# Hanging Swamps and Valley-Floor Swamps: Carnivorous Plant Habitats

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Hanging swamps and valley-floor swamps occur in the upper Blue Mountains of New South Wales, Australia and support the majority of local carnivorous plant species, plus many interesting non-carnivorous plants. They play a very important role in the hydrology of the area due to their water storage capacity, and are an interesting geomorphic feature. In this article I will describe both habitats and present a model on their formation.

The morphology of the area is that of an elevated, greatly dissected plateau which rises to the west to a maximum elevation of 1111 meters above sea-level. A concomitant increase in rainfall occurs from east to west, which peaks at just under 1500 mm per annum in parts of the upper Blue Mountains.

The geology of the upper Blue Mountains plays a fundamental role in determing its' land forms. The lithology consists of Triassic Narabeen Sandstone, a heterogeneous pebbly silicious sandstone, with shale lenses which contain a significant amount of iron. This is overlain by the more homogenous Hawkesbury sandstone which outcrops more extensively in the lower Blue Mountains. These units dip shallowly and thicken to the east, the importance of which will be discussed further on.

The sandstones are porous, but contain impervious shale layers and lenses, and iron-indurated sandstone which deflect ground water. These occur abundantly and extensively within the Narabeen Sandstone and include the extensive Wentworth Falls claystone member. Rain water which percolates into this sandstone moves down until it encounters an impervious layer; it will then flow downslope which in the majority of cases is to the east due to the dip of the units. The ground water reaches the surface where the impervious layers outcrop, and form soaks and springs. Due to the volume of sandstone, high rainfall, and slow percolation rates, the rocks of the Blue Mountains hold a significant volume of water the slow release of which maintains many streams in times of drought. Often the soaks and springs are vegetated by wetland vegetation or flow into a wetland which further regulates the flow of water.

Swamps in the Blue Mountains are easy to locate due to the predominance of low, herbaceous plants which contrast markedly with the surrounding Eucalyptus-dominated woodland. The change in vegetation types can be dramatic, especially on the upslope boundary of swamps. Despite the rain of seeds onto swamps, Euclayptus, and most other woodland species, are unable to establish themselves in the saturated substrate.

## HANGING SWAMPS

Swamps which occur on the sides of valleys, often on appreciable slopes, are called "hanging swamps", or alternatively "valley-side swamps" (Holland, 1974), as shown in Figure 1.(A). Although they may be readily seen from the main roads through the mountains, access to them is not always easy. The principal behind them is simple - water-loving, predominantly herbaceous vegetation colonizes a soak or a spring and

the area downslope where near-surface water occurs. Thin peat and sand soils develop in these swamps and bare rock commonly occurs. Plants requiring aerated soil are unable to become established in the area.

The upslope margin of the hanging swamp is often a sharp vegetation boundary. The lower section and sides often merge into the surrounding woodland. These swamps range in size from meters to decameters and many are wider than long.

## VALLEY-FLOOR SWAMPS

Valley-floor swamps are an unusual land form which occur at the heads of valleys. The streams of these valleys typically occur within an entrenched second inner valley, producing a valley-in-valley feature. They form on undulating, sub horizontal sandstone basement with a gently concave profile at the head of the outer valley. Water enters the hanging swamp from creeks, soaks or the hanging swamps often occurring on the surrounding rockwalls (Fig. 1. (B)). They are large features, up to several hundred meters long and wide.

Valley floor swamps are areas of deposition and accumulate a sand and peat soil of typically 1.2 to 1.5. m depth. Carbon-14 dating of a number of swamps in the Blue Mountains has yielded ages of 17 050 +/- 600 years and 4 100 +/- 100 years (Holland, 1974). The older age corresponds to the termination of a period of major bedrock erosion in the region. The younger age indicates that there is a limit to the amount of deposition which can occur. Once the weight-limit has been exceeded, some (or all) of the swamp material slumps downslope, re-exposing bedrock which then is slowly recolonised (Baker et al., 1984).

The recolonization of wet, bare rock indicates how valley floor swamps initially form. Initially isolated, water-loving, often herbaceous, plants colonize concave crevices in the wet sandstone and slowly form and accumulate leaf litter with sand. The material trapped by these pioneering plants holds water and provides more space for more plants. A positive feedback is set up in which water-loving plants literally form their own swamp. The sandstone at the lip of the swamp becomes indurated with iron oxides, whereas bedrock corrosion occurs at the back to produce a concave bedrock base (Holland, 1974). The swamp is held together by the matted root system of plants and because of it's flat surface it is able to dissipate flood energy and resist erosion. The accumulated soil stores a considerable volume of water which is continually released and maintains stream flow.

Both hanging swamps and valley-floor swamps provide a range of different environments which include slow-moving acidic water, saturated peat, to well-drained peaty creek banks. Most locally native carnivorous plants occur in them and include *Drosera auriculata*, *D. binata* var *dichotoma*, *D. peltata* var. "red-rosette/ white-petal", *D. pygmaea*, *D. spatulata*, *Utricularia lateriflora* and *U. uniflora*.

These swamps are interesting places to explore not only for the carnivorous plants which they contain but also because of how they form.

## REFERENCES

Baker, Margaret; Corrington, Robin and Dark, Jill. 1984. Native Plants of the Upper Blue Mountains. Three Sisters Productions.

Holland, William, N. 1974. Origin and Development of Hanging Valleys in the Blue Mountains, N.S.W. Unpublished honours thesis, University of Sydney.

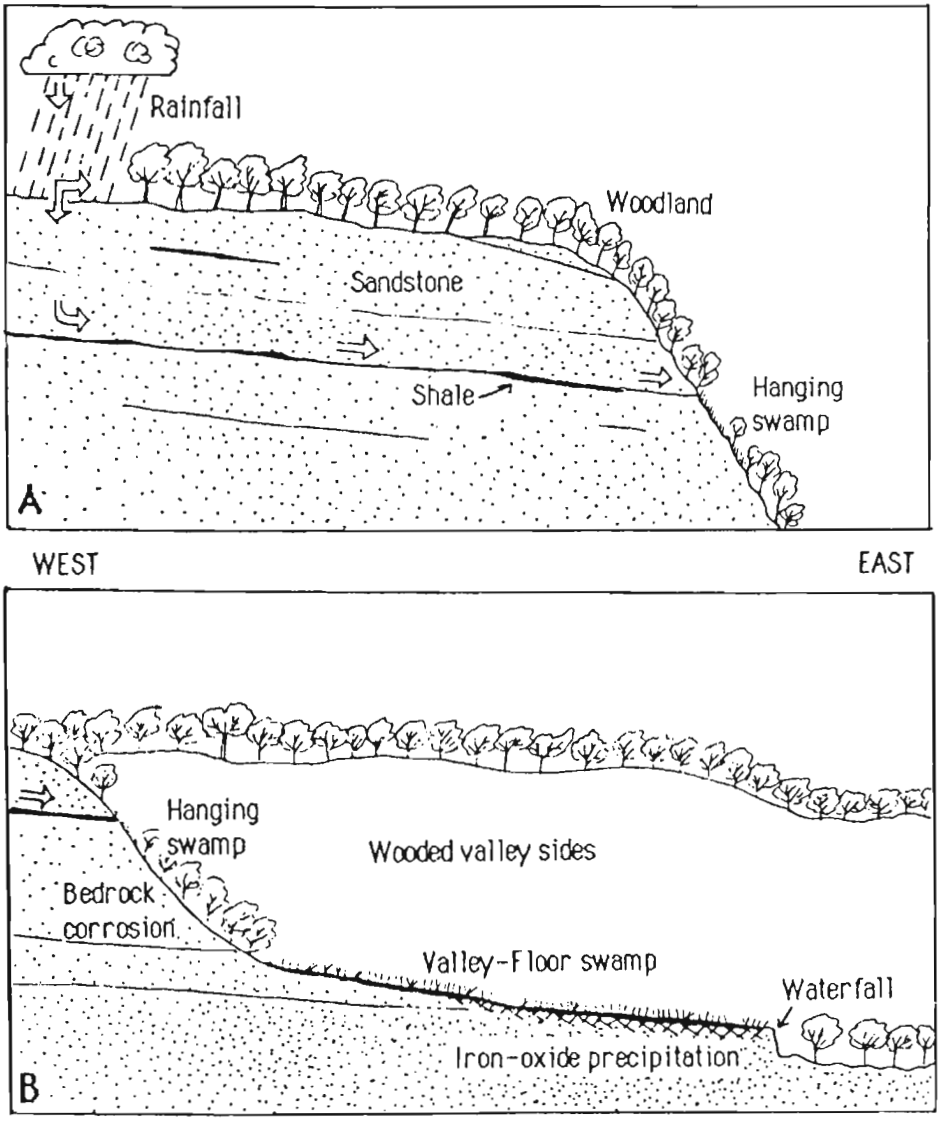


**Figure 1. Cross-section and model of: (A), a typical hanging swamp and, (B), a typical valley-floor swamp, in the upper Blue Mountains.** Hanging swamps occur on the sides of valleys where emergent ground water maintains wetland vegetation. This water was rainwater which had infiltrated and percolated through porous sandstone, then encountered, and followed the dip-slope of an impervious (shale) layer to its' outcrop. Valley-floor swamps occur at the head of valley-in-valley systems. They are significant areas of deposition which maintain their base-level by iron-oxide induration of the underlying sandstone. They are enlarged by bedrock corrosion of the headwall.