THE MANAGEMENT OF WATER AND SALINITY IN SOUTH-EAST SOUTH AUSTRALIA

SUMMARY

This brief review, focussing on long-term effects of current drainage proposals, was carried out at the request of a group of landholders and with the concurrence of the Department for Environment and Heritage and the Department of Water, Land and Biodiversity Conservation of South Australia. Every attempt was made to be objective and independent of any strongly held views within government agencies and the community.

As much relevant information as possible was gathered in the limited time available, by making a visit to the area, meeting people with different views and consulting the extensive documentation on the situation. There was general unanimity about the need to avoid damage to the natural system of wetlands and its associated biota and to the agricultural productivity in the area. It was obvious to all that this required appropriate management of water in the landscape as a whole. There was agreement that some of the changes made to the landscape and its natural resources, with the intention of increasing agricultural productivity, had also increased the potential for salinisation of a number of areas in the region, though there were differing views about how to deal with this phenomenon.

My conclusions are primarily influenced by my ecological training and experience of the behaviour of water in the landscape, with particular respect to wetland systems. However, this knowledge is conditioned by some 30 years of intermittent association with rural landholders and government agencies concerned with the management of water in Australian landscapes and, particularly, my recent experience of the success of Natural Sequence Farming procedures in reversing salinisation and sustaining pastures during the recent prolonged period of relatively low rainfall.

My recommendations are drawn from these conclusions and are directed towards strengthening the region's long-term capacity to meet the 'triple-bottom-line" criteria of:

- resilient natural resource systems,
- economically productive agriculture and
- a sustainable future for society as a whole in the region.

CONCLUSIONS

I have grave concerns about the current rationale for the construction of further deep drains in the Upper South East and with the haste with which this is being pursued, particularly in view of the considerable extent of unauthorised drains that have been constructed on private land in the area. I believe there is a real danger of drying out large areas of the landscape with salt intact, leading to reduced levels of biological activity, reduced water holding capacity and general loss of the integrity of the soil in a number of places.

A delay in proceeding with the proposed Bald Hill and Didicoolum drains would provide an opportunity to undertake intensive evaluation of the efficacy of deep drainage in controlling the rise of saline water and of any adverse impacts on the quality of the drained soils and wetland ecosystems and of the biota they support in both agricultural and natural systems. This delay would also provide an opportunity to design a thorough pre- and post-drainage evaluation of the whole range of consequences of drainage with the intention of putting this in place when any further drains are constructed.

I have been surprised by the rather sparse attention paid to previous monitoring of relevant consequences of drainage as a basis for current planning. I make this comment with some diffidence, since I have not had the time or the opportunity for an intensive search of the literature, although similar concerns have been alluded to by others (eg McEwan *et al.* 2002, Rural Solutions 2002(a), Rural solutions 2002(b)). In any event, this delay would also enable a critical assessment of such information as a basis for future management decisions.

My visit to the region and particularly the flight over the area also revealed considerable differences in the quality of asset management of agricultural land. Several of the properties exhibited examples of well developed pastures and other agricultural land in excellent condition, in spite of the recent drought, while others gave cause for concern. A critical examination of the factors which enable some landholders to make better use of the prevailing conditions than others – a feature which is characteristic of every farming community with which I have interacted – would also be of benefit for the design of ongoing sustainable management of the region.

RECOMMENDATIONS

1. Delay the implementation of the proposed Bald Hill and Didicoolum drains.

2. Institute a thorough, scientifically based assessment of the current condition of soils, groundwater, plant cover (native and introduced, as appropriate), and associated biota, in relation to the stated objectives for a range of selected sites likely to be impacted, positively or negatively, by the installation of the above drains.

3. Institute comparative studies, of the same design and intensity as above, in similar areas that have been affected by drains, which have already been installed, as a basis for completing, or modifying, the drainage program, or for terminating and replacing it with alternative management procedures.

4. Review the results of these investigations as a basis for proceeding with the proposed Bald Hill and Didicoolum drains, or for developing a different strategy.

5. In the event that the drains are installed, continue with the investigations of the already selected sites for possible adverse, or beneficial, impacts of drainage.

6. Undertake comparative studies of pasture and cropping management practices on selected farms that volunteer to participate, in the interests of improving overall agricultural and nature conservation standards in the district as a whole.

WHOLE REPORT

TERMS OF REFERENCE (TOR)

1. To examine current proposals for drainage of selected areas of south-east South Australia with particular reference to objectives, basic assumptions, rationale, implementation-procedures, potential for adverse impacts, and ongoing management following implementation.
2. To review existing information about the soils and landscape hydrology of the regions to be affected by the drainage proposals with respect to sustainable agricultural production
3. To examine ecological features of potentially affected areas, with particular reference to biodiversity, the presence of endangered species and species likely to be adversely affected by drainage, the extent and distribution of potentially affected wetlands, and the extent and distribution of saline and potentially saline areas.
4. To review and comment on any relevant alternative proposals with respect to their agricultural and ecological costs and benefits.
5. To comment on the likely effects of taking no action.

OUTLINE OF STUDY PROCEDURES

I sought to be open to all ideas and relevant information, to listen and to read critically but to form my conclusions on the basis of scientific understanding independently of the range of opinions I was to encounter. As any scientist would recognise, this cannot assure that these views are correct in every detail and, therefore, must remain open to critical review in the light of scientifically assessed experience. It is particularly important for major manipulations of Australian landscapes to follow a process of 'adaptive management' based on rigorously set objectives and procedures that progressively test the information and understanding on which management procedures are based (Holling 1978, Walters 1986).

In view of the limited time I had available, because of other commitments, I chose to pay a brief six day visit to the area from the 24th – 29th August, including travel time. This enabled me to meet landholders, members of government departments and of the community with a wide range of opinions and responsibilities including:

> Charlie Bruce, Frank Burden, Chris England, Tony Gardner, Brenton Grear, Claire Harding, Dan Harley, Ian James, Jonas Kasauskas, Rob Kemp, Michael Leak, Keith McBride, Lynton and Maureen McInnes, Kent and Rose Martin, Annie Moorehouse, Dean and Susan Prosser, John Ratcliff, David Rasheed, Alan Richardson, Pip Rasenberg, Patrick Ross, Peter Symonds.

I was also able to visit several farms with and without deep drains and areas of natural vegetation and wetlands that were thought to be relatively unaffected by drainage procedures. These isolated ground level examinations were complemented by an aerial survey in a small aircraft piloted by Ian James and accompanied by Patrick Ross and Pip Rasenberg from about 1000 ft above the ground. The survey commenced from the airstrip in Ian James' property, "Cooranga", at Woolumbool to the Coorong and back, flying over Tatiara Swamp, Fairview Drain, Marcollat Watercourse, Bimbimbi Swamp, Jip Jip, Bakers Range Watercourse, the Cortina

Lakes, Pitlochry Station, the large deep drain flowing into Morella Basin, Salt Creek, the Coorong, Tilley Swamp Watercourse, Mandina Wetlands, Henry Creek, Big Telowie Swamp, Double Swamps, Grey Teal Swamp, Rocky's Swamp, Tee Tree Swamp, Smith Swamp, Park Hill Wetlands, Bakers Range Drain.

During my visit, I collected as much written material as I could, for subsequent examination, as I could find time, on my return to Albury. To this end, I concentrated on obtaining the information required to address the matters made explicit in the Terms of Reference. I have listed the documents I have consulted – some more extensively than others – but I have chosen not to write a detailed review of them in this report because of time limitations. It should be noted that there was not sufficient time for me to give equal weight to each of the terms of reference, though I believe the knowledge they would provide is essential for making wise, well-informed and defendable decisions in this matter now and into the future.

The main guiding principle for my conclusions and recommendations has been the long-term (measured in decades) viability and sustainability of the region's natural systems of water movement and organic productivity. Together these are the basis of both agricultural productivity and ecological resilience and, thereby ensure the sustainability of the economic and environmental systems on which human society depends. Moreover, rural landholders in Australia who have sought to manage their properties so as to sustain the vigour of their natural resources as well as exploiting them for agricultural production, have found that the quality and resilience of both agricultural and natural systems become increasingly interdependent. There is a large and growing literature about their experiences of implementing, for example, the principles of Holistic Resource Management (Savory, 1988), Landcare (Campbell, 1991, 1994; Gleeson *et al.*, 2004), Environmental Management Systems (Natural Resource Management Ministerial Council, 2002) and Natural Sequence Farming (Attachment I, Keene, 2004, Andrews, *et al.*, 2005). These experiences reflect both the relative ease of implementing these practices and the complexities of the ecological responses to them. An example of the latter is that the development of a viable mosaic of areas of natural vegetation in an agricultural system, can lead to a reciprocal balance between vegetation and climatic factors at meso and micro levels which benefits both ecosystems (Ripl 1995, 2003, Mitchell 2003).

REGIONAL CHARACTERISTICS

The South-East of South Australia is bounded by the Victorian border to the east, the southern ocean to the south and west and extends north to the boundaries of Kingston and Tatiara District Councils. Shallow "valleys" run north south between a series of low hills that are parallel to one another and to the coast. These were formed originally by sand dunes that were established behind a succession of prior coastlines. The soils of the valleys between the hills were originally formed beneath the sea. Ranging from acid sands to alkaline clays, they are highly variable and therefore require careful management.

Commonly known as "The Limestone Coast", this region is uniquely well watered for the driest State in Australia, itself the driest vegetated continent in the world. Groundwater occurs in unconfined aquifers throughout the region. These waters are of low salinity (less than 500 mg/L) in the south, but salinities then range from 500 to 1500 mg/L through the central and eastern parts, increasing further to even exceed 35,000 mg/L (the salinity of seawater) in the North-West (South East Natural

Resource Management Plan, October 2003). Groundwater from a deeper confined aquifer in the southern part of the region exhibits salinity levels ranging from 500 to 800 mg/L and forms an important source for agricultural and municipal needs.

During the wet season, which generally occurs in the winter, widespread surface flooding can occur throughout the remarkably flat topography of the shallow valleys. These floodwaters flow naturally from east to west and then south to north along a series of watercourses within these valleys, giving rise to a sequence of ecologically significant swamps and ephemeral wetlands of potentially high biodiversity, as indicated by those few systems that have been adequately surveyed. Several rare and nationally endangered aquatic species have been recorded and it is possible that more intensive investigation will reveal others.

However, these natural ecological benefits have to be balanced against the potential impediments caused by the presence of the floodwaters at this time of the year to agricultural endeavours, which form the economic basis of many of the landholders in the region. In summary, the main concerns appear to be centred on the impact of flooding on soil conditions. It is generally considered that the high water tables in areas cleared of complex native vegetation promote increase in soil salinity consequent on capillary rise of deeper saline water. Moreover, there is apprehension that water tables across the region will rise progressively over time, thereby causing further increases in soil salinity. There is also a general conception that the widespread replacement of natural vegetation with crops and with pastures that tend to be overgrazed, especially in years of poor rainfall, have initiated various levels of environmental degradation of soil conditions, water quality and native ecosystems.

The Upper South East Dryland Salinity & Flood Management Program (The USE Program) was developed in the early 1990s to address these concerns and is in the final stages of its implementation.

The Issues

The main issues now confronting the authorities who are responsible for completing the Program and for the community they serve are summarised below.

- *Differing levels of certainty about the effectiveness of deep drainage.*
- *Pressure from some sectors of the community to replace proposals for deep drains with shallow drains, strongly opposed by other members of the community.*
- *General agreement within the community to conserve wetlands but with seemingly little agreement as how to do this.*
- *A propensity for some landholders to carry out extensive independent ecological manipulation within their properties that has limited accordance with the Government's program.*
- *Growing divisions between landholders in the area, leading to distrust and enmity between factions in the local community and between them and Government agencies.*

A BRIEF SYNTHESIS OF THE CURRENT SITUATION

It is clear from both the written and oral information, which I have been able to obtain, that the prevailing attitudes in the community with respect to the drainage proposals can be assigned broadly into two main groups:

- Landholders and members of Government Departments and the community who firmly believe that deep drains will remove rising saline ground waters that would otherwise salinise extensive areas of potentially productive soil. This follows the widely held view in many parts of Australia that the primary cause of soil salinisation is the inevitable rise in saline groundwater following widespread clearing of native vegetation. However it is not always the case as indicated by the falling watertable since the winters of 1995 and 1996 for most of the observation bores in the region Durkay (2004).
- Landholders and members of Government Departments and the community who believe the need for, and the benefits of, deep drainage to deal with threats of widespread increase in salinisation in the region are exaggerated. This group includes people who attach high priority to the conservation of natural components of the native flora and fauna. There is grave concern about the potentially adverse impact of deep drainage on currently productive farming enterprises and on remaining natural ecosystems, especially those associated with the original chain-of-ponds wetlands.

Both groups hold their opinions strongly. The first group perceives the matter to be relatively urgent, in order to complete a process set in train some time ago for which the requisite finances are currently available, including a levy to which they contributed. The second group believes that the precepts on which the drainage program was designed may be seriously flawed and that the assumptions on which the program was formulated need to be verified by demonstrating the intended benefits as well as assessing the ecological impacts, if any, of the drains that have already been installed, as was clearly argued in some of the earlier documents. In several cases, these differences are deep enough to lead to significant dissension in the community, with consequent long-term harm to relationships between neighbours, if they are allowed to persist. The experiences recounted by Olsson *et al.* could prove useful in ameliorating this potential problem.

The earliest outline of the background to these issues that I was able to obtain was a 69 page paper prepared for the Upper South East Dryland Salinity and Flood Management Plan Environmental Impact Statement by Nicholson (1993). This provided a concise description, in its introduction, of the hydrological situation that was perceived to exist in the region at that time. This then provided a useful baseline for the more extensive planning developments which were to follow over the next decade or so. I also found it a useful, balanced description of the situation at that time, as set out below.

"The Upper South East region is currently suffering from the combined problems of dryland salinity and increased surface water flows.

Extensive vegetation clearance in the wider catchment, which extends into western Victoria, and its replacement with shallow rooted annual crops, has resulted in a significant increase in groundwater recharge rates. This has caused groundwater levels to rise over large areas, resulting in groundwater salinity where the groundwater has risen to, generally, within 2 m of the surface. It is estimated that 400000 ha of the Upper South East is affected to some extent by dryland salinity. This is having serious

economic impacts, such as a loss in stock carrying capacity, and is threatening remnant stands of native vegetation and valuable wetland areas.

An additional problem is the increase in surface flows, observed since the late 1980s. This is most apparent at the downstream end of the catchment, within the Bakers Range and Marcollat Watercourses and the Henry Creek catchment being the worst affected. The recent practice of laser levelling to improve agricultural production has contributed to increased flows by increasing run-off. Private drainage works and bank construction have also redirected and speeded up water flows downstream. As a consequence, terminal wetlands of the affected watercourses are receiving flows at a much greater frequency than before. This will lead ultimately to increased salinisation and degradation of habitat."

This situation provided the background and the need for a study with the following objectives:

"to:

- provide detailed, site specific, water management guidelines for all wetlands, conservation parks and areas of remnant vegetation in the study area

- formulate protection strategies for conservation parks and remnant native vegetation under the influence of rising saline groundwater

- assess the long term sustainability of conservation parks and wetland areas under the influence of rising saline groundwater, and hence the implications of the 'do nothing' option."

The rest of the Introduction to the background paper outlined the distribution of conservation parks and wetlands and associated flora and fauna, to the extent that these were known, in the study area and described the pattern of water flows as well as the historic and current drainage patterns. This was followed by a brief consideration of present groundwater conditions and anticipated possible rises within 25 years based on the monitoring data provided by the Department of Mines and Energy. The bulk of the rest of the document dealt with all these factors separately for 26 systems in the area.

The conclusions and summary of recommendations formulated through the study included the following:

Based upon the available data, it is concluded that surface water management is the primary strategy that should be adopted in the Upper South East to ensure long-term protection of wetland habitat and associated terrestrial vegetation. (D Mitchell underlined). Specific hydrological management plans should be developed for each watercourse/catchment, incorporating the recommendations made in this report. These are specific to each wetland and have been based on the most appropriate surface water regimes required to maintain the health and vigour of the wetlands and fringing vegetation. This includes a consideration of the length and frequency of inundation and subsequent drying period, necessary to ensure a healthy population.

A major recommendation is the creation of a 'Wetlands Waterlink'. This would incorporate surface water management strategies and stretch from Bool Lagoon to the Coorong. These two wetlands of international significance would be linked effectively through several extended ribbons of swamps, lakes, marshes and native vegetation to provide a mosaic of integrated wetland and terrestrial habitat, major breeding grounds, extensive wildlife corridors, drought refuges and protection for rare and endangered species.

The wetlands waterlink would be based on the principle of balancing the use of surface flows for conservation purposes with protection of agricultural land from flooding.

The adoption of the waterlink concept would provide major environmental and agricultural benefits by ameliorating dryland salinity and flooding problems in the Upper South East, at the same time as providing a chain of wetlands that would be potentially worthy of international listing.

The groundwater data provided for this study, and the subsequent predictions made regarding areas at risk, is based upon 10 years of monitoring data from the Department of Mines and Energy. In many cases, data has been extrapolated from one site to another and, as a consequence, some degree of accuracy in the predictions has been lost. In the case of the Watervalley Wetlands, monitoring of groundwater levels only commenced in 1991. Any conclusions must therefore be treated with caution. A major recommendation is that groundwater monitoring continues, especially in the vicinity of the Watervalley wetlands, so that a more accurate indication of groundwater movements can be obtained.

There is no doubt that rising saline groundwater is threatening many agricultural and natural areas in the Upper South East , (though these trends were reversed shortly after this was written – DM inserted) and, based on the available data, groundwater interception has been recommended in the vicinity of Fairview Conservation Park and adjacent to the West Avenue Range Watercourse. This will help prevent further degradation of wetland habitat and associated terrestrial vegetation."

It is difficult to ascertain the extent to which this seminal document formed the basis for planning the program of revegetation and intended biodiversity enhancement that was developed during the 1990s, as I have found no further reference to it which is both surprising and disappointing, though I recognise my search of the literature is far short of being exhaustive. However, it is plain from more recent documents that the emphasis has changed from surface drains to deep drains. However I found little in depth treatment of data to lay the basis for this change in emphasis. Again, I make this comment with some diffidence: if the evidence is there, I have not found it.

There are, however references to the Waterlink concept with respect to it being the final component of the program, rather than it being the central link to an assured healthy series of the remarkable chain-of-ponds systems in the Upper South East region. These are an especially fine example of successful adaptation to the highly variable supply of water (on which all life depends) in the particularly flat topography of much of the southern half of the Australian continent.

Instead, it appears that the emphasis shifted towards an examination of engineering solutions to the perceived threat of increasing salinisation of agricultural land from rising saline groundwaters by the institution of a comprehensive "Upper South East Dryland Salinity and Flood Management Program". This inevitably focussed on treating the symptoms of the problem rather than investigating the causes, in spite of evidence to the contrary cited earlier in this document.

In the meanwhile agriculturists and land managers elsewhere in Australia were discovering that drainage of soils in landscapes under perceived threat of salinisation, often exacerbated the problem by extending the distribution of salt, without removing enough to alleviate salinity levels in the salt-affected areas. However, there were a few landholders who focussed on more intensive management of soils under both cropping and pasture regimes, by requiring water retention in the soil rather than drainage (eg Ive 2005, Paulin 2002, Andrews, *et al.* 2005). Many of these practices were contrary to the conventional wisdom of the water managers in state government bureaucracies, most of whom were engineers and many of the activities of the 'alternative' practitioners were actively discouraged and even prevented.

The final stage of the Upper South East Dryland Salinity and Flood Management Program was summarised as "the completion of the drainage system, establishment of an environmental management system for the drains, wetlands and other environmental features of the region between Bool Lagoon and the Coorong and commencement of a program of environmental enhancement and sustainable production." The program is due for completion by June 2007.

"The proposed targets include:

- Completion of a further 476 km of drains
- Maintaining hypersalinity and other Ramsar values of the Coorong while allowing for a current discharge limit of 40,000 ML pa (on a ten year rolling average)
- Improving the protection and conservation management of 64,000 ha of native vegetation not currently under some form of covenant (eg NPWS reserve or heritage agreement)
- Developing and maintaining management regimes to maintain the ecological integrity of the wetlands of the region
- Monitoring the extent of landholder establishment of deep-rooted perennial species (most significantly lucerne, recognising the potential long-term benefits from the establishment of approximately 70,000 ha)
- Enhanced management of all salt affected land in the Upper South East
- Coordinated management of the program with appropriate stakeholder involvement and the adoption of an adaptive management framework and system to guide decision-making."

By mid 2005, it appears that emphasis was being placed more on the first of these targets, at some cost, in my view, to the second and third more ecologically oriented targets. As a consequence, more emphasis was also being placed on engineering solutions to protect agricultural areas deemed to be at risk of salinisation supposedly from rising groundwaters. Instead of the Waterlink concept being addressed as a primary requirement, as recommended by Nicolson in 1993, it appears to have been subjugated to the need to construct deep drains to intercept rising saline groundwaters.

The conceptual understanding underlying the need for this apparent change in emphasis to give primary attention to drainage strategies is set out, for example, in the briefing notes prepared by Andrew Johnson (2005) for the Landholder Meeting on 28 September to discuss the Bald Hill and Winpinmerit Drains. These notes constitute a clear statement of the conventional understanding of the phenomena leading to salinisation of Australian landscapes as a whole, an understanding that, until recently, I would have shared. However my recent experience of the Natural Farming Sequence procedures (Peter Andrews, pers. comm., Mitchell 2004, Natural Heritage Trust 2004, Andrews *et al.*, 2005) and growing awareness of other interpretations eg Jones (2001-2002), together with accumulating research evidence being collected at present under the auspices of an Australia Research Council grant to Southern Cross University (A. Keene, pers. comm.) leaves me in no doubt that this explanation does not apply in every case. It appears to be particularly inappropriate when applied to examples of the chain-of-ponds systems that were once widespread in the Australian landscape as described by early explorers. These systems are classically exemplified in the wetland systems of the Upper South East of South Australia. They were intermittent waterways interspersed with sedge meadows and ponds which were connected to one another in wetter periods, but separated at dry times when they may progressively dry up altogether. They depended for their existence on periodic surface flows following wetting of soils with high water holding capacity under vegetation with well-developed understorey and groundcover of decomposing litter. Indeed, as recently as April this year, Jensen (2005) noted that the greatest threats to the future conservation of the biodiversity and other ecological values of the Willalooka Wetland

Complex were possible changes in water quality coupled with reductions in the seasonally variable water flows into these systems.

I appreciate that many people dealing with the problems of salinity and drainage in other parts of Australia, especially those who have been involved with engineering solutions find this approach difficult to accept. The recent widespread exposure of the Natural Sequence Farming technology in the ABC Television program, Australian Story on the 6th and 13th of June has excited a lot of interest in the rural community and in several state bureaucracies dealing with the management and use of water. I believe the relevant South Australian Departments should explore this technique as well, if they are not already doing so. I am a member of the International Reference Panel set up to carry the matter further, under the Chairmanship of John Williams, the recently retired Chief of CSIRO Land and Water and a member of the Wentworth Group of Concerned Scientists. I would be happy to facilitate a contribution to the examination of the best way forward for the Upper South East of South Australia in respect of its salinity and drainage program.

In the meanwhile, I still have grave concerns about the current rationale for the construction of further deep drains in the Upper South East and with the haste with which this is being pursued at present, particularly in view of the considerable extent of unauthorised drains that have been constructed on private land in the area. I believe there is a real danger of drying out large areas of the landscape with salt intact, leading to reduced levels of biological activity, reduced water holding capacity and general loss of the integrity of the soil in a number of places.

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Recommendations arising from these conclusions are listed at the bottom of Page 2 in the Summary at the beginning of this Report.

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ATTACHMENT I

Briefing Paper

NATURAL SEQUENCE FARMING

A Practical Approach to Sustainable Rural Development and Effective Drought Management

Summary

Natural Sequence Farming (NSF) is a rural landscape management technique based on ecological principles, low input requirements and natural cycling of water and nutrients. NSF offers a low-cost, widely-applicable method of reducing drought severity and boosting productivity on Australia's farms and landscapes. There is now an opportunity with modest government support for the development and deployment of this emerging land management tool. It promises to deliver huge dividends to Australia's vast farming lands, consistent with the widely-acknowledged need for long-term ecological sustainability and profitability in the rural sector.

The Context

The challenge to provide Australia's ongoing water requirements, without undermining the ecological resilience of the Australian environment, looms large. The structure and function of natural ecosystems and landscapes have not been sufficiently well understood for effective error-free management. Attempts to modify the former to suit human purposes have caused as many problems as they have solved. The drainage of wetlands, extensive clearing of natural vegetation, cultivation of unsuitable soils, storage of water in surface reservoirs and the use of intermittent streams and rivers as continuous water supply channels, all for apparently sensible reasons, have nevertheless had unexpected adverse consequences. There is an imperative need to develop procedures based on natural processes that have evolved over the millennia to allow plants and animals to flourish, in spite of the rigours imposed by the unpredictable variability of the Australian climate. The procedures must also be compatible with the need for Australians to benefit and thrive from the production of food and fibre for their requirements and for export.

The Process

Natural Sequence Farming (NSF) procedures meet these criteria and their value was dramatically confirmed during the dry conditions recently experienced in Australia. In essence, relatively simple earthworks restore the connection between rivers and their floodplains and promote the retention of water in natural storage systems. This has the additional beneficial effects of decreasing the leakage of salt into waterways and the generation of considerable amounts of organic matter on the flood plains. The latter is then available as stock food and for distribution to areas that are lacking organic matter. The process has been well-researched and conforms to current understanding of Australian natural resources, though hitherto it has only been demonstrated at relatively few sites.

The Beneficial Impacts

In addition to the direct environmental benefits outlined above, NSF improves water quality, restores stability to the banks of waterways, enhances the quality of natural habitats, promotes biodiversity and strengthens natural resilience within the landscape, thereby ensuring continuing sustainability of the constituent ecosystems. These benefits arise from implementing NSF procedures on the basis of a clear understanding of connections between the different ecological units within landscapes and of the natural processes that govern the evolution of landscapes dominated by natural forests to landscapes modified for various forms of agriculture.

The introduction of NSF practices will also make Australian agriculture more combatable with natural ecological processes in the landscape. This will promote the potential to increase cost-effectiveness of farming in Australia, for example, by decreasing reliance on expensive procedures to improve pastures and increase organic matter content of soils.

Professor David Mitchell –

Chair, Natural Sequence Farming Steering Committee,

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