

**RIPA-1 : FIRST INTERNATIONAL CONFERENCE ON RIPARIAN ECOSYSTEMS
SCIENCE AND MANAGEMENT
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**Habitat quality of Riparian Ecological Infrastructures and their
potential for the provision of biodiversity-related Ecosystem
Services in human-dominated landscapes**

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RIPARIAN ECOLOGICAL INFRASTRUCTURES

Riparian Ecological Infrastructures (REIs)
are a network of natural and/or semi-natural riparian patches...



...vital to support biodiversity and Ecosystems Services (ES)
in human-dominated landscapes.

OBJECTIVE

- ✓ Evaluate the habitat quality of **woody** and **non-woody** REIs and their potential for the provision of ES in Mediterranean human-dominated landscapes.



Woody REIs
trees and tall shrubs



Non-woody REIs
shrubs and herbaceous communities

METHODS

- ✓ Fieldwork was carried out in the riparian and floodplain areas of the rivers Tagus and Sorraia (Portugal) during Spring-Summer of 2019.

- ✓ Land use systems:

Intensive agriculture

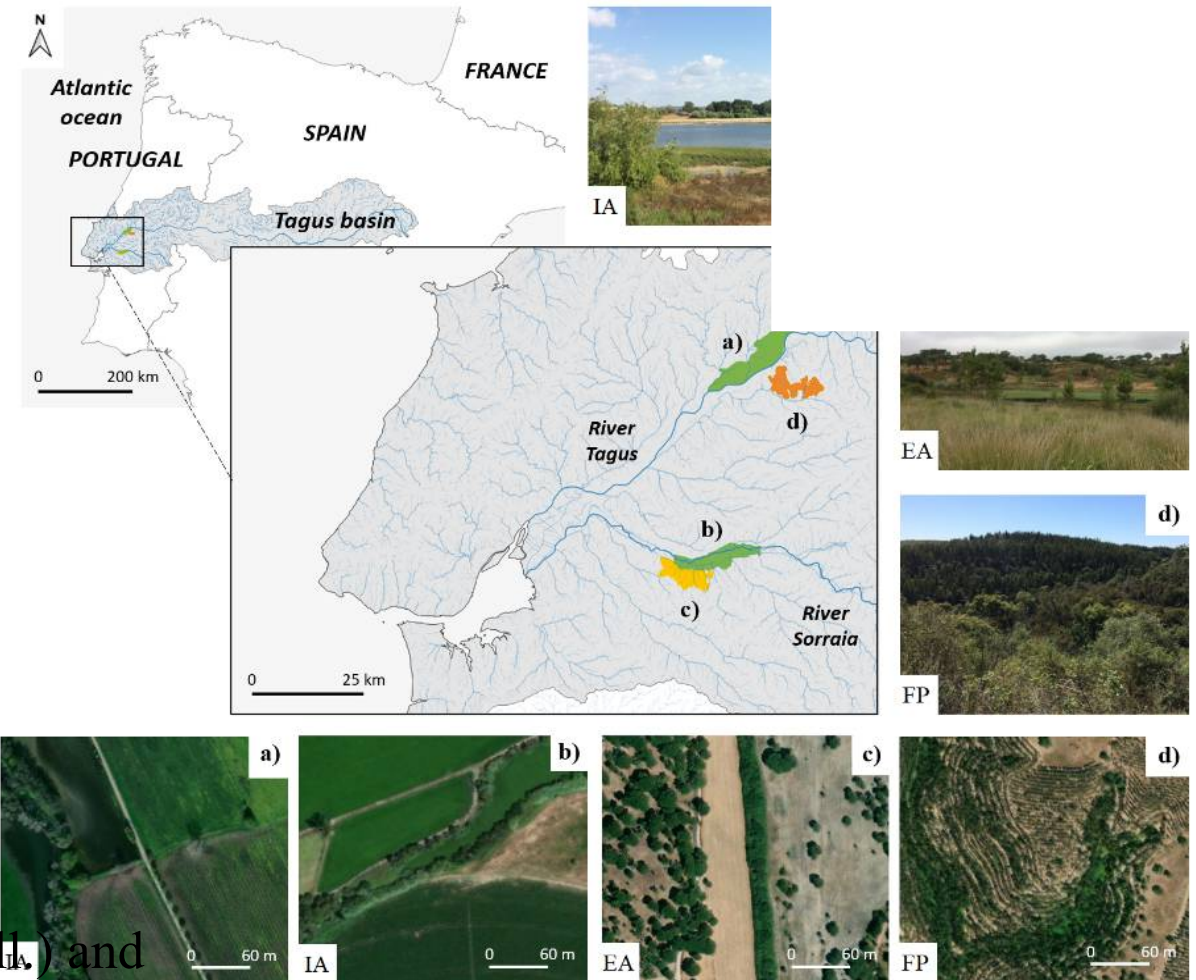
- a) Irrigated maize crops
- b) Rice paddies

Extensive agriculture

- c) “Montado”

Forest production

- d) Blue gum (*Eucalyptus globulus* Labill.) and maritime pine (*Pinus pinaster* L.) plantations





Intensive agriculture (Tagus)



Intensive Agriculture (Sorraia)



Extensive agriculture



Forest production

METHODS

RIPARIAN ECOLOGICAL INFRASTRUCTURES (REIs)

- ✓ Manual digitization of homogeneous riparian vegetation patches, at a 1:1000 scale, over the high-resolution Esri World Imagery layer
- ✓ Visual classification of patches into **woody** and **non-woody** classes, by on-screen photo interpretation based on differences of shape, colour, and texture in relation to their surroundings
- ✓ Minimum Mapping Unit (MMU) of 200 m², with a minimum width of 5 m
- ✓ Minimum Gap (MG) distance among REI patches of 10 m

METHODS

Habitat Ecological Infrastructure's Diversity Index (HEIDI)

1. Vegetation structure*

2. Vegetation habitats*

3. Associated habitats*

4. Vegetation management*

Floristic composition

Native tree species (N°)
Invasive species cover (%)
Vertical strata (N°)

Trees with microhabitats (< 3 m) (N°)
Trees with microhabitats (> 3 m) (N°)
Standing dead trees (N°)
Deadwood trunks on the ground (N°)
Large living trees (N°)
Leaf litter cover (%)

Rocky habitat types (N°)
Aquatic habitat types (N°)

Understorey clearing (%)
Tree clearing (%)

Tree species or genera
Shrub species or genera
Herbaceous families

5. Floristic suitability

*Adapted from the french Indice de Biodiversité Potentielle (IBP)
(Larrieu & Gonin, 2009)

Habitat quality of REIs

- ✓ Potential of a Sampling Unit (200 m²) to support three faunistic groups:
Short-range dispersers (ants)
Medium-range dispersers (pollinators)
Long-range dispersers (birds, bats and non-flying small mammals)
- ✓ Scores of “**low**”, “**fair**” and “**high**”, per faunistic group, supported by bibliographic research.

$$HEIDI = \frac{\sum_{i=1}^{[k/2]+1} w_i \bar{p}_i}{\sum_{i=[k/2]+1}^k w_{k-i+1} \bar{p}_i}$$

Adapted from Perakis et al. (2005)

METHODS

5. Floristic suitability

Seed production suitability (short-range dispersers - ants)

- Plant species with elaiosome-bearing seeds;
 - Potential for **myrmecochory**.

Pollen production suitability (medium-range dispersers - pollinators)

- Plants adapted to **entomophily**;
- Production of pollen and nectar.

Fruit production suitability (long-range dispersers – birds and non-flying small mammals)

- Plants adapted to **endozoochory**;
- Production of fleshy fruits.

HEIDI Floristic suitability scoring criteria

- ✓ Initial scoring system (1 to 10) based on plant characteristics, dispersion mode and abundance
- ✓ Increasing potential of plant taxa as forage resource providers for each faunistic group

METHODS

HEIDI SCORING CRITERIA

HEIDI categories and metrics	Short-Range Dispersers' Scores			Medium-Range Dispersers' Scores			Long-Range Dispersers' Scores		
	Low	Fair	High	Low	Fair	High	Low	Fair	High
1. Vegetation structure									
Native tree species (N°)	0	1 to 3	≥4	0	1 to 3	≥4	0	1 to 3	≥4
Invasive species cover (%)	≥30	]0, 30[	0	≥30	]0, 30[	0	≥30	]0, 30[	0
Vertical strata (N°)	1	2 or 3	4	1	2 or 3	4	1	2 or 3	4
2. Vegetation habitats									
Trees with microhabitats above 3 m (N°)							0	1 or 2	≥3
Trees with microhabitats below 3 m (N°)	0	1 or 2	≥3						
Standing dead trees (N°)				0	1 or 2	≥3	0	1 or 2	≥3
Dead wood trunks on the ground (N°)	0	1 or 2	≥3	0	1 or 2	≥3			
Large living trees (N°)							0	1 to 4	≥5
Leaf litter cover (%)	0	]0, 50[	≥50	≥50	]0, 50[	0			
3. Associated habitats									
Rocky habitat types (N°)	0	1	≥2						
Aquatic habitat types (N°)				0	1	≥2	0	1	≥2
4. Vegetation management									
Understory clearing (%)	≥60	[20, 60[	<20	≥60	[20, 60[	<20			
Tree clearing (%)							≥60	[20, 60[	<20
5. Floristic suitability									
Seed production suitability (initial scores)*	<3	[3, 16]	>16						
Pollen production suitability (initial scores)*				<20	[20, 38]	>38			
Fruit production suitability (initial scores)*							<10	[10, 23]	>23

* summed initial scores of all plant taxa found in each Sampling Unit.

RESULTS - REIs

Study area	River	Landscape area (ha)	REI patch type	NP	Sampling Units	REI cover (%)
Intensive agriculture	Tagus	8473.59	Woody	109	17	2.81
			Non-woody	91	9	0.12



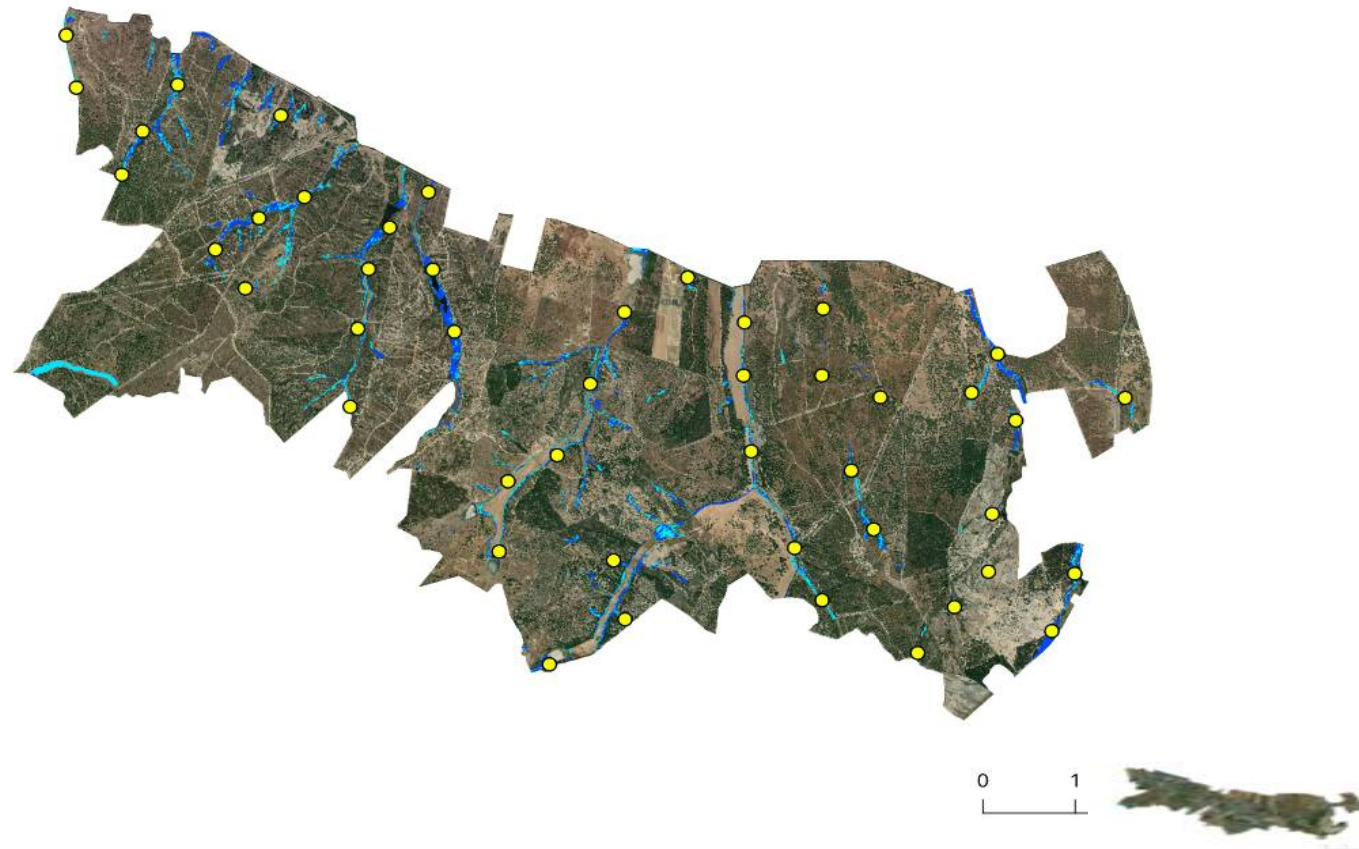
RESULTS - REIs

Study area	River	Landscape area (ha)	REI patch type	NP	Sampling Units	REI cover (%)
Intensive agriculture	Sorraia	5455.10	Woody	173	22	2.98
			Non-woody	165	13	0.56



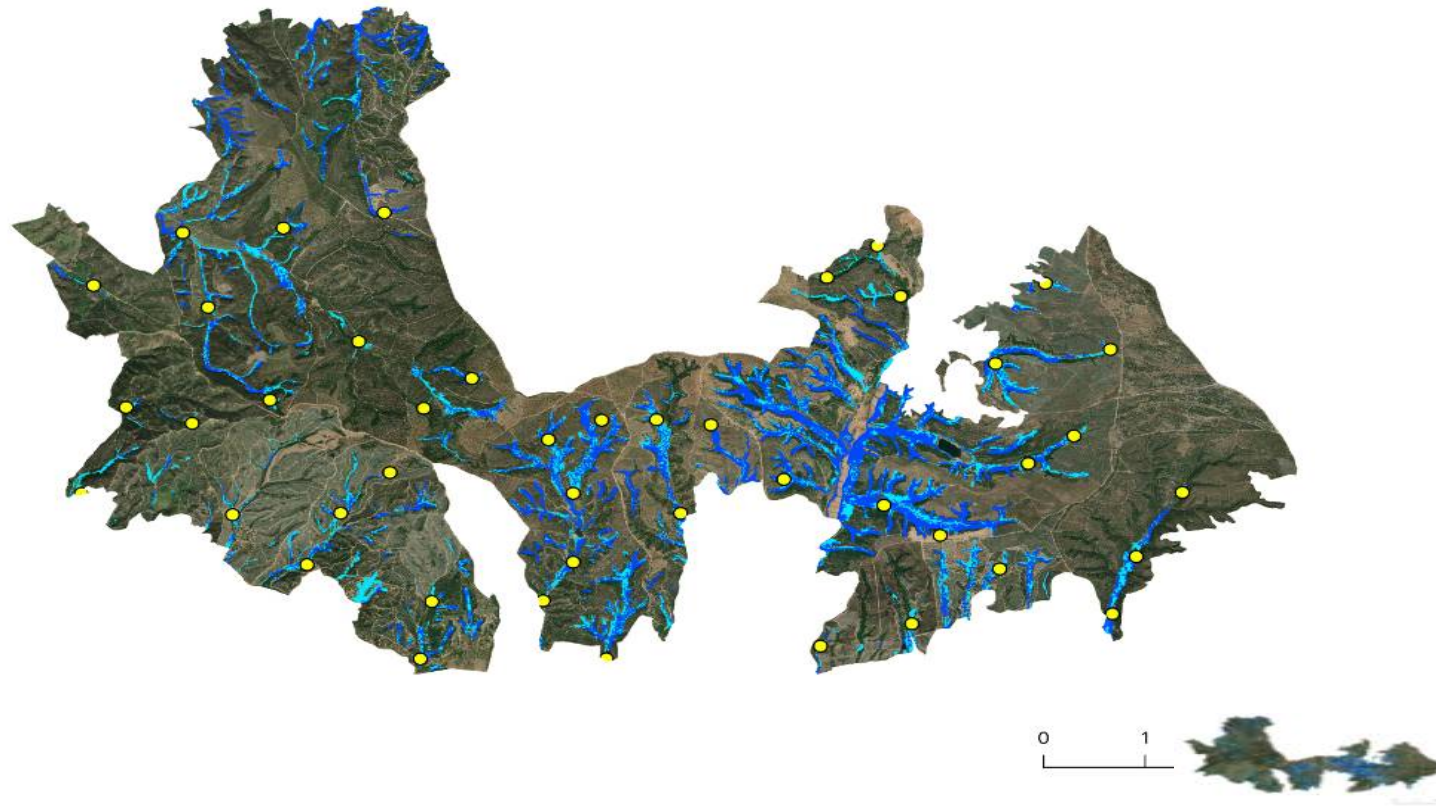
RESULTS - REIs

Study area	River	Landscape area (ha)	REI patch type	NP	Sampling Units	REI cover (%)
Extensive agriculture	Sorraia	4427.40	Woody	296	28	1.78
			Non-woody	295	18	1.44



RESULTS - REIs

Study area	River	Landscape area (ha)	REI patch type	NP	Sampling Units	REI cover (%)
Forest production	Tagus	4204.00	Woody	379	24	6.75
			Non-woody	441	20	4.25



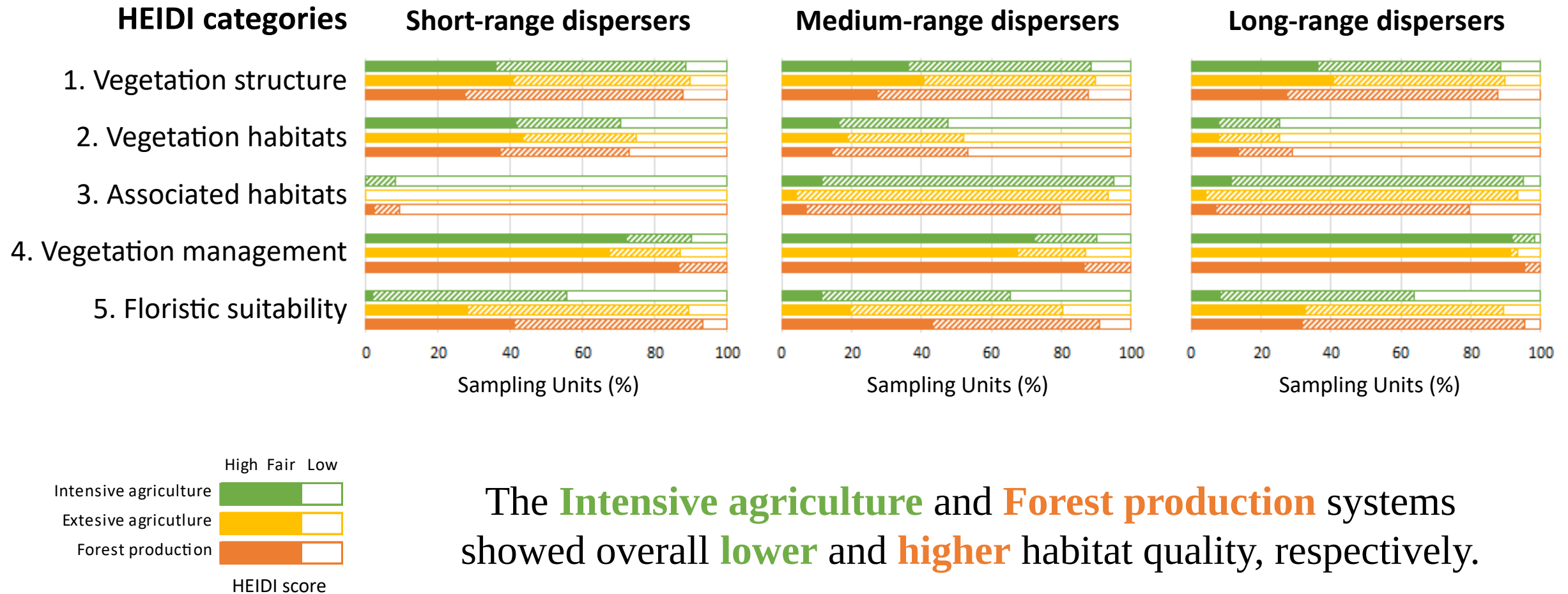
RESULTS – REI vegetation – relative occurrence (%)

	Intensive Agriculture (N=61)		Extensive Agriculture (N=46)		Forest Production (N=44)	
Tree taxa	Present	Dominant	Present	Dominant	Present	Dominant
<i>Fraxinus angustifolia</i> Vahl	18.03	19.67	0.00	0.00	0.00	0.00
<i>Pinus pinaster</i> Aiton	0.00	0.00	43.48	13.04	20.45	2.27
<i>Populus</i> spp.	13.12	19.67	6.52	4.34	0.00	0.00
<i>Quercus suber</i> L.	1.64	0.00	34.78	15.22	40.91	34.09
<i>Salix alba</i> L.	14.75	16.39	2.17	0.00	2.27	0.00
<i>Salix atrocinerea</i> Brot.	13.11	4.92	19.57	26.09	13.64	20.45
<i>Salix salviifolia</i> Brot.	8.20	13.11	4.35	15.22	2.27	2.27

Shrub taxa	Isolated individuals	Abundant	Dominant	Isolated individuals	Abundant	Dominant	Isolated individuals	Abundant	Dominant
<i>Cistus</i> sp.	4.92	0.00	0.00	10.87	50.00	4.35	6.82	45.45	2.27
<i>Erica</i> sp.	0.00	1.64	0.00	4.35	15.22	4.35	4.55	54.55	4.55
<i>Rubus</i> sp.	3.28	19.67	49.18	0.00	23.91	71.74	4.55	45.45	38.64
<i>Ulex</i> sp., <i>Stauracanthus</i> sp. and <i>Asparagus</i> sp.	4.92	3.28	0.00	15.22	36.96	0.00	4.55	61.36	11.36

Herbaceous family	Isolated individuals	Abundant	Dominant	Isolated individuals	Abundant	Dominant	Isolated individuals	Abundant	Dominant
Apiaceae	24.59	21.31	3.28	15.22	8.70	2.17	15.91	6.82	0.00
Asteraceae	31.15	27.87	6.56	28.26	36.96	2.17	25.00	20.45	9.09
Convolvulaceae	9.84	18.03	0.00	0.00	4.35	0.00	0.00	0.00	0.00
Lamiaceae	9.84	9.84	0.00	8.70	10.87	0.00	15.91	15.91	2.27
Poaceae	1.64	50.82	47.54	2.17	39.13	41.30	4.55	38.64	25.00

RESULTS – HEIDI scores



The **Intensive agriculture** and **Forest production** systems showed overall **lower** and **higher** habitat quality, respectively.

RESULTS – HEIDI values

HEIDI values (average)	Intensive agriculture	Extensive agriculture	Forest production
Short-range dispersers	0.95	1.26	1.43*
Medium-range dispersers	1.28	1.44	1.63*
Long-range dispersers	1.25	1.61	1.54
<i>Global</i>	1.16	1.43	1.53*

HEIDI values (average)	Woody REIs	Non-woody REIs
Short-range dispersers	1.40*	0.86
Medium-range dispersers	1.46	1.37
Long-range dispersers	1.72*	1.03
<i>Global</i>	1.53*	1.09

*diferences are statistically significant.

CONCLUSIONS

1. REIs in the **Forest production** system have **higher ecological quality**
2. REIs in the **Extensive agriculture** system are **more fragmented**
3. REIs in the **Intensive agriculture** system have **lower ecological quality**
4. **Woody REIs** have **higher ecological quality** and **more potential to support biological dispersal**

THANK YOU FOR LISTENING!

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