



UNITED NATIONS
HUMAN RIGHTS

Human Rights Council, Expert Mechanism on the
Rights of Indigenous Peoples, Thirteenth session

Geneva, June 8-12, 2020

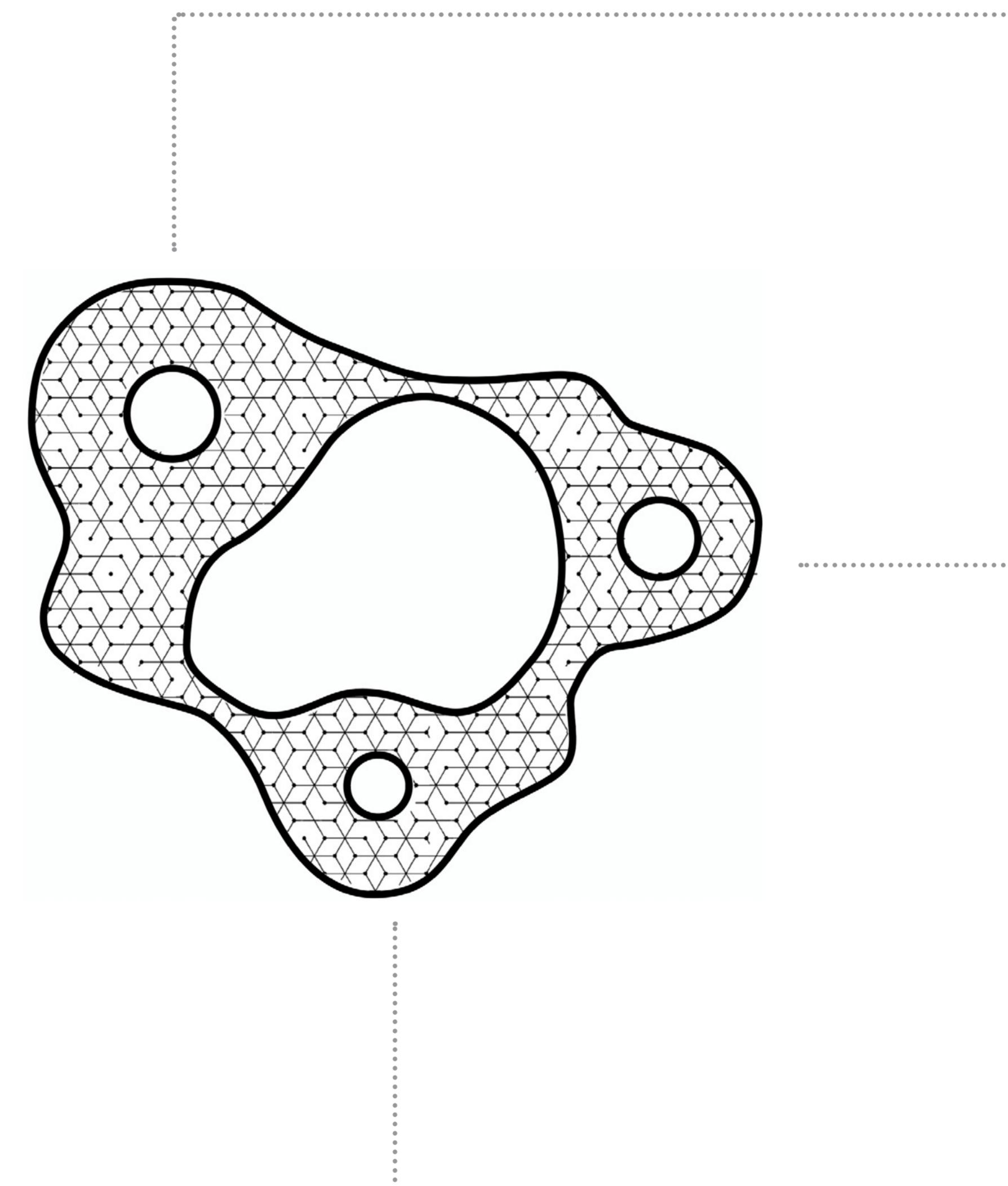


TRT WORLD

The logo consists of the words "TRT WORLD" in a bold, sans-serif font. The letters "TRT" are colored blue, while "WORLD" is white with a blue circular dot in the center of the letter "O". The entire logo is centered within a thick, light blue circular outline.

PROBLEM STATEMENT

Government officials and foreign companies in Tanzania and Kenya are using ecotourism and conservation laws to displace indigenous Maasai people, evicting them and denying them access to watering holes and vital grazing for their livestock.



1. Discrimination

- Forced migration
- Stolen land (eco-parks, reserves, private sale)
- Illegal village burns

2. Unreliable Information

- No reliable database to track & report injustices
- Nomadic villages difficult to locate
- Lack of government transparency
- Witnesses fear reprimand & punishment

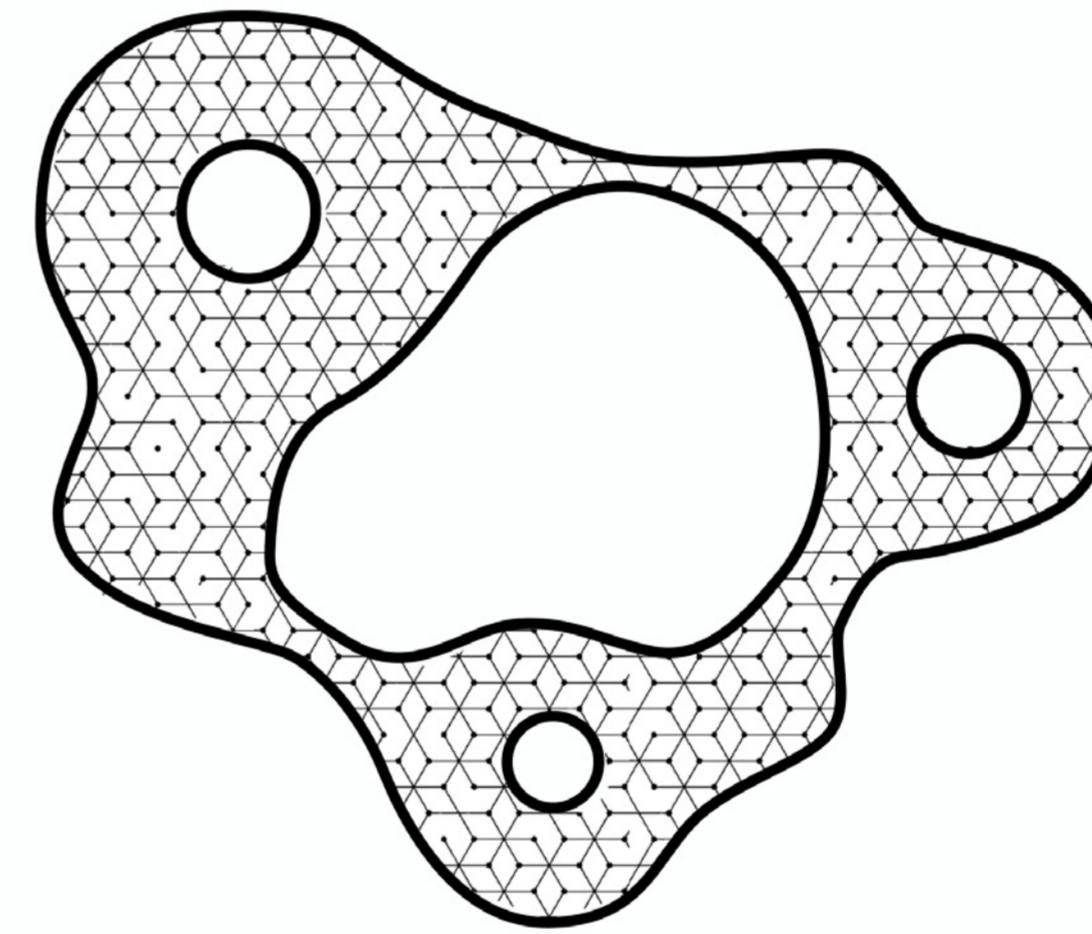
3. Little Control

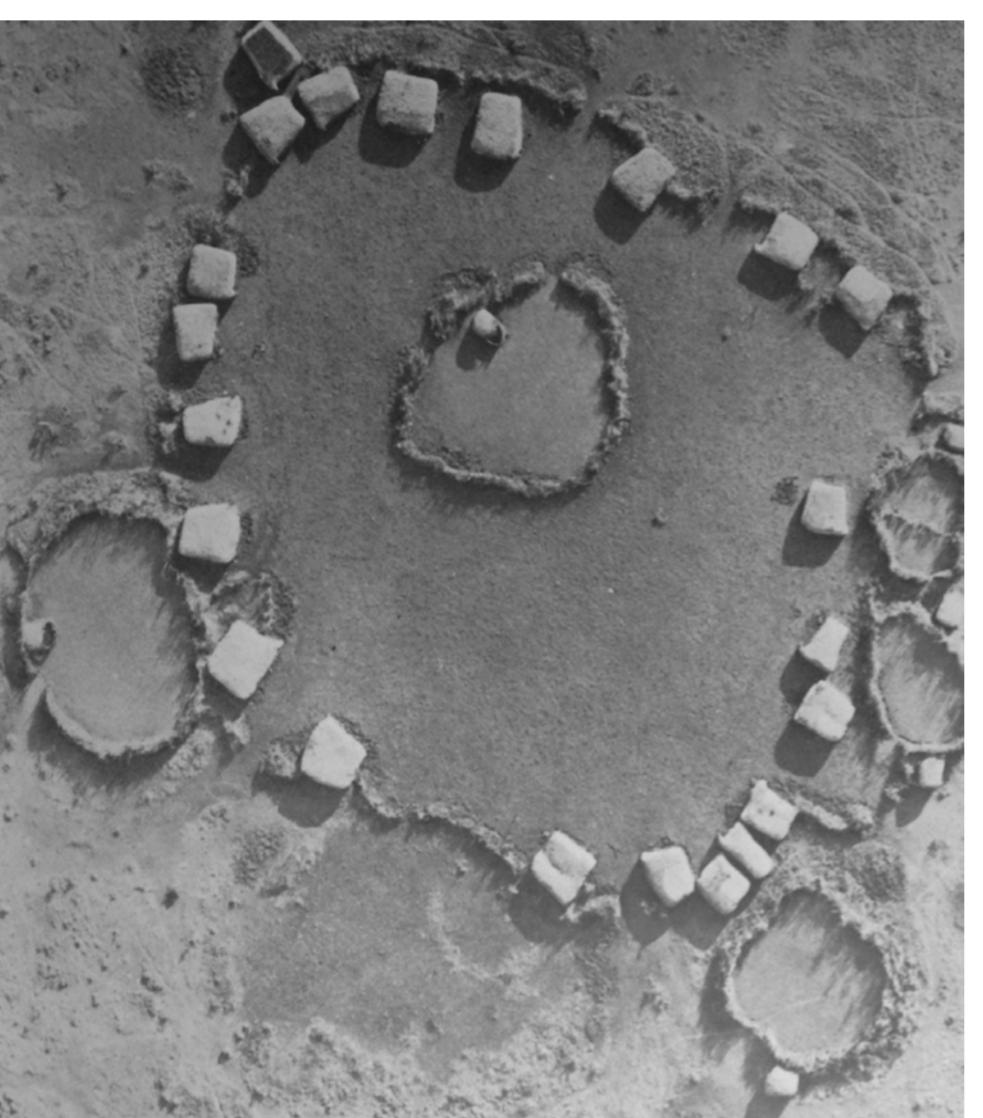
- Little control over future
- Few means to make a difference
- Culture at risk of disappearing

MAASAI SKYWATCH

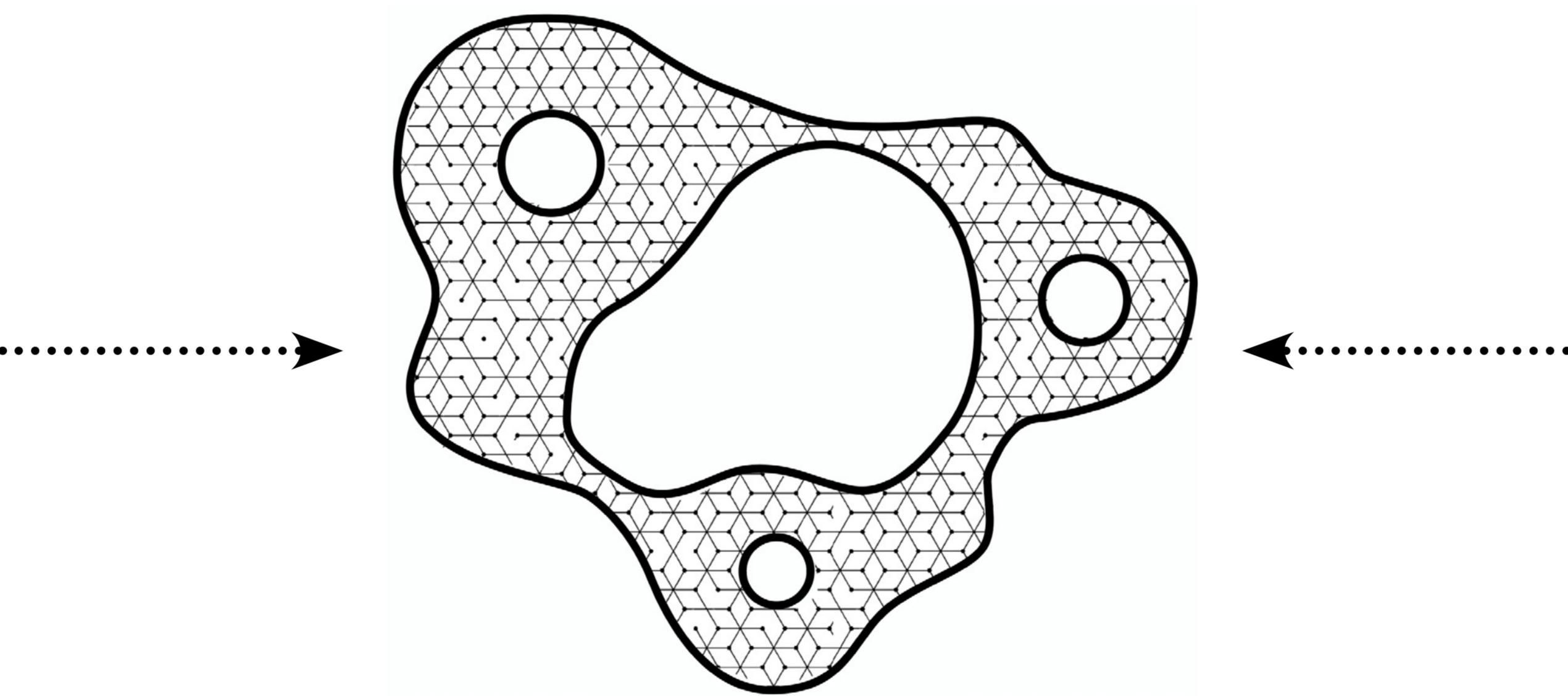
Defending Maasai land with A.I. and
satellite based observation

Luke McKinley // Rhys Broussard // Michael Hasey
General Assembly // Project 5 // 05.15.20

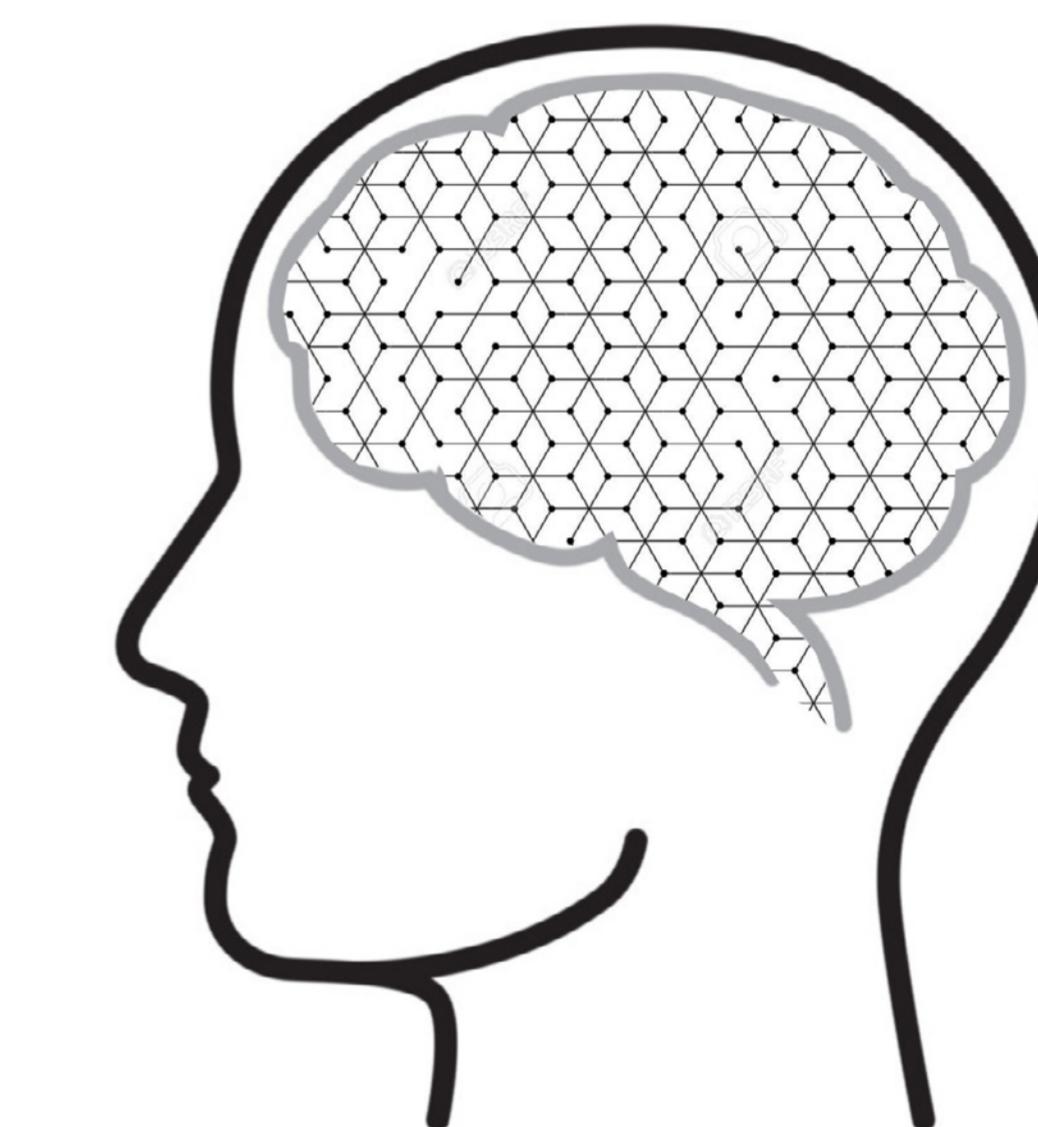




Social
Injustice

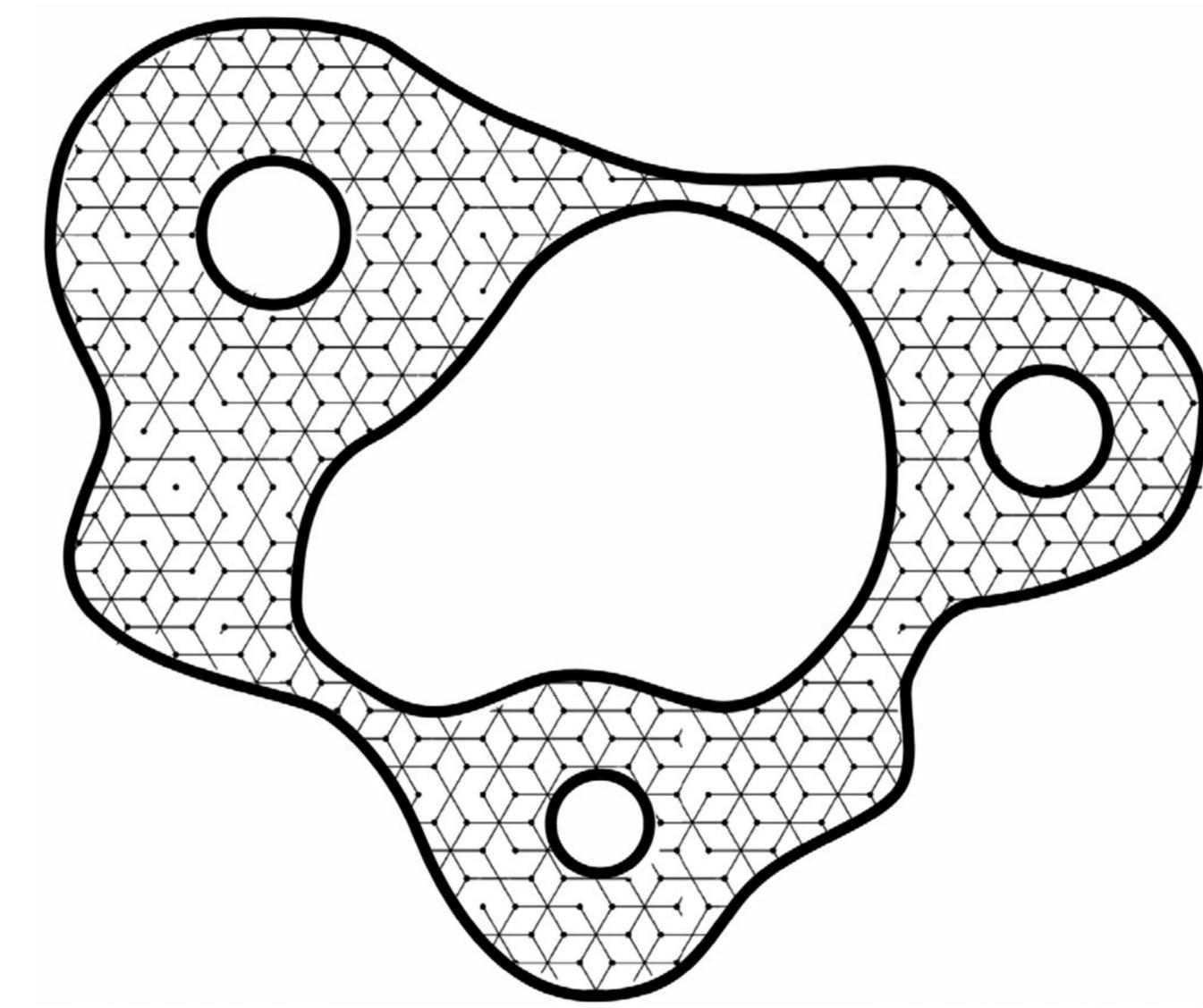


Maasai
Skywatch



A.I.
Technology

Our mission:



Provide the Maasai with a tool
to quickly identify illegal village
burns, forced migrations, &
potential land grabs.



Skywatch Live

An online, open-source
village-tracking database

- Monitor village/population movement
- Identify illegal events (burnings)
- Analyze patterns & trends and make predictions



Skywatch Live

Answering Important Questions

- How can social injustices be tracked?
- How can accurate statistics be acquired?
- How can official reports be confirmed / denied?
- Where do people go after eviction?
- How is traditional land use changing?

Skywatch Live

1. MONITOR

- Population movement
- Village counts per region
- Changes in village density and aggregation



Skywatch Live

1. MONITOR

- Population dispersal
- Village counts per region
- Changes in village density and aggregation

2. IDENTIFY

- Illegal village burns
- Forced evictions, other types of migration
- Changes in land use



Skywatch Live



1. MONITOR

- Population dispersal
- Village counts per region
- Changes in village density and aggregation

2. IDENTIFY

- Illegal village burns
- Forced migrations
- Changes in land use

3. ANALYZE

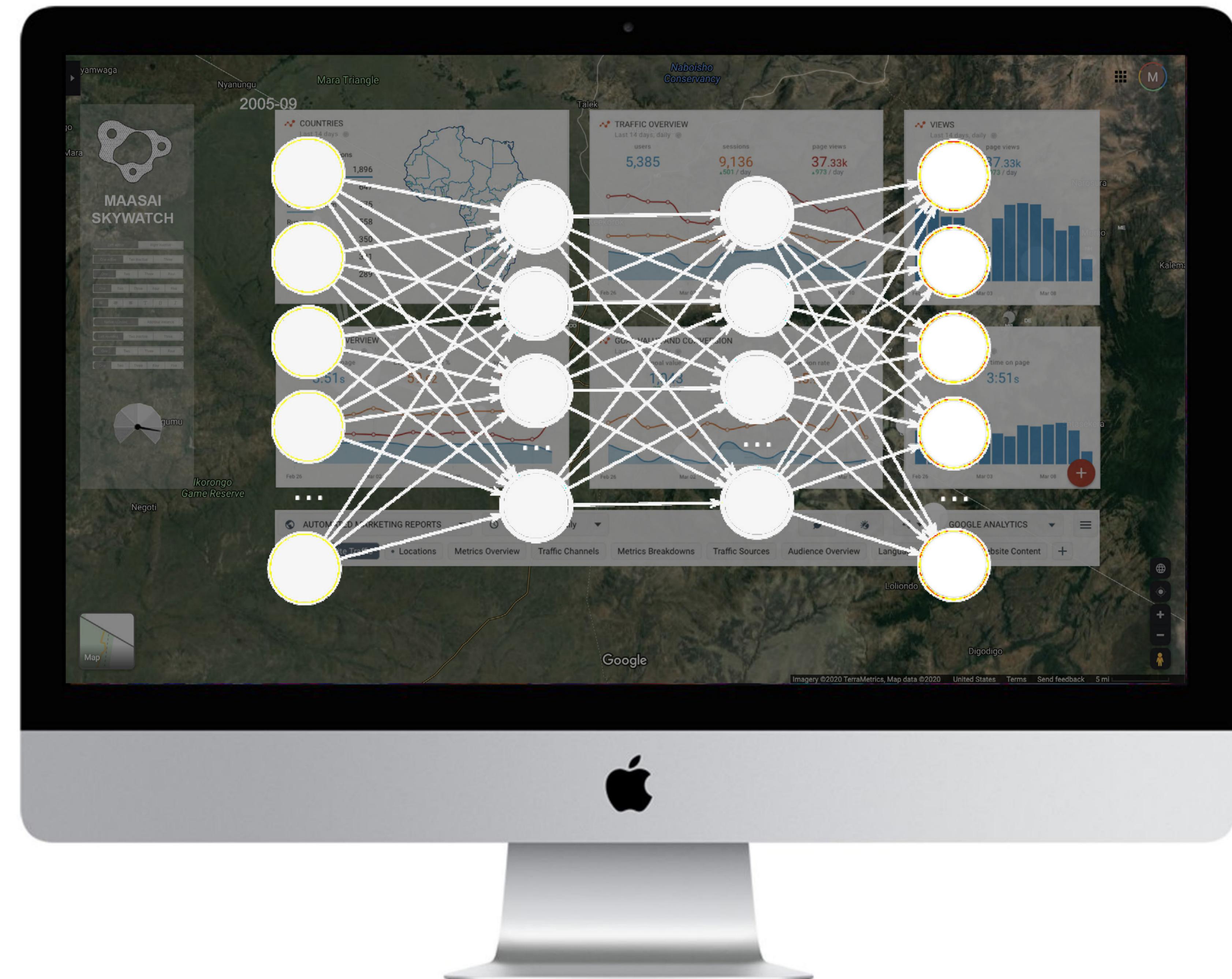
- Past and current population movement patterns
- Historic and current trends (eviction, migration..)
- Future predictions



Skywatch Live

A secure, reliable, and unbiased source of information to reduce social injustice.

- An autonomous platform based on publicly available satellite imagery.
- Provides the Maasai with the material needed to fight injustice.
- Reduces reliance on witnesses who may fear reprimand, punishment, or harm.



Skywatch Live

Uses Machine learning and A.I. based algorithms to provide accurate and reliable data

- Computer vision image classifiers
- Roboflow image dataset creators
- YoloV3 Object Detection models
- Live object detection classifiers (tbd)
- Google Earth Engine integration (tbd)
- Data analytics tools (tbs)

WHO ARE THE MAASAI ?

The Maasai, a semi-nomadic ethnic group, are based in the Great Rift Valley of East Africa, between Northern Tanzania and Southern and Central Kenya. With a population of almost 2 million, they have inhabited the region for centuries, moving their herds of cattle with the seasons.



WHERE DO THEY LIVE ?

The Maasai are one of many ethnic groups that occupy the countries of East Africa. Currently, they reside in both Kenya and Tanzania and have called these countries home for more than 500 years.



PASTORALISM

The Maasai are one of East Africa's many pastoral people, and like all others, are closely tied to their animals. However, the Maasai's livestock of cattle, goats and sheep are used for more than just personal sustenance, but also as local currency, for national and international trade, and as a marker of social standing, wealth, and power.



A VITAL TRADE NETWORK

- Responding to both increases and decreases in supply and demand; the Maasai are tied extremely closely to the Kenyan and International economy. As Kenya's main source of beef, the Maasai contribute 300 million dollars yearly towards the country's GDP (13% of total). Provides 28% of Kenya's total annual consumption of meat.



A HISTORY OF DISPLACEMENT

Over the past one hundred years, the Maasai have been relocated multiple times by various foreign political powers. As a result, Maasai land has become increasingly privatized by individual families, foreigners, or by group farms. In recent years, land grabbing has increased exponentially as non-Maasai have taken advantage of precarious land-rights laws in order to forcefully obtain land.



DISPLACEMENT BY CONSERVATION

Government officials and foreign companies in Tanzania are using ecotourism and conservation laws to displace indigenous Maasai people, evicting them and denying them access to watering holes and vital grazing for their livestock.

“As areas have been deemed “protected” or transferred to new owners, the Maasai have been driven into smaller and smaller areas, creating a map of confinement that is as stifling and foreign to them as a zoo to a lion,”

- Anuradha Mittal and Elizabeth Fraser,
The Oakland Institute



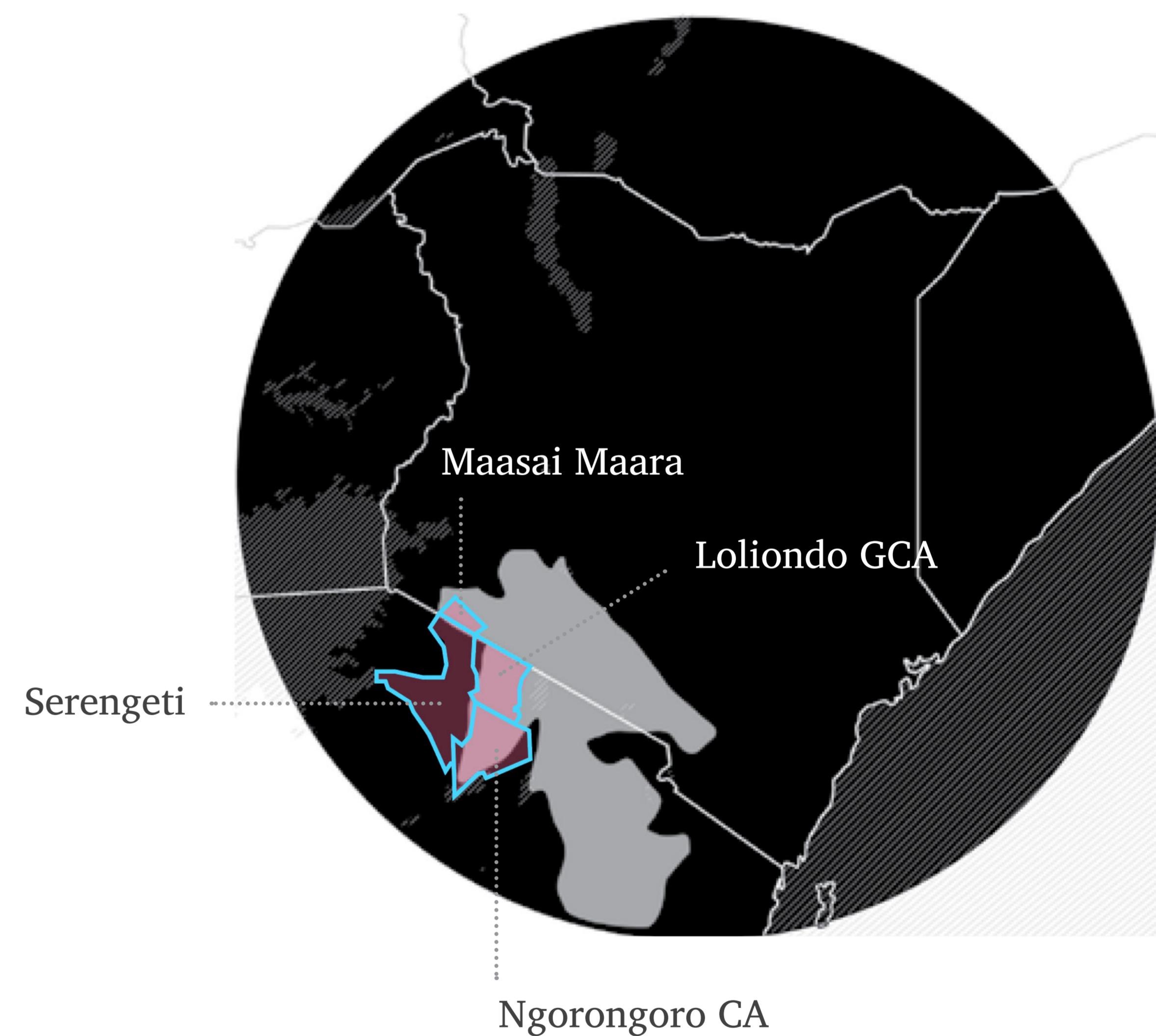
Tourism Industry
19% of Kenyas GDP

DISPLACEMENT BY CONSERVATION

Government officials and foreign companies in Tanzania are using ecotourism and conservation laws to displace indigenous Maasai people, evicting them and denying them access to watering holes and vital grazing for their livestock.

“As areas have been deemed “protected” or transferred to new owners, the Maasai have been driven into smaller and smaller areas, creating a map of confinement that is as stifling and foreign to them as a zoo to a lion,”

- Anuradha Mittal and Elizabeth Fraser,
The Oakland Institute

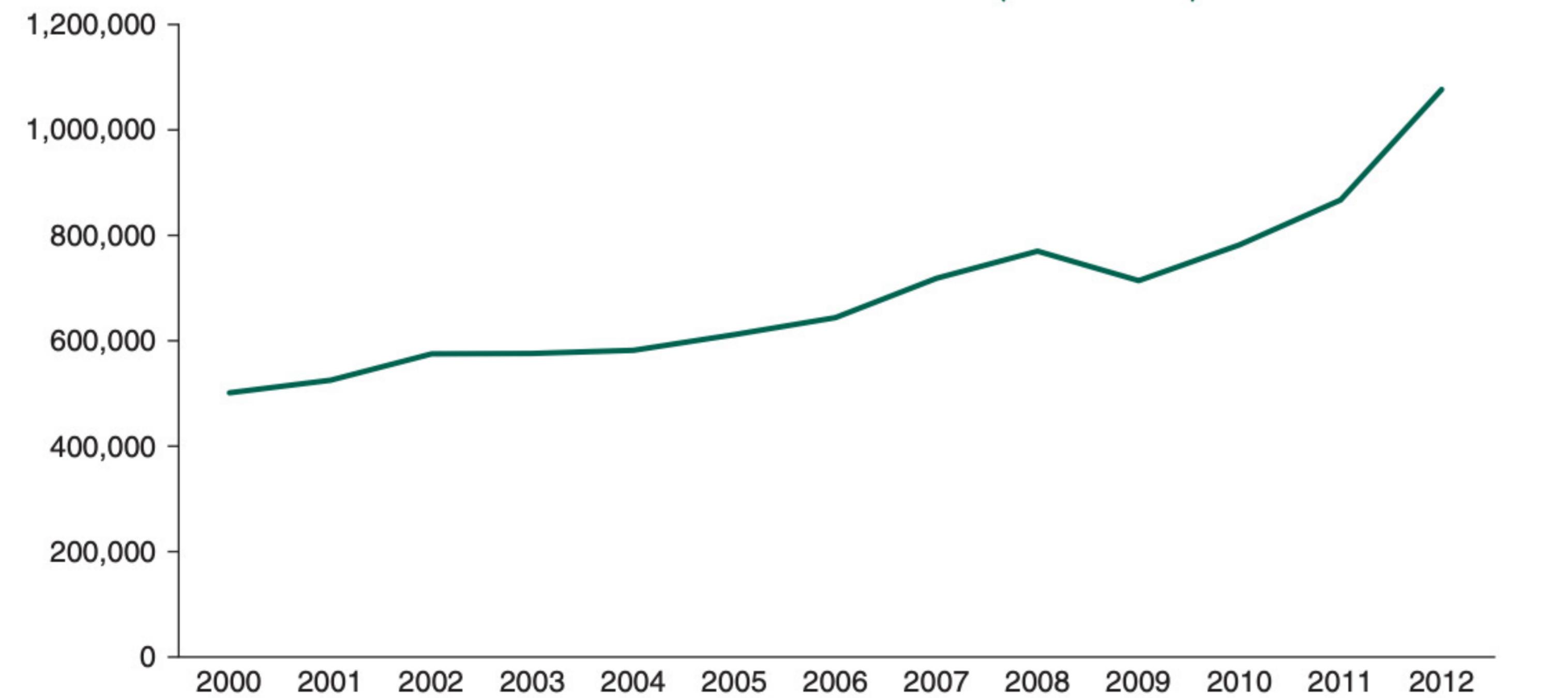


Tourism Industry
19% of Kenyas GDP

DISPLACEMENT BY CONSERVATION

Government officials and foreign companies in Tanzania are using ecotourism and conservation laws to displace indigenous Maasai people, evicting them and denying them access to watering holes and vital grazing for their livestock.

FIGURE 2.1. FOREIGN VISITORS TO TANZANIA (2000-12)



Source: Tanzania Tourism Statistical Bulletin 2012, Tourism Division, MNRT.



HUMAN RIGHTS VIOLATIONS

- Forced evictions
- Village burnings
- No resettlement plans
- Court Rulings
- Resources Taken
- Homes destroyed
- Livestock killed



DATA SOURCE

Satellite Imagery

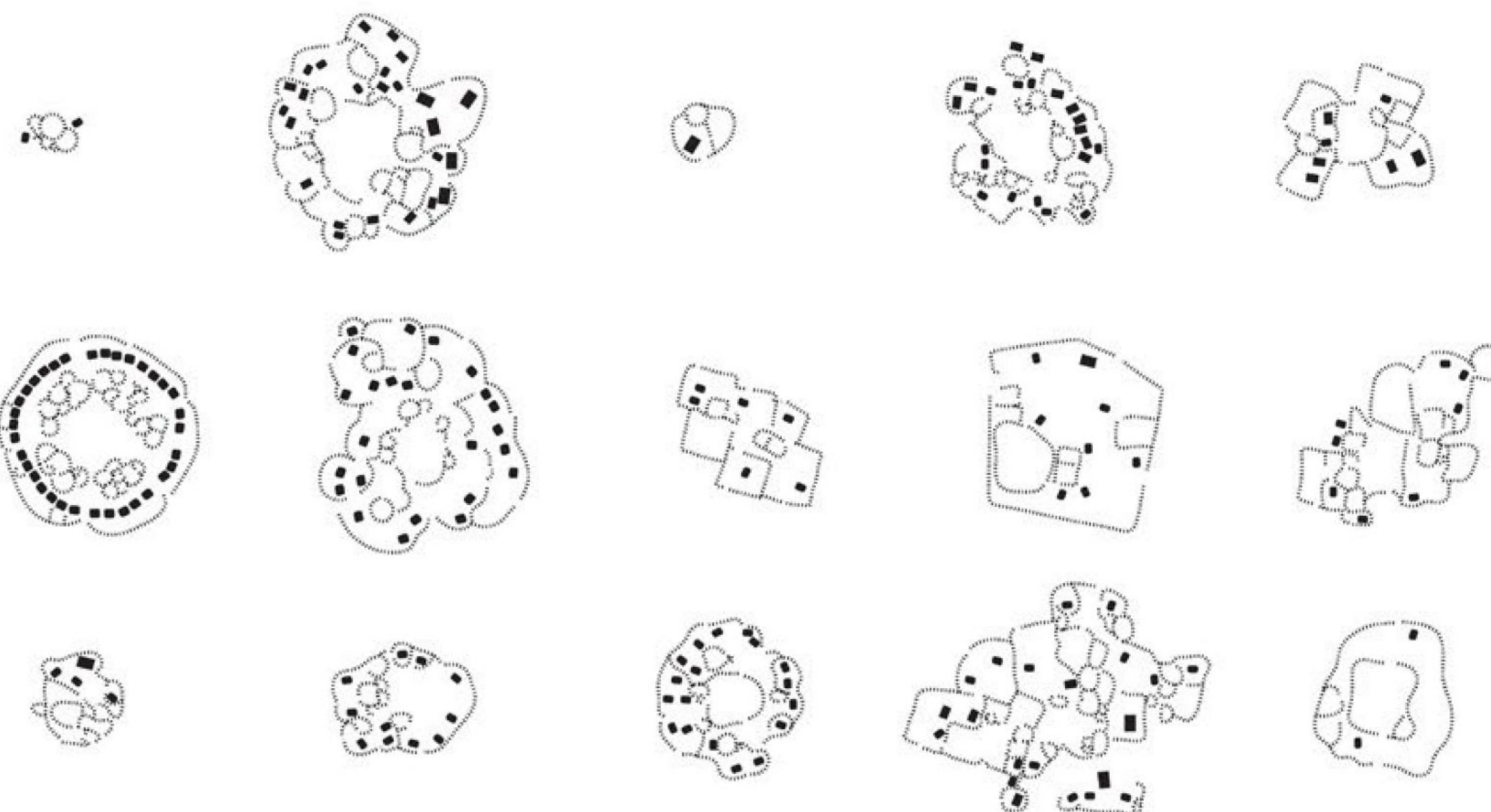
- CNES / Airbus, Maxar Technologies
(super high-res.)
- Sentinel-2, MSI (high-res.)
- Landsat-98 (medium-res.)



DATA TARGET

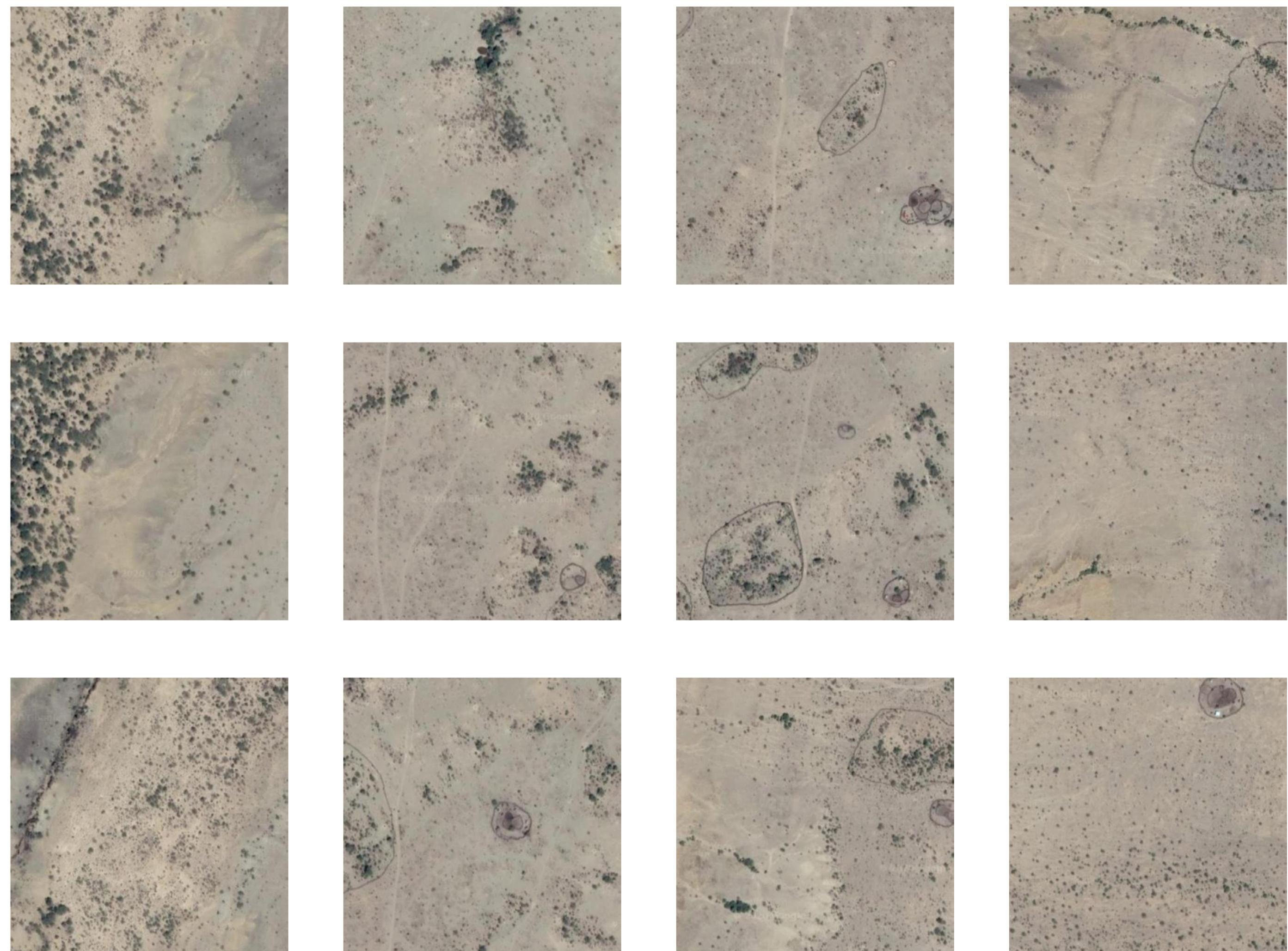
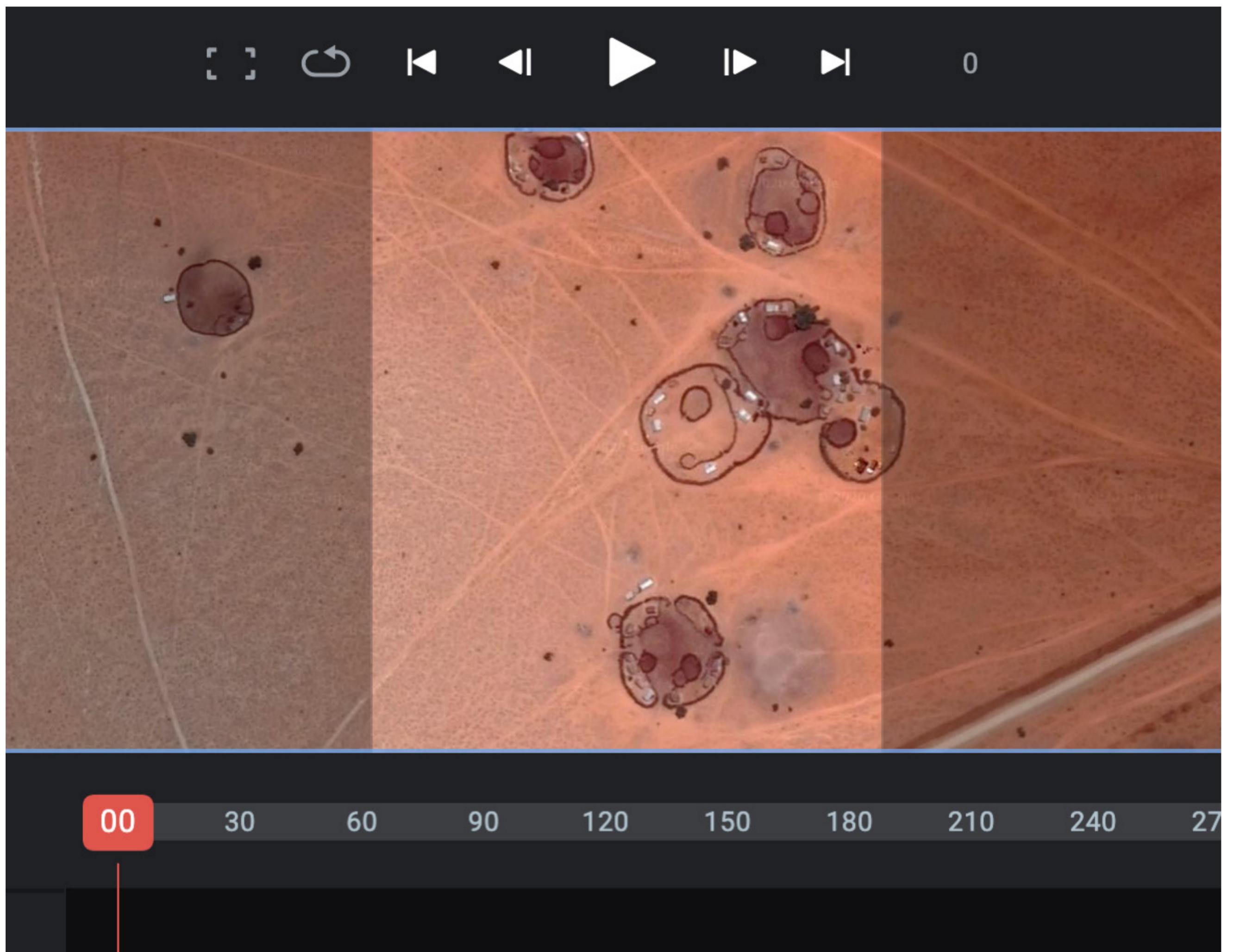
Villages as Training Data

- We trained our model on village imager data in order to extract spatial insight into various aspects of the Maasai's existence within Kenya and Tanzania.



DATA COLLECTION

Google Earth Studio



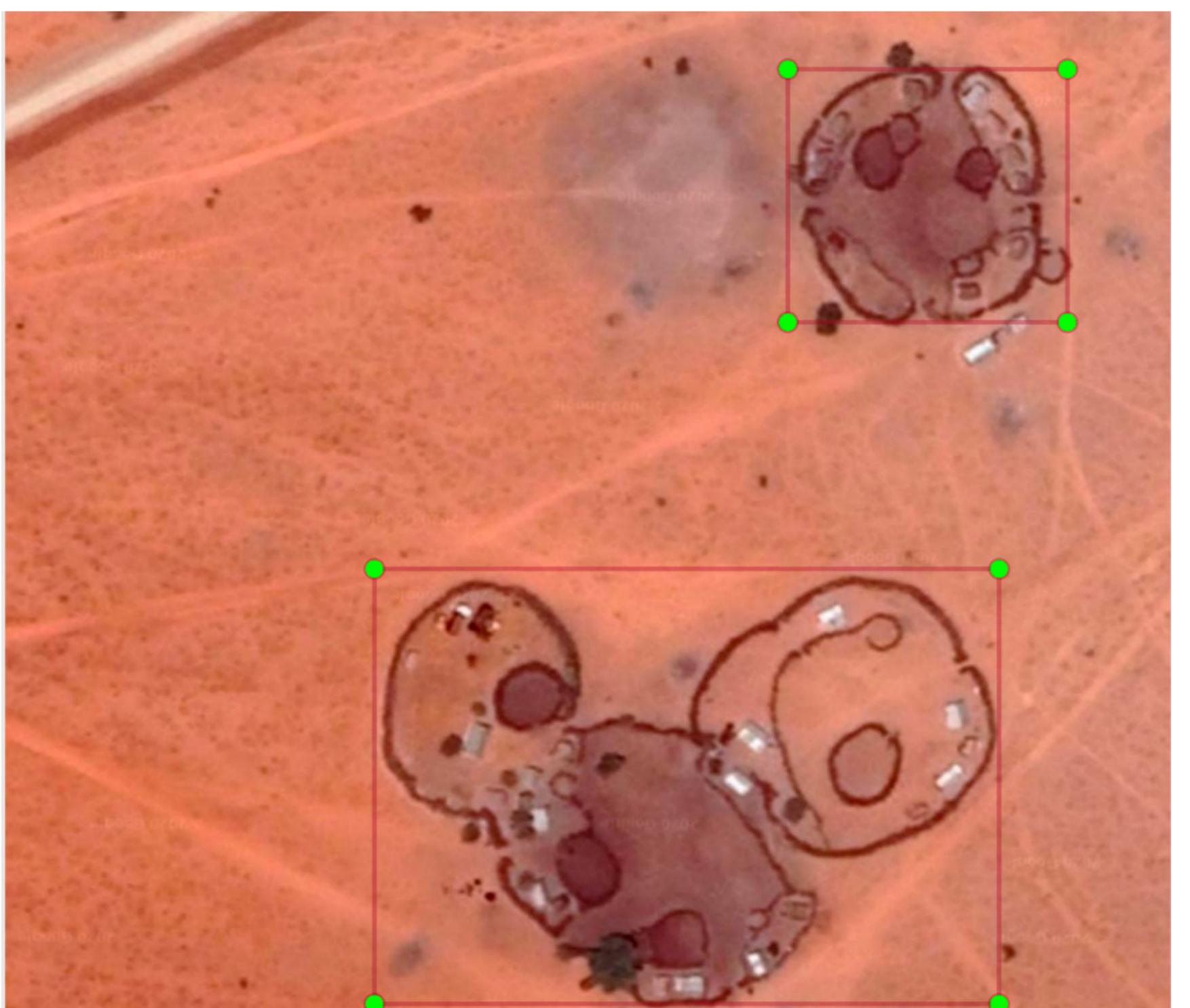
DATA COLLECTION

Meta-data

- altitude
- latitude
- longitude
- time

```
In [8]: ast.literal_eval(exif[37500].decode())
```

```
Out[8]: {'version': 3,
'gms_version': '1.3.1.20200421.r00',
'useragent': 'Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/81.0.4044.138 Safari/537.36',
'world_values': {'altitude': 2223.2900080749205,
'latitude': -2.588553393721469,
'longitude': 37.3760398726327,
'rotationX': 0,
'rotationY': 0,
'rotationZ': 0,
'fov': 20,
'planet': 0,
'atmospherics': 1,
'worldTime': 0,
'cloud': 1,
'clouddate': 1588399200000,
'seawater': 1,
'buildingsEnabled': 1}}
```



DATA LABELING

Label Image Tool



DATA AUGMENTATION

Roboflow

Loliondo_EV_3

Last Upload **a day ago**
98 images added

Dataset Size **98 images**
294 after augmentation

Annotations **villages**
Object Detection

Images

[View all images \(98\)](#) [Add More Images](#)

Pre-Processing Options

- Auto-Orient** Discard EXIF rotations and standardize pixel ordering.
- Resize** Downsize images for faster training.
- Grayscale** Merge color channels to make your model faster and insensitive to subject color.
- Auto-Adjust Contrast** Boosts contrast based on the image's histogram to improve normalization and line detection in varying lighting conditions.

Augmentation Options

Augmentations Per Image
The number of derived images you want to generate for each source image.

1 50 **Output Size**
294

Image Level Augmentations

Flip
Add horizontal or vertical flips to help your model be insensitive to subject orientation.
 Horizontal
 Vertical

90-Degree Rotations
Add 90-degree rotations to help your model be insensitive to camera orientation.
 Clockwise
 Counter Clockwise
 Upside Down

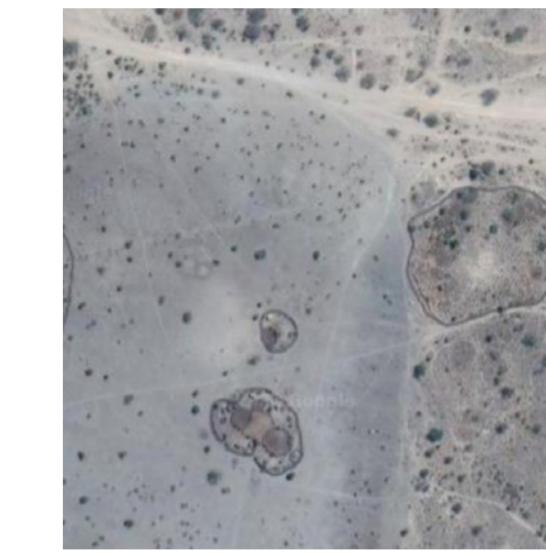
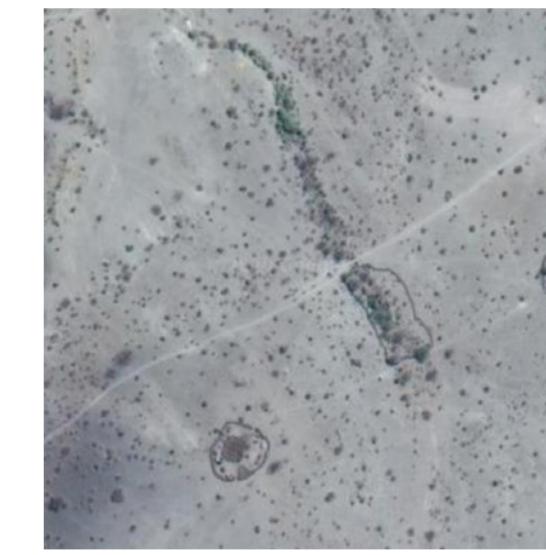
FINAL DATASETS

Model Training

Model
Training

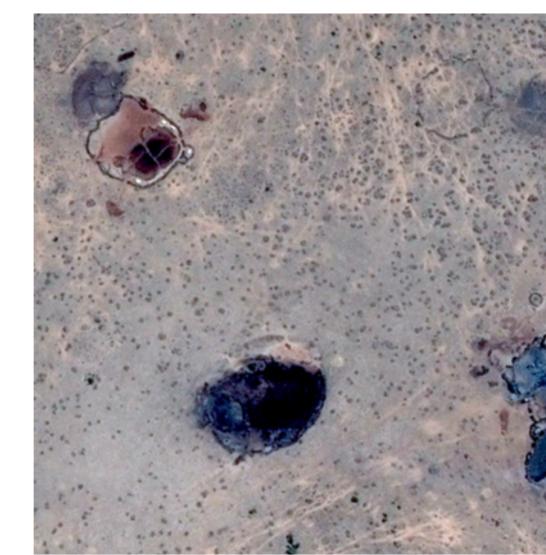
Dataset 1: Villages, Corrals, Farms

- low resolution
- 170 preprocessed images, 281 objects
- 510 post processed images, 843 objects



Dataset 2: Burned Villages

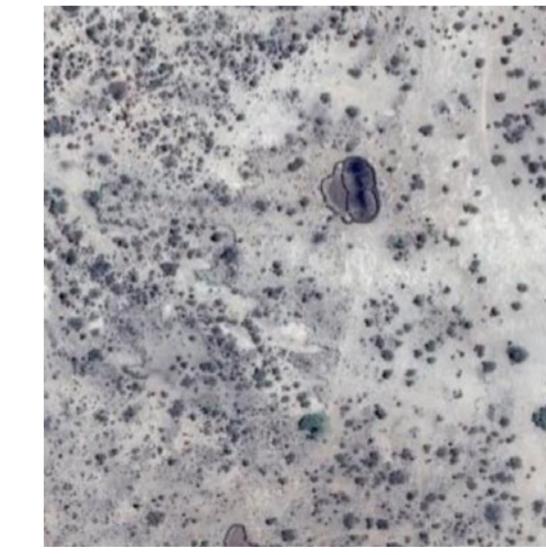
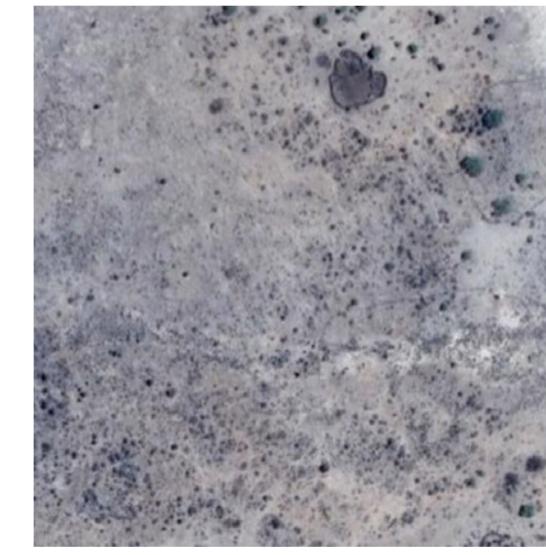
- high resolution
- 19 preprocessed images
- 57 post processed images



Testing

Dataset 3: Loliondo Area

- high resolution
- 100 preprocessed images
- 500 post processed images

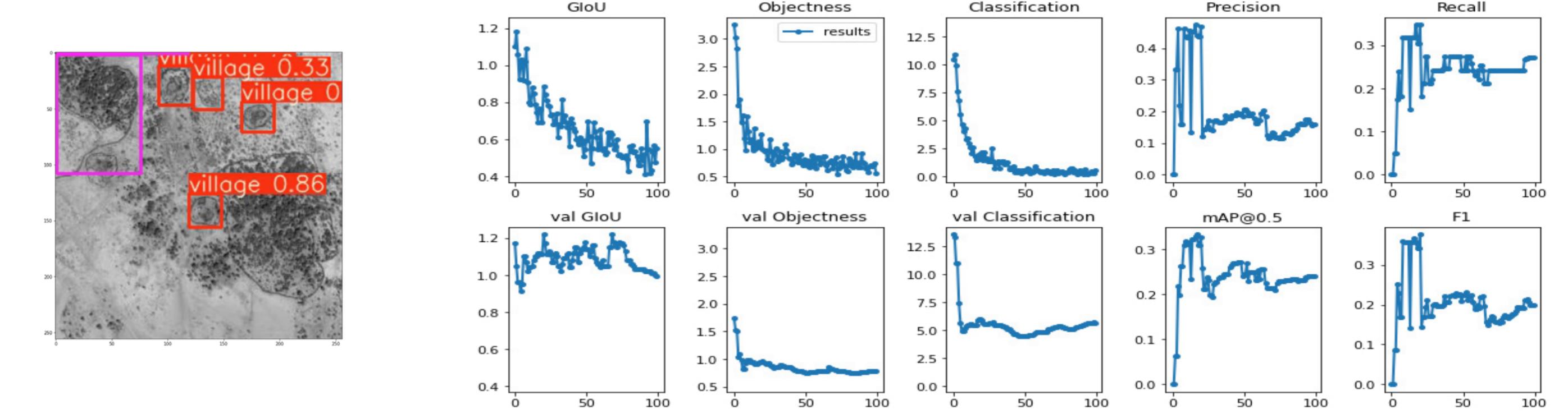
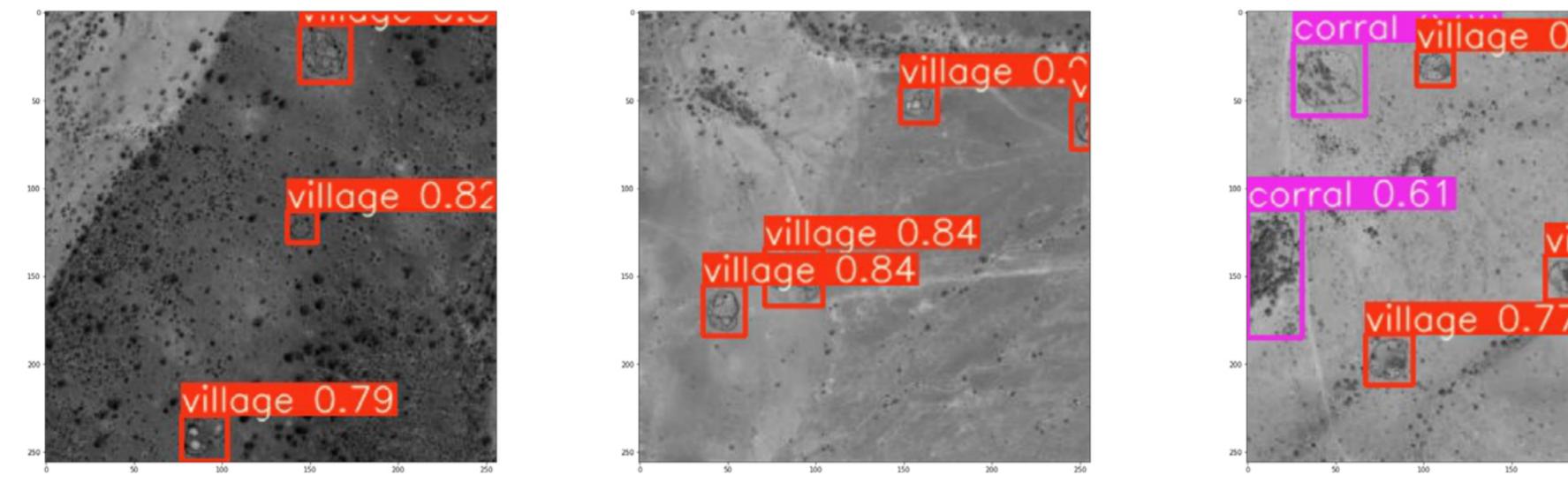


MODEL TRAIN / TEST

YoloV3 Object Classifier

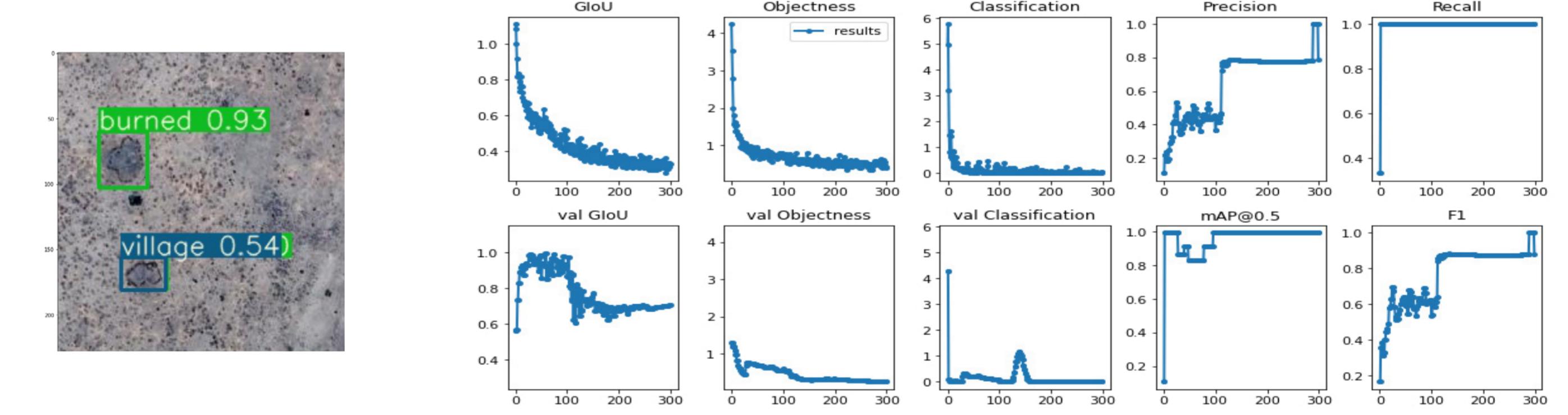
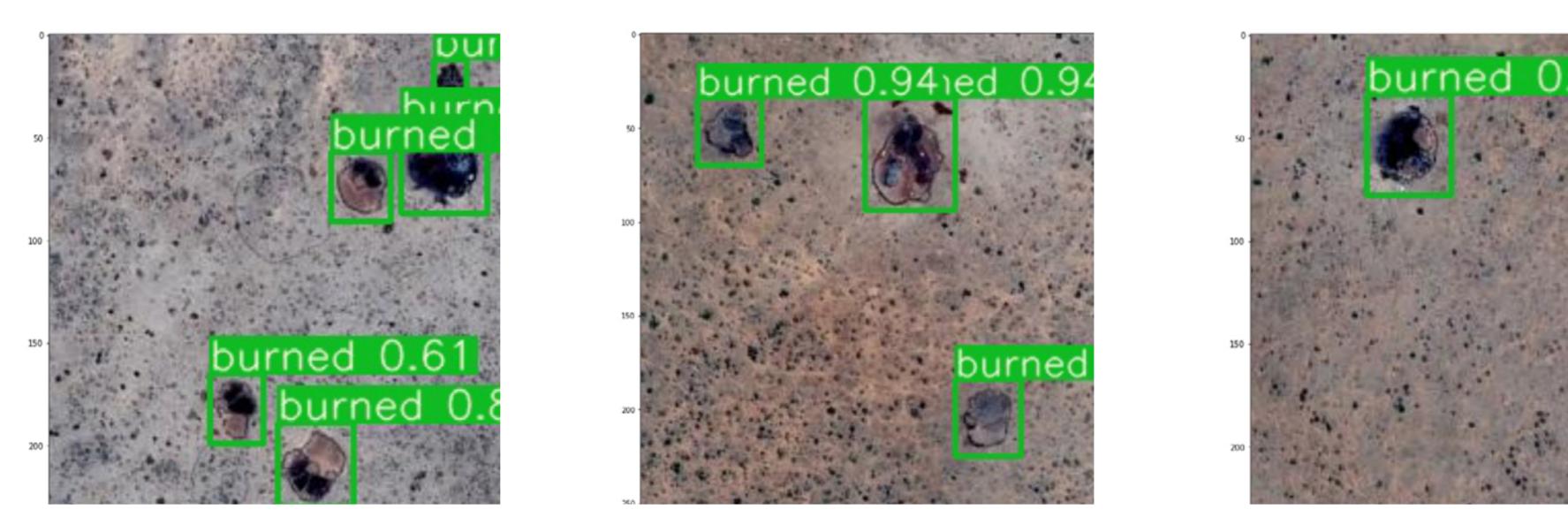
Dataset 1:

- villages, corrals, farms
- 14/16 correct predictions



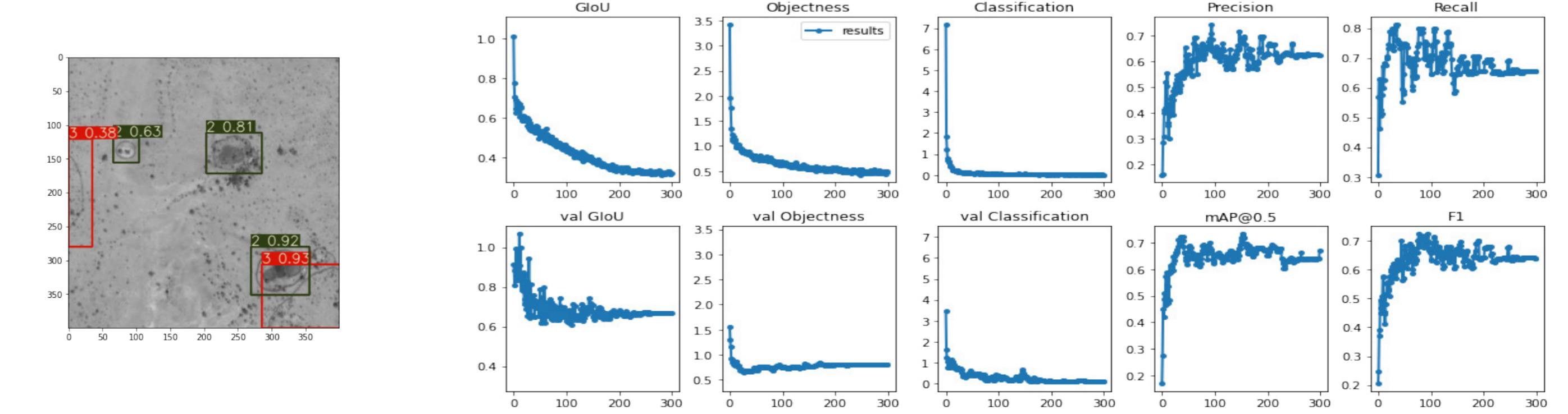
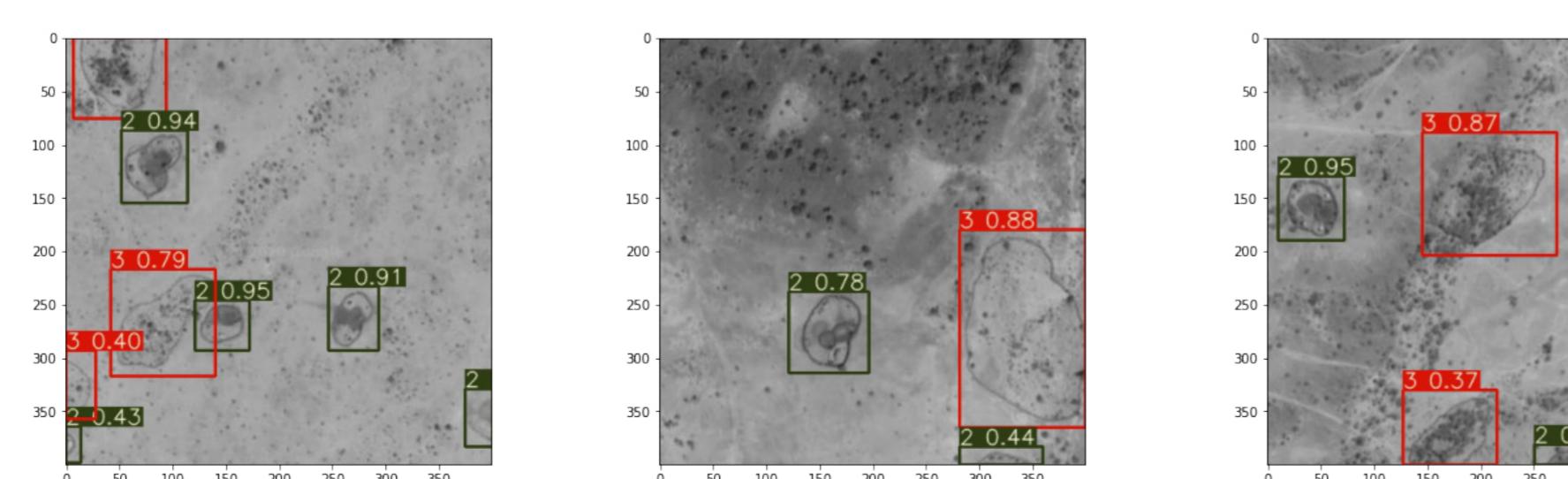
Dataset 2:

- burned villages



Dataset 3:

- Loliondo



CLASSIFYING OBJECTS

A Montage



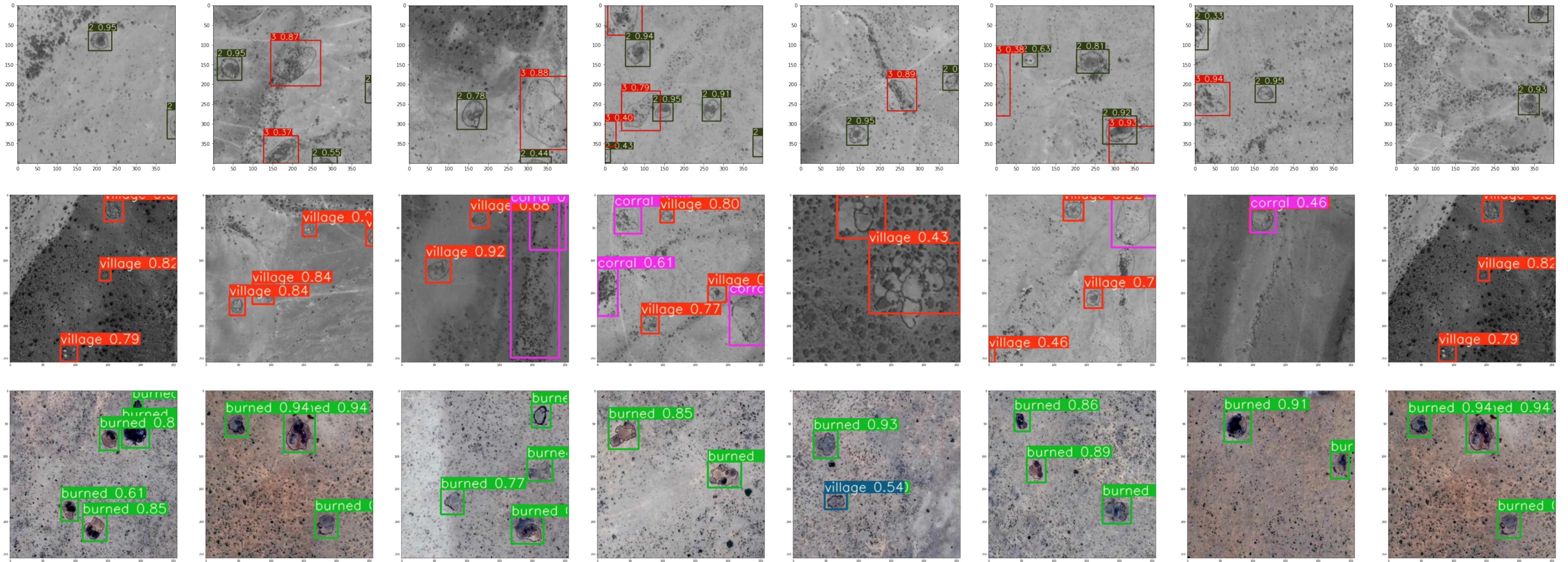
- villages

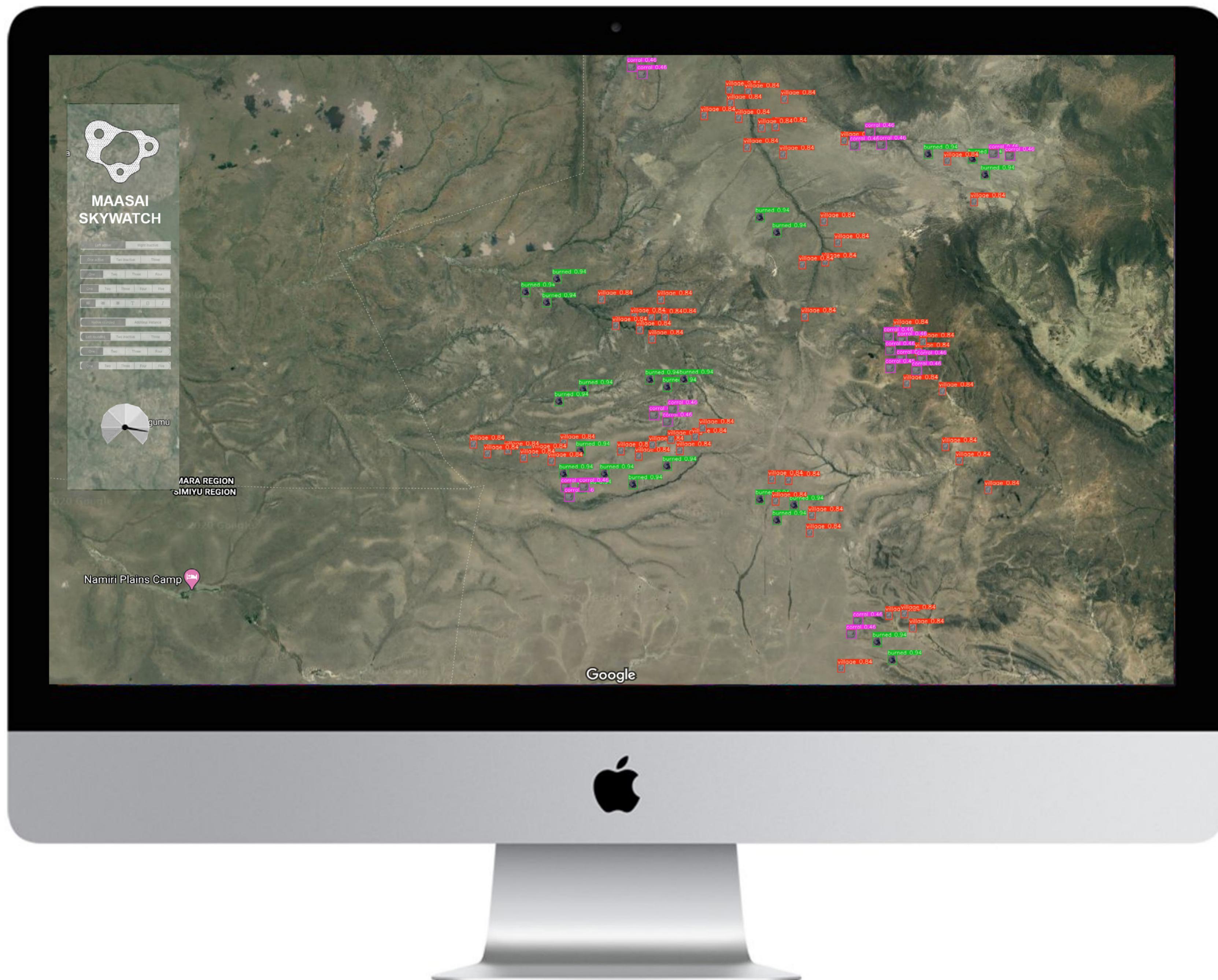


- burned village



- livestock corral





**Large scale object
detection & tracking
across Maasai Land**

DATA INSIGHT

Village Dispersal

- View current village dispersal and aggregation in any region



DATA INSIGHT

Village Count

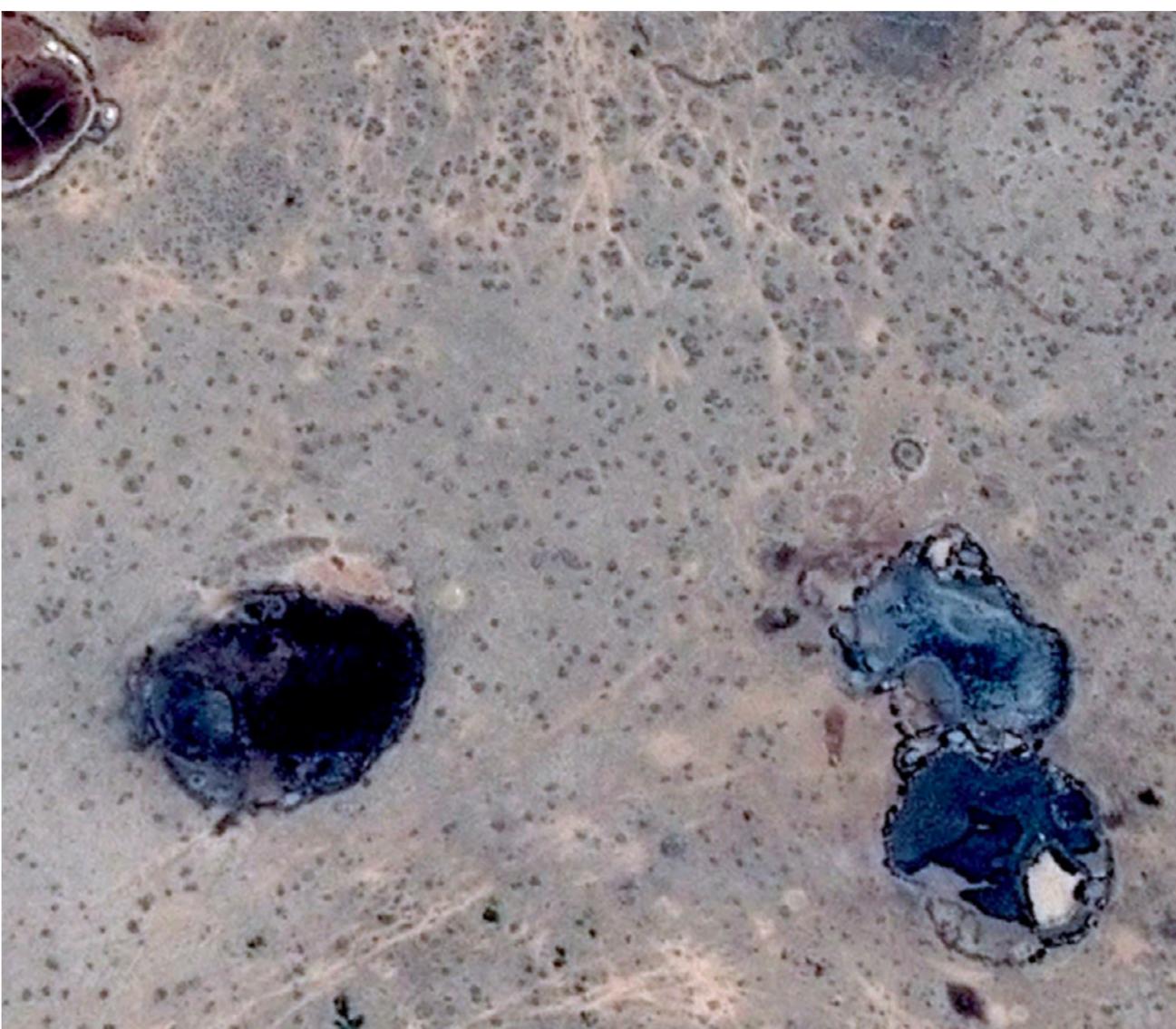
- Obtain village count within a certain region and at a certain year / time.



DATA INSIGHT

Illegal Village Burns

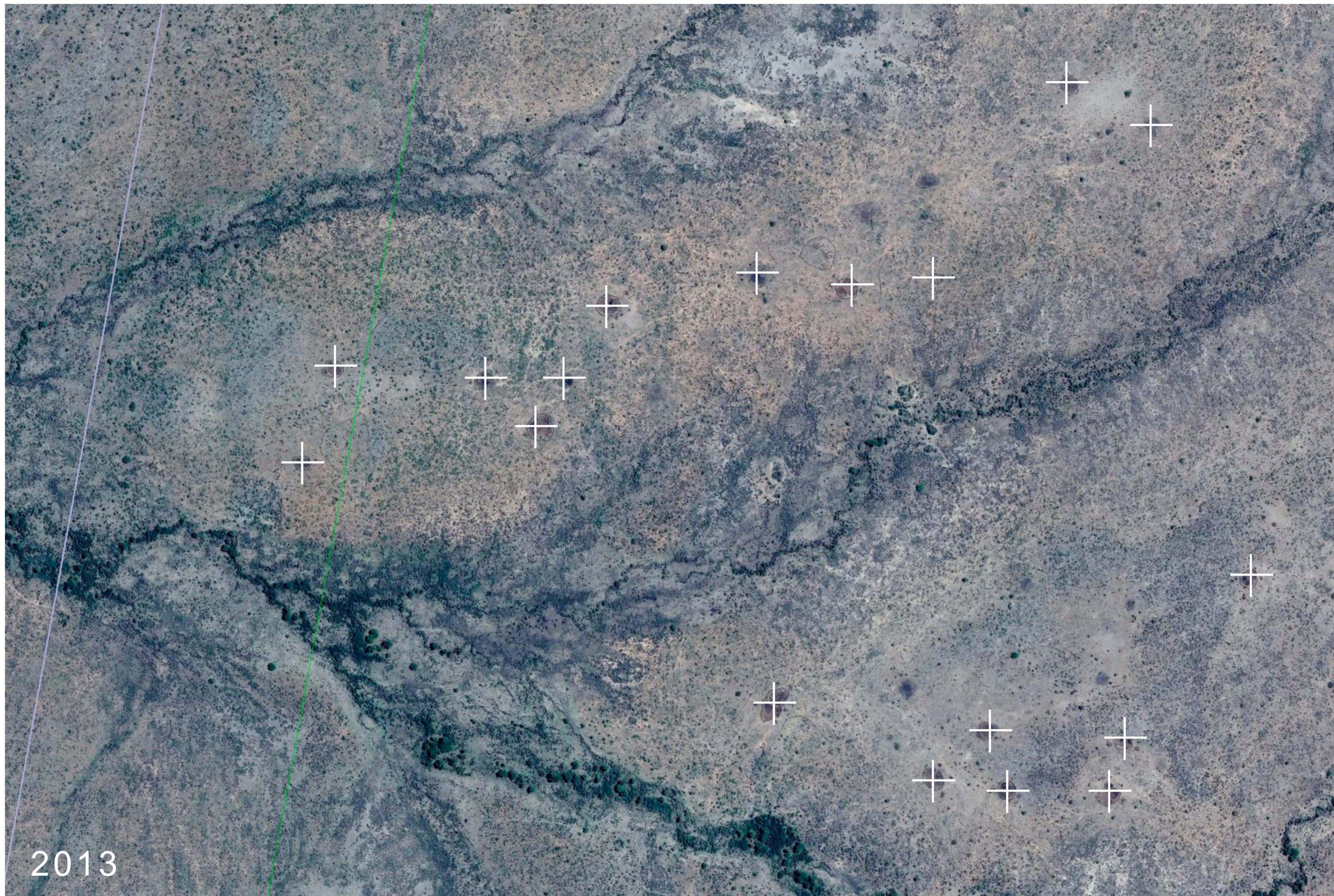
- Quickly identify, locate, and count burned villages in any selected region.



DATA INSIGHT

Village Density & Clustering

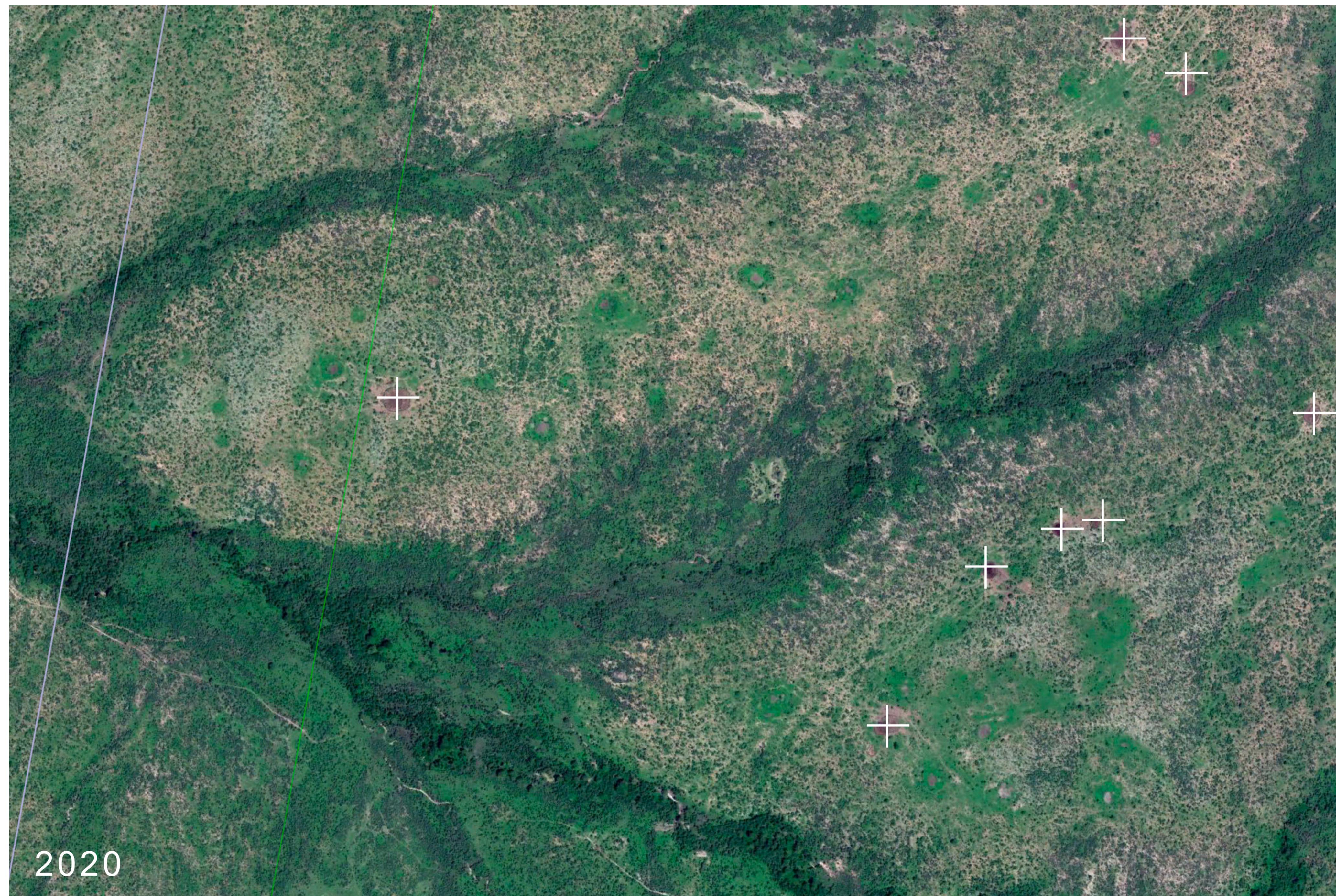
- Track and record increases or decreases in village density due to forced relocations, severe weather changes, access to resources, village burnings, etc.



DATA INSIGHT

Village Density & Clustering

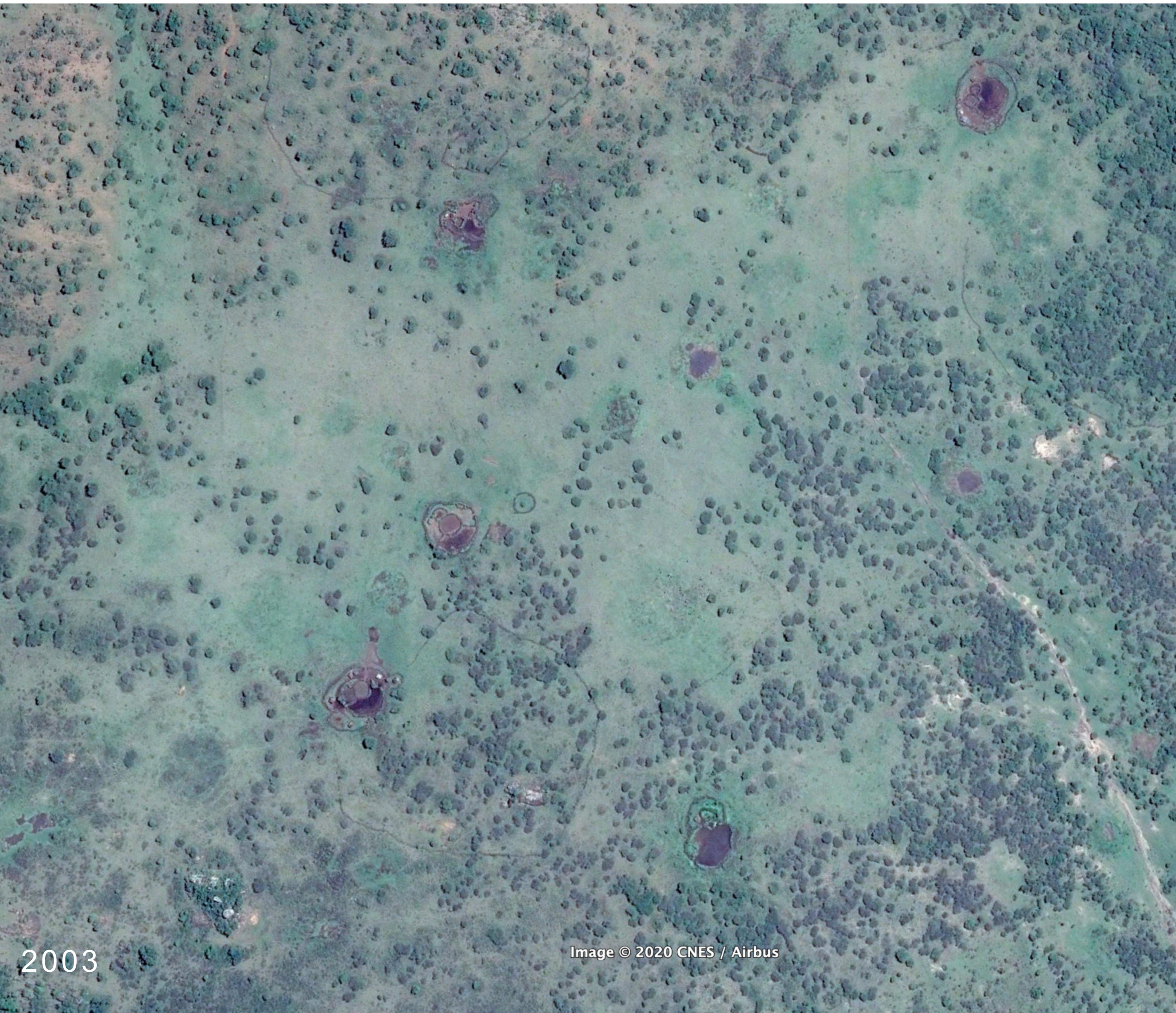
- Track and record increases or decreases in village density due to forced relocations, severe weather changes, access to resources, village burnings, etc.



DATA INSIGHT

Land Use Changes

- Quickly identify how land use is changing
- Is land use transitioning from open range pastoralism to segmented farmland?
- Is land being privatized and fenced off?
- Are Maasai becoming constrained?



2003

Image © 2020 CNES / Airbus

DATA INSIGHT

Land Use Changes

- Quickly identify how land use is changing
- Is land use transitioning from open range pastoralism to segmented farmland?
- Is land being privatized and fenced off?
- Are Maasai becoming constrained?



2011

Image © 2020 CNES / Airbus

DATA INSIGHT

Land Use Changes

- Quickly identify how land use is changing
- Is land use transitioning from open range pastoralism to segmented farmland?
- Is land being privatized and fenced off?
- Are Maasai becoming constrained?



2020

Image © 2020 Maxar Technologies



0 36.324

2.91

1791

on

Scripts Docs Assets

Filter scripts...

NEW ▾

- ▶ Owner (16)
- ▶ Writer
- ▶ Reader
- ▼ Examples
 - ▶ Image
 - ▶ Image Collection
 - ▶ Feature Collection
 - ▶ Charts
 - ▶ Arrays
 - ▶ Primitive
 - ▼ Cloud Masking
 - Landsat457 Surface Reflectance
 - Landsat8 Surface Reflectance
 - Landsat8 TOA Reflectance QA Band
 - MODIS Surface Reflectance QA Band
 - Sentinel2

Sentinel2

Get Link ▾

Save ▾

Run ▾

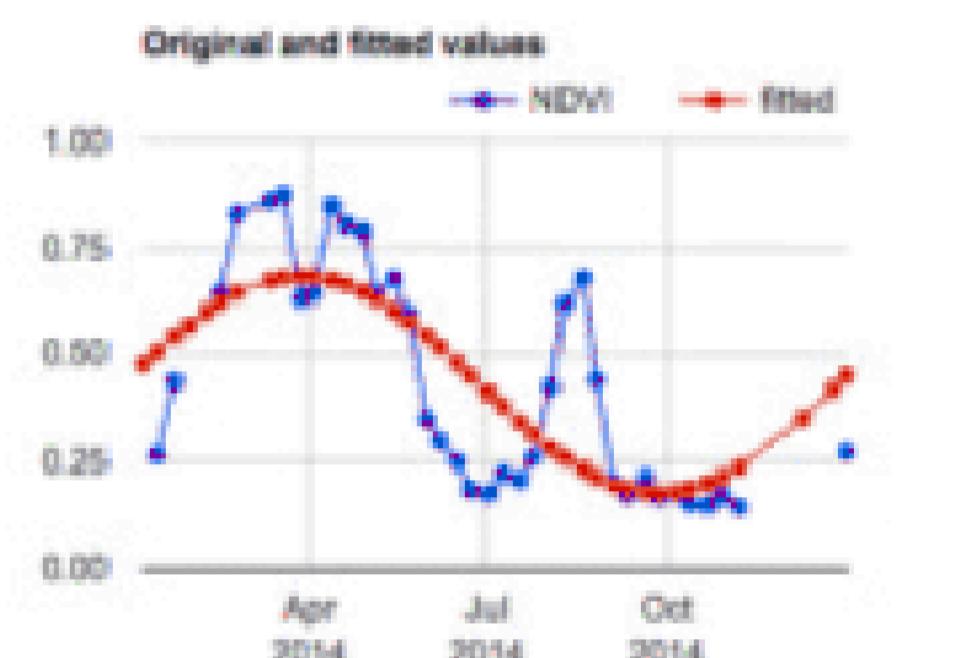
Reset ▾



Inspector Console Tasks

Use print(...) to write to this console.

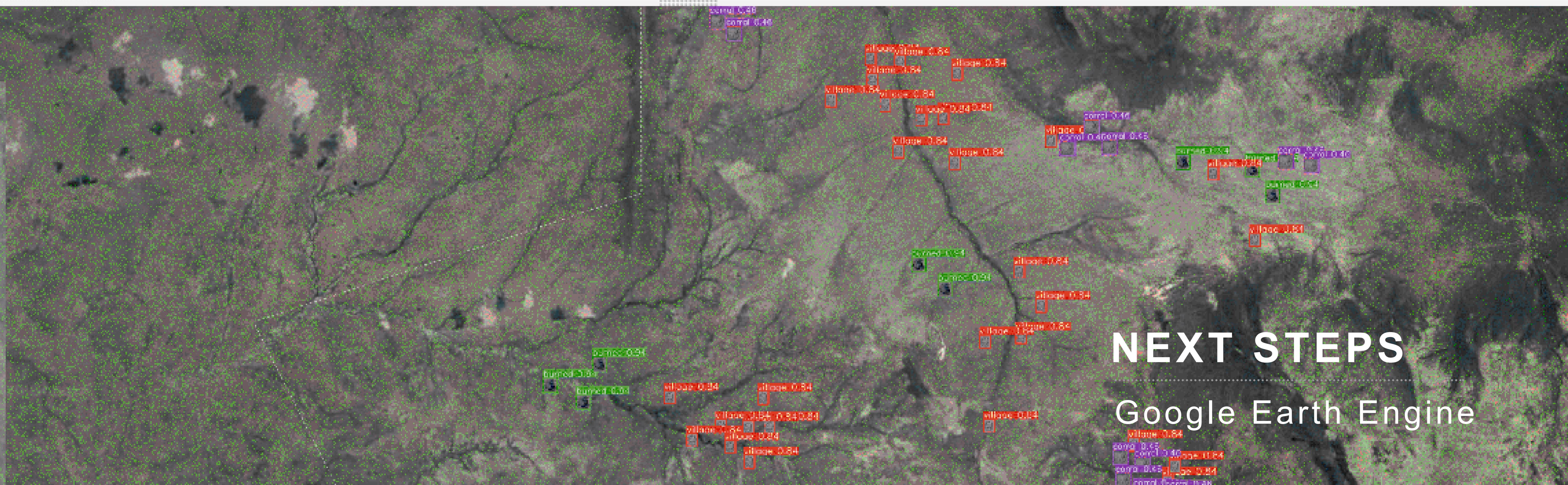
Use print(...) to write to this console.



```

1 // This example uses the Sentinel-2 QA band to cloud mask
2 // the collection. The Sentinel-2 cloud flags are less
3 // selective, so the collection is also pre-filtered by the
4 // CLOUDY_PIXEL_PERCENTAGE flag, to use only relatively
5 // cloud-free granules.
6
7 // Function to mask clouds using the Sentinel-2 QA band.
8 function maskS2clouds(image) {
9   var qa = image.select('QA60')
10
11  // Bits 10 and 11 are clouds and cirrus, respectively.
12  var cloudBitMask = 1 << 10;
13  var cirrusBitMask = 1 << 11;
14
15  // Both flags should be set to zero, indicating clear clouds.
16  var mask = qa.bitwiseAnd(cloudBitMask).eq(0).and(
17    qa.bitwiseAnd(cirrusBitMask).eq(0))
18
19  // Return the masked and scaled data, without the QA band.
20  return image.updateMask(mask).divide(10000)
21    .select("B.*")
22    .copyProperties(image, ["system:time_start"])
23

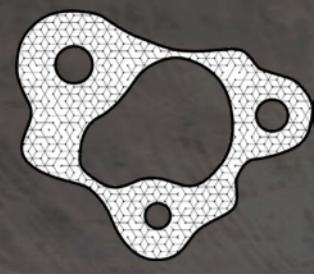
```





Maasai Skywatch

Making Maasai injustice
visible through Big Data
and A.I.



MAASAI SKYWATCH

Defending Maasai land with A.I. and satellite based observation

