Wetlands

Healthy Water = Healthy Landscapes **Wetlands = Water Quality**

Wetlands are effective filter beds (the kidneys) for our river systems, ground water and landscapes. Without wetlands to help filter the various sediments and nutrients collected from the landscape, the standard of our water quality would decrease, resulting in disruption to ecological and hydrological processes and lower bio-diversity. This in turn leads to landscape health issues, such as changing weather patterns, altered flood regimes and lowered ground water recharge.

Biodiversity Wetlands are highly productive systems. They cycle vast amounts nutrients within the landscape in the form of living organisms. These nutrients move through food chains via the fauna of surrounding terrestrial areas in an expanding ripple effect.

Natural processes such as runoff and erosion deposit nutrients into wetland ecosystems where they accumulate to support diverse and complex living communities. These nutrients and sediments then cycle throughout the wetland system, absorbing into aquatic vegetation and becoming available to other organisms. Birds and animals then carry these nutrients back out into the terrestrial landscape in the form of food for predators, and as droppings.

"Fire saw the fat of the land slowly flushed onto the floodplains and into the estuaries, where today it supports swamp and mangrove. It is no accident that such areas supported the greatest density of Aboriginal occupation at the time of European settlement."
Tim Flannery, The Future Eaters p233 (Australia, 1994)

Filtration of Sediments and Nutrients Removing wetland ecosystems breaks this cycle. Excessive amounts of nutrients are either flushed out to sea where they impact on marine environments, or become concentrated in our rivers and lakes leading to a general decline in water quality and outbreaks of toxic blue-green algae.

"*It has been calculated that 1 hectare (2.5 acres) of tidal wetland can do the job of US$123,000 worth of state of the art waste-water treatment, and many communities and companies are now recreating wetlands to cleanse their waste."*
David Bellamy, Introduction to Wetlands in Danger (1993)

Carbon Sinks Nutrients washing into wetlands promote substantial annual growth of wetland vegetation. Some nutrients, such as phosphorus and nitrogen, are recycled from year to year, while others, particularly carbon, are deposited through decaying vegetation into the beds of wetlands, progressively turning to peat and eventually forming coal.

In addition to the organic processes which deposit carbon as peat, wetlands also receive significant amounts of carbon in the form of charcoal from fires occurring within the landscape. This carbon is laid down in the wetlands (and river ponds and pools) as part of the sediment deposition process. Here the fresh carbon acts like an activated carbon filter, extracting nutrients and impurities such as heavy metals, biogenic salts and other compounds from the water.

These processes make functioning wetlands vital for providing an effective method of removing carbon from the atmosphere for the long term. Burning of drained wetlands releases substantial quantities of carbon dioxide (CO_2) and carbon monoxide (CO) back into the atmosphere.

"*Peat-forming wetlands, coral reefs and some marine plankton are today the only things that perform the vital function of keeping the gases of the atmosphere in balance. They are the true "lungs" of the Earth. The world's peatlands alone cover more than 2.3 million square kilometres (900,000 square miles) with 330*

billion tonnes of organic matter. If burned or drained and so opened up to slow oxidation, they would release 500 billion tonnes of carbon dioxide, almost double the amount present in the atmospheric greenhouse today."
David Bellamy, Introduction to Wetlands in Danger (1993)

Drainage of floodplains, wetlands and rivers through the cutting of channels allows water to rapidly exit the landscape to the sea, rather than being delayed in the landscape. This reduces freshwater within the soils and recharge to aquifers. Drained landscapes have reduced soil moisture content during the summer period. This reduces the quality and quantity of vegetative growth, including grass growth available for stock grazing.

Floods The greatest flood mitigators – floodplains and wetlands – slow water flow, and even-out flood peaks. Wetlands act like giant sponges absorbing water during wet times and slowly releasing it throughout the course of the year to aquifers, streams and the atmosphere.

"*In the Charles River of Massachusetts in the United States preservation of 38 square kilometres (15 square miles) of mainstream wetlands provides natural valley storage of flood waters. It is estimated that had 40 per cent of these wetlands been reclaimed, the increased flood damage would have cost US$3 million each year. And had they been filled completely, the added flood damage would have been over US$17 million per year.*"
Mitchell Beazley, p23 Wetlands in Danger (1993)

Ground Water A fresh water resource in aquifers must be replenished by fresh water recharge. Wetlands provide a significant portion of fresh water recharge points for aquifers. All wetlands seep to various degrees, with the water filtering through their beds (both through vegetation and soil) into ground water and aquifers.
Freshwater recharge dilutes saline ground water. This increases the range of plants able to survive by using the groundwater as the water is available for (not toxic to) a wider range of plant species. Loss of wetlands decreases the amount and the quality of water entering aquifers, which in turn leads to a decrease in ground water resource and a reduction in the quality of ground water. The salinisation of fresh water wetlands could lead to saline recharge entering fresh water aquifers.

Salinity Land clearing and the large scale draining of wetlands has highly altered soil hydrology processes within our landscape. Ground water receives higher levels of recharge due to the loss of vegetation which previously transpired surface moisture back into the atmosphere before it could enter deeper levels of storage. As ground water levels increase due to the additional recharge, water tables rise and enter into the drier sub-soil regions, which contain ancient salt crystals. These salts are then dissolved by the rising water table and mobilise upward into root zones where they affect vegetation, or crystallise on the surface of low-lying areas.

Saline groundwater can affect freshwater creeks and wetlands by causing them to become salty, and may also increase the salt levels within naturally saline areas. Groundwater, surface water, and salts interact. Because salt is dissolved by moisture, salts are carried by water throughout the landscape. This occurs both within surface water, and within the ground (soil moisture, ground water table, and aquifers). Altering the patterns of water movement in- and above-ground (through processes of wetland drainage and land clearing) influences the distribution of salts within our landscape.
Removal of wetlands on the scale that has occurred (approx 1,944 km^2 officially stated as having been lost in Victoria*) must have a significant impact on the salt-water balance in our soils, ground water and surface water.

* Wetlands The Heart of the South-west Wimmera Department of Natural Resources and Environment 2000

Land clearing alters water cycles. Moisture held within soils following rainfall is released back into the atmosphere by vegetation through the process of transpiration. This process, along with evaporation from sources of surface water (including lakes, wetlands, and the ocean), maintains moisture levels within the atmosphere which are necessary for cloud formation and the promotion of rainfall.

Loss of vegetation reduces the cycle of water from the soil being transferred into the atmosphere through transpiration. Less moisture in the atmosphere results in less rainfall. Loss of vegetation also affects surface moisture levels in two ways:

1. The removal of deep-rooted plants allows moisture to enter into water tables at an increased rate, as deep-rooted plants these plants once removed are not drawing on ground water for their growing requirements.
2. Vegetation removal exposes soils to higher evaporation rates. This causes a decrease in surface moisture levels. Many soils once dry can become water repellent and lose their ability to absorb moisture, resulting in higher run off and a further decrease in their ability to retain moisture. This eventually leads to an inability for soils to retain moisture.

Exposed soils are also prone to erosion by wind and water. Water is free to flow across the landscape and enter into the ground water table at an increased rate. Erosion leads to higher turbidity and nutrient levels within wetlands and rivers. Rising groundwater levels cause dryland salinity and the salinisation of wetlands, dams and rivers due to the mobilisation of salts into root zones and onto the surface. Further vegetation loss and alteration to soil conditions, water quality, groundwater, distribution of vegetation and weather patterns are a result.

These landscape changes resulting from the clearance of vegetation all have an impact on the health and function of wetlands.

Weather Rainfall requires moist air. Wetlands (particularly large ephemeral wetlands) evaporate large amounts of water, providing moisture to build weather systems (particularly early summer thunderstorms across south-eastern Australia), thus increasing rainfall.

Landscape alteration through processes such as land clearing, removal of wetlands, increased channelling and drainage to remove water from the landscape as rapidly as possible (as occurs within urban and agricultural areas), and the alteration of flood plains, reduces the distribution of water within the landscape. By limiting the quantity and duration water sits within the landscape, evaporation rates are reduced leading to changes in the distribution and behaviour of weather patterns.

Changing weather patterns affects land use, which contributes to changes in the distribution and composition of vegetation, the nature and volume of water within the landscape – whether it is permanent or ephemeral, whether it sits within the landscape (lakes and wetlands), or whether it flows in creeks and rivers on a permanent or seasonal basis (rivers and floodplains) – and the condition (fresh or saline) and level of the ground water table and of water stored in aquifers.

"*A canopy of broad-leaved 'dry' rainforest species, such as survives in tiny fire refuges across the north of Australia today, could, if they were more widespread, enhance rainfall by up to 60 per cent and push rainfall much further south. This is because the plants and the soils they protect retard the runoff of water. Through the leaves in their dense canopy they release vast amounts of the trapped water as moisture into the atmosphere. During the wet season, the winds blow in from the coast. As a result, the moisture transpired by the plants is formed into clouds and blown southwards to fall again as rain.*"
Tim Flannery, The Future Eaters p234 (Australia, 1994)

Turbidity has increased in many aquatic systems as a result of land clearing, heavy grazing, and conversion of rivers and floodplains into channels. Fine sediments are suspended in water making the water opaque and preventing sunlight from entering deep into the water. Submerged (and young emergent) aquatic vegetation is dependent on good light penetration into the water so that they can effectively photosynthesise, and thus produce the organic compounds (including sugars) necessary for rapid growth. Many wetland plants die back annually to underground parts, and thus effective photosynthesise is necessary to maintain populations of aquatic plants.
Aquatic plants (particularly those that are finely divided) are effective water purifiers, aiding the settling out and entrapment of fine particles. A healthy wetland plant community is able to cleanse water. Excessive turbidity can disrupt this process.

Managing Wetlands for the Future

The aim of wetland management is to maintain the balance of vegetation and fauna so as to sustain functioning wetland ecosystems. To achieve this there are three main management strategies which need to be applied:

1. Manage the threats to wetland ecosystems. These include drainage, flooding, grazing, alterations to salinity and nutrient levels, and invasive weeds.

2. Replace losses of wetland ecosystems – including individual plant and animal species, as well as ecological communities.

3. Net Gain. The current rate of decline in wetlands is endangering large numbers of wetland species. In the Wimmera catchment alone there are 58 Victorian Rare or Threatened Species associated with wetlands. If we are to protect these species and stabilise their populations, as well as wetland ecological communities as a whole, there needs to be no further losses of wetlands resulting from threats such as :
    - increased salinity
    - grazing pressures
    - drainage and development

   If all threats to wetland ecosystems are not stopped there will continue to be significant losses and decline of wetland species (flora and fauna).

4. To stabilise wetland species, we need to restore wetlands, create new wetlands to replace historic losses, and to eliminate threats. This is necessary to achieve a significant Net Gain on current wetland habitat (ie. regain a reasonable percentage of lost wetlands). This will help to stabilise threatened wetland species and provide for the long term sustainability of our wetland EVCs.

The window of opportunity to save our wetlands biodiversity is closing. Within 20 years, Victorian wetland ecosystems are looking at a catastrophic collapse. Inaction will guarantee this. Best results will only be achieved with immediate action aimed at obtaining Net Gain of wetland communities (ecological vegetation classes). The longer we wait the harder and more expensive it will become to save our wetland communities.

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