Water and Rivers Commission | WN9 January 2000

# Water notes

GOVERNMENT OF WESTERN AUSTRALIA

Natural Heritage Trust

ADVISORY NOTES FOR LAND MANAGERS ON RIVER AND WETLAND RESTORATION

## The value of Large Woody Debris (Snags)

### What is Large Woody Debris?

Large Woody Debris or Snags are tree branches, large limbs or whole trees which fall into a stream or river and are found either exposed, submerged or semi-submerged along the watercourse. Large Woody Debris (LWD) may remain in place where it falls into the waterway or it may be washed downstream and come to rest against an embankment or against other LWD or large rocks.

### Loss of Large Woody Debris

Early settlers removed LWD from watercourses to improve navigability along supply routes to townships. As the population of Western Australia grew, large areas of deep rooted natural vegetation were cleared and replaced with shallow rooted agricultural crops. This altered the water balance and meant that more water entered the waterways, increasing the frequency of flooding in the landscape. LWD was thought to slow the flow of flood water downstream and contribute to instability of the river channel. As a result, river management agencies and landholders undertook to remove LWD (de-snagging) and thereby improve the conveyance of waters downstream during flood events. This was thought to have the added advantage of improving channel stability and hence reducing the loss of valuable agricultural land. In many areas large scale removal of LWD has taken place with little regard for the function or value of LWD in our rivers.

*Large woody debris creates a variety of instream flow conditions and provides important habitat for a range of native fauna.* *L. Pen*

*De-Snagging on the Swan Coastal Plain*

Drainage schemes, which began on the Swan Coastal Plain in the early 1900s, moved large amounts of water off the landscape. To ensure clear passage of this water the Harvey, North and South Dandalup rivers were de-snagged. Pressure to find employment for large numbers of men during the depression of the 1930s led to the large scale de-snagging of large sections of the Murray and Serpentine rivers and further clearing of the North and South Dandalup rivers. This was met with resistance from owners of some farms, refusing to allow work teams onto their land. Widespread de-snagging operations very quickly caused environmental damage. In 1931 a shallow section of the North Dandalup River was scoured out to more than 1.8 metres. Floodwaters eroded the river banks, large amounts of silt poured downstream and large river pools vanished. On the Serpentine River, the once plentiful supplies of mature freshwater cobbler had disappeared by 1950, while other fauna such as the freshwater mussels and water rats became rare.

### How LWD influences the form and flow of a river

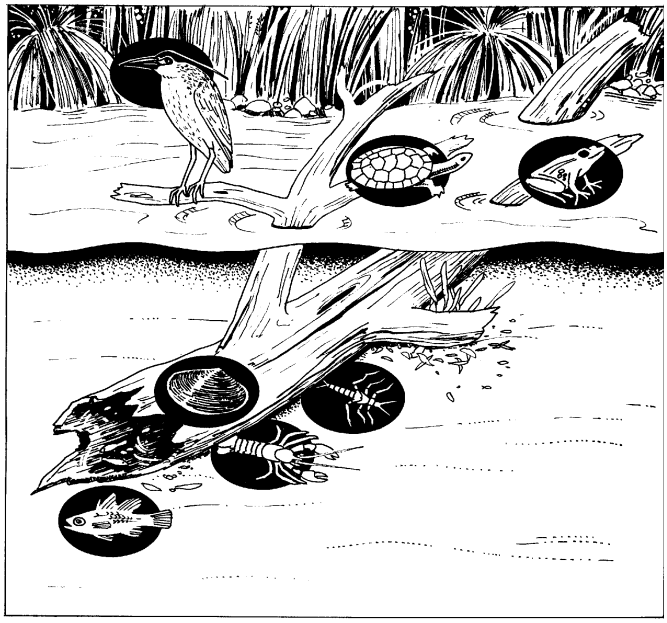
When a piece of LWD falls into a watercourse and lodges against the stream bed, smaller pieces of wood and leaves gather against it. The accumulating structure is known as a debris dam. Water flowing downstream is slowed by debris dams and where these are water-tight, water must divert around the dam. This diversion may cause small channels to widen upstream of the dam and decrease in depth.

Large Woody Debris is often thought to contribute to flooding. There is, however, little evidence that LWD increases flood frequency or reduces the capacity of a river to carry flood waters. Large Woody Debris will not impact on water levels unless it is blocking more than 10% of the cross-sectional area of a river.

The presence of LWD creates a variety of instream flow conditions depending on the depth of the water relative to the height of the LWD. Where water level is low, a piece of LWD lying across an entire channel will result in a slow flowing pools forming upstream. Water will cascade over LWD creating turbulent aerated zones. When water levels are high, LWD becomes submerged and flow conditions become less variable.

## Ecological Importance of Large Woody Debris

Large woody debris plays an important role in the ecology of stream systems. Some of the benefits of LWD are obvious and can be viewed by observing LWD from the riverbank.

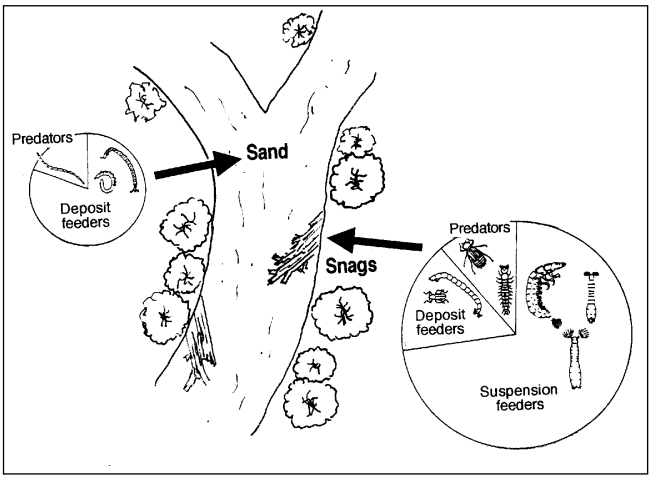


*Large Woody Debris provides important habitat for a variety of fauna. [Illustration by Dickinson Art]*

**Birds:** Large Woody Debris is often used by cormorants, herons and other birds which feed along our rivers. Large Woody Debris provides secure roosting and preening sites for birds as well as excellent feeding vantage points.

**Fish:** Our native fishes are more abundant and diverse in rivers with LWD. The fish take advantage of the slower flowing water upstream of LWD to escape the river flow. Also food resources, such as invertebrates, are often more abundant around LWD. Large Woody Debris provides protection from predatory birds and the fin-nipping habits of the introduced mosquitofish (*Gambusia* sp.). Pools created by LWD are important habitats for fish, particularly during summer dry periods when many Western Australian streams and rivers stop flowing. In these pools, LWD provides shade under which fish can escape the harsh summer sun.

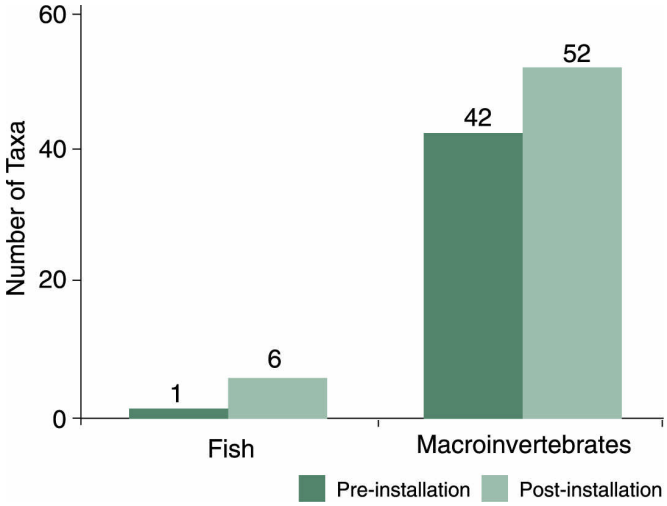
**Invertebrates:** Large Woody Debris provides an important habitat for tiny invertebrate fauna. This is particularly true in soft bottomed streams and rivers. In these systems, the sandy substrata is unstable and easily moved by increased flow and is unfavourable to many invertebrate species. LWD provides a stable habitat and the invertebrate fauna on and around LWD is often more abundant, diverse and productive than elsewhere in these systems.




*Macroinvertebrate communities are more diverse and abundant on Large Woody Debris than on a sandy river bed.*

**Ecosystem function:** Large Woody Debris plays an important role in function of stream systems, providing energy sources, essential to the food web. It provides a stable base for the colonisation of algae which uptake nutrients from the water column. The algae is then food to many invertebrate fauna and some native fish. Large Woody Debris also traps terrestrial leaf material that falls or is blown into the watercourse. The leaves are colonised by microbes and then by invertebrates which feed on both the microbes and the leaf material. These invertebrates, which are known as “shredders”, break the leaf material into smaller pieces as they feed on it. This finer material and the faeces that shredders produce is transported downstream in the flow and is then available to other invertebrates that filter their food from the water column. Some invertebrates feed on this fine organic material where it gathers in slow flowing areas upstream of LWD and in among the debris dams. As the wood itself decomposes, it too becomes food for invertebrates.

Large Woody Debris in rivers and streams can contribute to the reduction of nutrients entering our estuaries and near-shore marine areas. Where LWD is present, riverine pools are more common. The pools have slower water flow and stable substrata and as such algae and submerged plant material are often abundant. These can strip the water column of nutrients, thereby reducing the nutrient load being transported downstream.




*Number of fish species and macroinvertebrate taxa found in the Dandalup River, before and after the installation of Large Woody Debris (derived from Davies, 1999.)*

## Replacing wood in streams

Many Western Australian rivers and streams have low loads of LWD as a result of de-snagging and clearing of the riparian overstorey. In these systems natural LWD replacement may take many decades or centuries to provide adequate stream stability and restore the ecological balance.

Re-introduction of LWD by landholders and interested community groups will improve river stability and habitat for our native fauna. The approach to this must balance the ecological benefits with the need to remove water from the landscape. See Water notes 13 for guidelines on the management and replacement of LWD.

## Further reading

*Available from the Water and Rivers Commission*

Water note WN8 *Habitat of rivers and creeks.*

Water note WN12 *The values of the riparian zone*.

Water note WN13 *The management and replacement of Large Woody Debris in waterways.*

*Available from other sources*

Allan, J.D. (1995) *Stream Ecology: Structure and Function of Running Waters.* Chapman & Hall, London.

Benke, A.C. Van Arsdall, T.C. Jr, Gillespie, D.M. & Parrish, F.K. (1984) *Invertebrate productivity in a subtropical Blackwater River: the importance of habitat and life history*. In: Ecological Monographs 54: 25 - 63.

Beesely, L. (1996) *The Ecological Importance of Large Woody Debris in the Sandy River Systems of the Swan Coastal Plain (Perth, Western Australia).* Honours Thesis, University of Western Australia.

Bilby, R.E. & Likens, G.E. (1980) *Importance of organic debris dams in the structure and function of stream ecosystems*. In: Ecology 61: 1107 - 1113.

Bradby, K. (1997) *Peel-Harvey: The Decline and Rescue of an Ecosystem*. Greening the Catchment Taskforce, Mandurah.

Gippel, C.J. (1992) *Literature review of the physical significance of Large Woody Debris (snags) in streams and rivers.* In: The Hydraulic Basis of Snag Management. University of Melbourne, Victoria. pp 1-19.

[i] Davies, P.M. (1999) *Large Woody Debris in sandy river systems*. Unpublished report prepared for the Water and Rivers Commission. University of Western Australia.

For more information contact

WATER AND RIVERS
COMMISSION

Level 2, Hyatt Centre
3 Plain Street
East Perth Western Australia 6004
Telephone: (08) 9278 0300
Facsimile: (08) 9278 0301
or your regional office
Website: http://www.wrc.wa.gov.au

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Text by Dr. Kerry Trayler. Water note project coordination by Jodie Oates and Heidi Oswald.

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