

First come first served: "priority effect" benefits *Ambrosia artemisiifolia* L. more than other ruderal Asteraceae species

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- YOU SAID PRIORITY EFFECT? -

In plant communities, species that start their development earlier can be advantaged over the other species. This advantage given by an earlier development is called the priority effect and can have an important impact on plant communities' composition and structure. This is particularly true in ruderal habitats where disturbances are frequent.

Common ragweed (*Ambrosia artemisiifolia* L.) is an invasive plant causing a health crisis in Europe due to its allergenic pollen. This annual plant is highly affected by competition, has an opportunistic behavior, and is often found in ruderal habitats.



Step A : We planted seedlings of each species alone in different pots, for a total of 200 pots (8 species x 25 repetitions).

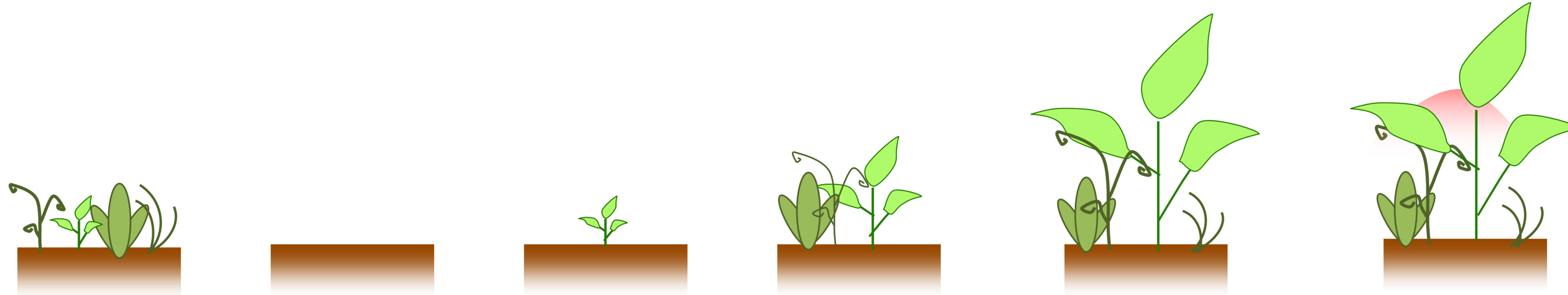


Illustration of how the priority effect affects ruderal communities. After a disturbance, the first species that starts its development can have a competitive advantage over the other species. This benefit is called the priority effect. In addition, the prioritized species may alter the development of the other species, and influence the community structure and composition.



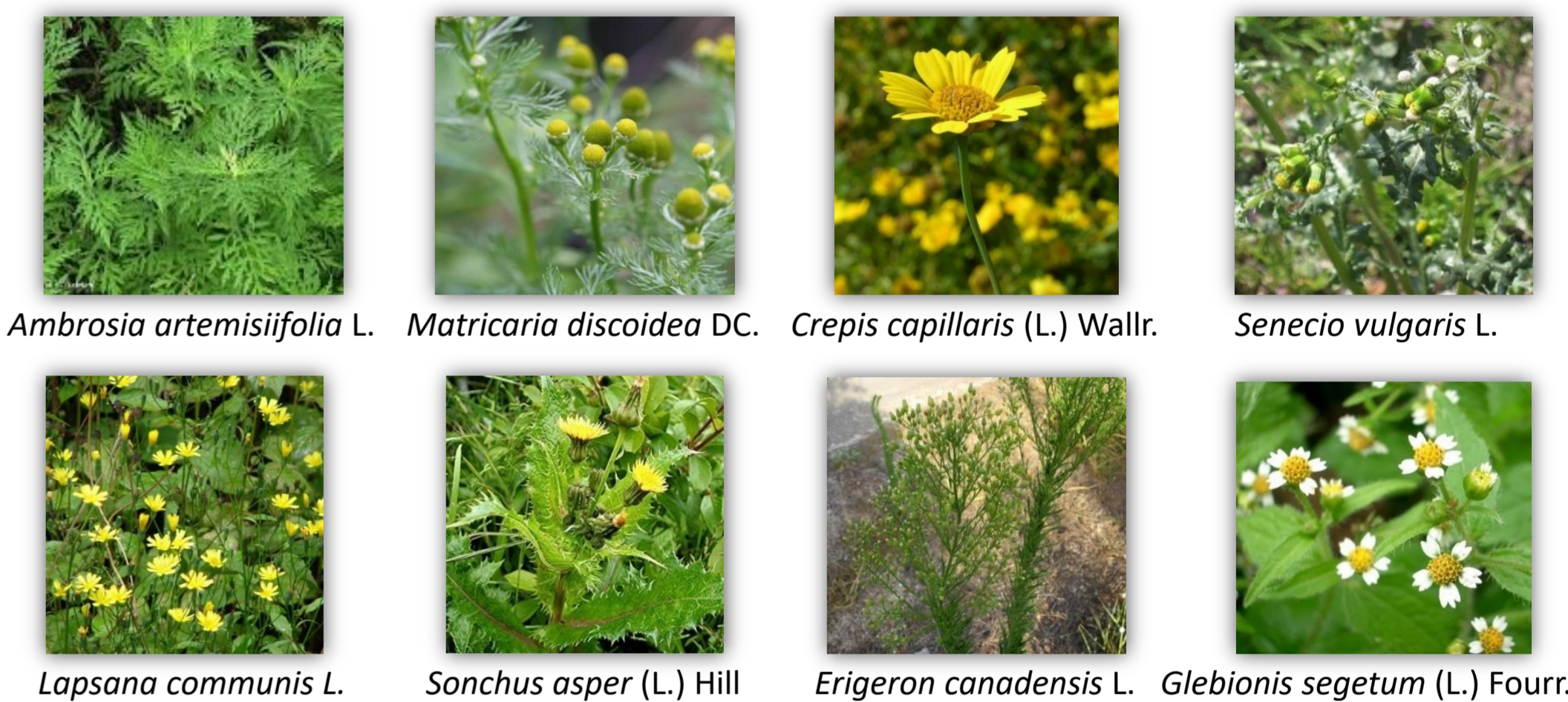
A prioritized plant of *A. artemisiifolia* flowering during the experiment



Step B : The other species were planted 3 weeks later, in order to have the 8 species in each pot, with one 3 weeks older than the others.

- SO... WHAT'S THE OBJECTIVE? -

The aim of this study was to evaluate the role the priority effect plays in the invasion success of common ragweed, by determining if the species is able to benefit more of the priority effect than other comparable species from ruderal habitats.



The different species we used to compare the benefit given by the priority effect. The species were all therophyte species from the Asteraceae family, growing in ruderal habitats.

- HOW DID YOU DO IT? -

We selected eight annual species from the Asteraceae family, growing in ruderal habitats in Belgium, among which *A. artemisiifolia*. At the beginning of the experiment, seedlings of each species were individually planted in separated pots.

Three weeks later, 7 other seedlings (one per species) were planted in the pots in order to have 8 seedlings from 8 different species in each pot, with one 3 weeks older than the others.

After two months, all the plants were cut at ground level, the above ground biomass was measured and the number of flowering head counted.



Step C : After 2 month of common life, we measured the number of flower heads and the above ground biomass of each plant.

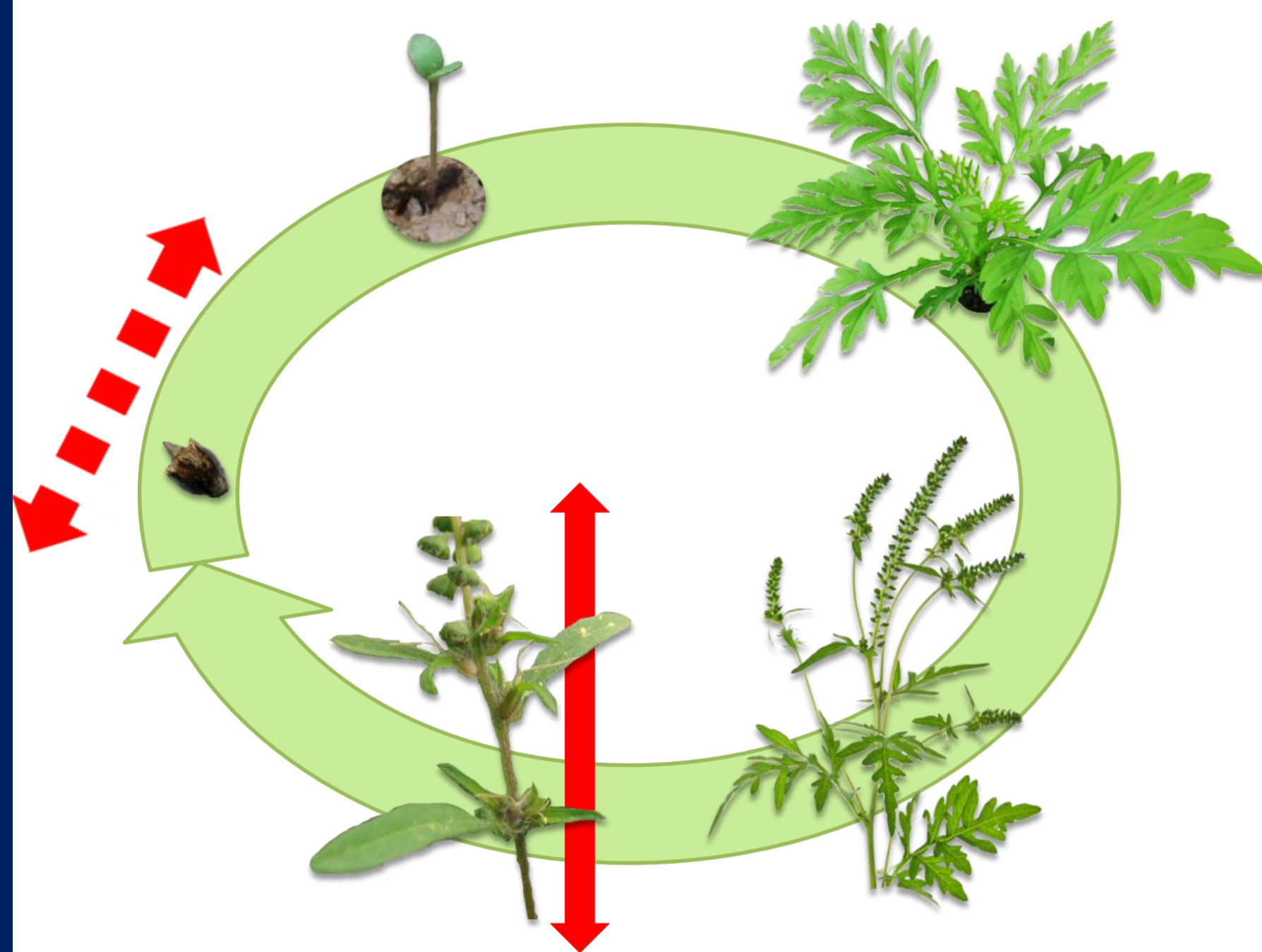
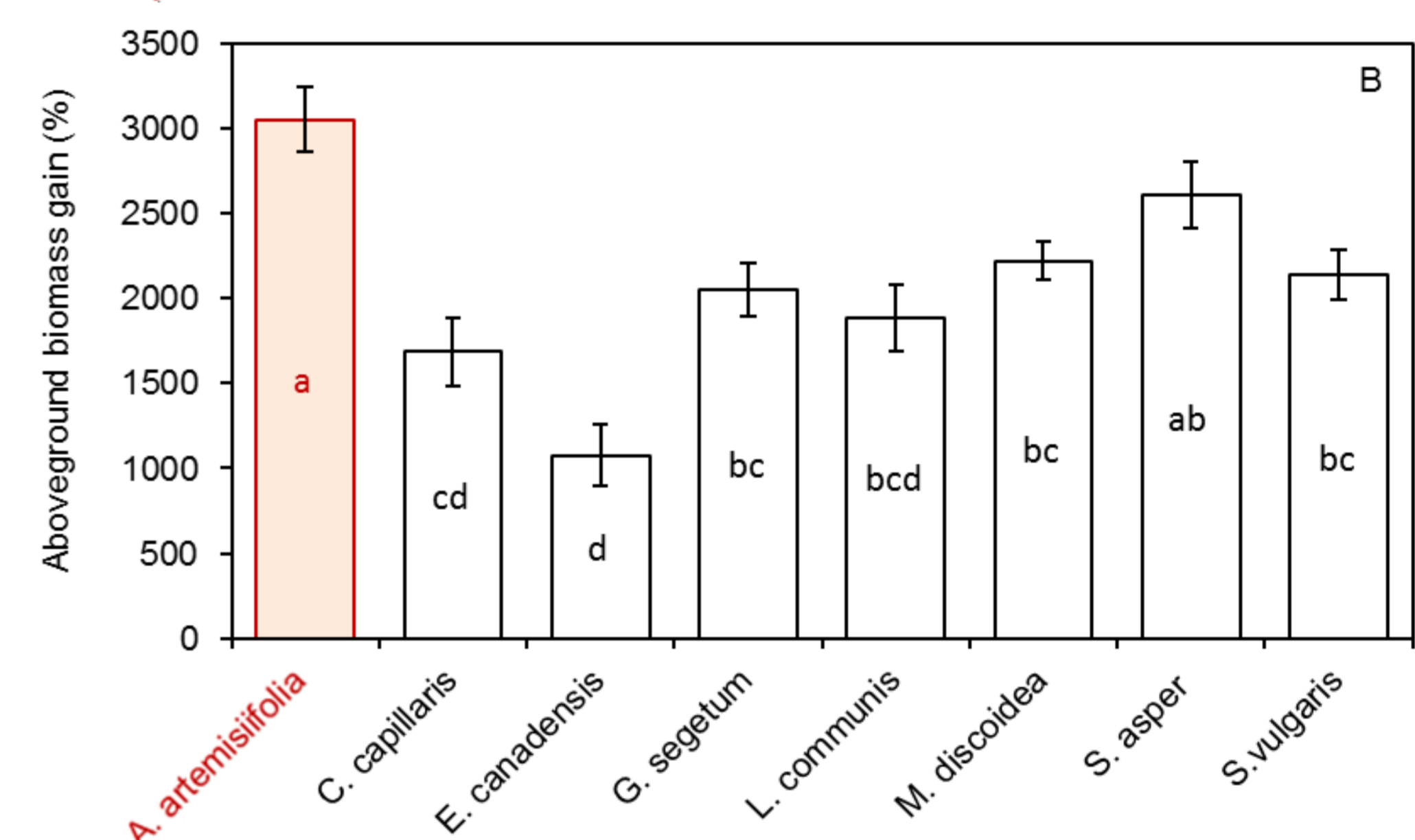
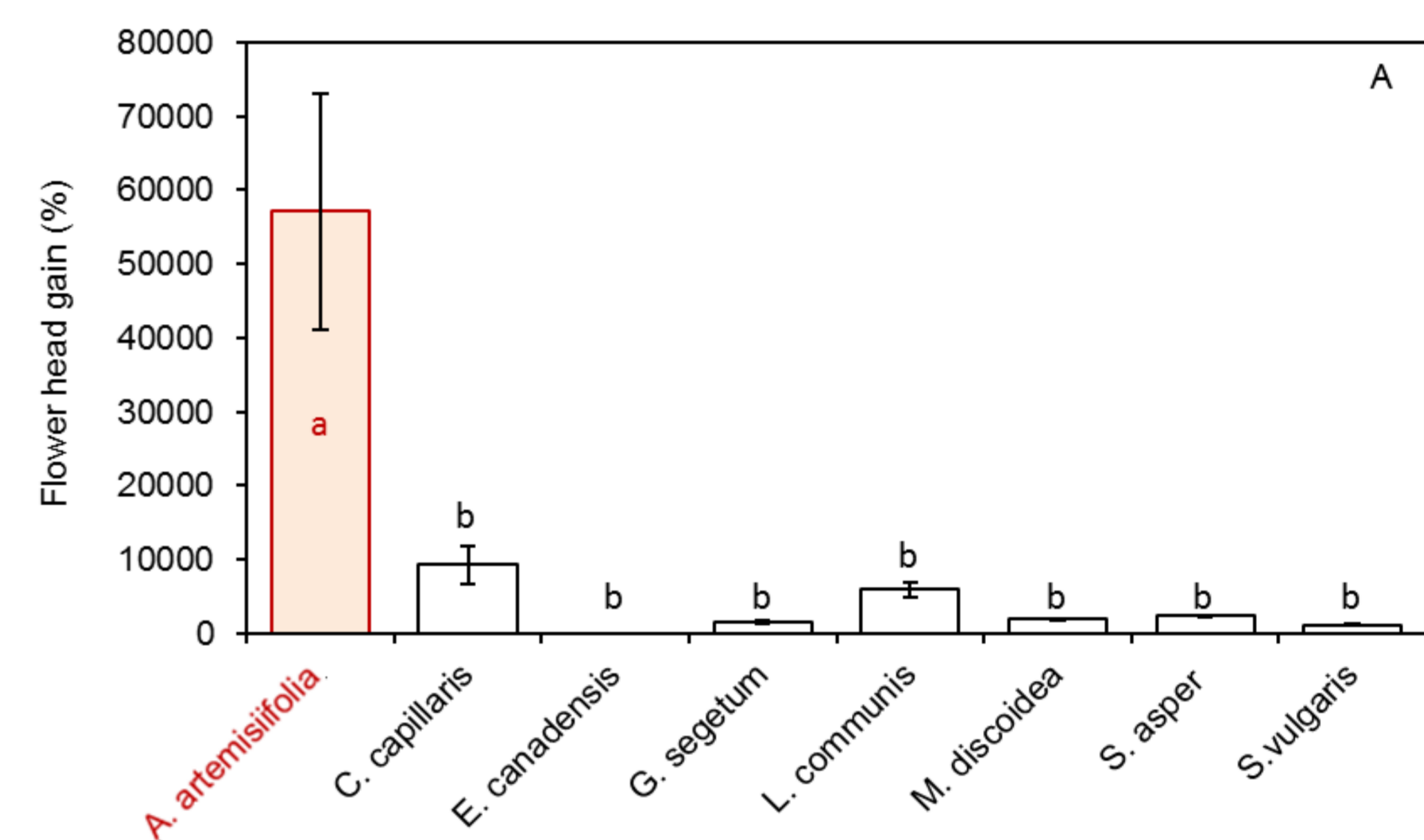


Illustration of the timing of the experimental design

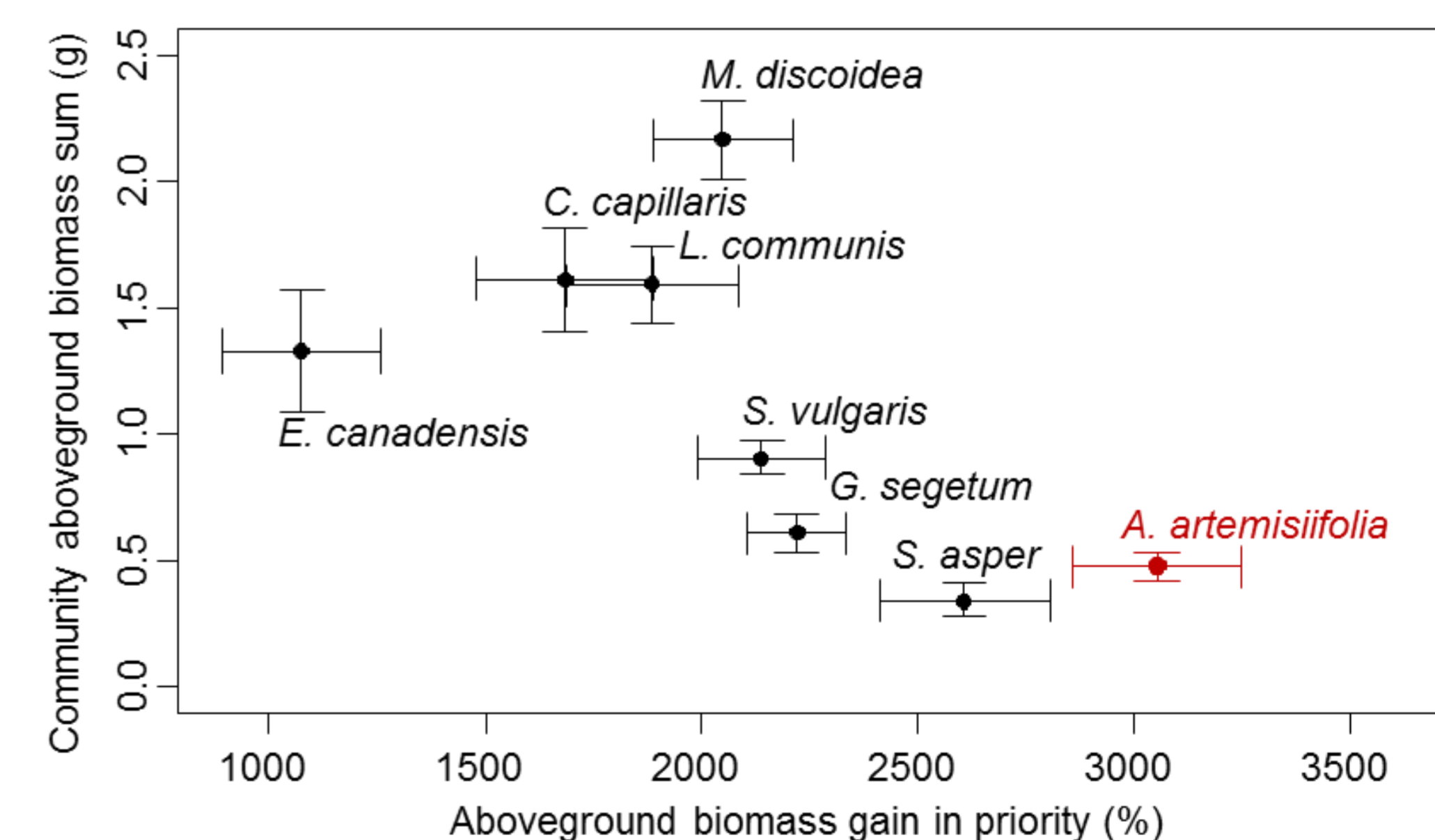
- OKAY. LET'S SEE THE RESULTS! -

The results showed that *A. artemisiifolia* benefited more from the priority than all the other species: its number of flowering heads was multiplied by almost 600 on average (Histogram A) and its aboveground biomass by 30 (Histogram B), when in priority.

Furthermore, when in priority *A. artemisiifolia* was the species that had the biggest negative impact on the development of the 7 other species (Scatterplot).



Histograms showing the gain from the priority effect for each species. A. Flower heads gain (%); B. Aboveground biomass gain (%). The letters in the center of the rectangles refer to the grouping of a Tukey's multiple comparisons tests.



Scatterplot representing the impact of the aboveground biomass gain of the prioritized species (x-axis) on the aboveground biomass of the rest of the community (y-axis).

A. artemisiifolia is an annual ruderal plant. If the species is able to exploit environment intermittently favorable condition, it could gain a benefit from the priority effect. Variation in the germination time, especially if it occurs before the competitors can thus greatly affects the final performance.

$$\text{Gain \%} = \left(\frac{x_{\text{priority}} - \bar{x}_{\text{dominated}}}{\bar{x}_{\text{dominated}}} \right)$$

To assess the benefit from the priority, we calculated a number of flower head gain and an above ground biomass gain for each prioritized plant. The gain is a relation between the prioritized position, and the dominated position.

- WHAT SHOULD WE LEARN FROM THIS STUDY? -

This work demonstrated the importance of maintaining native vegetation in invaded areas, since the growth of *A. artemisiifolia* without competition decuples its reproductive performance.

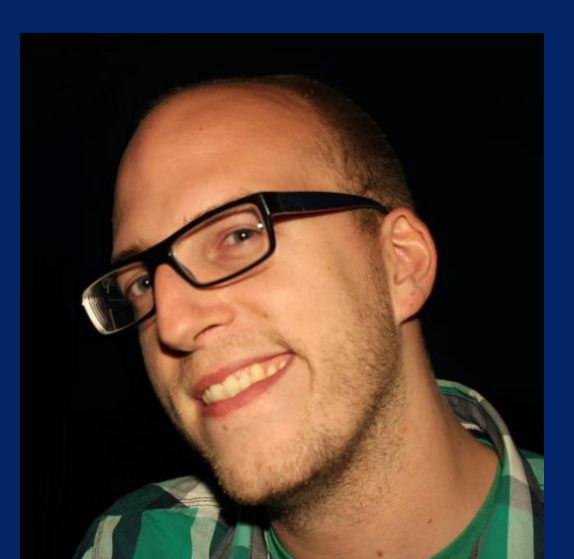
The avoidance of unnecessary disturbances is the first thing, but the artificial vegetation restoration of disturbed habitat can also have good results as showed in other studies.

This work also confirm a possible competition avoidance strategy in *A. artemisiifolia*. The species is highly impacted by the presence of competitors, and some authors have shown that the species is able to delay its seed germination in the presence of competitors. The high benefit from the priority can have been selected in order to take advantage of temporally favorable conditions, i.e. when a disturbance occurs.

TAKE-HOME MESSAGES

- *A. artemisiifolia* may pursue a "competition avoidance strategy", by hastening its development
- In priority, the species decuples its biomass, its flower heads, and reduce the other species growth
- It is therefore critical to avoid situations where *A. artemisiifolia* grows without competition

SEARCH FOR ME !



I look forward to answer your questions!