

1 Regional Conceptual Model

Systems analysis and resilience assessment requires an understanding of the system components and interactions between system elements in achieving desired outcomes. This section presents a conceptual model of the important components of the environmental and socio-economic system for the Avon Region.

The organisation of components within a system provides key insights into its structure and function. Developing conceptual models of the system being assessed is a critical element of developing a functional adaptive management strategy.

As the assessment was undertaken to inform the development of the regional strategy, the conceptual model was intended to reflect systems components at a regional scale. However, in reality there are interactions between scales. For instance, NRM – the management of soil, water and biodiversity – actually occurs at a paddock or reserve scale, by individuals or small groups of individuals. However, major stressors occur at an industry or whole of community level, often driven by national and global scale changes.

1.1 Dynamics and Natural Variability

Natural systems are inherently dynamic and typically contain large quantities of matter (eg. the large biomass of many natural ecosystem) displaying complex and/or convoluted flows of energy or information within and between system components. In this instance, quantities of matter in the Avon region refer landholdings, reserves and remnants, soil and water resources and human populations, industries and finance, etc. The flow of energy refers to the production of agricultural products, financial transactions, changes in populations, etc.

The structure and composition of the region changes from season to season, influenced by natural cycles such as weather patterns and commodity prices, availability of water, temperature fluctuations and (at a local scale) factors such as the presence or absence of fire in natural ecosystems.

Variations are essential to the underlying structure and function of our social and environmental systems, but can lead to the system becoming vulnerable to fundamental change. Seasonal variability within all systems presents significant challenges for native vegetation, aquatic ecosystems and agriculture alike. Changes to seasonal variability may present significant additional challenges, particularly for the Western Australian Wheatbelt, which – whilst a low-rainfall environment – has historically maintained relatively consistent seasonal conditions.

Effective management of natural resources requires an understanding of how natural variations in climatic and economic conditions influence our regional industry, economic and social capacity. This in turn requires an understanding of the flow paths influencing NRM within the region.

1.2 The System Overview

System stability and function is a product of system structure, with each component or species governed by abundance, productivity, fitness, diversity, collective memory/knowledge and adaptability. Communities are interdependent and interconnected as trophic networks, influenced by a range of environmental conditions which rarely remain static (Walker et. al. 2004).

The conceptual model developed for the Wheatbelt region attempts to describe the individual components of the system and interactions between key system components. The conceptual model attempts to provide a logical framework for determining the key pathways within the system to support the resilience assessment for the region.

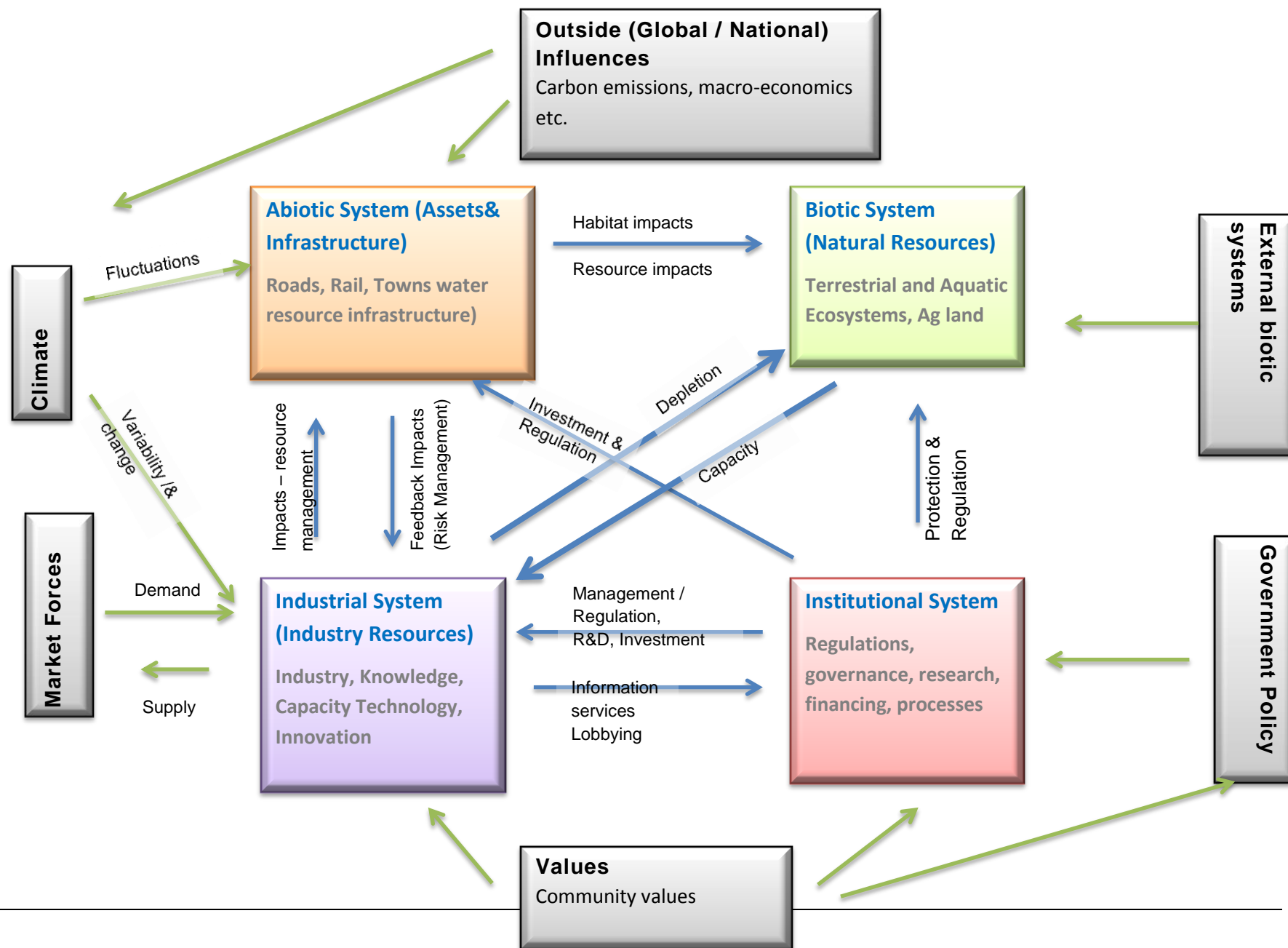
The conceptual model used for the Avon region was adapted from an ecological management model developed by the Food and Agriculture Organisation of the United Nations (FAO 2002). This model was used because it provides a mechanism for viewing various components of the community and interactions between elements. In addition, the model has previously been successfully employed in developing adaptive management systems, incorporating natural resources, social, civic and governance structures and infrastructure elements, thereby providing a suitable framework for describing the various components of the Avon River basin.

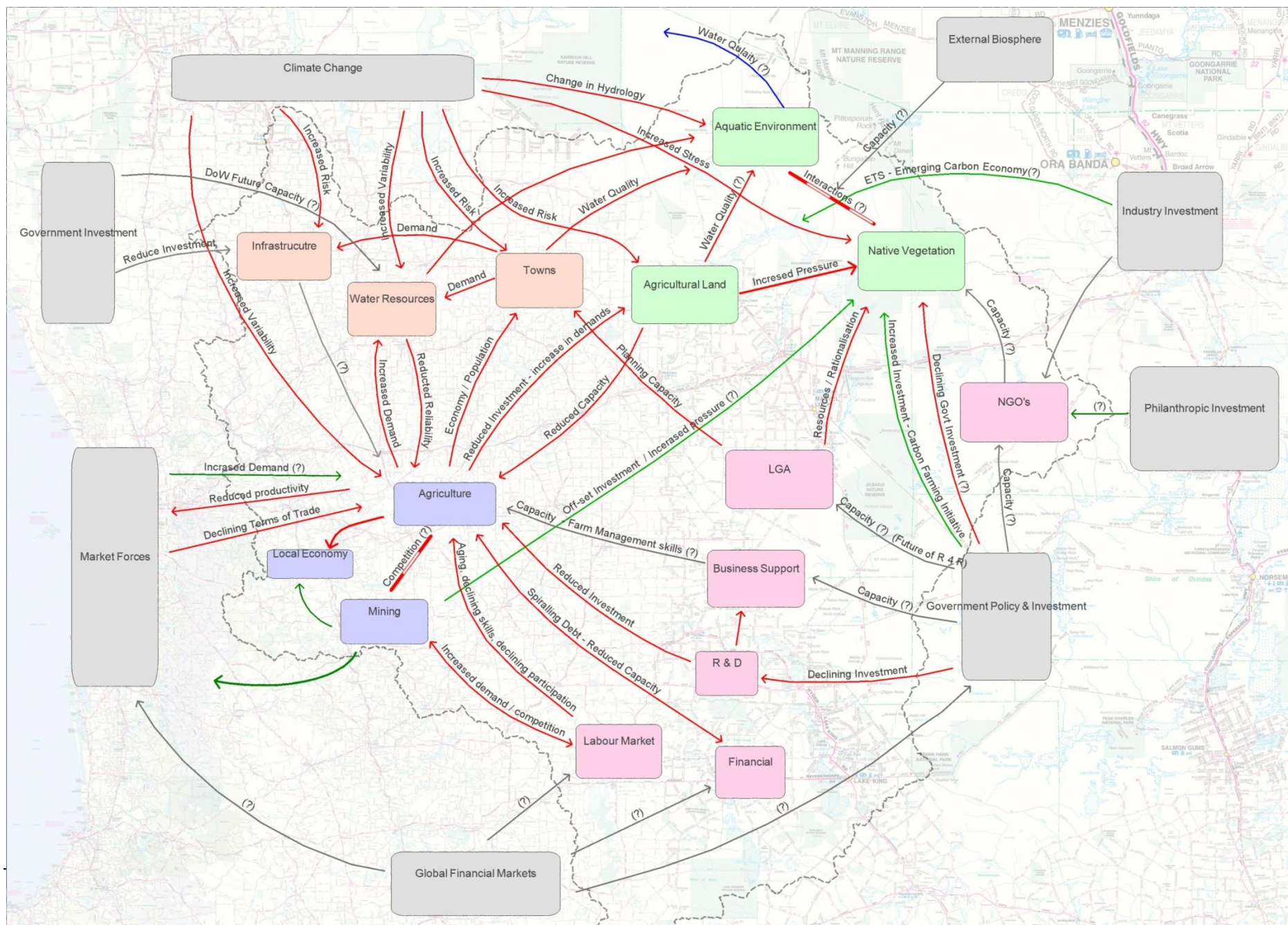
Essentially the model describes the community of the Avon River Basin, as having four interactive components:

- **Biotic** (environmental communities), including living habitat such as natural ecosystems and agricultural systems (the interaction between soils, water, crops, pastures, livestock etc.)
- **Abiotic** (resources and infrastructure), including natural and built infrastructure such as roads, rail, water resource infrastructure, buildings, bridges etc.
- **Socio-economic & Industry** (knowledge, technology and wealth), including essential elements of the economy of the region, management capacity, processes and activities
- **Institutional** (civic services and governance), comprising laws, regulations and organisations needed for governance of the region including local government and financial, business and scientific (including R&D) support for industry and the environment.

A simplified version of the model is presented in Figure 1, highlighting key interactions between major system components. A more detailed regional conceptual model is presented in Figure 2, intended to provide an indication of interactions between specific system components for the purposes of understanding primary relationships influencing stated goals and objectives for NRM within the region.

Figure 1. Simplified Community Model.





1.3 Discussion

The goals and objectives of Wheatbelt NRM are principally associated with protecting and enhancing natural resources that provide the region's community with a range of ecosystem services. These ecosystems include terrestrial and aquatic ecosystems and land supporting agricultural production. Wheatbelt NRM is principally concerned with the biotic system containing the natural resources of the region, and elements of the other system components that directly influence the management of these natural resources.

The success of Wheatbelt NRM in delivering outcomes within the region will be greatly influenced not only by actual investment made but also by the nature of relationships formed by the organisation. Wheatbelt NRM needs to invest in building relationships within industry, including sustainable agriculture and mining, where more effective NRM can be clearly demonstrated. Conversely, direct investment in NRM without understanding key underlying drivers and trends within the industry or key infrastructure needs could be futile or even counter-productive in achieving long-term NRM outcomes.

The conceptual model suggests that natural resources, principally including native vegetation, aquatic ecosystems and agricultural land, are influenced by a range of internal and external factors. Key internal regional influences impacting natural resources are:

- *Likely reduced investment and increasing demands on agricultural land as a result of tightening economic conditions within agriculture, and potentially reduced capacity of agricultural land to support increasing demands on productivity*
- *Increasing pressure from agricultural land on native vegetation and aquatic ecosystems, expressed as a range of stressors including increasing grazing pressure, potential worsening water quality, reduced investment and direct management due to competition for resources*
- *Potential changes to water resource management and their impact on environmental flow conditions, particularly in the light of predicted changes to rainfall patterns within the region*
- *Increasing urban and peri-urban impacts of aquatic ecosystems due to the population growth predicted for the Avon Arc sub-region*
- *Capacity of Local Government to manage development pressure within the region, and in particular effective and environmentally sensitive planning controls*
- *Capacity of NGOs to attract investment and effectively identify effective priorities and manage investment*
- *Population dynamics and capacity of community groups to sustain cohesiveness and support for the effective management of natural resources*
- *Declining government resources and services associated with managing natural resources within the region*
- *Increasing stress on natural environments associated with climate change.*

Ultimately the capacity and preparedness of the agricultural industry to invest in management of natural resources that are under private control is a critical factor influencing the future of natural resources within the region. Effective management of natural resources requires viable and vibrant

socio-economic conditions, and in particular suitable economic conditions to support investment in long-term management of the resource base.

Internal pressures influencing the management of natural resources within the region are further influenced by interactions with other internal and external stressors. For instance, the capacity and resilience of the agricultural industry is influenced by seasonal and longer-term climate variability, access to labour, access to finance, declining terms of trade, investment in appropriate research and development programs, and effective management support.

Primary external stressors influencing NRM within the region include:

- *Trends in global financial markets, influencing access to finance, terms of trade and demand for natural resources and agricultural products*
- *Climatic trends influencing seasonal variability and frequency and severity of destructive weather events, and the capacity of the global community to respond to drivers for and impacts of climate change*
- *Capacity and availability of state government agencies to manage the extensive natural heritage estate within the region*
- *Capacity and preparedness of state government agencies to undertake strategic planning and infrastructure management, and support local government in undertaking effective and environmentally responsible planning within the region*
- *The relationship between state government agencies and NGOs in delivering NRM outcomes within the region*
- *Capacity and preparedness of government and industry to invest in appropriate R&D, and extent of local industry connection and involvement within R&D programs*
- *Extent of external industry investment within the region, including the mining industry and the emerging carbon industry.*

Whilst many external stressors are beyond the capacity of Wheatbelt NRM to directly influence, understanding key relationships and trends associated with external drivers is critical in influencing regional investment priorities to achieve ongoing effective NRM outcomes. In addition, Wheatbelt NRM have a very important and emerging brokering role, bringing state government agencies, industry and NGOs together to more effectively deliver NRM outcomes within the region.

The conceptual regional model is central to the development of the strategy, as it highlights the principal areas of operation of the organisation and provides the first step in the analysis intended to precipitate investment priorities.