

# The impact of protected area governance and management capacity on ecosystem function in Central America

Cool forests at risk?

The critical role of boreal and mountain ecosystems for people, bioeconomy, and climate  
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# Protected Areas (PAs) prominent conservation tool

- Between 12.9% and 13.4% of the earth's land surface is protected (Coad et al., 2010; Jenkins & Joppa, 2009; Agrawal, Chhatre, & Hardin, 2008)
- Governance structures
  - 86% (5.4 billion ha) global forests in State regulated
  - 10% under private ownership
  - 4% in other forms of management such communal lands
- Management practices/categories





Convention on  
Biological Diversity



Convenio sobre la  
Diversidad Biológica

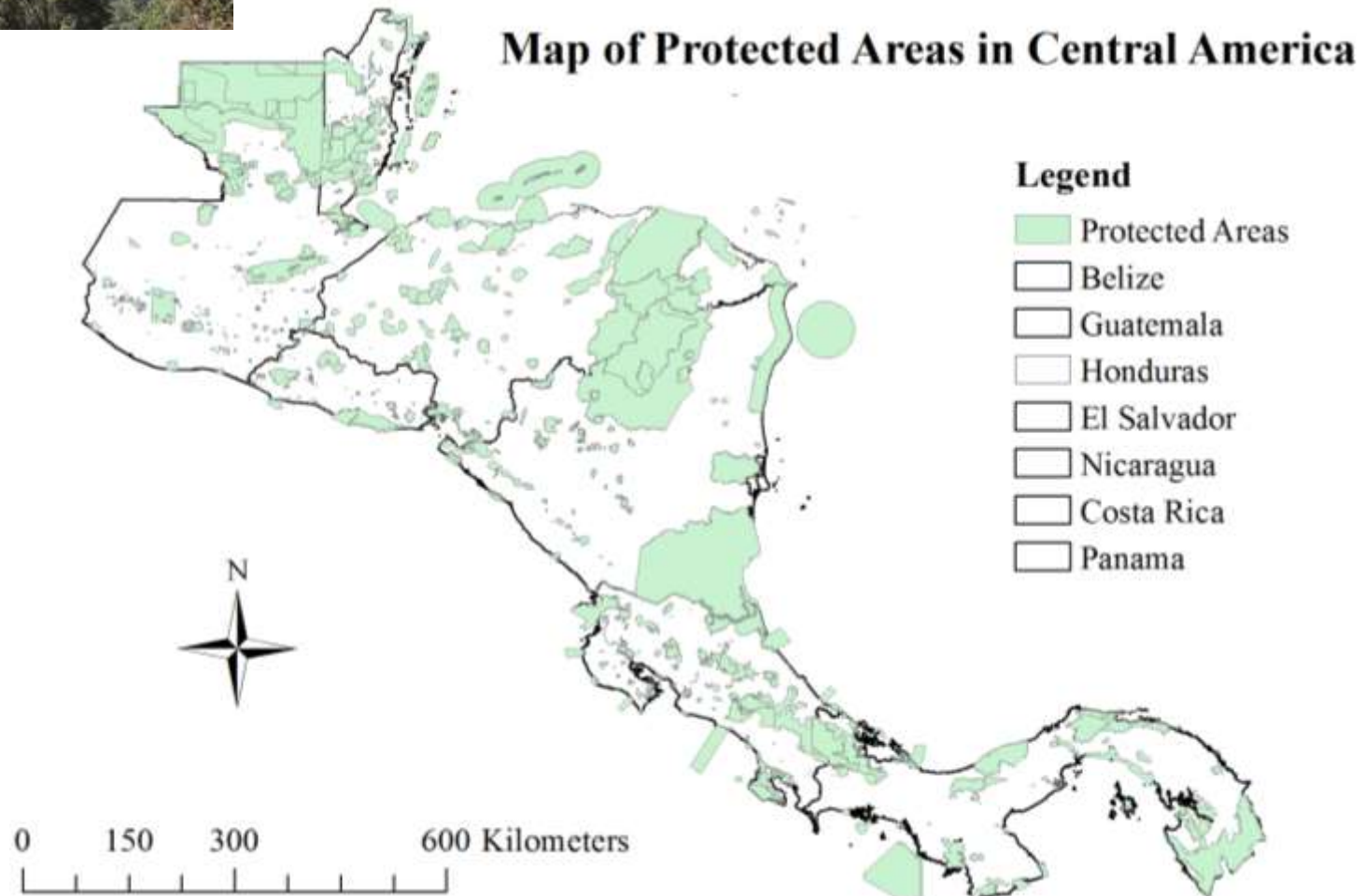
## CBD's Aichi Target 11

- **By 2020**...at least to **17%** (terrestrial, inland water), and **10 %** (coastal and marine)
- areas “are conserved through **effectively** and **equitably managed**... well connected systems” of PAs and other effective conservation measures “**integrated** into the wider landscapes and seascapes.”





# Protection/Conservation in Central America



# What is Governance = Gōpæřņāñžâ...???

- A key component in the study of governance is **decentralization**.
- Decentralization of natural resources implies
  - increased **involvement** in decision-making
  - **participation** in management and administrative activities by lower level governments and non-state actors (Larson, 2003; Nygren, 2005).
- Evidence on role of decentralization is **mixed**.

# Trifinio Region

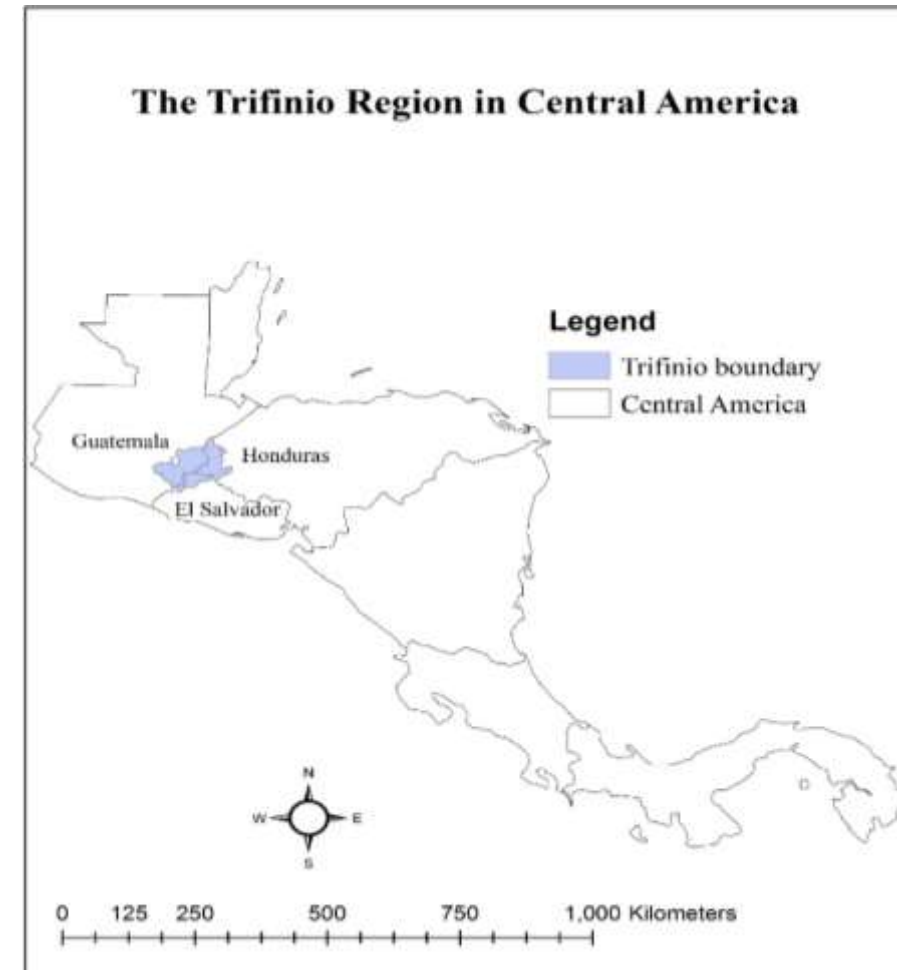


Michael & Patricia Fogden



# Background on Trifinio

- Trifinio Region = 3 countries
- A political administrative unit
  - Outcome of the process of democratization and Peace Accords August 7, 1987
  - Area of 7,541 km<sup>2</sup>
  - Population 818,911 (2014)

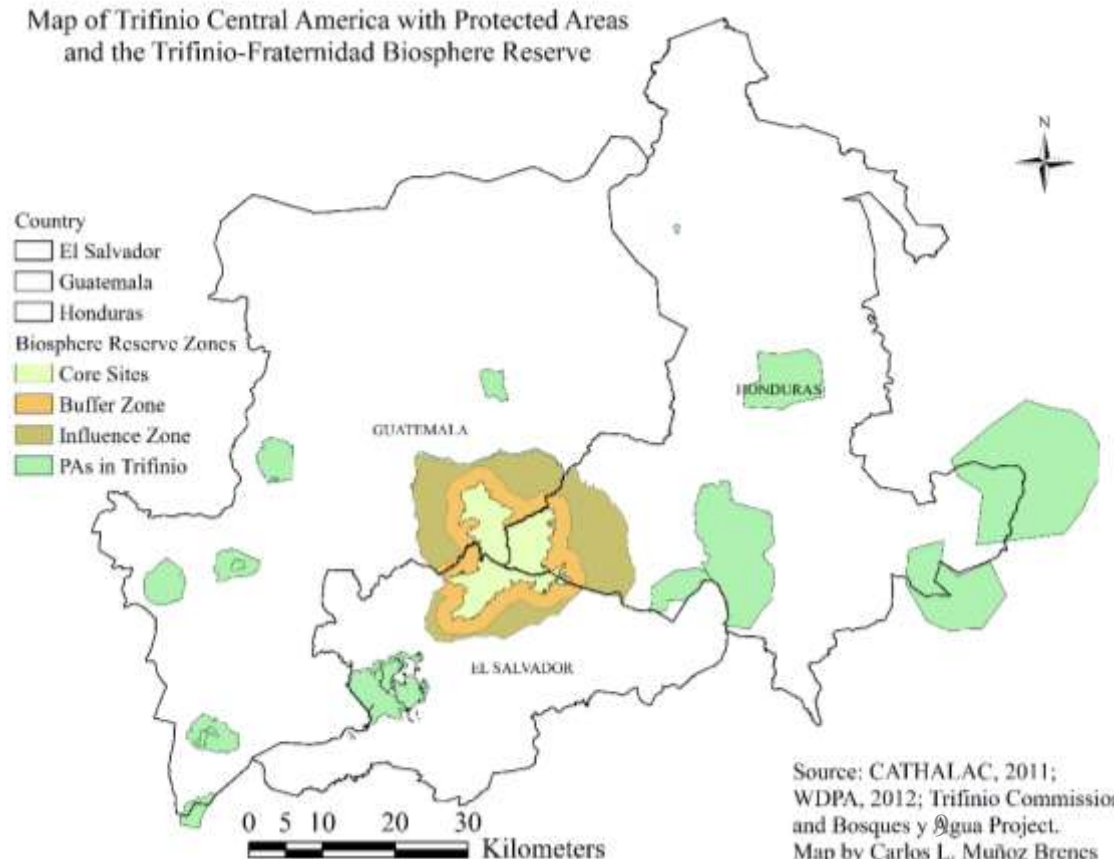




# Study area background

## PAs Policies in Trifinio Region

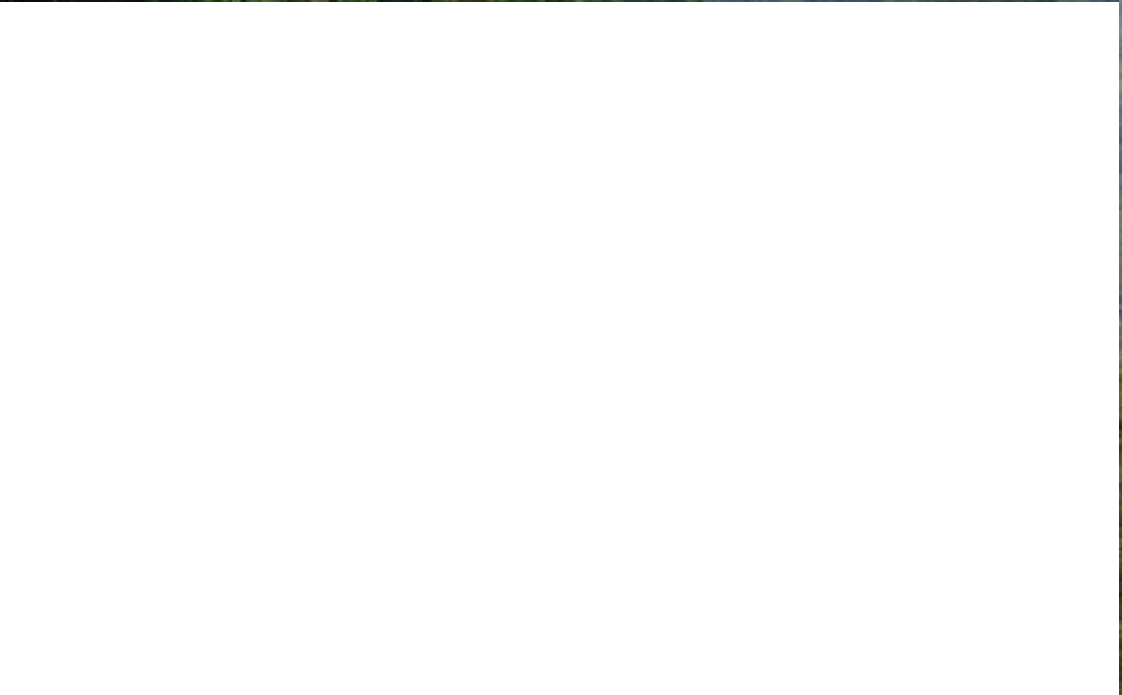
- 12 official forest PAs in Trifinio; N = 16.
- Most PAs are located on mountaintops or on low lands near water bodies
- Guatemala 7 (255.22 km<sup>2</sup>)
- Honduras 6 (680.78 km<sup>2</sup>)
- El Salvador 3 (154.87 km<sup>2</sup>)
- Trifinio-Fraternidad International (1987); UNESCO-MAB (2011)



# Research Questions

1. We examine how management restrictions, standardized according to the IUCN classification, correlate with NDVI change?
2. How levels of decentralization in decision-making and management capacity impact NDVI variation?
  - Knowledge on how PA governance affects conservation outcomes is **missing** (Macura, Secco, & Pullin, 2013, 2015).
  - This understanding is important to **improve and design** effective governance structures (Ferraro & Hanauer, 2015).





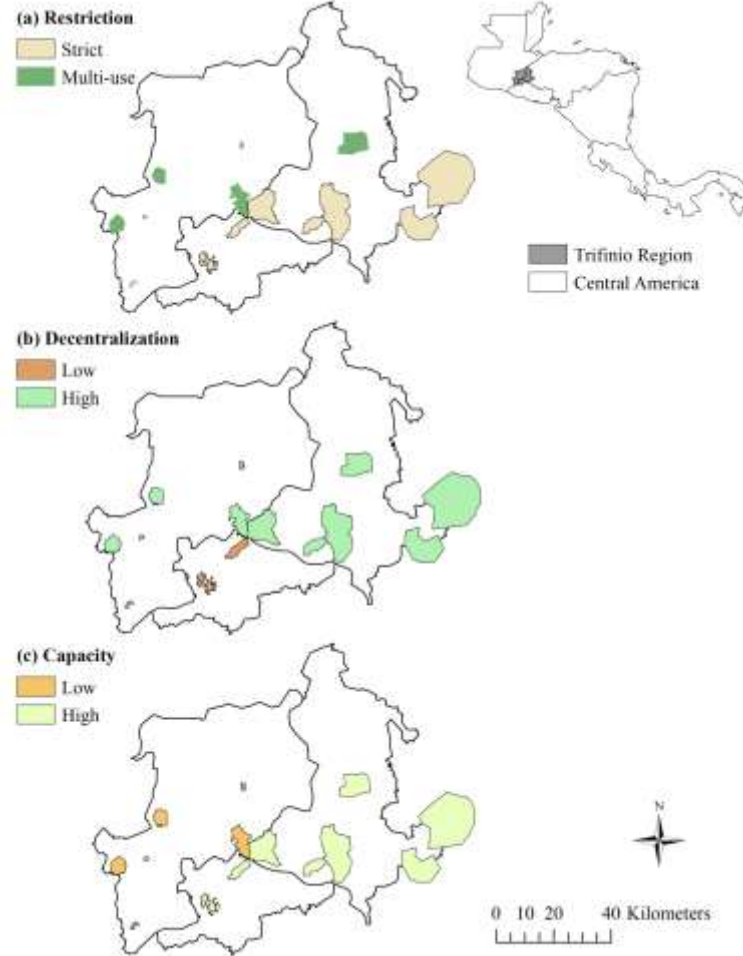
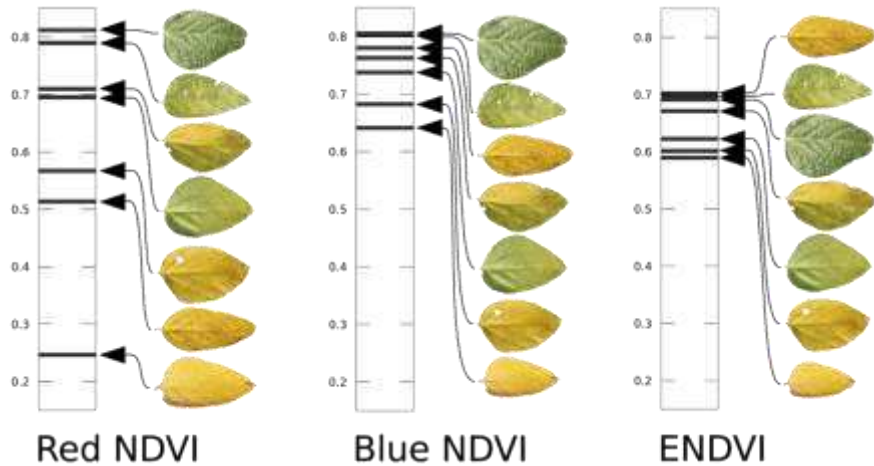
# Methodology and Data

- Theory of change and **counterfactual** approach (Ferraro, 2009)
- Matching & Potts-matching regression to assess impact (Blackman, 2013; Jones & Lewis, 2015). **ATET** (Abadie, Drukker, Herr, & Imbens, 2004)
- **Treatment:** protection/conservation in status
- **Covariates:** distance to roads, major city, capital; slope, elevation
- IUCN classification
- Interviews to cluster PAs by levels
  - Decentralization & Capacity
- Random sample of pixels: 1986-2016

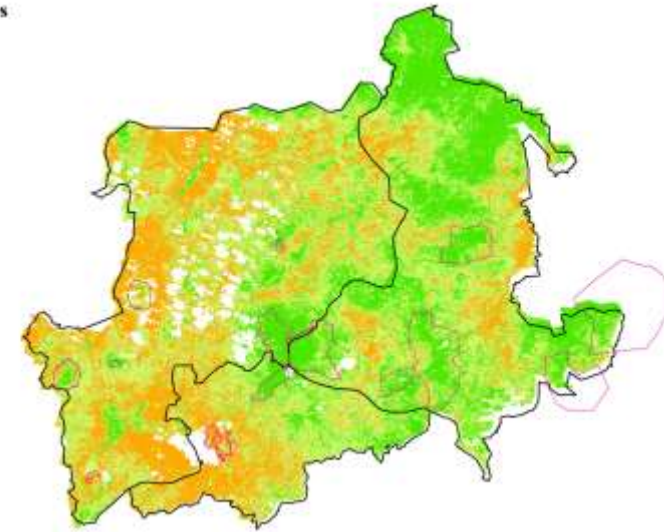
**Not only to compare “bananas to bananas” ... but all fruits we find**

# Methodology and Data

- Unit of analysis 30 m x 30 m pixels, Landsat
- 2 Dependent variable (outcome) **NDVI**:
- Annual % change
- Mean NDVI



(a) 1986 NDVI Values



ues

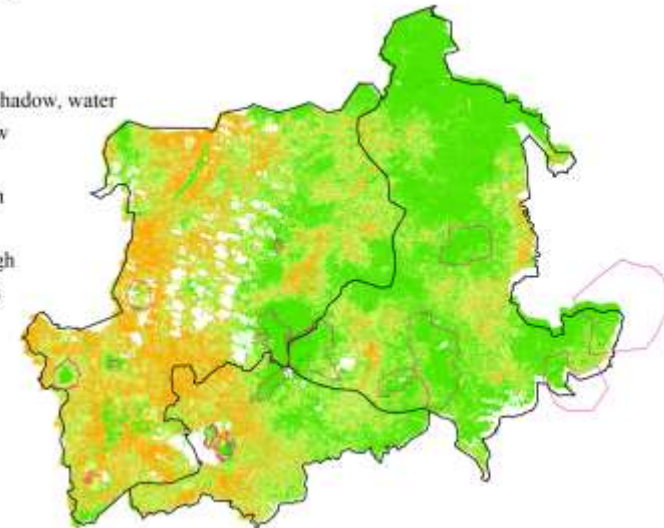
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## Impact of PAs on NDVI outcomes by governance & management sub-groups 1986-2016

Sub-group of PAs	Average annual change in NDVI (%)	Mean NDVI value
	“Enhance NDVI”	“Maintain NDVI”
	Post matching regression	Post matching regression
Strict	0.053***	0.020***
<i>Observations 14,500</i>	(0.005)	(0.001)
Multiple-use	0.055***	0.017***
<i>Observations 20,292</i>	(0.005)	(0.001)
High Capacity	0.090***	0.027***
<i>Observations 22,714</i>	(0.005)	(0.001)
Low Capacity	-0.068***	-0.015***
<i>Observations 6,902</i>	(0.008)	(0.002)
High Decentralization	0.082***	0.028***
<i>Observations 7,784</i>	(0.007)	(0.001)
Low Decentralization	0.051***	0.016***
<i>Observations 25,384</i>	(0.004)	(0.001)

*Robust standard errors in parentheses.*

*All estimators use a trimmed sample of PA and not PA observations based on propensity score matching (PSM). PSM is done for each sub-group of PAs to select a unique control group for that set of treatment observations.*

*Matching includes the following covariates: baseline NDVI, elevation, slope, distance to roads, municipal capital and country capital.*

*\*  $p < 0.10$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$*





# Policy Implications/Significance

## Lesson for global conservation community

- Governance and management influence PA effectiveness.
- Q1: Restriction vs multi-use similar outcome.
  - RISKS associated in this type of management (e.g., conflict).
- Q2: High Decentralization levels DO NOT have negative impact.
  - This is evidence for the decentralization approach community.
- Q2: Increasing administrative capacity is KEY.
  - Capacity may be more important than governance type or management restrictions

# Policy Implications/Significance

- **Back to Aichi... For next generation of PAs**
  1. Strong baseline with good data on key variables
    - a. Set realistic targets
    - b. ID the main challenges for national and transboundary conservation
  2. Look at process in relation to threat and challenges
    - a. Budget (Ministry of Finance)
    - b. Capacity building (Research centers and universities)
  3. Engage constituencies/key actors
    - a. Real social value of conservation
    - b. To minimize resistance and conflict

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Thank you!

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**Table 1. Number of PAs and sampled pixels by governance and management classification.**

	Management restriction		Management capacity		Decentralization	
	Strict	Multiple-use	High	Low	High	Low
PAs	6	6	7	5	4	8
NDVI pixels (30 m by 30 m)	11,612	10,288	17,527	4,373	8,835	13,065

Table 1. Forest State PAs in Trifinio and Classification by levels of restriction, administrative capacity, and decentralization

ID	PA Name	Country	Year Declared	Area Hectares	IUCN Category	Restriction Level	Decentralization Level	Capacity Level
1	Volcán Ixtepeque*	1	1956	1659.58	4	Multi-use	Intermediate	Low
2	Volcán Las Víboras	1	1956	2144.22	4	Multi-use	Intermediate	Low
3	Volcán Quezaltepeque	1	1956	332.00	4	Multi-use	Intermediate	Low
4	Volcán Suchitán	1	1956	2539.26	4	Multi-use	Intermediate	Low
5	Reserva de la Biosfera Trifinio-Fraternidad	1	1987	4000.00	4	Multi-use	High	Low
6	Laguna Güija	1	1989	1407.73	4	Multi-use	Intermediate	Low
7	Volcán y Laguna de Ipala	1	1998	2012.50	3	Multi-use	High	Low
8	Refugio de Vida Silvestre Erapuca	2	1987	6522.00	4	Multi-use	Intermediate	High
9	Parque Nacional Montaña Celaque*	2	1987	26268.00	2	Strict	High	High
10	Parque Nacional Montecristo Trifinio	2	1987	8270.00	2	Strict	High	High
11	Reserva Biológica El Guisayote	2	1987	14081.00	2	Strict	High	High
12	Reserva Biológica El Pital	2	1987	2700.00	2	Strict	Intermediate	High
13	Reserva Biológica Volcán Pacayita*	2	1987	10249.00	2	Strict	Intermediate	High
14	Parque Nacional Montecristo	3	1986	2154.16	2	Strict	Low	High
15	Paraje Galán*	3	2007	24.35	4	Multi-use	Low	Low
16	Parque Nacional San Diego, San Felipe, La Barra	3	2007	1916.00	2	Strict	Low	High

Notes: \* Denotes PA is only partially in Trifinio. Code: 1 = Guatemala, 2 = Honduras, 3 = El Salvador.

<b>Factors related to Decentralization</b>	<b>Factors related to Management Capacity</b>
Entity that holds responsibility for the PA (e.g., Secretary or Ministry, local organization as co-manager)	Existence of written management plan or annual operations plan
Authority responsible for appointing the director or person responsible for the PA (e.g., central government, local authority)	Main sources of funding for PA
Ways this person makes management decisions for PA (e.g., in consultation, dependency on centralized authority)	PA budget fluctuations
Political interference and transparency in decision making	Number of staff working for the PA
The number of stakeholders participating or involved in decision-making and management activities and coordination	Relevant data about PA is generated and available (e.g., biodiversity inventories, visitation, status of infrastructure, boundaries)
Frequency of interaction or meetings with external relevant actors, communication, and opportunity for feedback	Priority distribution of PA budget (e.g., staff, equipment and infrastructure, research)
Existence of co-management agreements	Allege illegal activities in PA lead to sanctions

## LCLUC and Conservation Approaches: View through Environmental Governance



- “the set of regulatory **processes, mechanisms** and organizations through which political actors **influence** environmental actions and **outcomes**” Lemos and Agrawal (2006, p. 298)

Governance is not government nor management

- “the set of processes and **institutions** through which management goals are identified,... management is charged with implementing the practical measures to achieve those goals” Lautze et al. (2011, p. 4)