

A Landscape-Based Protocol for Measuring Biodiversity Net Gain in the Atlantic Forest

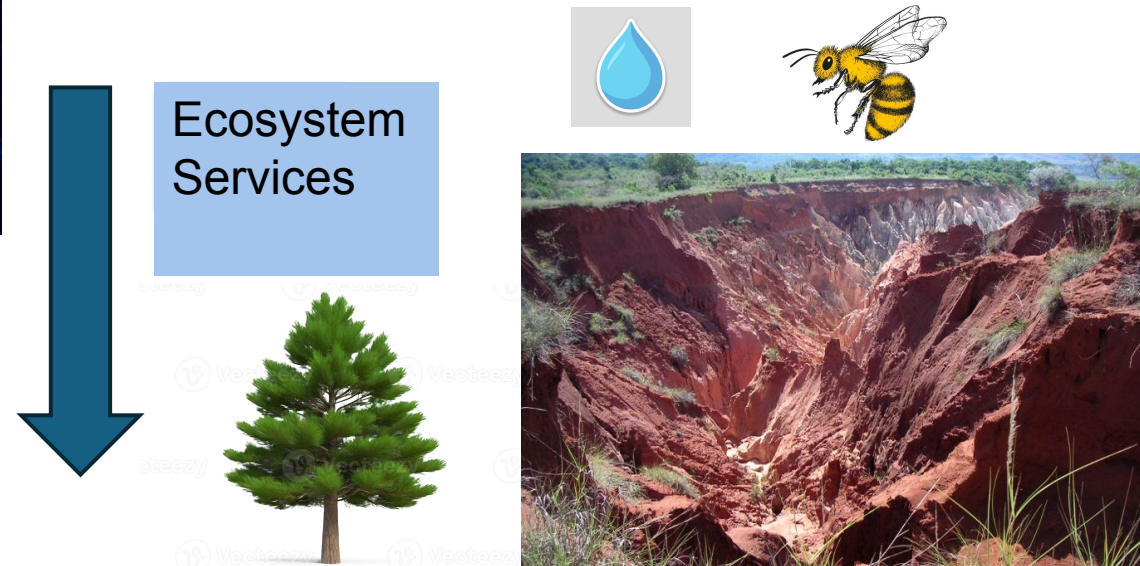
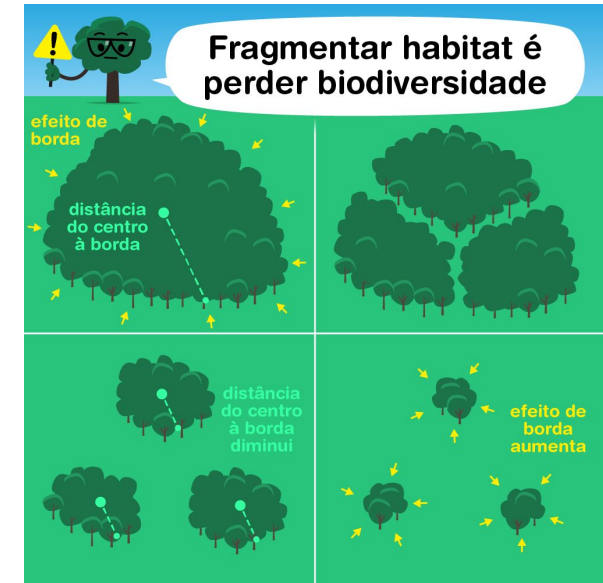


Maria Jose Brito Zakia (UNESP);
Natalia Guerin, Biophilium Environmental consultancy;
Gabriel Fratta Fritz (UNESP);
Gisele Gomes da Silva, Ministry of Agrarian
Development;
Iraê Amaral Guerrini, (UNESP);
Harrison Pereira, Guara environmental;
Ana Cristina André, Klabin S/A



July 3rd, 2025
Porto Seguro

Context



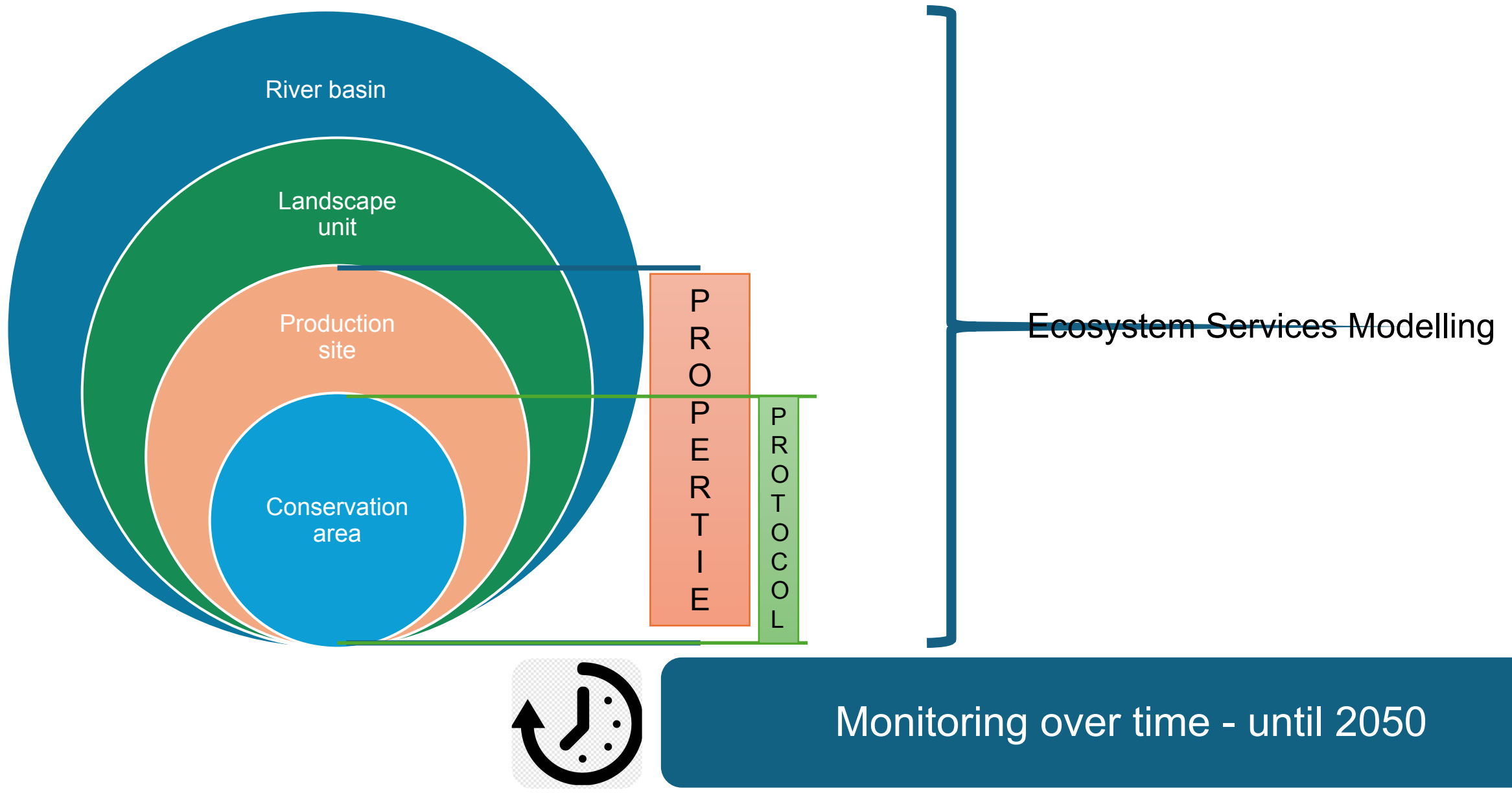
Context and objective



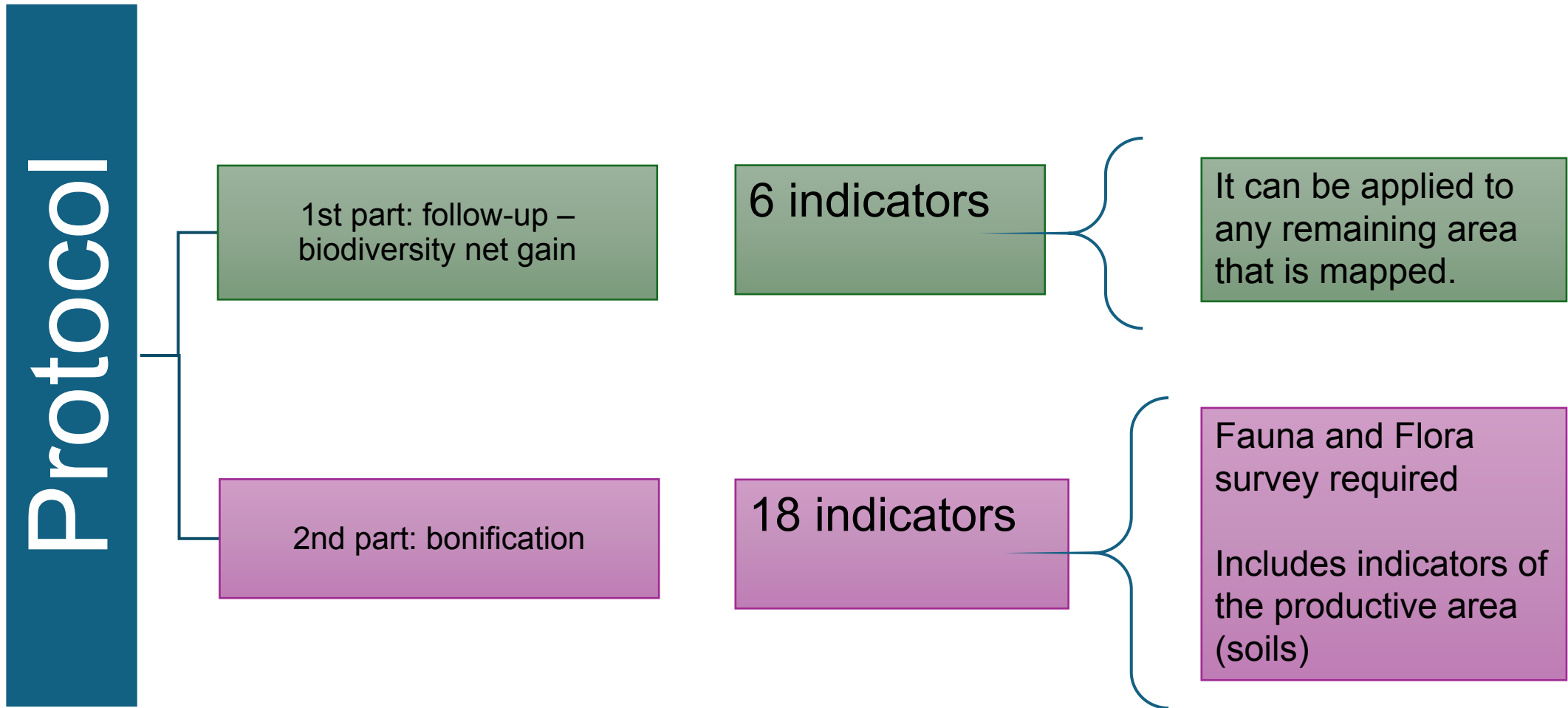
Objectives

- Analyze the property's contribution to biodiversity and the maintenance of some ecosystem services;
- Classify habitats according to their structure and quality;
- Calculate compensations for biodiversity management.

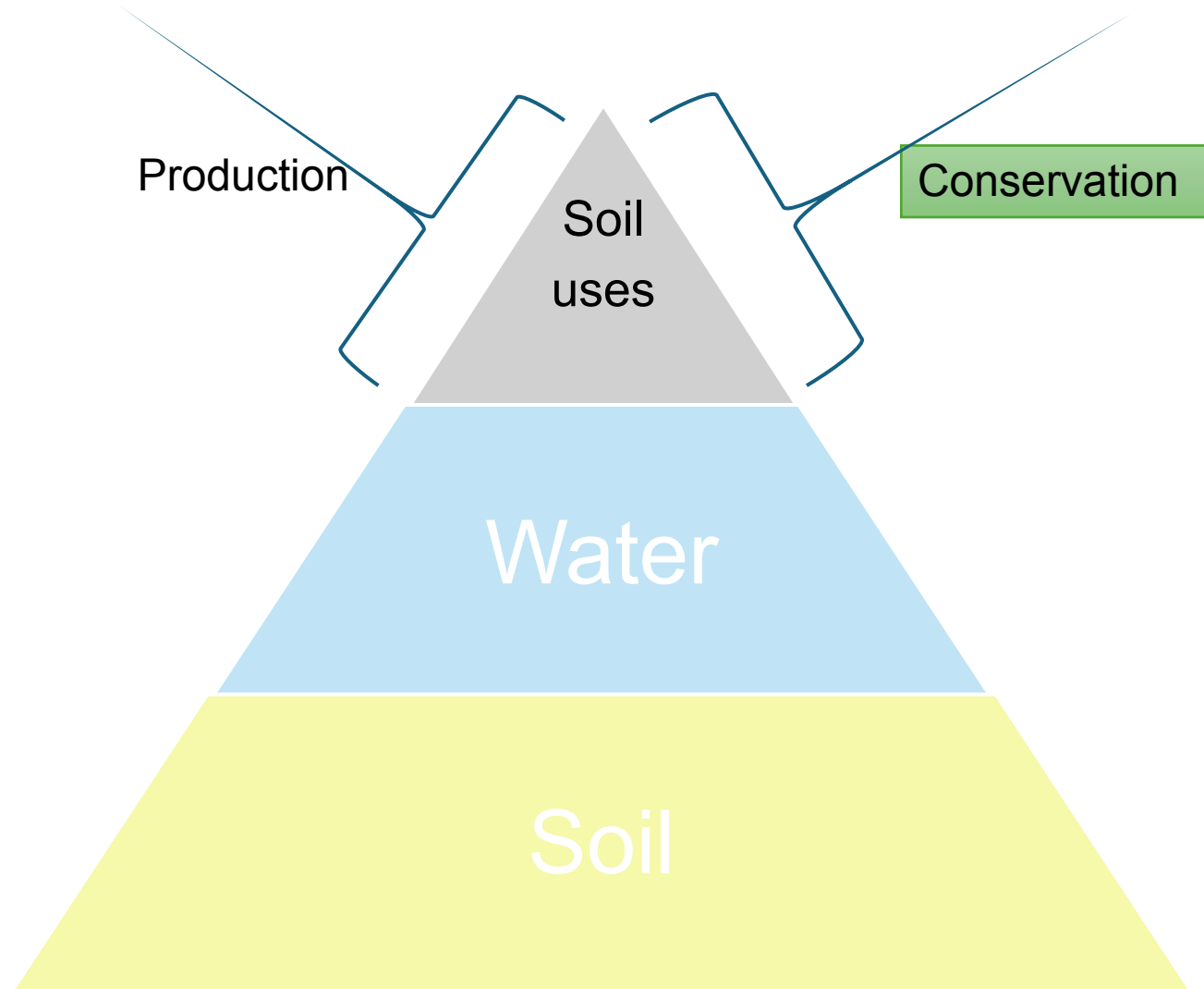
Methodology



Methods



Methods



Methods

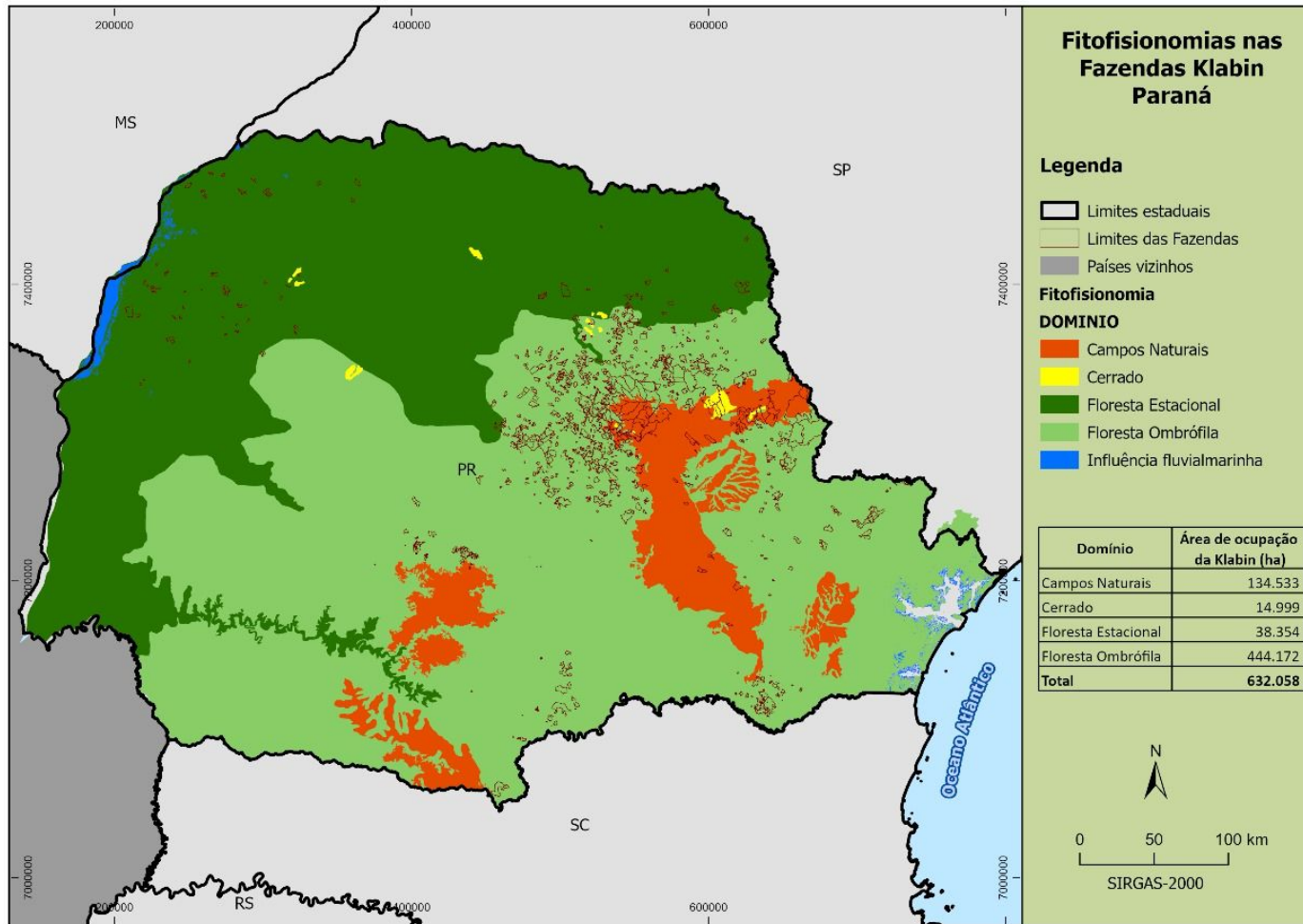
Order	Ecosystem attribute	Indicator	Metrics	Associated Services	Score Limits			
					1	2	3	4
1	Habitat quality	Area designated for the conservation of native vegetation on the property	% of native vegetation on the property	Habitat and nursery maintenance	< 10%	10,1 - 20%	20,1 - 35%	> 35,1 %
2	Habitat quality	Successional Stage of areas designated for conservation	Internship characterization	Habitat and nursery maintenance	Initial stage	Medium stage	Advanced stage	Primitive
3	Habitat quality	Fragment size	Total area of the fragment (ha)	Habitat and nursery maintenance	<50 ha	50,1 - 100 ha	100,1 ha - 500 ha	>500 ha
	Habitat quality	Fragment form	Shape Index	Habitat and nursery maintenance				
	Habitat quality	Environmental heterogeneity	Number of phytophysiognomies	Habitat and nursery maintenance	1	2 - 3	>3	NA
6	Habitat quality/matter cycles and energy flows	Presence of water	Drainage density (km/km ²)	Water provision; Habitat and nursery maintenance	≤ 0,5	0,51 - 2,0	>2,01	NA

Methods

Habitat quality	
Indicator name	Fragment size
Metric	Total area of each fragment (ha)
Interpretation and use	“Bigger is better” principle (MacArthur & Wilson, 1967; Margules et al., 1982; Noss & Csuti, 1997). Larger areas have a greater chance of maintaining large populations of species.
Methodology of calculation	Geoprocessing
Assessment Frequency	At each renewal of the valuation (if necessary)
Data source	Aerial imagery (UAVs), satellite imagery, or official state or federal mapping (state inventories, MapBiomas, for example)
Responsibility of assessment	Owner/Responsible for the area
Score criteria	
Class	Score
< 50 ha	1
50,1 a 100 ha	2
100,1 a 500 ha	3
> 500 ha	4

Habitat quality	
Indicator name	Environmental heterogeneity
Metric	Number of phytophysiognomies
Interpretation and use	Different vegetation physiognomies contain partially or totally distinct flora. Thus, greater diversity of physiognomies results in more species, a greater supply of habitat and more diverse food for fauna (DURIGAN et al. 2009).
Methodology of calculation	Identify the number of natural physiognomies present in the fragment.
Assessment Frequency	At each renewal of the valuation (if necessary)
Data source	Official vegetation mapping (state inventory), or published data (studies and technical reports)
Responsibility of assessment	Owner/Responsible for the area
Score criteria	
Class	Score
1	1
2 a 3	2
>3	3

Methods



It was applied in 4,253 remanentes of native vegetation in Paraná

245.000 ha of native vegetation

890 rural properties

Results

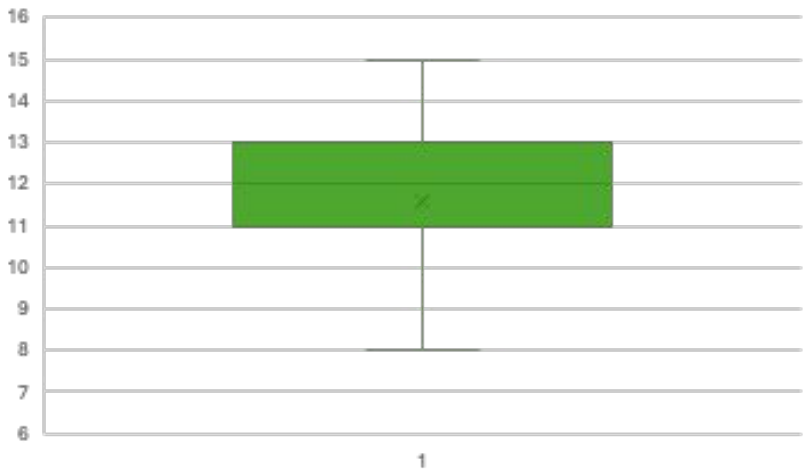
Baseline for monitoring of biodiversity net gain

Pontuação	% do total possível	Área (ha)	Numero de remanescentes
8	42%	1383,3	63
9	47%	7487,5	252
10	53%	25239,4	467
11	58%	80044,1	1131
12	63%	85261,8	1253
13	68%	36737,8	1005
14	74%	7832,6	78
15	79%	1433,3	4
Total Geral	61%	245.419,83	4253

Results

Habitats classification

Types of habitat (IFC, 2019)			
Criteria	Modified	Natural	Critic
Definition	Areas that have been altered by human activity but still maintain some relationship with the original ecosystem	Areas formed by viable associations of plant and/or animal species of predominantly native origin, with preserved primary ecological functions	Subset of natural and modified habitats considered to be of high biodiversity value, essential for threatened species or important ecological processes
Conservation State	Altered by human activities, but with recognizable ecological elements	Preserved, little or no human impact	Habitats of Critically Endangered Species, Unique Ecosystems, Areas of Concentration of Migratory Species
Application in Protocol	All remnants with score <=11	Remnants with score > 11 e < 16	Remnants with score >= 16 or that are monitored



Habitat Classification	Area (ha)
Critic	34.425,48
Modified	54.104,46
Natural	156.889,89
General Total	245.419,83

Discussion

Pilot project in the state of Paraná

Monitor and evaluate biodiversity gain and loss

Criteria for biodiversity compensation (equivalent hectares)

Use of public data as a data base (SICAR or
MAPBIOMAS)

Conclusion s

Bridges critical gaps between ecological theory and conservation practice

Conservation accounting possibilities

Thank
you!

gabriel.fratta@unesp.br

