



wheatbelt
natural resource
management

Regional Natural Resource Management Strategy for the Avon River Basin



Supported by:



Australian Government



Wheatbelt NRM Inc. has developed this Regional NRM Strategy to guide future understanding and priorities for the management of the natural resources of the Avon River Basin. Healthy natural resources are important to support current and future environments and community.

The Regional NRM Strategy 2013 builds on 20 years of natural resource management activities to meet the vision of **'A HEALTHY ENVIRONMENT THAT HAS A VIABLE AGRICULTURAL INDUSTRY AND RETAINS A STRONG SENSE OF PLACE'**.

The role of the Regional NRM Strategy is to set broad priorities and establish a framework for informing investment in the region. It is expected that this strategy will evolve and guide other organisations and that they will use this strategy where it meets their priorities.

This document explains how the Strategy was developed, it documents system resilience today, and provides future regional-scale management actions.

In 2010, a review of the Avon NRM Strategy was initiated using a resilience assessment framework.

Community was engaged to determine how the system worked and what values were important to them. Experts were engaged to understand the way the system interacted.

A systems analysis of the Avon Region can be found at:

www.wheatbeltnrm.org.au/nrmstrategy

A draft set of 5-year Strategic Objectives were presented to the 2013 Wheatbelt NRM AGM and feedback was obtained.

Identification of priorities and key Thresholds of Potential Concern (TPC) for the region are now provided, as well as strategic priorities for NRM in the region.

Wheatbelt NRM Inc. would like to thank all who had input into this review. A list of all contributors can be found at:

www.wheatbeltnrm.org.au/nrmstrategy/acknowledgements

Feedback can be provided at:

www.wheatbeltnrm.org.au/nrmstrategy/feedback

THE AVON RIVER BASIN SNAPSHOT

Inland from Perth city along the Great Eastern Highway, the Avon River Basin stretches from approximately Northam to Coolgardie, and from Pingelly to Dalwallinu, covering 12million hectares in Western Australia.

Embracing the Avon Arc, the Wheatbelt, and the Great Western Woodlands.

A population of approximately 44,000 residents, 43 small country towns and 2 regional centres - Northam and Merredin.

Economy fueled by a vibrant grains and livestock industry and a growing mining industry.

Traditional lands of the Aboriginal Noongar people, who now live in many of the regional towns.

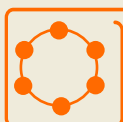
An internationally recognised biodiversity 'hotspot' containing more than 1% of the worlds known plant species.

The Avon River is the Swan River flowing from the Wheatbelt through Perth City to meet the Indian Ocean at Fremantle Port.

Responding to challenges

Natural Resource Management interventions do not happen if there is no shared vision for what we need to do and why. We need to be technically confident that a management intervention will have the outcome we intended. We need the financial capacity to afford it and most management interventions require human capacity to make it happen on-the-ground. On top of this we need to ensure that enforcing changes to increase resilience in one part of the system does not reduce its resilience in another.

The following are important contextual, cultural and capacity related challenges that Natural Resource Management (NRM) will need to embrace within the Avon River Basin.



Embedding a strategic adaptive management approach

The Avon River Basin's resource issues are complex and interlinked. The big 'drivers' of change pushing the system towards a threshold of concern are often slow moving and beyond our control to manage. Establishing system changes will not always be possible, interventions will take time and adjusting how we respond will need to adapt as we 'learn-by-doing'.



Adapting to climate change

The largest natural 'driver' of the system is climate. The future extent of dryland salinity will be largely determined by it, and it affects all system issues. Coping with climate variability 'shocks', such as frosts, floods and droughts will require a resilient system. Capacity to adapt and transform vulnerable parts of this system under a changing climate will require innovation.



Adapting to land use change

The increasing mining activities in the Eastern Region presents new challenges and opportunities.

The agricultural industry pressure to continually increase production comes at a cost to its resilience through reduced diversity, increased debt, loss of redundancy and declining population. New technologies and climate change will be important future drivers for this industry.



Protecting a biodiversity hotspot

The biodiversity of the region is internationally recognised as iconic and unique to Western Australia. Unfortunately, it will continue to experience an 'extinction debt' from the widespread historic land clearing legacy for some decades. Land clearing bans have prevented much further loss of native vegetation, but political pressure is resulting in changes to these policies. Some native species are still little understood or documented. Saving locally threatened species may not be possible given the multiple, historic and emerging stressors affecting native habitats. The impact of some of these, such as aridity, salinity and introduced invasive species have not yet been fully realised. Effective NRM will need to embrace inevitable landscape change.



Embracing multicultural values

Traditional ecological practices have been lost from our current management system, and whilst Aboriginal knowledge still remains, Aboriginal people's ability to care for country is only slowly being restored in this region. Our cultural and spiritual (and historic) connection and sense of well-being derived from Country (budja) are important community values.



General resilience

Access to human capital is recognised as a constraint to future development of the region. Demographically it is characterised by an aging population, decreasing levels of youth participation and a decline in professional skills.



Managing a major river system

The Avon River is iconic, degraded and responds slowly but directly to land management decisions. Restoration of waterways is only part of the solution to improving the river's health. This will occur once the other 'big' resource issues are kept away from critical thresholds.



Embracing desired social & economic development

The Wheatbelt 'blue print' for future social and economic growth will require a healthy system and resilient community as a starting point.



Strengthening partnerships

Natural resource challenges are simply too great for anything less than a whole-of-community, whole-of-landscape response. Relevant agencies, NGOs, land managers and other organisations within the region will need to work together to achieve the objectives of a shared vision.

As people, our values determine what we're interested in

We derive our livelihoods from our environment. It provides us with food, and a place to live and connect.

For the Avon River Basin of WA, agriculture is the largest land user and social, economic and cultural systems have grown around this.

A goods and services model is derived from what we use our environment for, as well as what we value from it.

Ecosystem services range from the production of food and fiber, and other commodities to cycling of nutrients and climate regulation, to flood regulations and disease protection, to social cohesion, a sense of place, cultural and spiritual connection and a general sense of well-being.

What do the Regional Community value?

It was clear through extensive engagement and group discussions with regional community members that quality of life was most important to them. They could also see how agriculture (and its changes) effects the whole system. Particular issues of concern included: the frequency of spring frosts, the spread of agricultural weeds, widespread agricultural chemical use and other changes in climate.

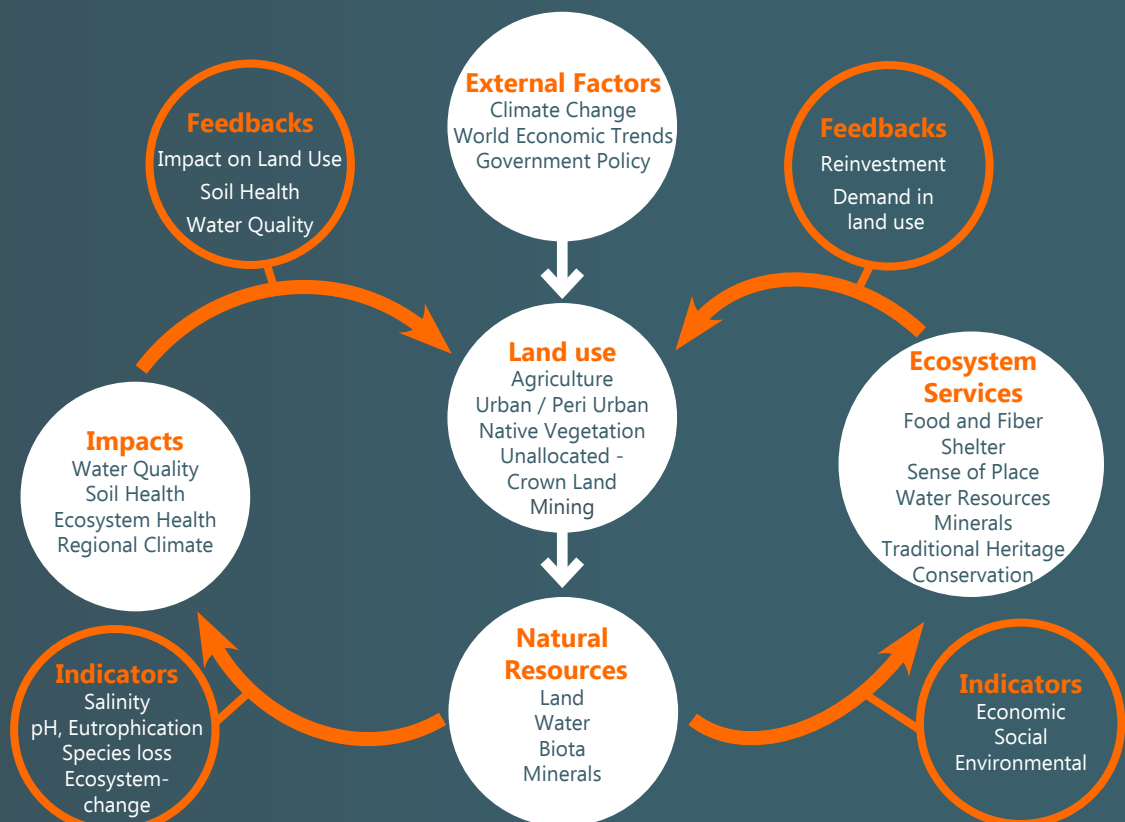
People in the region enjoy the country lifestyle. The safety people felt, their involvement in the community and feeling of self-determination were important values – including *“being my own boss”*. Many people expressed no desire to ‘join the city rat-race’.

In this region people have access to good services, land and housing affordability, they valued not being in traffic, hearing the birds and feeling the sunshine. To open the door at night and hear the peace. A town resident felt there was nothing better than being able to walk to work and mix with all age groups.

The regional landscape was integral to people’s lifestyle enjoyment. One described the region as “big paddocks, big skies and red soil” another described it as “trees and biodiversity and fields of crops integrated with a brilliant blue sky”.

When asked what would make them not want to stay in the region, many community members felt that the absence of suitable work, medical care, schools and affordable housing would do it. *“Withdrawal of services impacts on people’s ability to live in the community long-term”*. For some of the farmers in the region, they would not leave ...*“until the bank tells me to go”* or when they retired because their sons would not be coming back to farming.

Regional Ecosystem Services Model



Identifying Thresholds of Potential Concern (TPC)

Identifying big resource issues is important because they are fundamental to the underlying structure and function of the region. The top 7 resource issues were identified using a resilience assessment, based on their capacity to impact values, derived benefits, goods and services, and sense-of-place. What controls the development of these big issues? This is usually a fast or slow moving ‘controlling variable’ - the ‘system indicator’. How close are we to reaching major tipping points, that is... what is the ‘threshold’ amount of the controlling variable that causes the big issue to ‘tip’ over to a fundamentally new state? What are the ‘big’ drivers that move the system towards or away from the threshold and what are the appropriate points of intervention? It should be noted that individual resource issues do not function in isolation, but as part of a complex interlinked system.

For example: Native species viability is a big resource challenge for the region largely controlled by land clearing. The percentage of remaining native bushland is an indicator for this system-wide NRM issue. The big driver for this is, of course, land clearing and re-vegetation, but the issue of native species viability is also affected by over-grazing, feral animals and weed invasion, fire frequency and climate. Points of intervention for managing this issue relate to bushland protection from land clearing as well as the active management of remnant vegetation.

This Report Card is ‘LIVE’ and will change according to our growing understanding of how the system is changing.

Theme	Big resource issue	Key Controlling Variable (slow or fast moving) System Indicator	Thresholds of Potential Concern (TPC) causing fundamental system change	Where are we now	The ‘big’ drivers (controls) that move the system towards or away from a threshold	Points of Intervention and associated management actions
Ecosystem Health	Species viability (abundance & richness)	Cleared land	< 30 - 40% bush land ¹	30% (range 6% to 99%)	land clearing climate change	Sub-regions where bushland < 30% is enhanced and protected Sub-regions where > 30% remaining bushland is improved, protected and managed
		Fragmentation	Intact bushland patch size < 10ha ²	(see sub-regional map)	over grazing feral & weed invasions fire frequency climate change land clearing	Bushland patch size < 10ha is buffered and reconnected Bushland patch size where > 10ha remaining is improved, protected and managed
Soil Health	Soil productivity	Organic carbon	<1% soil organic carbon ¹	0.4 - 1%	land use land clearing	Promote soil testing and increase land cover in sub-regions < 1% soil organic carbon
		Acidity	50% ² top-soils <pH 5.5 ¹	80%	fertiliser use efficiency lime application	Promote soil testing and lime application in sub-regions where > 50% soils pH 5.5
Aquatic Health	River function (Avon River and major tributary)	Sedimentation	>30% ² waterways degraded	30%	waterway and riparian management	Sub-regions > 30% streams degraded are fenced and re-vegetated Sub-regions < 30% streams degraded are managed and enhanced
		Eutrophication	The Avon River > 0.06mg/L ¹ total phosphorus (TP) &/or > 1mg/L ¹ total nitrogen (TN)	(see sub-regional map)	fertiliser use efficiency climate	Encourage improved fertiliser use efficiency in sub-regions with > threshold Total Phosphorus or Total Nitrogen levels
		Acidity	Waterways pH < 6.5 ¹	(see sub-regional map)	deep drainage	Encourage retrofit of local dam disposal of saline discharge in sub-regions with pH < 6.5
Community Health	Agriculture industry viability	Farm financial viability	(surrogate) >25% ² farmers with a >3:1 debt to income ratio ²	10-15%	input costs market price climate government policy management decisions	Develop alternative, viable industry in sub-regions where > 25% farmers approaching a 3:1 debt to income ratio
	Community viability	Population trend	<70% ³ of residents and farmers within 50km of towns of > 600 people ² population change > 0% ²	74% 2% (range -9 - 10%)	farm amalgamation employment high school aging community government policy	Work with partners to promote lifestyle and support land use planning in sub-regions where < 70% population resides within 50km of towns of > 600 people (or < 0% population change)
Whole of System Health	System viability	Salinity	>10% landscape saline ³	4%	climate land use (perennial vegetation) land clearing	Re-vegetate and adapt to saline land in sub-regions where < 10% saline Promote re-vegetation to protect local assets in sub-regions where > 10% saline
	Catchment water availability	Drying catchment	(surrogate) catchment run-off threshold < 0 ²	-2	climate change land clearing	Protect strategically important environmental flows and adapt to climate change impacts in sub-regions where the catchment run-off threshold is < 0

Annotations

Thresholds of Potential Concern (TPC) are not always easy to determine and some are defined as a range. Confidence in identifying the threshold value can be high when it has been well researched (or represents an abrupt system change) or low, and some are values-based (i.e. not ecological thresholds). Bringing greater clarity to threshold points of system change increases with system understanding.

- ¹ TPC empirically well or fairly well understood.
² TPC informed by expert opinion.
³ TPC intelligent early guesswork.

Surrogate values are used where data is not yet available for the Threshold of Potential Concern.

¹ Soil acidity is a medium risk of recoverability because increasing soil pH is achievable for all system-soils, however the cost of inaction is a time-delay for soil pH recovery.

² Acidification of inland waterways and lakes is recognised as a resource issue for the Wheatbelt region and documented in the DAFWA Report Card, 2013.

³ 25% of farmers with a 3:1 debt to income ratio is based on a moving 5-year average, as it fluctuates annually. The sub-regional percentages have not been defined.

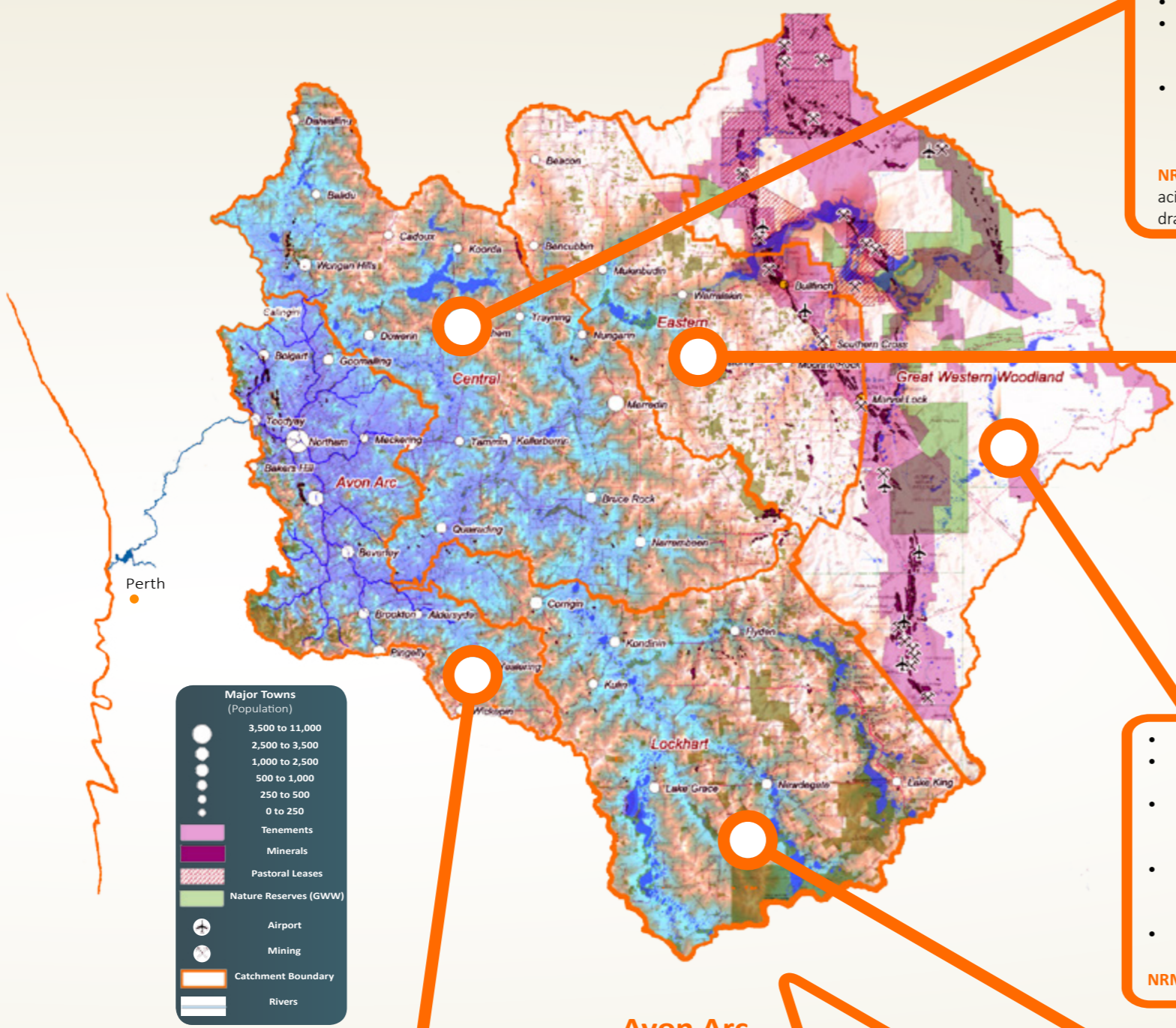
⁴ 70% of residents and farmers within 50km of towns of > 600 people is required to maintain and improve social services. 50km was considered the distance from a rural town that residents will frequently drive to access basic social services.

⁵ A value-based TPC for landscape salinity has been difficult to define. The ecological threshold that was crossed when the landscape was cleared of more than 20-30% of its native vegetation has not been included. The 4% of current extent is not inclusive of 1.6% primary salinity and 0.4% of moderately saline land.

⁶ The catchment run-off threshold is a surrogate for rainfall change that takes into account a run-off threshold for the catchment.

Sub-Regional Priorities of the Avon River Basin

Five sub-regions within the Avon River Basin have been identified that have unique characteristics and issues. Sub-regional differences can guide the prioritisation of management responses at a local level.



Central Wheatbelt

- Moderate population density
- Declining population
- Economy reliant on agriculture
- Muted structural adjustment in agricultural industry leading to increasing economic stress
- Early settled, high clearing rates, extensive local extinction

- 6% remaining bushland
- 6% remnant patches >10ha in size
- 6% salinity
- Majority soils below threshold pH 5.5
- 0% population growth
- 79% of town populations within 50km of towns > 600 people
- Exceeds threshold for Total Nitrogen(TP) and Mortlock catchment exceeds TP threshold
- 20-50% of river sample sites have severely acidic baseflow <pH 6.5 (DAFWA Report Card 2013)
- Limited fencing on major river tributary

NRM Priorities: Make productive use of saline land, manage modified biodiverse systems, address soil acidity issues, improve fertiliser efficiency on agricultural landscapes, retrofit to locally dispose of deep drainage water, fence and re-vegetate major tributaries

Eastern Wheatbelt

- Low population density
- Declining population
- Limited access to social services
- Emerging influence of mining on the local economy
- Ongoing structural adjustment with agricultural enterprises
- Most recent clearing, lower clearing rates, important ecological refuge

- 17% remaining bushland
- 13% remnant patches >10ha in size
- 1% salinity
- Majority soils below threshold pH 5.5
- -9% population growth
- 38% of town populations within 50km of towns > 600 people
- Exceeds threshold for Total Nitrogen
- Limited fencing on major river tributary

NRM Priorities: Enhance, protect and manage remaining biodiversity, prevent further salinity expansion, manage soil acidity issues, support land use planning and alternative industries, improve fertiliser efficiency of agricultural landscapes, fence and re-vegetation major tributaries

Great Western Woodlands

- Limited clearing
- Dominated by mining, traditional and conservation land uses
- Significant areas of Unallocated Crown Land (83%), open to potential future change in land use
- Key threats associated with changes to fire management, feral animal control, weed invasion and vegetation disturbance
- A few largely inactive pastoral leases

- 99% remaining bushland, all over 10ha
- No secondary salinity
- Unknown soil pH and organic carbon levels
- Small FIFO population—no data

NRM priorities: Protect and manage impacts on intact native vegetation

Avon Arc

- Higher rainfall
- Higher population density
- Increasing population
- Town economies greatly influenced by services industry
- Increases in urban and peri urban land use development
- Early cleared, high levels of local species extinctions
- Avon and Swan River impacts
- Management of land use planning

- 11% remaining bushland
- 9% remnant patches >10ha in size
- 4% salinity
- Large proportion soils below threshold pH 5.5
- 10% population growth
- 86% of town populations within 50km of towns > 600 people
- 99% Avon River fenced
- Exceeds threshold for Total Nitrogen
- Exceeds threshold for Total Phosphorus

NRM Priorities: Enhance, protect and manage fragmented, at-risk biodiversity, improve fertiliser efficiency of agricultural landscapes, major tributary riparian management, and manage peri-urban changes

Southern Wheatbelt

- Low population density
- Declining population
- Limited access to social services
- Ongoing structural adjustment with agricultural enterprises
- More recent clearing, lower clearing rates, important ecological refuge

- 20% remaining bushland
- 17% remnant patches >10ha in size
- 4% salinity
- Large proportion soils below threshold pH 5.5
- -4% population growth
- 27% of town populations within 50km of towns > 600 people
- Exceeds threshold for Total Nitrogen
- Limited fencing on major river tributary

NRM priorities: Enhance, protect and manage important biodiversity refuges, address soil acidity issues, prevent further salinity expansion, support land use planning , fence and re-vegetate major tributaries

Resilience thinking helps explain what the social-ecological system is doing

A system is said to be resilient if it can cope with 'shocks', such as de-population and sudden market prices changes, and reorganise itself to essentially remain functionally the same. Evolution is possible because the system is resilient.

The Avon River Basin is both a social and an ecological system—the two are inextricably linked. This system supports a whole range of ecosystem services, which in turn affect the system's ability to provide these services.

The use of resilience thinking in Natural Resource Management informs managers about what parts of the system are at risk

of crossing a 'Threshold of Potential Concern' (TPC's) from which it is difficult to return. Environmental problems are one outcome of this. Once crossed it can be difficult to 'pull' the system back. Our regional examples of this are dryland salinity, river eutrophication and local species extinction.

We need to keep the system away from crossing critical thresholds. Natural Resource Managers can assist this through prioritising (and funding, where possible) management interventions.

Vision: A healthy environment that has a viable agricultural industry and retains a strong sense of place

20 – 30 year objective: All of the community contributing to the improved management of the natural environment on both private and public land

5-year strategic objectives							
Develop a Strategic Adaptive Management approach and embed resilience/ systems thinking into NRM	Strengthen partnerships in the understanding and management of our social-ecological systems	Adapt to a changing climate	Increase perennial vegetation cover	Support agricultural industry innovation targeting efficiency in chemical use and improved soil health (NB. 'Chemical' includes fertiliser, herbicide, pesticide, lime, etc.)	Promote 'fit for purpose' land use	Coordinate fire and invasive species management in both conservation and agricultural systems	Encourage community action for environmentally sustainable lifestyles
5-year strategic priorities							
Develop a spatial planning tool	Build NRM into and encourage cross-jurisdictional planning	Plan for carbon sequestration	Maintain and increase areas of native vegetation	Improve the use of soil testing data for land management	Fence and re-vegetate waterways	Increase targeted feral animal control	Region leads in the production of renewable energy
Plan at sub-regional scale	Regional NRM Strategy influences planning processes impacting the region	Protect environmental water flows	Improve the connectivity of perennial vegetation systems	Minimise off-site impacts (including deep drainage)	Develop viable economic systems on saline land	Expand the Western Shield Program	Maximize water harvesting, re-use and recycling
Provide an adaptive management framework	Work with businesses to address NRM impacts of management decisions	Develop strategies for climate change adaptation	Exploit opportunities for re-vegetation in both conservation and agricultural systems	Optimise management of soil pH	Conserve the values of the Great Western Woodlands	Implement appropriate fire management regimes	Encourage household implementation of sustainable living practices
	Manage labor market and age demographic constraints in NRM activities	Improve water sensitive planning for land use change	Promote, support and implement active management of native vegetation	Improve nutrient use efficiency	Diversify agriculture to take advantage of landscape variability	Control weeds in native vegetation	
	Encourage profitable, environmentally sensitive and resilient enterprises	Promote and implement farming systems resilient to seasonal variability	Develop opportunities for perennial vegetation-based enterprises	Maintain ground cover on agricultural land		Implement sophisticated invasive species management that considers predator-prey interaction	
	Exploit novel ways to fund NRM						
				Increase understanding of herbicides and pesticides on community and ecosystem health		Improve our understanding of appropriate fire management	
Explore traditional Aboriginal knowledge							
Monitor resource condition against TPCs							

From Strategy to Action

Resilience thinking and systems analysis provide a perspective on how social-ecological systems work. **Thresholds** are points of system change to keep away from. **Drivers of change** ('stressors') point to priority interventions. But...how do we make good decisions on what to do where?

Success will depend on the development and delivery of priority projects and it is at the local scale that decision-making occurs for action on-the-ground.

The next step

- Spatial analysis of sub-regional issues and asset prioritisation in partnership with the community.
- A community action plan to determine how to prioritise actions, given available and limited resources.
- Building our understanding of possible system change through long-term resource condition monitoring.
- Knowledge gaps remain in our understanding of system change. Identifying and acting on emerging drivers of system change will be important to guide future sustainable development.

Alongside more than 50 other regional NRM groups and Catchment Management Authorities around Australia, Wheatbelt NRM has a key leadership role in bringing together partners, sourcing funds and coordinating delivery of the regional NRM strategy. It is anticipated that this strategy will be updated every 5 years.



More Information

To learn more about The Avon Region systems analysis (including chapters on resilience and adaptive management) visit the Wheatbelt Regional NRM Strategy on our website: www.wheatbeltnrm.org.au/nrmstrategy

To learn more about Resilience thinking visit:

- The Resilience Alliance website - www.resalliance.org
- The Stockholm Resilience Centre website - www.stockholmresilience.org

To learn more about Resilience assessments for NRM in Australia visit The Australian Resilience Centre website: <http://www.ausresilience.com.au/>

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Acknowledgments

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Published: November 2014, ©Wheatbelt NRM Inc

Keywords: Resilience, Adaptive Management, Wheatbelt, Avon River Basin, Natural Resource Management, NRM, NRM Strategy, NRM Western Australia

Thank you to the following for their input: Natarsha Woods and Wheatbelt NRM staff

This publication is produced by Wheatbelt NRM through funding from the Australian Government and the Western Australian Government's State NRM Office.

