LOCALIZED HUMANITARIAN MAPPING

USE CASES

Four unique case studies supported by
AI/ML and building footprints

DevGlobal ▶▶

🏢 ramp

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There's power in mapping.

Maps mean recognition – an acknowledgment that communities exist and have needs. To be on the map is to be counted for support and input and partnership and investment. Open and accessible maps are mission-critical for governments and humanitarians to get much needed relief and development assistance to every community in need.

**Ravi Shankar, WHO GIS Centre for Health Lead &
Rhiannan Price, Managing Director, DevGlobal**

THE RAMP PROJECT
Introduction

Maps display progress, identify gaps, and measure accessibility. It is critical for missions working on humanitarian relief and global development assistance to have access to up-to-date maps and the ability to redraft and deploy them as quickly as possible. This is why the Replicable AI for Microplanning (Ramp) Project exists.

The Ramp project is a DevGlobal initiative in partnership with the World Health Organization. The overarching objective of the project is to produce open-source deep learning models for digitizing buildings in low-and-middle-income countries using satellite imagery and enable in-country users to produce applications for their regions of interest.

There are two primary outputs:

1.   The model codebase and its related documentation, and

2.   The training datasets with add-on resources.

The add-on resources will ensure that in-country users apply the technology adequately. The resources include data label review tools, quality check methods for the datasets, user personas, signed distance transform masks, and other geospatial tools.

The first dataset series and corresponding code pinpoint primary health facilities covering 16 geographies. All training data labels and associated
imagery are available under a CC BY-N.C. 4.0 license on Radiant MLHub, an open library dedicated to EO training data and models for use with ML algorithms.

DevGlobal will release more imagery chips and labels that practitioners can use as input to ML models in the coming months.

PRIMARY
Use Cases

Building footprints are a necessary input to train the Ramp model to automatically extract features in imagery.

The technology and easy data access will allow in-country practitioners to build AI models and resulting maps, saving time, money, and lives. For example, data practitioners won't have to waste time looking for primary geospatial data during a crisis. They will know exactly where to send people and be able to identify the likely risks and hazards nearby. They will also be able to allocate limited resources effectively and feel confident about making quicker decisions given more available data on where people live and how to reach them. But, while data practitioners have more access to building footprint data than ever, it's ineffective unless one knows how to put the data to work.

There are different scenarios for using AI models and resulting building footprints. Here, we provide four use cases for data practitioners to employ available data sources and models to support humanitarian projects. Each use case offers a real- world example of organizations benefiting from data insights to improve decision-making.

There are also additional data use scenarios provided by DevAfrique, DevGlobal and DevIndia. These showcase the outcomes of incorporating the Ramp model and training data into existing workflows and toolkits by partner organizations

USE CASE OVERVIEW

Provision of goods and services to plan and deliver services to every household.

Risk exposure to understand vulnerabilities, risks, and possible scenarios.

Validation of existing data to enable interoperability and analyzability with other datasets.

Population density to asses population estimates and distributions in a given area.
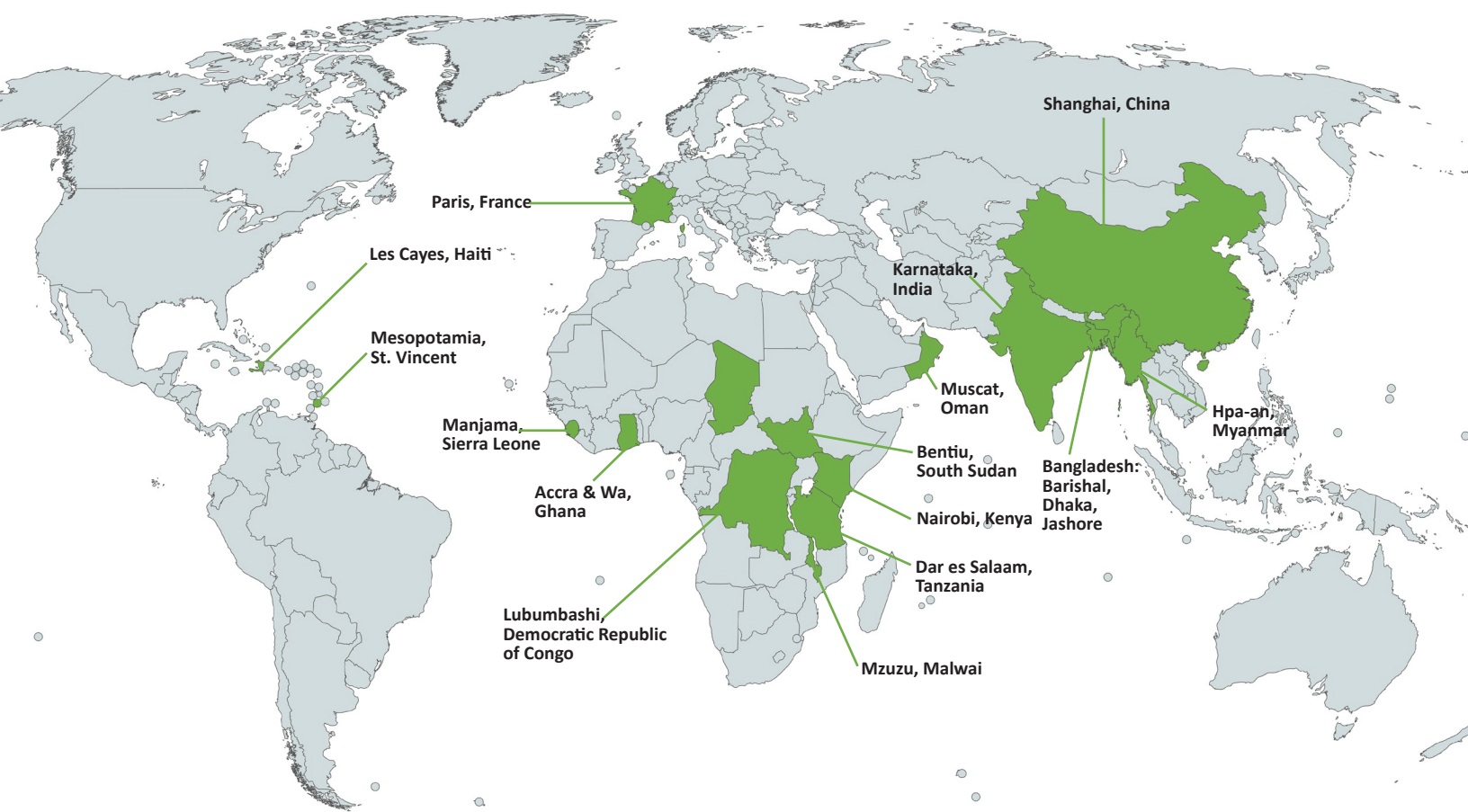
Sampling for household surveys and mobile data collection campaigns to enable updating building data layers with an open- source model.

OPEN-ACCESS
Training Datasets

These chipped training datasets include high-resolution imagery in a TIFF format and corresponding building footprint vector labels in a GeoJSON format. The imagery is broken into 256 x 256 pixel tile label pairs.

These training datasets are a Ramp Tier 1 dataset, meaning it has been thoroughly reviewed and improved. They can be used to build detailed maps depicting primary health center catchment areas for service delivery planning.

The datasets are available for download on Radiant MLHub, the world's first open-access cloud-based library dedicated to Earth observation training data and models for use with machine learning algorithms.

Shanghai, China

Paris, France

Les Cayes, Haiti

Karnataka, India

Mesopotamia, St. Vincent

Muscat, Oman

Manjama, Sierra Leone

Hpa-an, Myanmar

Accra & Wa, Ghana

Bentiu, South Sudan

Bangladesh: Barishal, Dhaka, Jashore

Nairobi, Kenya

Dar es Salaam, Tanzania

Lubumbashi, Democratic Republic of Congo

Mzuzu, Malwai

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Contributors

Humanitarian OpenStreetMap Team

HOT is a global non-profit organization creating open map data that enable disaster responders to reach those in need.

CERSGIS

CERSGIS is a private agency providing geospatial solutions to support socio-economic development planning to all sectors in Ghana.

CLINTON HEALTH ACCESS INITIATIVE

CHAI is an independent not-for-profit organization with a transformational goal: help save the lives of millions of people living with HIV/AIDS in the developing world by dramatically scaling up antiretroviral treatment

AKROS

Akros is a private organization supporting development agencies with service delivery systems to improve community health across Africa.

HOT
HUMANITARIAN OPENSTREETMAP TEAM

About HOT

Envisioning a world where community needs are addressed through mapping, anyone can access and contribute to the map, and data is available and used for impact.

The Technology & Innovation unit of the Humanitarian OpenStreetMap Team (HOT) exists to amplify connections between humanitarian needs and open map data by pursuing just and fair tech. By just, HOT means designing and building technologies with intention, investing in people and practice to ensure they do less harm and more good. To ensure fair technologies, HOT puts humanitarian needs at the center of their free and open source software technologies. Some important principles in this quest are ensuring they receive feedback from end-users, keep the AI models open and remain aware of model bias.

fAIr Use Case

fAIr is a service that uses AI models to detect map features based on satellite imagery and adds them into OpenStreetMap (OSM).

Unlike other AI data producers, fAIr is a free and open-source AI service that offers local communities accurate feedback through the efforts of OSM community mappers. This results in progressive intelligence of computer vision models. Whenever an OSM mapper uses the AI models for assisted mapping and completes corrections (which are the weaknesses of the models), fAIr can take those corrections as feedback to enhance the model's accuracy.

AI ASSISTED MAPPING

High-quality AI models increased the number of buildings added to OpenStreetMap by two-fold.

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HOT
HUMANITARIAN OPENSTREETMAP TEAM

ⓘ ELIMINATING AI BIAS

HOT is developing inclusive, just and open source AI models that are integrated in a workflow to assist OSM mappers and map communities more efficiently and precisely.

Outcomes

fAIr is at an exciting stage in its lifecycle where the models are being trained based on feedback from local OSM mappers. For example, when the model prediction identify empty land as a building or miss building boundaries, an OSM user can fixe those issues and pushe them to OSM. fAIr can then take those corrected features and teach the AI model about its misses. This eliminates model biases ensuring the models are relevant to the communities where the maps exist to improve the conditions of the people living there.

HOTs working goal is to provide OSM mappers access to AI-assisted mapping across mobile and in-browser editors using community created AI models.

Ramp Integration with fAIr

1. The training datasets would provide input for model training.

2. Open-source models can be re-trained to improve accuracy, without an AI engineer's intervention

3. Prediction will run live and be presented to end-users for validation and confirmation

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HOT — Humanitarian OpenStreetMap Team

CERSGIS
CENTER FOR REMOTE SENSING AND GEOGRAPHIC INFORMATION SERVIES, University of Ghana

About CERSGIS

CERSGIS is a non-profit entity with the mission to support development planning with geo-information technologies, generate geo-information products for decision making, build capacity, and make geospatial data widely available for research and development.

FLOOD RISK & SOLID WASTE MANAGEMENT MAPPING

Map products support urban planning and solid waste management facilities in flood-prone communities.

CERSGIS Use Case

CERSGIS provided map products for the Environmental and Social Impact Assessment of the Greater Accra Resilient and Integrated Development project. The goal of the project is to improve flood risk and solid waste management in the Greater Accra Metropolitan Area and improve access to basic infrastructure and services in targeted communities within the major river basin covering the area.

The availability of high-resolution building footprint data facilitated the identification of hot spots and vulnerable populations subjected to perennial flooding.
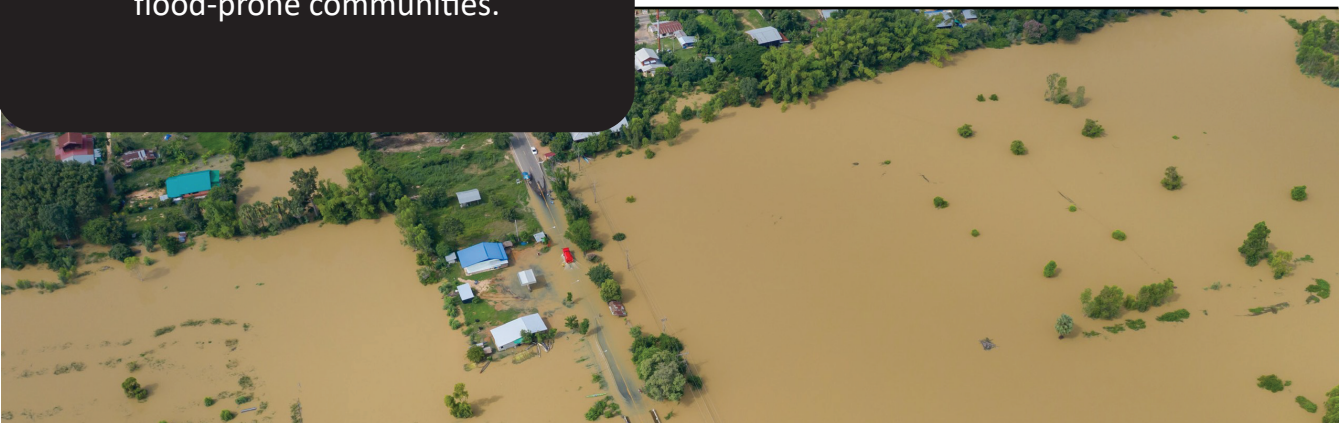
CERSGIS
CENTER FOR REMOTE SENSING AND GEOGRAPHIC INFORMATION SERVIES, University of Ghana

REDUCED IMPACT OF FLOODS

CERSGIS produces flood risk maps in Ghana to improve infrastructure design and service facilities in vulnerable communities that are subjected to perennial flooding.

Outcomes

Progressive reduction of flooding and related risk of losing lives, assets, and economic opportunities in the vulnerable communities. Map products helped in the detailed design of drains, access roads, alleyways, streetlights, and solid waste management facilities in flood-prone communities.

The map products are helping in the implementation of community-based solid waste management interventions in targeted crowded communities and outreach programs to sensitize and improve public behavior on solid waste management and litter management

Ramp Integration with CERSGIS

The map products used for the ESIA provide a 'snapshot model' of the project area. The Ramp model will provide near real-time data for the development of a monitoring system for the impact assessment studies in Ghana.

The Ramp Building Footprint Training Dataset over Accra, Ghana was used in developing the Ramp baseline model and contains 1,330 tiles and 40,786 buildings. It's available for download via Radiant MLHub.
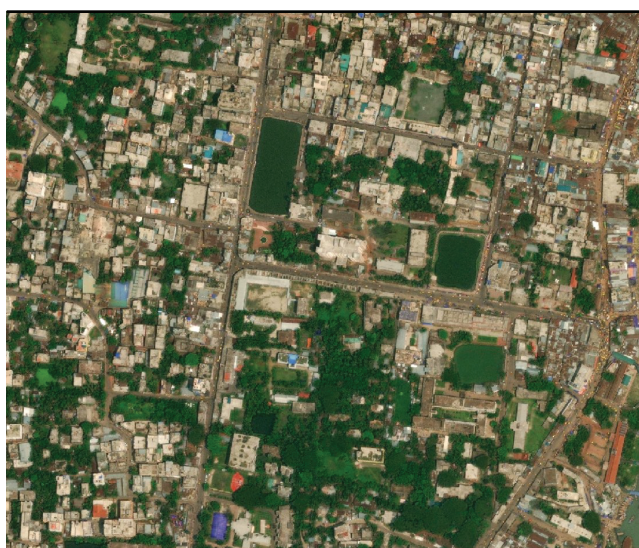
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CHAI
CLINTON HEALTH ACCESS INITIATIVE

About CHAI

CHAI is a global health organization committed to saving lives and reducing the burden of disease in low-and middle-income countries.

CHAI works with partners to strengthen the capabilities of governments and the private sector to create and sustain high-quality health systems that can succeed without third party assistance. In addition to supporting disease prevention, women and children's health, universal coverage and other cross-cutting health areas, CHAI is working to ensure that technology is used effectively to catalyze government health goals, by collaborating with governments, developers, donors, and end users (health care providers, health systems managers, and patients) to design, develop, scale, and institutionalize fit-for-purpose digital products.

CHAI Use Case

Digital health facility catchment maps, paired with physical accessibility analyses, provide key contextual information on the geographic access to immunization services, particularly identifying areas which are hardest to reach during micro-planning. Though high-quality health facility, stamp village (villages with a village chief), transport network and terrain data are available in Laos to form as a basis of such maps, there is incomplete information on the number and location of smaller sub-villages, which may be home to a considerable number of households. These communities may therefore be missed in rounds of microplanning, as these are limited to the stamp village level.

HOUSEHOLD MAPPING

Identifying clusters of households in health facility catchment maps for immunization campaigns.

CHAI
CLINTON HEALTH ACCESS INITIATIVE

IMPROVING IMMUNIZATION CAMPAIGNS

CHAI incorporates building footprints in their workflow to ensure smaller and hard-to- reach communities are included when planning immunization campaigns.

Outcomes

Having access to building footprints can serve as an easy and accurate way to identify clusters of households - and therefore the location of sub-villages - in health facility catchment maps and ensure these smaller communities are included when planning immunization campaigns.

One major challenge with this approach, however, is having stakeholders at various levels (from central down to health center) agree on the definition of a sub-village?

For example, what actually constitutes a sub-village? 10 households? 20 households? What about informal settlements such as camps?, both within and across programs, the latter being important when it comes to integrated health interventions.

There may therefore need to be some work done on the governance side, for there to be at least within the program a single definition of a sub-village.

Challenges

- Incomplete household information to support immunization campaigns
- Household level definitions

Ramp Integration with CHAI

Ramp can be trained on Laos satellite imagery to generate building footprints and subsequently analyzed to determine clusters of households that can be considered sub-villages.

Contact

CLINTON
HEALTH ACCESS
INITIATIVE

AKROS

IMPROVING MALARIA PREVENTION CAMPAIGNS

Reveal optimizes building footprints to assist planning, delivery, and management of household-level interventions to eliminate malaria.

Outcomes

Reveal has been used in numerous malaria and neglected tropical disease programs across western, southern, and eastern Africa to achieve immediate impact. It successfully supports intervention managers by accurately guiding and tracking the delivery of malaria prevention activities.

Ramp can optimize the drive to deliver these life-saving interventions to eliminate malaria. But before integrating the Ramp-produced data into Reveal can be deemed production-ready, there is an immediate need to pressure test the data workflow and assess the accuracy of the footprints that inform the given health campaign. Reveal has generated data that can be used to validate ramp-derived building footprints. This previously- validated Reveal data will be compared to ramp- produced building data, ensuring that plans of deploying Ramp in new geographies and visualizing in Reveal have the necessary accuracy and usability to be leveraged in global health campaigns.

Ramp Integration with Reveal

1. Ramp is a Digital Public Good that, when combined with Reveal, can accelerate the pace of mapping new regions and planning and implementing field activities.

2. The Ramp model can be re-trained and deployed on new geographies to produce up-to-date building data significantly faster than manual digitization practices from sources like OpenStreetMap
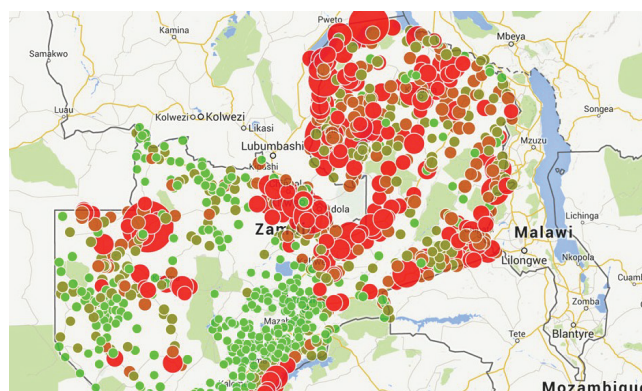
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⊛ AKROS

AKROS

About AKROS

Akros is a cutting edge organization establishing data-driven systems to improve the health and well-being of disadvantaged communities. They take pride in their ground-level knowledge of the service delivery systems where they work and the ability to provide novel, lasting solutions implemented in developing regions.

Reveal Use Case

Reveal is an open-source platform that uses spatial intelligence to drive delivery of life saving interventions to eliminate malaria and other neglected tropical diseases. The team uses program specific geospatial databases to improve how practitioners use the data and corresponding maps to identify malaria outbreaks and apply interventions in the right places.

The maps are used to stratify households and allow for precision targeting of Indoor Residual Spraying campaigns to eliminate malaria

MALARIA PREVALENCE MAPPING

Using maps to stratify households burdened with malaria outbreaks for indoor spraying campaigns.

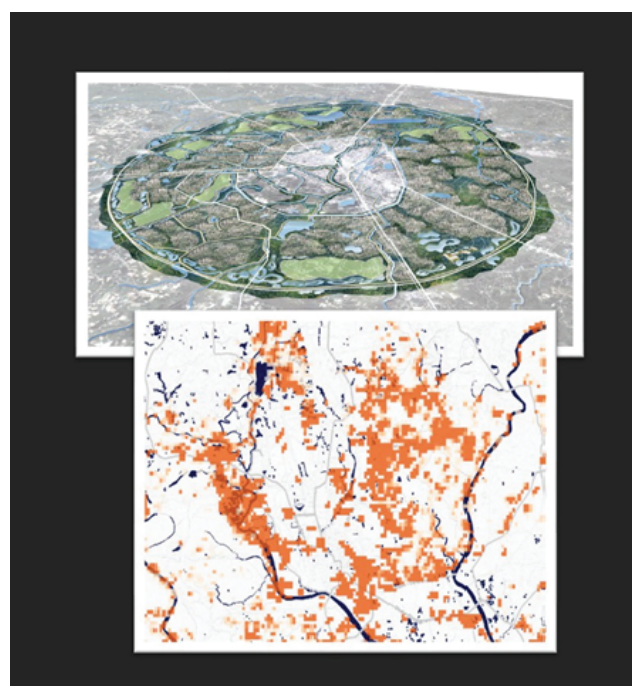# Urban Flood Reslience

DevAfrique | DevGlobal | DevIndia

What?

Analyzing building footprints alongside data like drainage networks, flood history, roads, waterways, water points, solid waste points, health facilities, educational facilities, among others to establish evidence-driven urban resilience interventions.
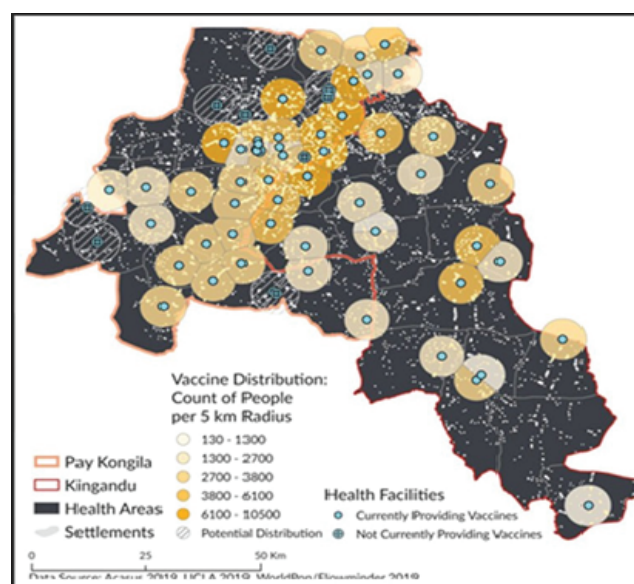

Outcomes

- Targeted expansions and improvements of drainage systems to mitigate flood risk

- Flood protection infrastructure, especially along shorelines

- Early warning systems and stormwater management awareness

- Passing and enforcement of zoning laws and community awareness

- Campaigns for wetland restoration and other greening initiatives

Digital Microplanning

DevAfrique | DevGlobal | DevIndia

What?

Using building footprints in population estimates and catchment area mapping for improved coverage in vaccination campaigns.

Outcomes

- Fewer resources spent searching for data
- More settlements mapped
- Fewer households missed in campaigns
- Improved vaccination coverage

Emergency Response

DevAfrique | DevGlobal | DevIndia

What?

Identifying affected households in emergencies and expediting humanitarian assistance to reach them

Outcomes

- Everyone accounted for in emergency planning and evacuation routes

- Ability to identify access routes for search and rescue missions

- Improved response time to the most vulnerable areas

IRS Campaigns

DevAfrique | DevGlobal | DevIndia

What?

Household stratification of malaria burden allowing for precision targeting of Indoor Residual Spraying (IRS) campaigns to eliminate malaria

Outcomes

- More precise resource targeting
- Improved IRS coverage
- Increased spray effectiveness
- Reduction in malaria incidence
- Reduced cost per malaria case averted
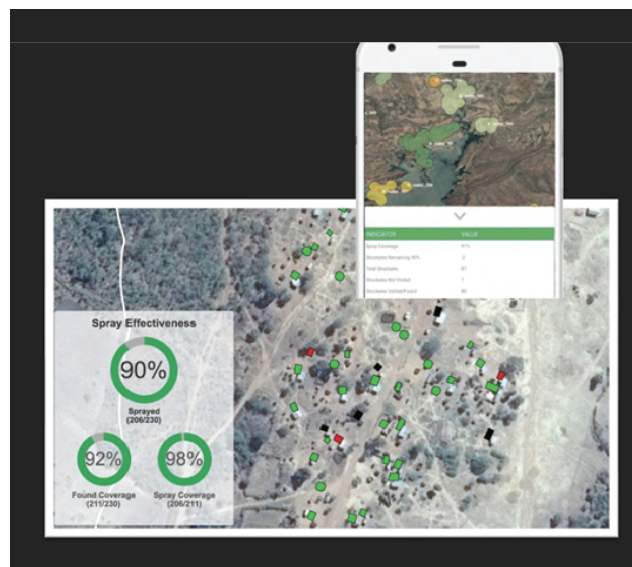
ACKNOWLEDGEMENT

ABOUT **DevGlobal**

Spanning Africa, India, and the United States, DevGlobal Partners supports the world's leading non-profits, companies, philanthropies, multilateral agencies, and government agencies on their innovation and sustainability initiatives.

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