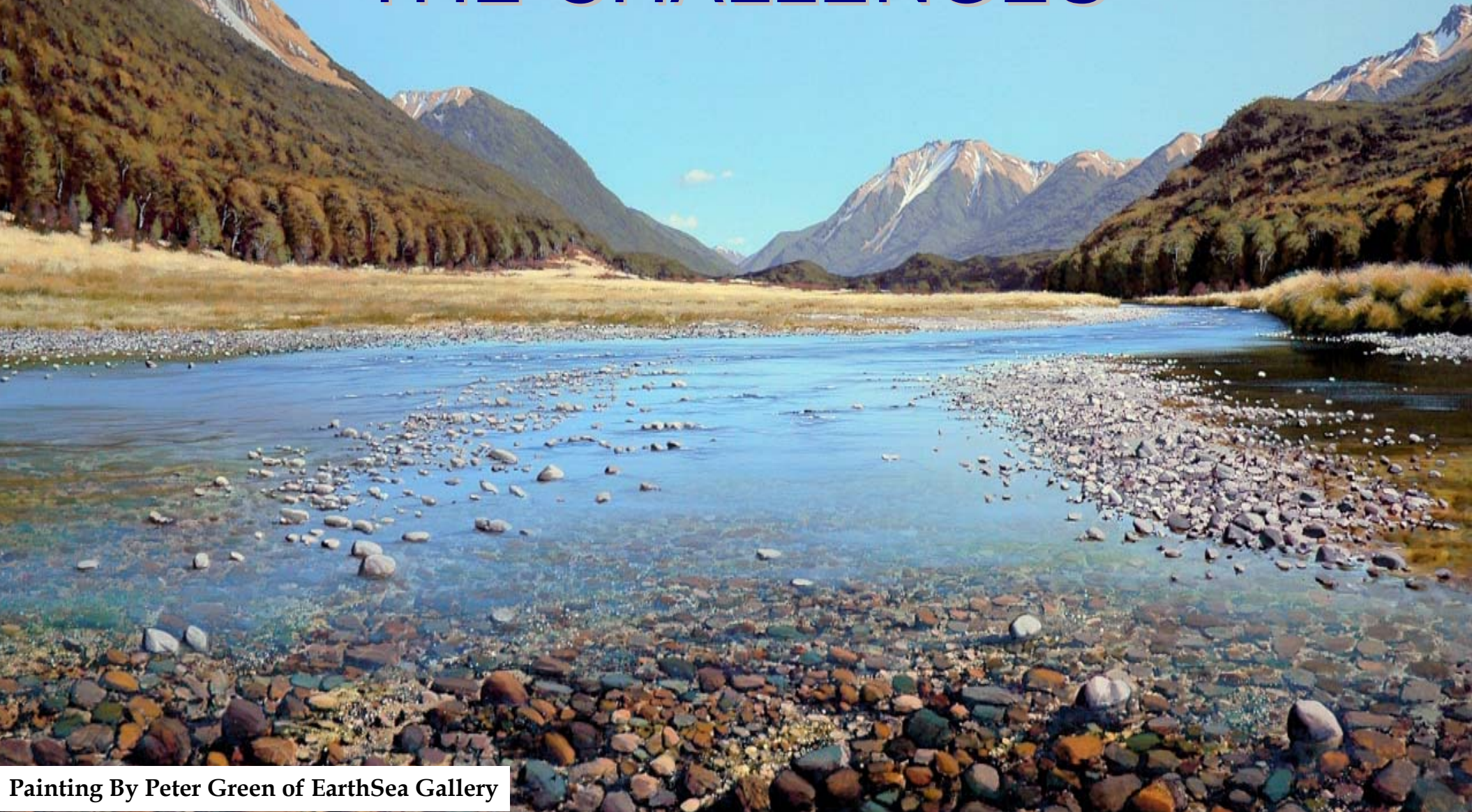
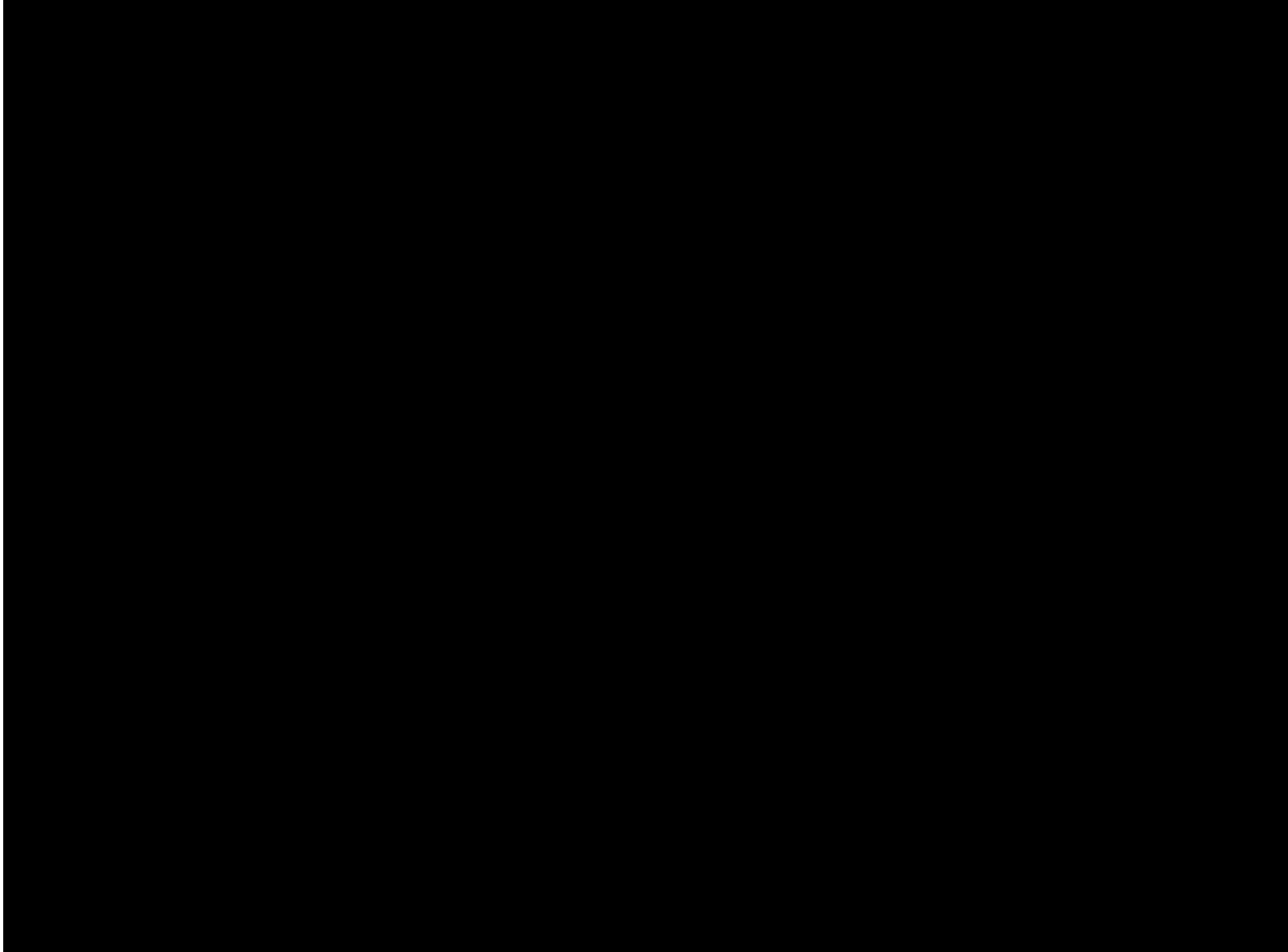


HEALTHY WATERWAYS — FOR ALL THE CHALLENGES



Painting By Peter Green of EarthSea Gallery





❖ What is responsible governance for holistic management of water eco-systems?

❖ What institutional or cultural arrangements support the health of water and people?

Responsible Governance of Watersheds

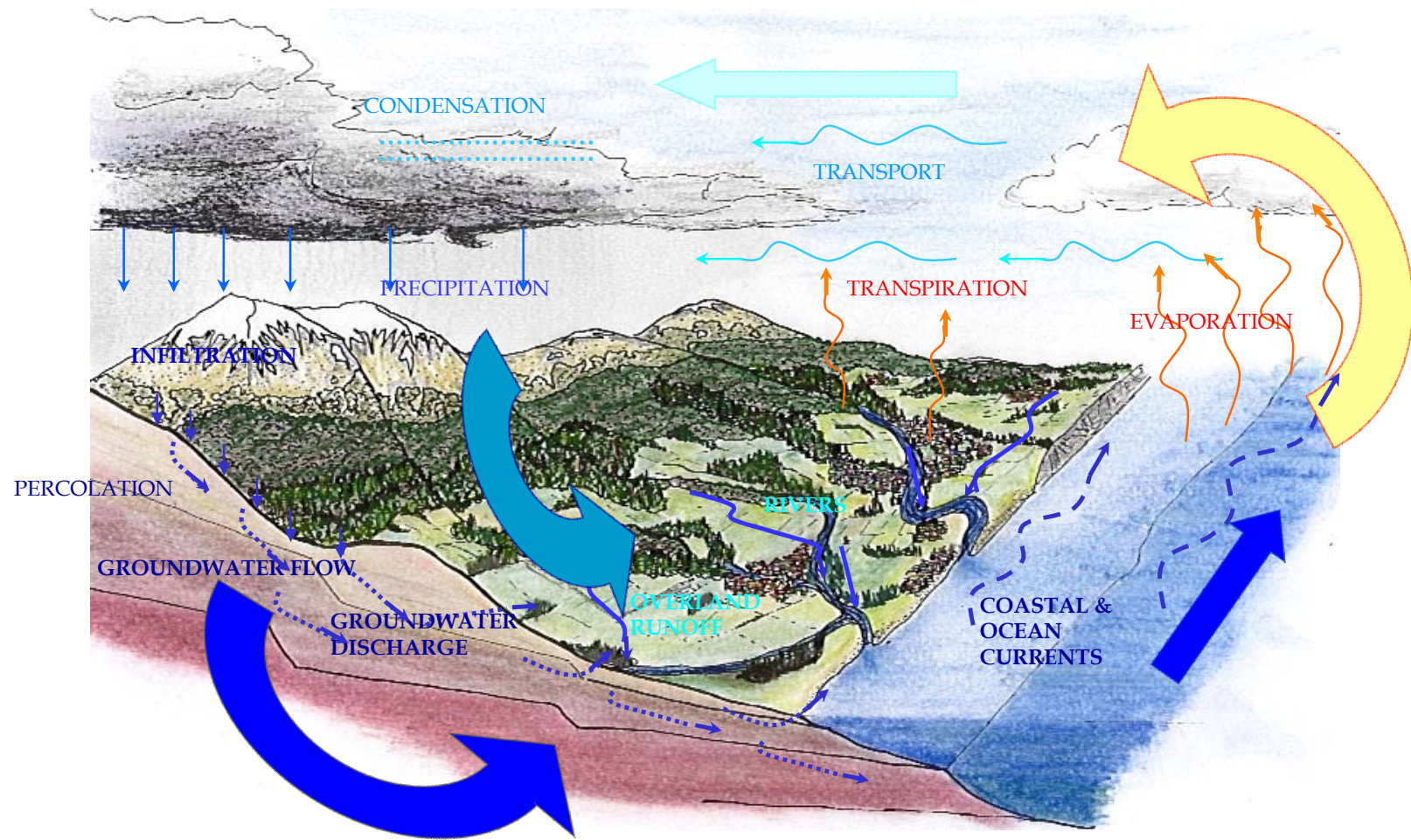
Global issues of care for watersheds with views from Aotearoa-New Zealand and the Pacific

❖ How do we measure or represent river health?

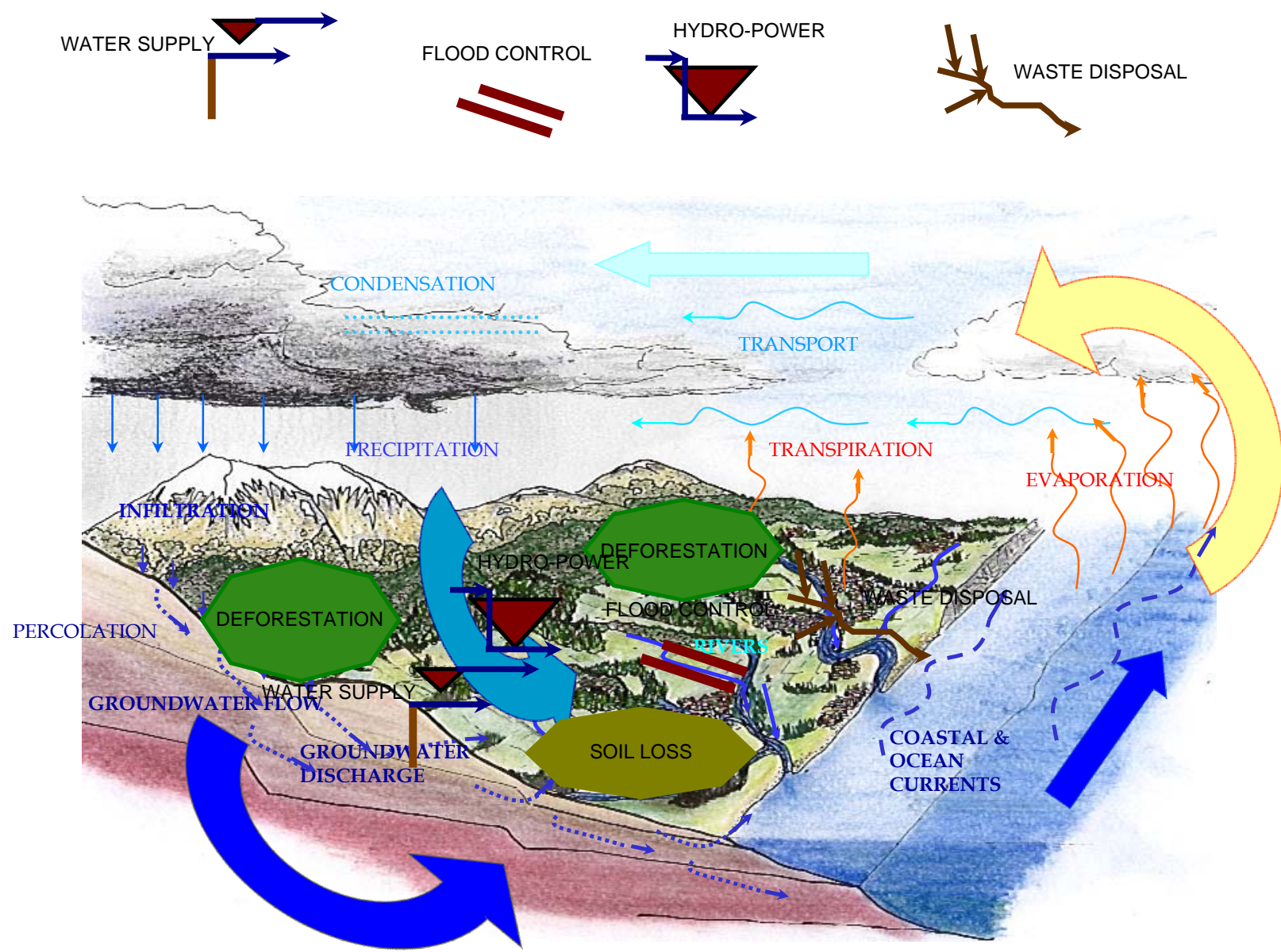
❖ What are the implications of natural dynamics for management?

❖ How does the Resource Management Act help or hinder holistic management?





WATER CYCLE



WATER CYCLE



RECIPROCITY
GIVE & TAKE

RIVER

WATERSHED

TAKE

AGRICULTURAL WATER SUPPLY

URBAN WATER SUPPLY

FLOOD CONTAINMENT

HYDRO-POWER

WASTE DISPOSAL

EROSION & SEDIMENTS

DE-FORESTATION

SOIL DEGRADATION

GIVE

WATER PURIFICATION

WATER REGENERATION

NATURAL CHARACTER

SOIL HEALTH

SOIL CONSERVATION

RE-FORESTATION

WETLANDS

NATURE of WATER PATTERNS



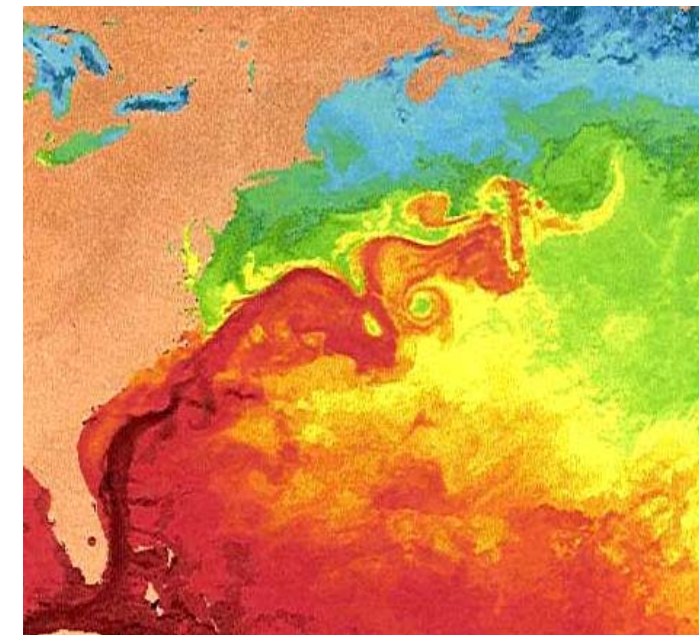
RIVER CHANNELS



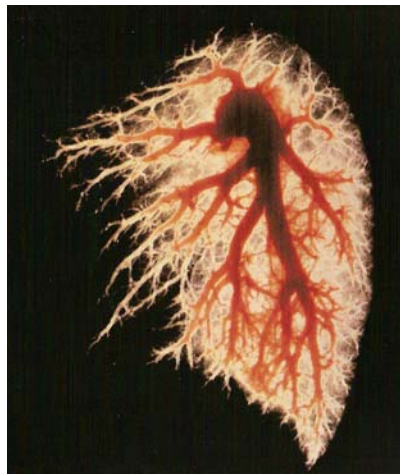
RIVER DELTA



SILT in OCEAN CURRENTS



GULF STREAM



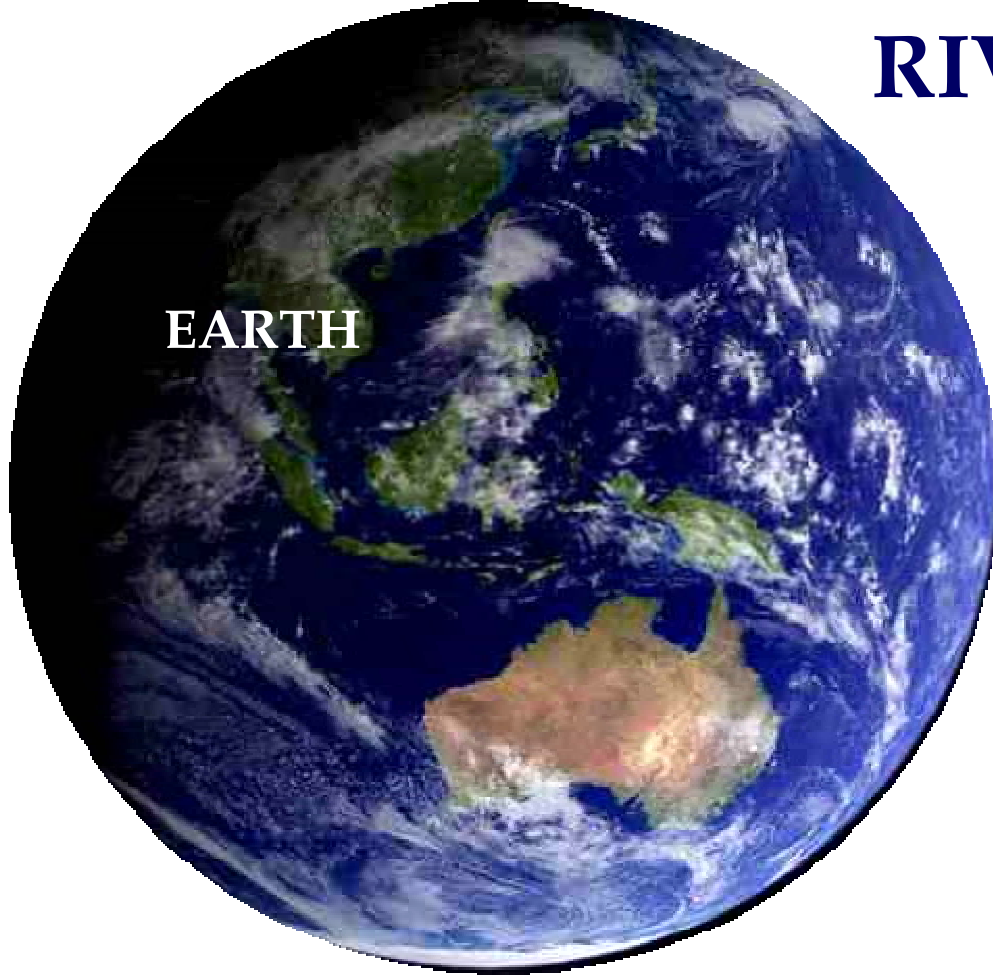
LUNG
ARTERIES



KIDNEY

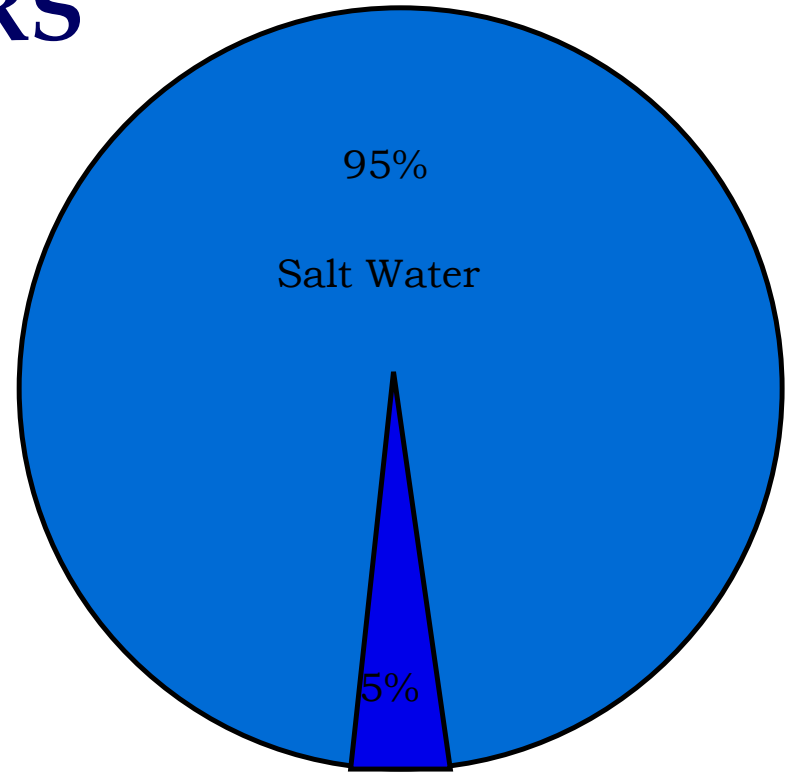
REPEATING PATTERNS of INTERCONNECTION

RIVERS

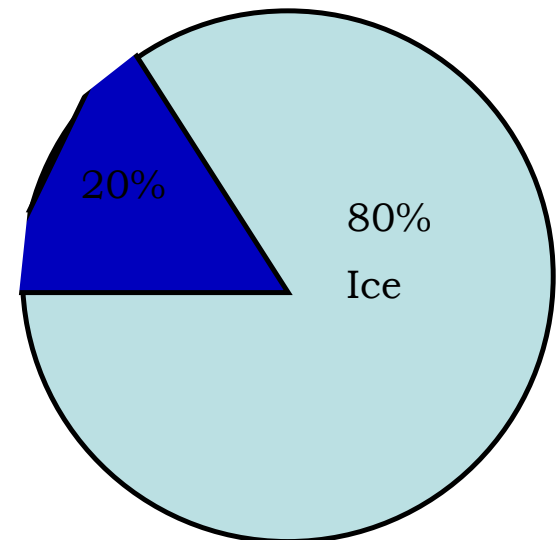


EARTH

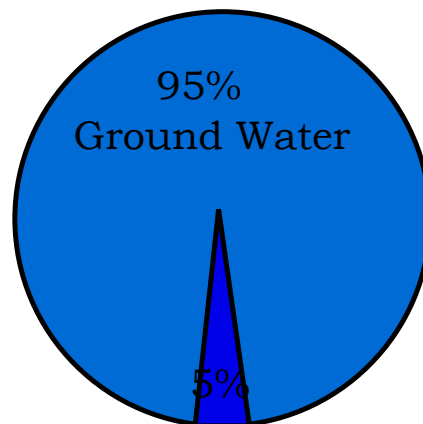
WATER



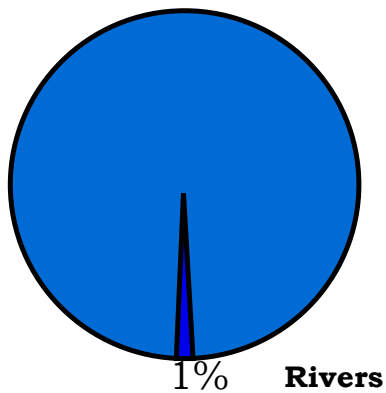
FRESH WATER



LIQUID FRESH WATER



SURFACE LIQUID FRESH WATER

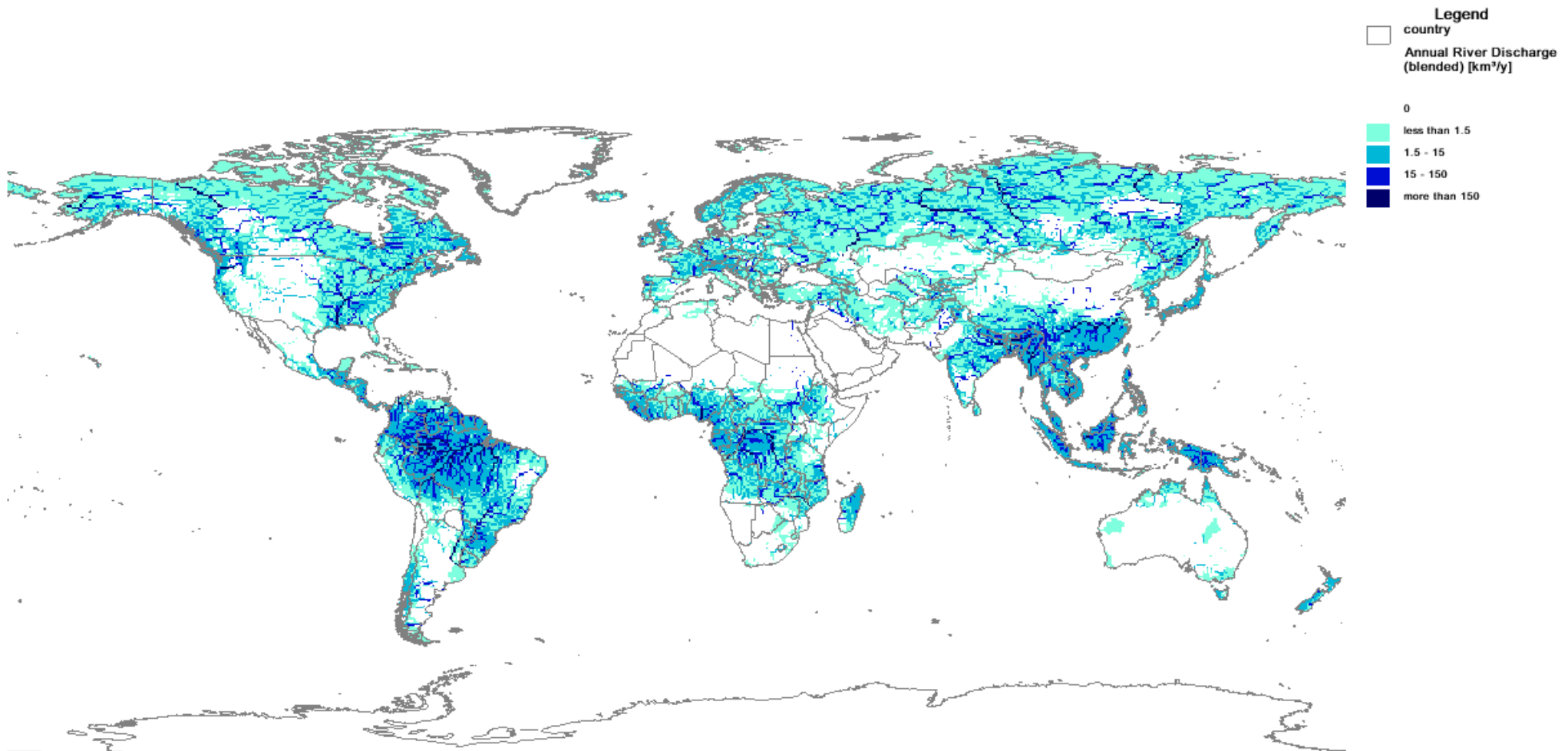


1%

Rivers

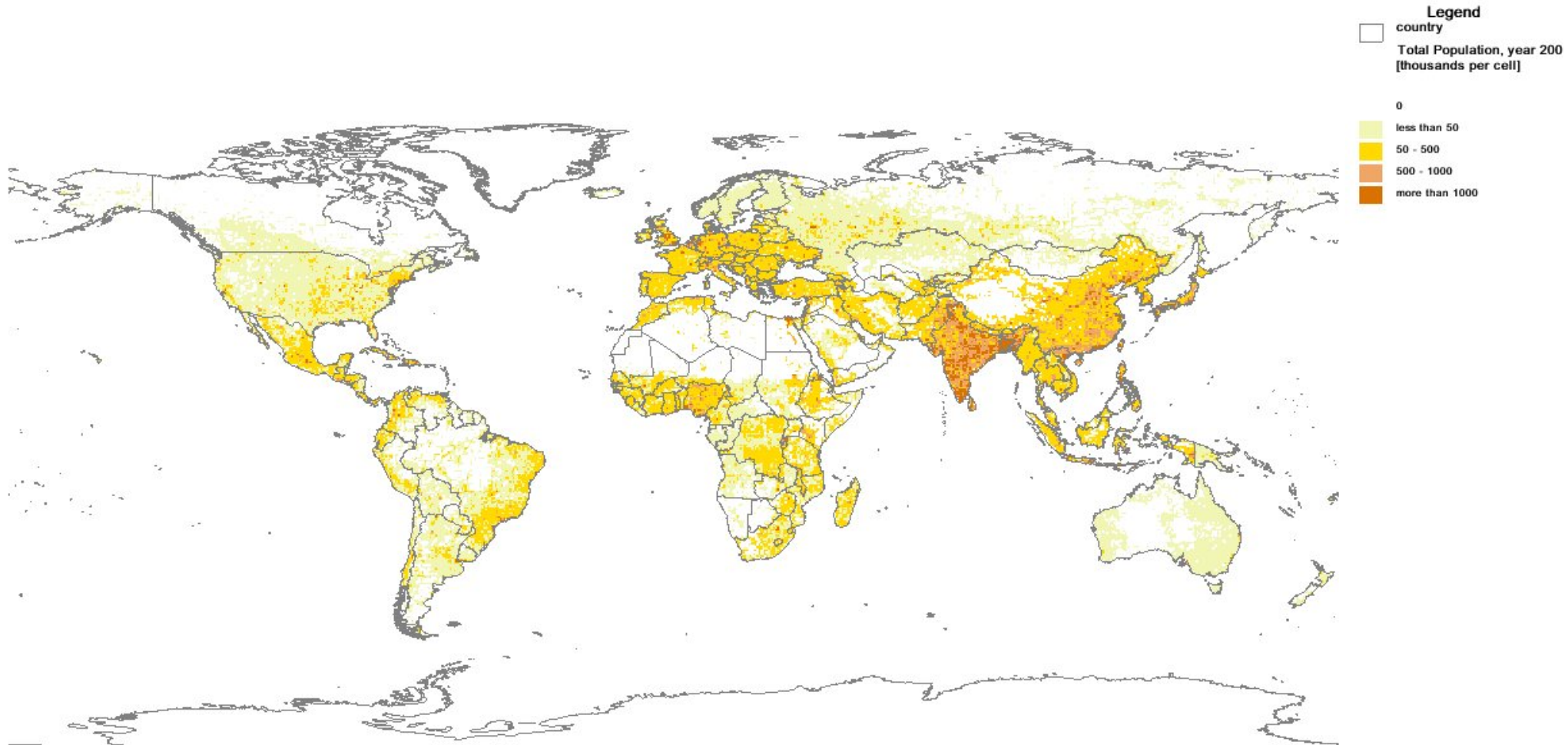
GLOBAL WORLD
WATERSHEDS

ANNUAL RIVER DISCHARGE



GLOBAL WORLD POPULATION

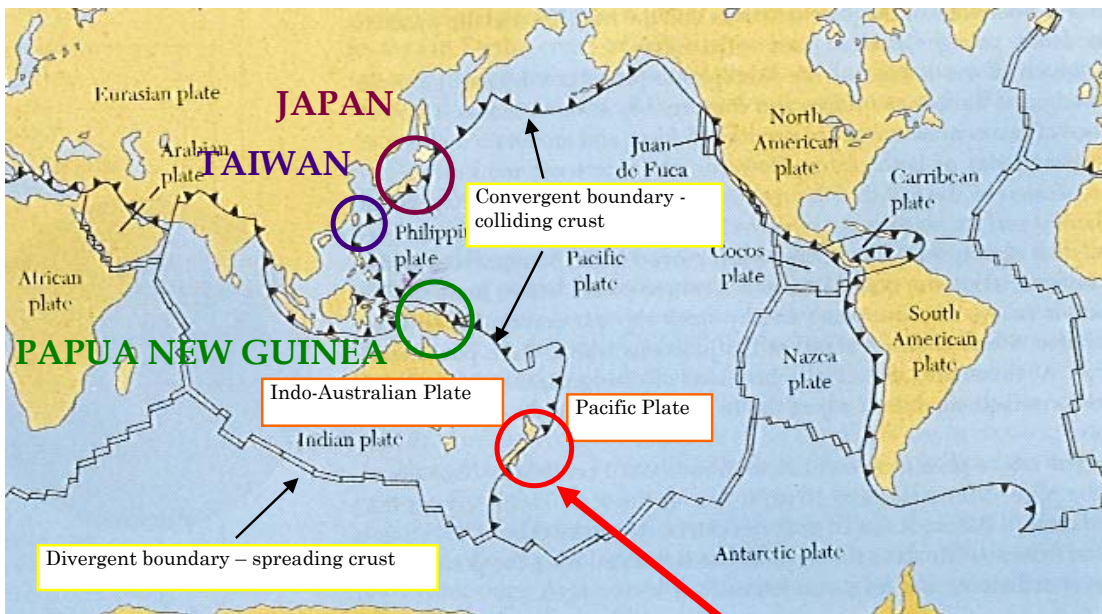
HUMAN POPULATION



NEW ZEALAND

ENVIRONMENT

ENVIRONMENT

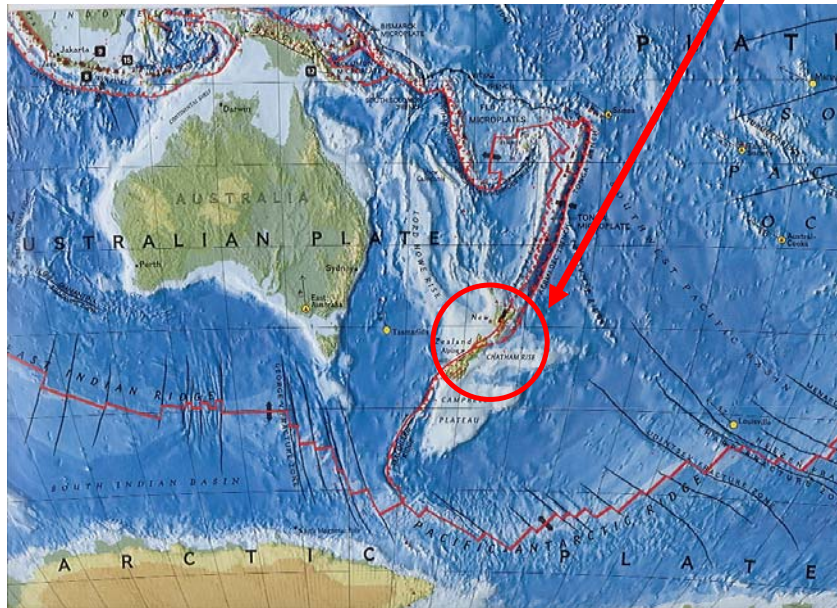


GEOLOGY

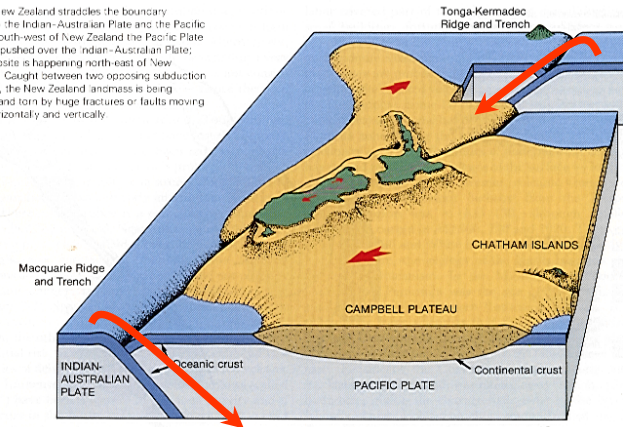
Large islands on the Pacific “Ring of Fire”.
Steep landscape of rapidly uplifted, shattered and weathered base rock, subject to high intensity rainfall – gives steep, highly mobile gravel-bearing rivers.

“The Evolving Coast” R A Davis, Scientific American Library

NEW ZEALAND



Today New Zealand straddles the boundary between the Indian-Australian Plate and the Pacific Plate. South-west of New Zealand the Pacific Plate is being pushed over the Indian-Australian Plate; the opposite is happening north-east of New Zealand. Caught between two opposing subduction systems, the New Zealand landmass is being twisted and torn by huge fractures or faults moving both horizontally and vertically.



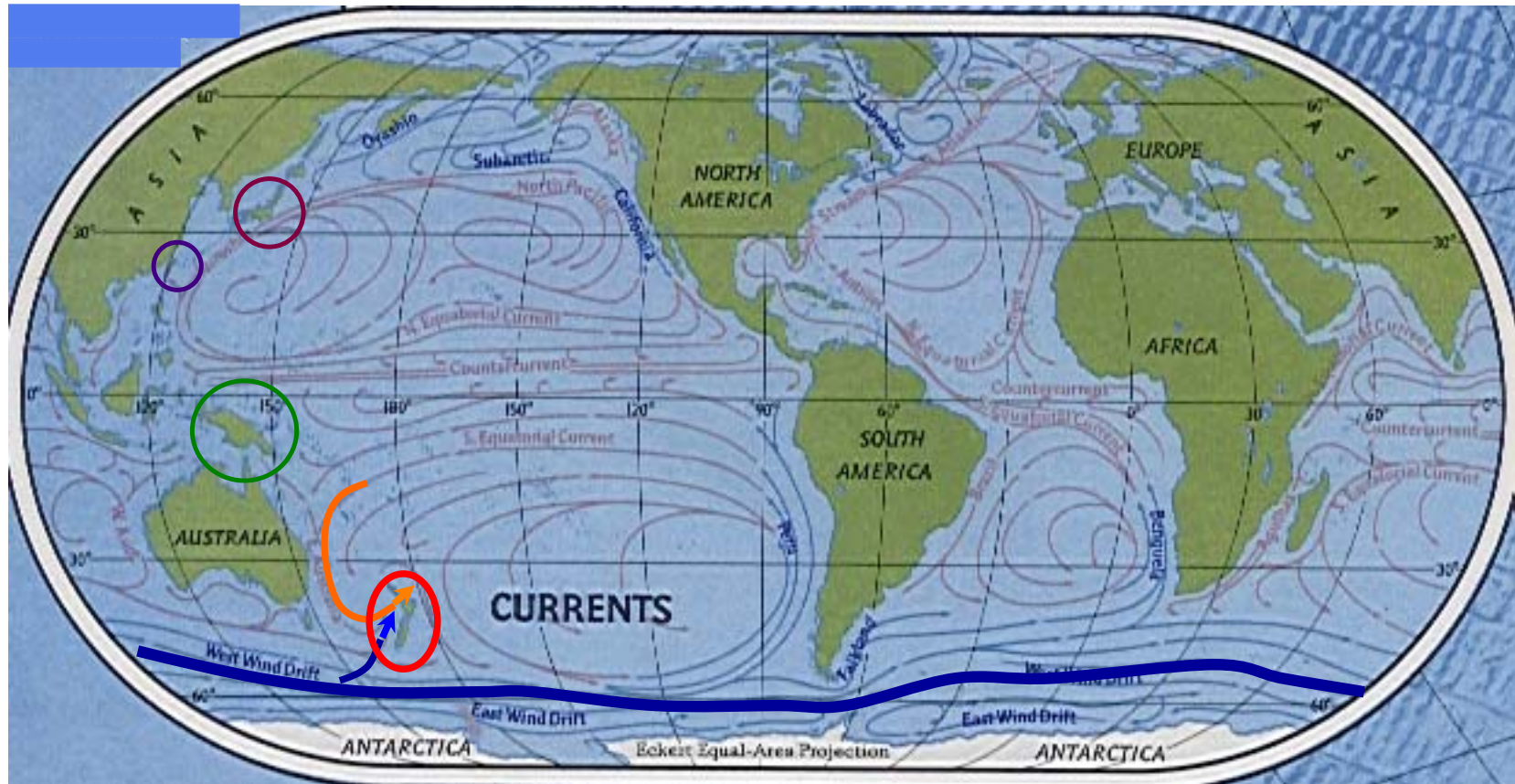
NEW ZEALAND GEOLOGY

TECTONIC

CLIMATE

Oceanic currents give rise to a variable climate,
with periodic oscillations.
(Equatorial currents with temperature
differences of El Nino/La Nina oscillations)

CURRENTS

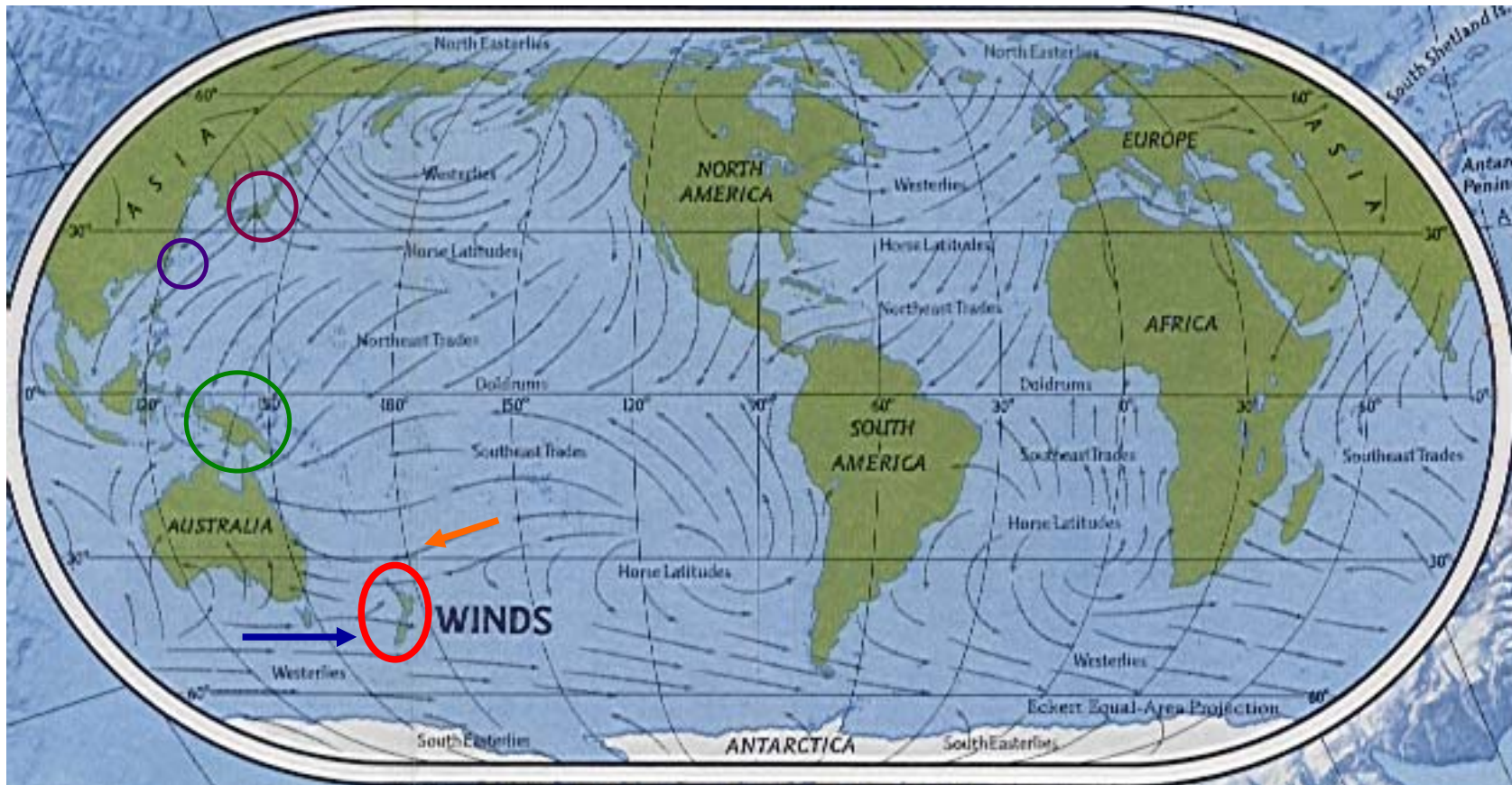


OCEANIC

CLIMATE

WINDS

Wind circulations also give rise to periodic oscillations in climate.
(± 30 year Pacific convergence zone oscillation)



MID-LATITUDE

CLIMATE

SEASONS



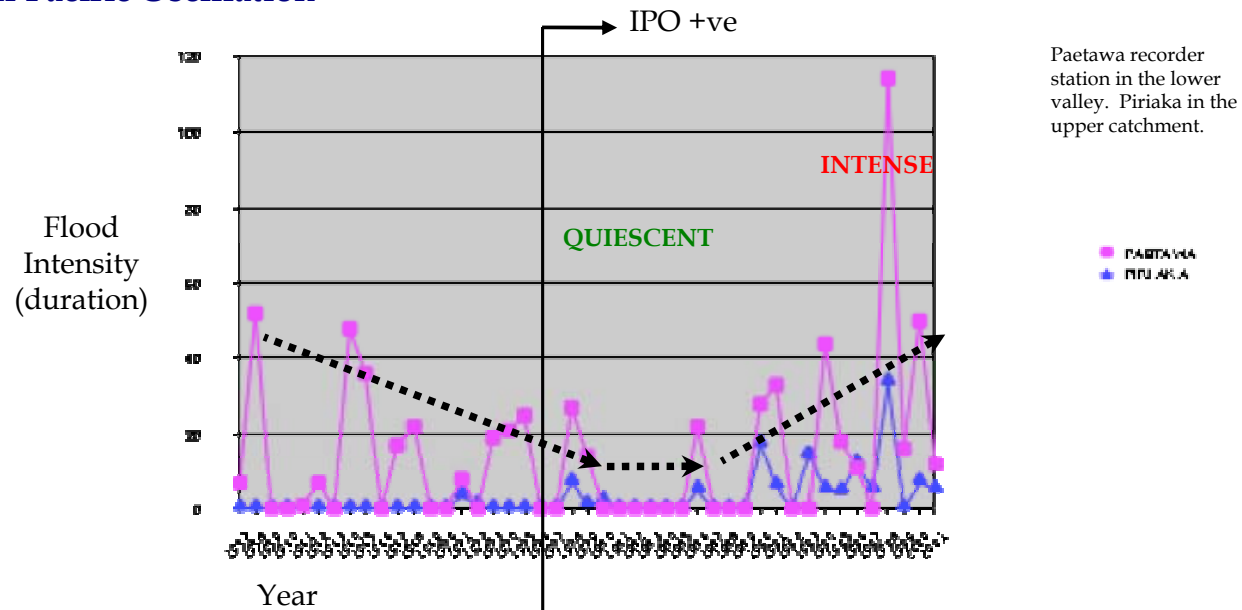
SUMMER



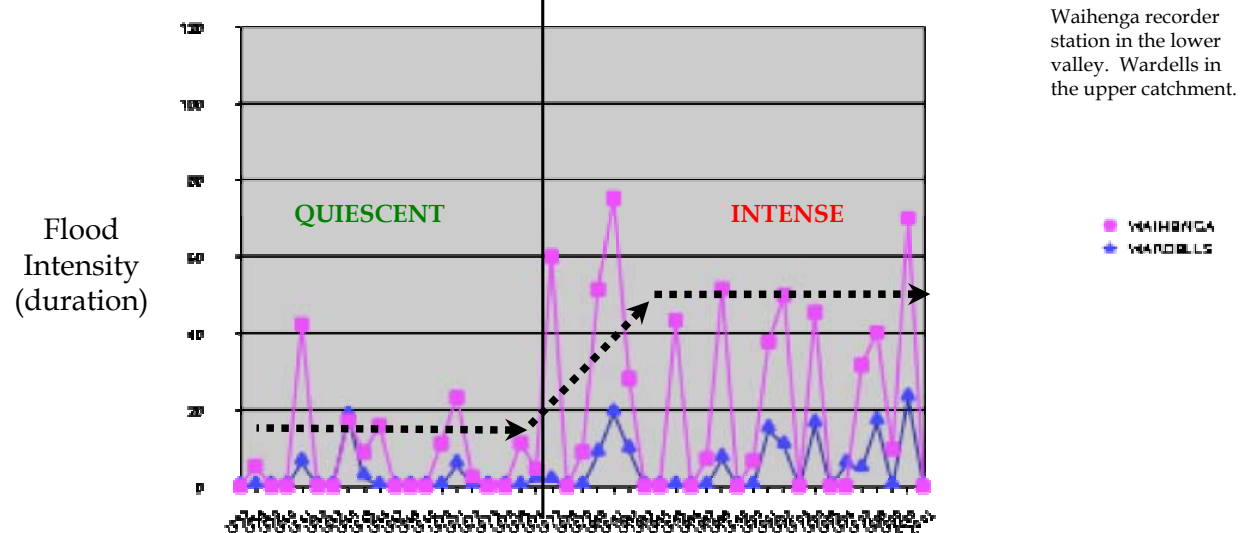
WINTER

Interdecadal Pacific Oscillation

WHANGANUI RIVER

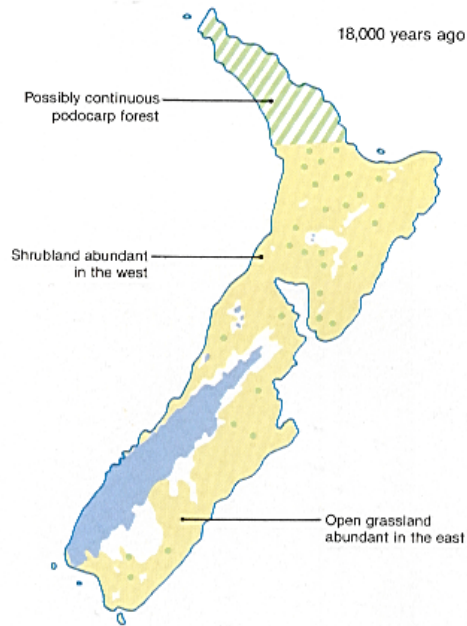


RUAMAHANGA RIVER

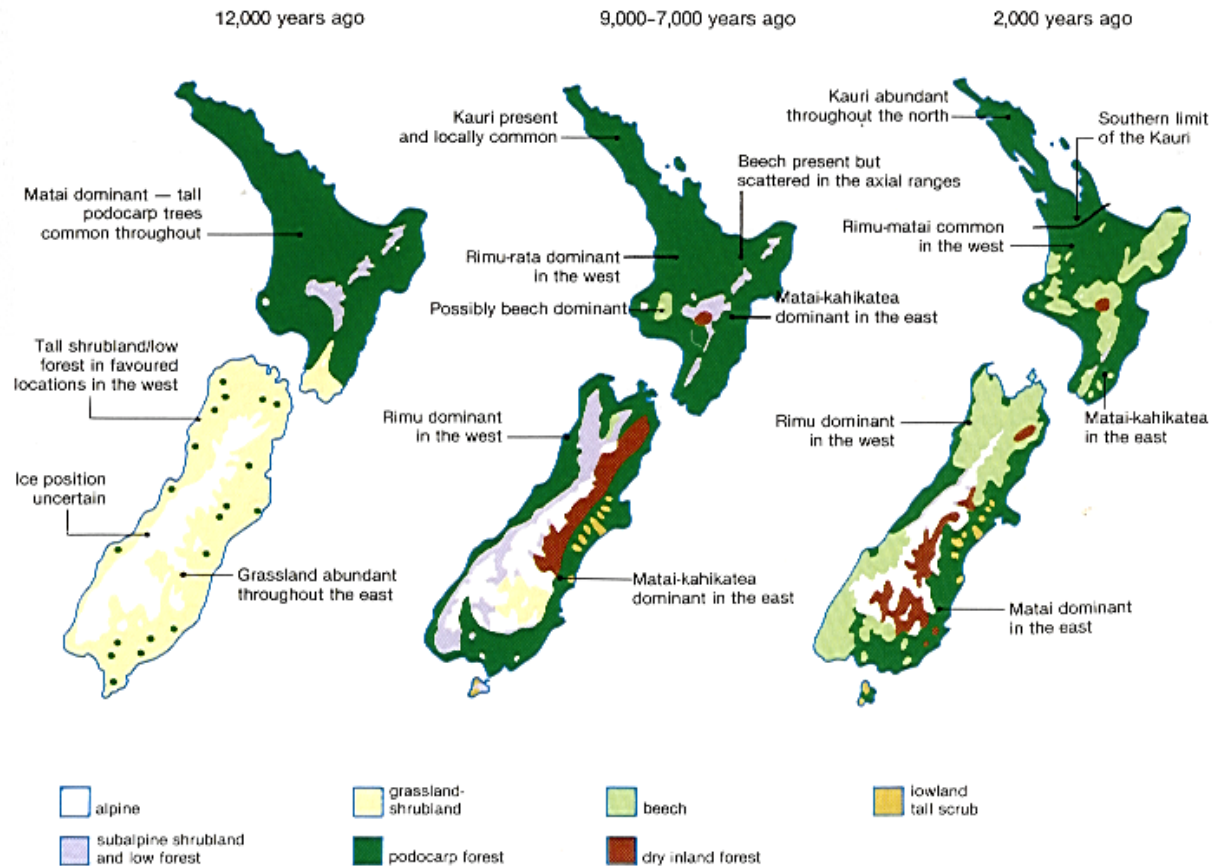


LANDSCAPE

Re-forestation of New Zealand in the current Inter-glacial period.



Ice age grassland vegetation.

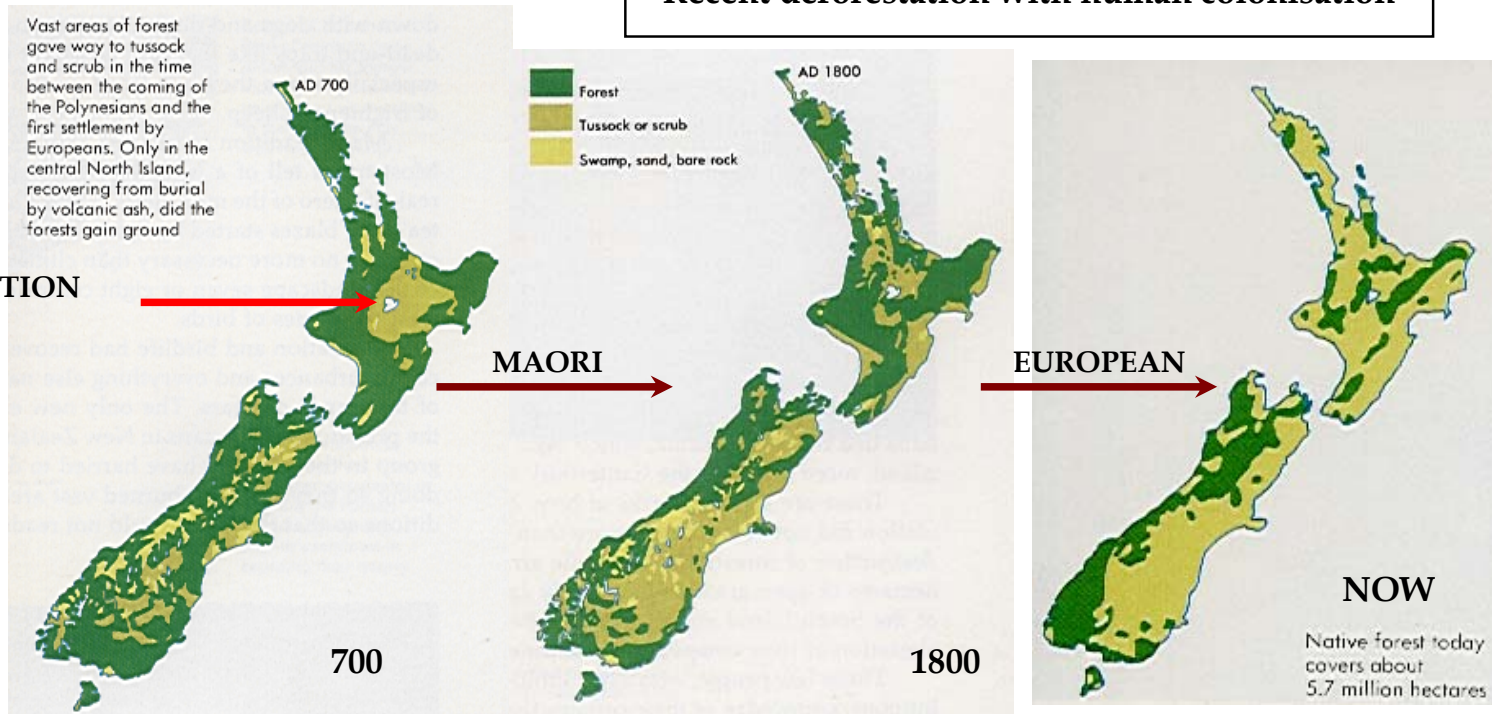


NEW ZEALAND VEGETATION COVER

LANDSCAPE

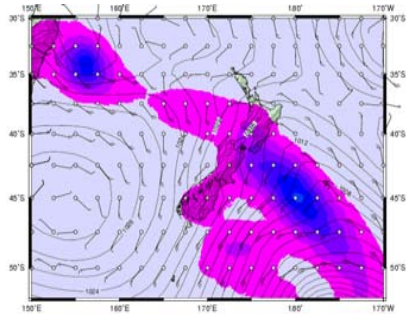
Recent deforestation with human colonisation

**VOLCANIC ERUPTION
(Taupo)**

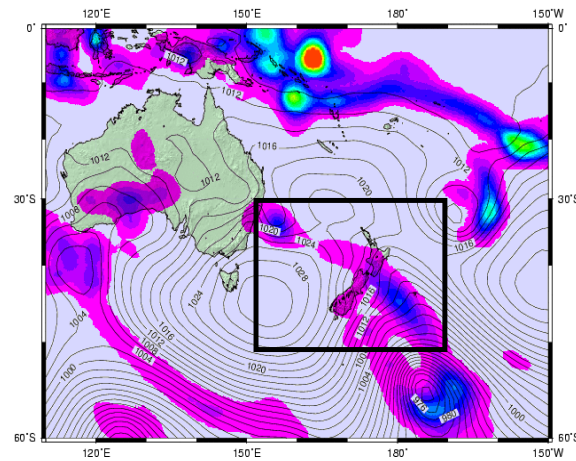


**NEW ZEALAND recent
change in FOREST COVER**

NEW ZEALAND

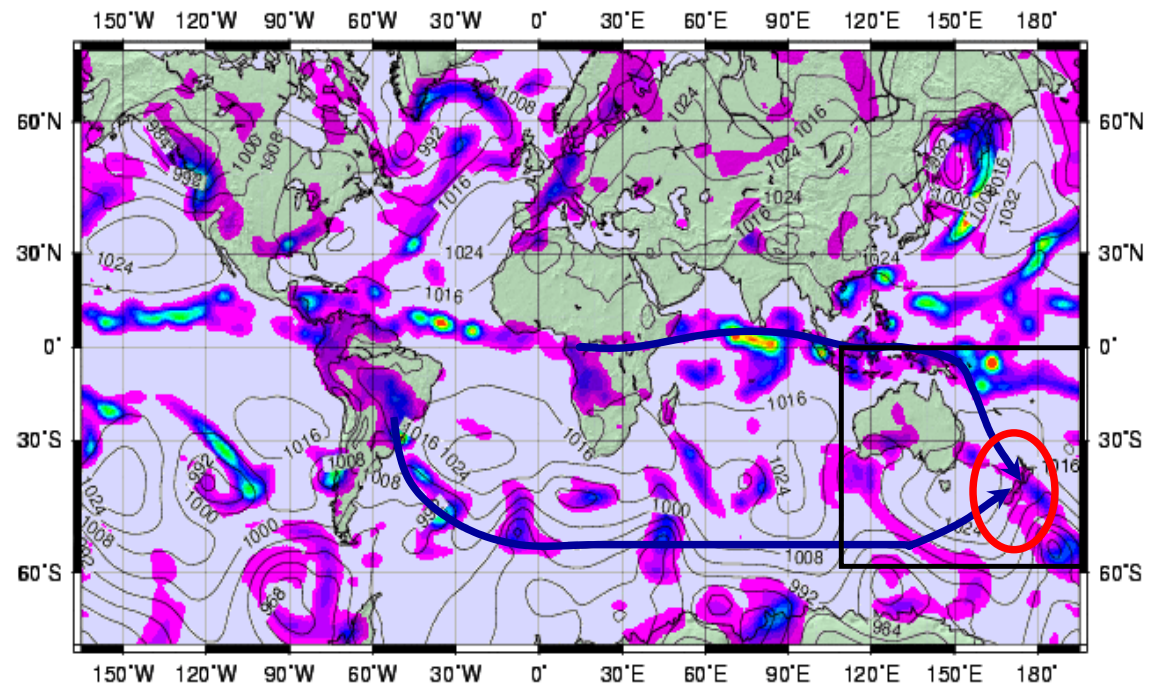


S W PACIFIC



Global inter-relationships.
NZ's rainfall is affected by what
happens to the forests of Brazil
and Zaire.

WORLD



CONNECTIVITY
GLOBAL CLIMATE

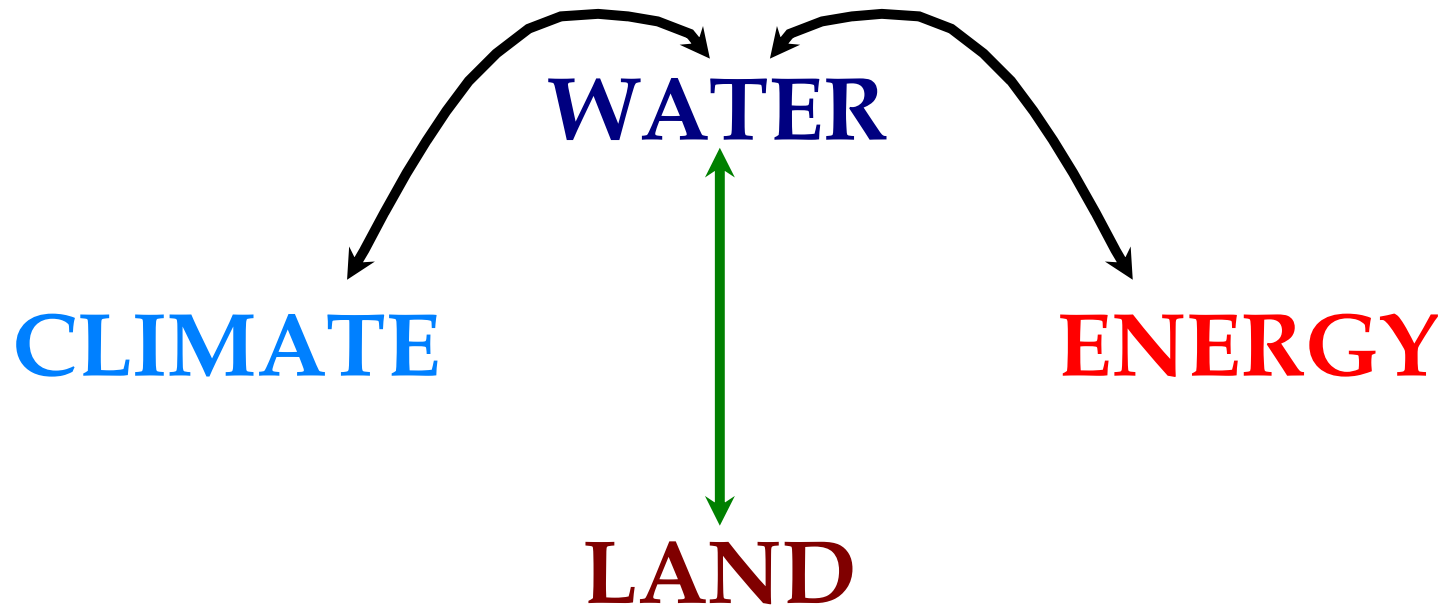
INTEGRATED & COLLABORATIVE MANAGEMENT



**INTEGRATED MANAGEMENT
WHOLE SYSTEMS**



2009 RiverSymposium Australia



**NEW ZEALAND
IRRIGATION**

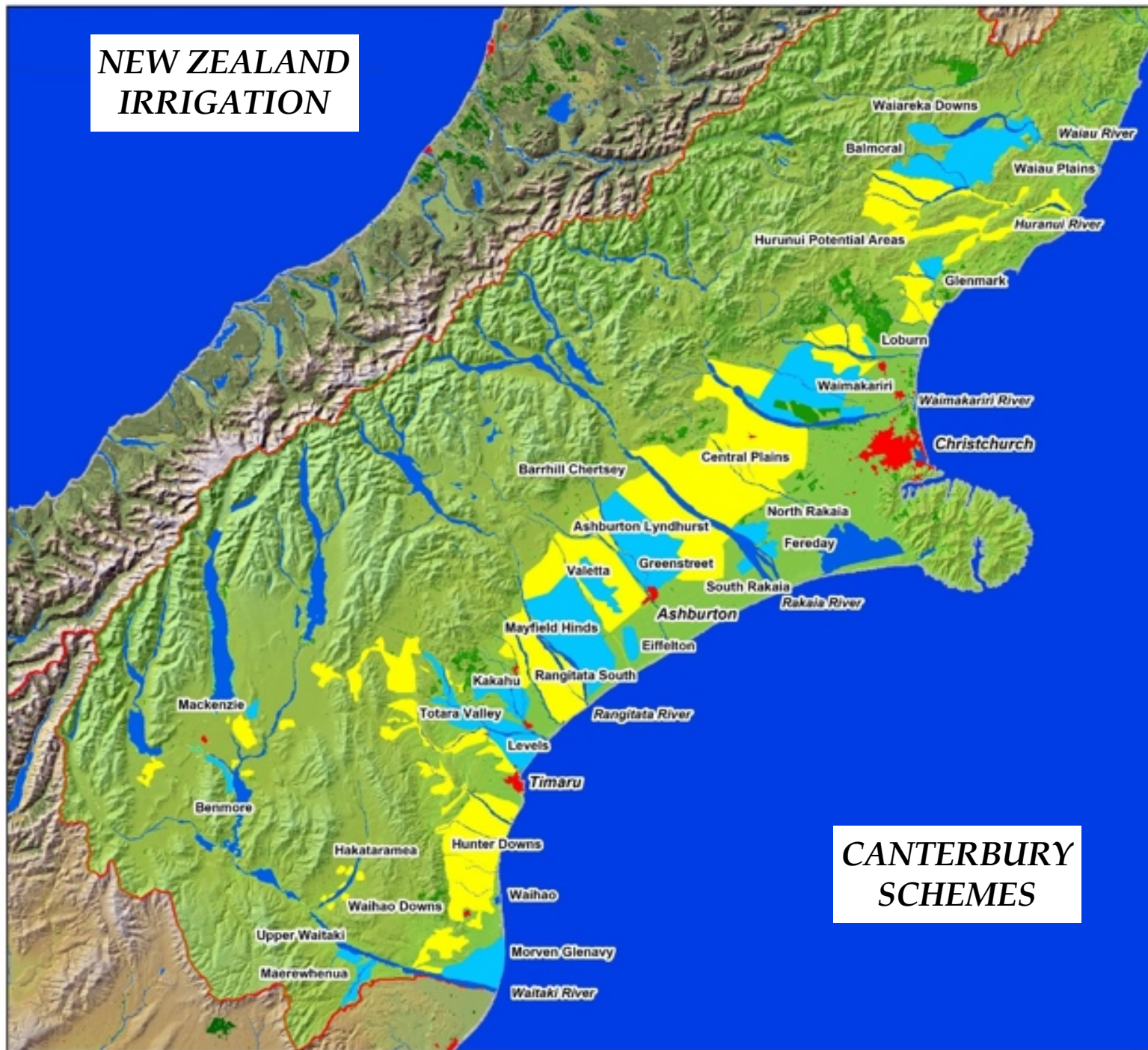
**AUSTRALIA
DE-SALINATION**

AUSTRALIA DE-SALINATION



PERTH

NEW ZEALAND IRRIGATION



CANTERBURY SCHEMES



Canterbury Irrigation Schemes

Legend

- Established Schemes
- Potential and Proposed Areas
- Canterbury Region
- Urban Areas
- Regional Boundary

Note: Irrigation areas are indicative only.

0 12.5 25 50 Kilometres

1:1,100,000

Disclaimer:

While every effort has been made to ensure the accuracy of the information contained in this map, the authors and developers accept no responsibility for any omissions.

Map Projection: New Zealand Map Grid

Topographic Image supplied by Geographix Ltd.



INTEGRATED MANAGEMENT
RECYCLING & RE-USE

MANAWATU RIVER

Painting By Wendy Hodder of Foxton



**INTEGRATED MANAGEMENT
CONSISTENT STANDARDS**

OPTION Z

PALMERSTON NORTH

TO RIVER

ADDITIONAL LOAD ON RIVER
ALREADY OVER-LOADED

OPTION A

TO LAND

USE NUTRIENT RICH WATER
ON WATER-SHORT SAND COUNTRY

"TREATMENT PLANT"

In the natural environment,
without rigid boundaries

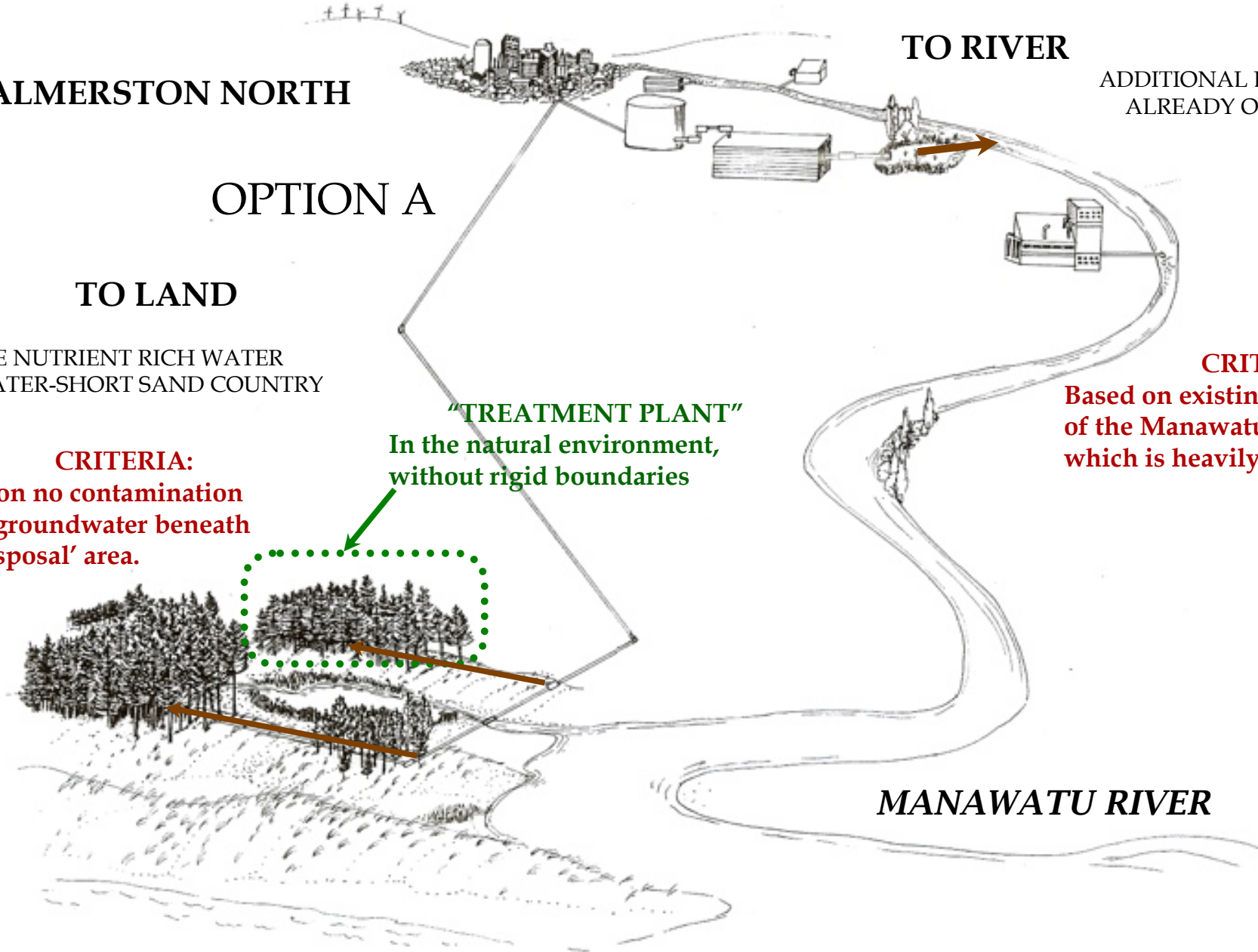
CRITERIA:

Based on no contamination
of the groundwater beneath
the 'disposal' area.

CRITERIA:

Based on existing water quality
of the Manawatu River,
which is heavily degraded.

MANAWATU RIVER



**INTEGRATED MANAGEMENT
SOIL MOISTURE**



survey of the Hurunui South Branch dam site.

HURUNUI RIVER

INTEGRATED MANAGEMENT
EFFECTIVENESS of METHODS

LOCAL

WETLANDS

WATERSHED FORESTS

VEGETATION DIVERSITY **WATERWAY STORAGE**

SOIL STRUCTURE

RIPARIAN BUFFERS

SOIL HEALTH

LAND CONTOURING

FARM STORAGE

ON-FARM

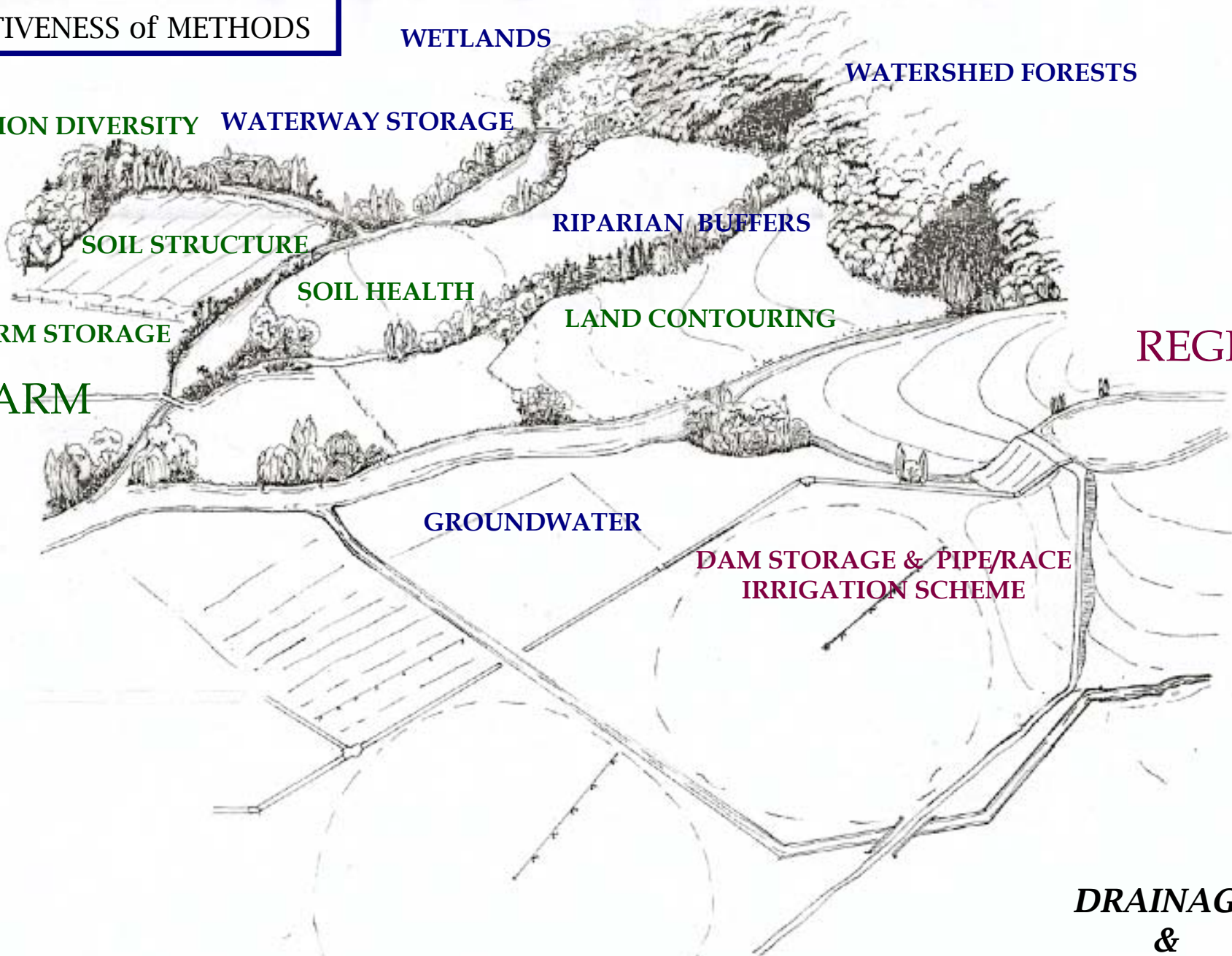
REGIONAL

GROUNDWATER

**DAM STORAGE & PIPE/RACE
IRRIGATION SCHEME**

METHODS of MANAGING FARM SOIL MOISTURE

**DRAINAGE
&
IRRIGATION**





RMA (section 6) – Matter of National Importance

The preservation of the natural character of the coastal environment, wetlands, lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use and development

**INTEGRATED MANAGEMENT
NATURAL CHARACTER**

Painting By Wendy Hodder of Foxton

NATURAL CHARACTER

RIVER HEALTH

WATER QUANTITY

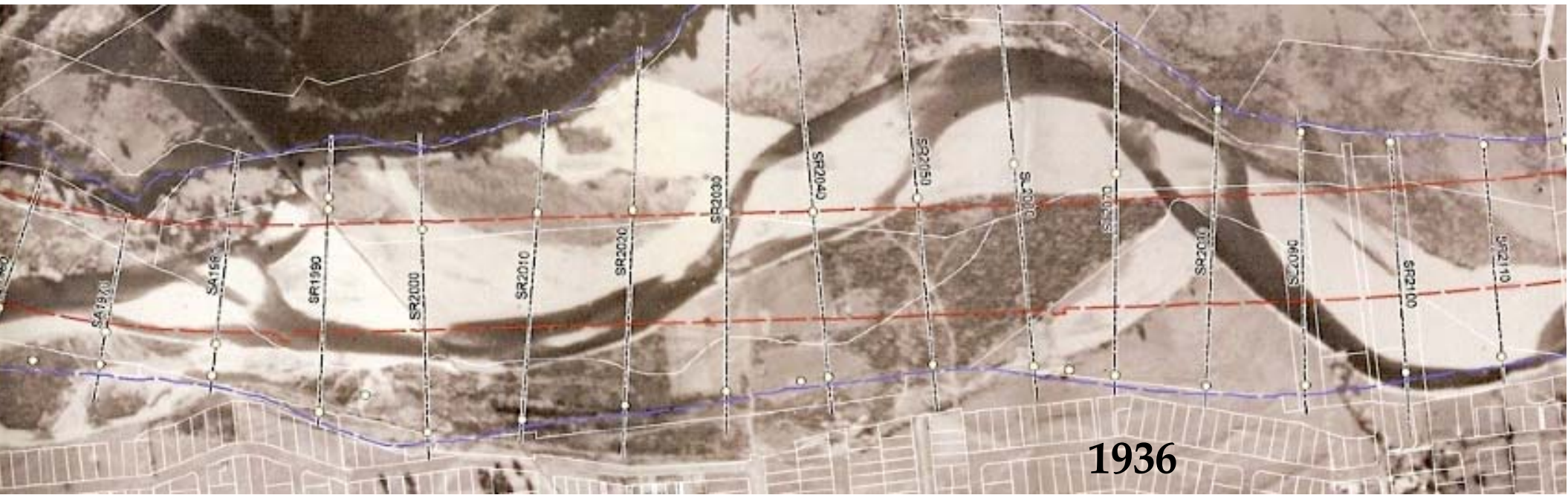
WATER QUALITY

INTEGRATED MANAGEMENT
NATURAL CHARACTER

INTEGRATED MANAGEMENT WATERWAY HEALTH

HUTT RIVER

2009

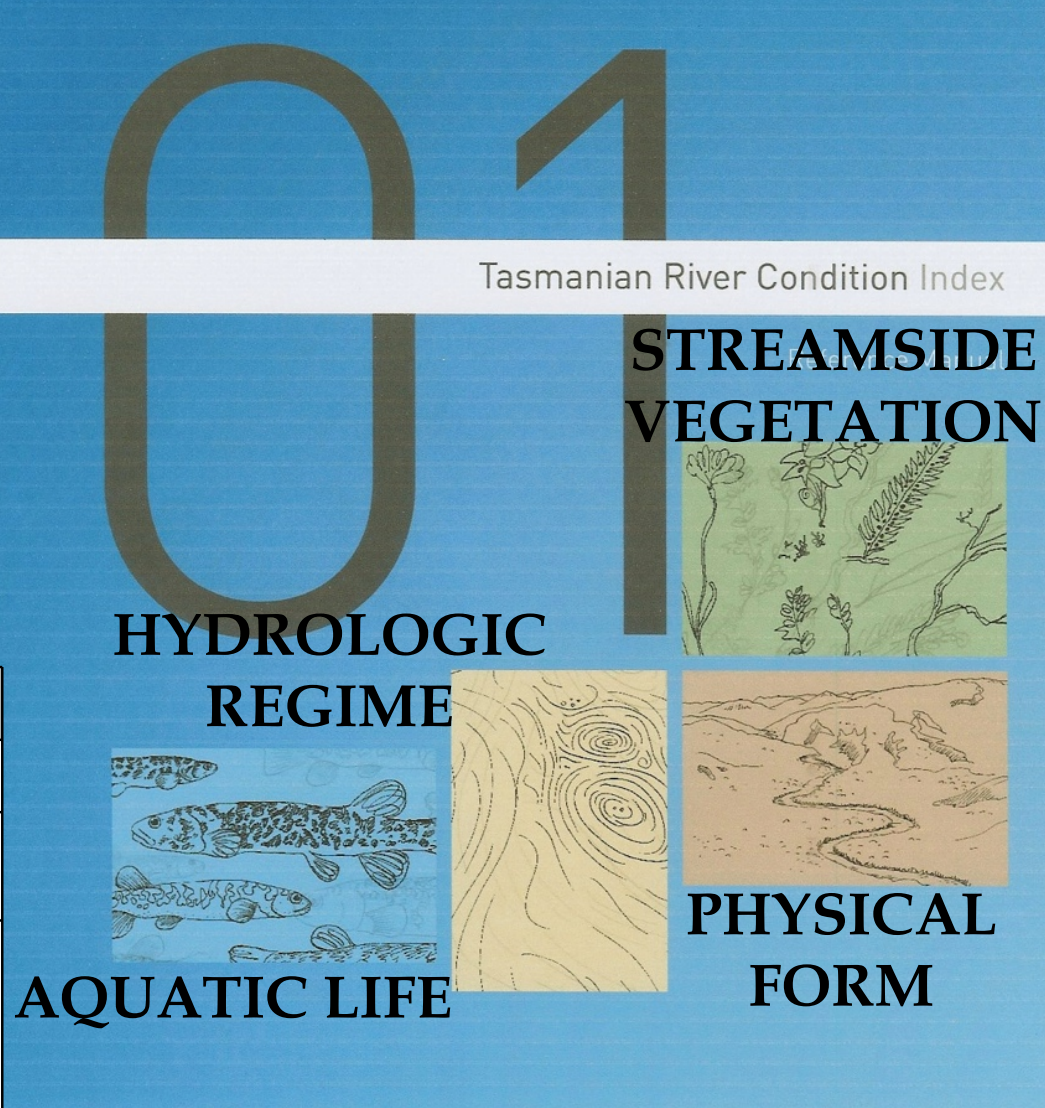


1936

RIVER CHARACTER

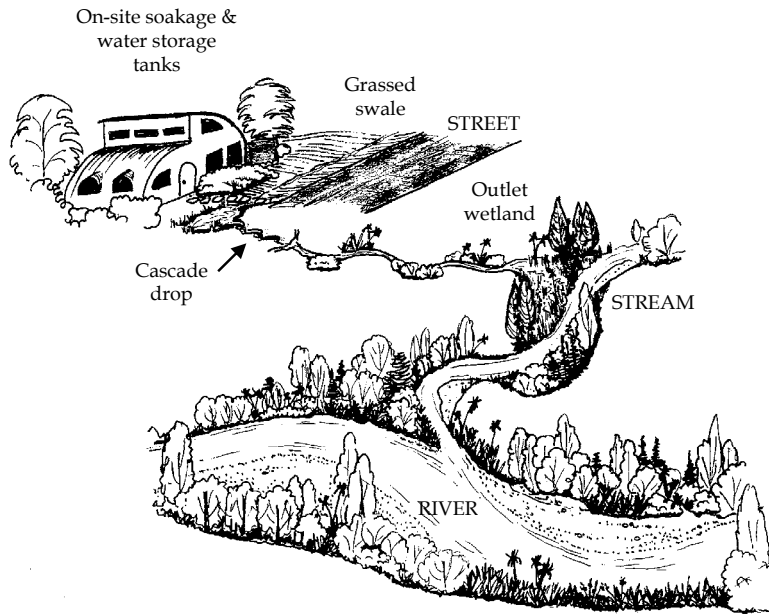
CONDITION INDEX

Tasmanian River Condition Index			
COMPONENTS			
AQUATIC LIFE	HYDROLOGY	PHYSICAL FORM	STREAMSIDE ZONE
Macro-invertebrates Fish Algae	Mean annual flow Seasonal amplitude Low Flow High flow High flow Low flow spells Proportion of zero flow Flow duration Variation index Seasonal period Overbank flow Overbank spells	Number of channels Sinuosity Artificial barriers Artificial floodplain features Bed material Bank material Bank shape Width/depth Flow types Bank erosion Large wood Debris Jams Macrophytes	Extent of vegetation Organic litter Logs Weeds Recruitment Canopy cover No. of species Cover Longitudinal continuity Large trees Patch size

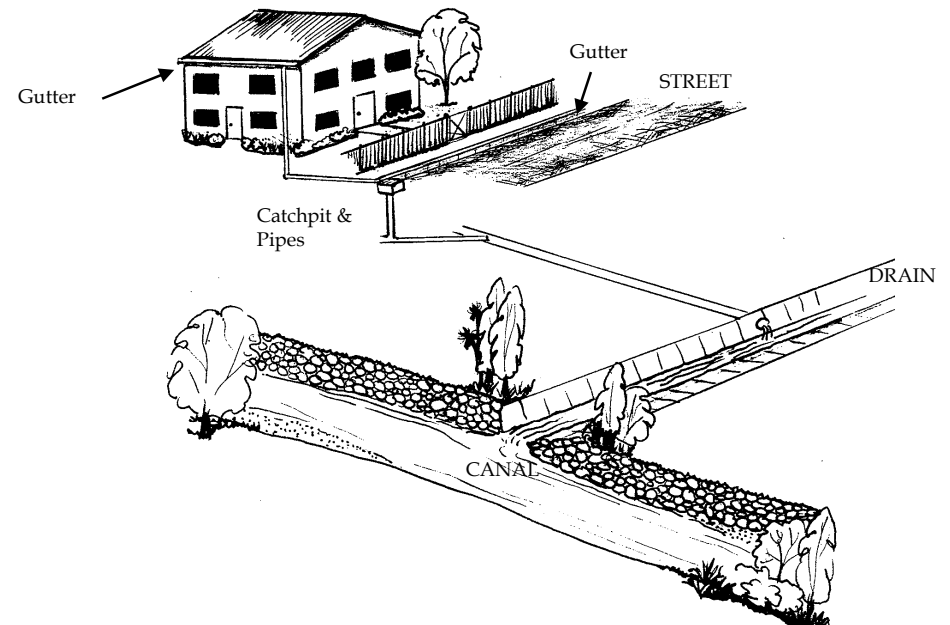


INTEGRATED MANAGEMENT

SOCIAL CULTURE



Natural rivers — Natural landscapes —
Nature based houses, access ways, cities etc



Artificial rivers — Artificial landscapes —
Artifact based houses, access ways, cities etc

All our works are an expression of our culture.
The way we manage our environment depends on our values and objectives.

COLLABORATIVE MANAGEMENT
COMMUNITY & STATE

ORGANISATIONAL STRUCTURE

NO NATIONAL AUTHORITY – for Water & Soil Resource Management

WATER & SOIL

MISCELLANEOUS PUBLICATION

NO CENTRAL Government involvement or support

NO NATIONAL Department/Ministry of public works or infrastructure

No. 45

**Catchment management for optimum
use of land and water resources:
Documents from an ESCAP seminar**

Part 1—Introductory and Country Statements

CO-ORDINATED NATIONAL – REGIONAL – LOCAL ORGANISATIONS

CIRCULATE INFORMATION, MANUALS, STANDARDS, TRAINING

FUNDING for MULTIPLE OBJECTIVES; from MANY AGENCIES/LEVELS of GOVERNMENT



**NATIONAL WATER AND SOIL
CONSERVATION ORGANISATION**

ISSN 0110-4705

WATER & SOIL

MISCELLANEOUS PUBLICATION

**A Draft For a National Inventory of
Wild and Scenic Rivers**

No. 42

Part I — Nationally Important Rivers

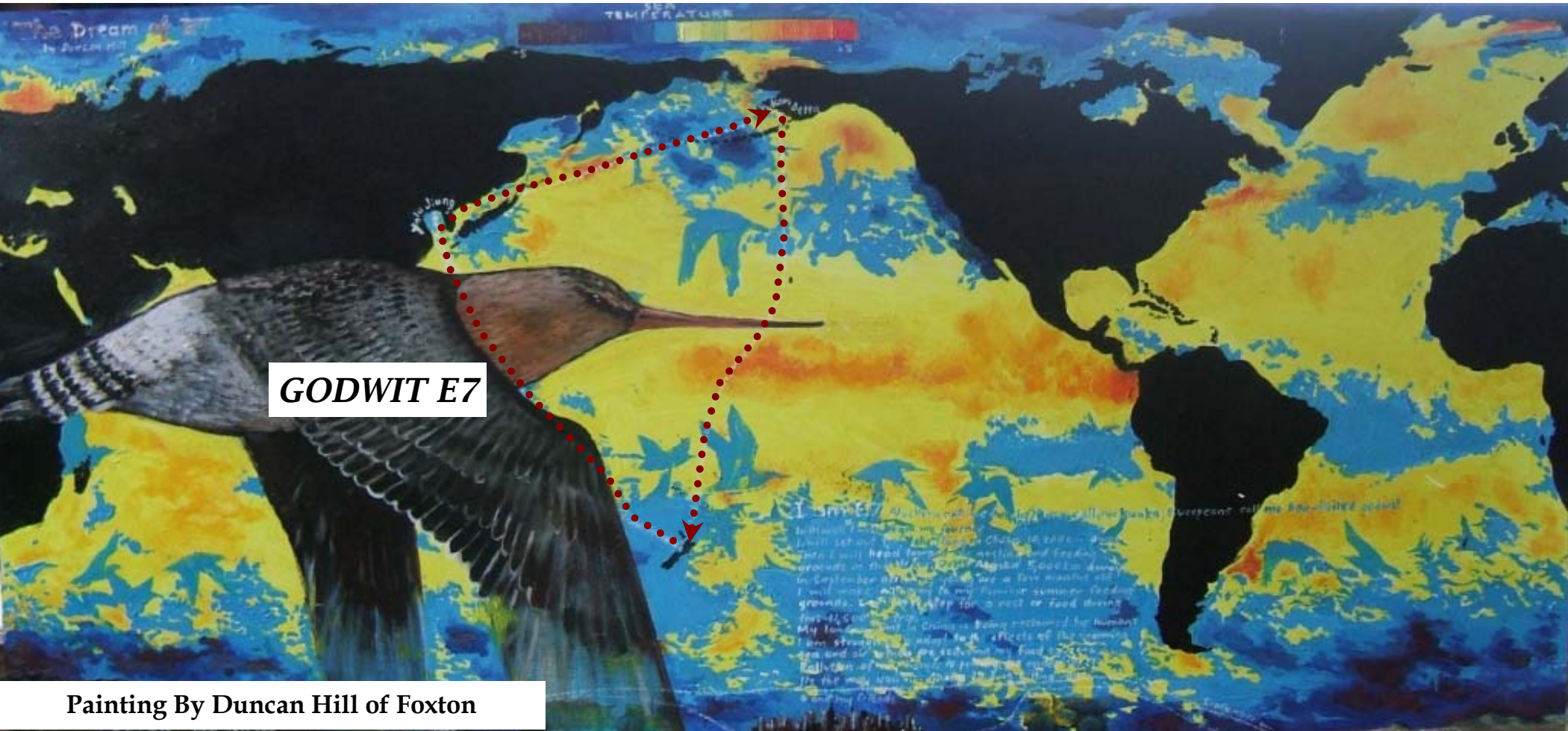


**NATIONAL WATER AND SOIL
CONSERVATION ORGANISATION**

COLLABORATIVE MANAGEMENT

PEOPLE & PLANET

WE ARE ALL IN IT TOGETHER – SO WHERE IS THE SOLIDARITY?



LIFE on EARTH is ALL INTERCONNECTED and ALWAYS RESPONDING

A detailed landscape painting showing a wide river flowing through a valley. The river is surrounded by rocky banks and patches of yellow grass. In the background, there are steep, forested mountains with patches of snow on their peaks and ridges. The sky is a clear, pale blue.

THE CHALLENGES ARE
POLITICAL, SOCIAL,
& ECONOMIC

NOT
TECHNICAL