



Implications of detailed settlement information for global asset exposure modeling

Experiences from the WB Country Disaster Risk Profiles initiative in Central America

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Social, Urban, Rural & Resilience (GP-SURR)



Context – Exposure and risk

“Disaster management is an inherently spatial problem”

(Quote by Michael F. Goodchild, 2005)



Crichton's Risk Triangle (1999)



Exposure and risk – What else & how?

The diagram illustrates the relationship between a hurricane and the assets it affects. A blue circle labeled 'hurricane' is shown moving along a dashed red line labeled 'path'. An arrow labeled 'Winds Speeds' points from the hurricane towards a grey shaded area representing the 'Affected inventory' of assets. The 'Track' of the hurricane is shown as a dashed red line passing through the affected inventory. The 'Exposure' is the area where the hurricane's path overlaps with the affected inventory. 'Vulnerabilities' are indicated by a dashed red line along the path. The World Bank Group logo is in the bottom right corner.

Image credit: G. Pita, CDRP project, 2014

Exposed assets

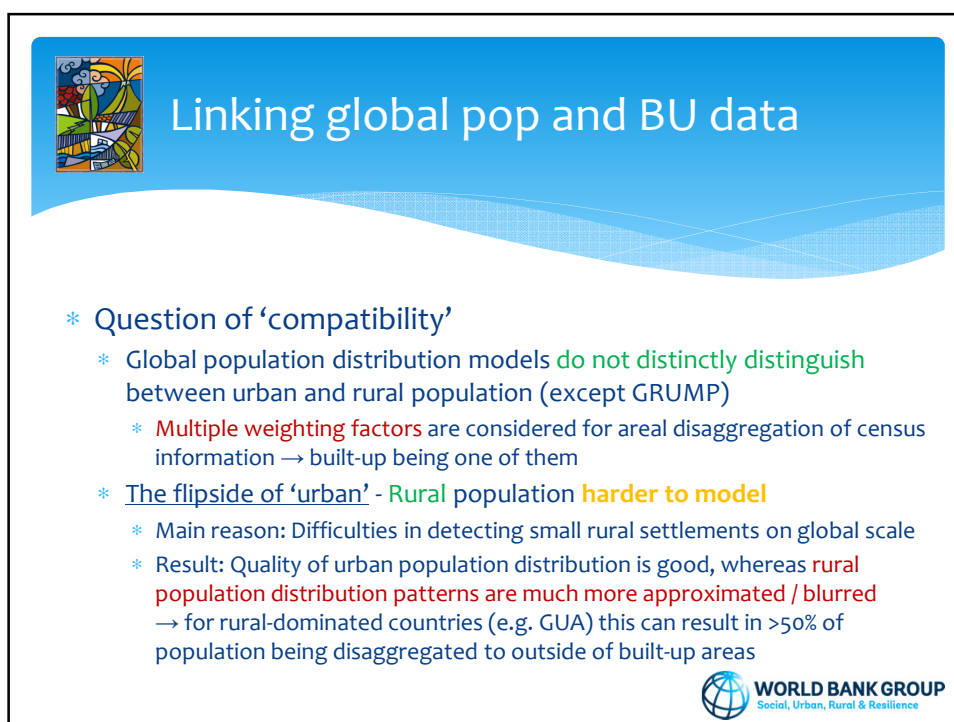
- * Focus on **building stock**
- * Therefore, **built-up area** relevant
 - * Data: Nightlights (ISA), MODIS, BUREF, GUF, GHSL, ORNL-BU^{HD}, etc.
- * Building typology distribution – associated costs of construction/replacement
 - * Data: PAGER, housing census, WB doing business reports, etc.
 - * **Global/national-level** information
- * Asset value calculation

The slide includes three small images: a row of colorful houses, a blue house under construction, and a white building under construction. The World Bank Group logo is in the bottom right corner.




Inventory regions

- * Information compiled for **inventory regions / occupancy types**
 - * Urban, rural / residential, non-residential
- * Spatial framework basis needed for proper linking
 - * What is 'urban'? → **Application-oriented** solution needed!
 - * Consider same definitions for correct link establishing
 - * National definitions of 'urban' vary
 - * Globally compiled in UN-WUP / WB-WDI ('urban' proportion of **population**)
- * Built-up area needs to be classified accordingly, thus link to population data is required



Linking global pop and BU data

- * Question of 'compatibility'
 - * Global population distribution models **do not distinctly distinguish** between urban and rural population (except GRUMP)
 - * **Multiple weighting factors** are considered for areal disaggregation of census information → built-up being one of them
 - * **The flipside of 'urban' - Rural population harder to model**
 - * Main reason: Difficulties in detecting small rural settlements on global scale
 - * Result: Quality of urban population distribution is good, whereas **rural population distribution patterns are much more approximated / blurred** → for rural-dominated countries (e.g. GUA) this can result in >50% of population being disaggregated to outside of built-up areas



Linking global pop and BU data

- * Illustrating the 'rural' issue
 - * Evaluation of sub-national urban-proportion information (GUA & PAN example) and cross-check with the population allocation within pre-identified **built-up** areas (GUF)
 - * Confirmation: **Urban population is well-covered/captured, but rural population is vastly under-captured**

Guatemala

Panama

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Linking global pop and BU data

GMR 2013 Rural-Urban Dynamics and the Millennium Development Goals

Rural Urban



Image credit: WB, GMR 2013

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Linking global pop and BU data

- * Addressing the 'rural' issue
 - * With higher-resolution built-up area data / settlement info becoming available, rural population can be modeled much more accurately
 - * First tests confirm that (GUF in WorldPop for Guatemala)
 - * However, there will still be a certain share of population distributed outside of built-up
 - * For a variety of reasons: to keep error residuals low, etc.
 - * As for linking built-up to building stock info population data is needed as proxy, all the population needs to be allocated within built-up
 - * Novel CDRP population reallocation model approach
 - * Moving from 'urban vs. rural' to 'urban & rural'

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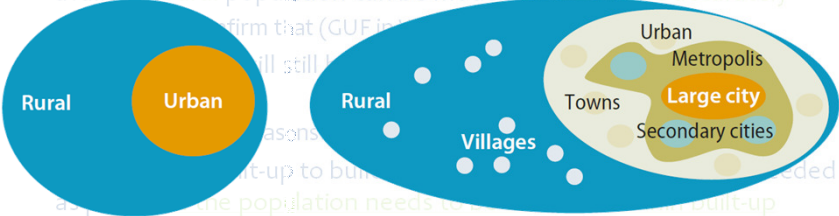

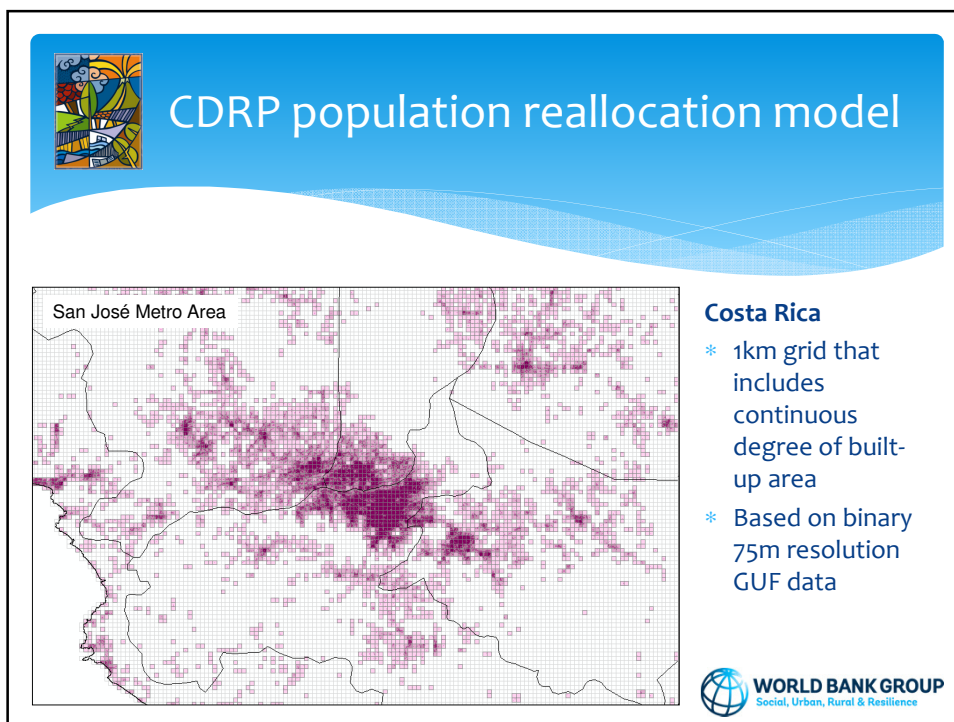
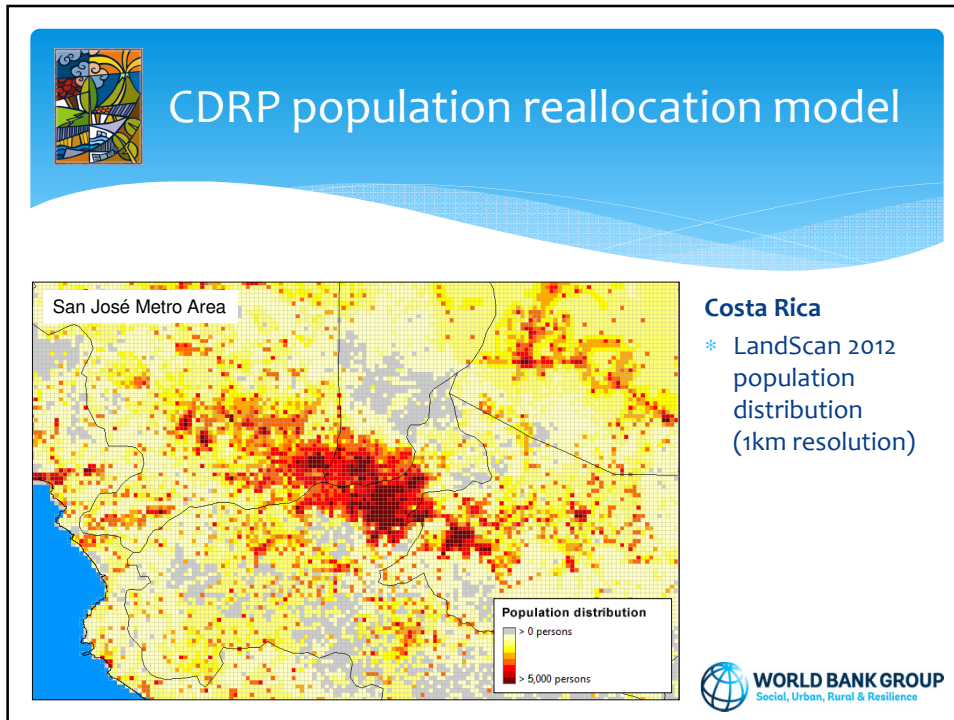
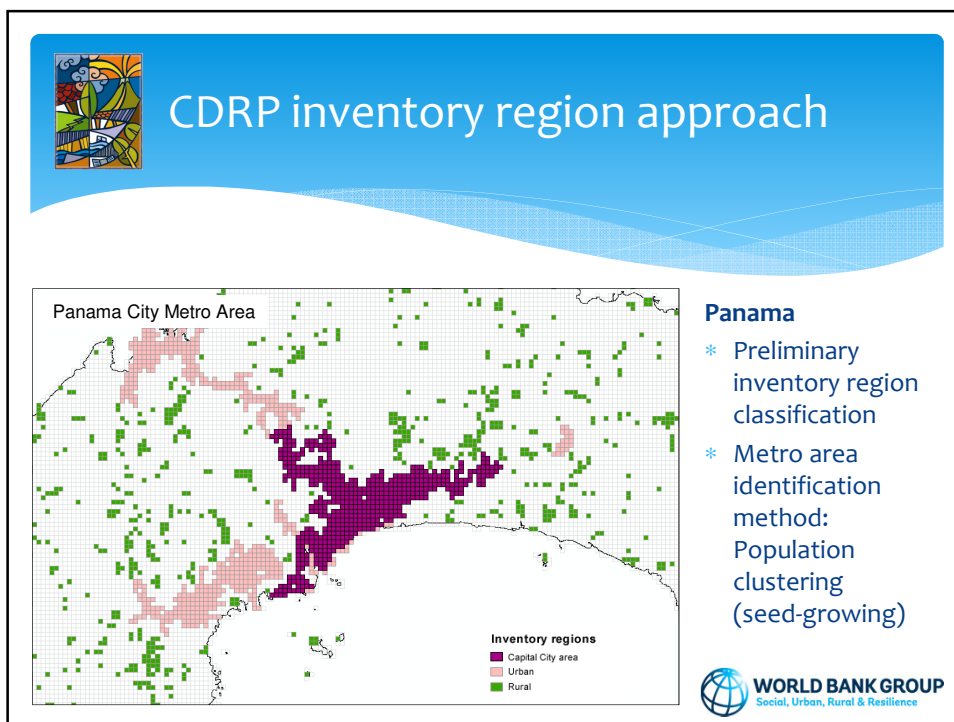
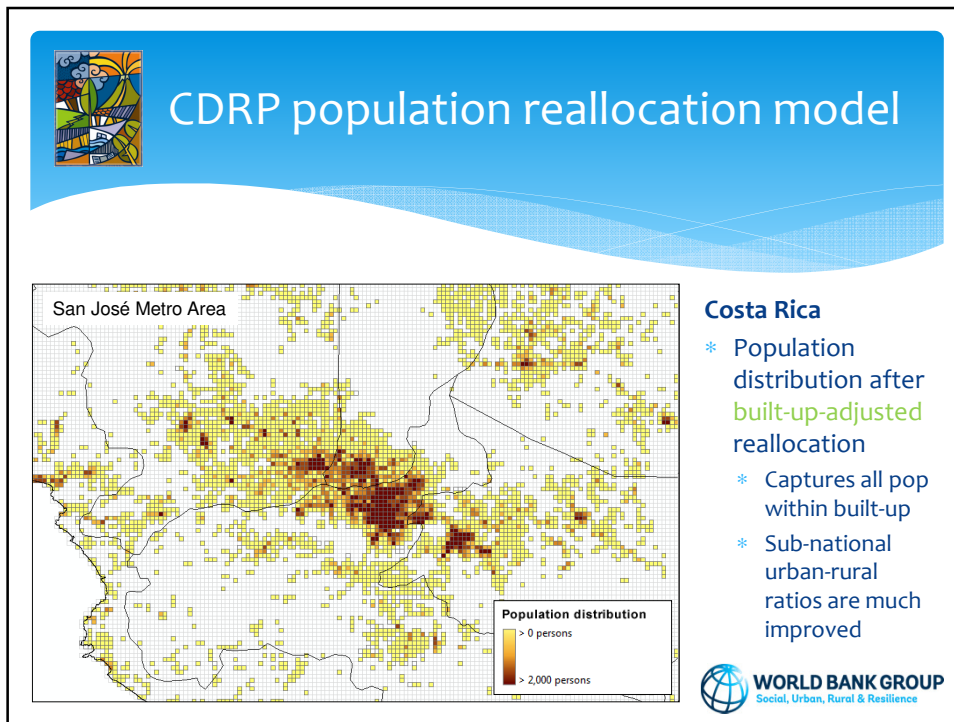
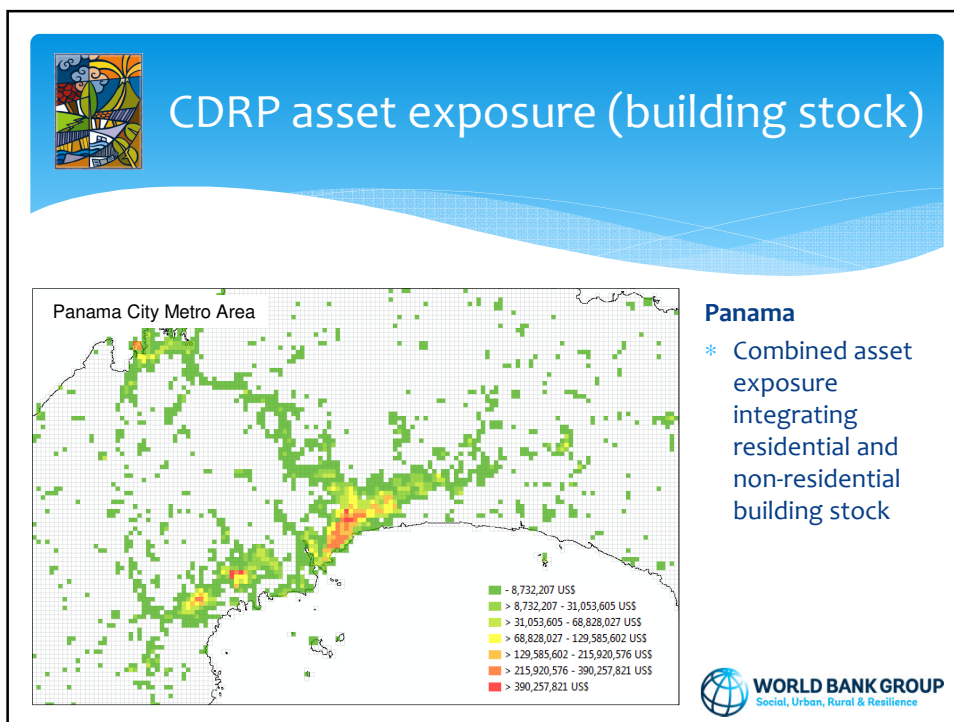
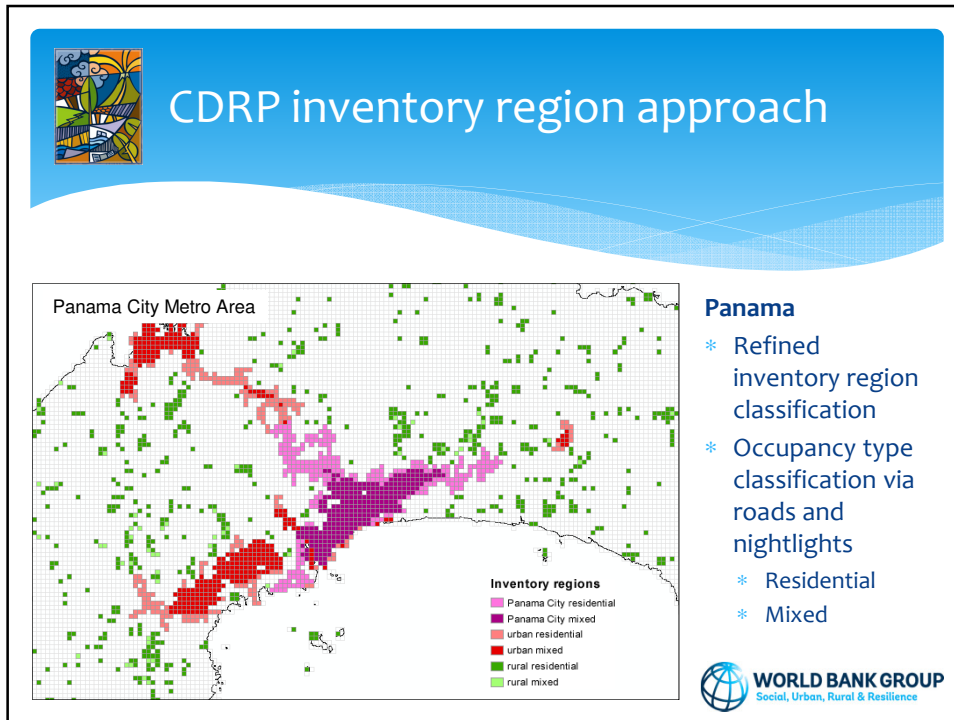
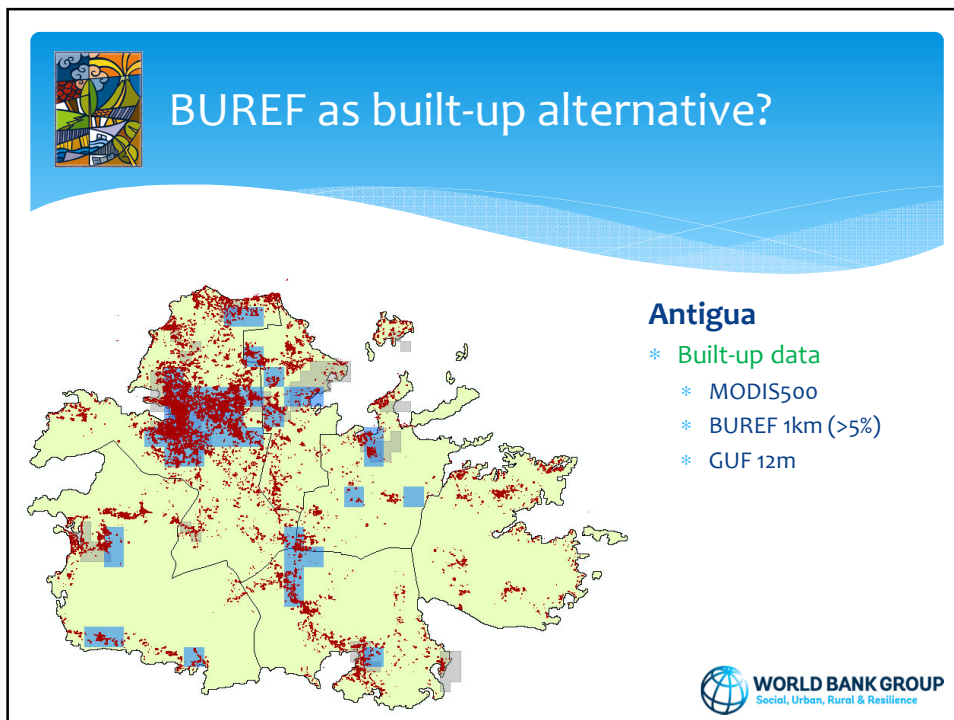
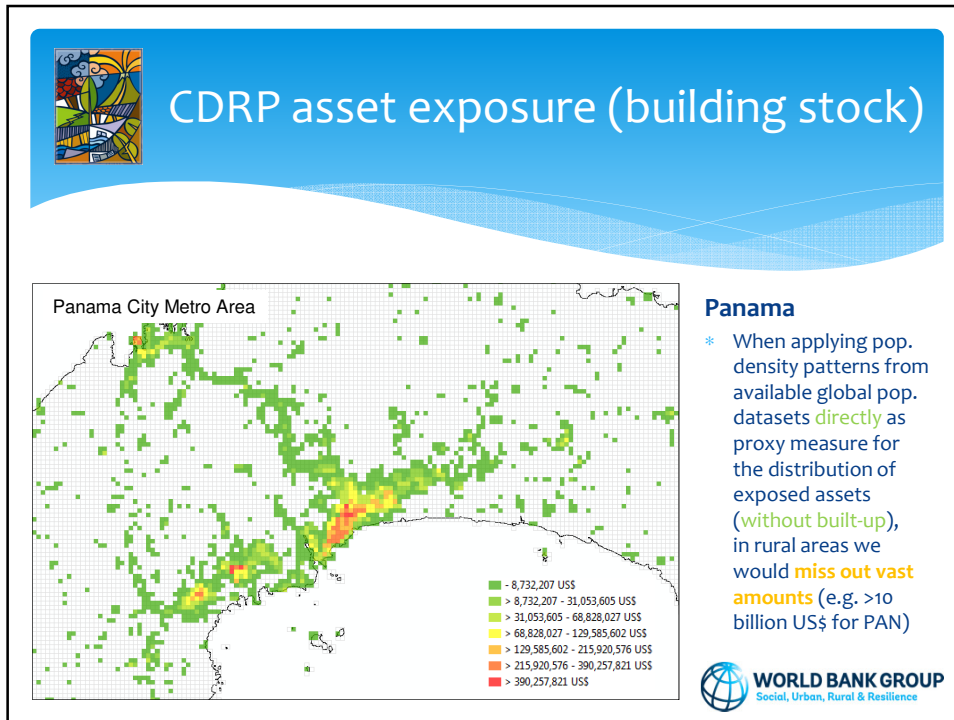




Image credit: WB, GMR 2013













 BUREF as built-up alternative?

Antigua



 

* GUF 12m binary * BUREF 1km continuous (%)


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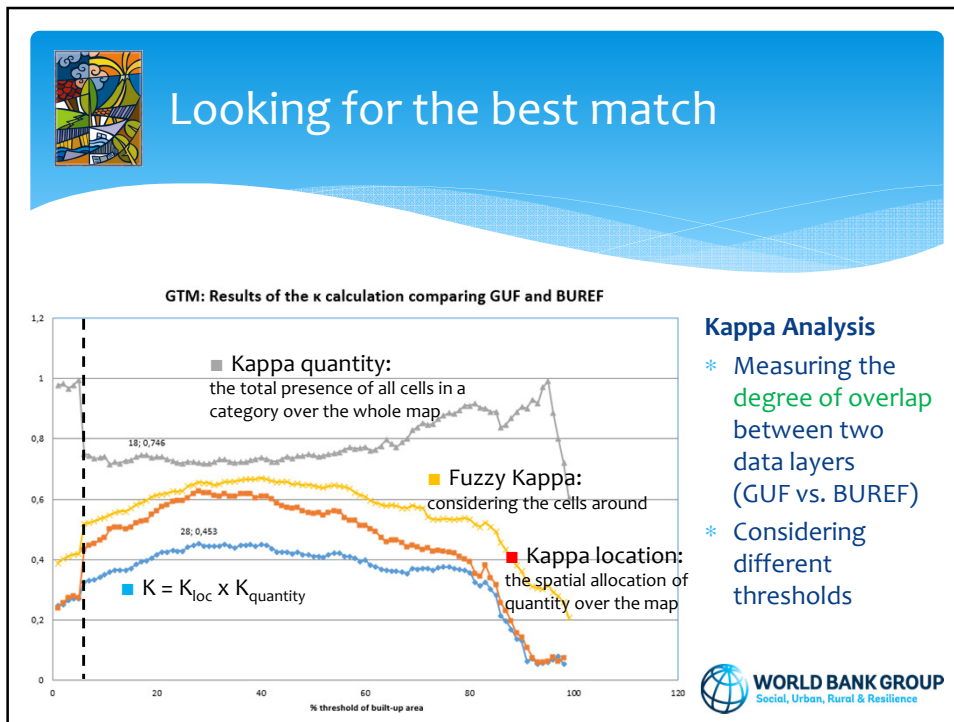
 BUREF as built-up alternative?

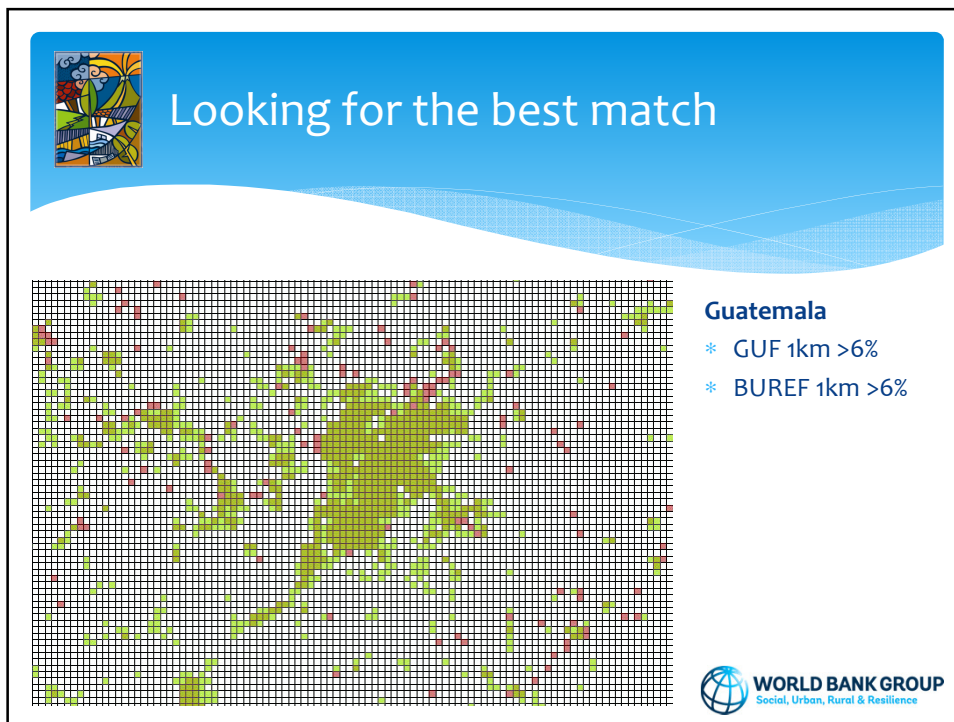
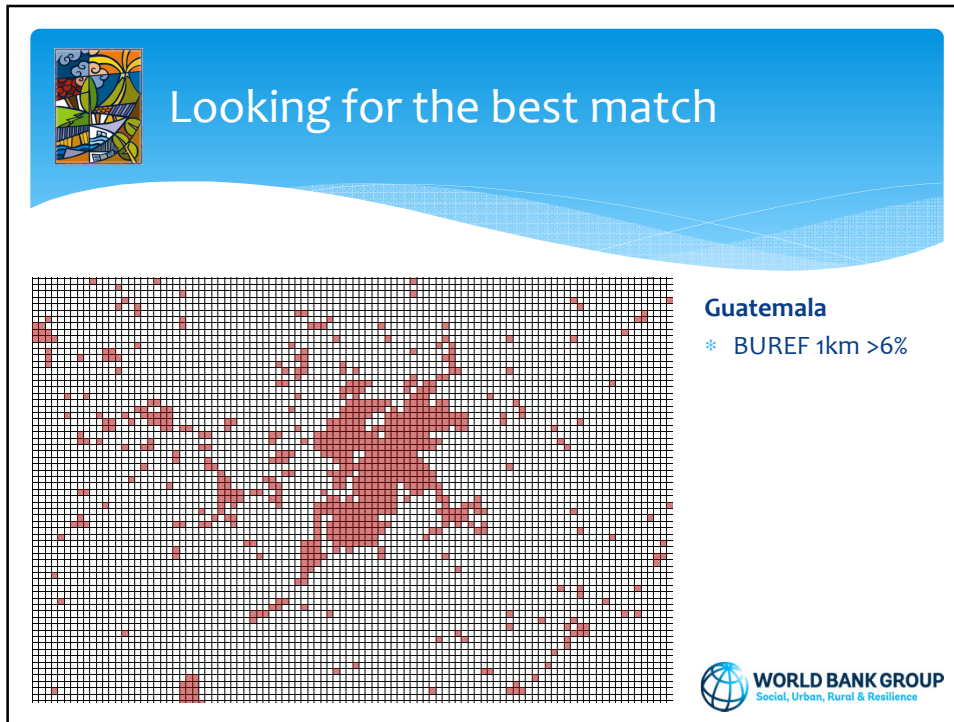
Antigua


 

* GUF 1km continuous (%)
* Aggregated & normalized * BUREF 1km continuous (%)

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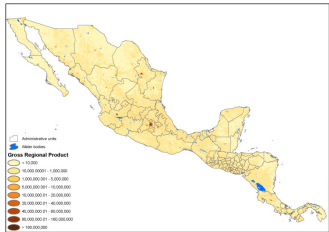






Potential application

- * For applications where **exclusive focus on buildings is not absolutely necessary**, e.g. economic exposure (gridded GDP)
- * 'Urban vs. rural' instead of 'urban & rural'
- * Use BUREF in combination with LandScan as proxy for urban thresholding



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Thanks for your attention!

Questions?

Christoph Aubrecht
& the CDRP team



IT'S A MODERN MAP... ALL THOSE TRADITIONAL GRIDS AND STRAIGHT LINES ARE BORING.



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