Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil-Vegetation Associations

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Soil / Vegetation Associations

Question:

I have an unusual occurrence of Scribbly Gum in an area of soils formed on Shale. As this is not normal for this area, could the soil conditions explain this?

Answer:

There is no doubt that the primary determinant of vegetation distribution is the soil type. It is essential in my view, when conducting vegetation surveys or collecting plant material, that the soil type should be examined also. Soil type, together with the influence of rainfall and runoff behaviour will provide a powerful predictive tool during site analysis for landscape planning. This is especially important when planning low maintenance landscapes as a plant type imposed on a soil and microenvironment unsuited to it will be a recipe for failure. Only if maintenance is high will it be possible to impose a vegetation type on an unsuitable soil.

There is no better example of the powerful association of soil with vegetation than at the Millennium Parklands associated with the Sydney Olympic site. In this example, the preliminary site soil analysis, together with a general understanding of soil science allowed a powerful understanding of the natural distribution of remnant vegetation. This understanding was used to predict future problems and thus influence a range of design considerations leading up to the design concept .

Firstly, it is generally observed that soils are deeper, moister, and more fertile at the bottom of a hill than at the top. We therefore find, even within one vegetation type, that the status of the vegetation is greater at the bottom of the hill. It would thus seem logical to design for deeper soil profiles and taller vegetation at the bottom and for lower status vegetation, even grassland, at the top of the hill, especially if soil resources are limited in a reinstatement exercise.

In poorly drained geology and soils such as those encountered in shale landscapes, elevation is no key to drainage and the top of a hill may show worse drainage or even hydromorphic soil conditions, as compared to the side slopes. This may lead to a heath like vegetation on the top of hills but a woodland/forest on the sides. Any flat areas in a poorly drained soil type in a humid zone can produce hanging swamps.

At the Homebush site itself, a soil survey revealed a strange occurrence of sandy clay soil on the top of flat topped hills. The normal rolling country that shale produces stood below these strange flat topped hills which are more typical of sandstone country. The GIS generated plan of gravel content (Fig 1) of the topsoil reveals nicely the occurrence of a soil which became known as Newington Laterite for its laterite gravel content. This soil is more typical of sandstone and indicates the past presence of a laminite of sandstone topping the underlying shale which forms the typical Blacktown soil landscape of heavy podsolic soils.

Once the occurrence of this lateritic soil became known, the anomalous occurrence of a stand of Scribbly Gum in a forest of ironbark associated with the Blacktown soil nearby in the Newington Forest became understandable. Scribbly Gum grows exclusively on sandstone soil and can grow only on the remnant cap of sandstone soil on top of the Blacktown landscape. This had escaped the attention of the vegetation surveyors who do not dig holes and they were at a loss to explain it. I wonder if your stand of Scribbly Gum shows the same thing.

Table 1. Natural Vegetation/Soil Associations of the Homebush Area.

Vegetation Type	Soil Type
1. Tall open Ironbark/Turpentine woodland	Red and Yellow podsolics on shale
2. Tall scribbly gum/grey gum forest	Lateritic yellow podsolics on sandstone weathering remnants
3. Hydromorphic /Casuarina tall form	Low lying grey and hydromorphic podsolics on shale, some of the deeper but poorly drained low lying reconstructed soils.
4. Hydromorphic Melaleuca Tea tree heath, short form some of the shorter Casuarinas	A heath of M. stypheliodes/nodosa occurred on dryland but poorly drained plateaux and slopes.
5. Dryland xerophytic heath	Kunzea, shrubby Melaleuca and Leptospermum, Dodonea and Bursaria
6. Riparian Melaleuca/Casuarina	Gleyed Humisols and solonchaks on the edges of water bodies, creeks and swamps both fresh and salt water.
6. Riparian rainforest remnants like Glochidion, F. rubiginosa, Eleocarpus, Callitris (Port Jackson cyprus).	Low lying spots just uphill from the riparian zone on deep yellow podsolics and colluviums. Sometimes only a few metres wide before giving way to ironbark woodland
7. Salt Marsh	Minimal solonchaks and gley clay
8. Mangroves	Unconsolidated gleyed clay and ooze
9. Freshwater swamps	Undifferentiated sediment, fill or alluvium substrate virtually unimportant.
10. Sedges and hydromorphic vegetation	Humose hydrosols in valleys and elevated hanging swamps.
11. Urban Vegetation	Wide variety of substrate both natural and reconstructed

Compiled From: Benson and Howell. (1990)

This strange occurrence partly explained the great variety of vegetation found at Homebush and referred to in the literature (eg Benson and Howell). The other powerful influence is the effect of water on a poorly drained subsoil clay and shale soil. Table 1 summarises this variety all of which can occur within 1 square kilometre. The typical catenary sequence would show dryland heath on the hill top, woodland on the sides, tall open forest on the footslope, littoral rainforest on the flats grading to littoral Casuarina forest just before it abruptly changes to saltmarsh and mangroves. Uniform Shale geology across the area, but very difference moisture regimes.

It became clear to the designers that the inherently poor drainage of the site soils was natural and lead to some fascinating vegetation diversity which could be used to advantage in the urban soil/vegetation association that was about to be imposed. The result will be a low maintenance landscape built of recycled resources and prioritising those scarce resources where they are most needed. By explaining to the artists the limitations of the site soil resources the scientists may have helped to obtain a more interesting result than if soil resources were unlimited.

Further Reading

Benson, D.H. and J. Howell. (1990) Taken for granted: the bushland of Sydney and its suburbs. The Royal Botanic Gardens Sydney.

Chapman, G. A. and Murphy, C.L. (1989), *Soil Landscapes of the Sydney 1:100,000 sheet.* Soil Conservation Service of NSW., Sydney.

Leake, S.W. and A. Todd. (1996) *Soil Conditions: Newington South Olympic Village Site.* Olympic Coordination Authority.