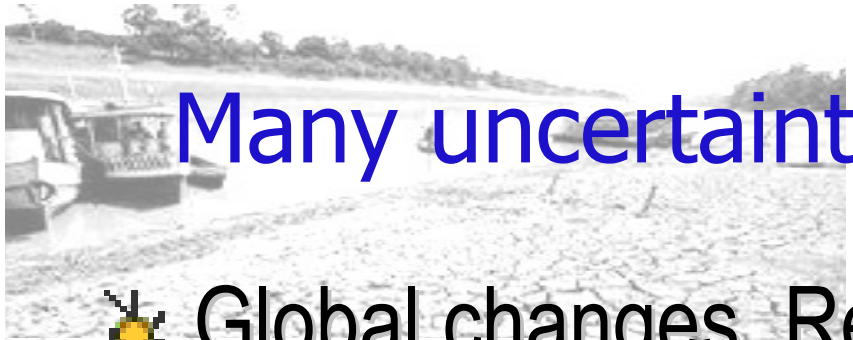
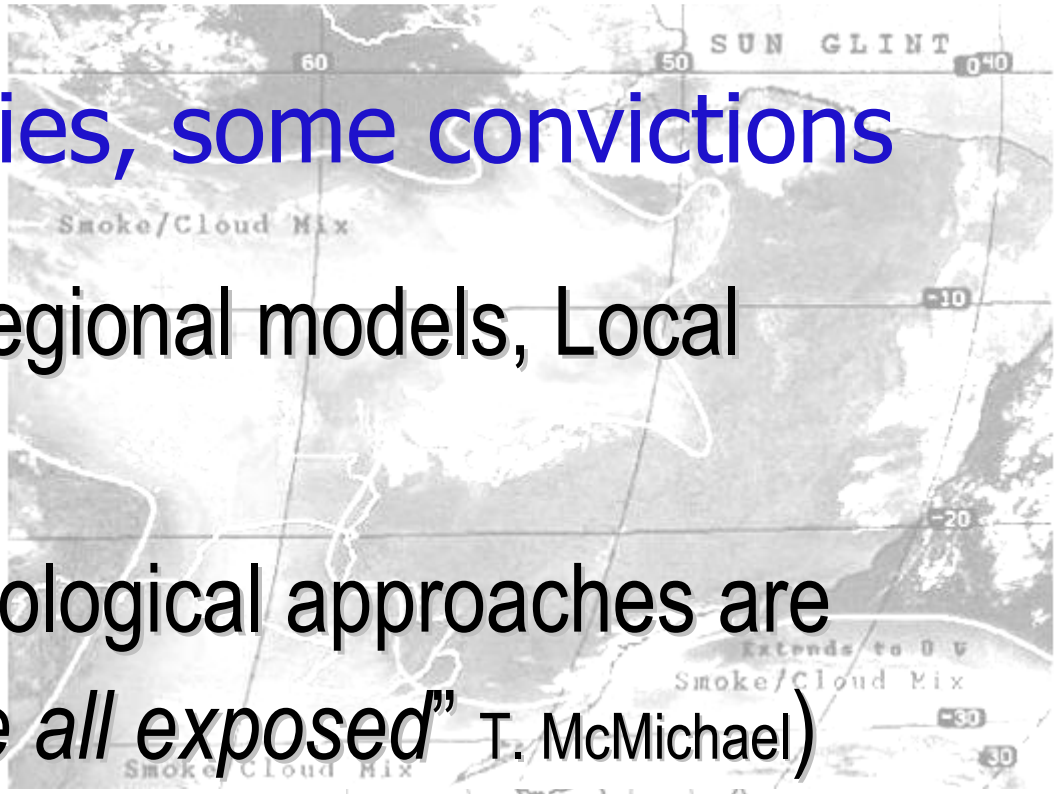


The lessons from the flooding

- The variability is inherent of complex systems, which can be disrupted by external or internal disturbances
- The technical systems have large coverage but are more vulnerable to extreme events
- The vulnerability is bigger amongst the poor and socially excluded groups (usually excluded from the technical systems)
- However, the richest ones are not out-of-risk, on the contrary, their response capacity is immunological and socially lower than the other group.

Many uncertainties, some convictions

- Global changes, Regional models, Local responses
- Traditional epidemiological approaches are insufficient ("*We are all exposed*" T. McMichael)
- Climate change and social inequalities are not competing agendas

Obrigado
Gracias
Thank you
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