Partner Housing Australasia (Building) Incorporated
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Web: www.partnerhousing.org
Pro-bono professional services and funding for South Pacific village infrastructure, housing, water, sanitation and training.

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Partner Housing is a signatory to the ACFID Code of Conduct, which is a voluntary, self-regulatory sector code of good practice. As a signatory we are committed and fully adhere to the ACFID Code of Conduct, conducting our work with transparency, accountability and integrity.

Environmental Sustainability

Basis

These policies and procedures set out the means of complying with the requirements of the "Constitution, Policies & Code of Conduct" of Partner Housing Australasia (Building) Incorporated.

Signed

Rod Johnston
President / CEO / Public Officer
Partner Housing Australasia (Building) Incorporated

Contents

Revisions

P21010114-2a 1 February 2022
Correction of minor typographical errors.
Addition of detailed procedures and background on the sustainable use of timber.
Change of name throughout to “Partner Housing Australasia”.

Policy

Partner Housing shall ensure that all undertakings are environmentally sustainable, employing materials and practices that minimize environmental impact.

Procedures

Policy

Partner Housing shall ensure that all undertakings are environmentally sustainable, employing materials and practices that minimize environmental impact.

Responsible Personnel

The personnel with specific tasks designated in the position descriptions, and/or most likely to be involved in implementation are the Professional Services Manager, Regional Managers and the Project Managers.

Applicable Sustainability Elements

Following is a list of the principal sustainability elements addressed in the Partner Housing Australasia programs.

a) Greenhouse gas capture and storage, through consideration of –
   - greenhouse gas emission during building product manufacture (see further comments on use of timber); and
   - operational greenhouse gas emissions, through the minimization of heating and cooling energy. Depending on the climate, these will be commonly achieved through roof insulation and roof ventilation (respectively). Considerations can include the use of naturally occurring local materials as insulation.

b) Soil erosion, as affected by both logging and replanting practices.

c) Water quality, as affected by –
   - both logging and replanting practices;
   - siting latrines and septic tanks, particularly in respect of potable water sources;
   - effluent disposal (where applicable).

Village water reticulation

Water reticulation projects provide drinking water from clean sources in the hills. This is piped to villages in which communal stand-pipes are constructed. The projects replace labour-intensive had collection of water with efficient piped water and do not have any detrimental effect the natural environment.

Water spring-box projects provide clean water to a remote village where no reliable source existed without any detrimental effects on the natural environment.

The material used in these projects shall be common plumbing pipes, tanks and fittings.

Village sanitation

Water-flush pit latrines replace defecation in the sea or bush.

The water used to flush the latrines is sea water carried by bucket to the latrines.

The pits drain through the porous bedrock and do not pollute either the sea or the adjacent land.

These projects reduce health hazards without any detrimental effect the natural environment.

The materials used in the projects shall be common building materials and fittings.

Village buildings and engineering

Village houses, clinics and educational buildings are constructed.

The materials used in the projects shall be common building materials and fittings. Rare or endangered species of timber shall not be used.

These projects provide safe shelter and community health and education facilities without any detrimental effect the natural environment.

Internal Operations

Partner Housing adopts practices that minimise its domestic environmental effect.

In particular, we do not work from a centralised office.

All volunteers work from their own home or office and are therefore conscious of reducing lighting and heating/cooling.

The Board only meets four times per year for Board Meetings and the Annual General Meeting. The rest of the time communication is by phone, text, email or teleconference. This reduces travel and its environmental impact.

Typical Report

Extract from Partner Housing 2020 Annual Report

Environmental Sustainability

Set out below is a report on the environmental impact of the current and previous programs funded by Partner Housing.

Village water reticulation

Water projects in Ranongga and Vella Lavella in the Western Province of Solomon Islands provide drinking water from clean sources in the hills. This is piped to villages in which communal stand-pipes are constructed. The material used in the projects are common plumbing pipes, tanks and fittings. The projects replace labour-intensive had collection of water with efficient piped water and do not have any detrimental effect the natural environment.

A previous water spring-box project in Papua New Guinea similarly provided clean water to a remote village where no reliable source existed without any detrimental effects on the natural environment.

Village sanitation

Water-flush pit latrines are being constructed in Gibitngil Island, Philippines, to replace defecation in the sea. The water used to flush the latrines is sea water carried by bucket to the latrines. The pits drain through the porous bedrock and do not pollute either the sea or the adjacent land. The materials used in the projects are common building materials and fittings. The project reduces health hazards without any detrimental effect the natural environment.

Previous latrine projects in remote villages in Solomon Islands similarly reduce health hazards without any detrimental effects on the natural environment.

Village buildings & engineering

Village houses, clinics and educational buildings are being constructed in Papua New Guinea. The materials used in the projects are common building materials and fittings. The project provides safe shelter and community health and education facilities without any detrimental effect the natural environment.

Cyclone-resistant village houses are being designed for the Freshwin Precinct for Port Vila, Vanuatu. The materials used in the projects are common building materials and fittings. The project provides safe shelter without any detrimental effect the natural environment.

Previous cyclone anchorage programs in Solomon Islands, Fiji and Cook Islands increase safety without any detrimental effects on the natural environment.

Use of timber in the PNG Community Health Buildings

a) These buildings are timber frames, with timber floors, timber internal linings. Future buildings could also use timber cladding.

b) From the point of view of the environment and maximising carbon capture, using timber (if done wisely) is a good thing.

c) In extremely simple terms, existing trees extract carbon from the atmosphere as they grow. Selected trees are then felled and incorporated into buildings (effectively capturing the carbon). New seedlings are planted, and as they grow, they capture more carbon, and the process repeats.

d) **Provided the trees are replaced and there are precautions regarding biodiversity, soil erosion, and outlawing clear felling**, timber framing and cladding is the most environmentally responsible building solution available.

e) PHA will work with various environmental organisations to refine its policies and procedures with a view to minimising the environmental impact of our building work. These organisations include –

- Green Building Council of Australia (GBA) https://new.gbca.org.au/
  CEO: Davina Rooney [Previously a director of Partner Housing Australasia]
  GBCA's policy priorities are carbon positive buildings, strong government leadership, realising our vision for cities and communities, smarter infrastructure investments and affordable, sustainable housing.
  https://gbca-web.s3.amazonaws.com/media/documents/embodied-carbon--embodied-energy-in-australias-buildings-2021-07-22-final-public.pdf
- Australian Sustainable Built Environment Council (ASBEC)
  CEO: Alison Scotland [currently a Director of Partner Housing Australasia]
  ASBEC is the peak body of key organisations committed to a sustainable, productive, resilient built environment in Australia.
- Responsible Wood: https://www.responsiblewood.org.au/
  CEO, Simon Dorries
  Responsible Wood is an umbrella organisation, which endorses national forest certification systems that have been developed through multi-stakeholder processes and tailored to local priorities and conditions.

, but it's more of a comparison of which Australian building products contribute to the most emissions (timber being the one product that doesn't).

The Practical Question – Tree Replacement

a. As an interim policy, PHA encourages (and will pay for as part of our donation), the purchase and planting of native tree seedlings to serve as carbon sinks, replacing those mature trees which have been harvested to serve as building products for the construction of village buildings.

b. The number of such trees to be planted shall be determined for each project based on a method to be outlined in the policy document. Preliminary calculations (subject to confirmation) indicate that the planting of 80 casuarina oligodon seedlings would be sufficient to completely replace the trees that have been harvested for the structural frames.

c. The species to be selected will depend on where they are planted. Casuarina oligodon seedlings (currently in common use in the PNG Highlands) would be a good starting point. I will provide papers supporting this selection in the policy document.

d. The best option is to pay the in-country partner (i.e., Vision for Homes) to plant the seedling in PNG (preferable on the site of the buildings). But because this may not be practical, a fallback position would be to fund the planting of the equivalent trees in Australia.

Typical Calculation

Replacement Timber		
Location	PNG Western Highlands Province	
Building	Kopeng Community Health Buildir	
Replacement species	Casuarina oligodon	
Mature height	25.0	m
Minimum mature girth	1000	mm
Minimum mature diameter	318	mm
Useable sections 0.3 to 3.3 m high		
Minimum mature girth	848	mm
Minimum mature diameter	270	mm
Width	45	mm
Depth	140	mm
Depth	90	mm
Depth	90	mm
Length	3.0	m
Volume of useable timber per mature tre	0.04	m^3
Useable sections 3.3 to 6.3 m high		
Minimum mature girth	636	mm
Minimum mature diameter	222	mm
Width	45	mm
Depth	140	mm
Depth	90	mm
Depth	90	mm
Length	3.0	m
Volume of useable timber per mature tre	0.04	m^3
Useable sections 6.3 to 9.3 m high		
Minimum mature girth	552	mm
Minimum mature diameter	176	mm
Width	45	mm
Depth	140	mm
Depth	90	mm
Depth	90	mm
Length	3.0	m
Volume of useable timber per mature tre	0.04	m^3

Useable sections 9.3 to 12.3 m high		
Minimum mature girth	408	mm
Minimum mature diameter	130	mm
Width	45	mm
Depth	90	mm
Depth	90	mm
Depth	0	mm
Length	3.0	m
Volume of useable timber per mature tre	0.02	m^3
Useable sections 12.3 to 15.3 m high		
Minimum mature girth	269	mm
Minimum mature diameter	86	mm
Width	45	mm
Depth	0	mm
Depth	0	mm
Depth	0	mm
Length	3.0	m
Volume of useable timber per mature tre	0.00	m^3
Volume of useabe sections	0.15	m^3
Volume of trunk	0.66	m^3
Proprotion of trunk used	23.2%	
Total volume of structural timber	11.39	m^3
Proportion of seedlings reaching maturit	90%	
Number of seedlings to be planted	82	
Perimeter of site	80.0	m
Spacing	2.0	m
Number that can be planted around peri	40	
Cost per seedling	$5.00	
Labour cost per seedling	$5.00	
Total cost of planting program	$ 822	

Appendix 1 – Casuarina oligodon

The following paper deals with the Casuarina oligodon, the species of she oak, which is common in the PNG Highlands.

Casuarina oligodon L. Johnson

Casuarinaceae

LOCAL NAMES
English (she-oak); Indonesian (kilu)

BOTANIC DESCRIPTION
Casuarina oligodon is an evergreen tree to 30 m tall, bark grey-brown, fissured, peeling off in irregular flakes, outer bark red, hard.

Leaves reduced to minute scales, arranged in whorls of 5-7 at the internodes of the thin, pendulous, green branchlets which function as leaves (phylloclades). There are 6 leaf scales in each whorl. Branchlets are grooved.

Flowers unisexual, male flowers are borne in spikes 1.5-4.5 cm long, usually borne on terminal branches, each flower consists of one stamen surrounded by 4 scales. Female cones shortly cylindrical or sub-cylindrical, 4-10 mm long, 0.7-0.9 mm diameter, each flower consists of an ovary with 2 branch thread-like styles and of 1 large and 2 small scales. They are red.

The fruit is a 1-seeded winged nut initially enclosed in accrescent woody bracteoles, which separate at maturity appearing like a dehiscent capsule. The fruit proper is a small samara about 4 mm long that is held by the enlarged and hardened scales fused into a small woody cone less than 1 cm in diameter and dull light brown.

Two subspecies have been recognized, ssp. oligodon which occurs in Papua New Guinea and ssp. abbreviata in the Indonesian province of Irian Jaya. They differ in the length of the leaves (teeth), ssp. abbreviata teeth are 0.4-0.5 m long, those of ssp. oligodon are 0.8-1 mm long.

Casuarina is from the Malay word 'kasuari', from the supposed resemblance of the twigs to the plumage of the cassowary bird. One of the common names of Casuarina species, 'she-oak', widely used in Australia, refers to the attractive wood pattern of large lines or rays similar to oak but weaker. The specific epithet comes from the Greek olig- (few), and -odon (tooth); meaning with few teeth.

BIOLOGY
In its natural range in Papua New Guinea, flowering starts around early August and cones are ready to collect by November-December. Flowers are unisexual. The tree is wind pollinated.

ECOLOGY
This species is confined to the island of New Guinea. It occurs at high elevations (up to 2 500 m) forming extensive pure stands along river beds and on ridge tops but at times is seen to be associated with C. papuana. The species grows in areas with high relative humidity throughout the year and a weak dry season in July and August. Temperatures vary from 11-15 deg C minimum at night to 24-30 deg C maximum during the day.

BIOPHYSICAL LIMITS
Altitude: 1 500-1 800 m
Mean annual rainfall: 1 900-2 600 mm
Soil type: C. oligodon is mostly found in sandy soils along creeks and rivers but grows well in colluvial soils, humic brown clay soils, alluvial and meadow soils.

DOCUMENTED SPECIES DISTRIBUTION

Native: Indonesia, Papua New Guinea
Exotic: Israel

PRODUCTS
Fuel: The wood is regarded as one of the best firewoods in the world, with a calorific value of the charcoal of over 700 k cal/kg.

Timber: The wood is generally hard and heavy (air-dry density is about 900-1 000 kg/cu m) and tends to split when sawn. Split wood is used to construct fences and houses. Round posts for construction, poles, fences suitable for use in the ground and for unprotected extension use in buildings, protected extension and intension work. Specialty uses include tool handles, shuttles and permanently submerged freshwater piles.

SERVICES
Erosion control: The species is used to control soil erosion on steep slopes. Fallen casuarina foliage provide a good protective layer against soil erosion and helps rebuild soils and protect unstable sites.

Shade or shelter: C. oligodon has been found to be a good shade tree for both cattle and sheep as it provides a good shade and improves pastures. It has also been used as a shade tree for coffee.

Nitrogen fixing: C. oligodon like other species of the Casuarinaceae possess nodules of nitrogen-fixing bactera in the rootlets.

Soil improver: When it is used as a shade tree for coffee, it further improves soil fertility by its leaf litter.

Boundary or barrier or support: One of the other main uses of C. oligodon is as wind breaks and in its natural range, can be seen in most villages where it is planted around the whole village protecting it from strong winds.

Intercropping: C. oligodon is planted in subsistence food gardens and as a fallow intercrop.

TREE MANAGEMENT
Trees should be fertilized with boron which tends to be deficient in highland grassland soils. It should be applied at 56g/tree during a 2 month period (28g, 1 month after planting and another 28g 1 month later).

Even though the species can grow with competition from grass, shrubs, trees etc, ring tending should be done after 3-5 months. C. oligodon grows well with close spacing and 1 110-2 500 stems/ha could be ideal. The rotation length depends on the end use. For use as fence posts, a rotation length of 12-15 years is sufficient with thinnings at age 6 which could be utilized as fuelwood etc.

GERMPLASM MANAGEMENT
Seed production by the species is very good. Storage of C. oligodon seeds is mainly in household refrigerators where they are kept until needed for sowing. No research has been carried so far into their longevity under these conditions, but appears to be orthodox for this family. There are 1.5-2 million seeds /kg. Viability is generally low.

PESTS AND DISEASES
The species does not have a problem with diseases. Boron deficiency in the species cause stunted growth with plants looking rounded and bushy with short internodes and the growing tips die.

FURTHER READNG

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SUGGESTED CITATION
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Other References

https://pfaf.org/user/Plant.aspx?LatinName=Casuarina+oligodon#:~:text=Casuarina%20oligodon%20is%20an%20evergreen%20tree%20with%20foliage,the%20best%20firewood%20producing%20trees%20in%20the%20world.

Summary

Casuarina oligodon is an evergreen tree with foliage consisting of slender, well-branched green to grey-green twigs bearing minute scale-leaves in whorls of 5-20. It grows up to 30 m tall and is a tropical highland species. It is considered to be one of the best firewood producing trees in the world. Its wood is hard and heavy and used as material for fences, houses, poles, and general construction. Also, it has an extensive root system making it an ideal species to control soil erosion on steep slopes.

Physical Characteristics

Tony Rodd flickr

Casuarina oligodon is an evergreen Tree growing to 25 m (82ft) at a medium rate.
It is hardy to zone (UK) 10. The flowers are pollinated by Wind.
It can fix Nitrogen.
Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: acid, neutral and basic (alkaline) soils and can grow in very acid and very alkaline soils.
It cannot grow in the shade. It prefers moist soil.

Other uses rating: High (4/5). Agroforestry Uses: The species has an extensive root system and is used to control soil erosion on steep slopes[303]. Fallen casuarina foliage provide a good protective layer against soil erosion and helps rebuild soils and protect unstable sites[303]. It is used in reforesting grasslands in the highlands of Papua New Guinea because it competes well with grasses such as Imperata cylindrica, Saccharum robustum and Themeda australis[310]. With its ability to improve soil fertility by fixing atmospheric nitrogen and with its leaf litter, the tree has been found to provide good shade and growing conditions for coffee[303]. The tree is planted as an intercrop in subsistence food gardens and as a fallow intercrop[303]. One of the other main uses of this species is as wind breaks and, in its natural range, it can be seen planted around whole villages, protecting them from strong winds[303]. Other Uses: The wood is generally hard and heavy and tends to split when sawn. Split wood is used to construct fences and houses. Round posts for construction, poles, fences suitable for use in the ground and for unprotected extension use in buildings, protected extension and intension work. Specialty uses include tool handles, shuttles and permanently submerged freshwater piles[303]. The wood is regarded as one of the best firewoods in the world, with a calorific value of the charcoal of over 700 k cal/kg[303].

This is truly a tropical highland species, being found at elevations up to 2,500 metres or sometimes even higher[303]. It grows in areas where the mean annual rainfall is in the range 1,900 - 2,600 mm, there is a high relative humidity throughout the year with a weak dry season of up to 2 months and the temperatures vary from 11 - 15°c minimum at night to 24 - 30°c maximum during the day[303]. Prefers a sunny position[418]. Mostly found in sandy soils along creeks and rivers in the wild, but also grows well in colluvial soils, humic brown clay soils, alluvial and meadow soils[303]. Prefers a pH in the range 5.5 - 6.5, tolerating 4.5 - 7.5[418]. For use as fence posts, a rotation length of 12 - 15 years is sufficient with thinnings at age 6 which could be utilized as fuel wood etc[303]. According to Johnson (1982), the species consists of two subspecies: subsp. Oligodon and subsp. Abbreviata Subsp. Oligodon has longer leaves, up to 1mm long. It is used locally in the eastern highlands of Papua New Guinea[317] Subsp. Abbreviata has shorter leaves up to 0.5mm long. It is used to restore soil fertility and control soil erosion in the N Baliem valley of Irian Jaya[317]. This species has a symbiotic relationship with certain soil micro-organisms, these form nodules on the roots of the plants and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[303].

Appendix 2 – PNG Highlands Hardwood

Group

The two broad groups of trees are included in this key, namely:
Conifer This category is used for the Cone-bearing trees, such as the species of *Araucaria* and *Pinus* that are included in this key.

Dicotyledon Describes the group of trees that are flowering plants.

Note: **Woody monocotyledons** (such as, palms) have not been included in this key.

Tradename

These are the non-scientific names used by the forestry and timber industry. Sometimes more than one name is used for the same species. In other cases, one name may refer to more than one species. The names used here are based on the Standard Trade Common Names officially recognised by the *Papua New Guinea Forest Authority* (Eddowes 1977).

Timber groups

This feature primarily distinguishes between softwood and hardwood timbers; it also distinguishes between the importance of different species as timber trees (such as major, commercial, minor and occasional). Furthermore, the special small group of plantation species has been distinguished by this character.

The six timber groups recognised are based on Eddowes (1977). These include:
Major exportable hardwoods The timbers in this category of trees are recognised as being the major Hardwood timber species harvested from Papua New Guinea.
Commercial hardwoods Many of the timbers in this group have been exported occasionally. However, substantial supplies, on a regular basis, for any particular species in this group would not be reliable.
Minor hardwoods Generally this category includes locally available species that have currently shown little export potential. Regular supplies of any one of these species is generally not possible. Therefore, they are currently of minor commercial value.
Softwoods The conifers have been harvested from plantations, mainly at higher altitudes, and are abundant in some areas, for example, in the Bulolo area.
Plantation species Several indigenous and introduced species have been planted in forest plantations throughout Papua New Guinea. *Araucaria* and *Pinus* species are two softwood examples included in this publication.
Occasional timber This category includes trees that are currently regarded as of little to no economic significance. The majority of these trees are limited in their distribution, but they have been recorded as sawn logs or of other utilitarian value.

Note: the term **"softwood"** refers to the conifers, whereas the **"hardwoods"** are the dicotyledonous flowering plants.

Timber tree

This features records whether or not a plant is known to be a timber species. If the species is regarded as a Timber tree, then it would also be classified as belonging to at least one of the categories in the Timber groups field. Although the timber of most trees has some local traditional use, such as for the framing of traditional buildings, these examples are not regarded as timber species because they have no known commercial value.

This feature is recorded as either:
yes, or
no – although the wood of a species may [have]been used traditionally, it is not regarded as belonging to one of the categories of timber with commercial value.

Appendix 3 – Analysis based on GBCA Publications

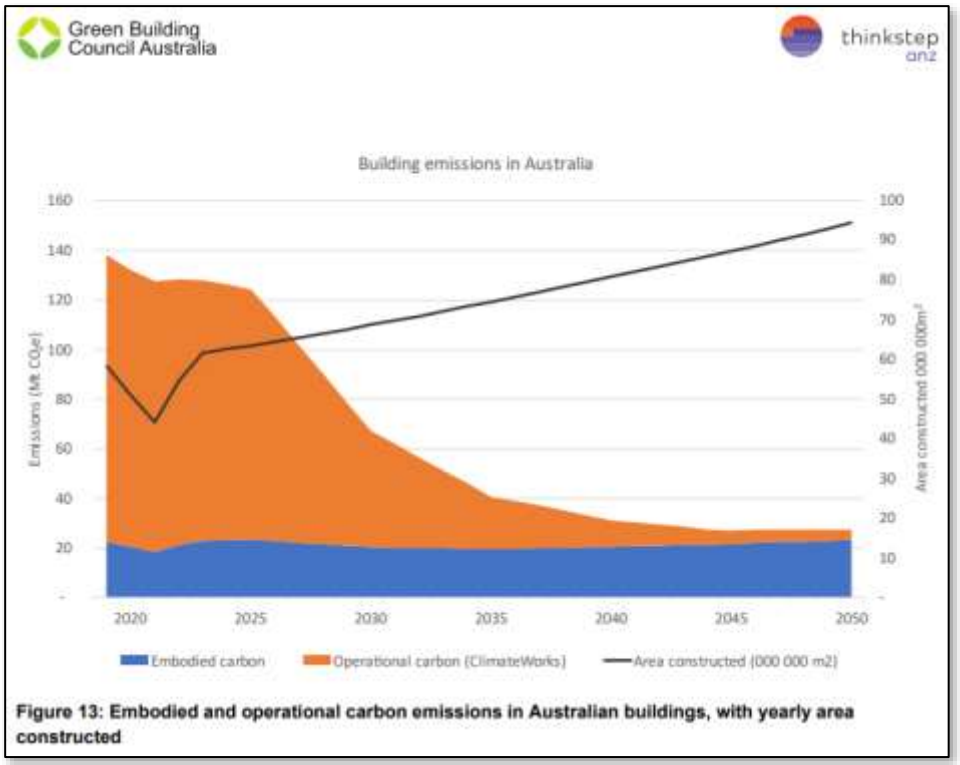

Figure 13: Embodied and operational carbon emissions in Australian buildings, with yearly area constructed