Evaluating Ecological Recovery and Stakeholder Perceptions in Crete

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Introduction

REACT4MED supports sustainable land & water management and implements large-scale land degradation restoration actions in 8 Pilot Areas (PAs) across the Mediterranean. The PA of Heraklion (Fig. 1) suffers from land degradation.

driven primarily by overgrazing and exacerbated by the local economy's reliance on water-intensive agriculture. During 2000-06, the CAP "Forestation" program paid farmers to plant forest tree species in agricultural land while excluding livestock until tree maturation (Fig. 2).

However, the effectiveness and social acceptance of these actions is rarely assessed. For this reason, an ecosystem restoration living lab involving over 80 stakeholders identified priority ecosystems functions and indicators. They also described barriers for upscaling sustainable practices and sustainable agriculture, rural revitalization, and cooperation as their main priorities for the future.
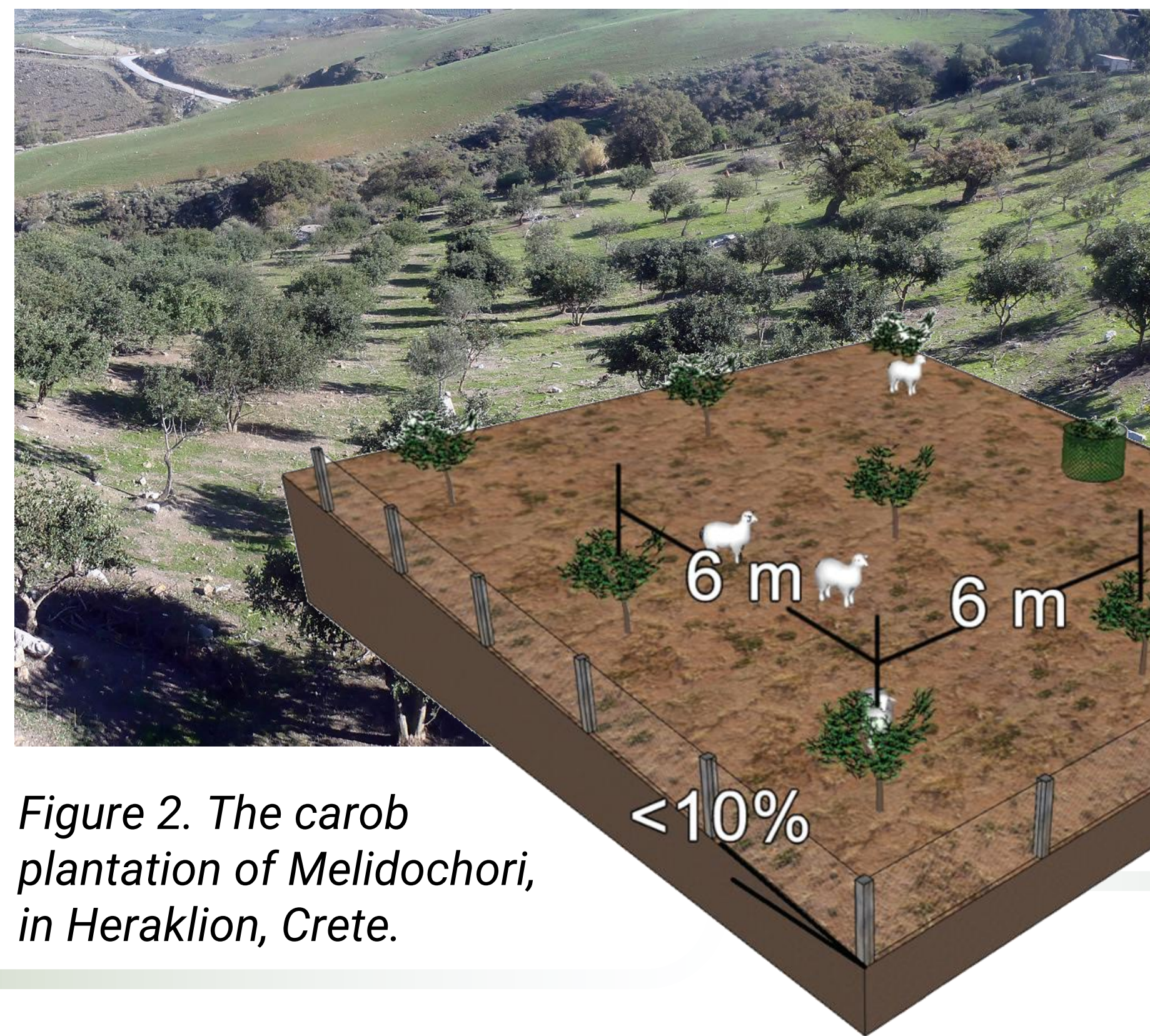

Figure 1. Heraklion, Crete, Greece Pilot Area.

Figure 2. The carob plantation of Melidochori, in Heraklion, Crete.

Figure 3. Heraklion Ecosystem Restoration Living Lab workshop.

Methodology

Based on stakeholder valued functions and indicators we compared the restoration progress in "Forestated", "Fenced", and "Open" fields (Fig. 4).
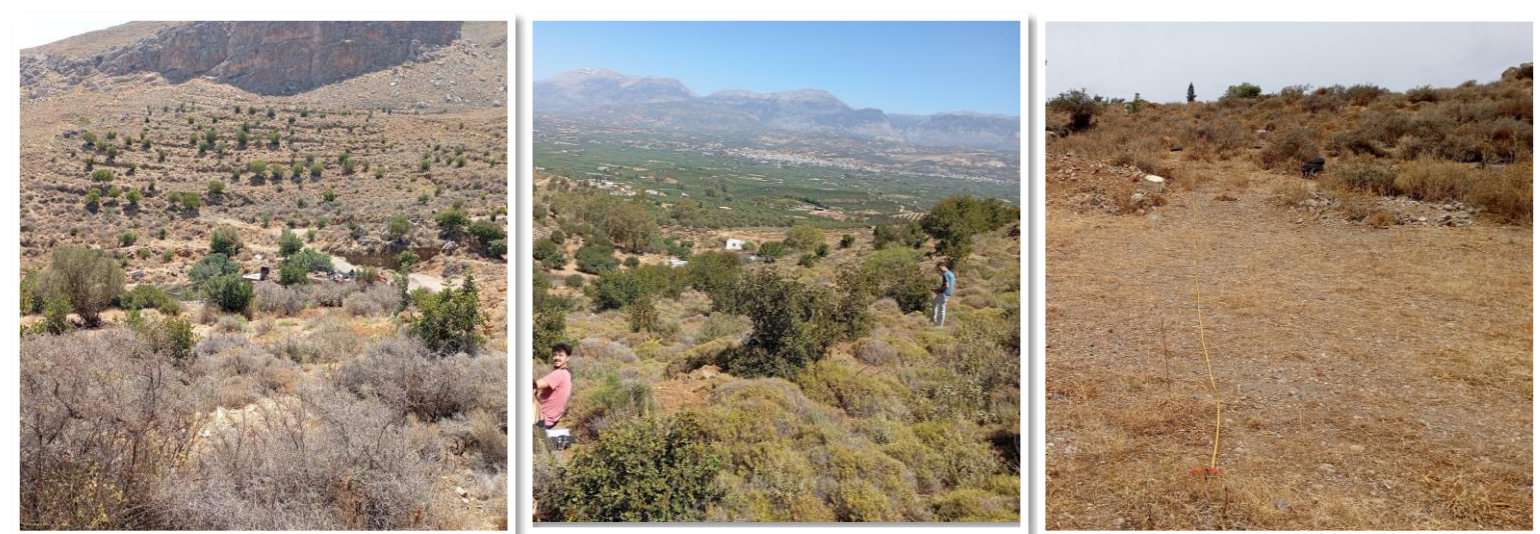

Fig. 4: Field Examples

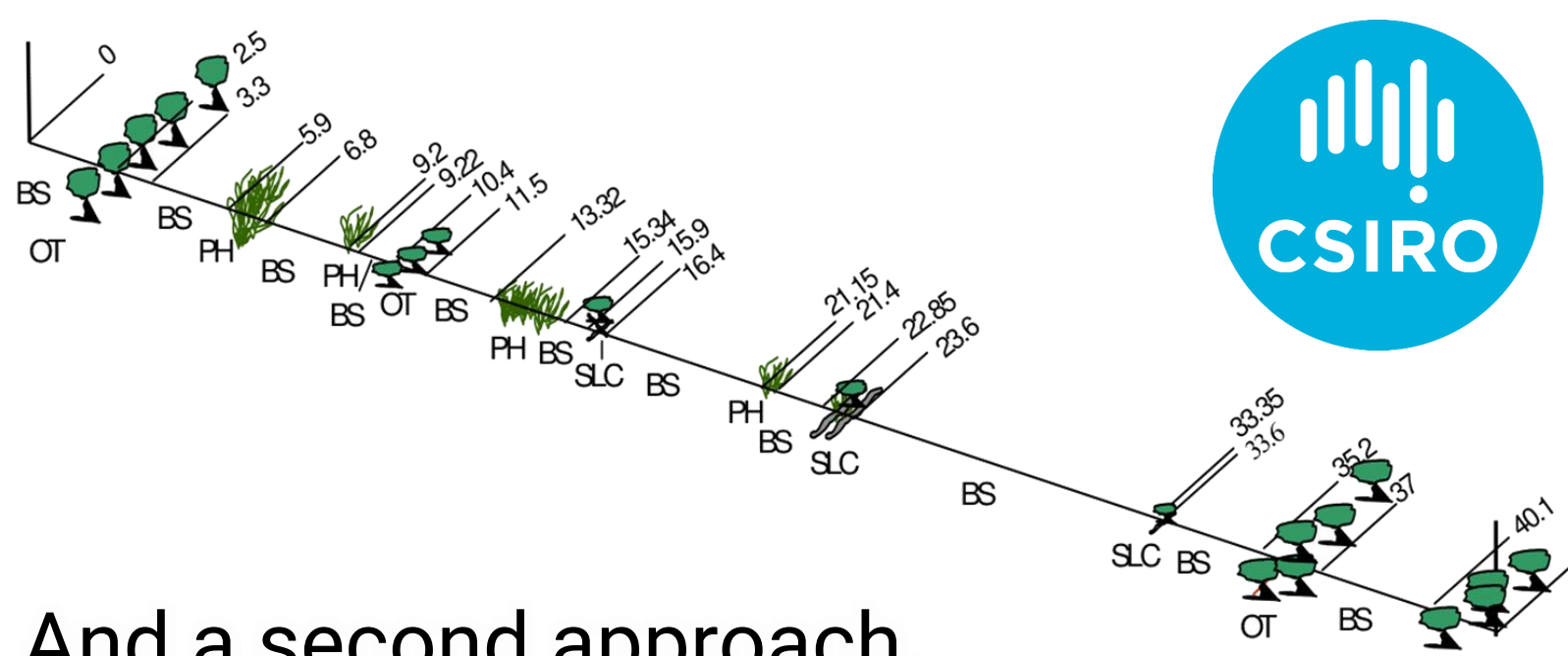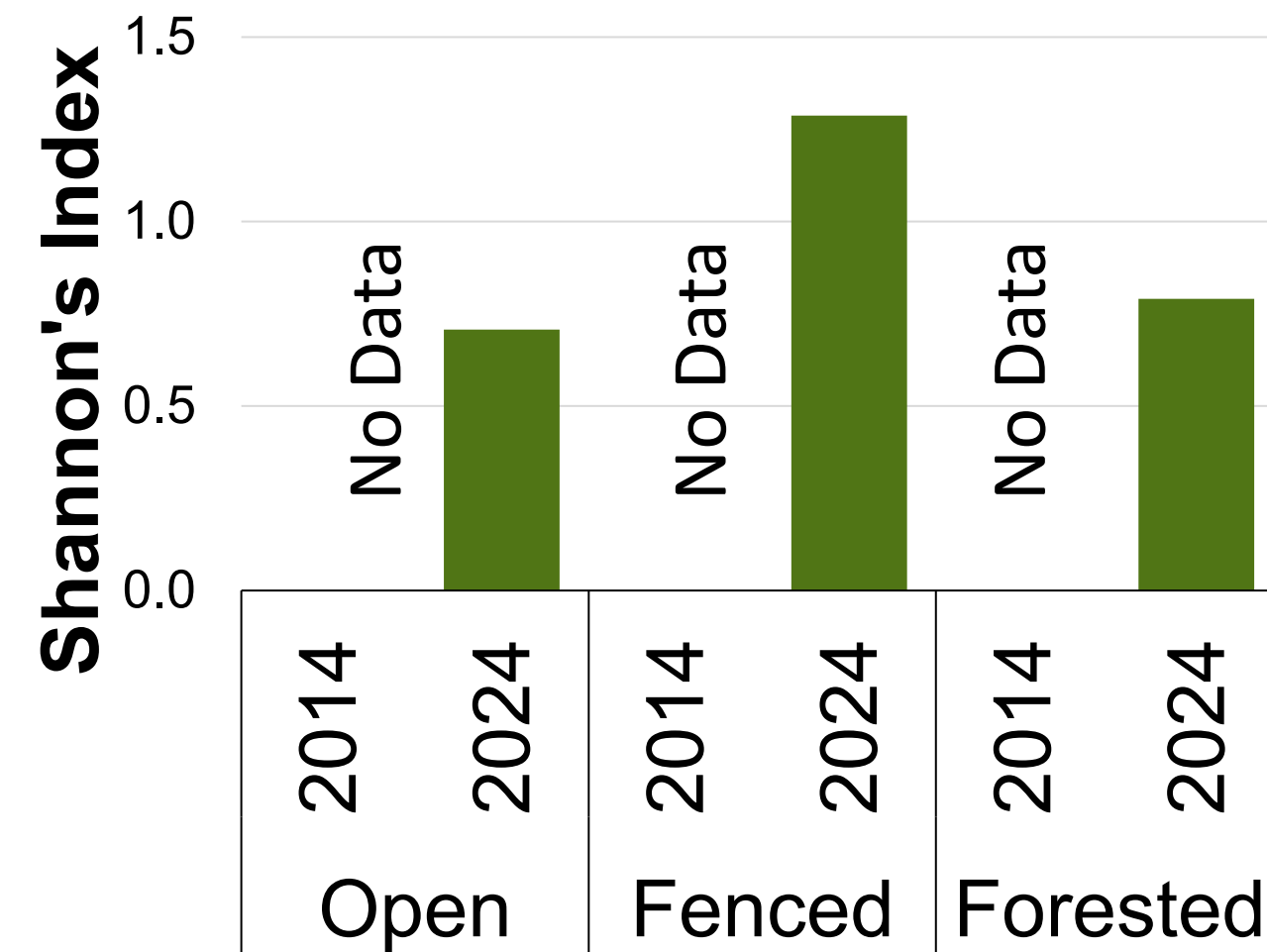The first approach involved the wandering quarter method alongside Landscape Function Analysis (LFA))

And a second approach, remote sensing (Normalised Difference Vegetation Index (NDVI) from Landsat 4-9 and Sentinel-2 imagery).

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

Finally, the REACT4MED Land degradation Decision-Support Toolbox (LanDS) was used to determine suitable areas for upscaling.

Conclusions

For a more complete understanding of recovery, other indicators like carbon stock and biodiversity could be included. Our approach highlights how restoration actions require coupling ecological measures with social engagement and that scaling forestation offers a pathway toward resilient landscapes and rural revitalization. For more information contact glouloudakis@hmu.gr.

Fig. 5: LFA Stability index

Fig. 6: Shannon diversity index

Fig. 7: Biomass production

Fig. 8: LanDS suitability map

Results
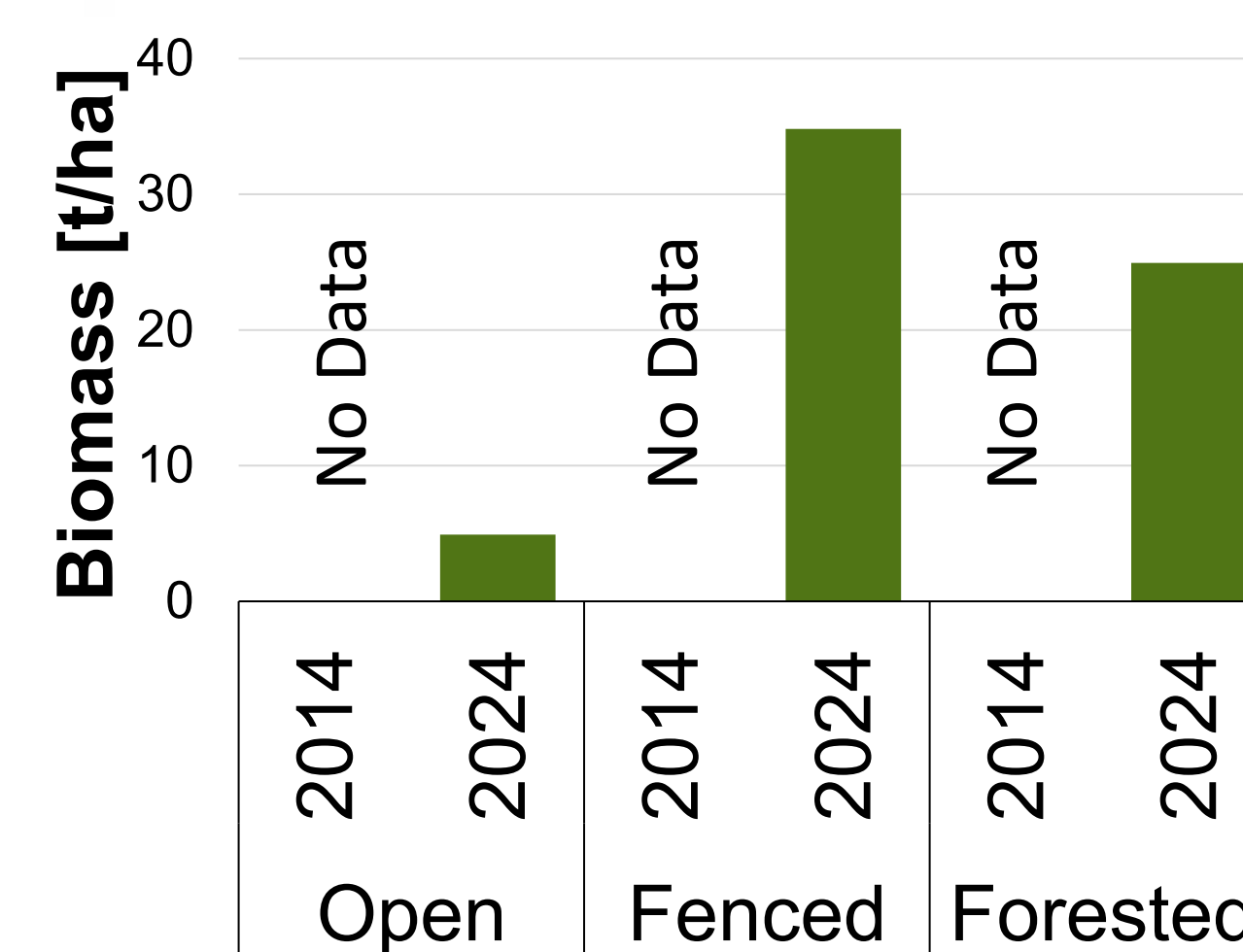
LFA measurements showed that "Forested" plots had significantly better soil stability (67.7%, Fig.5), though no major differences were found for infiltration or nutrient cycling (not shown here). Fenced sites scored 1.28 versus 0.7 for the "Open" and 0.8 for the Forested on the Shannon diversity index (Fig. 7) while also showed 40% biomass production (Fig. 6) more than the "Forested" and X7 more compared to the "Open" plots.

On the other hand, cumulative NDVI (Fig. 9) values show a break point from the business as usual, in the beginning of 2005 for the fenced plots, as well as for the "Forested" plots, 3 years after the ecosystem restoration actions were implemented with the "Forested" plots exhibiting a faster recovery.

Using LanDS (Fig. 8) we assess that similar this type of afforestation action can be successfully applied in over 300 km² (or over 11%) of the Prefecture of Heraklion.
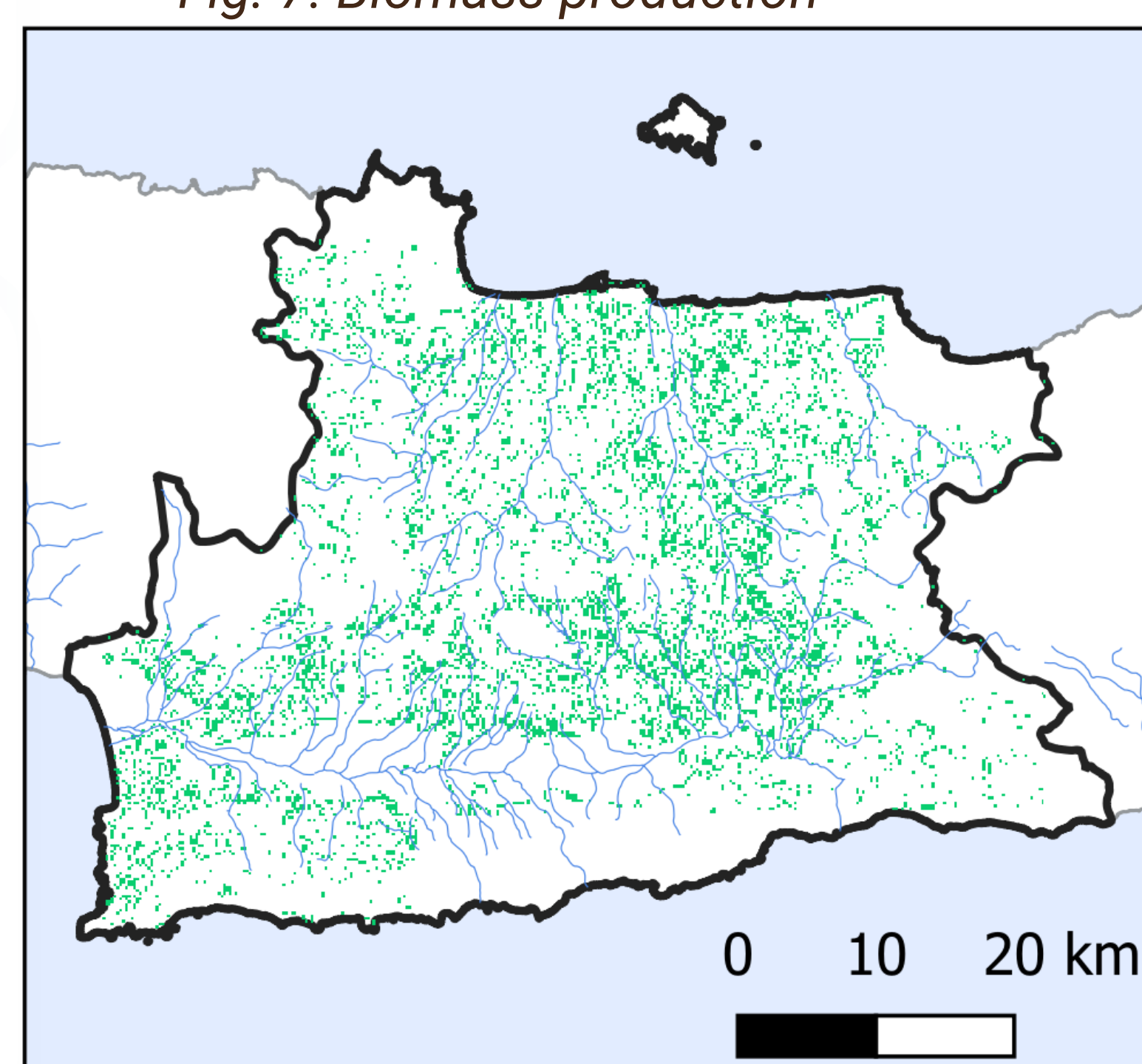

Before: y = -0.62 + 1.07x
R² = 0.9996
After: y = -6.79 + 1.17x
R² = 0.9999
2005-03

Before: y = 0.38 + 1.1x
R² = 0.9997
After: y = -14.29 + 1.32x
R² = 0.9996
2005-03
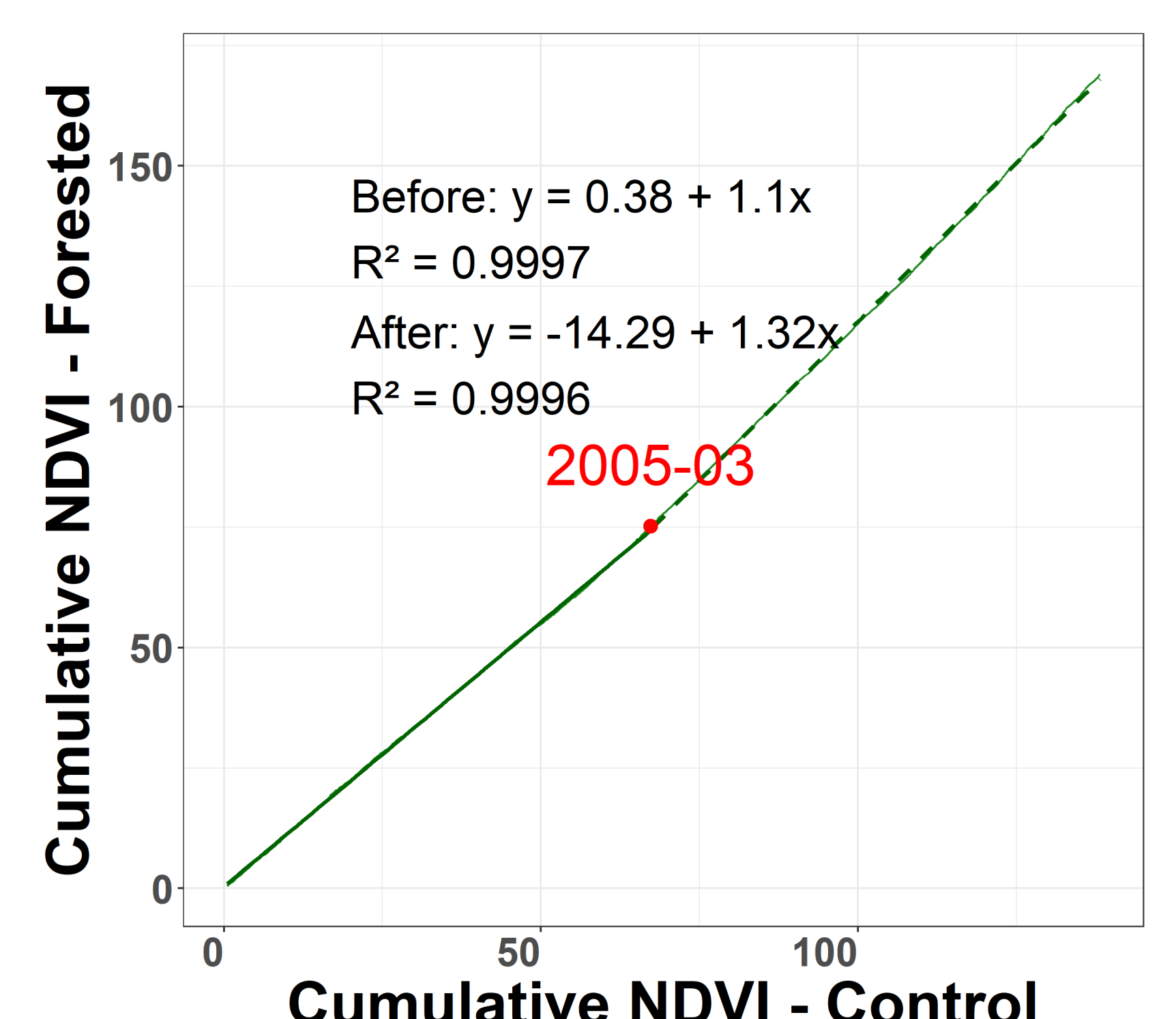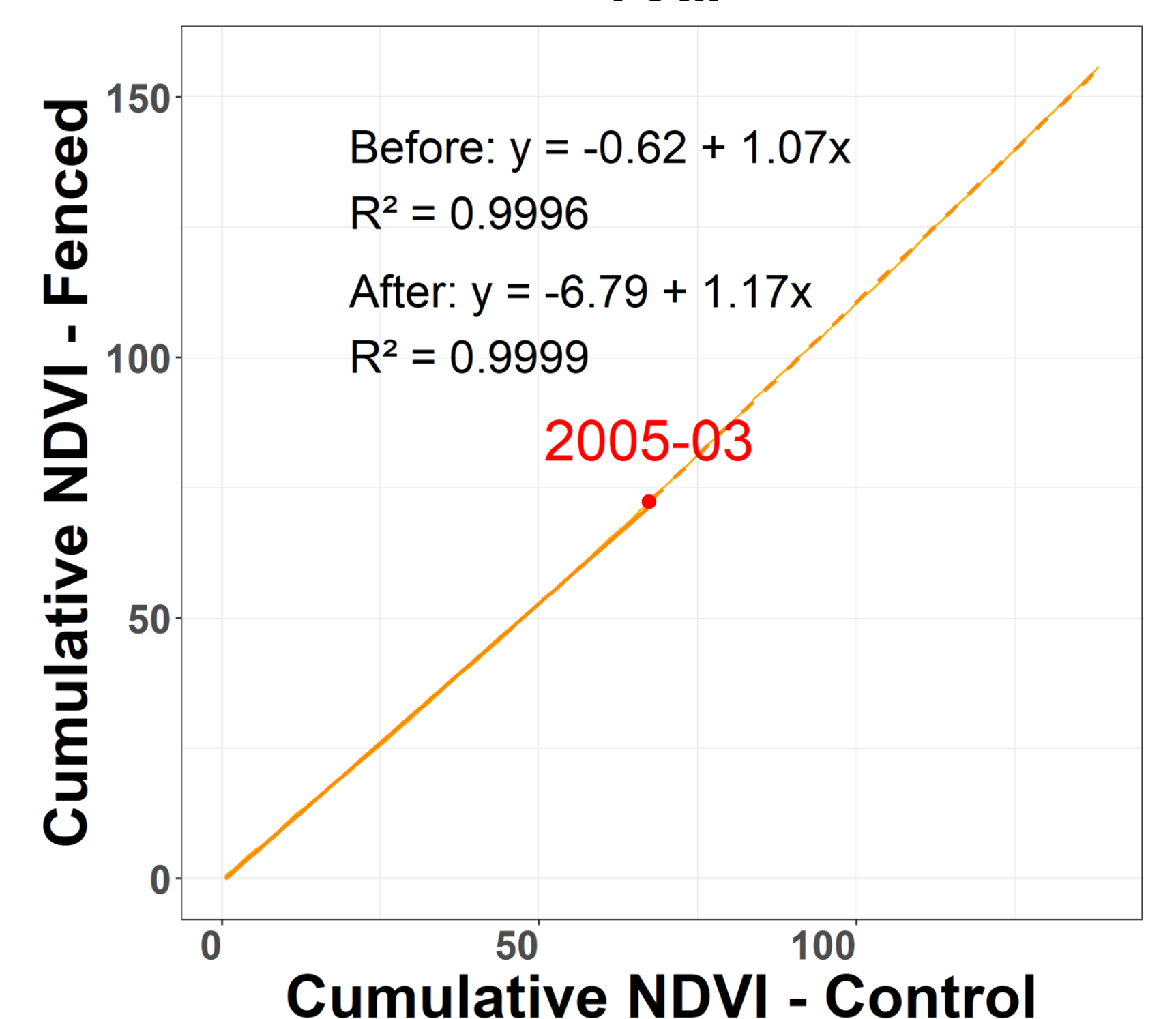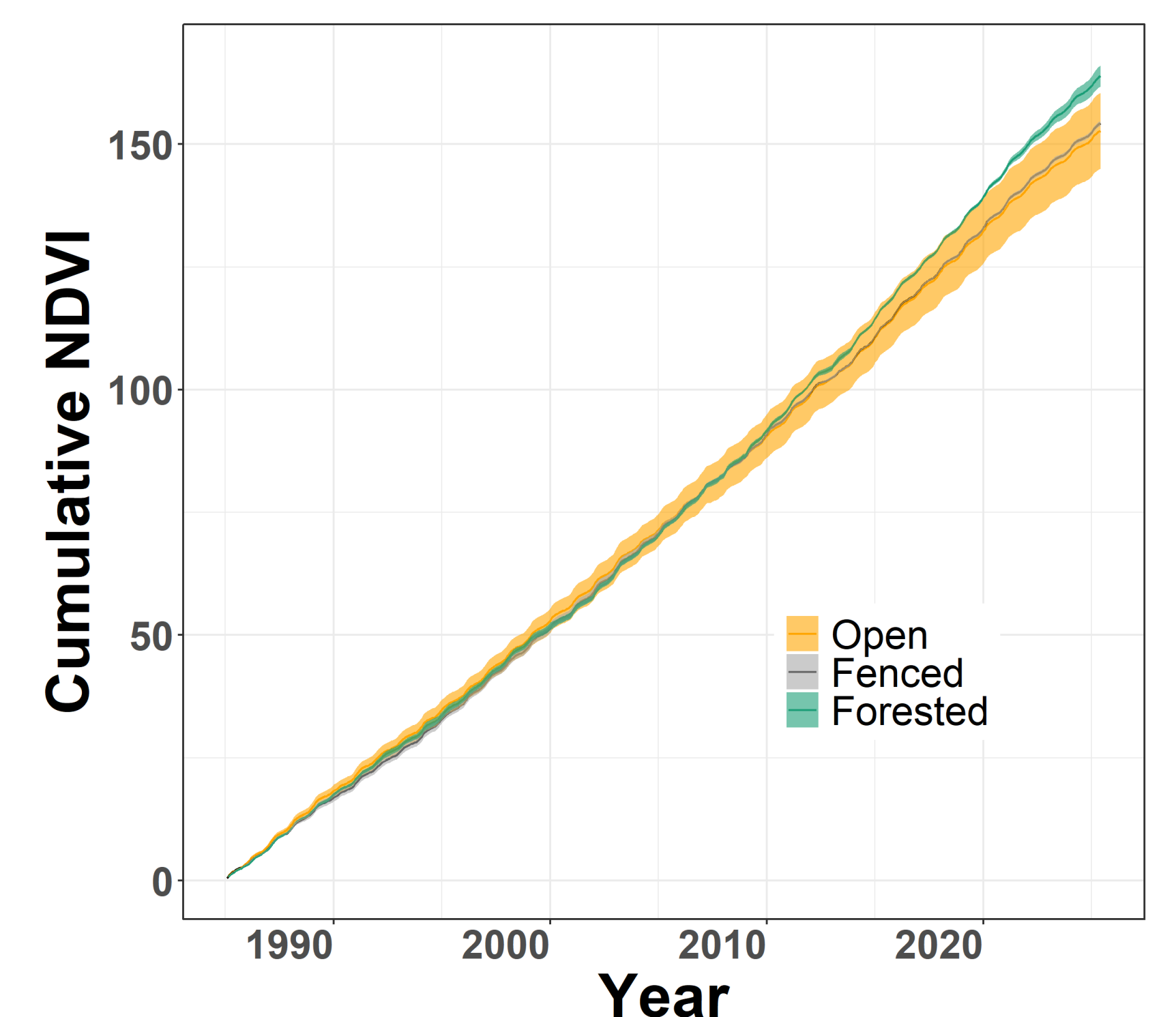
Fig. 9: Top, cumulative NDVI comparison, NDVI Pettitt's test break points against Open plots comparisons, Middle Fenced, Bottom – Forested

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