Assessment of 6 months spent working the Vieiro Property

This short synthesis sums up the work done by Louis Tung as a volunteer and intern for the 6 months between September 2021 and March 2022.

Special thanks to Daniel, Inês, José, Marco, Margarida.

## Analysis of the Vieiro property

Humidity and Plantations

The humid riparian areas are represented on the map below. I modeled them 10 meters wide, along the streams, based on field prospections. They represent a minor part of the property but contain a major part of the biodiversity. If there is to be conservation work on the property, it should be focused on these ones. For instance, by planting species that are mesohygrophile (ex: Alders trees *Alnus*, Ash trees *Fraxinus*) or mesophile (ex: common oaks *Quercus robur*) in these areas.

Humid areas in the Vieiro Property
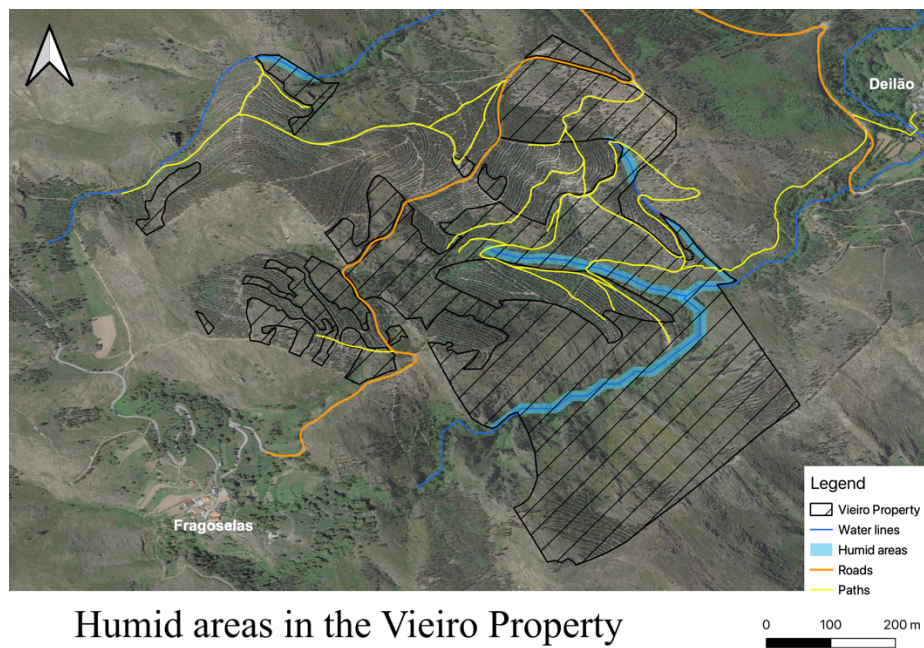
Exposure and Plantations

The exposure to the North is related to a colder a more humid area. In contrarious, an exposure to the South is usually linked to a drier and warmer area. Most of the property is exposed to the East or the North.
Only a small part of Vieiro is oriented to the South. It's the warmest and the driest, we would prefer planting thermophile, mesoxerophile (ex: Pyrenean oak *Quercus pyrenaica*) and xerophile (ex: cork oak *Quercus suber)* species in these areas. In the same way, preferring planting mesophile species in the blue and green areas (ex: common oak *Quercus robur*).
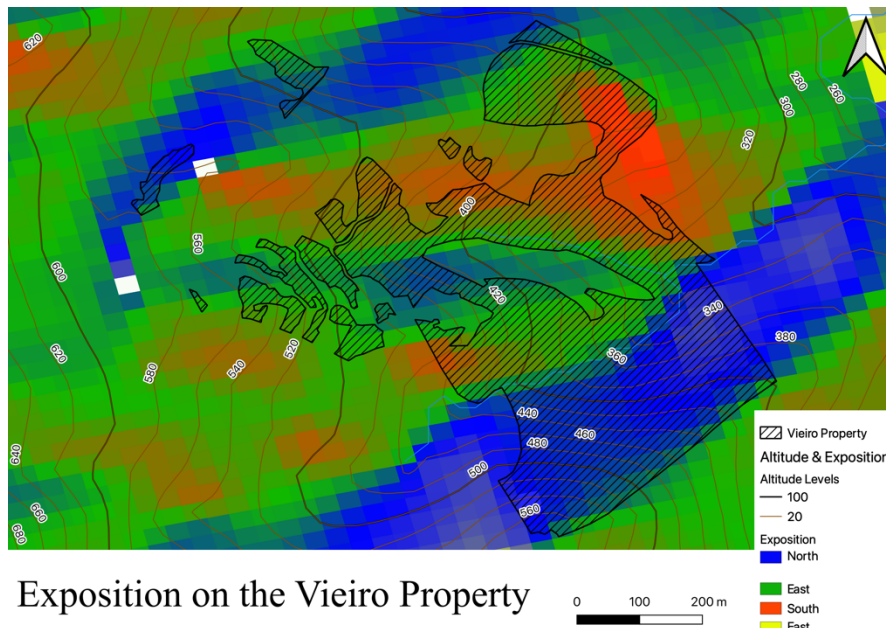
Exposition on the Vieiro Property

NB: planting according to the plot conditions is not mandatory: in Vieiro, some small individuals are present in areas that do not fit their ecological niches (probably due to local microvariations). Species can grow out of their ecological optimum, but the speed and final height is impacted. Since the goal is to grow a tree-filled cover as fast as possible, it is more efficient to do so.
Using the protocols below could provide the response of the vegetation to these parameters and adapt the planting methods.

Soil characteristics

The soil quality in Vieiro is described as "low" and not having a "high value of conservation". Vieiro does not contain HVE (High Environmental Value) vegetation either. The global vegetation quality is qualified as "variable".
The soil is supposed to be "50 to 100cm thick", which does not match with the field observations. The pH is supposed to be between 5.0 and 5.5 on all the property. However, when looking at the flora on the property, I noticed that some areas contain plants that prefer richer areas (ex: *Crataegus monogyna*), which shows the existence of pH variations on the property, especially along the water lines.
The Vieiro property is described as **Medium Texture** (= less than 35% of clay and more than 15% sand OR more than 18% clay if the sand content exceeds 65%). This is a big category and therefore not precise. During the tests of the protocols, I noticed that there is a fluctuation of soil texture between different plots in Vieiro.

Sources: ULisboa, WebGis shapefiles

These descriptions are quite unprecise, and a more accurate vision can be obtained collecting data with the following protocols.

NB: more characteristics about the vegetation and the invasive species in Vieiro can be found on the document *Characteristics of the Vieiro Property.pdf*, written in November 2021.

Soil and Biodiversity Protocols

To implement a monitoring of soil and biodiversity, I have been working on easy protocols doable by volunteers. To do so, I discussed about it with Mr. Justin Roborg-Söndergaard about easy monitoring experiments doable on the field, and with Margarida Silva about the problems of the previous protocols. I finally did several phases of testing on the field with volunteers, leading to modifications and improvement of the protocols.

The final protocols are presented at the end of this document, and also in the file *Protocols_LT.pdf*
They have been thought to be doable for volunteers, and do not require any scientific, ecologic, or botanic knowledge.
BUT it's necessary that at least one person per group knows how to use iNaturalist.

The goal of these protocols is to monitor the soils and the biodiversity in MONTIS properties. After doing repeating the protocols in several points of the properties, we get the species present on the property, but also their spatial repartition. Thanks to volunteers, it is then possible to create a map with the different habitats.

The protocols are also a good way to get a response of the vegetation to parameters mentioned above, providing a map of vegetation more accurate than theorical ones.

Determination of the coordinates of the plot

The protocol works with a system of plots: points where data is collected are defined before going to the field. There is then no bias on the appearance of the area or other parameter that can influence the position of the plot if it is chosen by the volunteers.
The volunteers receive the coordinates of the plot that has been assigned to them before going to the field.
The determination of the points can be done according to several criteria (altitude, humidity, exposition…) to create a sample that is as representative as possible of the property. But the easiest one is to let a software place random points (as shown in the example map below).
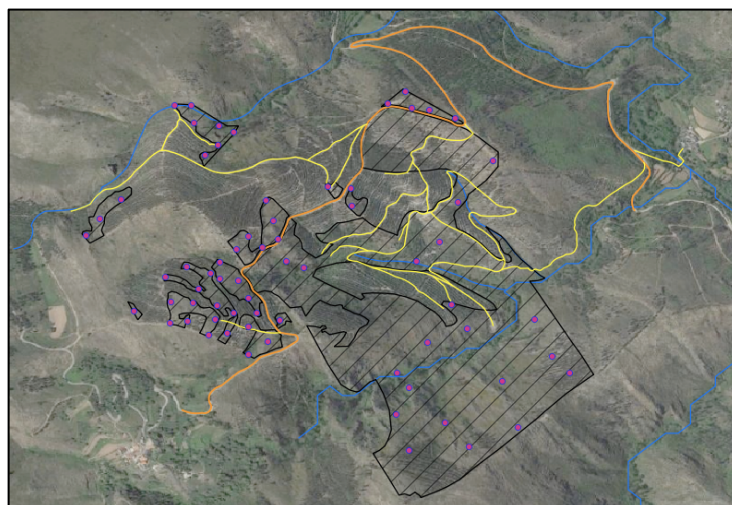
Example of plots: random distribution, 30 points, Vieiro property, QGIS.

The coordinates can be given to the volunteers at the beginning of the activity, and using the GPS of their phone, reach the plot that has been assigned to them and collect the data.

Instructions for Protocols

The protocols can be done alone or in group (better for untrained volunteers), and one set of sheets per plot.
The protocols are written in English, but it could be easier for local volunteers to translate it in Portuguese too.
The steps are supposed to be followed in order, but it's not compulsory.

The sheets need to be printed when used, at least one per group: I noticed a difficulties and diminution of interest and attention when it's done using a phone.
Around 30 minutes is required to record the data on one plot.

If it's done as a proper activity, the coordinator of the activity should read and detail the different steps with everyone before starting, to remove doubts or confusions about what to do and how.

For each plot, the material required per group is:
- the protocol sheets,
- a pen,
- a jar,
- a hoe,
- a marker,
- a 75cL bottle filled with water,
- a phone.

The test of the soil composition needs to be finished after going back from the field. It requires a one-day longer involvement for volunteers. It's important to remind volunteers at the end to continue the protocol back home and send the data to MONTIS.

In the end, the collected data must be compiled in an excel file that need to be filled whether by the coordinator or the volunteers.

Identifying biodiversity

For the biodiversity part, to help identify the plants, I started to create an annex (pages) which contains the most common species on MONTIS properties, and some descriptions and pictures of them.
During the tests of the protocols, it really helped the volunteers to identify plants.
Unfortunately, I didn't have time to finish it. As my internship was mostly in autumn and winter, most of the plants didn't have leaves or flowers so it wasn't optimal to complete this annex.
The annex can be found on the document *Annex_Protocol_Biodiversity_LT.pdf*.
It could be good to complete it with detailed and clear pictures in which we can clearly identify the species.
When used, the annex also needs to be printed. It's almost impossible to use on the phone. It can be placed in a transparent display book.

I also created a Guide on iNaturalist that contains the names of all the vegetal species that have been found on the MONTIS properties. The Guide is called "Montis Properties". It can help the volunteers to check if a species has already been found in the area, and therefore to reduce the error margin.

Biodiversity Monitoring

In Vieiro, during a 6-months camera-trap monitoring process, I have been recording wildlife, showing that the property offers a habitat to common mammals.

Latin name	English name	Number of records
Sus scrofa	Boar	18
Vulpes vulpes	Fox	12
Martes foina	Beech marten	2
Herpestes ichneumon	Egyptian mongoose/Ichneumon	1

The Vieiro property also hosts endangered species such as
- The European rabbit *Orictolagus cuniculus* (Treathened (Portugal, *IUCN*), Near Threatened (Portugal continental, *Livro Vermelho dos Vertebrados do Portugal*),
- The Iberian frog *Rana iberica* (Vulnerable (Global scale, *IUCN*)).

And species that attest of a great value of nature conservation:
- The Three-bird toadflax *Linaria triornithophora*
- The fire Salamander *Salamandra Salamandra*

But the eucalyptus cover remains an issue for the sustainability of the biodiversity, taking over space, light, and nutrients of native species. As soon as it is possible to substitute them with native species, they should be removed.

We can also add that 3 species of amphibians have been recorded, attesting of a good water quality (Iberian frog *Rana iberica*, fire Salamander *Salamandra Salamandra,* Bosca's newt *Lissotriton boscai*).

During these 6 months spent in Vieiro, more than 300 entries have been posted on the biodiversity monitoring app *iNaturalist*.

Protocols Soils and Biodiversity for Volunteers

These protocols have been thought to be doable for volunteers, and do not require any scientific, ecologic, or botanic knowledge.

The goal of this protocol is to monitor the soil and the biodiversity in MONTIS properties.

After doing this protocol, we have the species present on the property, but also their spatial repartition. Thanks to you, it is then possible to create a map with the different habitats.

The point that has been assigned to you is the center of the plot.
Each plot is 100m2 (10m x 10m). This is the area you will monitor.

➔ **Determine visually the limits of the area.**
If wanted, you can mark the four corners of the area (for example by putting a cloth or a bag)

Tip to determine the limits of the plot:

Start from the center of the plot and walk 7 steps in 4 directions. That's the 4 corners of the plot. See the drawing below.

7 steps 7 steps

X

7 steps 7 steps

10 meters

limits of the plot
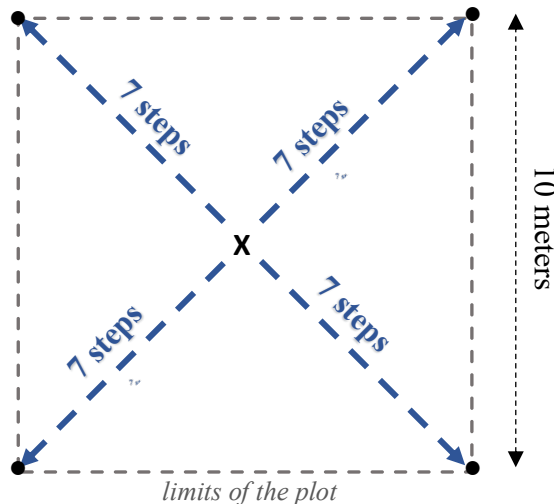
Soil variables

Humus
Are there dead leaves (full or shredded) on the ground?
> *Don't take them in account if it's the result of pruning.*

None
Partially, in some places only
Everywhere

Texture: Test of soil composition   **Material needed: jar, hoe, marker**

On the field:
Fill 1/3 of the jar with soil. Try to avoid putting stones that are bigger than 2cm.
Put a label on it to avoid confusion with other jars

When back home:
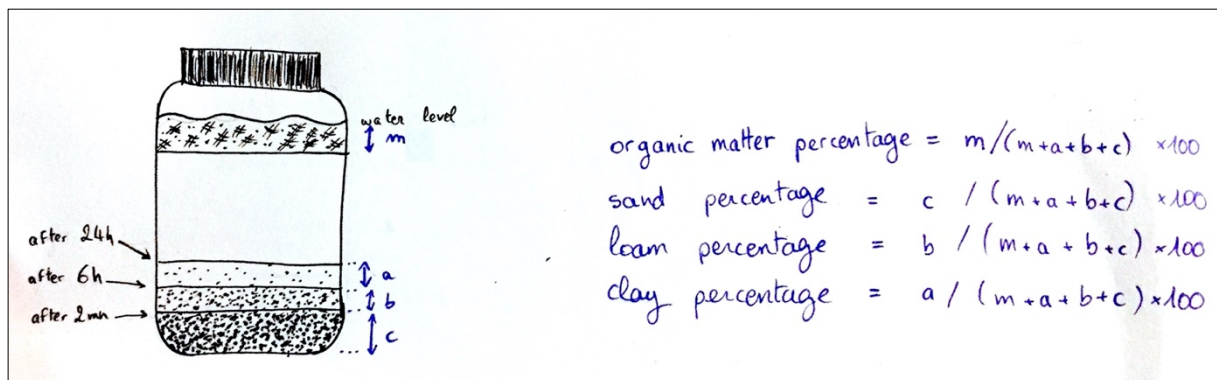Complete the rest of the jar with water
Shake it for 30s
After 2mn: mark the layer of soil at the bottom of the jar (= sand layer)
After 6h: same (=loam layer)
After 24h: same (=clay layer)
After 24h: the floating layer is the organic matter.
Measure everything and do a percentage as indicated in the drawing below.

$$\text{organic matter percentage} = m/(m+a+b+c) \times 100$$
$$\text{sand percentage} = c/(m+a+b+c) \times 100$$
$$\text{loam percentage} = b/(m+a+b+c) \times 100$$
$$\text{clay percentage} = a/(m+a+b+c) \times 100$$

Send the percentages to MONTIS. Thank you!

Infiltration test: **Material needed: 75cL bottle, hoe, phone**

Dig a little hole, 4x the width of the base of bottle, and at least 10 cm deep.
> ***Tip: the distance between the tips of your thumb and your little finger is around 20 cm long for an adult.***

Put water in the hole (75cL). Try to spill it as fast as possible.
Using your phone, measure the time needed for the hole to get empty: ……………
IMPORTANT:
- *Start the timer when you start spilling the water. Stop it when the hole is empty.*
- *if it lasts more than 3mn, no need to wait more, write* **">3mn"**

Soil color (underground)

Circle the color(s) that mostly fit the dirt you removed when digging.

Red	Orange	Ochre	Grey	Brown	Black

Characteristics observed:

On the plot, are there… ?

    Big rocks (>50cm large) on surface: YES   NO

When digging, did you notice… ?

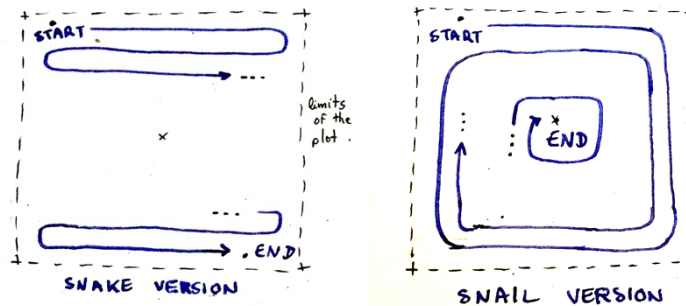   Lots of roots?   YES   NO
    Lots of stones (>30% of the volume of dirt removed)?   YES   NO

Soil color (underground)

Biodiversity Monitoring

Together, walk on all over the plot to be sure not to miss a species.
A good way is to do a snake or a snail (if possible) on the plot (as shown on the drawings below)

For each species (trees, bushes, herbs, mosses, ferns) that you encounter, take pictures of it, and put it on iNaturalist.
When adding an observation, don't forget to enter the coordinates of the localization.
Also tick the project named "Montis" when adding your observations.

- On at least one of the pictures, add "human item" (= an item with a well-known size (a hand, a pen, a knife, etc.)

- If you know the name of the species, suggest it on iNaturalist.
  Otherwise, you can use the annex to help you. It contains pictures of some of the most common species in the area.
  If the species is not registered in the annex, use the ID suggested by the app.

Finally, if possible, name the species that are the most dominant on the area (5 maximum).
- …………………………………………………………
- …………………………………………………………
- …………………………………………………………
- …………………………………………………………
- …………………………………………………………

Global variables

Finally, now that you have walked all over the plot, you can answer the last questions:

Is there a water line (stream, river) 20 meters (or less) far from you?   YES   NO

Using the 2-meters-high stick that was given to you, what is the main height of the vegetation on the plot?
  Higher than the stick = **tree filled**
  Shorter than the stick = **bush filled**
  Shorter than 50cm = **grass filled**

Did you notice any mushrooms on the plot?   YES   NO
  If YES, please add them on iNaturalist.

Annex Protocol Biodiversity

A few common species in MONTIS' properties

When you are saving an observation on iNaturalist, check this list to see if the species is noted here. If it is the case, use the Latin name on iNaturalist.
The commentaries next to the pictures are as important as the pictures themselves for identification.

Trees (plants that can grow higher than 2 meters)

Mimosa – Acacia dealbata

Height: between 0 and 15 meters
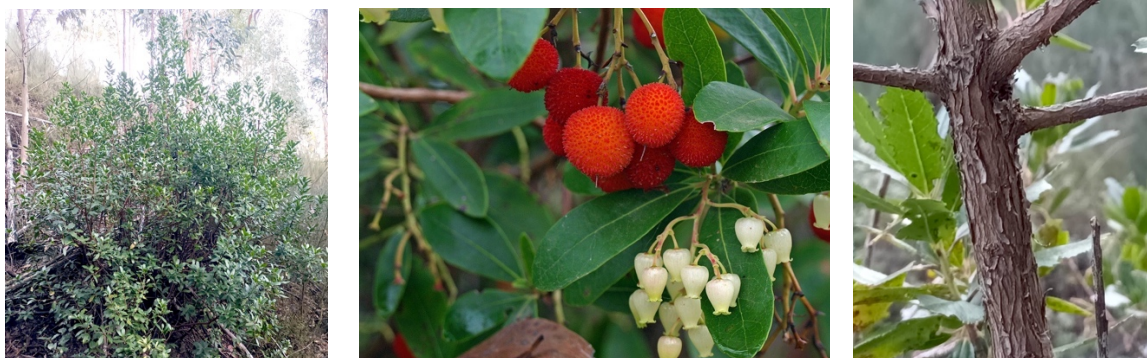The leaves are split a bit like a palm tree.
Invasive species: if possible, uproot after identification

Elder - Alnus glutinosa

The buds are round and have scales. (≠ *Frangula alnus*)

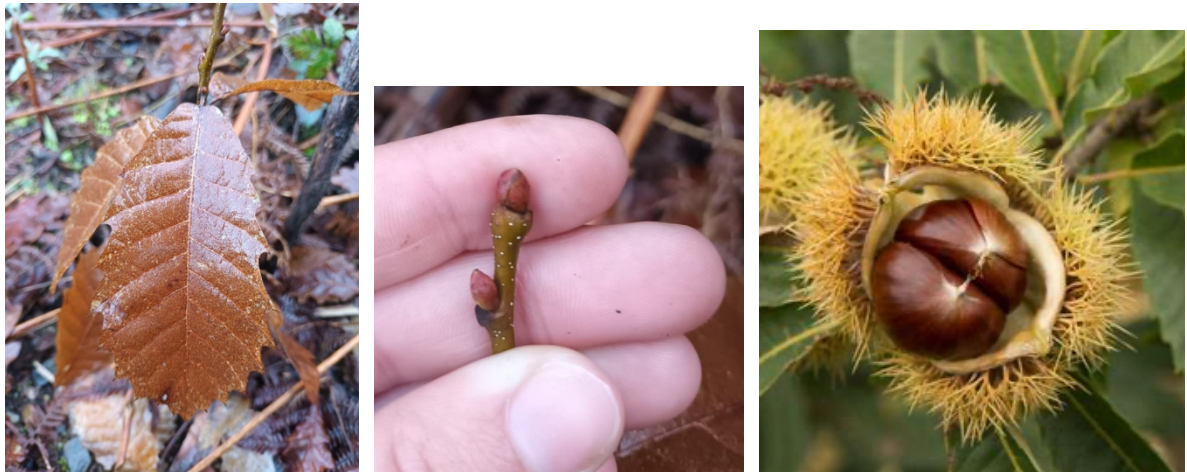### Strawberry tree – Arbutus unedo

Small teeth at the edge of the leaves

Chestnut - Castanea sativa

Long leaves with teeth all along
Big round brown buds

Eucalyptus - Eucalyptus globulus

Characteristic smell when rubing the leaves

Alder buckthorn - Frangula alnus

The bark is brown/red, with a lot of white/grey marks on it.
The buds are pointy and naked (no scale). (≠ *Alnus glutinosa*)

Olive tree – Olea europaea

The inferior face of the leaves is lighter, a bit grey and fury.

Maritime Pine - Pinus pinaster

Dark brown trunk
The shape of the mature tree looks like a toilet brush. (≠ *Pinus pinea* not described here)

Common oak – Quercus robur

The edges of the leaves are a bit wavy.
No fur under the leaves (≠ *Quercus pyrenaica*)

Pyrenaica oak – Quercus pyrenaica

There is a **fur under the leaves**. The lobes are usually deeper than the common oak.

Cork oak – Quercus suber

The leaves are a bit rigid and have small spiky teeth at the edge. They are usually lighter below. Presence of cork over the bark of the mature trees.

Willow – Salix cinerea

Buds sticked against the stem. When flourishing (end of Winter – Spring), a small cotton comes out of the buds. Young stems have usually a different color (orange/red or green) than the old ones (light grey brown).

Bushes (plants that are between 50cm and 2 meters high and have a rigid stem)

Calluna vulgaris

Height: up to 2meters high
The stems are a bit red and sometimes grey.
Can have purple flowers. The leaves are long look like they are made of small scales.

Cistus salvifolius

The leaves look like they are shared in small parts.
Red/brown stem.
The plant has a little fur that you can feel touching the leaves.

Cytisus scoparius

The plant looks like a broom (hence its name in English).
Green branches, very small leaves divided in 3 lobes.
Can grow up to 5 meters. Yellow flowers in summer.

Genista tridentata

The plant is very rigid, light green. The stems have two long growths on the side, so they look almost flat. The buds are round and brown.

Erica ciliaris

The leaves are oval and have small teeth at the edge.
Flowers look like small bells. They are purple/pink when ripe

Erica cinerea

Purple/pink flowers when ripe.

Hakea sericea

Invasive: pick up the fruits with gloves.
Uprooting/cutting the plant at the bottom if possible

Halimium ocymoides

The plant is
bluey / grey, with red standing stems and flower buds at the tip.

Lavandula stoechas

Lavender smell when rubbing the plant in your hands.

Rubus fruticosus

Fruits = Blackberries in Autumn.

Ulex europaeus

Big spikes (2-5cm), light green, with white hair on the young branches

Ulex micranthus

Tiny claw-like spikes, yellow flowers

Ulex minor

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Small spikes (0,5-1,5cm), yellow flowers

Flowers / Herbs (plant that are lower than 50cm with a flexible stem)

Conyza canadensis

Hairy plant
Invasive: pull out after identification

Digitalis purpurea

Really hairy plant. Purple flowers on a long stem
Toxic plant, avoid touching it
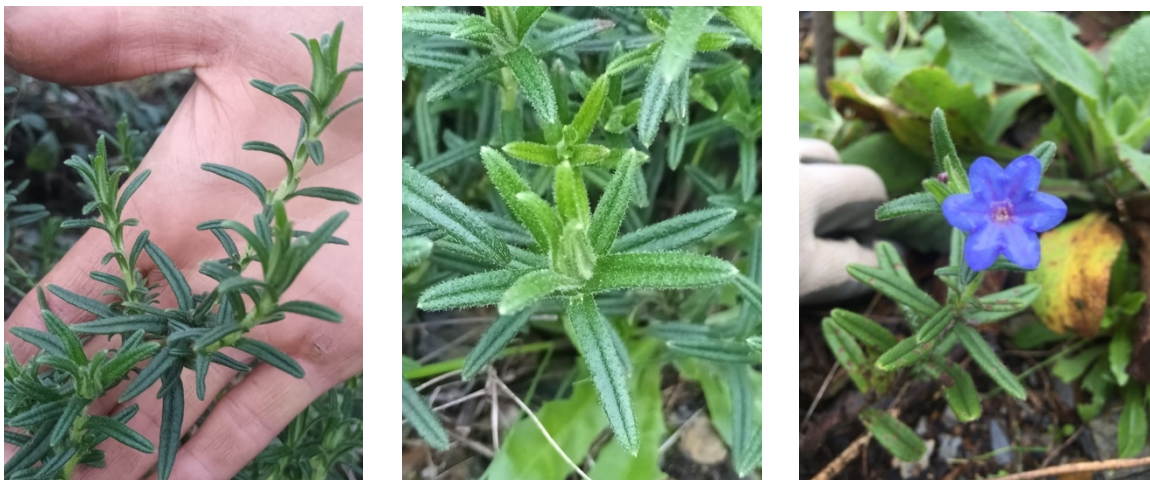
Drimia maritima

A bulb is visible at the bottom of the plant. (if not can be *Orchideae)*

Geranium robertianum

Big diversity of shapes in the leaves but more or less look like the picture above.

Glandora prostrata

Hairy plant, usually dark green.

Hedera helix

Vine

Jasione montana

Hairy plant

Linaria triornithofora

The floors of leaves can contain 3 or 4 leaves.

Lonicera periclymenum

Leaves are hairy
Vine

Solanum nigrum

Rumex acetosela

Usually, small lobes at the bottom of the leaves. Looks a bit like a spear blade.