EO for Africa Symposium 2024
23 – 26 September 2024
ESA | ESRIN, Frascati

INTRODUCTION TO A CLOUD-BASED TOOL FOR ON-DEMAND URBAN EXPANSION MAPPING IN AFRICA: The DIY-BU mapping tool

Marta Sapena, Johannes Mast, Christian Geiß & Hannes Taubenböck

German Aerospace Center (DLR)

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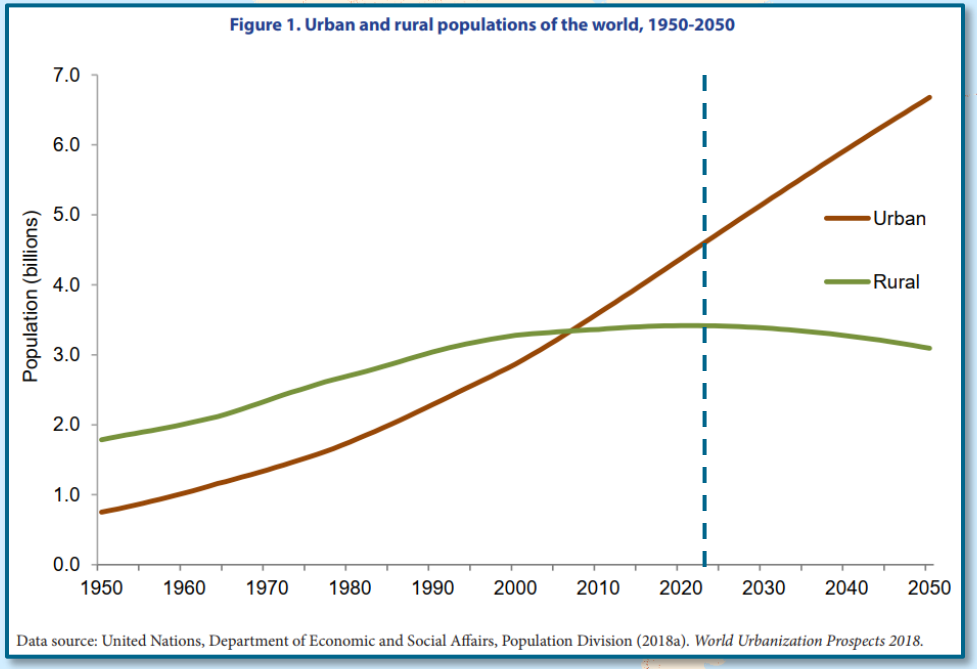
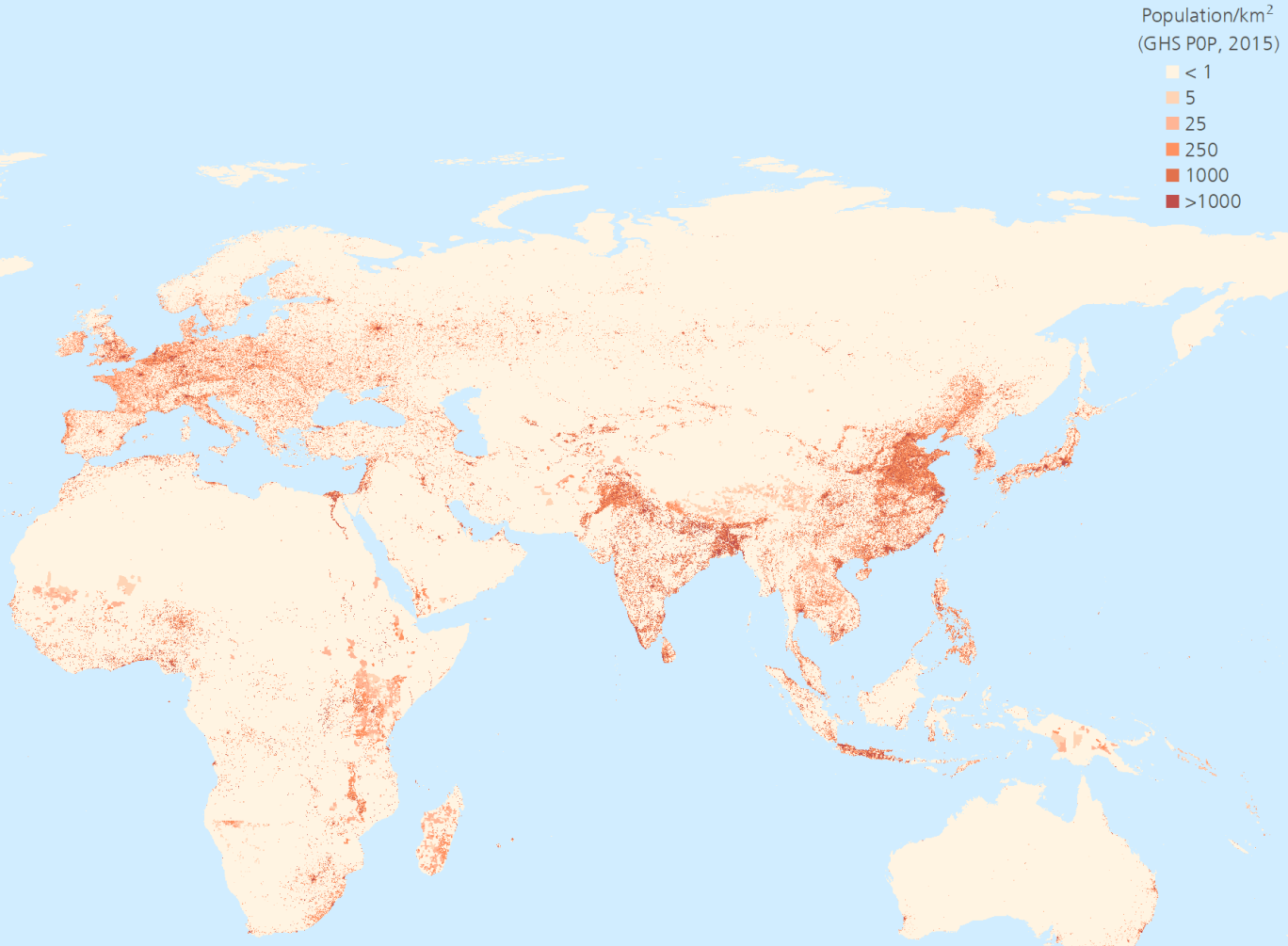
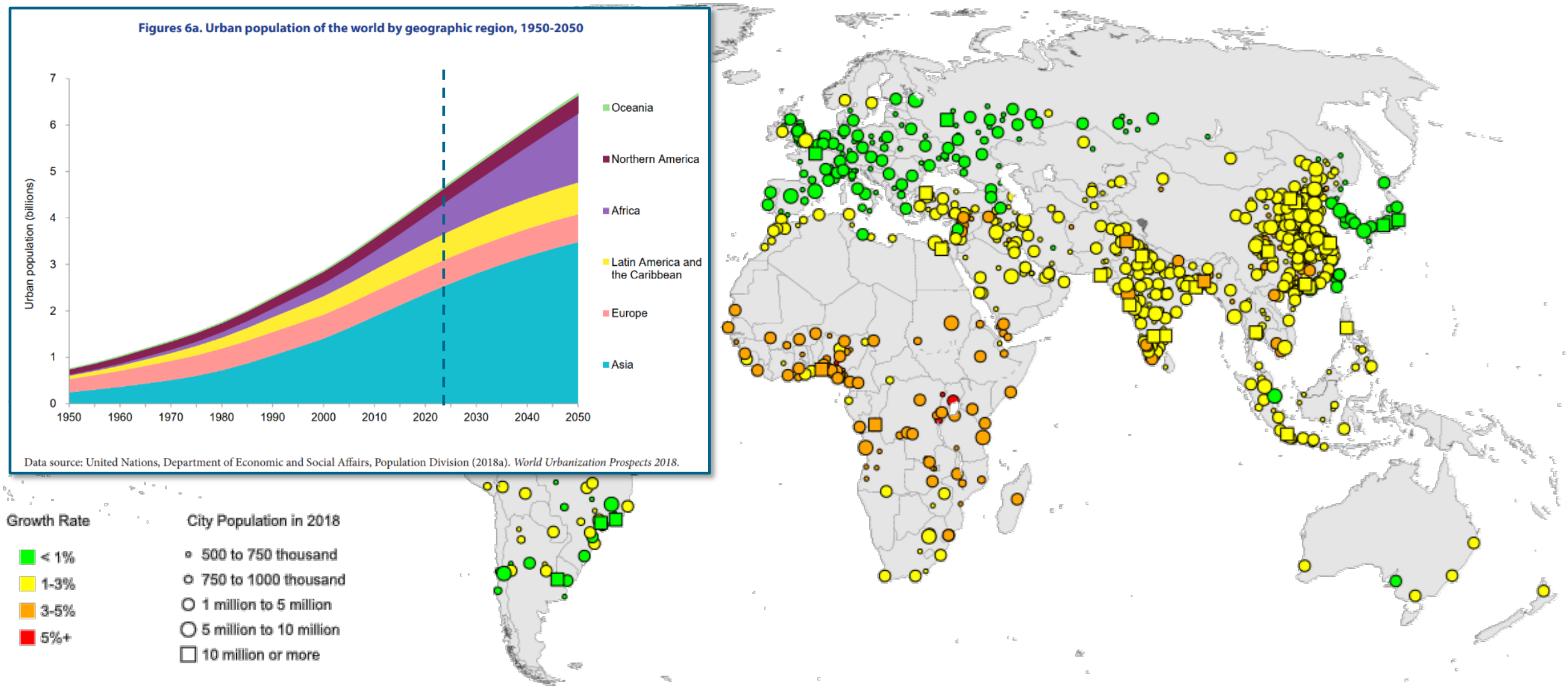
Introduction





Introduction



Introduction

- **Challenges** related to the **urbanization process** are reflected by the **Sustainable Development Goals** (SDGs). E.g., '**To end poverty**' and '**to build sustainable cities**' (SDG 1 & 11).

Introduction

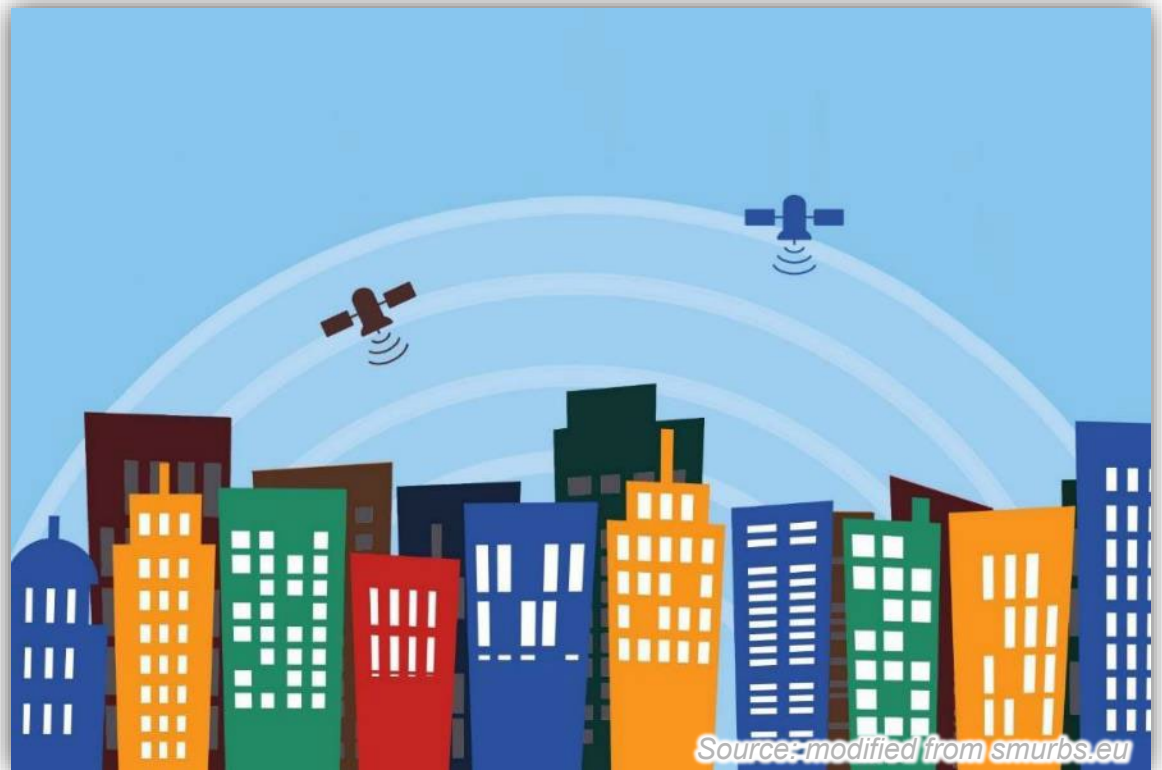
- **Monitoring** the development of **urban areas** provides evidence-based information and supports decision-making processes.

- For creating sustainable development strategies, **up-to-date** and **accurate data** are crucial.

Source: modified form blog.happyfox.com

Introduction

- The Copernicus Sentinel data brings the opportunity to have **large-area**, **cost-free** and **consistent coverage** of **high-resolution** satellite **data** to define useful indicators for localizing and characterizing human settlements.



DIY-BU-mapping tool

using Sentinel to map built-up areas over time in Africa

Pre-print

Sapena, M., Mast, J., Schoepfer, E., and Taubenböck, H.: ***Do-it-Yourself Built-Up Mapping Tool: A Practical Cloud-Based Solution Using Sentinel Imagery for Mapping Urban Expansion in Africa****. Available at SSRN: https://ssrn.com/abstract=4762416*

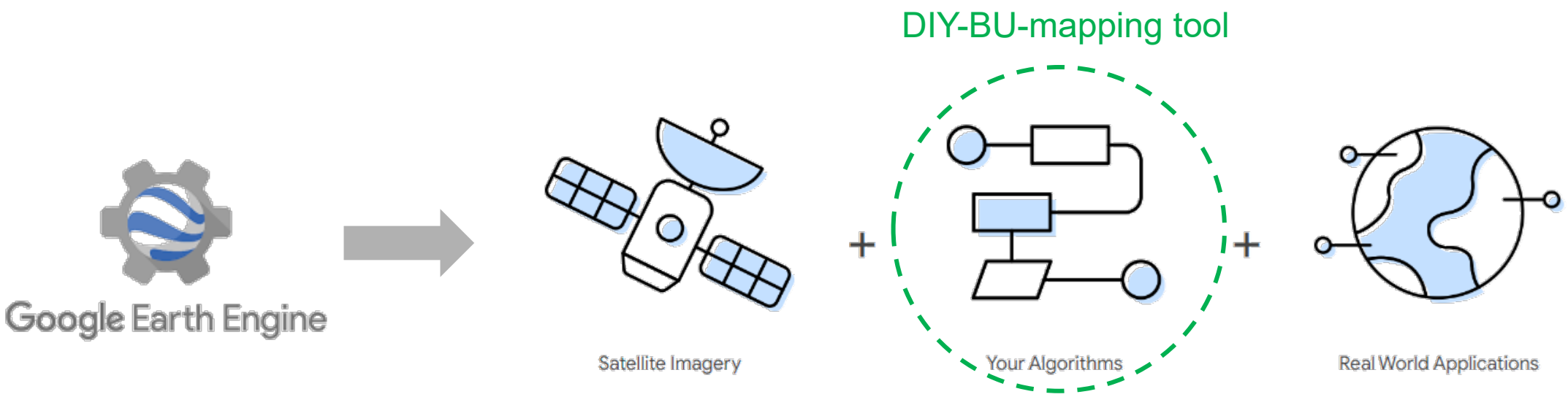
DIY-BU-mapping tool

Objective: to produce 10m-resolution annual maps of built-up areas in Africa using Sentinel-1 and Sentinel-2 data.

Characteristics:

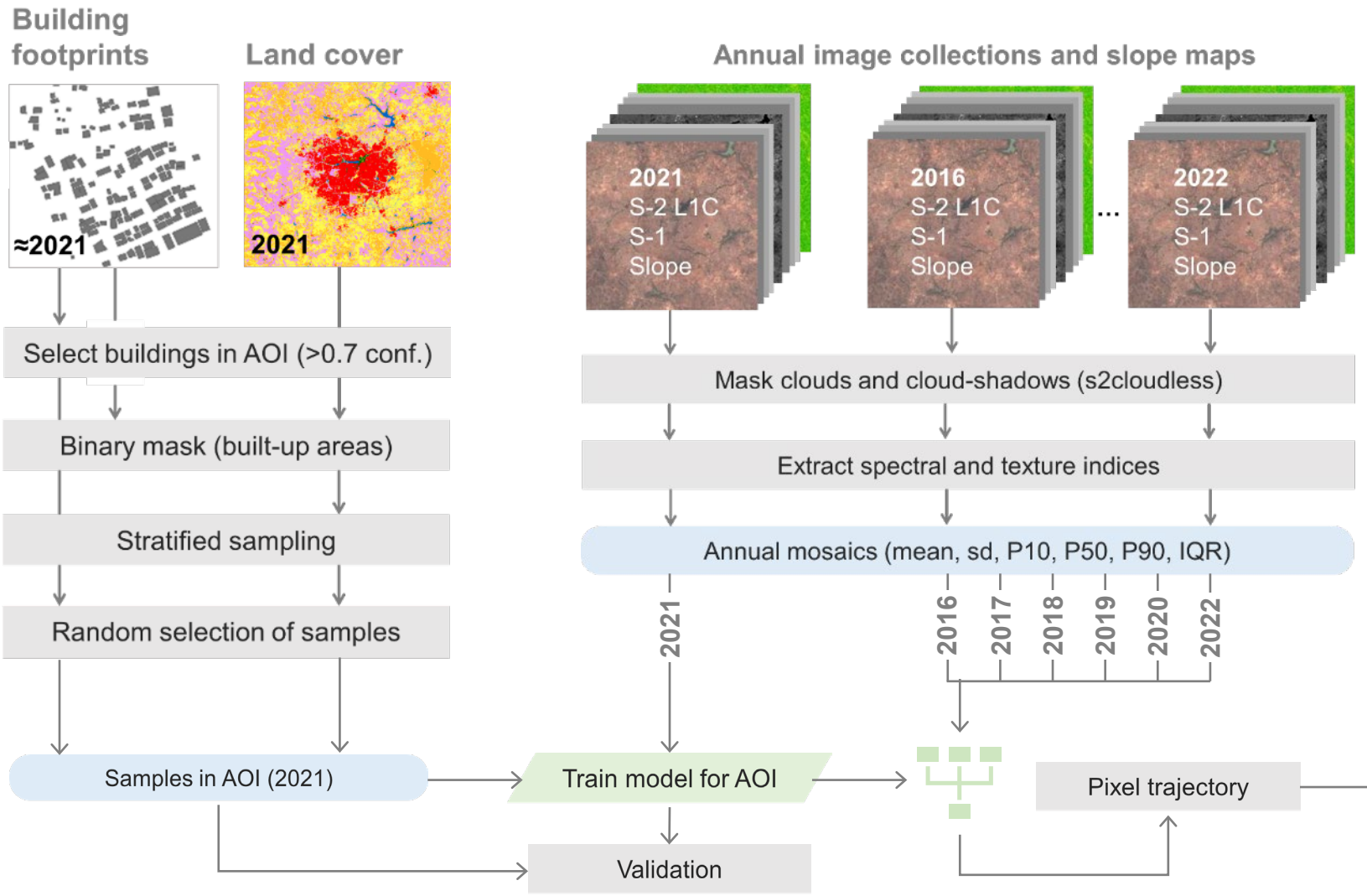
- Cloud computing.
- Application: areas of interest within Africa.
- Automatic (2-step).
- A local model is trained and evaluated for each application (site-specific).
- The results are a map and its accuracy assessment.
- The result can be fine-tuned.

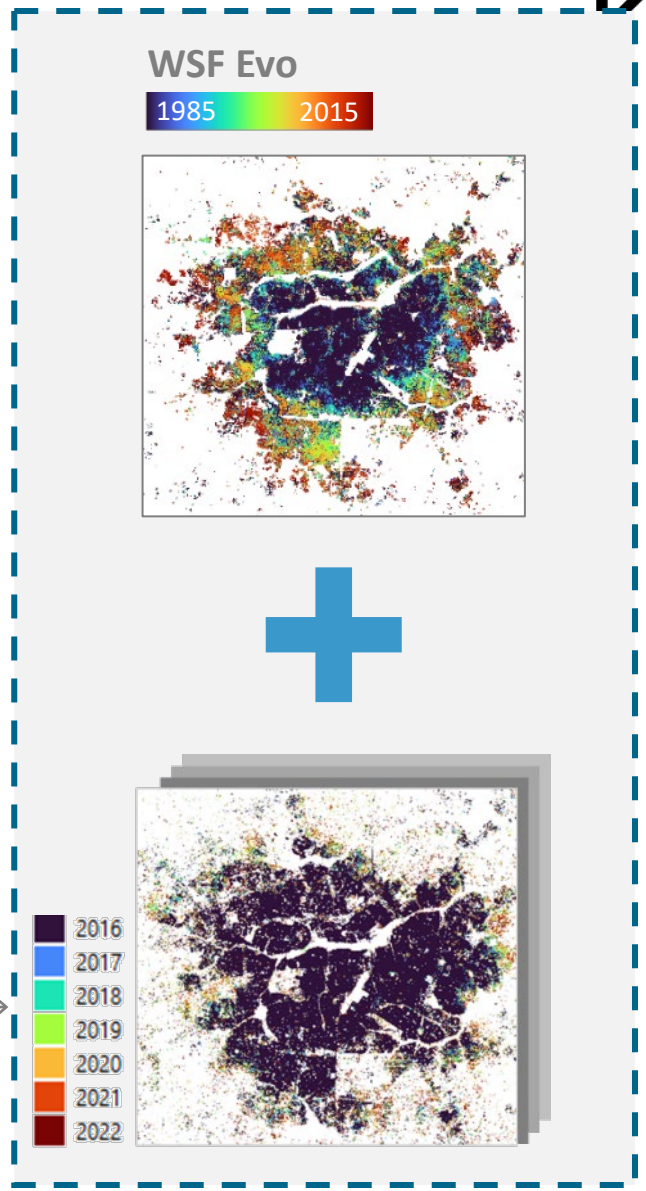
Google Earth Engine: A cloud computing platform



**The GEE Services are free of charge use for research and non-commercial activities*

Methodology





Do-it-yourself built-up mapping tool: A step-by-step tutorial

Do-it-yourself built-up mapping tool: A step-by-step tutorial

The Do-it-yourself built-up mapping tool (DIY-BU) is a free, open, and cloud-based tool that produces annual, high-resolution, accurate, and updated urban expansion maps for African cities, by leveraging multimodal datasets and Sentinel imagery to train random forest models in targeted regions. The DIY-BU mapping tool is available in Google Earth Engine (GEE).

GEE is a cloud-based computing and analysis tool for geospatial data, powered by the Google Cloud Platform. It is freely accessible for everyone to view, process, and assess satellite data, and is commonly utilized by scientists, organizations, and for education[1]. The requirements to use GEE are: a Gmail account, internet connection, and a web browser.

Learn More: https://earthengine.google.com/

This tutorial guides the user through all the steps of using the tool from start to finish, from the creation of a GEE account to the visualization of the resulting map. Three examples show different possibilities to run the tool.

The DIY-BU tool and this tutorial are part of the pre-print publication (currently in review):

Sapena, M., Mast, J., Schoepfer, E., Taubenböck, H.: Do-it-Yourself Built-Up Mapping Tool: A Practical Cloud-Based Solution Using Sentinel Imagery for Mapping Urban Expansion in Africa. Available at SSRN: http://dx.doi.org/10.2139/ssrn.4762416

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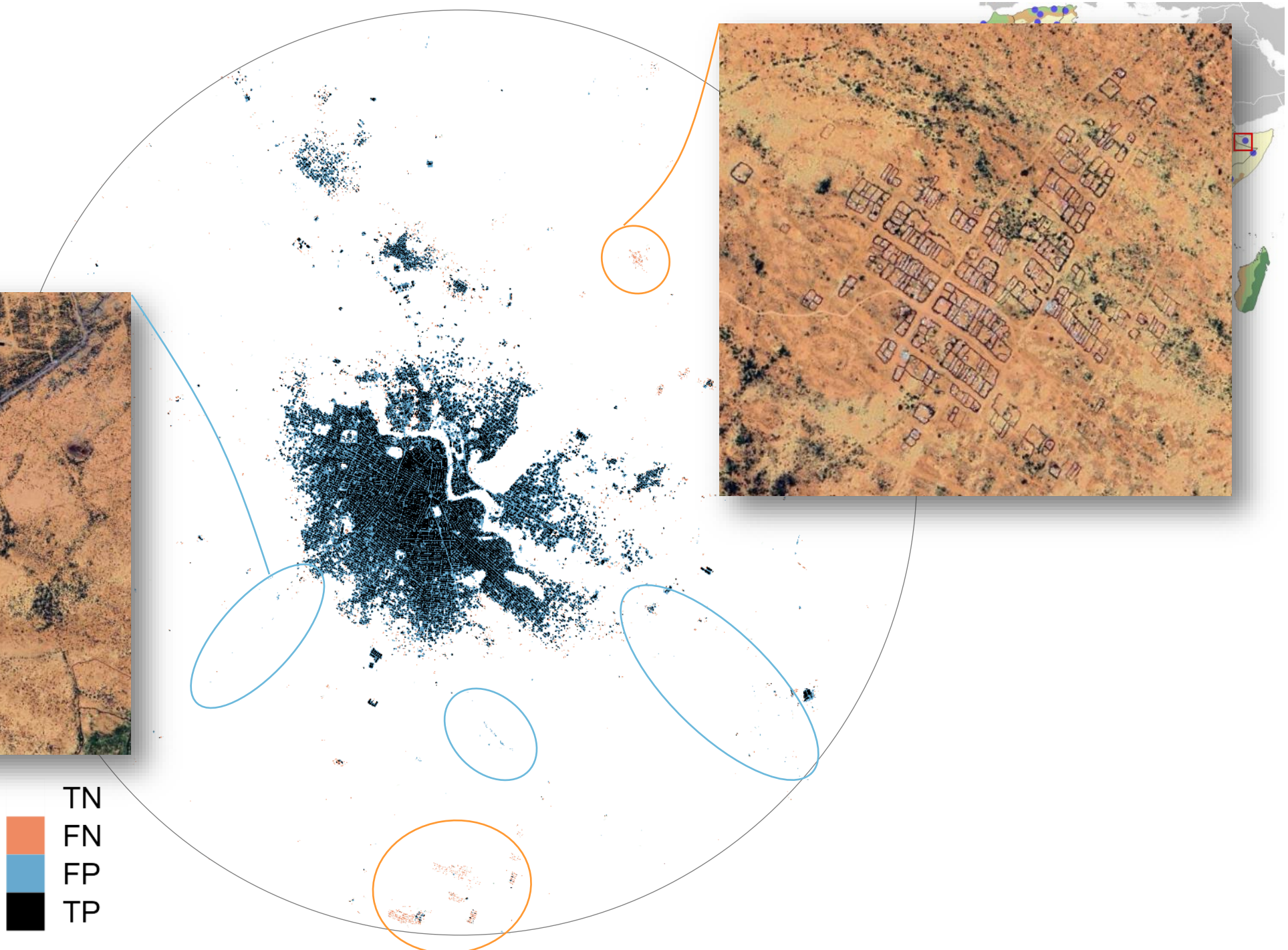
Results

Burao, Somalia

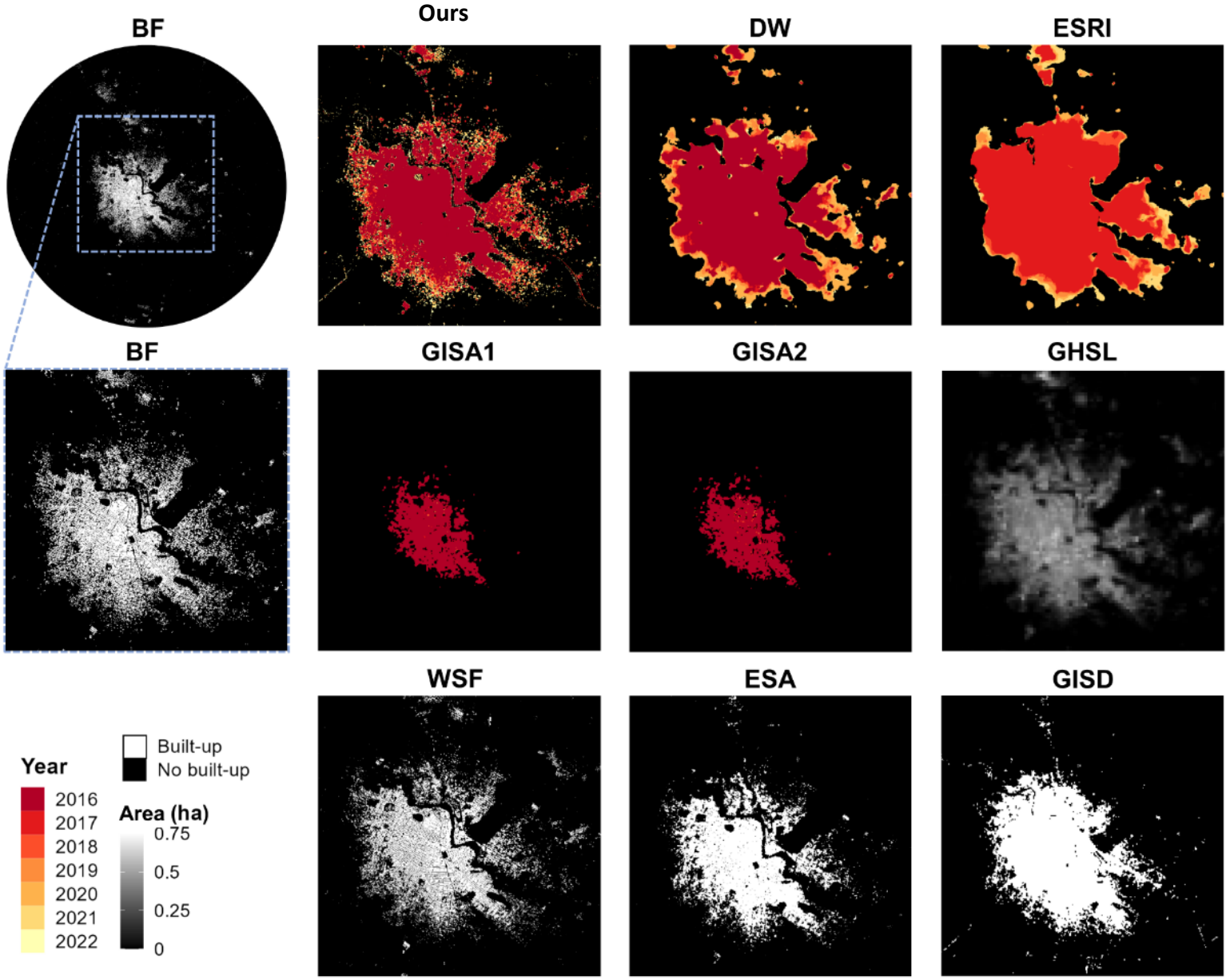
F1-score = 0.65

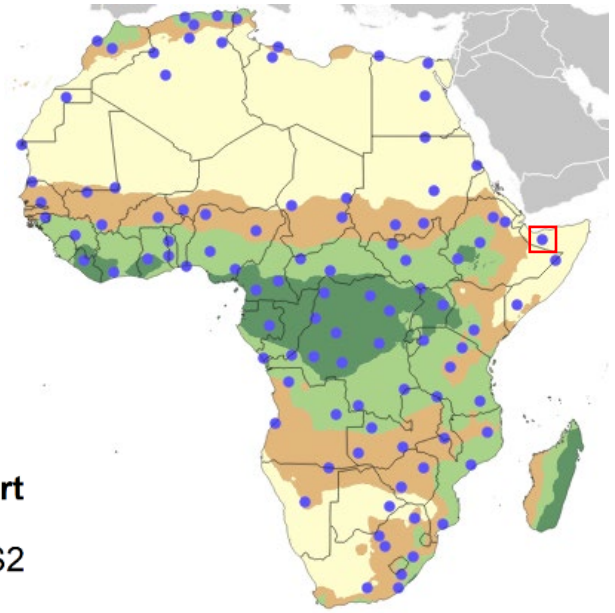
F1-score = 0.68

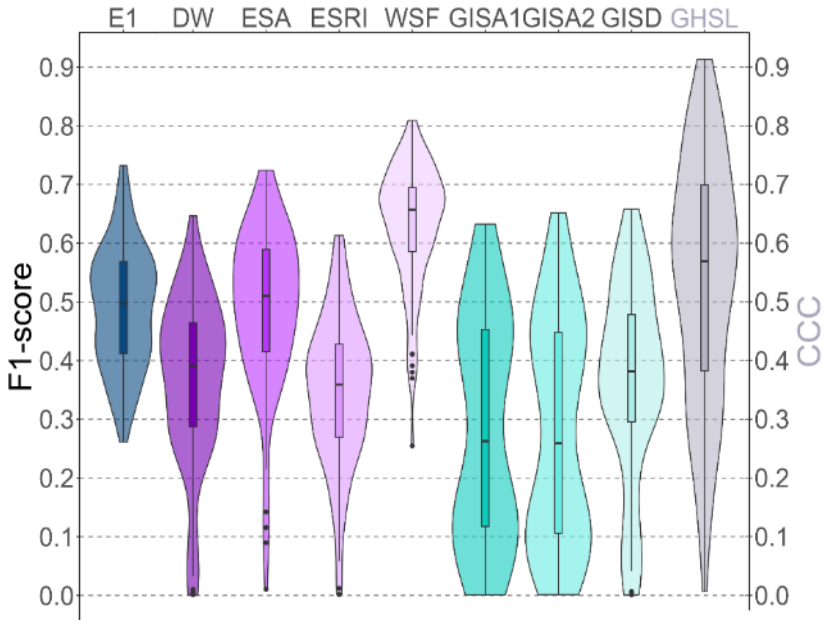


Results

Burao, Somalia








Ouagadougou,
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Map data ©2015 Google


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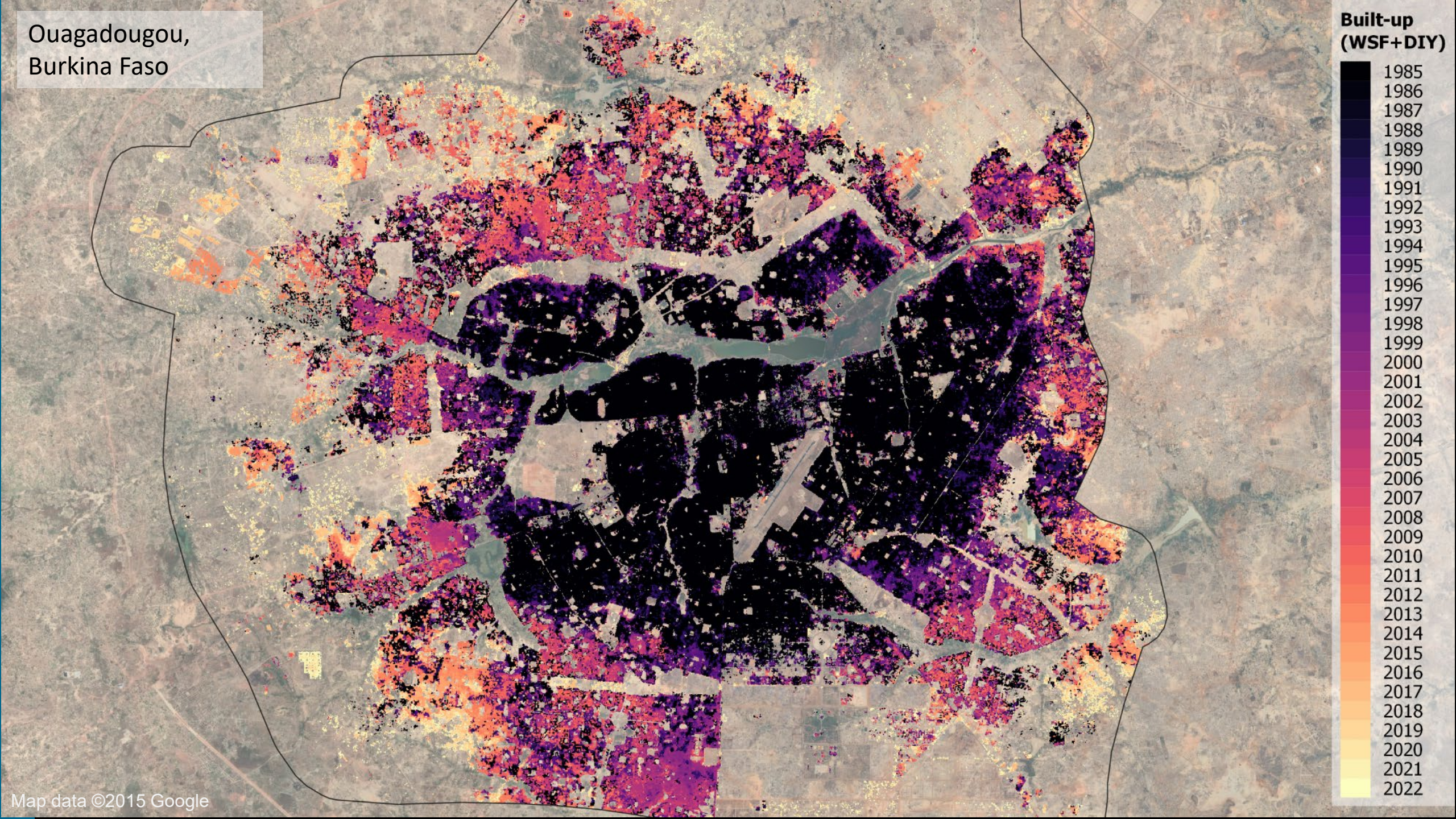
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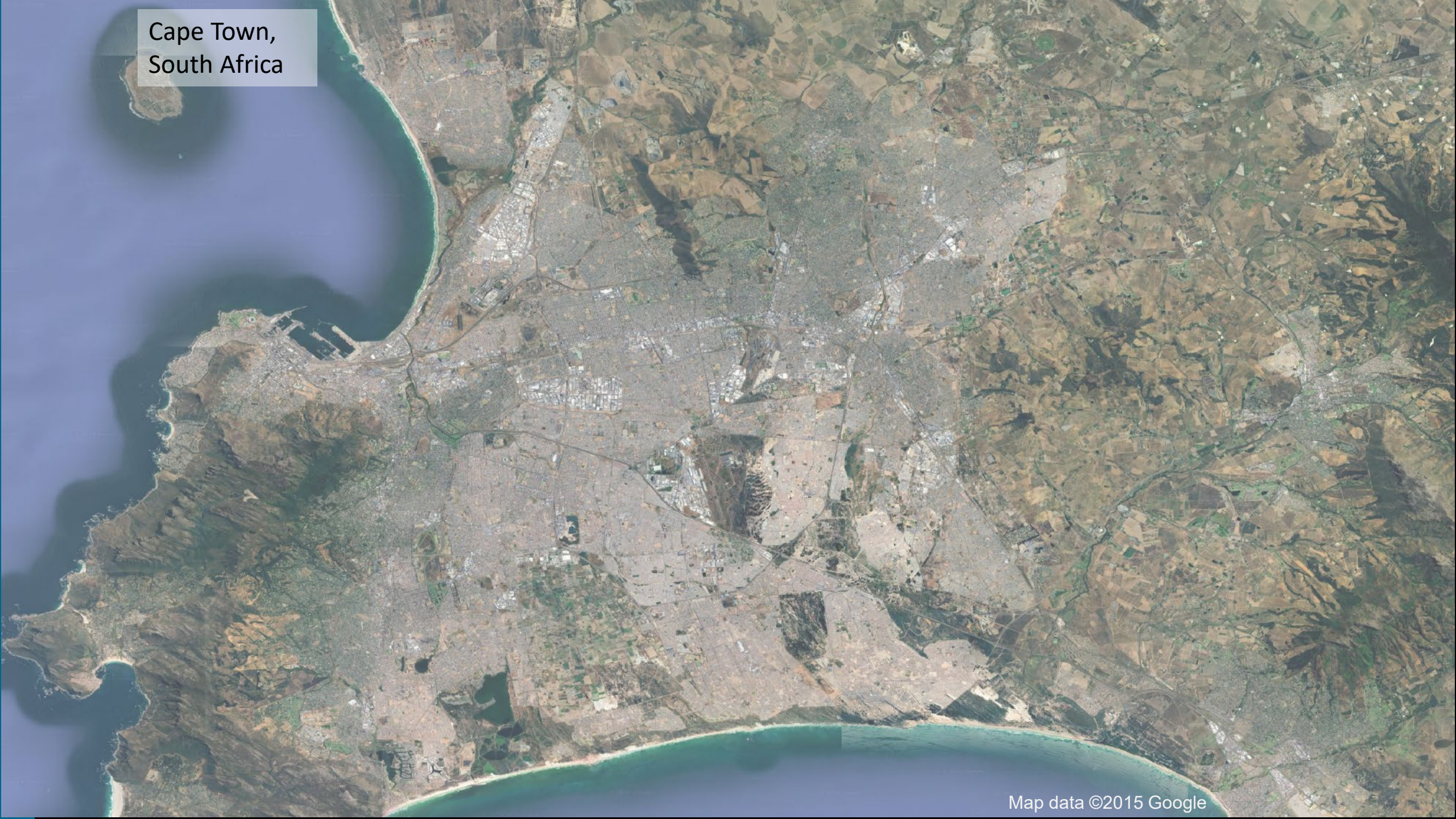
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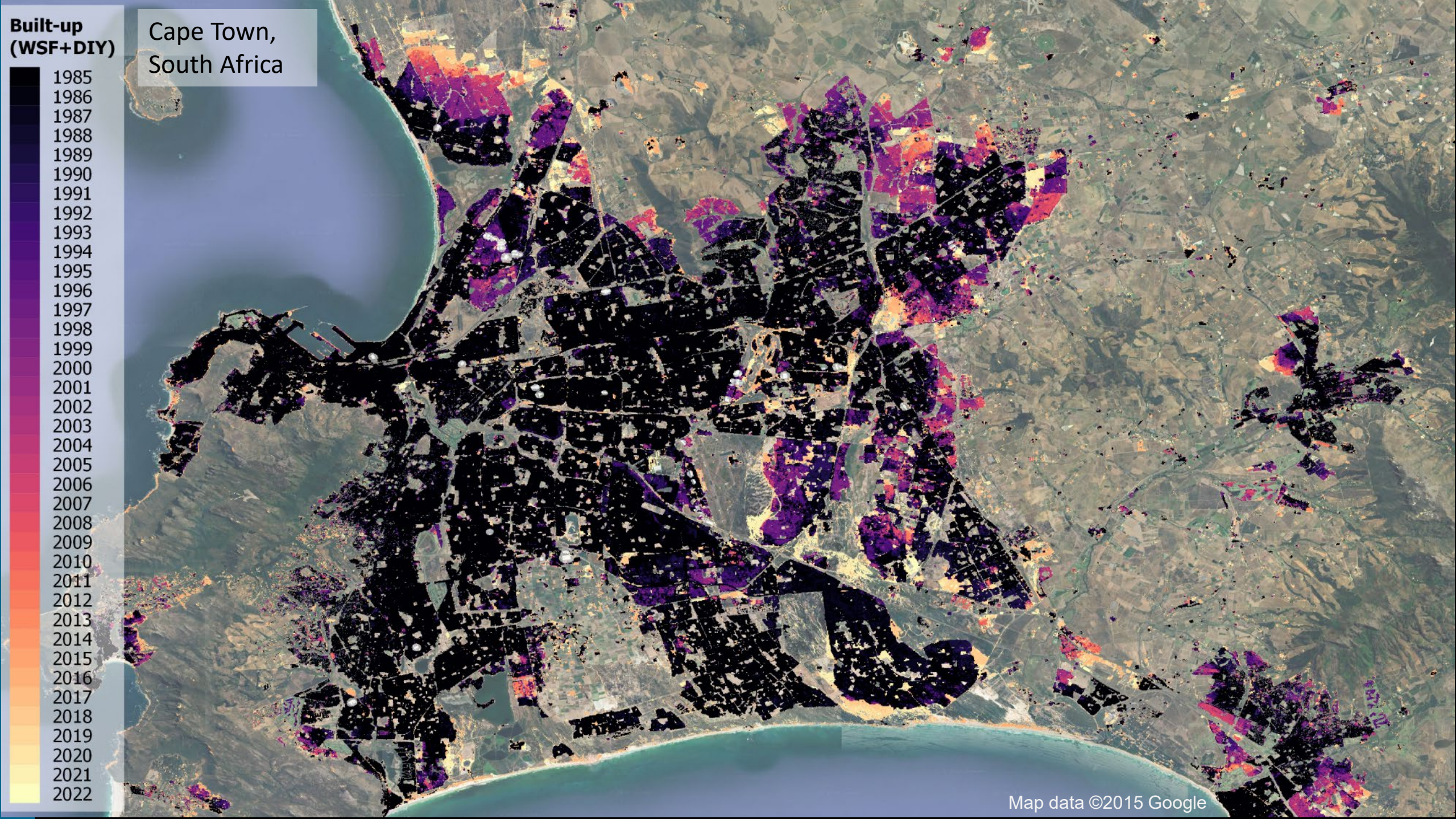
Map data ©2015 Google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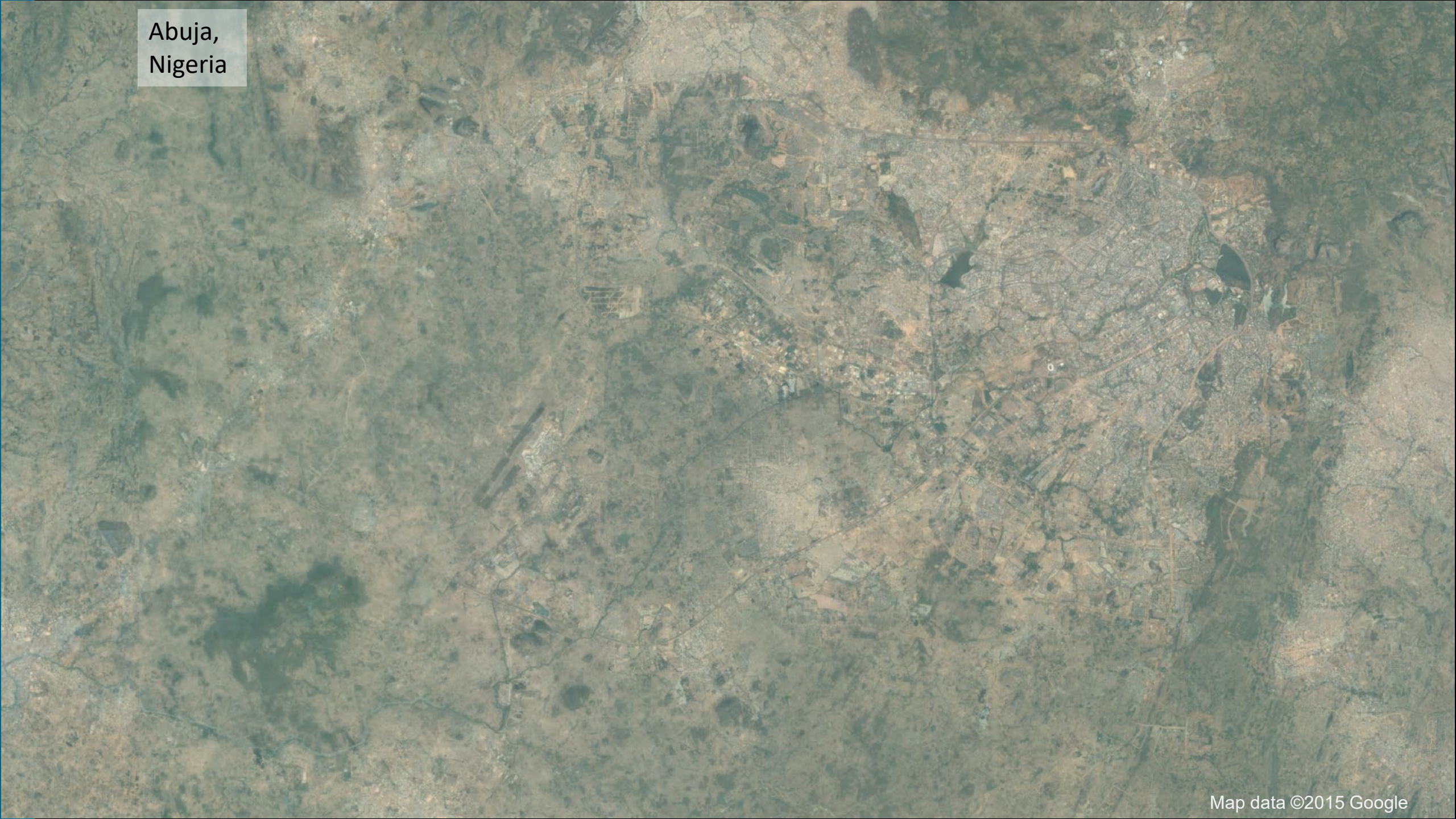
Map data ©2015 Google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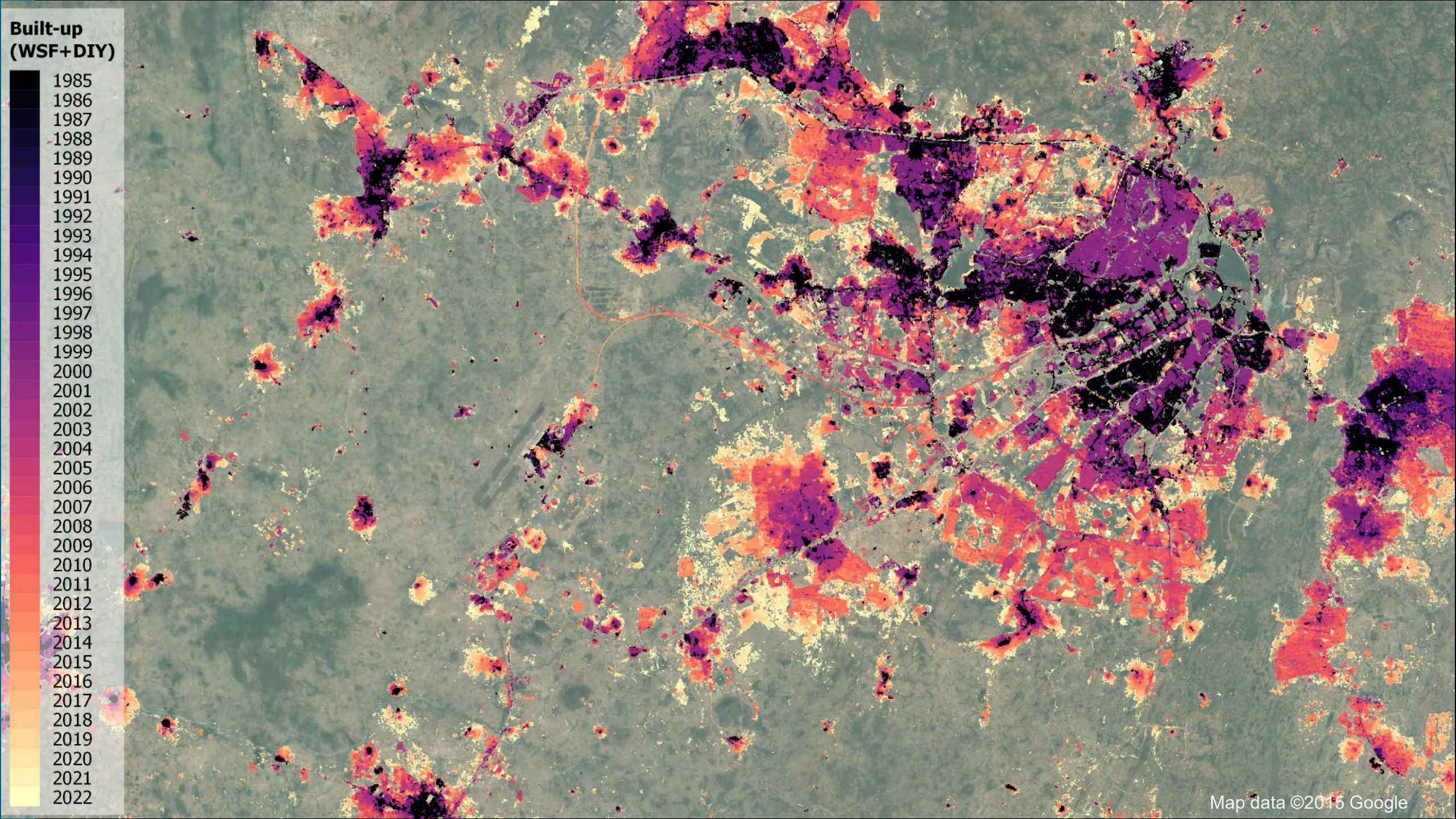
Map data ©2015 Google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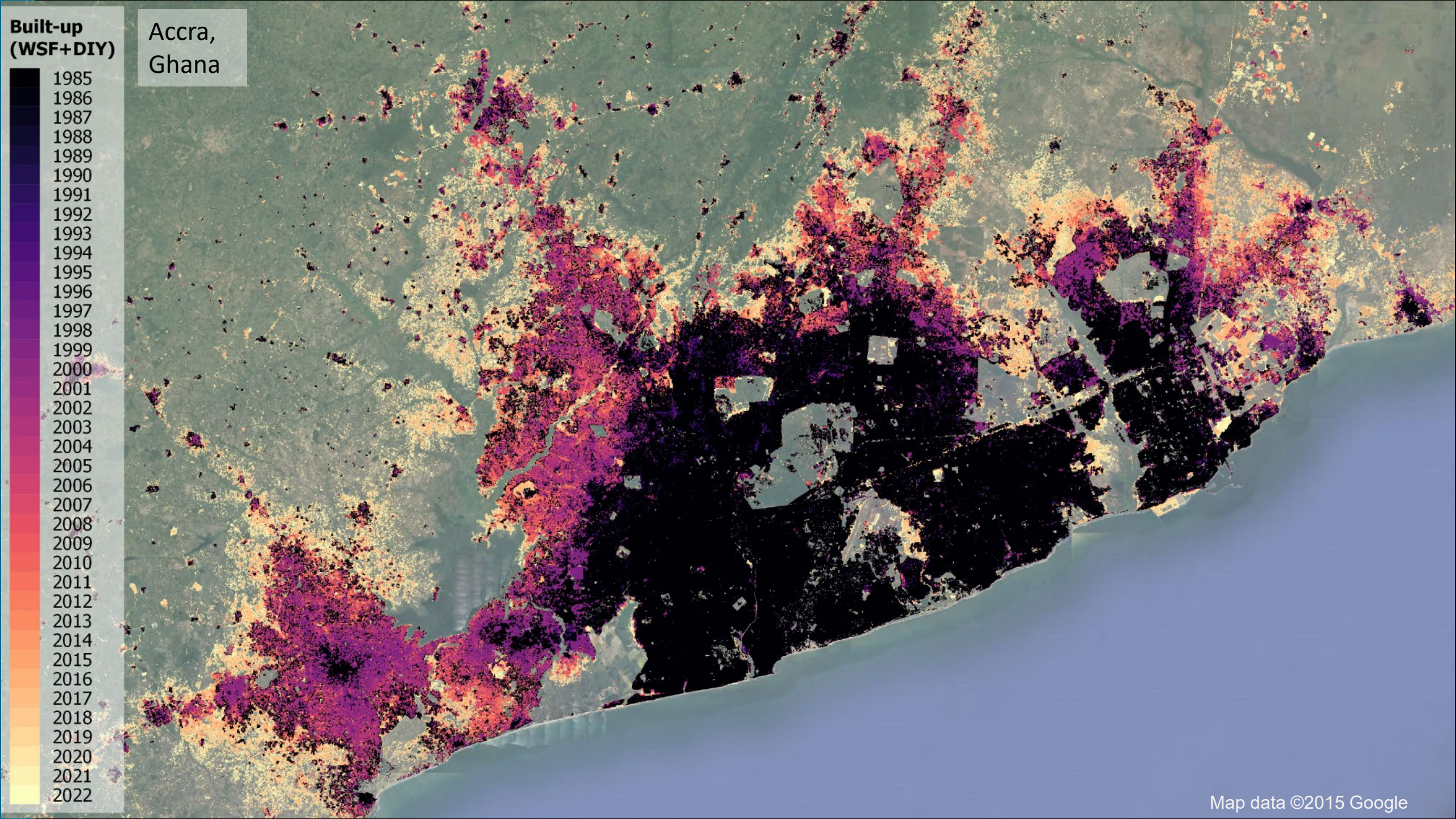
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Map data ©2015 Google

Summary and conclusion

We offer a **tool** to **monitor fast urbanization** processes in **African** cities, aimed at supporting decision-making.

- **Transferability**
- **Scalability in time**
- **Multifunctional**
- **Reproducibility**
- **Heterogeneity**

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