

# Exploring the Integration of Earth Observations to Support Community Management of a Protected Area in Guatemala

Lauren E. Carey<sup>1</sup>, Betzy Hernández Sandoval<sup>1</sup>, África Flores-Anderson<sup>2</sup>, Eric Anderson<sup>2</sup>, Billy Ashmall<sup>3</sup>, Emil Cherrington<sup>1</sup>, Kelsey Herndon<sup>1</sup>, Nina Copeland<sup>1</sup>  
(1) University of Alabama in Huntsville, Huntsville, AL, United States, (2) NASA Marshall Space Flight Center, Huntsville, AL, United States, (3) Universities Space Research Association, Washington D.C.

## I. INTRODUCTION

Central America faces increasing challenges of deforestation and habitat fragmentation with complex drivers. As part of a novel shared-management model, both the community of *Santa María Tzejá* and the *Protected Areas Council of Guatemala* (CONAP in Spanish) co-manage *Cerro Cantil*, a protected area of approximately 314.32 hectares in the Quiché department of northwestern Guatemala. The SERVIR program is currently working with community representatives to explore how earth observations (EO) can help demonstrate the importance of this small protected area within the broader geographic context.

**Objective:** Co-develop earth observation products that support forest and biodiversity monitoring, contribute to official reporting indicators, and highlight Cerro Cantil's importance in a region undergoing rapid deforestation.

## II. METHODOLOGY

This process of co-development (Fig. 1) is inspired by SERVIR's Service Planning methodology (QR code below), its critical component being that the creation of projects is driven by user needs. Following conversations with community leaders to assess key priorities, example outputs were generated for each EO product in Fig. 3 below.

**Fig. 3 - EO derived analyses and products considered for this project and their relevance to protected area reporting indicators**

Reporting indicator	Hotspots	Time series analysis	Biological corridors	Vegetation indices	Planet NICFI mosaics
<b>Connectivity:</b> The protected area has been studied, evaluated, documented and actions have been taken in the field to improve connectivity and promote biological corridors.	N/A	Historical analysis of landcover change using CCDC-SMA	Corridor modeled for <i>A. pigra</i> (Howler monkey) between Cerro Cantil and Montes Azules Biosphere Reserve (Mexico)	N/A	N/A
<b>Ecological integrity:</b> The protected area is in an ecologically-healthy state, requiring little human intervention to maintain natural ranges of variation.	N/A	Historical analysis of landcover change using CCDC-SMA	N/A	EVI, NDVI	N/A
<b>Environmental education:</b> A plan, program or tool is systematically executed and evaluated	Included in geoportal	To be included in geoportal	To be included in geoportal	N/A	Included in geoportal

Two themes that emerged during these conversations were the importance of education about Cerro Cantil and indicators used by CONAP to assess the community's management of the protected area. Key considerations to define products included the team's bandwidth and the potential to build on products in the future.

- To support education efforts, a geoportal was developed to visualize Planet NICFI mosaics, NASA FIRMS hotspots, and polygons of interest.
- To respond to reporting indicators, Continuous Change Detection & Classification Spectral Mixture Analysis (CCDC-SMA) (Chen et al. 2021) is currently being parameterized and tested (Fig. 2). The purpose is to characterize disturbance to forest cover in the broader Ixcán municipality in order to contextualize changes in forest cover of the protected area.

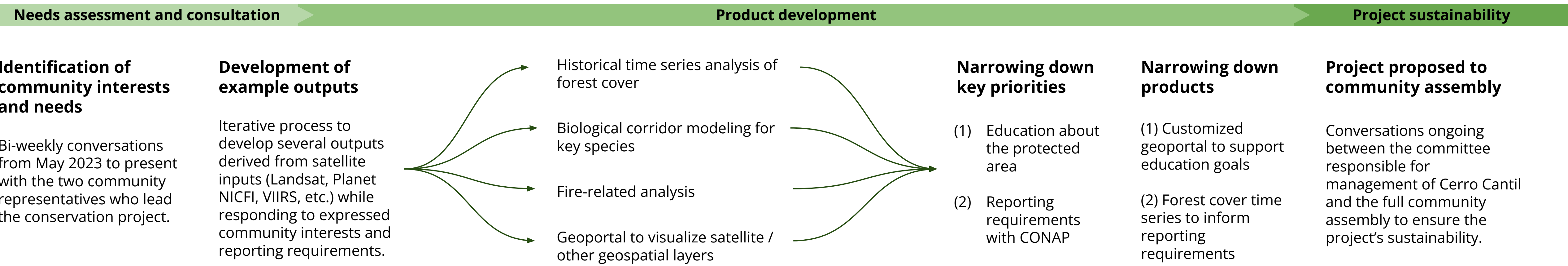


SERVIR Service Planning Toolkit

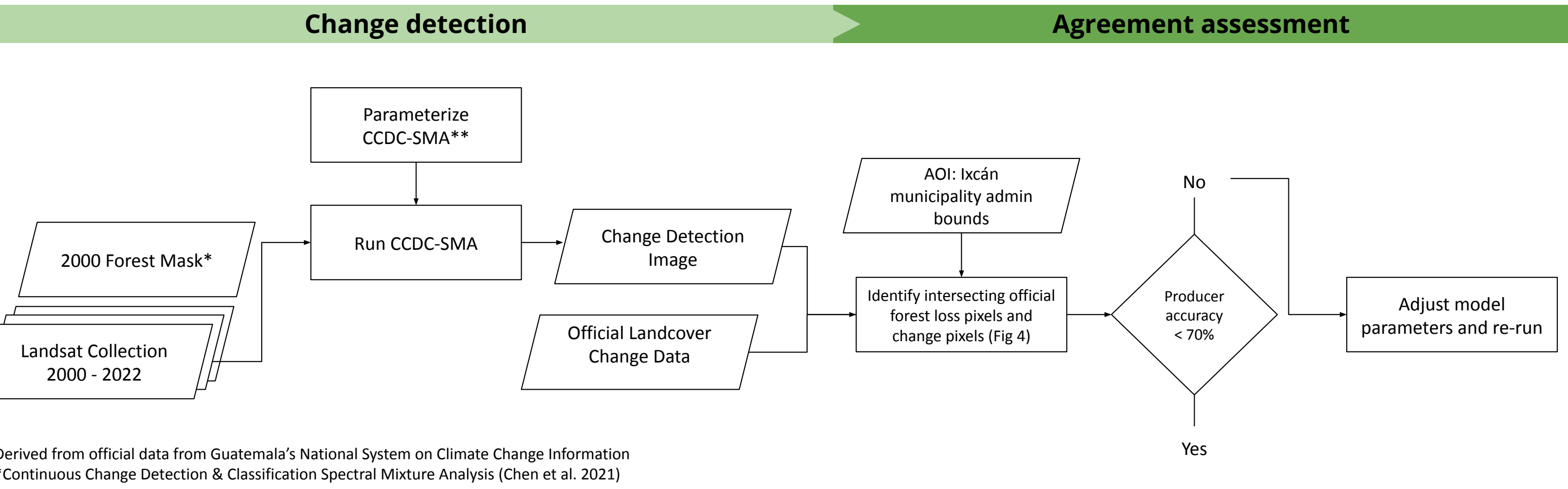


Change detection agreement assessment

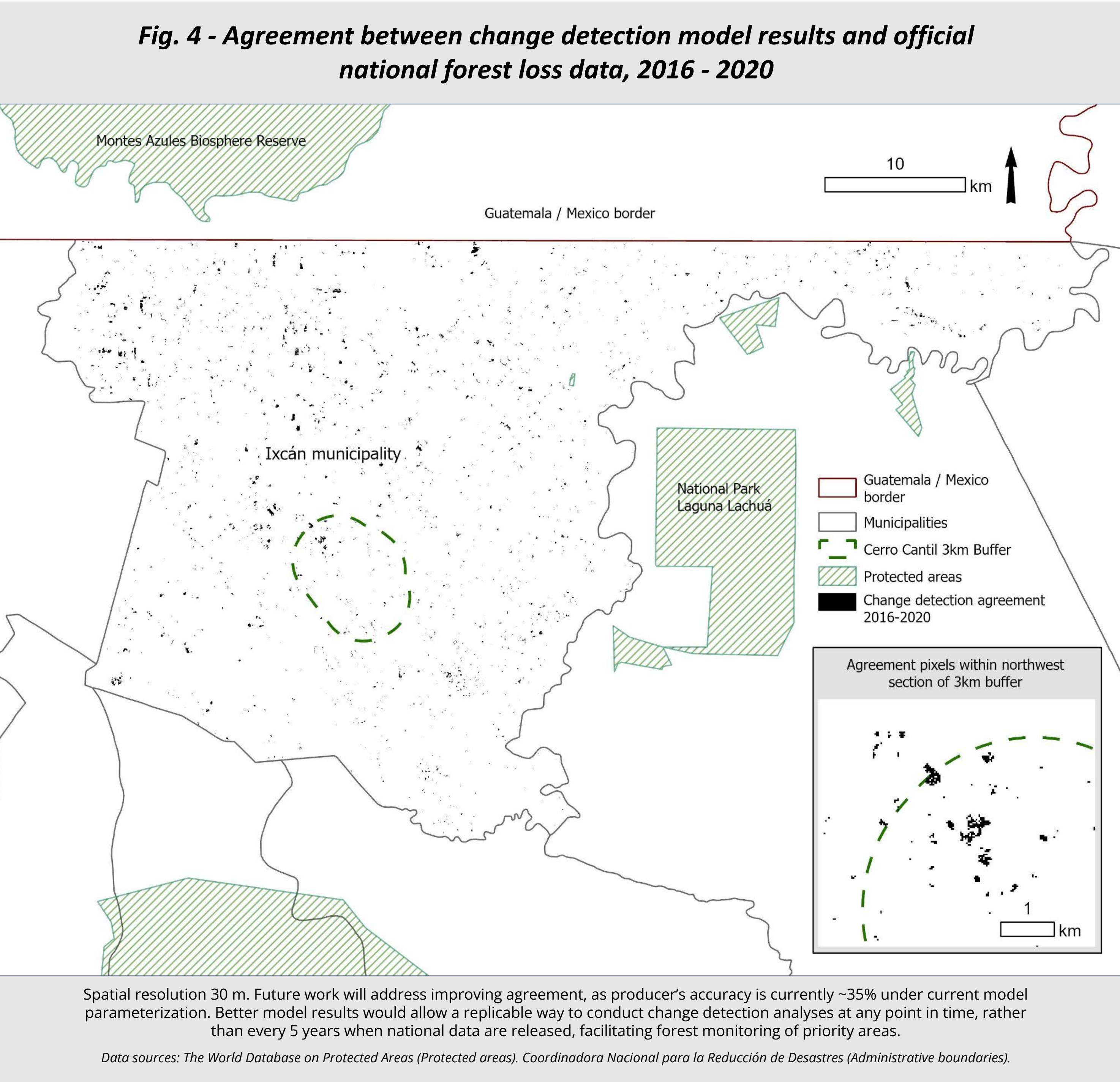
**Fig. 1 - Co-development workflow**



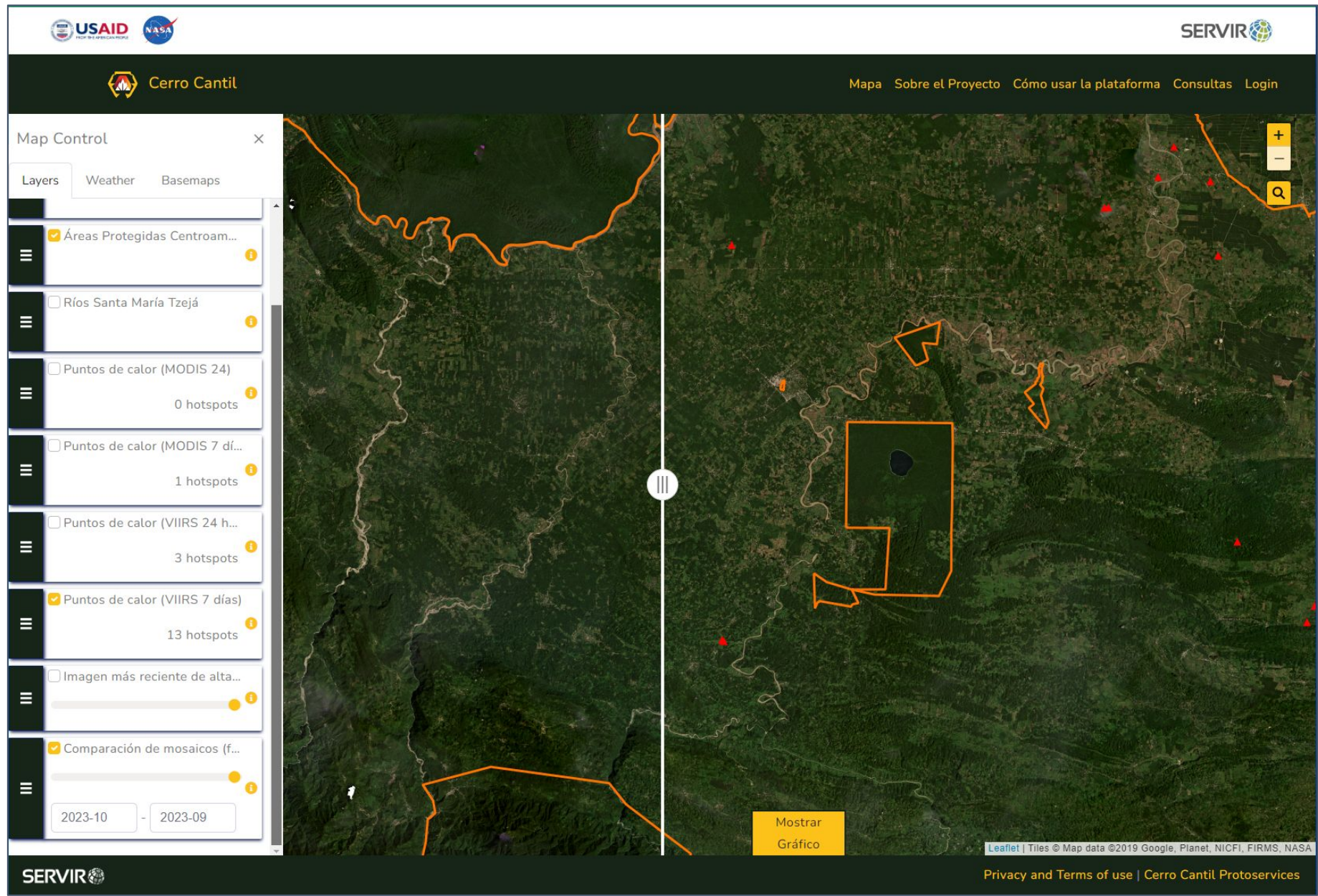
**Fig. 2 - Time Series Analysis**



\*Derived from official data from Guatemala's National System on Climate Change Information  
\*\*Continuous Change Detection & Classification Spectral Mixture Analysis (Chen et al. 2021)



**Fig. 5 - Geoportal in progress**



**Fig 5 - (above)** Monthly Planet NICFI mosaics (shown here) and hotspots from NASA FIRMS (red triangles) are automatically populated to the geoportal.

**Fig. 6 - (right)** Users may generate a historic hotspot histogram based on domain of interest.



## III. LESSONS LEARNED

- Be curious.** The process to arrive at key priorities for a community is not a linear timeline but rather an iterative activity.
- Iterate.** There are many interesting and useful applications of EO, however, narrowing down not only to those that address community concerns but are also practically achievable is important.
- Be flexible.** Community leaders are busy and may not be able to meet agreed-upon timelines.

## IV. DISCUSSION & NEXT STEPS

Remote sensing and geospatial data may be used to quantify the value-add of a protected area in metrics such as forest cover and landcover change. However, the cultural and historic value of forests to communities cannot be quantified. Development of educational materials on the geoportal and supporting research will be conducted in-step with community leaders and local processes to ensure these outputs address key priorities. Future training on the geoportal will be designed for youth supporting conservation activities of the protected area.

Questions about this project? [Lauren.e.carey@nasa.gov](mailto:Lauren.e.carey@nasa.gov)