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PRIORITIZING AREAS FOR FOREST RESTORATION IN SÃO PAULO STATE:

DEGRADATION, CONNECTIVITY AND DECISION-MAKING

Nathália Nascimento and Daniel Ferreira

University of São Paulo

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INTRODUCTION

CONTEXT

Forest restoration in Brazil faces major **barriers,** requiring strategic action.

IMPORTANCE

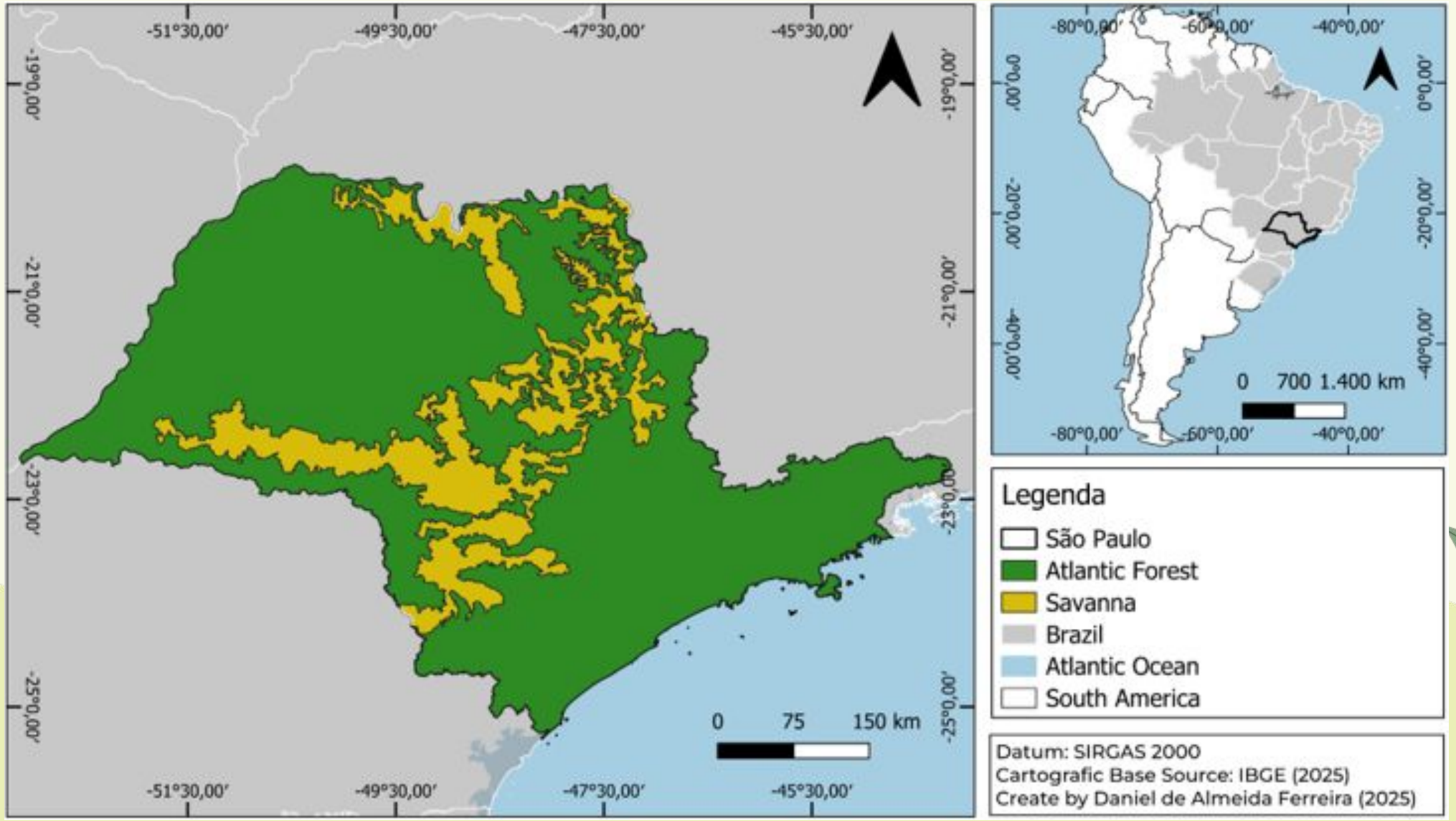
Targeted restoration can enhance connectivity, promote regeneration, and **increase policy impact**.

INTRODUCTION

OBJECTIVE

Identify forest areas in the state of São Paulo that **exhibit some level of degradation or are affected by multiple degradation drivers** such as edge effects, isolation, and fire.

Figure 1 - Map showing the original Atlantic Forest area in the state of São Paulo.



METHODS

STUDY AREA

DATA BASE

Remnants of the Atlantic Forest in the State of São Paulo:

Only **5%** of forest cover remains;

Approximately **2.5%** of remnants show signs of degradation with severe isolation, > 10 km between some fragments.

METHODS

STUDY AREA

DATA BASE

MAPBIOMAS — forest fragment size, edge, isolation, and fire occurrence.

IMAFLORA — private property limits.

Integrated into a **multi-criteria assessment approach** involves environmental indicators, connectivity analysis, and land ownership data.

Reference: Souza et al., 2020.

METHODS

The sum of each weight in the classification results in the **Total Degradation Index**.

Figure 2 - Degradation Index. That classification was created to estimate the impact of each format of degradation vectors.

	Degradation vector	Description	Classes	Unit	Year of data	Weight
Fragmentation	Edge area	area of native vegetation affected by contact with anthropic areas	<= 30	m	2021	6
			<= 60		2021	5
			<= 90		2021	4
			<=120		2021	3
			<=150		2021	2
			<=300		2021	1
	Fragment size	area of a fragment of native vegetation in the landscape	<= 3	ha	2021	6
			<= 5		2021	5
			<= 10		2021	4
			<= 25		2021	3
			<= 50		2021	2
			<= 75		2021	1
			>75		2021	0
	Isolation	relationship between the distance between source fragments of native vegetation and target fragments	25ha, 5km, 100ha	ha, km	2021	1
			25ha, 10km, 100ha		2021	2
Fire	Fire frequency	number of times the area was burned during the period (1985 a 2023)	0	Frequency	2019 - 2023	1
			1		2019 - 2023	2
			2		2019 - 2023	3
			3		2019 - 2023	4
			4		2019 - 2023	5

KEY RESULTS

They have an **area more representative** than smallholdings.

Although they don't have an obligation to reforest, restoration represents an opportunity to supplement financial income.

1		287,949 ha
2		87,455 ha
3		125,916 ha
4		3,224 ha

Figure 3 - Visualization of different degradation levels in small private properties of São Paulo.

KEY RESULTS

They have significant areas considered in a **low level of degradation.**

1		92,558 ha
2		17,571 ha
3		38,148 ha
4		1,201 ha

Figure 4 - Visualization of different degradation levels in smallholdings of São Paulo.

KEY RESULTS

They represent a **key spot** to decrease the fragmentation level.

1		390,064 ha
2		145,643 ha
3		162,378 ha
4		2,742 ha

Figure 5 - Visualization of different degradation levels average private properties of São Paulo.

KEY RESULTS

They represent the larger areas of forest fragments and those with the **best connectivity**.

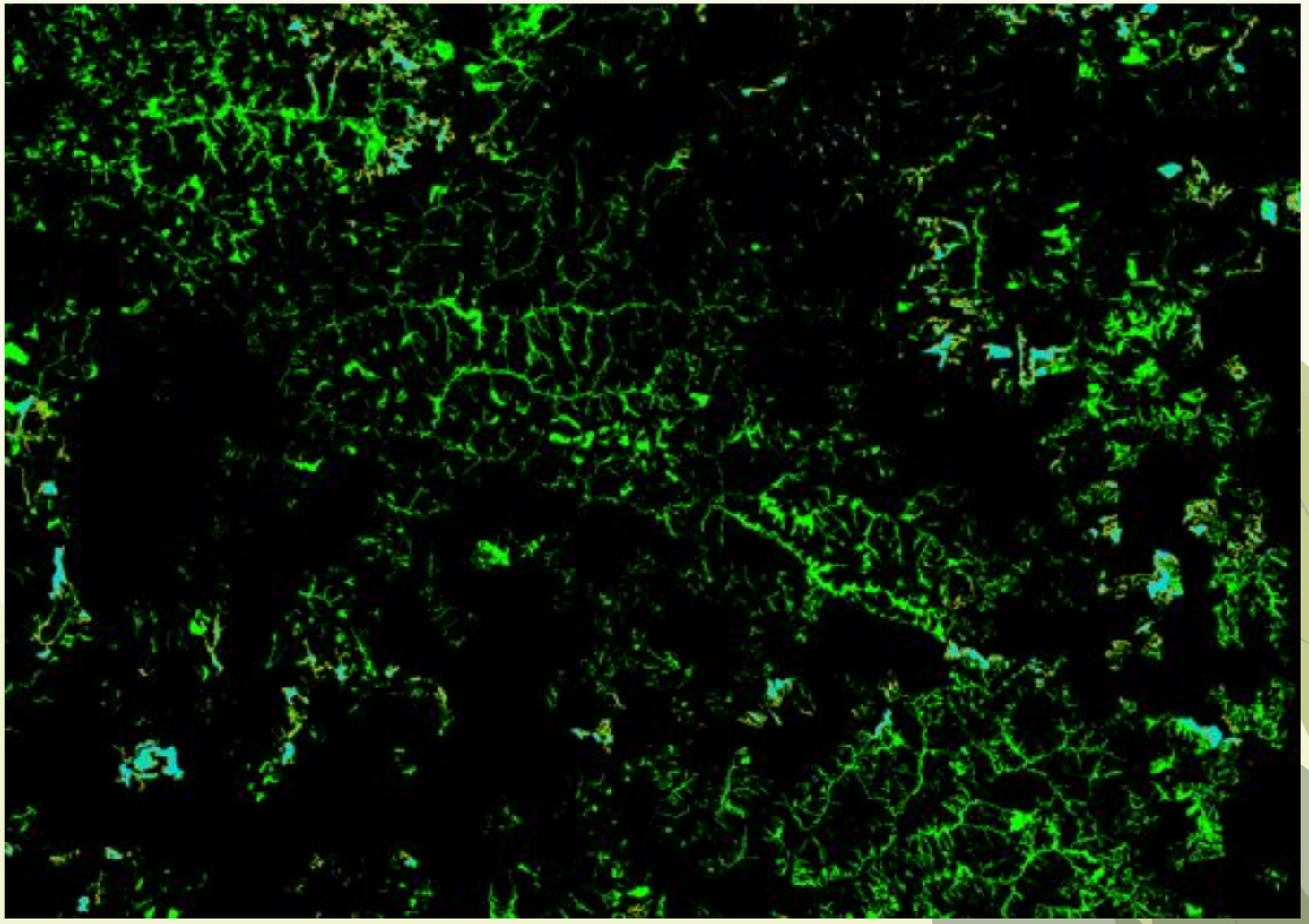
1		895,715 ha
2		423,259 ha
3		320,490 ha
4		2,375 ha

Figure 6 - Visualization of different degradation levels big private properties of São Paulo.

KEY RESULTS

However, this is related to the requirements of **Law No. 12,651/2012** to restore riparian forest areas or sloping areas.

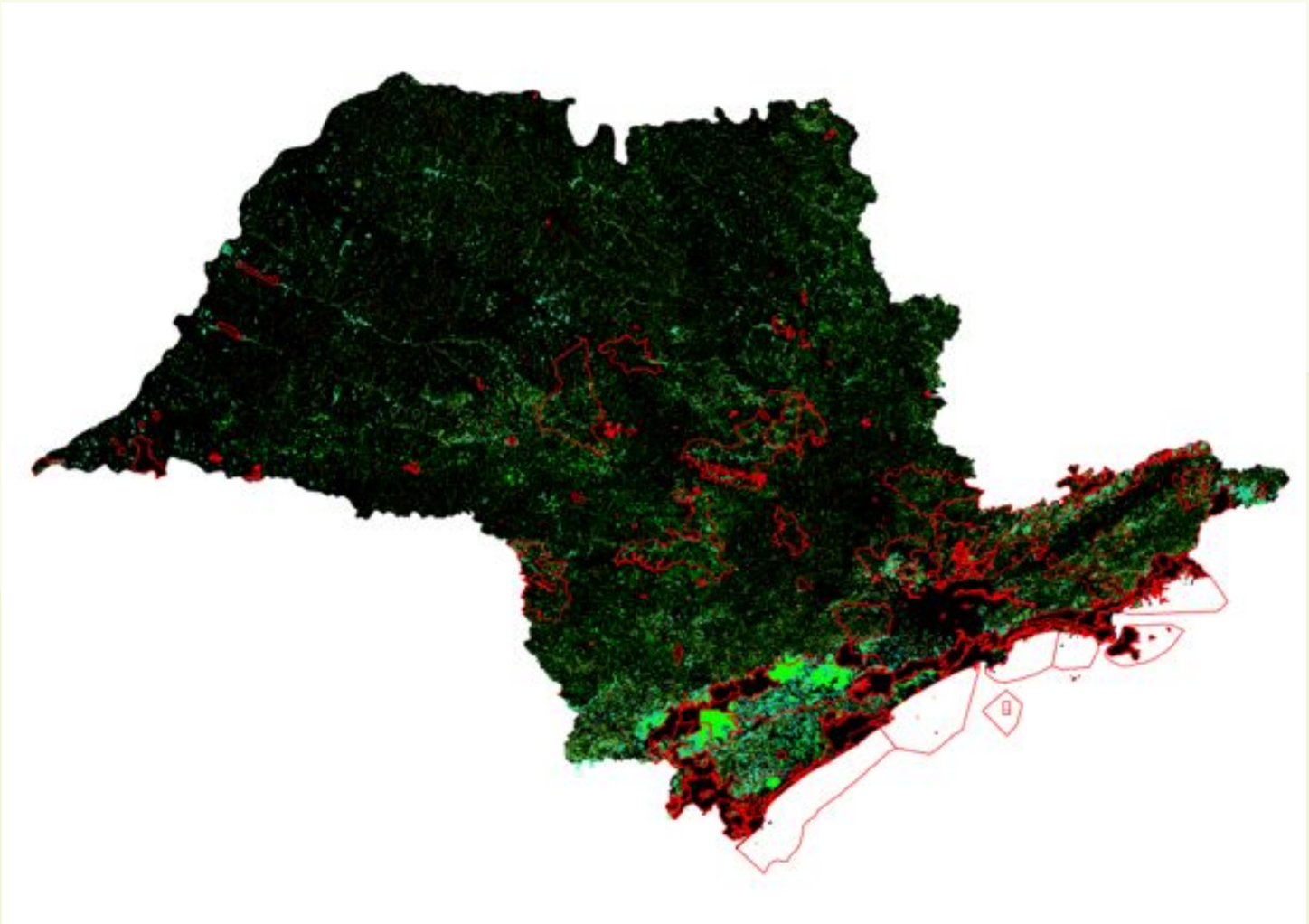
Figure 7 - The relation between fragmentation in different types of private properties and conservation units in São Paulo.



KEY RESULTS

The outcomes indicate that fragments close to or within conservation units are **less degraded and/or more connected.**

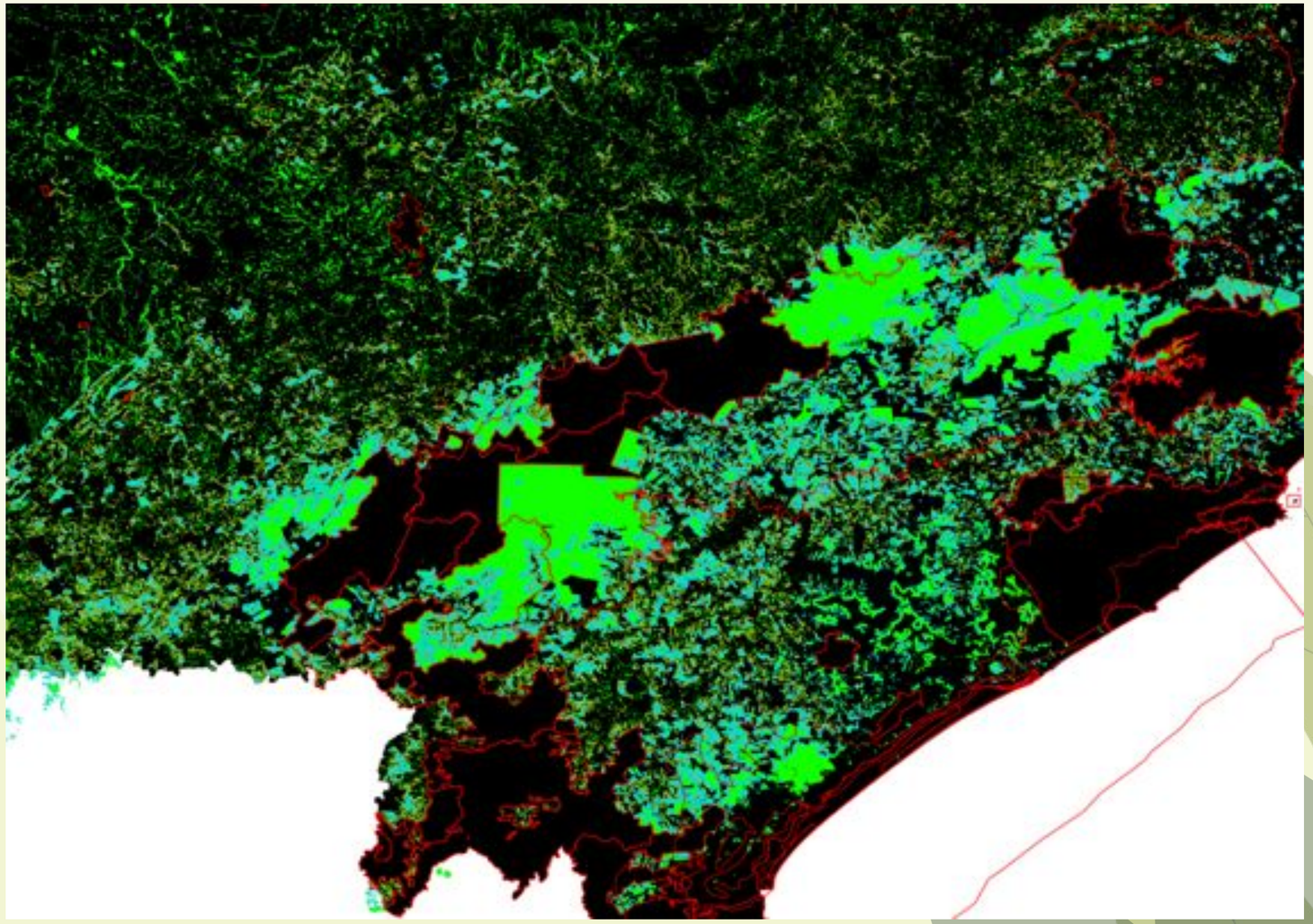
Figure 8 - The relation between fragmentation in different types of private properties and conservation units in São Paulo.



KEY RESULTS

This is particularly evident in the Serra do Mar region, an area of the state of São Paulo that has the largest and most important conservation units in the state.

Figure 9 - The relation between fragmentation in different types of private properties and conservation units in São Paulo.

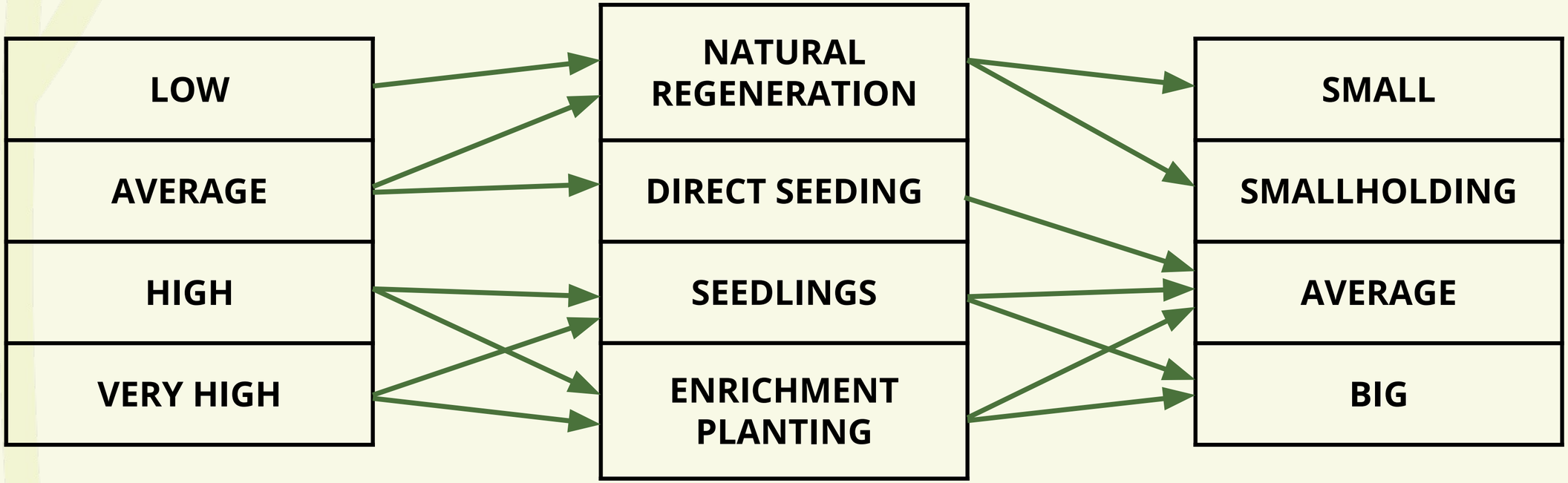


DISCUSSION

Degradation Level

Restoration Technique

Private Property



Reference: Nascimento and Brancalion, 2024.

ACKNOWLEDGMENTS

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THANK YOU!

Do you have any questions?

Nathália Nascimento
Author
nnascimentol@usp.br
+55 (12) 98806-0677

Daniel Ferreira
Presenter
ddferreira@usp.br
+55 (75) 98235-1624

REFERENCES

Souza, C.M., Z. Shimbo, J., Rosa, M.R., Parente, L.L., A. Alencar, A., Rudorff, B.F.T., Hasenack, H., Matsumoto, M., G. Ferreira, L., Souza-Filho, P.W.M., De Oliveira, S.W., Rocha, W.F., Fonseca, A.V., Marques, C.B., Diniz, C.G., Costa, D., Monteiro, D., Rosa, E.R., Vélez-Martin, E., Weber, E.J., Lenti, F.E.B., Paternost, F.F., Pareyn, F.G.C., Siqueira, J.V., Viera, J.L., Neto, L.C.F., Saraiva, M.M., Sales, M.H., Salgado, M.P.G., Vasconcelos, R., Galano, S., Mesquita, V.V., Azevedo, T., 2020. Reconstructing Three Decades of Land Use and Land Cover Changes in Brazilian Biomes with Landsat Archive and Earth Engine. Remote Sens. 12, 2735. https://doi.org/10.3390/rs12172735

Nascimento, N.; Brancalion, P. Bioeconomia e Restauração Florestal na Amazônia. Marcovich, J.; Val, Adalberto (Org.). Bioeconomia para quem?: bases para um desenvolvimento sustentável na Amazônia. São Paulo: Com arte, 2024. p. 265-302.