NEW BIOSPHERE AGRICULTURE

'Kin Domain'

Water Management

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We offer all contents in love and with the fullness of grace, which is intended to flow to readers who join us upon this fascinating journey throughout this incredible changing era we are all experiencing.

Namaste

KIN DOMAIN – WATER MANAGEMENT:

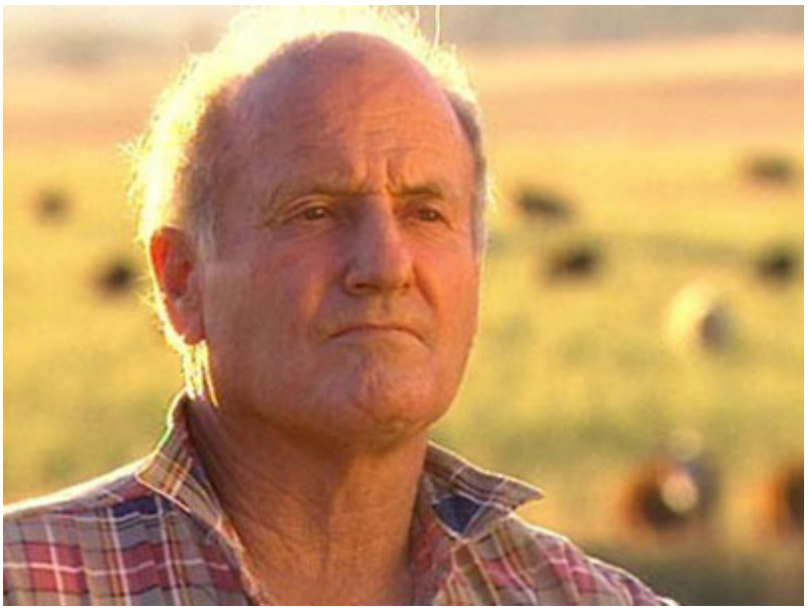
New Biosphere Agriculture management of **Kin Domain** projects and communities will entail resource manage of water in accordance with Peter Andrews' **Natural Sequence Farming** methods:

Peter Andrews

"It is absolutely essential to change the way we think. All other attempts at change will fail if we do not transform our thinking… A proper understanding of the way the world works requires people to think systemically, holistically, integratively and in a futures mode."

Lester Milbrath (1996) " Envisioning a Sustainable Society'

INTRODUCTION



Peter Andrews is a systemic thinker, environmentalist, a farmer and thoroughbred horse breeder from "Baramul Stud", Widden Valley in the Upper Hunter. He is a man who many believe is way ahead of his time. Peter has spent a lifetime on the land and his Natural Sequence Farming principles have been derived from a holistic understanding of the unique processes laid down in the Australian landscape. Peter has gained fundamental insights into the natural functioning of the land that leave him almost without peer. He has applied these insights in restoring his and other landholdings, to fertility levels that he says existed upon European arrival in this country. His unique NSF methods have been thought out integratively by looking at the properties of whole systems that emerge from the interaction of individual parts. This interdisciplinary, holistic approach is then applied with adaptive management practices to create a sustainable system of farming at individual sites.

On 'Australian Story' recently, Peter Andrews, backed by Dr John Williams[1], asserted that NSF methods were the SOLUTION to restoring the health of the Murray Darling. This potentially has the capacity to restore to present and future generations an enduring legacy.

Currently, Peter Andrews is engaged in overseeing the implementation of NSF techniques at "Baramul Stud" in the Widden Valley. He is also acting as a consultant to private and public sector parties interested in installing NSF in other parts of the country.

BACKGROUND:

Peter Andrews was born on a property outside Broken Hill and did not attend formal school until he was 13 years old. All the men were away at war and Peter grew up with the aboriginal stockmen who taught him how to 'read' the landscape, like the indigenous people would and to interpret it's meaning. Later,

he moved to Adelaide and then to Gawler in South Australia, to a small, degraded, salt-laden farm. It was here he began to explore the embryonic beginnings of NSF. Thirty years ago, Peter bought a larger, run-down 2000-acre grazing property called "Tarwyn Park", near Bylong in the Upper Hunter Valley. He then set about testing his theories on a larger scale. With remarkable success, he converted a degraded, salt-ravaged landscape into a fertile, drought-resistant property. Peter Andrews has done what no person ever thought to do – he has reconnected the natural functions of streams and wetlands by "jump-starting" the Australian landscapes unique processes of managing **drought, flooding** and **salinity**.

The startling results of his 'natural sequence farming' have been achieved very cheaply, simply and quickly. Peter has recognised how important the chain-of-ponds system is to many landscapes but prior-farming techniques had basically destroyed the connection of many streams and rivers from the floodplains and aquifers. Peter's NSF could 'jump-start' this system quickly and inexpensively. By 1976 Peter Andrews claimed that the model he had set up on "Tarwyn Park" was an example of a sustainable agricultural system subsequently verified by a CSIRO-led Expert Panel in 2002.

CONTEXT

Since the arrival of colonial settlers in 1788 we have changed the nature of our rivers and streams profoundly. The balance and resilience that existed in the Australian landscape has been depleting since that time. Our river systems did not always have a strongly defined channel or gully in them, what scientists now call INCISED. In fact, they were dominated by slightly convex flood plains and chains-of-ponds. The explorer, Edward John Eyre, as he was exploring through South Australia in 1841, complained of discontinuous water, or chain-of-ponds separated by massive reed beds.

'NSF describes an environmental management system or EMS, applied in agricultural landscapes, which is based on an understanding of landscape and ecological processes and implementing practices to achieve sustainability. This unique and affordable rural community-initiated method incorporates environmental management as part of a holistic farming system to restore hydrological connectivity between the stream and floodplain. Degradation from past management practices, compounded by natural climatic extremes, has caused the drainage and incision of streams and severed the hydrological exchange.

NSF restores the balance and resilience in the landscape by a very simple process. 'Natural Sequences' describe the way in which degraded stream systems can be better managed by utilising driving processes to enhance progressive changes via natural succession that restore ecological function. The NSF approach aims to effect long-term improvement in stream health and floodplain sustainability by the rehabilitation of a pool-riffle or chain-of-ponds type aquatic habitat together with inundated floodplain wetlands. The re-creation of a distributary flow system is achieved through the use of in-stream flow-control structures and secondary floodplain channels, combined with the effect of riparian vegetation changes, which provide morphological complexity in a degraded stream. Re-instating the hydrological balance increases groundwater storage in the floodplain aquifer, increasing freshwater re-charge and hence reducing saline groundwater discharge. This promotes the growth of pasture plants on the floodplain and riparian vegetation along stream banks.' (Keene 2005.)

KEY NSF SEQUENCES

- Create landforms that mimic the chain-of-ponds and swampy meadows by installing leaky weirs at choke points in the stream. This slows and de-energises the flow and facilitates lateral floodplain recharge from the shallow ponds along with

- Creating braided steams or flow lines above the leaky weirs to distribute water from 'freshes' to the break of slope.
- Return the natural water management function to the clay areas.
- The leaky weirs and braided streams send water out and over the floodplain creating a FRESHWATER LENS at the root zone. This freshwater lens sits atop the saline ground water and decreases SALINITY incursions.
- This raised freshwater lens, or water table, sitting in the landscape has a 'cooling effect', like dew and encourages "short" water cycling
- Spreads fertility over the floodplain which can be harvested and spread to the uplands.
- Increases plant and animal biodiversity.

NSF has the potential to transform agricultural production in degraded landscapes, which virtually are ALL riparian systems on the Eastern and Western areas of the country.

"The way we think influences what we see" Stephen Stirling (2004)

Peter Andrews' methods are so at odds with conventional scientific wisdom, that for 30 years he has been dismissed and ridiculed. He has had to have the resilience of personality to focus on restoring the natural resilience of the Australian landscape.

PRESENT ACTIVITIES.

Currently, Peter Andrews is drawing the nation's attention to NSF as a mainstream option of natural resource management. His present activities include engaging with the private sector in setting up a line of supply of produce from sustainable, NSF farming communities to the public.

He is also assisting urban developers and Local Government Councils in restoring degraded, eroded and incised creeks and developing sustainable landscape features. As well, he is in discussion with coal miners in the Hunter Valley to promote and restore degraded land on mining leases.

DEMONSTRATE HOW PETER ANDREWS HAS SHOWN COMMUNITY LEADERSHIP IN ETHICAL LAND STEWARDSHIP AT LOCAL, REGIONAL, STATE AND NATIONAL LEVEL.

Peter Andrews came to national attention in June of this year when the ABC's 'Australian Story' was shown over two consecutive weeks. At the program's conclusion it received the greatest response to any story in the program's decade long history.

The showing of that program was timely, as the drought had been prolonged and devastating. The producer's were able to show to the vast audience Peter Andrews' insights into how the Australian landscape dealt with drought. His property at "Tarwyn Park" was still cutting lucerne-hay four years into drought, without artificial irrigation, whilst all those properties around him were dry and barren.

In 2002, the then Deputy Prime Minister, The Honourable John Anderson, visited "Tarwyn Park" and was absolutely astounded at what he saw. When he got back to Canberra he immediately commissioned the CSIRO to gather a panel of interdisciplinary experts to report on NSF at "Tarwyn Park". Dr John Williams from CSIRO's Land and Water Division, headed up the team that produced the Expert Panel Report in July 2002 entitled The "Natural Farming Sequence. (Now known as Natural Sequence Farming, NSF.)

Both the Report and the ABC's story showed that Peter Andrew's had displayed Community Leadership in ethical land stewardship. The Panel said NSF is a successful and sustainable farming system, which has led to substantial agronomic and economic improvements.

At a local level, "Tarwyn Park" at Bylong has promoted NSF as a natural resource management technique. At a regional level Barramul Stud in the Widden Valley, which is owned by Mr Gerry Harvey, has also engaged Peter Andrews to manage and install his NSF principles. And currently, the Hunter Central Rivers Catchment Management Authority is looking very closely at the Widden Brook to analyse the effects so that they might be able to apply them more widely through the Hunter Region.

Peter has also shown leadership with the uptake of his NSF principles in the Southern Rivers region of NSW. Its Catchment Management Authority is taking a lead in supporting a trial / demonstration project using NSF techniques at Bungendore.

The opportunity exists at Gumlu near Townsville, to develop an existing registered water storage facility so that it takes many of the characteristics of an oxbow lake. Peter Andrews, has advised the owner on various options for landscape hydrology management. The food industry, supermarket and leading takeaway chains are taking an increasing interest in the cost-effective sustainable techniques which are being developed here on a large scale using NSF techniques.

At a State level the South Australian Government is showing increasing interest in NSF and the South Australian Farmer's Federation invited Perter Andrews to a crisis meeting on South Australian agriculture.

In NSW, a presentation of NSF has been made to all the Catchment Management Authority Chairs at the NSW Parliament House.

At a national level, presentations were made to Australian Government's Regional and State Natural Resource Management Facilitators planning conference in Melbourne recently. In coming weeks Peter Andrews will be presenting an outline of NSF to Senators at Parliament House, Canberra.

DEMONSTRATE HOW PETER ANDREWS HAS DEVELOPED AND IMPLEMENTED HIGHLY EFFECTIVE AND INNOVATIVE EDUCATIONAL AND PROMOTIONAL PROGRAMS.

FIELD DAYS

Peter Andrews has conducted regular field days at both "Tarwyn Park" and "Baramul Stud". Peter personally gives these to anyone who wants to see first hand his NSF principles at work and they are free to all comers.

Recently, I attended one such field day along with 70 others mostly from rural and farming backgrounds and Peter generously gave of his time and knowledge to everyone present.

POWER POINT PRESENTATION

NSF has helped develop a very powerful and informative educational and promotional tool with a 30Mb power point presentation. For the last 4 months this presentation has been given to hundreds of individuals, private sector opinion leaders and to many State and Commonwealth departments on request following the increased awareness arising from "Australian Story".

TELEVISION: AUSTRALIAN STORY

By far the greatest and most highly effective and innovative educational and promotional programs was the ABC's 'Australian Story' which was aired over TWO weeks, on the 6th and 13th June 2005. The program was entitled "Of Droughts and Flooding Rains- Part1 and 2".

To see information regarding Part 1 go to: http://www.abc.net.au/austory/content/2005/s1383562.htm
To see information regarding Part 2 go to: http://www.abc.net.au/austory/content/2005/s1388590.htm

This program will be repeated by popular accolade and there are further initiatives with DVD instructional techniques planned.

WEB SITE

Peter Andrews and NSF have developed a very informative web site, which has been a highly effective promotional and educational tool.

Web addresses are www.nsfarming.com – www.naturalsequencefarming.com -

NEW ABC BOOK

The ABC is to release a major book about NSF and Peter Andrews in October 2006.

DEMONSTRATE HOW PETER ANDREWS HAS UNDERTAKEN OR PROMOTED RESEARCH OR THE APPLICATION OF RESEARCH FINDINGS THAT HAVE A SIGNIFICANT CONTRIBUTION TO THE ABOVE CRITERIA.

The CSIRO-led Expert Panel produced their report in 2002 and determined that the implementation of NSF at "Tarwyn Park" **addressed** the following major environmental and agricultural issues:

- low floodplain productivity;
- elevated salt export;
- salt intrusion into the root zone of floodplain soils;
- channel erosion;
- hillslope erosion;
- low functional diversity of species;
- poor nutrient retention in plant-soil system;and
- altered surface-groundwater hydrology

The Panel recommended that a major scientific study of NSF be undertaken at "Baramul Stud" in the Upper Hunter. The outcome of this was a AU$1.5m Australian Research Council study commenced on "Baramul Stud" in 2004.

The consortium includes leading scientists from:

- Southern Cross University
- Australian National University
- Newcastle University

- NSW Department of Natural Resources in collaboration with the Hunter Central Rivers Catchment Management Authority.

Amongst some of the published papers on Peter Andrews NSF are:

- Anderson, P, Milne-Home, W A and Knight, M J, 1997, 'Hydrogeological evaluation of the natural farming sequence applied in the Bylong Valley at 'Tarwyn Park' and' Homeleigh' properties', Sydney, UTS, 130pp

- 2002 CSIRO Expert Panel "The Natural Farming Sequence"

- 2005 Keene, A., Bush, R., White, I., Erskine, W., " A farmer's approach to stream and floodplain management using 'natural sequences' " see Attachments"

The above authors, Keene et al, state, "the NSF approach is a practical method for achieving stream health and floodplain sustainability…..This rural community-initiated stream and floodplain management method for sustainable landscapes has potentially significant social, economic and environmental value".

REFEREES.

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ATTACHMENTS.

See attached supporting documents.

ENDNOTES
[1] see interview with Dr John Williams from ABC transcript in Attachments.

NATURAL SEQUENCE FARMING (NSF)

http://www.naturalsequencefarming.com

Introduction

Peter Andrews, is a third generation farmer who has been involved in farming and horse breeding for 60 years. He believes that heavy grazing of streambed banks following European settlement has, mainly by reducing vegetation, significantly increased stream velocities. This has resulted in gouging of streambeds and the lowering of water tables in floodplains.

Peter Andrews sees the effect of these changes in the landscape resulting in dry spells turning into drought conditions faster than they should, biodiversity being reduced, and in many instances fresh water that once sat on top of saline water being drained off, resulting in salt being released into the streambed.

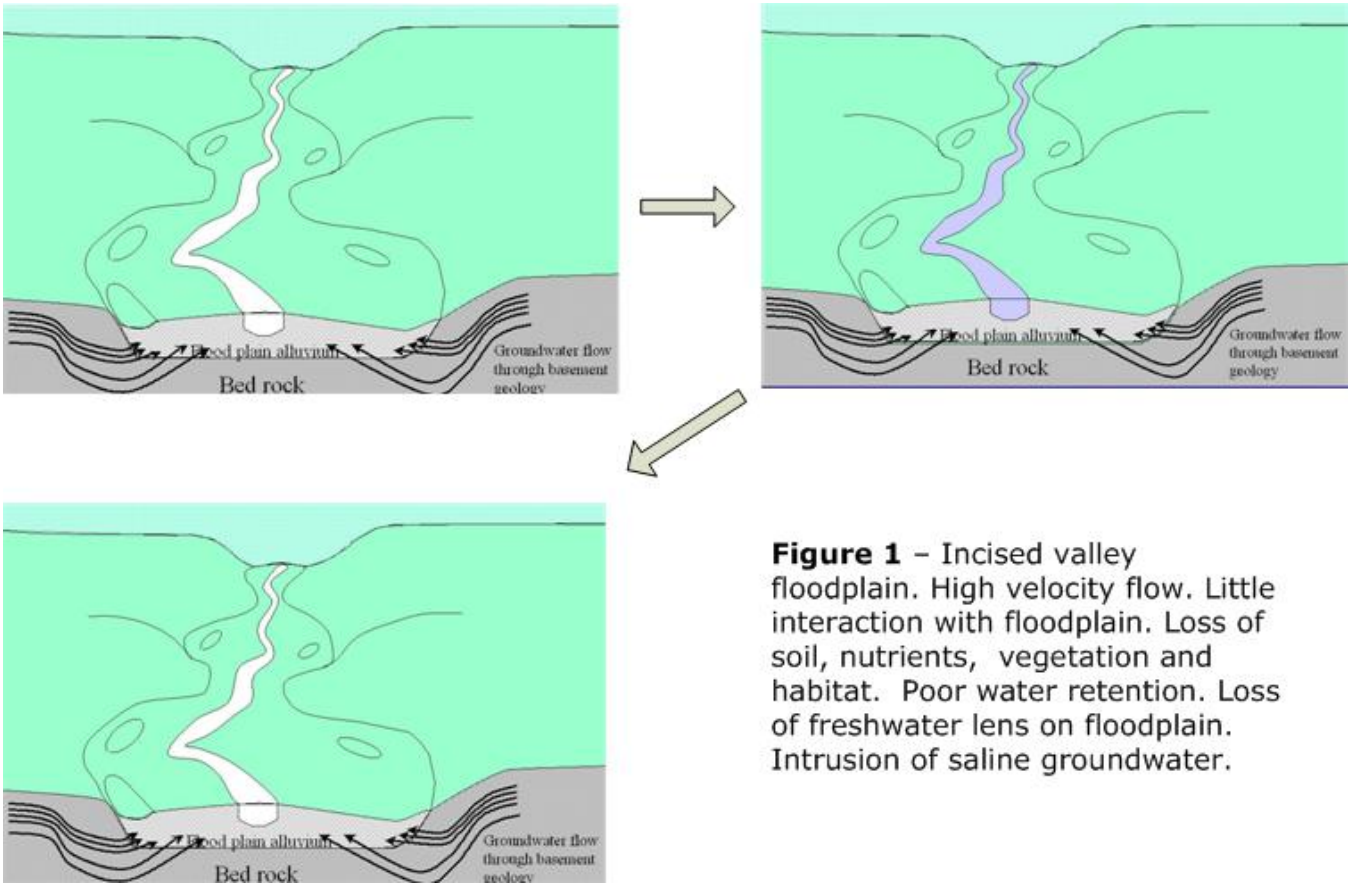


Figure 1 – Incised valley floodplain. High velocity flow. Little interaction with floodplain. Loss of soil, nutrients, vegetation and habitat. Poor water retention. Loss of freshwater lens on floodplain. Intrusion of saline groundwater.

Mr Andrews has developed, and is constantly refining, a system of farming based on his observations and interactions with a variety of natural landscapes. The insights he has gained are contained in the principles of Natural Sequence Farming (NSF).

While employing a holistic view of all the interactions in the landscape, Peter Andrews believes that the health of floodplains and their streambeds can be significantly restored by slowing the rate of water flow, especially after rain events, by a series of physical interventions in the landscape.

Implementing Natural Sequence Farming over a range of climatic regimes does not mean trying to take the landscape back to what it was pre-European settlement. Rather, NSF focuses on establishing how the natural system worked in a particular area and how it is working now.

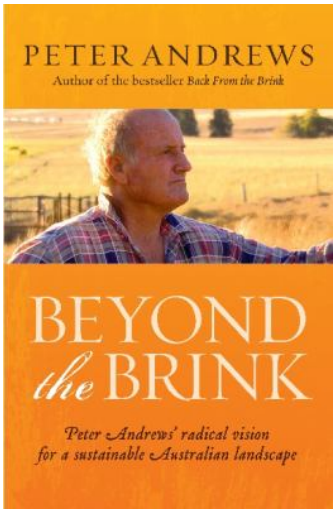
Peter Andrews, uses some of the same natural techniques, and mimics others, to address soil and water degradation and loss of biodiversity. He does so by re-connecting natural sequences of activities within the NSF management approach.

Interest in the approach has grown recently. Record drought has highlighted the ability of NSF to contain salinity and generate water savings and minimise dependence on conventional irrigation extractions from streams.

A growing number of experts believe that this holistic approach to natural resource management can be applied on a day-to-day basis to property, catchment and landscape management across diverse regions, in harmony with the Australian environment.

Natural Sequences

Natural sequences that can be harnessed by informed management include the movement of grazing animals, birds and insects from valley floors by day to higher levels on the valley sides at night and the transfer of fertility with them. There is a gradual movement of nutrients and seeds back down the valley sides via the water cycle, vegetation and soil processes, constantly refurbishing the fertility of the landscape.



In the process, various plants collect specific substances and the plant communities change in predictable sequences. As part of the biodiversity of a property and catchment, these plants are also a part of multiple food chains and a key to enhancing fertility.

Nutrients contained in soil or water are mobile and can be quickly lost off-site. Nutrients contained in bio-diverse living bodies are stable. NSF management keeps natural functions connected which allows for quick exchange and conversion of nutrients within ecosystems on properties.

Peter Andrews has found that even plants labelled as weeds can serve as pioneering species in inhibiting nutrient and soil erosion. They collect and supply essential substances for environmental health. Once slashed, fertility is built up and the weeds are replaced naturally by palatable grasses. To maximize production and conservation results requires a good understanding of interaction of the roles of clays and sands in the process.

This process is complemented by NSF property management when the initial erosion and fertility stabilising need has been met. The once degraded soils are then able to contribute to increased water use efficiency and optimal production levels through their increased organic content.

Areas such as floodplains, that collect large amounts of nutrients, can be harvested to redistribute some of the fertility. Like the daily migration of birds and animals, downpours flushing streams to a floodplain are a sequence in the periodic fertilisation and harvest cycle.

In this process, surface running water dissolves natural substances and collects sediments, algae, microbes and plant residues from all parts of the catchment. Re-connecting running water to the stepped and formation of the chain of ponds that used to dominate traditional Australian landscapes, slows water flow. This enhances the ability of growing plants, coupled with decreasing inclines, soils and sands, to filter the water feeding into streams running along the valley floor. This process, in turn, feeds plant roots from the sub-surface and caps saline groundwater from surrounding slopes by perching a freshwater lens above saline layers.

All substances are functional in this naturally managed environment. Salts managed as saline groundwater, where evaporation is excluded from concentrating and crystallizing the substances, allow plant, animal and water ecosystems to balance salinity in the landscape as a natural function. In this way a hillslope pasture or floodplain water meadow is re-created.

On the floodplain, hydrostatic pressure is maintained on the heavier lower saline layers though maintaining high freshwater tables in the perched chain of ponds. At the same time, the stream replenishes the floodplain and its meadows, through lateral transfer to the freshwater table just below the surface.

The floodplain is convex. The perched stream runs along the higher elevation or apex and the billabongs and backswamps are at the lower positions on the perimeter of the floodplain where it meets the valley sides. This shape is created by the natural flow of the stream and reinforced by heavier sediment being deposited on and near the stream-bed in flood.

A farming system founded on working with nature

In many regions of Australia, floodplains are disconnected from creeks and rivers and natural flow regimes. This leaves them unable to store water to support productive farming and the growth of riparian vegetation.

Many of today's floodplains are incised with deeply scoured gullies and gorges. These are channels that expedite the swift flowing removal of much of the land's fertility and the carriage of increasing amounts of salt. The soil and its nutrients are highly susceptible to leaching and erosion owing to the application of inappropriate agricultural and pastoral practices creating depleted soils and vegetation cover.

NSF takes a holistic approach to natural resource management by re-establishing the stream's connection to the surrounding landscape and re storing floodplains as 'sponges'. Although most landscapes have unique qualities, the principles of landform and management are the same. The physics remains constant.

Peter Andrews' interpretation of the landscape accepts that, pre-European settlement, the soil's natural salt content was kept in check by slow sub-soil movements of fresh water.

Under natural systems that are replicated by NSF, movement of fresh water is by surface and sub-surface flows. The surface flow is by the stream which is perched at the highest level of the floodplain on an accumulation of sediment. Surface water is buffered at each narrowed step position in the chain of ponds. Under NSF, this is achieved by a naturalised 'leaky weir' of rocks, sediment, trees, branches, reeds and grass roots mimicking the original natural slowing impediments to flows.

In floodplains in their pristine form, water is stepped slowly down the stream valley floor from one end of a catchment to the other. The stream valley floor is segmented with steps. These steps are where a new floodplain starts and the up-stream one finishes, and below which, large reed beds form on recharge areas.

The floodplains are soil, vegetation and water-filled ponds, forming links in a chain as they progress through each step down the valley. They are joined at each step where the valley sides narrow. Stream water travels through each linked floodplain as a sequence in the stream valley.

The stream meanders over each sequence. It covers the floodplain with sediments as it steadily descends the valley. Each floodplain has stream meanders, pools and riffles as well as wetland and water meadow filters.

Where an incised stream bed exists, during low to medium stream flows, the sides of the stream are contained by levee banks built up by flood deposits. The banks are protected from severe erosion by wetland plants such as phragmites, other natural grasses, and streamside trees and shrubs, which have colonised the area.

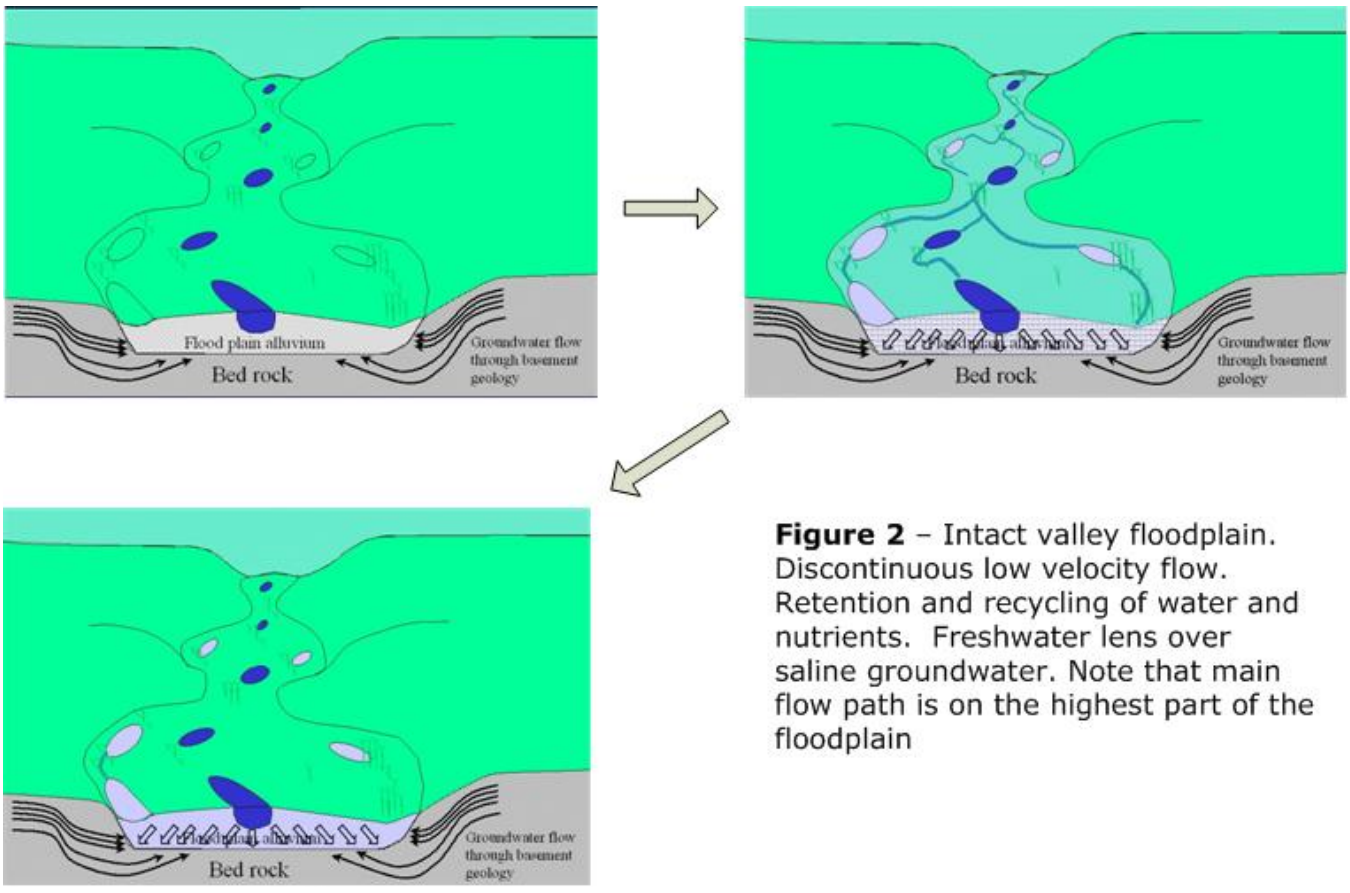


Figure 2 – Intact valley floodplain. Discontinuous low velocity flow. Retention and recycling of water and nutrients. Freshwater lens over saline groundwater. Note that main flow path is on the highest part of the floodplain

At the same time, hydrostatic pressure from the perched water table in the stream prevents the lateral intrusion of salinity from the floodplain even in low flow periods.

To recreate the chain of ponds effect, NSF uses small secondary diversion channels to reconnect streams to their floodplains. These channels braid out through the lush meadows to the edges of the floodplain and water then returns to the main stream through surface and sub-surface flows. They pick up peak flows that are diverted by the leaky weirs which maintain normal base flow to downstream properties.

During high flows, as water spreads across the floodplain in the braided diversion channels, some water is absorbed through sandy intake beds, recharging the groundwater lens above saline layers and just below the plant root systems.

Another portion of the surface water is carried in the channels towards historic floodplain terraces on the edge of the floodplain to refresh hollows and billabongs, facilitating fish passage in the process.

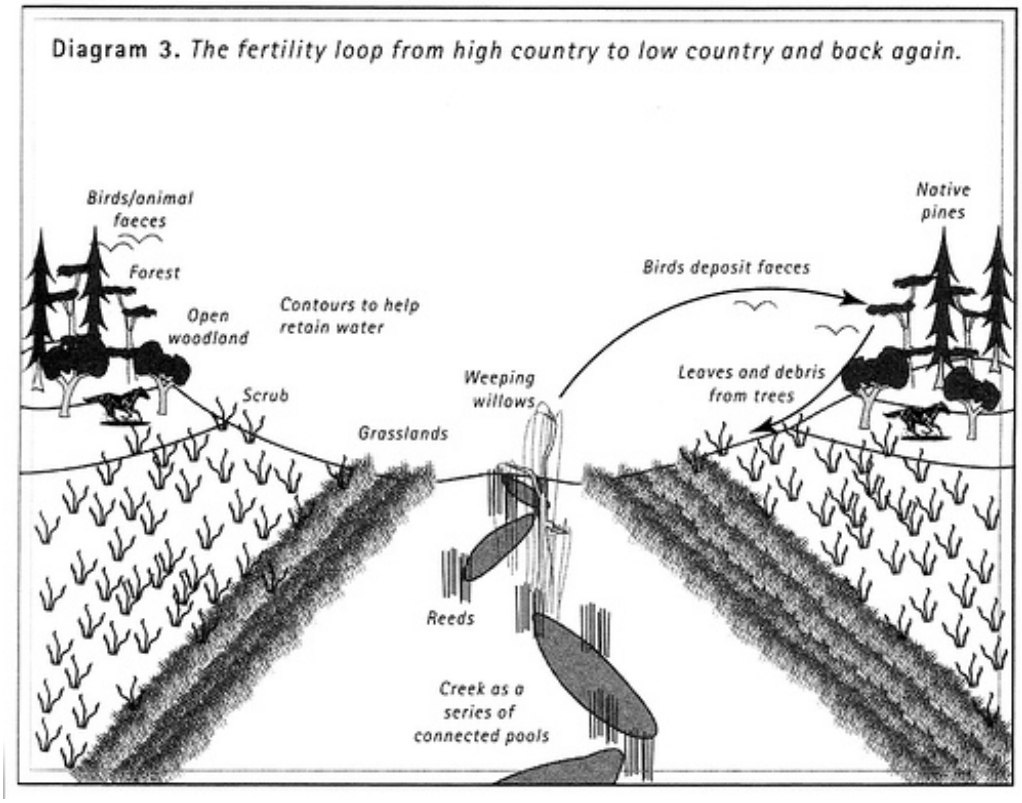


Diagram 3. *The fertility loop from high country to low country and back again.*

During flood events, the reed buffers along the stream sides and at the narrow ends, where each pond is joined in the chain, lay down to laminate the ground surface with their protective mat but are ready to grow upright again when the flows have subsided.

The hydrostatic pressure of water in the topped-up meadow and billabong storages on the floodplain prevents the plants on the floodplain from 'drowning' in the short interval when the water is at a high level. This process can mitigate the impacts of salt 'slugs' that may have been scoured from saline deposits in uplands.

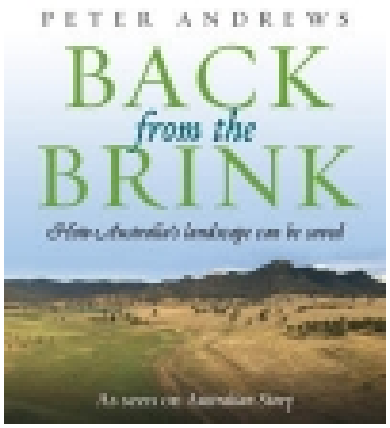
The stream water that is impounded in the recharged groundwater lens within the floodplain soils also provides a buffer against drought. There can be a period of several years of thriving plant growth before the water is fully transpired and the soil, which is heavily shaded by extensive vegetation cover, dries out. In normal years recharge from flooding would arrive earlier to restore the groundwater.

As part of NSF management, the farmer can divert flows between channels to dry out a meadow area for harvest while starting to produce increased growth in a new zone of the floodplain.

Maximum natural outcomes with minimum financial and manufactured inputs

Peter Andrews' NSF concepts are being applied at project sites as diverse as those featuring upland fast-flowing water courses, to broadacre cropping areas, dry gullies, and salt encrusted degraded lands as well as broad stream valleys and wetlands. Where human-induced impediments to natural growth and production are gradually replaced by the system built around the natural sequences of plants, animals, water and soils, properties have a solid foundation for increased profitability and long term sustainability. Industry analysts have been particularly attracted by the lush growth produced during drought conditions under Peter Andrews' system.

Under NSF, natural water flows are reintroduced to alluvial soil plains. In many ways natural alluvial soil floodplains form the whole waterway down the valley whether through surface or sub-surface flow. In contrast, irrigation is the artificial application of water to the land. Invariably, the source of the irrigation water is from artificial storages and highly moderated streams with incised and eroded channels. These have generally been created by past poor environmental practices such as the removal of ground cover.



Owing to its base of natural processes, NSF achieves more sustainable outcomes than traditional pipe and pump irrigation systems as it does not incur large financial costs or create long-term environmental degradation, loss of biodiversity and increasing salinity, as often occurs catchments with highly regulated stream regimes. NSF employs few imported or manufactured inputs such as pesticides, herbicides and artificial fertilisers. In terms of financial capital and operating inputs, it is not an expensive system to introduce and it brings Green house gas benefits through increasing carbon levels in the landscape.

The investment required is in training for the landholder to interpret the natural processes of the landscape and time spent by the farmer in 'reading the country' and applying the NSF principles to the particular property and landscape features of their region. It is no surprise to find that Peter Andrews grew up on a property near Broken Hill area and spent much time with his stockman father and members of the Aboriginal community learning to read country.

In most cases, Peter Andrews finds that resources available on-site only require intelligent redistribution for natural processes to work in favour of productivity and a reversal of human-induced environmental imbalance and degradation, as most of the naturally developed 'infrastructure' is still there.

In working with nature, NSF requires very low maintenance inputs. Where outside inputs are employed on a farm they can be targeted. Small amounts can be applied to specific areas or species where the system is temporarily out of balance owing, in most cases, to factors outside the property boundaries. NSF harmonises modern technology with natural plant progressions to achieve a resilient model of farming.

Where neighbouring landholders in a sub-catchment adopt NSF, even more rapid progress to increased profitability and environmental sustainability can be achieved, as NSF adopts a whole-of-catchment approach to farming.

NSF applied to Grazing

Under NSF, many forms of grazing are appropriate if a vigorous perennial plant community can be maintained. If cell-grazing methods are used, especially across valley segments from ridge to ridge, protection of the riparian zone needs to be considered. Over the medium to long term, weed control, nutrient balances and pest management can be managed by using Natural Sequence Farming methods.

The improved groundcover and reduced cultivation under NSF not only minimises farm costs but also reduces erosion, avoids soil compaction and maintains a soil structure with increased water holding capacity.

The use of water balances within NSF, brings the most increases in productivity and sustainability. Costs are also minimised, as water storage is in the groundwater lens rather than expensive above-ground dams, prone to siltation and with high evaporation rates when the water is needed most. Pasture is fed naturally from the roots rather than requiring extensive capital investments in pumps, pipes, irrigation gantries or feeder networks.

Traditional livestock husbandry methods can be complementary to Natural Sequence Farming. Under NSF, livestock are considered as a major tool in land management, including for transferring fertility and controlling weeds. However, feedlot methods of production and other methods of confining herds or flocks need to be well-sited in the catchment to utilise self-removal and self-collection of residues for fertility management.

Once the initial phase of re-establishment to natural sequences is well on the way, which in most cases only takes one or two years with low cost inputs, monitoring and the application of NSF principles in harmony with Nature achieves continuing sustainable production.

NSF applied to Agriculture

Under NSF, cropping is best suited to methods complementary to retaining significant areas of season-specific perennial pastures. If needed, cultivation may be confined to soils on valley slopes rather than floodplains but it can be worth exploring direct-drill minimum-till broadcast methods first.

Horticulture can be sited off flood plain areas, with careful transfer of valley floor fertility and water within the NSF system.

NSF harmonises well with organic approaches to producing premium farm produce for a growing domestic and export market. Increasing numbers of consumers and vendors are demanding products produced with environmentally sustainable systems coupled with farm accreditation and certified produce before acceptance.

The use of outside inputs or recycling farm produce on the property can be part of managed fertility transfer, both on the farm and in the sub-catchment. For instance, hay making of legume-rich pasture can be rotated around various areas of a property to work in with weed reduction needs and fertility management.

Irrigation is best-sited on valley floors although most areas managed with NSF require minimum supplementation of water transfers already naturally occurring on and beneath the floodplain.

Sustainable Landscape Outcomes under Natural Sequence Farming

Under Natural Sequence Farming, a sustainable farm landscape evolves where:

- Stream water is carried on the highest formed land on a flood plain, which includes not only the stream channel and wetlands but also water meadows fed by subsurface flow and braided channels.

- The wetlands and meadows evolve a form of periodic harvest through NSF practice to maintain ecological balance and promote biodiversity

- Farm managers factor in flood inundation as a beneficial part of the natural sequence.

- Floodplains are maintained by fresh water-filled subsurface flows through porous soil intake beds.

- Erosion is balanced by sedimentation.

- Polluted stream water is filtered as it moves through the chain of ponds, its wetlands, lush floodplain meadows, sandy groundwater intake beds and reedbeds along the length of the stream valley floor.

- Whole-of-farm ground cover is at a high ratio, with season specific perennial and annual plants maintained in a balance of natural sequences in turn confining weeds to a small percentage of the plant community.

- The farming system and livestock movement is harmonised with the periodic harvest sequence of crops, grasslands and water meadows to maintain habitat and nutrient balance in the landscape.

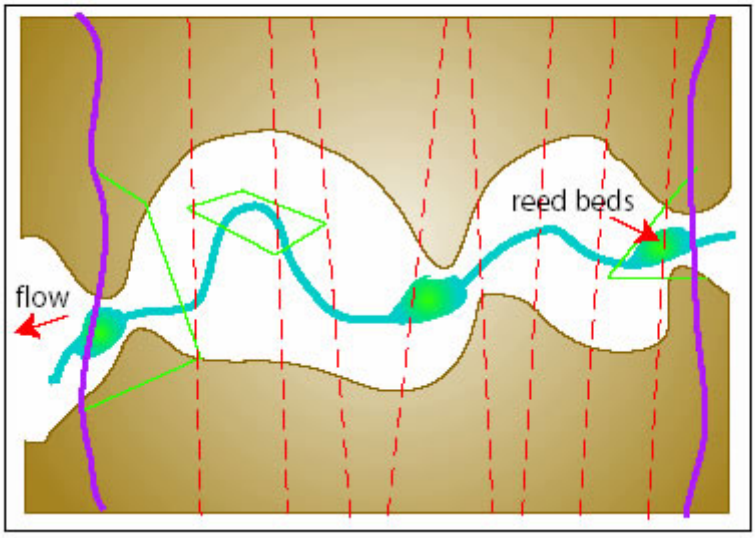
- Biodiversity is maintained at a high level with the diversity of habitats created by the natural vegetation and aquatic sequences**.**

http://www.nsfarming.com/index.html
http://www.nsfarming.com/Principles/principles4.html

The diagrams below illustrate some of the concepts central to Natural Sequence Farming.

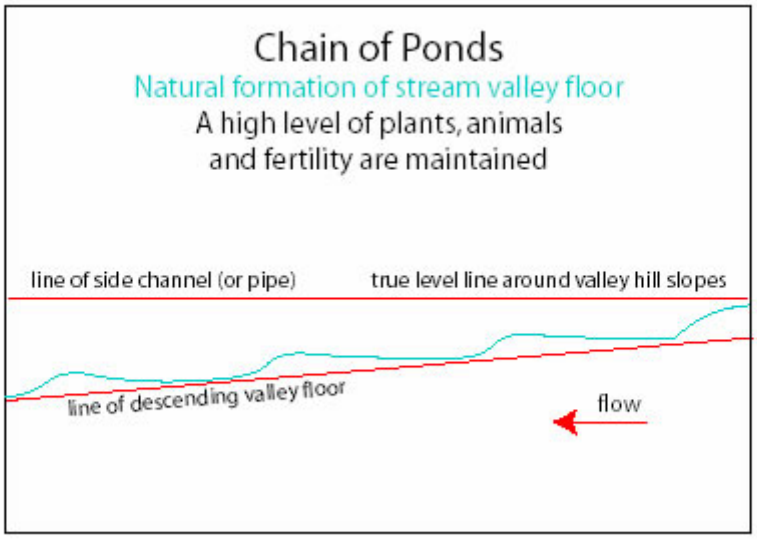
Chain of Ponds

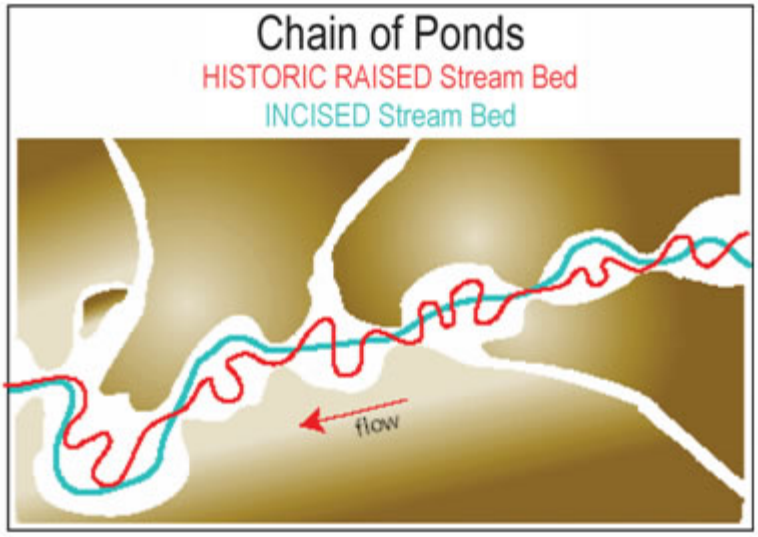
Fenced Fragile Riparian Zones Proposed Cell Grazing Fence Lines
Boundary of Area

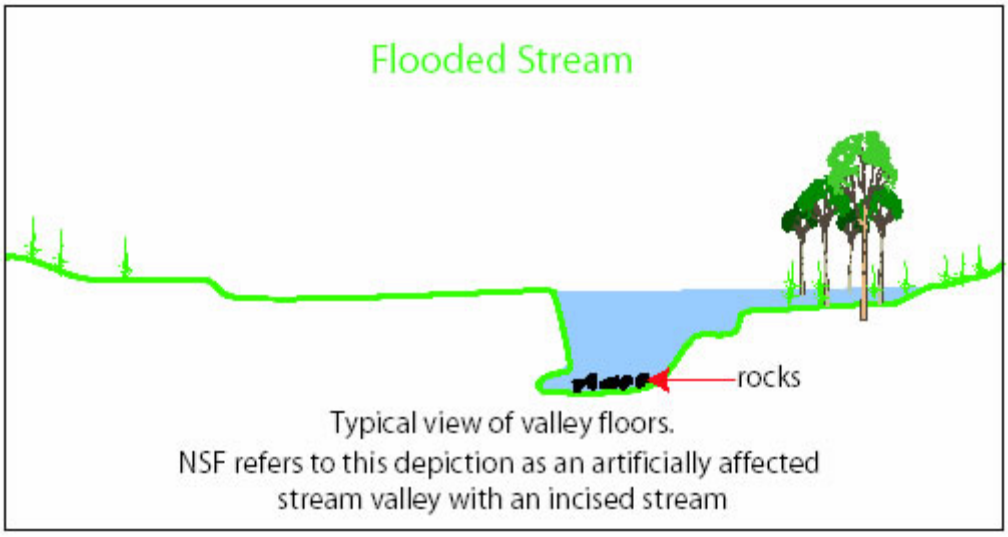


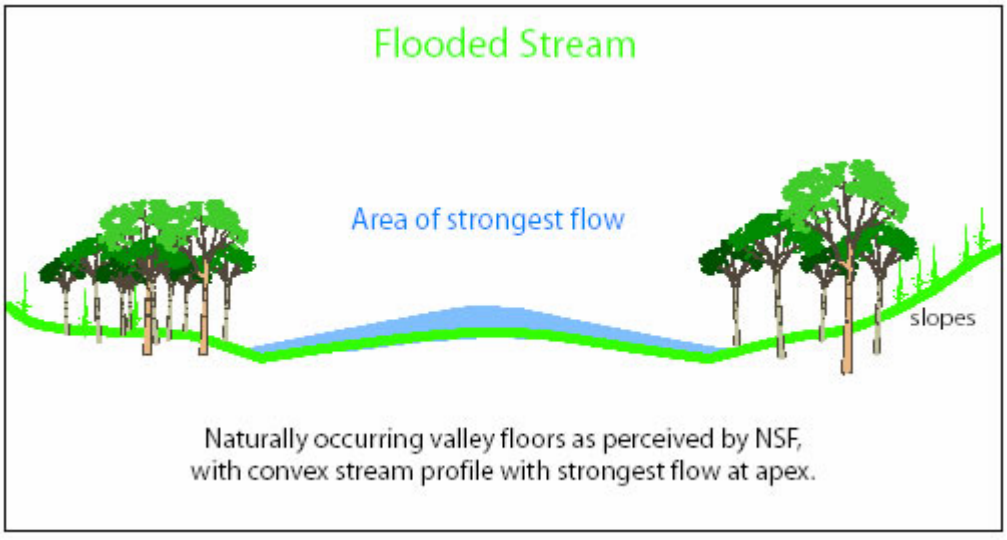
Chain of Ponds

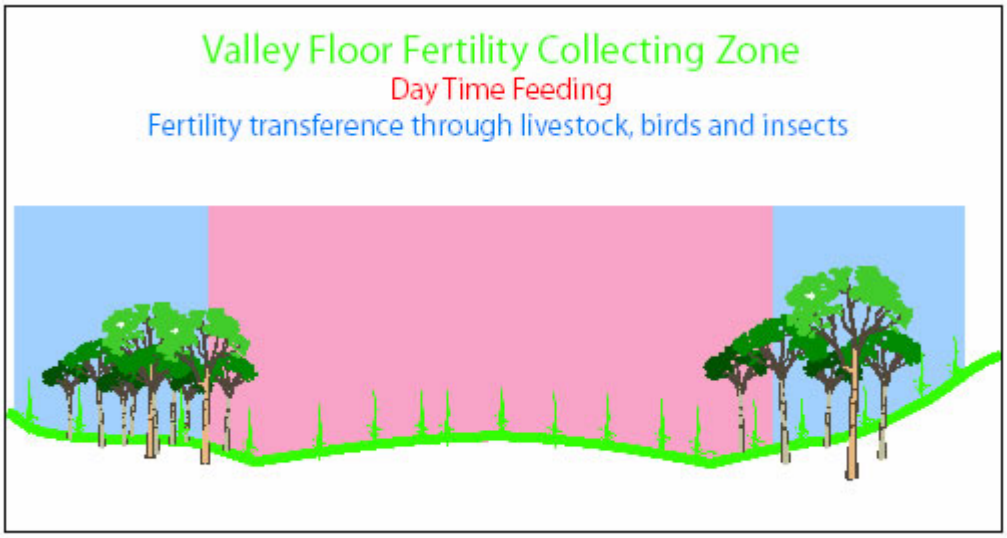
Natural formation of stream valley floor
A high level of plants, animals
and fertility are maintained




Chain of Ponds
HISTORIC RAISED Stream Bed
INCISED Stream Bed
flow


Flooded Stream
rocks
Typical view of valley floors.
NSF refers to this depiction as an artificially affected
stream valley with an incised stream


Flooded Stream
Area of strongest flow
slopes
Naturally occurring valley floors as perceived by NSF,
with convex stream profile with strongest flow at apex.



Overview

Preliminary research suggests that Natural Sequence Farming offers a cost-effective approach for dealing with a national challenge – the management of landscapes that are prone to leach salts into water courses and to lose fertility owing to unsustainable cropping and grazing practices.

NSF has the potential to offer significant environmental, economic and social returns to landholders and communities.

Early adopters and entrepreneurs, such as Gerry Harvey, see Natural Sequence Farming based on re-creating the core of the past to manage the present, as the future foundation for Australian farming.

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AQUIFERS:

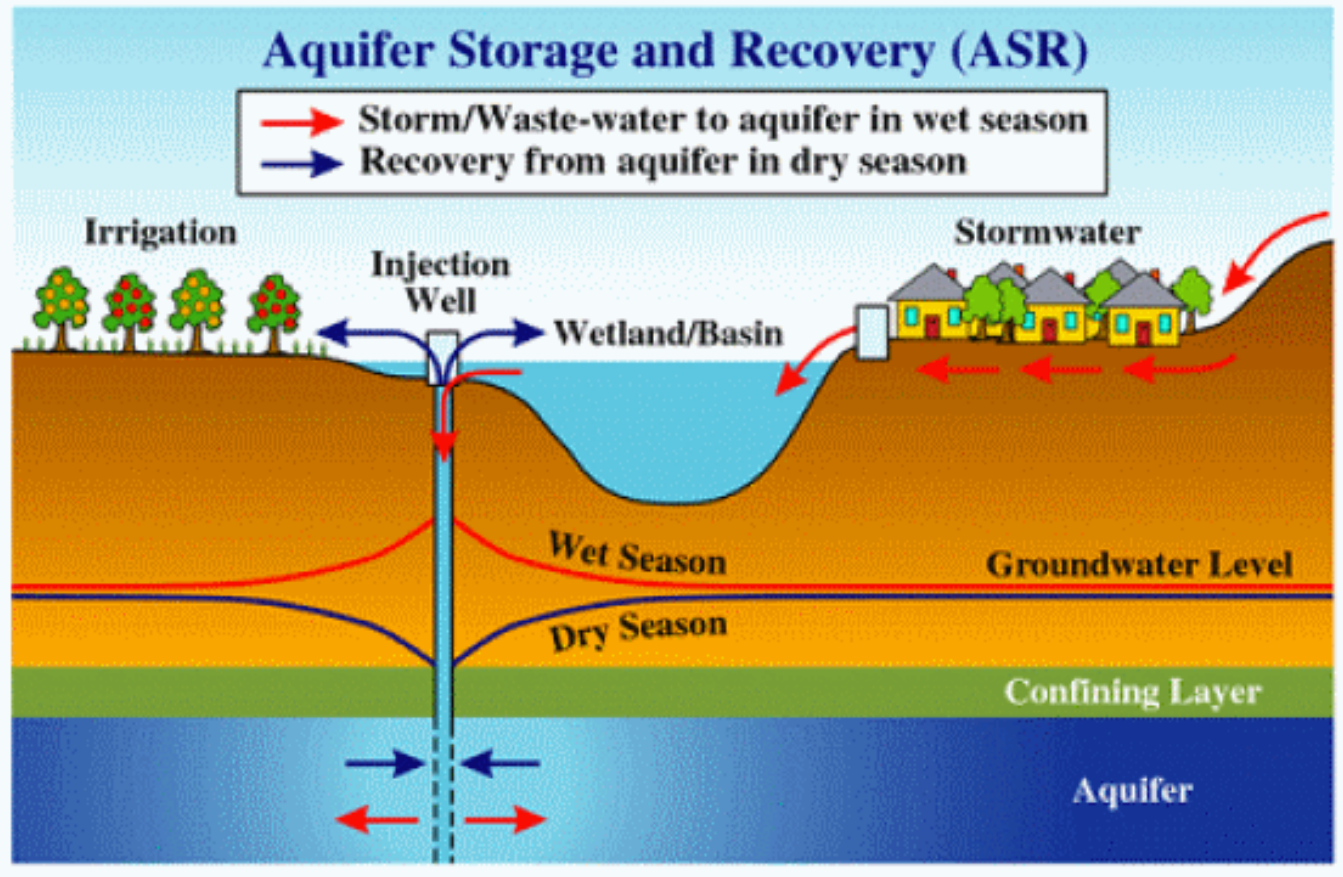
Colin Pitman

'Making water Work'

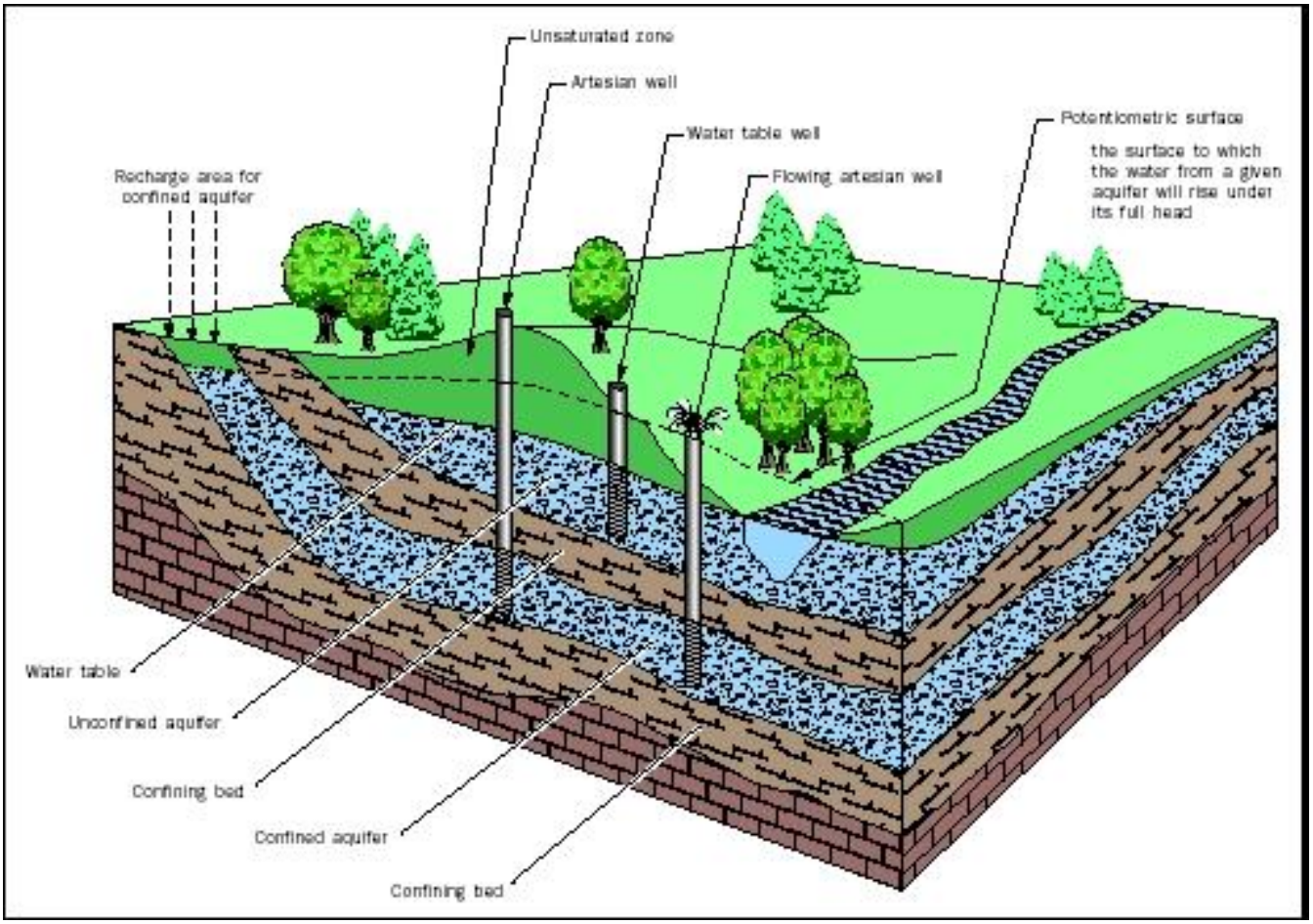
The City of Salisbury, Adelaide, South Australia, commenced the construction of wetlands in the mid-eighties as a means of combining the attributes of flood mitigation with the provision of biodiversity and a pleasant integrated landscape.

It was then found that the wetlands significantly improved the water quality and 53 wetlands have now been constructed.

In the early nineties, it was discovered that the water could be pumped into the aquifer, and later extracted for irrigation purposes. Salisbury now has a large number of these aquifer storage and recovery (ASR) systems. Colin Pitman has directed this ASR program since its outset.



Aquifer Storage and Recovery (ASR) involves injecting water into an aquifer through wells or by surface spreading and infiltration and then pumping it out when needed. The aquifer essentially functions as a water bank. Deposits are made in times of surplus, typically during the rainy season, and withdrawals occur when available water falls short of demand.



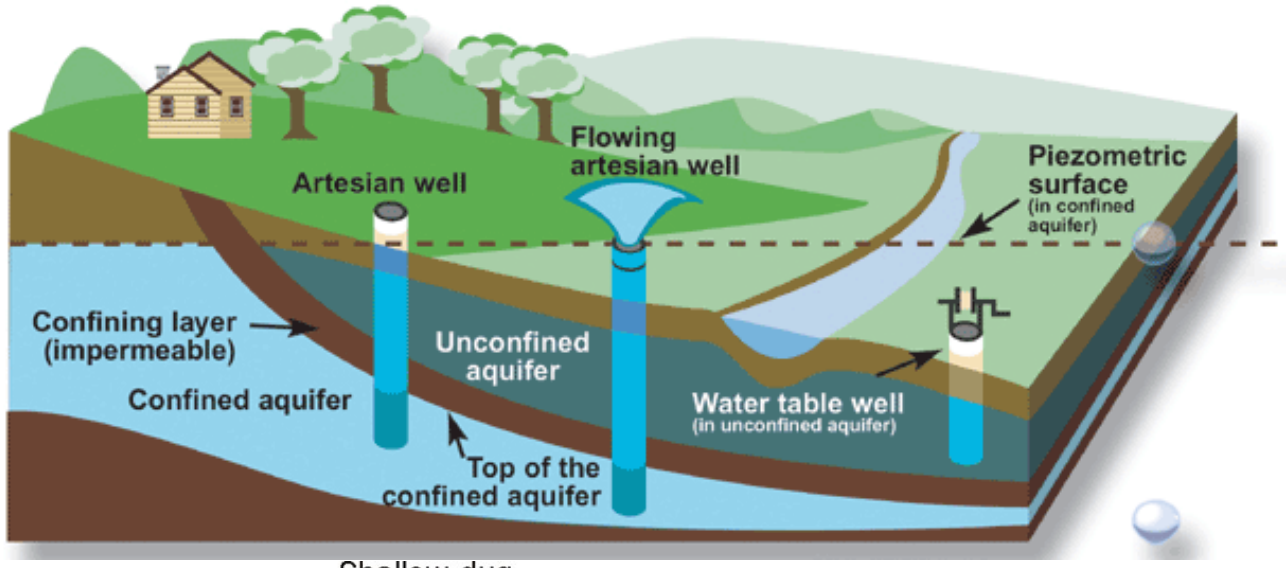
Water in a sand aquifer tends stay in place or move very slowly. Water injected into unconfined sand forms a stationary dome, and if there are confining layers then water spreads out horizontally.

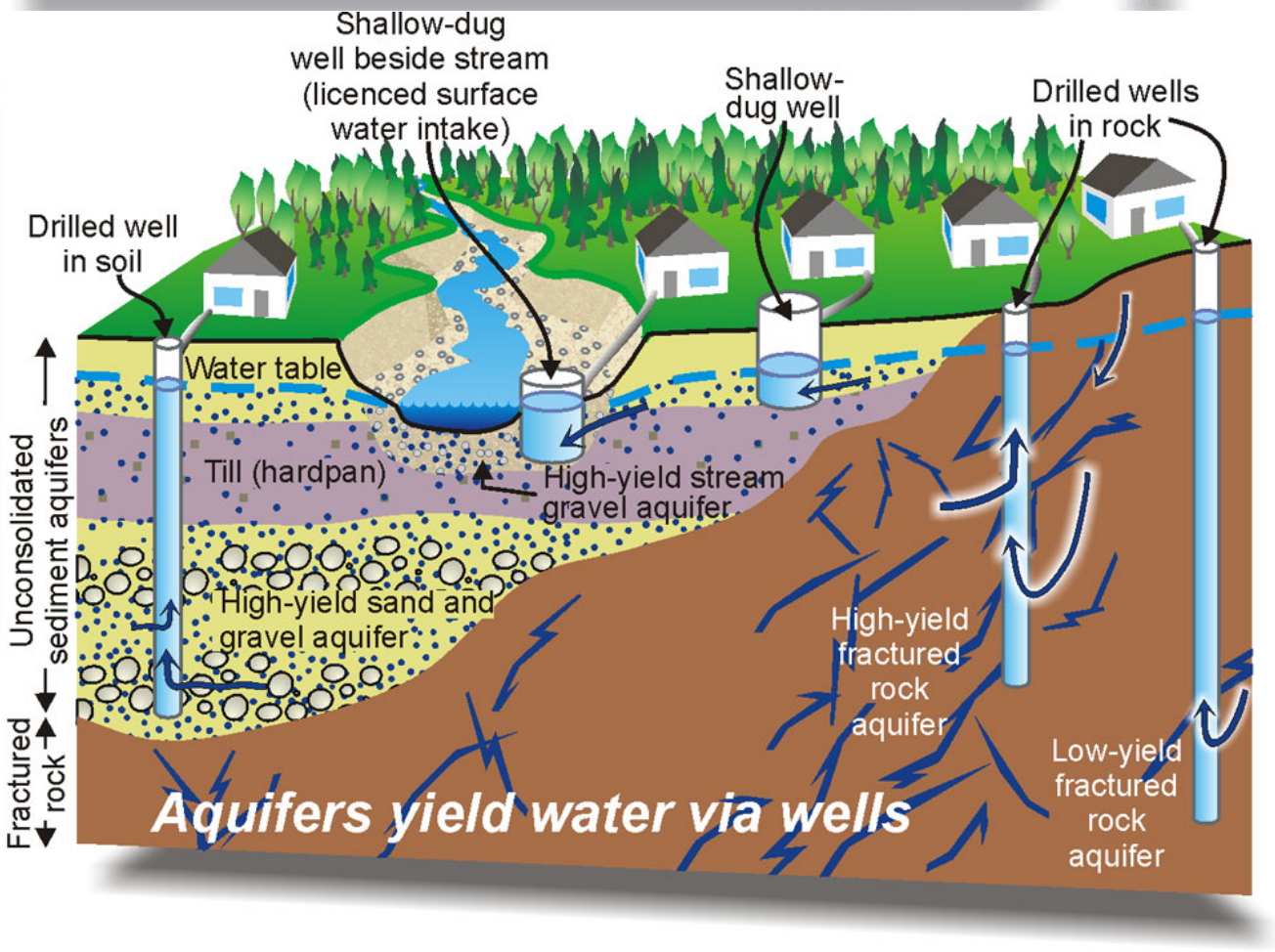
Either way, it is possible to store water in sand and come back years later and extract the exact same water. This is the concept behind Aquifer Storage and Recovery (ASR). When there is extra water around, it could be injected into locally occurring sands and extracted during times of shortage. Water from other sources could also be transported and stored in the sands for later use.

ASR technology addresses one of the region's biggest problems: there is hardly any storage locations where water can be put in times of plenty for later use. One big advantage of storing water in sand instead of a reservoir is that no water evaporates. Also, it's easy to ensure the people who pay for the project are the ones who benefit, which is not necessarily the case with other options.

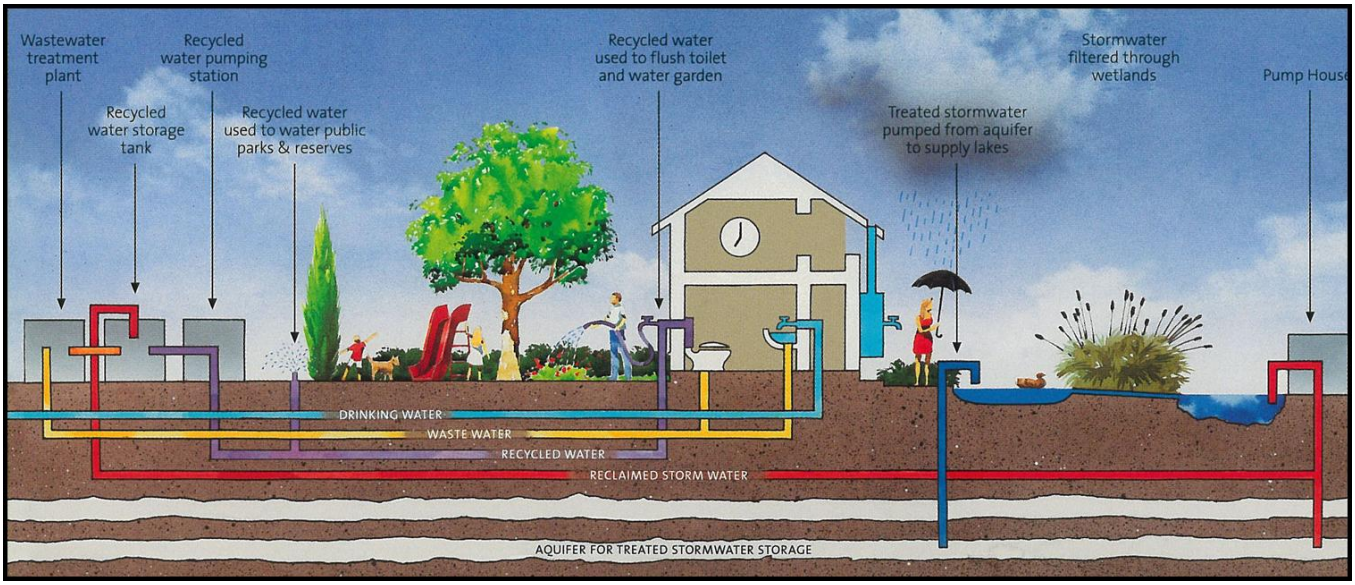
The rules are that before water can be injected, it has to meet drinking water quality standards so there is no chance that water already in the ground could be contaminated.

Aquifers and wells





Recycled Water System



Aquifer Storage and Recovery (ASR) is the process of injecting water into a suitable underground aquifer for storage and later reuse, and it can be a means of artificially recharging depleted underground water supplies.

ASR is a modification of the natural system that has been occurring for millions of years. Natural recharge occurs by filtration of rainwater through the soil profile, past the vegetation root zone and down to permeable rocks known as aquifers.

Aquifers can store large quantities of water without losses from evaporation and with reduced risk of contamination, both of which are problems associated with surface water storage areas such as reservoirs.

The Department of Primary Industries and Resources South Australia (PIRSA) and the City of Salisbury in conjunction with the CSIRO Centre have pioneered ASR in South Australia over the past 15 years for Groundwater Studies and local consultants.

During the high rainfall period in winter, excess stormwater, filtered and cleaned by the wetlands, is pumped into the aquifer, 164 metres below the ground. During the dry summer, the water is recovered as needed to irrigate sports fields and turf areas. This eliminates the demand on mains water for irrigation, conserving water and reducing costs.

ASR technology has been proven with a number of small and large scale systems now operating throughout the State. It has the potential to enhance the State's water resources and relieve the pressure on traditional sources, including the River Murray, which is threatened by reduced flows and increased salinity.

Opportunities exist to use ASR to transform traditional water management and distribution policies and to provide cost-effective and innovative alternatives to current methods of water supply for irrigation and industry.

MULLOON INSTITUTE:

Mulloon Institute http://themullooninstitute.org/ near Canberra, developed by Antony Coote.

The Mulloon Institute's vision is to inspire individuals, corporations and governments at every level to actively invest in sustainable methods to repair the landscape and support ethical, regenerative, non-synthetic farming to feed present and future generations. By connecting society, food production and the environment, it is their belief that this will build resilience for future generations so they can face the challenges of a changing climate.

The Mulloon Creek Natural Farms, demonstrate a sustainable, working role model of excellence, coupled with the outstanding research, forecasting, educational programmes and advocacy of the Institute. The return on this investment is the creation of a quantifiably more sustainable and resilient environment and society; thereby serving the needs of the present without compromising future generations.

Located within 45 minutes drive from Canberra airport, the MCNF comprises two farms, the Home Farm and Duralla, both on Mulloon Creek.

The Home Farm has a total area of 1,740ha (4,300ac) including 730ha (1,800ac) of dry sclerophyll forest, with the remainder being floodplain pasture and sloping rangelands that have been biodynamically managed since 1994. The Home Farm spans the Great Dividing Range – which puts it in an interesting position of being at the headwaters of two of the major water catchments in Australia.

Straddling the Great Dividing Range at an altitude of 860m (2,825ft), the western side of the property feeds into the Murrumbidgee river, which forms part of the catchment for the Murray Darling Basin. The eastern side of the property contains the Mulloon Creek, a tributary to Reedy Creek, which in turn feeds into the Shoalhaven River – a primary source of water for the city of Sydney.

A further 9km downstream from the Home Farm, Duralla is located on the old Boro-Mullon (the original name) coach road (now Hazeldell road) that was used to travel between Tarago and Queanbeyan, passing through Bungendore. It is at the junction of four creeks; Mulloon Creek, Shiel Creek, Sandhills Creek and Reedy Creek. Spanning 590ha (1,450ac), Duralla is the home to their organic free-range egg operation.

NEW BIOSPHERE AGRICULTURE

"Beacons of Light" around the globe

This document overall: **Map of Consciousness calibration 625**