

River life

Teachers' notes

EDUCATION RESOURCE 2010



Department of Conservation
Te Papa Atawhai

These resources were developed in cooperation with the Department of Conservation by Jocelyn Pappill and Chandra Littlewood, Educational Consultants, in 2009



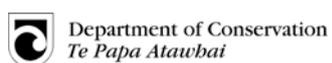
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Braided—the interwoven life of the upper Waitaki River system

Introduction

This education resource has been prepared for use at Level 7 of the New Zealand Curriculum. It supports learning programmes in biology, education for sustainability and geography, and may be adapted to meet the outcomes of an integrated learning approach. Two Level 2 Achievement Standard tasks have been written to complement these units of learning.

The focus is on enhancing understanding of the elements that make up and impact on the braided river ecosystem. The concept of 'ecological niche' helps us to understand how organisms in an ecosystem interact with each other.

The community provides the habitat—the place where a particular plant or animal lives. Within the habitat, organisms occupy different niches. A niche is the functional role of a species in a community—that is, its occupation or how it 'earns its living'.

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Suggestions for using this resource

This resource has as its central theme 'sustainability', especially the long-term sustainability of native plants and animals within the natural environment of the Mackenzie Basin, including the upper Waitaki River system. The learning activities have been developed with this concept in mind and have been aligned with the achievement objectives of the New Zealand curriculum (2007). The supporting information contained herein is sourced from material provided by the Department of Conservation.

The Department of Conservation's Project River Recovery (PPR) programme is highlighted in the resource as it is central to the maintenance and enhancement of the river and wetland habitats of the Mackenzie Basin and upper Waitaki River. PRR is funded by Meridian Energy Limited.

Further information about braided-river environments can be obtained from the bank of resources noted in the bibliography.

The activities and support material are designed to get students thinking and enquiring about the

upper Waitaki River ecosystem, the species found there and the impact human activity has had on the ecosystem balance. It is envisaged that each learning activity could stand alone as a short experiential module undertaken during a field trip, or be woven into a more comprehensive speciality subject learning programme.

Curriculum links and learning outcomes

This resource is written with Year 12 (Curriculum Level 7; NCEA Level 2) in mind, though much of the material can be adapted for use with younger and older groups of students. The main target learning areas are science, particularly biology; education for sustainability and social science, particularly geography; though these resources can be used to support learning across other curriculum areas such as English, technology, or the arts.

This resource supports the development of knowledge, skills and understanding of a key future-focused theme – that of sustainability and of the principle of community engagement (see page 9 of the NZ Curriculum document). It is expected that students will be introduced to the principles and concepts of sustainability prior to beginning this study. This is so they have a base on which to build their understanding of the imperatives for conservation and the mitigation of the impacts of human activities on the native flora and fauna. Their learning will be connected to the community (and the future-focused theme of 'citizenship') as they will be able to see how members of the community can become involved in conserving species. In this respect they will have the chance to explore the values of 'community participation for the common good' and 'ecological sustainability, which includes care for the environment' (p10 NZC)

Possible Achievement Objectives (AO) - Level 7		
Science	Education for Sustainability	Social Sciences
Living World Strand	Concepts of sustainability	Geography
<p>Ecology</p> <ul style="list-style-type: none"> Explore ecological distribution patterns and explain possible causes for these patterns. <p>Nature of Science The AOs under this strand complement the key competencies and all are important in developing a comprehensive learning programme.</p>	<ul style="list-style-type: none"> Environmental sustainability aims to rehabilitate and/or maintain biophysical systems and biodiversity Human actions; economic, cultural, social and environmental, have consequences for sustainability Social, economic and technological practices need to be redesigned to achieve a sustainable future A sustainable future encompasses decisions that involve the social, cultural, economic and biophysical environment 	<ul style="list-style-type: none"> Understand how the processes that shape natural and cultural environments change over time, vary in scale and from place to place, and create spatial patterns Understand how people's perceptions of and interactions with natural and cultural environments differ and have changed over time

Intended Learning Outcomes (LO)

It is intended that following this unit of learning students will be able to:

- Define the spatial patterns of species distribution and the natural systems that support each species
- Describe the biophysical systems of the Mackenzie Basin and illustrate one system in more detail
- State what biodiversity is and how it may be enhanced or destroyed
- Discuss in what ways the natural environment has changed over time
- Examine the impact human activities have had on the biophysical environment of the Mackenzie Basin and upper Waitaki River
- Evaluate diverse values and perceptions held about the natural environment of the Mackenzie Basin and upper Waitaki River
- Discuss aspects of sustainability and explore possible scenarios for a sustainable future
- Employ appropriate investigation methodology in the field
- Evaluate decision-making processes with respect to species recovery and preservation
- Appraise group relationships against agreed outcomes.



Suggested ideas for integration with other subjects

The following learning areas would complement learning in the three listed in the previous table:

Learning Area	Level 7 Achievement Objective	Integrates well with:
English	Language features – select and integrate a range of language features appropriately for a variety of effects	Information presentation, particularly to persuade or inform in a way that holds attention.
Mathematics and Statistics	Statistical investigations – carry out investigations of phenomena, using the statistical enquiry cycle <i>Statistical literacy</i> – evaluate statistically based reports	Data gathering both in the field and from secondary sources. Analysis of data, such as charts and statistical maps.
Health	People and the environment – analyse ways in which the environment and the well being of a community are affected by population pressure and technological processes	Investigation into the spiritual connection Ngāi Tahu has with indigenous species in the area. Investigation into health and well being when natural balances are compromised.
Other Social Sciences	Economics – understand how government policies and contemporary issues interact	Analysis of government policies, such as the biodiversity strategy, conservation and costs associated with them. Trade-offs and real cost economics for sustainability outcomes.

Connection to Key Competencies (KC)

Sustainability education is about equipping people to discern and think critically about the imperatives for sustainability and the choices to be made if we are to create a decent and humane future. Our future depends on people having an understanding of how we are placed in the web of life; that we are citizens of the biotic community not isolated individuals operating only for ourselves. It also depends on people having the capability to participate, to act, to reflect and to connect. In this respect the development of competencies is a vital ingredient of education for sustainability.

Education, as Stephen Sterling proposes is for “the whole person – spirit, heart, head and hands” so that they operate in a world where people require “flexibility, resilience, creativity, participative skills, competence, material restraint and a sense of responsibility and transpersonal ethics to handle transition and provide mutual support.”¹

This learning resource aims to develop the five key competencies of the NZ Curriculum through learning activities that engage, encourage and enthuse students. The methodologies used are of **observation, experience, participation, discussion and reflection** that may lead to deeper understanding of the issues, further questioning, possible change and action. There are no right answers in this process of inquiry and discourse; there are, however, many opportunities for new understandings and insights about how we live in relationship to each other and all living things on this planet.

Thinking – most of the activities encourage intellectual curiosity and require students to think critically about the biophysical world and human activities. It is important for the teacher to model this active curiosity and to encourage the students to question the underlying assumptions related to continued economic growth, conservation and species regeneration, and to question the notion that the answers to our problems can be found solely through science and technology. Many students will not be used to active thinking and will need to be introduced to the vocabulary of thinking and exposed to a variety of thinking tools.

Using language, symbols and text – this competency is an important one for young people to develop as it enables them to interpret the world around them using words, numbers, images, metaphor and various technologies. While studying the Mackenzie Basin and the elements within

1 P22, Sterling, Stephen (2001) Sustainable Education Re-visioning Learning and Change

the area, students will hear and use new words, and develop an understanding of symbols and texts used by people working on issues like species recovery, such as Department of Conservation rangers. The learning activities challenge the students to look beyond the marketing of restoration, conservation or species recovery programmes to understanding the ecological, ethical and value perspectives that drive such programmes.

Managing self – this competency is about developing the ability to set goals and achieve them, but it is also about looking inside oneself, to gain some understanding of what drives our values, attitudes and behaviours. This is especially important if transformative learning is to occur. In this respect it is important that the teacher takes time for reflection circles and discussions about collaboration skills as well as about the blocks or barriers students may face in their learning experiences.

Relating to others – many of the activities in this unit require students to actively work collaboratively with others. They are expected to take part in group discussions, to listen with empathy to the ideas and perspectives of others, and to actively contribute.

Participating and contributing – this competency is about authentic learning. The units of learning aim to deeply engage students in real issues affecting them now and into the future. They will be exposed to the issues of conservation and species recovery in the Mackenzie Basin and, by working with others, will see that they have a role in influencing change and contributing effectively to the problem-solving and decision-making.

Assessment links

This resource provides learning experiences and activities that support students who may be undertaking the following NCEA Level 2 Achievement Standards:

Education for Sustainability

- AS 90813 Describe values and associated behaviours in relation to a sustainable future; 3 Credits
- AS 90811 Describe the consequences of human activity within a biophysical environment in relation to a sustainable future; 4 Credits
- AS 90814 Describe aspects of sustainability in relation to a sustainable future; 4 Credits

OR these Unit Standards in Ecological management

(from the Skills Active Aotearoa Limited - Community Recreation Advisory Group)

- 20668 Demonstrate a basic ecological understanding of animal species in a park area, 1 Credit
- 20427 Demonstrate a basic ecological understanding of plant species in a park area, 2 Credits

View the entire range of EfS Achievement Standards on the NZQA website - www.nzqa.govt.nz/ncea Search 'environment' Level 2

Biology

- AS 90460 2.4 Investigate an inter-relationship or pattern in an ecological population or community, 3 Credits
- AS 90769 2.2 Research the interaction between humans and an aspect of biology, 3 Credits
- AS 90461 2.5 Describe concepts and processes relating to ecology, 3 Credits. External

OR these Unit Standards

- 6309 version 4 Evaluate practices used for managing a resource to ensure ecological sustainability, 4 Credits
- 6314 version 4 Complete an investigation into the ecological niche of a plant with guidance, 4 Credits
- 6297 version 4 Describe methods for the management of introduced species, 4 Credits

View the entire range of Biology Achievement Standards on the NZQA website - www.nzqa.govt.nz/ncea Search 'biology' Level 2



Geography

- AS 90331 Explain natural landscapes 3 credits
- AS 90336 Explain a contemporary geographic issue and evaluate courses of action 3 credits
- AS 90335 Carry out and present guided geographic research 5 credits

View the entire range of Geography Achievement Standards on the NZQA website - www.nzqa.govt.nz/ncea Search 'geography' Level 2

Assessment activities

The following two standards have assessment tasks written for them that are specific to the study area of the Mackenzie Basin.

- ➔ Achievement Standard 90769 v1 Research the interaction between humans and an aspect of biology, Credits: 3
- ➔ Achievement Standard: 90811 Describe the consequences of human activity within a biophysical environment in relation to a sustainable future, Credits: 4

The following activities are suggestions only. Choose those that best meet the desired Learning Outcomes and that best support the development of understanding and knowledge in preparation for undertaking achievement or unit standard assessments.

Suggested learning activities

1. Where are we at? What do we know?

Resource booklet reference pg 5-7

Many of you may already be familiar with the landscape of the Mackenzie Basin and upper Waitaki River. You may have skied in the area or tramped, fished, boated, or just sat on lake shores eating a picnic. It is a popular area for recreation but it is so much more.

By the end of this study you will know a great deal more about the biophysical nature of the Mackenzie Basin. You will not only visit parts of it but also undertake an investigation into at least one aspect of its environment. Your teacher may determine you will study it from a geographic perspective or from an ecological perspective. Both perspectives will incorporate an understanding of sustainability and what that means for the environment, biodiversity and future generations.

Before reading over the introductory page, jot down all the things you know about the area. This could include history, geology, plant and animal life, recreational activities, famous people, places of interest – anything that you know or have experienced about the region. Share your jottings with the class. Were there plenty of similar experiences and knowledge?

You are going on a field trip to the Mackenzie Basin and upper Waitaki River area, and will be based in Twizel. Consider what you would hope to know about the area after the trip is over.

- What burning questions do you have formed that you want answered during the trip?
- What do you want to learn about the biophysical environment?
- What do you think you could do with your new knowledge and understanding after the trip?

Discuss as a class why it may be important for humans to understand the ecology of an environment. Should we be concerned with preserving other species or particular habitats?

Location, resource, tools

- In school, prior to field trip or site visit
- Individual, peer, class activity – no particular resources needed except a positive learning environment.

2. Ecosystem processes of the upper Waitaki River system

Any group of living and non-living things interacting with each other can be considered as an **ecosystem**. Each ecosystem is composed of **habitats**, which are in turn made up of **populations**.



Each population has its own habitat. A population is a group of living organisms of the same kind living in the same place at the same time. All of these populations interact and form a **community**. The community of living things interacts with the **non-living** world around it to form the ecosystem. The habitat must supply the needs of organisms, such as food, water, temperature, oxygen, and minerals. If a population's needs are not met, it will move to a better habitat or die out. Two different populations can not occupy the same **niche** at the same time, however. So the processes of **competition, predation, co-operation, and symbiosis** occur.

Achievement Objectives	Intended Learning Outcomes
Ecology <ul style="list-style-type: none"> Explore ecological distribution patterns and explain possible causes for these patterns. 	It is intended that following this unit of learning, students will be able to: <ul style="list-style-type: none"> Describe the biophysical systems of the upper Waitaki River system and illustrate one system in more detail Explain the spatial patterns of species distribution Discuss biodiversity in relation to the upper Waitaki River system: the variety of species found in the area and how it has changed over time
Geography <ul style="list-style-type: none"> Understand how the processes that shape natural and cultural environments change over time, vary in scale and from place to place, and create spatial patterns 	
Education for Sustainability <ul style="list-style-type: none"> Environmental sustainability aims to rehabilitate and/or maintain biophysical systems and biodiversity 	

Suggested learning activity

Resource booklet reference pages 8-15

SLO: Describe the biophysical systems of the Mackenzie Basin and upper Waitaki River – illustrating one system in more detail.

You could approach this learning outcome from any number of directions. The direction taken will depend on the primary focus of the study – geographic, biological or sustainability. The description could be mainly visual, using flow charts, diagrams or systems models, or it could be solely a written descriptive account.

Because of the interconnected nature of biophysical systems the biophysical aspects that need to be acknowledged include the geographic pattern of landforms, soils, vegetation, hydrology, coasts, and climate, as well as the nature of the species (both plant and animal) associated with the area. Below are some possible tasks you could undertake to familiarise yourself with the region.

- Describe the geography of the Mackenzie Basin and upper Waitaki River. Use a map, or another visual, to illustrate the relief and geology of the system. Make particular reference to the distribution of fluvial landforms in which native species are found.
- Investigate the climate of the area, i.e. wind patterns, mean annual rainfall, aspect, temperature variations. What part does climate play in shaping the biophysical environment of the Mackenzie Basin?
- The upper Waitaki River area is part of the iconic Mackenzie Basin with much of the vegetation being tussock grassland. What other types of vegetation are found in the area and how has it changed over time? How has the vegetation adapted to the environment (provide an illustrative example)?
- Soils – what type of soils are found in this region and how do they influence the plants and animals of the area?
- How has the fauna of this biome adapted physically and behaviourally to the environment? (Provide an illustrative example)
- The survival and well being of a biome and its organisms depends on ecological relationships. Using the material provided, build up a picture of the living and the non-living things that make up the ecosystem of the upper Waitaki River. You may use the drawing in appendix 1 as a basis for explaining the interdependence of the biotic and abiotic aspects of this environment.

SLO: Explain the spatial patterns of species distribution

This learning outcome is primarily about the living things found in an ecosystem and the nature of



the habitat they require to survive. On a map of the area, shade areas or habitats where particular species are found. Provide explanatory annotations as to why the patterns are as they are.

SLO: Explain biodiversity in relation to the upper Waitaki River system

This could be a mini essay or a complex mind map that shows your understanding of the term 'biodiversity' as you apply it to the upper Waitaki River and Mackenzie Basin. In your explanation you may like to consider in what ways the biodiversity of the area has changed over time.

Location, resource, tools

- Pre-trip research via library and internet, i.e. en.wikipedia.org/wiki/Twizel or www.twizel.com or a PhD paper: ir.canterbury.ac.nz/handle/10092/1513 or www.newzealandecology.org or www.niwa.cri.nz/edu/resources/climate/overview
- Field trip observation, recording and personal interaction with various spokes people
- National Geographic lessons on biodiversity: www.nationalgeographic.com/xpeditions/lessons/08/g68/preserve.html www.mfe.govt.nz/publications/water/waitaki-freshwater-ecological-values-nov04/html/page2.html

3. Human impact on the ecosystem over time

Within a naturally-operating ecosystem a system of resource conservation occurs, particularly of energy and water, since these are vital to the survival of an ecosystem. In ecosystems in balance, this conservation of resources is a natural, almost unnoticeable process. Life materials, for example, are recycled in the ecosystem: the waste of one species becomes food for another. When resources become limited, the conservation process becomes unbalanced and more urgent.

If imbalance continues, species become endangered and extinction can occur. A species becomes endangered when there is not enough habitat available to support all members of the population. When the habitat vanishes, and all members of the population die, then the species is considered extinct. In this unit of learning we will investigate the impact human activities have had on the natural balance of the ecosystem of the upper Waitaki River system, in particular the impact on some endemic species.

Achievement Objectives	Intended Learning Outcomes
<p>Education for Sustainability</p> <ul style="list-style-type: none"> • Human actions; economic, cultural, social and environmental; have consequences for sustainability 	<p>It is intended that following this unit of learning students will be able to:</p> <ul style="list-style-type: none"> • Examine the impact human activities have had on the biophysical environment of the upper Waitaki River system • Evaluate diverse values and perceptions held about the natural environment of the upper Waitaki River system • Employ an appropriate investigation methodology in the field • Appraise group relationships against agreed outcomes.
<p>Geography</p> <ul style="list-style-type: none"> • Understand how the processes that shape natural and cultural environments change over time, vary in scale and from place to place, and create spatial patterns • Understand how people's perceptions of and interactions with natural and cultural environments differ and have changed over time. 	
<p>Science Investigating in Science</p> <ul style="list-style-type: none"> • Develop and carry out investigations that extend their scientific knowledge, including developing their understanding of the relationships between investigations and scientific theories and models 	

Suggested learning activity

Resource booklet reference pages 16 - 22

SLO: Examine the impact human activities have had on the biophysical environment of the upper Waitaki River system

- Identify two human activities that have modified the biophysical environment. Explain in what way the human activity influenced change.
- An introduced species is an animal or plant that is not native to an area but has been accidentally or purposefully brought to the area by humans. The results of species introduction can be devastating. Identify specific problems in the upper Waitaki River system

relating to native species that are caused by introduced species.

SLO: Evaluate diverse values and perceptions held about the natural environment of the upper Waitaki River system

- The people that live and work in the area hold different world views with respect to their interaction with the environment. Research or interview local people to find out about the differing viewpoints held by people about the Mackenzie Basin and upper Waitaki River, e.g. DOC, Ngāi Tahu, Meridian Energy, Fish and Game, tourism operators, recreational users, community groups and landowners . **Either** develop a continuum chart that illustrates the diversity of these viewpoints. Provide an explanation of each viewpoint – what core value is at the heart of their viewpoint, what world view may influence the way they look at the natural world? Evaluate each viewpoint through the lens you look through at the natural world ; explain why some viewpoints sit less comfortably with you compared with others. **Or** develop a role-play debate based on the viewpoints of various people to debate the moot 'that water is a taonga and must be respected'.

SLO: Employ an appropriate investigation methodology in the field

- Using both primary and secondary sources, investigate how humans have changed the biophysical environment of the upper Waitaki River system. You may do this either to support your general understanding of the area or while undertaking the assessment task for EfS Achievement Standard 90811 (see the activity attached).

SLO: Appraise group relationships against agreed outcomes.

- In collecting, collating and presenting the information gathered during the field trip you have interacted with other people. Before you begin any group or team activity it is important to understand your roles and responsibilities. Develop criteria against which you will appraise yourself and others in the team – team values, expectations, timelines. Regularly reflect on your group/team relationships as you undertake the pre-trip activities, field visits and post-trip activities, then evaluate at the end. What went well, what could be improved for next time, what have you learnt about yourself and working with others?

Location, resource, tools

- Pre and post trip research
- Field trip observation, recording and personal interaction with various spokes people

4. Sustaining ecosystems and biodiversity

The benefits that people obtain from ecosystems are a powerful lens through which to understand human relationships with the environment and to design policies that maintain biodiversity and promote environmental sustainability outcomes.

Here we need to understand the values people hold about the upper Waitaki Basin ecosystem and the services it provides. Sometimes these systems values will be monetised and possible trade-offs assessed among alternative scenarios of resource use and land-use changes.

Achievement Objectives	Intended Learning Outcomes
<p>Science Participating and contributing</p> <ul style="list-style-type: none"> • Use relevant information to develop a coherent understanding of socio-scientific issues that concern them, to identify possible responses at both personal and societal levels 	<p>It is intended that following this unit of learning students will be able to:</p> <ul style="list-style-type: none"> • Employ an appropriate investigation methodology in the field • Discuss aspects of sustainability and explore possible scenarios and/or possible redesigns of social, economic and technological practices for a sustainable future. • Evaluate diverse values and perceptions held about the natural environment of the upper Waitaki River system • Evaluate decision-making processes with respect to species recovery and preservation.
<p>Education for Sustainability</p> <ul style="list-style-type: none"> • Social, economic and technological practices need to be redesigned to achieve a sustainable future • A sustainable future encompasses decisions that involve the social, cultural, economic and biophysical environment 	
<p>Geography</p> <ul style="list-style-type: none"> • Understand how people's perceptions of and interactions with natural and cultural environments differ and have changed over time. 	

Suggested learning activity

Resource booklet reference pages 6-7 and 23-27

SLO: *Employ an appropriate investigation methodology in the field*

- Develop hypothesis or research questions so that you may begin to understand why people decide to conserve, preserve or otherwise maintain biophysical aspects of an environment. Use both primary and secondary sources in your investigation of the interaction humans have with the ecology of the Mackenzie Basin and/or upper Waitaki River system. The following SLOs will provide guidance as to the type of questions you could investigate. You may do this either to meet the SLOs or while undertaking the assessment task for Biology Achievement Standard 90769 (see the activity attached).

SLOs: *Evaluate diverse values and perceptions held about the natural environment of the Mackenzie Basin and/or upper Waitaki system AND evaluate decision-making processes with respect to species recovery and preservation of biodiversity.*

Listening to the diverse voices of individuals and communities is acknowledged as important in the development of conservation policy and management. Many of the activities organisations like DOC undertake would probably be less successful without the support of individuals and groups within the community. An understanding of people's perceptions, and values which inform those perceptions, is important in a political environment where there is increasing devolution of responsibility from central government, and its agencies, to communities. Various Acts of Parliament, such as the Conservation Act 1987 and Resource Management Act 1991 (RMA), make community consultation mandatory.

People take different approaches when making the case for preserving biodiversity. Some argue that biodiversity is important to ensure access to new medications, while others emphasise the importance of maintaining healthy ecosystems for recreational purposes, such as fishing or tramping. Of course, many people use more than one argument when calling for biodiversity protection. Students will discuss the importance of maintaining ecosystems and will learn about the various arguments that people make in favour of preserving the earth's biodiversity.

Explore the various values people hold about the following:

- Choose two opposing values positions and explain why people may hold these opposing views. How may different world views or philosophies influence and inform people's perceptions and values? Explain how understanding the different world view people hold may help the process of consultation and decision-making. Share your findings with the group.
- Find out and evaluate how decisions are made with respect to what species will be protected or become part of a recovery programme. How are members of the community consulted? What trade-offs are made or how are ecological values weighed against economic values? What weight is given to anthropomorphic values as opposed to bio-centric values? Can there be a balance between the two?
- Write a brief evaluative summary of your findings on values, perceptions and decision-making processes with respect to species recovery and preservation. Write an essay that explains what you feel are the most compelling reasons for preserving biodiversity. Describe the arguments you think would be most likely to convince the general public that biodiversity in the Mackenzie Basin and/or upper Waitaki River system should be preserved.
- Undertake the assessment task attached for Biology Achievement Standard 90769 v1.

SLO: *Discuss aspects of sustainability and explore possible scenarios and/or possible redesigns of social, economic and technological practices for a sustainable future.*

If we take sustainability to mean "Improving the quality of human life while living within the carrying capacity of supporting ecosystems" (IUCN 1991) see www.dieoff.org/page113.htm then we need to consider the development of a sustainable future for the upper Waitaki River system.

- Describe what you think such a future could look like.
- What values may need to be fostered in order to achieve a sustainable future? Suggest and evaluate processes that could be used to foster those values.
- Suggest at least two possible scenarios that would foster a sustainable future for the upper Waitaki River **or**
- Suggest in what ways social, economic or technological practices could be redesigned to support the development of a sustainable future for the Mackenzie Basin and upper Waitaki River system.

Location, resource, tools

- Field trip observation, recording and personal interaction with various spokes people



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- Further research post-trip.
- National Geographic on captive breeding programmes:
www.nationalgeographic.com/xpeditions/lessons/08/g912/breeding.html
- Useful resource: A David Suzuki Collection – A Lifetime of Ideas (2003) Suzuki, David Greystone Books

Contacts

The following is a list of useful organisations and agencies you can contact for further information:

Project River Recovery, Department of Conservation, Twizel Area Office
(03) 435 0802, TwizelAO@doc.govt.nz

Chief Executive, Central South Island Fish and Game
(03) 615 8400, csi@fishandgame.org.nz, www.fishandgame.org.nz

Government agencies

Department of Conservation www.doc.govt.nz

Project River Recovery www.doc.govt.nz/conservation/land-and-freshwater/freshwater/upper-waitaki-braided-rivers/project-river-recovery-work/

Ministry of Agriculture and Fisheries Information Bureau www.maf.govt.nz

Ministry for the Environment www.mfe.govt.nz

Crown Research Institutes

Institute of Environmental Science and Research Ltd (ESR) www.esr.co.nz

Landcare Research New Zealand Ltd www.landcare.co.nz

National Institute of Water and Atmospheric Research Ltd www.niwa.cri.nz

New Zealand Pastoral Agriculture Research Institute Ltd (AgResearch) www.agresearch.cri.nz

Local, regional and city councils

Environment Canterbury www.ecan.govt.nz

Mackenzie District Council www.mackenzie.govt.nz

Christchurch City Council www.ccc.govt.nz

Other organisations

Royal Forest and Bird Protection Society of New Zealand www.forest-bird.org.nz

Greenpeace www.greenpeace.org.nz

Meridian Energy www.meridianenergy.co.nz

New Zealand Conservation Authority www.conservation.co.nz

World Wide Fund (WWF) for Nature New Zealand, www.wwf.org.nz

Education for Sustainability New Zealand www.e4s.org.nz

Many other organisations can help out with advice and resources.



Appendix 1

