Australian Plants Society NORTH SHORE GROUP

Ku-ring-gai Wildflower Garden

# Topic 12: **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.

Plant Communities descriptions combine the disciplines of ecology, biology, topography, geology, history and plant identification. They are made up, not only of species, but 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, such as the Shale-Sandstone Transition Forest (the endangered community which grows between shale soil communities, such as the Cumberland Plain Woodland, or Blue Gum High Forest, and Sandstone communities). At other times you can get sharp-edge boundaries in vegetation (such as those encountered at the edge of wetlands, 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). Note comments on communities of the Lane Cove Valley as well (Martyn 2010).

## Development and changes

The distribution of different plant communities is a function of many factors. The effects of disturbances such as bushfire, drought and flood depend on the intensity, type, season and frequency of the disturbances.

### 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. Particular temperature ranges and durations are necessary signals for 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.)

The vertical leaves of the Eucalyptus allow light through to lower shrubs and groundcovers

- **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**.

**Soils** 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.

**Soils from different rock types**.

In the Ku-ring-gai area:-

**Shales** weather to form red/brown clay soils which are usually deep, fertile and easily eroded or highly vulnerable. A thin layer of **sandy loam over a clay base** 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.
**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 Ku-ring-gai Wildflower Garden (KWG) and St Ives Showground.

## 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 KWG, this succession is observed particularly 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 are uncommon now (2011). 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.

## 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

## Features of different plant communities.

### Species Assembly Communities

- consist of the mix of different species that occur together. Some communities are very diverse, others have only a couple of species present.

### 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.
  A classification for structural plant communities was developed by plant ecologist, Ray Specht in 1970 (See p8).
  It is based on 3 key factors.
  1 - the dominant vegetation. The tallest stratum.
  2 - the height of the dominant vegetation.
  3 - the percentage foliage cover.

## Growth form of plants (Physiognomy)

This includes the degree of woodiness, type of leaves, and direction of stem growth. Moist environments support lush rainforests, with plants that are able to take up large volumes of water and grow quickly. Large soft leaves with drip tips are features of these environments. In drier environments, hardy shrubs and grasses have adaptations to reduce moisture loss such as small leaves with waxy or hairy surfaces.

## Local Endangered Plant Communities

**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 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 and soils are fertile and is 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). This community 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.** 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 in many Local Government Areas within the County of Cumberland.

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

## 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 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 South-West section *E. sieberi* also occurs indicating an association with Duffys Forest Vegetation.
SSGF is generally confined to gullies and sheltered hillsides, particularly on the Southern and Eastern aspects. It may have 3 units;

1. Open-forest/woodland where the main trees are *E. piperita* and *Angophora costata*.
2. Tall open-forest where the trees are *E. pilularis*, *Syncarpia glomulifera*. (This assembly is not at KWG).
3. Closed forest with *Ceratopetalum apetalum*.

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

## Specht's Structural Formation Communities at KWG

The late Val Williams conducted painstaking structural plant community analysis, developed plant lists and combined these with soil surveys and topographic observation to produce a comprehensive picture of the Structural Communities of the Ku-ring-gai Wildflower Garden. She found nine overlapping communities in an irregular patchwork pattern. The following is a summary of these 9 communities, where they can be found, and the main species occurring in each community.

**Low open forest** (<10m height; 30-70%cover) and **Open forest** (<30m height; 30-70% cover) These occur 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 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* and *Gleichenia spp.*

**Closed forest** (10-30m height; >70% cover)
This consists of rainforest species in narrow bands in very 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 and 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 7imbricata* fall into the moss and grow into low shrubs.

**Open heath and closed scrub and emergents** (<2m height; varying cover)
Pockets of heath with occasional low trees in depressions and fractures on large flat sandstone outcrops. 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.

## References


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Fairley, Alan and Waterhouse, David - **West Sydney Wild**, Exploring Nature in Sydney's Western Suburbs. 2005
Friends of Berowra Valley Regional Park - **A Guide to Berowra Valley Regional Park.** 2001
Howell, Jocelyn and Benson, Doug - **Sydney's Bushland, More than meets the eye.** 2000
Keith, David - **Ocean Shores to Desert Dunes, The Native Vegetation of NSW and ACT**. 2004
Martyn, John – **Field Guide to the Bushland of the Lane Cove Valley.** 2010

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**On the Web**
The ecology of the Cumberland Plain Woodland:
www.rbgsyd.nsw.gov.au/science/current research/Ecology of Cumberland Woodland
Threatened Ecological Communities, their management, identification, regulatory requirements:
www.threatenedspecies.environment.nsw.gov.au/tsprofile/home_tec.aspx

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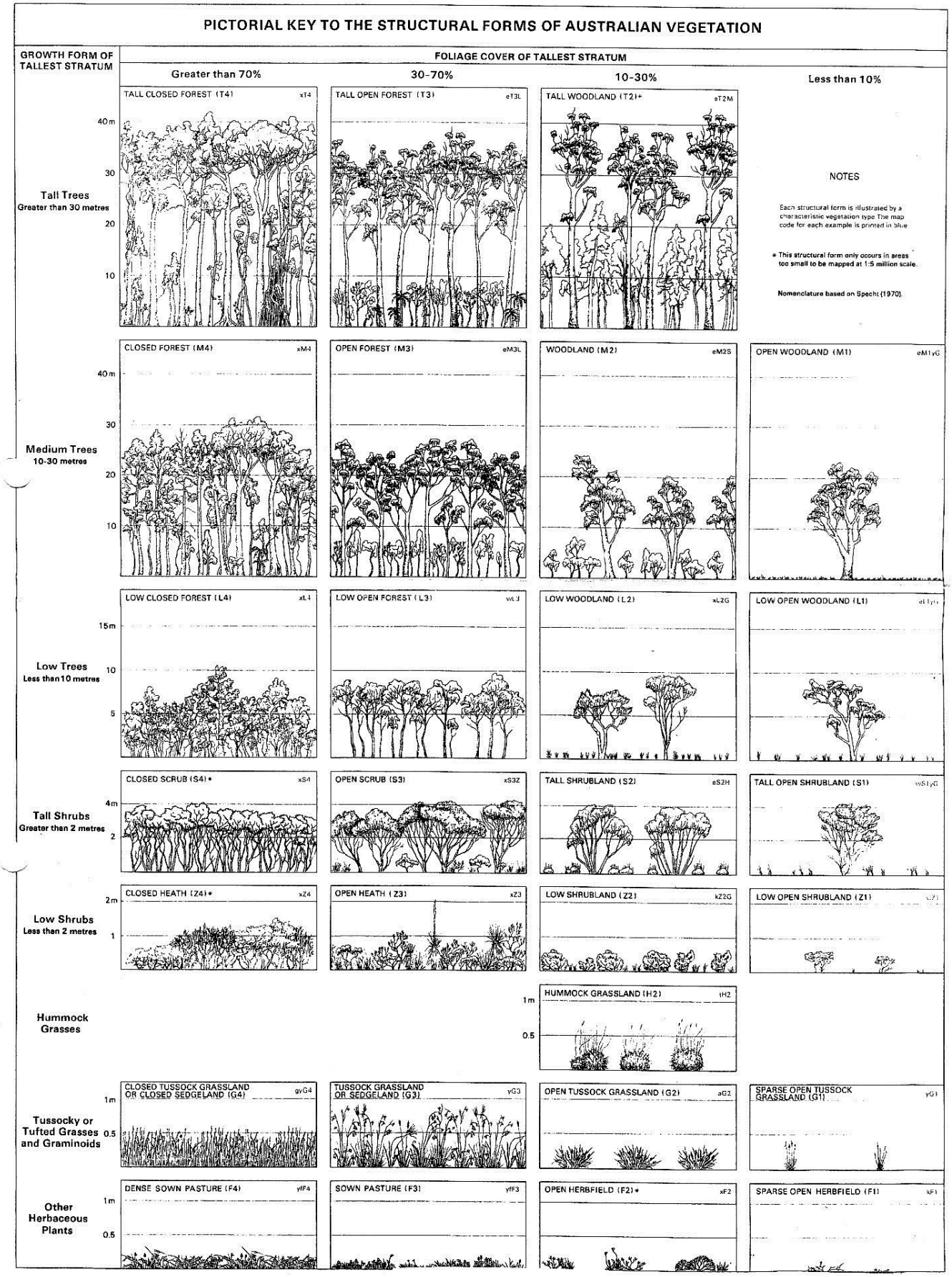


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