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Implications of the Golden Age of Remote Sensing on Earth Observation Applications in Central America

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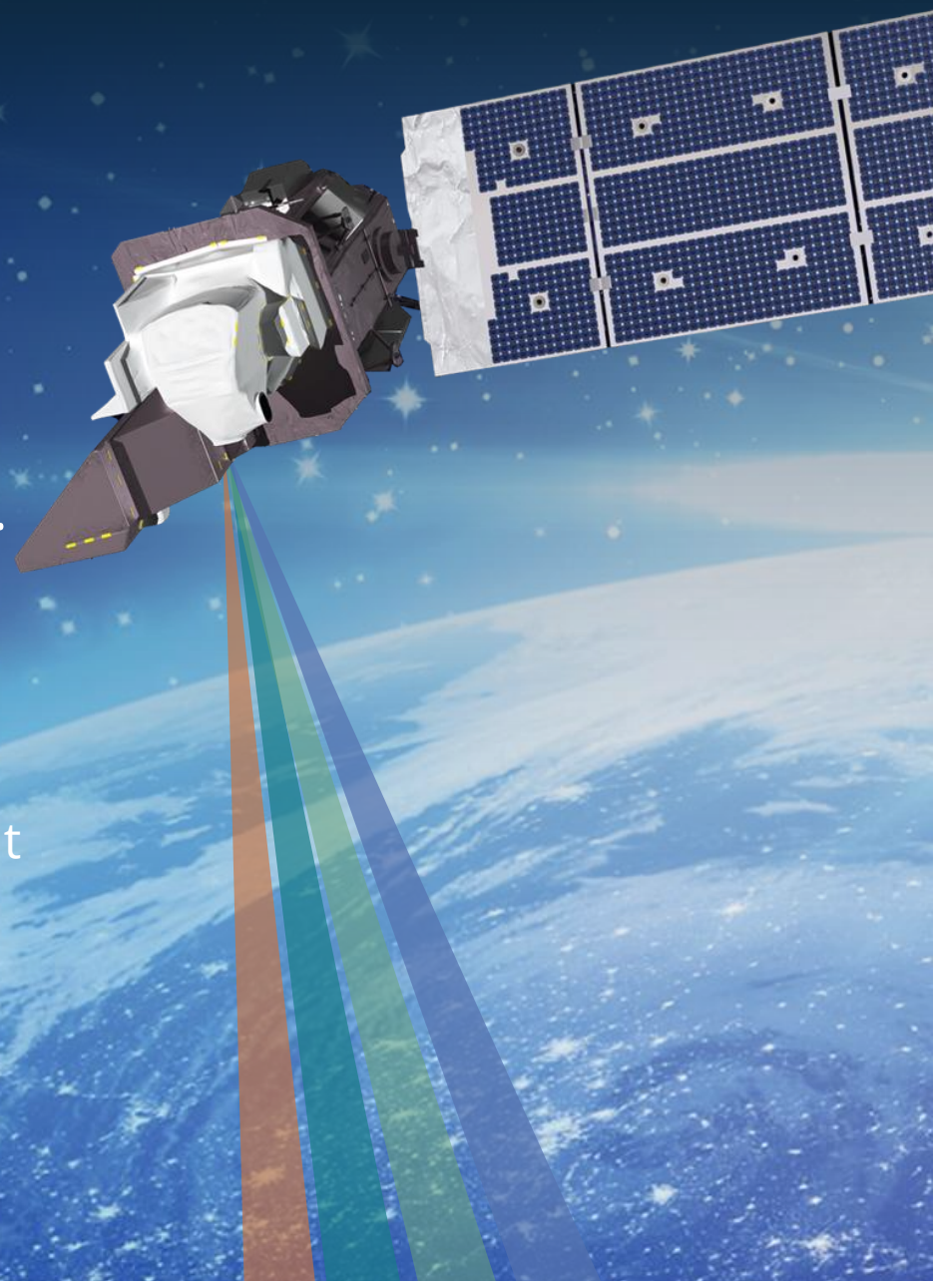
Objectives

- Utilize Central America (CA) as a case study for examining the development of EO capacity (terrestrial)
- Examine the trajectory of the development of EO capacity in CA
- Identify lessons learned from such development, esp. as applicable to other regions
- Consider the way forward

CONNECTING **SPACE** TO **VILLAGE**



SERVIR is a partnership of NASA, USAID, and leading geospatial organizations in Asia, Africa, and Latin America.

- We work with countries and organizations in the use of free and open satellite data to build resilience to climate change and address its contributing causes.
- We co-develop innovative solutions through a network of regional hubs to improve sustainable resource management at local, national and regional scales.
- We build capacity to address critical challenges in climate change, food security, water and related disasters, land use, and air quality.

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SERVIR focuses on countries in Asia, Africa, & the Americas

Regional characteristics

Physical

- High biodiversity
- Deforestation a priority issue
- 0.52 million km^2 area
- Low overall cloud cover in 5 of 7 countries
- Dry season from Jan. to May
- 43 Landsat scenes to cover

Political

- *7 countries**
- *50.7 million inhabitants in 2020*
- *Regional integration system (SICA) est. in 1991*
- *Mesoamerican Biological Corridor est. c.1992*
- *All countries members of the Group on Earth Observations (GEO)*

** Dominican Republic is not a part of CA, but is the 8th SICA member nation.*

Timeline

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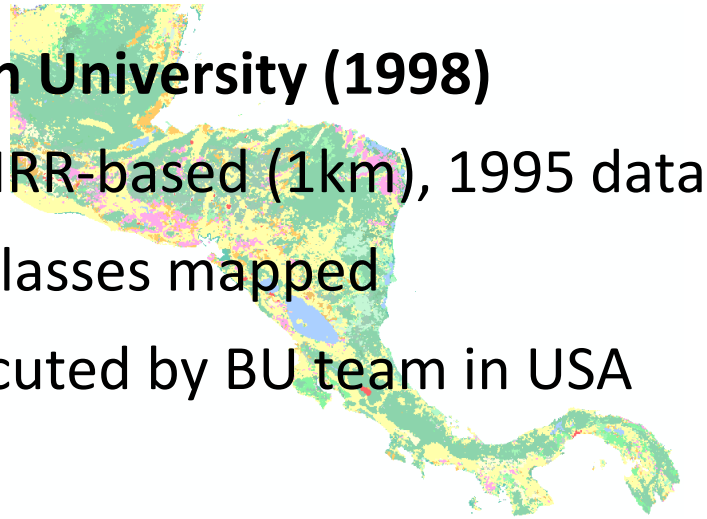
Regional

- 1989: CCAD established
- 1990: 1st regional AirSAR mission (NASA)
- 1991: SICA established
- 1992: CA Biodiversity Convention / Biological Corridor
- 1998: CA veg. study | NASA-CCAD MOU
- 1999-2002: CA Ecosystem Mapping project
- 2004: 2nd regional AirSAR mission (NASA)
- 2005-2011: SERVIR [Mesoamerica] established
- 2006-2009: ESA DIVERSITY project
- 2009-2011: PREVDA regional land cover mapping
- 2010: REDD-CCAD-GIZ project established
- 2018: Irazú cube satellite (Costa Rica) launched
- 2019: NASA-SICA Joint Statement
- 2020: Quetzal-1 cube satellite (Guatemala) launched
- 2021: Copernicus CA outreach project

Global

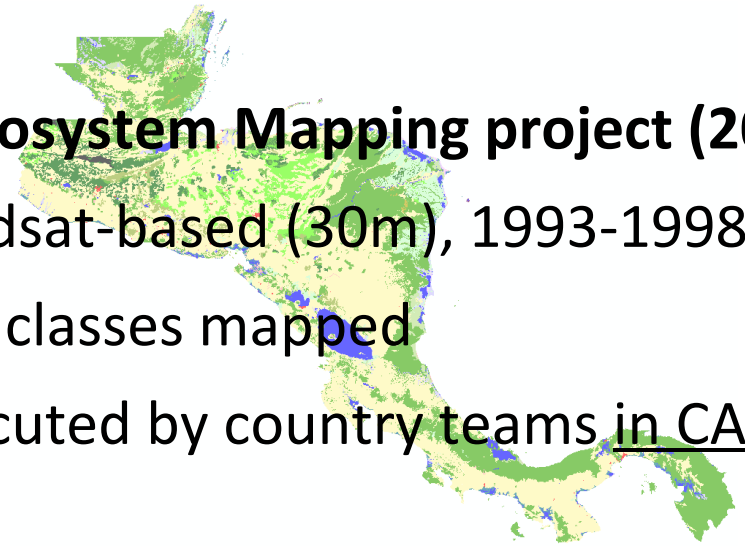
- 1972: Landsat-1 launched
- 1998: Global Land Cover Characterization (USGS)
- 1998-2002: GeoCover 1990 and 2000 datasets generated
- 2004: SRTM global DEM data publicly released
- 2005: Google Earth released; Group on Earth Observations (GEO) established
- 2007: REDD mechanism approved at COP-13
- 2008-2009: Landsat archive opened
- 2010: Google Earth Engine released
- 2013-2014: Hansen et al. / Global Forest Watch data
- 2014: Copernicus Sentinel-1 launched
- 2020: PlanetScope imagery of tropics become available
- 2021: Latin American & Caribbean Space Agency (ALCE) established; 3 global 10m land cover products released

Regional land cover datasets



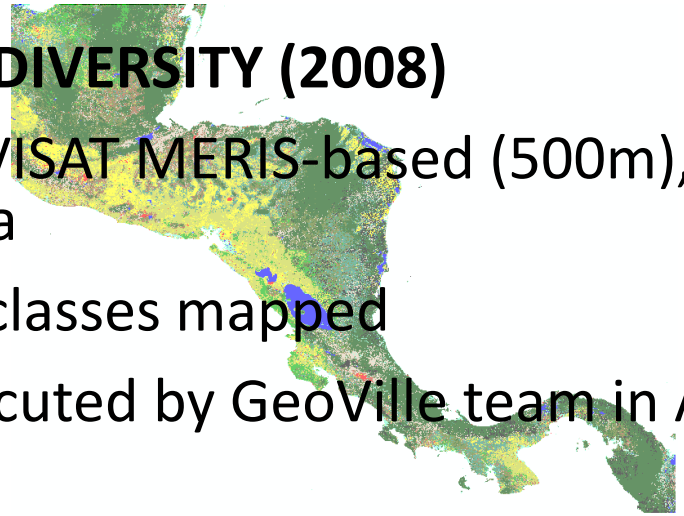
(i) Boston University (1998)

- AVHRR-based (1km), 1995 data
- 26 classes mapped
- Executed by BU team in USA



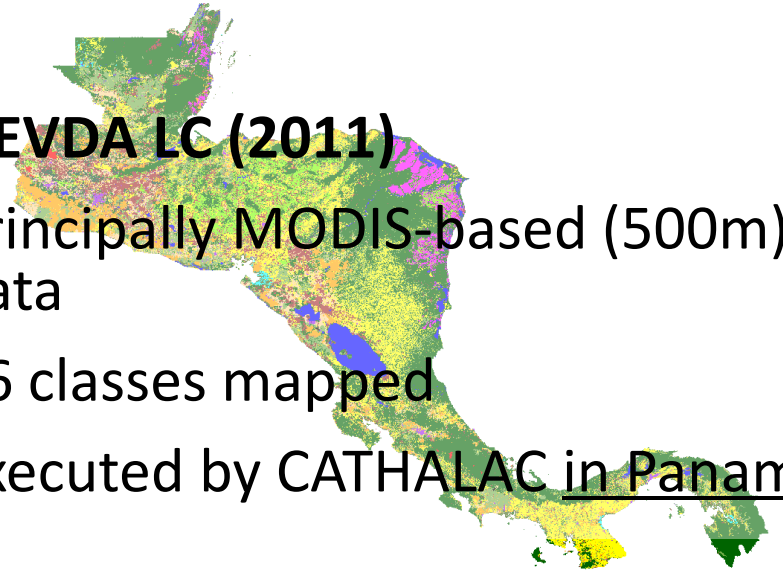
(ii) CA Ecosystem Mapping project (2002)

- Landsat-based (30m), 1993-1998 data
- 197 classes mapped
- Executed by country teams in CA



(iii) ESA DIVERSITY (2008)

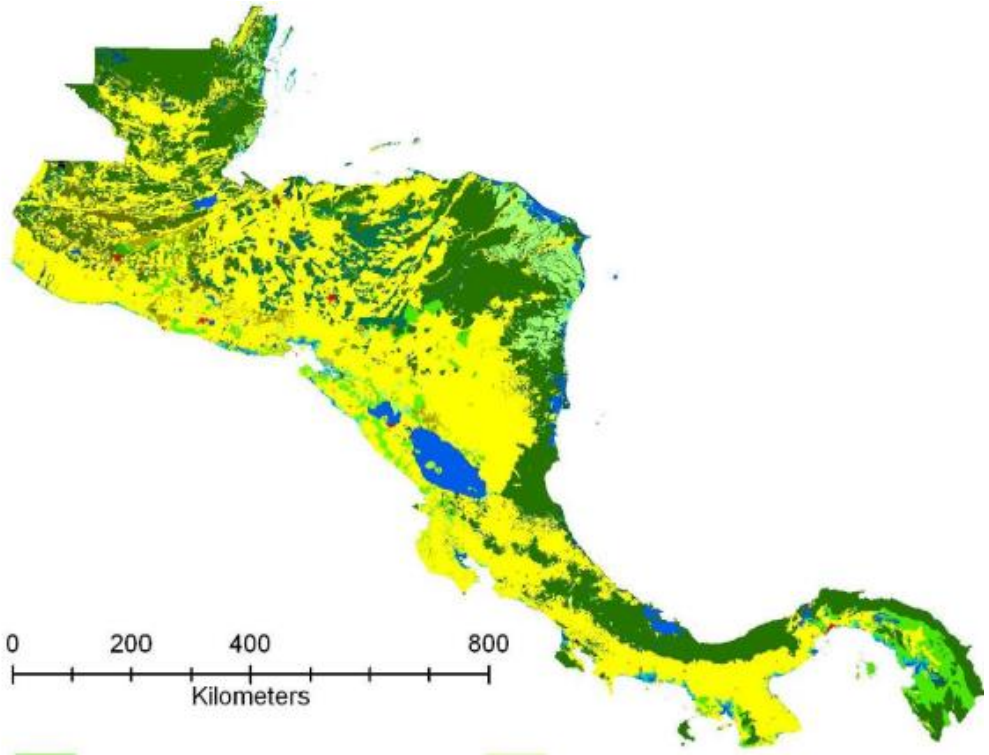
- ENVISAT MERIS-based (500m), 2008 data
- 12 classes mapped
- Executed by GeoVille team in Austria



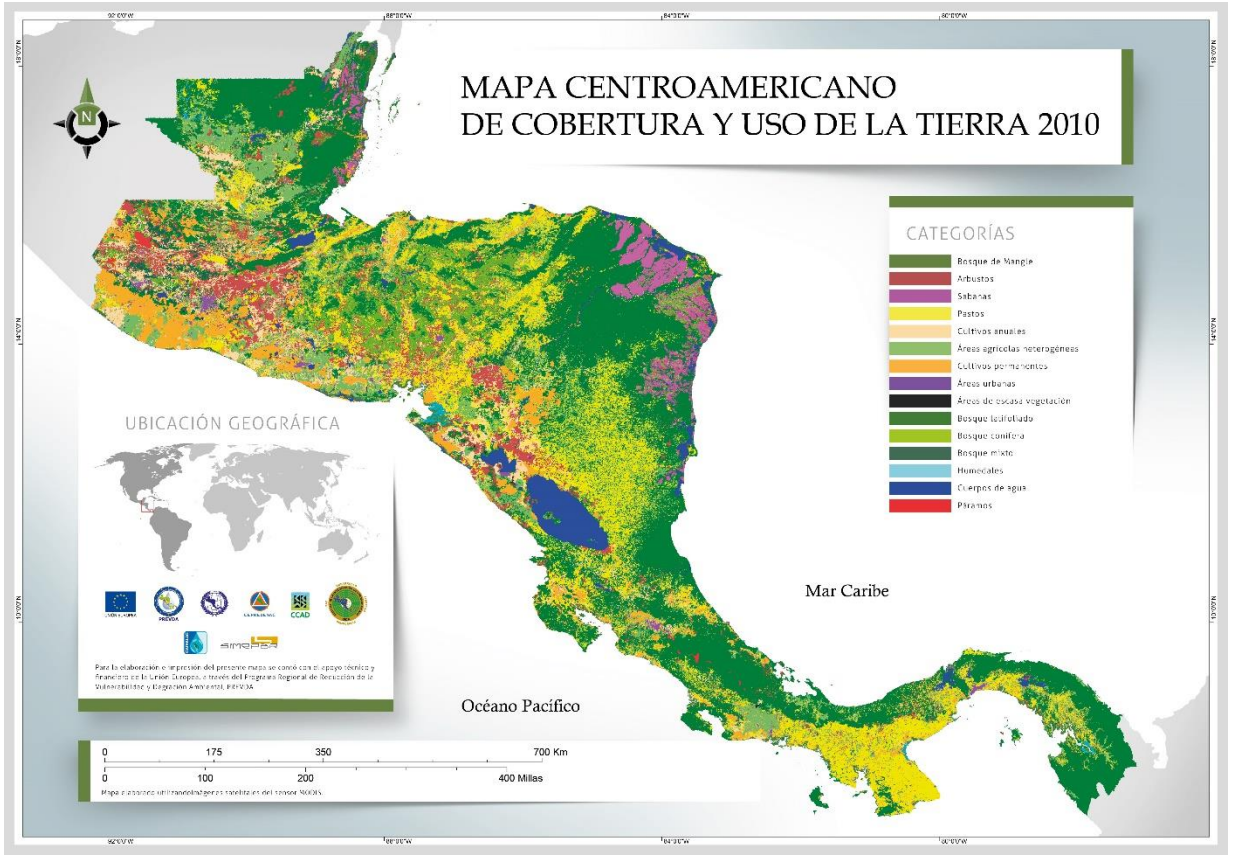
(iv) PREVDA LC (2011)

- Principally MODIS-based (500m), 2010 data
- 16 classes mapped
- Executed by CATHALAC in Panama

Regional land cover datasets



source: World Bank / CCAD



source: CATHALAC / SERVIR Mesoamerica

REDD+ as a driver of capacity development

- Reducing Emissions from Deforestation and forest Degradation (REDD+) established as a part of the Bali Action Plan coming out of 2007's UNFCCC COP-13
- Focus of REDD+ on development of Monitoring, Reporting, and Verification (MRV) systems
- REDD+ MRV systems invariably require use of EO data for monitoring forests
- REDD+ helped stimulate various activities globally, regionally, nationally
  - Global: GEO Forest Carbon Tracking Task (now GFOI), and US' SilvaCarbon
  - Regional in CA: REDD-CCAD-GIZ project launched in 2007
  - National: All 7 CA countries have been developing national forest monitoring systems

Targeted capacity building

- **SERVIR-Mesoamerica** (2005-2011): Remote sensing / GIS trainings (regional)
- **REDD-CCAD-GIZ** (2010-present): Forest monitoring trainings (regional + national)
- **SilvaCarbon** (2014-present): Forest monitoring trainings, focused on specific CA countries (bilateral)
- **NASA-SICA Joint Statement** (2019-present): Various virtual training activities (regional)
- **Copernicus CA** (2021-2022): Awareness raising, virtual (regional)

National forest cover datasets *(not updated)*

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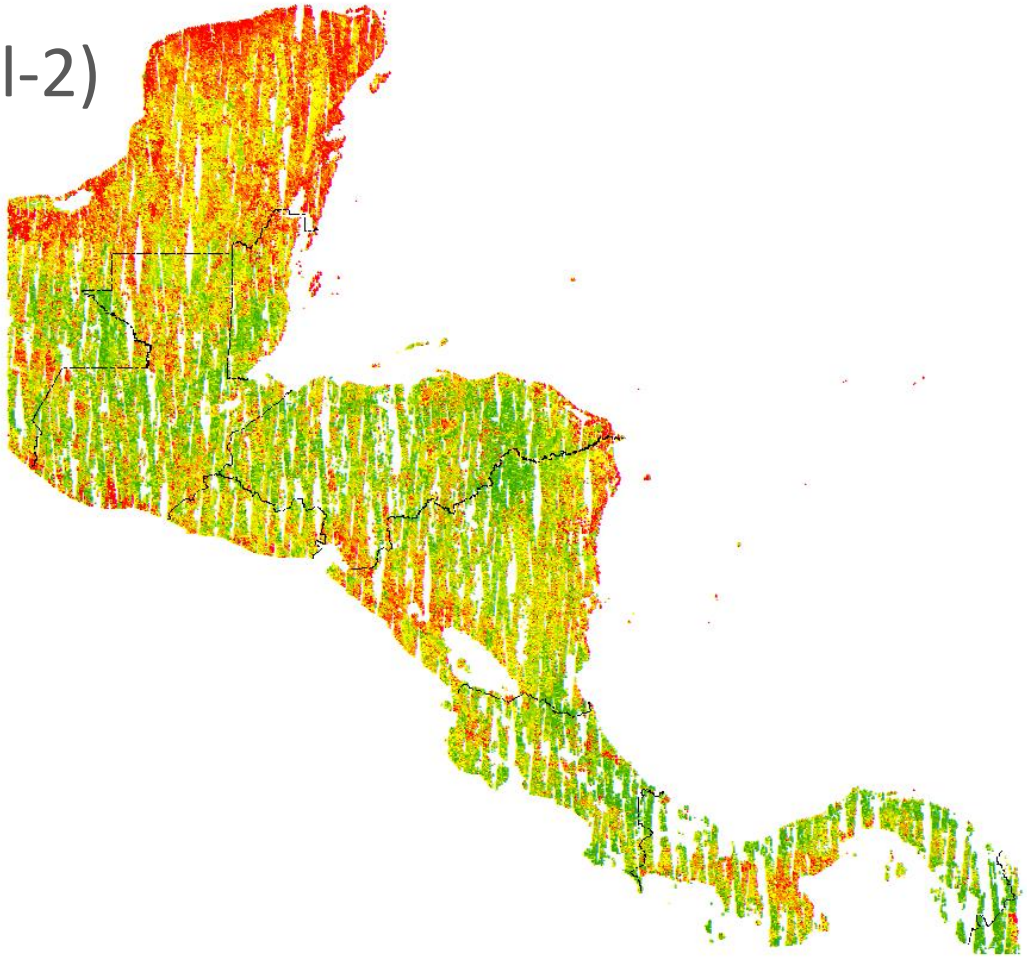
Year	Belize	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica	Panama	Dom. Rep.
1980	1980							
1985					1988			
1990	1989	1991			1990	1990	1992	
1995	1994	1995	1993	1995		1997		1996
2000	2000	2001	2000	2000	2000	2000	2000	2000
2005	2004	2006	2006			2005		
2010	2010	2010		2009			2008	
2011								2011
2012	2012					2012	2012	
2013	2013							
2014	2014							
2015	2015							
# maps	10	5	3	3	3	5	4	3

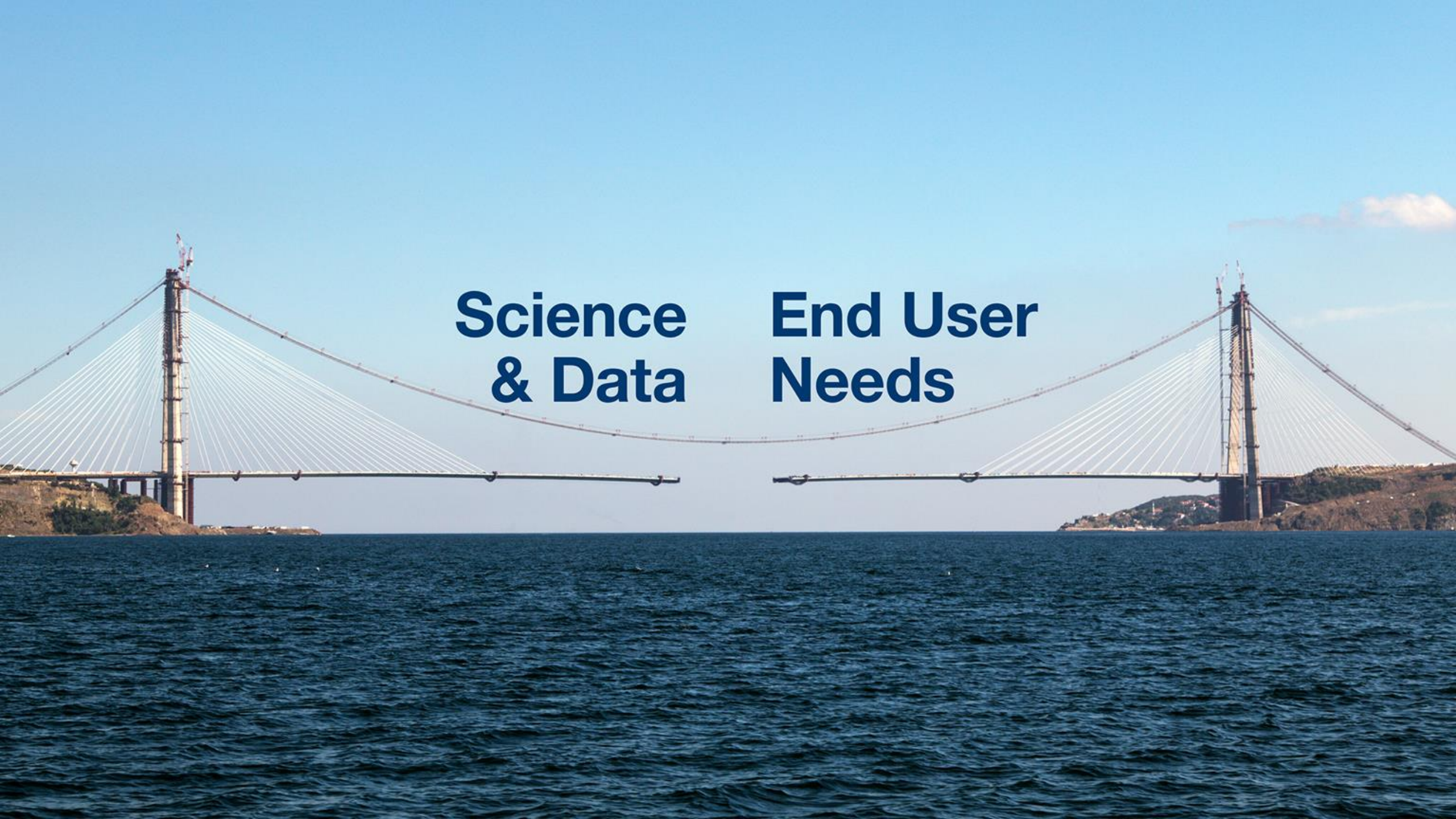
sources: CATHALAC (2015), A. Jimenez / GIZ (2014)

What does a Golden Age of Remote Sensing look like?

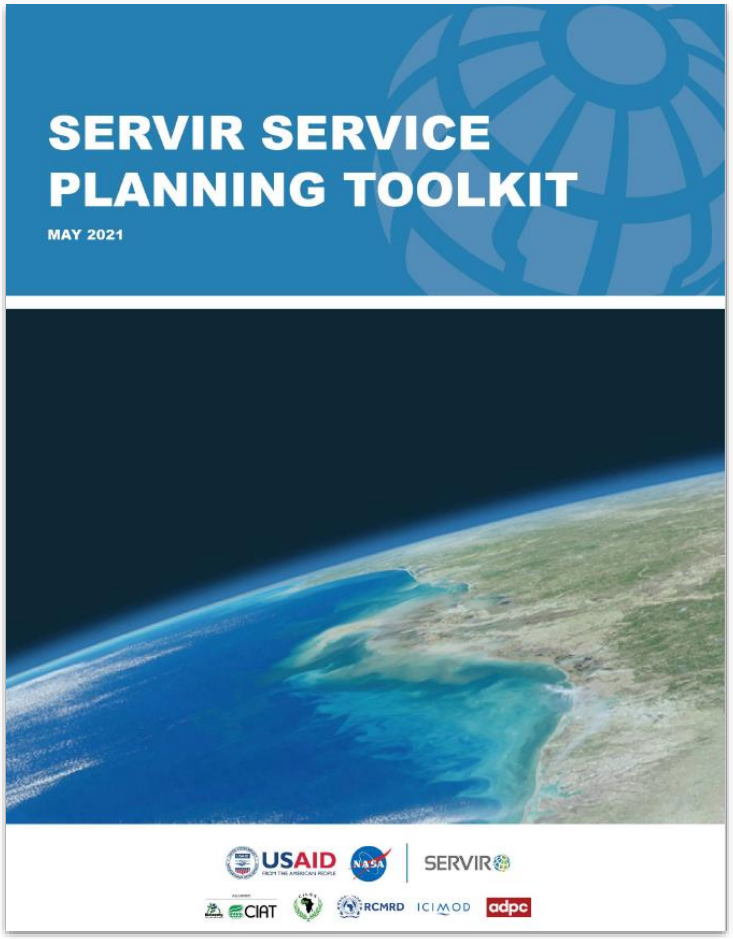
- Access to open data
  - Medium res optical (Landsat, Sentinel-2)
  - High res. optical (PlanetScope)
  - SAR (ALOS PALSAR, Sentinel-1)
  - Spaceborne LiDAR (GEDI, ICESat-2)
- Access to open tools
  - GIS: QGIS
  - RS: SNAP
  - Cloud computing: GEE
- Access to training materials
  - ARSET, EO College



GEDI canopy height model data (source: NASA)


Science
& Data
End User
Needs

SERVIR service planning approach



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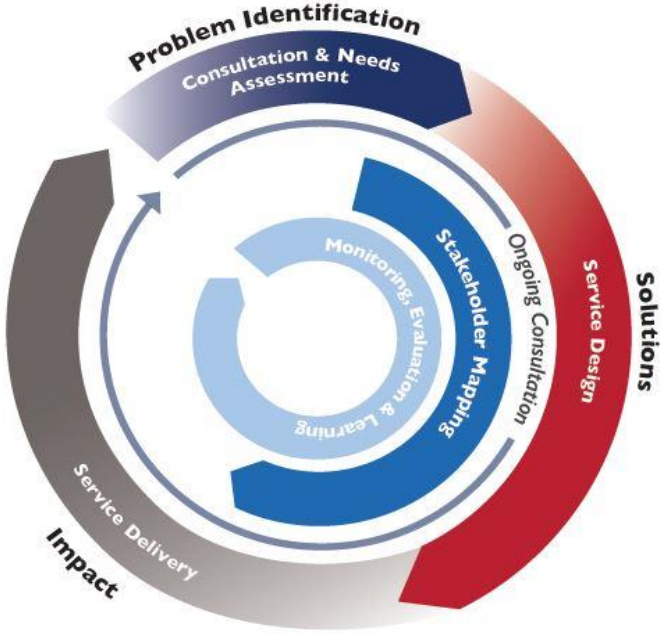
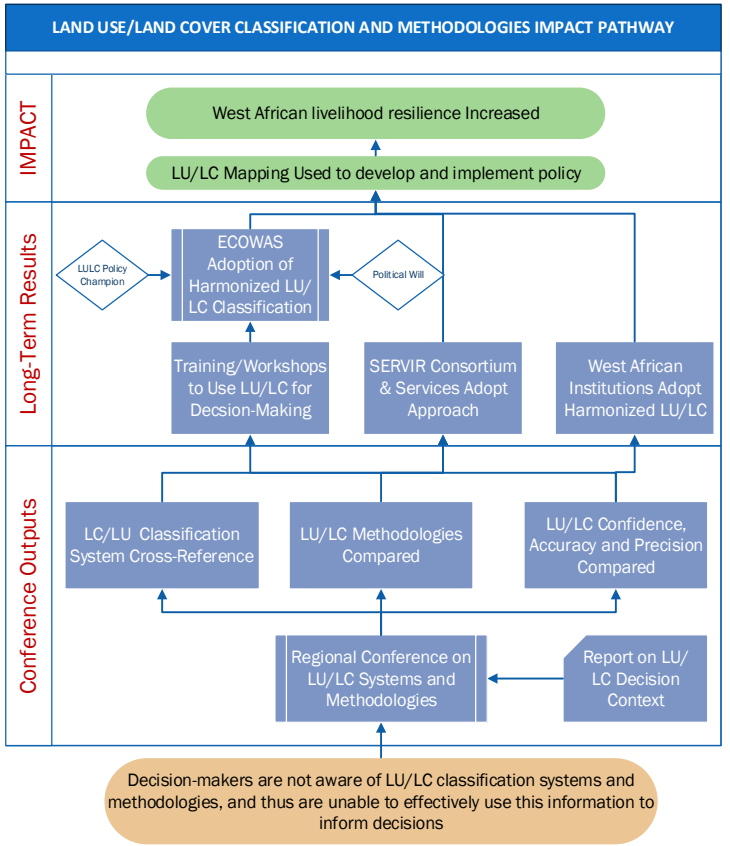


Example Theory of Change from SERVIR West Africa land cover harmonization activity



Summary

- Regional perspective on EO began w/ AVHRR study in 1998, continued through early 2010s
- REDD+ institutionalized countries' terr. monitoring approaches -> links to various mechanisms
- Countries generate own LC data
- Deforestation remains a concern
- Countries experimenting w/ CubeSat development, despite greater access to external EO assets
- Extensive use of Landsat archive, Copernicus Sentinel-2 imagery
- EO capacity likely concentrated w/in specific govt. ministries
- Small but capable region
- Deeper dives / assessments needed

Opportunities

- SilvaCarbon / GFOI
- AmeriGEO / GEO
- CEOS WGCapD

Considerations

- What does adequate EO capacity look like?
- How to appropriately institutionalize EO capacity?
- Where does the region need to go next / what is a desired outcome?
- What is needed for impactful / sustained applications of EO data?
- Are countries adequately taking advantage of what exists, and if not, why / how can they?
- How can other regions can learn from CA?

Space To Village

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Thank you!

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