HEALTHY COUNTRY
"A LIGHT ENVIRONMENTAL FOOTPRINT FOR PERTH AND SOUTHWESTERN AUSTRALIA"

Proposed elements of an integrating conceptual framework

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Goal

Prosperous and adaptable Southwestern communities amid resilient landscapes.

Perth and regional communities of south-western Australia will have a highly developed understanding of the landscapes in which they live and capacity to address and adapt to economic, environmental, and social imperatives in achieving a sustainable development pathway for this rapidly changing part of the country. The region will be recognised internationally as a leading centre of excellence in environmental management and related technologies.

Hypotheses

There is a set of inter-connected failures in Australian natural resource management systems that have caused land and water degradation and biodiversity decline. They include failures in policies, markets and property rights, inappropriate land use, technology and management, and inability to predict and explain biophysical, social and economic change. Together these causes reduce landscape resilience and the ability of communities to adapt to opportunities and threats.

We propose to form R&D partnerships to conduct regional projects that test these hypotheses.

Context

The southwest of WA is among the fastest growing regions in Australia. Perth, the capital city of the State has a population of 1.38 million people and aims to be the most liveable, environmentally sustainable city in Australia by 2025. Western Australia is a true city-state, with the vast majority of its citizens, wealth and economic activity focussed in the capital. The wealth and environmental condition of Perth is reliant on the natural resources and environmental integrity of the hinterlands. The largest catchment in Western Australia, the Swan-Avon, is the size of Tasmania and discharges directly into the estuarine waters of Perth.

The diverse environmental issues on the Swan Coastal Plain involve the water, mining and manufacturing industries in an intimate way within a sensitive urban environment, and primary industries which place the relatively fragile landscapes of the hinterlands under pressures that are both intense and extensive.

Innovation in natural resource management initiatives and community action is a hallmark of WA. Nevertheless, the combined pressures of population growth, industry expansion, and environmental sensitivity have created a complex planning and regulatory challenge with respect to sustainability.

Present institutions are increasingly responding to NRM crises and losing the capacity to take a more strategic approach to development. There is a clear need to underpin environmental planning with analyses that integrate knowledge and values from across a very complex system, and to provide policy, management and technological solutions that are effective, commercially viable, environmentally sensitive and socially acceptable. Achieving the vision of making southwestern Australia a world centre for environmentally sensitive economic and social development is an audacious, exciting and worthy goal.

The region is experiencing six main stresses on the environment, all of national significance:

1. Climate change: The long-term hydrologic drought (post-1975) appears to be climate change, and is translating to severe water shortages for people and the environment in and around the region. The size of the rainfall decline is consistent with climate change, but some 25 to 100 years earlier than predicted. The implications to the environment, agriculture and industry are profound. It is time to adapt to this climate state change in the south west of Western Australia.
2. Salinity: Widespread land clearance for agriculture is associated with 70% of Australia's current dryland salinity. Impacts to date include $500M p.a. of road infrastructure depreciation, $100-200M p.a. of lost agricultural productivity, $100M of lost surface water resources, and the potential extinction of 450 spp of plants and 218 spp of invertebrates.
3. Biodiversity loss: The SW of WA has been identified as one of 25 global biodiversity hot spots on the basis of "exceptional concentration of endemic species undergoing exceptional loss of habitat". It is the only one in Australia and biodiversity loss continues as a result of habitat fragmentation, salinity, weed invasion, predation by introduced animals and phytophora disease.
4. Water as a drinking resource: Due to reduced rainfall over thirty years, dams storages are under stress. Groundwater will be increasingly used to supplement water from dams (60% reliance in Perth on groundwater as a drinking resource), but this resource is under similar pressures from drought.
5. Water pollution: Agricultural, industrial, and urban nutrient pollution are associated with the eutrophication of Perth Waters (Swan River), other estuaries, and the inshore marine environment.
6. Air pollution: Industrial contaminants associated with heavy industry along the Kwinana Strip are affecting the environmental and human health of the local coastal plain and Cockburn Sound as is forest fuel management and urban pollution of Perth's air.

The rapid growth of Perth, combined with a serious long-term drought, is placing more pressure on water resources at the probable expense of the environment. The multi-decadal drought, consistent with future climate change expectations, has introduced a costly element of uncertainty into decision-making. No other Australian metropolitan area is facing such difficult decision making issues in balancing costly water development options against potential shortage of water in the future. The

debate over price, source, and allocation to the environment is current and would top the list of pressing state NRM issues.

For this region in particular, these climate variability and change processes are a fundamental issue and impact on the entire spectrum of natural resource management and utilisation in the region. Because of a need to quantify, water supply and allocation decisions have been at the forefront of the response to these problems and resources have effectively been written down between 20% and 40%. However, other sectors also need to decide on appropriate actions required particularly the conservation and agricultural sectors.

The region has been active in identifying the challenges due the changes in climate, as exemplified by the Indian Ocean Climate Initiative. There is now a determination to turn the challenge into opportunity by developing and marketing technological expertise in these areas.

The national and international significance of the current and potential biodiversity loss in southwestern Australia are widely recognised (e.g., Myers *et al* Nature 403:853-58). For instance, the Fitzgerald National Park contains more plant biodiversity than the Murray Darling Basin. The State Salinity Strategy, which has evolved over two changes of state government, identifies the impacts of salinisation and their remediation as a state priority, and the National Action Plan for Salinity and Water Quality has identified four large regional catchments as national priorities.

The health of the Swan estuary is of immense importance to the people of Perth with 8% of Australians living around the estuarine system. Closure of the Swan River for 10 days due to a toxic algal bloom associated with a large input of nutrient rich water from the Upper Avon in January 2000 was a social, economic and environmental crisis. It demonstrated in the most lurid of terms that the health of the estuary is indeed connected to even the remotest parts of the Avon – a catchment the size of Tasmania. The Swan-Canning Cleanup Program is an action plan to clean up the Swan River and estuary and has extended over two changes of state government. Nutrient availability is one of the main reasons excessive algal blooms are occurring. The program has been developed for action over five years (1999 – 2004), with recognition that clean-up activities will need to continue for at least 20 years and is aimed at ensuring that the fundamental ecological processes are restored to ensure the health of the system.

Cockburn Sound is an internationally recognised coastal ecosystem with fringing land use of heavy industry. A long list of contaminants results from this industry, and their individual and cumulative impacts on marine health are a source of frequent and serious concern to the state. The inputs and residues to this industry are a high profile public concern with respect to human health and environmental protection.

Perth has very poor urban air quality on occasions during autumn and winter. Surveys of environmental concerns rate this as a priority for the public. Photochemical smog

has generally been associated with the large cities of Europe and the US, but it is not confined to these. In Australia, air quality studies in the 1970s and 1980s alerted Sydney and Melbourne authorities to the growing problem of smog. More recently, studies to assess the extent of the photochemical smog in Perth have been initiated.

As part of the Perth study, CSIRO Coal and Energy Technology scientists collaborated with colleagues from the Flinders Institute for Atmospheric and Marine Sciences to obtain data on the air above Perth. Most interesting was that the ozone measurements showed two distinct plumes, suggesting different sources, one from the main urban area, and the other probably from the Kwinana industrial area.

Consistent with the rest of Australia, the future of the Southwest will be characterised by increased urbanisation of the coastal plain, new heavy and light industries associated with primary mineral resources, and continual change in inland rural primary industries and the communities they support. These human developments will take place in the most ancient, biodiverse and fragile of Australia's ecosystems. The challenge for Australia is to manage the trends in regional development recognising:

- Globalisation of economic systems and the implications in terms of trade and environmental quality assurance;
- An increasing, but uneven understanding of the extent to which economic and social sustainability is linked to the integrity of the natural resource base and the sustainability of its use and consequent pressure for change in current practice; and
- Increasing inequality in skills, services, lifestyle and political influence between urban and rural communities, and between sectors within rural, regional and remote communities that in turn impact on economic development and the ability to manage environmental impacts.

Pressures across the 'triple bottom line' combine to place significant pressures on current use of the natural resource base and consequent robustness of regional economies and communities, and those of the City of Perth. These are manifest by social, economic and biophysical degradation of the landscape in many areas. Addressing these pressures demands new thinking on the foundations for regional economies and new evidence-based, strategic approaches to better managing the total landscape through markets, policy and community action.

Excellent research will be required to underpin these responses by providing the technical foundations, improving the capacity of communities to participate, devising ways to improve the effectiveness of institutions and developing improved methods of evaluation.

Contributions from Healthy Country in the Southwest

We will work in partnership by making particular contributions to:

- **providing technical foundations and the "science of the gaps" knowledge** - by generating process understanding of the behaviour of the physical, ecological, social and economic landscape; developing predictive tools that deal with pathways and uncertainty across systems and are consistent with adaptive management principles; by improving access to that data and

knowledge; and by providing tested technologies that will facilitate the triple bottom line.

- **improving the capacity of rural and urban communities to participate** - by providing the tools to use information effectively, and the organisational skills to improve outcomes;
- **improving the effectiveness of working between institutions** - by devising the right structures for new challenges, and the appropriate relationships across scales of influence;
- **developing theory and practice** by learning through working with communities, rigorous evaluation and transferring experience into the broader policy domain;
- **developing a deeper, more shared understanding of the environmental values of the region and the implications to those values implied by development.**

Outcomes, outputs & performance indicators

Outcomes

- Resource use increasingly well matched to fundamental resource capability, long term economic viability and community aspirations;
- The implementation of integrated solutions to achieving these targets;
- Enhanced economic and social adaptive capacity of communities in the Southwest, thus increasing the resilience of the social-ecological system;
- Rural and urban communities and the three levels of Government incorporate research-based knowledge and decision-making methods into the effective, strategic management of the Southwest;
- Identified and corrected the Institutional failures in legislation, policy and administrative arrangements that inhibit the resolution or adoption of improved environmental health of the Southwest;
- New technologies for water and waste management that can be commercially exported worldwide and serve to improve the social, economic and environmental well-being of the Southwest;
- International recognition of the Southwest as a leader in sustainable development and a healthy urban and rural environment.

Outputs

1. We will work with our partners to map out desired economic, environmental and community futures. To achieve this we will develop:

   - Research agendas based on open dialogue with government, industry and the community;
   - Predictive understanding of the bio-physical, economic and social landscapes of the Southwest;
   - Tools and technologies for evaluating economic, social and environmental trade-offs to enhance the sustainability of regional communities;
   - Tools and technologies for minimising the environmental impacts of industry;

- Integrated knowledge-based inputs into planning resource use that build regional economies, sustain and develop communities and protect environmental values.
- Science-based policy advice relating to large-scale rural, regional and urban issues.
- Enhanced community capacity to visualise, understand and manage their environment.
- Better planning and technologies for remedying pollution and protecting estuarine and coastal environments.
- New commercial technologies for managing water (fresh; urban runoff; effluent; saline, minerals).
- Better planning and techniques for protecting biodiversity (water allocation, drainage, revegetation).
- A comprehensive water supply strategy that will secure Perth's water future in the face of modelled climate change forecasts.
- Analytical and operational flows and loads model for managing our rivers, our estuaries and coastal waters, and expectations.

2. In working with communities, our outputs are:
   - Scenarios for resource use options developed with communities;
   - Evaluations of scenarios in environmental, social, and economic terms;
   - Pathways for transitions to new scenarios.

3. To achieve this, we will develop time bound and quantifiable targets relating to the six stressors described above (climate change, salinity, biodiversity, water availability, water quality and air pollution) within the first twelve months in partnership with stakeholders.

4. We have succeeded if:
   - Through appropriate partnerships we contribute to the development of regional and urban strategy plans by providing science-based insights into trade-offs between economic, ecological and social objectives.
   - These strategy plans have a material and substantial impact on investment in economic development, on the health of the region, and on the quality of the coastal and marine environments
   - Our partnerships, when complete, leave viable and on-going processes and capacity.

What do we need to do to succeed?

1. Build effective regional partnerships with communities, industry and government (local, State and Federal).

2. Build effective relationships with policy makers at State and Federal levels as well as representative bodies and other opinion leaders in policy formation to ensure that the findings of our research can impact beyond our case studies.

3. Recognise the high transaction costs of participatory research, invest in skills in communication and facilitation, and find effective ways of ensuring institutionalisation of our investments.

4. Find effective ways of operating in an inherently political research arena. Knowledge generates power. In seeking to work in partnerships we need to find defensible ways of operating as an agent of change rather than arguing that we simply generate knowledge for regional sustainability.

5. Be clear and agreed on our role (eg. providing guidance and skills in negotiation / change processes and leadership in analysis and modelling – not decision-making or planning functions). Negotiating and communicating our role is vital to ensure that CSIRO can define, argue and sustain a role and mandate in Healthy Country.

How do we choose where to work & who to work with?

The disproportionate size, influence and intensity of the Perth urban situation argues strongly for an emphasis and focus on the limited area. However, recognition of the flows of natural resources (water in particular), wealth, and pollutants to and from the hinterland, and the inherent value of the well being of rural communities and landscapes, argues for a balance between urban and rural focus. The concept of "Footprint Perth" is perhaps an appropriate working notion.

The footprint concept can be understood using the example of water management. The diversion and supply of potable water to Perth, the Wheatbelt and Kalgoorlie, the ineffective use of rainfall leading to salinisation and subsequent biodiversity loss, and the water-borne pollution of rivers, estuaries and the coastal marine environment collectively define a region extending from the Moore River in the north, the whole of the Swan-Avon system and beyond to Kalgoorlie in the east, and south to the Blackwood Catchment and the coastal plain to Bunbury. The synthesis of information on environmental, social and economic processes and adaptation will necessarily extend at least to these limits to be meaningful to the Perth footprint in the Southwest.

We will partner with the State Government, state NRM, primary industries, planning agencies, industry and regional associations (e.g., Cockburn Sound Management Council, Kwinana Industry Association, Avon Catchment Council), local government (e.g., through WALGA), NGOs (Green WA, Conservation Council of WA) and universities to establish the direction and capacity of *A Healthy Country* in the southwest of Western Australia.

Some key questions that *A Healthy Country* could address in Western Australia

Salinity

- What is the cumulative downstream impact on water quality, water yield and flood peaks of plant-based and engineering interventions?
- How can we manage the flows and loads of water and salt on a regional basis to minimise risk and impact?
- How will the system respond, and how will drivers vary, under anticipated climate change?
- Where are the institutional failures, potential policy instruments, and social issues related to regional catchment management?
- What works where, and for whom?
- What are the likely new industries that form part of the solution, and what is their future and role?

Biodiversity

- What are the biodiversity assets most at risk in a region, and most in need of protection?
- What are the tradeoffs among biodiversity protection, industry, the community, and catchment health and how do we optimise this decision?
- What technologies are needed to protect or enhance biodiversity?

Water Quality

- What are the cumulative impacts of the various nutrient and pollutant inputs into an estuary, river or inshore body as a function of time, management, policy?
- What is the socially acceptable return period for the closure of a water body due to an algal event?
- What new technologies are needed in restoring and protecting water bodies?
- What are the human health risks associated with poor water quality, and the technologies and strategies that will mitigate this risk?

Air Quality

- What are the sources and cumulative impacts of air pollution for Perth?
- What are the social expectations for air quality, and where can the greatest gains be made to achieve this level? What will these changes cost and to whom?
- What enabling technologies could we develop that will help achieve this goal?

- **WA Healthy Country Model**