Responsible Land Governance:
Towards an Evidence Based Approach
Annual World Bank Conference on Land and Poverty
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UNDERSTANDING THE URBAN STORY USING EARTH OBSERVATION

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Abstract:

Focus of the presentation is set to present ways on how Earth Observation can be applied as suitable measure to understand the logic of urban agglomerations as first step towards sustainable urban planning. It can act as a cost effective baseline information to guide urban development and reduce risks to the people by considering the environmental characteristics in a multi-thematic and way considering the past.

Focus is set to increase understanding of the users needs and raise discussion in order to apply services more precisely and transport benefits of Earth Observation Services.

Examples will be shown on selected metropolitan areas and how they were applied to benefit local needs.

Key Words:

Earth Observation, Urban Atlas, Urban Change, Urban Planning

Introduction

Addressing the fact that urban agglomerations are home for more than 50% of the world's population, rapid growth happens contraire to sustainable city management. [UN 2014] First step to urban controlling and development is analysis of actual status, recent development in combination with understanding the characteristic circumstances that course the individual/ typical behavior of the city. This is the first step to all kind of planning activities and generation of statistical analysis.

This paper will show how Earth Observation Baseline Service are designed and an essential value to support the understanding of the multi-parametric 'equations' of the urban agglomerations tailored to the needs of stakeholders and local users.

With respect to the natural circumstances, the political and cultural frame urban development results in different characteristics, but following comparable logic. It is a severe challenge for local authorities to push forward sustainable planning and land management. – It demands reliable, up-to-date reference information, homogeneous over a larger area.

Managing the Urban Environment

Identifying the strengths and weaknesses of the cities in general as well as within is essential to open-up ideas for initiatives towards providing sustainable urban regions on the overall goal towards contributing the Resilient City. Numerous factors need to be considered, understood at different scale and their status mapped in order to feed and enliven the urban model. It is an elementary step for improvement and optimization of the metropoles within the objective of making the cities a better place to live.

It is obvious that the overall urban picture of a city can hardly be seen as autonomous, but is significantly shaped by its actual extent and distribution, historical aspects, the overall geo-spatial location and circumstances, combined with economic and socio-economic factors (Figure 1). They are very complex in structure and origin and require information of broader scale (and large extend) in combination with high detail (and discriminatory extend).

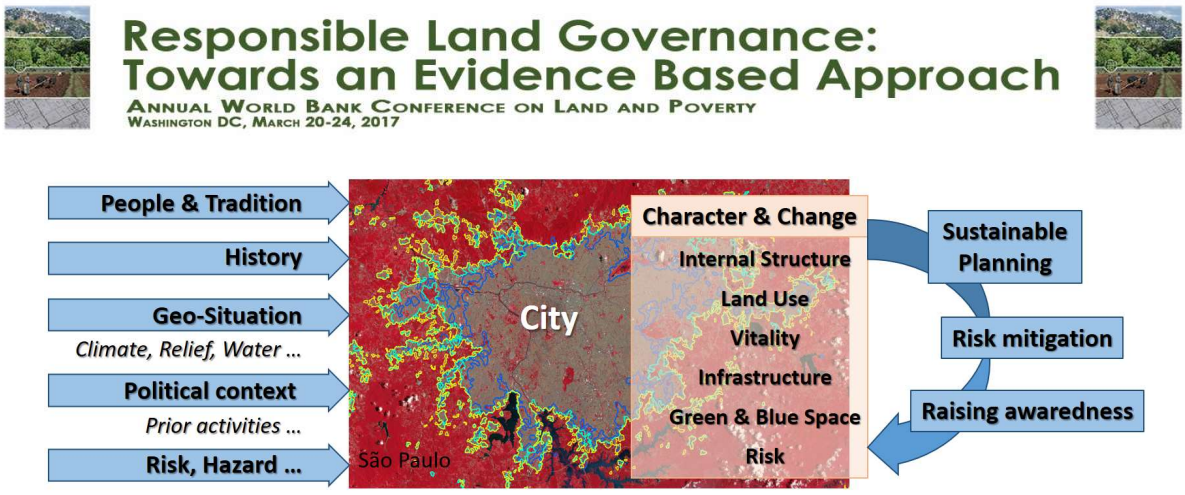

Figure1: influences and internal characteristics of a changing city

There is a geo-spatial competition between geodata of lower spatial resolution and such presenting very high detail. In general both represent different extend, thematic detail as well as actuality at comparable costs and have direct effect on the modelling baseline to be set-up. The ***Urban Atlas*** concept, providing such baseline with very high thematic detail proves to be suitable and highly flexible within this context using medium resolution data (2.5-10m). At comparably low costs status of urban structures get identified and separately mapped according to function, cover and use. Less and high densely populated sectors are spatially extracted in combination with related infrastructure – essential for analysis focusing on population related spatial distribution.

There is no simple one-dimensional solution to this topic, it requires a multi-layered and multi-dimensional approach, developed by a multi-disciplinary team of EO experts, urban and environmental planners, education and communication specialists co-developed and co-designed in close collaboration with relevant stakeholders. The presentation will provide some thoughts and essential issues that need to be considered and how this this exciting, multi-faceted challenge can benefit from EO data, which is not yet applied adequately.

Supporting the Urban Development towards Sustainability

To achieve the overarching goal of providing up-to-date and sustainable planning we need to understand the complexity, show what is possible at suitable costs, enable the decision making sector to understand and support the use of geodata by preparing simple and , cost effective tools (products) and services.

Besides looking into the urban extent itself, the surrounding features can be significantly responsible for the urban situation and need to be considered. This interdependency increases the larger and faster the urban agglomeration develops and is often responsible for major risks the local population has to face.

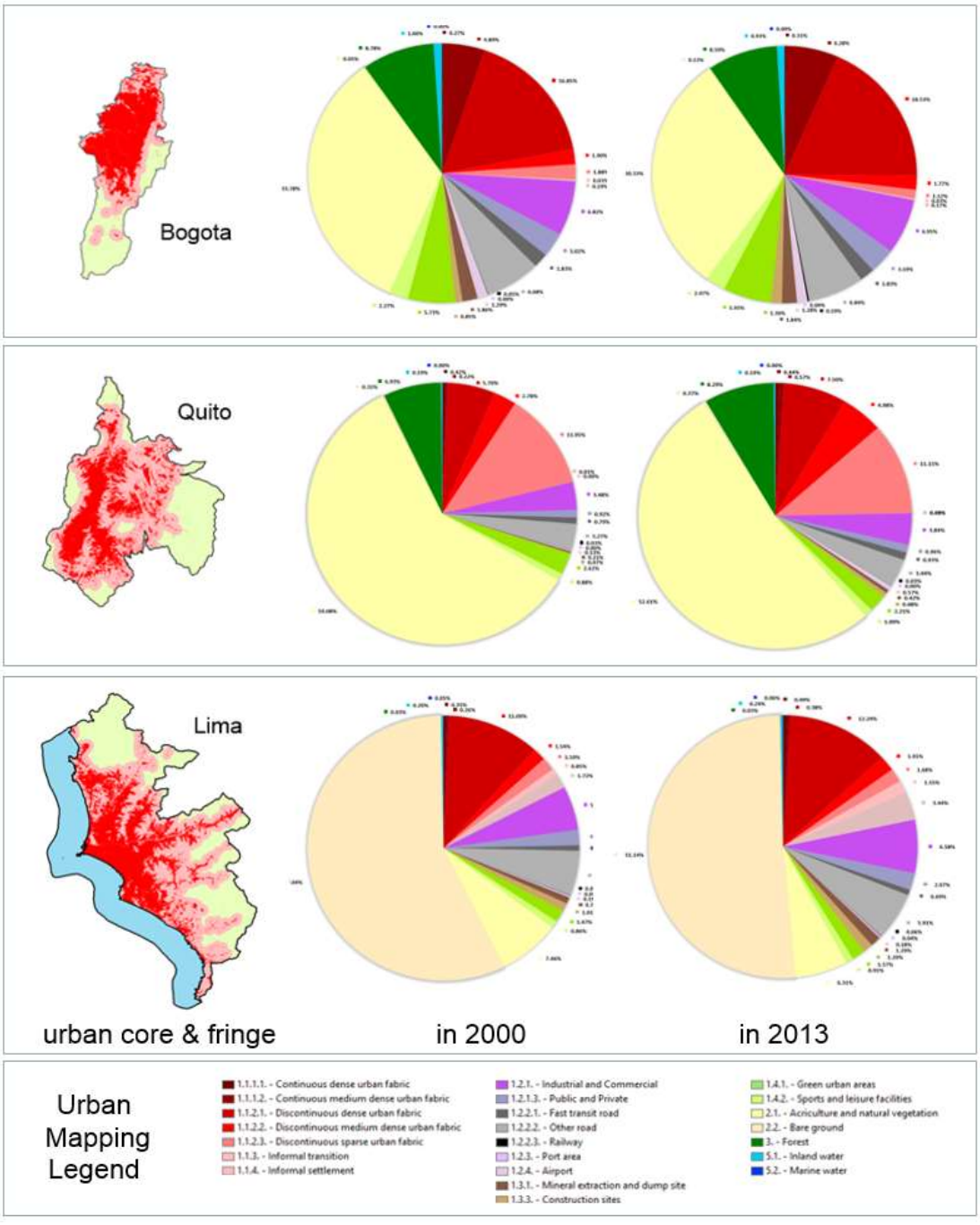

Figure 2: Example on distribution of classes (Urban Atlas)

Based on a selection of preferably South American cities, it will be shown how satellite imagery can support this need for information and help to fill the gap of information need at reasonable costs. Figure 2 underlines the need and consideration of knowledge beyond a single geodata layer showing urban extent within time. Disparities are salient in urban spaces. Bogota and Quito, for example, are amongst the top-10 most unequal cities. These representative metropoles within one continent, show very different structure related to natural and political aspects. Comparable up-to-date spatial data can be generated and this can significantly increase the quality if statistically derived information that is – so far – often stored relative to administrative sectors. It enables the decision making sector to perform super regional/ super national analysis.

Heterogeneity in the density of urban settlements and differences in the accessibility of peripheral parts of a city can be interpreted this way. Spatial expansions of cities and growing disparities bring major challenges for urban planning agencies. With the EO information products it is possible to monitor the expansion and development of different urban fabrics. As different urban fabrics can be related to different socio-economic classes (e.g. informal settlements to underclasses, continuous medium-dense urban fabrics when combined with green areas to the upper classes) EO information products are able to complement measurements of poverty and trace its evolution within urban spaces. Changes in living conditions (economically and socially) can also be monitored by analyzing the connectivity of spaces within cities. Connectivity of the population is given by accessibility to transport infrastructure. Also the access to parks and green areas within the city or changes in vegetation layers in parts of a city provide an indication for changing disparities.

Urban Mapping (Urban Atlas, figure 2) is a suitable measurement in scale and thematically, accomplished by an additional layer of green urban spaces that distinguishing between low and high vegetation and highlights significant single trees. Green areas and the amount of significant trees in streets and as part of urban fabrics allow for a deepening of the characteristics of different districts within each city. [Handke, 2015]

Copernicus Policy

The latest ESA data access policy with its SENTINEL Satellite series provides a new path for developing multi scale mapping solutions within a globally comparable manner, driven by the users' needs and combined with the knowledge that is already there. Besides pure product enhancements, which were repeatedly placed in the center of development, emphasis need to be put onto combining the different sources to a greater picture.

"In line with its data and information policy, the Copernicus programme provides users with free, full and open access to environmental data.

Depending on their needs, users can obtain these data either from the Copernicus services or directly from the Copernicus satellites. No registration is required for discovery and view services while it is a prerequisite to download Sentinel data." [Copernicus Programme http://www.copernicus.eu/main/data-access]

The EO information products based on these medium scale data help to enhance research on monitoring of the evolution of inner-city socio-economic disparities within local, regional and international scale. It will be shown on selected cities worldwide how Copernicus Earth Observation data of different type supports this process. Focus is put on how EO information can support the knowledge gap between the decision making sector and the individual structure, fragmentation and circumstances (natural and political) a wider metropolitan region offers. Urban planning needs to match physical expansion with access to jobs, affordable housing and shopping, public transportation, health and education services to ensure equal opportunity for disadvantaged communities.

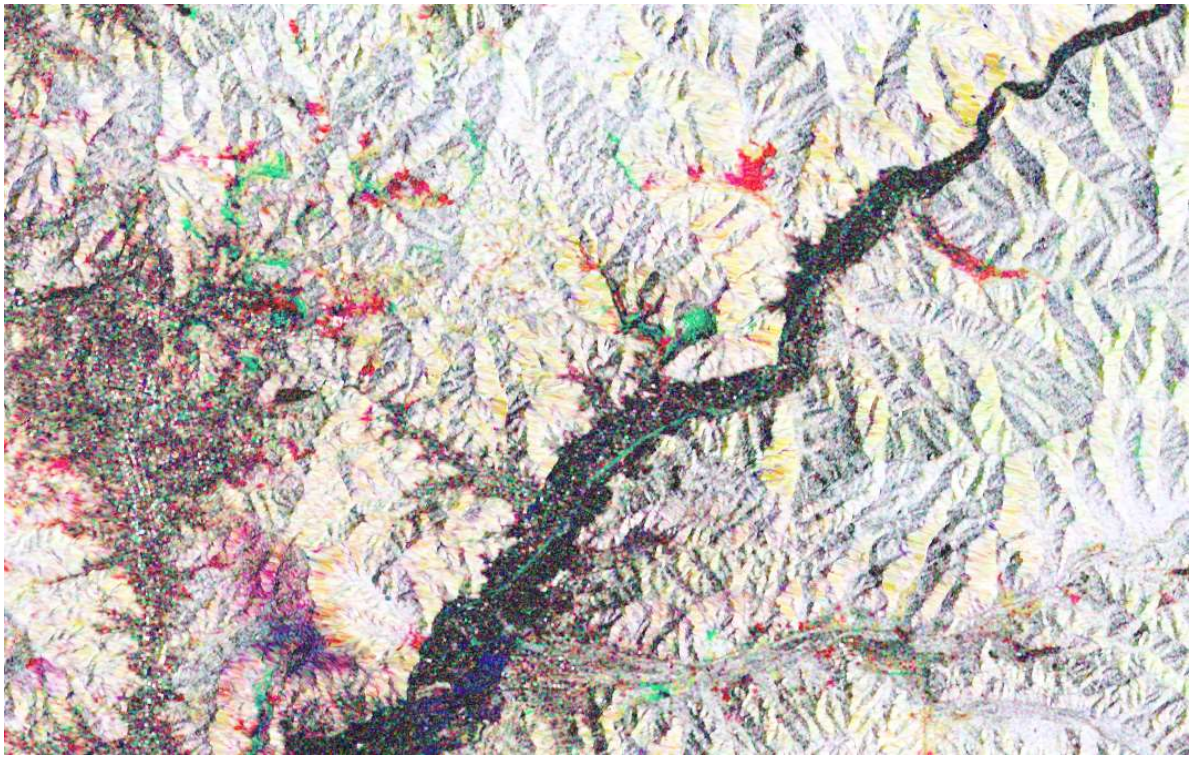

Figure 3: simple hot-spot identification: Copernicus Sentinel 1 Coherency Image showing change in land cover (green, red) within 2014 and 2016 (Lima)

Summary

The logic of a metropolitan area is comparable to a multi-parameter equation with a number of parameters that can be identified, some are generously known, others are known within a certain context, a wide range of assumptions as well as factors, which will be filled in within time. Geo-spatial experts on one side need to value the pressing needs of the decision making sector in order to identify intersections and suitable interfaces – not the number of very specialized services will decide on success or failure of this cooperation. As critical point, the benefit of the users' process must be kept in focus and will be measured qualitatively.

It will be discussed, how well-fitting customizations of Earth Information Services can benefit to the decision making sector, whereas it needs to be pointed out that besides technical possibilities delivering "another geo-service" personal interaction with the user play a major role within the chain of raising awareness at supra-regional, regional and local level. In correspondence, this will often include the option of different adaptations to different circumstances.

After all, the need for policy makers on different levels is, to ensure that urbanization proceeds in an economically efficient, sustainable and inclusive manner so that also the underprivileged people can benefit. Approaching this challenge will decide on peaceful togetherness of and within metropoles that are growing fast right now.

Acknoledgement

Some of the presented baseline products (Urban Atlas mapping result or Lima, Bogota and Quito) are the outcome of a project funded by ESA in 2015 (Monitoring Urbanization in Latin American Metropolitan Areas, ESRIN AO/1-7663/13/I-AM) and prepared for Worldbank. However, they have been furtherly enhanced, and combined within other thematic focus.

Results shown from other metropoles worldwide had been generated on behalf of the presenter IABG mbH in order to promote the use of Copernicus EO data in combination with other information and information services.

References

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United Nations, Department of Economic and Social Affairs, Population Division (2015): World Urbanization Prospects: The 2014 Revision, (ST/ESA/SER.A/366).

Figures

Figure1: influences and internal characteristics of a changing city

Figure 2: Example on distribution of classes (Urban Atlas)

Figure 3: simple hot-spot identification: Radar Coherency Image showing change in land cover (green, red) within 2014 and 2016 (Lima)