

Eucalyptus and Corymbia Species for Mulchwood, Pulpwood, Energywood, Bioproducts, Windbreaks, and/or Phytoremediation¹

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Introduction

In Florida, *Eucalyptus* species grow faster than our native tree species. *E. grandis* (EG), *E. grandis* x *E. urophylla* (EH), *E. benthamii* (EB), and *E. amplifolia* (EA), in particular, are fast-growing trees that, when planted on suitable sites and managed properly, produce commercial products such as mulchwood, pulpwood, energywood, and bioproducts. *Eucalyptus* can also phytoremediate, i.e., remediate environmental problems (Table 1). *Eucalyptus* species are not invasive, having been planted commercially in Florida since the 1960s without spreading from managed plantations. EG and EA, along with *Corymbia torelliana* (CT), also may be used as windbreaks for citrus and vegetables. This circular describes potential applications and presents planting guidelines for these species.

Applications

Applications for EG, EH, EB, EA, and CT in Florida ranging from traditional and innovative forest products to phytoremediation systems and windbreaks are demonstrated in various locations (Table 1).

Forest Products. Commercial markets for *Eucalyptus* wood currently exist for landscape mulch and pulpwood and may be developed for oriented strand board, specialty pulp, and medium-density fiberboard. The color, texture, and

durability of mulch produced from EG and EA compare very favorably to those of cypress mulch. EG and EH in southern Florida and EB and EA in northern Florida may be harvested for landscape mulch. About 50,000 acres of *Eucalyptus* plantations could perpetually supply the feedstock needs of the Florida mulch industry.

Considerable *Eucalyptus* pulp is imported into the United States. Florida-grown EG, EH, EB, and EA have very acceptable properties for pulp and paper making, and hardwood pulpwood demand and price are strong in the Southeast. Still, *Eucalyptus* plantations grown for pulpwood need to be in close proximity to existing pulpmills in northern Florida. EG used for specialty pulp could be greater distances from pulpmills.

Energy and Bioproducts. Trees can be bioenergy and bioproduct feedstocks. Energywood may be utilized for electricity generation by many utilities in Florida by cofiring with coal, for example. Some utilities in Florida currently use woody biomass to produce electricity and steam. Woody biomass also has numerous other energy-related applications including direct combustion, thermo-chemical gasification, methane, alcohol, and other bioproducts including biochar, diesel fuel, and graphene. Trees grown for energy applications may qualify for tax credits. EA and CT flowers are attractive to honeybees.

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Windbreaks. The rapid growth and evergreen nature of *EG*, *EA*, and *CT* make them ideal for quickly establishing effective windbreaks around citrus and vegetables. With a wind-slowing effect extending approximately 10 times tree height, after six years these species can easily provide wind and disease protection for crops up to 600 feet downwind from the windbreak. *EA* and *EG* windbreaks tend to open at the bottom as the trees grow and lower branches self-prune; *CT* windbreaks typically stay full as the trees grow. Mixed species and coppicing can maximize early and continuous windbreak effectiveness.

Phytoremediation Systems. The rapid year-round growth of *EG* and *EA* is advantageous for phytoremediation applications such as a) effluent from sewage treatment facilities, b) stormwater in urban and industrial areas, and c) agricultural irrigation water. Water and nutrient uptakes by *EG* and *EA* depend on climatic limits, tree age and vigor, and the timing and extent of the wastewater applications. The upper limit on annual water uptake is approximately 65 inches. Annual nutrient accumulations by vigorous *EG* may reach 190, 35, 95, 80, and 25 pounds/acre of N, P, K, Ca, and Mg, respectively. In phytoremediation systems, *Eucalyptus* should be managed to reach full canopy development as rapidly as possible and to maintain active growth. They should be harvested as soon as productivity diminishes; they regenerate through vigorous coppicing (sprouting from the stump). At the accelerated growth rates *EA* and *EG* can achieve in phytoremediation applications, plantings as small as two acres could be commercially harvested in three to four years. *Eucalyptus* production combined with wastewater recycling thus has many mutual advantages, such as increasing tree growth, recycling nutrients, and renovating wastewater while at the same time producing mulch, pulpwood, biochar, or energywood.

Planting Guidelines

Successful establishment and management of *EG*, *EH*, *EB*, *EA*, and *CT* have several aspects (Table 2):

Growing Region. No single species is the most productive in all regions of Florida nor most suitable for all applications. Species choice by region (Figure 1) reflects freeze hardiness differences, particularly in northern Florida. Improved *EB* and *EA* are freeze hardy enough for all of Florida. The limited hardiness of *EG* restricts use of improved seedlings to southern and central Florida, but *EG* cultivars may also be used in northern Florida. *EH* and *CT* have freeze tolerance appropriate for central and southern Florida.

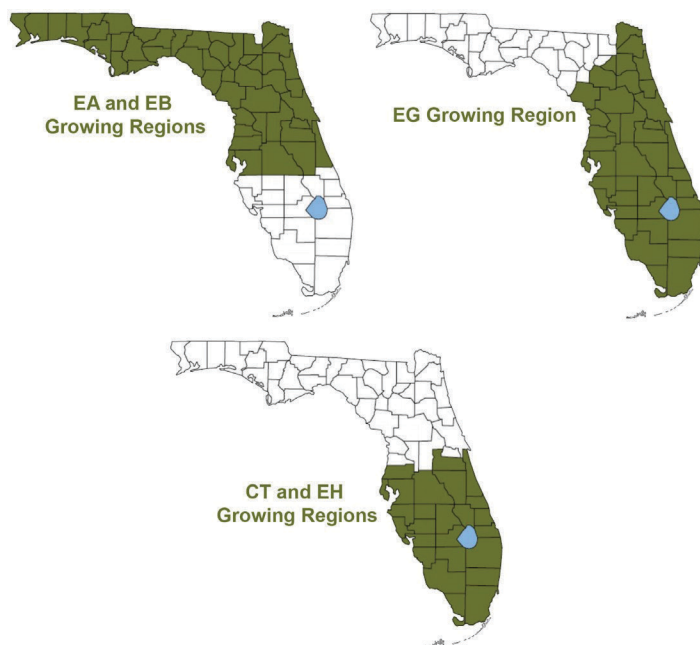


Figure 1. Climate-defined growing regions in Florida for *E. amplifolia* (EA), *E. benthamii* (EB), *E. grandis* (EG), *E. grandis* x *E. urophylla* hybrid (EH), and *C. torelliana* (CT).

Site Requirements. *EA*, *EB*, *EG*, *EH*, and *CT* all grow best on agricultural lands. Lands recently in agricultural use or marginal for agricultural production are typically ideal. *EA* requires high quality land with relatively high pH. *EG* and *CT* have a wide site tolerance. *EG* and *EH* grow very well on sandy or organic soils and grow more rapidly than *EA*, *EB*, and *CT* on most sites.

All species may be grown on poorer sites if amendments are added to raise nutrient levels and/or pH. *EG*, for example, grows well on low-phosphorus sites when ground rock phosphate is applied. All these species are very responsive to fertilizer amendment. Some *EG* cultivars have acceptable flood tolerance.

Cultural Practices. On poorly drained flatwood sites or in phytoremediation applications involving flooding, bedding is essential. Beds should be at least one foot high and allowed to settle for about three months before the trees are planted.

All species survive and grow best when competing vegetation is well controlled during the first two years. The initial site preparation, if bedding is involved, is usually sufficient for vegetation control during the first growing season. Preemergent herbicides provide good first season weed control. With good tree growth during the first year, the trees typically dominate other vegetation for the rest of the rotation. *Without adequate vegetation control during the first year, eucalypts will grow very slowly and are likely to fail.*

Planting Stock. Superior genotypes have been identified within each species through two (*CT* and *EA*) and five (*EG*) generations of genetic testing and selection. These superior genotypes have far better growth and frost resilience than untested trees of the same species.

EA, *EB*, *EG*, *EH*, and *CT* can all be propagated as containerized trees. Superior *EG* seed is readily available, and *EA* and *CT* seed is increasingly available. *EG* is also currently available as vegetatively propagated cultivars G3, G4, and G5, but *EB* seedlings and *EH* cultivars are no longer commercially available. While the cultivars cost ~\$.60 each compared to ~\$.45 per seedling, their numerous attributes typically justify their higher cost.

EA, *EG*, and *CT* should be planted at the onset of the summer rainy season when soil moisture is ample. Use of water-absorbing gel can initiate or extend the planting season by about a month. Eucalypts planted too late will not reach a size that conveys some resistance to freeze damage.

Management. Management intensity and rotation length vary with species, site, and application. For example, through the 1980s, culture of *EG* for pulpwood on up to 15,000 acres of flatwoods sites in southern Florida had low intensity and consisted of 1) planting about 600 trees per acre, 2) basic application of ground rock phosphate and minimal weed control through bedding, 3) 8–10 year rotation, and 4) two to three rotations.

For the fastest-growing species grown for energywood, the time from planting to harvest may be two years or less if planted on a high-quality site or intensively managed at close spacing (for instance, *EG* planted on muck soils at 4,000 trees/acre). To maximize production, management may include intensive culture (environmentally safe site amendment with slow release organic fertilizer and biochar, irrigation, and weed control practices).

For mulchwood production, an intermediate planting density of about 1,000 trees/acre with a rotation of some six years could produce trees of suitable size. However, *EG* grown for mulchwood at Palmdale (Table 1) involves relatively low intensity culture of superior planting stock.

EA, *EB*, *EG*, *EH*, and *CT* all coppice (sprout from the stump) after harvest. In the coppice rotation, tree growth may exceed first rotation growth by some 20% and shorten the time to the second harvest by at least one year, but the time of harvest is critical to coppicing success. *EA* and *EH* coppice well throughout the year, while *EG* and *CT* harvests must be done during the winter to ensure good coppicing.

Coppice cycles may be repeated up to six times. Windfall risk, e.g., from hurricanes, can be managed by a combination of genetics, site, culture, and rotation length options.

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Table 1. Location and description of EG, EH, EA, EB, and CT applications in Florida.

Application	Species	Location	Description
Phytoremediation	EA	Tallahassee	Trees planted on landfill cap
Phytoremediation	EG, EA	Tampa	Trees in 1.5-acre stormwater pond
Energywood	EA, EG	Gainesville	Cultivars in seed orchard/clone bank
Energywood	EA, EG, CT	Perry	Progenies and cultivars on sandy loam at various spacings
Energywood	EA, EB	Gainesville	Progenies and cultivars on sandy loam at three spacings and cultures
Energywood	EG, EH, CT	Ft Pierce	Cultivars and progenies on sandy soil at various spacings
Energywood	EG, EH	Ft Meade	Cultivars on clay settling areas at various spacings
Mulchwood	EG	Palmdale	Trees planted at 12 x 7' on bedded flatwoods
Honey	CT	Mims	Flowers for bees
Windbreak	CT	Clewiston	Trees planted around vegetable fields
Windbreak	EA, EG	Citra	Trees planted around citrus grove
Windbreak	EG, CT	Clermont	Trees planted around citrus grove
Windbreak	EG, CT	Ft Pierce	Trees planted around citrus grove
Windbreak	EG	Winter Garden	Trees planted around citrus grove

Table 2. Guidelines for the establishment and management of EG, EH, EA, EB, and CT in Florida.

Species	EG, EH	EA, EB	CT
Applications¹	E, M, P, R, W, B	E, M, P, R, W, B	W, B
Growing Region	Southern, central, and possibly northern FL	Northern and central FL	Southern and central FL
Site Requirements	Ag land or flatwoods	Ag or forest land $SI^2 \geq 65$; $pH > 5.5$	Ag land or flatwoods
Culture	Disk on muck; chop, burn, ½-ton ground rock phosphate/acre, and bed on flatwoods; add N up to 270 lbs/acre or equivalent biosolids on flatwoods; plant in summer	Disk and herbicide; add 15–20 tons/acre of compost or N and P up to 250 lbs/acre or equivalent biosolids; Plant in spring or summer	Disk and herbicide; add N and P up to 250 lbs/acre or equivalent biosolids; plant in spring or summer
Planting Stock	Improved seedlings or commercial cultivars ³	Improved seedlings	Improved seedlings
Growth	46 ft tall in 2.5 yrs on muck; 33 ft in 2 yrs and 55 ft in 5 yrs on flatwoods	46 ft in 3 yrs on ag lands	30 ft in 2 yrs on ag lands
Rotation	2 yrs on muck; 5 yrs on flatwoods	2–5 yrs	–
Coppicing (sprout from the stump)	Good in winter, poor in summer; 33 ft. in 1.75 yrs on muck, 66 ft in 5 yrs on flatwoods	Excellent in winter and summer; 16 ft. in 6 mos on ag lands	Good in winter and spring; 10 ft. in 6 mos on ag lands
Productivity (dry tons/acre/yr)	Up to 16	Up to 11	–

¹ E = energywood, M = Mulch, P = Pulpwood, R = Remediation, W = Windbreak, B = Bioproducts

² Site Index (base age 25 years) for slash pine

³ UF cultivars G3, G4, or G5 as appropriate for site and climate