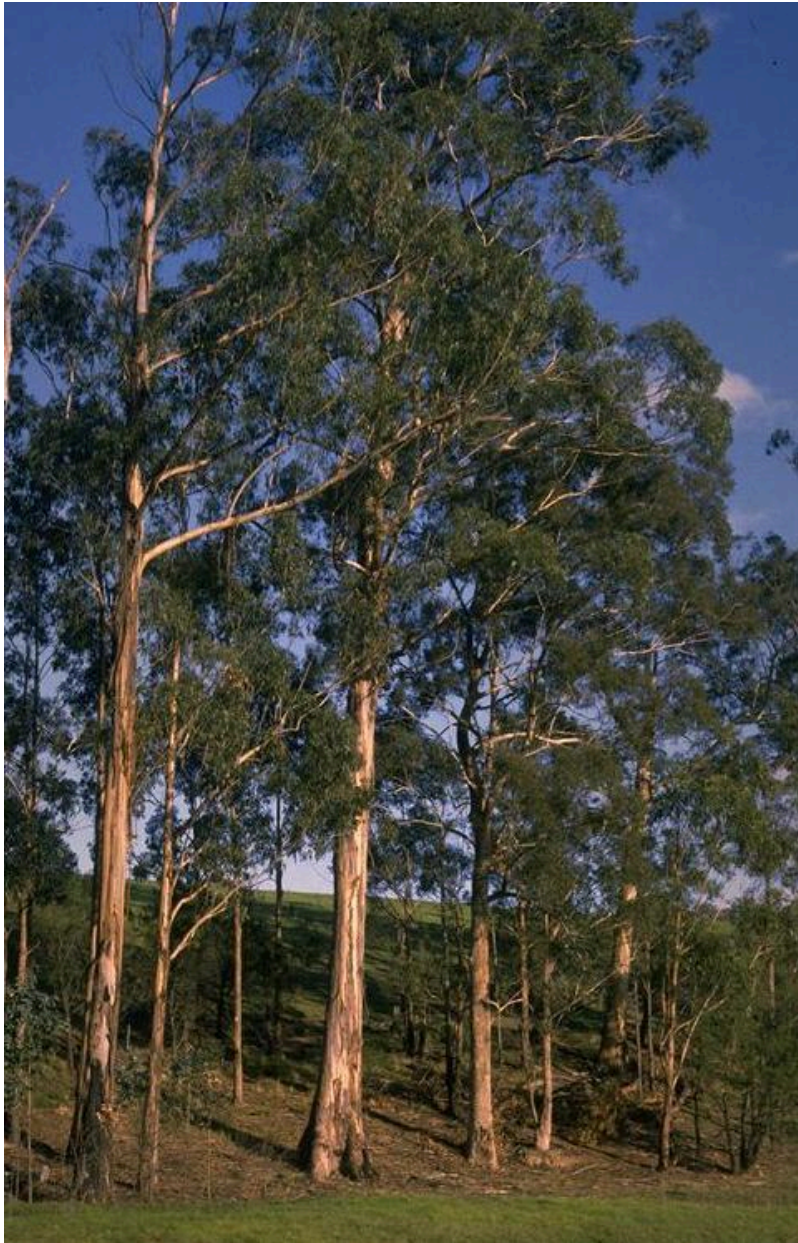


Eucalyptus globulus Labill.



Pablo Juan Karaman

Colegio Bolivar

Table of Contents

Chapter 1: Introduction.....	3
Chapter 2: Agroecology.....	5
2.1 TAXONOMY.....	5
2.2 Fossil record.....	9
2.3 Origin of the plant.....	10
2.4 Current distribution.....	11
2.5 Ecological Region.....	12
2.6 Climate and Light Preferences.....	12
2.7 Soils and Geology.....	13
2.8 Water Requirements.....	14
2.9 Light and Temperature Regimes.....	14
Chapter 3: Biology.....	15
3.1 Chromosome Complement.....	15
3.2 Life cycle and phenology.....	16
3.2.1 Life cycle.....	16
3.2.2 Phenology.....	17
3.3 Reproductive Biology.....	17
3.3.1 Pollen.....	17
3.3.2 Sexuality.....	18
Chapter 4: Propagation and management.....	19
4.1 Natural regeneration.....	19
4.2 Vegetative regeneration.....	20
4.3 Nursery propagation.....	21
4.4 Cuttings.....	21
4.5 Plantings.....	22
4.6 Management of pests and diseases.....	23
4.7 Pests and diseases control.....	23
4.8 Cultivation.....	23
4.9 Fertilizing.....	24
4.10 Growth stages.....	24
4.11 Fruiting.....	24
4.12 Harvesting.....	25
4.13 Pruning- re-planting.....	25
Chapter 5: Importance, markets, and uses.....	26
5.1 Importance.....	26
5.2 Markets.....	26
5.3 Uses.....	27
References.....	28

Chapter 1: Introduction

Eucalyptus globulus, commonly known as Tasmanian blue gum, is one of the most widely planted tree species in the world due to its fast growth, adaptability, and multiple economic uses. Native to southeastern Australia, especially Tasmania and nearby coastal regions, this species has expanded far beyond its original habitat and is now cultivated in countries across Europe, South America, Africa and Asia. This wide distribution shows that *Eucalyptus globulus* is not only ecologically adaptable but also highly valuable in global agricultural and forestry systems.

One of the main reasons for its importance is rapid growth and high biomass production which make it ideal for industries such as paper, timber, and essential oils. In many countries, it is used in large scale plantations because it can produce wood faster than many native species. This means that it plays a key role in meeting industrial demand while also reducing pressure on natural forests. However, this rapid growth and adaptability also raise ecological concerns, especially in non native regions where the species may compete with local vegetation or alter soil and water conditions.

From a biological perspective, *Eucalyptus globulus* is also an interesting species because of its reproductive strategies and ability to survive in different environments. It reproduces mainly through seeds, which are efficiently dispersed by the wind, but it can also regenerate vegetatively through resprouting after disturbance such as fire or cutting. This combination of reproductive strategies allows the species to recover quickly and maintain stable populations even in

challenging conditions. This explains why it is so commonly found in fire prone ecosystems and managed plantations

In addition, The species shows clear adaptations to specific environmental conditions, including preferences for well drained soils, moderate temperatures and high light availability. These factors influence its growth, distribution, and productivity, making it important to study not only its biological characteristics but also its ecological requirements. Understanding these conditions is essential for optimizing cultivation and ensuring sustainable management practices.

This monograph will analyze *Eucalyptus globulus* from multiple perspectives, including its taxonomy and agroecology, its biological characteristics, and its propagation and management systems. By examining how the species grows, reproduces, and interacts with its environment, it is possible to understand both its advantages and its limitations in agricultural and ecological contexts. This is important because it allows for better decision making in plantation management, conservation and sustainable resource use.

Chapter 2: Agroecology

2.1 TAXONOMY

Botanical Authority

The accepted name is *Eucalyptus globulus* Labill. The abbreviation *Labill.* Refers to Jacques-Julien Houtou de Labillardière (1755–1834), a French botanist. He described the species in *Relation du Voyage à la Recherche de la Pérouse* (1800), based on samples collected in Tasmania during the d'Entrecasteaux expedition (1791–1793). Labillardière is recognized as the official authority for this species. (*USDA Plants Database Plant Profile General*, n.d.)

Labillardière was one of the first European botanist to study the flora of Australia and the south of the pacific, making important contributions to plant taxonomy. His description of *Eucalyptus globulus* gave the species its official scientific name and placed it in the wider plant classification (Duyker, 2011). In taxonomy, the author citation “*Labill.*” is important because it gives credit to him and prevents confusion with other names that may have been used.

According to the ICN, Labillardière’s name is accepted because it is the earliest correct description. This makes the name legitimate and consistent for scientists. Today, *Eucalyptus globulus* is one of the most known eucalyptus species, used worldwide for medicine, paper, and essential oils, and the accepted authority “*Labill.*” remains significant in relation to agricultural writing (Skinner, n.d.). (*USDA Plants Database Plant Profile General*, n.d.).

Table 1*Taxonomic hierarchy of Eucalyptus globulus*

TAXONOMIC RANK	TAXON NAME (AUTHORITY)	HIERARCHY EXPLANATION
Kingdom	<i>Plantae</i> - Plants	Broadest category, includes all plants
Subkingdom	<i>Tracheobionta</i> - Vascular plants	Plant with special tissues for water and nutrient transport.
Superdivision	<i>Spermatophyta</i> - Seed plants	Plants that reproduce through seeds.
Division	<i>Magnoliophyta</i> - Flowering plants	Plants that produce flowers and fruits with seeds enclosed.
Class	<i>Magnoliopsida</i> - Dicotyledons	Flowering plants with two seed leaves.
Subclass	<i>Rosidae</i>	A major line of dicotyledons that include roses and related plants.
Order	<i>Myrtales</i>	An order of flowering plants including myrtles and related families.
Family	<i>Myrtaceae</i> Juss. - Myrtle family	A family of aromatic plants with essential oils, including <i>Eucalyptus</i> , guava and clove.
Genus	<i>Eucalyptus</i> L'Hér. - gum	A genus of evergreen trees and shrubs native to Australia and its surrounding regions.
Species	<i>Eucalyptus globulus</i> Labill. - Tasmanian bluegum	A fast-growing <i>Eucalyptus</i> species, widely cultivated for timber, pulp and oil.

Note: table data collected from USDA plant database (*USDA Plants Database Plant Profile General*, n.d.)

Taxonomic setting

Kingdom: *Plantae*

Eucalyptus globulus belongs to the kingdom plantae. Every member of this kingdom is made of many cells, has cellulose walls, and produces its own food through photosynthesis (Dickinson et al., 2025).

Subkingdom: *Tracheobionta*

Vascular plants have special transport systems, which move water and food through the plant. This feature allows them to grow larger and live in many distinct environments (*USDA Plants Database Plant Profile General*, n.d.).

Superdivision: Spermatophyta

Seed plants reproduce with seeds, which protect and feed the young seeds. This group includes both gymnosperms and angiosperms (Judd et al., 2015,).

Division: Magnoliophyta

Flowering plants, also known as angiosperms, produce flowers and fruits that contain the seeds. They are the largest and unique group of plants (*Phylum MAGNOLIOPHYTA - Herbarium Virtual Ifac - Generalitat Valenciana*, n.d.).

Class: Magnoliopsida

Such plants usually have two seed leaves, veins in the leaves that form like a net pattern, and flower parts in fours or fives. *Eucalyptus globulus* shows their traits (*USDA Plants Database Plant Profile General*, n.d.).

Order: Myrtales

Myrtales are flowering plants that often contain aromatic oils, have opposite leaves, and flowers with floral cups. Most are shrubs or trees adapted to warm weather (*Myrtales | Description, Families, Characteristics, & Natural History*, n.d.).

Family: Myrtaceae

The Myrtaceae family is recognized for green leaves with oil glands and flowers that usually have many stamens. Some important members are Myrtus, Guava, and *Eucalyptus* (Tornhill et al., 2015,).

Genus: *Eucalyptus*

The genus *Eucalyptus* has over 700 species of trees, mostly native to Australia. They grow fast, they are very important ecologically, and are planted worldwide for timber and oils (Dean, 2024).

Species: *Eucalyptus globulus*

At the species level, *Eucalyptus globulus* is called the Tasmanian Bluegum. It has long, curved leaves, soft bark that peels off in parts, and it can grow up to 70 meters tall. It is grown for its wood, pulp, and essential oils, all over the world. (Skinner, n.d.).

2.2 Fossil record

The fossil record of the Myrtaceae family, which *Eucalyptus* belongs to, shows that this group has an ancient origin. Fossilized pollen grains named Myrtaceidites have been found in sediments from late periods, suggesting that members of this family already existed more than 60 million years ago (Thornhill & Macphail, 2012,). These fossils have been found in regions that were once part of the supercontinent Gondwana from the times of Pangea, which included Australia, Antarctica, and South America, which supports the claim that the Myrtaceae family originated in the Southern Hemisphere and spread when pangea happened.

More specific evidence of the *Eucalyptus* genus comes from fossil discoveries in Patagonia, Argentina, at a site called Laguna del Hunco. These fossils, including leaves, flowers, and even fruits, date to about 52 million years ago (Gandolfo et al., 2011). Remarkably, these fossils are almost identical to living species of *Eucalyptus* in Australia, which means that it was already a different genus by that time.

This discovery also changes the idea that *Eucalyptus* evolved only in Australia. Instead, it shows that ancient *Eucalyptus* trees grew in Thai terrains before South America and Australia became separate continents. However, there are no known fossils of *Eucalyptus globulus*. The fossils belong to other extinct species of the genus, like *Eucalyptus* Patagonia, but they help us understand that *Eucalyptus globulus* and its relatives evolved from a very old species that existed millions of years ago (Hermsen et al., 2012,).

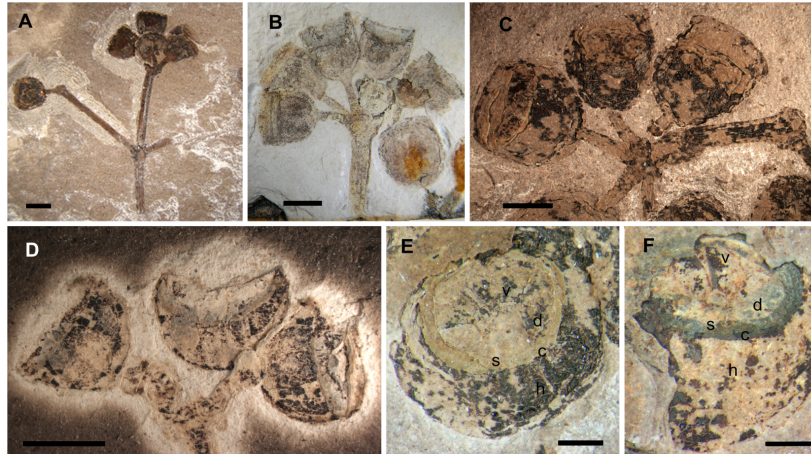


Figure 1: Oldest Known Eucalyptus Macrofossils Are from South America (Gandolfo et al., 2011)

2.3 Origin of the plant

Eucalyptus globulus, commonly known as Tasmanian blue gum, originated in southeastern Australia, mainly off the island of Tasmania and the near coasts of Victoria and New South Wales (Yost et al., 2021,). The species was first described by Jacques-Julien Houtou de Labillardière in 1800, based on specimens collected during the d'Entrecasteaux expedition (1791–1793). The fossils found in South America do not mean this species started here, they only show that ancient *Eucalyptus* trees lived across Gondwana. Modern *Eucalyptus globulus* evolved later in Australia from those older relatives (Gandolfo et al., 2011). Its natural home is the cool, coastal forests of Tasmania, where it is still native today.

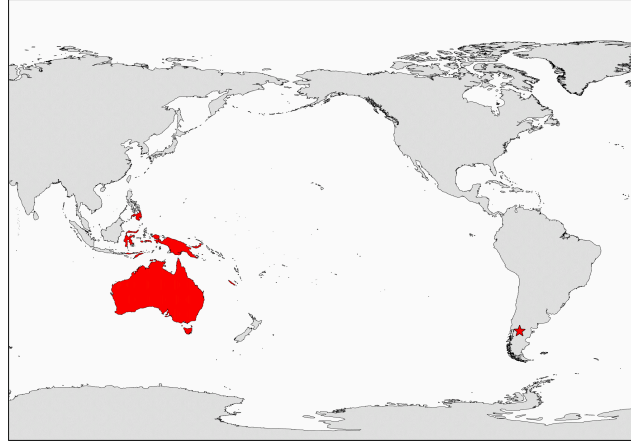


Figure 2: Oldest Known Eucalyptus Macrofossils Are from South America (Gandolfo et al., 2011)

2.4 Current distribution

Today *Eucalyptus globulus* grows in many countries around the world. It is one of the most widely planted trees because it grows fast and is useful for making paper, timber and essential oils. It grows naturally in Tasmania and southeastern Australia, but it has been planted in Mediterranean countries like Portugal and Spain, and also in Brazil, Chile, Uruguay, South Africa, India, and China (Ball, 1993.). These countries have large *Eucalyptus* plantations and are major producers of pulp and wood from this tree.

2.5 Ecological Region

Eucalyptus globulus naturally grows in moderate and subtropical regions of southeastern Australia, mainly on the island of Tasmania and along the coasts of Victoria and New South Wales (Yost et al., 2021,). Its native environment includes moist, cool forests in the coast and low mountain slopes, sometimes near rivers or valleys where soils are deep and well-developed. This species often prefers areas with neutral temperatures and medium to high rainfall, typically between 600-1200 mm per year (Boland et al., 2006,).

These forests are part of the temperate broadleaf evergreen biome, these are not tropical or desert regions. In its natural habitats, *Eucalyptus globulus* often grows with other tall *Eucalyptus* and forms open forests or mixed woodlands. It is not a weak species, instead it is a dominant canopy tree, reaching up to 70 meters in height under good conditions. The blue gum also shapes the forest structure and provides habitat for many birds and mammals.

2.6 Climate and Light Preferences

In terms of climate *Eucalyptus globulus* prefers temperate zones with relatively pleasant winters and warm summers. It does not tolerate frozen temperatures or very dry, dry conditions for long periods (Ball, 1993,). Optimal growth occurs in areas with an average temperature between 10°C and 20°C, though mature trees can handle lower temperatures. Because the species evolved in open, shore and hilly areas, it grows best in direct sunlight rather than shaded places.

This need for sun and medium rainfall explains why *Eucalyptus globulus* has adapted to Mediterranean climates in places like Spain and Portugal. These areas are very similar to the conditions of Southeastern Australia with cool winters and dry warm summers. In its natural habitat, the tree helps regulate soil moisture and protects fire adapted ecosystems, as its thick bark and healing ability allow it to recover after wildfires. (Yost et al., 2021,) (Ball, 1993,).

2.7 Soils and Geology

Eucalyptus globulus naturally grows in deep, drained soils found in Tasmania and southeastern Australia. These soils usually come from dolerite, granite, or sandstone rocks, which create soils that have pores and are loose, that let water and air enter and move easily around the roots. This species prefers slight acid soils with pH between 5.0 and 6.5, which are common in areas with lots of rainfall where minerals are washed away (Araújo, 2009,).

The tree has deep roots that reach nutrients in the lower layers of the soil and form mutually beneficial relationships between plants and fungi; these relationships help absorb nitrogen and phosphorus, nutrients that are often missing in poor soils (Araújo, 2009,). It does best in soils with moderate organic matter and soils that have good drainage, and it does not tolerate salty or waterlogged soils.

In its native regions, the geology provides the right mineral balance and depth for strong growth. Similar conditions explain why *Eucalyptus globulus* grows well in plantations in Chile, Portugal, and Brazil, which have climates and soils like southeastern Australia (Ball., 1993,).

2.8 Water Requirements

Eucalyptus globulus needs a fairly high amount of water to grow well. In many plantation settings, annual water use approaches the rainfall amount because the trees use water efficiently and grow fast (White et al., 2021,). This means that during warm, dry months the trees are vulnerable if rainfall drops or their watering is interrupted for more than a few weeks. Young trees benefit from monthly rainfall or extra watering during spring and summer, meanwhile mature trees with deep roots can manage dry periods better. Good water management practice includes having well drained soils, avoiding waterlogging, and monitoring soil humidity during the dry season, (Ball, 1993,).

2.9 Light and Temperature Regimes

Eucalyptus globulus grows in full sunlight and does not perform well in shade environments because it is naturally a canopy tree in open forest. Research shows that the best temperature for photosynthesis in *Eucalyptus globulus* changes depending on the season, but does not do well in climates above 25°C in conditions that are not native to the tree (Crous et al., 2013,). This suggests that the species is better in climates with medium temperatures in the day that go from 15°C to 25°C and with good light, rather than hot tropical climates. Because the tree evolved in cool temperate zones with mild summers, young plants are more sensitive to extreme heat and long high nighttime temperatures. Ensuring strong light exposure and avoiding really long heat stress improves growth and productivity.

Chapter 3: Biology

3.1 Chromosome Complement

Eucalyptus globulus has been traced with the chromosome complement $2n=22$, meaning that it possesses 22 chromosomes in its somatic cells (11 pairs). This is a common count across many *Eucalyptus* species, despite some reported instances of 20 or 24, often due to chromosomal breaks. (Li et al., 2025)

3.2 Life cycle and phenology

3.2.1 Life cycle

Eucalyptus globulus reproduces mainly through sexual reproduction, starting when the tree produces flowers from November to April in places like California, with the strongest flowering in February and March (Skolmen & Ledig, 1990,). Each flower bud has a cap (Called an operculum) that falls off, so the stamens can open and allow pollination by insects, birds and other animals that are attracted to the nectar. After pollination and fertilization, the tree forms a hard woody capsule that takes about 11 months to mature. When these capsules dry and open, they release the seed, which is mostly spread by the wind. The seeds germinate quickly if they have enough light and moisture, and the seedlings grow bluish, waxy juvenile leaves that can last for more than a year. Trees usually start producing their own seeds at around 4–5 years old, and large seed crops appear every 3–5 years. Besides sexual reproduction, *Eucalyptus globulus* can also regrow by sprouting strongly from the trunk after being cut or after a fire. On good sites, seedlings can reach 1 meter in 6 months, 2 meters in 1 year and 4 meters in 2 years, eventually becoming mature trees. This combination of seed production and strong sprouting allows *Eucalyptus globulus* to survive well in plantations, spread near forests, and recover quickly after fires.

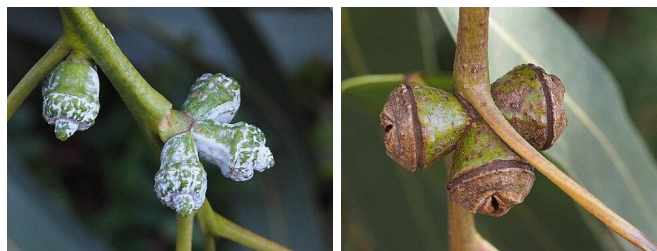


Figure 1: flower bud cap (operculum) Left new, right mature

3.2.2 Phenology

Eucalyptus globulus shows clear seasonal growth patterns, influenced by temperature and rainfall. In mediterranean climates like california, flowers mainly from november to april, in the cooler and water season (Skolmen & Ledig, 1990,). In tropical areas like Hawaii, flowering can occur all year around, but it is usually the strongest in the late winter or even early spring. After pollination happens, the woody fruits take about 10 to 12 months to mature, and seeds are released soon after ripening, especially in dry conditions. Vegetative growth is most active during warm periods with enough soil moisture and slows during cold and dryer seasons. Younger trees are often sensitive to cold weathers, but the resistance increases as they mature (Skolmen & Ledig, 1990,).

3.3 Reproductive Biology

3.3.1 Pollen

Eucalyptus globulus produces many small, tri-colporate grains, typical of the Myrtaceae (Thornhill & Macphail, 2012,). The flowers have numerous stamens that release large amounts of pollen and give the flower its brush-like shape (Skolmen & Ledig, 1990,).

It is mainly pollinated by insects, especially bees. The pollen is usually released before the stigma is receptive, which promotes cross pollination. Fossil pollen such as Myrtacidites shows that the pollen type from Myrtaceae dates back to the paleogene (Thornhill & Macphail, 2012,).

3.3.2 Sexuality

Eucalyptus globulus is monoecious, meaning that each tree has bisexual flowers with both male and female organs (Skolmen & Ledig, 1990,). Each flower contains many stamens that produce pollen and one pistil that develops into a woody capsule after fertilization.

Chapter 4: Propagation and management

4.1 Natural regeneration

Eucalyptus globulus regenerates naturally mainly through seed production, which allows it to spread efficiently in both natural forests and plantation environments. The tree produces a large number of small seeds in the environment. These seeds are mainly dispersed by wind, which allows them to travel short to moderate distances and colonize open areas, especially after disturbances such as fire or land clearing (Skolmen & Ledig, 1990). The tree produces a large number of small seeds stored inside woody capsules, (**Figure 1**), which open when dry and release the seeds into the environment. Natural regeneration is particularly successful in environments with high light availability, because *Eucalyptus globulus* does not tolerate shade during its early stages. Optimal germination occurs in mid to warm temperatures between 15°C and 25°C which are typically of the temperature climates where the species naturally grows, southeastern Australia and Tasmania (Boland et al., 2006). Soil conditions are also critical since seeds require well drained soils to avoid waterlogging, which can reduce oxygen availability and negatively affect root development (FAO, 1993). At the same time, sufficient soil moisture is necessary during the early stages of germination and seedling growth (Skolmen & Ledig, 1990).



Figure 1: Seeds from the *Eucalyptus globulus* (The Pepper Pantry, s.f.)

4.2 Vegetative regeneration

Besides seed based regeneration, *Eucalyptus globulus* has a strong ability to regenerate vegetatively through resprouting. After disturbances such as fire, cutting or mechanical damage, the tree can produce new shoots from the base of the trunk or from lignotubers, which are specialized structures that store energy and nutrients (Boland et al., 2006). This ability is especially important in fire prone environments, as it allows the tree to recover quickly even when the aerial part is damaged (Skolmen & Ledig, 1990). This means that the species can

maintain its presence in ecosystems that experience frequent disturbances, making it highly resilient (FAO, 1993).

4.3 Nursery propagation

Nursery propagation is widely used in commercial plantations to ensure higher survival rates and more uniform growth (FAO, 1993). Seeds are collected from mature capsules and planted under controlled conditions where temperature, moisture and light can be regulated (Skolmen & Ledig, 1990). Germination typically occurs within one to two weeks when conditions are optimal, which shows that the species has a relatively fast early development (Boland et al., 2006). Seedlings are usually grown until they reach a height of about 20-30 cm before being transplanted into the field, as the size provides greater resistance to environmental stress (FAO, 1993)

4.4 Cuttings

Eucalyptus globulus can also be propagated through cuttings, although this method is less common than seed propagation, cuttings are usually taken from young, actively growing shoots and treated with rooting hormones to improve root formation, as clearly seen in **Figure 2**. This Method allows the production of genetically identical plants, which is useful in plantations where specific traits such as fast growth or disease resistance are desired (Hartmann et al., 2011). However it requires controlled conditions and more management, which makes it less widely used in large scale production (FAO, 1993).

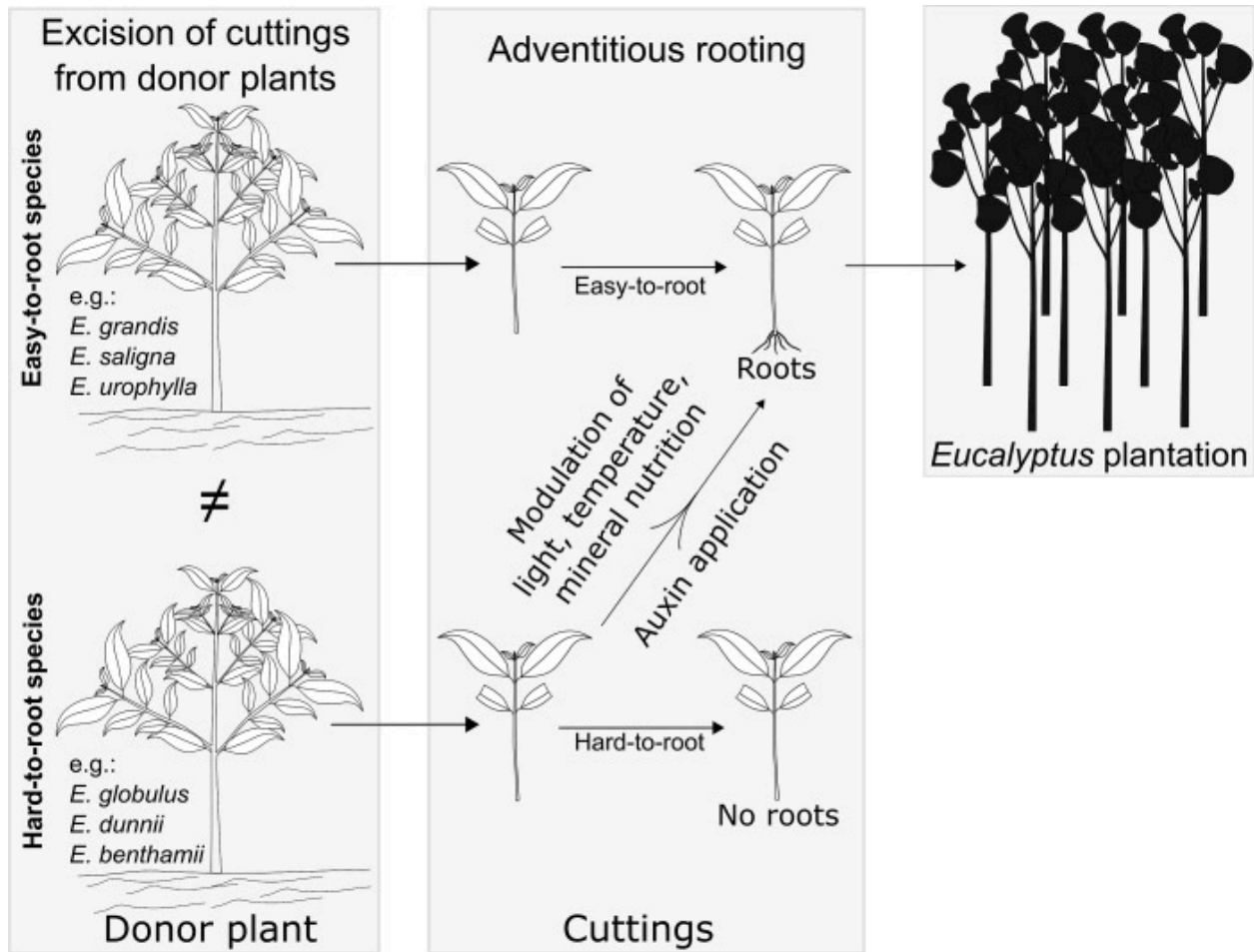


Figure 2: Diagram that shows how cuttings work for *Eucalyptus globulus* (Jonathan, 2019)

4.5 Plantings

Planting *Eucalyptus globulus* is usually done at the beginning of the rainy season to ensure that seedlings have enough water during establishment. Proper site preparation is essential, including soil loosening and removal of competing vegetation as this reduces competition for nutrients and water (FAO, 1993). Spacing between plants typically ranges between 2 to 4 meters depending on the purpose of the plantation and the desired growth conditions (Boland et al., 2006).

4.6 Management of pests and diseases

Eucalyptus globulus is relatively resistant to many pests and diseases, but it can still be affected under certain conditions, particularly in dense plantations. Common issues include fungal diseases such as leaf spots and root rot, as well as insect pests like beetles and caterpillars (Boland et al., 2006). These problems tend to increase in environments with high humidity and low air circulation, which create favorable conditions for pathogen development (FAO, 1993)

4.7 Pests and diseases control

Effective pest and disease control involves a combination of different strategies including cultural biological and chemical methods (FAO, 1993). Cultural practices such as pruning, proper spacing and removal of infected material help reduce the spread of pathogens (Boland et al., 2006). Biological control methods can be used to manage insect populations by introducing natural predators while chemical treatments are generally reserved for severe cases (FAO, 1993).

4.8 Cultivation

Eucalyptus globulus is widely cultivated because of its fast growth and adaptability to different environments. It grows best in temperate climates with moderate rainfall and full sunlight, which allows for high photosynthetic activity and rapid biomass production (Boland et al., 2006). This species prefers deep well drained soils and does not tolerate waterlogged or saline conditions, which can limit root development and overall growth (FAO, 1993). During early stages, practices such as weeding and soil management improve establishment (Skolmen & Ledig, 1990).

4.9 Fertilizing

Fertilization can significantly improve growth, especially in soils that are low in nutrients.

Fertilizers are usually applied during the early stages of development, when the plant has the highest demand for nutrients (FAO, 1993). The main nutrients required are nitrogen, phosphorus and potassium, which support root development, leaf production and overall plant growth.

However excessive fertilization should be avoided as it can lead to imbalances in growth and reduced efficiency (Boland et al., 2006).

4.10 Growth stages

The growth of *Eucalyptus globulus* follows several stages, including germination, seedling establishment, rapid vegetative growth and maturity. During the first year, growth is particularly fast, with seedlings reaching significant heights under favorable conditions (Skolmen & Ledig, 1990). As the plant matures, growth slows and more resources are allocated to structural development and reproduction. This pattern of rapid early growth explains why the species is widely used in commercial plantations (Boland et al., 2006)

4.11 Fruiting

Fruiting occurs after the flowering stage, when fertilized flowers develop into woody capsules that contain numerous seeds (Skolmen & Ledig, 1990). These capsules take several months to mature and eventually dry and open, releasing the seeds (Boland et al., 2006). This process ensures continuous regeneration of the species and contributes to its ability to spread in suitable environments (FAO, 1993).

4.12 Harvesting

Eucalyptus globulus is harvested mainly for timber, pulp and essential oils, depending on the production system (FAO, 1993). In pulp production, trees are often harvested at a younger age to maximize fiber quality and growth efficiency (Boland et al., 2006). Harvesting is typically done by cutting the tree near the base, which can also stimulate regrowth in some cases. Proper management of harvesting cycles is important to ensure sustainability and continuous production (Skolmen & Ledig, 1990).

4.13 Pruning- re-planting

Pruning is an important practice used to improve tree structure and increase productivity, especially in timber plantations (Boland et al., 2006). By removing unnecessary branches, the tree can allocate more resources to vertical growth, improving wood quality. Re-planting is carried out after harvesting or when productivity declines, allowing for continuous production and the introduction of improved plant material. This ensures that plantation systems remain efficient over time (FAO, 1993).

Chapter 5: Importance, markets, and uses

5.1 Importance

Eucalyptus globulus is one of the most widely planted eucalyptus species in the world because of its fast growth and high wood productivity. It is especially important in countries such as Portugal, Spain, Chile, Brazil, and Australia, where large plantations supply raw material for the production of pulp and paper industry (FAO, 1993). In some regions, like Portugal and Chile, it is a major forestry crop that contributes significantly to the local economy, providing employment, supporting forest industries, and generating export revenue. Its adaptability to different climates and soils has made it one of the most important plantation trees in the world (White et al., 2021,).

5.2 Markets

The market for *Eucalyptus globulus* is largely driven by the pulp and paper industry. Wood from plantations is commonly exported as pulp or processed into paper products, especially from countries with large commercial plantations. Although a large part of production is exported, the species is also used domestically in many countries for fuelwood and other forestry products.

Because of the strong demand for paper, packaging materials, and biomass energy, *Eucalyptus globulus* remains an important commercial species in international markets. (White et al., 2021,).

5.3 Uses

Eucalyptus globulus is used for several products, Its wood is mainly processed into pulp for paper production, which is its most important industrial use. It is also widely used as fuelwood and charcoal because it burns efficiently and produces good quality charcoal (FAO, 1993). In addition, the leaves are used to extract eucalyptus essential oil, which is used in medicines, cosmetics, and cleaning products. The flowers are also important for honey production, and the trees are commonly planted as windbreaks, erosion control plantings, and biomass energy sources.

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