LIFELINES

Linear Infrastructures Networks with Ecological Solutions

Testing wild plants seed mixtures along grey infrastructures

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Linear Infrastructure Networks with Ecological Solutions
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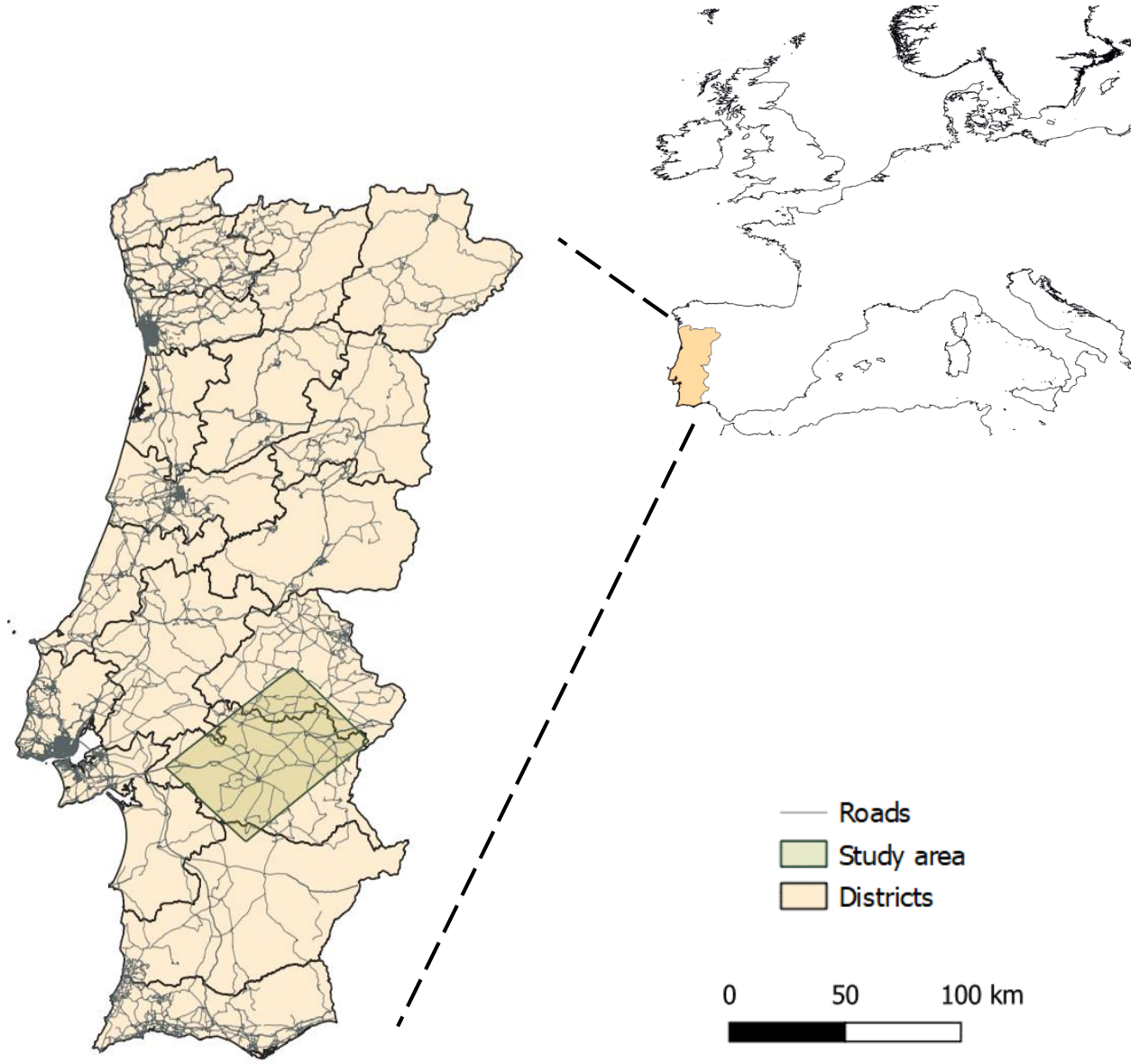
Study area

South of Portugal

High concentration of linear infrastructures

Roads
or
Disabled Railways (ecotrails)



Main aims

To test, evaluate and disseminate mitigation measures

To promote a demonstrative Green Infrastructure

To mitigate negative effects of linear infrastructures and improve the local biodiversity

Mixtures main aims

To promote:

- **Plants diversity**
- **Butterflies habitat**
- **Small mammals' habitat**

Development of two assortments of wild species biodiverse seed mixtures

Roads verges

Ecotrails verges

Species selection criteria

Both mixtures

- Native species
- Seeds harvested in the study region
- Species with conservation interest

- 30% of Fabaceae
- 30% of Poaceae
- 10% of Asteraceae

Roads Mixture

- In compliance with road security:
  - Low biomass = small amount of fuel
  - Low height = to not impair visibility
- Early flowering ≡ successful seed set

Ecotrails Mixture

- Species less common
- Species attractive to fauna
- Extended flowering period
- Without known toxicity

Ex-situ plots

Autumn 2016

Roads Mixtures

Mixture 1 – 19 Species

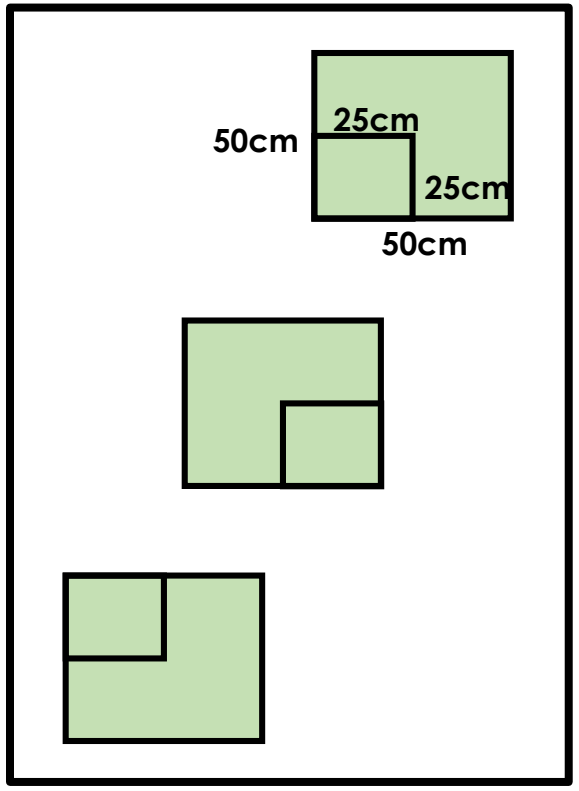
Mixture 2 – 19 Species

Mixture 1 – 23 Species

Mixture 2 – 23 Species

Ecotrails Mixtures

12 Plots



50 Species in total from 13 families

Density: 2000 seeds/m²

Spring 2017-2018

- ✓ Frequency of seeded species
- ✓ Abundance - % cover
- ✓ Height
- ✓ Aerial Biomass (25x25cm)

Ex-situ plots

Final Mixtures' Selection

Road mixtures

Mixture 2

- More species germinated
- More balanced family representation
- Greater coverage
- Biomass related only with coverage

Mixture 2:

Apparently more suitable

Ecotrail mixtures

Both mixtures had:

- Same % germinated species
- Same % coverage
- Same % aerial biomass

Mixture 2:

- More balanced family representation

A combination of the two mixtures was chosen

In-situ plots

Autumn 2018

Road Mixtures

Mixture – 19 Species

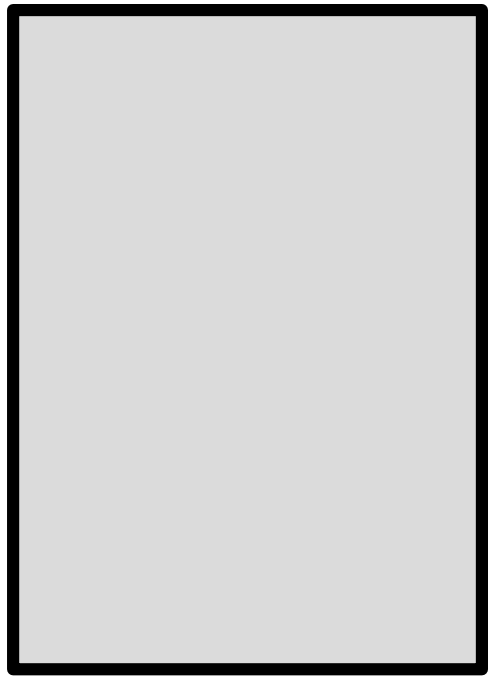
Mixture – 23 Species

Ecotrail Mixtures

34 Species in total from 12 families

Density: 2000 seeds/m^2

21 Plots



10m

2m

Spring 2019, 2020…

- ✓ Frequency of seeded species
- ✓ Abundance - % coverage
- ✓ Height

Roads mixture

Anchusa undulata

Briza maxima

Campanula lusitanica

Coleostephus myconis

Dactylis glomerata

Hymenocarpos lotoides

Misopates orontium

Ornithopus pinnatus

Papaver hybridum

Papaver rhoeas

Petrorhagia nanteuilii

Phagnalon saxatile

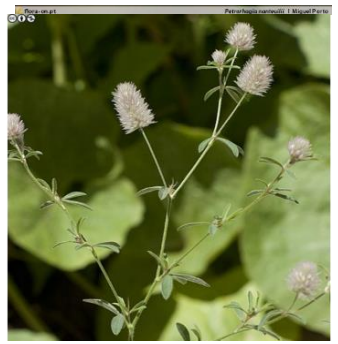
Salvia verbenaca

Sanguisorba hybrida

Silene colorata

Silene gallica

Silene scabriflora



Trifolium arvense

Trifolium stellatum

Ecotrails mixture

Aegilops geniculata

Aegilops triuncialis

Astragalus pelecinus

Brachypodium distachyon

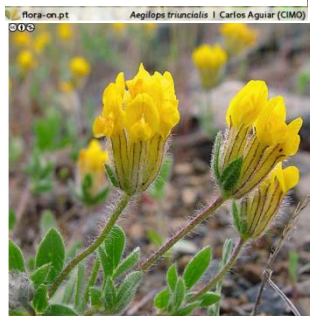
Briza maxima

Campanula rapunculus

Coleostephus myconis

Cynosurus echinatus

Gynandriris sisyrinchium



Hymenocarpus lotoides

Jasione montana

Lamarckia aurea

Linaria spartea

Mantisalca salmantica

Papaver pinnatifidum

Petrorhagia nanteuilii

Pterocephalidium diandrum

Sanguisorba hybrida

Scorpiurus vermiculatus

Silene gallica

Silene scabriflora

Trifolium arvense

Trifolium campestre

Main Results

Germinated in both types of plots:

- ✓ *Lamarckia aurea*
- ✓ *Silene scabriflora*
- ✓ *Petrorhagia nanteuilii*
- ✓ *Pterocephalidium diandrum…*

Species tested showed different behaviors:

- ✓ In the *ex-situ* plots
- ✓ In the *in-situ* plots

Didn't germinate in the *in-situ* plots in first year (2019):

- ✓ *Dactylis glomerata*

Germinated only in the *in-situ* plots:

- ✓ *Campanula lusitanica*
- ✓ *Campanula rapunculus*
- ✓ *Jasione montana*
- ✓ *Linaria spartea...*

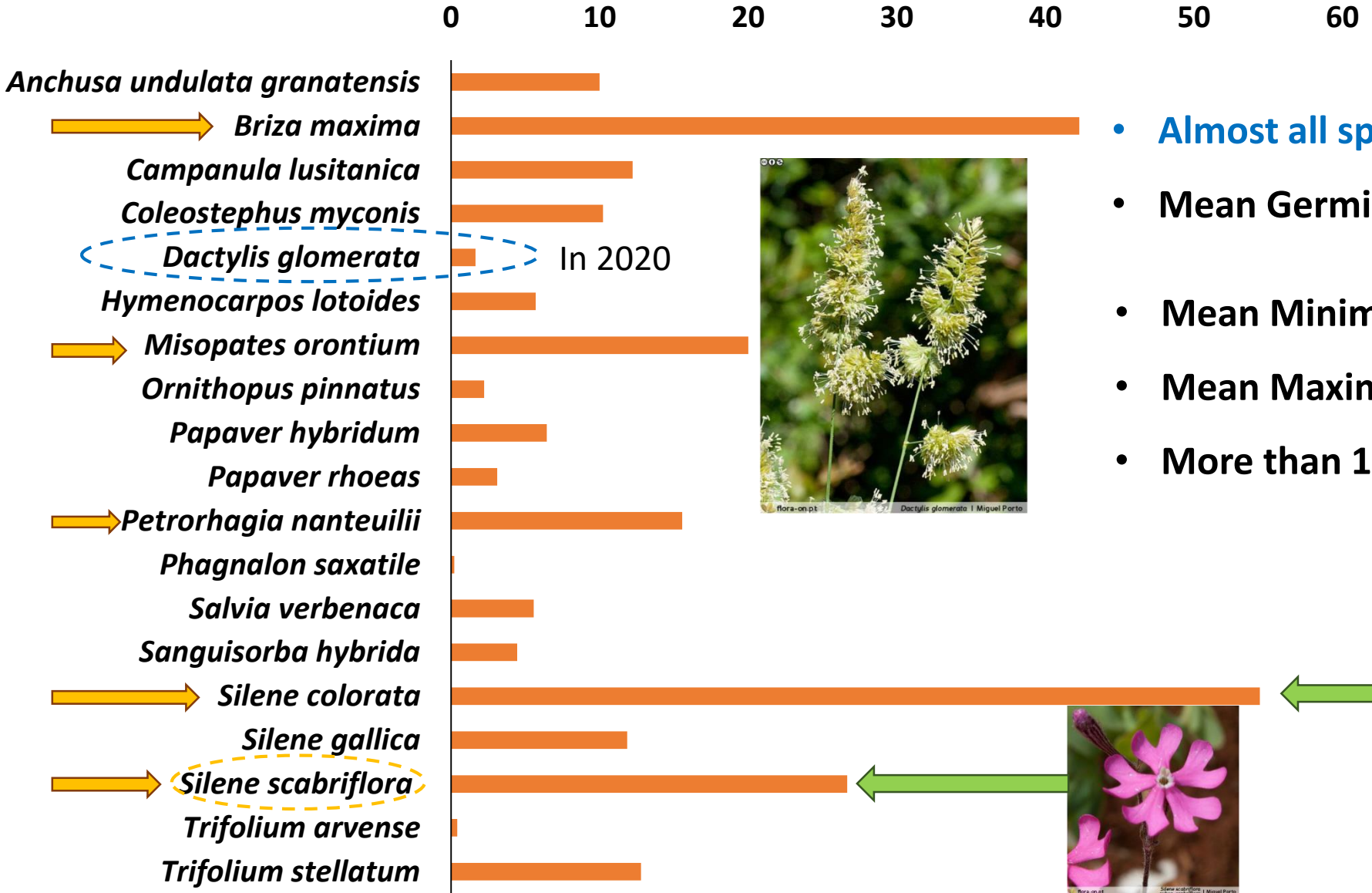
In-situ plots – on the roads

Autumn 2018

Spring 2019 and 2020

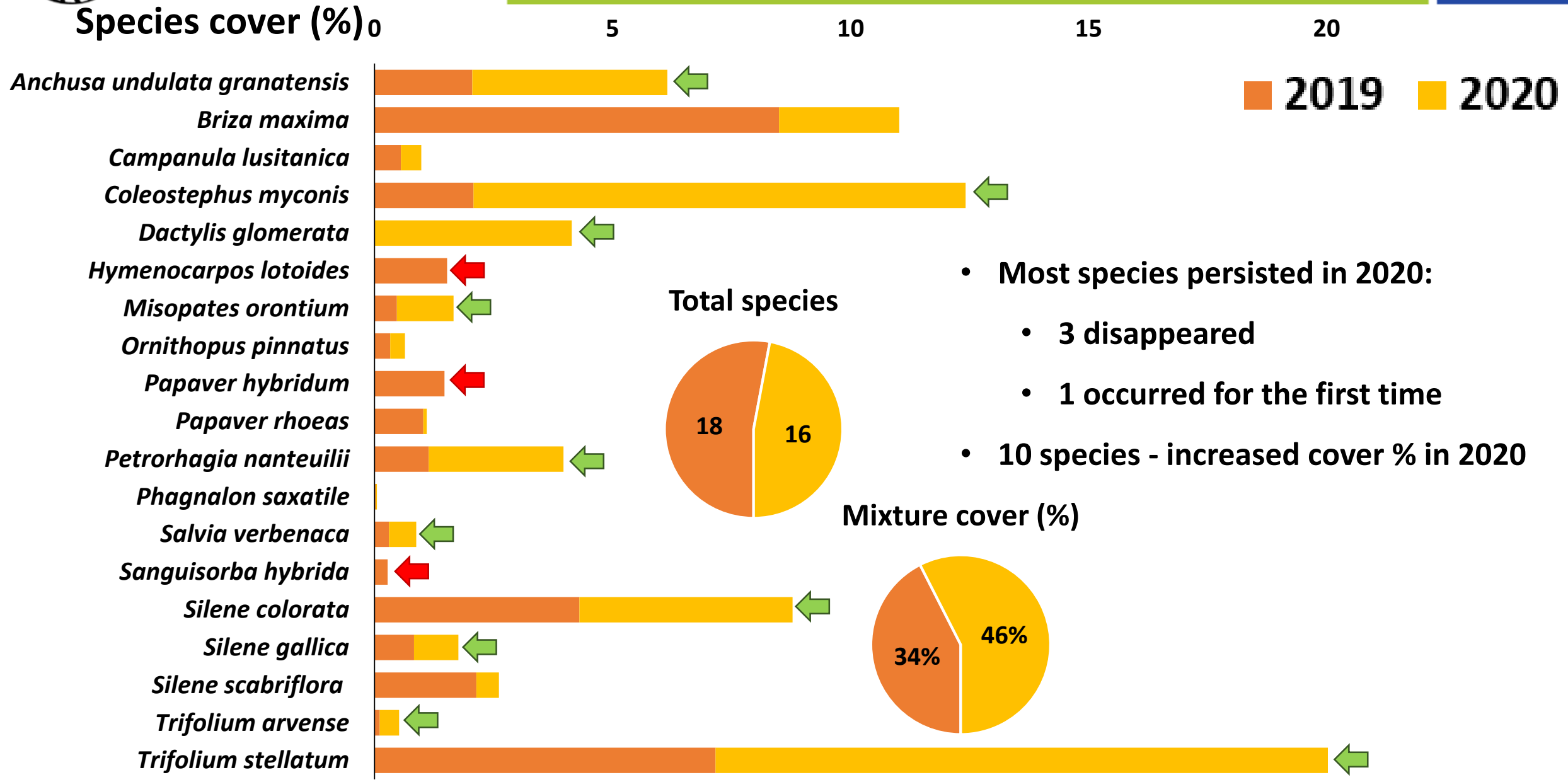
Results – Road Mixture

Species germination (%) – 1st year



- Almost all species germinated in the first year
- Mean Germination: 13%
- Mean Minimal Germination: 0.2%
- Mean Maximum Germination: 54%
- More than 15% germination: 5 species

Results – Roads Mixture



Total species

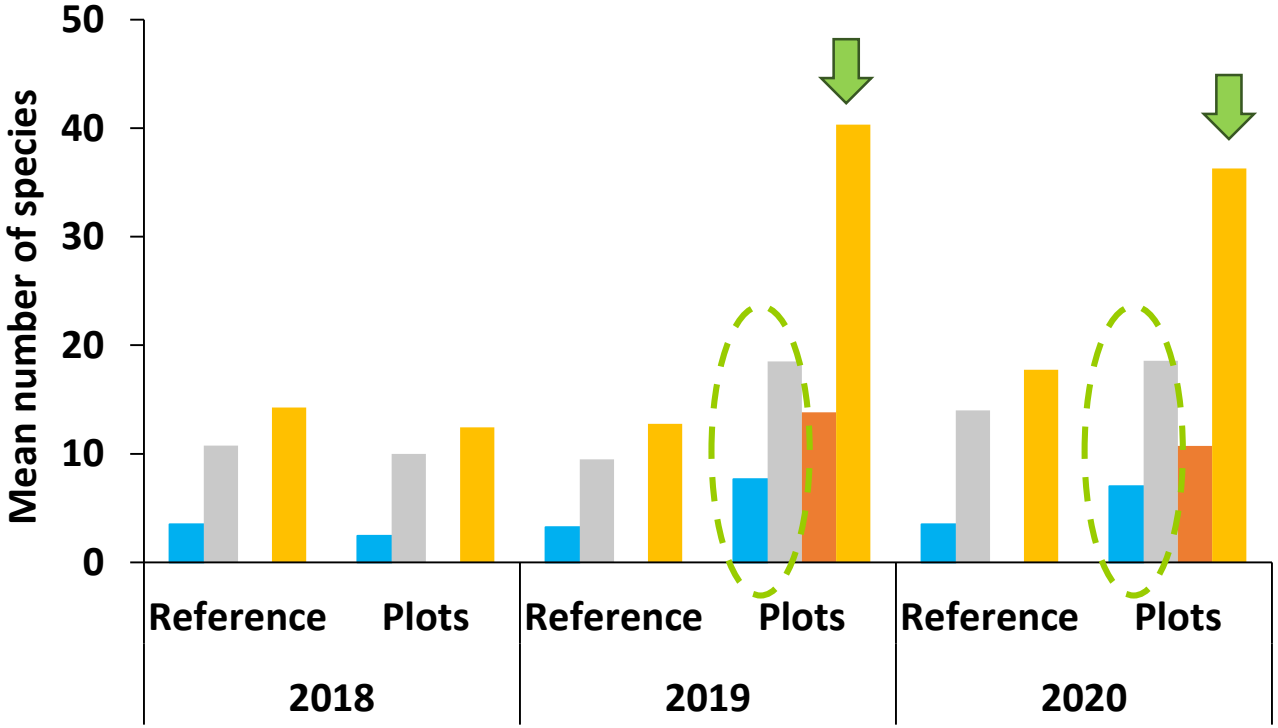
- Most species persisted in 2020:
  - 3 disappeared
  - 1 occurred for the first time
- 10 species - increased cover % in 2020

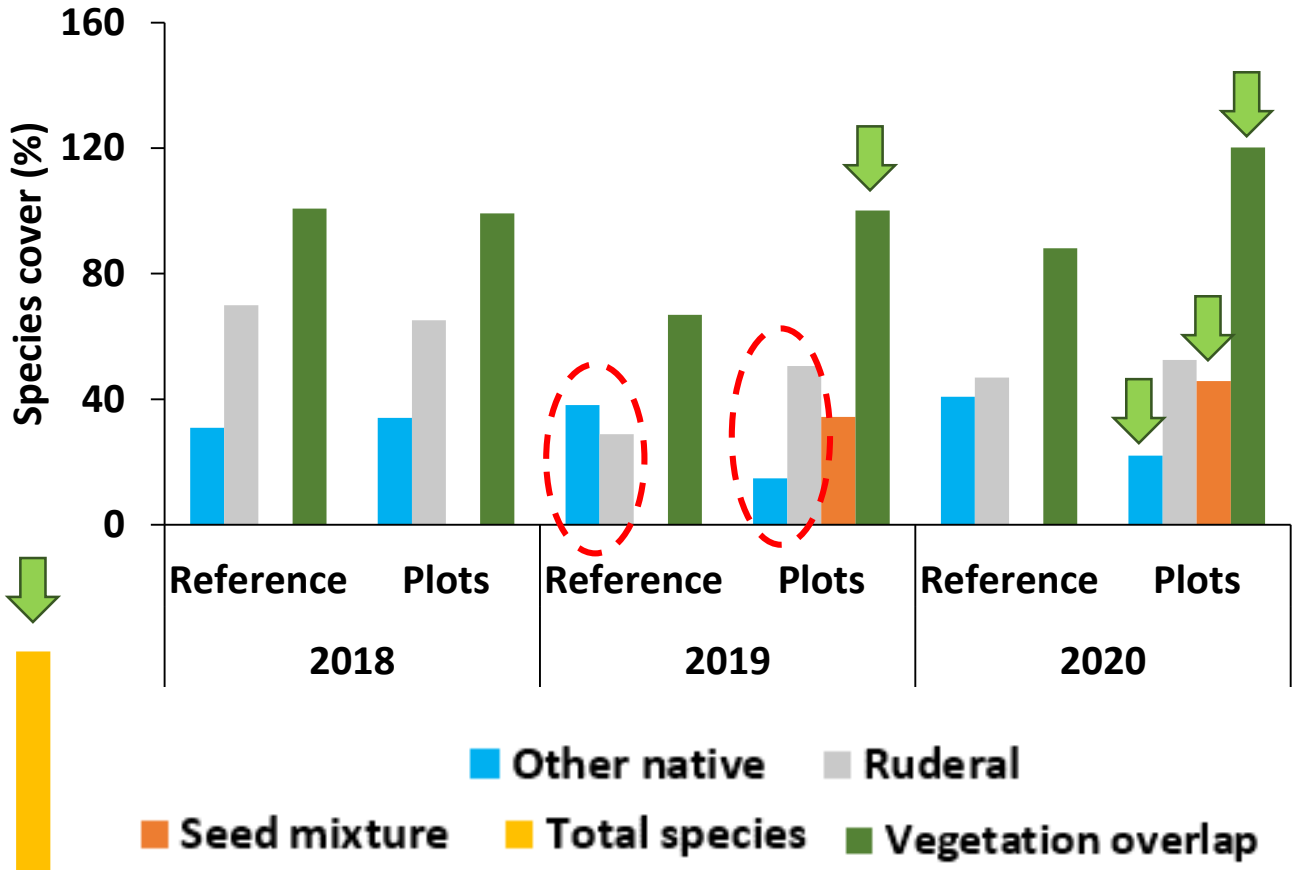
Mixture cover (%)

Results – Road Mixture

Floristic community

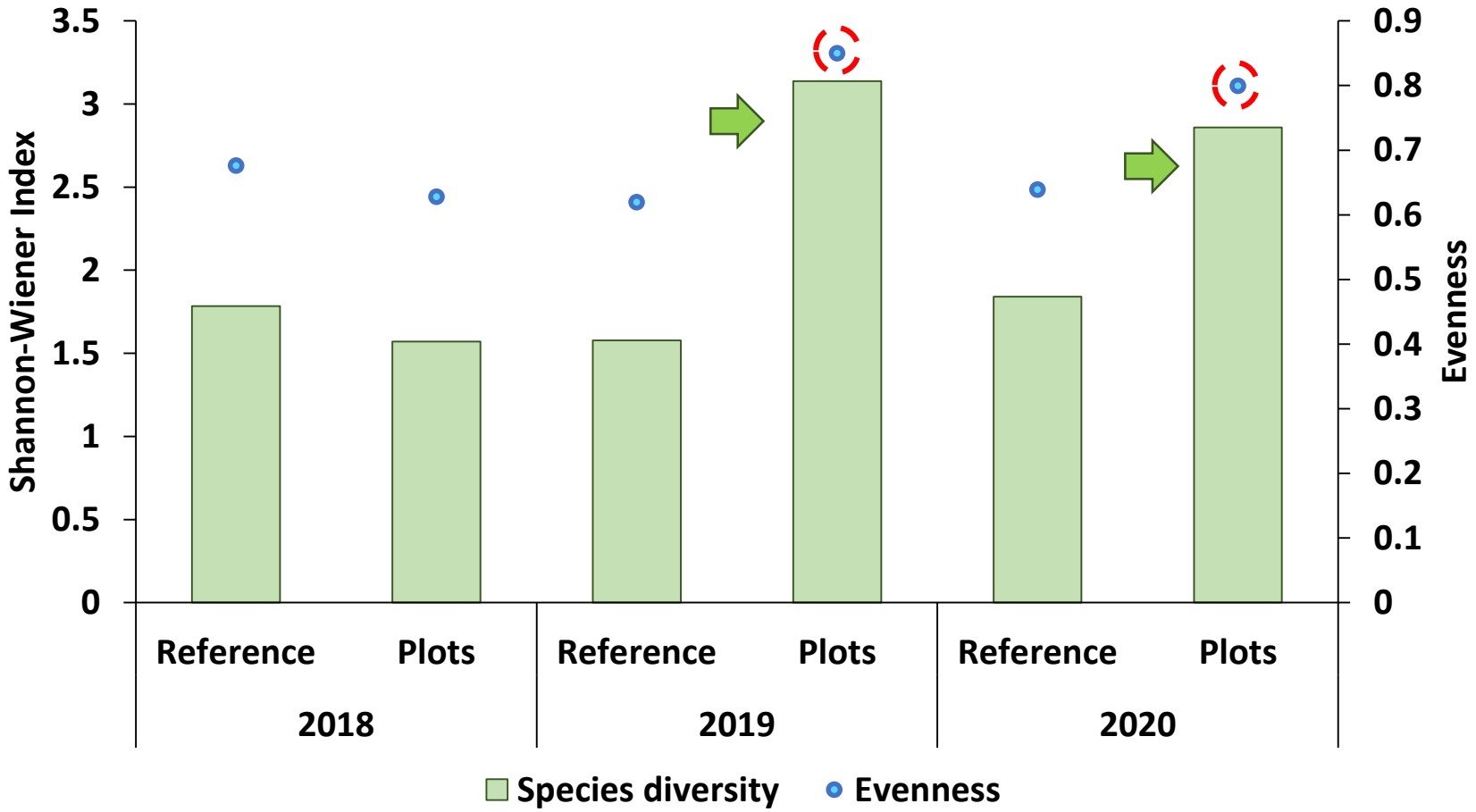
- Overall <u>increase</u> of:
  - The number and cover of native species
  - The vegetation overlap





Results – Road Mixture

Floristic community



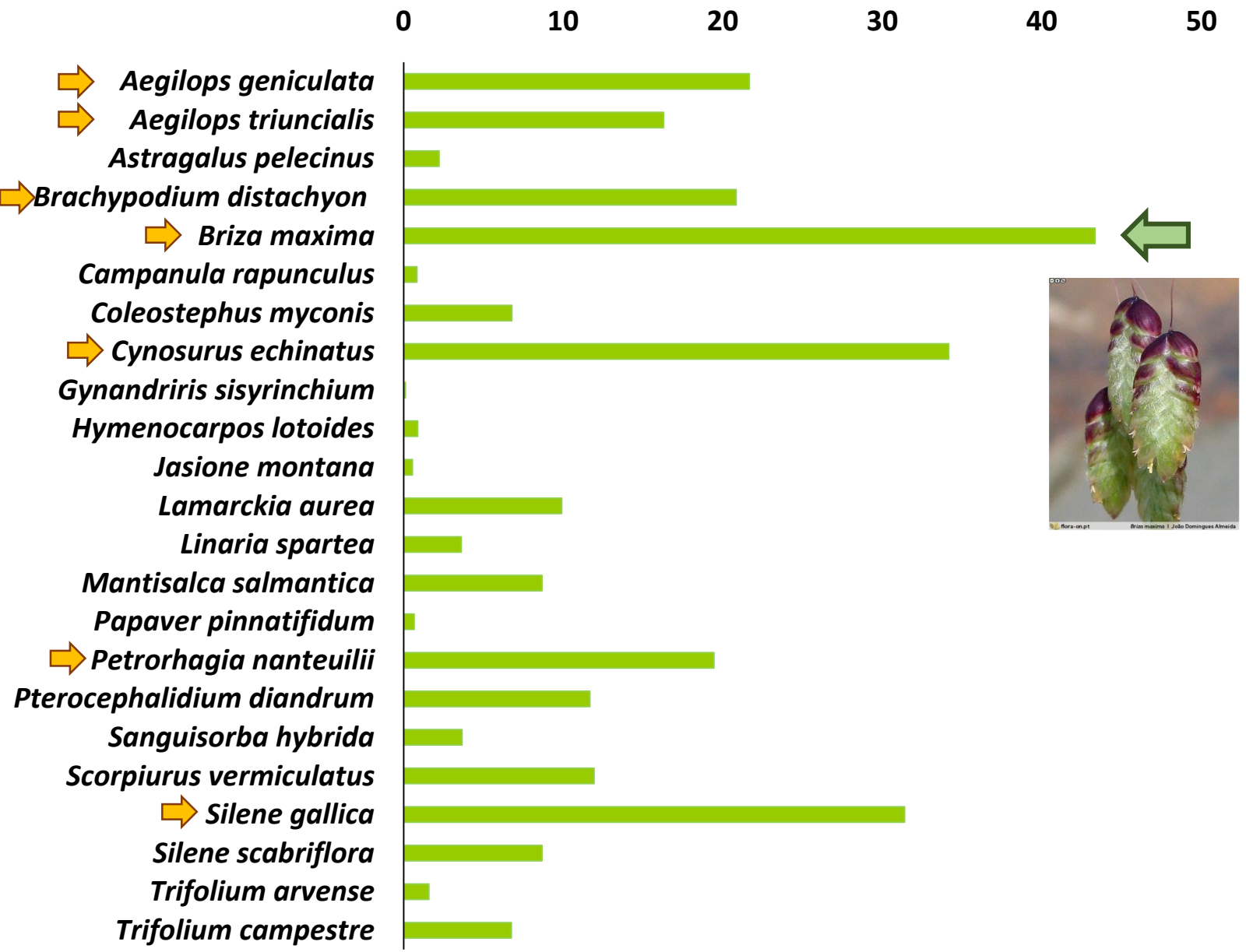
- Increase of:
  - Species diversity
  - Evenness

In-situ plots – on the ecotrails

Autumn 2018

Spring 2019 and 2020

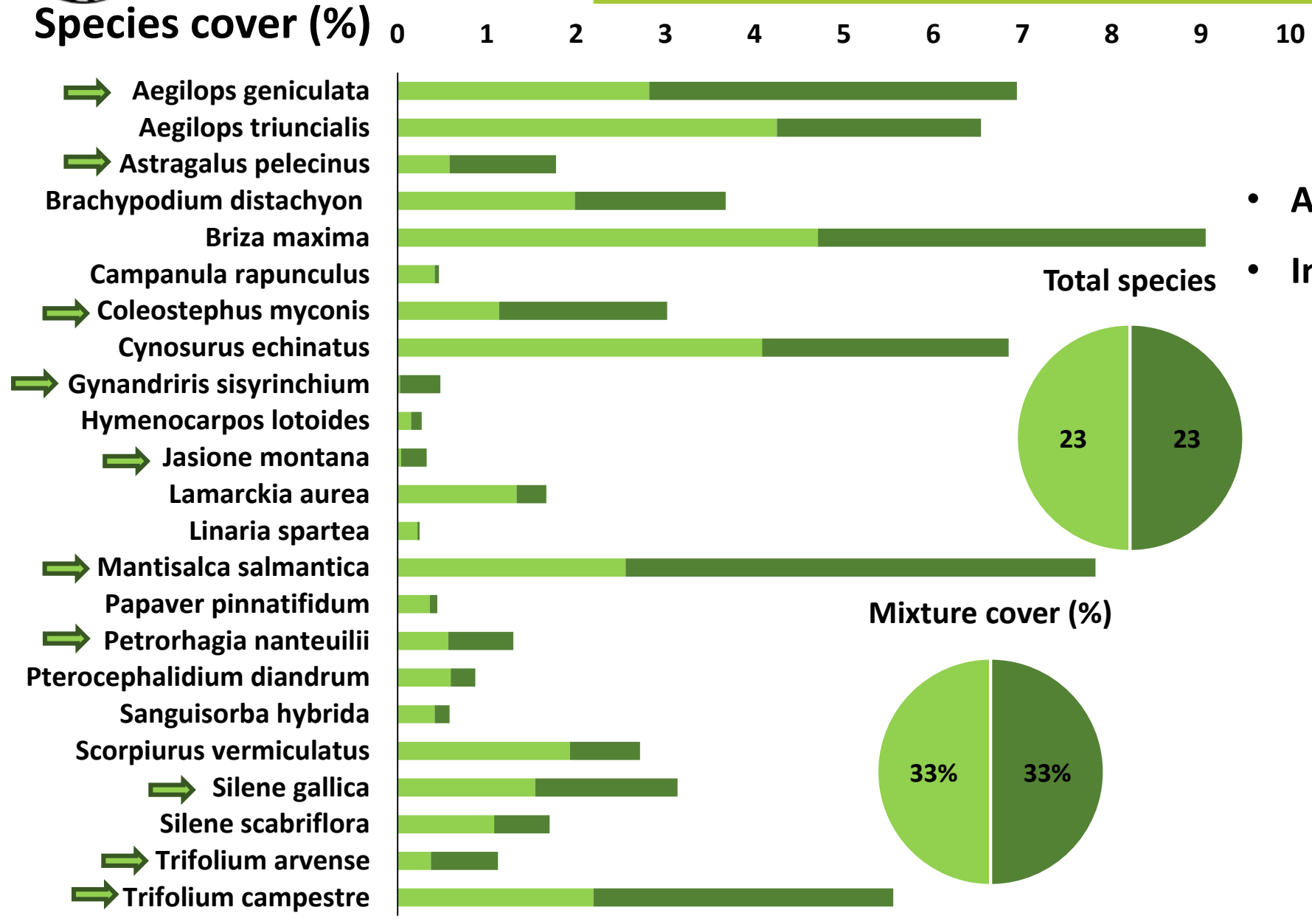
Results – Ecotrail Mixture



Species germination (%) – 1st year

- All species germinate in the first year
- Mean Germination: 11%
- Mean Minimal Germination: 0.1%
- Mean Maximum Germination: 43%
- More than 15% germination: 7 species

Results – Ecotrail Mixture



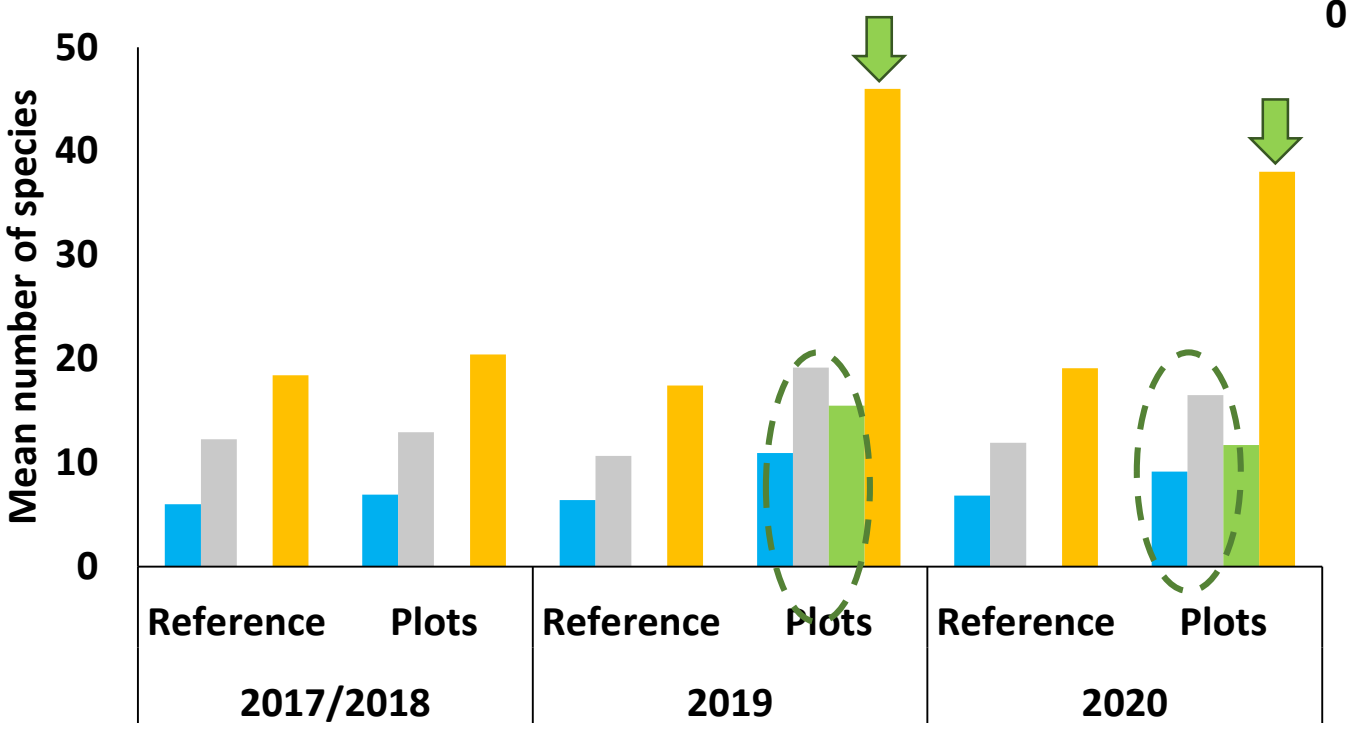
2019 2020

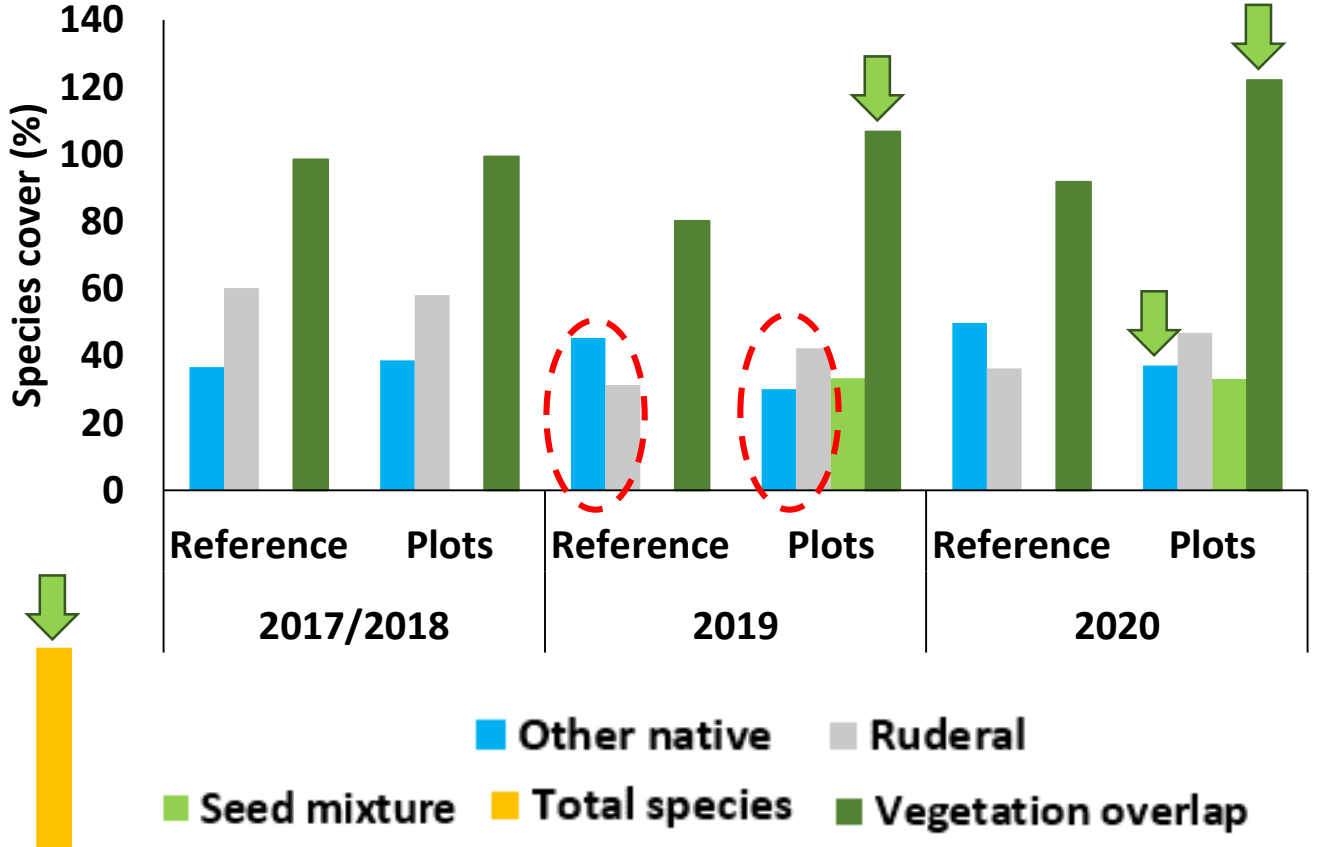
- All the species present in 2019-2020
- In 2020, the cover %:
  - Increase: 10 species
  - Decrease: 10 species
  - Equal: 3 species

Results – Ecotrail Mixture

Floristic community

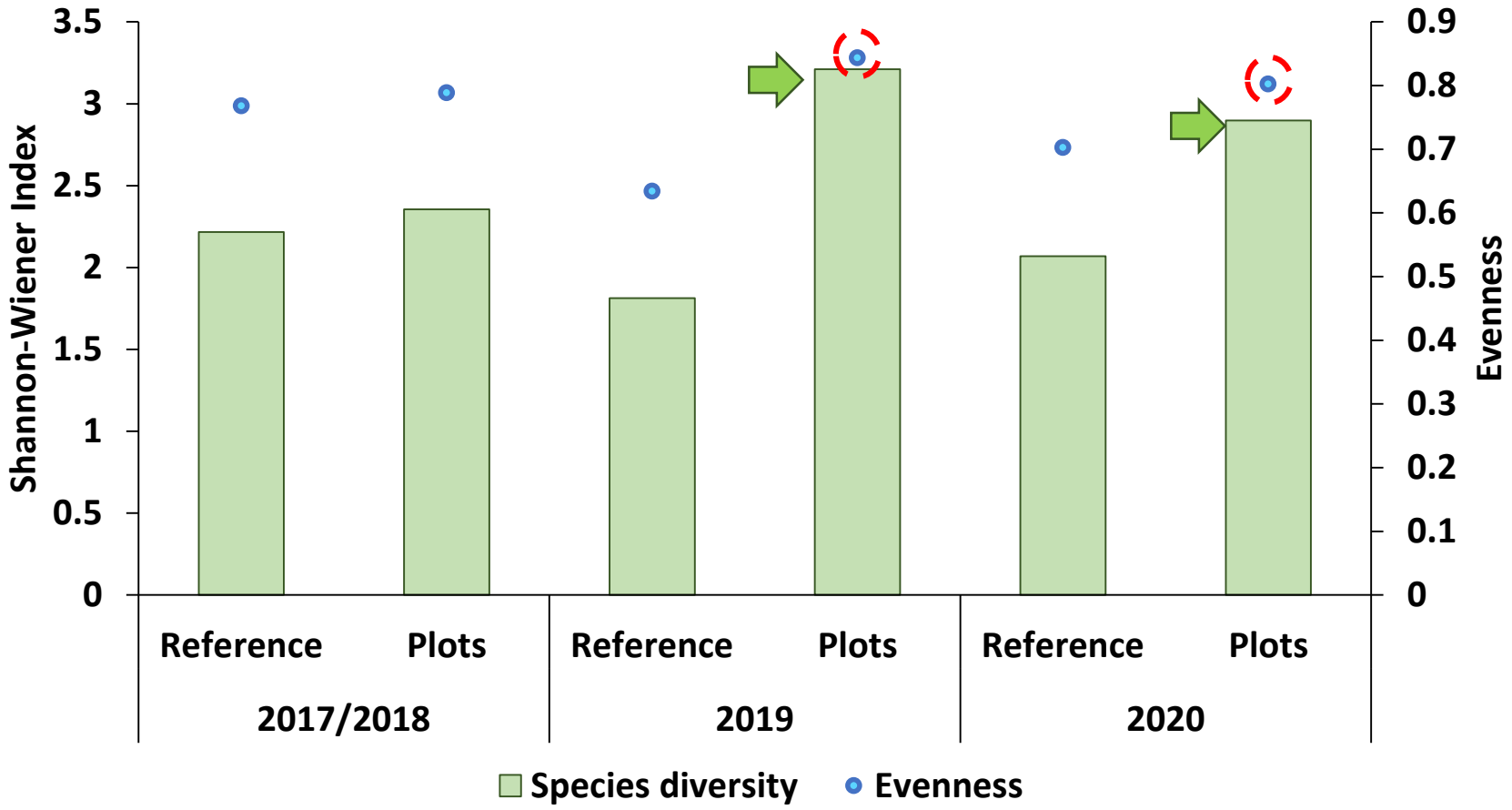
- Overall <u>increase</u> of:
  - The number and cover of native species
  - The vegetation overlap





Results – Ecotrail Mixture

Floristic community



- Increase of:
  - Species diversity
  - Evenness

Taking Home Ideas

All species tested germinated in *in-situ* plots
Sown species were registered in all the *in-situ* plots

Local plant diversity and evenness increased

Greater production of flowers and seeds

Good indicator of sustainability

The seed mixtures are suitable to be used in the south of the Iberian Peninsula

This study constitutes a basis to improve management standards

Further monitoring of the two seed mixtures dynamics and evolution

Possible adjustments to species composition or proportions

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Thank you for listening!

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