Global spatial data for
Exposure Modeling
in the context of
the development of
Country Disaster Risk Profiles
(CDRPs)

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Why are we working on this?

- Lack of quantitative (and reliable) information on disaster risk, available at the country level
- Lack of an open and transparent methodology to develop disaster risk profiles

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What are we developing?

- Development of an consistent methodology for exposure modeling using openly available information
  - ! Being broad-scale in the approach but highly adaptive and flexible
    → Using highest quality data where available
- Based on existent developments, building of an open tool for country disaster risk profiles (implemented in CAPRA environment)
- Development of an harmonized set of CDRPs for LAC, with a vision of expanding…

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Scalability
Generalization
Resampling…

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Antigua & Barbuda

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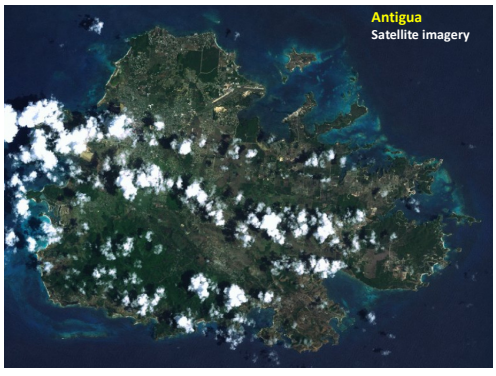
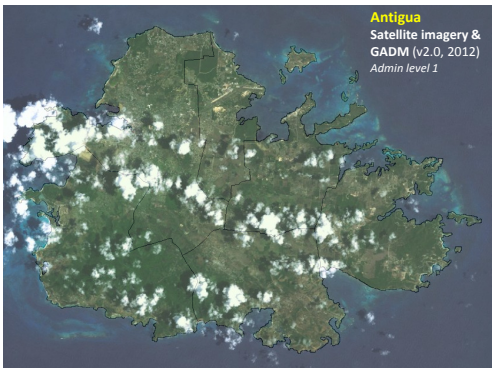
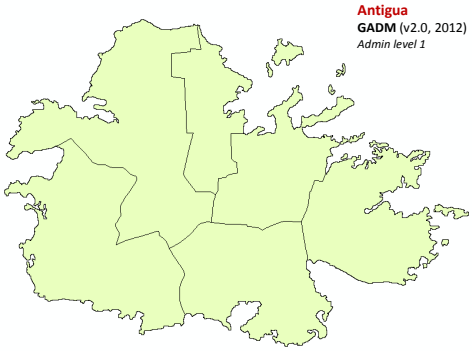
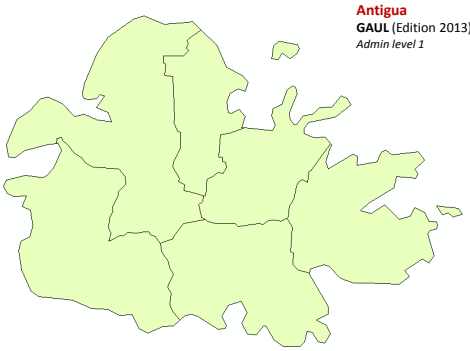
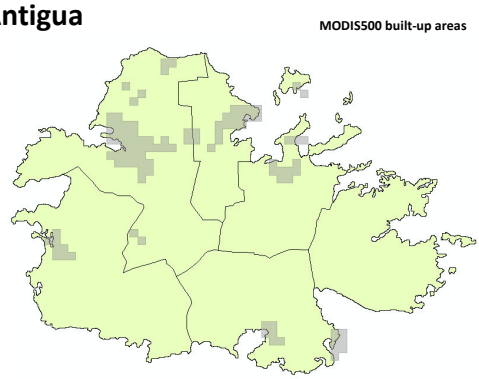


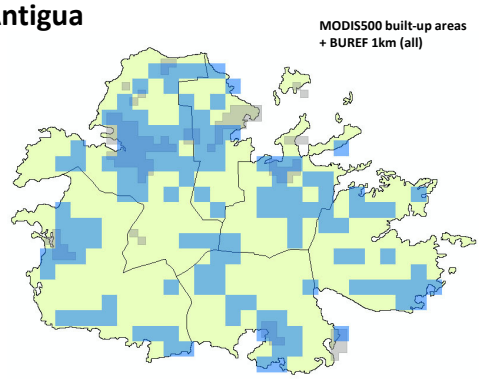


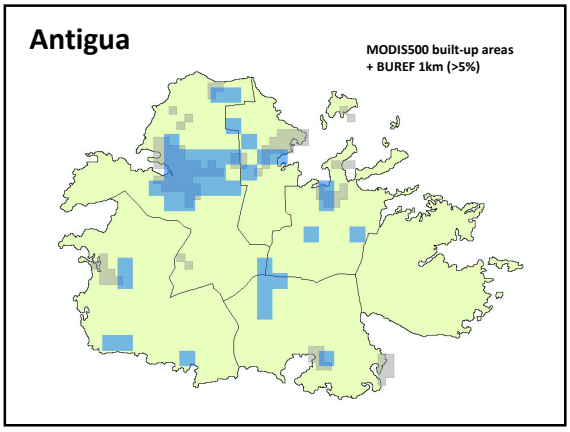


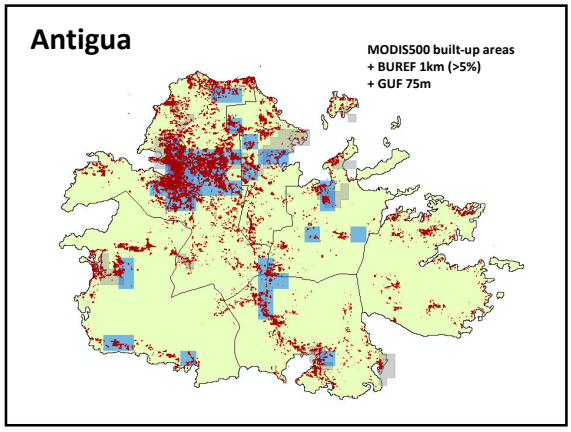


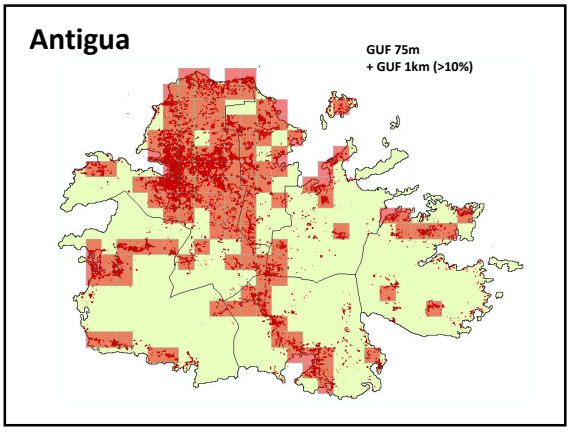
The "urban" issue

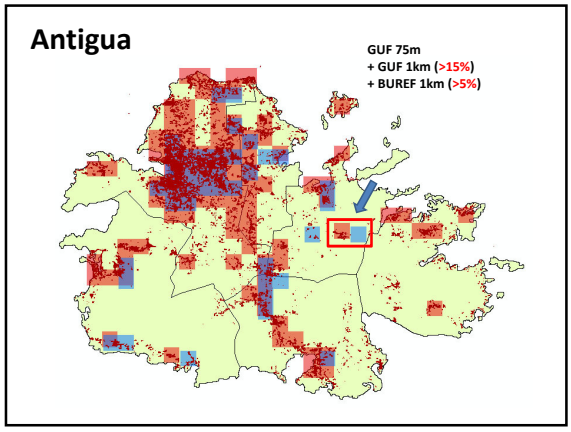


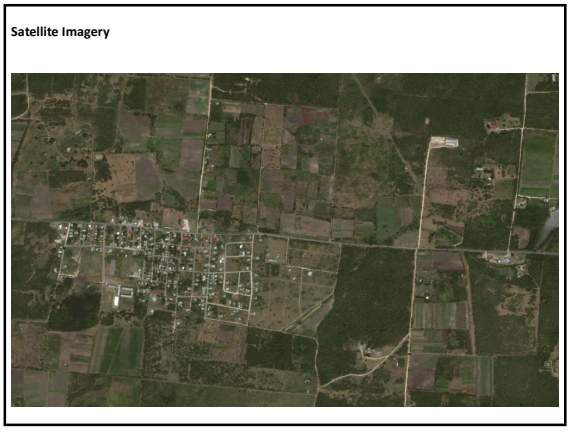


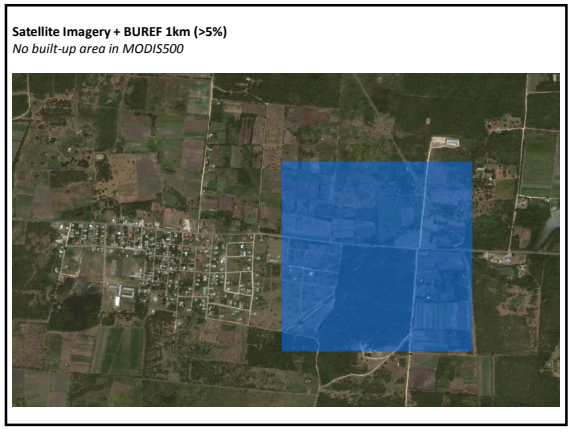

Antigua
MODIS500 built-up areas
+ BUREF 1km (>5%)


Antigua
MODIS500 built-up areas
+ BUREF 1km (>5%)
+ GUF 75m

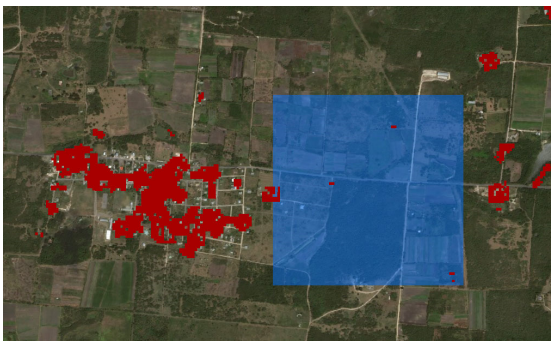

Antigua
GUF 75m
+ GUF 1km (>10%)


Antigua
GUF 75m
+ GUF 1km (>15%)
+ BUREF 1km (>5%)

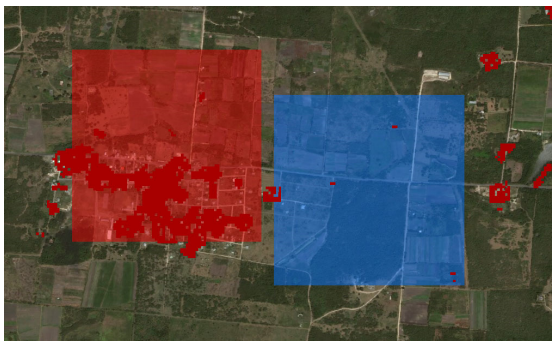

Satellite Imagery


Satellite Imagery + BUREF 1km (>5%)
No built-up area in MODIS500

Satellite Imagery + BUREF 1km (>5%) + GUF 75m
No built-up area in MODIS500



Satellite Imagery + BUREF 1km (>5%) + GUF 75m + GUF 1km (>15%)
No built-up area in MODIS500



Satellite Imagery + BUREF 1km (>5%) + LandScan2012
Explanation for the BUREF detection; LandScan model 'bug'

Context

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A glimpse at the Exposure Model

- It is a transparent, accessible and robust exposure model employing a top down approach, to be used in national level catastrophic risk profiling.
- It is run on a country-by-country basis. Although it uses global datasets, it has flexibility to integrate higher resolution and country-specific data and provide a measure of confidence.
- The model makes use of global population, built-up, infrastructure, impervious surface area, census data, housing/building data, macroeconomic datasets which are (or are envisaged to be in the future) largely available in the public domain.

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A glimpse at the Exposure Model

- 3 main phases
  - Disaggregation component
  - Building typology / vulnerability component
  - Asset value determination

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Integration

Panama

Administrative unit-based sub-national data

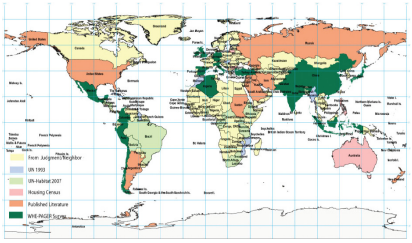
Panama: 2010 housing and population census

	Housing Units (5/2010)	Popul. (5/2010)	p/house	Housing Units (%)	Popul. (%)
BOCAS DEL TORO	28,948	121,952	4.21	2.7%	3.7%
COCLÉ	72,840	228,676	3.14	6.9%	6.9%
COLÓN	73,445	232,748	3.17	7.0%	7.0%
CHIRIQUÍ	134,033	409,821	3.06	12.7%	12.3%
DARIÉN	15,310	46,951	3.07	1.4%	1.4%
HERRERA	39,861	107,911	2.71	3.8%	3.2%
LOS SANTOS	38,999	88,487	2.27	3.7%	2.7%
PANAMÁ	537,666	1,663,913	3.09	50.9%	50.1%
VERAGUAS	74,092	226,641	3.06	7.0%	6.8%
COMARCA KUNA YALA	5,662	31,577	5.58	0.5%	1.0%
COMARCA EMBERÁ	2,411	9,544	3.96	0.2%	0.3%
COMARCA NGÖBE BUGLÉ	32,941	154,355	4.69	3.1%	4.6%
Panama	**1,056,208**	**3,322,576**	**3.15**	**100.0%**	**100.0%**

The "urban" issue

- Urban/Rural split in census
  - On administrative level, the population is 'split' in an **urban share** and a **rural share**

Building typology distribution – PAGER and PAGER 2.0 (USGS)



Building typology distribution – PAGER and PAGER 2.0 (USGS)

- PAGER uses such splits (at country-level) and refines it building type-specifically (share of people per structure type)
  - Another additional distinction is made between residential and non-residential
- In the LAC-focused CDRP efforts we are currently collecting/updating/refining in order to come up with improved relative distributions of building types
  - In parallel hazard-specific vulnerability schemes are created for those building types

The "urban" issue

Are we talking about
defining

Urban vs. **Rural**

or

Urban & **Rural**

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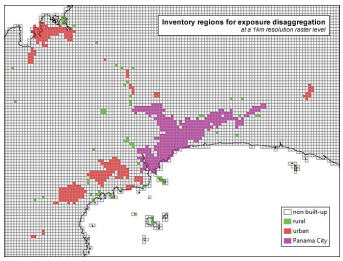
Inventory regions - basic



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Urban & Rural

- Rural area is **not irrelevant** for many applications and contexts!
  - Just defining it as "**the rest**" may not be reasonable
  - In particular in an **exposure** context, **built-up** is considered the most significant proxy for asset value determination
  - **Built-up ≠ urban** → split built-up in urban and rural
- In Panama, according to census 2010, around 1/3 of the population is 'allocated' to rural areas

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Urban & Rural

- Challenge for the 'data community'
  - When identifying the population within pre-identified **urban-built-up** and **rural-built-up** areas, it becomes obvious that urban population is pretty well-covered/captured, but **rural population is vastly under-captured** (Panama → 95%!)
    - This clearly depends on many influencing factors incl. the initial selection and subsequent classification of built-up

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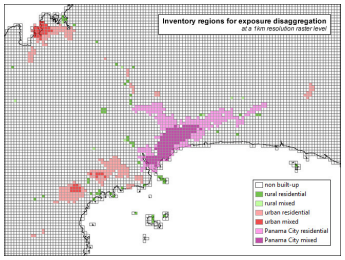
Inventory regions - refined



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Integration step x

- Unit costs of construction
  - In line with the above-shown building-type-specifics we are compiling a database of **unit costs (US$/m²)** for building types
    - Obviously varying by country
    - Additionally varying by inventory region
    - Additionally varying by occupancy type (res. vs. non-res.)
  - As an example:
    - C-type single-family building in an urban residential area 600 US$/m²
    - Average size 75m² → 45,000 US$

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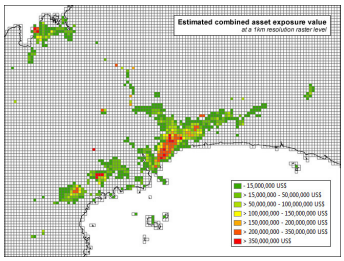
Combined asset exposure grid



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Urban & Rural

- Challenge for the 'DRM community'
  - When identifying the population within pre-identified **urban-built-up** and **rural-built-up** areas, it becomes obvious that urban population is pretty well-covered/captured, but **rural population is vastly under-captured** (Panama → 95%!)
  - When directly applying **population density patterns** (from available global population datasets) as proxy measure for the **distribution of exposed values**, in rural areas we would miss out on 10 billion US$ (Panama example)

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Some related issues
Joint work with WB-DEC

- Updated GDP per sq. km methodology
  - updated and additional datasets
  - new methodology
  - consistency with disaggregation approach
- Physical stock model
  - methodology being developed
  - correlation to GDP
  - potential for other applications

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Thanks for your attention!

Questions?

C. Aubrecht, R. Gunasekera, O. Ishizawa
& the CDRP team

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Disclaimer | Work-in-progress

- *The presented examples are taken from a study that is work-in-progress*
- *All given estimations and results are preliminary*
- *These slides should be treated confidentially and are not to be shared without prior agreement of the LCSDU CDRP team (contact caubrecht@worldbank.org)*

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