

Àrea de
Productes
Secundaris del
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Collecting *Arctostaphylos uva-ursi*, *Gentiana lutea* and *Thymus* spp. in Spain

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Studying area





We want to conserve our medicinal flora, we don't want wild harvesting definitively disappear!!

Our goal

The study of traditional wild collection can help us...

- ▶ Improving and making it a more productive and economically attractive activity for rural population.
- ▶ Increasing in value some neglected forests and rural areas, which usually lose their traditional land use.

We want to know...

1. What MAP resources have we got in the wild? Which can be collected?

- ▶ Literature & policy framework review, flora data bases and herbariums, local knowledge.

Arnica, rosemary, lavender,
Salvia lavandulifolia

2. Which of them are worth to be studied?

- ▶ Market and social surveys.

3. How much of these MAP resources do we really have?

- ▶ Inventories, resource density.

Arnica, thyme,
lavender, savory

We want to know...

4. Which wild populations are the most interesting to be collected?

- ▶ Yield estimation, biometrics, accessibility, chemical quality.

Arnica, thyme,
lavender, savory,
bearberry

5. How does collection affect to the regeneration and survival of the species/population?

- ▶ Reproduction studies.
- ▶ Effect of wild harvesting on the population and habitat (Collection/non-collection experimental studies).

Yellow gentian,
bearberry, thyme,
lavender, savory

Wild harvesting of *Arctostaphylos uva-ursi*

- ▶ The leaves are the part of the plant used.
- ▶ 2.6 t/year of dry herb are collected in the Pyrenees.
- ▶ The main compound obtained from this species is the arbutin.



- ▶ The leaves are used for its antiseptic and astringent qualities and applied mainly to the disinfection of urinary duct and bladder.
- ▶ *Arctostaphylos uva-ursi* has an ecological relevance against soil erosion, as well as soil formation whit its organic material.

Main objective of the study

- ▶ To know the leaves biomass production of *Arctostaphylos uva-ursi* and its regenerative capacity according to the **harvesting method** (intensity, frequency and season) or its **habitat conditions** (substrate, orientation and forestry vegetation cover)



Resource assessment

1. Annual production and optimal leaf gathering season (autumn or spring) according to location.
2. Sprouting capacity according to the previous gathering season (spring or autumn).
3. Biomass regeneration capacity according to the intensity of previous extraction.
4. Biomass regeneration capacity according to annual or biennial extraction.
5. Level of arbutin according to the gathering season.

1. Annual production and optimal leaf gathering season according to location

METHOD

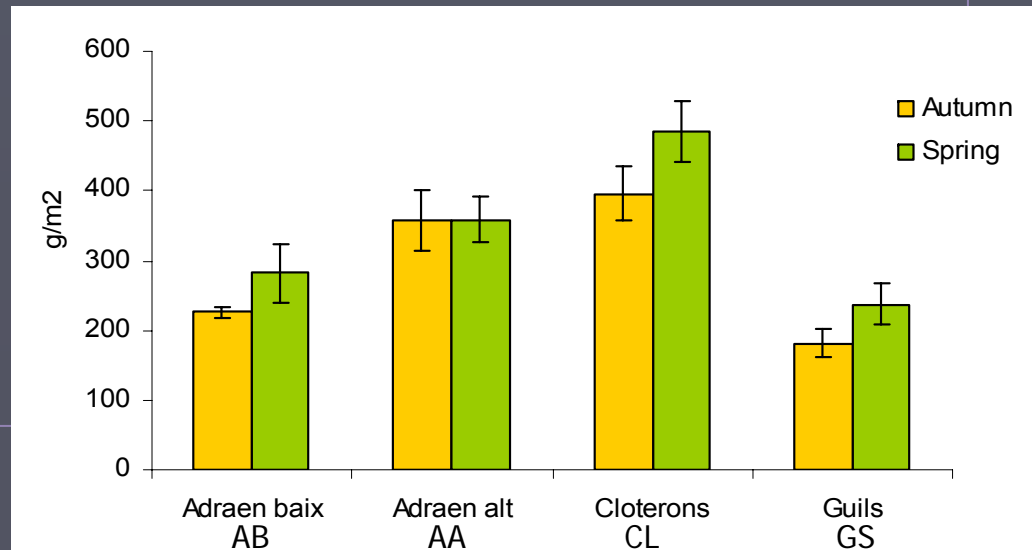
- ▶ Four places with different habitats conditions: AB, AA, CL, GS.
- ▶ Twenty plots (1m²) in each place.
- ▶ Selective pruning was carried out in each plot.
- ▶ Two different periods of gathering: autumn 99 (10 plots) and spring 00 (10 plots) in each place.

Autumn 99	Winter 99	Spring 00
AB: 10 plots		AB: 10 plots
AA: 10 plots		AA: 10 plots
CL: 10 plots		CL: 10 plots
GS: 10 plots		GS: 10 plots

1. Annual production and optimal leaf gathering season according to location

RESULTS

- ▶ In all the locations, except AA, yield of biomass gathered in spring 00 was bigger than the gathered in autumn 99 but the differences were not statistically significant.
- ▶ The highest biomass obtained came from the CL location, characterized by a minimum forest cover, southern exposure and calcareous substrate. The lower biomass was in GS with high tree cover, northern exposure and siliceous substrate.
- ▶ The highest yield was 484 g/m² of dry leaves in spring and the lowest was 181 g/m² in autumn.



2. Sprouting capacity according to the previous gathering season (spring or autumn)

METHOD

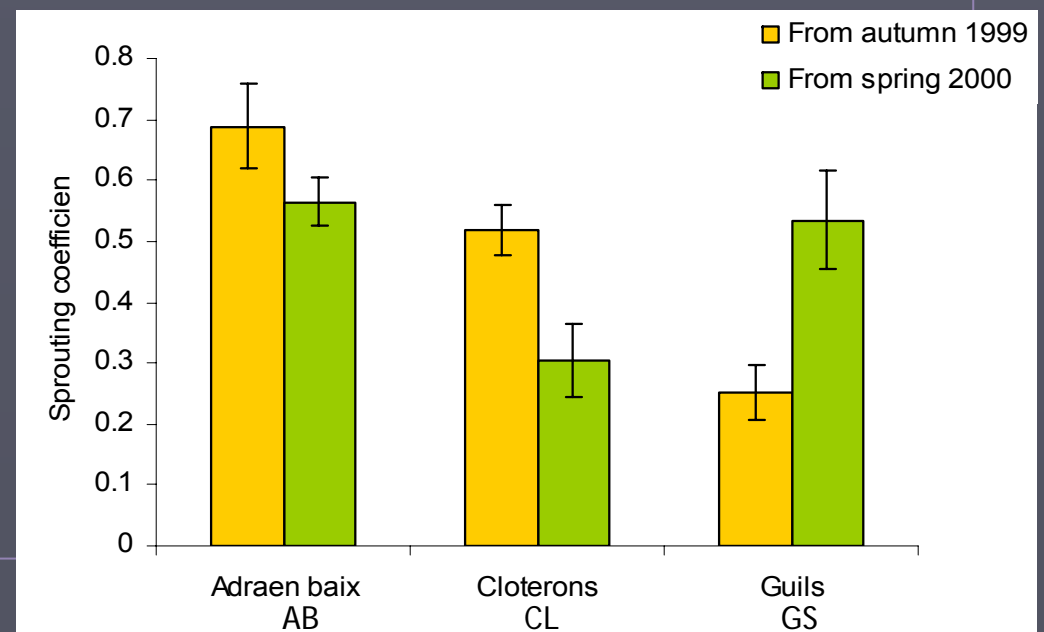
- ▶ Three locations with different habitats conditions: AB, CL, GS.
- ▶ Twenty plots (1m²) in each place.
- ▶ Selective pruning was carried out in each plot.
- ▶ Two different periods of gathering: autumn 99 (10 plots) and spring 00 (10 plots) in each place.
- ▶ The sprouting capacity was evaluated in summer 00.

Autumn 99	Winter 99	Spring 00	Summer 00
AB: 10 plots CL: 10 plots GS: 10 plots		AB: 10 plots CL: 10 plots GS: 10 plots	Evaluation the sprouting capacity cutting the 20 plots of every place

2. Sprouting capacity according to the previous gathering season

RESULTS

- ▶ In all the locations, the gathered biomass obtained in summer 00 was lower than the biomass obtained the autumn 99 or previous spring 00, for this reason, in all the cases, the estimated sprouting capacity coefficient was lower than the unity.
- ▶ In two localities *Arctostaphylos uva-ursi* showed a sprouting capacity coefficient higher if it is gathered in the previous autumn than in spring. In GS the answer was different.



3. Biomass regeneration capacity according to the intensity of previous extraction

METHOD

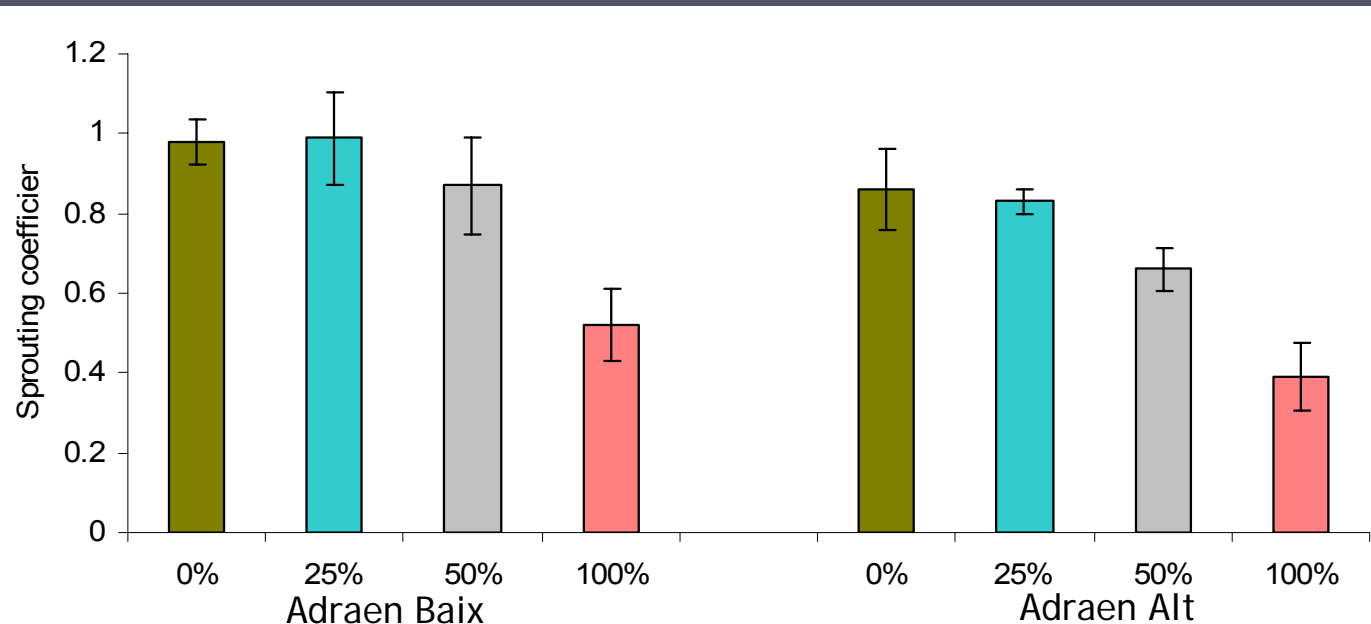
- ▶ Two places: AB, AA.
- ▶ Ten replicates for each treatment.
- ▶ Four different treatments: 0%, 25%, 50% and 100% of surface extraction.
- ▶ The extraction was whit non selective pruning.
- ▶ The sprouting capacity was evaluated in summer 00 when all the plots were gathered with selected pruning.

Autumn 99	Winter 99	Spring 00	Summer 00
AB and AA: four different extraction intensities: 0%, 25%, 50%, 100%.			All the plots were gathered with selected pruning

3. Biomass regeneration capacity according to the intensity of previous extraction

RESULTS

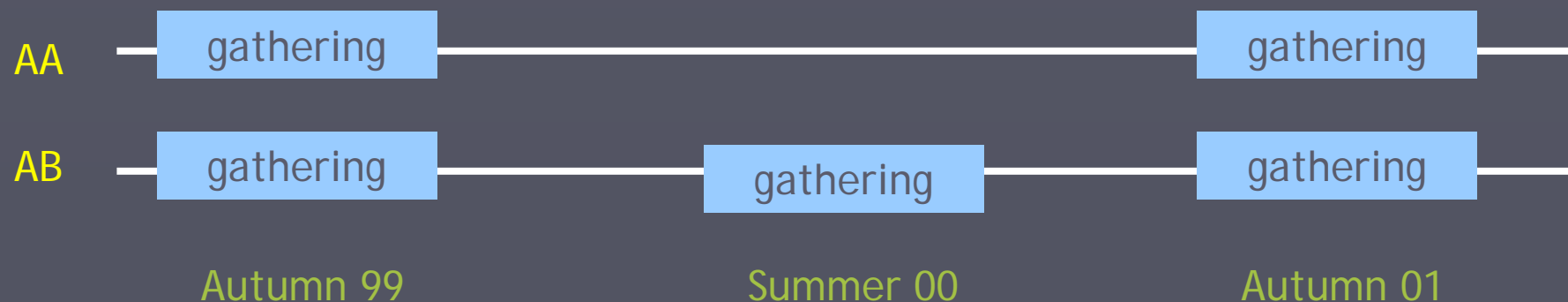
- ▶ In both localities, the sprouting coefficient decreased according to the intensity of extraction. However, the partly gathered plots (25% of entire area) did not show any significant difference in relation to the control treatment (0%).
- ▶ The lowest values of the sprouting capacity coefficient were observed in the completely gathered plots (100%) with values of 0.52 in AB and 0.39 in AA.



4. Biomass regeneration capacity according to annual or biennial extraction

METHOD

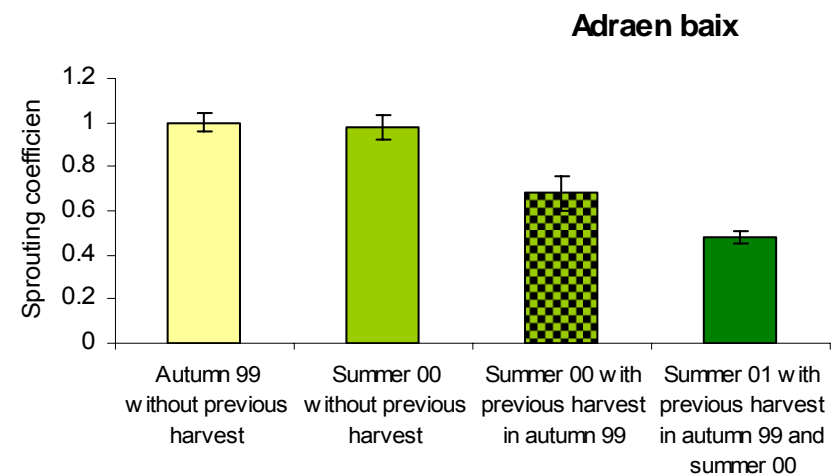
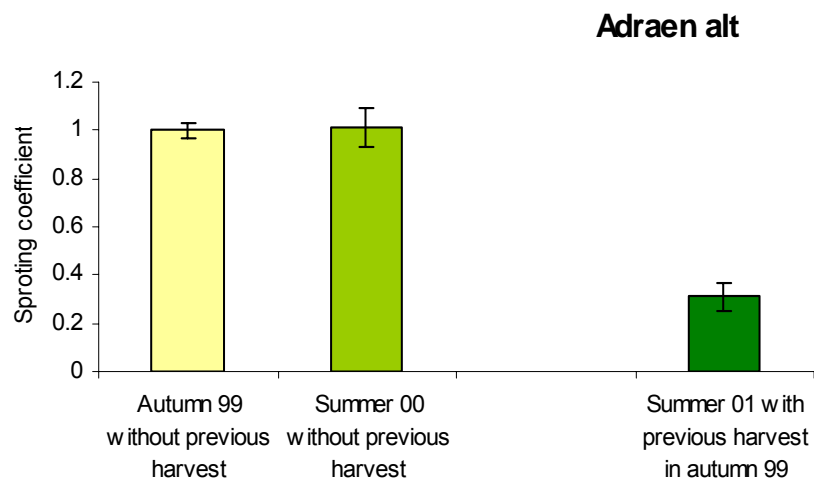
- ▶ Two places: AB, AA.
- ▶ In both localities the plots were completely pruned in autumn 99, and in AB the plots were pruned again in summer 00.
- ▶ In autumn 01 all those plots were gathered.



4. Biomass regeneration capacity according to annual or biennial extraction

RESULTS

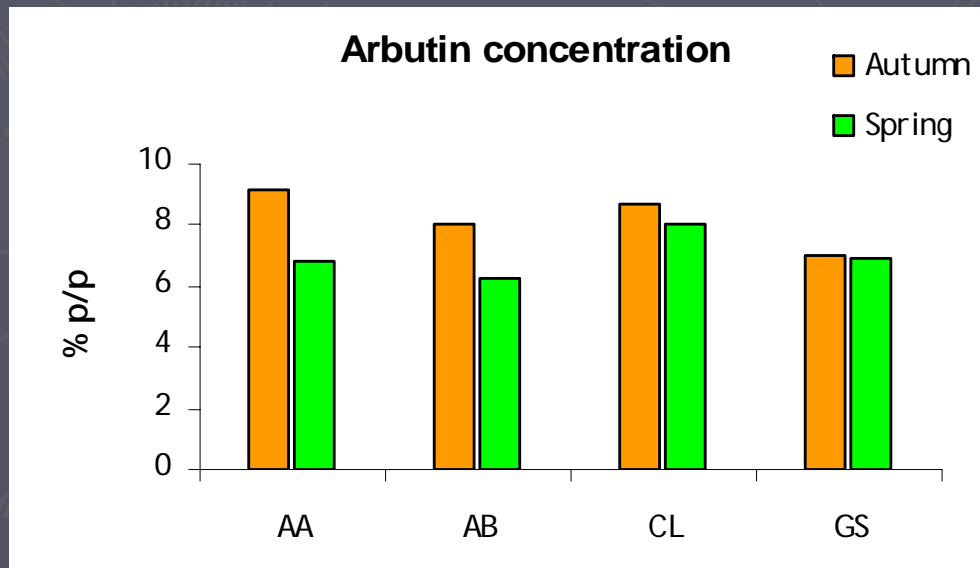
- ▶ In summer 01 no differences were observed in biomass values between AB plots (annual gathering) and AA plots (biennial gathering).
- ▶ In summer '00 no differences were detected between the coefficients from plots without previous gathering of both localities .
- ▶ On the contrary, a significant decrease in this coefficient was observed when the population was gathered the year before (only AB).



5. Level of arbutin according the gathering season

METHOD

- ▶ Four localities.
- ▶ Two different gathering season.
- ▶ Six samples of leaves from each locality and season.
- ▶ Chemical analysis.



RESULTS

- ▶ The total level of arbutina find in the *Arctostaphylos uva-ursi* leaves is very interesting, the highest was 9.16% of dry weight and the lowest 6.3%.
- ▶ The best season for gathering bearberry in order to obtain the highest arbutin concentration is in autumn.

Wild harvesting of *Gentiana lutea*

- ▶ The roots are the part of the plant used.
- ▶ 8 t/year of fresh roots are collected in the Pyrenees.
- ▶ The roots contain bitter substances used in the liqueur industry and in homeopathy.
- ▶ Traditional harvesting implies large periods for recovering wild populations and has a huge visual impact.



Resource assessment

1. Relation between the habitat and the abundance.
2. Resource density.
3. Biology of the species: phenology, biometrics, reproduction.
4. Effect of the harvesting method.

1. Relation between the habitat and the abundance

METHOD

- ▶ Transects 2 x 20 m
- ▶ Exposure (N, S, E & W).
- ▶ Total number of non-flowered plants and total number of flowered plants.
- ▶ 2 years of measures.

RESULTS

- ▶ Total number of plants is function of the exposure, but not of the year of sampling. Highest densities are registered in southern exposures.
- ▶ Total number of flowered plants depends on the year of sampling.

2. Resource density

METHOD

- ▶ Location of the collectable areas: estimation of total surface.
- ▶ Sampling: a % of the total surface, depending on the plant distribution homogeneity.
- ▶ Sampling unit: 5 m²-plots.
- ▶ Total number of plants and total number of flowered plants.

RESULTS

- ▶ In the Pyrenees we have found, densities of yellow gentian vary between 0.6 to 2.8 plants/m².

3. Biology: phenology

METHOD

- ▶ Phenology: during the annual life cycle, measures every week.
- ▶ 5 plots of 4 m²
- ▶ Next stage when 50-70 % of plants are not in the previous stage.
- ▶ Non-flowering plants: 4 phenologic stages.
- ▶ Flowering plants: 7 phenologic stages.

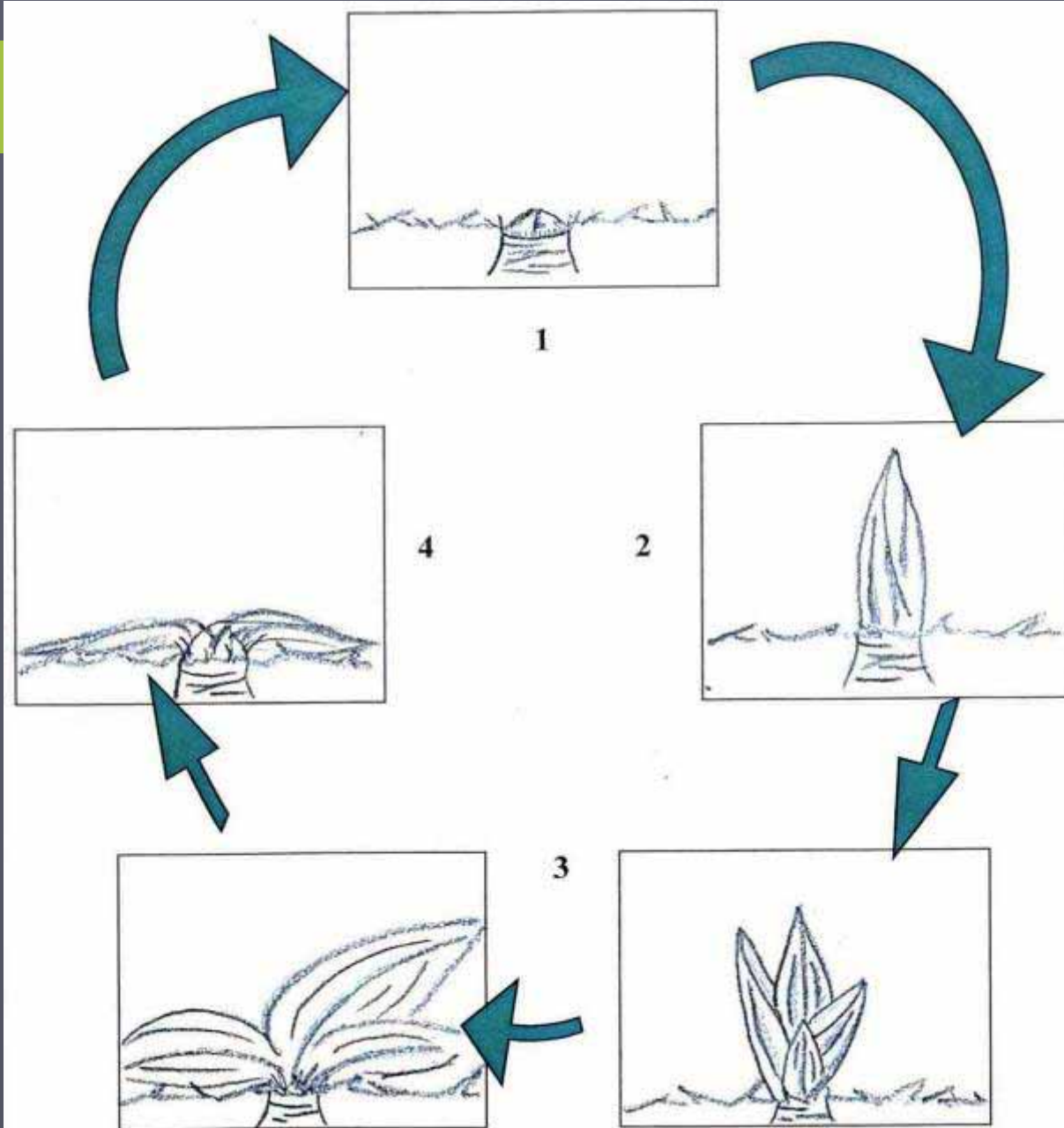
RESULTS

- ▶ In the Pyrenees the vegetative growth starts from the end of May to the beginning of June and finishes at the end of September.
- ▶ Blooming lasts from mid June to mid July, and fruit and seed formation, from mid July to mid August.

Biology: phenology

NON-FLOWERING PLANTS

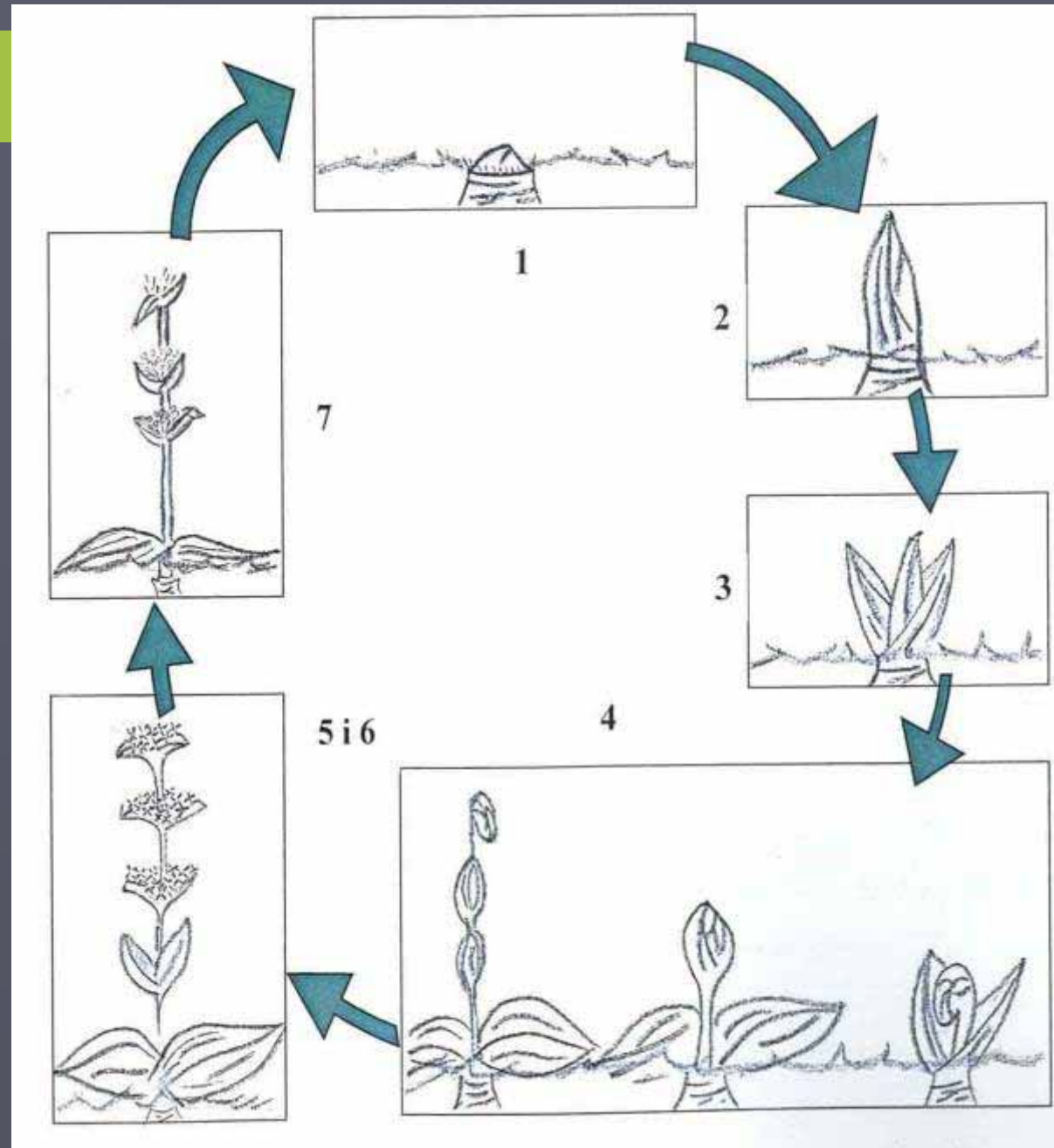
1. Winter stage
2. Sprouting
3. 1st leaves and vegetative growth
4. Senescence.



Biology: phenology

FLOWERING PLANTS

1. Winter stage
2. Sprouting
3. 1st leaves and vegetative growth
4. Floral bud formation
5. Blooming
6. Fruiting and seed formation
7. Fruit opening, seed dissemination and plant senescence.



3. Biology: reproduction

METHOD

Seed Germination

- ▶ Treatments: seed conservation method (room temp., low temp. and stratification), scarification, GA3 treatment. Germination conditions for all the treatments: 12 h day+25°C and 12 h night+15°C.

Shoot's rooting capacity

- ▶ Plant material: shoots (with 2-3 cm of root and the apical bud), apical root's fragments (with vegetative buds), root's fragments.
- ▶ Substrates: natural soil (from gentian's habitat) and peat.

RESULTS

Seed germination

- ▶ The greatest germination rate (19-23%) was obtained in seeds conserved at low temperatures and pre-treated with a GA3 bath.

Shoot's rooting capacity

- ▶ Only the shoots were able to sprout and root after being planted in pots, both in natural soil and peat.

4. Effect of the harvesting method

METHOD

- ▶ Permanent plots with similar initial plant density. 5 replicates x 2 locations.
- ▶ Treatments: non-collection (control), collection (1sts studies: extraction rate= 80 %, without planting shoots; latest studies: extraction rate= 80%, planting 4-5 collected shoots).
- ▶ Number of plants, number of shoots, and number of shoots per plant: before and one-year after the extraction.

RESULTS

- ▶ The total number of plants and shoots decrease one-year after the treatment, but this reduction cannot be considered statistically different when some of the harvested shoots are planted.





Cutting gentian shoots.



Gentian shoot ready to be planted.

Immediately after harvesting...



One year after harvesting...



Wild harvesting of *Thymus vulgaris*

Effect of harvesting technique

METHOD

- ▶ Collection technique: (1) cutting the green plant parts (annual biomass production), (2) cutting the whole plant (plants cannot sprout) or (3) no-cutting.
- ▶ Extraction rate: 50% or 100% of the plants.
- ▶ Periodicity: annual or biennial.
- ▶ Only the plants "able to be collected" are harvested.
- ▶ Every year, measures of the total number of plants in each plot (able and not able to be collected).
- ▶ 21 permanent plots in each population. Plots of 1.5 x 1.5 m .
- ▶ 2 populations.

Year 0	Year 1	Year 2	Year 3
Counting, cutting annual and biannual treatments	Counting, cutting annual treatments	Counting, cutting annual and biannual treatments	Counting, cutting all treatments.



THANK YOU!!!