

# Reflections about land use planning challenges and methods



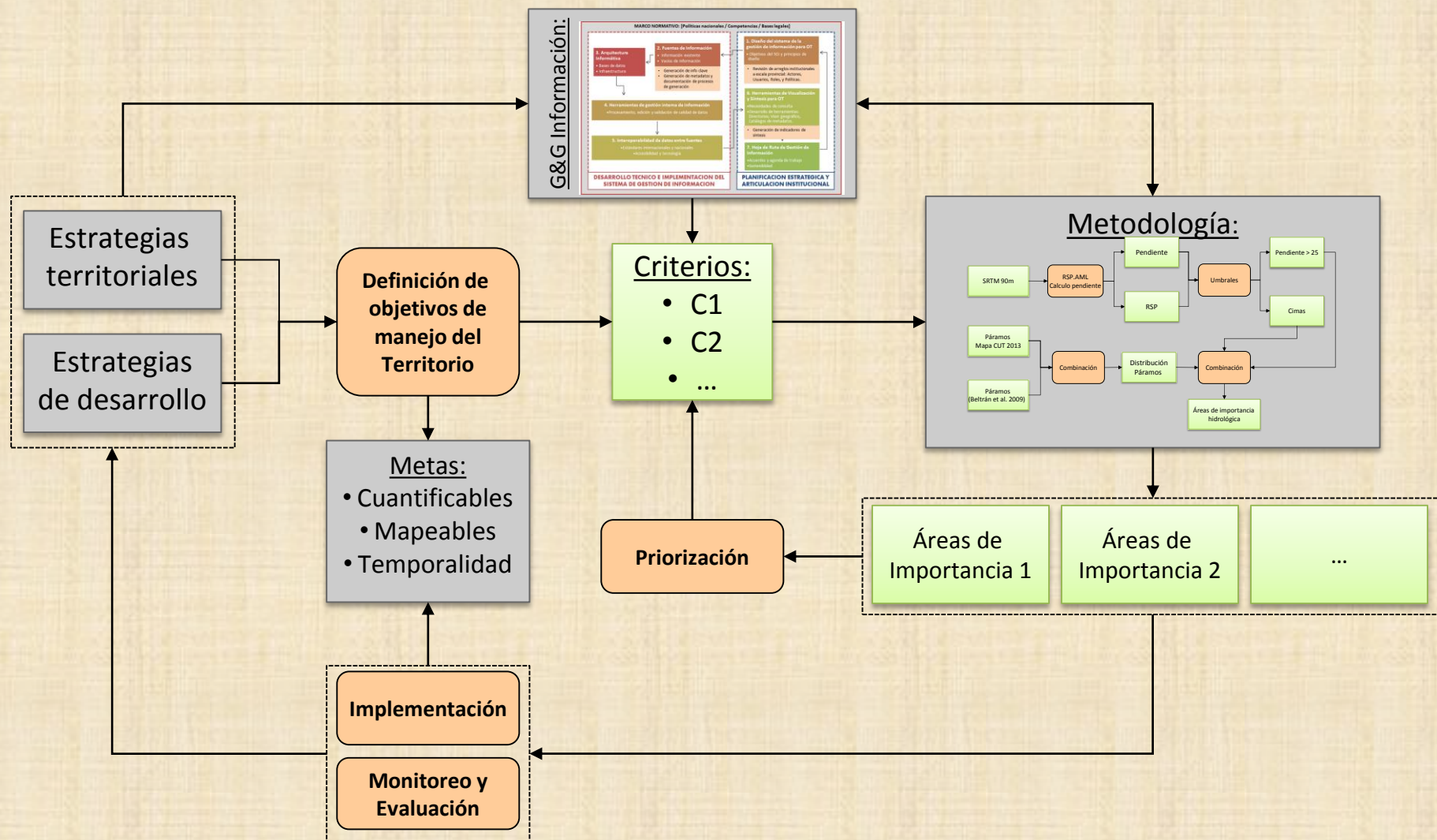
Manuel Peralvo  
CONDESAN

Ormea, July 17th 2019

# Related approaches



# Land use planning and adaptive management





# Umbrella species to support protected area management

## **Goal**

To develop a proposal of priority conservation areas of Andean bear habitat through the modeling of this species habitat availability inside the Cayambe – Coca Ecological Reserve (RECAY) and its influence area.







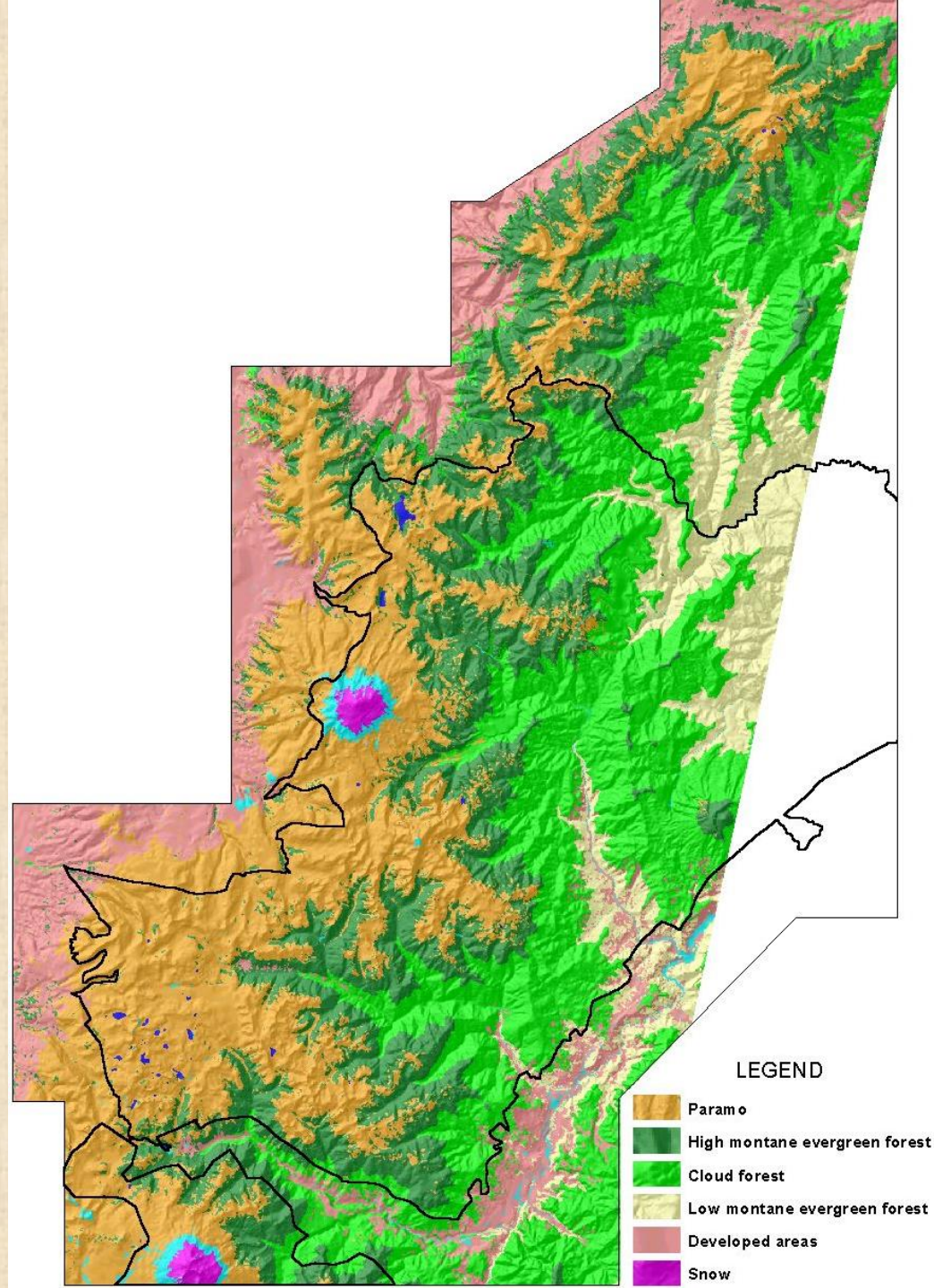
US Dept of State Geographer  
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Image Landsat / Copernicus  
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Google Earth



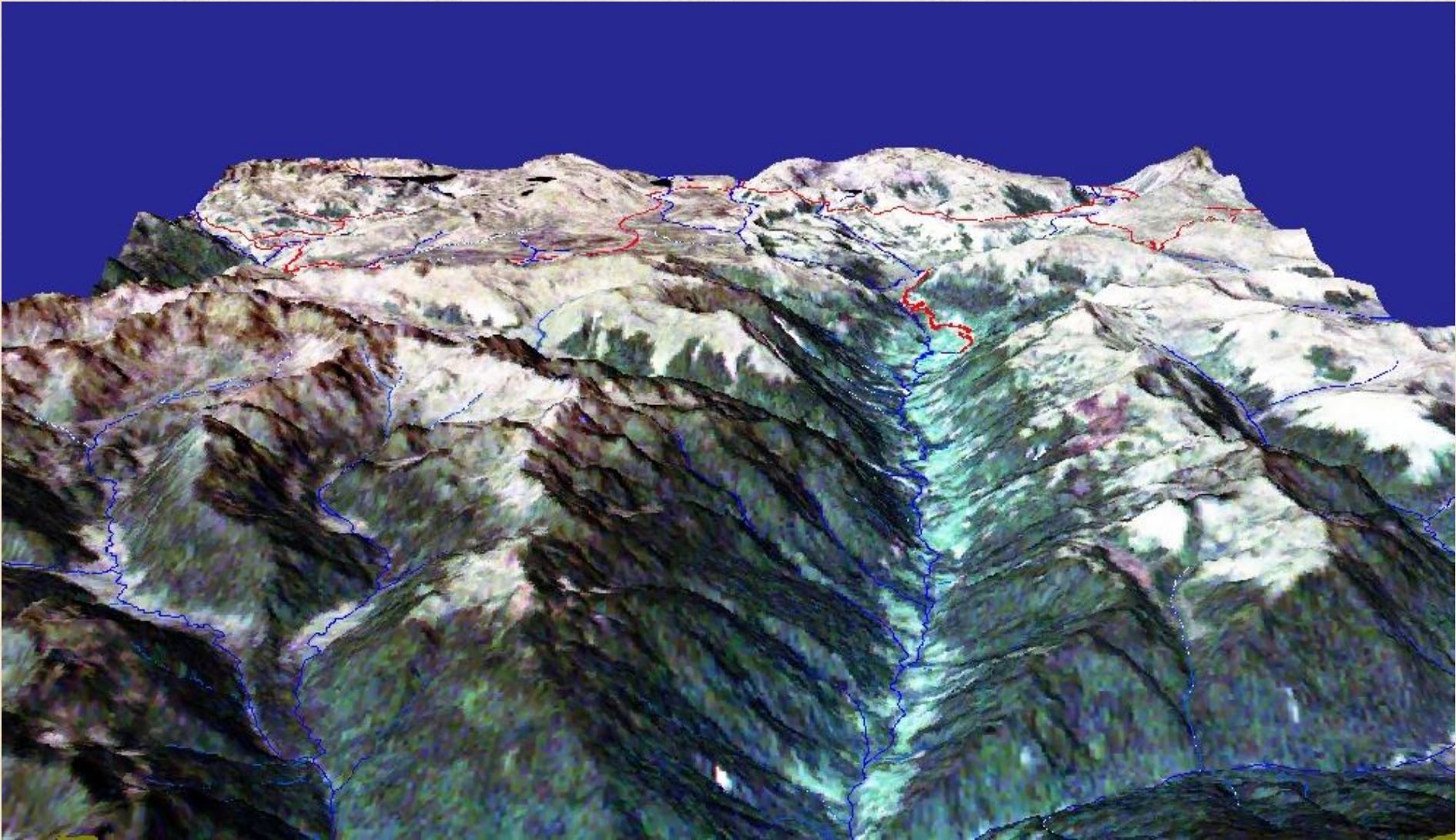
# STUDY AREA

- Area : 605.075 ha
- Altitudinal range:  
1800 – 4300 m
- Vegetation types:
  - Wet Paramo
  - High montane evergreen forest
  - Cloud forest





# Study area



Vista desde el Este









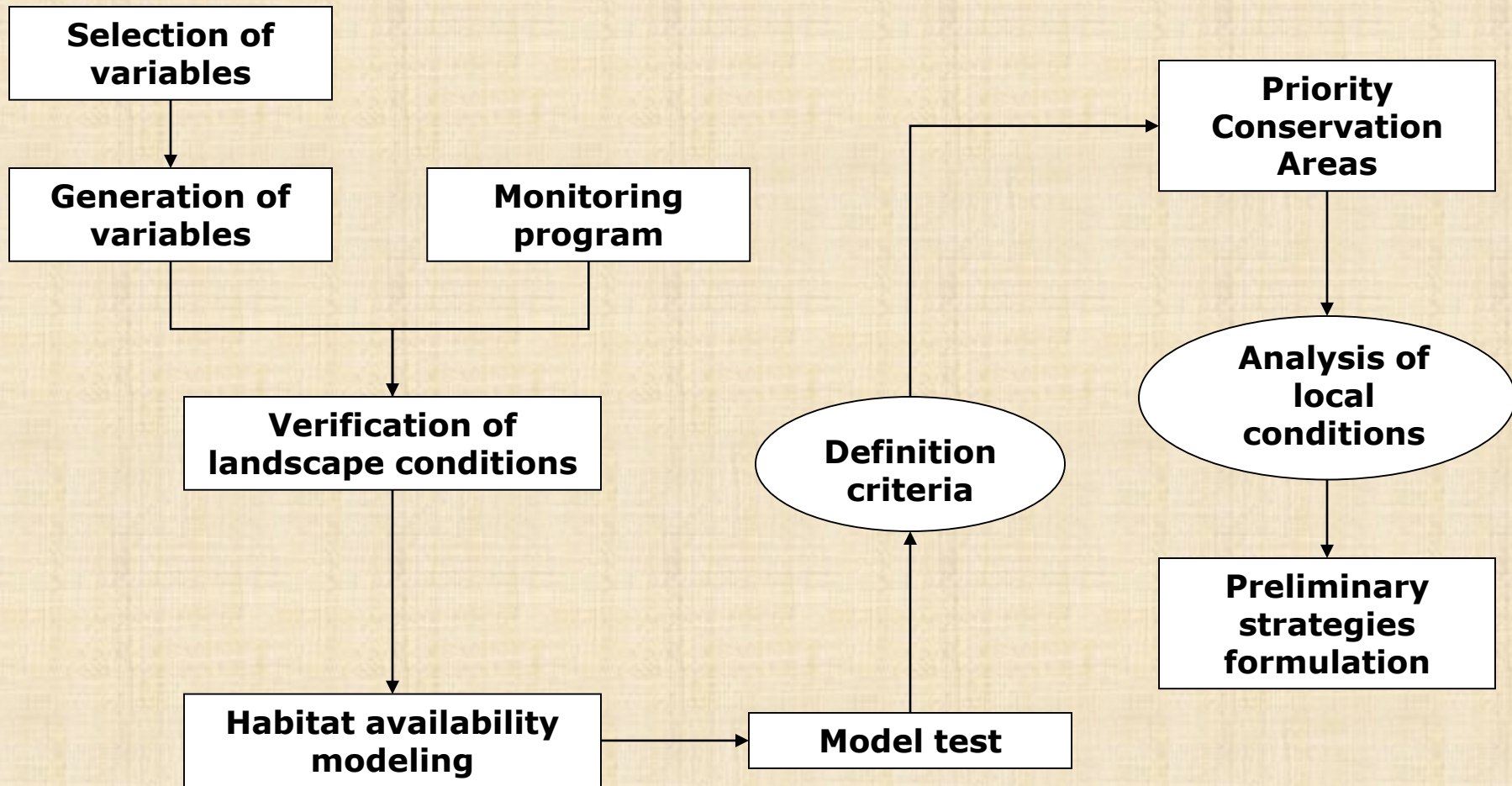






# DEFINITION OF PRIORITY CONSERVATION AREAS

## Methods



# HABITAT AVAILABILITY MODELING

## Habitat Variables

Work scale: 1:100.000

Pixel resolution: 30 m

### *Physical variables*

- Altitude
- Slope
- Terrain Shape index (McNab 1989)

### *Ecological Variables*

- Vegetation coverage
- Distance to the closest river

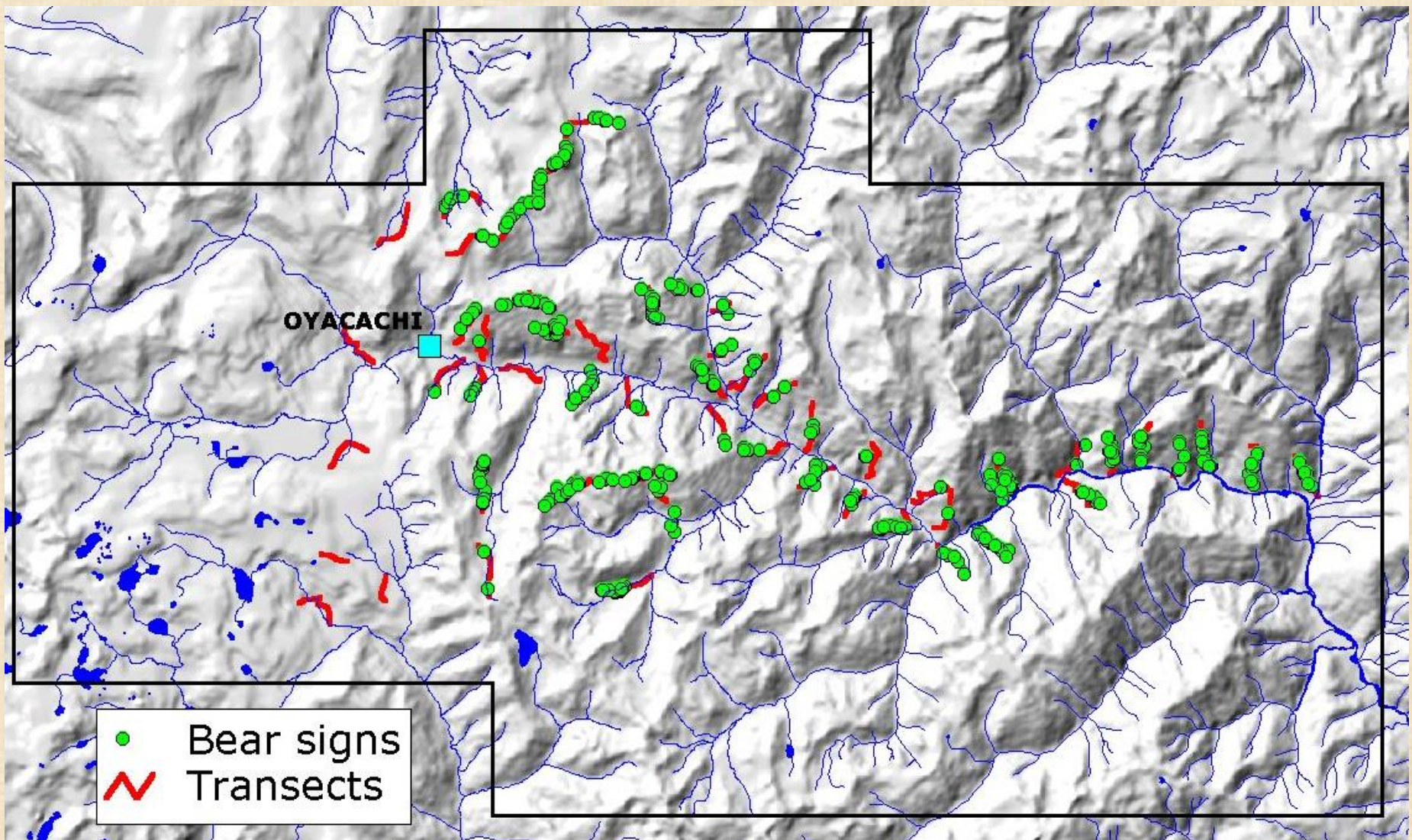
### *Human influence variables*

- Percentage of developed area
- Road density



# HABITAT AVAILABILITY MODELING

## Monitoring program





# HABITAT AVAILABILITY MODELING

Mahalanobis distance (Rao 1952)

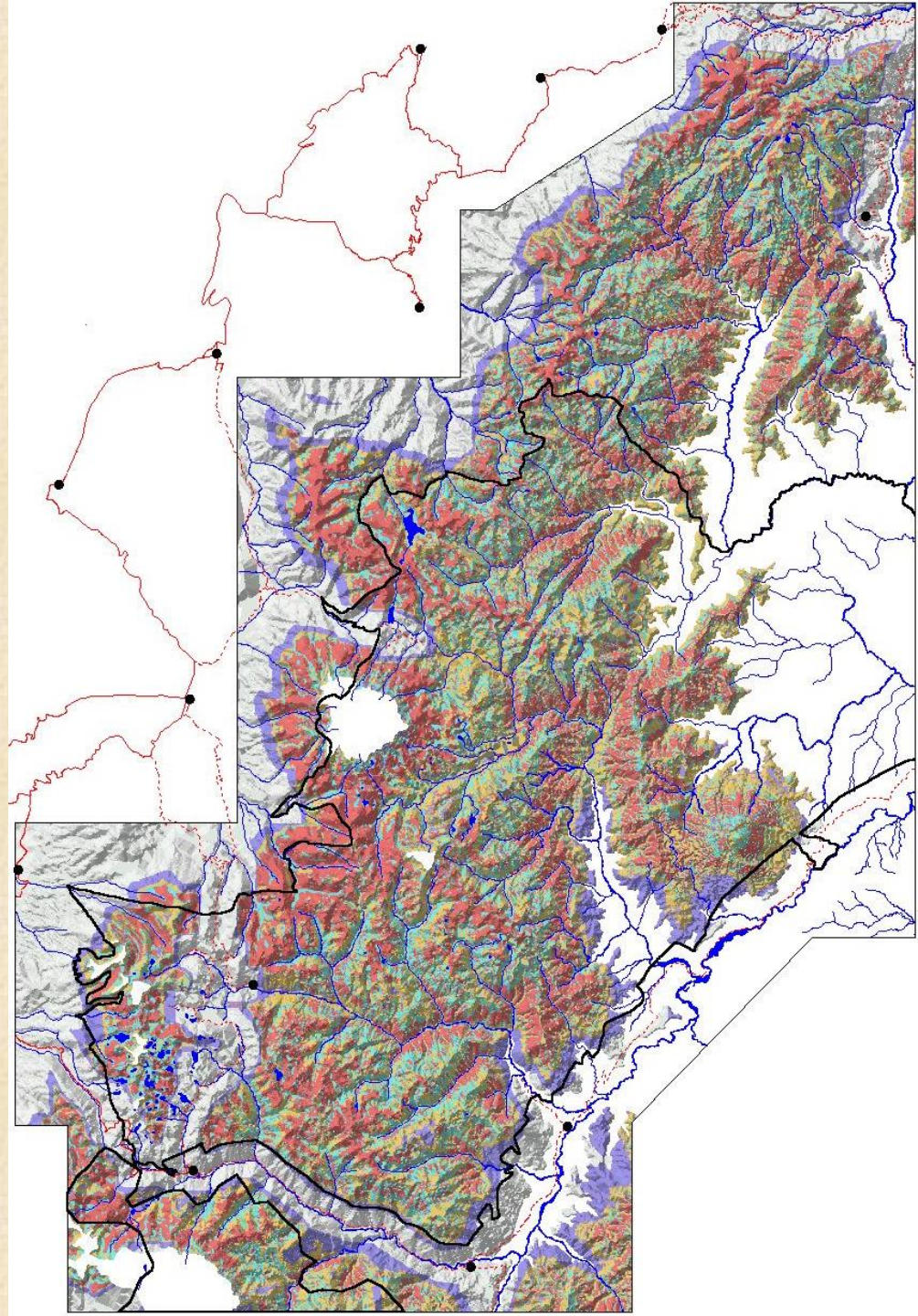
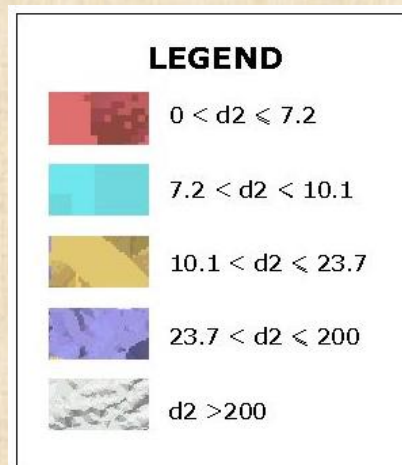
$$d^2 = (x - \bar{u})' \Sigma^{-1} (x - \bar{u})$$

$x$  = Vector of habitat characteristics

$\bar{u}$  = Mean vector of habitat variables of sampling points

$\Sigma^{-1}$  = Inverse of variance covariance matrix

# HABITAT AVAILABILITY MODELING Model Result





# PRIORITY CONSERVATION AREAS

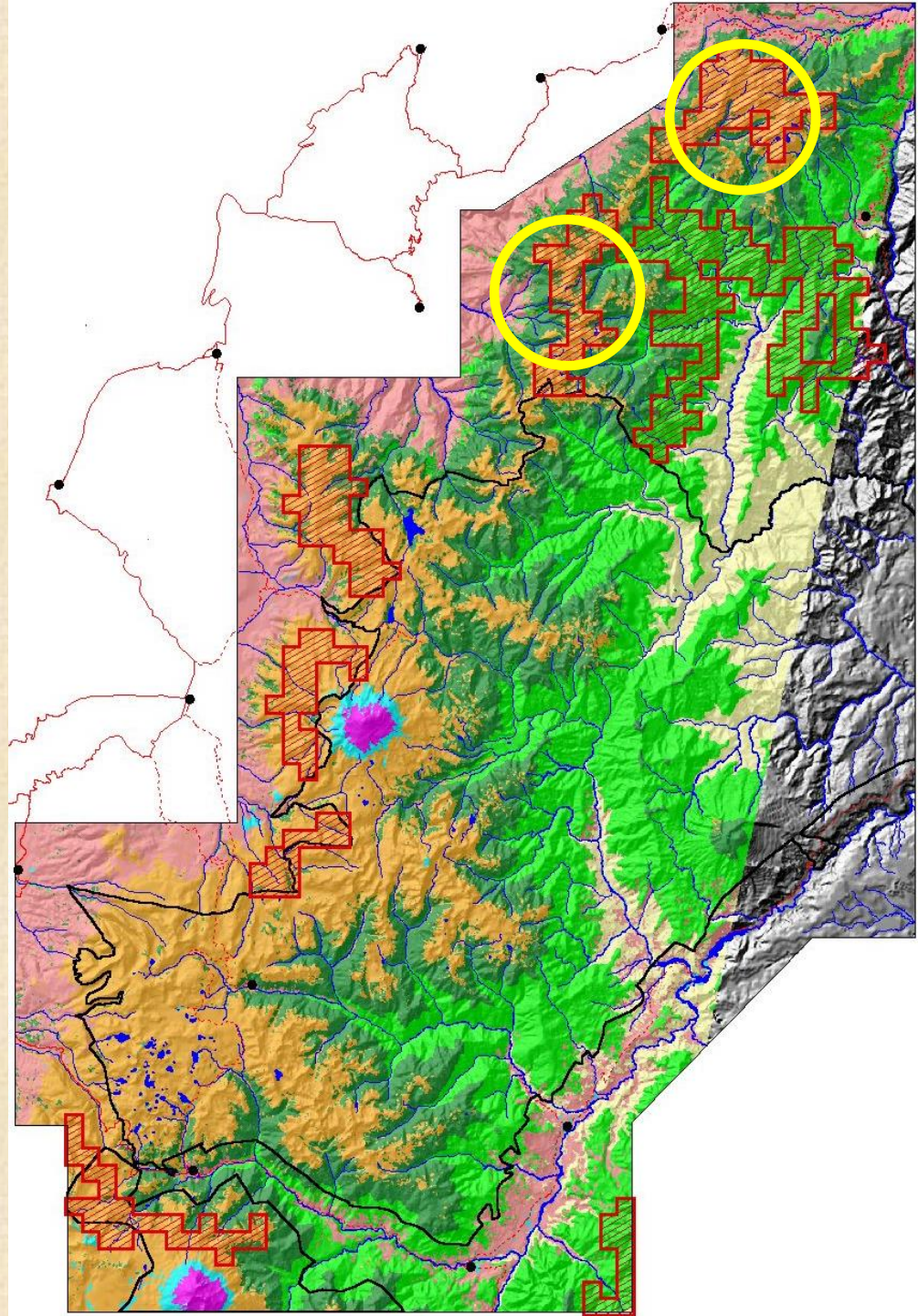
## Preliminary Strategies

- Status:

- High human pressure
- Intensive agriculture

- Strategies:

- Private reserves
- Corridor design
- Watershed management

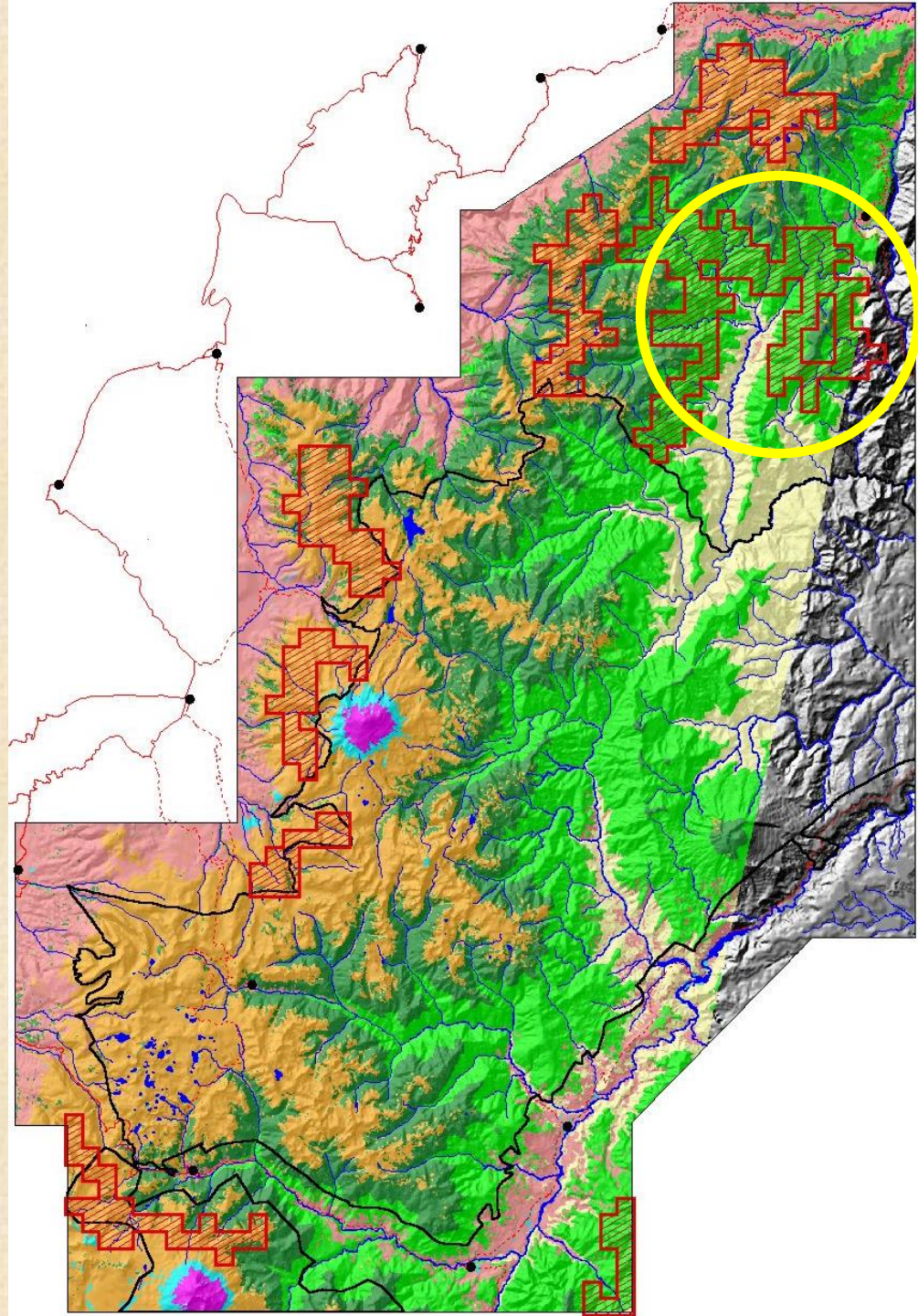




# PRIORITY CONSERVATION AREAS

## Preliminary Strategies

- Status:
  - Low human pressure
  - Incomplete range
- Strategies:
  - Expansion of the reserve
  - Research





# PRIORITY CONSERVATION AREAS

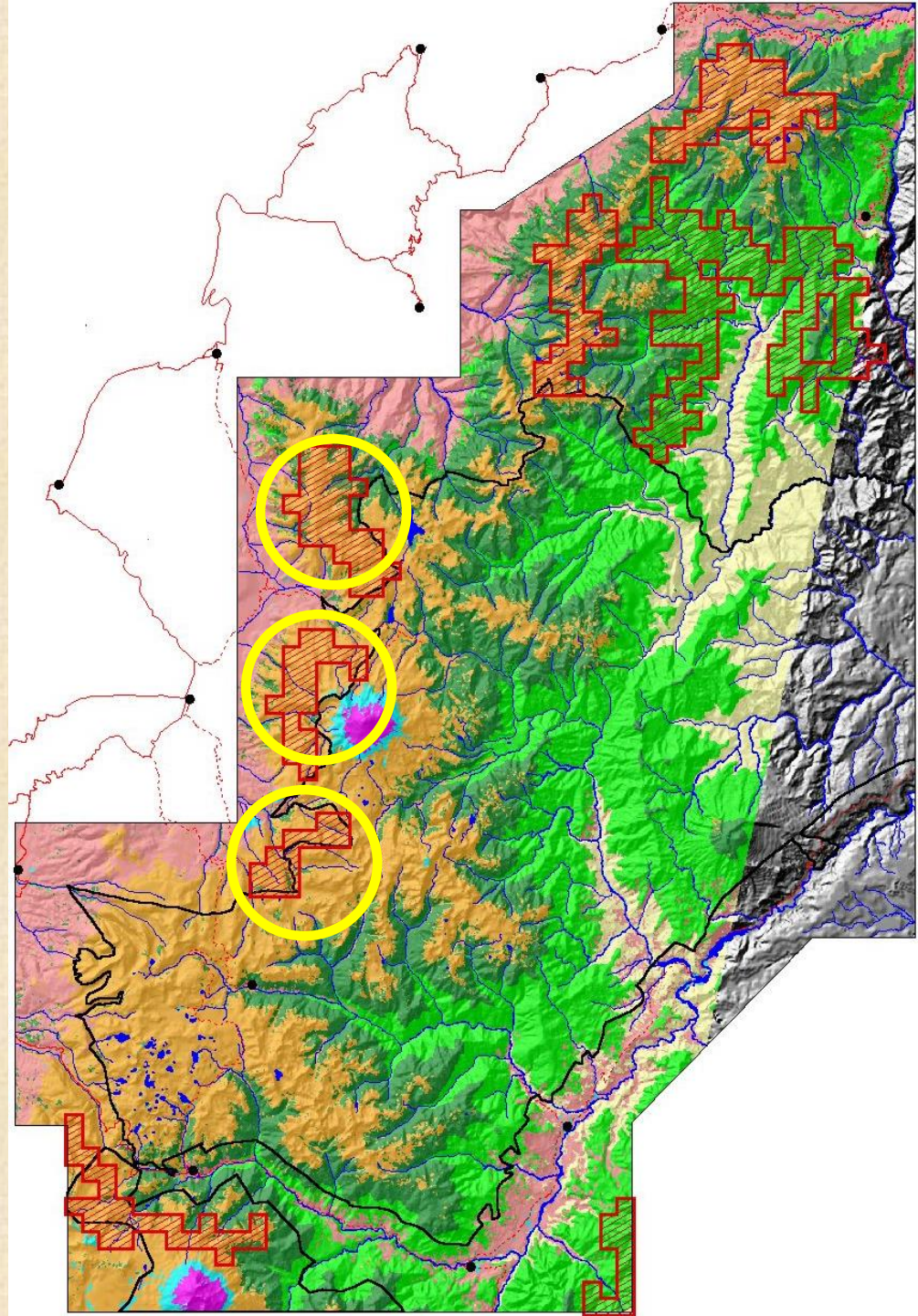
## Preliminary Strategies

- Status:

- High human pressure
- Extensive agriculture
- RECAJ's buffer areas

- Strategies:

- Private reserves
- Management of water sources

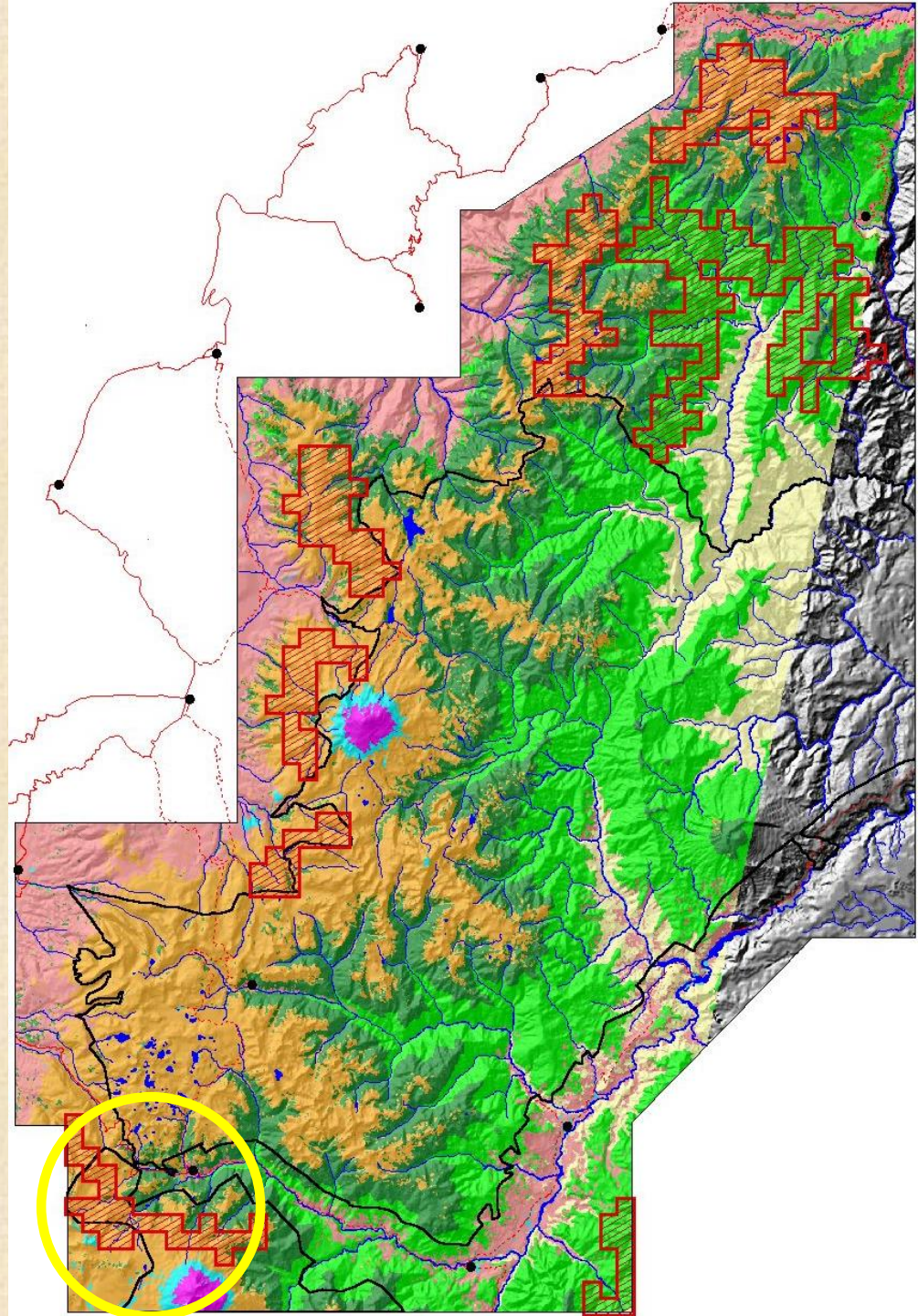




# PRIORITY CONSERVATION AREAS

## Preliminary Strategies

- Status:
  - Already protected area
- Strategies:
  - Research
  - Conectivity with RECAY





## CONCLUSIONS (ca 2001)

- The methodology is a good tool to define critical areas at regional scales
- An ecological baseline is needed to ensure meaningful conservation strategies
- Is necessary to complete the study for the complete Andean bear's altitudinal range
- It is necessary to work in the definition of local strategies adjusted to different conditions
- Management of water resources is a critical conservation issue to be addressed

## REFLECTIONS (+18 yr)

- ICDPs links to land use planning tended to overlook key governance issues (protected area, indigenous territory, local governments)
- No real integration of goals: disciplinary boundaries, lack of robust frameworks to assess complex SE systems
- Land use planning was (still is?) seen as detached from main discussions regarding development, conservation, and SLM goals



# Restoration opportunities at the landscape level

## Goal

Identify priority areas for forest landscape restoration





## Legend



Main road



Secondary road

## LUC



Urban



Shrubs



Forest

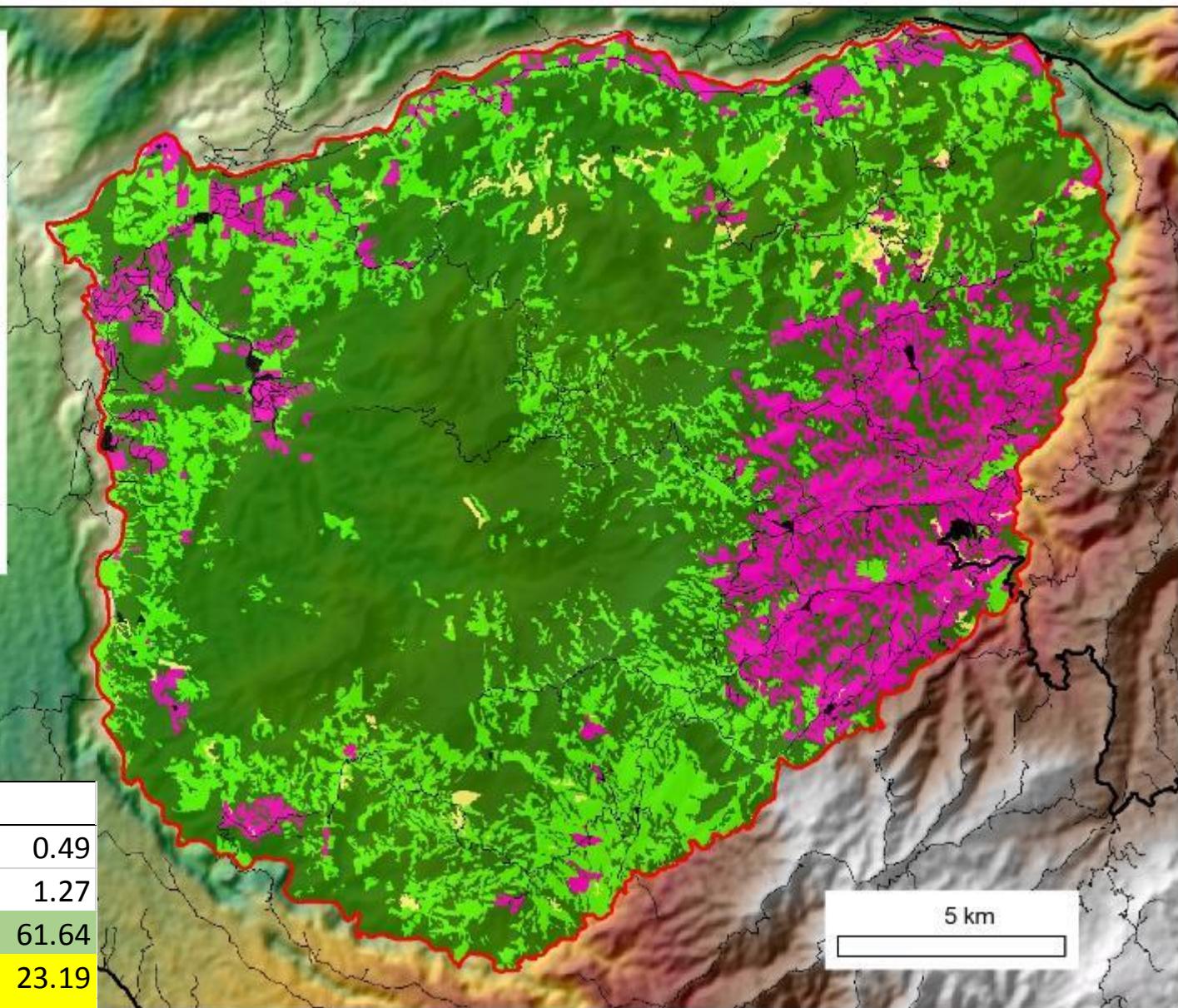


Pasture



Crop

Land use	Area (ha)	%
Urban, other	168.25	0.49
Shrubs	436.66	1.27
Forest	21 249.78	61.64
Pasture	7 995.80	23.19
Crop	4 623.97	13.41
	34 474.45	100.00

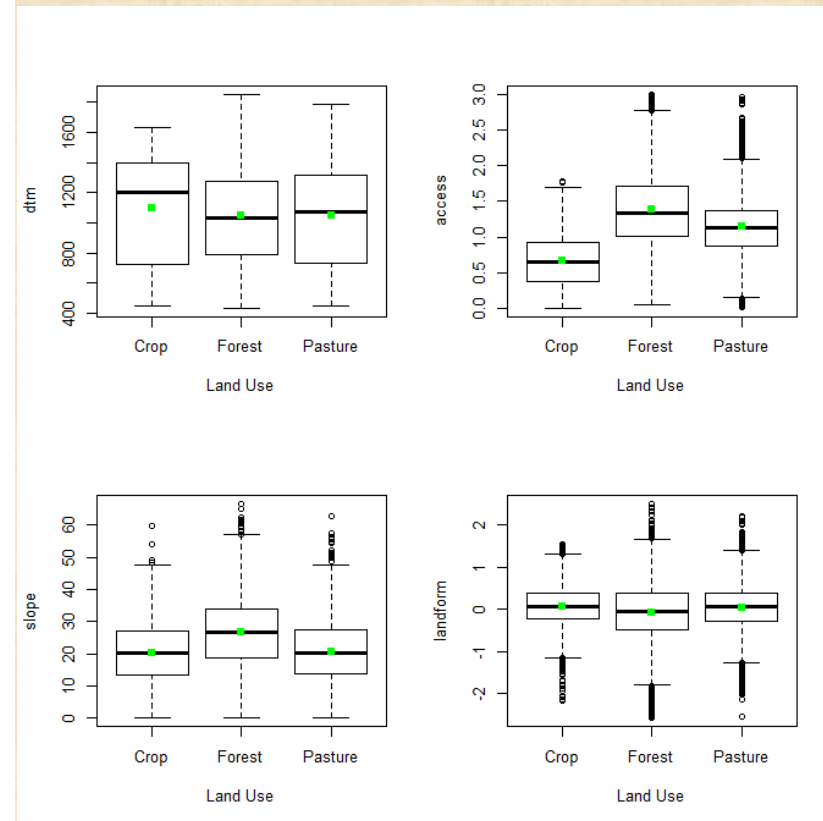
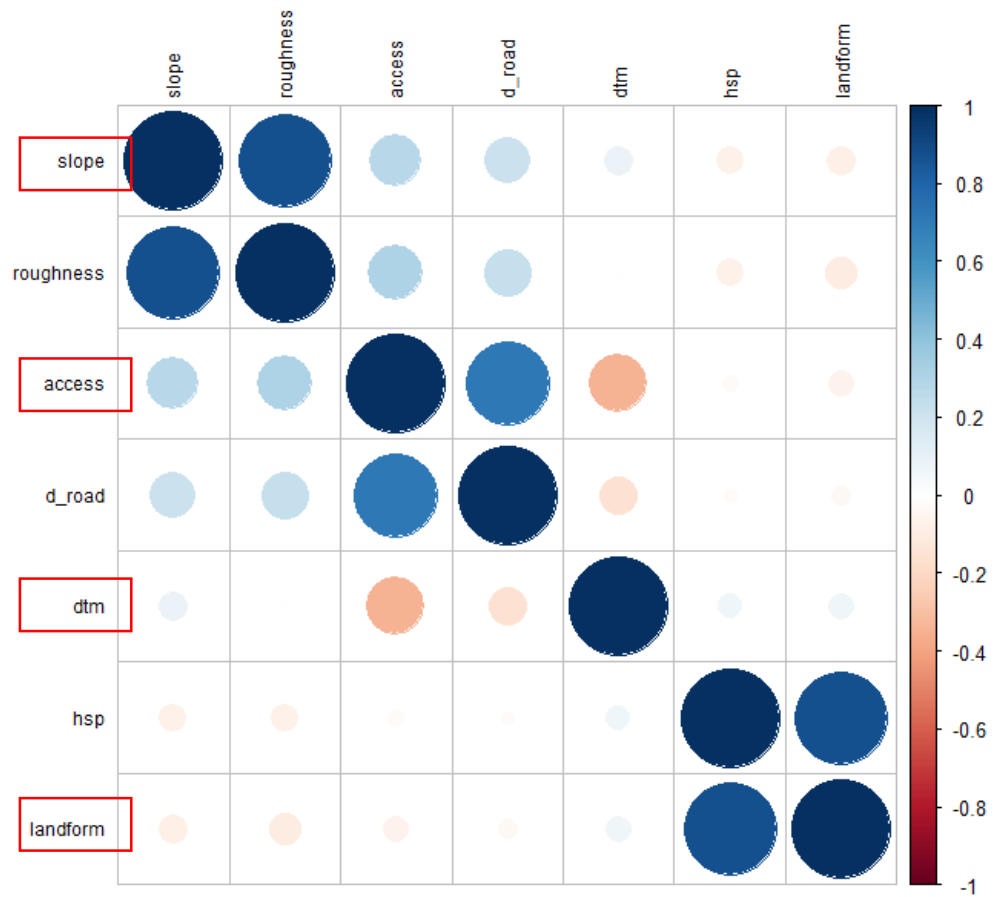


5 km

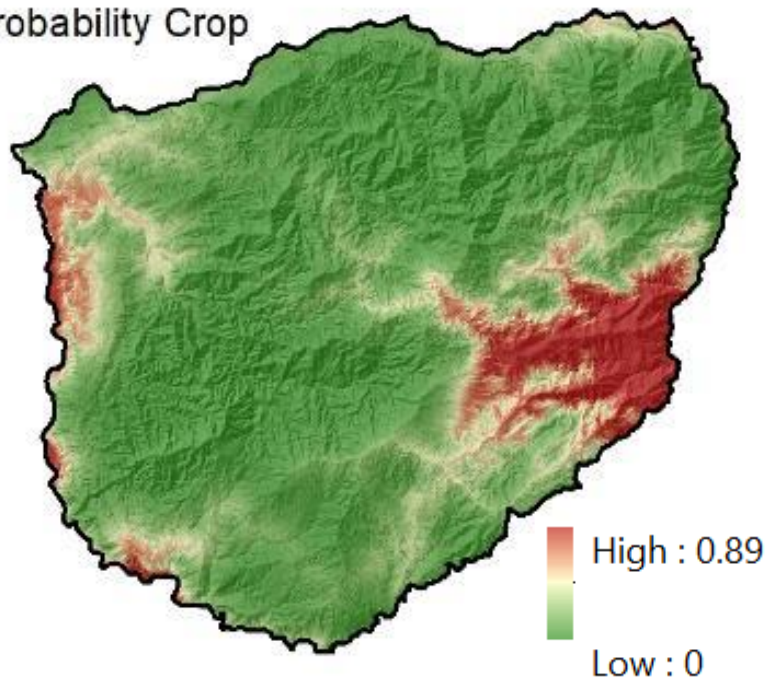


# Methods

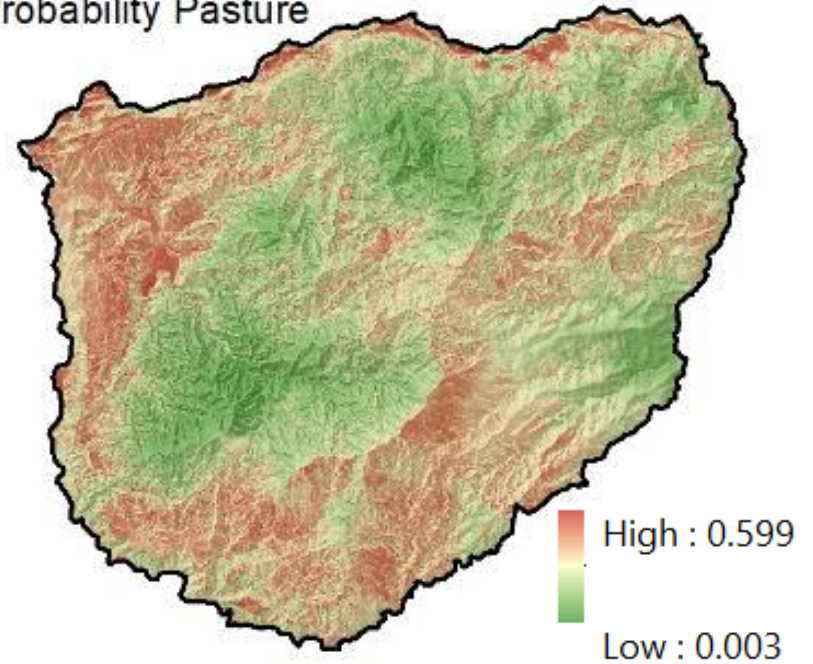
- Multinomial logit model (Crop, Pasture, ref= forest)



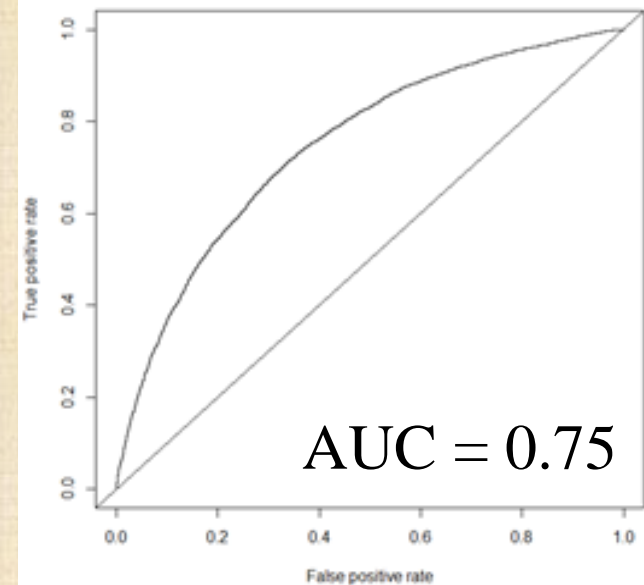
Probability Crop



Probability Pasture



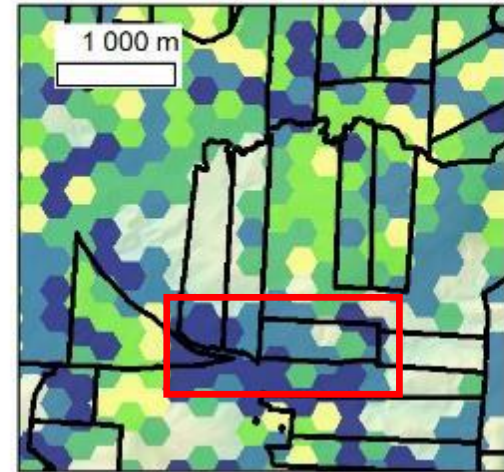
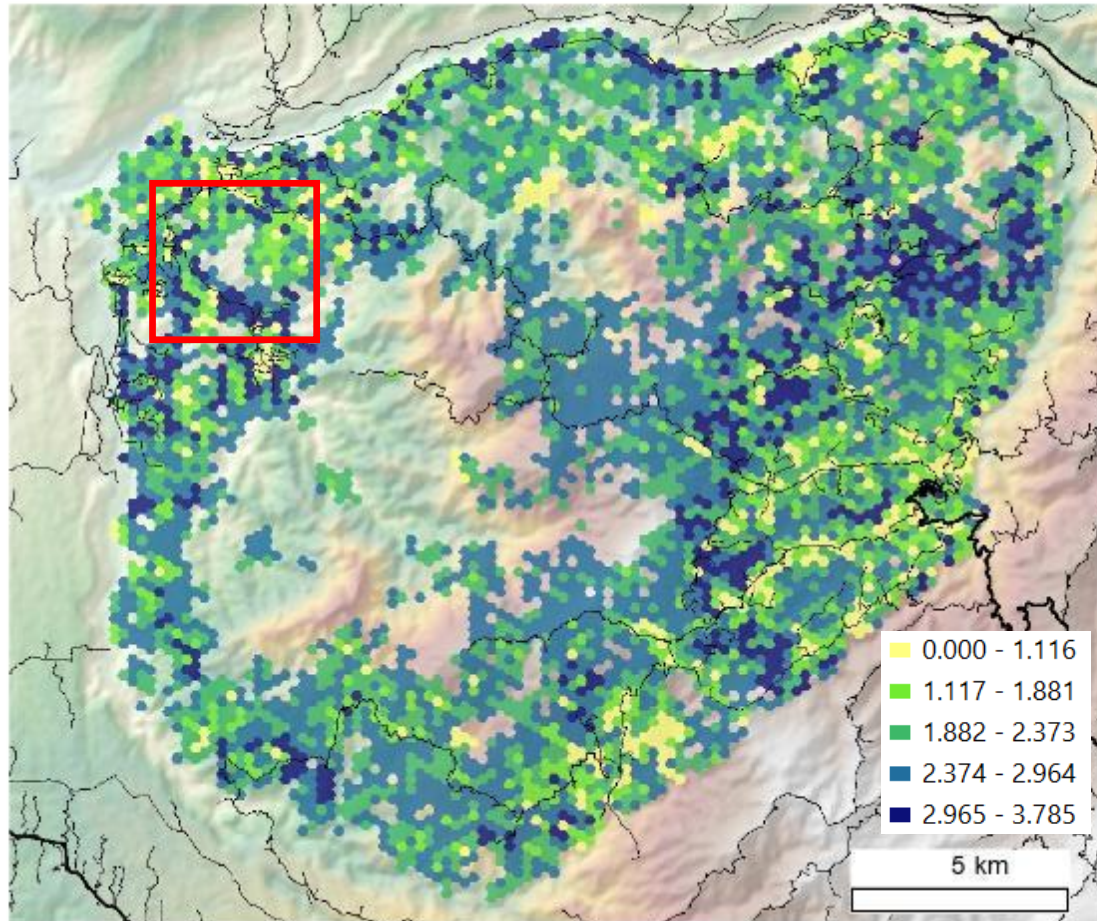
Coefficients:					
	(Intercept)	dtm	slope	access	landform
Crop	5.1858	-0.0017	-0.0374	-4.4732	0.3445
Pasture	1.4057	-0.0004	-0.0420	-0.8882	0.2786
Value/SE (Wald statistics):					
Crop	202.2367	-31.0035	-14.1117	-98.6182	7.3498
Pasture	16.9062	-6.7476	-24.2926	-23.2022	10.0072
exp(COEFF):					
Crop	178.7245	0.9983	0.9633	0.0114	1.4113
Pasture	4.0785	0.9996	0.9589	0.4114	1.3212



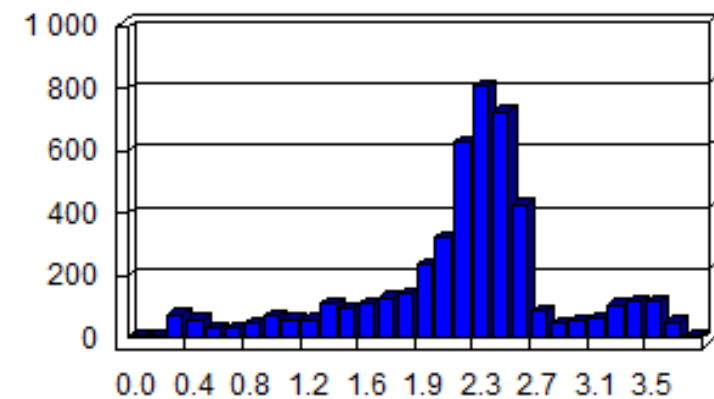


# Resultados

Restoration suitability



Frequency Distribution





# Sendero de la restauración, Mashpi









# A few recommendations

- Flexible tool to optimize existing LUC information and commonly available spatial variables
- Can be adapted to represent alternative landscape management goals and generate possible future scenarios
- Key processes missing:
  - Link livelihood patterns ↔ land Access
  - Historical land use patterns
  - Climate change effects





# Land use planning for multiple land management goals: Andean Choco Commonwealth

## Goal

Incorporate multiple values and land use  
management goals in a complex mountain  
landscape



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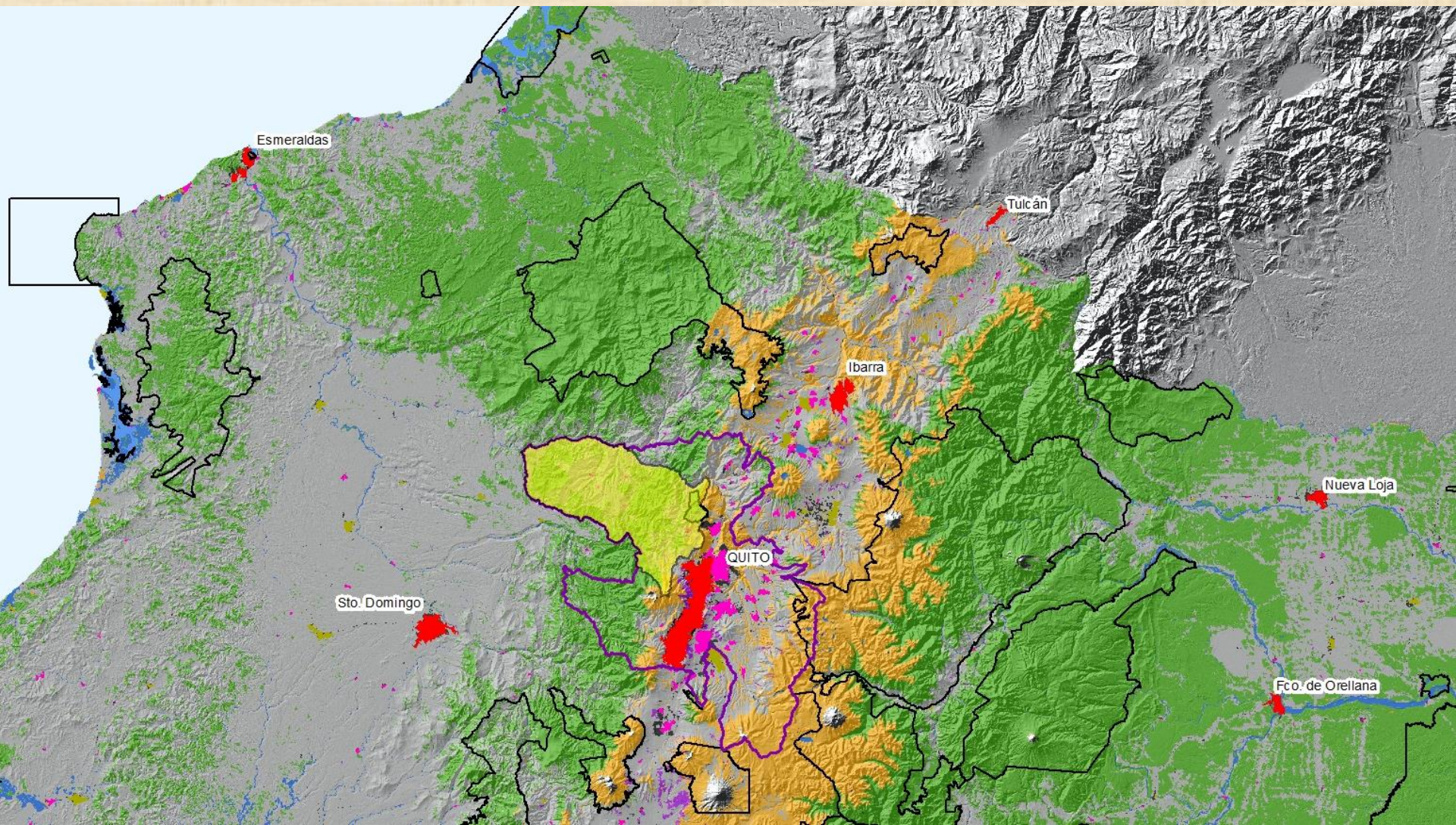


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de la Ecorregión Andina







# Objetivos / estrategias de gestión territorial

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## → Land management goals

- Maintain / recover critical areas for the provision of key hydrological services
- Maintain and recover forest connectivity along the elevation gradient
- Conserve critical habitats in the long term

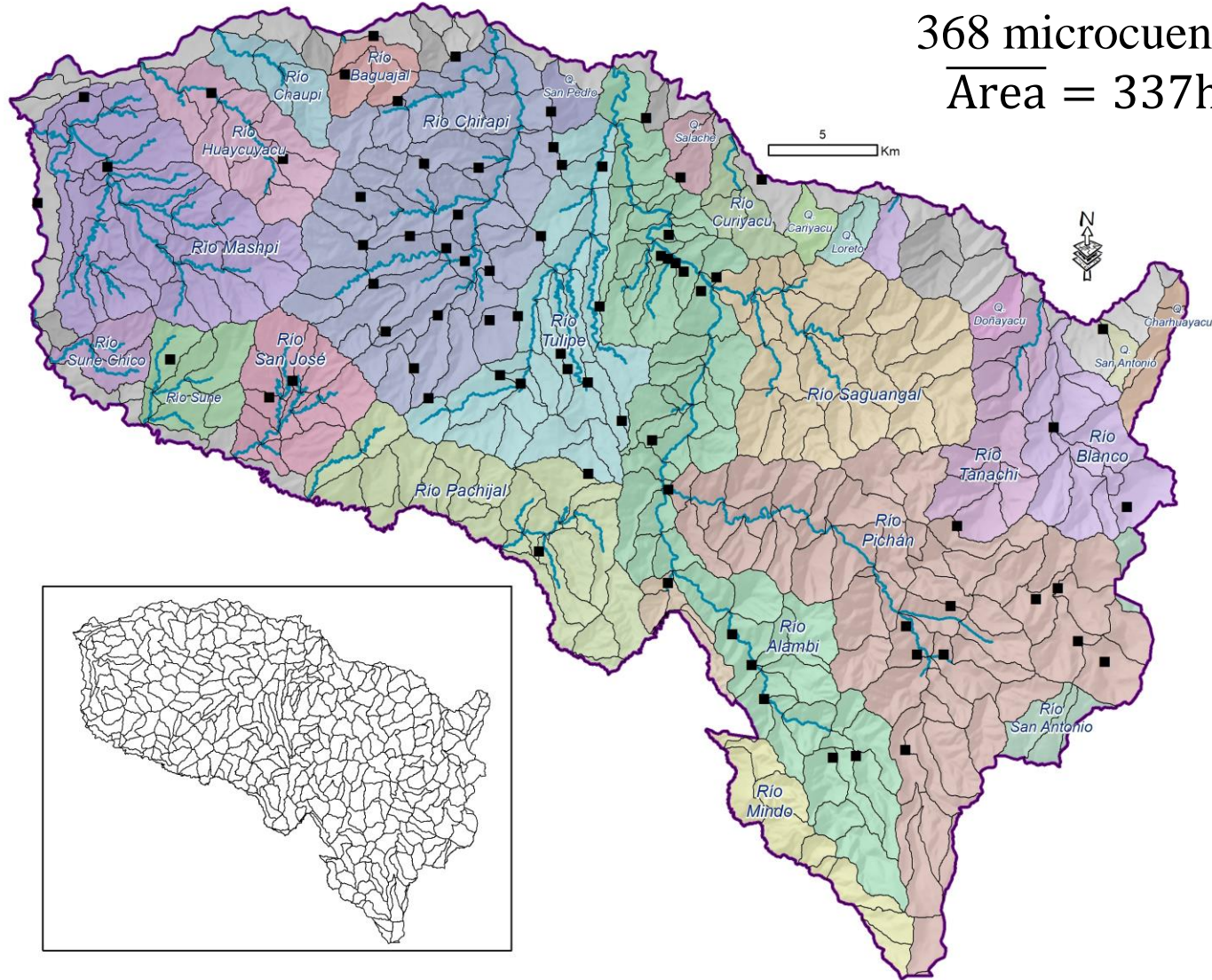
## → Intervention strategies

- Ecosystem restoration
- Areas of conservation and sustainable management
- Sustainable production: agroforestry, cattle ranching, forestry



# Integración cartográfica: Microcuencas

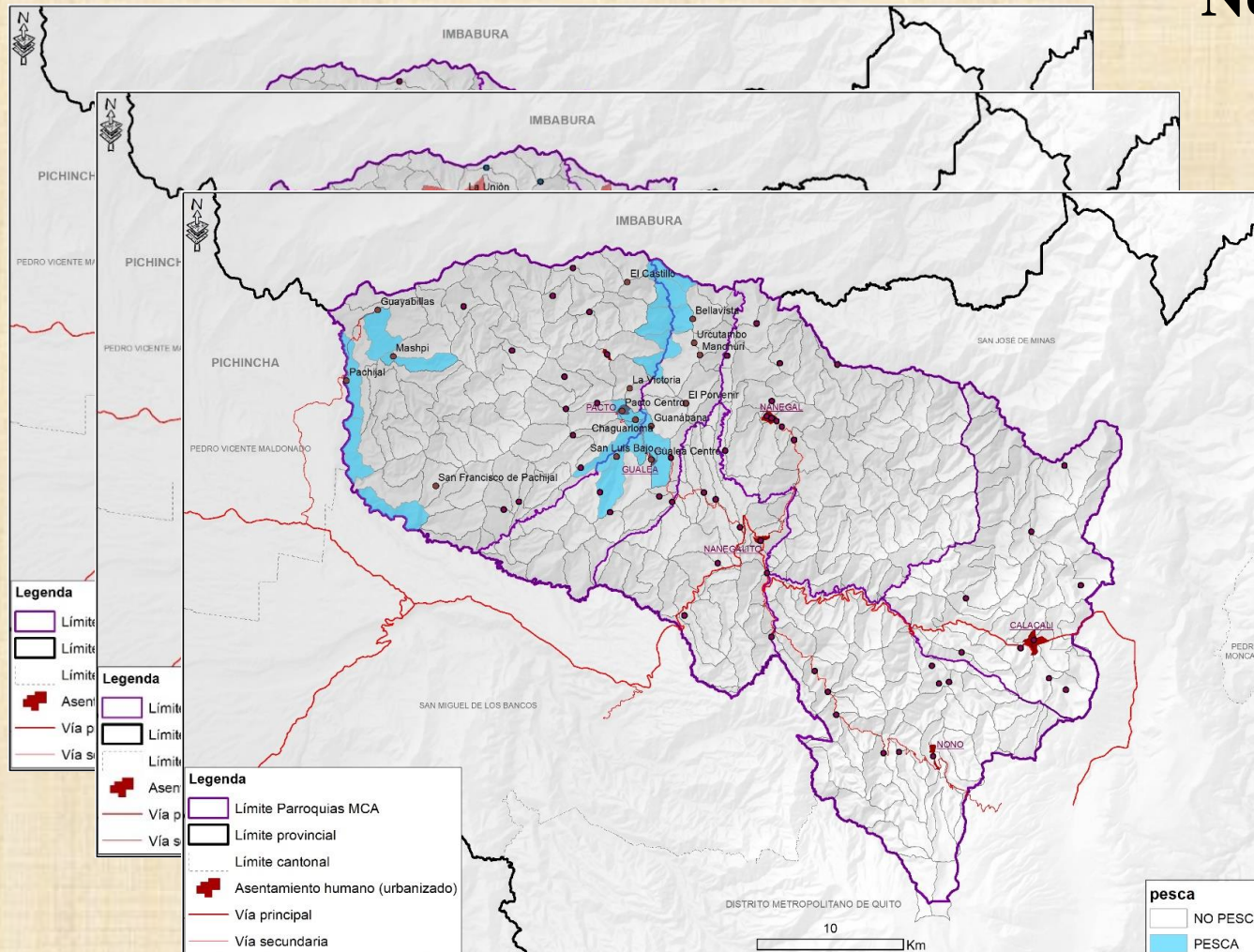
368 microcuencas  
 $\overline{\text{Area}} = 337\text{ha}$





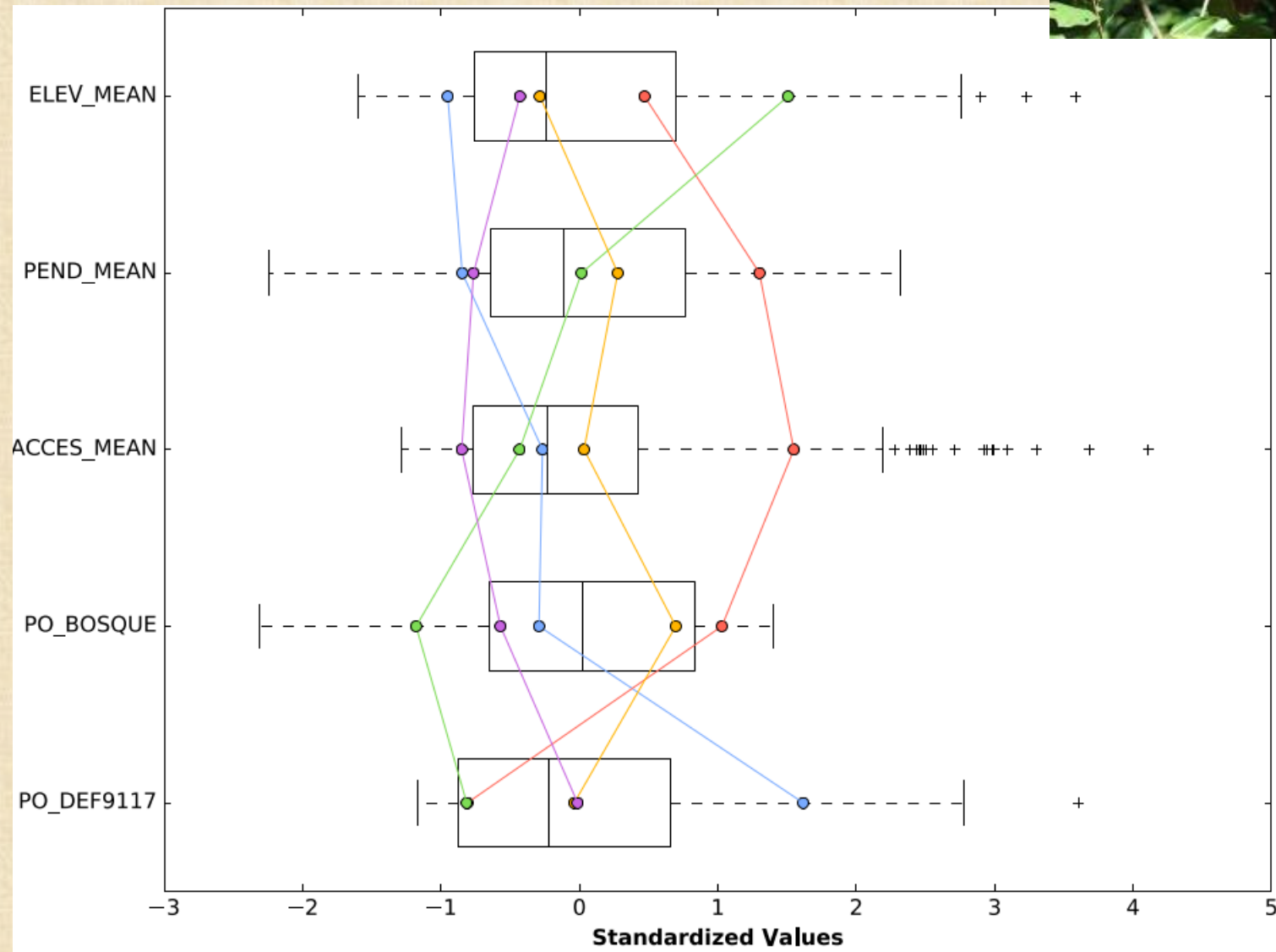
# Problemática actual: Patrimonio Natural

**Non-sustainable  
land uses**



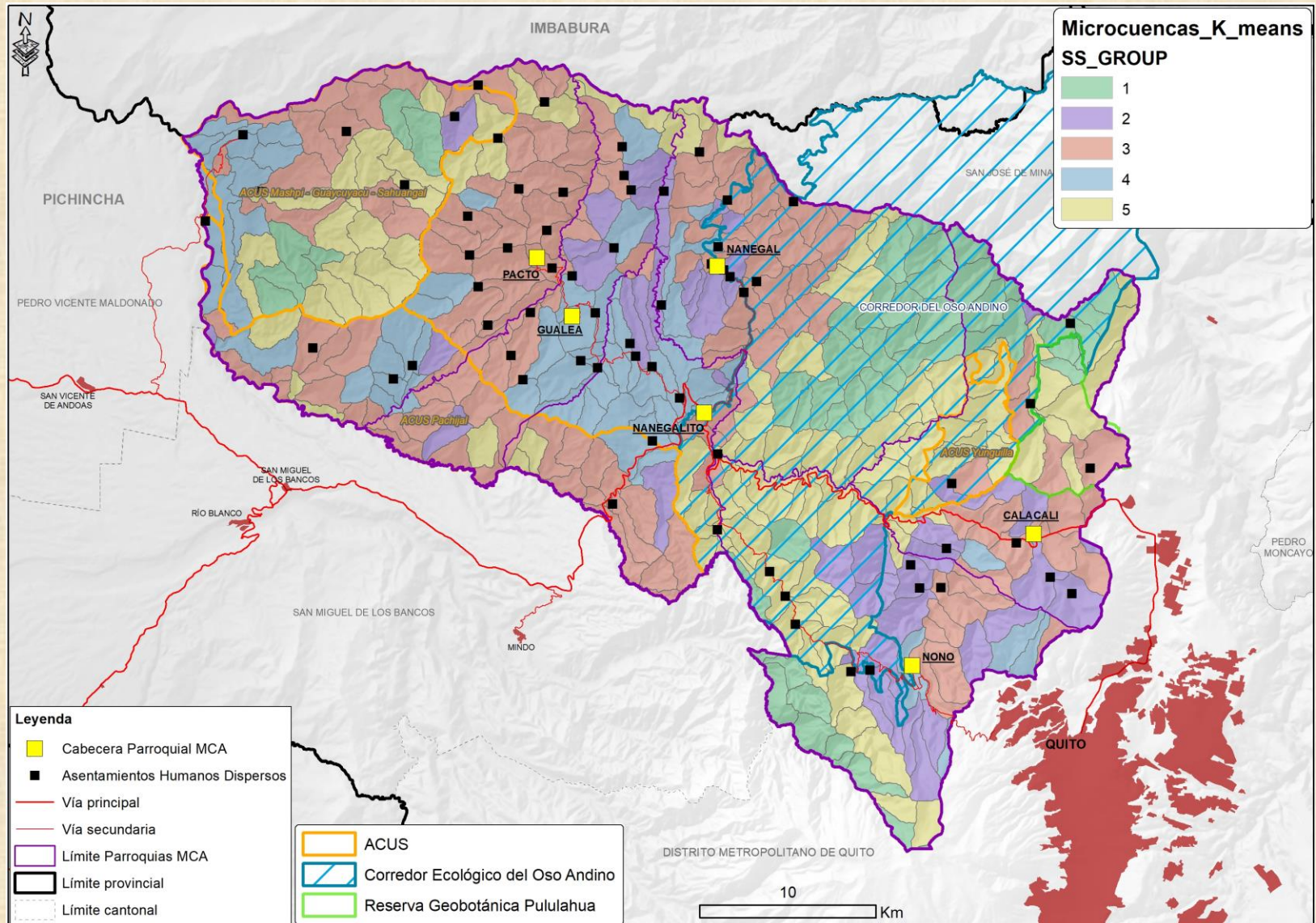


# Cluster analysis: K-means

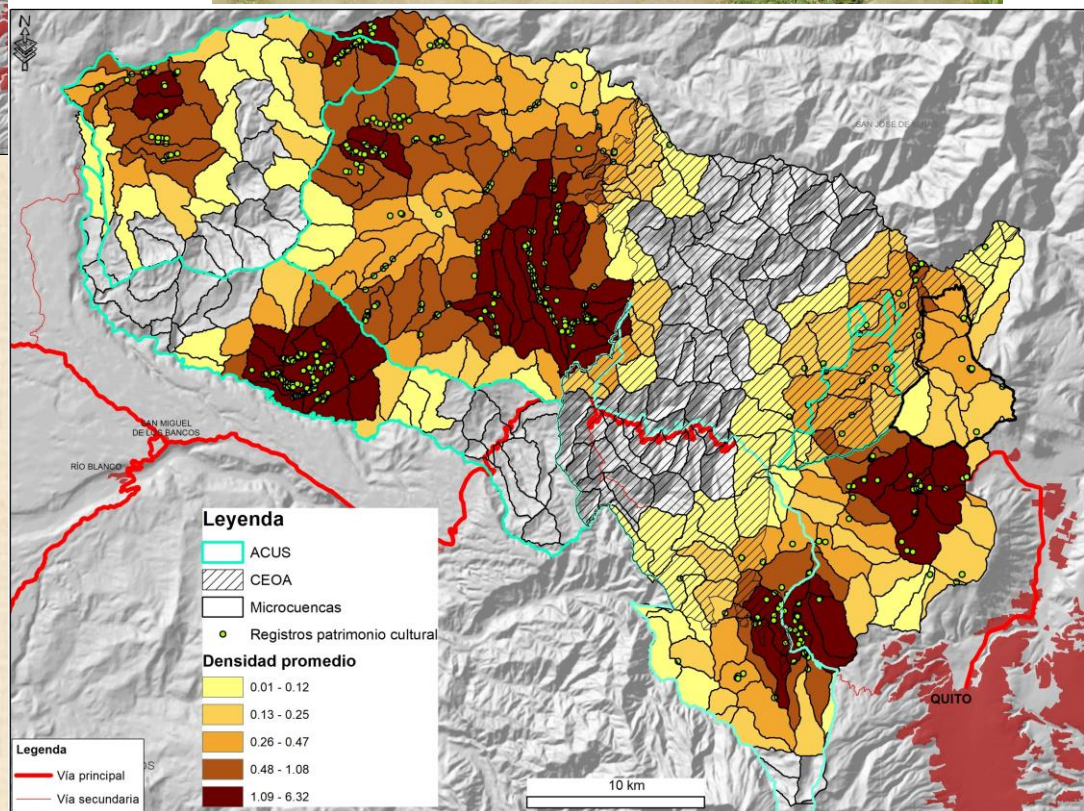
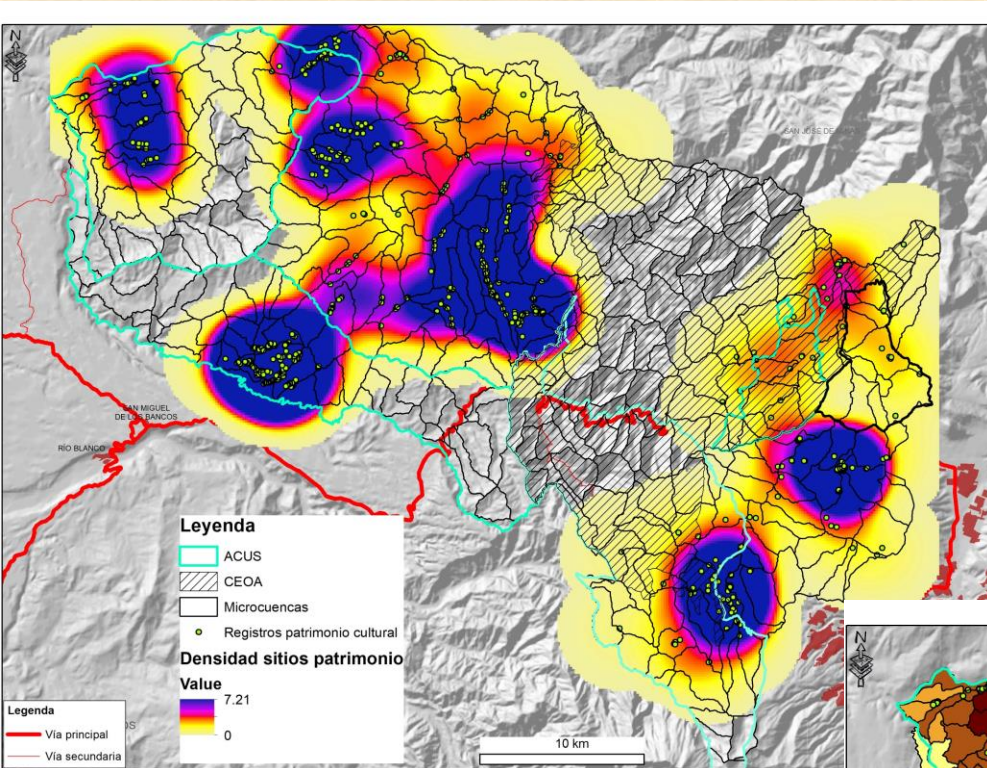




## Escenario 2: Recuperación de la conectividad del hábitat











IMBABURA

PUOS (ord.192 - 2018.junio.29)

P. Ecol/Conser. Patri. N - PQ

Uso Vigente

Agrícola Resid.

Equipamiento

Industrial 3

Industrial 4

Multiple

P. Ecol/Conser. Patri. N

RN/Prod. Sostenible

RNNR

Resid Rural 1

Resid Rural 2

Resid Urbano 1

Resid Urbano 2

Resid Urbano 3

NANEGAL

PACTO

QUALEA

NANEGALITO

CALACALI

NONO

QUITO

10

Km

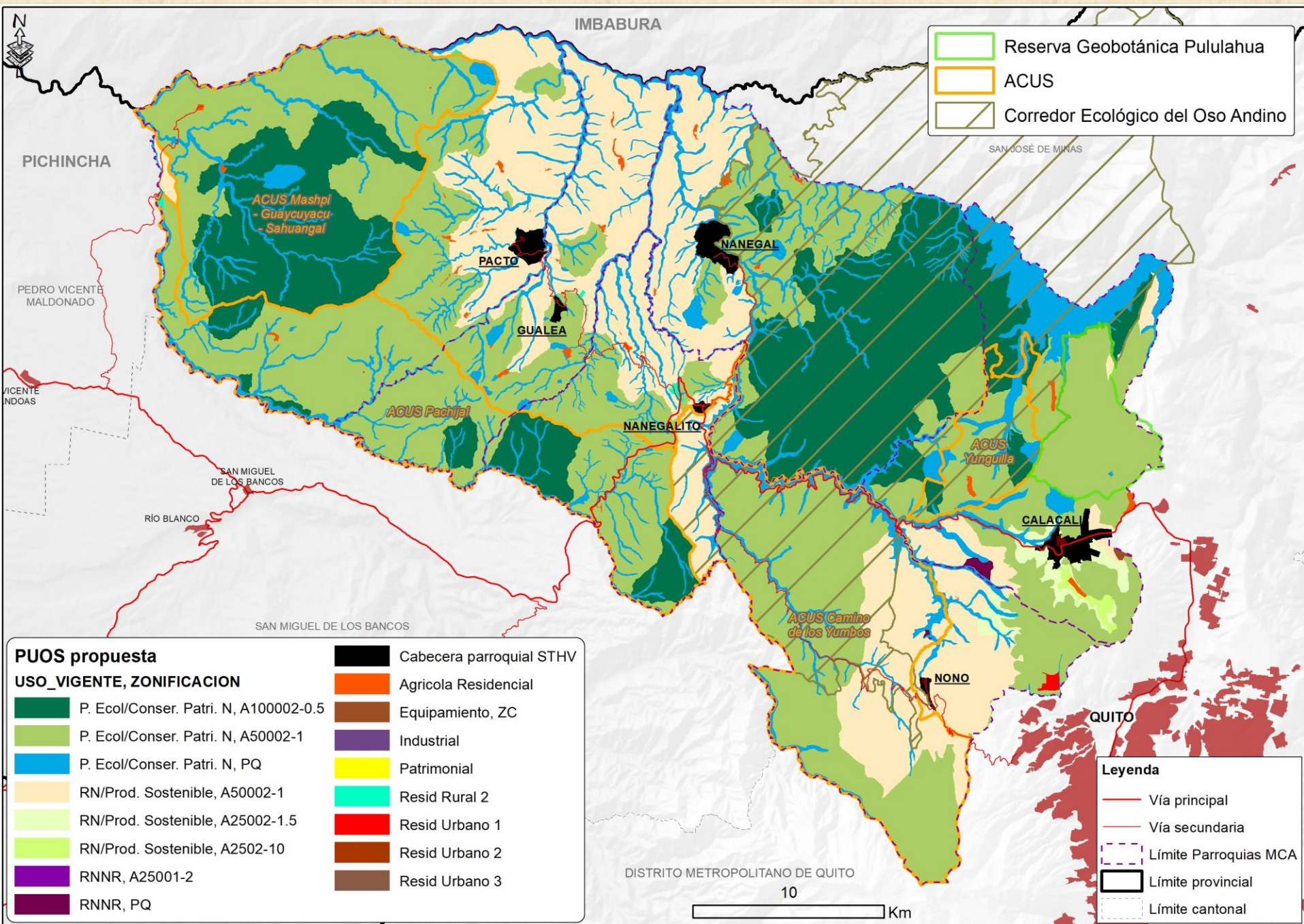
Legenda

Via principal

Límite Parroquias MCA

Límite provincial









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# Looking towards the future

Manuel Peralvo, CONDESAN

Ormea, July 17th 2019

ARGENTINA / BOLIVIA / CHILE / COLOMBIA / ECUADOR / PERU / VENEZUELA



Bett

ISSUE BRIEF 2018  
SUSTAINABLE MOUNTAIN DEVELOPMENT

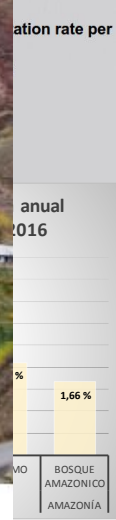
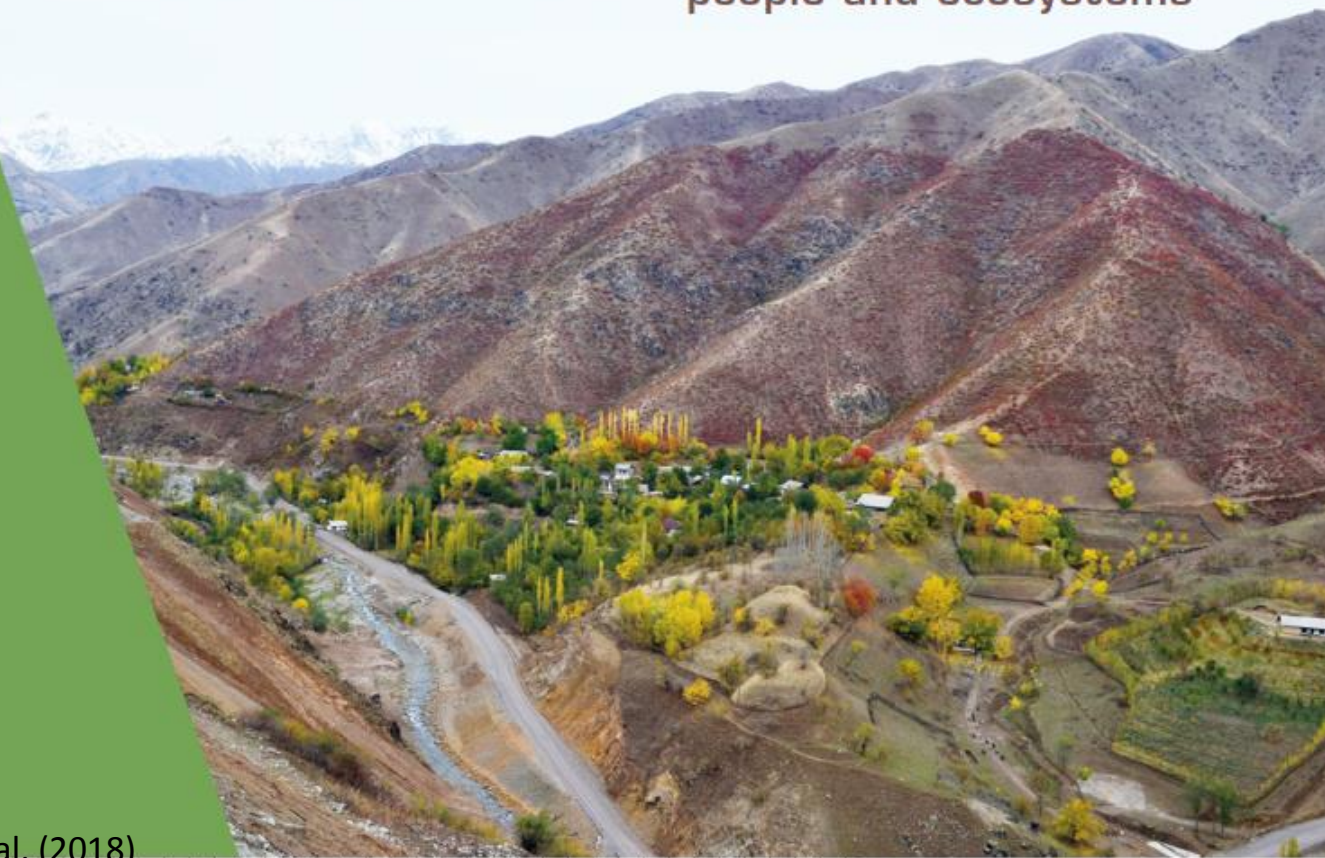
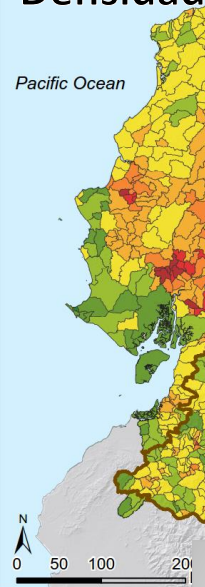
# Leaving no one in mountains behind

Localizing the SDGs for resilience of mountain  
people and ecosystems

- Sta  
(EC

Densidad

Pacific Ocean



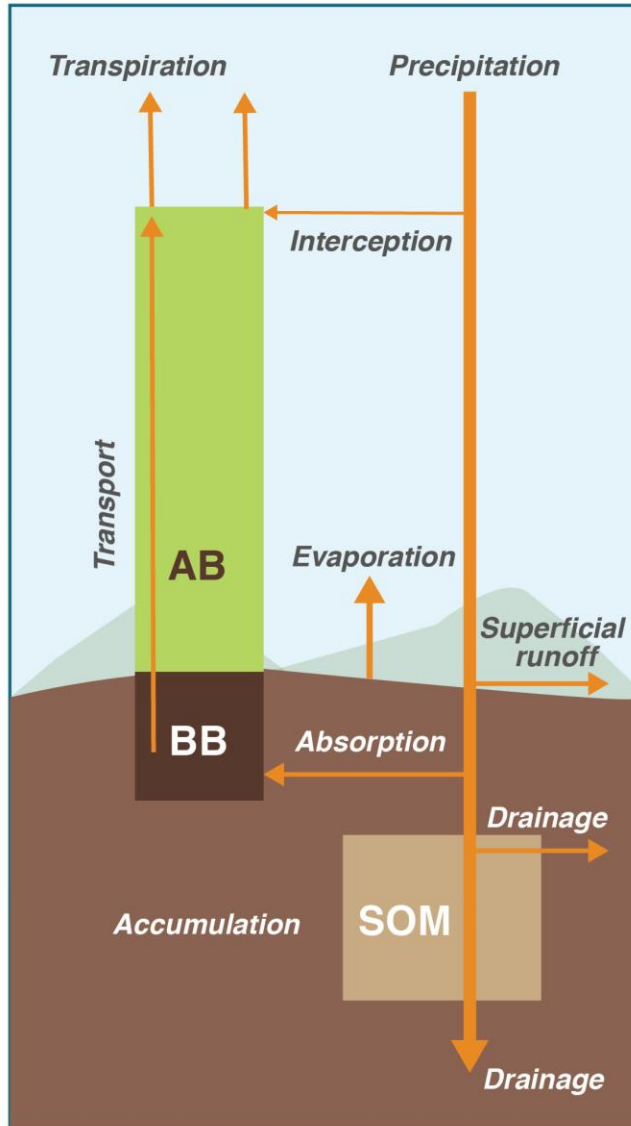
Source: Wymann von Dach et al. (2018)



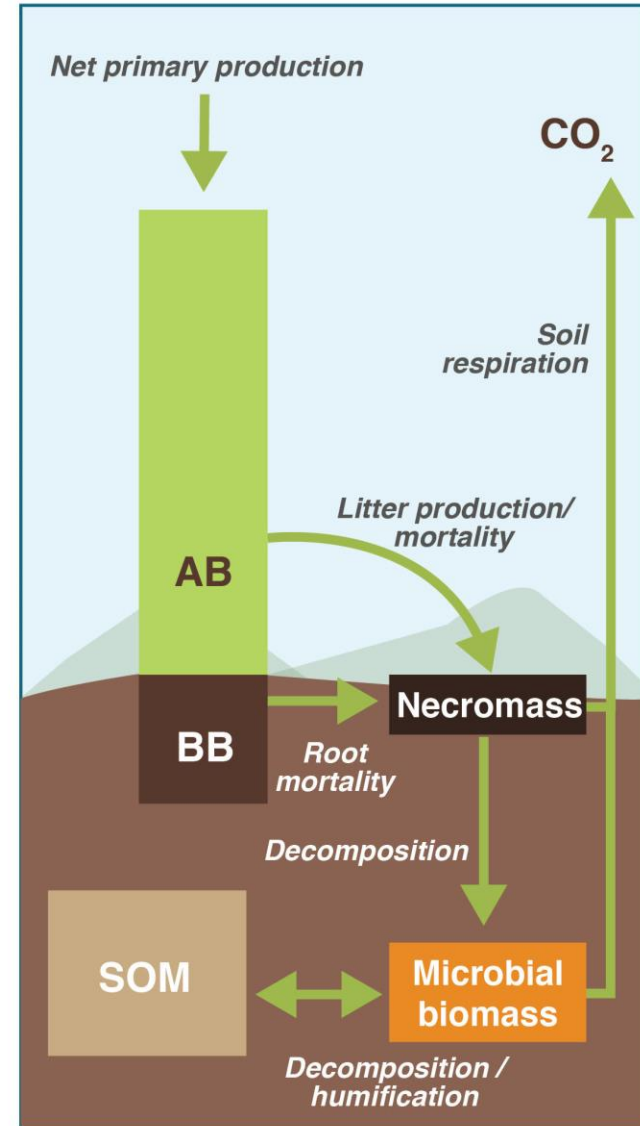
# Functional Diversity

Plant  
Functional  
Traits

## Water Balance



## Carbon Balance



Plant height

Leaf traits  
(e.g. specific leaf area)

Stem traits  
(e.g. wood density)

Plant Growth  
Forms  
(biomass allocation)

Root traits  
(e.g. root density)





# Land Use Planning for SLM

- Linkages land use – land tenure – land governance
- Linking spatial and policy dimensions (monitoring impact)
- Multi sectoral and cross-scale coordination
- “Design” viable SLM alternatives (balance regulation / incentives)





# Move normative principles to the forefront

- Who benefits vs. who should benefit
- Specify goals and define their prevalence

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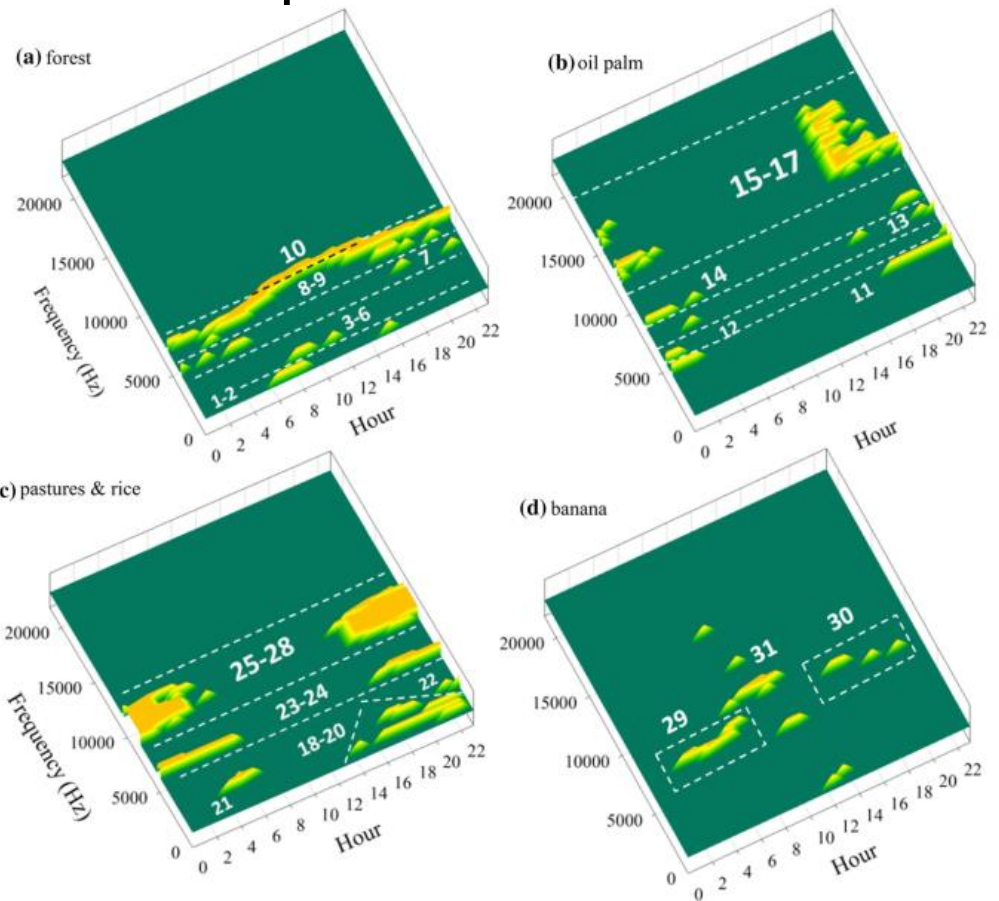
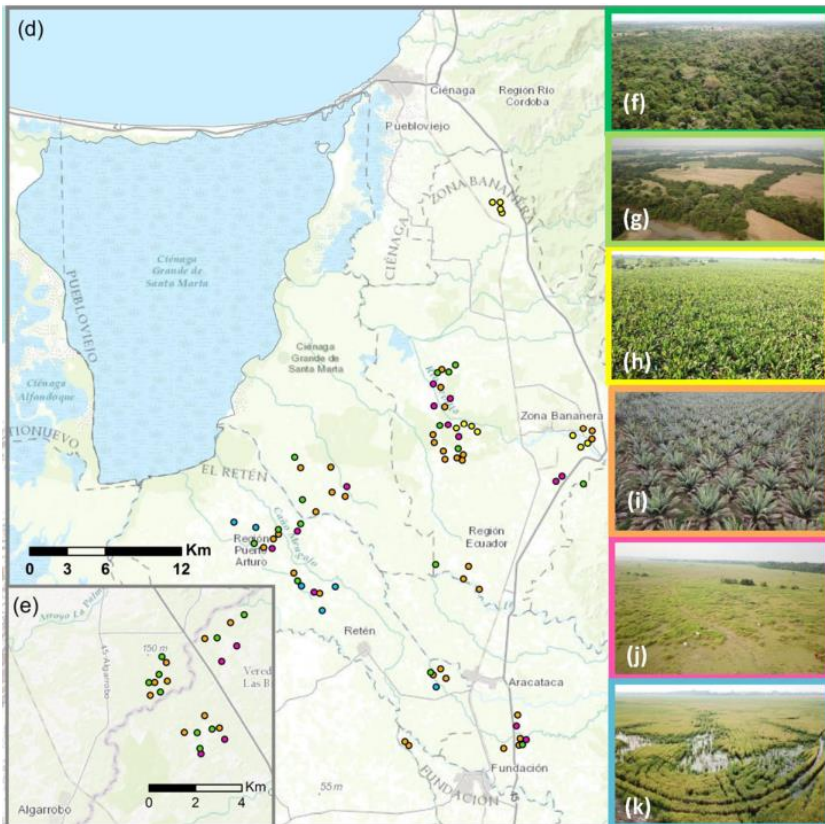
	<i>Conservation projects with development (CPD)</i>	<i>Development projects with conservation (DPC)</i>
Target	Species, ecosystems	Local peoples
Desired condition	Viable populations and areas	Socioeconomic develop- ment; equitable social conditions
Role of humans	Threat	Target
Principal activities	Protection; restoration; threat alleviation; stake- holder education	Enterprise development; institution building; improved livelihoods; empowerment

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# Testing new methods

- Camera trap monitoring, soundscapes

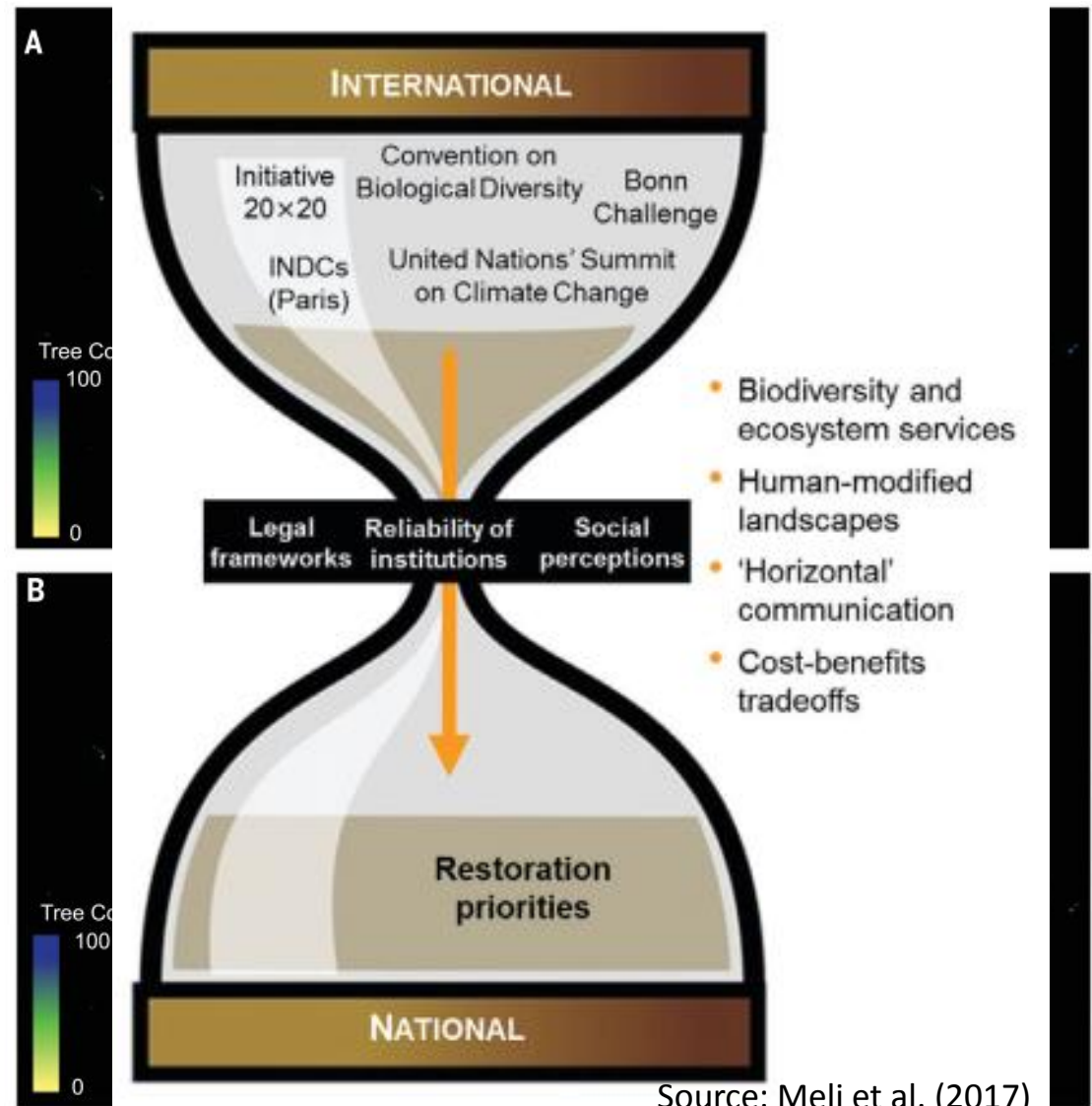


Source: Furumo and Aide (2019)

# Effective scaling-up of SLM practices

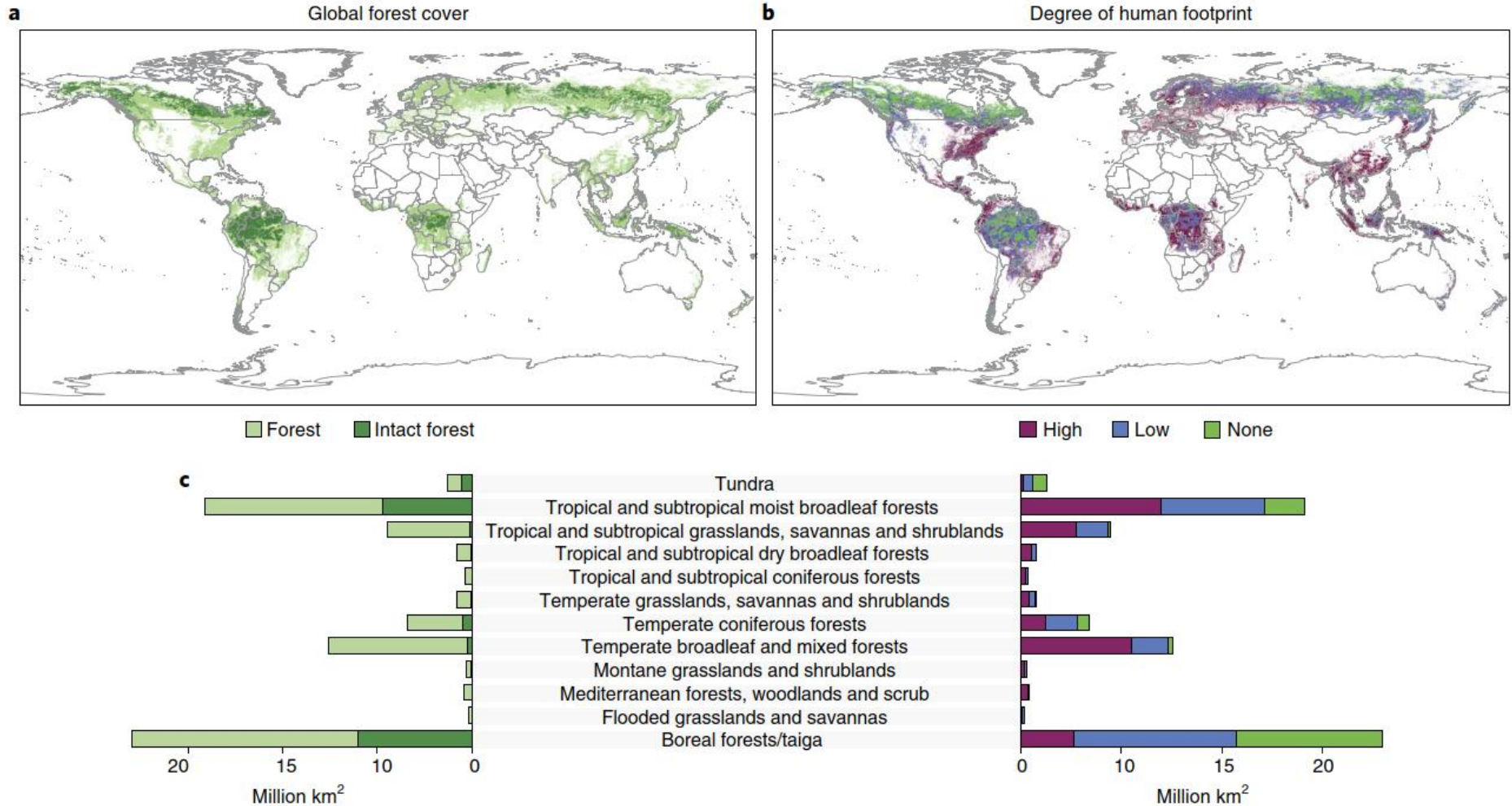
## Forest restoration in Andean landscapes:

- Highly fragmented
- Complex governance
- Less visible in global agendas?



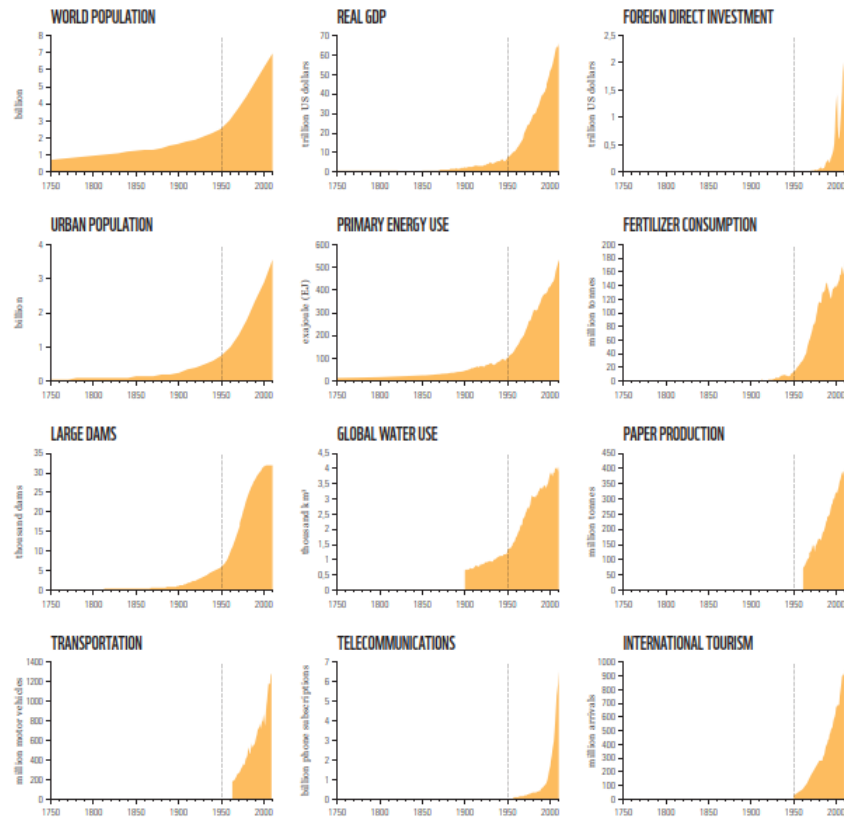


# Conservation is a key component of sustainable landscape management

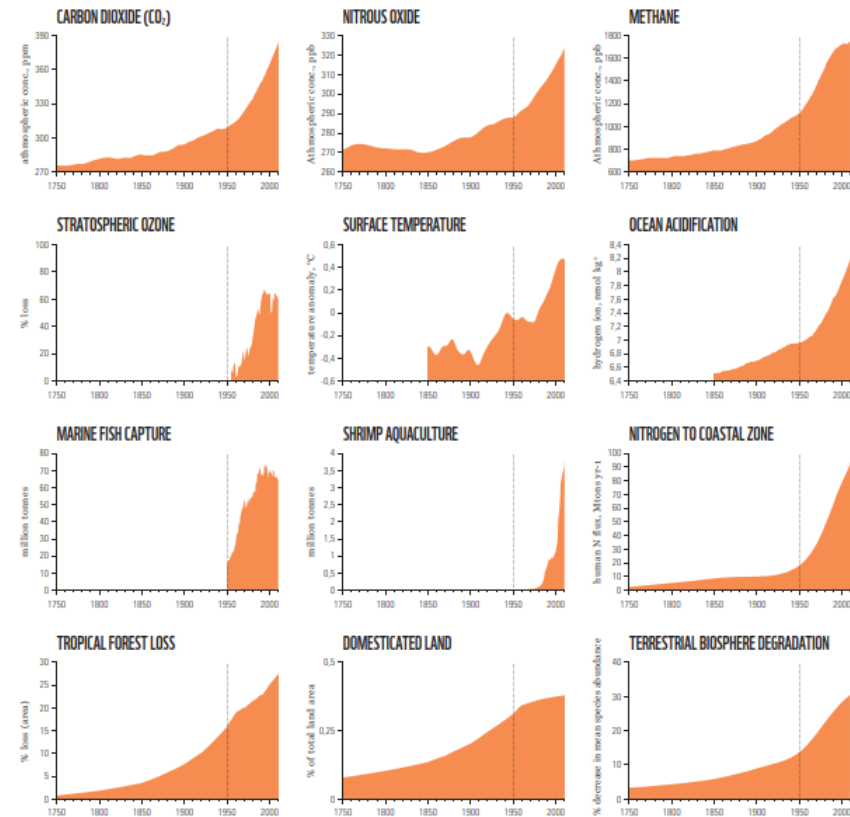


# Effective scaling-up of SLM practices

## SOCIO-ECONOMIC TRENDS

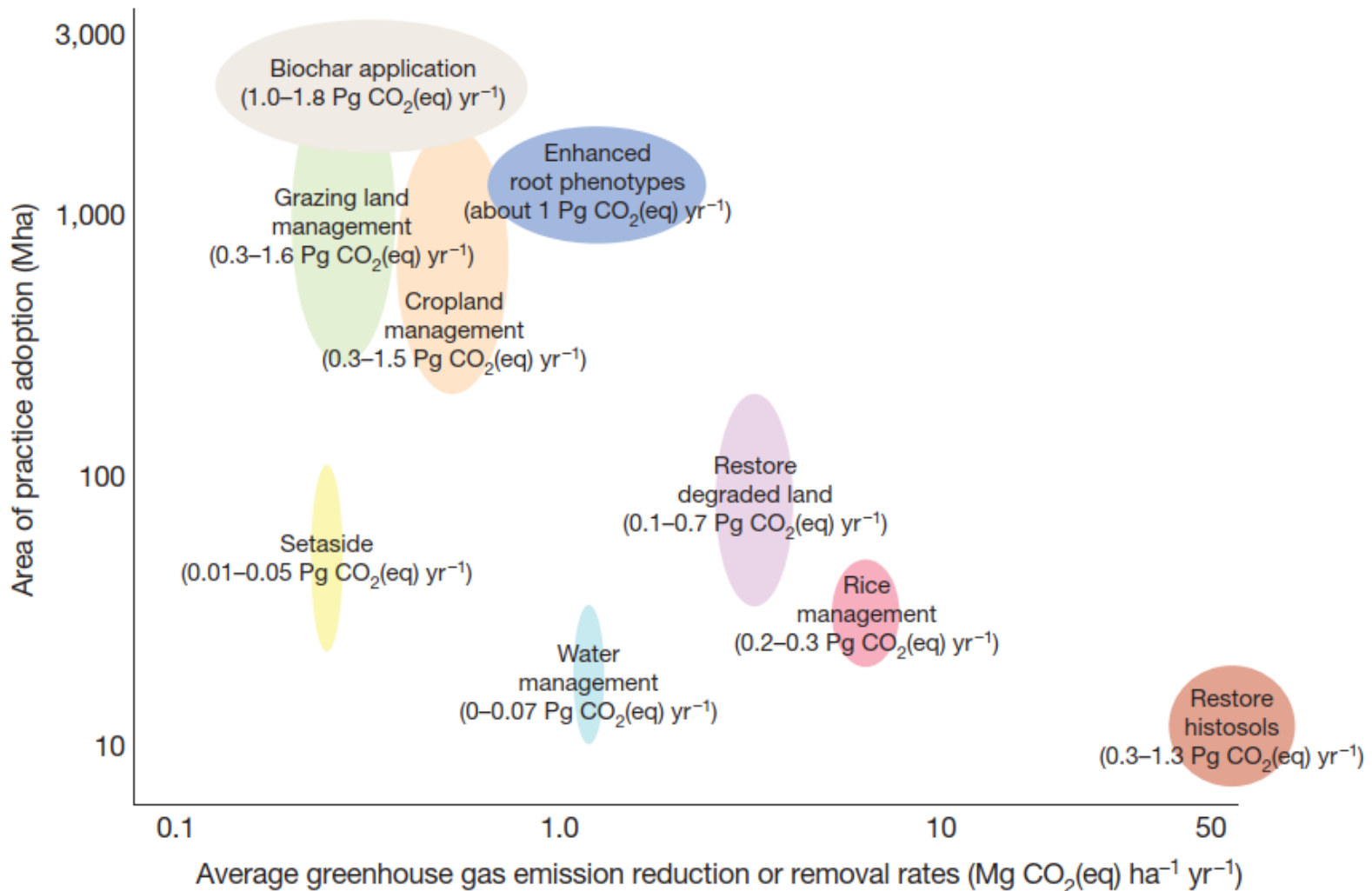


## EARTH SYSTEM TRENDS

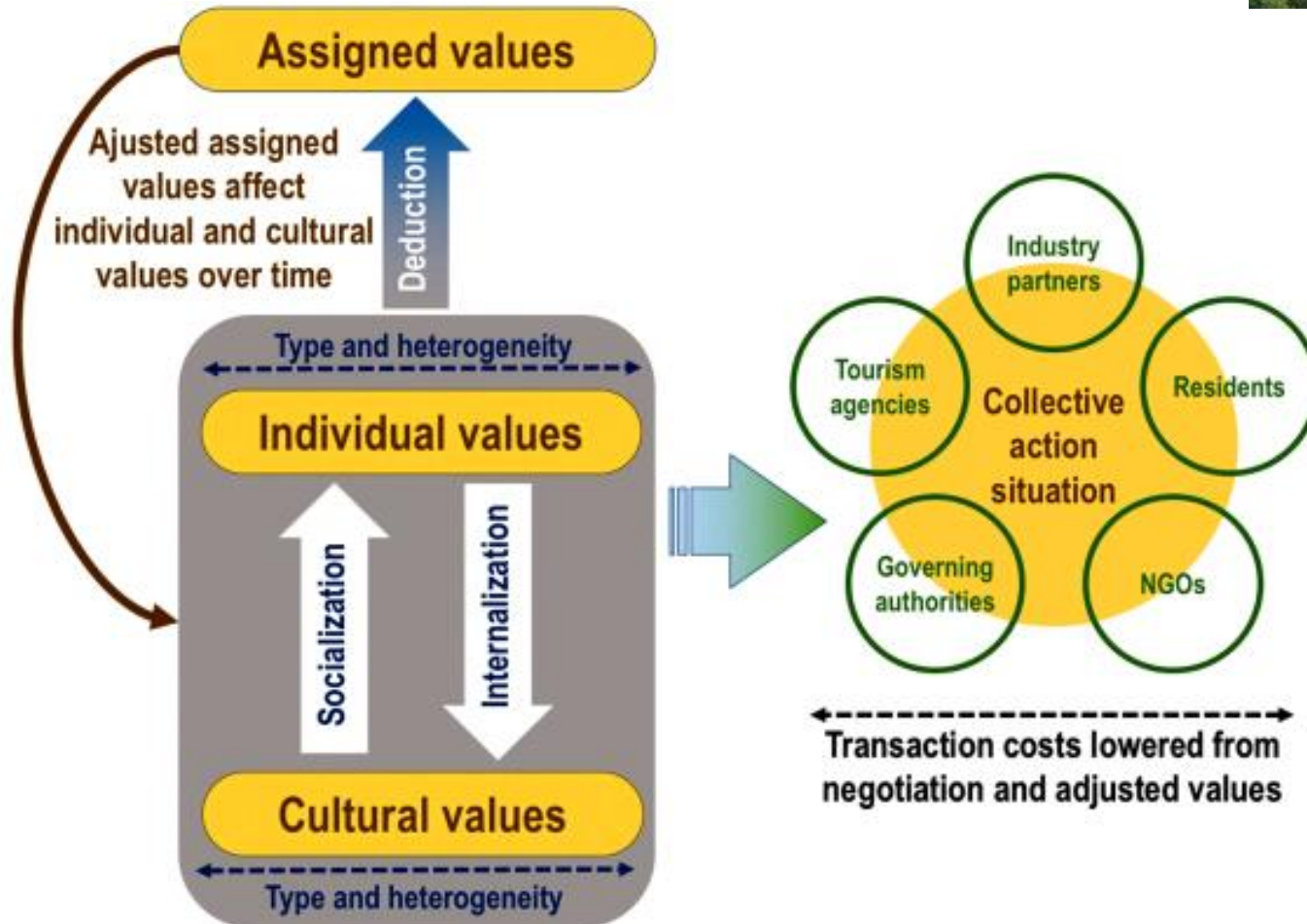




# Soil restoration



# Understanding the role of values







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## Thank you



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