Greece 2.0
NATIONAL RECOVERY AND RESILIENCE PLAN

GREENERGY

Resilient Vertical Forest Renovation of Reinforced Concrete Structures in Seismic Prone Areas

(H.F.R.I. Project Number 015376)

Catalog of plant species for VF buildings

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Project Principal Investigator	**Dr. Theodoros Rousakis**
Affiliation	**Democritus University of Thrace / Department of Civil Engineering**
Email	**trousak@civil.duth.gr**
Telephone	25410 79645, 461 / 6977421569
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Contributors	Aristotelis Zygouris, Maria Stefanidou, Katerina Vatitsi, Ifigeneia Theodoridou, Giorgos Mallinis, (AUTh) Theodoros Rousakis, Maristella Voutetaki, Adamantis Zapris (DUTh)

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Ίδρυμα / Τμήμα	**Δημοκρίτειο Πανεπιστήμιο Θράκης / Πολιτικών Μηχανικών**
Email	**trousak@civil.duth.gr**
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LIST OF ACRONYMS

WUE	Water-Use Efficiency
VOCs	Volatile Organic Compounds

ΠΕΡΙΛΗΨΗ

Το ερευνητικό έργο GREENERGY ακολουθεί τις πλέον πρόσφατες αντιλήψεις και εξελίξεις στον κατασκευαστικό τομέα, που αποσκοπούν σε ένα δομημένο περιβάλλον μηδενικής κατανάλωσης ενέργειας και ενός ουδέτερου αποτυπώματος άνθρακα, προκειμένου να προωθηθεί η «πράσινη συμφωνία» της ΕΕ.

Το ερευνητικό έργο GREENERGY έχει σκοπό να αναδείξει την χρηστικότητα και τη σημασία των κάθετων δασών για την άμβλυνση των επιπτώσεων των ακραίων καιρικών συνθηκών και την παροχή οικοσυστημικών υπηρεσιών από «πράσινα» ανακαινισμένα κτίρια, ακόμα και σε περιβάλλον υψηλής σεισμικότητας.

Το παρόν έγγραφο (Παραδοτέο D1.1) υλοποιείται στο πλαίσιο του πρώτου πακέτου εργασίας (WP1) του έργου, δηλαδή «Τυπολογίες κτιρίων με κάθετα δάση, οφέλη, διακινδύνευση από κινδύνους και βασικές παράμετροι για την ανακαίνιση προς ένα αστικό περιβάλλον υψηλής πράσινης πυκνότητας».

Ως εκ τούτου, το παρόν παραδοτέο προσδιορίζει την κατάλληλη βλάστηση και προτείνει μια ενιαία ταξινόμηση για την επιλογή της κατάλληλης βλάστησης για διάφορα κτίρια. Τελικός σκοπός είναι μια βάση δεδομένων (κατάλογος) ειδών της χλωρίδας για τα κτίρια που έχουν υιοθετήσει την παρέμβαση των κάθετων δασών.

Αρχικά, το παραδοτέο περιλαμβάνει μια επισκόπηση των απαιτήσεων των φυτών (τόσο περιβαλλοντικές όσο και διατροφικές απαιτήσεις), των χαρακτηριστικών και των οικοσυστημικών υπηρεσιών. Όσον αφορά τις οικοσυστημικές υπηρεσίες, αξιολογούνται ο καθαρισμός του αέρα, η ρύθμιση της θερμοκρασίας, η ενίσχυση της βιοποικιλότητας και οι αισθητικές και πολιτιστικές αξίες, που παρέχουν τα φυτά που χρησιμοποιούνται στην ανάπτυξη κάθετων πράσινων δασών.

Μετά από μια σύντομη περιγραφή των συστημάτων των πράσινων δασών (τοίχων), παρέχεται ένας λεπτομερής κατάλογος φυτών κατάλληλων για εκτεταμένους και εντατικούς πράσινους κάθετους τοίχους.

Στη συνέχεια παρουσιάζονται επίσης φυτά ανθεκτικά στην ξηρασία καθώς και αυτοφυή και ενδημικά ελληνικά φυτά.

Για κάθε φυτό που προσδιορίζεται, καταγράφονται οι ακόλουθες μεταβλητές και πληροφορίες:

- Όνομα φυτού
- Κοινή ονομασία
- Οικολογικά χαρακτηριστικά
- Περίοδος άνθησης
- Χρώμα των ανθέων
- Απαιτήσης άρδευσης
- Ύψος
- Εικόνα φυτού

SUMMARY

GREENERGY goes beyond the leading state of the art concepts in the area that aim mainly to produce nearly zero energy consumption and neutral carbon footprint within built environment in urban areas in order to promote the "green deal" while the real green nature itself is suppressed. Such an approach may satisfy merely mathematical indices and goals. However, it fails to revive natural growth in areas forests were once dominating, i.e. before urbanization. It holds down the decisive, that is natural mechanisms for sustainable environment of high air quality, controlled humidity, satisfaction and comfort for habitants.

GREENERGY envisions forest diffusion to alleviate extreme weather conditions impacts in coastal seismic urban regions and to optimize inclusive people-centric social engagement towards habitant comfort and satisfaction, through high-density urban forestation starting from green- renovated buildings. Based on the poor state of the art in the field of renovation towards vertical forests and the great necessity for their urgent development to really cope with detrimental climate change consequences and advance environmental resilience.

This document (D1.1) is developed within the framework of the first work package (WP1) of the project namely "Vertical Forest buildings typologies, benefits, hazard-dependent risks and key parameters for renovation towards high-density urban greening".

Therefore, this Deliverable identifies the suitable vegetation and proposes a unified taxonomy for classifying the various VF buildings' suitable vegetation and delivers a catalog of plant species for VF buildings.

Originally, the Deliverable includes an overview of plant requirements (both environmental and nutritional demands), traits and ecosystem services. In terms of ecosystems services, the air purification, thermal regulation, biodiversity enhancement, and aesthetical and cultural values, provided by plants used in green walls retrofitting are assessed.

Following a brief description of the green walls gardening systems, a detailed plant list of plants appropriate for extensive and intensive green walls is provided.

Subsequently drought-tolerant plants as well as native and endemic Greek plants are also presented.

For each plant identified, the following variables and information is recorded:

- Plant Name
- Common name
- Ecological Characteristics
- Flowering Period
- Flower Color
- Water Demand
- Height
- Plant image

1 INTRODUCTION

Green walls or vertical gardens have become one of the most innovative approaches to urban landscaping while bringing numerous advantages ecologically, aesthetically, and psychologically. Biophilic buildings not only contribute to the increase in visual value of the building; they also contribute much toward improvement in air quality, biodiversity creation, and thermal regulation.

Selection of appropriate plant taxa is vital for the sustainability and functional efficiency of green wall systems as identified by Safikhani et al. (2014). In a study, it has been shown that incorporation of greenery in the urban setup may result in improving the urban ecosystem and local climatic condition by providing biodiversity to the urban ecology as identified by Manso & Castro-Gomes (2015). Indeed, Kazemi et al. (2011) explains that most bird and insect species are attracted by vegetation since plants provide predictable microclimates which improve the strongly radiant power of the sun and strong winds.

Chiquet et al. (2013) demonstrated that green walls enhance the species of birds in the urban area because birds tend to use the climbing greeneries for feeding, nesting, and roosting. Bird visitor observation on green wall often favor the upper part because they are often covered with evergreen foliage cover due to the presence of more sheltering and protective opportunities, and also due to having a safe feeling during the whole year.

Kazemi et al. (2011) emphasized that the invertebrates of vegetative ecosystems represent a very important contribution to increasing urban biodiversity-more than vertebrates or vascular plants-and green walls are very significant in this sense. Most importantly, Madre et al. (2015) determined that living walls host a greater diversity of life compared to traditional green façades. For instance, a higher density of foliage within the Virginia creeper (Parthenocissus quinquefolia), usually used for green façades, can sustain higher invertebrates' density (Safikhani et al., 2014). Flowering species within planter boxes attract more invertebrates as well, so the biodiversity is even higher in those cases (Kazemi et al., 2011).

Evidence has shown that vegetative features in either urban areas or building structure have captivated human attention more dynamically compared to conventional gardens and are psychologically beneficial by way of stress reduction and combatting obesity Safikhani et al. (2014). Humans have always utilized green façades for aesthetic purposes; however, several recent studies have uncovered that these features add value to the real estate Ghazalli et al. (2018); Manso & Castro-Gomes (2015).

Externally, the building surfaces can be structurally deteriorated by the continuous impacts of solar radiation, changing ambient temperatures, acid rain, and air pollutants for a long period. Green façades and living walls offer the ability to shield these external surfaces, prolonging their useful lives and reducing the demands for refurbishments (CRCWSC, 2017).

In relation to arid settings, the green wall systems are preferred with native plant species due to their low irrigation need and potential to acclimatize with the prevailing environmental and climate settings. In the living wall systems in arid areas, the drought-tolerant plant species such as lightweight succulents may be useful during their low maintenance and limited irrigation requirement over the useful life, Manso & Castro-Gomes (2015) states. However, while the choice of species that supposedly would enhance thermal comfort is done, it is

expected that plants that can produce higher evapotranspiration rates are more desirable as stated by Razzaghmanesh & Razzaghmanesh, (2017). It then calls for a careful synchronization between the varied traits of the chosen species with the design objectives of the green wall.

Regarding green façade systems, climbing plants or creepers are a low-cost option that requires less maintenance, where these plants attach to structure vertical supports and give almost a full coverage of the façade surface area, as Safikhani et al. (2014) explained. However, in designing the system, the life-cycle of such plant types should be put into consideration since some species can have a low life span of 3 to 5 years and can grow to achieve a maximum height of between 5 and 25 meters (Manso & Castro-Gomes, 2015).

Plant species selection has always been a very critical factor in the sustainability and performance of green walls in this hot, dry summer and mild, wet winter Mediterranean climate. This guidebook is thus very necessary to help the landscape architect, urban planner, and enthusiastic garden hobbyist in choosing plants suitable for Mediterranean conditions to maximize all the potential benefits of a green wall.

The Mediterranean climate is typical not only in countries surrounding the Mediterranean Sea but also for Southern California and parts of Australia, having specific environmental peculiarities for vegetative development: high levels of solar radiation, limited summer rainfall, and pronounced seasonality with respect to plant water availability. Due to this, vegetation that has successfully adapted to this climatic type usually possesses drought resistance, temperature tolerance, and the ability to survive on well-drained substrates. Insight into these adaptations is of immense importance in the selection of species for green walls and, if selected properly, can thrive even in very unfavourable conditions.

Selection of plants in constructing green walls in the Mediterranean climate will be focused primarily on those species that are typically showing xerophytic traits, allowing them to store water within and therefore resistant to drought conditions. Regarding Mediterranean flora, many of the plant species have developed some strategies to save water by developing an extended root apparatus, succulent leaves, or by a waxy cuticle. These adaptations contribute not only to the robustness of plants but also to the total sustainability of the green wall system, reducing irrigation and maintenance requirements.

Besides, indigenous flora is preferred to help a lot in increasing biodiversity levels. Locally adapted species provide shelter and nutrition to local wildlife, from native pollinators and beneficial insects to larger animals, thus supporting a functioning ecosystem with its full range. Including diverse native plants in the design of a green wall can help create a dynamic, multifunctional space that supports the wildlife while enhancing the aesthetic values of an urban landscape.

In addition to the native vegetation, drought-tolerant cultivars and hybrid types, bred for better performance under Mediterranean climatic conditions, must be considered. Many of such plants offer desirable attributes such as striking colors, interesting textures, and longer flowering seasons that make them suitable for placement on green walls. A diverse range of such plants can therefore give the designer the opportunity to create an aesthetically interesting yet ecologically sound green wall that will go a long way in creating a resilient city.

Basic considerations in designing green walls for Mediterranean climates concern plant selection that is congruent with the distinct microclimates arising from the vertical structure. The intensity of sunlight, wind flow, and humidity between different areas of a green wall can be very disparate. It thus considers good acquaintance with the site-specific condition for

better positioning of plants. Plants sited in sunnier areas may require a more drought-resistant variety, while shaded spots will benefit more from types that retain more moisture.

Also, green wall maintenance requires so much planning and care in the Mediterranean region. Although many plants emanating from the Mediterranean have low maintenance ratings, to keep them in good condition they also need not to be neglected but cared for constantly by checking on their need for water, controlling infestation, and applying proper nutrition. Intelligent irrigation systems and the use of organic fertilizers can help enhance green wall sustainability so much as to thrive with minimum environmental impact.

Vegetation selection to be planted in green walls within the Mediterranean climatic zone can be rather complex, deep, and requires knowledge of both the physiological input of plants and the prevailing environmental conditions. A focus on native species and plants resistant to drought will help designers to realize bright and sustainable green walls, thereby improving urban aesthetic and contributing more to ecological well-being.

This handbook is an attempt to give an overview of the best flora species within Mediterranean climatic conditions, followed by detailed advice regarding installation and maintenance practices that will stand on behalf of your vertical garden's long-term sustainability.

2 PLANT REQUIREMENTS, TRAITS AND ECOSYSTEM SERVICES

2.1 PHYSIOLOGICAL TRAITS AND WATER-USE EFFICIENCY

Water-use efficiency (WUE) is the prime physiological attribute of plants over Mediterranean climates due to scarcity in water availability. Plants native to the Mediterranean have expressed high WUE, enabling them to optimize photosynthesis with minimal water loss. Species such as Olea europaea (olive tree) and Cistus spp. have, over the evolutionary course, developed mechanisms for enhancing WUE by stomatal regulation. These plants tend to close their stomata during the hours of high intensity of the day to avoid transpiration and thus save water (e.g., Gallé et al. 2011; Gómez-Bellot et al. 2023; Ferrara et al. 2023). Apart from exhibiting a high WUE, plants native to the Mediterranean region typically possess extensive and deep root architectures. Species such as Quercus ilex and Arbutus unedo, commonly referred to as the strawberry tree, can tap into deeper soil moisture, which renders them well-suited for green wall systems characterized by restricted substrate depth (Babington et al., 2023). Their capacity to thrive with limited water availability makes these species particularly advantageous for extensive green walls, especially in contexts where irrigation is constrained.

2.1.1 Environmental and Nutritional Demands

Mediterranean plants are generally adapted to poor soil conditions, which is favorable for green walls due to the limited substrate volume. A big number of Mediterranean species have a symbiotic relationship with mycorrhizal fungi that enhance nutrient uptake, especially phosphorus. For example, the *Thymus vulgaris*, commonly known as thyme, and Salvia officinalis, known as sage, are popular for their survival conditions in poor nutrient conditions and hence are considered potential candidates for extensive green walls, which do not require high maintenance (Varela-Stasinopoulou et al., 2023).

About light demand, most *of the* Mediterranean plants prefer full sun and fare very well during the time it is available. Species such as *Helichrysum italicum* commonly known as curry plant and *Santolina chamaecyparissus* known as cotton lavender require high levels of light to maintain compact growth forms and to produce their specific fragrance oils. Some species, however, such as *Cyclamen hederifolium (*ivy-leaved cyclamen*)* tolerate shade and it is possible to use them in greening wall where light is not as abundant *(Codola, 2014)*.

Water requirements by Mediterranean flora are relatively low because most plant species developed high degrees of drought tolerance. These species like *Lavandula spp.* and *Rosmarinus officinalis*, which have deep root systems and water storage capacities, have a lesser demand for water, which will make them highly suitable for large-scale green walls that might need less frequent watering (Esfahani et al., 2022).

2.1.2 Ecosystem Services Provided by Mediterranean Plants

Mediterranean plants may provide a number of ecosystem services: air purification, thermal regulation, biodiversity, and aesthetics, which would make them a greening wall system of high value.

2.1.2.1 Air Purification

Mediterranean plants are effective at capturing airborne particulate matter (PM), which is a key service in urban environments with high levels of pollution. Species such as *Rosmarinus officinalis* and *Lavandula angustifolia* have dense foliage that can trap PM on their leaf surfaces, helping to improve air quality in cities (Hozhabralsadat et al., 2022). Additionally, these plants

can absorb volatile organic compounds (VOCs), further contributing to the reduction of air pollution (Leotta et al., 2023).

2.1.2.2 Thermal Regulation

Green walls have substantial benefits regarding thermal control by reducing the surface temperatures of buildings via various mechanisms such as shading and evapotranspiration. The succulent species, such as *Sedum album* and *Sedum sediforme*, cool the surrounding atmosphere even more efficiently because of the higher rates of evapotranspiration. These cooling effects contribute to reducing the urban heat island effect and make the urban areas more pleasant by subsequently reducing energy use associated with cooling (e.g., Kuronuma and Watanabe, 2017).

2.1.2.3 Biodiversity Enhancement

Extensive green walls can enhance urban biodiversity by providing habitats for pollinators, birds, and beneficial insects. Mediterranean plants such as *Euphorbia characias* (Mediterranean spurge) and *Arbutus unedo* are known for attracting pollinators like bees and butterflies, while also offering food resources and shelter for birds. This contributes to a more balanced ecosystem in urban areas, promoting biodiversity and ecological resilience (Babington et al., 2023).

This process of green wall gardening enhances the opportunity for flora rarity maintenance through the inclusion of several species that are in the list of threatened species due to urban expansion and degradation of habitat. It forms part of the world's hotspots of biodiversity due to the high density of endemism-that is, plants native only within the area-which plants Middle East and North Africa share in common (Quézel & Médail, 2003). Their introduction to urban vertical gardens would go toward preserving at least genetic material but also to raise social awareness about such distinctive regional flora. Such an example of an endemic species that could be used in the walls of green houses for conservation and public awareness-raising towards Mediterranean biodiversity protection could be the shrub *Sarcopoterium spinosum*, originating in the Eastern Mediterranean Myers et al. (2000). This is very important for metropolitan areas where green infrastructure can serve as a living laboratory in the interests of education and conservation of biodiversity.

2.1.2.4 Aesthetic and Cultural Value

Their aesthetic value is central in linking the social and cultural connections to the natural environment, aside from the ecological contributions provided by indigenous and endemic species. Indeed, the Mediterranean region has a rich botanical heritage with many species that are integrally connected with the cultural and historical identity of the region (Pignatti, 2002). Aromatic herbs like *Thymus vulgaris* and *Salvia officinalis* add not only aesthetic value but also fragrance that uplifts the senses in city spaces. Consequently, such features have a significant cultural convention that enhances the well-being of the community and the level of social interaction, especially in the most populous areas (Papafotiou et al. 2013).

Integration of distinct native species in the design of green walls allows urban areas to reflect the natural beauty and botanical identity of the region, building a place and sense of identity in the rapidly urbanizing environment Talhinhas et al., 2023. The cultural aspect is the least considered in most urban greening efforts but plays a very important role in the development of an environment that is relatable to the community and can encourage interaction with green infrastructure.

3 GREEN WALLS GARDENING SYSTEMS

They can be broadly categorized into two types of green walls: a) extensive green walls and b) intensive green walls. A Mediterranean climate is characterized by hot, dry summers and mild, wet winters; thus, it provides different opportunities and challenges regarding the greening of building walls. This paper analyses different systems of green walls, their design considerations, and plants that best adapt under Mediterranean environmental conditions.

3.1 EXTENSIVE GREEN WALLS

Extensive green walls have recently received growing attention for their potential contribution to urban greening, offering several advantages such as improving air quality, reducing the heat island effect in cities, and enhancing biodiversity. Species choice is paramount for the performance and functioning of green walls, especially under Mediterranean climatic conditions with hot and dry summers and temperate, wet winters. Those specific climatic and ecological features met within this area would, therefore, favor those species adapted to water stress, high light intensity, and poor soil conditions.

Extensive green walls are, however, light systems wherein the planting modules have a shallow profile. These systems, therefore, are designed for supporting low-growing vegetation that is drought-resistant, hence suitable for the Mediterranean climate. The substrate in the extensive systems is less than 15 cm deep, which seriously restricts the choice of plant species. Common traits among them include low maintenance requirements and lower irrigation needs of the extensive green walls, thus favorable for the water supply-limited regions (Dunnett & Kingsbury, 2008).

In areas with Mediterranean climates, for example, quite tall vertical gardens can be created using a wide range of succulent plants, sedums, and other plants that do not require much water. These plants are unusually well adapted to local climatic conditions and can thrive with low water input. Thus, *Sedum spp*., *Delosperma spp*., and many local Mediterranean herbs like thyme (*Thymus spp*.) and oregano (*Origanum spp*.) are unusually well-suited for use in extensive vertical gardens (see e.g., Yildirim and Özden 2018, Dover, 1986).

Figure 1 Characteristic images from extensive green wall gardening. Direct greening system (a), indirect greening system (b), indirect greening system combined with planter boxes (c). (Source: Perini et al., 2013).

3.2 INTENSIVE GREEN WALLS

Intensive green walls are much deeper, greater than 15 centimeters, and can support a great range of plant species, from shrubs to small trees. These systems are heavier, demand stronger structural backing, and maintenance but are capable of hosting a wider variation of design options and vegetation, according to Perini et al. 2013. However, the intensive green

wall systems may employ an irrigation system that can host richer plant species which can also host flowering species and small fruitful species.

In a Mediterranean climate, an intensive green wall can host a variety of plants that thrive during the warm, dry summers. Such plants may include flowering perennials like lavender (Lavandula spp.) and rosemary (Rosmarinus officinalis), complemented by Mediterranean fruit trees such as dwarf citrus varieties. Beyond aesthetic appeal, this layer of vegetation will bring greater biodiversity and provide habitat for pollinators (see e.g., Bosch et al. 1997, Simón-Porcar et al. 2018).

Figure 2 Intensive green wall gardening (Bosco Verticale, Milan).

3.3 DESIGN CONSIDERATIONS FOR GREEN WALLS

Several factors come into consideration in designing the green wall system, particularly in the Mediterranean climate.

a) **Irrigation**: This is highly required due to the dry summer season of the area. For both the extensive and intensive farming systems, drip irrigation is often recommended because this method provides water to the immediate roots of plants, which reduces loss through evaporation (Raimondo et al., 2015).

b) **Microclimate**: The orientation of the green wall itself could substantially influence plant growth. While south-facing walls are inclined to receive more sunlight and heat, which might be perfect for thermophilous species and could need supplementary irrigation; north-facing walls can allow shade-tolerant species to thrive on them (Savi et al., 2015).

c) **Soil and Substrate**: The choice of substrate is critical for plant health. In Mediterranean climates, a lightweight, well-draining substrate that retains some moisture is ideal. The substrate should also be rich in organic matter to support plant growth (Chenot et al., 2017).

Species for greening walls in the Mediterranean region need to be chosen for drought tolerance, aesthetics, and ecological benefit. Recommended plant categories are as follows:

i. **Succulents and Cacti**: These plants are well adapted to dry conditions and require minimal water. Species such as Echeveria, Agave, and various cacti can thrive in extensive green wall systems.

ii. **Herbs**: Mediterranean herbs are extremely drought-tolerant while providing many culinary benefits. Thyme, rosemary, and sage (Salvia spp.) are exceptional choices and can thrive under both extensive and intensive production systems.

iii. **Flowering Perennials**: Ornamental flowering perennials such as lavender, salvia, and gaura add beauty and color to complement the attraction of pollinators and thus enhance biodiversity within intensive green walls where such species have been integrated.

iv. **Dwarf Shrubs**: These can be very useful in intensive green wall systems, providing structure and year-round greenery, ranging from things like boxwood (Buxus spp.) through to dwarf citrus trees.

v. **Native Plants**: In order to optimize the ecological added value of the green wall, native Mediterranean plants could be used. Plants like rockrose (Cistus spp.) and most wildflowers are adapted to the local conditions and support native wildlife (see e.g., Maloupa et al. 2005, Chimona & Rhizopoulou 2018).

4 PLANT SELECTION FOR GREEN WALLS

4.1 EXTENSIVE GARDENING

Plants from the Mediterranean region represent a series of specific adaptations enabling them to bear harsh environmental conditions. Most of these adaptations are mainly directed towards resisting drought conditions and living on nutrient-poor soils. Ecosystems of Mediterranean-type are characterized by pronounced seasonality in rainfall, given by extensive periods of summer drought and a brief period when water is available, during winter.

Xerophytes are one of the most important plant groups in Mediterranean climate regions, and have evolved specific mechanisms that reduce water loss. For example, plants like *Lavandula angustifolia* (lavender) and *Rosmarinus officinalis* (rosemary) have small, thick, and waxy leaves to reduce transpiration (Leotta et al. 2023). The *Sedum spp*., commonly used in green walls, on the other hand, are succulent plants because they store water in leaves to withstand dry periods (Esfahani et al., 2022).

Other Mediterranean plants, represented by the group of halophytes, are adapted to saline conditions and therefore represent a very good candidate for green walls in urban environments where the soil may be saline. Species like *Atriplex halimus* (saltbush) can tolerate high salinity levels, offering resilience against such adverse conditions in the soil (Belkheiri and Mulas, 2013).

As mentioned earlier, plants native to the Mediterranean region are adapted to survive with limited water through their deep roots and effective water storage capacities. However, plants do require supplemental irrigation while getting established, especially those on extensive green wall installations where the substrate is easily dried due to its shallow depth.

In Table 1~~Table 1~~, characteristic and common plants suitable for extensive green wall gardening in Mediterranean regions are presented

Table 1 Common plants suitable for extensive green wall gardening in Mediterranean regions.

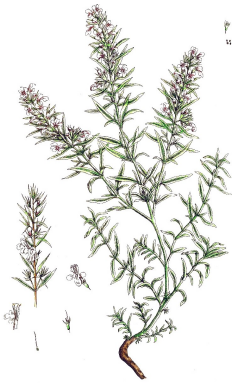
Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Lavandula angustifolia	English Lavender	Drought tolerant, prefers well-drained soils, attracts pollinators	June - August	Purple	Low	Low	
Rosmarinus officinalis	Rosemary	Evergreen, drought tolerant, aromatic, suitable for poor soils	March - May	Pale Blue	Low	Low	
Sedum acre	Stonecrop	Succulent, highly drought tolerant, grows in rocky and poor soil	May - July	Yellow	Very Low	Very Low	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Thymus vulgaris	Thyme	Aromatic, thrives in dry, well-drained soils, attracts pollinators	April - June	Pink/Purple	Low	Low	
Helichrysum italicum	Curry Plant	Drought tolerant, prefers sandy or rocky soils, aromatic, evergreen	June - August	Yellow	Low	Low	
Euphorbia characias	Mediterranean Spurge	Drought tolerant, thrives in rocky and well-drained soils, semi-evergreen	March - May	Yellow-Green	Low	Medium	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Drosanthemum floribundum	Ice Plant	Succulent, drought tolerant, thrives in poor soils, ideal for vertical planting	May - September	Pink	Low	Low	
Jasminum fruticans	Wild Jasmine	Climbs or spreads, drought tolerant, prefers rocky soils	April - June	Yellow	Low	Medium	
Pelargonium peltatum	Ivy-leaved Geranium	Drought tolerant, ideal for vertical gardening, prefers well-drained soils	May - October	Pink/Red/White	Medium	Medium	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Teucrium chamaedrys	Wall Germander	Evergreen, drought tolerant, thrives in rocky, well-drained soils, attracts pollinators	July - September	Pink	Low	Medium	
Santolina chamaecyparissus	Cotton Lavender	Drought tolerant, aromatic, prefers sandy soils, attracts pollinators	July - August	Yellow	Low	Low	
Artemisia absinthium	Wormwood	Drought tolerant, prefers poor, dry soils, aromatic	July - September	Yellow	Low	Low	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Verbena officinalis	Common Verbena	Tolerates dry soils, attracts pollinators, medicinal uses	June - October	Pink/Purple	Medium	Medium	
Ceratostigma plumbaginoides	Leadwort	Ground-cover, drought tolerant, prefers well-drained soils, ideal for walls	August - October	Blue	Low	Low	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Satureja montana	Winter Savory	Evergreen, aromatic, thrives in dry, rocky soils, attracts pollinators	July - September	White/Pink	Low	Low	
Atriplex halimus	Saltbush, Mediterranean saltbush	Drought-tolerant and salt-tolerant, thrives in nutrient-poor, saline soils, prefers sandy, alkaline, and saline soils	May–August	Yellow-green	Low	Low	

4.2 INTENSIVE GARDENING

Intensive green wall systems differ from extensive ones by their ability to accommodate a wider variety of plant species due to the use of deeper substrates, better irrigation systems, and more frequent maintenance. Mediterranean plants, with their characteristic adaptations to hot, dry climates and poor soils, are ideal candidates for such systems. This article explores the selection of Mediterranean plants for intensive green walls, highlighting their ecology, physiology, environmental and nutritional demands, as well as the ecosystem services they provide.

For intensive gardening, we can mainly use climbers, however the deeper substrate (where technical specifications allow) can also support sclerophyllous shrub and tree species, characterized by tough, leathery leaves that resist desiccation. *Quercus ilex* (holm oak) and *Pistacia lentiscus* (mastic tree) are examples of sclerophyllous plants that are well-suited for intensive green walls because they can withstand dry conditions and retain their foliage year-round, ensuring visual interest even during the dry summer months (Leotta et al., 2023).

In Table 2~~Table 2~~, the most commonly used climbers are presented, alongside ecological and nutrition information. Trees and shrubs for extensive green walls are presented in separate tables that follow in the next paragraphs.

Table 2 Most common pant climbers, suitable for intensive green wall gardening in Mediterranean regions.

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Campsis radicans	Trumpet Vine	Vigorous climber, tolerates heat, prefers moist but well-drained soils	June - September	Orange/Red	Medium	Medium	
Hedera helix	English Ivy	Evergreen climber, tolerates shade and drought, adaptable to various soils	Year-round	N/A (Foliage)	Low	Medium	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Bougainvillea glabra	Bougainvillea	Heat and drought tolerant, prefers well-drained soils, ideal for warm climates	June - October	Purple/Pink	Low	Low	
Clematis montana	Mountain Clematis	Deciduous climber, prefers fertile, moist soils, attracts pollinators	April - May	Pink/White	Medium	High	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Lonicera japonica	Japanese Honeysuckle	Fast-growing, drought tolerant, attracts pollinators	June - September	White/Yellow	Medium	Medium	
Trachelospermum jasminoides	Star Jasmine	Evergreen, fragrant flowers, tolerates partial shade, prefers well-drained soils	May - July	White	Medium	Medium	
Ficus pumila	Creeping Fig	Evergreen climber, fast-growing, tolerates heat, prefers well-drained soils	N/A (Foliage)	N/A (Foliage)	Medium	Medium	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Wisteria sinensis	Chinese Wisteria	Deciduous climber, prefers moist, well-drained soils, highly ornamental	April - May	Purple/Blue	Medium	Medium	
Passiflora caerulea	Passionflower	Evergreen climber, tolerates drought, prefers moist soils, attracts pollinators	June - October	Blue/Purple	Medium	Medium	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Jasminum officinale	Common Jasmine	Deciduous to evergreen, prefers well-drained soils, highly fragrant flowers	June - September	White	Medium	Medium	
Plumbago auriculata	Cape Leadwort	Drought tolerant, prefers well-drained soils, attracts pollinators	July - September	Blue	Low	Medium	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Solanum jasminoides	Potato Vine	Evergreen climber, fast-growing, prefers moist, well-drained soils	June - September	White	Medium	Medium	
Pandorea jasminoides	Bower Vine	Evergreen climber, prefers well-drained soils, thrives in sun and shade	Summer	Pink/White	Medium	Medium	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Nutrient Demand	Plant image
Muehlenbeckia complexa	Maidenhair Vine	Evergreen climber, adaptable to different soil types, tolerates drought	N/A (Foliage)	N/A (Foliage)	Low	Medium	
Lonicera periclymenum	Common Honeysuckle	Deciduous climber, tolerates various soil types, attracts pollinators	June - August	White/Pink	Medium	Medium	

4.3 DROUGHT-TOLERANT PERENNIALS, SUITABLE FOR MEDITERRANEAN CLIMATES

By necessity, species selection in designing a living wall for the Mediterranean climate should contribute to the biodiversity and resilience of the whole garden, besides putting up with drought. A mix of herbaceous plants, succulents, and climbing species will be used to provide year-round interest and stand up to the worst of weather conditions. Besides, they are insulating and cooling the surroundings of buildings, hence reducing energy consumption, and are therefore eco-friendly in an urban context. Selection of perennials that are drought tolerant must be very judicious since green walls in the Mediterranean climatic conditions have hot dry summers and mild wet winters. These are complemented by a wide variety of flora that can adapt to such conditions, making them apt choices for vertical gardens and ensuring ecological sustainability and visual appeal.

The best options include herbaceous perennials such as Lavandula (Lavender), Santolina chamaecyparissus (Lavender Cotton), and Euphorbia characias (Mediterranean Spurge). These are considered good specimens of Mediterranean plants which have adapted to soil and water conditions in their native habitats characterized by well-drained ground with little water. For example, lavender bears aromatic foliage with bright purple-colored flowers that are very attractive to pollinators like bees and butterflies. Being quite drought tolerant once established, this makes it apt for the green wall, where water conservation is paramount.

Succulents are excellent candidates that best suit Mediterranean-style green walls, especially those from the Sedum species. Their thick, swollen leaves store water, which allows them to go for long periods without much water and maintenance. They add texture and interesting elements to a green wall*—*from sedums that form a mat on the ground to upright types.

The most drought-tolerant woody shrubs include Cistus (Rockrose) and Spartium junceum (Spanish Broom). Of these, Rockrose is particularly drought tolerant and brings colored, papery flowers to the landscape through summer while Spanish Broom bears fragrant yellow blooms that may rise to 10 feet in height to provide height and visual structure to a green wall.

In addition, the vertical elements from climbers such as Bougainvillea and Hedera helix enhance the green wall in terms of vertical scale by shading large areas for a meager water requirement. Bougainvillea has bright pink or purple bracts and is able to thrive under very dry, hot conditions, being well resistant to the extreme summer conditions of the Mediterranean region.

In the following table (Table 3~~Table 3~~), a list of common, drought-tolerant plants, suitable for Mediterranean climates is provided, to guide plant selection for green wall gardening.

Table 3. Drought-tolerant plants, suitable for Mediterranean climates.

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Lavandula angustifolia	English Lavender	Aromatic, prefers well-drained soils, attracts pollinators	June - August	Purple	Low	30-60 cm	
Echinacea purpurea	Purple Coneflower	Attracts pollinators, tolerant of poor soils, thrives in dry conditions	July - September	Purple	Low	60-120 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Achillea millefolium	Yarrow	Thrives in poor soils, attracts pollinators, medicinal uses	June - September	White/Pink/Yellow	Low	30-90 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Salvia officinalis	Common Sage	Aromatic herb, drought tolerant, thrives in dry, well-drained soils	May - July	Purple/Blue	Low	30-60 cm	
Sedum spectabile	Stonecrop	Succulent, drought-tolerant, thrives in rocky soils	August - October	Pink	Very Low	30-60 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Gaura lindheimeri	White Gaura	Prefers well-drained soils, tolerant of drought, blooms profusely	June - September	White/Pink	Low	60-100 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Verbena bonariensis	Tall Verbena	Attracts pollinators, thrives in well-drained soils, long blooming period	July - October	Purple	Low	90-150 cm	
Coreopsis verticillata	Threadleaf Coreopsis	Thrives in poor, dry soils, attracts pollinators, long flowering season	June - September	Yellow	Low	30-60 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Agapanthus africanus	African Lily	Tolerates dry, rocky soils, beautiful blue or white flowers	July - September	Blue/White	Low	60-90 cm	
Helianthemum nummularium	Rock Rose	Evergreen, thrives in rocky and dry soils, attracts pollinators	May - July	Pink/Yellow/White	Low	15-30 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Phlomis fruticosa	Jerusalem Sage	Evergreen shrub, drought-tolerant, thrives in rocky, well-drained soils	April - July	Yellow	Low	60-100 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Perovskia atriplicifolia	Russian Sage	Drought-tolerant, aromatic, attracts pollinators	July - October	Blue	Low	90-120 cm	
Erigeron karvinskianus	Mexican Daisy	Thrives in dry, well-drained soils, blooms profusely, attracts pollinators	May - October	White/Pink	Low	15-30 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Nepeta faassenii	Catmint	Aromatic, thrives in dry soils, attracts pollinators	May - September	Purple	Low	30-45 cm	

4.4 NATIVE AND ENDEMIC GREEK PLANTS

The integration of indigenous and endemic Greek flora in the practice of green wall gardening within Greece offers diverse ecological and aesthetic benefits. Being identified as a Mediterranean biodiversity hot spot, Greece boasts a wide range of plant species, many of which are endemic to this part of the world (Dimopoulos et al. 2013). Including native species in green wall systems is crucial for local biodiversity, enhancement of ecosystem services, and sustainability in urban areas (Maloupa et al., 2005). Greek flora such as Cistus creticus, Pistacia lentiscus, and Origanum vulgare are better adapted to the Mediterranean climate's rigorous conditions, as they are highly resistant to drought and poor nutrient soil conditions. They are the best option for the green wall systems due to their low maintenance and less water consumption.

In this sense, the inclusion of endemic species in green wall gardening contributes significantly to the preservation of the unique flora of Greece, a large portion of which is threatened because of habitat destruction and climate change. The Balkan Peninsula harbors a significant number of endemic species, adding up to the exceptionally rich biodiversity of the region (see e.g., Tan and Iatrou 2001, Dimopoulos et al. 2013). These plant species integrated into urban green walls enhance their chances of survival, while acting as habitats for pollinators and other forms of wildlife, boosting urban biodiversity. Besides, local plants are adapted to the given environmental conditions, thus making unnecessary all kinds of external inputs in terms of fertilization or the use of pesticides, hence creating more sustainable cultivation.

Besides their ecological importance, native Greek flora and endemic species can contribute even more to the aesthetics of green walls: for example, species like Lavandula stoechas and Thymus capitatus add not just visual variation due to their remarkable flowers but also provide fragrant oils, thus providing a sensory environment that enriches urban spaces (Halevy, 2005). These plants contribute key ecological benefits, mostly linked to air quality improvement by trapping dust and other pollutants, besides mitigation of the urban heat island effect through their evapotranspiration processes.

In this connection, the selection of native and endemic species for green walls ensures that, when developing ecofriendly city landscapes in Greece, its rich botanical heritage will also be preserved. This falls under global sustainability targets that include using native species in landscape design in order to assure biodiversity and the resilience of ecosystems

In the following tables (Table 4, Table 5 and Table 6), lists of native perennials, herbs and shrubs / trees are presented, respectively, alongside ecological information and relevant images. These lists provide indicative gardening material for green walls, however, local and regional endemics can be also selected after the in-situ gardening studies.

Table 4 Native Greek perennials plants for green walls.

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Sideritis syriaca	Greek Mountain Tea	Endemic to Greece, thrives in rocky and poor soils, medicinal and aromatic herb	June - August	Yellow	Low	20-40 cm	
Origanum vulgare	Greek Oregano	Aromatic herb, drought-tolerant, prefers well-drained soils, culinary uses	June - September	White/Pink	Low	30-60 cm	
Centaurea raphanina	Cretan Cornflower	Endemic to Crete, thrives in rocky and dry soils, attracts pollinators	April - June	Purple	Low	30-50 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Phlomis fruticosa	Jerusalem Sage	Evergreen shrub, drought-tolerant, thrives in rocky, well-drained soils	April - July	Yellow	Low	60-100 cm	
Dianthus fruticosus	Shrubby Carnation	Native to rocky habitats, thrives in dry, poor soils, attracts pollinators	May - August	Pink	Low	20-40 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Acanthus spinosus	Spiny Bear's Breeches	Tolerates dry, rocky soils, thrives in partial shade, architectural foliage	May - July	White/Pink	Low	100-150 cm	
Stachys cretica	Cretan Lamb's Ear	Drought-tolerant, prefers rocky and well-drained soils, silvery foliage	May - July	Purple	Low	30-60 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Iris unguicularis	Winter Iris	Thrives in dry, rocky soils, blooms in winter, prefers well-drained soils	December - March	Purple/Blue	Low	20-40 cm	
Euphorbia acanthothamnos	Spiny Spurge	Native to rocky habitats, thrives in poor soils, drought-tolerant, semi-evergreen	March - May	Yellow-Green	Very Low	30-60 cm	
Verbascum macrurum	Greek Mullein	Prefers dry, well-drained soils, attracts pollinators, thrives in full sun	June - August	Yellow	Low	50-100 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Salvia fruticosa	Greek Sage	Aromatic, drought-tolerant, thrives in dry, rocky soils, medicinal and culinary uses	May - July	Purple/Blue	Low	60-100 cm	
Crocus sieberi	Sieber's Crocus	Endemic to Greece, thrives in rocky and poor soils, blooms in early spring	February - March	Purple/White	Low	5-10 cm	
Artemisia arborescens	Tree Wormwood	Aromatic shrub, drought-tolerant, thrives in poor soils, silver-gray foliage	N/A (Foliage)	N/A (Foliage)	Low	100-150 cm	

Plant Name	Common name	Ecological Characteristics	Flowering Period	Flower Color	Water Demand	Height	Plant image
Campanula celsii	Greek Bellflower	Endemic to rocky habitats, thrives in poor soils, attracts pollinators	June - August	Blue/Purple	Low	30-60 cm	
Helichrysum orientale	Eastern Strawflower	Drought-tolerant, prefers rocky and poor soils, aromatic, evergreen	June - September	Yellow	Low	20-40 cm	

Table 5 . Native Greek herbs for green walls.

Herb Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Origanum vulgare	Greek Oregano	Drought-tolerant, thrives in well-drained soils, attracts pollinators	Culinary, medicinal, aromatic	June - September	White/Pink	Low	30-60 cm	
Salvia fruticosa	Greek Sage	Aromatic, drought-tolerant, thrives in rocky soils, attracts pollinators	Culinary, medicinal, aromatic	May - July	Purple/Blue	Low	60-100 cm	

Herb Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Sideritis syriaca	Greek Mountain Tea	Endemic to Greece, thrives in rocky, poor soils, medicinal herb	Medicinal, tea herb	June - August	Yellow	Low	20-40 cm	
Thymus vulgaris	Common Thyme	Drought-tolerant, prefers well-drained soils, attracts pollinators	Culinary, medicinal, aromatic	April - June	Pink/Purple	Low	20-40 cm	

Herb Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Rosmarinus officinalis	Rosemary	Evergreen, drought-tolerant, thrives in dry, poor soils, attracts pollinators	Culinary, medicinal, aromatic	March - May	Pale Blue	Low	50-150 cm	
Mentha pulegium	Pennyroyal	Thrives in moist, but well-drained soils, spreads easily	Culinary, medicinal, aromatic	July - September	Purple	Medium	30-60 cm	

Herb Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Melissa officinalis	Lemon Balm	Prefers well-drained soils, aromatic herb, attracts pollinators	Culinary, medicinal, aromatic	June - September	White	Medium	30-60 cm	
Foeniculum vulgare	Fennel	Thrives in dry, poor soils, attracts pollinators, highly aromatic	Culinary, medicinal, aromatic	June - September	Yellow	Low	150-200 cm	

Herb Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Anethum graveolens	Dill	Thrives in well-drained soils, prefers sunny spots, aromatic	Culinary, medicinal	June - September	Yellow	Medium	40-60 cm	
Crocus sativus	Saffron	Native to northern Greece, thrives in well-drained soils, valuable for culinary uses	Culinary (spice)	October - November	Purple	Low	10-30 cm	

Herb Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Levisticum officinale	Lovage	Thrives in well-drained, fertile soils, highly aromatic	Culinary, medicinal	July - August	Yellow-Green	Medium	150-200 cm	
Ruta graveolens	Common Rue	Drought-tolerant, thrives in dry soils, aromatic, historically used medicinally	Medicinal, aromatic	June - September	Yellow	Low	60-90 cm	

Herb Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Mentha spicata	Spearmint	Thrives in moist, well-drained soils, aromatic, attracts pollinators	Culinary, medicinal, aromatic	June - August	Purple	Medium	30-60 cm	

Table 6. Native Greek shrubs and trees for green walls.

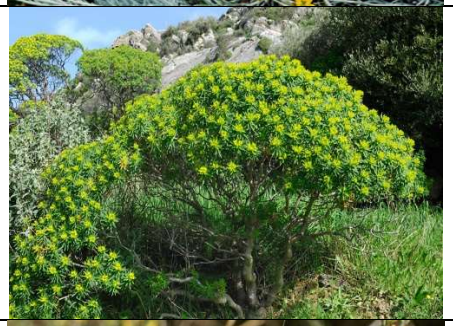
Shrub Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Phlomis fruticosa	Jerusalem Sage	Drought-tolerant, thrives in rocky, well-drained soils, attracts pollinators	Ornamental, medicinal	April - July	Yellow	Low	60-100 cm	
Cistus creticus	Cretan Rockrose	Thrives in dry, rocky soils, drought-tolerant, evergreen, attracts pollinators	Ornamental, medicinal	April - June	Pink	Low	60-90 cm	

Shrub Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Arbutus unedo	Strawberry Tree	Evergreen, drought-tolerant, thrives in poor soils, produces edible fruit	Ornamental, edible fruits	October - December	White/Pink	Low	200-500 cm	
Spartium junceum	Spanish Broom	Drought-tolerant, thrives in poor, rocky soils, fast-growing, fragrant flowers	Ornamental, erosion control	May - July	Yellow	Low	150-300 cm	
Pistacia lentiscus	Mastic Tree	Evergreen, drought-tolerant, thrives in poor soils, aromatic resin (mastic)	Ornamental, resin production	March - May	Yellow-Green	Low	100-300 cm	

Shrub Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Quercus coccifera	Kermes Oak	Evergreen, drought-tolerant, thrives in rocky, poor soils, provides wildlife habitat	Ornamental, wildlife value	April - May	Greenish	Low	200-400 cm	
Quercus ilex	Holm Oak	Evergreen, adapting well to a range of conditions including poor, dry, and rocky soils. It is highly drought-tolerant, making it suitable for arid environments	Ornamental, wildlife value	March-May	Yellow-Green	Low	15-25 m	
Olea europaea	Olive tree	Evergreen, Drought-tolerant, Prefers well-drained soils, Attracts pollinators like bees	Produces olives for oil and consumption, Ornamental landscaping, Wood is valued for furniture and crafts	May-June	White - cream-colored - green	Low	4-9m	

Shrub Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Vitex agnus-castus	Chaste Tree	Drought-tolerant, thrives in sandy and rocky soils, attracts pollinators	Ornamental, medicinal	June - September	Purple	Low	100-250 cm	
Lavandula stoechas	French Lavender	Evergreen, drought-tolerant, thrives in well-drained soils, highly aromatic	Ornamental, aromatic	March - May	Purple	Low	30-90 cm	
Calicotome villosa	Hairy Thorny Broom	Drought-tolerant, thrives in poor, rocky soils, nitrogen-fixing, wildlife habitat	Erosion control, wildlife	March - May	Yellow	Low	100-200 cm	

Shrub Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Rhamnus alaternus	Italian Buckthorn	Evergreen, drought-tolerant, adaptable to various soils, wildlife-friendly	Ornamental, erosion control	March - May	Greenish-White	Low	200-400 cm	
Myrtus communis	Common Myrtle	Evergreen, drought-tolerant, aromatic, thrives in poor soils, attracts pollinators	Ornamental, aromatic	June - August	White	Low	100-200 cm	
Bupleurum fruticosum	Shrubby Hare's Ear	Drought-tolerant, thrives in rocky soils, evergreen, attracts pollinators	Ornamental, wildlife value	June - September	Yellow-Green	Low	100-250 cm	

Shrub Name	Common name	Ecological Characteristics	Uses	Flowering Period	Flower Color	Water Demand	Height	Plant image
Helichrysum italicum	Curry Plant	Drought-tolerant, thrives in rocky, well-drained soils, aromatic, evergreen	Ornamental, aromatic	June - August	Yellow	Low	30-60 cm	
Euphorbia dendroides	Tree Spurge	Deciduous, highly drought-tolerant, thrives in rocky soils, striking foliage	Ornamental	March - June	Yellow-Green	Very Low	150-200 cm	
Genista acanthoclada	Thorny Broom	Drought-tolerant, thrives in rocky, poor soils, nitrogen-fixing, attracts pollinators	Erosion control, wildlife	April - June	Yellow	Low	100-200 cm	

5 CONCLUSIONS

Green walls/forests can be categorized into two primary types: (a) extensive and (b) intensive green walls.

Extensive green walls are lightweight systems that typically consist of shallow planting modules. These walls are designed to support low-growing, drought-tolerant plants, making them suitable for Mediterranean climates

Intensive green walls, in contrast, have a deeper substrate and can support a wider variety of plants, including shrubs and small trees. These systems require more structural support and maintenance but offer greater design flexibility and biodiversity

Mediterranean plants exhibit specific adaptations that enable them to thrive in harsh environmental conditions. These adaptations are primarily related to drought tolerance and the ability to survive in nutrient-poor soils. Mediterranean ecosystems are shaped by seasonal rainfall patterns, where plants must endure prolonged periods of drought during summer and exploit brief windows of moisture availability in winter.

Overall, in this report we provide a list of sixteen plants suitable for extensive green wall gardening in Mediterranean regions and fifteen plants suitable for extensive green wall gardening in Mediterranean regions.

In addition, we propose fourteen common, drought-tolerant plants, suitable for Mediterranean climates, to guide plant selection for green wall gardening.

Finally, fourteen native Greek perennials plants, thirteen native Greek herbs and seventeen native Greek shrubs and trees for green walls are provided.

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