

Crafting Technologies for Agriculture and Health

2019 November 17

William Wu <w@qed.ai>

Director of QED | <https://qed.ai>

- Job: “Technologist”



William Wu

Ph.D. EE, M.S. Math (Stanford)
B.S. EECS (Berkeley)
Ex-NASA Jet Propulsion Lab

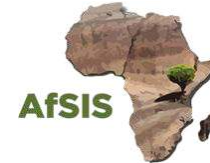
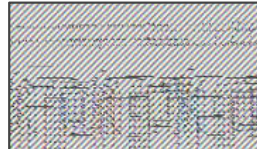


(first computer)

- Past:



- Present: 



- Why:



(SDGs)

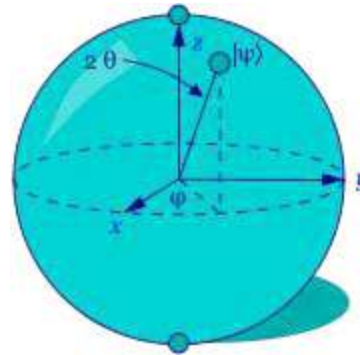
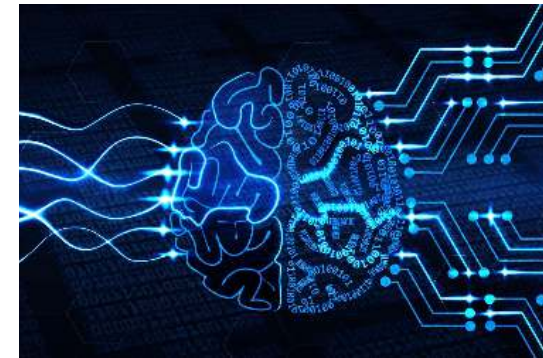
- What: Scale operations and lower costs with TECHNOLOGY.

- **Goal #1**

Provide global perspective on using tech to address problems in ag and health.



- Goal #2: Tech we need vs. Tech we don't

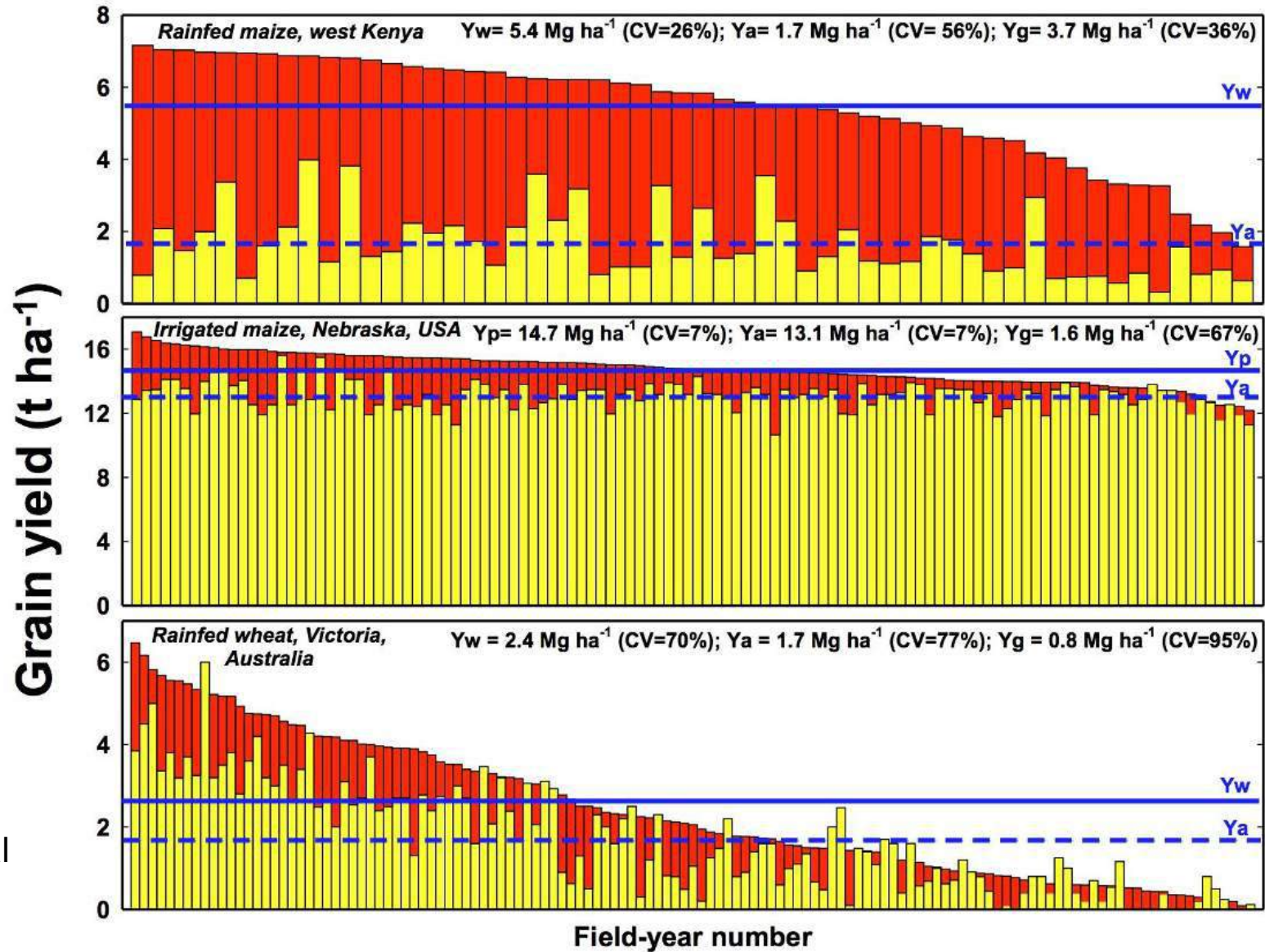


- **Goal #3: How to work together?**

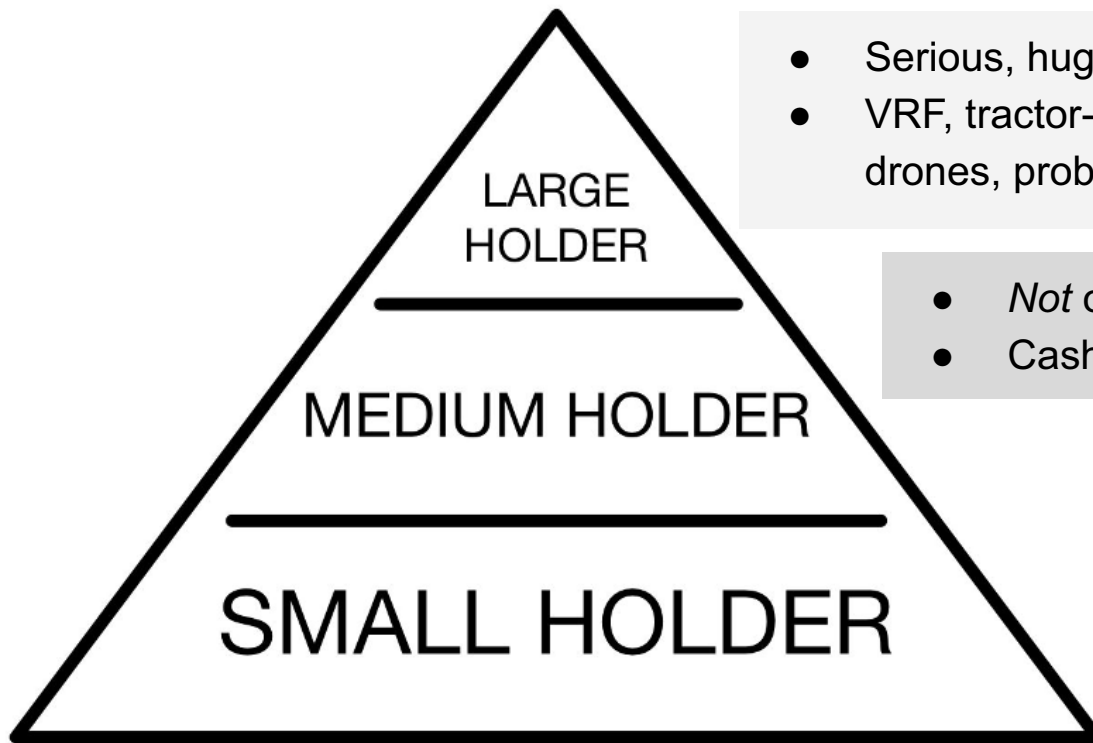


Agriculture

The Gap



(Ittersum 2013)



- Serious, huge farms with \$\$\$\$
- VRF, tractor-mounted spectrometers, drones, probes, soil labs, ...

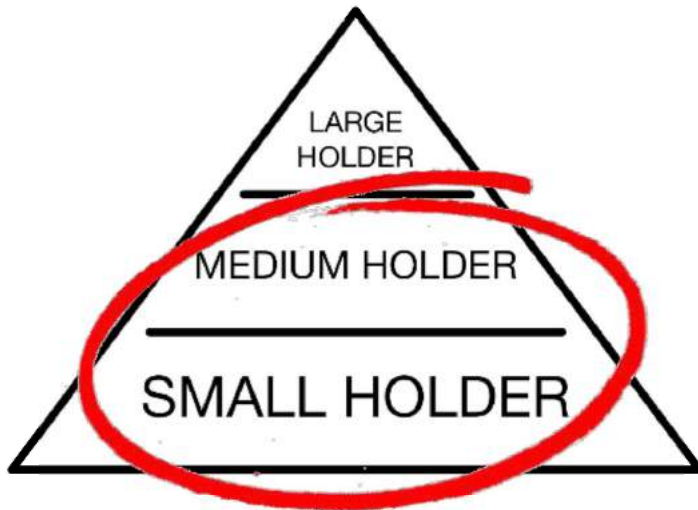
- *Not* originally farmers.
- Cash crops. Have some \$\$

- plot size < 2 ha
- **One-third of population (~2.5B)**
- 60-80% female
- Maize, wheat, rice, cassava ...
- 84% of farms *
- 24% of agricultural area **
- **30-34% of world food supply ****
- **80% of 3rd world food supply**
- income: \$1-2 / day

- ~1B hectares of African arable land is **uncultivated**
 - e.g. TZ: 44M ha arable, only 33% cultivated
- SSA: 20% of arable land, 2% of fertilizers at 17 kg/ha

*: Lowder 2016, "The number, size, and distribution of farms, smallholder farms, and family farms worldwide"
 China: 98%, India: 80%, Ethiopia: 90%, Mexico: 50%, Brazil: 20% -- FAO, "The economic lives of smallholder farmers"

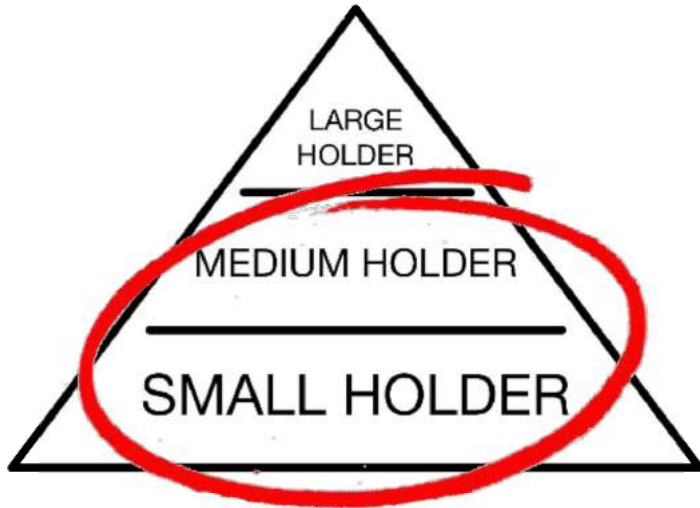
** : Riccardi 2018, "How much of the world's food do smallholders produce?" (often 70% is claimed somehow)



Huge untapped markets!
BUT ... do you dare enter?

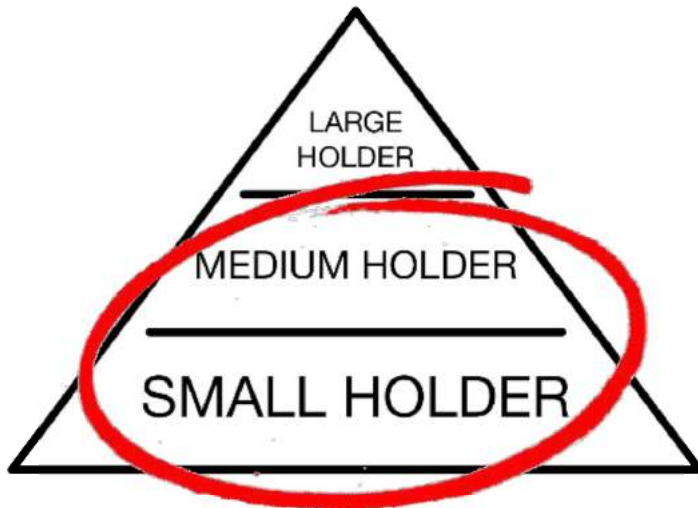
- *“He will win who knows when to fight and when not to fight.”*
- *“The general who wins the battle makes many **calculations** in his temple before the battle is fought. The general who loses makes but few calculations beforehand.”*
- *“To hell with circumstances. I create opportunities!”*





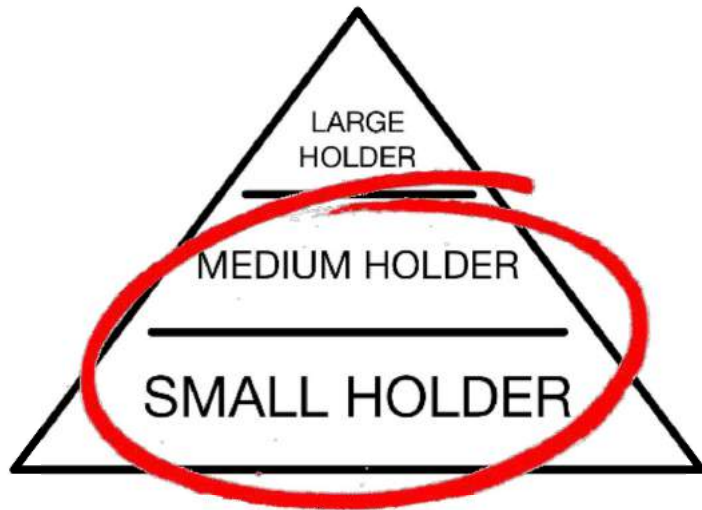
CALCULATIONS

- **Where are these farmers?**
 - **Croplands**
 - **Houses**
- **What's their farm like?**
 - **Size**
 - **Crop types**
 - **Finances**



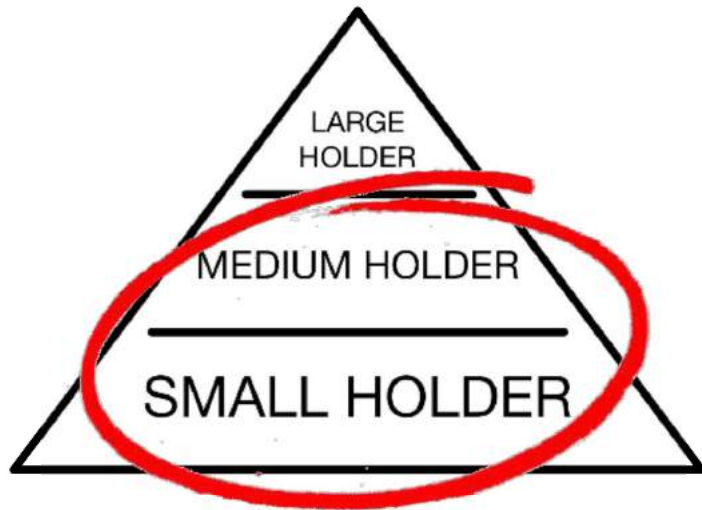
CALCULATIONS

- **What fertilizer do they need?**
 - **Soil health**
 - i. **Macro**
 - ii. **Micro**
 - iii. **Biologicals**
 - iv. **Acidity ***
 - **Optimal blends**
 - **Availability**
 - i. **suppliers + agro-dealers**
 - ii. **govt. policy**



CALCULATIONS

- **How to facilitate sales?**
 - **Aggregators + distribution**
 - **Outgrower schemes**
- **How to advise and monitor?**
 - **Crop health surveillance**
 - **Sensors**
 - **Support hotlines**
 - **Extension agents**



CALCULATIONS

- **How to provide good seeds?**
 - **Genotyping**
 - **Phenotyping**
 - **Adulteration detection**

Where are the farmers and crops?

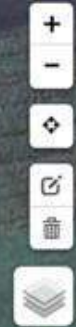


geosurvey
qed.ai

Scalably annotate any imagery (for AI).
<https://geosurvey.qed.ai>



Longitude:
36.933830
Latitude:
-3.354526
Zoom Level:
18



Are croplands present?

Outline the boundaries of the croplands.

Are houses present?

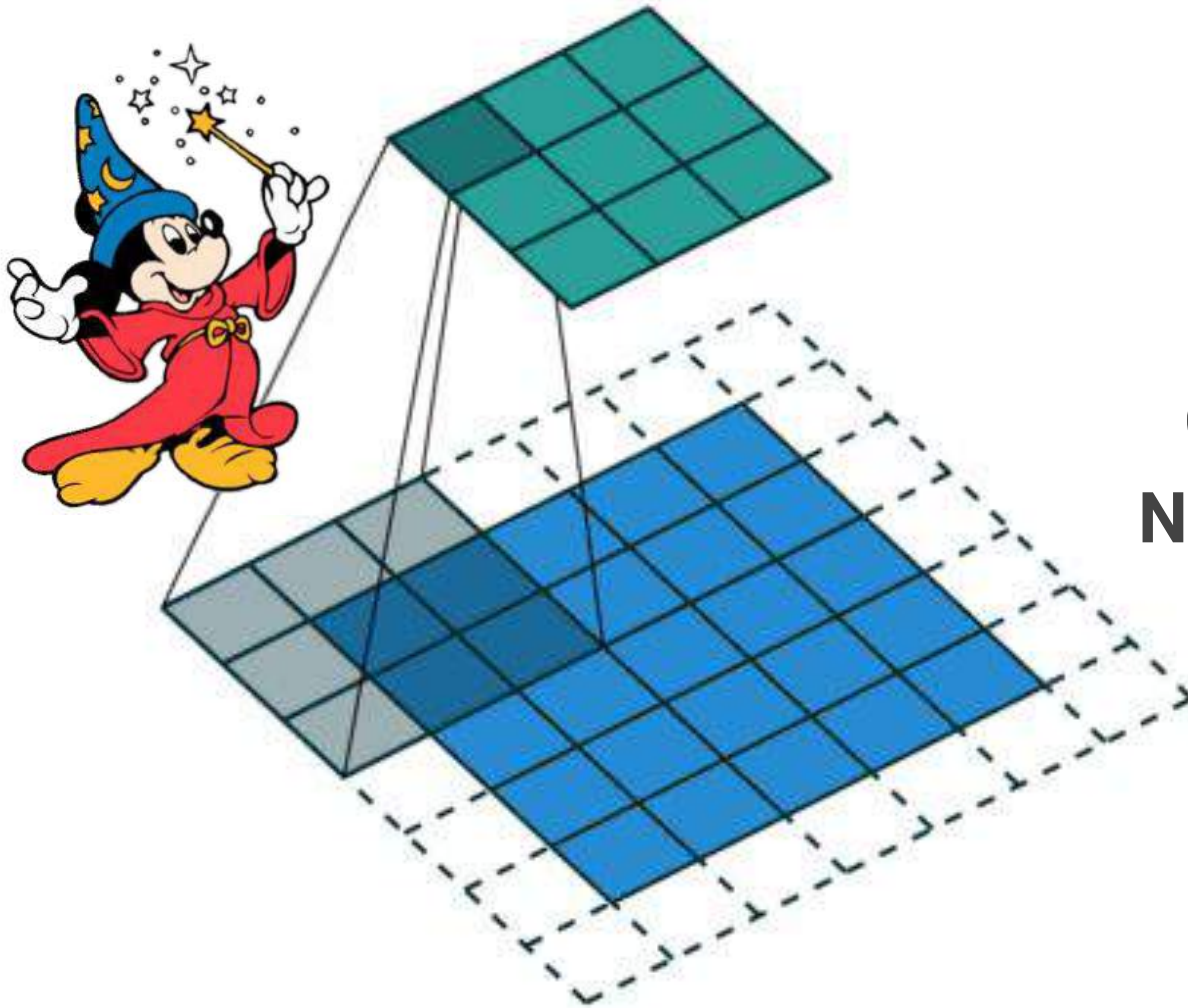
Place pindrops on the rooftops.

Are forests present?

Place some pindrops in the forest patches.

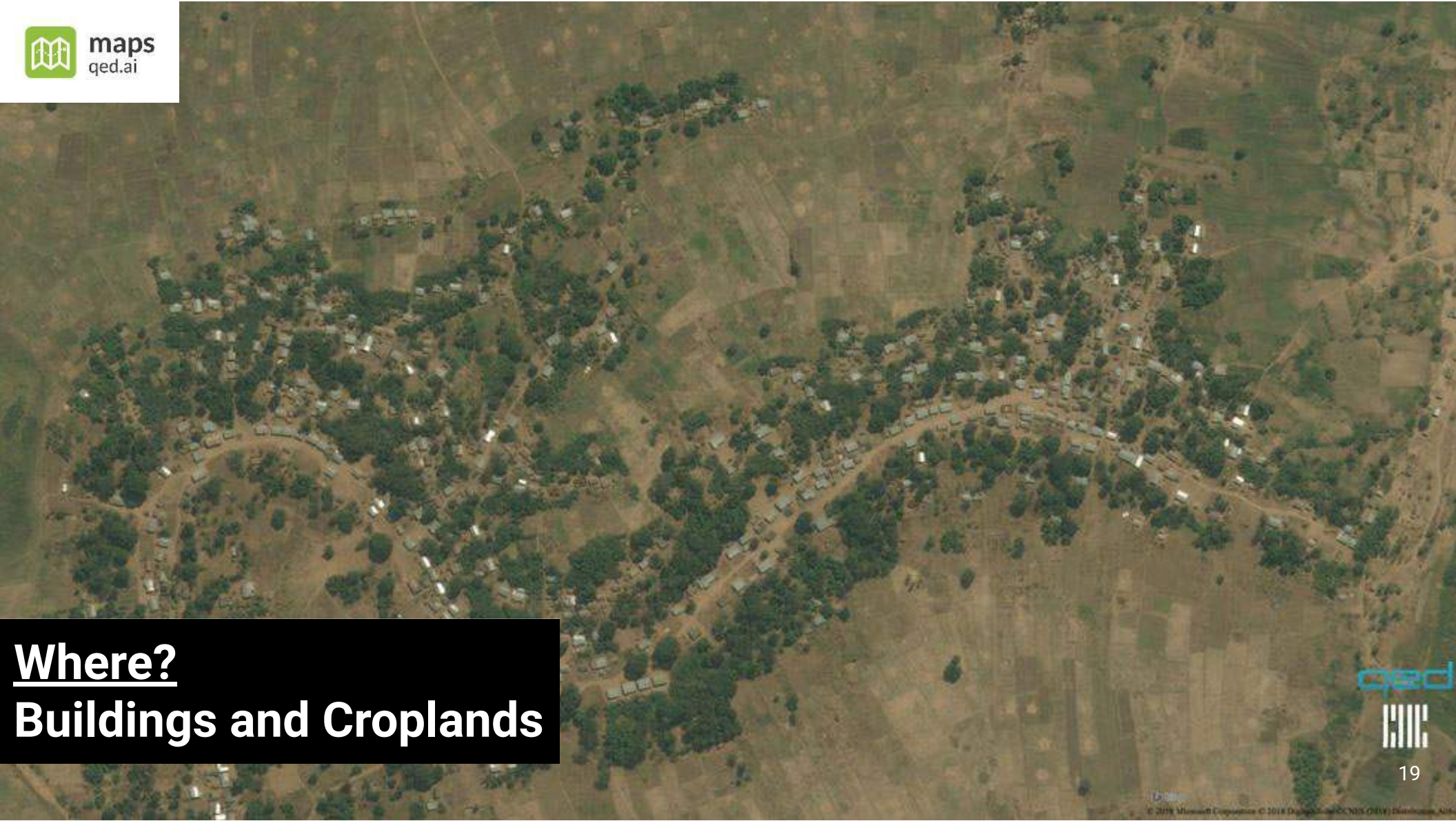
Survey

Discuss

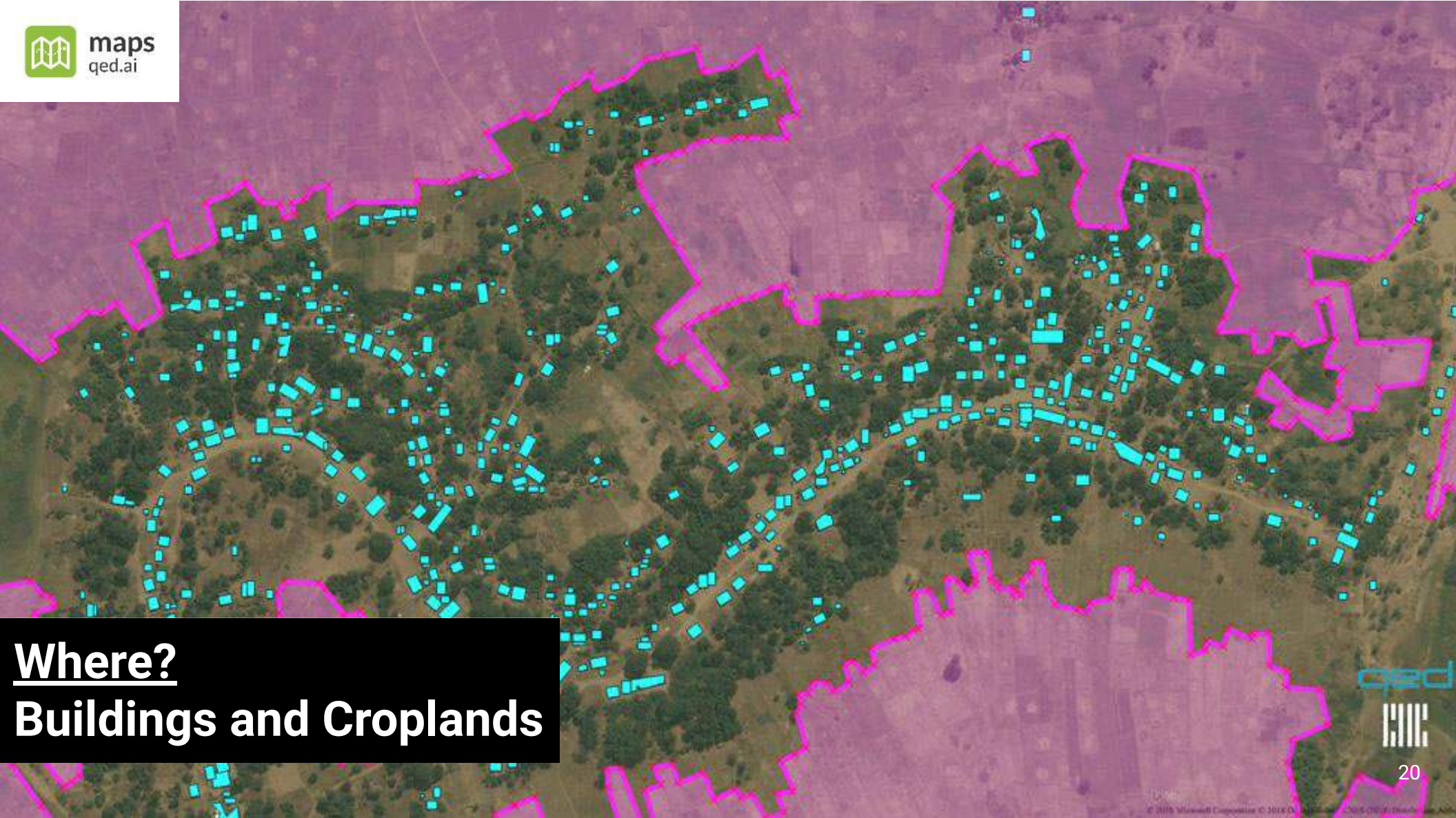


Convolutional Neural Networks

Deep Learning

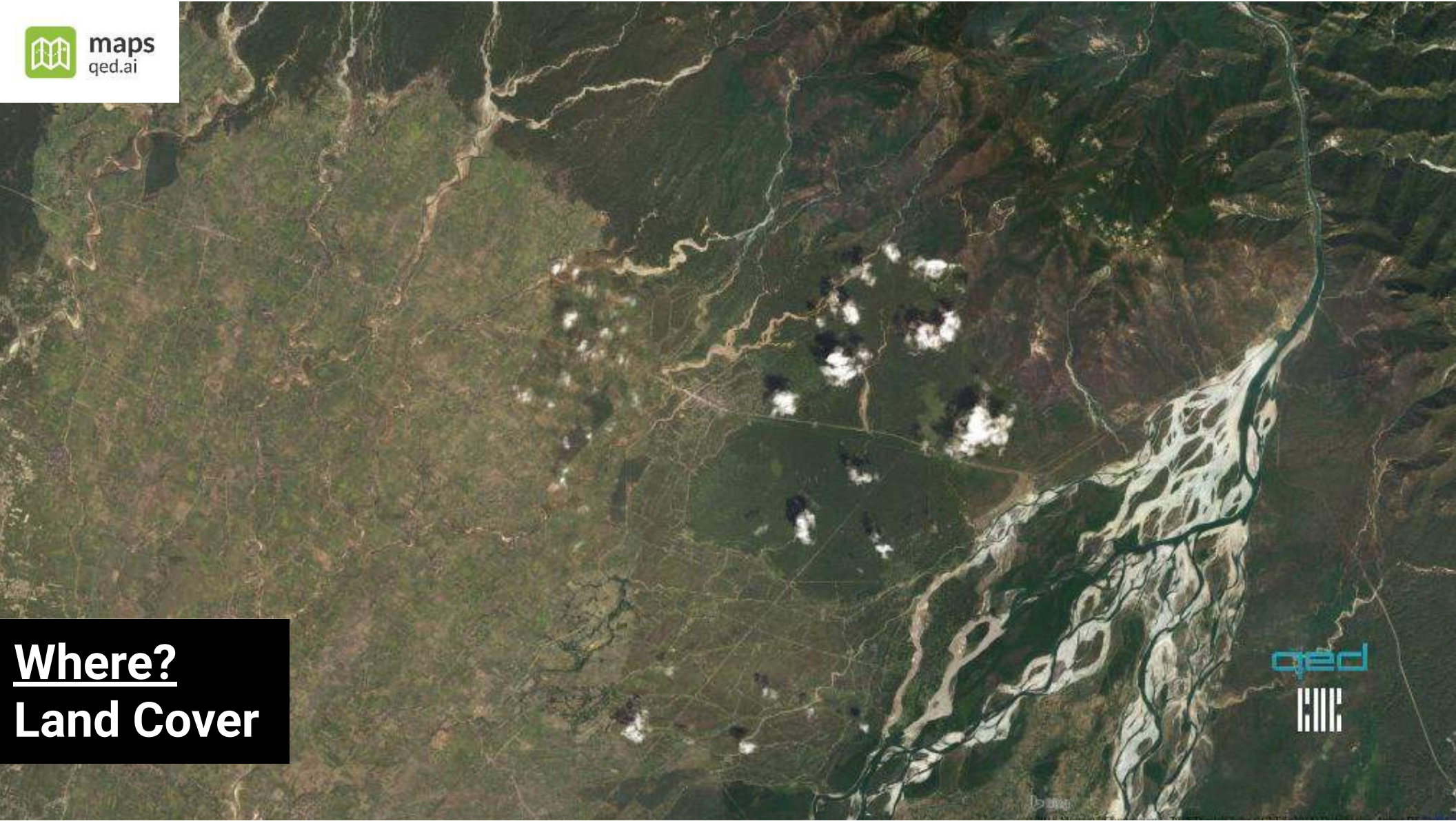


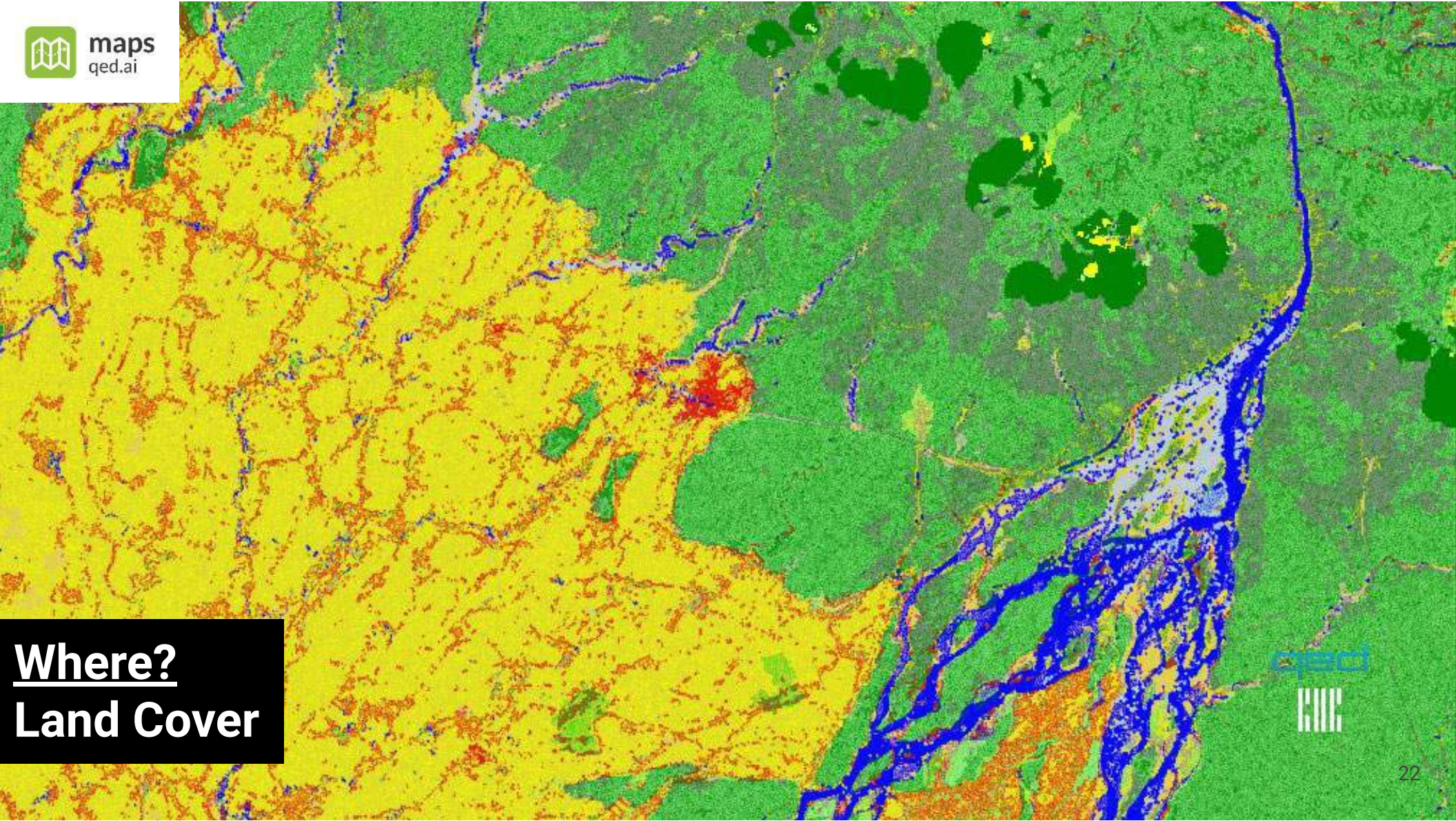
Where?
Buildings and Croplands



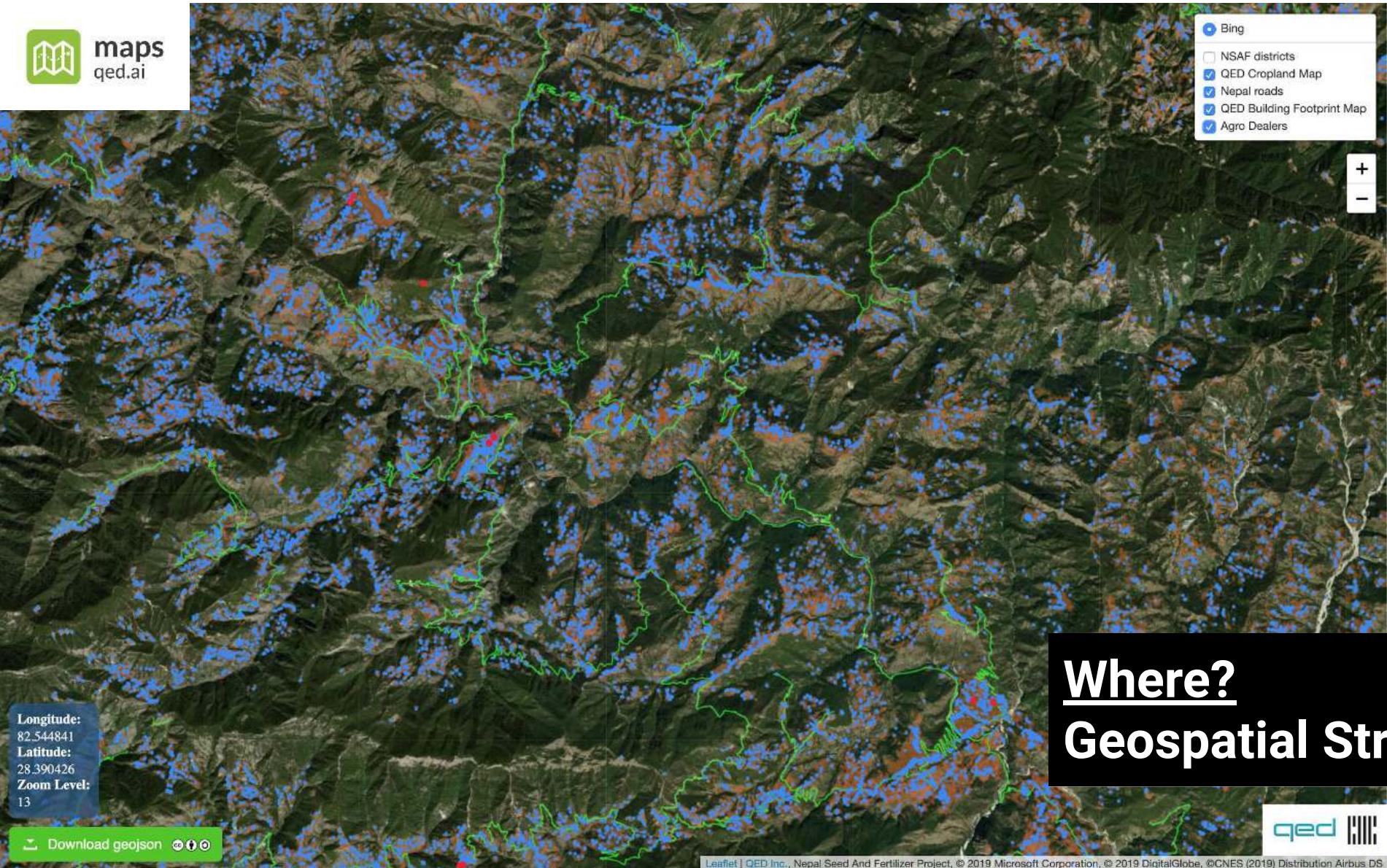
Where?
Buildings and Croplands

Where? Land Cover

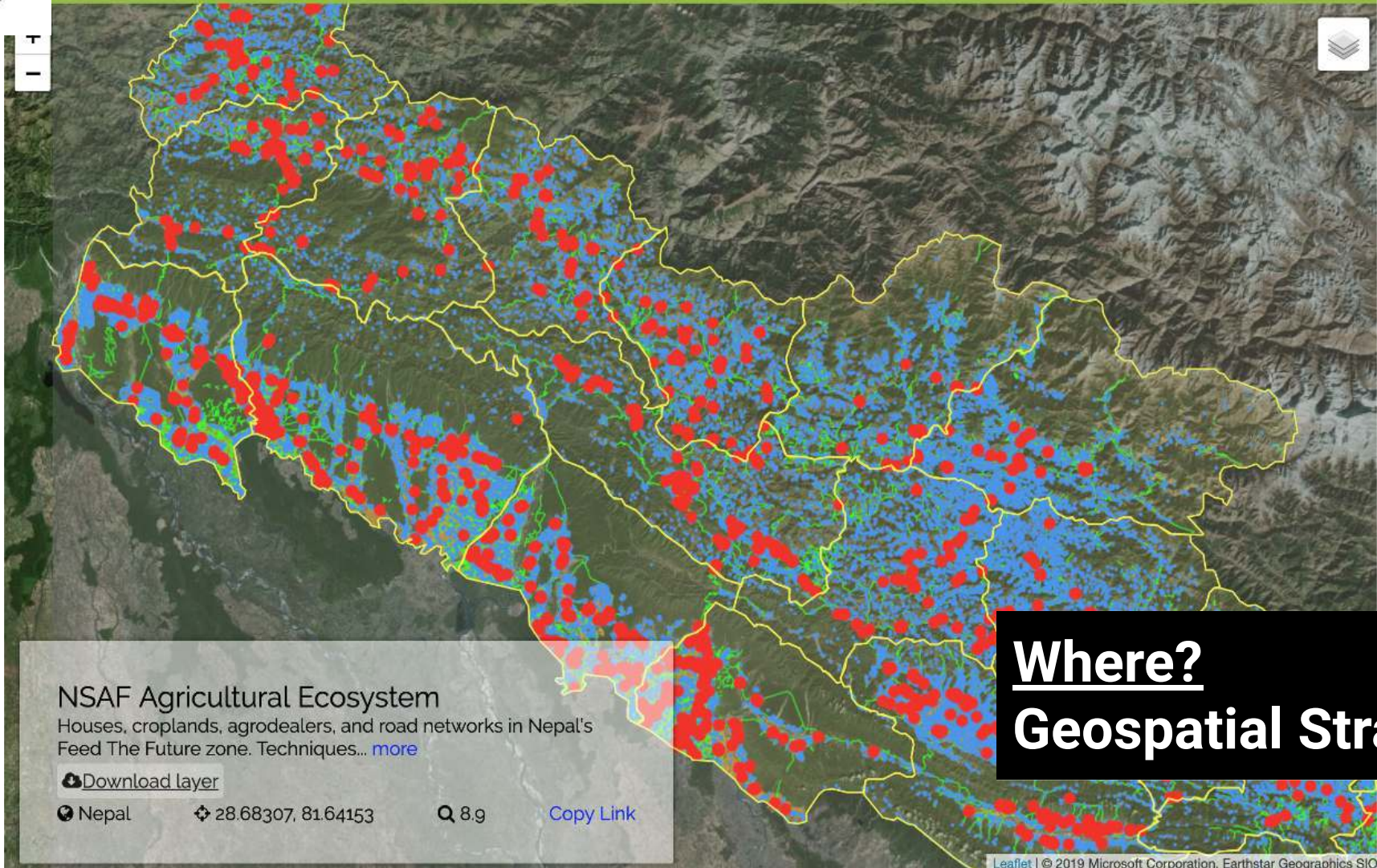




Where?
Land Cover

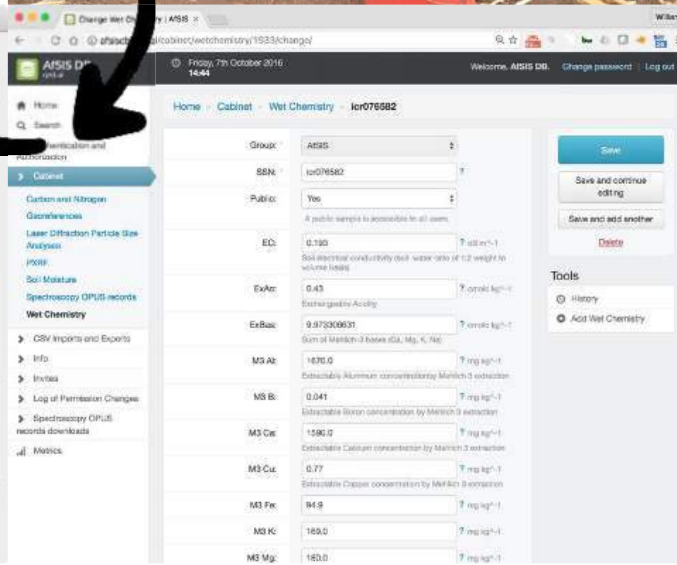
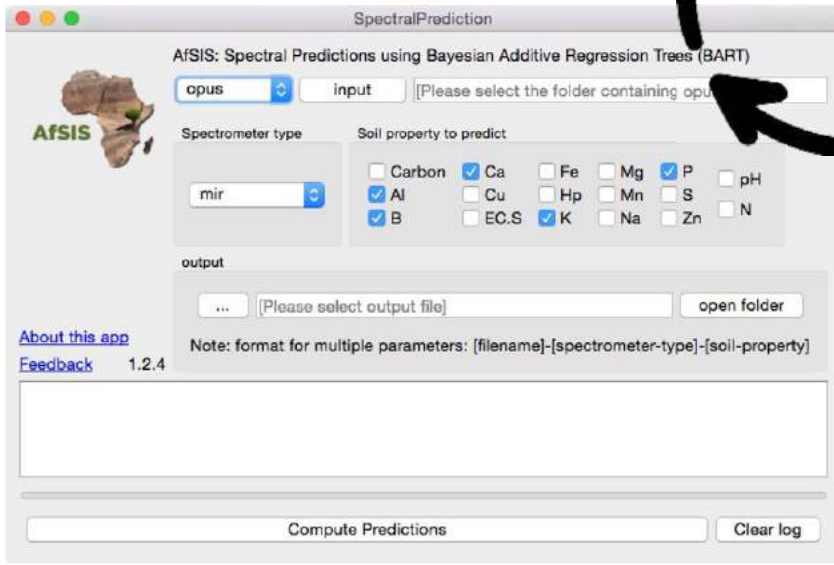
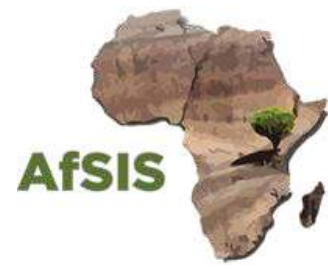
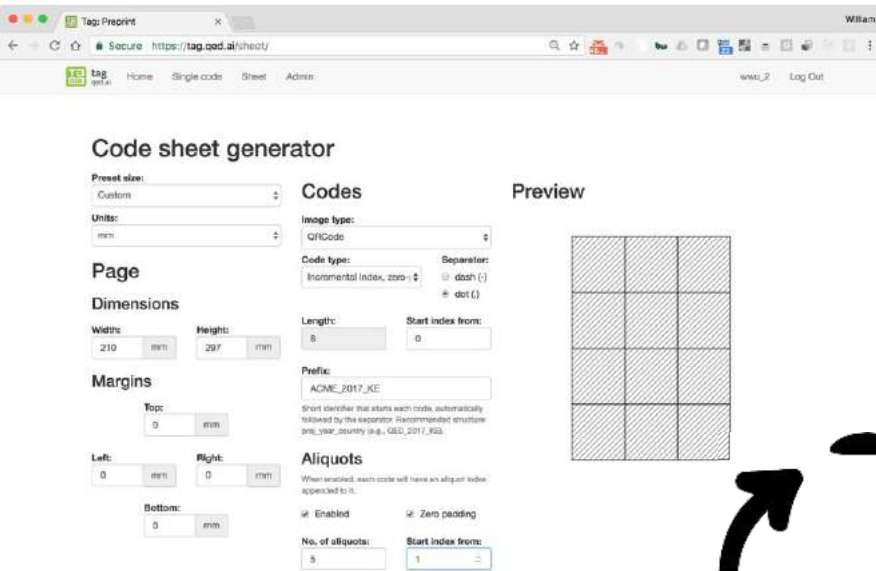


Where? Geospatial Strategy



Where? Geospatial Strategy

What's their soil like?

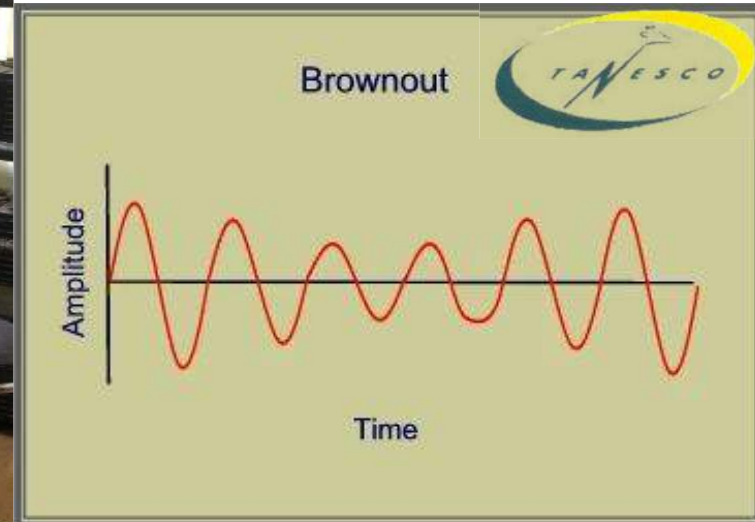


Field-to-Lab

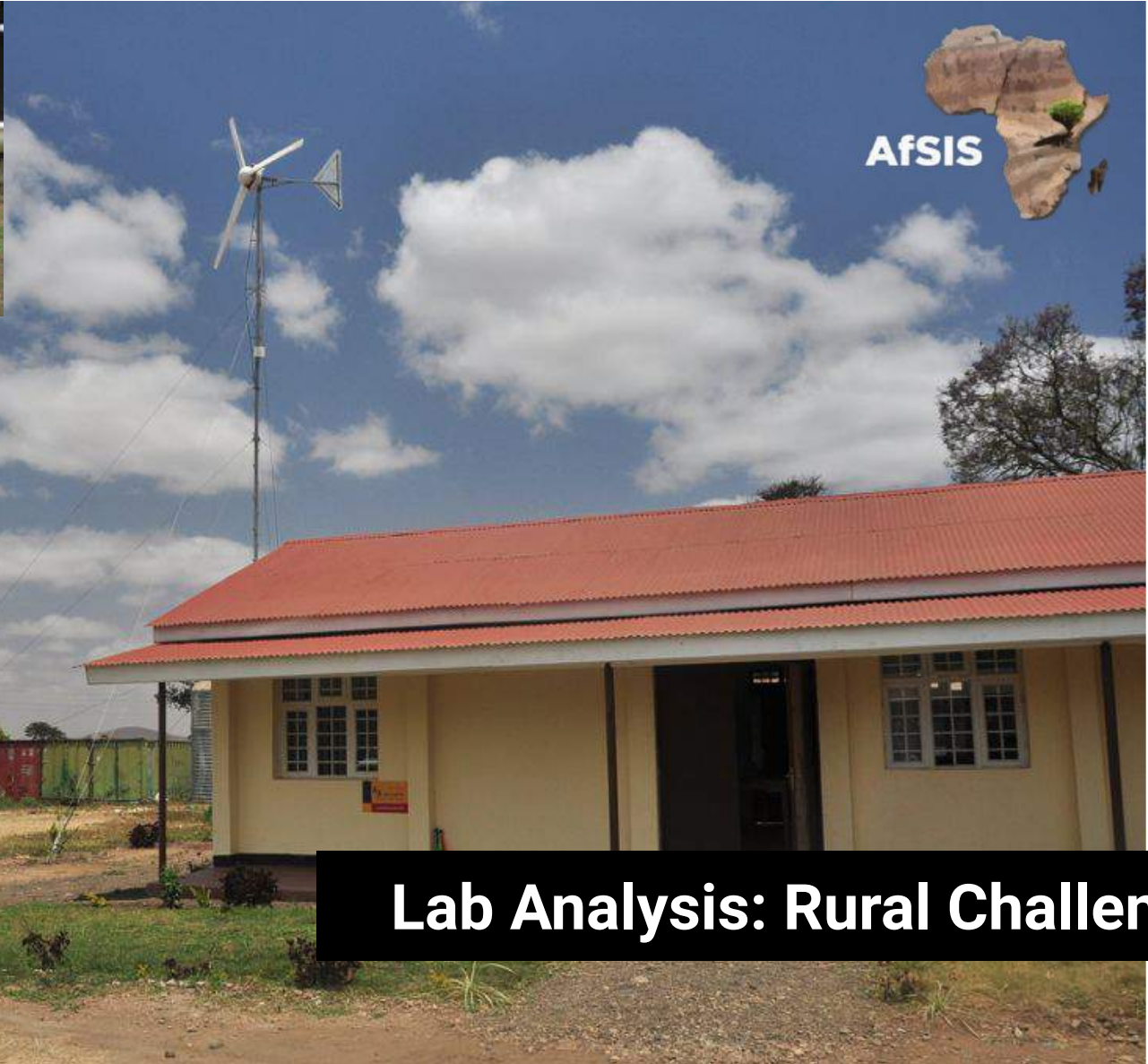
- Barcoding
- Sampling
- Surveys
- LIMS
- Analysis



ICP-MS, HPLC, UV-VIZ, C/N, XRF, LDPSA, ELISA, PCR



Challenges of Labs in Rural Areas



Lab Analysis: Rural Challenges

R² Values: MIR vs. Wet Chem

Acidified.Carbon: 0.9088957 *

m3.Al: 0.89998

pH: 0.898851

m3.Ca: 0.867247 *

Total.Nitrogen: 0.8357734 *

m3.Mg: 0.7831268 *

m3.Hp: 0.716419

m3.B: 0.712866 *

m3.Cu: 0.6225734

m3.S: 0.6402575 *

m3.Mn: 0.5416367 *

m3.Na: 0.5564027

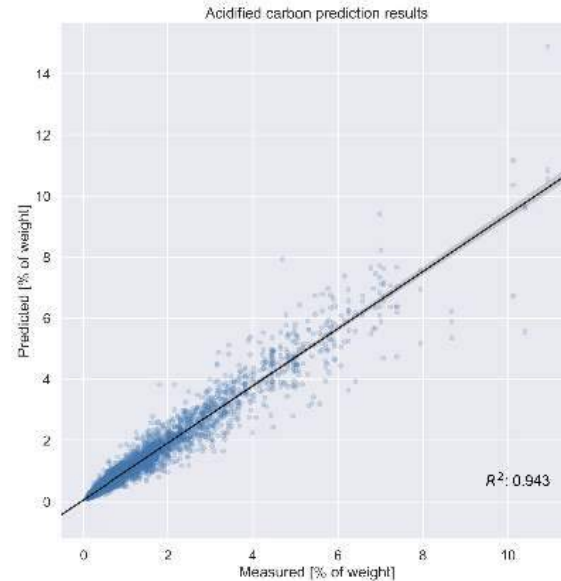
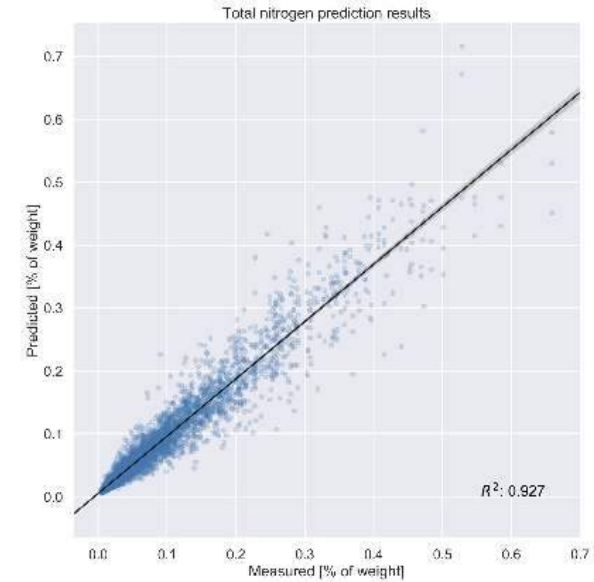
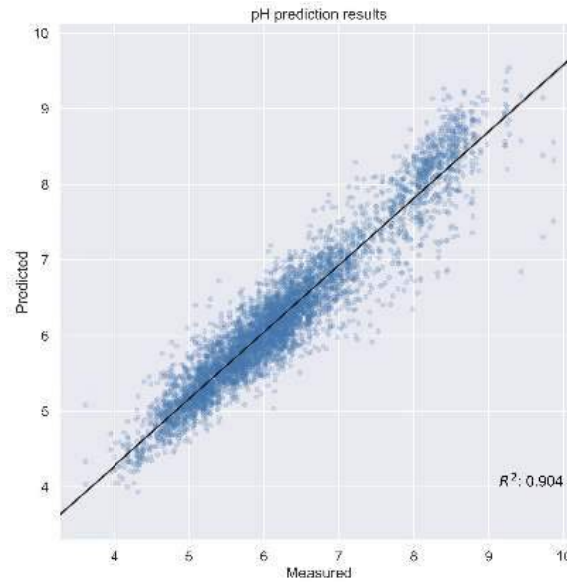
m3.Fe: 0.4624206

m3.K: 0.4587326 *

m3.EC.S: 0.3556439

m3.Zn: 0.294272 *

m3.P: 0.2575507 *





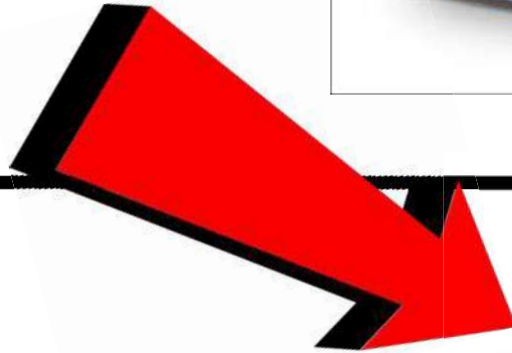
\$\$\$\$
500K



\$\$\$
50K



Field-to-Lab



\$
.5K?

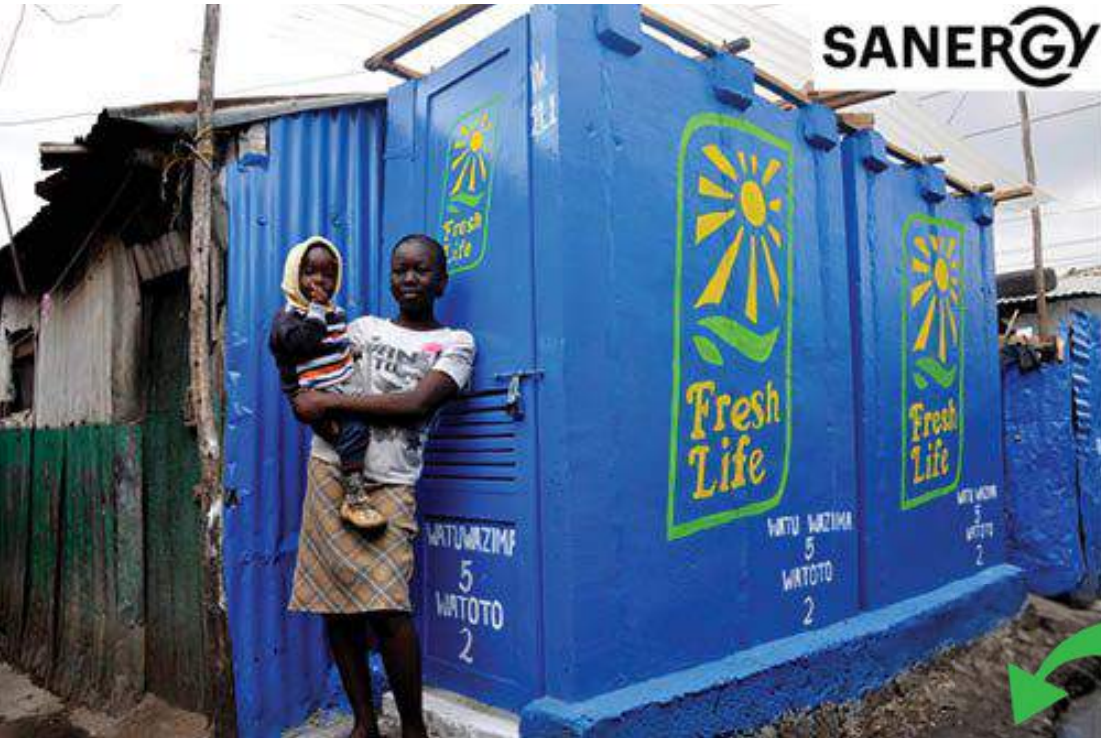


Lab-to-Field

\$
.5K?







How to advise and monitor?



Visual Analysis

geosurvey
qed.ai

Dashboard Forum Admin How It Works Feedback Log Out

Longitude: 35.006018
Latitude: 0.814655
Zoom Level: 19
Country: Kenya
Side length of box: 10000m
Submitter: oaf59
Taken at: 2017-11-16, 10:10 AM UTC
Description: teared leaves
maize_variety: SC DUMA 43
disease_prevalence: low
district_name: Ndalul
OAF_ID: 76331

Map data ©2018 Google Imagery ©2018 CNES / Airbus, DigitalGlobe | Terms of Use

Upper leaves, Lower leaves or All leaves?
 Upper leaves Lower leaves All leaves

Any other colors on the leaves?
 Yes No

What color/s do you see in the upper part of the leaves?
 White/Yellow (Iron) Bright Yellow (Sulfur) Brown (MLND) None above

Any holes on the leaves?
 Yes No

Stemborer or hail damage or armyworms?
 Stemborer Hail Fall Armyworms None above

Are there tears along the edges?
 Yes No

Calcium or hail damage or

Survey Discuss



Create Sample

Vegetable Doctor

What kind of plant is it?

Beetroot

Carrot

Lettuce

Pepper

Potato

Fill ou

Visual Analysis

- Home
- Surveys >
- Collections
- Users
- Debug Mode
- Maintenance Alert
- Control Registration

Visualization Maize Doctor - OAF

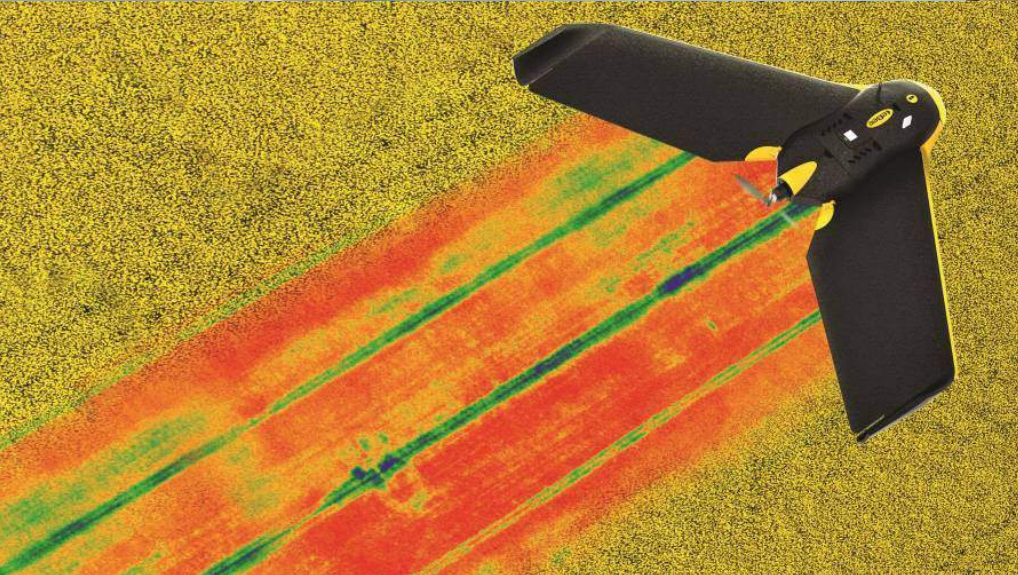
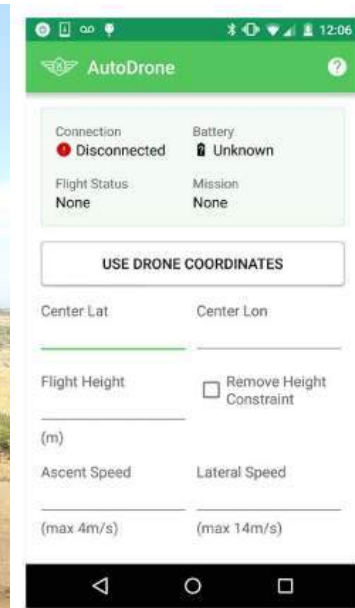
Tags:

Submit



Crop Health Surveillance





Landscapes

Arable Mark 2

- Thermal and acoustic sensors replace laborious rain gauges and sap flow methods
- Rainfall: 0.2mm/hr accuracy
- Hourly water stress, daily leaf water potential
- Radiation, temp, wind, soil moisture, etc.



Mini Weather Station

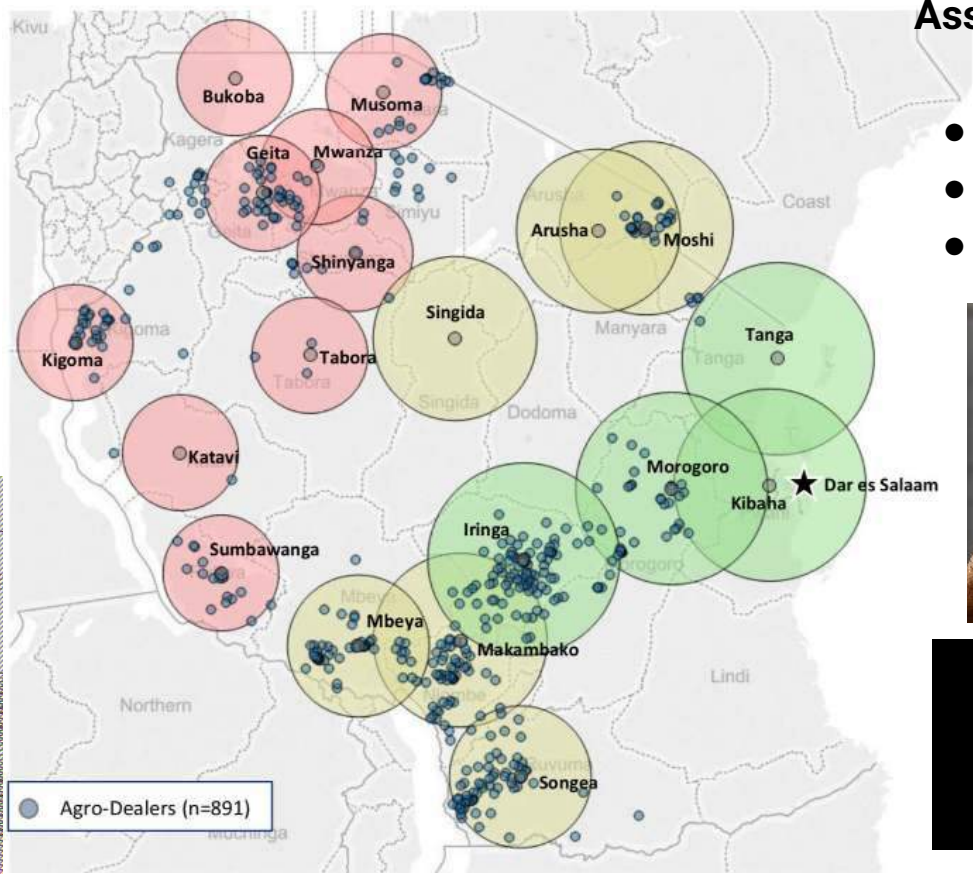
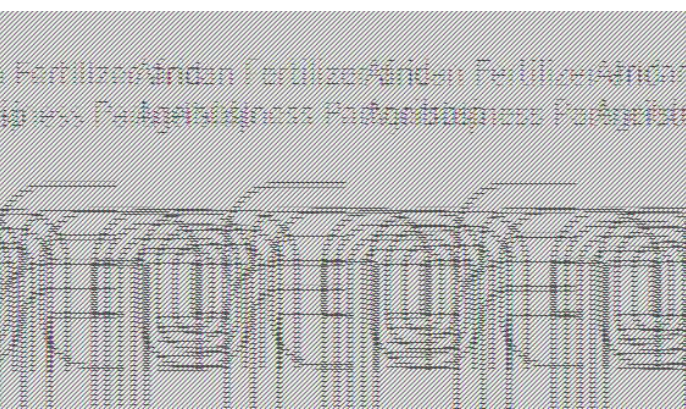


How to facilitate sales?



Wholesale Agro-dealers (“Hubs”)

- Aggregate demand
- Few points of sale
- Local agronomist
- Storage capacity
- Lower default risk



Assistance



- Credit guarantees
- Matching grants
- Policy (AMOFERT)



Value Chains And Policy

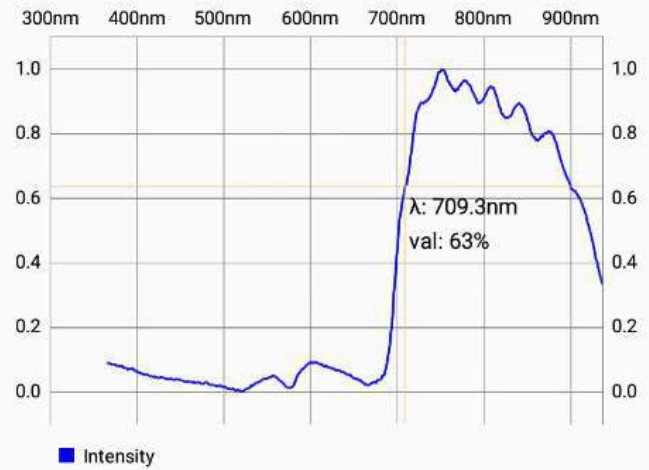
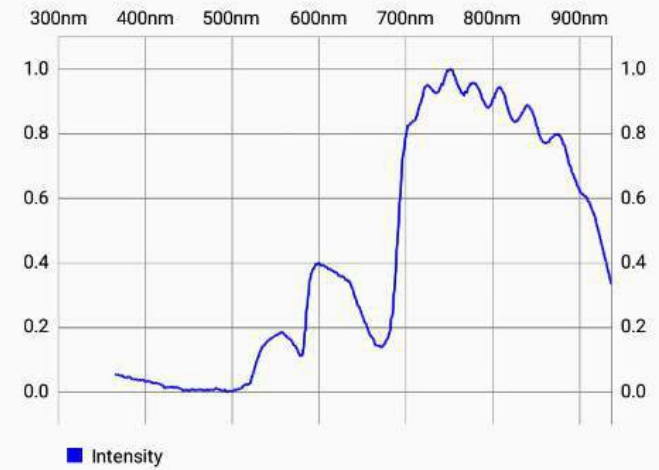
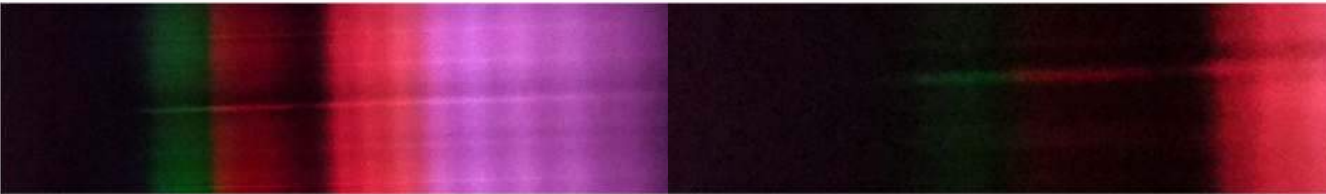
How to provide good seeds?



Breeding

Sample #7 - sick again

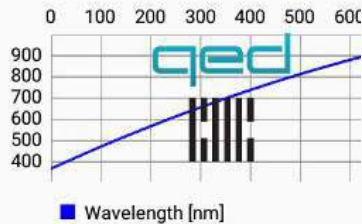
Sample #4 - very healthy again



NDVI: 0.441

Calibration coefficients:

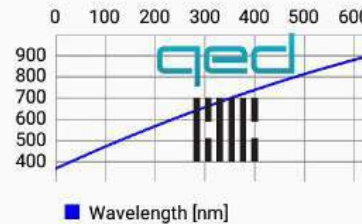
- a: -0.0004
- b: 1.0717
- c: 365.8285



NDVI: 0.856

Calibration coefficients:

- a: -0.0004
- b: 1.0717
- c: 365.8285



Breeding

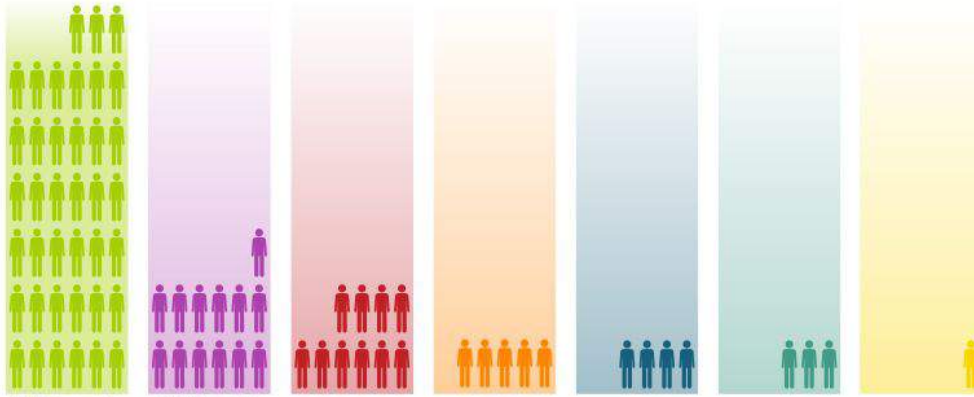


Inspirations from Health

Direct Delivery

Number of people living with HIV in 2015

Region	Number of people living with HIV in 2015
Eastern and Southern Africa	19 million
Western and Central Africa	6.5 million
Asia and Pacific	5.1 million
W. and C. Europe and N. America	2.4 million
Latin America and Caribbean	2 million
East Europe and Central Asia	1.5 million
Middle East and North Africa	230,000



AVERT.org Source: UNAIDS 2016



Drug Delivery



Active Surveillance

PROBLEM

- <5 deaths/yr = 5.6 M, mostly in SSA
- Why?

APPROACH

- At high-mortality sites:
 - Get consent from parents in 24 hrs
- Collect **everything**:
 - HIV, TB, Malaria ...
 - PCR, CSF, Pathology ...
 - MITS and verbal autopsy ...
 - Demographics ...
- Objective: **Determine Cause of Death**
- Duration: **20 years**

epidemic	Kisumu	US (%)
<5	10	0.6
TB	0.6	0.003
HIV	20-25	0.3



CHAMPS

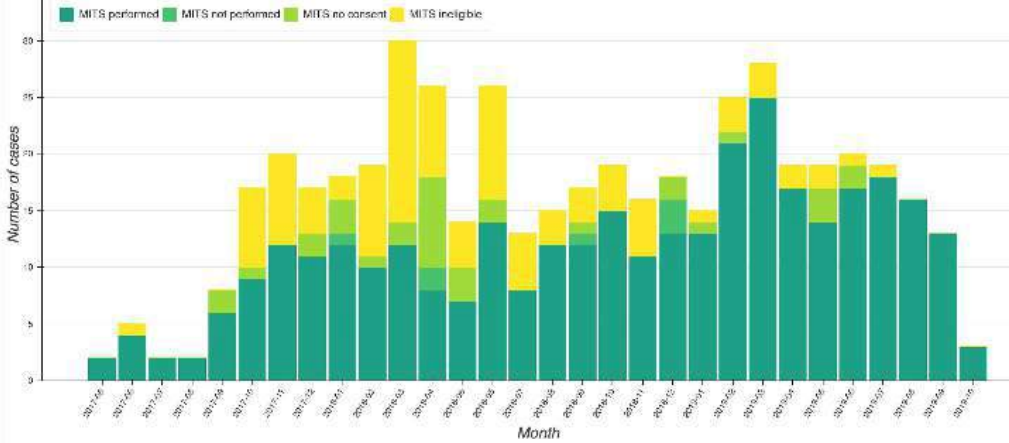
Sample ID	DP1.1.A Initial Death Notification	DP1.1.B Eligibility Screening and Consent Tracking	DP1.2.A Consent Authorization	DP1.2.B Post-Consent Questions	DP3.1.A Disposition of Body Form	DP3.1.B Mts Specimen Collection Form	DP3.1.C Gross Examination	DP3.1.D PMA Procedure Form	DP3.1.E Malaria Lab Results - PCR	DP3.1.E Malaria Lab Results - Rapid	DP3.1.F HIV Lab Results	DP3.1.G TB Lab Results - Cultures	DP3.1.G TB Lab Results - Rapid	DP3.1.H Clinical Lab Results	DP3.1.I Bld Microbiology Results	DP3.1.J CSF Microbiology Results	DP3.1.K Tac Tracker	DP3.1.L Site Pathology Report	DP3.1.M PMA Pathology Report	DP3.2.A: Child Case Info	Status	Deadline
KEAA00138	✓	✓	✓																		✗	06 May 2018 11:13 AM
KEAA00140	✓	✓	✓		✓	✓	✓				✓	✓			✓	✓	-30w	✓			✗	06 May 2018 10:05 AM
KEAA00142	✓	✓	✓		✓	✓	✓				✓	✓			✓	✓	-30w	✓			✗	06 May 2018 12:55 PM
KEAA00144	✓	✓	✓																		✗	11 May 2018 09:52 AM
KEAA00145	✓	✓	✓		✓						✓	✓			✓	✓	✓	✓			✓	10 May 2018 12:37 PM
KEAA00147	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	12 May 2018 12:01 PM
KEAA00149	✓	✓	✓		✓	✓					-33w				-33w	-32w					✗	13 May 2018 01:21 PM
KEAA00151	✓	✓	✓																			
KEAA00152	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	-29w	✓	✓		✗	13 May 2018 01:51 PM
																					✗	17 May 2018 12:43 PM
																					✗	21 May 2018 07:07 AM
																					✗	

Deadline: 21 Jan 2018, 12:01 PM

Case Mgmt.

MITS yield breakdown for CHAMPS eligible cases: 2019-10-07

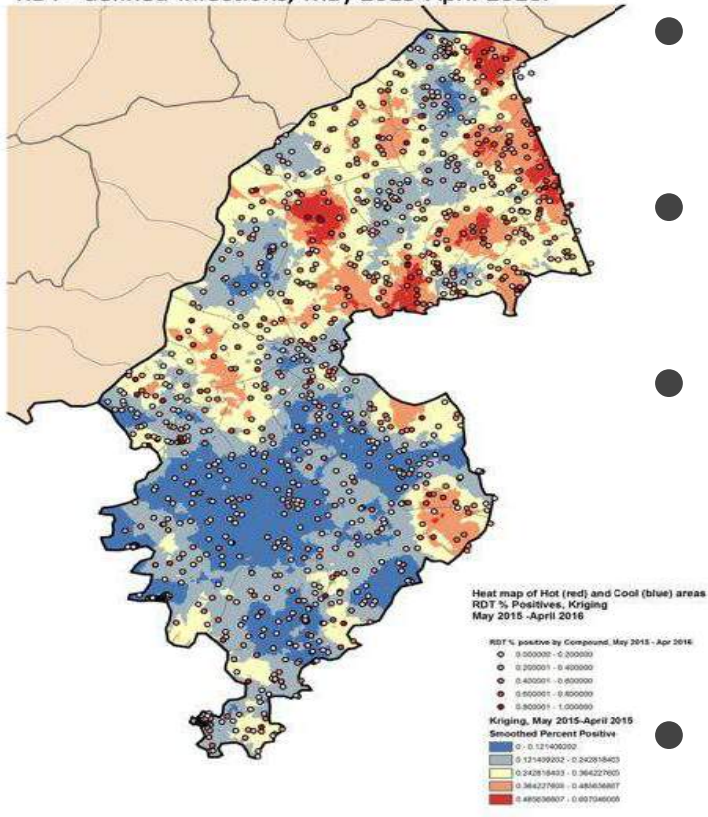
KEMRI + QED | <https://champs-viz.qed.ai>



Passive Surveillance

A Path to Sustainable Surveillance

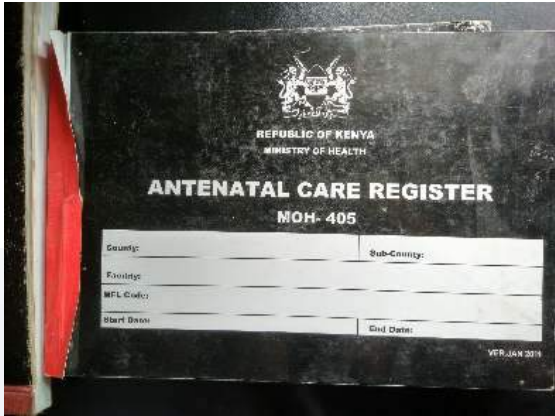
Heat map showing hot (red) and cool (blue) areas of RDT –defined infections, May 2015-April 2016.



Smoothed Map created with Ordinary Kriging, using nearest neighbors.

- **ACTIVE**
Costly parallel network, door-to-door surveys.
- **PASSIVE**
Strengthen *existing* network (e.g., govt, biz, ...)
- **Existing network:**
>90% pregnant women → antenatal care (ANC)
Random cross-section.
Integrate finger-prick into checkup.
- **Last step:**
Just collect ANC registers! Oh wait ...

REALITY CHECK



No electricity!
No internet!
No computers!
No scanners!
No book removal!
...
(No running water!)
(No funding!)

*** not reflective of *all* situations, just *many*** 56



Cross the ovals with an "X" like this. If you have made a mistake in an oval or box, then fill it in completely, like this: If no data is available, leave it blank.

POCTRI Kit Lot # Kit Expiry Date (dd/mm/yy) District Site Code

Date of Visit (dd/mm/yy) HTS Number

Client Consented to POC TRI Yes No

Sex M FNP FP

Residence

Age

Last HIV Test Result L- L+ L- L+

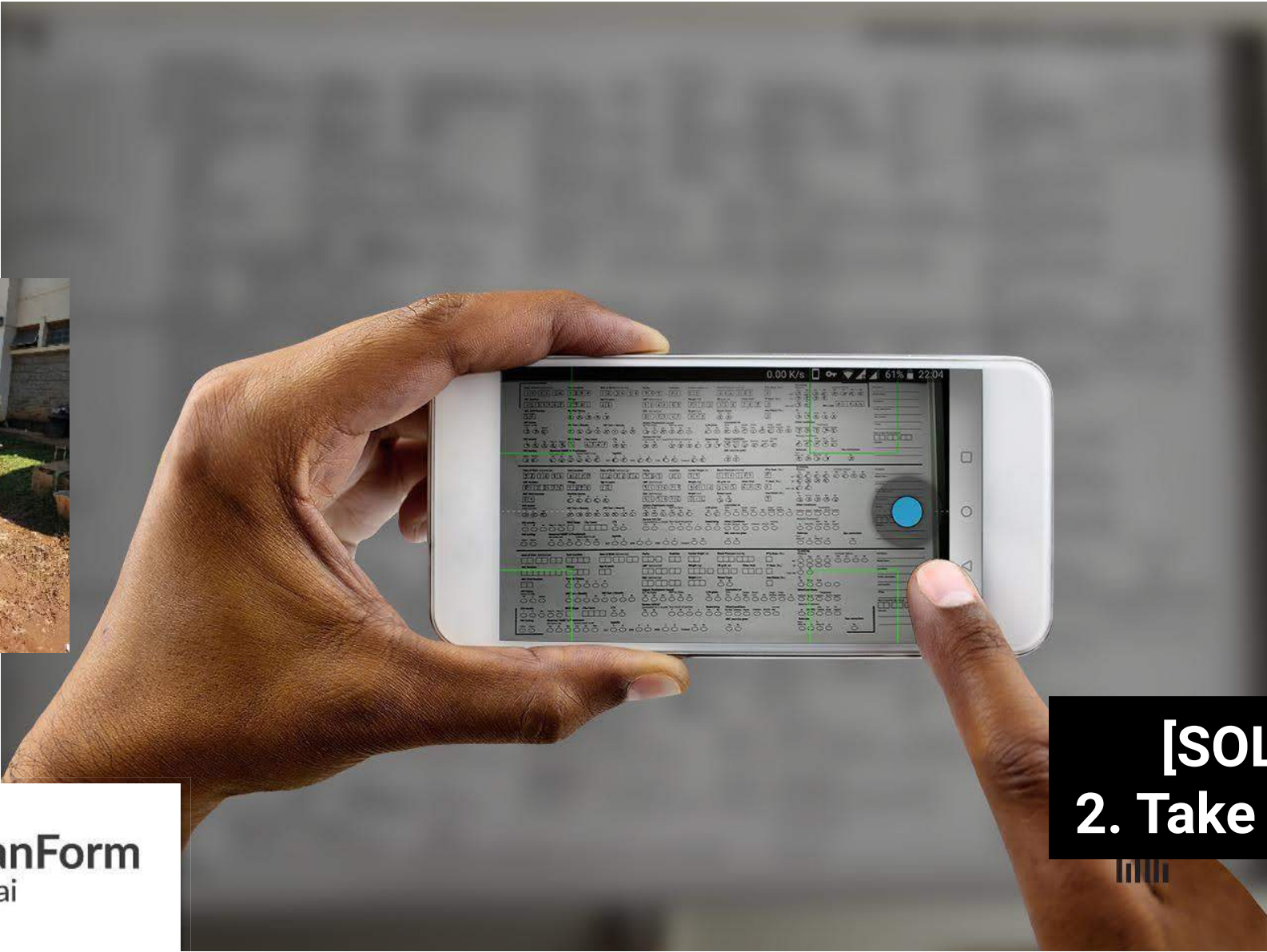
Time Since Last Test yrs+ mths

Unigold Result R NR

Final HIV Test Result P+ H+ H- Ind



[SOLUTION]
1. Keep using paper.



[SOLUTION]
2. Take picture!



ScanForm
qed.ai



Cross the ovals with an "X" like this. .
If no data is available, leave it blank.

ANTENATAL CARE REGISTER (MOH 405)



First Name _____
Middle Name _____
Last Name _____
Tel No. (own/other) _____
Sub-Location Name _____
Village Name _____
Date of Next Visit (dd/mm/yy) _____
Remarks _____

Date of Visit (dd/mm/yy) 18/02/19	Sub-Location Code 0008	Date of Birth (dd/mm/yy) 06/12/97	Parity 01+0	Gravidae 02	Blood Pressure (mmHg) (sys/dias) / /	Counseled on Birth Plan <input checked="" type="checkbox"/> Danger Signs <input checked="" type="checkbox"/> FP <input checked="" type="checkbox"/>	ANC Prophylaxis On ARV before 1st ANC Visit <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/> Rev <input type="checkbox"/>	MFL Code 13771		
ANC Number 01112118	Village Code 0008	Age in Years Fundal Height (w) 21 16	LMP (dd/mm/yy) / /	HB g/dL 1st Visit /	Breast Exam Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Breast Care Suppl. Feeding <input checked="" type="checkbox"/> Breast Care <input checked="" type="checkbox"/>	Started HAART in ANC Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>	Screening Cervical Cancer <input checked="" type="checkbox"/> PAP <input type="checkbox"/> VIA <input type="checkbox"/> VILI <input type="checkbox"/> ND <input type="checkbox"/> No TB Sus <input type="checkbox"/> TB Rx <input type="checkbox"/> REF <input type="checkbox"/> ND <input type="checkbox"/> TB <input checked="" type="checkbox"/> X		
ANC Visit No. 03	Marital Status M <input checked="" type="checkbox"/> D <input type="checkbox"/> W <input type="checkbox"/> SE <input type="checkbox"/> SI <input type="checkbox"/>	Height (cm) Weight (kg) 172 092.0	EDD (dd/mm/yy) / /	HB g/dL Other Visit /	Fever 48h Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Infant Feeding ITN ITN <input checked="" type="checkbox"/>	ANC Prophylaxis CTX <input type="checkbox"/> AZT for Baby <input type="checkbox"/> NVP for Baby <input type="checkbox"/>	ANC Exercise Given Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Has Corrections? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	Other Parameters 1. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/> 2. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>
Syphilis Screening <input checked="" type="checkbox"/> RDT <input type="checkbox"/> HPR <input type="checkbox"/> VDRL <input type="checkbox"/> ND <input checked="" type="checkbox"/>	HIV Status Before 1st ANC <input checked="" type="checkbox"/> KP <input type="checkbox"/> U <input type="checkbox"/> Resit <input type="checkbox"/>	HIV Testing Initial <input type="checkbox"/> Retest <input type="checkbox"/> ND <input checked="" type="checkbox"/>	HIV Test 1 Results P <input type="checkbox"/> I <input type="checkbox"/> N <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/>	Malaria Screening P <input type="checkbox"/> ND <input checked="" type="checkbox"/> BS <input type="checkbox"/> P <input type="checkbox"/> N <input type="checkbox"/> ND <input checked="" type="checkbox"/>	Other Conditions Hypert <input type="checkbox"/> Diabetes <input type="checkbox"/> Epilepsy <input type="checkbox"/> RTI/STI <input type="checkbox"/> Other <input type="checkbox"/> Please specify	Prophylaxis IPT Dose (No.) <input checked="" type="checkbox"/> NA <input type="checkbox"/> LL/ITN given <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	ANC Exercise Given Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Referrals From Other HF <input type="checkbox"/> CU <input type="checkbox"/>	Other Parameters 1. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/> 2. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>	
HIV Results P <input type="checkbox"/> N <input checked="" type="checkbox"/> NA <input type="checkbox"/> Prev. P <input type="checkbox"/> Prev. N <input type="checkbox"/>	Partner HIV C&T Counseled as a couple <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Test result on partner <input type="checkbox"/> P <input type="checkbox"/> KP <input type="checkbox"/> N <input type="checkbox"/> U <input type="checkbox"/>	WHO Stage CD4 Count / /	Malaria Treatment AL <input type="checkbox"/> DHA-PPQ <input type="checkbox"/> Artesunate <input type="checkbox"/> Qui <input type="checkbox"/> Qui (paarm) <input type="checkbox"/>	Other Conditions Treatment Hypert <input type="checkbox"/> Diabetes <input type="checkbox"/> Epilepsy <input type="checkbox"/> RTI/STI <input type="checkbox"/> Other <input type="checkbox"/> Please specify	Prophylaxis TT Dose (No.) <input checked="" type="checkbox"/> Deworming <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	ANC Exercise Given Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Referrals From Other HF <input type="checkbox"/> CU <input type="checkbox"/>	Other Parameters 1. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/> 2. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>		

First Name _____
Middle Name _____
Last Name _____
Tel No. (own/other) _____
Sub-Location Name _____
Village Name _____
Date of Next Visit (dd/mm/yy) _____
Remarks _____

Date of Visit (dd/mm/yy) 18/02/19	Sub-Location Code 0008	Date of Birth (dd/mm/yy) 14/02/92	Parity 02+0	Gravidae 03	Blood Pressure (mmHg) (sys/dias) / /	Counseled on Birth Plan <input checked="" type="checkbox"/> Danger Signs <input checked="" type="checkbox"/> FP <input checked="" type="checkbox"/>	ANC Prophylaxis On ARV before 1st ANC Visit <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/> Rev <input type="checkbox"/>	Screening Cervical Cancer <input checked="" type="checkbox"/> PAP <input type="checkbox"/> VIA <input type="checkbox"/> VILI <input type="checkbox"/> ND <input type="checkbox"/> No TB Sus <input type="checkbox"/> TB Rx <input type="checkbox"/> REF <input type="checkbox"/> ND <input type="checkbox"/> TB <input checked="" type="checkbox"/> X		
ANC Number 01902119	Village Code 0003	Age in Years Fundal Height (w) 27 24	LMP (dd/mm/yy) / /	HB g/dL 1st Visit /	Breast Exam Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Breast Care Suppl. Feeding <input type="checkbox"/> Breast Care <input checked="" type="checkbox"/>	Started HAART in ANC Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>	Screening Cervical Cancer <input checked="" type="checkbox"/> PAP <input type="checkbox"/> VIA <input type="checkbox"/> VILI <input type="checkbox"/> ND <input type="checkbox"/> No TB Sus <input type="checkbox"/> TB Rx <input type="checkbox"/> REF <input type="checkbox"/> ND <input type="checkbox"/> TB <input checked="" type="checkbox"/> X		
ANC Visit No. 01	Marital Status M <input checked="" type="checkbox"/> D <input type="checkbox"/> W <input type="checkbox"/> SE <input type="checkbox"/> SI <input type="checkbox"/>	Height (cm) Weight (kg) 183 063.0	EDD (dd/mm/yy) / /	HB g/dL Other Visit /	Fever 48h Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Infant Feeding ITN ITN <input checked="" type="checkbox"/>	ANC Prophylaxis CTX <input type="checkbox"/> AZT for Baby <input type="checkbox"/> NVP for Baby <input type="checkbox"/>	ANC Exercise Given Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Has Corrections? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	Other Parameters 1. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/> 2. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>
Syphilis Screening <input checked="" type="checkbox"/> RDT <input type="checkbox"/> HPR <input type="checkbox"/> VDRL <input type="checkbox"/> ND <input checked="" type="checkbox"/>	HIV Status Before 1st ANC <input checked="" type="checkbox"/> KP <input type="checkbox"/> U <input type="checkbox"/> Resit <input type="checkbox"/>	HIV Testing Initial <input type="checkbox"/> Retest <input type="checkbox"/> ND <input checked="" type="checkbox"/>	HIV Test 1 Results P <input type="checkbox"/> I <input type="checkbox"/> N <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/>	Malaria Screening P <input type="checkbox"/> ND <input checked="" type="checkbox"/> BS <input type="checkbox"/> P <input type="checkbox"/> N <input type="checkbox"/> ND <input checked="" type="checkbox"/>	Other Conditions Hypert <input type="checkbox"/> Diabetes <input type="checkbox"/> Epilepsy <input type="checkbox"/> RTI/STI <input type="checkbox"/> Other <input type="checkbox"/> Please specify	Prophylaxis IPT Dose (No.) <input checked="" type="checkbox"/> NA <input type="checkbox"/> LL/ITN given <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	ANC Exercise Given Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Referrals From Other HF <input type="checkbox"/> CU <input type="checkbox"/>	Other Parameters 1. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/> 2. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>	
HIV Results P <input type="checkbox"/> N <input checked="" type="checkbox"/> NA <input type="checkbox"/> Prev. P <input type="checkbox"/> Prev. N <input type="checkbox"/>	Partner HIV C&T Counseled as a couple <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Test result on partner <input type="checkbox"/> P <input type="checkbox"/> KP <input type="checkbox"/> N <input type="checkbox"/> U <input type="checkbox"/>	WHO Stage CD4 Count / /	Malaria Treatment AL <input type="checkbox"/> DHA-PPQ <input type="checkbox"/> Artesunate <input type="checkbox"/> Qui <input type="checkbox"/> Qui (paarm) <input type="checkbox"/>	Other Conditions Treatment Hypert <input type="checkbox"/> Diabetes <input type="checkbox"/> Epilepsy <input type="checkbox"/> RTI/STI <input type="checkbox"/> Other <input type="checkbox"/> Please specify	Prophylaxis TT Dose (No.) <input checked="" type="checkbox"/> Deworming <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	ANC Exercise Given Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Referrals From Other HF <input type="checkbox"/> CU <input type="checkbox"/>	Other Parameters 1. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/> 2. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>		

First Name _____
Middle Name _____
Last Name _____
Tel No. (own/other) _____
Sub-Location Name _____
Village Name _____

Date of Visit (dd/mm/yy) 18/02/19	Sub-Location Code 0009	Date of Birth (dd/mm/yy) 03/11/95	Parity 03+0	Gravidae 04	Blood Pressure (mmHg) (sys/dias) / /	Counseled on Birth Plan <input checked="" type="checkbox"/> Danger Signs <input checked="" type="checkbox"/> FP <input checked="" type="checkbox"/>	ANC Prophylaxis On ARV before 1st ANC Visit <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/> Rev <input type="checkbox"/>	Screening Cervical Cancer <input checked="" type="checkbox"/> PAP <input type="checkbox"/> VIA <input type="checkbox"/> VILI <input type="checkbox"/> ND <input type="checkbox"/> No TB Sus <input type="checkbox"/> TB Rx <input type="checkbox"/> REF <input type="checkbox"/> ND <input type="checkbox"/> TB <input checked="" type="checkbox"/> X		
ANC Number 0200119	Village Code 0024	Age in Years Fundal Height (w) 22 28	LMP (dd/mm/yy) 23/07/18	HB g/dL 1st Visit /	Breast Exam Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Breast Care Suppl. Feeding <input checked="" type="checkbox"/> Breast Care <input checked="" type="checkbox"/>	Started HAART in ANC Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>	Screening Cervical Cancer <input checked="" type="checkbox"/> PAP <input type="checkbox"/> VIA <input type="checkbox"/> VILI <input type="checkbox"/> ND <input type="checkbox"/> No TB Sus <input type="checkbox"/> TB Rx <input type="checkbox"/> REF <input type="checkbox"/> ND <input type="checkbox"/> TB <input checked="" type="checkbox"/> X		
ANC Visit No. 02	Marital Status M <input checked="" type="checkbox"/> D <input type="checkbox"/> W <input type="checkbox"/> SE <input type="checkbox"/> SI <input type="checkbox"/>	Height (cm) Weight (kg) 159 055.0	EDD (dd/mm/yy) 30/04/19	HB g/dL Other Visit /	Fever 48h Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Infant Feeding ITN ITN <input checked="" type="checkbox"/>	ANC Prophylaxis CTX <input type="checkbox"/> AZT for Baby <input type="checkbox"/> NVP for Baby <input type="checkbox"/>	ANC Exercise Given Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Has Corrections? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	Other Parameters 1. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/> 2. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>
Syphilis Screening <input checked="" type="checkbox"/> RDT <input type="checkbox"/> HPR <input type="checkbox"/> VDRL <input type="checkbox"/> ND <input checked="" type="checkbox"/>	HIV Status Before 1st ANC <input checked="" type="checkbox"/> KP <input type="checkbox"/> U <input type="checkbox"/> Resit <input type="checkbox"/>	HIV Testing Initial <input type="checkbox"/> Retest <input type="checkbox"/> ND <input checked="" type="checkbox"/>	HIV Test 1 Results P <input type="checkbox"/> I <input type="checkbox"/> N <input checked="" type="checkbox"/> NA <input checked="" type="checkbox"/>	Malaria Screening P <input type="checkbox"/> ND <input checked="" type="checkbox"/> BS <input type="checkbox"/> P <input type="checkbox"/> N <input type="checkbox"/> ND <input checked="" type="checkbox"/>	Other Conditions Hypert <input type="checkbox"/> Diabetes <input type="checkbox"/> Epilepsy <input type="checkbox"/> RTI/STI <input type="checkbox"/> Other <input type="checkbox"/> Please specify	Prophylaxis IPT Dose (No.) <input checked="" type="checkbox"/> NA <input type="checkbox"/> LL/ITN given <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	ANC Exercise Given Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Referrals From Other HF <input type="checkbox"/> CU <input type="checkbox"/>	Other Parameters 1. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/> 2. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>	
HIV Results P <input type="checkbox"/> N <input checked="" type="checkbox"/> NA <input type="checkbox"/> Prev. P <input type="checkbox"/> Prev. N <input type="checkbox"/>	Partner HIV C&T Counseled as a couple <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Test result on partner <input type="checkbox"/> P <input type="checkbox"/> KP <input type="checkbox"/> N <input type="checkbox"/> U <input type="checkbox"/>	WHO Stage CD4 Count / /	Malaria Treatment AL <input type="checkbox"/> DHA-PPQ <input type="checkbox"/> Artesunate <input type="checkbox"/> Qui <input type="checkbox"/> Qui (paarm) <input type="checkbox"/>	Other Conditions Treatment Hypert <input type="checkbox"/> Diabetes <input type="checkbox"/> Epilepsy <input type="checkbox"/> RTI/STI <input type="checkbox"/> Other <input type="checkbox"/> Please specify	Prophylaxis TT Dose (No.) <input checked="" type="checkbox"/> Deworming <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>	ANC Exercise Given Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Referrals From Other HF <input type="checkbox"/> CU <input type="checkbox"/>	Other Parameters 1. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/> 2. Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>		

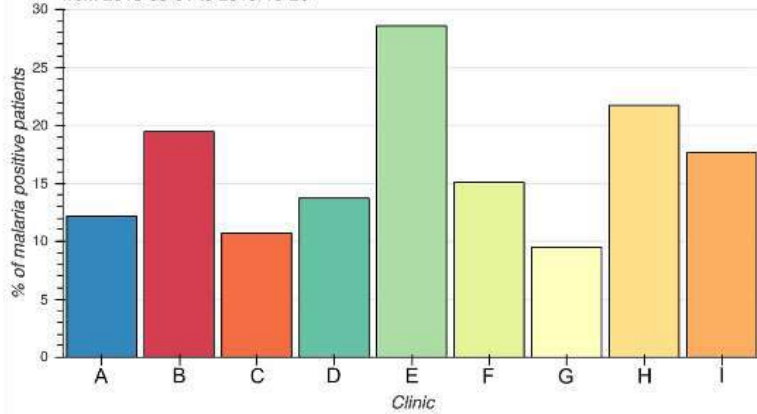
Fully digital data!



% of malaria positive patients

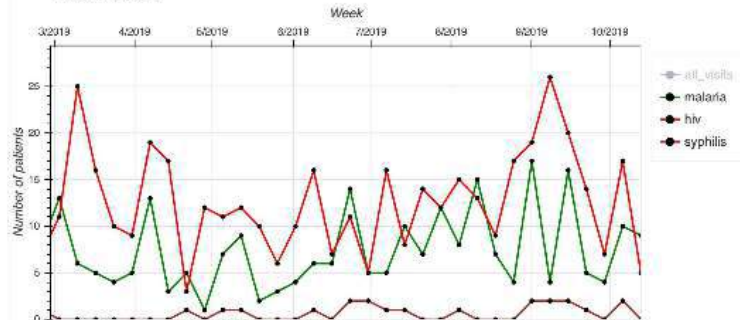
QED | <https://qed.ai>

from 2018-09-01 to 2019-10-26

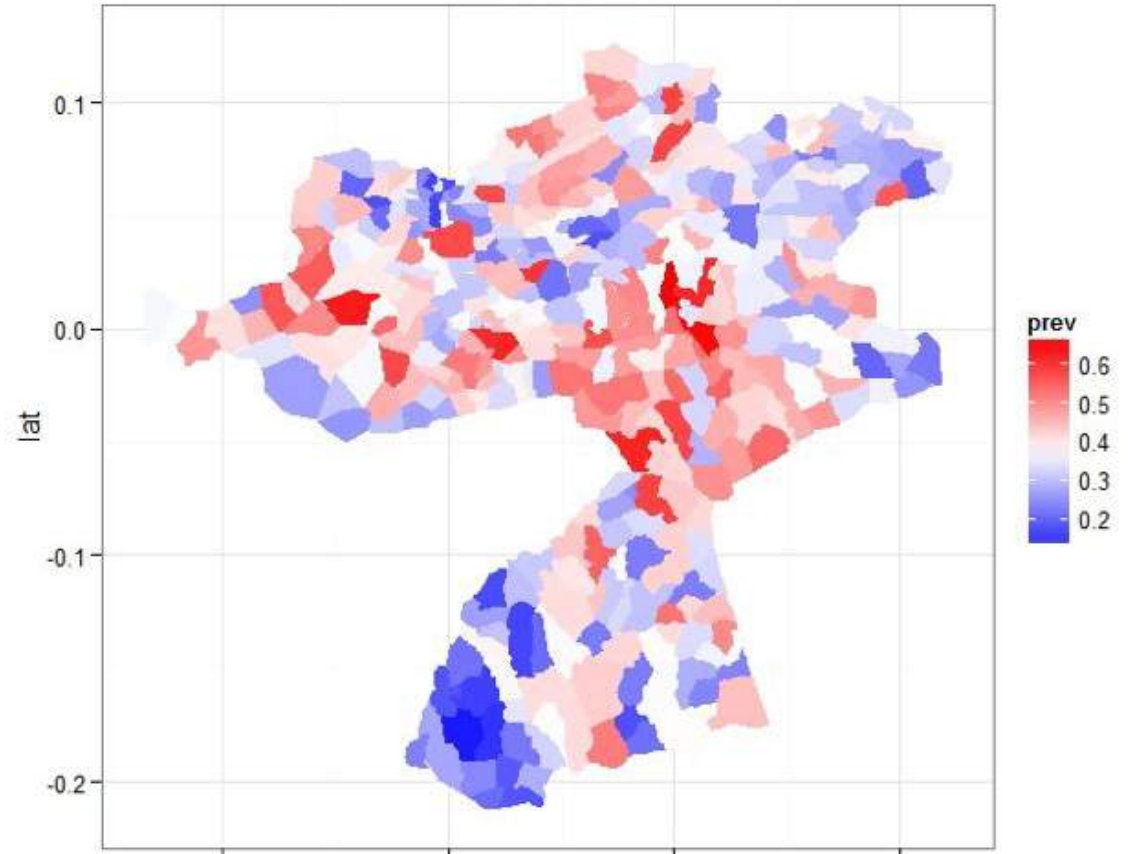


Weekly visits of patients with diseases

QED | <https://qed.ai>



Prevalence



ScanForm
qed.ai

**Automated analytics.
Sustainable passive surveillance.**

Closing

Tech Strategy: Closing Remarks

- **Customize tech for realities on the ground. Ignore the West.**
 - **Motivate technologists with problems worth fighting for.**
 - **Achieving “Sustainable Development Goals” also requires learning to sustain ourselves!**
- Industrial partnership is key to the future of humanity.**

Contact: William Wu <w@qed.ai>

Business: <https://business.qed.ai>

