CHAPTER FIFTEEN

Dead leaf encrusted with hot snow/hot frost.

A crystalline hoar frost no spring warmth will melt.

A false frost lightens the ground around dead trunks.

The trees have the pinched look of a mouth tasting raw olives.

CHAPTER 15

SALINITY

Salinity, in all its guises, has also had a large impact on floodplain waterbodies and vegetation. One River Murray study found that 53 percent of native floodplain vegetation classified as severely degraded owed its problems to salinisation. (55) Floodplain salinity problems are similar to, although probably more acute than, those in other parts of the Basin. The causes and effects are complex, and vary enormously with different localities.

Dryland salinity, for example, affects the Basin as a whole. It is caused mostly by clearing for agriculture, which replaces deep-rooted native vegetation with shallow-rooted crops and pasture. Before such clearing, each tree behaves like a pump, taking up rainwater through its roots and releasing it to the air. With the trees — or pumps — gone, the rainwater remains in the soil. Most areas of the Murray-Darling Basin lie over shallow, saline watertables. Any surface water not taken up by trees and other vegetation trickles down through the soil to join the watertable, raising it and bringing its salt closer to the surface.

OTHER HUMAN IMPACTS

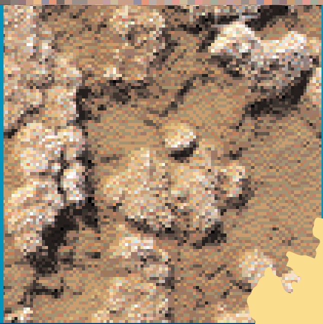
The Basin-wide problem of saline groundwater mobilised by clearing in catchments and mallee areas arguably represents a greater long-term threat to the river system than any other human-induced change. Ultimately, if the dryland salinity problem is not checked, the ecological importance of many floodplain ecosystems may become a matter of mere historic interest, because the floodplains, and the rivers they support, will be lost to salt. Some scientists fear saline groundwater inflow may ultimately so change many river ecosystems as to render them unrecognisable, and their water unusable.

The south-western portion of the Basin has been lost to salt before, through past geological and climatic changes. The last great salty episode peaked at the height of the last ice age in the Northern Hemisphere, around 18,000 years ago. A change in climate caused groundwater in the Basin to rise, poisoning vast tracts of land and the rivers that ran across it. Floodplain lakes turned to dry salt, and the wind whipped-up crescent-shaped, saline dunes along their shores. It took some 2,000 years for the watertable to fall again, and for vegetation to re-establish in low-lying areas. (56) Some scientists believe post-European clearing has mimicked the conditions of 18,000 years ago, bringing saline groundwater back to the surface and mobilising it on a vast scale. Some fear dryland salinity may be already so far advanced it might again take the Basin many centuries to recover.

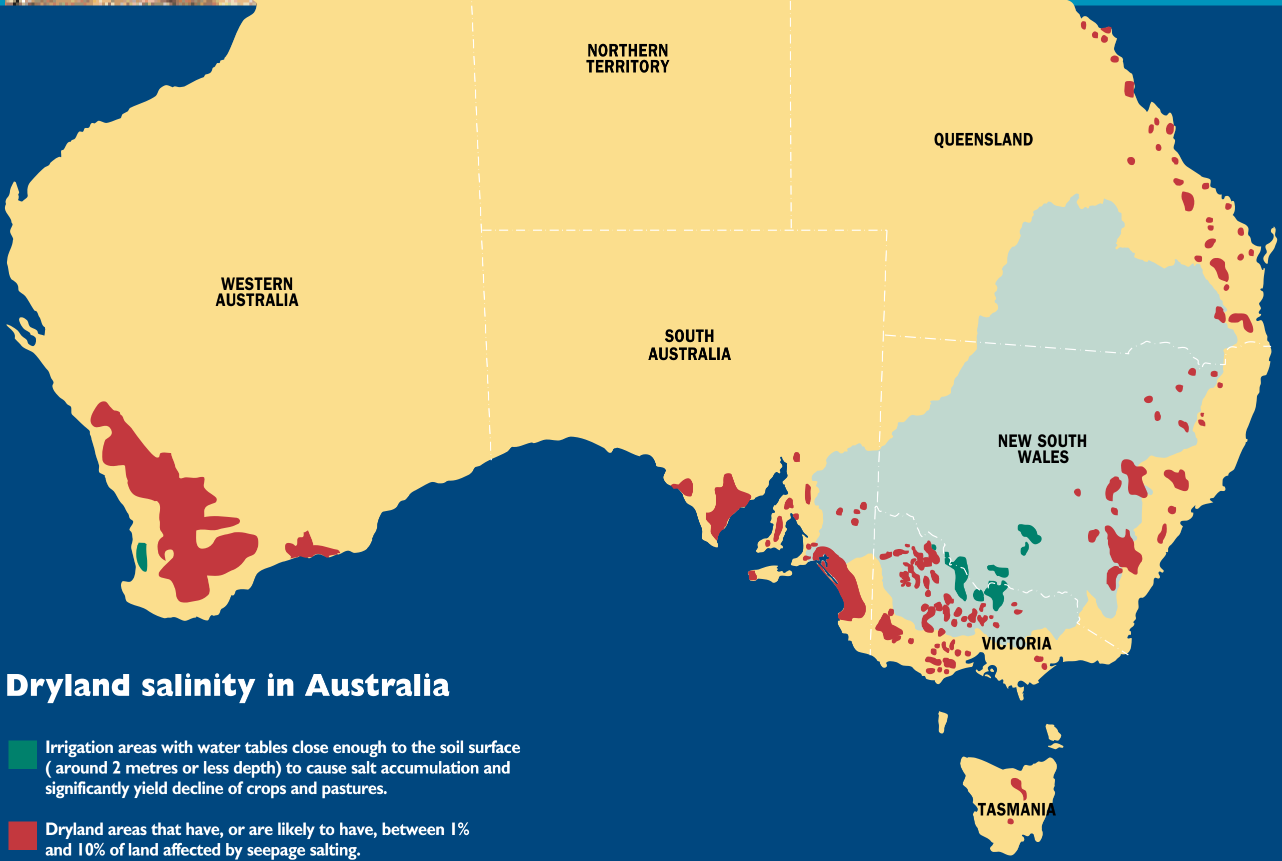
Human activities, especially irrigation, have also caused more localised, although often still very widespread, waterlogging and rising salinity on floodplains. Overuse of water on crops or pasture, for example, can top-up local watertables and bring salt to the surface. Drains carrying excess water away from irrigated areas also carry high levels of salt, leached from the soil.

In the past, intermittent floodplain wetlands were often used as evaporation basins for disposing of saline irrigation drainage water, a practice that has been halted. However, some floodplain wetlands are still used as dumping grounds for irrigation drainage, which is sometimes the only water available to wetlands alienated from the natural flooding cycle. Because floodplains are low-lying, they tend to be among the first areas affected by rising groundwater. Such watertable problems are compounded when floodplains are isolated from river flooding, so they are not periodically flushed.

One common problem in regulated rivers is that impoundments such as weirs not only dam rivers at higher-than-natural levels, they also top-up surrounding groundwater. Watertables under floodplains upstream of weirs can be up to two metres higher than under natural flow, bringing saline groundwater within the root zones of trees and other vegetation. This phenomenon has been blamed for widespread dieback among black box trees on the Chowilla floodplain in South Australia.



Rising salinity in irrigated rice fields.
Photos: *David Eastburn, MDBC*
Left: Salt crystals form as evaporation concentrates the saline solution.



Dryland salinity in Australia

- Irrigation areas with water tables close enough to the soil surface (around 2 metres or less depth) to cause salt accumulation and significantly yield decline of crops and pastures.
- Dryland areas that have, or are likely to have, between 1% and 10% of land affected by seepage salting.

In the northern Murray-Darling Basin irrigated agriculture is often concentrated on floodplains. Floodplain soils are less suitable for irrigation in most of the southern Basin, but substantial floodplain areas have been developed on some rivers. Like most Murray-Darling irrigators, floodplain farmers face the threat of rising watertables, bringing saline groundwater within reach of crop roots. Continual applications of freshwater can limit the problem for the irrigator, leaching salts downward and holding the saline groundwater at bay beyond the crop root zone, but not for nearby native vegetation. Salinity tends to concentrate in undeveloped land surrounding irrigated areas, where it can have severe effects on remnant native vegetation and on floodplain waterbodies.

The effects of rising saline watertables on floodplain wetlands are difficult to gauge, but may be profound in some areas. It is not known what effect increased river water salinity has on floodplains. Short-term, occasional saline flushes probably cause little long-term damage, but chronic river salinity may cause irreversible problems.

A complicating factor is that much of the native ecology is adapted to occasional incursions of salt, and that floodplain salinity occurs naturally in many areas. However, the problem is serious and worsening, and the native life of floodplains now suffers at least as much from rising salt as do crops and horticulture, and probably more so.

Pollution

One of the more contentious issues facing river and catchment managers is the effect of catchment and floodplain pollution on river life. Pollution sources can either be diffuse or concentrated. Diffuse sources include fertiliser spread on crops and pasture, livestock manure, farm chemicals, wildlife manure and nutrients naturally present in catchment and floodplain soils. Concentrated, or point-source, pollutants include sewage and stormwater outflows from towns, and from intensive agricultural sites such as livestock dips, feedlots and horticulture.

There is fierce and continuing debate about the relative importance of different sources of nutrients entering rivers. Some scientists emphasise the importance of diffuse sources; others believe point sources are more responsible. But, wherever they originate, high levels of nutrients cause water quality to decline, and help promote cyanobacterial blooms in streams and storages.

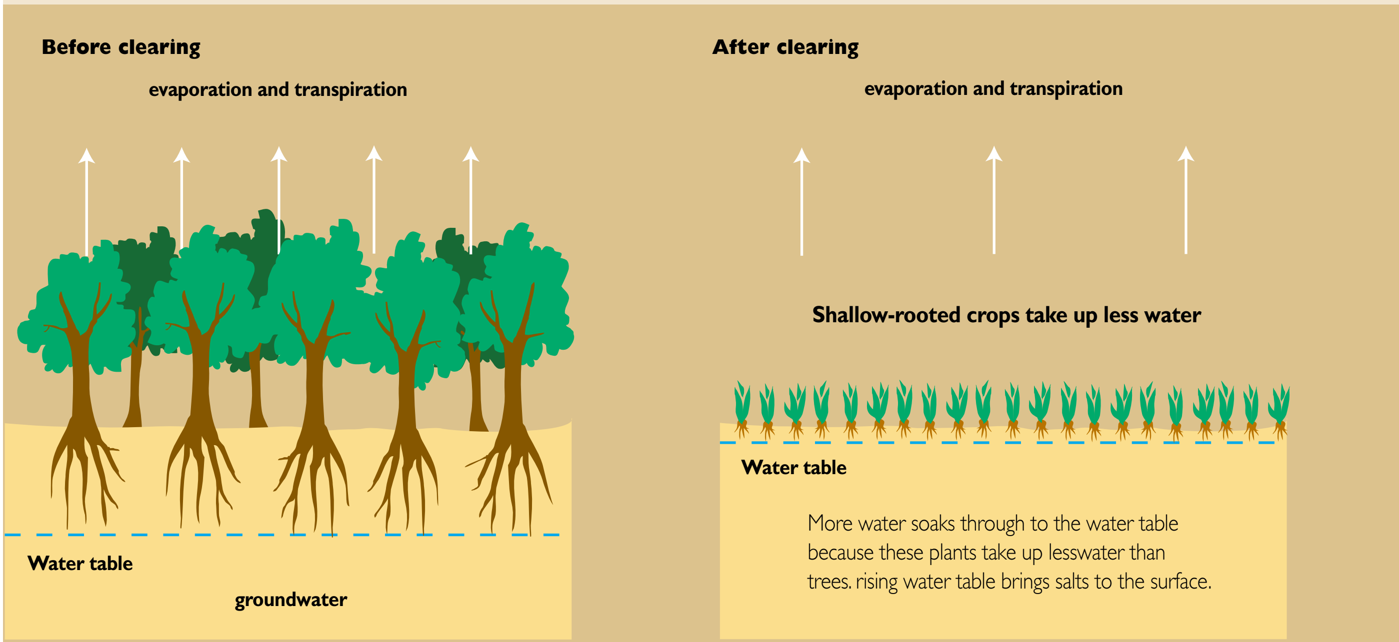
Less is known about the effects of other pollutants on Murray-Darling waters, although the destructive effects of chemical pollution on river systems elsewhere have been well-documented. Floodplain sediments generally now contain about twice as much heavy-metal contamination as they did before European settlement, and measurable traces of agricultural pesticides. There are clear local cases where contamination has damaged, or even destroyed, floodplain waterbodies, particularly billabongs (Chapter 11).

Recreation and tourism

Because of their proximity to rivers, and because of their pleasantly treed surrounds, floodplains have long been favourite sites for camps, barbecues, caravan parks, horseriding, motor sports, shacks, hunting, firewood collection, boating, fishing and similar recreational pursuits. The combined impact of many hundreds of thousands of visitors has caused much localised environmental damage, as well as exacerbated more general problems.

Despite this, tourism remains one of the likely bright spots for floodplains, particularly as improved community understanding and tougher restrictions minimise the impact of recreational users on floodplains. Indeed, the trend toward more enlightened ecotourism may help put value on natural resources, such as native

Deep rooted trees are removed and replaced by shallow-rooted plants such as crops, which use less water; less rainwater is absorbed and more percolates downwards. As a result, the water table will usually rise. This brings salts from deep in the soil up to the surface layer.



Source: Australian Academy of Science

Although the major commercial and social uses of Murray water are for irrigation and for urban and industrial supplies, it is also used for recreation and to generate hydro-electricity

Photos: ***David Eastburn, MDBC***

vegetation and pristine billabongs, which until now have often been regarded as having little economic worth. The recreation and tourism industries, both of which are already multi-million dollar industries, are likely to be big winners from any efforts to rehabilitate floodplain environments.

Greenhouse

Global warming caused by the 'greenhouse effect' is likely to have important implications for flow and flooding in the Murray-Darling Basin. Unfortunately predictions about whether the greenhouse effect will deliver more or less rainfall to Murray-Darling catchments vary widely, and are extremely uncertain. There were some initial suggestions that a greenhouse climate might deliver more water to Basin rivers, but predictions based on more recent computer models are equivocal, and some suggest a drier rather than a wetter inland climate. Researchers now say it could just as easily go either way.

Whatever its effects on the quantity of water falling in the Basin, greenhouse warming will affect the seasonality and variability of river floods and flows. Present rainfall patterns are expected to move slowly south, bringing more of the Basin under the influence of the monsoonal, summer-rain pattern now confined to its northern-most catchments. At the same time shrinking snowfields in the Australian Alps could change the seasonality and intensity of flows from that catchment. Much winter precipitation is stored in the mountains as fallen snow, then trickles gradually into rivers with the spring melt. As greenhouse warming diminishes the snowfields, floods in snow-fed rivers are likely to be more extreme and to come earlier in the season. (57)

All areas of the Basin will suffer more frequent and more intense storms, floods and possibly droughts. Overall the already variable climate facing floodplain rivers is likely to become even more variable and extreme, which has serious implications for the irrigation industry, for flood management and for the riparian environment.

What does the future hold?

The environmental trends affecting river floodplains in inland Australia are not all bad — not quite. It is true that massive ecological disruption has happened, and is continuing to happen. It is also true that the situation will continue to worsen, for decades and perhaps for centuries to come, even without further disruption. However, a few of the pressures which European settlement has placed on the floodplain system have already eased. And, if the community wants it badly enough, it should be possible to ease some of the other pressures.

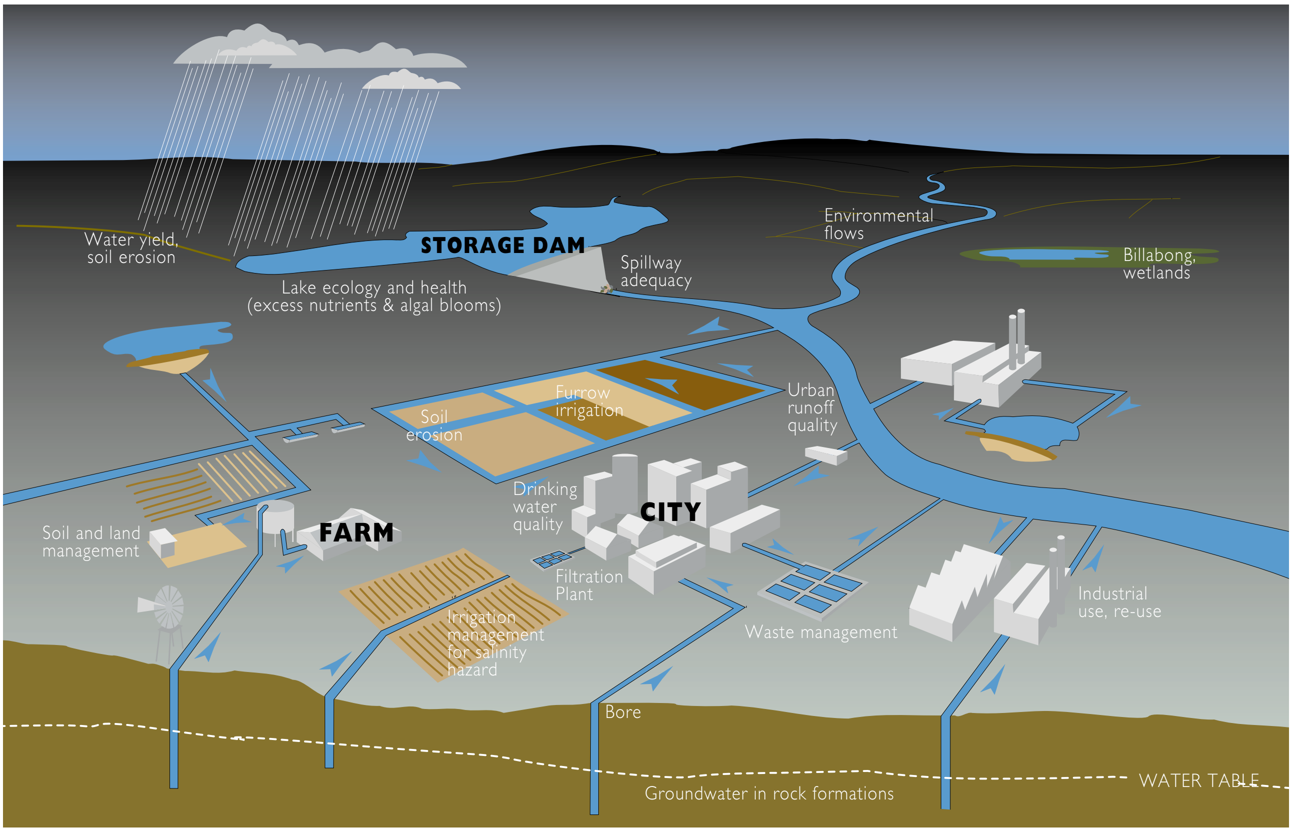
Many of the forces that have already been unleashed will still take many years to work their way through the system. Exotic weeds will continue to spread, and new problem plants will doubtless invade from other areas of Australia and from other countries. Some of the new pasture and garden plants that are regularly introduced and promoted will inevitably include varieties that will escape and cause problems. We may be growing the next willow or Paterson's curse in our nurseries now.

Similarly, the effects of past catchment erosion, increased sedimentation and nutrient pollution may take generations to work their way through the rivers, with weirs and other in-stream structures helping to prevent them from moving downstream. Higher and changed flows have altered the patterns of channel and bank erosion, with consequences for the surrounding floodplains. The river systems have not yet had time to adjust to these changes — the pulse of extra sediment which gushed into the river from about the 1860s has probably not yet worked its way through to the sea, and may take hundreds of years to do so. Nutrients from diffuse and point-source pollution may remain bound up in floodplain and river sediments for another generation, increasing the risk of cyanobacterial blooms.

River regulation is the most recent, large-scale change wrought by Australians. The entire river system has been physically altered by the changed flows, and is still adjusting (Chapter 12). It is far from clear what form it will take when, and if, it finally settles down. Floodplain ecosystems continue to be affected by all these changes, and are also still adjusting. Long-established trophic pyramids (Chapter 4) have been shaken from the bottom up, and many are still quaking.

The effects of ecological disruption can lag many years behind its causes, particularly with longer-lived species such as tortoises. The experience elsewhere has been that species declines and extinctions continue for many years after ecological disturbances have halted. Some floodplain waterbodies may have already settled down to new patterns, such as billabongs that have been switched from water plant domination to domination by plankton (Chapter 13). Others are still in flux, and some may remain so indefinitely. Indeed, a failure to settle down into any long-term ecological equilibrium may turn out to be a defining feature of some Australian inland waterbodies.

However, there are also positive signs. Aside from regulation, the peak of human activity on floodplains is now probably in the past. Most floodplains will never see again the frenetic timber-getting and intense grazing which swept along river valleys in the last half of the 19th century. Stocking rates are now much lower, if still too high in some areas, and the remaining large river red gum forests are mostly being managed to sustain the timber resource and much of the original ecosystem. Catchment erosion has slowed, and replanting is beginning to rival and even outpace clearing in the worst affected areas. Some trends are positive. Things can be done, if the community wants to do them. There is no going back, but there may be a way forward. The major unresolved issue is water, and how it is controlled at all scales throughout the river system.



Water management issues in a catchment. The pollution and excess nutrients which make their way into our rivers come from both diffuse - agriculture and urban stormwater - and point sources – sewage treatment plants and industrial waste.