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**International Master in
QUATERNARY AND PREHISTORY**

Tesis de Master:

For everything there is a season: a paleoethnobotanical approach to
plant management in the Neolithic farming community of La Draga
(Banyoles, Spain).

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Abstract

People and their environments have always experienced interactions of a dialectic nature regardless of the subsistence strategies utilized. Throughout human history, plants have provided people with many of their basic needs including shelter, food, medicine, fuel, and raw materials. La Draga, due to its waterlogged conditions provides an exceptional case study to assess plant management strategies and people-plant relationships in early farming societies. This open-air site, settled between 7270 and 6750 cal. years BP, is located on the eastern shore of Lake Banyoles, Girona, Spain. It is the only lake-shore dwelling site and the only Neolithic site with organic plant remains preserved in waterlogged conditions in the Iberian Peninsula. In this Master thesis a database was developed to create a comprehensive compilation of the work of the many archaeobotanical researchers at La Draga across seven proxies. This resulted in 172 taxa with information in three main content areas: species (botanical) information, archaeobotanical data related to proxy type and preservation, and ethnobotanical information relevant to the recovered remains. The resulting analysis of the database highlighted the diverse plant management strategies at La Draga, characterized by the complementarity of intensive mixed farming and wild plant acquisition strategies, intense exploitation of a reduced catchment area made possible by the initial selection of a lakeside site with a rich floral offering across many ecozones. A seasonal calendar of possible activities based on the results has been proposed that reflects the people-plant interconnectedness at La Draga and the diversity of taxa exploited. The results demonstrate the benefits of a multi-proxy, multi-disciplinary approach informed by relevant ethnobotanical information in the interpretation of archaeobotanical assemblages.

Table of Contents

1. Introduction. The first farmers: a new dialectic relationship of people and plant management.	6
1.1 Introduction of domesticate plants	7
1.2 The Western Mediterranean and Early farmers of the Northeast Iberian Peninsula.....	8
1.3 Paleoethnobotany contributions and limitations	10
2. La Draga: a rare window into the people-plant relationships of the Early Neolithic.....	13
2.1 The site of La Draga: description and history of excavation	13
2.2 Chronology of the site and recovered remains.....	15
2.3 Use of archaeobotanical proxies to reconstruct vegetal landscapes and plant management at La Draga.....	16
2.3.a. Pollen studies.....	16
2.3.b. Fruit and seed studies	17
2.3.c. Charcoal and wood studies	19
2.3.d. Fiber studies	20
2.3.e. Resin studies.....	22
2.3.f. Fungi studies	23
2.4 Objectives of the Study	25
3. Material and Methods.....	25
3.1 Species/botanical information	25
3.2 Archaeobotanical data	26
3.3 Ethnobotanical Information.....	27
4. Results.	28
4.1 Species/Botanical Information	28
4.2 Archaeobotany	39

4.3 Ethnobotany	49
5. Discussion.	63
5.1 The Botanical database.....	64
5.1.a. The Database Botanical data - families	64
5.1.b. The Database Botanical data – ecozones/ecological groups	65
5.1.c. The Database Botanical data – plant life cycle	66
5.2 The Database Archaeobotanical data	66
5.2.a. The Database Archaeobotanical data – type of remains	66
5.2.b. The Database Archaeobotanical data – type of preservation	67
5.2.c. The Database Archaeobotanical data – use of multiple proxies/disciplines	68
5.3 The Database Ethnobotanical data	71
5.3.a. The Database Ethnobotanical data – plant parts and seasonality	71
5.3.b. The Database Ethnobotanical data – plant uses, food	72
5.3.c. The Database Ethnobotanical data – plant uses, medicine.....	73
5.3.d. The Database Ethnobotanical data – plant uses, raw materials.....	74
5.3.e. The Database Ethnobotanical data – plant uses, fuel	75
5.3.f. The Database Ethnobotanical data – plant uses, building and repairs	75
5.3.g. The Database Ethnobotanical data – plant uses, fodder.....	76
5.3.h. The Database Ethnobotanical data – plant uses, other	77
5.4 People-plant relationships and plant management strategies	77
6. Conclusion.....	82
Bibliography.....	83
Figures and tables.....	91

1. Introduction. The first farmers: a new dialectic relationship of people and plant management.

“For everything there is a season. A time for every purpose under heaven. A time to be born and a time to die. A time to sow and a time to reap.” Ecclesiastes 3:1-8

People and their environments have always experienced interactions of a dialectic nature regardless of the subsistence strategies utilized. Throughout human history, botanical resources have been of vital importance to the diet and provided for most of society’s needs (Piqué et al., 2022). Researchers working with wild plant uses have completed ethnobotanical surveys that list more than 7,000 taxa worldwide that have been used for human food at some point in our history (Bharucha & Pretty, 2010). The use of the term wild plant is frequently defined as a plant whose growth has not been influenced by people (Bharucha & Pretty, 2010). However, we know that humans do in fact influence most plants within their environment so in this work wild plant is defined as a plant that has not undergone genetic modification through human intervention. Though it is common in literature to see a clear distinction drawn between hunter-gatherer and agropastoralist groups, there appears to be a complex *continuum* of people and plant interactions. For example, Smith, (2011) identifies six niche constructions involving people’s management of plants that fall between traditional views of the interactions of hunter-gatherers with plants and the plant management efforts of agropastoralists. Plant food production, the investment of labor on plant material to consume for an alimentary purpose, includes all strategies of production and is applicable to cultivated and non-cultivated plants (Antolín, 2013). Early farmers lived in the wild, grew their crops in the wild and may not have conceptualized the distinction between cultivated and wild plants that people make today. In early agricultural societies the management of cultivated and wild resources may have been closely related or interconnected. Management of plants required complex and specific knowledge about each plant which included understanding the plant’s growth cycle, season of availability and desirability, and the properties of their parts. This would have been critical to thriving and in some cases survival in the lives of prehistoric people. Despite their vital role in human lives, plants have not received the attention paid to other recovered remains of archaeological interest and within archaeobotanical work wild plants have not seen the focus that domesticated plants have enjoyed. Our knowledge about past people’s technological use of plants, including their collection, processing and consumption is very limited especially in the Mediterranean region (Piqué et al., 2022). Antolín (2013) suggests the lack of attention

paid to the archaeobotanical record is due in part “to the difficulties of studying wild plant management among prehistoric groups: the scarce archaeobotanical evidence due to the lower chances of fruits becoming charred, the lack of specific tools, and the use of systems of storage that are not properly identified in the archaeological record”. Adding to this, current scholars’ familiarity and focus on domesticated resources, biased them when approaching the archaeobotanical record of the past.

1.1 Introduction of domesticate plants

In the area known as the fertile crescent region of the eastern Mediterranean, wheat, barley, peas, lentils, and flax along with cattle, sheep, goats, and pigs, were domesticated more than 12,000 years ago. The new subsistence practices, referred to as agropastoralism or agriculture spread across most of Europe by 7,700 years ago and had reached much of its arable regions by 5,500 years ago (Ruddiman, 2013). For each geographic area of study in Europe there are proponents of the demic diffusion model or migration hypothesis as well as those who advocate for a Neolithization through a cultural diffusion model in which indigenous hunter-gatherers voluntarily picked up the agrarian lifestyle. Still others argue for an integrationist approach recognizing both the role of migration and cultural diffusion but disagreeing about the degree to which each component played a role. The most recent consensus based on integrating radiocarbon dating and GIS methodologies proposes a complex and multi-directional diffusion across multiple pathways along the coast and across land (Antolín & Buxó, 2012). Debates have been ongoing as to the nature, pace, and path of the spread of agriculture and indeed as to why it was adopted originally. While some researchers continue to see it as a revolution that transformed the relationship of people and the environment, others have argued for a gradual transition of increasingly complex niche constructions building over generations of plant and people coevolution (Smith, 2011). The change that characterized the outset of the Neolithic period affected both humans and their environments on many levels including demography, subsistence, technology, and social organization (Peña-Chocarro et al., 2018). We do know that the spread of agriculture coincided with a marked deforestation, which proponents of the Anthropocene, attribute to the land management practices of farmers who cleared land formerly forested (Ruddiman, 2013; Revelles et al., 2015; Revelles, 2017).

Four farming models have been proposed to describe the practices of the first farmers in the European Neolithic: floodplain agriculture, shifting agriculture, intensive mixed agriculture, and extensive agriculture (Bogaard, 2004a) (Bogaard, 2004b). Floodplain cultivation requires no tillage, weeding or manuring as soils are self-cultivating and crops would be sown in the

spring. Shifting agriculture, sometimes referred to as slash-and-burn, requires constantly moving to new fields each of which is good for a few years and there is no need for manuring of fields. The intensive mixed, garden-type cultivators cleared limited woodlands for fields and probably confined a small number of livestock to arable land mainly at night resulting in heavy manuring of fields. In this intensive mixed farming process animal exploitation was diverse including meat, milk and possibly traction. The fourth model describes extensive agriculture involved using animal traction for plowing and much larger cultivated fields.

1.2 The Western Mediterranean and Early farmers of the Northeast Iberian Peninsula

The Western Mediterranean is a territory between the west coast of Italy and the east coast of the Iberian Peninsula with the northern coast of what today is Morocco, Algeria, and Tunisia as a southern boundary. Tracing the spread of agriculture in this territory has proven both difficult and complex with two cultural traditions, Impressed Ware and Cardial Ware, being involved. The earliest agriculture seems to have been on the Italian coast around 6000 cal BC with evidence of the Impressed Ware culture. It appears that initially, hulled wheats predominated the cultivated plants but were largely replaced over time by naked wheat during the second half of the 6th millennium cal BC (Antolín & Buxó, 2012). Diversity of crops in the Iberian Peninsula is far greater than what is found in Central Europe. Some researchers suggest bread wheat spread from the Near East to Central Europe while hard wheat expanded from the Western Mediterranean to Central Europe via the Rhone Valley (Peña-Chocarro et al., 2018). The spread of agriculture to the eastern coast, the south, the Pyrenees, the Northern Plateau, the Upper Ebro Valley, and Portugal occurred during the second half of the 6th millennium BC. The earliest Neolithic sites shared a climate like that of the Eastern Mediterranean. The spread to different environments required adaptations like what happened in the spread of farming in the Eastern Mediterranean. Unlike Central Europe, emmer and einkorn did not play a dominating role though they are present in the archaeological record (Peña-Chocarro et al., 2018). The lack of open air early Neolithic sites on the Iberian Peninsula has hindered the understanding of the Neolithization process. Most excavated sites have been caves in what is modern day Spain and shell middens in Portugal. Some researchers suggest this is because herding as opposed to farming was the initial activity while others believe many initial Neolithic sites have simply not been found. A good example is the site of La Draga in Spain which was unknown until discovery in 1990 when work was being done to accommodate an Olympic rowing activity.

The archaeobotanical record of the Iberian Peninsula from 7650 cal BP onwards reflects the arrival of different groups of farmers who settled a variety of landscapes containing diverse ecosystems. This was the last region in the Mediterranean to adopt agriculture and the farming lifestyle. The archaeobotanical record suggests people with a well-developed knowledge of agriculture and a varied group of crops (Peña-Chocarro et al., 2018). Researchers (Antolín et al., 2015) studied 24 Neolithic sites (see Figure 1) in the northeast of the Iberian Peninsula and have identified ten crops including cereals *Triticum aestivum/durum/turgidum* L., *Triticum dicoccum* Schübl., *Triticum monococcum* L., *Hordeum vulgare/distichum* L. and *Hordeum vulgare* var. *nudum*, legumes *Vicia faba* L., *Lens culinaris* Medik. and *Pisum sativum* L. as well as oil plants *Linum usitatissimum* L. and *Papaver somniferum* L. The crop assemblages of the early Neolithic (5400-4500 cal BC) appear to evidence two different traditions. It is thought that one group of farmers settled in the northeastern area of the region and chose to grow free-threshing cereals, especially naked wheat, while a second group settled in the central Catalan coast and along the Llobregat river and included glume wheats as important crops. These two traditions seem to have survived through the middle Neolithic, when naked barley becomes the main crop at some sites, maybe due to contacts with northern groups. It was determined that the farming settlements in the region were probably more sedentary than previously believed and an intensive exploitation of both domestic and wild plants near the settlements was practiced in a sustainable way that permitted long-term interactions (Antolín & Jacomet, 2015). The first evidence of a Neolithic presence in NE Iberia occurred in the second half of the 8th millennium cal. BP. The expansion of the agrarian lifestyle was rapid and discontinuous in the Iberian Peninsula spreading over coastal regions and some inland site following river courses in less than two centuries (Bernabeu et al., 2014).

There appears to be a period prior to this when the region was uninhabited and therefore the newly arrived farmers probably migrated to the area and found it available for their farming efforts which differs from migrants settling on the Eastern coast of the Iberian Peninsula where there is evidence of indigenous Mesolithic hunter-gatherers being present. The populating patterns of these first farmers to the Northeast Iberian Peninsula were in the form of permanent open-air settlements such as La Draga, Font del Ros, and Sant Pau del Camp (Revelles, 2017). The construction and maintenance of these large permanent settlements implies a large investment of labor and a noticeable transformation of the landscape.

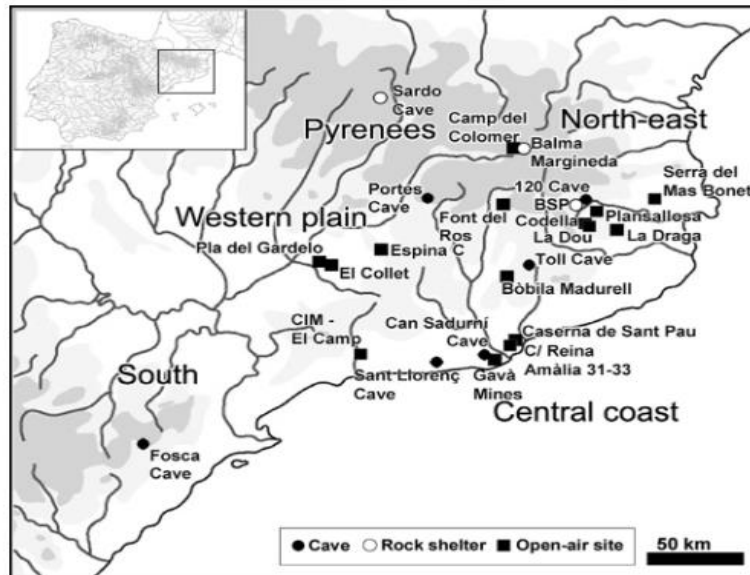


Figure 1 - Region studied. (Antolín and Jacomet, 2015).

1.3 Paleoethnobotany contributions and limitations

One of the key goals of archaeology is to learn about past human behavior by recovering and analyzing material evidence (remains). The analysis of plant remains from archaeological sites has been ongoing since Kunth wrote of the botanical traces found in ancient Egypt in 1826. The studies investigating people-plant interrelationships became more formal when Jones in 1941 published “The Nature and Status of Ethnobotany” (Wright, 2010). Paleoethnobotany also known as archaeobotany (the former term used more commonly in North America where the emphasis is on the contribution of ethnographic studies and the later in Europe where the emphasis is on the discipline’s role within archaeology) then is the study of past people-plant interactions through the recovery and analysis of ancient plant remains. The routine of recovering botanical remains through a process of regular sampling at archaeological sites burgeoned in the late seventies of the previous century and grew in practice during the eighties and nineties. Despite these efforts, an insufficient funding stream has led to a relatively low number of publications of complete site reports and little synthesis of work (Antolín, 2013). Contributing to the issue is a lack of awareness among archaeologists of the potential of archaeobotanical remains and a lack of regularity in what type of samples and material are mandatory in recovering remains at sites.

Plant remains from archaeological sites fall into two main categories macrobotanical, those remains that can be seen with the naked eye or with low-powered microscopes, and microbotanical, those plant parts visible only with the aid of high-powered microscopes. Macrobotanical remains include wood, seeds, fruits, tubers, fibers and resin and are studied by

specialist in carpology, anthracology, and dendrochronology. Microbotanical remains include pollen, spores, phytoliths and starch grains which are studied by specialists in palynology and phytolith studies.

Ethnobotany is an interdisciplinary field that explores the relationship between plants and people. Ethnobotanists study plants used as food, raw material, and medicine, cultivated and wild, and the present and past ways plants were managed and utilized by people. The cultural aspects of plant-human interactions are a focus of study including economics (how people use plants), cognitive (how people know and conceptualize plants), and ecological (how people interact with plants in an evolutionary and coevolutionary way). Research into wild plant use has gradually become a major area of study especially in the 21st century and linked to efforts to prevent cultural loss and increase the use of sustainable environmental practices. Archaeobotany has made strides in understanding human-environment interactions of the past through the study of archaeobotanical remains but is still limited in addressing how each plant resource was exploited and consumed and in its understanding of the diversity of exploited plants. There is great potential of the archaeobotanical studies of wild plant use to offer knowledge of the role of wild plants in past economies. The combined study of ethnographic sources, archaeobotanical remains and archaeological artefacts can improve our understanding of past peoples' lifestyles and their relationships to their environments (Antolín et al., 2016). It is critical to the success of these efforts to build models based on ethnobotanical and ethnographic records which summarize the process of production of plant foods from wild resources. Ethnobotanical and ethnographic descriptions provide valuable insight into the interpretation of archaeobotanical remains both for possible uses and the processes involved from gathering through to consumption (Berihuete-Azorín, 2016).

Wild fruits may be eaten away from the site and often require little processing if eaten at the settlement, leaving little or no archaeological evidence in the charred state, therefore the charred samples are dominated by domesticated (largely cereal) remains. Antolín (2013) created pie charts to demonstrate the dramatic difference between remains found at the waterlogged site of La Draga and the other non-waterlogged sites in his study area (see figures 2 &3).

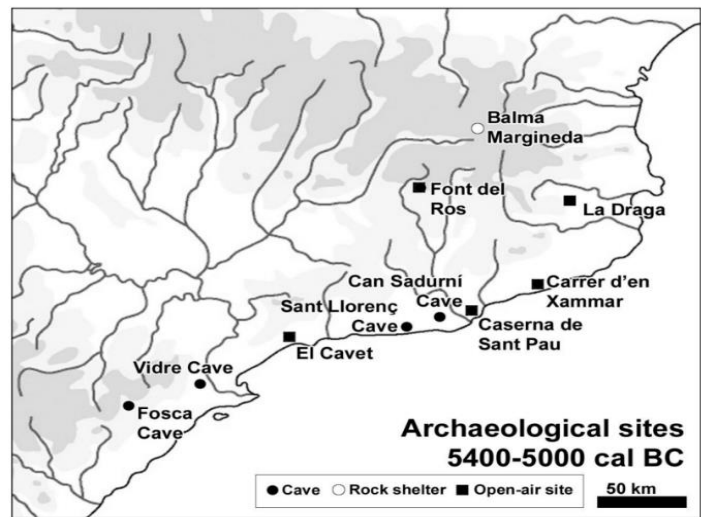


Figure 2 - Map of sites dated to 5400-5000 cal BC referenced in figure 2 below (Antolín, 2013).

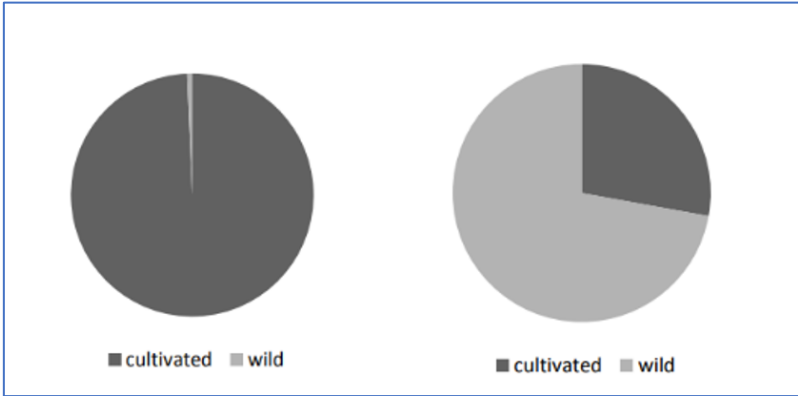


Figure 3 - Proportion of wild and cultivated seed/fruit remains in charred state in the Neolithic record of the region (left). Proportion of wild and cultivated seed/fruit remains in waterlogged state in La Draga (right). (Antolín, 2013).

When archaeobotanical assemblages preserved by charring and those preserved by waterlogging are systematically compared, the former possessed on aggregate about 35% of the range of edible plants documented from waterlogged assemblages (Colledge & Conolly, 2014). Though it is not a new finding that waterlogged assemblages offer more robust samples for a fuller spectrum dietary reconstruction, Colledge and Conolly, have demonstrated that waterlogged preservation provides additional insight into the importance of wild plant foraging as a diet component that is underrepresented at sites with only charred remains. The charred assemblages alone are not quantitatively reliable to determine the importance of wild gathered plants in the diet because of taphonomic processes that make the number of recovered items mostly unrepresentative (Antolín & Jacomet, 2015). It is key that both charred and waterlogged

samples be integrated to develop a complete picture of plant diet breadth (waterlogged samples) and the reconstruction of crops and farming systems (charred samples) (Colledge & Conolly, 2014).

The state of preservation, the plant use, way of discard, pedoturbation, recovering techniques and other processes can have distorting effects on the palaeobotanical record. It is important therefore to understand the taphonomy of the site to interpret distortions. Wright (2010) offered the following as reminders of the limitations of paleoethnobotany;

1. Not all human behaviors and values result in patterned plant remains;
2. Of those which do, not all will occur where there is an opportunity for inclusion in archaeological contexts.
3. Of all those which are included, not all will be preserved.
4. Of those which are preserved not all will be exposed to, or by, the archaeologist; and
5. Among the plant remains exposed to the archaeologist, not all will be perceived or properly identified.

2. La Draga: a rare window into the people-plant relationships of the Early Neolithic

La Draga, due to its waterlogged conditions provides an exceptional case study to assess the role of wild plant uses in early farming societies. It is the only lake-shore dwelling site and the only Neolithic site with organic plant remains preserved in waterlogged conditions in the Iberian Peninsula (Piqué et al., 2022).

2.1 The site of La Draga: description and history of excavation

This open-air settlement is located on the eastern shore of Lake Banyoles with the archaeological site covering an area of over 15,000 m² (see figure 4). Lake Banyoles is of a karst landform which is fed by underground waters. It was originally drained on the eastern side by a river, now the Terri, a tributary of the Ter River. It is probable that the river created an area of marshes on the northern shore where La Draga is located. During its Neolithic occupation this area would have formed a peninsula stretching into the lake. The climate in this region is humid Mediterranean and has an annual precipitation of 750 mm with a mean annual temperature of 15° C. The site is similar to other early Neolithic settlements which favored

wetland locations on the shore of lakes, lagoons or marshes all of them having good agricultural land nearby (Palomo et al., 2011). The settlement would have been in a densely wooded landscape of broadleaf deciduous forests (*Quercus* and *Corylus*) and in the surrounding mountain areas conifers (*Abies* and *Pinus*) could be found (Burjachs, 2000; Revelles et al., 2016). Also, close to the settlement riparian forests (*Ulmus*, *Fraxinus*, and *Salix*) would have been growing near the lakeshore (Burjachs, 2000; Revelles et al., 2015, 2016). Arrival of early farmers brought new technologies for forest exploitation and the cutting of trees and shrubs with new tools designed for the woodwork including adzes, axes, planes, and chisels (Piqué, et al., 2021). A large quantity of charred cereal grains was found at the site with tetraploid naked wheat the main cereal cultivar at the site (Antolín et al., 2014).

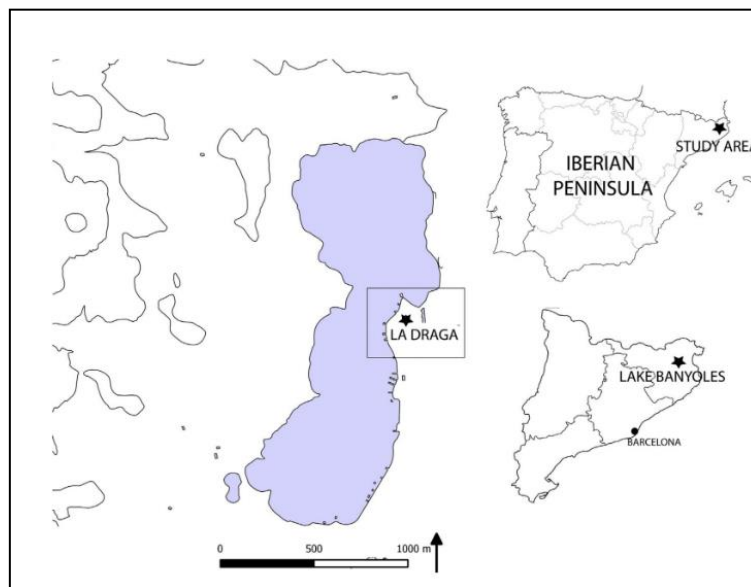


Figure 4 - Location of site, (Revelles, 2021).

La Draga was discovered in 1990 during construction work to accommodate the Olympic rowing competition to be held at Lake Banyoles. Excavations were conducted by the local Archaeological Museum until 2005 and then a second field project began in 2010 with excavations, led by a joint team from the CSIC, UAB and MAC, ongoing since then. There are four sectors that have been differentiated (see figure 5):

- Sector A has archaeological levels above the water table and corresponds to the highest elevation of the site and is at the greatest distance from the lake. Only the lower tips of the oak posts used as piles were preserved. Excavations took place from 1990-1995, 2013-2017 and 2018-2021.

- Sector B and D are located on dry land but are closer to the lake and are under the current water table with excellent preservation of organic remains. Sector B excavations date from 1997-2005 and sector D excavations from 2010-2013
- Sector C is currently submerged under the lake with well-preserved organic materials. Excavations were from 1995-2005.

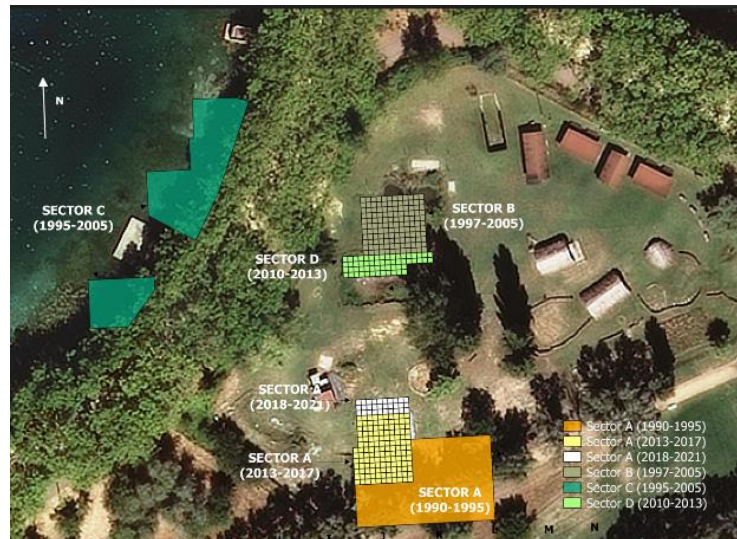


Figure 5 - Sectors and dates of excavations at La Draga, (Revelles, 2022).

2.2 Chronology of the site and recovered remains

Two main settlement phases (both considered early Neolithic) have been documented at La Draga, Phase I dated between 7274-6927 cal BP and Phase II between 7160-6746 cal BP (Piqué et al., 2021). The two distinct construction traditions share the pottery styles within the late Cardial Ware Neolithic culture. Phase I had what appears to be wooden huts built on piles (to avoid flooding) driven onto the top of the lake marl (hundreds of stakes, poles and planks have been recovered from the collapsed construction of this phase). The village was most likely a pile dwelling site, and the preservation of wooden elements is excellent due to the anoxic conditions caused by the silting of the collapsed structures and the rising of the water table since the Neolithic period. In addition to the wood recovered, the archaeobotanical record consists of other material charred and uncharred including charcoal, seed and fruit remains, plant tissues and fibers (Terradas et al., 2017). A second phase, dated to 7160-6746 cal BP, constituted a new settlement mostly built on an artificial floor of travertine stones. The second settlement phase was a significant departure from the first with a change in building techniques. In this second phase large surfaces were covered in travertine slabs, and it appears that domestic

activities were carried out here in a more public setting. This archaeological level has less preservation of archaeobotanical remains and the organic material is mostly in a charred state of preservation. Ovoid shaped huts with paved floors were constructed rather than the rectangular huts built on piles of the first phase. The large number of hearths found may have been the result of open-air installations devoted to more everyday activities (Bosch et al., 2008).

2.3 Use of archaeobotanical proxies to reconstruct vegetal landscapes and plant management at La Draga

Archaeobotany is a blended discipline that combines botanical knowledge with archaeological materials. It focuses on the study of preserved plant evidence from archaeological sites to reconstruct and interpret past people-plant relationships. Many articles have been published based on archaeobotanical remains found at La Draga by researchers representing several disciplines. Carpology is devoted to the study of seeds and fruits and because of the excellent preservation conditions at La Draga much has been discovered about both domesticated and wild plant use in the early Neolithic. Anthracology is a discipline that focuses on wood charcoal macro-remains and has made significant contributions to the interpretation of archaeological remains found at the site. Palynology, which undertakes the study of pollen grains and other spores, has been successful in reconstructing the vegetational environment of the site. Dendrochronology, fiber, and resin studies have also contributed to the reconstruction of the relationship of people and plants at La Draga. The present work adopts a holistic approach combining the results of different archaeobotanical disciplines to achieve a wider and more detailed picture of how the people of La Draga interacted with the vegetal environment to shed light on their plant management strategies.

2.3.a. Pollen studies

Palynological studies in the area have been able to reconstruct the evolution of the vegetal landscape at both the local and regional levels and identify the contribution of climatic and anthropic factors in the vegetation changes recorded in the pollen sequence (Revelles, 2017, 2019). The first farmers at La Draga found a densely forested environment with a dominance of oak (*Quercus* deciduous) and hazelnut (*Corylus*) forest formations at the low altitudes and pines (*Pinus*) and firs (*Abies*) in the mountains surrounding the site. Riparian forests containing alder (*Alnus*), willow (*Salix*), elm (*Ulmus*) and other tree and plant taxa grew near the site (Revelles et al., 2015, 2016). Pollen studies have been able to provide important information about intra-site spaces and environments (Revelles et al., 2017). Reconstructions combined

with archaeological evidence from the site have offered necessary data to characterize the first human impact on the landscape at La Draga and in Northeast Iberia. A dramatic decrease in broadleaf deciduous formations after the arrival of the early farmers at La Draga around 7270 cal BP has been documented. This has been interpreted as resulting from forest clearance for wood exploitation for building, tool manufacture and firewood rather than due to clearing of land for cultivation (Revelles, 2017).

2.3.b. Fruit and seed studies

Early farmers in the Neolithic faced many challenges as pioneers in a new landscape and their practices involved in the management of cultivated and wild plants was labor intensive. Understanding these practices inform us about how the people organized subsistence efforts and have potential to provide information about labor capacity, risk reduction strategies and the evolution of social relations and gender roles in food production. Archaeobotanical efforts seek to find answers to questions such as what type of agriculture was practiced, how much of the diet depended on domestic crops versus wild plant gathering and what processes were involved in food production. Carpology work at the site recovered over 2,000 plant remains in a charred state and 18,000 in waterlogged conditions (Antolín, 2013) for analysis which identified 66 wild plant taxa with alimentary or medicinal value. Among the many plant remains found were beads made of cherry stones (*Prunus* cf. *avium*) (see figure 6). The most common wild plant species identified were *Quercus* sp., *Corylus avellana*, and *Vitis vinifera* subsp. *sylvestris* while the domestic plant taxa included two-row barley (*Hordeum distichum*), naked wheat of hexaploid and tetraploid species (*Triticum durum/turgidum*, *Triticum aestivum*, *Triticum timopheevii*), emmer (*Triticum dicocum*) and einkorn (*Triticum monococcum*) (see figure 7) as well as the pulses lentil (*Lens culinaris*), pea (*Pisum sativum*) and broad bean (*Vicia faba*). Opium poppy (*Papaver somniferum*) was also found in quantities at the site. Naked wheat was the most important crop grown and was probably sown in rows with a medium density and naturally manured by livestock. The intensive garden type agriculture describes the management of small permanently cultivated plots around the site and usually includes small herds of livestock kept nearby (Bogaard, 2005). Cattle, sheep, goats, and pigs were the domesticated animals at La Draga with a mixed herding strategy (Saña, 2011). Meat was the main product with milk and traction probably of lesser importance. The cultivation of cereals, pulses and oil plants was supplemented with the gathering of numerous wild plants that provided resources for varied uses (Antolín et al., 2021). The archaeobotanical evidence

supports the practice of intensive garden type management with the majority of tasks carried out at the household level. It follows that the early residents of La Draga established enduring relationships with networks in the region necessary to support the subsistence efforts and reproduction needs of the community (Antolín, 2013). In addition to plants utilized for food and raw materials several plants with medicinal properties, listed on the Plants for a Future database, have been documented at La Draga including the strawberry tree (*Arbutus unedo*) with well-known astringent and diuretic properties; the versatile common boxwood (*Buxus sempervirens*) with uses such as antirheumatic, cathartic, cholagogue, febrifuge and others as well as the bay tree (*Laurus nobilis*) with numerous applications as an antiseptic, carminative, diaphoretic, digestive, etc. (Piqué et al., 2021).



Figure 6 - La Draga wild fruit, beads of *Prunus cf. avium*

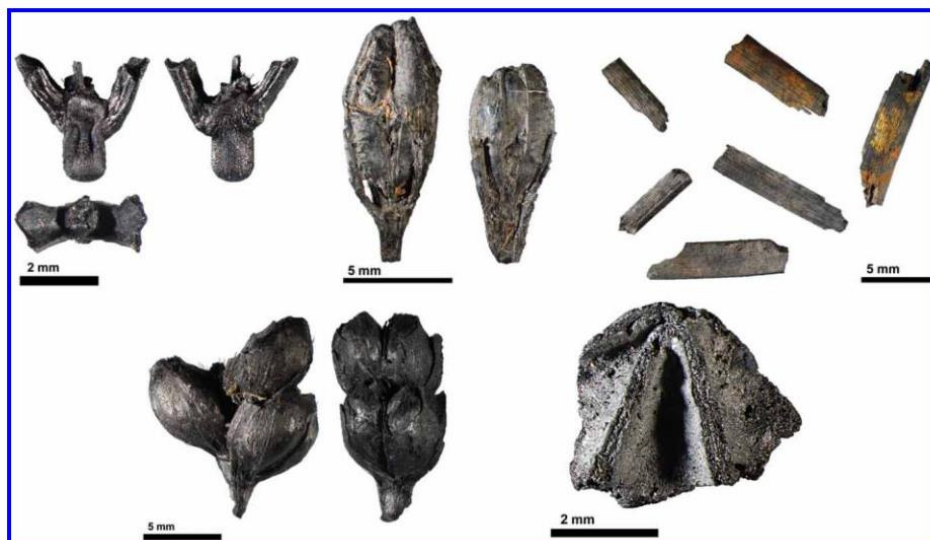


Figure 7 - La Draga crops (left to right) *Triticum sp./new type*, spikelet fork; *Hordeum distichum*, ear fragment; *cf. cerealia*, fragments of straw; *Triticum durum/turgidum* type, ear fragment; and *Papaver somniferum*, capsule fragment (Antolín, 2014).

2.3.c. Charcoal and wood studies

The large number of wooden remains in superb condition found at La Draga have permitted an exceptional insight into the use of vegetal forest resources by the settlers, and have engaged the work of anthracologists, dendrochronologists, and carpologists. Oak was the preferred taxon for construction of buildings with the majority of wood posts consisting of *Quercus* deciduous. A large number of tools probably used in domestic settings and in agriculture were identified including digging sticks, sickles, reapers, adze handles, combs, spindles, hooks and spoons among others (see figure 8) (Palomo et al., 2013). The recovery of a neolithic bow, constructed from yew, at La Draga was the first evidence of archery in Neolithic Europe (Piqué et al., 2015). Plant management of forest can be reconstructed based on the findings demonstrating that the people engaged in an intensive exploitation of the same to obtain raw material for building construction, tool making and firewood. People of La Draga were selective in their gathering of wood resources opting for the material best suited to their needs (López-Bultó, 2016). Boxwood (*Buxus sempervirens*) was the most often selected for tool making, while the use of other taxa were also common including; strawberry tree (*Arbutus unedo*), maple tree (*Acer* sp.), dogwood (*Cornus sanguinea*), hazel tree (*Corylus avellana*), juniper (*Juniperus* sp.), bay tree (*Laurus nobilis*), pine tree (*Pinus* sp.), oak (*Quercus* deciduous), willow (*Salix* sp.), yew (*Taxus baccata*), lime/linden (*Tilia* sp.) and others (López-Bultó et al., 2020). As previously stated, wood gathered for construction and firewood is considered largely responsible for the decline in deciduous forests, oak (*Quercus* deciduous) and bay tree (*Laurus nobilis*) composed the largest number of charcoal remains, together with boxwood (*Buxus sempervirens*) being the most abundant in the latest phase. This may indicate the spread of this taxa because of human cutting and gathering activities (Caruso Fermé & Piqué i Huerta, 2014).



Figure 8 - Objects and tools made from organic material: 1) rope; 2) spoon (*Quercus sp. caducifoli*); 3) sickle (*Buxus sempervirens*); 4) wooden comb (*Buxus sempervirens*); 5) Adze handle (*Pinus sp.*); 6) digging stick (*Buxus sempervirens*); 7) hook (*Buxus sempervirens*). (Palomo et al., 2011).

2.3.d. Fiber studies

Artefacts made of plant raw materials are not often preserved in archaeological contexts in the Iberian Peninsula making the numerous plant fibers found at La Draga a rare opportunity to study this aspect of plant management. Analysis of plant-based remains have identified several taxa used in the production of cordage, basketry and possibly textiles. A minimum of five taxa belonging to five families, four monocotyledons (Cyperaceae, Poaceae, Juncaceae and Typhaceae) and one dicotyledon (Malvaceae) have been identified as used in the production of baskets at the site (Herrero-Otal et al., 2021). Ethnobotanical research has documented a large range of plants used in the production of plant-based goods including the bark of trees like lime or willow along with a variety of grasses, cattails, sedges, and rushes all of which could be found near the site. The basketry at La Draga was produced using the sewn coiled technique where a bundle of fibers from a central point or base is coiled around itself and then secured with sewn stitches at each turn (see figure 9). The stitches are made through a hole that is pierced beforehand with an awl between the bundle and previous stitch. When the base is complete the coiled bundles are overlaid creating the walls of the basket until the desired height is achieved. This technique is versatile and can be used in making baskets, lids, and matting. When 49 samples were analyzed for identification, the majority were monocotyledon fibers, 86%, bast fibers made from the lime bast (*Tilia sp.*) were 14% with one object having rods of

hazel (*Corylus avellana*). In summary monocotyledons, chiefly herbaceous leaves, and lime bark fibers were used for the stitches while monocotyledon leaves and stems were used for the bundles. Documented species at the site suitable for basket making are numerous like *Juncus effusus* L. (common rush), *Cyperus longus* L. (sedge), *Typha latifolia* L., and *Typha angustifolia* L. (bulrush) available in the lacustrine environment surrounding the site. Archaeobotanical research at the site has identified several monocotyledons that grew at the site including cereals (wheat and barley), Typhaceae, Cyperaceae, and rushes. Presumably, basketry would have been made locally with raw materials available and considering the functionality of tools found at the site which included flint flakes, blades and *Mytilus galloprovincialis* shells that could be used for cutting and scraping fibers and awls used to sew the fibers. Interestingly, the functional study of the blades attached to sickles used in harvesting indicates that they made contact with soil when the cereals were cut near the ground which would produce straw that could be another source material for baskets (Romero-Brugués et al., 2021). The skill agency to make the basketry found at La Draga indicates a local production by skilled artisans with a good knowledge of plant fibers who created basketry for different functions like transport and storage.

In addition to basketry several cords made of twisted plant fibers, and one made of liana were found at the site. The roll of liana made of *Clematis* sp. was probably used without preparation and at other sites is associated with a material used to hold architectural elements together. Analysis suggests fibers were from the bast of trees or shrubs and had features similar to *Tilia* sp. found growing at the site. No evidence of flax has been found at La Draga but nettle bast is well known as a source for producing cordage and textiles and seeds of *Urtica* sp. have been found at the site (Piqué et al., 2018). A final word on fiber use at La Draga involves the probable use of fiber in creating textiles though no direct evidence has been found to date. Study of textiles in the Iberian Peninsula has proven challenging because of the poor preservation of fabrics and the lack of a tradition of research in the field (de Diego et al., 2017). A use-wear analysis of tools known to be used in textile making was carried out at the site on nine long spindle-like objects of the same material and eighteen bone awls. The results provided indirect evidence of textile production at the site. The experimental work done with reproductions of tools found at the site confirmed their effectiveness in combing, spinning and weaving plant fibers (de Diego et al., 2017).



Figure 9- Basketry from La Draga (Romero-Brugués et al., 2021).

2.3.e. Resin studies

Plant resin studies can provide useful information into the environmental, ecological, and cultural adaptations of past peoples. Despite the potential of these studies, they are frequently undervalued and not fully utilized in part due to issues of preservation (being prone to degradation) and the lack of characteristic morphology in archaeological assemblages. Though pine resin and birch bark tar have been identified as adhesive material since the Paleolithic they are scarce in the archaeological record. When discovered at an archaeological site they are usually identified as materials used to haft tools, mend ceramic items or to waterproof materials (Rageot et al., 2021). Birch (*Betula pendula*) is the primary source of bark in the production of birch bark tar and was found in the botanical remains of La Draga. Researchers determined that the production at La Draga involved an autothermic process and probably the birch bark tar was mixed with a fatty substance (like tar produced by condensation methods) that suggests it was a composite glue applied to a marble bracelet, possibly as a decorative element (Rageot et al., 2021) (see figure 10). Because no evidence of production of birch bark tar has been found at the site it remains a question as to whether it was produced on site or obtained through trade (Piqué et al., 2022). The use of birch bark tar at the site is further evidence that early Neolithic people commanded a comprehensive knowledge of available plant resources and exploited them in a diversity of ways.

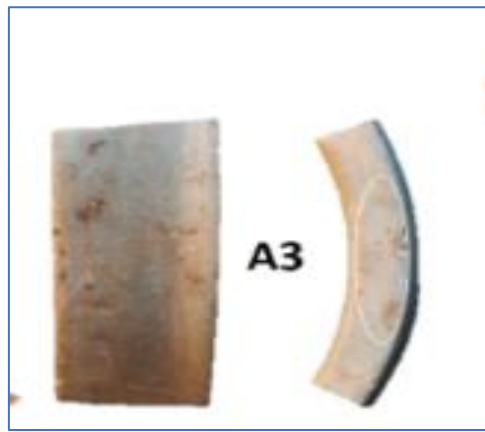


Figure 10 - Decoration/assembling adhesive applied to a marble bracelet La Draga (Rageot et al., 2021)

2.3.f. Fungi studies

Preservation issues related to the perishable nature of fungi along with a lack of specialists on site who can identify them causes fungi to be less represented in the archaeological record than plant or animal remains. Findings of fungi remains has been restricted to sites that are waterlogged or in permanent ice states. Even with all these challenges some fruiting bodies of fungi have been recovered at early archaeological site such as Star Carr (Mesolithic) in the UK (Clark et al., 1950; Robson, 2018). Also the famous remains of Ötzi from the Chalcolithic, found after being frozen in the Alps, which strongly suggest use as tinder (Peintner & Pöder, 2000). La Draga has once again demonstrated its amazing preservation conditions with the recovery of 86 fungi remains from excavations of sectors B-D with 84 of the remains being identified to the species level. The six taxa (see figures 11 & 12) identified from the site were brownflesh bracket (*Coriolopsis gallica*), oak mazegill (*Daedalea quercina*), cramp balls (*Daldinia concentrica*), southern bracket (*Ganoderma adspersum*), hazel bracket (*Skeletocutis nivea*), and *Lenzites warnieri* found in various ecosystems and with several known uses (Berihuete-Azorín et al., 2018). All six taxa are polypore mushrooms and given their host species could be found in the woods near the La Draga settlement. *Daedalea quercina* and *Ganoderma adspersum* would have found hosts in the deciduous forest near the site while the others would have found hosts in the nearby riparian forests. *Lenzites warnieri* and *Ganoderma adspersum* are found on living trees while the other taxa are found on dead wood. *Lenzites warnieri* and *Ganoderma adspersum* therefore would not be found growing on the dead wood of the constructed dwellings and the diverse ecosystems and hosts of the remaining taxa make it unlikely that they were growing in the same place so probably not at the site itself (Berihuete-Azorín et al., 2018). The varied ecology and hosts of the fungi found and the site conditions along with the abundance of fungi found in the reduced space of sectors B-D led to the conclusion the

polypores were gathered and intentionally brought to the site. In addition, most of the found fungi are known historically as being used for tinder and at least two show signs of manipulation while the range of sizes are biased towards medium and small specimens. The finds at La Draga provide evidence of bracket fungi being gathered as a frequent process during the site's occupation in the early Neolithic. Analysis encompassing the fruiting bodies macro-fossils, fungal spores from the recovered sediments and the review of ethnographic sources support the hypothesis that fungi were gathered, transported to the site, dried, stored and used as tinder (Piqué et al., 2020).



Figure 11 - Fruiting bodies of *Ganoderma adspersum*. (Berihuete-Azorín et al., 2018).

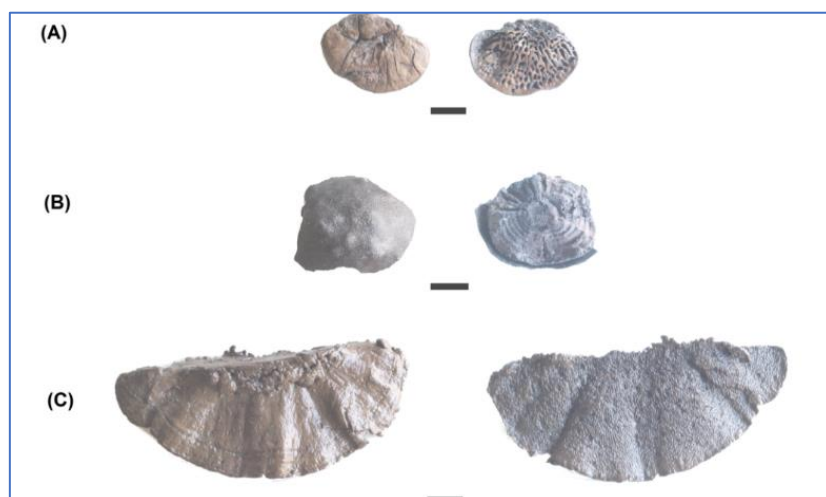


Figure 12 - (A) *Daedalea quercina*, (B) *Daldinia concentrica*, (C) *Coriolopsis gallica* (Berihuete-Azorín et al., 2018).

2.4 Objectives of the Study

This Master thesis presents a comprehensive record of all documented botanical (+fungi) taxa identified by different proxies at La Draga. Building on the work of Antolín (2013) this work intends to expand the initial 66 identified wild plant taxa with the addition of the archaeobotanical data available from the publications of materials excavated at La Draga. A bibliography, figures' index, and a tables' index complete the work. Going beyond a mere taxa list, other botanical, archaeobotanical and relevant ethnobotanical data will be gathered for each taxon to accomplish this study's aims to:

- Create a comprehensive archaeobotanical database of the site
- Increase understanding of the relationship between people and plants at La Draga
- Propose a seasonal calendar to characterize the plant management strategies utilized at the site.

3. Material and Methods.

Starting with Antolín's list of 66 wild species (Antolín, 2013) with alimentary and or medicinal value, a database was created in Excel incorporating the many archaeobotanical studies of La Draga with three main content areas; species (botanical) information, archaeobotanical data excavated from the site and ethnobotanical information relevant to the recovered remains.

3.1 Species/botanical information

Species information included binomial name, family name, common English name, the ecological group (referred to in this work as ecozone) the taxa is known to be found in, distance from the site to where the taxon is found and the growth cycle (perennial, biennial and annual). Ten ecological distributions or ecozones were identified in the area surrounding the site (see table 1). Antolín (2013) determined ecological classification of the found taxa on an actualistic basis which followed the Flora Manual dels Països Catalans (de Bolòs et al., 2005) or (Brombacher & Jacomet, 1997) when the flora did not have an exact description (only taxa from the lakeshore at La Draga). Antolín (2013) concedes that it cannot be assumed that present plant associations are applicable to the past since present associations are the result of over 7,000 years of people and plant interactions and significant changes could have taken place. However, assignment to an ecozone (ecological group) is necessary to get a general sense of the potential ecological distribution of the taxa given what is known about their present distribution. Two zones were added to the original eight (Mediterranean woodland and

Mountain woodland) to assist in creating a more complete picture. The distances to La Draga from the assigned ecozones were estimated based on previous archaeobotanical (Antolín, 2013) and palaeoecological research (Revelles et al., 2015, 2016).

Table 1 - Ecozones with Distance from La Draga

Ecozones with Distance from La Draga			
Ecozone	< 1km	1km-5km	>5km
Cultivars/fields	X	0	0
Ruderals/weeds	X	0	0
Pasture/clearings	0	X	0
Deciduous woodland	0	X	0
Woodland edge/clearings	0	X	0
Mediterranean woodland	0	0	X
Mountain woodland	0	0	X
Riparian/ lakeshore	X	0	0
Aquatic	X	0	0
Diverse/Unknown	NA	NA	NA

3.2 Archaeobotanical data

The Archaeobotanical information included one or more of the following **recovered parts**:

- A. Fruiting Body/Spores (Fruiting body: a multicellular structure on which spore-producing structures such as basidia or asci are born. Spore: a reproductive cell resulting from meiotic cell division in a sporangium, representing the first cell of the gametophyte generation).
- B. Seeds & Fruits (Seed: Ripened ovule. Fruit: ripened ovary and any other structures which are attached and ripen with it).
- C. Resin (A broad collection of compounds that are composed of polymerized terpenes mixed with volatile oils).
- D. Charcoal (A porous solid, consisting of an amorphous form of carbon, obtained as a residue when wood mater is heated in the absence of oxygens).
- E. Wood (The hard fibrous material that forms the main substance of the trunk or branches of a tree or shrub).
- F. Fibers (Elongated cells whose long, tapering ends interlock, thus providing maximum support to a plant. They often occur in bundles and are found in the stem, the roots, and

the vascular bundles in leaves. Many are important sources of raw material for textiles and other woven goods.

- G. Pollen (The mature microspores or developing male gametophytes of a seed plant, produced in the microsporangium of a gymnosperm or in the anther of an angiosperm).

Type of **preservation** was included as charred, waterlogged, or charred and waterlogged indicated with 1 for present and 0 for not present.

Finally, the bibliographical **source** of archaeobotanical information was included for each taxon (see table 2).

Table 2 - Archaeobotanical Sources by Proxy

Archaeobotanical Sources by Proxy					
Pollen	Fruits/Seeds	Charcoal/Wood	Fibers	Resin	Fungi
Revelles et al., 2015	Antolín, 2013	Caruso-Fermé & Piqué i Huerta, 2014	de Diego et al., 2017	Rageot et al., 2021	Berihuete-Azorín et al., 2018
Revelles et al., 2016	Antolín et al., 2014	López-Bultó, 2016	Herrero-Otal et al., 2021		Piqué et al., 2020
Revelles et al., 2017	Antolín et al., 2015	López-Bultó & Piqué Huerta, 2018	Piqué et al., 2018		
Revelles, 2017	Antolín & Jacomet, 2015	López-Bultó, 2020	Piqué et al., 2022		
Revelles, 2019	Antolín et al., 2016	López-Bultó et al., 2020	Romero-Brugués et al., 2021		
	Antolín et al., 2021	Piqué et al., 2015			
	Jesus & Antolín, 2022	Piqué et al., 2022			
		Palomo et al., 2013			

3.3 Ethnobotanical Information

The ethnobotanical information included five possible **used plant part** categories:

- A. Fruits/Seeds/Fruiting body or spore (Ripened ovary and any other structures which are attached and ripen with it, an organ specialized for producing spores).
- B. Flowers (The reproductive portion of the plant, consisting of stamens, pistils, or both, and usually including a perianth of sepals or both sepals and petals).
- C. Young shoots (Young stem or branch).
- D. Aerial parts (Occurring above ground or water).
- E. Roots (The portion of the plant axis lacking nodes and leaves and usually found below ground).

In order to provide a glimpse into **seasonality**, each plant part with an identified use had its season of harvest/availability indicated by 1 for yes and 0 for no for each of the four seasons defined below.

Winter	December, January, February
Spring	March, April, May
Summer	June, July, August
Autumn	September, October, November

Known uses of each taxon were identified as:

- A. Food (any nutritious substance that people ingest for sustenance).
- B. Medicine (a substance or preparation used in treating or preventing disease).
- C. Raw Material (substances used to create tools, products such as wood for digging sticks and reeds for baskets).
- D. Fuel (Material burned to produce heat or power including tinder).
- E. Building Material (substances used for constructing structures).
- F. Fodder (plants fed to domestic animals).
- G. Other (such as recreational, dyes, ritual, etc.).

The Plants for a Future (PFAF; <https://pfaf.org/user/default.aspx>) database was the main source of ethnobotanical information. This is a comprehensive compilation of information about plant species including details on more than 7,000 plants. It provides data on plant biology, ecology and ethnobotanical uses including food and medicinal ratings as well as other known uses.

Data analysis was performed in Excel to create lists, tables, and charts. The database will be registered and made available online, in alignment to the FAIR principles¹, dedicated to improving the Findability, Accessibility, Interoperability, and Reusability of digital assets.

4. Results.

4.1 Species/Botanical Information

Starting with the original 66 taxa identified by Antolín, (2013) as being wild plants with medicinal and/or food value, another 46 taxa were added for a total of 112 taxa with one or more of the identified uses as: food, medicine, raw material, fuel, building material, fodder or

¹ <https://www.go-fair.org/fair-principles/>

other (see table 3). An additional 60 taxa were added as pollen only, many identified at the family level (see table 4) with a total of 172 taxa entries in the database.

Table 3 - Plant and Fungi Remains Found at La Draga

Plant and Fungi Remains Found at La Draga			
Binomial name	Common name	Binomial name	Common name
<i>Hordeum distichum</i>	hulled barley (two rowed)	<i>Quercus</i> sp. deciduous	oak
<i>Hordeum vulgare</i> var. <i>nudum</i>	naked barley	NA	apple subfamily
<i>Lens culinaris</i>	lentil	<i>Tilia</i> sp.	lime/linden
<i>Triticum durum/turgidum</i>	naked wheat	<i>Agrimonia eupatoria</i>	agrimony
<i>Triticum aestivum</i>	naked wheat	<i>Crataegus monogyna</i>	common hawthorn
<i>Triticum dicoccum</i>	emmer	<i>Fragaria vesca</i>	woodland strawberry
<i>Triticum monococcum</i>	einkorn	<i>Origanum vulgare</i>	oregano
<i>Triticum timopheevii</i>	new glume wheat	<i>Physalis alkekengi</i>	winter cherry
NA	peas	<i>Prunus spinosa</i>	blackthorn/ sloe
<i>Papaver somniferum</i>	poppy	<i>Rubus fruticosus</i> agg.	blackberry
<i>Vicia faba</i>	broad bean	<i>Sambucus</i> cf. <i>nigra</i>	elderberry
<i>Ammi majus</i>	Queen Anne's Lace	<i>Vicia sepium</i>	bush vetch
<i>Brassica rapa</i>	wild turnip	<i>Arbutus unedo</i>	strawberry tree
<i>Capsella bursa-pastoris</i>	sheperd's purse	<i>Quercus ilex-coccifera</i>	evergreen oak, live oak
<i>Carthamus</i> cf. <i>lanatus</i>	wooly distaff thistle	<i>Betula</i> sp.	birch
<i>Chenopodium album</i>	lamb's quarters/ goosefoot	<i>Betula pendula</i>	silver birch
<i>Epilobium angustifolium</i>	willow herb	<i>Taxus baccata</i>	English yew
<i>Euphorbia helioscopia</i> subsp. <i>Helioscopia</i>	madwoman's milk	<i>Alisma plantago-aquatica</i>	great water plantain
<i>Galium aparine</i> subsp. <i>spurium</i>	stickywilly	<i>Alnus glutinosa</i>	alder
<i>Hyoscyamus niger</i>	henbane	<i>Apium nodiflorum</i> subsp. <i>nodiflorum</i>	fool's watercress
<i>Lathyrus aphaca</i> type	yellow pea	NA	sedges
<i>Polygonum aviculare</i>	knotweed, knotgrass	<i>Carex hirta</i> type	hammer sedge
<i>Polygonum lapathifolium</i>	curlytop knotweed	<i>Cladium mariscus</i>	swamp sawgrass
<i>Portulaca oleracea</i>	green purselane	<i>Eupatorium cannabinum</i>	hemp agrimony
<i>Reseda phyteuma</i>	rampion mignonette	<i>Iris pseudacorus</i>	yellow flag
cf. <i>Scandix pecten-veneris</i>	sheperd's needle	<i>Laurus nobilis</i>	bay tree
<i>Silene vulgaris/latifolia</i>	bladder campion	<i>Lycopus europaeus</i>	gypsywort
<i>Silybum marianum</i>	milk thistle	<i>Mentha</i> cf. <i>aquatica</i>	water mint
<i>Sonchus oleraceus/asper</i>	prickly sow thistle	<i>Phragmites australis</i>	common reed
<i>Stellaria media</i>	chickweed	<i>Plantago major</i> subsp. <i>intermedia</i>	common plantain
<i>Urtica dioica</i>	stinging nettle	NA	willow
<i>Urtica pilulifera</i>	roman nettle	NA	grasses
<i>Urtica urens</i>	annual nettle	<i>Ranunculus sceleratus</i>	celery-leaved buttercup
<i>Verbena officinalis</i>	vervain	<i>Salix</i> sp.	willow
<i>Vicia villosa</i> type	winter vetch	<i>Scirpus lacustris</i>	bulrush
<i>Apium graveolens</i>	wild celery	<i>Ulmus</i> sp.	wych elm/elm
<i>Arenaria serpyllifolia</i>	thyme-leaf sandwort	<i>Vitis vinifera</i> subsp. <i>sylvestris</i>	wild grape

<i>Campanula cf. rotundifolia</i>	harebell	NA	sedges
<i>Hypericum perforatum</i>	St. John's wort	<i>Cyperus longus</i>	galingale
<i>Leucanthemum vulgare</i>	ox-eye daisy	<i>Juncus effusus</i>	soft rush
<i>Linum catharticum</i>	fairy flax	NA	rushes
<i>Potentilla cf. reptans</i>	creeping cinquefoil	<i>Typha angustifolia</i>	small reed mace
cf. <i>Pulicaria dysenterica</i>	fleabane	<i>Typha latifolia</i>	reedmace
<i>Silene gallica</i>	common catchfly	<i>Najas marina</i>	spiny naiad
<i>Valerianella cf. dentata</i>	corn salad	<i>Nymphaea alba</i>	white water lily
<i>Acer</i> sp.	maple	<i>Ranunculus aquatilis</i>	water crowfoot
<i>Buxus sempervirens</i>	common boxwood	NA	bulrushes
NA	leather flower	<i>Amaranthus</i> sp.	amaranth
<i>Clematis vitalba</i>	traveller's Joy	cf. <i>Dactylis glomerata</i>	cock's foot
<i>Cornus sanguinea</i>	common dogwood	<i>Rumex</i> sp.	dock
<i>Corylus avellana</i>	common hazel	<i>Coriopsis gallica</i>	brownflesh bracket
<i>Juniperus</i> sp.	juniper	<i>Daedalea quercina</i>	oak mazegill
<i>Pinus</i> sp.	pine	<i>Daldinia concentrica</i>	cramp balls
<i>Pinus sylvestris/nigra</i>	ScotchPine, black pine	<i>Ganoderma adsperum</i>	southern bracket
<i>Prunus avium</i>	wild cherry	<i>Lenzites warnieri</i>	none
<i>Pyrus malus</i> subsp. <i>sylvestris</i>	crab apple	<i>Skeletocutis nivea</i>	hazel bracket

Table 4 - Additional taxa (pollen only)

Additional taxa (pollen only)		
Binomial name	Family name	Common name
NA	Apiaceae	celery family
<i>Hedera helix</i>	Araliaceae	ivy
<i>Asphodelus</i>	Asphodelaceae	NA
Aster-type	Asteraceae	aster
<i>Asteraceae liguliflorae/Cichorioideae</i>	Asteraceae	aster
<i>Asteraceae tubuliflorae/Asteroideae</i>	Asteraceae	aster
<i>Centaurea</i>	Asteraceae	knapweeds
<i>Cirsium</i> -t	Asteraceae	plum thistles
<i>Echium</i> -type	Boraginaceae	bugloss
<i>Symphytum</i> -type	Boraginaceae	comfrey
NA	Brassicaceae	mustards
NA	Campanulaceae	bellflower
NA	Cannabaceae	hemp
NA	Caryophyllaceae	pinks
<i>Paronychia</i> -type	Caryophyllaceae	nailwort
NA	Cistaceae	rock roses
<i>Helianthemum</i> sp.	Cistaceae	rock roses
<i>Crassula</i> sp.	Crassulaceae	pigmyplants
<i>Sedum</i>	Crassulaceae	stonecrops
<i>Dipsacus</i> sp.	Dipsacaceae	teasel
<i>Ephedra</i> sp.	Ephedraceae	NA
<i>Erica</i> sp.	Ericaceae	heather

<i>Euphorbia</i> sp.	Euphorbiaceae	spurges
<i>Astragalus cruciatus</i>	Fabaceae	NA
<i>Hedysarum</i> -type	Fabaceae	sweetvetch
<i>Vicia</i> -type	Fabaceae	vetch
<i>Juglans regia</i>	Juglandaceae	walnut
NA	Lamiaceae	mints
<i>Mentha</i> -type	Lamiaceae	mint
<i>Lythrum</i> sp.	Lythraceae	loosestrife
<i>Nuphar</i> sp.	Nymphaeaceae	water-lily
<i>Nymphaea</i> sp.	Nymphaeaceae	water-lily
<i>Fraxinus</i> sp.	Oleaceae	Ash
<i>Olea europaea</i>	Oleaceae	European olive
<i>Phillyrea</i> sp.	Oleaceae	NA
<i>Melampyrum</i>	Orobanchaceae	cow wheat
<i>Pedicularis</i> sp.	Orobanchaceae	lousewort
NA	Papaveraceae	poppy
<i>Hypecoum</i> -type	Papaveraceae	NA
<i>Abies alba</i>	Pinaceae	Fir
<i>Plantago</i> sp.	Plantaginaceae	plantains
<i>Antirrhinum</i> -type	Plantaginaceae	snapdragons
<i>Linaria</i> -type	Plantaginaceae	toadflax
<i>Rumex tingitanus</i>	Polygonaceae	NA
<i>Primula</i> -type	Primulaceae	primroses
NA	Ranunculaceae	buttercups
<i>Aquilegia</i> -type	Ranunculaceae	columbine
<i>Rhamnus alaternus</i>	Rhamnaceae	Italian buckthorn
NA	Rosaceae	roses
<i>Fragaria</i> sp.	Rosaceae	wild strawberries
<i>Filipendula</i> sp.	Rosaceae	NA
<i>Potentilla</i>	Rosaceae	cinquefoils
<i>Rubus</i> -type	Rosaceae	brambles
<i>Sanguisorba minor</i>	Rosaceae	salad burnet
<i>Sorbus</i> sp.	Rosaceae	rowan
<i>Galium</i> -type	Rubiaceae	bedstraw
<i>Osyris</i> -type	Santalaceae	sandalwoods
NA	Scrophulariaceae	figworts
<i>Typha-Sparganium</i>	Typhaceae	bulrush
<i>Urtica</i> sp.	Urticaceae	nettles

The taxa represented 72 botanical families with Rosaceae containing the most taxa (14) followed by Asteraceae (10), Fabaceae (9) and Poaceae (8) (see table 5).

Table 5 - Family taxa count

Family taxa count

Family Name	Count	Family Name	Count	Family Name	Count
Rosaceae	14	Boraginaceae	2	Adoxaceae	1
Asteraceae	10	Rubiaceae	2	Primulaceae	1
Fabaceae	9	Fagaceae	2	Cupressaceae	1
Poaceae	8	Solanaceae	2	Iridaceae	1
Cyperaceae	6	Crassulaceae	2	Asphodelaceae	1
Ranunculaceae	6	Salicaceae	2	Rhamnaceae	1
Caryophyllaceae	6	Amaranthaceae	2	Araliaceae	1
Apiaceae	5	Orobanchaceae	2	Rosaceae	1
Polygonaceae	4	Cistaceae	2	Fomitopsidaceae	1
Typhaceae	4	Taxaceae	1	Juglandaceae	1
Betulaceae	4	Cannabaceae	1	Hypericaceae	1
Plantaginaceae	4	Proaceae	1	Santalaceae	1
Lamiaceae	4	Valerianaceae	1	Poaceae	1
Oleaceae	4	Dipsacaceae	1	Alismataceae	1
Urticaceae	4	Vitaceae	1	Buxaceae	1
Brassicaceae	3	Portulacaceae	1	Tiliaceae	1
Pinaceae	3	Aceraceae	1	Hypoxylaceae	1
Polyporaceae	3	Resedaceae	1	Polyporales	1
Papaveraceae	3	Najadaceae	1	Onagraceae	1
Nymphaeaceae	3	Rosaceae/Maloideae	1	Lamiaceae	1
Euphorbiaceae	2	Ephedraceae	1	Verbenaceae	1
Ericaceae	2	Scrophulariaceae	1	Lauraceae	1
Juncaceae	2	Cornaceae	1	Linaceae	1
Campanulaceae	2	Ulmaceae	1	Lythraceae	1
Grand Total including all proxies					172

Taxa identified at the site were assigned to one or more of ten ecozones in which they are found (see tables 6-15).

Table 6 - Cultivars

Cultivars

Binomial name	Family	Common name
<i>Hordeum distichum</i>	Poaceae	hulled barley (two rowed)
<i>Hordeum vulgare</i> var. <i>nudum</i>	Poaceae	naked barley
<i>Lens culinaris</i>	Fabaceae	lentil
<i>Triticum durum/turgidum</i>	Poaceae	naked wheat
<i>Triticum aestivum</i>	Poaceae	naked wheat
<i>Triticum dicoccum</i>	Poaceae	emmer
<i>Triticum monococcum</i>	Poaceae	einkorn
<i>Triticum timopheevii</i>	Poaceae	new glume wheat
NA	Fabaceae	peas
<i>Papaver somniferum</i>	Papaveraceae	poppy
<i>Vicia faba</i>	Fabaceae	broad bean

Table 7 - Ruderals/Weeds

Ruderals/Weeds

Binomial name	Family	Common name
<i>Ammi majus</i>	Apiaceae	Queen Anne's Lace
<i>Brassica rapa</i>	Brassicaceae	wild turnip
<i>Capsella bursa-pastoris</i>	Brassicaceae	shepherd's purse
<i>Carthamus</i> cf. <i>lanatus</i>	Asteraceae	wooly distaff thistle
<i>Chenopodium album</i>	Amaranthaceae	lamb's quarters/ goosefoot
<i>Epilobium angustifolium</i>	Onagraceae	willow herb
<i>Euphorbia helioscopia</i> subsp. <i>Helioscopia</i>	Euphorbiaceae	madwoman's milk
<i>Galium aparine</i> subsp. <i>spurium</i>	Rubiaceae	stickywilly
<i>Hyoscyamus niger</i>	Solanaceae	henbane
<i>Lathyrus aphaca</i> type	Fabaceae	yellow pea
<i>Polygonum aviculare</i>	Polygonaceae	knotweed, knotgrass
<i>Polygonum lapathifolium</i>	Polygonaceae	curlytop knotweed
<i>Portulaca oleracea</i>	Portulacaceae	green purselane
<i>Reseda phyteuma</i>	Resedaceae	rampion mignonette
cf. <i>Scandix pecten-veneris</i>	Apiaceae	shepherd's needle
<i>Silene vulgaris/latifolia</i>	Caryophyllaceae	bladder campion
<i>Silybum marianum</i>	Asteraceae	milk thistle
<i>Sonchus oleraceus/asper</i>	Asteraceae	prickly sow thistle
<i>Stellaria media</i>	Caryophyllaceae	chickweed

<i>Urtica dioica</i>	Urticaceae	stinging nettle
<i>Urtica pilulifera</i>	Urticaceae	roman nettle
<i>Urtica urens</i>	Urticaceae	annual nettle
<i>Verbena officinalis</i>	Verbenaceae	vervain
<i>Vicia villosa</i> type	Fabaceae	winter vetch

Table 8 - Pastures and Clearings

Pastures and Clearings

Binomial name	Family	Common name
<i>Apium graveolens</i>	Apiaceae	wild celery
<i>Arenaria serpyllifolia</i>	Caryophyllaceae	thyme-leaf sandwort
<i>Campanula</i> cf. <i>rotundifolia</i>	Campanulaceae	harebell
<i>Hypericum perforatum</i>	Hypericaceae	St. John's wort
<i>Leucanthemum vulgare</i>	Asteraceae	ox-eye daisy
<i>Linum catharticum</i>	Linaceae	fairy flax
<i>Potentilla</i> cf. <i>reptans</i>	Rosaceae	creeping cinquefoil
cf. <i>Pulicaria dysenterica</i>	Asteraceae	fleabane
<i>Silene gallica</i>	Caryophyllaceae	common catchfly
<i>Valerianella</i> cf. <i>dentata</i>	Valerianaceae	corn salad
NA	Poaceae	grasses

Table 9 - Deciduous Woods

Deciduous Woods

Binomial name	Family	Common name
<i>Acer</i> sp.	Aceraceae	maple
<i>Buxus sempervirens</i>	Buxaceae	common boxwood
NA	Ranunculaceae	leather flower
<i>Clematis vitalba</i>	Ranunculaceae	traveller's Joy
<i>Cornus sanguinea</i>	Cornaceae	common dogwood
<i>Corylus avellana</i>	Betulaceae	common hazel
<i>Prunus avium</i>	Rosaceae	wild cherry

<i>Pyrus malus</i> subsp. <i>sylvestris</i>	Rosaceae	crab apple
<i>Quercus</i> sp. <i>deciduous</i>	Fagaceae	oak
NA	Rosaceae/Maloideae	apple subfamily
<i>Tilia</i> sp.	Tiliaceae	lime/linden
<i>Nymphaea alba</i>	Nymphaeaceae	white water lily
<i>Daedalea quercina</i>	Fomitopsidaceae	oak mazegill
<i>Ganoderma adsperum</i>	Polyporales	southern bracket

Table 10 - Woodland edge/clearings

Woodland edge/clearings

Binomial name	Family	Common name
<i>Agrimonia eupatoria</i>	Rosaceae	agrimony
<i>Crataegus monogyna</i>	Rosaceae	common hawthorn
<i>Fragaria vesca</i>	Rosaceae	woodland strawberry
<i>Origanum vulgare</i>	Lamiaceae	oregano
<i>Physalis alkekengi</i>	Solanaceae	winter cherry
<i>Prunus spinosa</i>	Rosaceae	blackthorn/ sloe
<i>Rubus fruticosus</i> agg.	Rosaceae	blackberry
<i>Sambucus</i> cf. <i>nigra</i>	Adoxaceae	elderberry
<i>Vicia sepium</i>	Fabaceae	bush vetch

Table 11 - Mediterranean Woodland

Mediterranean Woodland

Binomial name	Family	Common name
<i>Arbutus unedo</i>	Ericaceae	strawberry tree
<i>Quercus ilex-coccifera</i>	Fagaceae	evergreen oak, live oak

Table 12 - Mountain Woodland

Mountain Woodland

Binomial name	Family	Common name
<i>Betula</i> sp.	Betulaceae	birch
<i>Betula pendula</i>	Betulaceae	silver birch

<i>Pinus</i> sp.	Pinaceae	pine
<i>Pinus sylvestris/nigra</i>	Pinaceae	ScotchPine,black pine
<i>Taxus baccata</i>	Taxaceae	English yew
<i>Juniperus</i> sp.	Cupressaceae	juniper

Table 13 - Riparian/lakesore

Riparian/Lakeshore

Binomial name	Family	Common name
<i>Alisma plantago-aquatica</i>	Alismataceae	great water plantain
<i>Alnus glutinosa</i>	Betulaceae	alder
<i>Apium nodiflorum</i> subsp. <i>nodiflorum</i>	Apiaceae	fool's watercress
NA	Cyperaceae	sedges
<i>Carex hirta</i> type	Cyperaceae	hammer sedge
<i>Cladium mariscus</i>	Cyperaceae	swamp sawgrass
<i>Eupatorium cannabinum</i>	Oleaceae	hemp agrimony
<i>Iris pseudacorus</i>	Iridaceae	yellow flag
<i>Laurus nobilis</i>	Lauraceae	bay tree
<i>Lycopus europaeus</i>	Lamiaceae	gypsywort
<i>Mentha</i> cf. <i>aquatica</i>	Lamiaceae	water mint
<i>Phragmites australis</i>	Proaceae	common reed
<i>Plantago major</i> subsp. <i>intermedia</i>	Plantaginaceae	common plantain
NA	Salicaceae	willow
NA	Poaceae	grasses
<i>Ranunculus sceleratus</i>	Ranunculaceae	celery-leaved buttercup
<i>Salix</i> sp.	Salicaceae	willow
<i>Scirpus lacustris</i>	Cyperaceae	bulrush
<i>Ulmus</i> sp.	Ulmaceae	wych elm/elm
<i>Vitis vinifera</i> subsp. <i>sylvestris</i>	Vitaceae	wild grape
<i>Coriolopsis gallica</i>	Polyporaceae	brownflesh bracket
<i>Daldinia concentrica</i>	Hypoxylaceae	cramp balls
<i>Lenzites warnieri</i>	Polyporaceae	none
<i>Skeletocutis nivea</i>	Polyporaceae	hazel bracket

Table 14 - Aquatic

Aquatic

Binomial name	Family	Common name
NA	Cyperaceae	sedges
<i>Cyperus longus</i>	Cyperaceae	galingale
<i>Juncus effusus</i>	Juncaceae	soft rush
NA	Juncaceae	rushes
<i>Typha angustifolia</i>	Typhaceae	small reed mace
<i>Typha latifolia</i>	Typhaceae	reedmace
<i>Najas marina</i>	Najadaceae	spiny naiad
<i>Nymphaea alba</i>	<i>Nymphaeaceae</i>	white water lily
<i>Ranunculus aquatilis</i>	Ranunculaceae	water crowfoot
NA	Typhaceae	bulrushes

Table 15 - Diverse/Unknown

Diverse/Unknown

Binomial name	Family	Common name
<i>Amaranthus</i> sp.	Amaranthaceae	amaranth
cf. <i>Dactylis glomerata</i>	Poaceae	cock's foot
<i>Rumex</i> sp.	Polygonaceae	dock

The two ecozones containing the most taxa were weed/ruderal and riparian/lakeshore with 21% each followed by deciduous woodlands with 12% (see Figure 13).

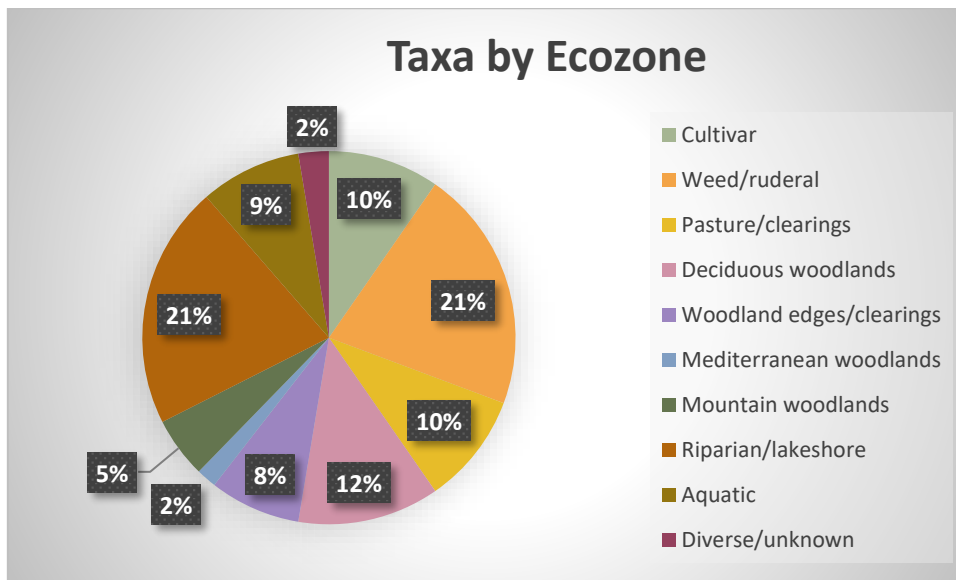


Figure 13 - Percentage of Taxa by ecozone.

The largest number of taxa were within 1km of the settlement (see figure 14).

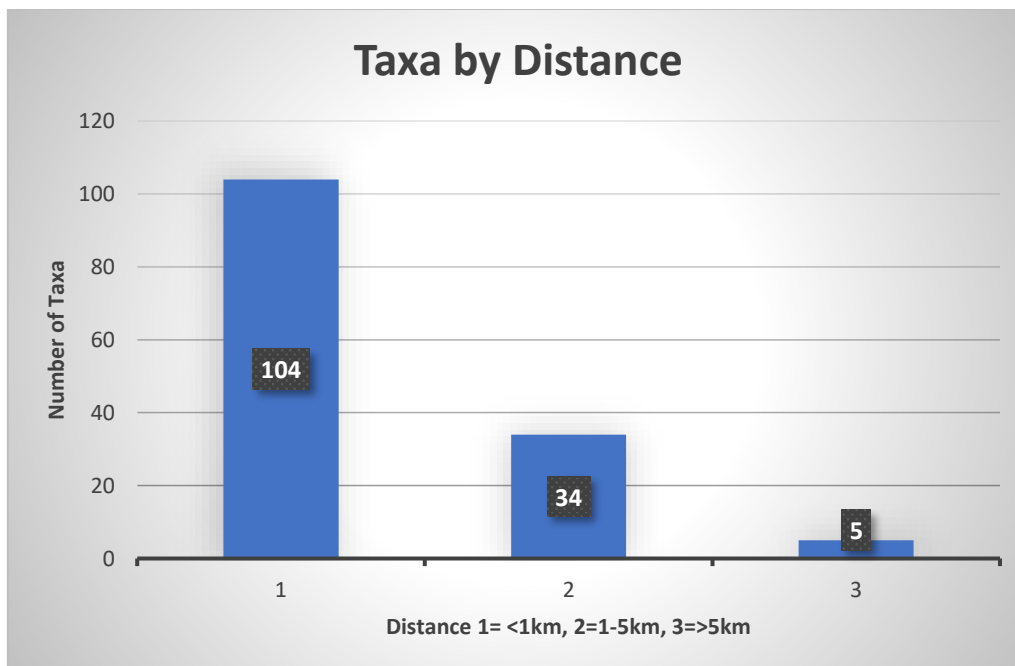


Figure 14 - Number of taxa by distance from the site.

The taxa were classified by their growth cycle of perennial, biennial and annual with the majority, 64%, being in the perennial grouping (see figure 15).

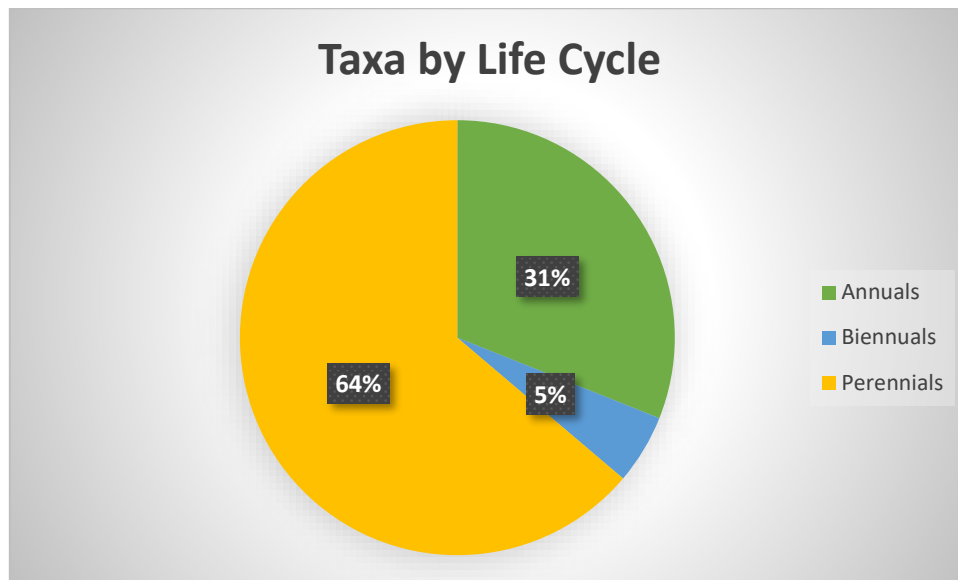


Figure 15 - Percentage of taxa by life cycle.

4.2 Archaeobotany

Though fungi are not in the plant kingdom their fruiting bodies may be found at archaeological sites and studied by carpologists. Six taxa of fungi were recovered at La Draga (see table 16).

Table 16 – Identified fungi species

Fungi taxa			
Binomial name	Family	Common name	Archaeobotanical source
<i>Corioloopsis gallica</i>	Polyporaceae	brownflesh bracket	Berihuete et al., (2018)
<i>Daedalea quercina</i>	Fomitopsidaceae	oak mazegill	Berihuete et al., (2018)
<i>Daldinia concentrica</i>	Hypoxylaceae	cramp balls	Berihuete et al., (2018)
<i>Ganoderma adspersum</i>	Polyporales	southern bracket	Berihuete et al., (2018)
<i>Lenzites warnieri</i>	Polyporaceae	none	Berihuete et al., (2018)
<i>Skeletocutis nivea</i>	Polyporaceae	hazel bracket	Berihuete et al., (2018)

The largest number of taxa were recovered as fruits and seeds (see table 17).

Table 17 - Fruits and seeds taxa

Fruits & Seeds taxa			
Binomial name	Family	Common name	Source of archaeobotanical data
<i>Hordeum distichum</i>	Poaceae	hulled barley (two rowed)	Antolín & Buxo (2014)
<i>Hordeum vulgare</i> var. <i>nudum</i>	Poaceae	naked barley	Antolín (2016)
<i>Lens culinaris</i>	Fabaceae	lentil	Antolín (2016)
<i>Triticum durum/turgidum</i>	Poaceae	naked wheat	Antolín & Buxo (2014)
<i>Triticum aestivum</i>	Poaceae	naked wheat	Antolín & Buxo (2014)
<i>Triticum dicoccum</i>	Poaceae	emmer	Antolín & Buxo (2014)
<i>Triticum monococcum</i>	Poaceae	einkorn	Antolín & Buxo (2014)
<i>Triticum timopheevii</i>	Poaceae	new glume wheat	Antolín & Buxo (2014)
NA	Fabaceae	peas	Antolín (2013)
<i>Papaver somniferum</i>	Papaveraceae	poppy	Antolín & Buxo (2014)
<i>Vicia faba</i>	Fabaceae	broad bean	Antolín (2013)
<i>Ammi majus</i>	Apiaceae	Queen Anne's Lace	Antolín (2013)
<i>Brassica rapa</i>	Brassicaceae	wild turnip	Jesus & Antolín (2022)
<i>Capsella bursa-pastoris</i>	Brassicaceae	sheperd's purse	Antolín (2013)
<i>Carthamus</i> cf. <i>lanatus</i>	Asteraceae	wooly distaff thistle lamb's quarters/ goosefoot	Antolín (2013)
<i>Chenopodium album</i>	Amaranthaceae		Antolín (2013)
<i>Epilobium angustifolium</i>	Onagraceae	willow herb	Piqué (2016)
<i>Euphorbia helioscopia</i> subsp. <i>Helioscopia</i>	Euphorbiaceae	madwoman's milk	Antolín (2013)
<i>Galium aparine</i> subsp. <i>spurium</i>	Rubiaceae	stickywilly	Antolín (2013)
<i>Hyoscyamus niger</i>	Solanaceae	henbane	Antolín (2013)
<i>Lathyrus aphaca</i> type	Fabaceae	yellow pea	Antolín (2013)
<i>Polygonum aviculare</i>	Polygonaceae	knotweed, knotgrass	Antolín (2013) Revelles et al., (2016, 2017) Revelles (2019) Antolín (2013)
<i>Polygonum lapathifolium</i>	Polygonaceae	curlytop knotweed	Antolín (2013)
<i>Portulaca oleracea</i>	Portulacaceae	green purselane	Antolín (2013)
<i>Reseda phyteuma</i>	Resedaceae	rampion mignonette	Antolín (2013)
cf. <i>Scandix pecten-veneris</i>	Apiaceae	sheperd's needle bladder	Antolín (2013)
<i>Silene vulgaris/latifolia</i>	Caryophyllaceae	campion	Antolín (2013)
<i>Silybum marianum</i>	Asteraceae	milk thistle	Antolín (2013)
<i>Sonchus oleraceus/asper</i>	Asteraceae	prickly sow thistle	

			Antolín (2013)
<i>Stellaria media</i>	Caryophyllaceae	chickweed	Antolín (2013)
<i>Urtica dioica</i>	Urticaceae	stinging nettle	Antolín (2013)
<i>Urtica pilulifera</i>	Urticaceae	Roman nettle	Piqué (2016)
<i>Urtica urens</i>	Urticaceae	annual nettle	Piqué (2016)
<i>Verbena officinalis</i>	Verbenaceae	vervain	Antolín (2013)
<i>Vicia villosa</i> type	Fabaceae	winter vetch	Antolín (2013)
<i>Apium graveolens</i>	Apiaceae	wild celery	Antolín (2013)
<i>Arenaria serpyllifolia</i>	Caryophyllaceae	thyme-leaf sandwort	Antolín (2013)
<i>Campanula</i> cf. <i>rotundifolia</i>	Campanulaceae	harebell	Antolín (2013)
<i>Hypericum perforatum</i>	Hypericaceae	St. John's wort	Antolín (2013)
<i>Leucanthemum vulgare</i>	Asteraceae	ox-eye daisy	Antolín (2013)
<i>Linum catharticum</i>	Linaceae	fairy flax	Antolín (2013)
<i>Potentilla</i> cf. <i>reptans</i>	Rosaceae	creeping cinquefoil	Antolín (2013)
cf. <i>Pulicaria dysenterica</i>	Asteraceae	fleabane	Antolín (2013)
<i>Silene gallica</i>	Caryophyllaceae	common catchfly	Antolín (2013)
<i>Valerianella</i> cf. <i>dentata</i>	Valerianaceae	corn salad	Antolín (2013)
<i>Clematis vitalba</i>	Ranunculaceae	traveller's Joy	Antolín (2013)
<i>Cornus sanguinea</i>	Cornaceae	common dogwood	Antolín (2013)
<i>Corylus avellana</i>	Betulaceae	common hazel	Antolín (2013)
<i>Prunus avium</i>	Rosaceae	wild cherry	Caruso-Fermé (2014)
<i>Pyrus malus</i> subsp. <i>sylvestris</i>	Rosaceae	crab apple	Antolín (2013)
<i>Quercus</i> sp. deciduous	Fagaceae	oak	Antolín (2013) Caruso-Fermé (2014) Revelles (2016, 2017) Revelles (2019)
NA	Rosaceae/Maloideae	apple subfamily	Antolín (2013) Caruso-Fermé (2014)
<i>Agrimonia eupatoria</i>	Rosaceae	agrimony	Antolín (2013)
<i>Crataegus monogyna</i>	Rosaceae	common hawthorn	Antolín (2013)
<i>Fragaria vesca</i>	Rosaceae	woodland strawberry	Antolín (2013)
<i>Origanum vulgare</i>	Lamiaceae	oregano	Antolín (2013)
<i>Physalis alkekengi</i>	Solanaceae	winter cherry	Antolín (2013)
<i>Prunus spinosa</i>	Rosaceae	blackthorn/sloe	Antolín (2013)
<i>Rubus fruticosus</i> agg.	Rosaceae	blackberry	Antolín (2013) Caruso-Fermé (2014) Revelles et al. (2016,2017) Revelles (2019)
<i>Sambucus</i> cf. <i>nigra</i>	Adoxaceae	elderberry	Antolín (2013)
<i>Vicia sepium</i>	Fabaceae	bush vetch	Antolín (2013)
<i>Taxus baccata</i>	Taxaceae	English yew	Antolín (2013) Caruso-Fermé (2014)

<i>Alisma plantago-aquatica</i>	Alismataceae	great water plantain	Antolín (2013)
<i>Alnus glutinosa</i>	Betulaceae	alder	Antolín (2013) Caruso-Fermé (2014)
<i>Apium nodiflorum</i> subsp. <i>nodiflorum</i>	Apiaceae	fool's watercress	Antolín (2013) Caruso-Fermé (2014)
NA	Cyperaceae	sedges	Revelles (2019) Antolín (2013)
<i>Carex hirta</i> type	Cyperaceae	hammer sedge	Antolín (2013)
<i>Cladium mariscus</i>	Cyperaceae	swamp sawgrass	Antolín (2013)
<i>Iris pseudacorus</i>	Iridaceae	yellow flag	Antolín (2013)
<i>Lycopus europaeus</i>	Lamiaceae	gypsywort	Antolín (2013)
<i>Mentha</i> cf. <i>aquatica</i>	Lamiaceae	water mint	Antolín (2013)
<i>Phragmites australis</i>	Proaceae	common reed	
<i>Plantago major</i> subsp. <i>intermedia</i>	Plantaginaceae	common plantain	Antolín (2013) Revelles et al. (2016, 2017, Revelles (2019)
NA	Poaceae	grasses	Herrero-Otal (2021), Revelles et al. (2016,2017) Revelles (2019)
<i>Ranunculus sceleratus</i>	Ranunculaceae	celery-leaved buttercup	Antolín (2013)
<i>Salix</i> sp.	Salicaceae	willow	Caruso-Fermé (2014) Piqué (2020) Revelles et al. (2016, 2017) Revelles 2019
<i>Scirpus lacustris</i>	Cyperaceae	bulrush	Antolín (2013) Piqué (2016) Caruso- Fermé (2014)Revelles (2019)
<i>Ulmus</i> sp.	Ulmaceae	wych elm/elm	
<i>Cyperus longus</i>	Cyperaceae	galingale	Piqué (2020)
<i>Juncus effusus</i>	Juncaceae	soft rush	Piqué (2020)
<i>Typha angustifolia</i>	Typhaceae	small reed mace	Piqué (2020) Revelles et al. (2016, 2017) Revelles 2019
<i>Typha latifolia</i>	Typhaceae	reedmace	Caruso-Fermé (2014) Piqué (2020)
<i>Najas marina</i>	Najadaceae	spiny naiad	Antolín (2013)
<i>Nymphaea alba</i>	<i>Nymphaeaceae</i>	white water lily	Antolín (2013)
<i>Ranunculus aquatilis</i>	Ranunculaceae	water crowfoot	Antolín (2013)
<i>Amaranthus</i> sp.	Amaranthaceae	amaranth	Antolín (2013)
cf. <i>Dactylis glomerata</i>	Poaceae	cock's foot	
<i>Rumex</i> sp.	Polygonaceae	dock	Antolín (2013) Revelles et al. (2016, 2017) Revelles 2019

Twenty taxa were identified in the recovery of charcoal at La Draga (see table 18).

Table 18 - Charcoal taxa

Charcoal taxa			
Binomial name	Family	Common name	Archaeobotanical Source
<i>Epilobium angustifolium</i>	Onagraceae	willow herb	Piqué (2016)
<i>Urtica pilulifera</i>	Urticaceae	Roman nettle	Piqué (2016)
<i>Urtica urens</i>	Urticaceae	annual nettle	Piqué (2016)
<i>Acer</i> sp.	Aceraceae	maple	Caruso-Fermé (2014)Revelles (2019)
<i>Buxus sempervirens</i>	Buxaceae	common boxwood	Caruso-Fermé (2014)Revelles (2019)
<i>Corylus avellana</i>	Betulaceae	common hazel	Antolín (2013) Caruso-Fermé (2014)Revelles (2019)
<i>Juniperus</i> sp.	Cupressaceae	juniper	Caruso-Fermé (2014)Revelles (2019)
<i>Pinus</i> sp.	Pinaceae	pine	Caruso-Fermé (2014)Revelles (2016, 2017) Revelles (2019)
<i>Pinus sylvestris/nigra</i>	Pinaceae	ScotchPine, black pine	Lopez-Bulto(2018)
<i>Prunus avium</i>	Rosaceae	wild cherry	Antolín (2013) Caruso-Fermé (2014)
<i>Quercus</i> sp. deciduous	Fagaceae	oak	Antolín (2013) Caruso-Fermé (2014) Revelles (2016, 2017) Revelles (2019)
NA	Rosaceae/Maloideae	apple subfamily strawberry tree	Caruso-Fermé (2014)
<i>Arbutus unedo</i>	Ericaceae	tree	Caruso-Fermé (2014)
<i>Taxus baccata</i>	Taxaceae	English yew	Antolín (2013) Caruso-Fermé (2014)
<i>Alnus glutinosa</i>	Betulaceae	alder	Antolín (2013) Caruso-Fermé (2014)
<i>Eupatorium cannabinum</i>	Oleaceae	hemp agrimony	Antolín (2013) Caruso-Fermé (2014)
<i>Laurus nobilis</i>	Lauraceae	bay tree	Caruso-Fermé (2014)
NA	Salicaceae	willow	Caruso-Fermé (2014) Piqué (2020) Revelles et al. (2016, 2017) Revelles 2019
<i>Salix</i> sp.	Salicaceae	willow	Caruso-Fermé (2014) Piqué (2020) Revelles et al. (2016, 2017) Revelles 2019
<i>Ulmus</i> sp.	Ulmaceae	wych elm/elm	Piqué (2016) Caruso-Fermé (2014)Revelles (2019)
<i>Vitis vinifera</i> subsp. <i>sylvestris</i>	Vitaceae	wild grape	Antolín (2013) Caruso-Fermé (2014)
<i>Cyperus longus</i>	Cyperaceae	galingale	Piqué (2020)
<i>Juncus effusus</i>	Juncaceae	soft rush	Piqué (2020) Piqué (2020) Revelles et al. (2016, 2017) Revelles 2019
<i>Typha angustifolia</i>	Typhaceae	small reed mace	Revelles 2019
<i>Typha latifolia</i>	Typhaceae	reedmace	Piqué (2020)

Nineteen taxa were recovered as wood (see table 19).

Table 19 - Wood taxa

Wood taxa			
Binomial name	Family	Common name	Archaeobotanical source
<i>Acer</i> sp.	Aceraceae	maple	Caruso-Fermé (2014) Revelles (2019)
<i>Buxus sempervirens</i>	Buxaceae	common boxwood	Caruso-Fermé (2014) Revelles (2019)
<i>Clematis vitalba</i>	Ranunculaceae	traveller's Joy	Antolín (2013) Caruso-Fermé (2014)
<i>Cornus sanguinea</i>	Cornaceae	common dogwood	Antolín (2013) Caruso-Fermé (2014)
<i>Corylus avellana</i>	Betulaceae	common hazel	Antolín (2013) Caruso-Fermé (2014) Revelles (2019)
<i>Juniperus</i> sp.	Cupressaceae	juniper	Caruso-Fermé (2014) Revelles (2019)
<i>Pinus</i> sp.	Pinaceae	pine	Caruso-Fermé (2014) Revelles (2016, 2017) Revelles (2019)
<i>Pinus sylvestris/nigra</i>	Pinaceae	Scotchpine, black pine	Lopez-Bulto(2018)
<i>Prunus avium</i>	Rosaceae	wild cherry	Antolín (2013) Caruso-Fermé (2014)
<i>Quercus</i> sp. deciduous	Fagaceae	oak	Antolín (2013) Caruso-Fermé (2014) Revelles (2016, 2017) Revelles (2019)
NA	Rosaceae/Maloideae	apple subfamily	Caruso-Fermé (2014)
<i>Sambucus</i> cf. <i>nigra</i>	Adoxaceae	elderberry strawberry tree	Antolín (2013) Caruso-Fermé (2014) Revelles et al. (2016,2017) Revelles (2019)
<i>Arbutus unedo</i>	Ericaceae	tree	Caruso-Fermé (2014)
<i>Taxus baccata</i>	Taxaceae	English yew	Antolín (2013) Caruso-Fermé (2014) Caruso-Fermé (2014)
<i>Laurus nobilis</i>	Lauraceae	bay tree	Caruso-Fermé (2014)
NA	Salicaceae	willow	Caruso-Fermé (2014) Piqué (2020) Revelles et al. (2016, 2017) Revelles 2019
<i>Salix</i> sp.	Salicaceae	willow	Piqué (2016) Caruso-Fermé (2014)Revelles (2019)
<i>Ulmus</i> sp. <i>Vitis vinifera</i> subsp. <i>sylvestris</i>	Ulmaceae	wych elm/elm	Antolín (2013) Caruso-Fermé (2014)
	Vitaceae	wild grape	Antolín (2013) Caruso-Fermé (2014)

Just one taxon has been identified as resin (see table 20).

Table 20 - Resin

Resin taxa			
Binomial name	Family	Common name	Source of archaeobotanical data
<i>Betula pendula</i>	Betulaceae	silver birch	Rageot (2021)

Sixteen taxa were identified as fibers (see table 21).

Table 21 - Fiber taxa

Fiber taxa			
Binomial name	Family	Common name	Source of archaeobotanical data
<i>Epilobium angustifolium</i>	Onagraceae	willow herb	Piqué (2016)
<i>Urtica pilulifera</i>	Urticaceae	Roman nettle	Piqué (2016)
<i>Urtica urens</i>	Urticaceae	annual nettle	Piqué (2016)
NA	Ranunculaceae	leather flower	Piqué (2018)
<i>Clematis vitalba</i>	Ranunculaceae	traveller's Joy	Antolín (2013) Caruso-Fermé (2014) Herrero-Otal (2021) Piqué (2018) Piqué (2016) Revelles (2019)
<i>Tilia</i> sp.	Malvaceae	lime/linden	Herrero-Otal (2021), Revelles et al. (2016,2017) Revelles (2019)
NA	Poaceae	grasses	Caruso-Fermé (2014) Piqué (2020) Revelles et al. (2016, 2017) Revelles 2019
<i>Salix</i> sp.	Salicaceae	willow	Piqué (2016) Caruso-Fermé (2014)Revelles (2019)
<i>Ulmus</i> sp.	Ulmaceae	wych elm/elm	Herrero-Otal (2021)
NA	Cyperaceae	sedges	Piqué (2020)
<i>Cyperus longus</i>	Cyperaceae	galingale	Piqué (2020)
<i>Juncus effusus</i>	Juncaceae	soft rush	Herrero-Otal (2021)
NA	Juncaceae	rushes	Piqué (2020) Revelles et al. (2016, 2017) Revelles 2019
<i>Typha angustifolia</i>	Typhaceae	small reed mace	Piqué (2020)
<i>Typha latifolia</i>	Typhaceae	reedmace	Herrero-Otal (2021)
NA	Typhaceae	bulrushes	

Pollen identified at the site was the second largest group see table (22).

Table 22 - Pollen taxa

Pollen taxa			
Binomial name	Family	Common name	Archaeobotanical source
<i>Polygonum aviculare</i>	Polygonaceae	knotweed, knotgrass	Antolín (2013) Revelles et al. (2016, 2017) Revelles (2019)
<i>Acer</i> sp.	Aceraceae	maple	Caruso-Fermé (2014) Revelles (2019)
<i>Buxus sempervirens</i>	Buxaceae	common boxwood	Caruso-Fermé (2014) Revelles (2019)
<i>Corylus avellana</i>	Betulaceae	common hazel	Antolín (2013) Caruso-Fermé (2014) Revelles (2019)
<i>Juniperus</i> sp.	Cupressaceae	juniper	Caruso-Fermé (2014) Revelles (2019)

<i>Pinus</i> sp.	Pinaceae	pine	Caruso-Fermé (2014) Revelles (2016, 2017) Revelles (2019)
<i>Quercus</i> sp. deciduous	Fagaceae	oak	Antolín (2013) Caruso-Fermé (2014) Revelles (2016, 2017) Revelles (2019)
<i>Tilia</i> sp.	Malvaceae	lime/linden	Herrero-Otal (2021) Piqué (2018) Piqué (2016) Revelles (2019)
<i>Sambucus</i> cf. <i>nigra</i>	Adoxaceae	elderberry	Antolín (2013) Caruso-Fermé (2014) Revelles et al. (2016,2017) Revelles (2019)
<i>Quercus ilex-coccifera</i>	Fagaceae	evergreen oak, live oak	Revelles et. al (2016, 2017) Revelles (2019)
<i>Betula</i> sp.	Betulaceae	birch	Revelles et. al (2016, 2017) Revelles (2019)
NA	Cyperaceae	sedges	Caruso-Fermé (2014) Revelles (2019)
<i>Eupatorium cannabinum</i>	Oleaceae	hemp agrimony	Antolín (2013)
<i>Plantago major</i> subsp. <i>intermedia</i>	Plantaginaceae	common plantain	Antolín (2013) Revelles et al. (2016, 2017, Revelles (2019)
NA	Poaceae	grasses	Herrero-Otal (2021), Revelles et al. (2016,2017) Revelles (2019)
<i>Salix</i> sp.	Salicaceae	willow	Caruso-Fermé (2014) Piqué (2020) Revelles et al. (2016, 2017) Revelles 2019
<i>Ulmus</i> sp.	Ulmaceae	wych elm/elm	Piqué (2016) Caruso-Fermé (2014)Revelles (2019)
<i>Rumex</i> sp.	Polygonaceae	dock	Antolín (2013) Revelles et al. (2016, 2017) Revelles 2019
NA	Apiaceae	celery family	Revelles et al. (2016, 2017) Revelles (2019)
<i>Hedera helix</i>	Araliaceae	ivy	Revelles et al. (2016, 2017) Revelles (2019)
<i>Asphodelus</i>	Asphodelaceae	NA	Revelles et al. (2016, 2017) Revelles (2019)
<i>Aster</i> -type	Asteraceae	aster	Revelles et al. (2016, 2017) Revelles (2019)
<i>Asteraceae</i> <i>liguliflorae/Cichorioideae</i>	Asteraceae	aster	Revelles et al. (2016, 2017) Revelles (2019)
<i>Asteraceae</i> <i>tubuliflorae/Asteroideae</i>	Asteraceae	aster	Revelles et al. (2016, 2017) Revelles (2019)
<i>Centaurea</i>	Asteraceae	knapweeds	Revelles et al. (2016, 2017) Revelles (2019)
<i>Cirsium-t</i>	Asteraceae	plum thistles	Revelles et al. (2016, 2017) Revelles (2019)
<i>Echium</i> -type	Boraginaceae	bugloss	Revelles et al. (2016, 2017) Revelles (2019)
<i>Symphytum</i> -type	Boraginaceae	comfrey	Revelles et al. (2016, 2017) Revelles (2019)
NA	Brassicaceae	mustards	Revelles et al. (2016, 2017) Revelles (2019)
NA	Campanulaceae	bellflower	Revelles et al. (2016, 2017) Revelles (2019)
NA	Cannabaceae	hemp	Revelles et al. (2016, 2017) Revelles (2019)
NA	Caryophyllaceae	pinks	Revelles et al. (2016, 2017) Revelles (2019)
<i>Paronychia</i> -type	Caryophyllaceae	nailwort	Revelles et al. (2016, 2017) Revelles (2019)
NA	Cistaceae	rock roses	Revelles et al. (2016, 2017) Revelles (2019)
<i>Helianthemum</i> sp.	Cistaceae	rock roses	Revelles et al. (2016, 2017) Revelles (2019)
<i>Crassula</i> sp.	Crassulaceae	pigmyplants	Revelles et al. (2016, 2017) Revelles (2019)

<i>Sedum</i>	Crassulaceae	stonecrops	Revelles et al. (2016, 2017) Revelles (2019)
<i>Dipsacus</i> sp.	Dipsacaceae	teasel	Revelles et al. (2016, 2017) Revelles (2019)
<i>Ephedra</i> sp.	Ephedraceae	Na	Revelles et al. (2016, 2017) Revelles (2019)
<i>Erica</i> sp.	<i>Ericaceae</i>	heather	Revelles et al. (2016, 2017) Revelles (2019)
<i>Euphorbia</i> sp.	Euphorbiaceae	spurges	Revelles et al. (2016, 2017) Revelles (2019)
<i>Astragalus cruciatus</i>	Fabaceae	NA	Revelles et al. (2016, 2017) Revelles (2019)
<i>Hedysarum</i> -type	Fabaceae	sweetvetch	Revelles et al. (2016, 2017) Revelles (2019)
<i>Vicia</i> -type	Fabaceae	vetch	Revelles et al. (2016, 2017) Revelles (2019)
<i>Juglans regia</i>	Juglandaceae	walnut	Revelles et al. (2016, 2017) Revelles (2019)
NA	Lamiaceae	mints	Revelles et al. (2016, 2017) Revelles (2019)
<i>Mentha</i> -type	Lamiaceae	mint	Revelles et al. (2016, 2017) Revelles (2019)
<i>Lythrum</i> sp.	Lythraceae	loosestrife	Revelles et al. (2016, 2017) Revelles (2019)
<i>Nuphar</i> sp.	Nymphaeaceae	water-lily	Revelles et al. (2016, 2017) Revelles (2019)
<i>Nymphaea</i> sp.	Nymphaeaceae	water-lily	Revelles et al. (2016, 2017) Revelles (2019)
<i>Fraxinus</i> sp.	Oleaceae	Ash	Revelles et al. (2016, 2017) Revelles (2019)
<i>Olea europaea</i>	Oleaceae	European olive	Revelles et al. (2016, 2017) Revelles (2019)
<i>Phillyrea</i> sp.	Oleaceae	NA	Revelles et al. (2016, 2017) Revelles (2019)
<i>Melampyrum</i>	Orobanchaceae	cow wheat	Revelles et al. (2016, 2017) Revelles (2019)
<i>Pedicularis</i> sp.	Orobanchaceae	lousewort	Revelles et al. (2016, 2017) Revelles (2019)
NA	Papaveraceae	poppy	Revelles et al. (2016, 2017) Revelles (2019)
<i>Hypocoum</i> -type	Papaveraceae	NA	Revelles et al. (2016, 2017) Revelles (2019)
<i>Abies alba</i>	Pinaceae	Fir	Revelles et al. (2016, 2017) Revelles (2019)
<i>Plantago</i> sp.	Plantaginaceae	plantains	Revelles et al. (2016, 2017) Revelles (2019)
<i>Antirrhinum</i> -type	Plantaginaceae	snapdragons	Revelles et al. (2016, 2017) Revelles (2019)
<i>Linaria</i> -type	Plantaginaceae	toadflax	Revelles et al. (2016, 2017) Revelles (2019)
<i>Rumex tingitanus</i>	Polygonaceae	NA	Revelles et al. (2016, 2017) Revelles (2019)
<i>Primula</i> -type	Primulaceae	primroses	Revelles et al. (2016, 2017) Revelles (2019)
NA	Ranunculaceae	buttercups	Revelles et al. (2016, 2017) Revelles (2019)
<i>Aquilegia</i> -type	Ranunculaceae	columbine	Revelles et al. (2016, 2017) Revelles (2019)
<i>Rhamnus alaternus</i>	Rhamnaceae	Italian buckthorn	Revelles et al. (2016, 2017) Revelles (2019)
NA	Rosaceae	roses	Revelles et al. (2016, 2017) Revelles (2019)
<i>Fragaria</i> sp.	Rosaceae	wild strawberries	Revelles et al. (2016, 2017) Revelles (2019)
<i>Filipendula</i> sp.	Rosaceae	NA	Revelles et al. (2016, 2017) Revelles (2019)
<i>Potentilla</i>	Rosaceae	cinquefoils	Revelles et al. (2016, 2017) Revelles (2019)
<i>Rubus</i> -type	Rosaceae	brambles	Revelles et al. (2016, 2017) Revelles (2019)
<i>Sanguisorba minor</i>	Rosaceae	salad burnet	Revelles et al. (2016, 2017) Revelles (2019)
<i>Sorbus</i> sp.	Rosaceae	rowan	Revelles et al. (2016, 2017) Revelles (2019)
<i>Galium</i> -type	Rubiaceae	bedstraw	Revelles et al. (2016, 2017) Revelles (2019)
<i>Osyris</i> -type	Santalaceae	sandalwoods	Revelles et al. (2016, 2017) Revelles (2019)
NA	Scrophulariaceae	figworts	Revelles et al. (2016, 2017) Revelles (2019)
<i>Typha-Sparganium</i>	Typhaceae	bulrush	Revelles et al. (2016, 2017) Revelles (2019)
<i>Urtica</i> sp.	Urticaceae	nettles	Revelles et al. (2016, 2017) Revelles (2019)

Regarding the number of recovered taxa, the archaeobotanical remains fall largely in one of two groups, fruits and seeds and pollen (see figure 16).

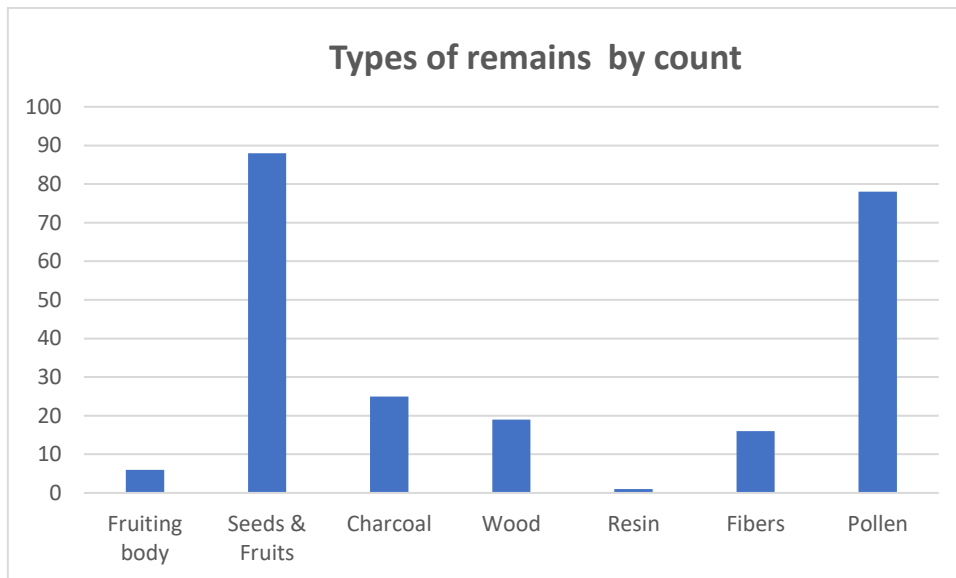


Figure 16 - Archaeobotanical remains by type

The archaeobotanical information also included the type of preservation (charred, waterlogged and charred and waterlogged) applicable to all remains except pollen. The main percentage of taxa found, 63%, were in waterlogged conditions (see Figure 17).

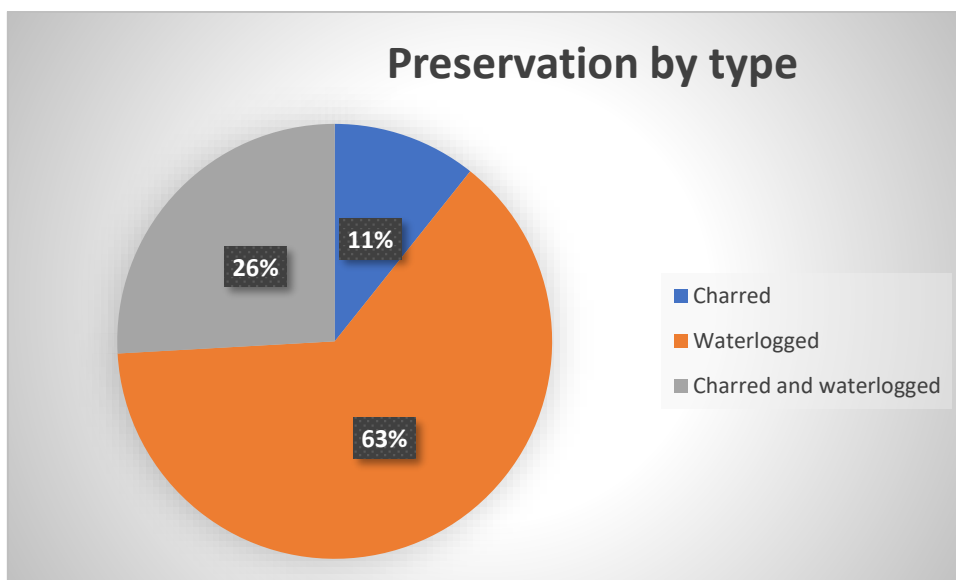


Figure 17 - Preservation type percentages (pollen excluded).

4.3 Ethnobotany

All taxa had data entered for each useful plant part and the season(s) of harvest were also recorded (see table 23).

Table 23 - Plant part by harvest season(s) (taxa count)

Plant part by harvest season(s) (taxa count)					
Plant part	Winter	Spring	Summer	Autumn	
Fruits/Seeds/Fruiting body	11	15	55	58	139
Flower	1	12	24	9	46
Young Shoots	1	26	6	1	34
Aerial Parts	28	72	90	60	250
Roots	10	17	31	31	89
	51	142	206	159	

More plant parts were collected in summer with most of them being aerial parts (see figure 18). Autumn was next with fruits and seeds being the most harvested parts (see figure 19). Spring followed again with aerial parts being the majority of plant parts harvested (see figure 20). Finally, winter saw the lowest number of plant parts harvested with aerial parts the main plant parts harvested (see figure 21). Summer with 36% of the plant part harvest was slightly more than the 31% harvested in autumn (see figure 22).

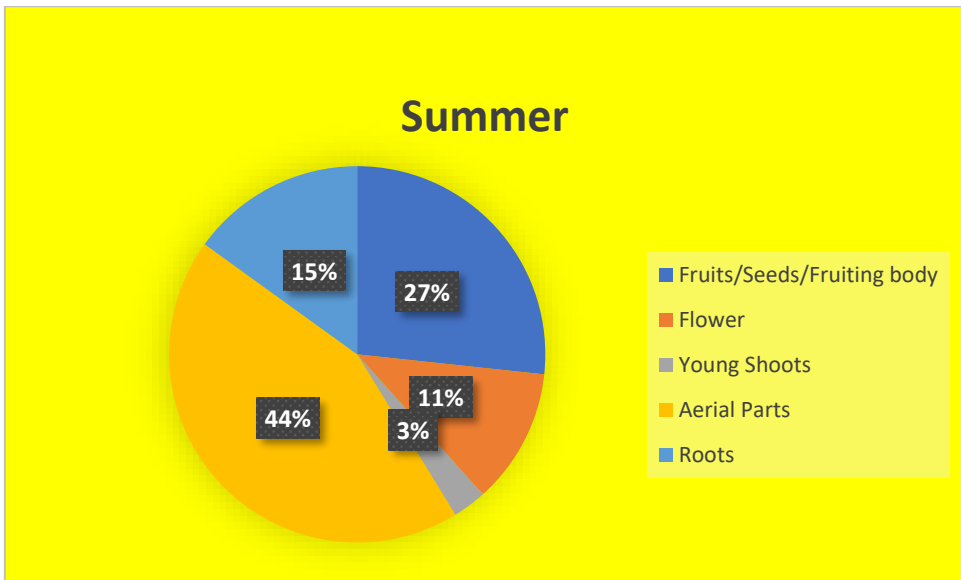


Figure 18 - Percentages of plant parts harvested in summer.

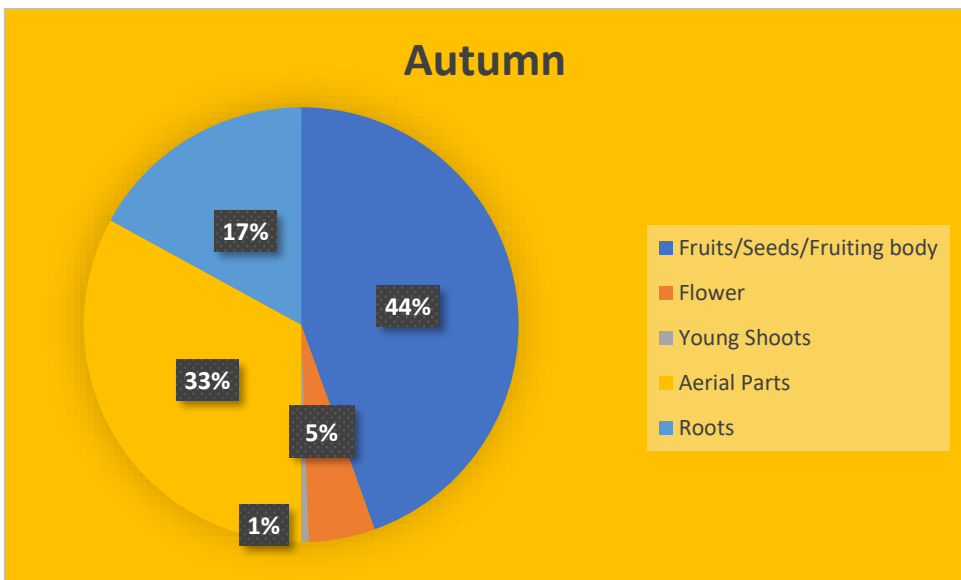


Figure 19 - Percentage of plant parts harvested in autumn.

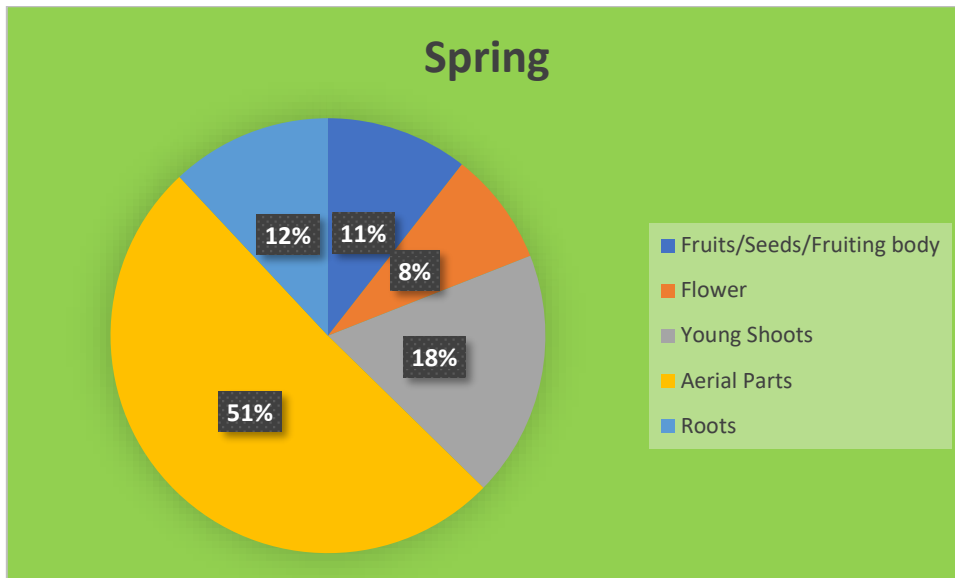


Figure 20 - Percentages of plant parts harvested in spring.

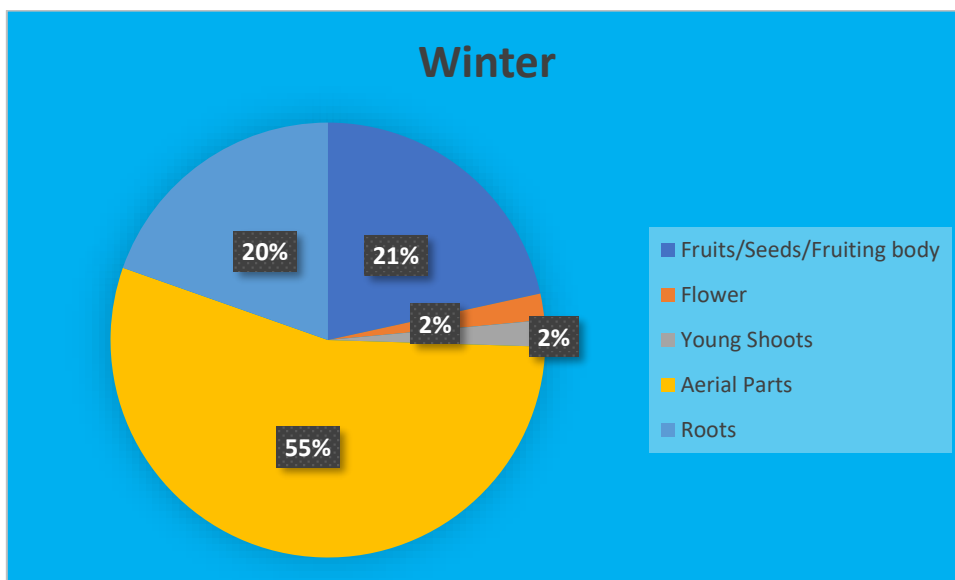


Figure 21 - Percentages of plant parts harvested in winter.

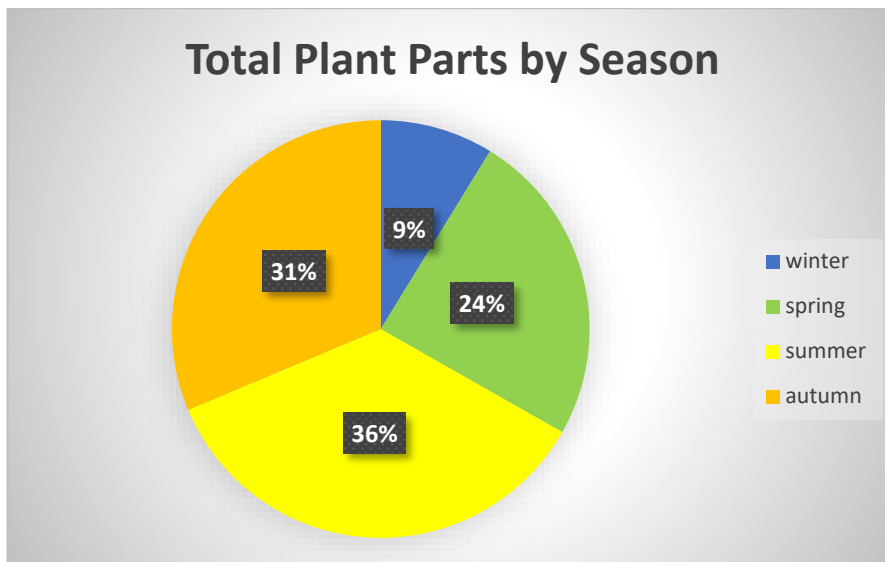


Figure 22 - Percentages of total plant parts by season.

Taxa range from availability of harvest in every season to one season (see table 24).

Table 24 - List of taxa available by season

List of taxa available by season							
Winter harvest taxa		Spring harvest taxa		Summer harvest taxa		Autumn harvest taxa	
Binomial name	Common name	Binomial name	Common name	Binomial name	Common name	Binomial name	Common name
<i>Capsella bursa-pastoris</i>	sheperd's purse	<i>Capsella bursa-pastoris</i>	sheperd's purse	<i>Lens culinaris</i>	lentil	<i>Hordeum distichum</i>	hulled barley (two rowed)
<i>Stellaria media</i>	chickweed	<i>Carthamus cf. lanatus</i>	wooly distaff thistle	<i>Triticum durum/turgidum</i>	naked wheat	<i>Hordeum vulgare</i> var. <i>nudum</i>	naked barley
<i>Pinus sylvestris/nigra</i>	ScotchPine, black pine	<i>Stellaria media</i>	chickweed	<i>Triticum aestivum</i>	naked wheat	<i>Lens culinaris</i>	lentil
<i>Arbutus unedo</i>	strawberry tree	<i>Hypericum perforatum</i>	St. John's wort	<i>Triticum dicoccum</i>	emmer	<i>Triticum durum/turgidum</i>	naked wheat
<i>Typha latifolia</i>	reedmace	<i>Pinus sylvestris/nigra</i>	ScotchPine, black pine	<i>Triticum monococcum</i>	einkorn	<i>Triticum aestivum</i>	naked wheat
<i>Coriopsis gallica</i>	brownflesh bracket	<i>Prunus avium</i>	wild cherry	<i>Triticum timopheevii</i>	new glume wheat	<i>Triticum dicoccum</i>	emmer
<i>Daedalea quercina</i>	oak mazegill	<i>Fragaria vesca</i>	woodland strawberry	NA	peas	<i>Triticum monococcum</i>	einkorn
<i>Daldinia concentrica</i>	cramp balls	<i>Ulmus</i> sp.	wych elm/elm	<i>Papaver somniferum</i>	poppy	<i>Triticum timopheevii</i>	new glume wheat
<i>Ganoderma adspersum</i>	southern bracket	<i>Typha latifolia</i>	reedmace	<i>Vicia faba</i>	broad bean	NA	peas

<i>Lenzites warnieri</i>	none	<i>Corioloopsis gallica</i>	brownflesh bracket	<i>Ammi majus</i>	<i>Queen Anne's Lace</i>	<i>Papaver somniferum</i>	poppy
<i>Skeletocutis nivea</i>	hazel bracket	<i>Daedalea quercina</i>	oak mazegill	<i>Brassica rapa</i>	wild turnip	<i>Vicia faba</i>	broad bean
<i>Acer</i> sp.	maple	<i>Daldinia concentrica</i>	cramp balls	<i>Capsella bursa-pastoris</i>	sheperd's purse	<i>Ammi majus</i>	Queen Anne's Lace
<i>Buxus sempervirens</i>	common boxwood	<i>Ganoderma adsporum</i>	southern bracket	<i>Carthamus</i> cf. <i>lanatus</i>	wooly distaff thistle	<i>Brassica rapa</i>	wild turnip
NA	leather flower	<i>Lenzites warnieri</i>	none	<i>Chenopodium album</i>	lamb's quarters/ goosefoot	<i>Capsella bursa-pastoris</i>	sheperd's purse
<i>Cornus sanguinea</i>	common dogwood	<i>Skeletocutis nivea</i>	hazel bracket	<i>Hyoscyamus niger</i>	henbane	<i>Chenopodium album</i>	lamb's quarters/ goosefoot
<i>Corylus avellana</i>	common hazel	<i>Brassica rapa</i>	wild turnip	<i>Lathyrus aphaca</i> type	yellow pea	<i>Euphorbia helioscopia</i> subsp. <i>Helioscopia</i>	madwoman's milk
<i>Juniperus</i> sp.	juniper	<i>Leucanthemum vulgare</i>	ox-eye daisy	<i>Polygonum aviculare</i>	knotweed, knotgrass	<i>Hyoscyamus niger</i>	henbane
<i>Pinus</i> sp.	pine	<i>Tilia</i> sp.	lime/linden	<i>Polygonum lapathifolium</i>	curlytop knotweed	<i>Lathyrus aphaca</i> type	yellow pea
<i>Prunus avium</i>	wild cherry	<i>Agrimonia eupatoria</i>	agrimony	<i>Portulaca oleracea</i>	green purselane	<i>Polygonum aviculare</i>	knotweed, knotgrass
<i>Pyrus malus</i> subsp. <i>sylvestris</i>	crab apple	<i>Crataegus monogyna</i>	common hawthorn	<i>Silybum marianum</i>	milk thistle	<i>Polygonum lapathifolium</i>	curlytop knotweed
<i>Quercus</i> sp. deciduous	oak	<i>Prunus spinosa</i>	blackthorn/ sloe	<i>Stellaria media</i>	chickweed	<i>Portulaca oleracea</i>	green purselane
NA	apple subfamily	<i>Rubus fruticosus</i> agg.	blackberry	<i>Urtica dioica</i>	stinging nettle	<i>Silybum marianum</i>	milk thistle
<i>Tilia</i> sp.	lime/linden	<i>Sambucus</i> cf. <i>nigra</i>	elderberry	<i>Urtica pilulifera</i>	roman nettle	<i>Stellaria media</i>	chickweed
<i>Rubus fruticosus</i> agg.	blackberry	<i>Betula pendula</i>	silver birch	<i>Apium graveolens</i>	wild celery	<i>Urtica dioica</i>	stinging nettle
<i>Sambucus</i> cf. <i>nigra</i>	elderberry	<i>Vitis vinifera</i> subsp. <i>sylvestris</i>	wild grape	<i>Hypericum perforatum</i>	St. John's wort	<i>Urtica pilulifera</i>	roman nettle
<i>Quercus ilex-coccifera</i>	evergreen oak, live oak	<i>Hordeum vulgare</i> var. <i>nudum</i>	naked barley	<i>Cornus sanguinea</i>	common dogwood	<i>Urtica urens</i>	annual nettle
<i>Betula</i> sp.	birch	<i>Triticum aestivum</i>	naked wheat	<i>Corylus avellana</i>	common hazel	<i>Vicia villosa</i> type	winter vetch
<i>Betula pendula</i>	silver birch	NA	peas	<i>Prunus avium</i>	wild cherry	<i>Cornus sanguinea</i>	common dogwood
<i>Alnus glutinosa</i>	alder	<i>Chenopodium album</i>	lamb's quarters/ goosefoot	<i>Pyrus malus</i> subsp. <i>sylvestris</i>	crab apple	<i>Corylus avellana</i>	common hazel
<i>Laurus nobilis</i>	bay tree	<i>Epilobium angustifolium</i>	willow herb	<i>Quercus</i> sp. deciduous	oak	<i>Juniperus</i> sp.	juniper

NA	willow	<i>Galium aparine</i> subsp. <i>spurium</i>	stickywilly	<i>Agrimonia eupatoria</i>	<i>agrimony</i>	<i>Pyrus malus</i> subsp. <i>sylvestris</i>	crab apple
<i>Salix</i> sp.	willow	<i>Silene vulgaris/latifolia</i>	bladder campion	<i>Crataegus monogyna</i>	<i>common hawthorn</i>	<i>Quercus</i> sp. deciduous	oak
<i>Ulmus</i> sp.	wych elm/elm	<i>Silybum marianum</i>	milk thistle	<i>Fragaria vesca</i>	<i>woodland strawberry</i>	<i>Crataegus monogyna</i>	common hawthorn
NA	sedges	<i>Urtica dioica</i>	stinging nettle	<i>Physalis alkekengi</i>	<i>winter cherry</i>	<i>Fragaria vesca</i>	woodland strawberry
<i>Cyperus longus</i>	galingale	<i>Urtica pilulifera</i>	roman nettle	<i>Rubus fruticosus</i> agg.	<i>blackberry</i>	<i>Prunus spinosa</i>	blackthorn/ sloe
<i>Alisma plantago-aquatica</i>	great water plantain	<i>Urtica urens</i>	annual nettle	<i>Sambucus</i> cf. <i>nigra</i>	<i>elderberry</i>	<i>Rubus fruticosus</i> agg.	blackberry
<i>Typha angustifolia</i>	small reed mace	<i>Apium graveolens</i>	wild celery	<i>Vicia sepium</i>	<i>bush vetch</i>	<i>Vicia sepium</i>	bush vetch
<i>Nymphaea alba</i>	white water lily	<i>Clematis vitalba</i>	traveller's Joy	<i>Taxus baccata</i>	<i>English yew</i>	<i>Arbutus unedo</i>	strawberry tree
		<i>Apium nodiflorum</i> subsp. <i>nodiflorum</i>	fool's watercress	<i>Alisma plantago-aquatica</i>	<i>great water plantain</i>	<i>Quercus ilex-coccifera</i>	evergreen oak, live oak
		<i>Cladium mariscus</i>	swamp sawgrass	NA	<i>sedges</i>	<i>Taxus baccata</i>	English yew
		<i>Phragmites australis</i>	common reed	<i>Carex hirta</i> type	<i>hammer sedge</i>	<i>Alisma plantago-aquatica</i>	great water plantain
		<i>Scirpus lacustris</i>	bulrush	<i>Cladium mariscus</i>	<i>swamp sawgrass</i>	<i>Cladium mariscus</i>	swamp sawgrass
		<i>Juncus effusus</i>	soft rush	<i>Laurus nobilis</i>	<i>bay tree</i>	<i>Iris pseudacorus</i>	yellow flag
		<i>Typha angustifolia</i>	small reed mace	<i>Phragmites australis</i>	<i>common reed</i>	<i>Phragmites australis</i>	common reed
		<i>Papaver somniferum</i>	poppy	<i>Plantago major</i> subsp. <i>intermedia</i>	<i>common plantain</i>	<i>Plantago major</i> subsp. <i>intermedia</i>	common plantain
		<i>Vicia faba</i>	broad bean	<i>Scirpus lacustris</i>	<i>bulrush</i>	<i>Ranunculus sceleratus</i>	celery- leaved buttercup
		<i>Euphorbia helioscopia</i> subsp. <i>Helioscopia</i>	madwoman's milk	<i>Ulmus</i> sp.	<i>wych elm/elm</i>	<i>Scirpus lacustris</i>	bulrush
		<i>Portulaca oleracea</i>	green purselane	<i>Vitis vinifera</i> subsp. <i>sylvestris</i>	<i>wild grape</i>	<i>Vitis vinifera</i> subsp. <i>sylvestris</i>	wild grape
		cf. <i>Scandix pecten-veneris</i>	shepherd's needle	<i>Nymphaea alba</i>	<i>white water lily</i>	<i>Typha angustifolia</i>	small reed mace
		<i>Sonchus oleraceus/asper</i>	prickly sow thistle	<i>Coriopsis gallica</i>	<i>brownflesh bracket</i>	<i>Typha latifolia</i>	reedmace

		<i>Verbena officinalis</i>	vervain	<i>Daedalea quercina</i>	<i>oak mazegill</i>	<i>Nymphaea alba</i>	white water lily
		<i>Arenaria serpyllifolia</i>	thyme-leaf sandwort	<i>Daldinia concentrica</i>	<i>cramp balls</i>	<i>Amaranthus</i> sp.	amaranth
		<i>Campanula</i> cf. <i>rotundifolia</i>	harebell	<i>Ganoderma adsperum</i>	<i>southern bracket</i>	<i>Rumex</i> sp.	dock
		<i>Linum catharticum</i>	fairy flax	<i>Lenzites warnieri</i>	<i>none</i>	<i>Corioloopsis gallica</i>	brownflesh bracket
		<i>Potentilla</i> cf. <i>reptans</i>	creeping cinquefoil	<i>Skeletocutis nivea</i>	<i>hazel bracket</i>	<i>Daedalea quercina</i>	<i>oak mazegill</i>
		<i>Valerianella</i> cf. <i>dentata</i>	corn salad	<i>Epilobium angustifolium</i>	<i>willow herb</i>	<i>Daldinia concentrica</i>	cramp balls
		<i>Acer</i> sp.	maple	<i>Verbena officinalis</i>	<i>vervain</i>	<i>Ganoderma adsperum</i>	southern bracket
		<i>Buxus sempervirens</i>	common boxwood	<i>Linum catharticum</i>	<i>fairy flax</i>	<i>Lenzites warnieri</i>	none
		NA	leather flower	<i>Tilia</i> sp.	<i>lime/linden</i>	<i>Skeletocutis nivea</i>	hazel bracket
		<i>Cornus sanguinea</i>	common dogwood	<i>Origanum vulgare</i>	<i>oregano</i>	<i>Epilobium angustifolium</i>	willow herb
		<i>Corylus avellana</i>	common hazel	<i>Eupatorium cannabinum</i>	<i>hemp agrimony</i>	<i>Origanum vulgare</i>	oregano
		<i>Juniperus</i> sp.	juniper	<i>Lycopus europaeus</i>	<i>gypsywort</i>	<i>Eupatorium cannabinum</i>	hemp agrimony
		<i>Pinus</i> sp.	pine	<i>Typha angustifolia</i>	<i>small reed mace</i>	<i>Lycopus europaeus</i>	gypsywort
		<i>Pyrus malus</i> subsp. <i>sylvestris</i>	crab apple	<i>Typha latifolia</i>	<i>Reedmace</i>	Brassicaceae	sheperd's purse
		<i>Quercus</i> sp. deciduous	oak	<i>Galium aparine</i> subsp. <i>spurium</i>	<i>stickywilly</i>	<i>Hypericum perforatum</i>	St. John's wort
		NA	apple subfamily	<i>Silene vulgaris/latifolia</i>	<i>bladder campion</i>	<i>Leucanthemum vulgare</i>	ox-eye daisy
		<i>Quercus ilex-coccifera</i>	evergreen oak, live oak	<i>Leucanthemum vulgare</i>	<i>ox-eye daisy</i>	<i>Silene gallica</i>	common catchfly
		<i>Betula</i> sp.	birch	<i>Euphorbia helioscopia</i> subsp. <i>Helioscopia</i>	<i>madwoman's milk</i>	<i>Acer</i> sp.	maple
		<i>Alisma plantago-aquatica</i>	great water plantain	<i>Reseda phyteuma</i>	<i>rampion mignonette</i>	<i>Buxus sempervirens</i>	common boxwood
		<i>Alnus glutinosa</i>	alder	cf. <i>Scandix pecten veneris</i>	<i>sheperd's needle</i>	NA	leather flower
		NA	sedges	<i>Sonchus oleraceus/asper</i>	<i>prickly sow thistle</i>	<i>Clematis vitalba</i>	traveller's Joy
		<i>Carex hirta</i> type	hammer sedge	<i>Urtica urens</i>	<i>annual nettle</i>	<i>Pinus</i> sp.	pine
		<i>Laurus nobilis</i>	bay tree	<i>Vicia villosa</i> type	<i>winter vetch</i>	<i>Pinus sylvestris/nigra</i>	ScotchPine, black pine

		<i>Plantago major</i> subsp. <i>intermedia</i>	common plantain	<i>Arenaria</i> <i>serpyllifolia</i>	thyme-leaf sandwort	<i>Prunus avium</i>	wild cherry
		NA	willow	<i>Campanula</i> cf. <i>rotundifolia</i>	harebell	NA	apple subfamily
		NA	grasses	<i>Potentilla</i> cf. <i>reptans</i>	creeping cinquefoil	<i>Tilia</i> sp.	lime/linden
		<i>Ranunculus</i> <i>sceleratus</i>	celery- leaved buttercup	cf. <i>Pulicaria</i> <i>dysenterica</i>	fleabane	<i>Sambucus</i> cf. <i>nigra</i>	elderberry
		<i>Salix</i> sp.	willow	<i>Silene gallica</i>	common catchfly	<i>Betula</i> sp.	birch
		<i>Cyperus longus</i>	galingale	<i>Valerianella</i> cf. <i>dentata</i>	corn salad	<i>Betula pendula</i>	silver birch
		NA	rushes	<i>Acer</i> sp.	maple	<i>Alnus glutinosa</i>	alder
		<i>Najas marina</i>	spiny naiad	<i>Buxus</i> <i>sempervirens</i>	common boxwood	<i>Laurus nobilis</i>	bay tree
		NA	bulrushes	<i>Clematis vitalba</i>	traveller's Joy	<i>Mentha</i> cf. <i>aquatica</i>	water mint
		<i>Amaranthus</i> sp.	amaranth	<i>Juniperus</i> sp.	juniper	NA	grasses
		cf. <i>Dactylis</i> <i>glomerata</i>	cock's foot	<i>Pinus</i> sp.	pine	<i>Salix</i> sp.	willow
		<i>Rumex</i> sp.	dock	<i>Pinus</i> <i>sylvestris/nigra</i>	ScotchPine, black pine	<i>Ulmus</i> sp.	wych elm/elm
		<i>Arbutus unedo</i>	strawberry tree	NA	apple subfamily	NA	sedges
		<i>Iris</i> <i>pseudacorus</i>	yellow flag	<i>Prunus spinosa</i>	blackthorn/ sloe	<i>Cyperus longus</i>	galingale
		<i>Nymphaea alba</i>	white water lily	<i>Arbutus unedo</i>	strawberry tree	<i>Juncus effusus</i>	soft rush
				<i>Quercus ilex-</i> <i>coccifera</i>	evergreen oak, live oak	NA	rushes
				<i>Betula</i> sp.	birch	NA	bulrushes
				<i>Betula pendula</i>	silver birch	<i>Galium aparine</i> subsp. <i>spurium</i>	stickywilly
				<i>Alnus glutinosa</i>	alder	<i>Silene</i> <i>vulgaris/latifolia</i>	bladder campion
				<i>Mentha</i> cf. <i>aquatica</i>	water mint	<i>Sonchus</i> <i>oleraceus/asper</i>	prickly sow thistle
				NA	willow	<i>Apium</i> <i>graveolens</i>	wild celery
				NA	grasses	<i>Campanula</i> cf. <i>rotundifolia</i>	harebell
				<i>Ranunculus</i> <i>sceleratus</i>	celery- leaved buttercup	<i>Potentilla</i> cf. <i>reptans</i>	creeping cinquefoil
				<i>Salix</i> sp.	willow	<i>Carex hirta</i> type	hammer sedge
				<i>Cyperus longus</i>	galingale		

				<i>Juncus effusus</i>	soft rush		
				NA	rushes		
				<i>Najas marina</i>	spiny naiad		
				<i>Ranunculus aquatilis</i>	water crowfoot		
				NA	bulrushes		
				<i>Amaranthus</i> sp.	amaranth		
				cf. <i>Dactylis glomerata</i>	cock's foot		
				<i>Rumex</i> sp.	Dock		
				<i>Iris pseudacorus</i>	yellow flag		

Food and medicine were the uses with the most taxa (see table 25.) The percentages of taxa by possible uses were computed (see figure 23). Taxa are listed by their known or possible uses (see tables 26 and 27).

Table 25 - Taxa count by possible use

Taxa count by possible use

Food	Medicine	Raw material	Fuel	Building material	Fodder	Other
87	82	43	32	15	8	30

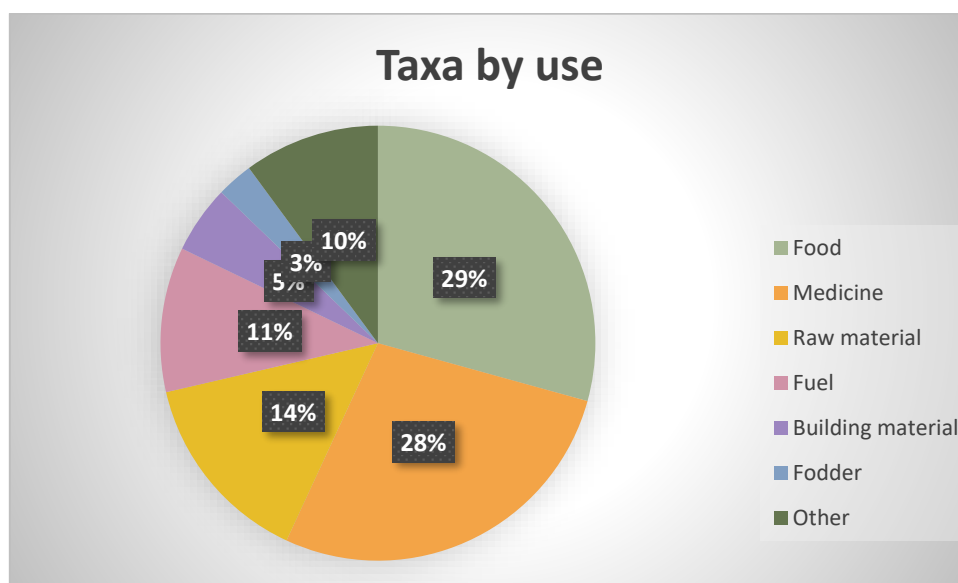


Figure 23- Taxa percentage by use

Table 26 - Taxa with known and possible uses (food, medicine, and other)

Taxa with known and possible uses (food, medicine, and other)					
Known and possible taxa used for food		Known and possible taxa used for medicine		Known and possible taxa used for other	
Binomial name	Common name	Binomial name	Common name	Binomial name	Common name
<i>Hordeum distichum</i>	hulled barley (two rowed)	<i>Hordeum vulgare</i> var. <i>nudum</i>	naked barley	<i>Chenopodium album</i>	lamb's quarters/ goosefoot
<i>Hordeum vulgare</i> var. <i>nudum</i>	naked barley	<i>Lens culinaris</i>	lentil	<i>Galium aparine</i> subsp. <i>spurium</i>	stickywilly
<i>Lens culinaris</i>	lentil	<i>Triticum aestivum</i>	naked wheat	<i>Polygonum aviculare</i>	knotweed, knotgrass
<i>Triticum durum/turgidum</i>	naked wheat	NA	peas	<i>Polygonum lapathifolium</i>	curlytop knotweed
<i>Triticum aestivum</i>	naked wheat	<i>Papaver somniferum</i>	poppy	<i>Silene vulgaris/latifolia</i>	bladder campion
<i>Triticum dicoccum</i>	emmer	<i>Vicia faba</i>	broad bean	<i>Silybum marianum</i>	milk thistle
<i>Triticum monococcum</i>	einkorn	<i>Ammi majus</i>	Queen Anne's Lace	<i>Urtica pilulifera</i>	roman nettle
<i>Triticum timopheevii</i>	new glume wheat	<i>Brassica rapa</i>	wild turnip	<i>Urtica urens</i>	annual nettle
NA	peas	<i>Capsella bursa-pastoris</i>	sheperd's purse	<i>Hypericum perforatum</i>	St. John's wort
<i>Papaver somniferum</i>	poppy	<i>Carthamus</i> cf. <i>lanatus</i>	wooly distaff thistle	NA	leather flower
<i>Vicia faba</i>	broad bean	<i>Chenopodium album</i>	lamb's quarters/ goosefoot	<i>Cornus sanguinea</i>	common dogwood
<i>Ammi majus</i>	Queen Anne's Lace	<i>Epilobium angustifolium</i>	willow herb	<i>Pinus sylvestris/nigra</i>	ScotchPine, black pine
<i>Brassica rapa</i>	wild turnip	<i>Euphorbia helioscopia</i> subsp. <i>Helioscopia</i>	madwoman's milk	<i>Prunus avium</i>	wild cherry
<i>Capsella bursa-pastoris</i>	sheperd's purse	<i>Galium aparine</i> subsp. <i>spurium</i>	stickywilly	<i>Quercus</i> sp. deciduous	oak
<i>Carthamus</i> cf. <i>lanatus</i>	wooly distaff thistle	<i>Hyoscyamus niger</i>	henbane	<i>Agrimonia eupatoria</i>	agrimony
<i>Chenopodium album</i>	lamb's quarters/ goosefoot	<i>Lathyrus aphaca</i> type	yellow pea	<i>Origanum vulgare</i>	oregano
<i>Epilobium angustifolium</i>	willow herb	<i>Polygonum aviculare</i>	knotweed, knotgrass	<i>Prunus spinosa</i>	blackthorn/ sloe

<i>Euphorbia helioscopia</i> subsp. <i>Helioscopia</i>	madwoman's milk	<i>Polygonum lapathifolium</i>	curlytop knotweed	<i>Rubus fruticosus</i> agg.	blackberry
<i>Galium aparine</i> subsp. <i>spurium</i>	stickywilly	<i>Portulaca oleracea</i>	green purselane	<i>Sambucus</i> cf. <i>nigra</i>	elderberry
<i>Lathyrus aphaca</i> type	yellow pea	<i>Silene vulgaris/latifolia</i>	bladder campion	<i>Arbutus unedo</i>	strawberry tree
<i>Polygonum aviculare</i>	knotweed, knotgrass	<i>Silybum marianum</i>	milk thistle	<i>Betula pendula</i>	silver birch
<i>Polygonum lapathifolium</i>	curlytop knotweed	<i>Sonchus oleraceus/asper</i>	prickly sow thistle	<i>Alnus glutinosa</i>	alder
<i>Portulaca oleracea</i>	green purselane	<i>Stellaria media</i>	chickweed	NA	sedges
<i>Reseda phyteuma</i>	rampion mignonette	<i>Urtica dioica</i>	stinging nettle	<i>Carex hirta</i> type	hammer sedge
cf. <i>Scandix pecten-veneris</i>	sheperd's needle	<i>Urtica pilulifera</i>	roman nettle	<i>Lycopus europaeus</i>	gypsywort
<i>Silene vulgaris/latifolia</i>	bladder campion	<i>Urtica urens</i>	annual nettle	<i>Phragmites australis</i>	common reed
<i>Silybum marianum</i>	milk thistle	<i>Verbena officinalis</i>	vervain	<i>Vitis vinifera</i> subsp. <i>sylvestris</i>	wild grape
<i>Sonchus oleraceus/asper</i>	prickly sow thistle	<i>Apium graveolens</i>	wild celery	<i>Typha angustifolia</i>	small reed mace
<i>Stellaria media</i>	chickweed	<i>Arenaria serpyllifolia</i>	thyme-leaf sandwort	<i>Typha latifolia</i>	reedmace
<i>Urtica dioica</i>	stinging nettle	<i>Campanula</i> cf. <i>rotundifolia</i>	harebell	<i>Rumex</i> sp.	dock
<i>Urtica pilulifera</i>	roman nettle	<i>Hypericum perforatum</i>	St. John's wort		
<i>Urtica urens</i>	annual nettle	<i>Leucanthemum vulgare</i>	ox-eye daisy		
<i>Verbena officinalis</i>	vervain	<i>Linum catharticum</i>	fairy flax		
<i>Vicia villosa</i> type	winter vetch	<i>Potentilla</i> cf. <i>reptans</i>	creeping cinquefoil		
<i>Apium graveolens</i>	wild celery	cf. <i>Pulicaria dysenterica</i>	fleabane		
<i>Arenaria serpyllifolia</i>	thyme-leaf sandwort	<i>Silene gallica</i>	common catchfly		
<i>Campanula</i> cf. <i>rotundifolia</i>	harebell	<i>Buxus sempervirens</i>	common boxwood		
<i>Hypericum perforatum</i>	St. John's wort	<i>Clematis vitalba</i>	traveller's Joy		
<i>Leucanthemum vulgare</i>	ox-eye daisy	<i>Cornus sanguinea</i>	common dogwood		
<i>Potentilla</i> cf. <i>reptans</i>	creeping cinquefoil	<i>Corylus avellana</i>	common hazel		
<i>Valerianella</i> cf. <i>dentata</i>	corn salad	<i>Juniperus</i> sp.	juniper		

<i>Clematis vitalba</i>	traveller's Joy	<i>Pinus sylvestris/nigra</i>	ScotchPine, black pine		
<i>Cornus sanguinea</i>	common dogwood	<i>Prunus avium</i>	wild cherry		
<i>Corylus avellana</i>	common hazel	<i>Pyrus malus</i> subsp. <i>sylvestris</i>	crab apple		
<i>Juniperus</i> sp.	juniper	<i>Quercus</i> sp. deciduous	oak		
<i>Prunus avium</i>	wild cherry	<i>Tilia</i> sp.	lime/linden		
<i>Pyrus malus</i> subsp. <i>sylvestris</i>	crab apple	<i>Agrimonia eupatoria</i>	agrimony		
<i>Quercus</i> sp. deciduous	oak	<i>Crataegus monogyna</i>	common hawthorn		
<i>Tilia</i> sp.	lime/linden	<i>Fragaria vesca</i>	woodland strawberry		
<i>Agrimonia eupatoria</i>	agrimony	<i>Origanum vulgare</i>	oregano		
<i>Crataegus monogyna</i>	common hawthorn	<i>Physalis alkekengi</i>	winter cherry		
<i>Fragaria vesca</i>	woodland strawberry	<i>Prunus spinosa</i>	blackthorn/ sloe		
<i>Origanum vulgare</i>	oregano	<i>Rubus fruticosus</i> agg.	blackberry		
<i>Physalis alkekengi</i>	winter cherry	<i>Sambucus</i> cf. <i>nigra</i>	elderberry		
<i>Prunus spinosa</i>	blackthorn/ sloe	<i>Arbutus unedo</i>	strawberry tree		
<i>Rubus fruticosus</i> agg.	blackberry	<i>Quercus ilex-</i> <i>coccifera</i>	evergreen oak, live oak		
<i>Sambucus</i> cf. <i>nigra</i>	elderberry	<i>Betula pendula</i>	silver birch		
<i>Vicia sepium</i>	bush vetch	<i>Taxus baccata</i>	English yew		
<i>Arbutus unedo</i>	strawberry tree	<i>Alisma plantago-</i> <i>aquatica</i>	great water plantain		
<i>Quercus ilex-</i> <i>coccifera</i>	evergreen oak, live oak	<i>Alnus glutinosa</i>	alder		
<i>Betula pendula</i>	silver birch	NA	sedges		
<i>Taxus baccata</i>	English yew	<i>Eupatorium</i> <i>cannabinum</i>	hemp agrimony		
<i>Alisma plantago-</i> <i>aquatica</i>	great water plantain	<i>Iris pseudacorus</i>	yellow flag		
<i>Apium nodiflorum</i> subsp. <i>nodiflorum</i>	fool's watercress	<i>Laurus nobilis</i>	bay tree		
NA	sedges	<i>Lycopus europaeus</i>	gypsywort		
<i>Carex hirta</i> type	hammer sedge	<i>Mentha</i> cf. <i>aquatica</i>	water mint		
	swamp sawgrass	<i>Phragmites australis</i>	common reed		
<i>Iris pseudacorus</i>	yellow flag	<i>Plantago major</i> subsp. <i>intermedia</i>	common plantain		

<i>Laurus nobilis</i>	bay tree	<i>Ranunculus sceleratus</i>	celery-leaved buttercup		
<i>Lycopus europaeus</i>	gypsywort	<i>Scirpus lacustris</i>	bulrush		
<i>Mentha</i> cf. <i>aquatica</i>	water mint	<i>Ulmus</i> sp.	wych elm/elm		
<i>Phragmites australis</i>	common reed	<i>Vitis vinifera</i> subsp. <i>sylvestris</i>	wild grape		
<i>Plantago major</i> subsp. <i>intermedia</i>	common plantain	<i>Cyperus longus</i>	galingale		
<i>Ranunculus sceleratus</i>	celery-leaved buttercup	<i>Juncus effusus</i>	soft rush		
<i>Scirpus lacustris</i>	bulrush	<i>Typha angustifolia</i>	small reed mace		
<i>Ulmus</i> sp.	wych elm/elm	<i>Typha latifolia</i>	reedmace		
<i>Vitis vinifera</i> subsp. <i>sylvestris</i>	wild grape	<i>Nymphaea alba</i>	white water lily		
<i>Cyperus longus</i>	galingale	<i>Ranunculus aquatilis</i>	water crowfoot		
<i>Juncus effusus</i>	soft rush	cf. <i>Dactylis glomerata</i>	cock's foot		
<i>Typha angustifolia</i>	small reed mace	<i>Coriopsis gallica</i>	brownflesh bracket		
<i>Typha latifolia</i>	reedmace	<i>Daedalea quercina</i>	oak mazingill		
<i>Najas marina</i>	spiny naiad	<i>Ganoderma adsperum</i>	southern bracket		
<i>Nymphaea alba</i>	white water lily				
<i>Ranunculus aquatilis</i>	water crowfoot				
<i>Amaranthus</i> sp.	amaranth				
<i>Rumex</i> sp.	dock				
<i>Daedalea quercina</i>	oak mazingill				

Table 27 - Taxa listed by known or possible use (raw material, fuel, building material, and fodder).

Taxa listed by known or possible use (raw material, fuel, building material, and fodder).							
Possible raw material taxa		Possible fuel taxa		Possible building material taxa		Possible fodder taxa	
Binomial name	Common name	Binomial name	Common name	Binomial name	Common name	Binomial name	Common name
<i>Hordeum vulgare</i> var. <i>nudum</i>	naked barley	<i>Epilobium angustifolium</i>	willow herb	<i>Triticum durum/turgidum</i>	naked wheat	<i>Hordeum distichum</i>	hulled barley (two rowed)
<i>Triticum durum/turgidum</i>	naked wheat	<i>Galium aparine</i> subsp. <i>spurium</i>	stickywilly	<i>Triticum aestivum</i>	naked wheat	<i>Hordeum vulgare</i> var. <i>nudum</i>	naked barley
<i>Triticum aestivum</i>	naked wheat	<i>Acer</i> sp.	maple	<i>Triticum dicoccum</i>	emmer	<i>Brassica rapa</i>	wild turnip
<i>Triticum dicoccum</i>	emmer	<i>Buxus sempervirens</i>	common boxwood	<i>Triticum monococcum</i>	einkorn	<i>Silybum marianum</i>	milk thistle
<i>Triticum monococcum</i>	einkorn	<i>Cornus sanguinea</i>	common dogwood	<i>Triticum timopheevii</i>	new glume wheat	<i>Urtica dioica</i>	stinging nettle
<i>Triticum timopheevii</i>	new glume wheat	<i>Corylus avellana</i>	common hazel	<i>Acer</i> sp.	maple	<i>Quercus ilex-coccifera</i>	evergreen oak, live oak
<i>Epilobium angustifolium</i>	willow herb	<i>Juniperus</i> sp.	juniper	<i>Buxus sempervirens</i>	common boxwood	<i>Phragmites australis</i>	common reed
<i>Urtica dioica</i>	stinging nettle	<i>Pinus</i> sp.	pine	<i>Quercus</i> sp. deciduous	oak	cf. <i>Dactylis glomerata</i>	cock's foot
<i>Urtica pilulifera</i>	roman nettle	<i>Pinus sylvestris/nigra</i>	ScotchPine, black pine	NA	apple subfamily		
<i>Urtica urens</i>	annual nettle	<i>Prunus avium</i>	wild cherry	<i>Arbutus unedo</i>	strawberry tree		
<i>Acer</i> sp.	maple	<i>Quercus</i> sp. deciduous	oak	<i>Laurus nobilis</i>	bay tree		
<i>Buxus sempervirens</i>	common boxwood	NA	apple subfamily	<i>Phragmites australis</i>	common reed		
NA	leather flower	<i>Crataegus monogyna</i>	common hawthorn	NA	willow		
<i>Clematis vitalba</i>	traveller's Joy	<i>Sambucus</i> cf. <i>nigra</i>	elderberry	<i>Typha angustifolia</i>	small reed mace		
<i>Cornus sanguinea</i>	common dogwood	<i>Arbutus unedo</i>	strawberry tree	<i>Typha latifolia</i>	reedmace		
<i>Corylus avellana</i>	common hazel	<i>Quercus ilex-coccifera</i>	evergreen oak, live oak				
<i>Juniperus</i> sp.	juniper	<i>Taxus baccata</i>	English yew				
<i>Pinus</i> sp.	pine	<i>Alnus glutinosa</i>	alder				

<i>Pinus sylvestris/nigra</i>	ScotchPine, black pine	NA	sedges				
<i>Prunus avium</i>	wild cherry	<i>Laurus nobilis</i>	bay tree				
<i>Quercus</i> sp. deciduous	oak	NA	willow				
NA	apple subfamily	<i>Salix</i> sp.	willow				
<i>Tilia</i> sp.	lime/linden	<i>Ulmus</i> sp.	wych elm/elm				
<i>Rubus fruticosus</i> agg.	blackberry	<i>Vitis vinifera</i> subsp. <i>sylvestris</i>	wild grape				
<i>Sambucus</i> cf. <i>nigra</i>	elderberry	<i>Typha angustifolia</i>	small reed mace				
<i>Arbutus unedo</i>	strawberry tree	<i>Typha latifolia</i>	reedmace				
<i>Betula</i> sp.	birch	<i>Coriopsis gallica</i>	brownflesh bracket				
<i>Betula pendula</i>	silver birch	<i>Daedalea quercina</i>	oak mazingill				
<i>Taxus baccata</i>	English yew	<i>Daldinia concentrica</i>	cramp balls				
<i>Laurus nobilis</i>	bay tree	<i>Ganoderma adsperum</i>	southern bracket				
<i>Phragmites australis</i>	common reed	<i>Lenzites warnieri</i>	none				
NA	willow	<i>Skeletocutis nivea</i>	hazel bracket				
NA	grasses						
<i>Salix</i> sp.	willow						
<i>Ulmus</i> sp.	wych elm/elm						
<i>Vitis vinifera</i> subsp. <i>sylvestris</i>	wild grape						
NA	sedges						
<i>Cyperus longus</i>	galingale						
<i>Juncus effusus</i>	soft rush						
NA	rushes						
<i>Typha angustifolia</i>	small reed mace						
<i>Typha latifolia</i>	reedmace						
NA	bulrushes						

5. Discussion.

The three goals of this study were to create a comprehensive archaeobotanical database of the site by combining the archaeobotanical data from the published studies, increase understanding of the relationship between people and plants at La Draga by analyzing the combined database

with the addition of ethnobotanical information, and to propose a seasonal calendar to characterize the plant management strategies utilized at the site.

5.1 The Botanical database

Starting with the original 66 taxa identified by the fruit and seeds studies of Antolín (2013), as being wild plants with medicinal and/or food value, inclusion of the work of fungi, charcoal, wood, fiber and resin studies added another 46 taxa for a total of 112 taxa with one or more of the identified uses of: food, medicine, raw material, fuel, building material, fodder or other uses. An additional 60 taxa were added from the work of pollen studies, most identified at the family level for a total of 172 taxa (Revelles, 2019).

5.1.a. The Database Botanical data - families

The combined taxa from the seven proxies were a diverse group containing 72 botanical families represented with Rosaceae containing the most numerous taxa, followed by Asteraceae, and Fabaceae. The Rosaceae family comprises 100 genera and 3,000 species and includes important taxa of economic value such as fruits, nuts, herbs, and woody plants among others (Soundararajan et al., 2019). At La Draga 8 taxa were identified as possibly used as food and 8 as possibly used as medicine in the Rosaceae family including wild cherry (*Prunus avium*), crab apple (*Pyrus malus* subsp. *sylvestris*), woodland strawberry (*Fragaria vesca*), blackthorn (*Prunus spinosa*) and blackberry (*Rubus fruticosus* agg.) and one species (*Prunus avium*) was identified as a source of raw material for the manufacturing of decorative beads. The family of Asteraceae is one of the largest flowering plant families and includes over 1600 genera and 25,000 species across the world. Most of the family members have medicinal value and some are known to have a long history of use as food and medicine (Rolnik & Olas, 2021). Woolly distaff thistle (*Carthamus* cf. *lanatus*) and milk thistle (*Silybum marianum*) both found at La Draga belong to the Asteraceae family and can be used to produce oil and have medicinal properties, 4 taxa were identified as a possible food source and 5 had possible medicinal value in this family. Fabaceae is a diverse family with 770 genera and 19,500 species many of which provide a highly nutritious source of protein and micronutrients (Gomes et al., 2018). Six taxa were identified in this family that had food value and 4 with possible medicinal uses of which 3 are cultivars: lentils (*Lens culinaris*), broad bean (*Vicia faba*), and peas. Deciduous oak (*Quercus* sp. deciduous) and evergreen oak (*Quercus ilex-coccifera*), members of the Fagaceae family, found at La Draga could have been used for multiple purposes.

5.1.b. The Database Botanical data – ecozones/ecological groups

La Draga was a permanent settlement, and it appears the choosing of the site was intentional so that the important resources would have been close at hand. Early farming efforts restricted people to a small area very unlike the much larger landscapes to which most hunter-gatherers made use. The identified taxa were assigned to ten ecozones with the greatest number of taxa being in the weed/ruderal ecozone and the riparian/lakeshore ecozone with 21% each. Deciduous woods had the next most numerous taxa. This provides an approximate picture of where the numerous plant resources needed by the settlers were found and gathered. Though all ten nearby ecozones contained taxa found at La Draga and were probably exploited by the settlers, the greatest number of taxa (104 of the 112) were most likely found within a kilometer radius of the settlement. This supports the data of pollen studies at the site that show a degradation of the forests near the site after human exploitation resulted in a marked reduction in *Quercus* sp. deciduous (oak) (Revelles, 2017). Labor demands of the domesticated crops and animals in an intensive mixed farming economy was one reason why proximity to these resources was important. Having the deciduous forest and riparian/lakeshore resources near the settlement and thereby the fields would have shortened time required to locate and gather needed resources and made more time available for farming activities and for more intensive exploitation of wild plant resources. Settlers evidenced a preference for acquiring frequently needed resources like firewood and tinder from specific taxa near the settlement. It is evident that when they desired a particular resource, such as *Taxus baccata* (yew) for a bow or *Pinus* sp. (pine) for an adze handle, they would travel further to obtain it. Pollen studies have been key in assessing the vegetal environment prior to farming activities and have demonstrated the degradation of that environment with the impact of generations of people heavily exploiting the landscape for resources (see figure 24).

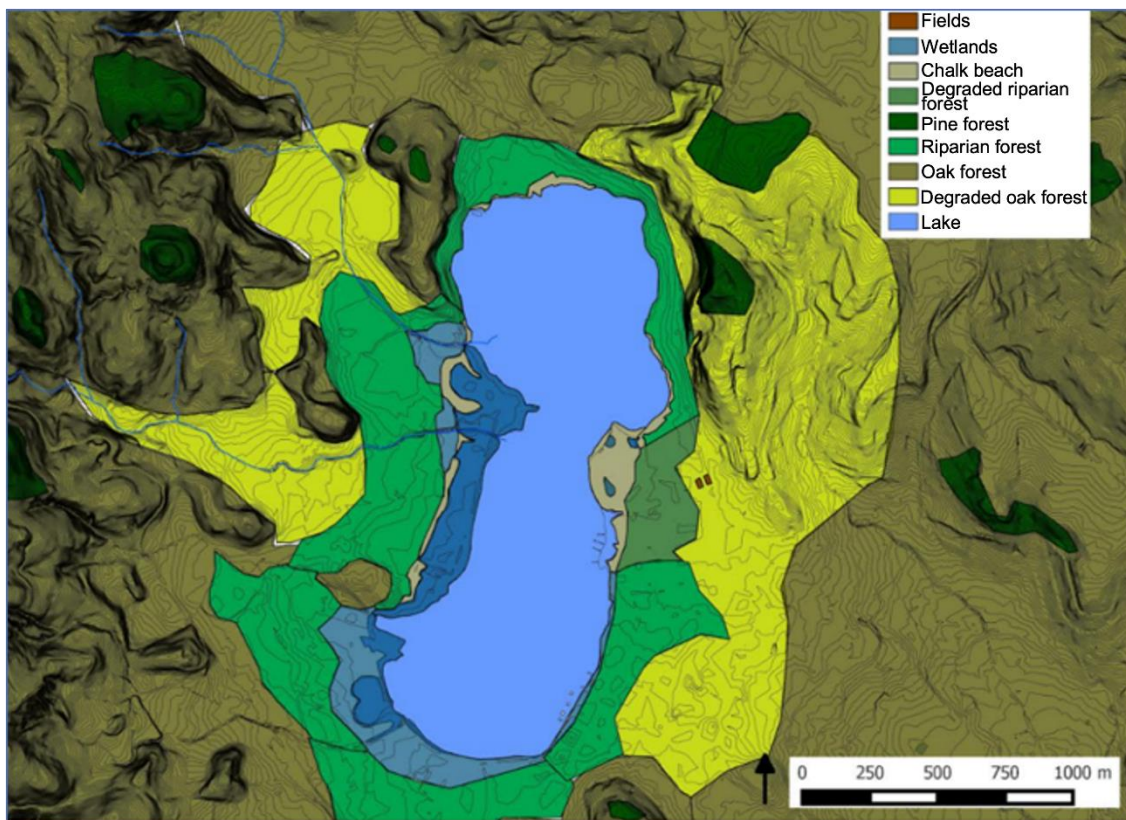


Figure 24- proposed view of ecozones after human degradation of landscape. (after Revelles, 2022).

5.1.c. The Database Botanical data – plant life cycle

The greatest number of taxa are classified as perennial (64%) with just 31% classified as annual taxa and 5% considered biennials. The cultivars were annuals and would have made up the largest portion of food intake despite the low number of taxa (11). Just as it is important to remember that wild plants are often underrepresented in the archaeobotanical record due to taphonomy and preservation issues and therefore ubiquity values are an important consideration, it is also key to remember that though cultivars represent a small number of taxa they constitute the largest group of archaeobotanical remains. It seems likely that early farmers depended on cultivars especially wheat for their main alimentary needs though wild plants would still have supplied a significant part to the diet (Antolín & Jacomet, 2015).

5.2 The Database Archaeobotanical data

5.2.a. The Database Archaeobotanical data – type of remains

The archaeobotanical remains largely fall into one of two types, fruits and seeds or pollen.

Combining the work of the many archaeobotanists who have recovered and analyzed remains at La Draga has allowed for a data base of 172 taxa identified by seven proxies (see table 29, figure 25), with some taxa identified in multiple proxies. The number of taxa alone do not account for the importance of contributions from the various proxies. Some remains like fruiting bodies, resin and fibers are rarely preserved and can be easily overlooked in the scarce cases when they are present which makes the contributions from their study more valuable in the attempt to understand plant management strategies in the past.

Table 28 - Taxa count by proxy

Taxa count by proxy						
Fruiting body	Seeds & Fruits	Charcoal	Wood	Resin	Fibers	Pollen
6	88	25	19	1	16	78

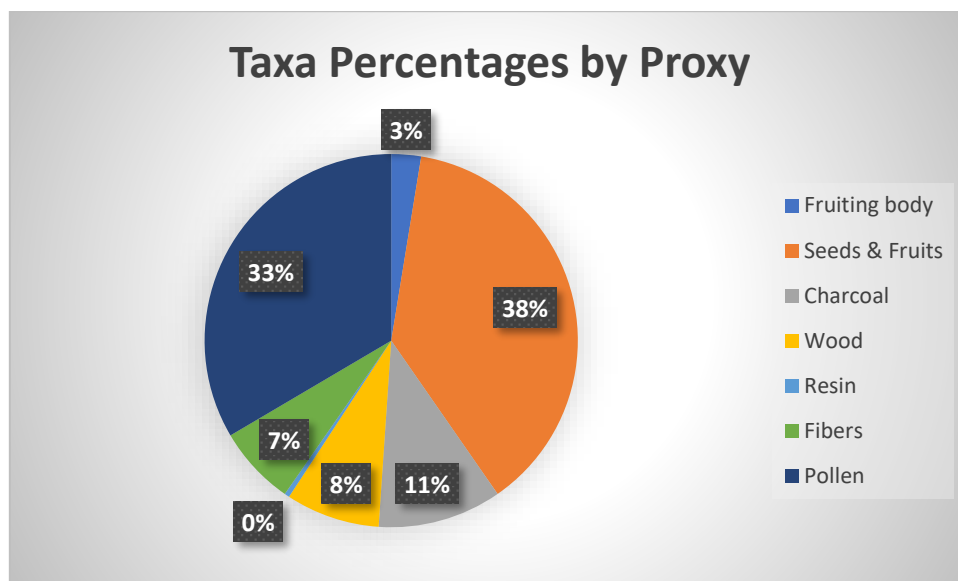


Figure 25 - Taxa percentages by proxy

5.2.b. The Database Archaeobotanical data – type of preservation

The largest percentage of taxa found (63%) were in waterlogged conditions with the greatest number of taxa belonging to fruits and seeds while the smallest percentage of taxa were found in charred preservation (11%). This supports the findings of other works related to the larger number of taxa found in waterlogged sites versus charred sites (Colledge & Conolly, 2014) (Antolín et al., 2014). It also reflects the challenge of understanding people-plant relationships

given the small percentage of waterlogged sites and underscores the importance of sites like La Draga in archaeobotanical research.

5.2.c. The Database Archaeobotanical data – use of multiple proxies/disciplines

Archaeobotany as a discipline has roots in the practice of ethnobotany and focuses on the social and cultural dimensions of plant use through time. Going beyond lists of plants, archaeobotanists attempt to answer meaningful questions covering a wide range of topics and in this quest the research of ethnobotany provides useful information when interpreting the archaeobotanical remains (Berihuete-Azorín, 2016). Combining the studies of the seven proxies at La Draga facilitated an expanded understanding of the human management of botanical resources and exploitation of the surrounding ecozones. Pollen studies have been critical in reconstructing the vegetal environment prior to farming activities and have demonstrated the impact on that environment. Generations of people heavily exploiting the landscape for resources provoked degradation of the landscape surrounding the settlement as evidenced by pollen studies (Revelles, 2015, 2017). Carpology has provided information on early farming strategies and type of cultivars by providing evidence of an intensive farming model at the site and documenting cultivars and their relative abundance (Antolín, 2013, Antolín, et al., 2014, 2015). The studies on fruits and seeds at La Draga has also provided evidence of wild plants with possible alimentary, medicinal, and other uses (Antolín, et al., 2015, 2016, 2021, Jesus & Antolín, 2022). Charcoal and wood studies have contributed evidence of the intensity and diversity in the exploitation of woodland resources including the species used in securing materials for construction, repairs, and fuel (Caruso Fermé & Piqué i Huerta, 2014; López-Bultó, 2016, 2020; López-Bultó et al., 2018, 2020; Piqué, 2015, 2021, 2022). The single finding of resin at the site offered valuable insight into the possible uses and manufacturing of resin and the possibility of further finds (Rageot, 2021). The waterlogged conditions at La Draga provided a rare opportunity for the studies on recovered fibers resulting in analysis of plant-based remains which identified a diverse number of taxa used in the production of cordage, basketry and possibly textiles. Fiber studies also provided information on the manufacturing process of basketry and cordage and the skill level required (de diego et al., 2017, Herrero-Otal et al., 2021, Piqué et al., 2018, 2022, Romero-Brugués et al., 2021). Fungi studies have contributed another example of the diverse strategies utilized in the exploitation of forest resources (Berihuete-Azorín, 2018; Piqué et al., 2020). Ethnobotany involves the work of researchers from many fields including: biologists, botanists,

agriculturalists, horticulturalists, foresters, anthropologists, pharmacists, chemists, archaeologists, historians and/or economists and therefore has adopted an interdisciplinary approach well suited to archaeobotanical studies. Each discipline involved contributes a critical piece in the understanding of this important era when a new dialectic relationship of people and plant management was being forged. As Lydia Zapata said “... the necessary over-specialisation of the researchers as well as the limitations and incomplete nature of many of our sources makes interdisciplinarity obligatory” (Books et al., 2014.) Each type of proxy study offers contributions and its own limitations, hence the value of a multi-disciplinary approach is to maximize the contributions and minimize or effectively address the challenges (see table 30) (Wright, 2010; López-Bultó, 2020).

Table 29 - Contributions and challenges of Archaeobotanical Disciplines

Summary table of contributions and challenges of Archaeobotanical Disciplines				
Proxy (remain)	Type	Discipline(s)	Benefits/contributions	Challenges
Wood	Macro	Dendochronologists Anthracologists	Wood tends to be the most ubiquitous of the macrobotanical remains Wood studies contribution to archaeological reconstructions of: natural environments climate change human use of timber dendro-chronological and radiocarbon dating of archaeological sites Wood analysis can contribute to understanding technological processes related to tools and objects	Recovery of items made of wood rare unless in a waterlogged site Woodworking debris and formless pieces are often ignored Species identification not always possible
Fruits & Seeds	Macro	Carpologists	Remains of seeds, fruits, nutshell, and tubers can aid in determining diet and subsistence strategies. Studies have been vital to understanding bio-diversity, seasonality, and critical information on domestication and the origins of agriculture.	Limited preservation in quantity and quality in charred sites and few waterlogged sites. Identification not always possible.
Fibers	Macro	Arcaheobotanists	Fiber studies help to understand other kind of resources employed and other types of manufacture production, providing information on technique, choice and access to material, diffusion, and transmission of technologies.	Plant-base artefacts are rarely preserved Overlapping characteristics make identification difficult

			Eventually inform on storage and transport strategies	Lack of specialized bibliography
Charcoal	Macro	Anthracologists	<p>Wood charcoal analysis provides site-related information on:</p> <ul style="list-style-type: none"> • species occurrence • woodland composition <p>The analysis of charred wood is of extra importance on sites where sediments containing pollen are lacking, providing the only source to reconstruct (woody) vegetation</p> <p>Potential to establish occurrences of woody species for vegetation reconstruction on a fine spatial scale, or to document wood resource usage of local human populations.</p> <p>Archaeoanthracology adds to the discussion of landscape openness, with its local vegetation signal, when pollen analysis is not possible.</p>	<p>Bias towards cultivars (grains) and wood, nuts. Other taxa don't appear in the charcoal remains.</p> <p>Stratigraphical and taphonomic issues are complicated. The legacy of the remains is normally only discontinuously available.</p> <p>The species spectra when interpreted for vegetation reconstruction have the danger of human bias due to potential selection of certain species, for e.g. fire making, house construction or charcoal making</p>
Fungi	Macro	Mycologists	<p>Can combine ethnomycological information with analysis of distribution and physical characteristics of the remains to determine use</p> <p>Contribute to the knowledge of the role of fungi in past societies</p> <p>Can offer important information for interpretation of fungal spores and fruiting bodies</p>	<p>Fruiting bodies are rarely preserved, scarce in the record unless waterlogged or ice conditions</p> <p>Lack of attention in the archaeological record</p> <p>Lack of specialists who can identify on archaeological teams</p>
Pollen	Micro	Palynologists	<p>Upon recovery, the shape, size, and surface features of palynomorphs and non-palynomorphs are used to assign a specimen to a particular family, genus, or species.</p> <p>Palynology is recognized for enhancing our understanding of past environments and human land-use strategies. Palynology is matchless in yielding some idea about fluctuations in vegetation that might be associated with climate change and/or human impact.</p> <p>Palynology can contribute other information relevant to people's exploitation of plants.</p> <p>Pollen collected from middens often indicates the types of plants collected and utilized for food or</p>	<p>Understanding how plant remains came to be a part of an archaeological site is essential. For instance, pollen can move through the environment in several ways. When interpreting pollen data, it becomes necessary to consider human and nonhuman activities that might be responsible for their presence.</p> <p>Working with pollen, is complex. The complexities of how human behavior creates pollen</p>

			<p>other economic purposes by prehistoric cultures. Fossil pollen found in floor sediments can be used to suggest potential types of room utilization. Scrapings from the inside surfaces</p> <p>Pollen analysis enables us to identify occurrences and relative changes with a high taxonomical resolution, encompassing both tree and herb species, higher plants.</p> <p>The possibility of reconstructing local and/or regional vegetation diachronically.</p>	<p>assemblages and how natural pollen rain, and post-depositional processes distort and transform the pollen record.</p> <p>Often identification cannot be beyond the family level with species and genus undetermined.</p>
Ethnobotany		<p>Ethnobotanist Archaeoethnobotanist Anthropologists</p>	<p>Interdisciplinary involving the expertise of many fields</p> <p>Provides information across many cultures and with specific detail of plant use and processing</p> <p>Can provide insights into plant use and processing which can guide further research questions</p>	<p>Qualitative data is not as respected as quantitative data</p> <p>Reliance of uniformitarianism</p> <p>Studies can prove difficult to replicate</p>

Many studies now embrace a multi-disciplinary approach to site analysis like a 2010 study that was undertaken to assess the benefits of combining pollen and charcoal studies to evaluate Holocene vegetation composition and dynamics. Researchers determined that combining the two studies enabled a better reconstruction of vegetation composition and human impact with more precision in the spatial resolution (Nelle et al., 2010). Researchers studying charcoal have recognized the need to work with other disciplines like dendrochronology and ethnoanthracology to further the contributions of anthracologists in archaeobotanical work and promote interactions with other research fields and interdisciplinarity (Ludemann & Nelle, 2017). Other archaeobotanical researchers have worked to synthesize various studies to promote a more integrated understanding of plant resources recovered through archaeobotanical work (Piqué et al., 2022).

5.3 The Database Ethnobotanical data

5.3.a. The Database Ethnobotanical data – plant parts and seasonality

Plant management strategies at La Draga strongly suggest people equipped with the knowledge and skills to utilize seasonal resources and diverse ecozones to acquire desired taxa at the right time in a plant's life cycle to meet their needs. More plant parts were collected in summer than any other season with most of them being aerial parts. Summer had the greatest plant part harvest (36%), just slightly more than the percentage harvested in autumn (31%). Winter saw

the lowest percentage of plant parts harvested (9%) with the majority being aerial parts. The later supports the work of other researchers (Piqué, et al., 2022) who found most of the oak for building construction was cut in the winter. Food was the identified use for the greatest number of taxa found at La Draga (87) with medicine a close second (82) and raw material third. The combined studies of carpology, charcoal, wood, fibers, and resin along with ethnographic information allowed for the expansion of the database to include multiple uses of plants. Combining the archaeobotanical finds of the various disciplines involved in the work at La Draga with ethnobotanical research into the use of plants sheds light on how the settlers at the site may have exercised their plant management strategies especially those related to seasonality and ecozone exploitation.

5.3.b. The Database Ethnobotanical data – plant uses, food

Cultivation activities were labor intensive requiring the clearing of forests to create fields, preparing the soil, sowing, harvesting, threshing, dehusking, storage and preparation for ingestion all involving knowledge of plants, appropriate tools, and skills as well as careful timing to optimize crop survival and yields. At La Draga it is not possible to know with certainty when cultivars were sown but there is no evidence for a spring sowing season and probably a late autumn/winter sowing season was the case according to the present archaeobotanical and archaeozoological data (Antolín, 2013). The combined studies of archaeobotany and archaeozoology at the site point to the practice of an intensive mixed farming on permanent plots near the settlement with a high harvest and low-scale processing of the crops taking place in the domestic space where the grain harvest would be stored (Antolín et al., 2014). Pollen studies have also proven useful in determining intra-site spatial use (Revelles et al., 2017). This management strategy allowed for livestock to graze on crop stubble and facilitated manuring of the fields. It is likely that small animals were managed by the household and larger animals required cooperative management between households (Antolín et al., 2014). Cultivars were the best represented taxa among the assemblage (Antolín & Buxó, 2011) and found in charred form only with naked wheat (*Triticum aestivum/durum/turigidum*) probably the most important crop and barley (*Hordeum vulgare*) and glume wheat secondary crops.

All other activities would have been planned around the demands of cultivated crops and management of domestic animals which provided the primary food for the community. A study of 24 Neolithic sites in the north-east of the Iberian Peninsula support an intensive wild plant use for at least the first 1,300 years of the Neolithic era (Antolín & Jacomet, 2015). This study, which included the site of La Draga, noted the diverse ecozones from which the recovered plant

remains probably originated. Large numbers of *Rubus fruticosus* (blackberry) were recovered from La Draga and probably originated in woodland edges and clearings. In addition, *Prunus spinosa* (blackthorn) and *Crataegus monogyna* (hawthorne) were found in lower numbers (Antolín, 2013). *Quercus* sp. and *Corylus avellana* from deciduous woodlands are well represented as well as *Vitis vinifera* var. *sylvestris* from a riparian/lakeshore environment (Antolín, 2013). Researchers found evidence of *Brassica rapa* (turnip), *Carthamus* cf. *lanatus* (wooly distaff thistle) *Urtica dioica* (stinging nettle), *Papaver somniferum* (poppy), and *Silybum marianum* (milk thistle) at La Draga in the form of seeds gathered possibly for the making of oil. This required knowledge of seasonality (when seeds ripened) and a multi-step process of production of which we have some archaeological evidence (Jesus & Antolín, 2022). Looking over the vast numbers of plants exploited by the early farmers at La Draga, it appears that plant management strategies were seasonally planned to consider plant availability, qualities of the plants during their growth cycle, human needs, and labor availability. A study on agroecology and food sovereignty of modern-day small farmers demonstrated that multi-cropping intensive mixed farming methods provide adequate food from small plots and make intensive gathering of wild fruits from nearby woodlands a compatible activity (Altieri et al., 2012). Wild plants used as food would have been collected as their edible parts were at an optimum as an important supplement to the diet.

5.3.c. The Database Ethnobotanical data – plant uses, medicine

Wild plants for medicinal purposes would have been collected when the needed plant part was available and as need arose. Only five of the taxa identified as possibly used for medicine were more than 5km from the settlement. Forty-eight of the taxa identified as of possible medicinal value were less than a km from the settlement. It is of interest that 25 of the taxa found at the site and identified as having possible medicinal value were also found in and near home gardens in a recent ethnobotanical study of medicinal plants currently in use by residents of Catalonia (see table 30), (Agelet et al., 2000). This study found 250 plants being gathered and used by locals in the study area, all found in home gardens, additional plants used as medicine were gathered as ruderals in nearby fields and orchards. Though present day gathering and use of plants with medicinal value cannot be direct evidence of past use it is of note that the subjects of the 2000 study in Catalonia used many plants gathered near their homes and exchanged them in a complex neighbor network that is used to find and secure needed medicinal plants. Eighty-two taxa found at La Draga were identified with possible medicinal value and of these only 5

had no other use identified henbane (*Hyoscyamus niger*), fairy flax (*Linum catharticum*), fleabane (cf. *Pulicaria dysenterica*), common catchfly (*Silene gallica*), and hemp agrimony (*Eupatorium cannabinum*). It appears that many plants were utilized for two or more purposes maximizing the gathering and processing efforts.

Table 30 - Garden plants for medicine in modern Catalonia. Agelet, et al., (2000); Antolín (2013)

Medicinal plants currently found in Catalonia gardens and in remains at La Draga	
<i>Apium graveolens</i> (wild celery)	<i>Plantago major</i> (common plantain)
<i>Sonchus oleraceus</i> (prickly sow thistle)	<i>Polygonum aviculare</i> (knot weed)
<i>Corylus avellana</i> (hazelnut)	<i>Portulaca oleracea</i> (green purselane)
<i>Capsella bursa-pastoris</i> (shepherd's purse)	<i>Prunus avium</i> (wild cherry)
<i>Sambucus nigra</i> (elderberry)	<i>Pyrus malus</i> (apple)
<i>Hypericum perforatum</i> (St. John's Wort)	<i>Galium aparine</i> (sticky willy)
<i>Arbutus unedo</i> (strawberry tree)	<i>Physalis alkekengi</i> (winter cherry)
<i>Euphorbia helioscopia</i> (madwoman's milk)	<i>Taxus baccata</i> (yew)
<i>Vicia faba</i> (broad bean)	<i>Urtica dioica</i> (stinging nettle)
<i>Quercus ilex</i> (evergreen oak)	<i>Urtica urens</i> (annual nettle)
<i>Origanum vulgare</i> (oregano)	<i>Verbena officinalis</i> (vervain)
<i>Laurus nobilis</i> (bay tree)	<i>Vitis vinifera</i> (wild grape)
<i>Papaver somniferum</i> (poppy)	

5.3.d. The Database Ethnobotanical data – plant uses, raw materials

The over 200 wooden implements recovered at La Draga represent at a minimum 17 taxa involved in their fabrication and show a diversity of raw materials and use of multiple ecozones for acquisition (Palomo et al., 2013). *Buxus sempervirens* is the most frequently used taxa for manufacturing tools with *Quercus* sp. deciduous second in importance. *Taxus baccata* was also used a wide range of implements. Other taxa were used for specific products such as bows from *Taxus* and adze handles from *Pinus* and *Taxus* (Piqué et al., 2022). Plants needed for fiber were probably cut and gathered in the spring and summer when they were abundant and had the desired properties e.g., pliable do to sap climbing within the plant. Nettle fibers would most likely have been gathered in mid or late summer so that the material was of suitable size and pliability. Summer is also the ideal time to harvest lime bast fibers because the leaves are fully developed, and the bark is easier to remove with the sap risen. This same maturity would also have been desirable for the gathering of cattail and rushes in late summer. Pine bark tar would have been easiest to gather in spring and early summer when sap had risen (Piqué et al., 2022).

Settlers at La Draga evidenced knowledge of seasonality when gathering plants as raw material for fabrication of desired implements from bows to baskets and demonstrated preferences for specific taxa and the knowledge of the environment sufficient to secure them. This affirms the findings of studies on wood procurement at La Draga that revealed an intensive exploitation of woodlands in the number of taxa procured and the number of environments (ecozones) exploited along with the quantity and volume of raw materials utilized (López-Bultó & Piqué, 2018).

5.3.e. The Database Ethnobotanical data – plant uses, fuel

Wood charcoal has been recovered from La Draga from all layers and both occupations. Charcoal remains are both ubiquitous and abundant facilitating almost 5,000 fragments that were studied to identify taxa and the main features of the firewood used at the site (Caruso-Fermé & Piqué i Huerta, 2014). Nineteen taxa were identified, however, only three were of a significant quantity; *Quercus* sp. deciduous (oak) and *Laurus nobilis* (bay tree) representing more than 80% of the identified remains and *Buxus sempervivrens* (boxwood) in phase II. The people of La Draga had numerous taxa available for use as fuel but practiced a strategy demonstrating their preference for harvesting largely oak and bay tree which were at hand in the deciduous and riparian forests near the settlement, this supports pollen studies that demonstrated the degradation of oak deciduous forests after long term human occupation (Revelles, 2017). A total of 86 remains of fungal fruiting bodies were recovered at La Draga representing six taxa: *Coriolopsis gallica*, (brownflesh bracket), *Daedalea quercina*, (oak mazingill), *Daldinia concentrica*, (cramp balls), *Ganoderma adspersum*, (southern bracket), *Lenzites warnieri*, (none), *Skeletocutis nivea* (hazel bracket) (Berihuete-Azorín et al., 2018). Some remains show clear indications of modification (cut and partially charred) and there is evidence the fungi were intentionally brought to the site probably for use as tinder in fire making efforts (Piqué et al., 2020). Other needs related to the constant use of fire would have resulted in regular perhaps daily collection of wood and fungi for fire available year-round (Piqué et al., 2022).

5.3.f. The Database Ethnobotanical data – plant uses, building and repairs

Quercus sp. deciduous (oak) was the primary material chosen for construction at La Draga composing 99% of the determined piles and 96% of the planks with a minimal presence of *Cornus sanguinea* (dogwood), *Corylus avellana* (hazelnut), *Acer* sp. (maple), Maloidea (apple family), and *Laurus nobilis* (bay tree) (Piqué et al., 2022). Oak for piles was mostly harvested

in the winter, probably because this is the easiest time to harvest with the tools that were in use and labor was more available, while planks had more material harvested in summer and autumn though the majority was cut in winter (Piqué et al., 2022). Grasses (wheat and barley) cultivated at La Draga would have produced straw that may have served many purposes including use as thatch in roofing or in other construction needs. *Typha angustifolia* (small reed mace), *Phragmites australis* (common reed), and *Typha latifolia* (reedmace) were also present and may have been a source of thatch used in construction. Of course, wood need for ongoing repairs would have been harvested as needed and this is reflected in analysis of wood pieces found at the site (Piqué et al., 2022).

5.3.g. The Database Ethnobotanical data – plant uses, fodder

Foddering represents another plant management strategy and evidence suggests that it was practiced at La Draga as part of the intensive farming model employed there. This model supports domestic animals accessing fields and grazing on the stubble which has an additional benefit, in that fields are fertilized by the manure the animals produce while feeding (Antolín et al., 2014). Livestock, in the intensive farming model, had a reduced range to exploit for feeding and relied to some extent on human management for alimentary needs especially in summer when females needed greater feed for lactation or winter when available food was less. This required either moving the herds to more distant grazing areas or providing fodder which might consist of grass, grains, or the by-products from processing crops. Caprine and bovine herds were probably fed with variable fodder strategies while sheep were grazed in swamps or forest resources near the settlement. *Triticum* sp. (wheat), *Hordeum vulgare* (barley) have been identified as possible fodder for goats and cattle at La Draga, probably fed in late summer and autumn. Pulses; (*Lens culinaris*), (*Vicia faba*), and peas as well as the grasses *Triticum* sp. (wheat), and *Hordeum vulgare* (barley), would have been possible fodder for pigs raised at the site (Navarrete et al., 2019). *Brassica rapa* (wild turnip), *Silybum marianum* (milk thistle), *Urtica dioica* (evergreen oak, live oak), *Phragmites australis* (common reed), and cf. *Dactylis glomerata* (cock's foot) were wild plants identified at La Draga that along with branches from trees and shrubs could possibly have been gathered for fodder. The evidence at La Draga supports an intensive herd management with livestock kept near the settlement especially during winter and during breeding (Navarrete et al., 2019) whose success probably relied on human interventions including securing and providing fodder for all domestic animals except for sheep.

5.3.h. The Database Ethnobotanical data – plant uses, other

Thirty taxa were identified at La Draga that may have had uses other than the ones explored above. These uses from ethnobotanical research are varied and include dyes, inks, soap, illuminants, containers, tannins, and substances to curdle milk among others. These are possible uses that are beyond the scope of this work and merit further research efforts. It is interesting to note that most taxa recovered at La Draga have been identified with multiple possible uses by ethnobotany research (see table 31). Five taxa were identified that had six possible uses including *Quercus* sp. deciduous (oak) and *Arbutus unedo* (strawberry tree) and five taxa were identified with five possible uses including *Cornus sanguinea* (dogwood), *Prunus avium* (wild cherry), and *Vitis vinifera* subsp. *sylvestris* (wild grape). It appears likely that there could have been more uses than the ones currently identified. Another very important need for further research is the processing of collected plant materials both domestic and wild (Berihuete-Azorín, 2016) that would further our understanding of plant management strategies at La Draga and other Neolithic sites.

Table 31 - Taxa count by possible use(s)

Number of possible uses by taxa count							
# of uses	Six uses	Five uses	Four uses	Three uses	Two uses	One use	total
# of taxa	5	5	18	24	38	22	112

5.4 People-plant relationships and plant management strategies

Archaeobotany and ethnobotany have both tackled the seasonal use of plants, as an important source of information on plant management by human communities (Jones & Lister, 2022; Chisholm Hatfield et al., 2018; Faruque et al., 2019). The main study focus on domesticated plants has been on stem morphology and the impact on harvesting techniques, other trait changes in the evolution of people-plant relationships also had significant ramifications on those relationships, including photoperiod response. Archaeobotanists have studied the seasonality response of cultivated plants considering their flowering response to changing daylength and how that impacted relocation of cultivars great distances from their place of origin ((Jones & Lister, 2022). Researchers have found that shifts in photoperiod response was noted and utilized by early prehistoric farmers and central to the successful spread of agriculture across latitudinal ranges. As previous ethnobotanical studies have shown, seasonality determines to a variable extent how human communities organized the different plant management tasks (Chisholm Hatfield et al., 2018; Faruque et al., 2019). The study of five

western tribes, located in USA, found that seasonality referred to how annual environmental changes affected harvesting, monitoring, storing, and consuming hundreds of diverse plants and animals. Traditional knowledge relied on an understanding of environmental cues and finding the best timing to act on those indicators. The entire system of knowledge is complex and sensitive to change (Chisholm Hatfield et al., 2018). A study of the Pangkhua community in Bangladesh found the gathering of 117 plants for medicinal use that required knowledge of specific plant locations in the vast local forests as well as seasonality of plant part availability (Faruque et al., 2019).

The use of information from ethnobotanical research has proved a useful tool in the interpretation of archaeobotanical finds. Though we are not able to travel back in time to observe firsthand the interactions of people and plants at La Draga, the careful recovery and identification of archaeobotanical remains in conjunction with judiciously applied information gathered by ethnobotanists can afford us considerable insight into the plant management strategies of the settlers at La Draga. The intensive mixed farming strategy proposed for La Draga was complimentary to wild plant gathering with several ecozones near the site to exploit for needed plant resources. A study of 15 early Neolithic sites in the Western Mediterranean region (modern Iberia and northern Morocco) revealed a diversity of cultivated plants and evidence of wild plant usage as food (Peña-Chocarro et al., 2013). A study of one of these 15 sites, Ifri Oudadane (Morocco), found evidence of the importance of wild plant species at the beginning of agriculture in Morocco. Cultivated and wild plants were identified among the macro remains of the Neolithic layers with wild plants found in abundance including the cultivars barley (*H. vulgare*), hulled wheat (*T. monococcum/dicoccum*), free threshing wheat (*T. aestivum/durum*) and hard wheat (*T. durum*). In addition, over 7,000 remains of wild plants representing diverse taxa were recovered including seeds of the mastic tree (*Pistacia lentiscus*), being the most abundant, and many other species such as the dwarf palm (*Chamaerops humilis*) or the juniper (*Juniperus phoenicea*) are common (Morales et al., 2013).

The complementarity of intensive mixed farming and wild plant gathering has been studied in sites distant from the Western Mediterranean (Treasure et al., 2019; Bestal et al., 2018; Tang et al. 2022). A study in Wales reviewed archaeobotanical evidence from 95 Neolithic sites. The study concluded that the early Neolithic in Wales was marked by a widespread increase in cereals, with wheat probably the main crop, along with evidence of continued wild plant exploitation, primarily hazelnuts and wild fruits. There was even a possibility that some wild plants and woodlands were consciously managed or altered to encourage growth of specific species (Treasure et al., 2019). The early Neolithic site of Zhuzhai, in the middle Yellow River

region of China, revealed archaeobotanical evidence of broomcorn millet (*Panicum miliaceum*), foxtail millet (*Setaria italica* ssp. *Italica*), and rice (*Oryza* sp.) as cultivars along with many fruits, seeds, tubers, and nuts (with nuts being the most abundant) ((Bestel et al., 2018). Interestingly, this study concluded that in the early Neolithic nuts were a dietary mainstay and domestic cereals a lesser addition to an economy based on nuts. A second study in China of the middle Neolithic site of Anle, Lower Yangtze region, found evidence of the cultivars rice (*Oryza sativa*), foxtail millet (*Setaria italica*), and common millet (*Panicum milaceum*) as well as many wild plants with possible use as food and medicine (Tang et al., 2022). This study concluded that the farmers at Anle created a complex seasonal sequence of crops that had temporal compatibility that allowed for making a niche for rice and millet while creating opportunities for the regular exploitation of wild plants in their nearby environment. The study concludes that the diverse subsistence strategies evidenced at Anle aid us in understanding how people deliberately constructed regional landscapes by creating new ecological niches increasing food availability within seasonal systems of domestic plant cultivation.

Archaeobotanical evidence from La Draga and many other Neolithic sites reveal a seasonal approach to plant management with diverse and deliberate selection and acquisition from the available ecozones within a small area that required a comprehensive knowledge of plants and their environments (see tables 32 and 33).

Table 32 – Seasonal Activity Calendar - Cultivars/Wild Plants for Food at La Draga

Seasonal Activity Calendar - Cultivars/Wild Plants for Food												
Activity	January	February	March	April	May	June	July	August	September	October	November	December
Sowing Cultivars <i>Triticum durum/turgidum</i> (Naked wheat, tetraploid), <i>Hordeum distichum</i> (Hulled barley), <i>Triticum aestivum</i> (Naked wheat hexaploidy), <i>Hordeum vulgare var. nudum</i> (Naked barley)												
Sowing Cultivars <i>Papaver somniferum</i> (poppy)												
Sowing Cultivars <i>Vicia faba</i> (Broad bean), <i>Fabaceae</i> (Peas) <i>Lens culinaris</i> (lentils)												
Harvesting Cultivars <i>Triticum durum/turgidum</i> (Naked wheat, tetraploid), <i>Hordeum distichum</i> (Hulled barley), <i>Triticum aestivum</i> (Naked wheat hexaploidy), <i>Hordeum vulgare var. nudum</i> (Naked barley)												
Harvesting Cultivars <i>Papaver somniferum</i> (poppy)												
Harvesting Cultivars <i>Vicia faba</i> (Broad bean), <i>Fabaceae</i> (Peas) <i>Lens culinaris</i> (lentils)												
Fodder goats & cattle <i>Triticum</i> sp. (wheat), <i>Hordeum vulgare</i> (barley)												
Fodder pigs <i>Triticum</i> sp. (wheat), <i>Hordeum vulgare</i> (barley), Pulses (<i>Lens culinaris</i>) (<i>Vicia faba</i>) peas												
Fodder gathered in wild for livestock <i>Brassica rapa</i> (wild turnip), <i>Silybum marianum</i> (milk thistle), <i>Urtica dioica</i> (evergreen oak, live oak), <i>Phragmites australis</i> (common reed), and cf. <i>Dactylis glomerata</i> (cock's foot) Branches (trees and bushes)												
Gathering fruits & seeds <i>Quercus</i> sp. (Oak, acorns) <i>Corylus avellana</i> (hazelnuts)												
Gathering fruits & seeds <i>Vitis vinifera</i> subsp. (wild grape)												
Gathering oil plants <i>Carthamus</i> cf. <i>lanatus</i> (wooly distaff thistle)												
Gathering oil plants <i>Silybum marianum</i> (milk thistle), <i>Brassica rapa</i> (wild turnip), <i>Urtica dioica</i> (stinging nettle), <i>Papaver somniferum</i> (poppy)												

Table 33 – Seasonal Activity Calendar - Deciduous and Riparian Woodlands

Seasonal Activity Calendar - Deciduous and Riparian Woodlands at La Draga												
Activity	January	February	March	April	May	June	July	August	September	October	November	December
Wood for construction <i>Quercus</i> sp. deciduous (oak)												
Wood for repairs <i>Quercus</i> sp. deciduous (oak)												
Wood for tools <i>Buxus sempervirens</i> (boxwood) <i>Quercus</i> sp. deciduous (oak) <i>Taxus baccata</i> (yew) <i>Juniperus</i> sp.(juniper), <i>Salix</i> sp. (willow), <i>Pinus</i> sp.(pine), <i>Acer</i> sp (maple)., <i>Arbutus unedo</i> (strawberry tree), <i>Cornus sanguinea</i> (dogwood), <i>Corylus avellana</i> (hazelnut), <i>Laurus nobilis</i> (bay tree)												
Gathering tinder <i>Coriopsis gallica</i> , (brownflesh bracket) <i>Daedalea quercina</i> , (oak mazegill) <i>Daldinia concentrica</i> , (cramp balls) <i>Ganoderma adsperum</i> , (southern bracket) <i>Lenzites wamieri</i> , (none) <i>Skeletocutis nivea</i> (hazel bracket)												
Wood for fuel <i>Quercus</i> sp. deciduous (oak) <i>Laurus nobilis</i> (bay tree) <i>Buxus sempervirens</i> (boxwood)												
Resin gathering <i>Betula pendula</i> (silver birch)												
Gathering plants for fiber <i>Urtica dioica</i> (stinging nettle) <i>Urtica pilulifera</i> (Roman nettle) <i>Urtica urens</i> (annual nettle) <i>Cyperaceae</i> , <i>Juncaceae</i> , <i>Typhaceae</i> (sedges, rushes, cattails)												
Gathering plants for fiber <i>Tilia</i> sp. (lime bast)												
Gathering plants for fiber <i>Clematis vitalba</i> (traveler's joy)												

This work has relied substantially on data of a qualitative nature to facilitate answering questions about the kind of people and plant relationships at the early farming site of La Draga. Both quantitative and qualitative data provide valuable information when undertaking to understand past people through the archaeological record. Each type of data offers possible answers to different questions that arise as we study the remains recovered from archaeological sites and it is difficult to have a comprehensive work without data analysis from both types of data (see table 34).

Table 34 - Comparison of qualitative and quantitative research

Brief Review of Data Type Contributions		
	Qualitative	Quantitative
Research questions	Answers how and why	Answers how many, how much, how often
Data analysis results	Understand, explain, interpret	Test hypothesis, make predictions
Types of Analysis	Patterns, characteristics, and themes identified	Statistical relationships identified
Expression of results	Largely descriptive	Largely numeric

6. Conclusion

The archaeological evidence strongly suggests the people of La Draga engaged in an intensive mixed farming strategy that included an intense and diverse exploitation of wild plants near the settlement (see figure 26).



Figure 26 - Neolithic intensive farming strategy

The initial goal of this work to develop a comprehensive database including the work of the many archaeobotanical researchers at La Draga across seven proxies was achieved. The expansion to include species/botanical information and ethnographic information on each taxon was both challenging and rewarding. Integrating the botanical, archaeobotanical, and ethnobotanical information permitted a comprehensive analysis of taxa found at the site. A palynology study of six Mediterranean sites including La Draga concluded that since the Neolithic and into the Bronze Age people adopted a diffuse pattern of land use with diverse activities taking place in the same area that often reflected the combination of field cultivation, animal breeding and activities to obtain timber, fuel, seeds, and fruits. This multifunctional exploitation of their relatively small areas was evidence of a strategy that reduced pressure on the environment of permanent settlements making the sedentary lifestyle sustainable (Mercuri et al., 2019). Regarding a better understanding of people plant relationships at the site, the effort to collect the many archaeobotanical studies into one database highlighted the diverse plant management strategies at La Draga, characterized by the complementarity of intensive mixed farming and wild plant acquisition strategies and the intense exploitation of a reduced catchment area made possible by the initial selection of a lakeside site with a rich floral offering across many ecozones. Eventually this intensive exploitation provoked major changes in the landscape resulting in degradation of the broadleaf deciduous forests.

The database created by combining the archaeobotanical work of the studies of seven proxies generated a large amount of data that merits further exploration and research. The actual processing of both domestic and wild plants at La Draga across multiple uses is another intriguing area of future research.

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Figures and tables

Figure 1 - Region studied. (Antolín and Jacomet, 2015).	10
Figure 2 - Map of sites dated to 5400-5000 cal BC referenced in figure 2 below (Antolín. 2013).....	12
Figure 3 - Proportion of wild and cultivated seed/fruit remains in charred state in the Neolithic record of the region (left). Proportion of wild and cultivated seed/fruit remains in waterlogged state in La Draga (right). (Antolín. 2013).	12
Figure 4 - Location of site, (Revelles, 2021).....	14
Figure 5 - Sectors and dates of excavations at La Draga, (Revelles, 2022).....	15
Figure 6 - La Draga wild fruit, beads of <i>Prunus cf. avium</i>	18
Figure 7 - La Draga crops (left to right) <i>Triticum sp./new type</i> , spikelet fork; <i>Hordeum distichum</i> , ear fragment; <i>cf. cerealia</i> , fragments of straw; <i>Triticum durum/turgidum</i> type, ear fragment; and <i>Papaver somniferum</i> , capsule fragment (Author: Antolín, 2014).....	18
Figure 8 - Objects and tools made from organic material: 1) rope; 2) spoon (<i>Quercus sp. caducifoli</i>); 3) sickle (<i>Buxus sempervirens</i>); 4) wooden comb (<i>Buxus sempervirens</i>); 5) Adze handle (<i>Pinus sp.</i>); 6) digging stick (<i>Buxus sempervirens</i>); 7) hook (<i>Buxus sempervirens</i>). (Palomo et al., 2011).	20
Figure 9- Basketry from La Draga	22
Figure 10 - Decoration/assembling adhesive applied to a marble bracelet La Draga (Rageot et al., 2021).....	23
Figure 11 - Fruiting bodies of <i>Ganoderma adspersum</i> . (Berihuete-Azorín et al., 2018).	24
Figure 12 - (A) <i>Daedalea quercina</i> , (B) <i>Daldinia concentrica</i> , (C) <i>Coriolopsis gallica</i> (Berihuete-Azorín et al., 2018).	24

Figure 13 - Percentage of Taxa by ecozone.	38
Figure 14 - Number of taxa by distance from the site.....	38
Figure 15 - Percentage of taxa by life cycle.....	39
Figure 16 - Archaeobotanical remains by type	48
Figure 17 - Preservation type percentages (pollen excluded).	48
Figure 18 - Percentages of plant parts harvested in summer.....	50
Figure 19 - Percentage of plant parts harvested in autumn.	50
Figure 20 - Percentages of plant parts harvested in spring.	51
Figure 21 - Percentages of plant parts harvested in winter.	51
Figure 22 - Percentages of total plant parts by season.	52
Figure 23- Taxa percentage by use	57
Figure 24- proposed view of ecozones after human degradation of landscape. (after Revelles, 2022).....	66
Figure 25 - Taxa percentages by proxy	67
Figure 26 - Neolithic intensive farming strategy	82
Table 1 - Ecozones with Distance from La Draga	26
Table 2 - Archaeobotanical Sources by Proxy	27
Table 3 - Plant and Fungi Remains Found at La Draga	29
Table 4 - Additional taxa (pollen only)	30
Table 5 - Family taxa count.....	32
Table 6 - Cultivars.....	32
Table 7 - Ruderals/Weeds	33
Table 8 - Pastures and Clearings	34
Table 9 - Deciduous Woods	34
Table 10 - Woodland edge/clearings.....	35
Table 11 - Mediterranean Woodland	35
Table 12 - Mountain Woodland	35
Table 13 - Riparian/lakesore	36
Table 14 - Aquatic.....	37
Table 15 - Diverse/Unknown	37
Table 16 – Identified fungi species	39
Table 17 - Fruits and seeds taxa	40
Table 18 - Charcoal taxa	43

Table 19 - Wood taxa	44
Table 20 - Resin	44
Table 21 - Fiber taxa	45
Table 22 - Pollen taxa.....	45
Table 23 - Plant part by harvest season(s) (taxa count)	49
Table 24 - List of taxa available by season	52
Table 25 - Taxa count by possible use	57
Table 26 - Taxa with known and possible uses (food, medicine, and other)	58
Table 27 - Taxa listed by known or possible use (raw material, fuel, building material, and fodder.	62
Table 28 - Taxa count by proxy	67
Table 29 - Contributions and challenges of Archaeobotanical Disciplines	69
Table 30 - Garden plants for medicine in modern Catalonia. Agelet, et al., 2000)	74
Table 31 - Taxa count by possible use(s).....	77
Table 32 – Seasonal Activity Calendar - Cultivars/Wild Plants for Food at La Draga	80
Table 33 – Seasonal Activity Calendar - Deciduous and Riparian Woodlands.....	81
Table 34 - Comparison of qualitative and quantitative research.....	82