Integrated multi-project impact assessment for the contribution of NASA Earth Observation products to support biodiversity decision-making in Colombia



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Background

- Colombia is the second most biodiverse country globally.
- It is home of a great number of endemic and threatened species and some of the world's rarest (e.g., páramo) and most threatened ecosystems (e.g., tropical dry forests).
- Rapid biodiversity loss urges the integration of biodiversity knowledge into decision-making.

Project goal

To evaluate the impact of four projects previously funded by NASA to support decision making for the identification, declaration and management of protected areas in Colombia at the national, regional and local levels.

Participants and roles

Victor H. Gutierrez-Velez (PI, Temple University)

Viviana Ceballos (Impact Assessment Expert)

María C. Londoño (Co-I, IAvH)

Mary Blair (Co-I, AMNH)

Patrick Jantz (Co-I, NAU)

Maria Helena Olaya (Collaborator, IAvH)

María Camila Parra (Collaborator, IAvH)

BioTablero

EXPLORA NUESTROS MÓDULOS

0:00

¿Qué son las consultas geográficas?

BioModelos

INICIO MODELOS GRUPOS INGRESAR REGISTRARSE EN

Nombre científico

CONSULTA CONTRIBUYE PUBLICA BÚSQUEDA AVANZADA

MEJORES MODELOS CON EL APOYO DE EXPERTOS

MAMÍFEROS	AVES	REPTILES	ANFIBIOS	PECES	INVERTEBRADOS	PLANTAS
496	2060	222	224	572	580	5386

Estado actual modelos de distribución por grupos taxonómicos

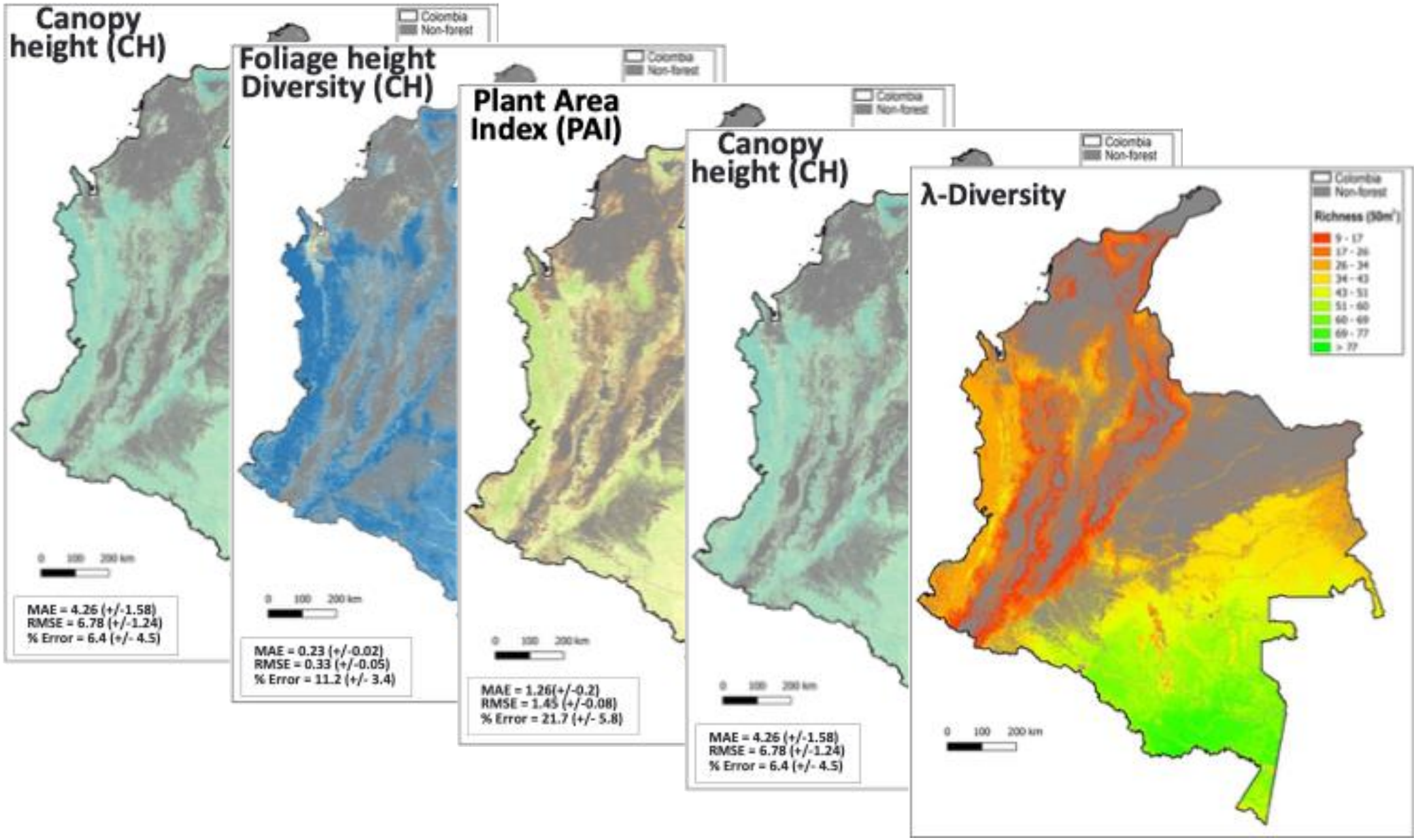
Instituto de Investigación de Recursos Biológicos
Alexander von Humboldt

0:00

PUBLICAR
INFO

ACERCA DE BIOMODELOS
TÉRMINOS
CONTACTO

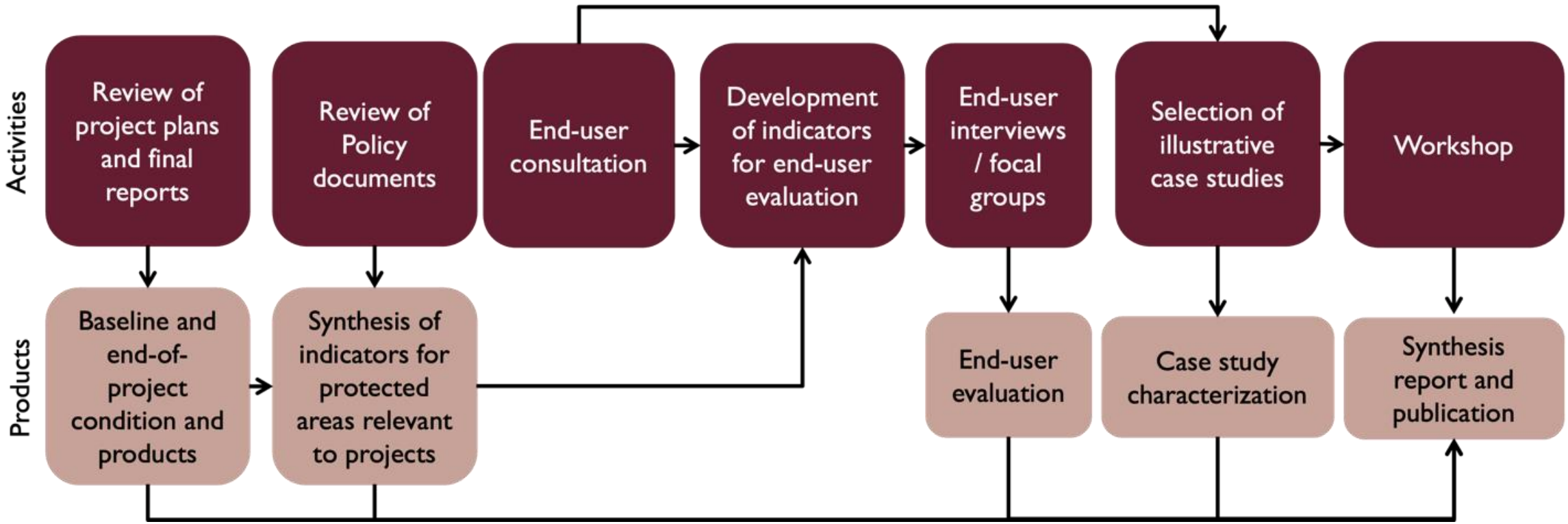
Vertical Structure



Community-based biodiversity monitoring

Arce-Plata, Maria & Herrera Varón, Yenifer & Gutiérrez, César & Londoño-Murcia, Maria. (2020). Monitoreo comunitario de la biodiversidad en Montes de María.

METHODS


Activities
Review of project plans and final reports
Review of Policy documents
End-user consultation
Development of indicators for end-user evaluation
End-user interviews / focal groups
Selection of illustrative case studies
Workshop
Products
Baseline and end-of-project condition and products
Synthesis of indicators for protected areas relevant to projects
End-user evaluation
Case study characterization
Synthesis report and publication

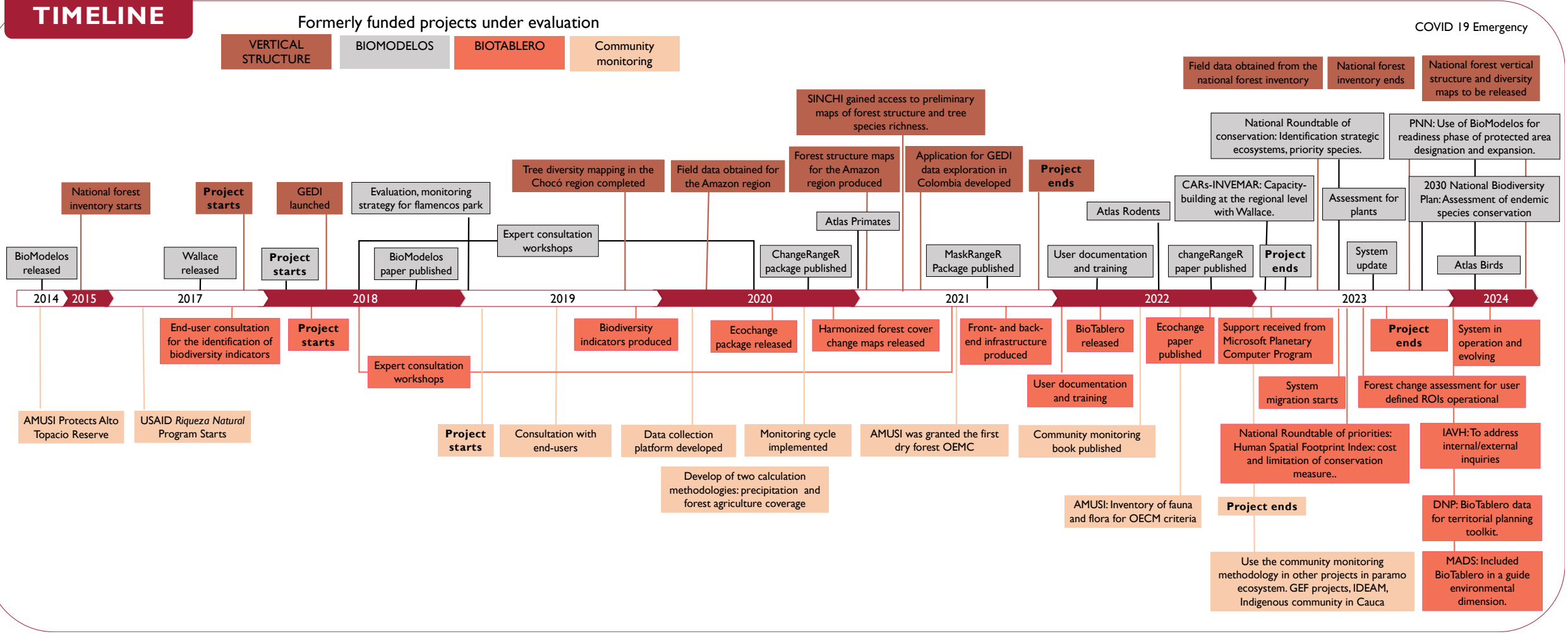
End-user consultation

Decision-Makers	Number of Meetings	Number of participants
AMUSI	2	46
Decentralized system of environmental protection CARs	5	45
IAVH- Project Team's	11	45
Ministry of the Environment and Sustainable Development	2	27
National Park Unit	6	39
Regional System of protected areas -SIRAP's	3	22
Marine and coastal research institute- INVEMAR	1	2
Total	**30**	**226**

Results

Baseline, end-of-project and current conditions

TIMELINE



Decision-making element: Declaration and expansion of protected areas (MADS 2015)

1. PREPARATION

Initial ecosystem representativeness assessment using biophysical information

- Habitat suitability for threatened or endemic species.

2. READINESS

Analysis of primary and secondary information to support the need for declaration or expansion

- Species representativeness
- Ecological integrity
- Threatened status
- Ecosystem irreplaceability
- Socioeconomic, and cultural*
- Other criteria*

3. DECLARATION

Administrative proceedings

1. **Elaboration of technical support documentation:** Using results from phases 1 and 2
2. **Public consultations**
3. **Technical concepts** National Academy of Science, National Research Institutes
4. **Official act of declaration for protected area.**

Workflow components

- Three declaration phases
- Final decision

* **Potential uses**

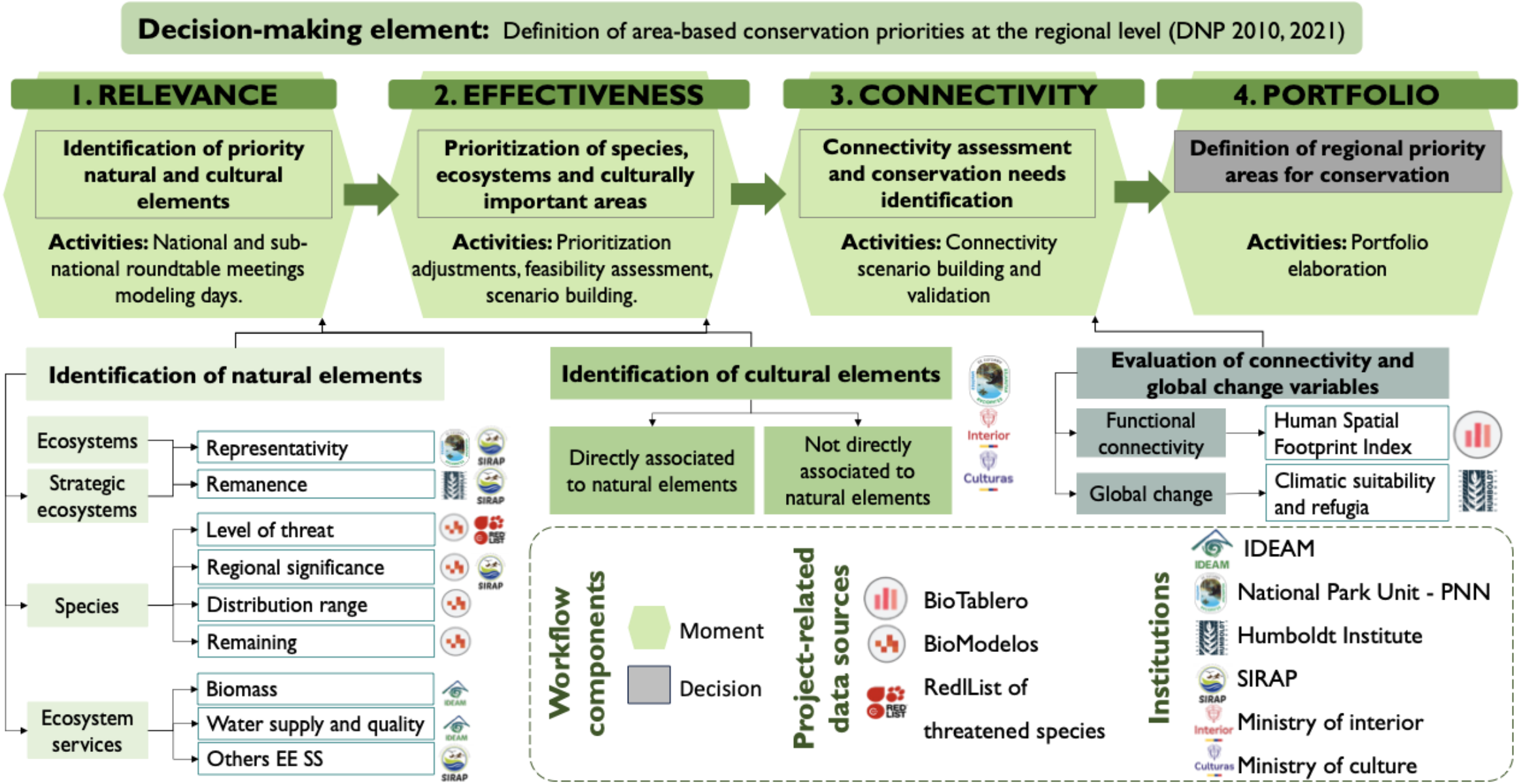
Project-related data sources

- **BioModelos**: Species distribution maps.
- **BioTablero**: Human spatial footprint, climate change, and connectivity indicators.
- **Vertical Structure**: Canopy and foliage height and cover, λ-diversity.

Actors

- National Park Unit - PNN
- National Academy of Sciences
- SIRAP
- Humboldt Institute
- Regional Environmental Authorities

* Detailed version available as appendix in final report.



* Detailed version available as appendix in final report.

Decision-making element: Designation of "El Salto" reserve as Other Effective Area-based Conservation Measure (OECM)

Background 1995-2017

- Land titling (1995)
- AMUSI's creation and official registration (2008)
- Institutional support for capacity building (2012)
- Implementation of sustainable food production practices (2012)
- First bird biodiversity inventory with Humboldt Institute's support (2014)

Final decision

Project implementation 2018-2022

Conservation Objectives

Identification of conservation priorities

Water regulation and supply	Forest use	Sustainable production	Water conservation	Biodiversity conservation
Restore, conserve, and connect forests associated with water.	Eliminate hunting and logging in reserve areas.	Shift to silvopastoral and agroforestry systems	Improve water availability and quality for crops, livestock, and humans	Achieve harmony between people and nature

Conservation action

Integration of sustainable agriculture, and conservation practices and monitoring

Water resilience	Sustainable agriculture	Funding access	Capacity building
Water consumption census, installation of water storage tanks and community cattle ponds, rainwater usage.	Integration of yam production into agroforestry systems, life fencing and sustainable firewood production.	Funding from USAID for community biodiversity monitoring and conservation integrated with yam production.	Formal agreements with private land-owners and initiation of active community restauration, water conservation and biodiversity monitoring in the reserve

OCEM denomination

Application processes for the designation of the reserve as OECM

Area definition and governance	Conservation goals defined	Conservation impacts demonstrated	Community conservation outcomes
Area delimited (16.3ha) with no overlap with other protected areas, local private governance demonstrated.	Sustainable food production, and conservation of water sources and tropical dry forest biodiversity.	Identification of threatened and vulnerable species of fauna and flora in tropical dry forest relicts to be conserved.	The reserve provides improved water supply for human consumption and crops. Conservation promotes the recovery of native species.

OECM designation

Official denomination as OECM by the Ministry of the Environment, and the United Nations Environment Program

Continued biodiversity monitoring: Monitoring of fauna, flora, and water resources using the community monitoring methodology.

* Detailed version available as appendix in final report.

Summary impacts

	Bio-Modelos	Bio-Tablero	Vertical-Sturcture	Comm. Monit.
Knowledge gain				
• 10 publications, 3 software packages, 7+ datasets (including 8k+ SDM)*	✓	✓	✓	
• Improved methods for SDMs and community-based monitoring	✓			✓
• Calculation of 18+ biodiversity indicators		✓		
Use				
• Inputs for territorial planning and conservation prioritization (MADS, DNP)		✓		
• Identification of protected areas and biodiversity offsets	✓	✓		
• Reporting on protected area representativeness and effectiveness	✓	✓		
• Integration into biodiversity platforms (NBP, IUCN)	✓			

* some of these impacts are post-project

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Summary impacts

	Bio-Modelos	Bio-Tablero	Comm. Monit
Change in behavior			
• Adoption of good modeling practices and workflows	✓		
• Institutionalization for biodiversity data in policy and planning	✓	✓	
• Reference for biodiversity-friendly land use			✓
Benefit			
• Increased accuracy and efficiency in SDM production	✓		
• Justification for conservation-area prioritization and designation	✓	✓	
• Local engagement in monitoring and sustainable practices			✓
Sustainability			
• BioModelos, BioTablero operational and active	✓	✓	
• Ongoing community participation and capacity building			✓

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Main conclusions

- NASA support has facilitated access to key biodiversity information for reporting biodiversity policy and planning and implementing area-based conservation strategies.
- We show that the products are permeating official decision-making engines in Colombia, suggesting promising long-term conservation impacts.
- Coordination between the Humboldt Institute and end-users for operationalizing conservation decisions in Colombia has been essential for achieving project impacts.
- Continued system operation and improvements along with new products and capabilities generated after the end of projects suggest that the full realized impacts are yet to come.

Gracias



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Extras


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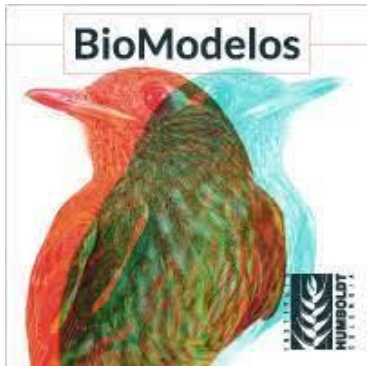
Evaluated projects

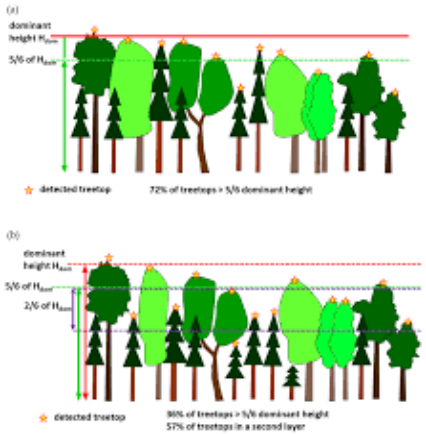
BioTablero

Temple U, IAVH,
Víctor Gutiérrez (PI)



BioModelos-Wallace

AMNH, IAVH
Mary E. Blair (PI)



Vertical Structure

NAU, IAVH, SINCHI
Patrick Jantz (PI)

Community-based biodiversity monitoring

IAVH, Temple, UMed
María C. Londoño (PI)

Methodological approaches considered

Baseline Assessment: Before vs after comparison

- Baseline assessments are available but were narrowly constraint to product quality so their use for recently adopted metrics of impact by NASA is insufficient.

Counterfactual Analysis: Comparison between control vs intervention group

- It was not possible to assess end-user familiarity with data products a-priory.

QuIP (Qualitative Impact Assessment Protocol): collection and analysis of causal narratives as evidence to support impact.

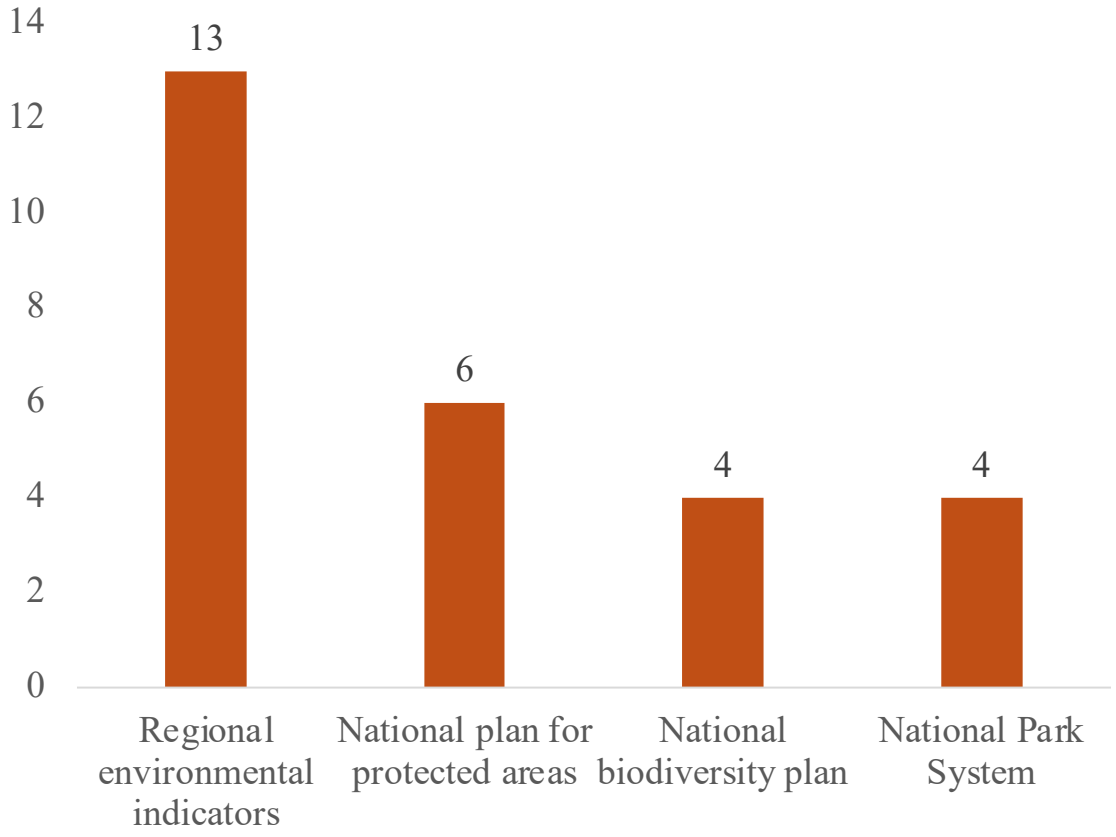
•**Case Study Approach:** Examination of intervention effects through a detailed analysis of specific situations.

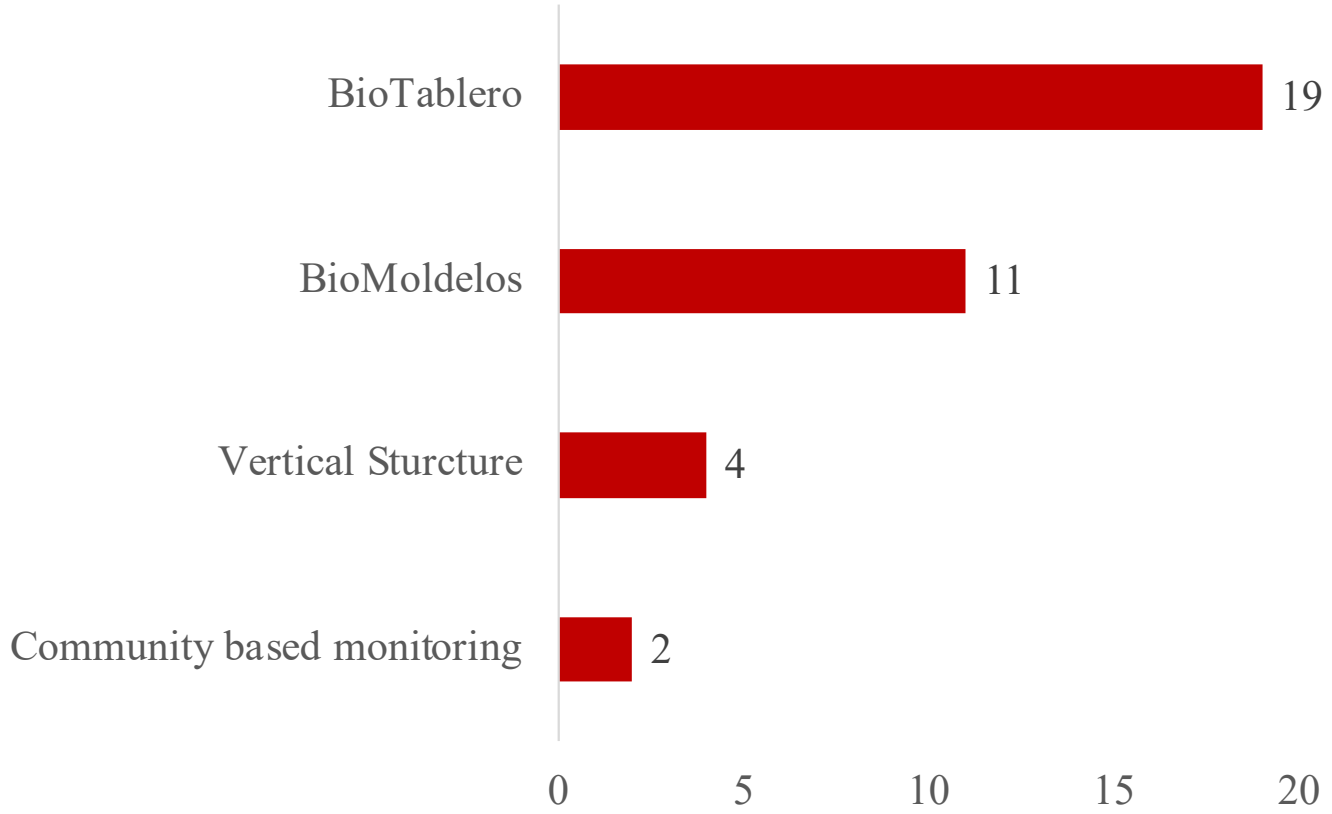
Documented study cases

Development of three workflows connecting decisions to products.

- **National:** Use of the products for the declaration and expansion of national protected areas.
- **Regional:** Use of the products in the definition of conservation priority areas for the regional system of protected areas.
- **Local:** Contribution of the community monitoring protocol to facilitate the declaration of the OECM of the dry forest in Montes de María.

Synthesis of relevant indicators





Summary impacts (BioModelos-Wallace)

Knowledge gain: 4 publications and two computer packages

Use: Collaborative production of SDMs, Reporting indicators of protected area representativeness and effectiveness*, Re-processing and expansion of the entire BioModelos database (8,200)*, Production of species red-list and atlases for rodents, birds and primates.

Change in behavior: Adoption of good SDM production practices*, Adoption in workflows for protected area declaration.

Benefit: Increased accuracy and processing efficiency.*

Awareness and perception: reference for the production of the NBP, Integration in IUCN platform for extinction risk assessment.

Sustainability: BioModelos Up and running.

* Enabled by subsequent funding from NASA

Summary impacts (BioTablero)

- **Knowledge gain**: 3 publications, 1 computer package, 1 dataset, and calculation of 18 biodiversity indicators.
- **Use:** Identification of priority conservation areas, addressing internal and external queries for user defined areas on biodiversity status, identification of biodiversity offset areas.
- **Change in Behavior:** Adoption in workflows for protected area declaration.
- **Awareness and perception:** incorporation in official online tools for territorial planning, incorporation in official guidelines for the production of sub-regional Development Plans.
- **Sustainability:** BioTablero up and running.

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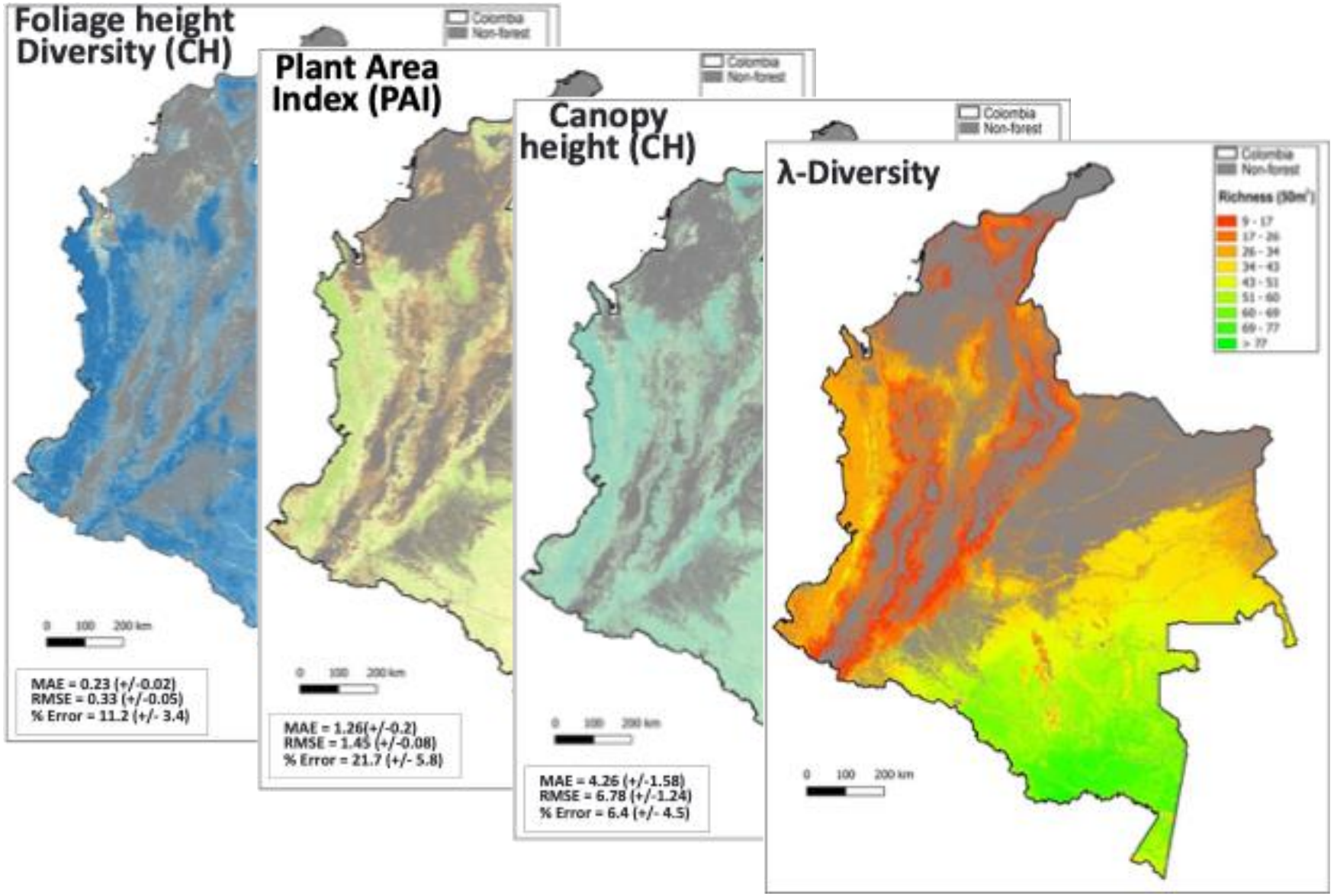
Summary Impacts (Vertical structure)

- **Knowledge gain:** 3 publications and 5 datasets



Summary impacts (community-based biodiversity monitoring)

- **Knowledge gain:** Standard methods and capacity building for community-based biodiversity monitoring, production of local biodiversity monitoring data.
- **Use**: local periodic biodiversity measurements, Adoption of monitoring framework in other regions/projects.
- **Change in behavior:** reference for adoption of biodiversity-friendly agricultural practices.
- **Benefit**: Supporting evidence to justify conservation-area recognition.
- **Awareness and perception:** involvement of other community members in biodiversity-friendly agricultural practices and monitoring.
- **Sustainability:** Continuous engagement in biodiversity monitoring, capacity building for accessing additional funds.

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Selected testimonials (edited for brevity*)

- *"Products developed for* BioModelos *and* BioTablero *have been essential inputs for our work within the methodological framework used to identify priority natural and cultural areas and elements. These efforts will ultimately shape the country's conservation goals for 2030."*

- *"BioModelos and BioTablero allow us to prioritize some goals of the action plan and to visualize in a single tool information that helps to make decisions on how, where, and how much to compensate summarizing a methodology that had been very extensive."*

- *"BioModelos has enhanced informed decision-making regarding the declaration and expansion of protected areas. By providing a central source of initial species information and guiding data collection efforts, BioModelos empowers NPU to perform more comprehensive and precise analyses from the onset of the process".*

- *"The main achievement that was obtained after this Humboldt intervention is that today we can have an OMEC, for us it means the recovery of our territory, but also of the environment, of what it offers us".*

* Full version available in final report

Recommendations for NASA

- The developed workflow methodology, demonstrating the link of products to specific decisions, can inform proposal guidelines for future NASA Ecological Conservation program solicitations.

- **Multi-tiered solicitations are recommended to ensure meaningful impacts:**
  - **Feasibility phase (ARL 1–3, 1 year):** Collaborative development of proof of concept, identifying decision-making needs, institutional readiness. Funding could support workshops, focus groups, and white papers to ensure proposals are grounded in user needs.
  - **Implementation phase (ARL 4–8, 3 years):** operationalization within the end-user environment.
  - **Impact evaluation phase (ARL 9, 1 year):** Evaluate impacts beyond immediate outcomes and project timelines, identifying the best timing for meaningful assessment is key.

Recommendations for NASA

- Adding functionalities to existing tools (e.g., BioModelos) can yield immediate impacts, while building new systems (e.g., BioTablero) can offer long-term potential. Proposal evaluations should weigh immediate vs long-term impact potential.

- Continued investment in follow-up projects helps consolidate and extend the relevance of previously funded efforts (e.g., A39 – PI Blair).

- Enabling financial support for international end-users is key for success and can expand project impacts (e.g., through programs like Community-based monitoring).

- Data from impact assessment projects can help to determine the optimal timing for post-project evaluations to capture the full realization of project impacts.