Key Words: Low Risk, Biomass Tree, Hybrid, Low Seed Set, Self-incompatible, Shade intolerant

Family: ***Myrtaceae***

Taxon: ***Eucalyptus urograndis***

Synonym: *Eucalyptus grandis X Eucalyptus urophylla* ***Common Name:*** urograndis hybrid

Questionaire :	current 20090513	**Assessor:**	Chuck Chimera	**Designation:**	L
Status:	Assessor Approved	**Data Entry Person:**	Chuck Chimera	**WRA Score**	**1**

101	**Is the species highly domesticated?**	**y=-3, n=0**	**n**
102	**Has the species become naturalized where grown?**	**y=1, n=-1**	
103	**Does the species have weedy races?**	**y=1, n=-1**	
201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**(0-low; 1-intermediate; 2-high) (See Appendix 2)**	**High**
202	**Quality of climate match data**	**(0-low; 1-intermediate; 2-high) (See Appendix 2)**	**High**
203	**Broad climate suitability (environmental versatility)**	**y=1, n=0**	**y**
204	**Native or naturalized in regions with tropical or subtropical climates**	**y=1, n=0**	**y**
205	**Does the species have a history of repeated introductions outside its natural range?**	**y=-2, ?=-1, n=0**	**y**
301	**Naturalized beyond native range**	**y = 1*multiplier (see Appendix 2), n= question 205**	**n**
302	**Garden/amenity/disturbance weed**	**n=0, y = 1*multiplier (see Appendix 2)**	**n**
303	**Agricultural/forestry/horticultural weed**	**n=0, y = 2*multiplier (see Appendix 2)**	**n**
304	**Environmental weed**	**n=0, y = 2*multiplier (see Appendix 2)**	**n**
305	**Congeneric weed**	**n=0, y = 1*multiplier (see Appendix 2)**	**y**
401	**Produces spines, thorns or burrs**	**y=1, n=0**	**n**
402	**Allelopathic**	**y=1, n=0**	**y**
403	**Parasitic**	**y=1, n=0**	**n**
404	**Unpalatable to grazing animals**	**y=1, n=-1**	**y**
405	**Toxic to animals**	**y=1, n=0**	**n**
406	**Host for recognized pests and pathogens**	**y=1, n=0**	**y**
407	**Causes allergies or is otherwise toxic to humans**	**y=1, n=0**	**n**
408	**Creates a fire hazard in natural ecosystems**	**y=1, n=0**	
409	**Is a shade tolerant plant at some stage of its life cycle**	**y=1, n=0**	**n**
410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**y=1, n=0**	
411	**Climbing or smothering growth habit**	**y=1, n=0**	**n**

412	**Forms dense thickets**	**y=1, n=0**	**n**
501	**Aquatic**	**y=5, n=0**	**n**
502	**Grass**	**y=1, n=0**	**n**
503	**Nitrogen fixing woody plant**	**y=1, n=0**	**n**
504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**y=1, n=0**	**n**
601	**Evidence of substantial reproductive failure in native habitat**	**y=1, n=0**	**n**
602	**Produces viable seed**	**y=1, n=-1**	**y**
603	**Hybridizes naturally**	**y=1, n=-1**	
604	**Self-compatible or apomictic**	**y=1, n=-1**	**n**
605	**Requires specialist pollinators**	**y=-1, n=0**	**n**
606	**Reproduction by vegetative fragmentation**	**y=1, n=-1**	**n**
607	**Minimum generative time (years)**	**1 year = 1, 2 or 3 years = 0, 4+ years = -1**	
701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**y=1, n=-1**	**n**
702	**Propagules dispersed intentionally by people**	**y=1, n=-1**	**y**
703	**Propagules likely to disperse as a produce contaminant**	**y=1, n=-1**	**n**
704	**Propagules adapted to wind dispersal**	**y=1, n=-1**	
705	**Propagules water dispersed**	**y=1, n=-1**	
706	**Propagules bird dispersed**	**y=1, n=-1**	**n**
707	**Propagules dispersed by other animals (externally)**	**y=1, n=-1**	
708	**Propagules survive passage through the gut**	**y=1, n=-1**	
801	**Prolific seed production (>1000/m2)**	**y=1, n=-1**	**n**
802	**Evidence that a persistent propagule bank is formed (>1 yr)**	**y=1, n=-1**	
803	**Well controlled by herbicides**	**y=-1, n=1**	**y**
804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y=1, n=-1**	**y**
805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	**y=-1, n=1**	

Designation: L **WRA Score** **1**

Supporting Data:

101	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Is the species highly domesticated? No] "The hybrid Eucalyptus EH1 used to produce the transgenic trees has not been shown to be weedy or invasive in the U.S. An assessment has been conducted on the weediness or invasiveness potential of the hybrid by The University of Florida IFAS (see the section above Biology of Eucalyptus and Status in the United States). In that assessment it was concluded that it is not likely to be invasive and can be a recommended species for planting. None of the genes introduced into the Eucalyptus hybrid code for traits that would be expected to make the GE hybrids more weedy or invasive." [Cultivated, but no evidence of selection for reduced weediness]
101	2012. WRA Specialist. Personal Communication.	[Is the species highly domesticated? No] Cultivated, but no evidence of selection for reduced weediness.
102	2012. WRA Specialist. Personal Communication.	NA
103	2012. WRA Specialist. Personal Communication.	NA
201	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Species suited to tropical or subtropical climate(s) 2-High] "Currently, it is one of the most important hybrids used in Brazil, planted widely for the production of pulp and paper, from the equator to 30°S, in the states of Pará, Maranhão, Bahia, Espírito Santo, São Paulo and Rio Grande do Sul."
202	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Quality of climate match data 2-High]
203	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Broad climate suitability (environmental versatility)? Yes] - Altitude range: 0 - 1000 m - Mean annual rainfall: 1200 - 2000 mm - Rainfall regime: uniform - Mean annual temperature: 18 - 24ºC"
204	2012. WRA Specialist. Personal Communication.	[Native or naturalized in regions with tropical or subtropical climates? Yes] Parent species used to make hybrid originate from regions with a tropical or subtropical climate, and E> urograndis is grown in tropical regions
205	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Does the species have a history of repeated introductions outside its natural range? Widely planted, although no natural range] "E. urograndis is commercially planted in Brazil, Venezuela, Colombia, Congo, South Africa and China. It has also been introduced at experimental level in countries such as Australia, Indonesia, Vietnam, Taiwan, Ecuador, Mexico and Hawaii, USA."
301	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Naturalized beyond native range? No evidence] "The species hybrid E. grandis x E. urophylla (also known as E. urograndis) that ArborGen wishes to allow to mature and flower under this permit has not been categorized as invasive. The E. grandis x E. urophylla hybrid has been grown for forty years in South America and during this time there has been no evidence of invasiveness by into natural forest areas which are growing as part of an integrated land management system (Luis Silva, International Paper Company, Brazil, comment to docket APHIS-2008-0059)." … "Where the non-engineered hybrid Eucalyptus (EH1) has been grown in Brazil, on an estimated 400,000 acres planted over 15 years, there has been no indication that large numbers of seedlings are being produced and are becoming invasive from the commercial plantations (L. Pearson, ArborGen pers. comm. and Luis Silva, International Paper Company, Brazil, comment to docket APHIS-2008-0059)." … "Regular volunteer monitoring of six different trials over 2-5 years have further confirmed the absence of any seeded volunteers in or around the field tests. No seedlings have been found established beneath the trees or in the surrounding areas"
302	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Garden/amenity/disturbance weed? No evidence]
302	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Garden/amenity/disturbance weed? No evidence]
303	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Agricultural/forestry/horticultural weed? No evidence]
303	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Agricultural/forestry/horticultural weed? No evidence]

304	2011. Langeland, K.. You Want to Plant what for Biomass? Regulation, Research and Reason In Considering Weed Potential of Energy Crops. Aquatic Weed Control Short Course, May 3-5, 2011. Coral Springs, Florida. UF/IFAS, Gainesville, FL	[Environmental weed? No evidence] "Potential Biomass Crops Assessed as Not Invasive" [Includes Eucalyptus urograndis(E. grandis x E. Europhylla)]
305	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Congeneric weed? Yes] Eucalyptus cladocalyx. E. diversicolor and E. globulus are listed as Environmental Weeds
401	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Produces spines, thorns or burrs? No evidence]
402	2008. Espinosa-Garcia, F.J./Martinez-Hernandez, E./Quiroz-Flores, A.. Allelopathic potential of Eucalyptus spp plantations on germination and early growth of annual crops. Allelopathy Journal. 21(1): 25-37.	[Allelopathic? Yes] "We investigated the allelopathic potential of soil from Eucalyptus species (E. grandis, E. urophylla and E. grandis × urophylla) plantations on the germination and early growth of 4 crops [maize (Zea mays), bean (Phaseolus vulgaris), watermelon (Cucurbita pepo) and squash (Citrullus vulgaris)]." … "Among the three Eucalyptus species, E. grandis × urophylla was most inhibitory against maize, bean and watermelon growth, whereas, E. grandis adversely affected the squash." … "Since 1990's, extensive plantations of E. grandis, E. urophylla and hybrid E. grandis × urophylla have been raised in Mexican humid tropics for cellulose in paper industry (29). However, many farmers objects to large-scale plantations due to various reasons including their possible negative allelopathic effects on the local flora and crops (15)."
403	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Parasitic? No] Myrtaceae
404	2008. Espinosa-Garcia, F.J./Martinez-Hernandez, E./Quiroz-Flores, A.. Allelopathic potential of Eucalyptus spp plantations on germination and early growth of annual crops. Allelopathy Journal. 21(1): 25-37.	[Unpalatable to grazing animals? Yes] "Both E. grandis and E. urophylla and their hybrid have allelochemicals that presumably protect the plants against herbivores and pathogens (10,25,26) and many of these compounds are inhibitory to plants and microbes."
405	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Toxic to animals? No] "The most likely animals to encounter the transgenic Eucalyptus trees in this confined field trial would be browsing mammals (e.g., deer), burrowing animals (such as rodents), and leaf consuming insects (considered plant pests). In the event of consumption of plant material or seeds by other animals, the gene products produced by the selectable marker gene and genes of interest do not produce any toxin or have any similarity to known toxins"
406	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Host for recognized pests and pathogens? Yes] "In Indonesia, a trial with this hybrid was affected by Puccinia sp, Pestalotia sp, Alternaria sp and Macrospora sp (Hardiyanto and Tridasa, 2000). Not all individual trees showed the same infestation level, and all sites had a mean annual rainfall greater than 2000 mm."
406	2009. Kumari N., K.. Bioecology and Management of Eucalyptus Gall Wasp, Lepiocybe invasa Fisher & La Salle (Hymenoptera: Eulophidae). MSc Thesis. University of Agricultural Sciences Dharwad, Karnataka, India	[Host for recognized pests and pathogens? Potentially Yes] "Except Corymbia citriodora, all the genotypes tested were equally susceptible for oviposition damage. Among the different species screened, E. pellita and E. urophylla were tolerant to gall infestation. Eucalyptus urograndis was moderately susceptible while E. tereticornis was highly susceptible. Phenol content was directly correlated with the resistance."
407	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Causes allergies or is otherwise toxic to humans? No] No evidence. Answer derived from evaluation of parent species
408	2007. Tuffi Santos, L.D. et al. Morophological responses of different eucalypt clones submitted to glyphosate drift. Environmental and Experimental Botany. 59: 11–20.	[Creates a fire hazard in natural ecosystems? Unknown] "Most Eucalyptus communities in Australia have evolved in the presence of periodic fire, and fires are an integral part of the Eucalyptus ecosystem (Ashton 1981, Gill 1997). Many Eucalyptus species are known to be highly flammable and depending upon the species, location and age, they can be very resistant or susceptible to fire damage (Gill 1997). Eucalyptus fires can be very hot and move rapidly. The bark catches fire readily, and deciduous bark streamers tend to carry fire into the canopy and to disseminate fire ahead of the main front (Ashton 1981, Skolmen and Ledig 1990, Esser 1993). Other features of Eucalyptus that promote fire spread include heavy litter fall, flammable oils in the foliage, and open crowns bearing pendulous branches, which encourages maximum updraft (Esser 1993, Gill 1997). In the U.S., there have been reports of significant fires in California and many have been blamed on the widespread planting of Eucalyptus. Fuel buildup occurs very rapidly in unmanaged bluegum Eucalyptus stands in California which has led to significant forest fires. The buildup of litter and dead grass are primary responsible for the spread of these fires"

409	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Is a shade tolerant plant at some stage of its life cycle? No] "E. urophylla is similar to other eucalpts in that it is a vigorous, light demanding species and growth is curtailed with increasing weed competition." … "Eucalyptus grandis is a light demanding, shade intolerant species which responds well to heavy thinning (Jacobs, 1981)." [Parental species are shade intolerant]
409	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Is a shade tolerant plant at some stage of its life cycle? No evidence] "Eucalyptus generally has difficulty establishing without human intervention, even in warmer climates. Eucalyptus is intolerant of shade or weedy competition."
410	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Tolerates a wide range of soil conditions? Unknown. Parent species show different soil tolerance] "It prefers moist, well drained, deep, loamy soils of alluvial or volcanic origin although it can tolerate poorer skeletal soils if rainfall is adequate (Streets, 1962). However, it can not tolerate excessively moist or poorly drained soils or extended periods of soil waterlogging (Turnbull and Pryor, 1984). It can tolerate periods of drought but generally it is not suitable for sites on dry, stony, skeletal soils or those that are exposed with relatively little soil depth." [E. grandis = No] … "- Soil reaction: acid; neutral - Soil types: clay soils; podzols; volcanic soils" [E. urophylla = Yes]
411	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Climbing or smothering growth habit? No] Tree
412	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Forms dense thickets? No evidence for E. grandis or E. urophylla] Evidence derived from parent species
412	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Forms dense thickets? No evidence]
501	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Aquatic? No] Terrestrial tree
502	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Grass? No] Myrtaceae
503	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Nitrogen fixing woody plant? No] Myrtaceae
504	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] Woody tree
601	2012. WRA Specialist. Personal Communication.	[Evidence of substantial reproductive failure in native habitat? No] An artificially created hybrid
602	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Produces viable seed? Yes] "In recent field releases allowed to flower in Alabama and Florida, ArborGen has observed a low level of seed production. Controlled seed germination studies have been conducted with seed capsules collected over three years from field trials that have been allowed to flower. Results have indicated that either no, or a very low number of viable seeds, are produced in the transgenic as well as in the control trees, most likely as a result of limited self-fertilization by pollen from the fertile control trees." … "There could be a concern that seeds of the hybrid could be widely distributed by severe storms such as hurricanes or tornadoes. The Eucalyptus hybrid that is being grown in these proposed field tests produces mature capsules in February and seed fall is shortly after this. Therefore seed release is in late winter / early spring and well outside out of the normal hurricane season which occurs between June and November"

603	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Hybridizes naturally? Unknown, but maybe possible] "Even among the closely related species of Eucalyptus, hybridization rates are generally very low (Volker 1995). The published literature supports the fact that natural hybridization among distantly related species within genus Eucalyptus is rare and hybrid inviability increases with increasing taxonomic distance between parents (Potts and Dungey 2004). Where hybridization is possible, it often requires significant human intervention in directed breeding/crossing efforts. Potts and Dungey (2004) make reference to the high degree of inviability in F1 hybrids (offspring). Inviability of these offspring may be expressed at germination, in the nursery and even after planting in the field. Slower germination of hybrid seed often occurs, along with reduced survival of germinants in the nursery, and many seedlings have abnormal phenotypes. Griffin et al. (1988) surveyed natural and manipulated hybrids in the genus Eucalyptus and discussed the challenges of developing even human made hybrids from such wide crosses (in this case E. grandis and E. globulus in sections Transversaria and Maidenaria, respectively), with only 4.4% of seed germinating and only 3.2% of these producing trees that were worthy of further evaluation. To achieve the development of viable hybrids sometimes hundreds of hand pollinations must be made to find a viable hybrid that will grow normally. An example of the procedures required to make these wide-cross hybrids is given in Barbour and Spencer (2000)."
604	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Self-compatible or apomictic? No] "In experiments conducted in Brazil and Alabama, the control self-pollinated seed obtained from this genotype had abnormal morphology and failed to germinate (ArborGen, unpublished results)." … "As discussed in previous sections of this EA, there are multiple mechanisms in place that would prevent these Eucalyptus hybrids from establishing themselves in the wild. Since only one clone is being planted, viable seed set is likely to be limited due to self- incompatibility."
605	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Requires specialist pollinators? No evidence from genus] "Eucalyptus is adapted for insect pollination, with bees being the predominant vector (Pacheco et al. 1986, Pacheco 1987, House 1997). Under ideal conditions of humidity and temperature, viable Eucalyptus pollen can only be found within approximately 100 meters from the edge of nearest tree stand (Peters et al. 1990, Linacre and Ades 2004). Pacheco (1987) verified that bees (Apis spp.) are the most effective pollinators of Eucalyptus, with activity increasing up to 100 meters from the beehive, and decreasing after this distance. de Assis (1996) indicated that the minimum distance to prevent undesirable pollen contamination of seed producing areas is approximately 300 meters. Even if bees were to transport pollen farther distances from the field test sites, there are no sexually compatible species nearby with which they could cross and produce offspring (see description of the field test sites below)."
606	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Reproduction by vegetative fragmentation? No evidence] "Unlike some other hardwood forest trees, Eucalyptus does not spread in the environment via natural abscissions of branches, or cladoptosis. The asexual propagation of shoots via rooted cuttings requires specific environmental conditions such as a greenhouse or a high humidity environment (Hartney 1980), so it is highly unlikely that any shoots that fall or that are removed from the trees would propagate themselves in the wild." … "Suckering (production of shoots from subterranean roots) does not occur in this Eucalyptus hybrid."
607	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Minimum generative time (years)? Unknown] "E. urophylla … Flowering starts within two years and seeds are produced abundantly within 4 years of growth." … "E. grandis typically flowers within 2-3 years after seed germination"
701	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? No evidence] "In Brazil where E. grandis, E. urophylla and their hybrids have been grown since the 1960's and are now planted on several thousand hectares, there is no evidence that wind borne seeds are spreading the trees beyond managed plantations. Over 70,000 hectares of the hybrid has been planted extensively by International Paper, who developed EH1, with no evidence of invasiveness (Luis Silva, International Paper Company, Brazil – comment to the docket to the EA for permits 08 011-106rm and 08-014 101rm)."

702	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Propagules dispersed intentionally by people? Yes] "Currently, it is one of the most important hybrids used in Brazil, planted widely for the production of pulp and paper, from the equator to 30°S, in the states of Pará, Maranhão, Bahia, Espírito Santo, São Paulo and Rio Grande do Sul. In Indonesia, a trial with this hybrid was affected by Puccinia sp, Pestalotia sp, Alternaria sp and Macrospora sp (Hardiyanto and Tridasa, 2000). Not all individual trees showed the same infestation level, and all sites had a mean annual rainfall greater than 2000 mm. E. urograndis is commercially planted in Brazil, Venezuela, Colombia, Congo, South Africa and China. It has also been introduced at experimental level in countries such as Australia, Indonesia, Vietnam, Taiwan, Ecuador, Mexico and Hawaii, USA."
703	2012. WRA Specialist. Personal Communication.	[Propagules likely to disperse as a produce contaminant? No evidence]
704	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Propagules adapted to wind dispersal? Possibly. Although this reference states otherwise, Eucalyptus seeds are adapted for dispersal by wind] "Even if seed are produced in the test, several factors in the biology of Eucalyptus would limit the potential for seed dissemination. Although Eucalyptus seed is very light and small, it is not adapted to wind dispersal and consequently the dispersal of seed is very limited, generally being confined within a radius of twice the tree or canopyheight (approximately 50 meters for a 25 meter tall tree at harvest age)(Cremer 1977, Gill 1997, Linacre and Ades 2004)." … "In Brazil where E. grandis, E. urophylla and their hybrids have been grown since the 1960's and are now planted on several thousand hectares, there is no evidence that wind borne seeds are spreading the trees beyond managed plantations. Over 70,000 hectares of the hybrid has been planted extensively by International Paper, who developed EH1, with no evidence of invasiveness (Luis Silva, International Paper Company, Brazil – comment to the docket to the EA for permits 08 011-106rm and 08-014-101rm). In these environments Eucalyptus obviously does not behave like other windblown seeds of grasses, for example, which can be pioneering species."
705	2012. WRA Specialist. Personal Communication.	[Propagules water dispersed? Unknown]
706	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Propagules bird dispersed? No] Not fleshy-fruited
707	2012. WRA Specialist. Personal Communication.	[Propagules dispersed by other animals (externally)? Unknown] Small seeds, if produced, could theoretically stick to mud on feet or lodge in fur
708	2012. WRA Specialist. Personal Communication.	[Propagules survive passage through the gut? Unknown] Seeds, if produced, not adapted for internal dispersal
801	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Prolific seed production (>1000/m2)? No] "In recent field releases allowed to flower in Alabama and Florida, ArborGen has observed a low level of seed production. Controlled seed germination studies have been conducted with seed capsules collected over three years from field trials that have been allowed to flower. Results have indicated that either no, or a very low number of viable seeds, are produced in the transgenic as well as in the control trees, most likely as a result of limited self-fertilization by pollen from the fertile control trees."
802	2012. Final Environmental Assessment. Field testing of genetically engineered Eucalyptus grandis X Eucalyptus urophylla. USDA, APHIS, BRS, Riverdale, MD	[Evidence that a persistent propagule bank is formed (>1 yr)? Unknown] "Eucalyptus seeds do not have any dormancy barriers to prevent germination of volunteer seeds (Grose 1960, Wellington 1989, Gill 1997) and seed viability and storage of Eucalyptus seeds in soil are less than one year (Gill 1997)."
803	2003. Little, K.M./du Toil, B.. Management of Eucalyptus grandis coppice regeneration of seedling parent stock in Zulu land, South Africa. Australian Forestry. 66(2): 108-112.	[Well controlled by herbicides? Yes] "Glyphosate, a systemic herbicide, resulted in the death of the coppice regrowth following translocation of the active ingredient without negatively affecting the performance of the remaining coppice stems." [E. grandis]
803	2007. Tuffi Santos, L.D. et al. Morophological responses of different eucalypt clones submitted to glyphosate drift. Environmental and Experimental Botany. 59: 11–20.	[Well controlled by herbicides? Yes] "This work aimed to evaluate the effects of simulated glyphosate drift on leaf growth and micromorphology of Eucalyptus spp. clones, using subdoses. A factorial scheme consisting of three clones, Eucalyptus urophylla, E. grandis and the hybrid E. urophylla × E. grandis (E. urograndis) and five sub-rates (0; 43.2; 86.4; 172.8 and 345.6 g e.a. ha−1 of glyphosate) were used in a randomized block design, with four repetitions. The herbicide was applied on the plants so as not to reach the superior third, 23 days after seedling planting. At 7 and 15days after application (DAA), the leaves collected from the first basal branch of the plants were processed according to the conventional methodology used for micromorphological studies. The effects of glyphosate drift were proportional to the rates tested, with E. urophylla being more tolerant to the herbicide than E. grandis and E. urograndis."

804	2005. CAB International. Forestry Compendium. CAB International, Wallingford, UK	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "- Ability to regenerate rapidly; coppice"
805	2006. Uchida, J./Zhong, S.. First Report of a Rust Disease on Ohia Caused by Puccinia psidii in Hawaii. Plant Disease. 90(4): 524.	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Potentially. Puccinia psidii infects Eucalyptus species and is widespread in the Hawaiian Islands, as well as Florida, California, and Australia] "P. psidii is reported to be native to South and Central America that later spread to some Myrtaceous plants in the Caribbean countries (1). It has a very wide host range within the family Myrtaceae (2). To our knowledge, this is the first report of P. psidii in Hawaii. This rust disease may pose a formidable threat to Myrtaceous species that make up the native Hawaiian forests and are grown as ornamental plants or for the production of wood chips."

Summary of Risk Traits

High Risk / Undesirable Traits

- Grows in tropical and subtropical climates
- Broad climate suitability
- Other *Eucalyptus* species documented to be invasive
- Allelopathic properties
- Unpalatable to browsing animals
- Host of *Puccinia* spp. and other pathogens
- Seeds may be wind-dispersed (if produced)
- Able to coppice

Low Risk / Desirable Traits

- No reports of naturalization or weediness despite widespread cultivation
- Unarmed
- Non-toxic
- Shade-intolerant
- Limited or no seed set
- Self-incompatible
- Biomass tree for pulp, paper, and fuel
- Herbicides may provide effective control if trees do spread