



# VITAL SIGNS

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# An integrated monitoring system

- The Millennium Assessment set out to demonstrate the links between biodiversity, ecosystem services and human wellbeing
- It failed to do that, partly because no datasets existed that measured all three in ways that were compatible in space, time and definition
- VSA is an attempt to fix that

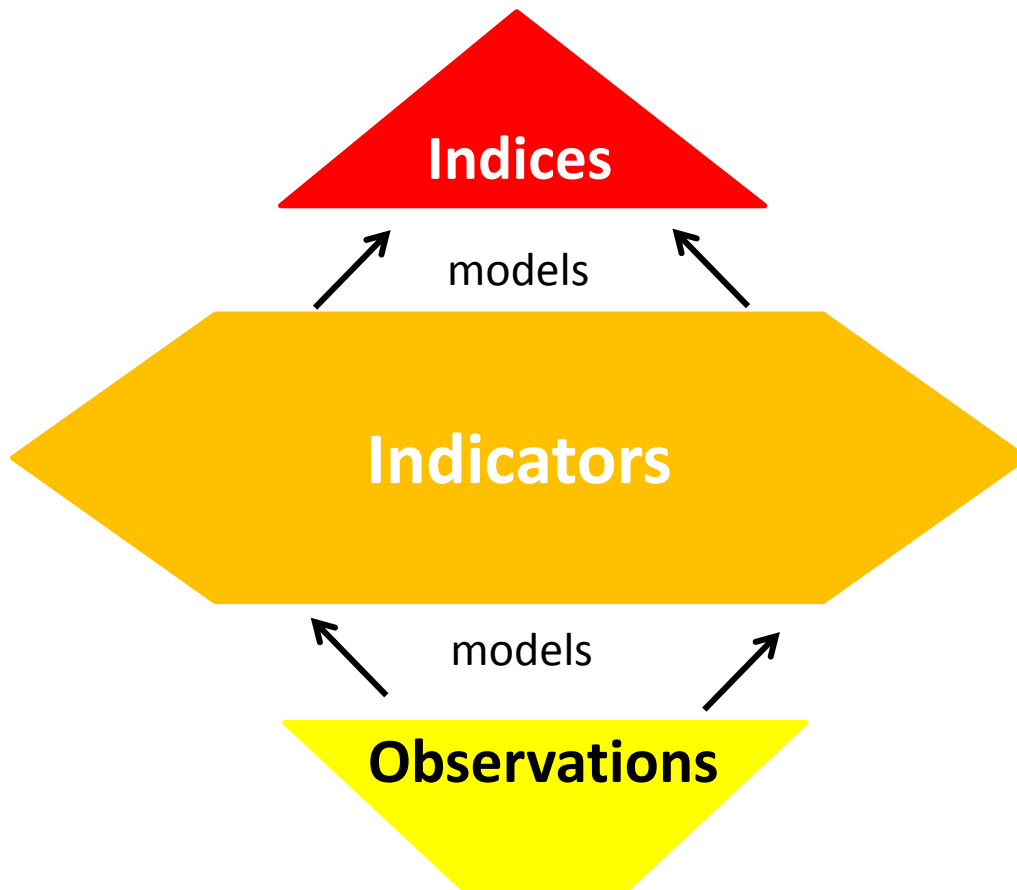
# What does *integrated* mean to VSA?

- Compatible observations in space and time
- Across disciplines: human wellbeing, ecosystem services, biodiversity, agriculture
- From primary observations, through models to indicators and decision support indices
- In situ, household survey, remote sensing
- global resources, national resources, project resources

# A COMPREHENSIVE FRAMEWORK



# The shape of an observation system



Very few, 'synthetic', in decision-maker terms

As many as you like  
Change over time  
Defined in topic expert terms

Relatively few,  
defined in stable terms

Thread for  
Climate forcing  
v1 Nov 12

Net AFOLU  
Climate forcing

Net CO2  
emission/uptake

Net CH4  
emission/uptake

Net N2O  
emission

Net change in  
albedo

IPCC  
Guideline

IPCC tier 2  
emissions  
model

IPCC emissio  
n factors

IPCC emissio  
n factors

Bird et al 2010  
Net forcing

C content  
and  
expansion  
factors

Livestock density  
(from livestock  
thread)

Area planted to  
rice

Area and type of  
legumes

Use of N fertiliser

Land cover  
change

Burned area  
MODIS

AG and BG  
Woody biomass

Soil Carbon to  
1 m

Colgan et al  
algorithm

Allometry  
Nickless &  
Scholes 2011

AfSIS  
interpolation  
algorithm

Tree cover  
MODIS

Tree height  
ICESAT

Tree basal area

Tree height

Tree species

Soil C

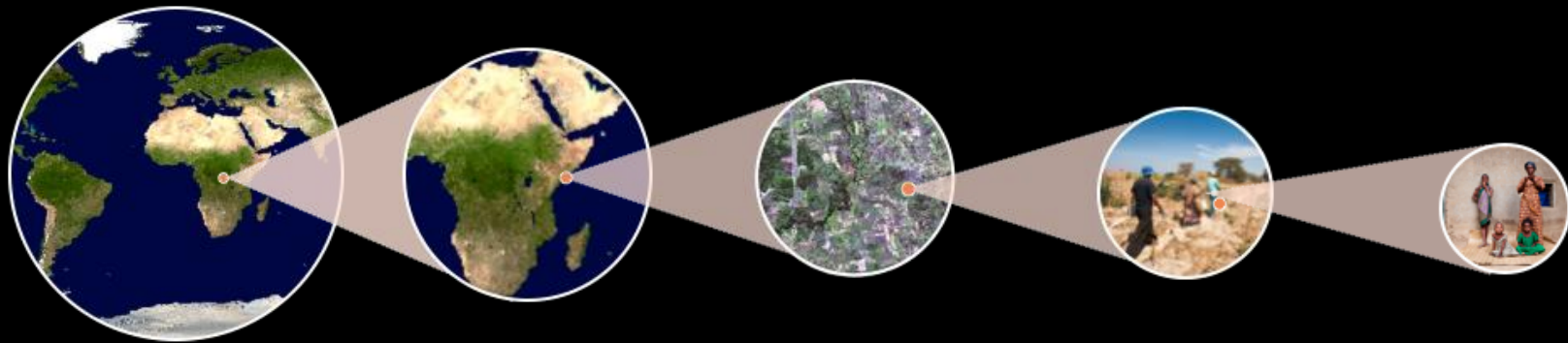
MISR or MODIS  
albedo

# The VSA sampling frame

- How do you satisfy the need for large coverage, adequate detail, and affordability?
- A sparsely-nested hierarchy
  - A few basic things measured everywhere, remotely
  - A moderate number measured in situ in a representative set of locations
  - A detailed package in a few, selected places

# VITAL SIGNS MEASUREMENT SCALES

Information for All Decision-Making Levels



## GLOBAL

Facilitating comparisons among different regions



## REGION

Providing insights and information at the scales agricultural investment decisions are made.



## LANDSCAPE

Measuring the links between agricultural intensifications, water availability, soil health and other ecosystem services together with human well-being.



## PLOT

Tracking agricultural production, including which seeds what fertilizer is used and what crop yields they deliver.



## HOUSEHOLD

Using surveys on health, nutritional status, income and assets.



# A sparse hierarchy

Tier	Characteristics	Examples
1	Wall-to-wall, repeated 5-yearly	Land cover map from Modis Weather data from satellite
2	Statistically valid sample, standard methods, repeated 3-yearly	Vegetation plots 1 ha Agricultural plots 1 ha Household surveys
3	Continuous in time	Weather station, flow records
4	High resolution, detailed, selected	Landscapes 10 x 10 km @ 1 m

# The VSA sample

Sample unit name	Scale	Number per region	Notes
Region	~250 000 km <sup>2</sup>	1	An area defined by a key stakeholder, or in some cases, a jurisdictional boundary
Land cover type	Each at least 1% of region and no more than 20%	10-20	LCCS level 2 or 3
Landscape	10 x 10 km	~5-10	Repeated high-resolution imagery
Patch	Any size, but typically 10-1000 ha	Thousands	Contiguous mapped land cover/use units
Plot	~1 ha (100 m x 100 m)	~500 detailed plots	Revisited every 3-5 years
		~5000 rapid plots	Not necessarily revisited
Subplots	Variable, ~ 10 m <sup>2</sup>	9-36 per detailed plot	E-sampling suggested as the way to distribute within plots
Quadrats	~0.25 m <sup>2</sup>	9-36 per detailed plot	
Points	No dimension	Variable	

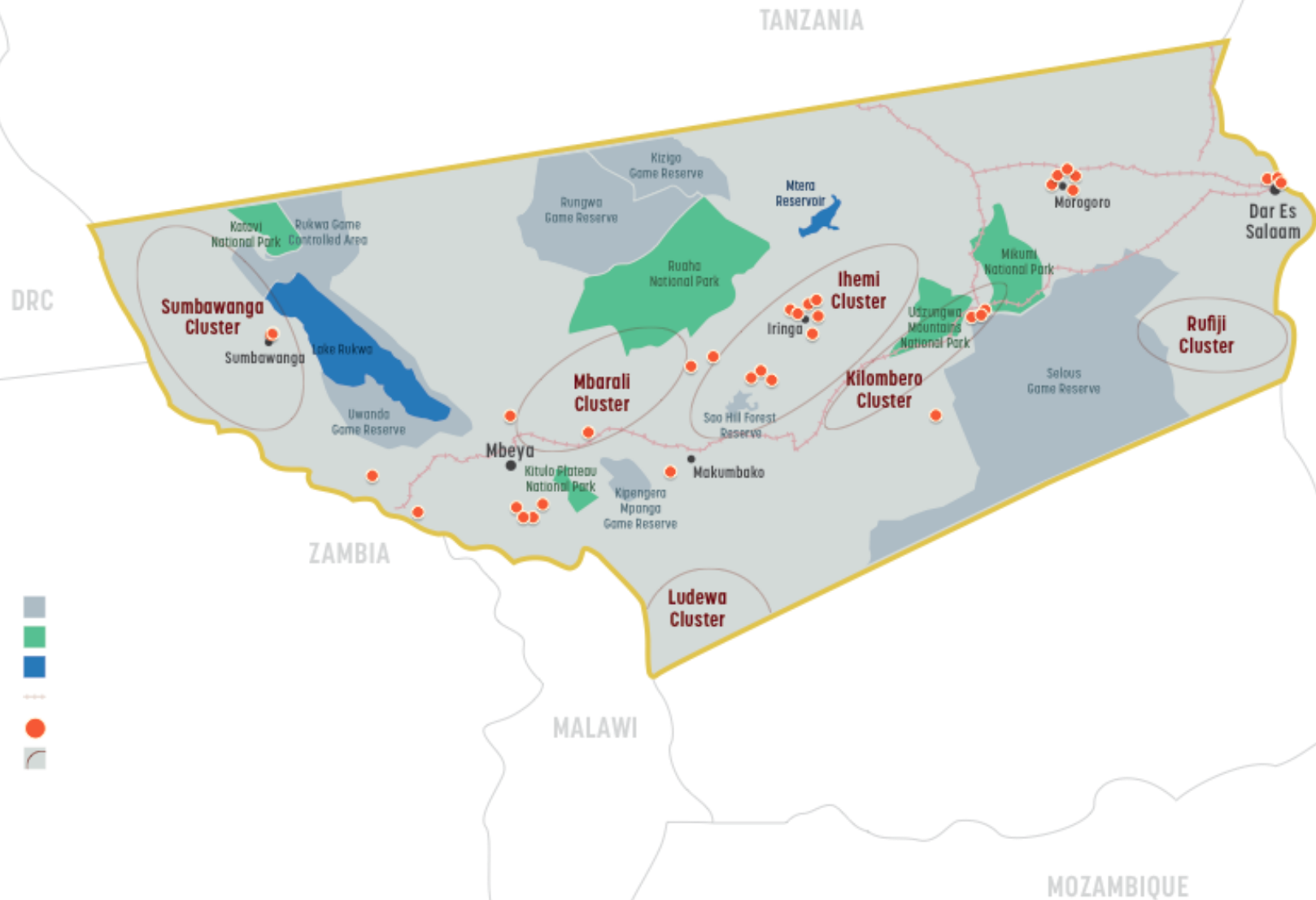
# Use smart technology if it helps

- Data capture on tablets
  - Include GPS and time, observer, pictures plus structured datasets
- SoilDoc and Compartment Bag Technique
  - Chemical and microbiological analysis in field
- Cellphones for crowdsourcing
- Cutting-edge remotely-sensed data products
- Drones for field plots

# Vital Signs Africa Phase 1 footprint



# Southern Agricultural Growth Corridor of Tanzania





70% of farmers  
in SAGCOT earn

<50¢

A DAY

From Agriculture

# MARKET VALUE OF SERVICES FROM NATURE

**Protein**      **\$63**      Wild Meat & Fish from Local Market

**Soil Nutrients**      **\$50**      1 Bag of Fertilizer

**Fuel Wood**      **\$91**      Electricity From the Grid

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**TOTAL**      **\$204**

**\$183**      Annual Household  
Revenue from Agriculture

# What would success look like?

- Dramatically improved human wellbeing for the majority of people living in, and dependent on, the target regions
- A sustained level of provision of ecosystem services ('Natural Capital' non-declining after an initial, modest loss which is less than the gains in Human and Manufactured Capital)
- An interacting network of protected habitats for biodiversity such that it can persist with minimal human intervention





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**Interconnected challenges  
require interconnected  
solutions.**

”

Melinda Gates, Bill & Melinda Gates Foundation