Australian Plants Society NORTH SHORE GROUP

Ku-ring-gai Wildflower Garden

PLANT COMMUNITIES

Did you know that,

A Plant Community

- is defined as an inter-related assemblage of vegetation having structural and species diversity, forming a recognisable association.
- may vary from time to time in composition.
- may be based on its structural or species composition form.

Components of a Plant Community

A Plant Community is a recognisable association of plant species. Plant Communities descriptions combine the disciplines of ecology, biology, topography, geology, history and plant identification. They are made up of all the processes and interactions that bind them together.

Identifying Plant Communities

The classification of vegetation into distinct groups is intuitive and subjective. Vegetation communities are not static. They vary continuously both in time and space and may merge into each other. At other times you can get sharp-edge boundaries in vegetation (such as those encountered at the edge of wetlands or at the climatic tree-line and on geological boundaries). Often edges are by no means clear, and not all vegetation falls easily into just one recognisable plant community. New classifications of communities are appearing. Follow the latest changes on the NSW Government's Website (www.environment.nsw.gov.au). It is possible that some standardisation of the allocation of communities is needed.

Development and changes

Many factors may affect the distribution of plant communities. Disturbances such as bushfire, drought and flood can cause changes in these communities. (See Appendix for more details).

Succession

Succession is the slow orderly progression of changes in community composition during development of vegetation in any area from initial colonisation to the attainment of the climax typical of a particular area. The climax is the final or stable community that is more or less in equilibrium with existing environmental conditions.
At Ku-ring-gai Wildflower Garden (KWG), this succession was observed after fire (e.g. Smith's Track, which was burnt in 1991, and the area known as Donnelly's swamp, burnt in 1994), and takes about 20 years. In 1991, commonly observed species on the Smith's Track included *Boronia ledifolia and Dillwynia retorta.* No records have been kept for this area, but these species were uncommon before the recent burn. After the fire in 1994, species in the Donnelly's swamp area such as *Blandfordia nobilis, Sprengelia incarnata, Drosera binata, Aotus ericoides, Xyris sp and Gahnia sp* were prominent. At a later stage,

Viminaria juncea dominated. It is uncommon to find those plants there today but some of these are now regenerating after the recent planned burn here.

Soils

Soils are a factor in Community development (See Appendix). In Ku-ring-gai soils from different rock types include:-
Shales which weather to form red/brown clay soils. They are usually deep, fertile and easily eroded or highly vulnerable. These shale soils are found in the higher parts of the area. Occasionally a thin layer of **sandy loam over a clay base** is found and is poorly drained and gives rise to marshy sedgeland and mallee communities.
Sandstone generally weathers to form grey/yellow sandy soils which are acidic with low fertility. These support a very high diversity of plant species. Sandstone is located in the lower parts of the area.
Laterites, from iron and aluminium oxides, are remnants of a previous extensive shale plateau surface. They provide some nutrients to the yellow soils and are able to support low open forests. They are found on higher sandstone soils and there are examples in the vicinity of KWG and St Ives Showground.

Although the KWG vegetation is essentially Hawkesbury Sandstone flora, it could be influenced by the presence of Shale in some of the higher areas.

Features of different plant communities.

Species Assembly Communities

- consist of the mix of different species that occur together. Some communities are very diverse or may have only a couple of species present and others have been classified as endangered. Benson and Howell (1994) described communities based on map units in their report 'The natural vegetation of the Sydney 1:100 000 map sheet'.

Structural Formation Communities

- The largest/tallest plants are known as the **dominant** species of a community. Isolated tall plants are called **emergents** and are generally discarded in evaluation of a particular community.
  The classification for structural plant communities was developed by Specht (1981). It has 3 key factors:-
  1 - the tallest stratum of the dominant vegetation
  2 - the height of the dominant vegetation.
  3 - the percentage foliage cover.

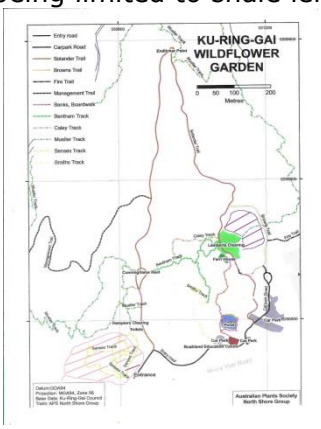
At KWG the late Val Williams found 9 Specht Structural communities.

Local Endangered Plant Communities

There are six endangered ecological communities in Ku-ring-gai.

- Blue Gum High Forest
- Duffys Forest
- Sydney Turpentine–Ironbark Forest
- Coastal Upland Swamp
- Swamp Oak Floodplain Forest
- Estuarine Saltmarsh

Duffy's Forest Vegetation Community (DFVC)
DFVC has the structural form of open forest or woodland. Distribution is naturally patchy, being limited to shale lenses and lateritic soils on Hawkesbury Sandstone, typically found on ridgetops, plateaux and underslopes. Rock outcrops are usually absent from the community. It occurs primarily within the Warringah and Ku-ring-gai council areas. This community is listed as an **endangered ecological community**. Components of DFVC are located at KWG around the Senses' Track and below (east of) Lambert's Clearing.



Dominant canopy trees - *Eucalyptus sieberi* (Black Ash or Silvertop Ash), *Corymbia gummifera* (Red Bloodwood), *Angophora costata* (Sydney Red Gum), and frequently a Stringybark (*E. capitellata* or *E. oblonga).* Some remnants of DFVC provide habitat for threatened species including *Epacris purpurascens var purpurascens, Grevillea caleyi, Pimelea curviflora var curviflora and Tetratheca glandulosa.*

Blue Gum High Forest (BGHF).
BGHF is a moist, tall open forest community that occurs only in areas where rainfall is high, soils are fertile and derived from shale of the Wianamatta group. It can be seen at Dalrymple-Hay Nature Reserve, St Ives. (In lower rainfall areas, it grades into Sydney Turpentine-Ironbark Forest). BGHF is listed as a **critically endangered** ecological community.
Dominant canopy trees - *Eucalyptus saligna* (Sydney Blue Gum), *E. paniculata* (Grey Ironbark) and *E. pilularis* (Blackbutt). Other trees include *Allocasuarina torulosa* (Forest Oak) and *Angophora costata* (Sydney Red Gum).

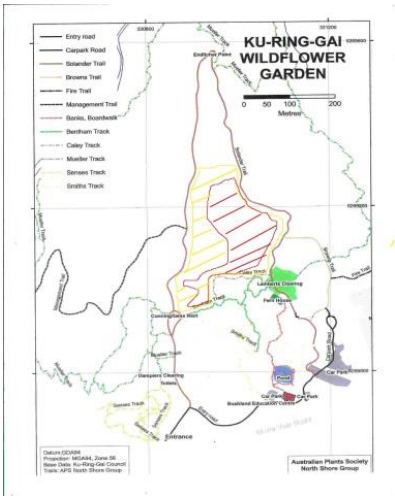
Contrast BGHF with Cumberland Plain Woodland, both on the same soil, but with different temperatures and rainfall.

Left: BGHF at Dalrymple Hay Nature Reserve St Ives

Right: Cumberland Plain Woodland

Sydney Turpentine-Ironbark Forest (STIF) is listed as an **Endangered Ecological Community** under the State Act and **Critically Endangered** under the Federal Act**.** It was originally forest, but may now exist as woodland or remnant trees. The assembly of species varies between sites depending on location and local conditions (e.g. topography, rainfall or exposure). STIF occurs on areas with clay soils derived from Wianamatta Shales or shale layers within Hawkesbury Sandstone. It is found between the Shale and Sandstone. In Ku-ring-gai, it is well represented at Bicentennial Park, West Pymble. It was found originally on the Cumberland Plain in many Local Government Areas of the Sydney region.

Characteristic species are *Syncarpia glomulifera, Eucalyptus paniculata, E. resinifera, E. globoidea, Angophora costata and A. floribunda.*



Coastal Upland Swamp (CUS), also listed as an **Endangered** Ecological Community, is found at KWG. It is associated with periodically waterlogged soils on Hawkesbury Sandstone plateaus with somewhat higher rainfall. Soils are acidic, yellow or grey sandy loams with a shallow organic horizon. Generally treeless, the vegetation is dominated by sclerophyll shrubs and/or sedges, but it may include scattered trees. The final determination by the NSW Scientific Committee lists 70+ species which characterise this Community but the actual composition varies from place to place. Ku-ring-gai Council (Edmonds & Robinson, 2012) found in limited surveys over 30 of these listed species in CUS areas in its Council area. Threatened Flora species have been found in these CUS areas.

Some of the species in the list of those which characterise CUS include:-*Banksia ericifolia, Banksia oblongifolia, Dampiera stricta, Dillwynia floribunda, Epacris microphylla, Hakea teretifolia, Leptospermum squarrosum, Petrophile pulchella, Thysanotus juncifolius, Xanthosia tridentata, Xyris sp.*

Epacris microphylla

Leptospermum squarrosum

Banksia oblongifolia,

Species Assembly Vegetation Communities of KWG

The mapped vegetation of KWG, assumed to be the same as that in the neighbouring Ku-ring-gai Chase National park, is essentially Sydney Sandstone Complex, which ranges from tall open forest to low woodland and open scrub (Benson & Howell 1994). Two map units are described; **Sydney Sandstone Ridgetop Woodland** (SSRW) and **Sydney Sandstone Gully Forest** (SSGF).

SSRW is found on the more exposed ridges and plateaux with shallower soils interrupted by outcrops of rock. SSRW consists mainly of areas of Woodland, Open Woodland and Low Open Woodland. Characteristic tree species of SSRW in KWG are *Corymbia gummifera*, *Eucalyptus oblonga*, *E. haemastoma* and *E. racemosa*. In the North-West section *E. sieberi* also occurs. Patches of *Banksia ericifolia* and *Hakea teretifolia* occur in open-scrub sites with poorly drained soil.

SSGF is generally confined to gullies and sheltered hillsides, particularly on the Southern and Eastern aspects. It may have 3 units;

- Open-forest/woodland where the main trees are *E. piperita* and *Angophora costata*. *Corymbia gummifera* and *Allocasuarina littoralis* are also present.
- Tall open-forest where the trees are *E. pilularis*, *Syncarpia glomulifera*. (This assembly is not at KWG).
- Closed forest with *Ceratopetalum apetalum*.

Specht's Structural Formation Communities at KWG

Low open forest (<10m height; 30-70% cover) and **Open forest** (<30m height; 30-70% cover) occurring mainly on lateritic soils at higher elevations and gentle downslopes in the **SSRW** areas. The most consistent dominants are:- *Corymbia gummifera, Eucalyptus haemastoma, E. sieberi, E. oblonga.* Other common plants include *Acacia myrtifolia, Banksia spinulosa, Bossiaea obcordata* and the ground Orchids, *Cryptostylis* sp, *Dipodium* sp and *Calochilus* sp.

The other area where **Open Forest** is found is on protected eastern and southern **slopes**, where water drains down from the ridges in **SSGF** areas**.** In KWG it overlaps with the Low open forest and the low woodland communities.
The dominants are *Angophora costata*, *Eucalyptus piperita* and to a lesser extent, C*orymbia gummifera.*

Low woodland (<10m height; 10-30% cover)

This area occurs on higher slopes, often quite steep and exposed north- or west-facing. The soil is shallow and infertile. This community is commonly found below heath areas. *Eucalyptus racemosa* replaces *E. haemastoma* (both Scribbly gums).

Dominants are *Eucalyptus racemosa* (narrower leaves, smaller gumnuts), *Corymbia gummifera, Eucalyptus oblonga, E. sieberi* and *Angophora crassifolia.* An often dense and diverse shrub layer may be found in the understorey with *Banksia serrata, Banksia marginata, Persoonia levis, Conospermum longifolium, Crowea saligna, Petrophile pulchella, Grevillea speciosa and Styphelia tubiflora.*
The rare *Darwinia procera* appears in the low woodland slopes near Fern Tree Gully.

Low open woodland (<10m height; <10% cover)

The rare mallee, *Eucalyptus luehmanniana* dominates this community, occurring in hanging swamps below forested areas.

Low closed forest (<10m height; >70% cover)
This includes Gully vegetation that occurs on some small creeks and in upper Tree Fern Gully.
Species include; *Callicoma serratifolia, Bauera rubioides, Austromyrtus tenuifolia, Leionema dentatum, Grevillea linearifolia* and *Gleichenia spp.*

Closed forest (10-30m height; >70% cover)
This consists of rainforest species in narrow bands in protected areas along creeks with steep gully sides and a drop in elevation. These areas are small (e.g. under Phantom Falls) and do not have a wide range of species. Species include; *Ceratopetalum apetalum, Tristaniopsis laurina and Lomatia myricoides.*

Closed Sedgeland (<1m, >70%)
This small area on Browns Trail is the largest hanging swamp in KWG. Scattered shrubs, heaths and ferns occur in poorly drained sandstone soils around one of the main streams flowing into Tree Fern Gully.

Species include; *Gahnia sieberana, Callistemon citrinus, Gleichenia dicarpa* and *Aotus ericoides.*

Pockets of heath on rocky outcrops
(½ to 1m height; varying cover)
These are likely to be an early stage in the colonisation of bare rock.
Lichens and Mosses are the first colonizers, then the seeds of *Darwinia fascicularis* and *Baeckea imbricata* fall into the moss and grow into low shrubs. *Pterostylis daintreana* also is located in the mossy area.

Open heath and closed scrub with emergents (<2m height; varying cover)
Pockets of heath with occasional low trees in depressions and fractures are on large flat sandstone outcrops. It occurs on benches and low slope areas on waterlogged, thin, shallow, stony yellow-brown to grey soils.

Taller species: *Hakea teretifolia, Banksia ericifolia, Allocasuarina distyla, Angophora hispida, Leptospermum squarrosum.*
Shorter species: *Epacris microphylla, Kunzea capitata, Darwinia fascicularis, Actinotus minor, Xanthorrhoea resinosa.*
Rare: *Tetratheca glandulosa.*
Because succession from the Open Heath to Closed Scrub occurs as the taller plants crowd out the smaller ones, these 2 communities have been mapped as one.

APPENDIX

Communities Development and Changes

Factors:-

- **Climate** - temperature, rainfall, winds. Changes can occur in the short term. The variability of rainfall from year to year is well known in Australia and plants and animals have evolved to live with cycles of drought and flood. The range and duration of temperature affect plant germination, flowering and growth.
- **Light.** The plants that perform best in shady conditions, especially if they are warm, have large leaves that optimise the collection of flecks of light and are slow growing. (The dominant genus in most of Australia's forests, *Eucalyptus*, is unusual in that the light that penetrates its vertical-leaved foliage is sufficient for successful growth of almost all other plants. Thus eucalyptus forests usually have dense understoreys, in contrast to the sparseness of the rainforest floor.)
- **Topography** - exposure, drainage, aspect, elevation
- **The influence from living things**:
    - Between plant species: shading, root competition. Species need to win the competition from other species for light, moisture, nutrients and space. They may develop substances produced in leaves, stems or roots to suppress or kill other plant species. Many plants have a mutually beneficial association with

mycorrhizal fungi. Proteaceae species have proteoid roots to help extract nutrients from infertile soils.
    - Between plants and animals (They need to arm themselves against predation from animals. e.g. grazing, insect attack.)
- **Human effects**: fires, rock removal, mowing, clearing, introducing weeds and feral species - these may become 'Threatening Processes'.
- **Fire**. Some plants are killed, but others survive fire due to underground organs which re-establish the whole plant (lignotubers). Many plants (e.g. Eucalypts) have epicormic buds under their bark that shoot after stress, enabling them to survive until normal growth reoccurs. Other plants such as wattles and native peas deposit huge amounts of seed in the soil that require heat or mechanical disturbance for germination. Some plants resist fire through high foliage water. Smoke promotes germination in some species.
- **Oxygen**. Aerial roots (mangrove), breathing bark (some *Melaleuca* sp), the ability to re-aerate soil (many wet heath species) are modifications that help plants survive in low-oxygen environments.
- **Excess salt/wind**. Leaves are desiccated by salt air near the coast, abrasive sand in the air in arid areas or the drying effects of strong winds.
- **Soils**. They are a critical determining factor, components of which include:
    - soil texture i.e. the proportion of sand and clay in the soil
    - soil depth.

Both are particularly important because they affect:

- Water availability and drainage. Although clay soils potentially hold more water than sandy soils, they provide less water for the plants where evaporation exceeds precipitation.
- Nutrient availability and retention. The effect of phosphorus is important.
- Air present in the soil
- Root development and anchorage
- Tree stability in winds
- Erosion
- Soil depth is largely determined by topography. In sandstone country, on the tops and sides of rough, rugged hills, soil tends to be shallow, while on valley floors and on gently undulating plains the soils can accumulate to considerable depths.

Climate change

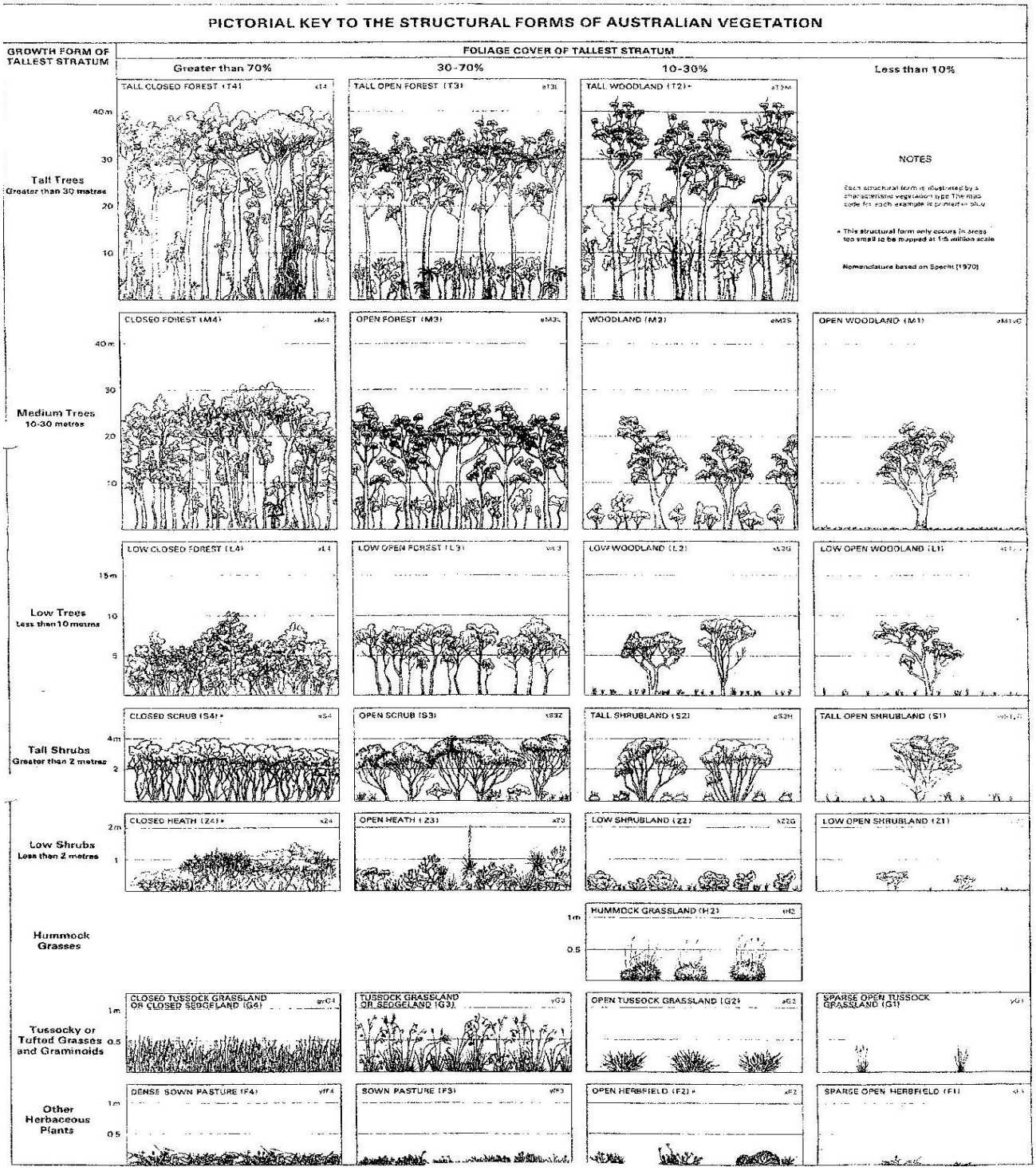
Climate change is increasingly becoming relevant to the discussion about Plant Communities. Changing temperature and rainfall patterns mean that some species will be outside their limits of tolerance. 1°C warming needs a shift of about 100km latitude to maintain temperature OR 100m altitude shift. In a continent where the average height of land is 330m, and 99% of land is under 1000m, there are not many options of going up, so species need to migrate, adapt, OR DIE.

The winners will be those species that have

- short generation times (ie time between seeding and flowering)
- good seed dispersal
- wide climatic tolerance
- wide habitat tolerance
- opportunistic features

The losers will be

- isolated populations
- genetically impoverished
- specialists



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Acknowledgements

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On the Web

Threatened Ecological Communities, their management, identification, regulatory requirements:

The lists of threatened species, populations, ecological communities and key threatening processes in the Schedules of the Biodiversity Conservation Act 2016 are updated when a Final Determination is published on the NSW Legislation website.

https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations

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