RIPARIAN VEGETATION COMMUNITIES UNDER FLUVIAL DISTURBANCE DECLINE

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INTRODUCTION

- Rivers of Madrid region are strongly altered by human activities and show **significant geomorphological adjustments**

- Fluvial landscape complexity has gradually decreased in parallel with the **encroachment of riparian vegetation**

OBJECTIVES OF RESEARCH:

- To **quantify** geomorphological **changes** along the last decades
- To understand riparian vegetation **temporal trends**
- To explore potential drivers and the **indicator value** of woody and herbaceous vegetation

This research forms part of the **SAUCERES Project** entitled: "***The decline of shrub Salix formations along regulated rivers in Central Spain (Madrid)***", supported by the Spanish National Research Programme, 2019-2022

STUDY SITE

3 Main rivers of Madrid Region belonging to the TAJO BASIN:

- **JARAMA** river (12 gravel-bed reaches)
- **LOZOYA** river (8 gravel-bed reaches)
- **GUADARRAMA** river (9 sand-bed reaches)

FIELD WORK

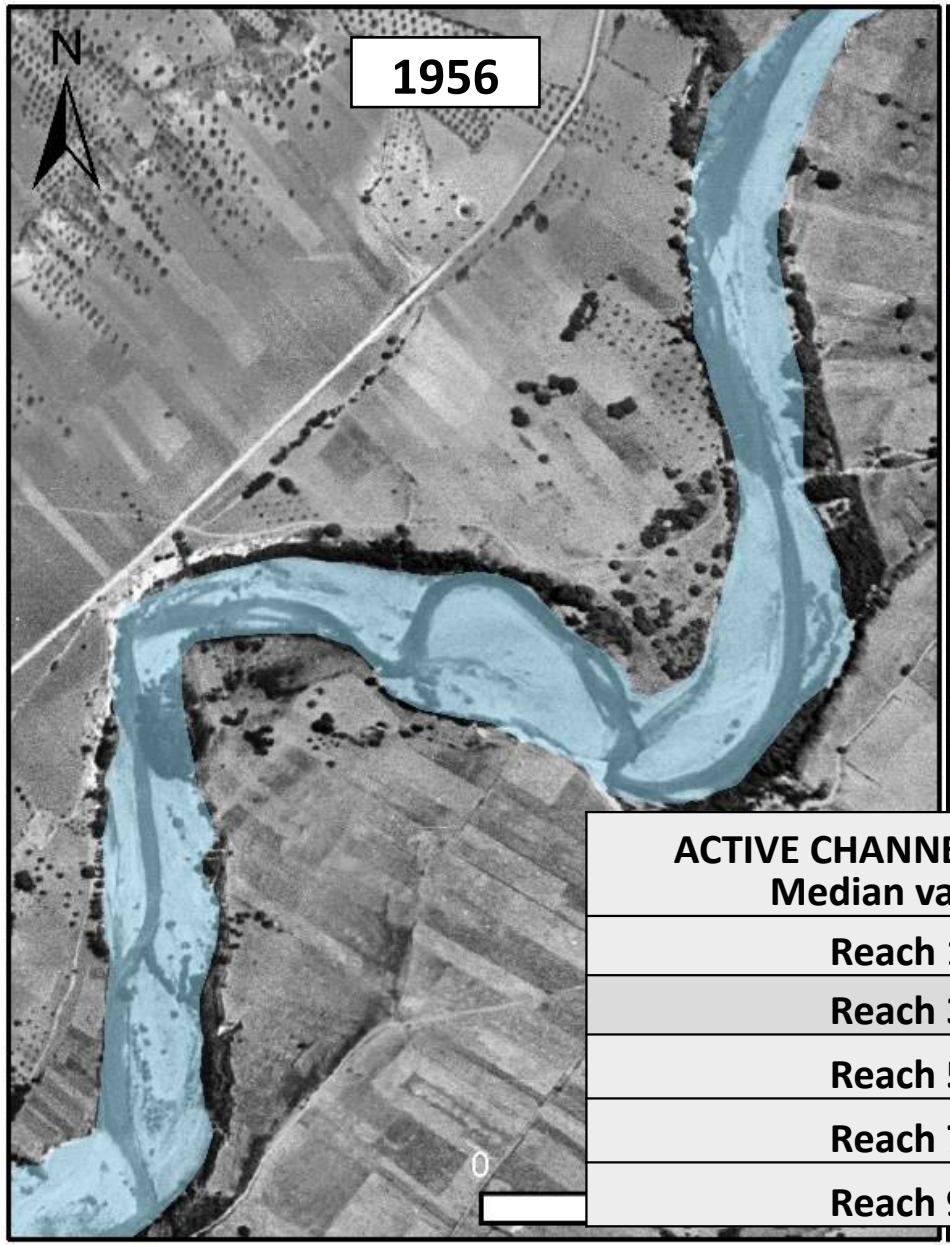
Field sampling along 3-4 transects per river reach (preliminary results from **56 sites**)

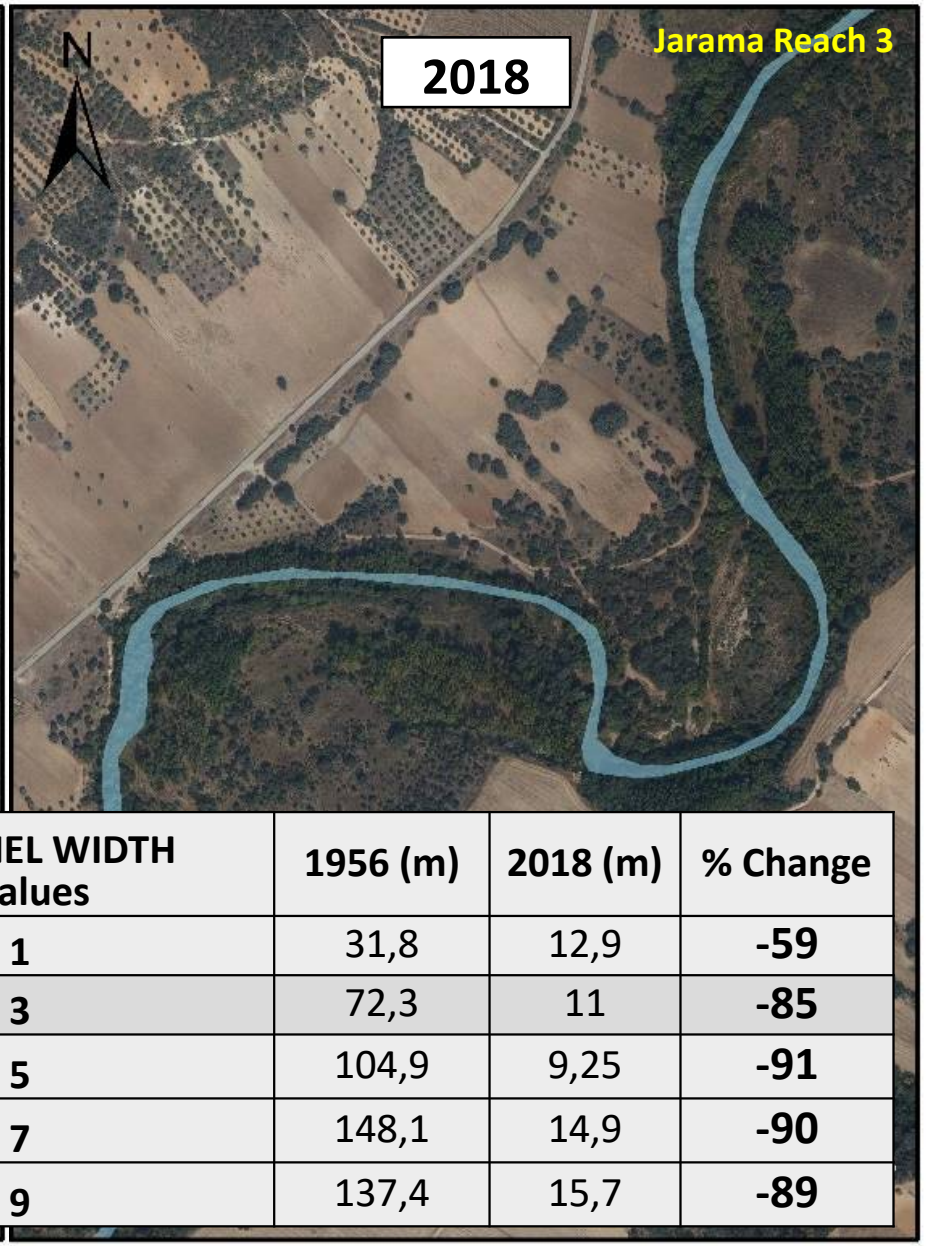
- **Woody plants**: Identification of species, age class and distance to bank channel
- **Herbaceous vegetation**: Identification of species, coverage and distance to bank channel

DESK WORK

- Areal photographs digitalization (1956, 1998, 2018) to **characterize land covers** and **channel mobility**

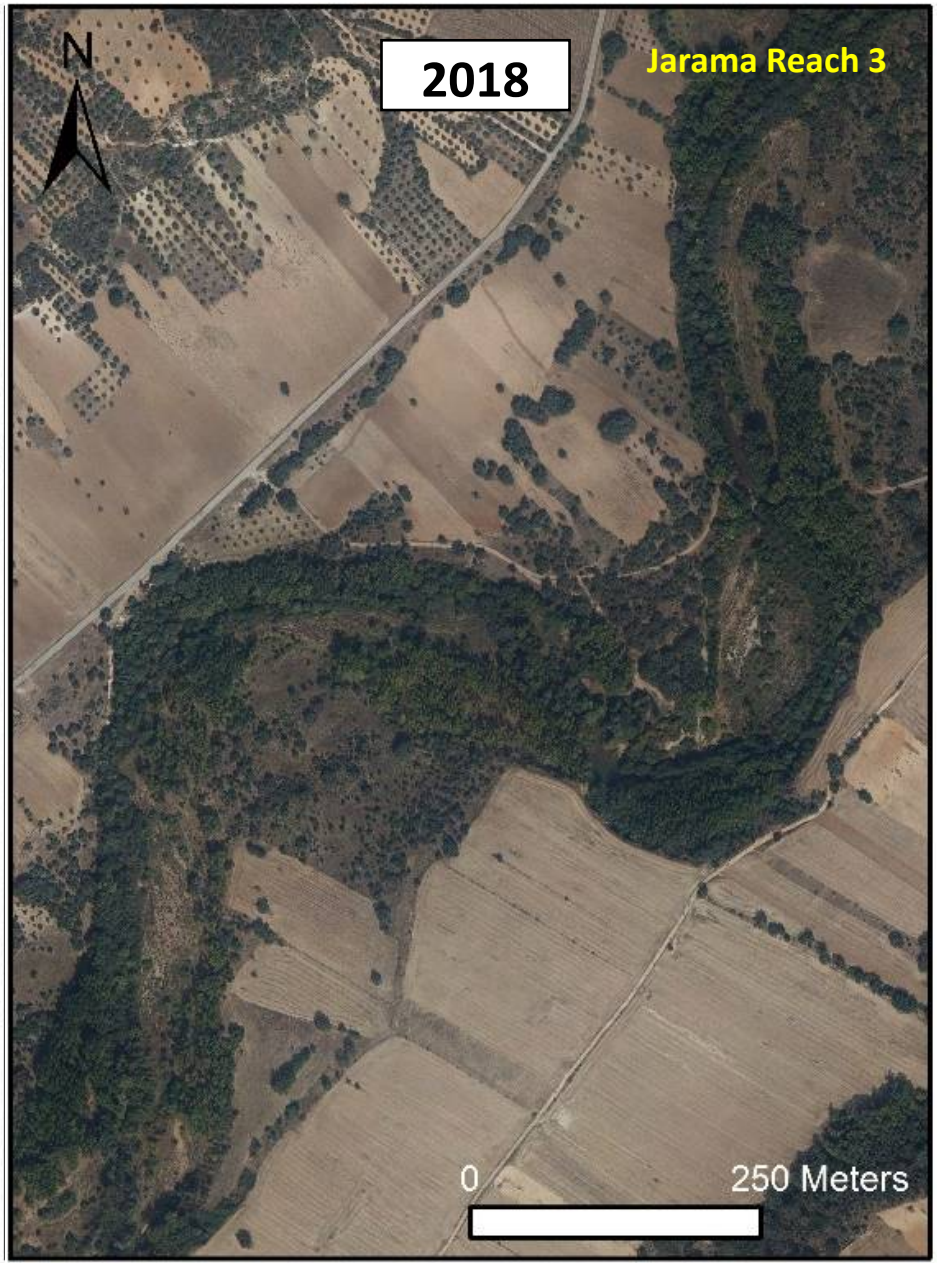
RESULTS: Geomorphological Trends: CHANNEL NARROWING





ACTIVE CHANNEL WIDTH Median values	1956 (m)	2018 (m)	% Change
Reach 1	31,8	12,9	**-59**
Reach 3	72,3	11	**-85**
Reach 5	104,9	9,25	**-91**
Reach 7	148,1	14,9	**-90**
Reach 9	137,4	15,7	**-89**

RESULTS: Geomorphological Trends: VEGETATION ENCROACHMENT



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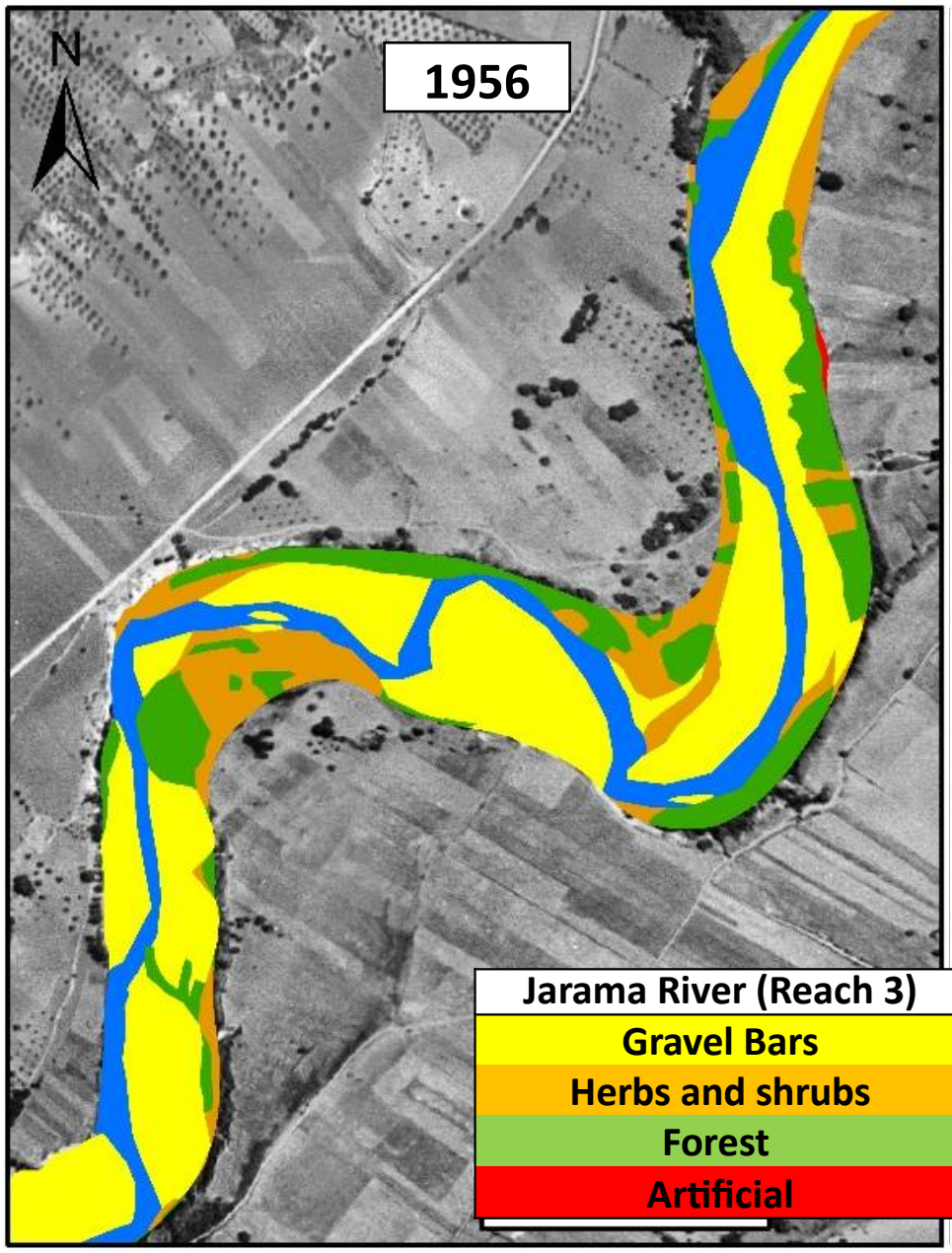
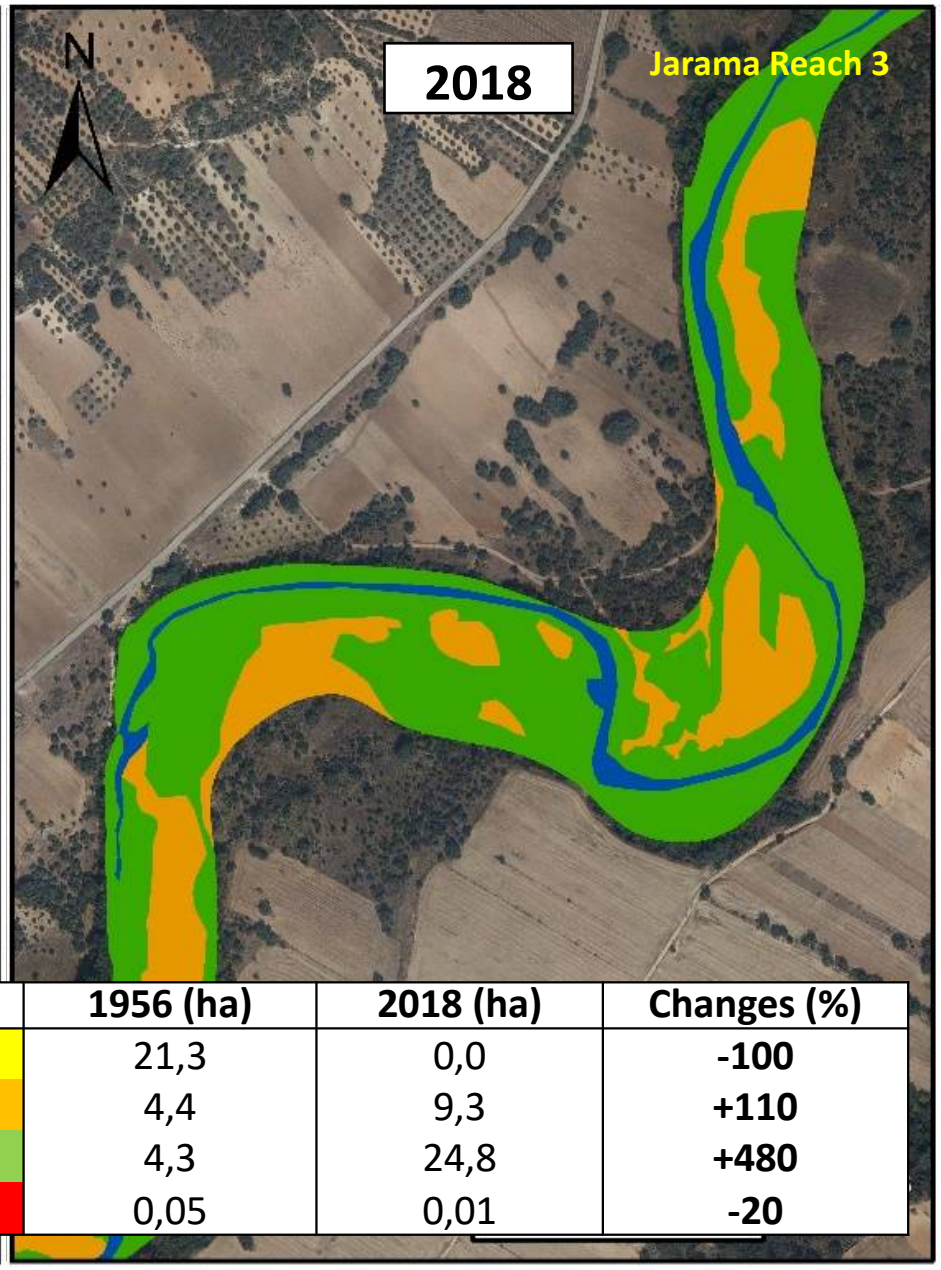




Jarama River (Reach 3)	1956 (ha)	2018 (ha)	Changes (%)
Gravel Bars	21,3	0,0	-100
Herbs and shrubs	4,4	9,3	+110
Forest	4,3	24,8	+480
Artificial	0,05	0,01	-20

RESULTS: Riparian Vegetation: COMPOSITION AND RICHNESS

WOODY VEGETATION:

- **35 species**: 18 (51%) trees
  17 (49%) shrubs
  26 (74%) native
  9 (26%) exotic

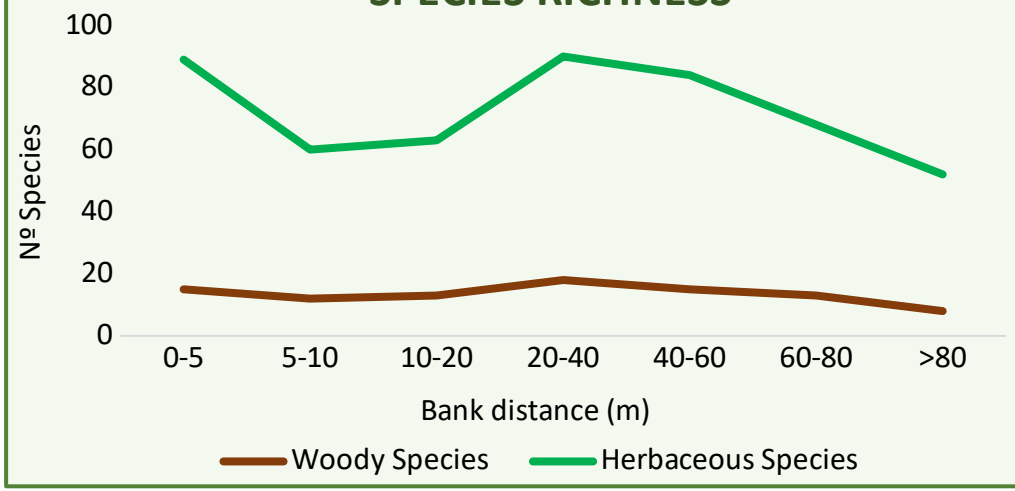
- Dominant species (% plants):
  - *Fraxinus angustifolia* (30%)
  - *Salix salvifolia* (15 %)
  - *Populus alba* (11%)

HERBACEOUS VEGETATION:

- **266 species**: 58 (22%) Gramineae
  42 (16%) Compositae
  32 (12%) Umbelliferae

Dominant species (> 20 sites, >70% cover):
Bromus spp.
Urtica dioica
Avena spp.

SPECIES RICHNESS



RESULTS: Riparian Vegetation: SUCCESION AND TEMPORAL TRENDS

AGE CLASSES

Young: <2 yr.
Juvenile: 2-10 yr.
Adult: 10-25 yr.
Mature: >30 yr.

% individuals per age-class

GUADARRAMA	Young	Juvenile	Adult	Mature
Salix salvifolia	1.2	23.5	52.9	22.4
Fraxinus angustifolia	7.62	34.29	32.18	26.91
Populus alba	26.42	23.58	23.58	26.42
JARAMA	**Young**	**Juvenile**	**Adult**	**Mature**
Salix salvifolia	5.1	23.4	52.5	19
Fraxinus angustifolia	30.29	40.15	25.18	4.38
Populus alba	38.94	26.59	23.89	10.62
LOZOYA	**Young**	**Juvenile**	**Adult**	**Mature**
Salix salvifolia	3.8	17.5	52.5	26.3
Fraxinus angustifolia	8.91	38.61	49.5	2.97
Populus alba	0	7.69	23.08	69.23

- **Pioneer** shrub species (e.g. *Salix salvifolia*) with **reduced regeneration** in all rivers
- **Late-seral** species (e.g. *Fraxinus angustifolia*) with much **more active regeneration**
- Vegetation succession **from open shrub galleries of willows** (*S. salvifolia, S. purpurea*) **to closed mature forest of ash and poplars**

RESULTS: Riparian Vegetation: SUCCESION AND TEMPORAL TRENDS

CROSS-SECTION OF AGE-CLASSES

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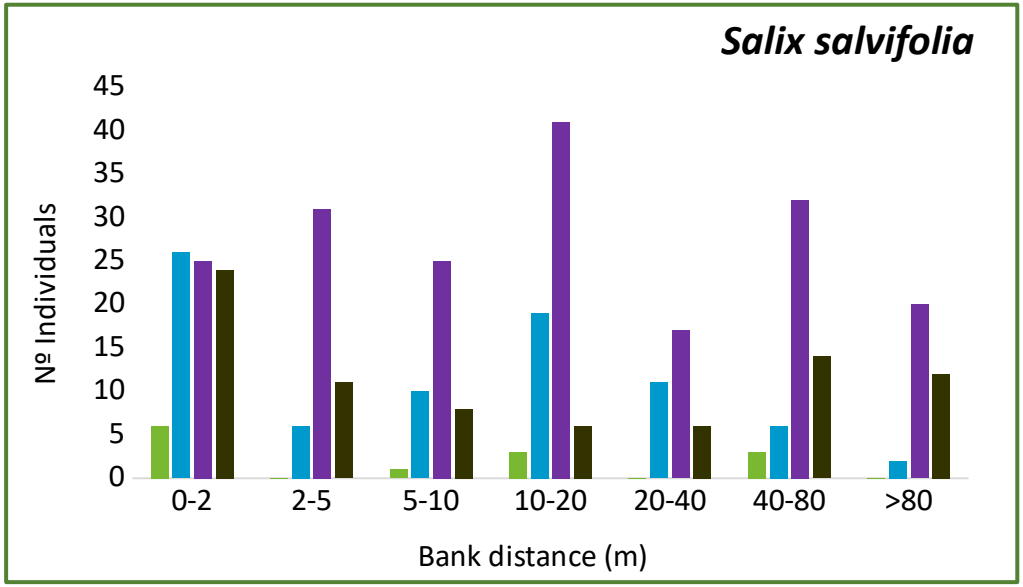
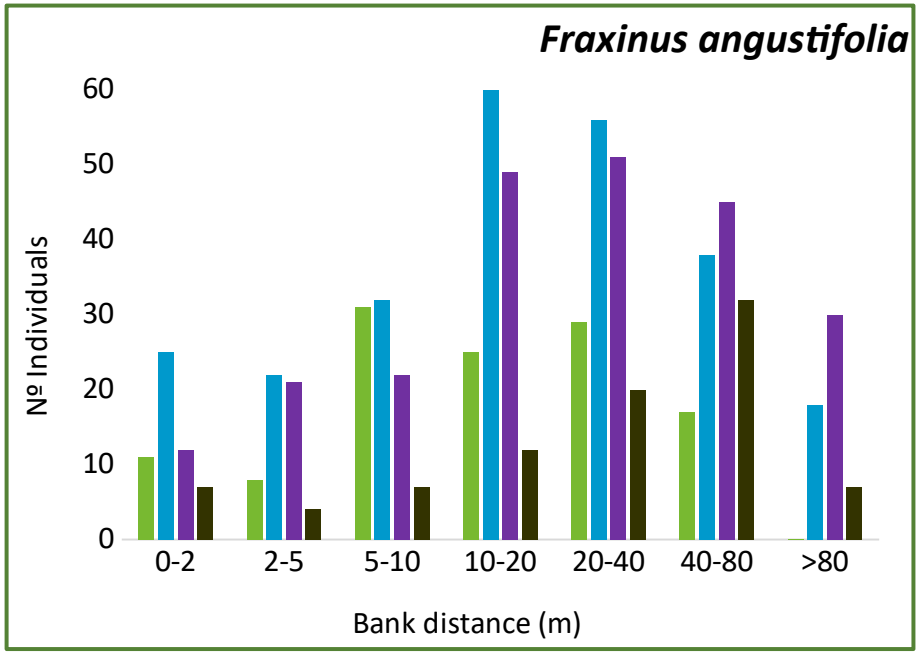
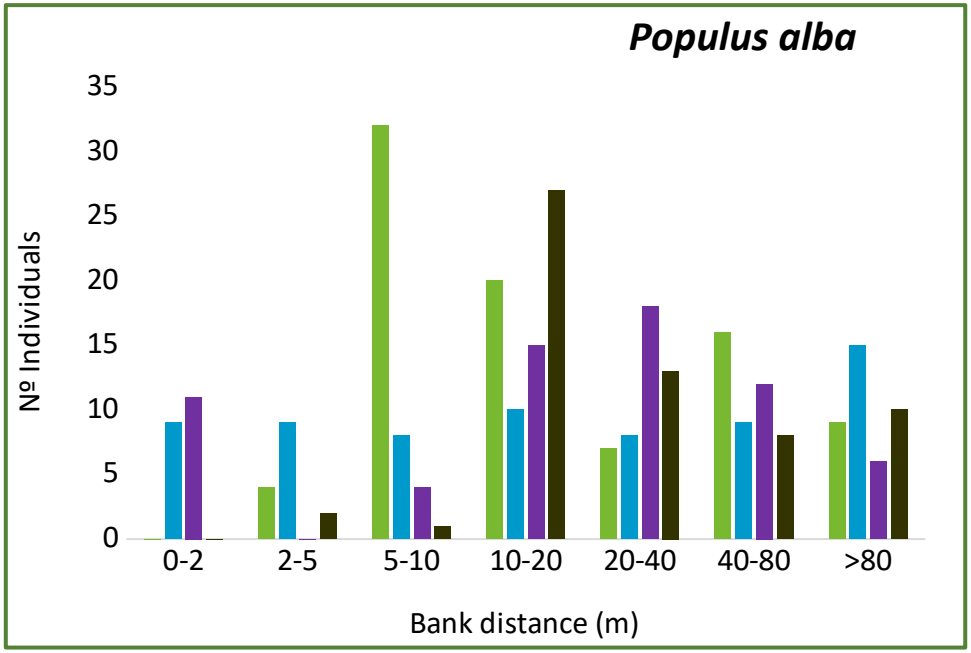
Mature: >30 yr.







RESULTS Riparian Vegetation: SUCCESION AND TEMPORAL TRENDS

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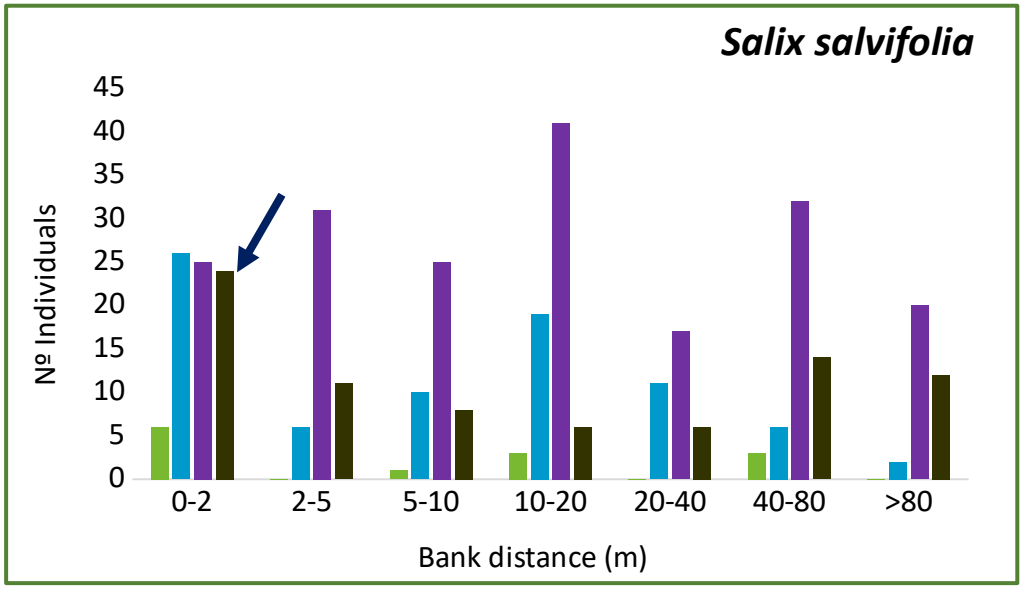

***S. salvifolia*:**

- Pioneer-shrub species **characteristic** of siliceous rivers **of Central Spain,** frequently **associated to river-banks**
- **Aged galleries** across proximal (**current river-banks**) and distal (**past river-banks**) parts to the channel, with little regeneration

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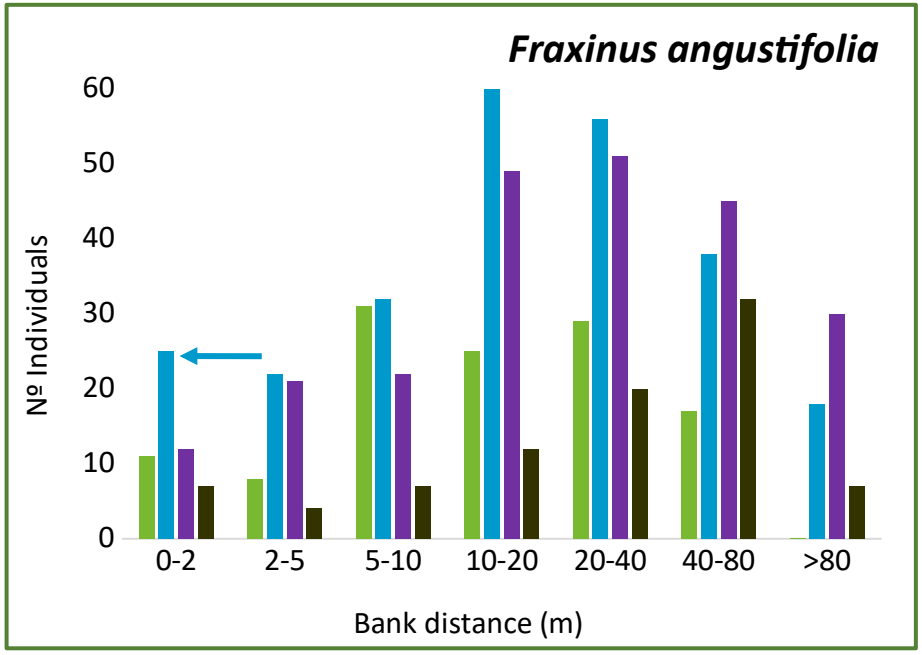
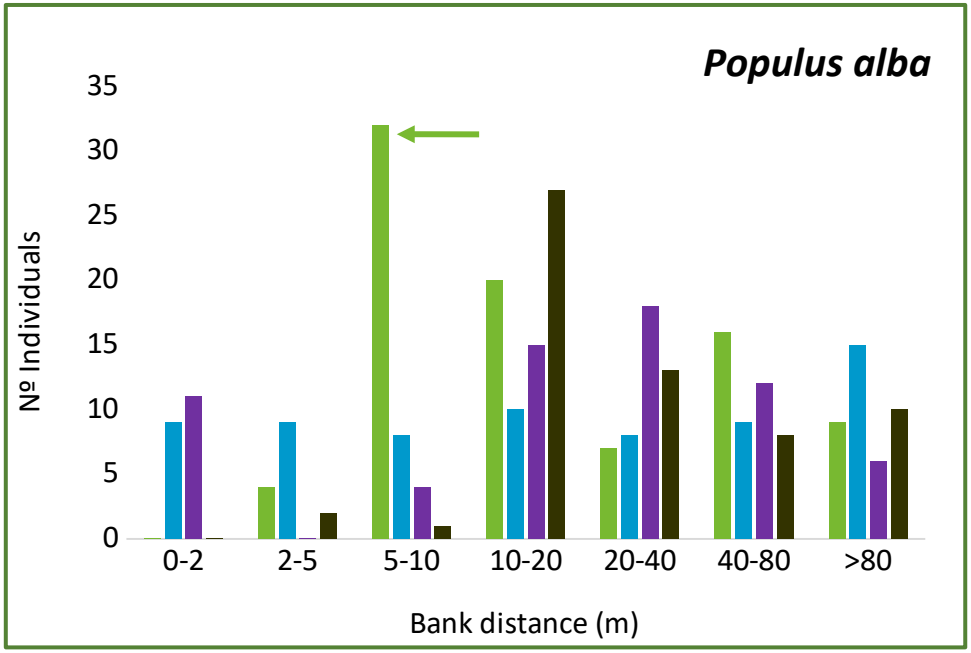
F. angustifolia:

Late-seral tree species increasing in **young stages towards the banks**, frequently replacing pioneer shrub-species

P. alba:

Pioneer tree-species, frequently associated to mid- and distal part of riparian zones, also **increasing towards the banks**





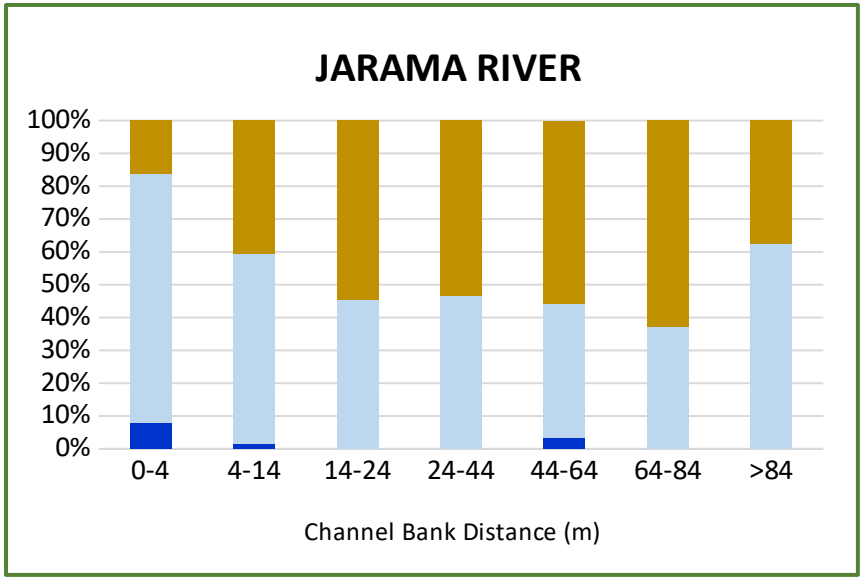
RESULTS: Herbaceous species: INDICATOR VALUE OF SOIL MOISTURE

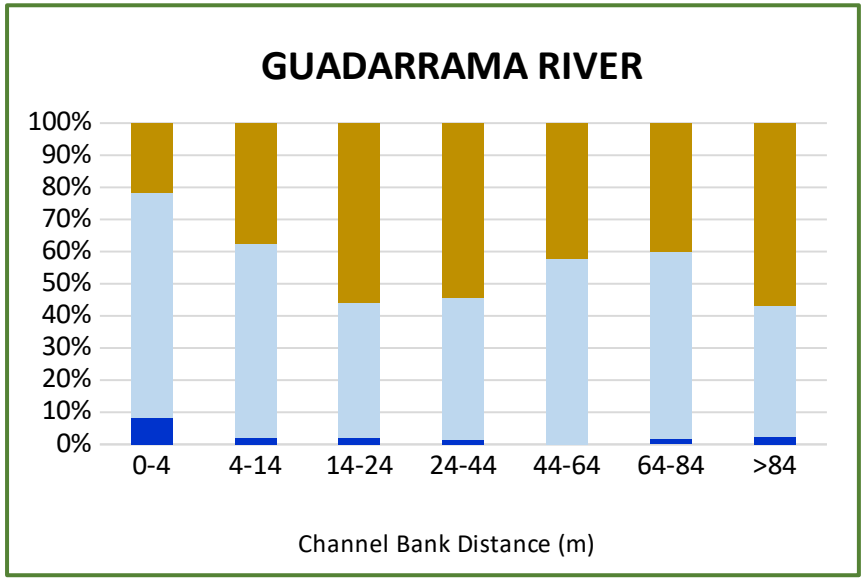
% SPECIES INDICATING RANGE OF SOIL MOISTURE

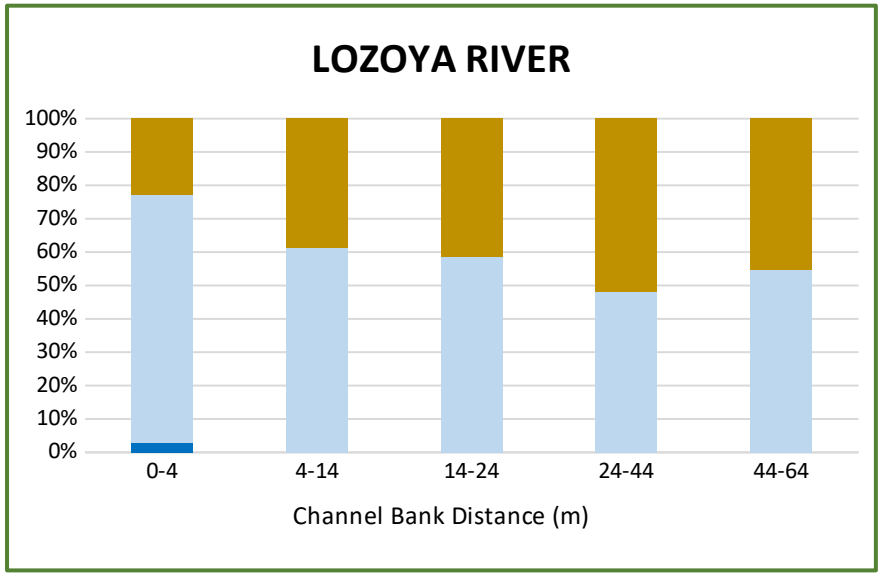
High soil moisture

Moderate soil moisture

Low soil moisture







CONCLUSIONS

- Significant **channel narrowing** and **vegetation encroachment** in the studied rivers along the **last half century**
- **Strong reduction of bare gravel bars** and open areas with incipient pioneer recruitment, implying the **decrease in geomorphic complexity**
- **Declining trend of shrub willow galleries** (*Salix salvifolia*) in all the studied reaches, being partially **replaced by late-seral tree species** (*F. angustifolia*)
- Herbaceous vegetation wtih similar species composition across the studied rivers, dominated by plants related to **soils with moderate to low soil moisture**
- A generalized **hydrological decline** of the Madrid region, with significant **reduction of floods and coarse sediment supply** previously studied**,** may explain these reported processes and temporal trends


Thank you for your
attention