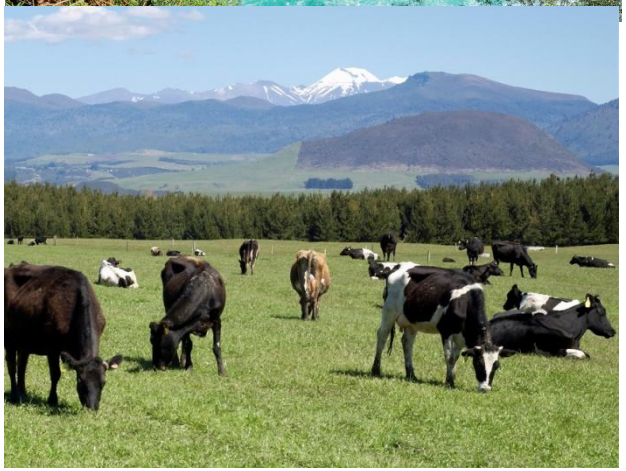
# WISE

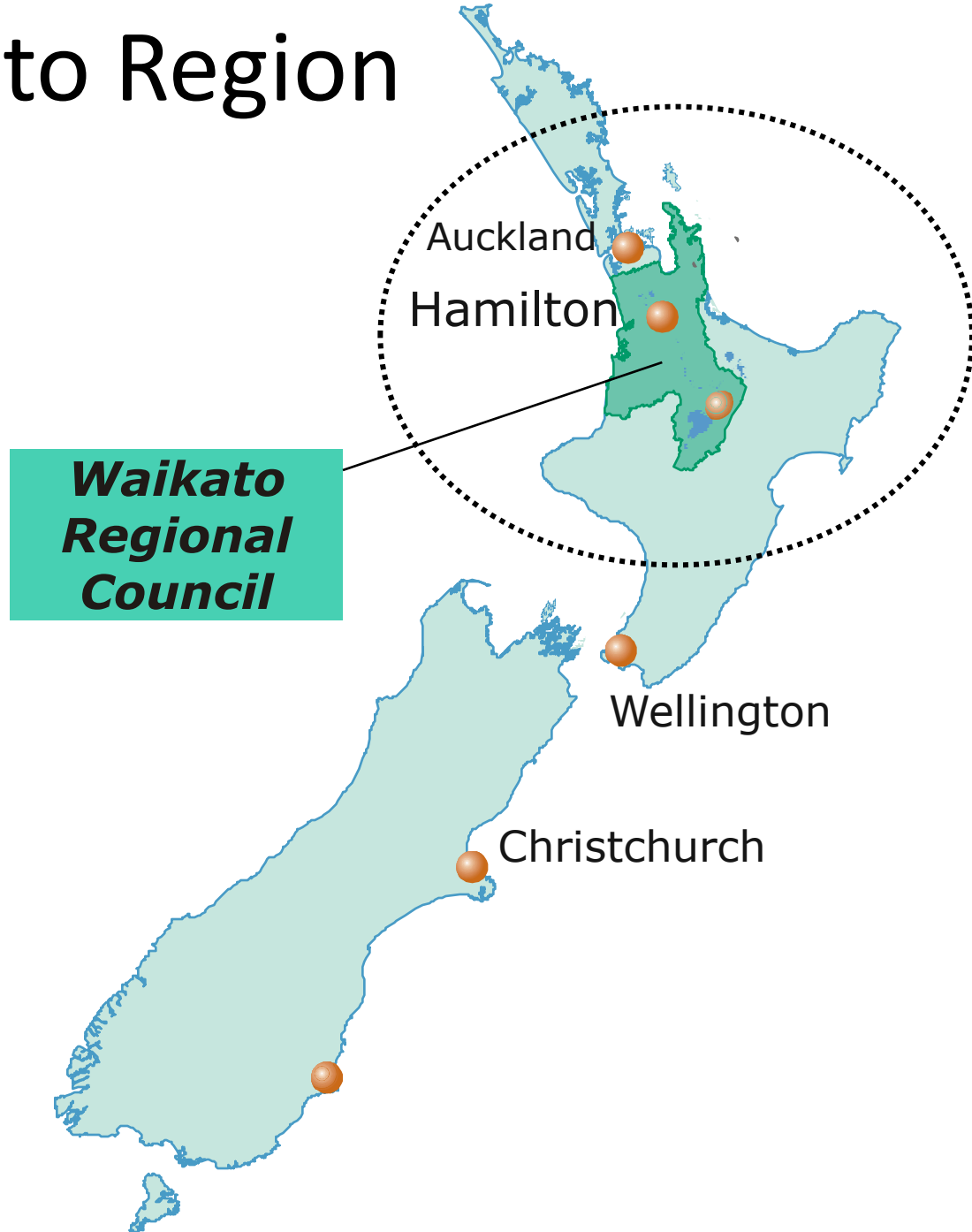
## - Waikato Integrated Scenario Explorer

**NIU presentation** – 27 Nov 2014

Beat Huser, Waikato Regional Council

# Waikato Region





# *Waikato Region - what we manage*

- 25,000 $km^2$ total area
- 1,150 km coastline
- Longest river, largest lake

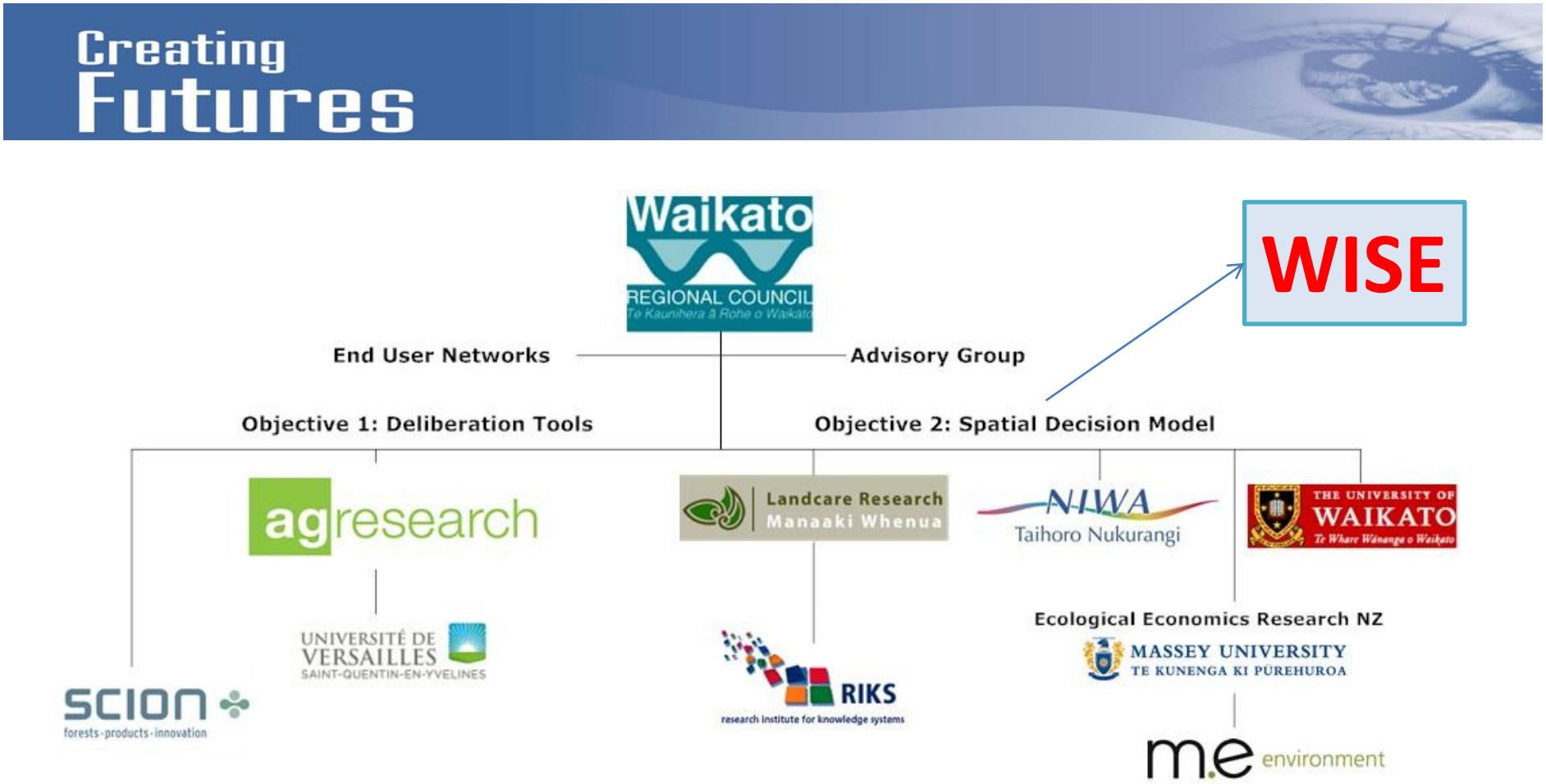
- 400,000 people (10% of NZ)
- $11Billion GDP (10% of NZ)
- $ 6 Billion Agriculture Export

# WISE

## Waikato Integrated Scenario Explorer

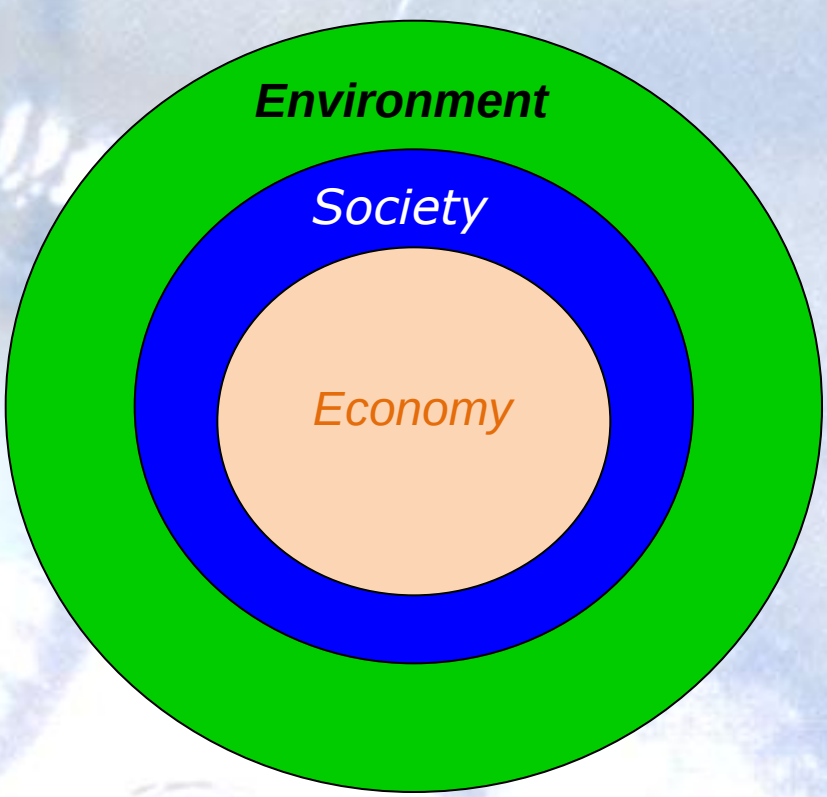
WISE on YouTube; WISE website

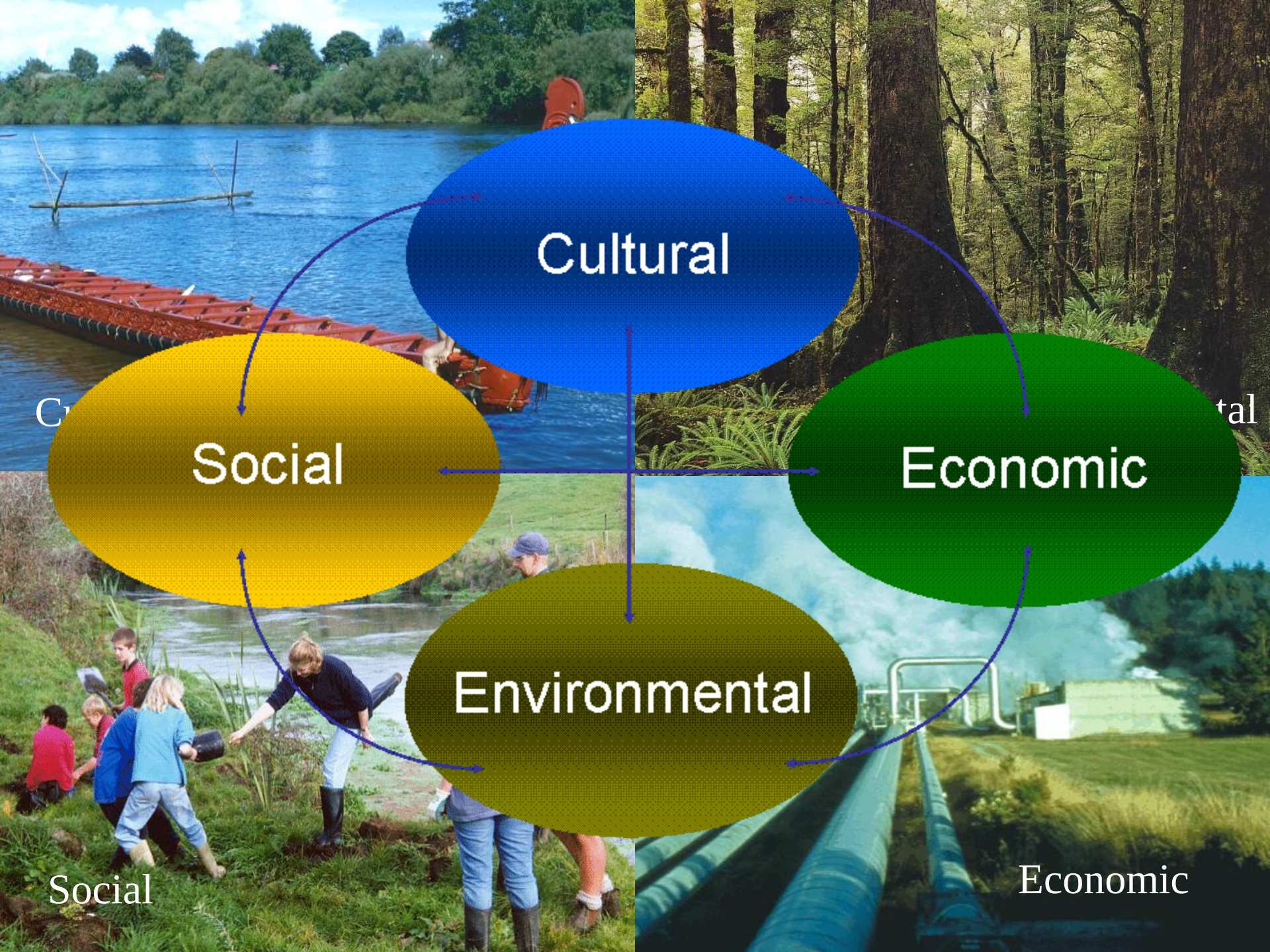
# Created through a research partnership



# Why ‘Creating Futures’ project

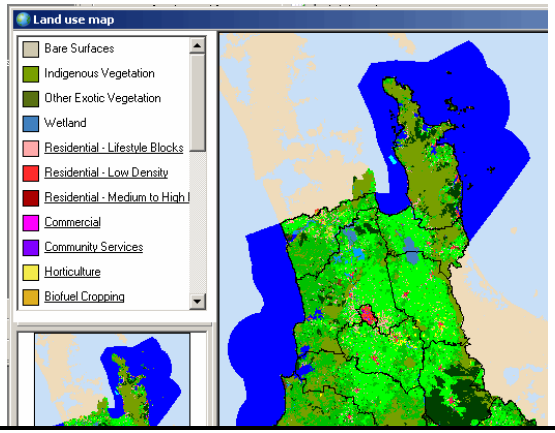
1. **LONG TERM** planning and enhanced strategic focus
2. **LINKING SCIENCE** to Policy
   - evidence-based
   - informed decision-making
3. **NEW TOOLS** to support planning and decision-making
4. **INTEGRATION**
   - Strategic partnerships
   - Linking the four well-beings



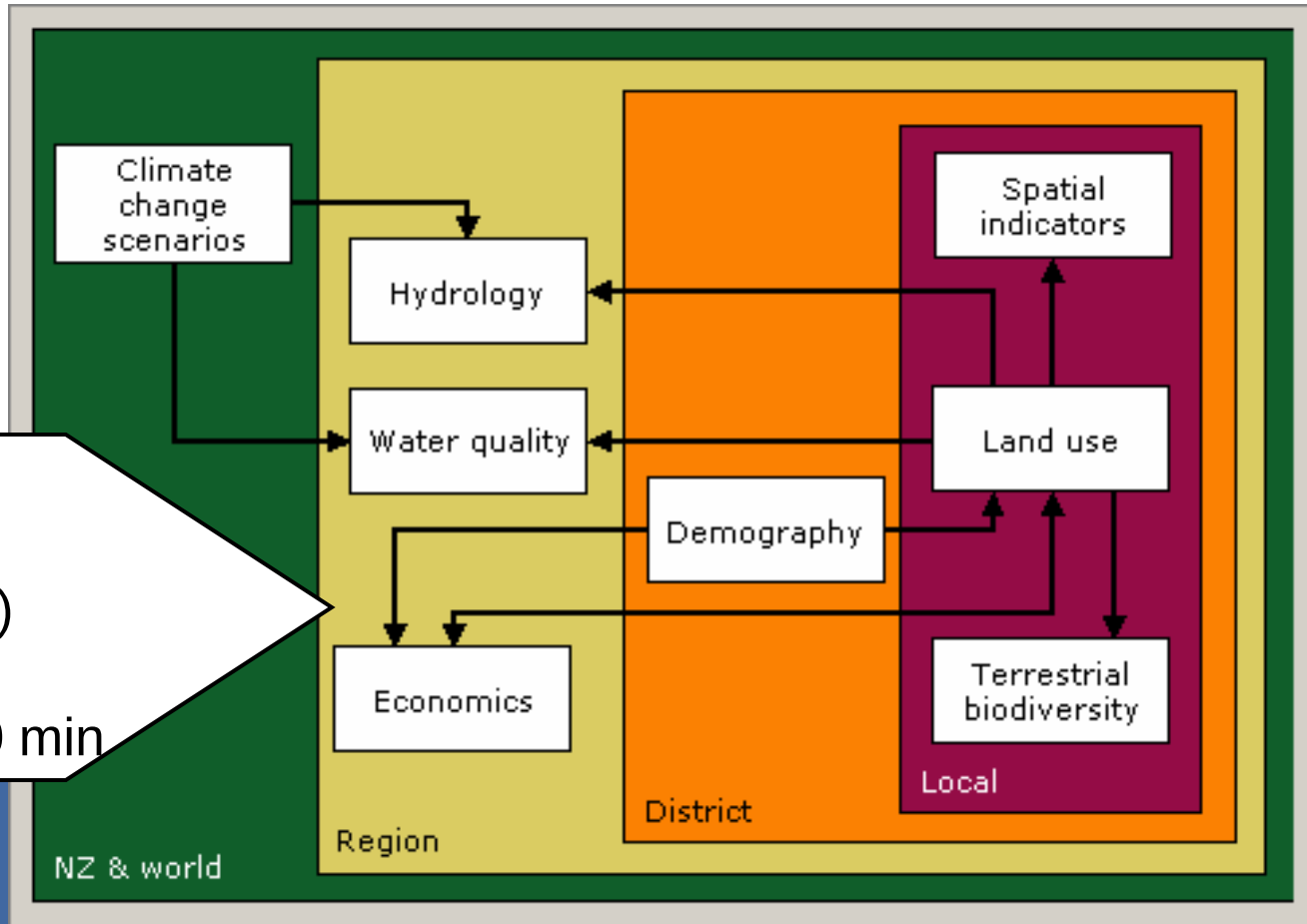

Cultural
Social
Economic
Environmental
Social
Economic

# What is **WISE**

- A dynamic simulation model
- Tool to <u>support</u> integrated spatial planning
- Stand-alone software application
- System of interacting models



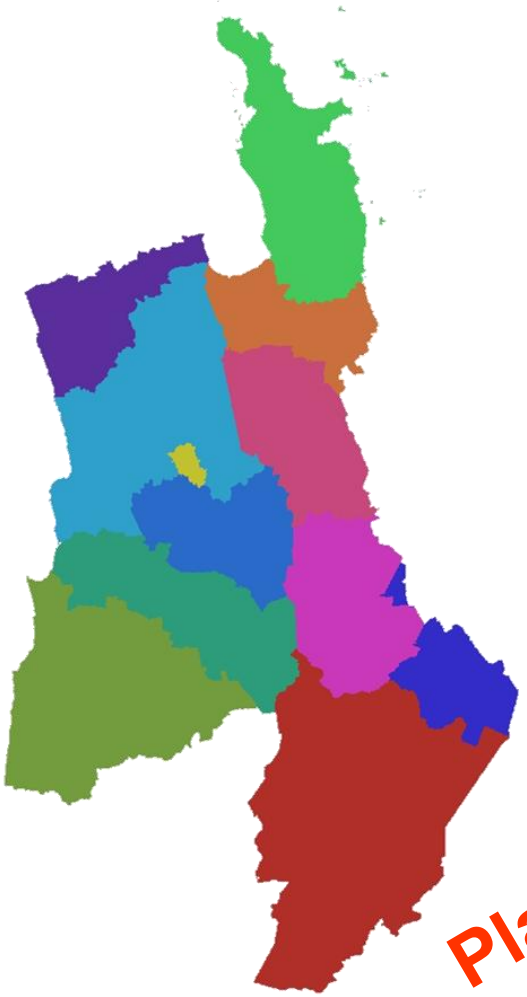

- ✓ 48 economic sectors
- ✓ 25 land uses
- ✓ Cells 4 ha (200x200m)
- ✓ To 2050, 1 year steps
- ✓ Simulation takes 5 -10 min



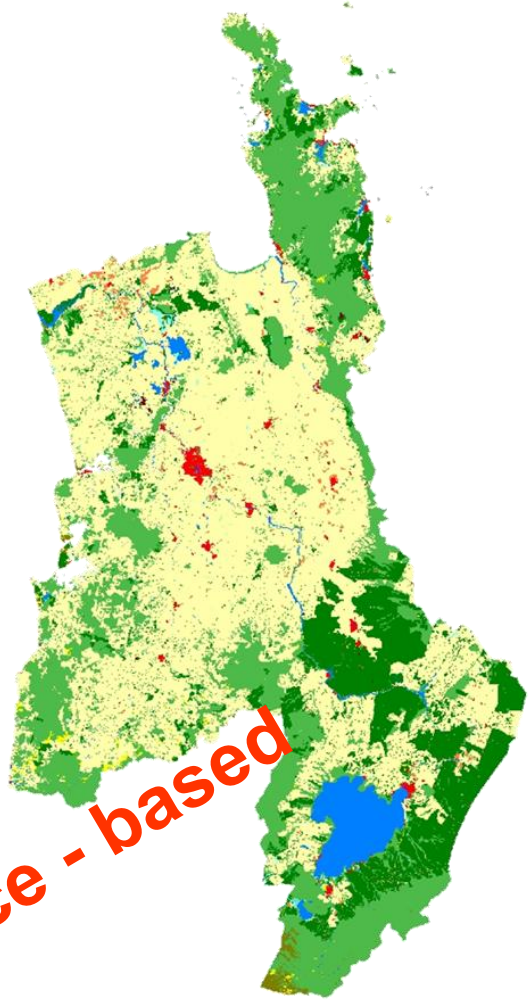

Futures

# Multi-scale

Region



District



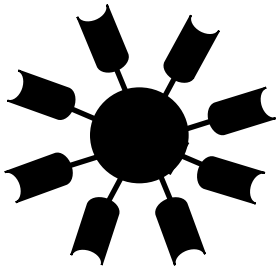
Local
(200 x 200 m cells)

Place - based

# How WISE was built

Adapted from: RIKS

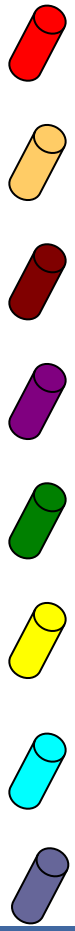
**Basic Framework**



Geonamica

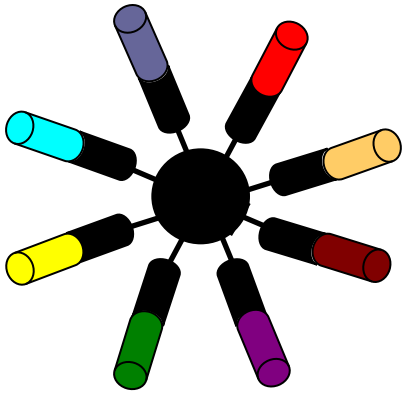
RIKS
research institute for knowledge systems

**Model library**



- Economic
- Population
- Transport
- Land use
- Climate
- Hydrology
- Water Quality
- Biodiversity

**WISE**



**NZ Project Partners**

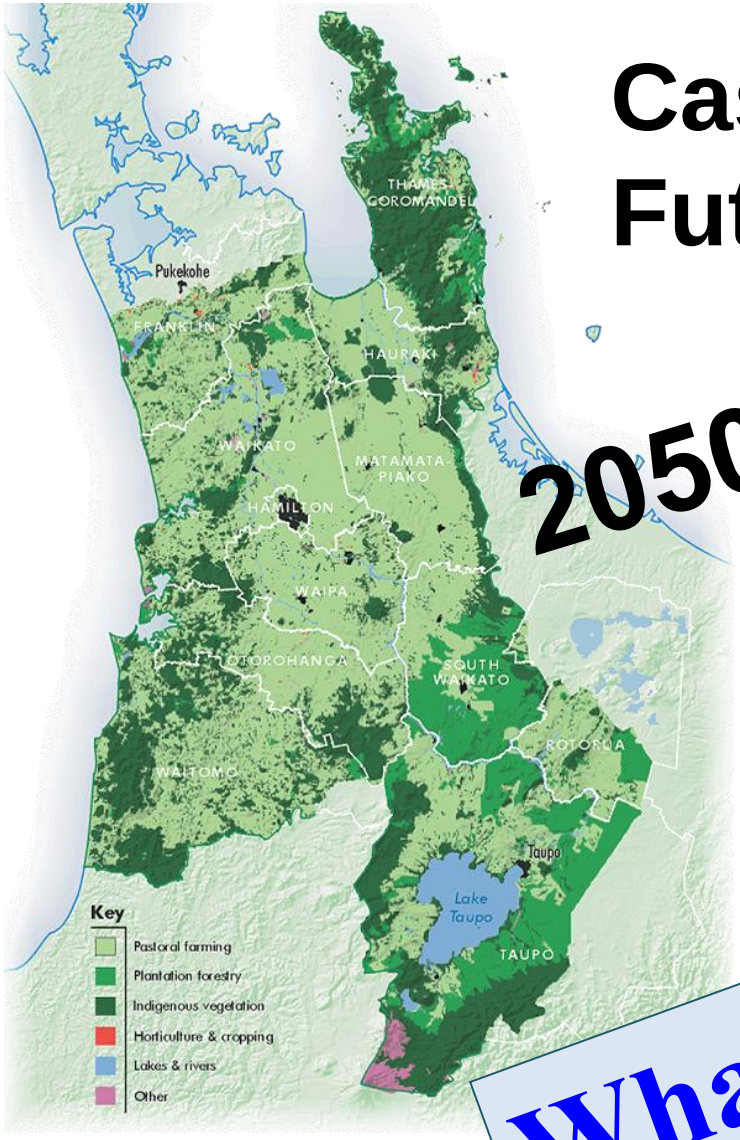
Waikato Regional Council · Manaaki Whenua Landcare Research · agresearch · RIKS research institute for knowledge systems · NZIER · NIWA Taihoro Nukurangi · The University of Waikato · SCION Next generation biomaterials

Creating Futures

# Case Studies

1. Land use change
2. Urban growth – Future Proof
3. Carbon strategy
4. Biodiversity
5. Catchment prioritisation – for RPS

# Case Study 1:
# Future Land Use Options



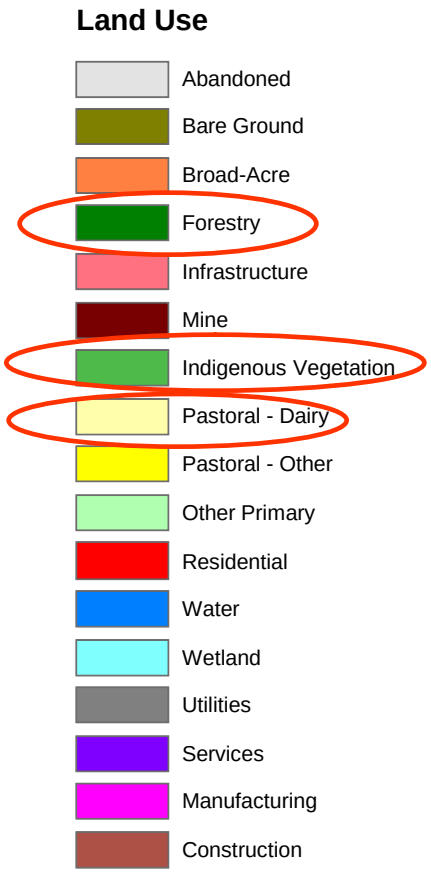

2050?

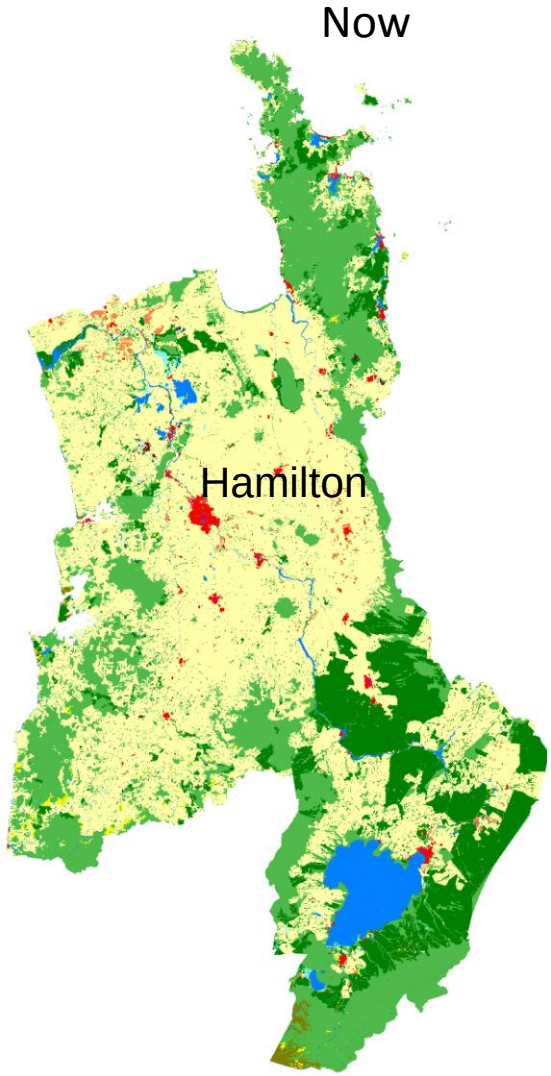
What, if…?

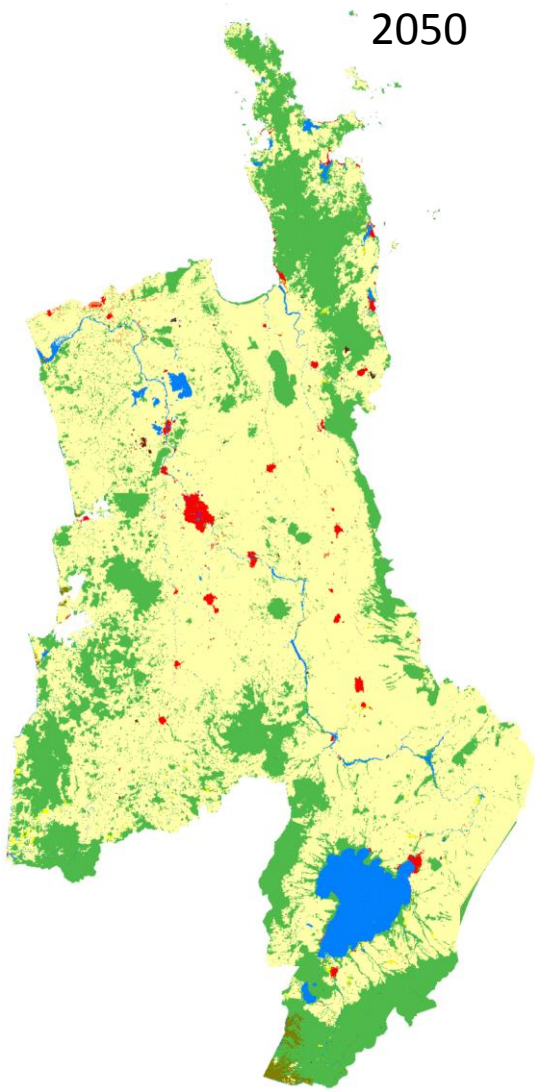
# Waikato in 2050?

***what/if ?***

Land for dairy farming increases ~4% annually




based on WISE Prototype

Source: Landcare Research & RIKS

# Three Scenarios for Waikato's Future 2001-2050 based on WISE Prototype

*Note: these are animations, click to run*

## Dairy Expansion

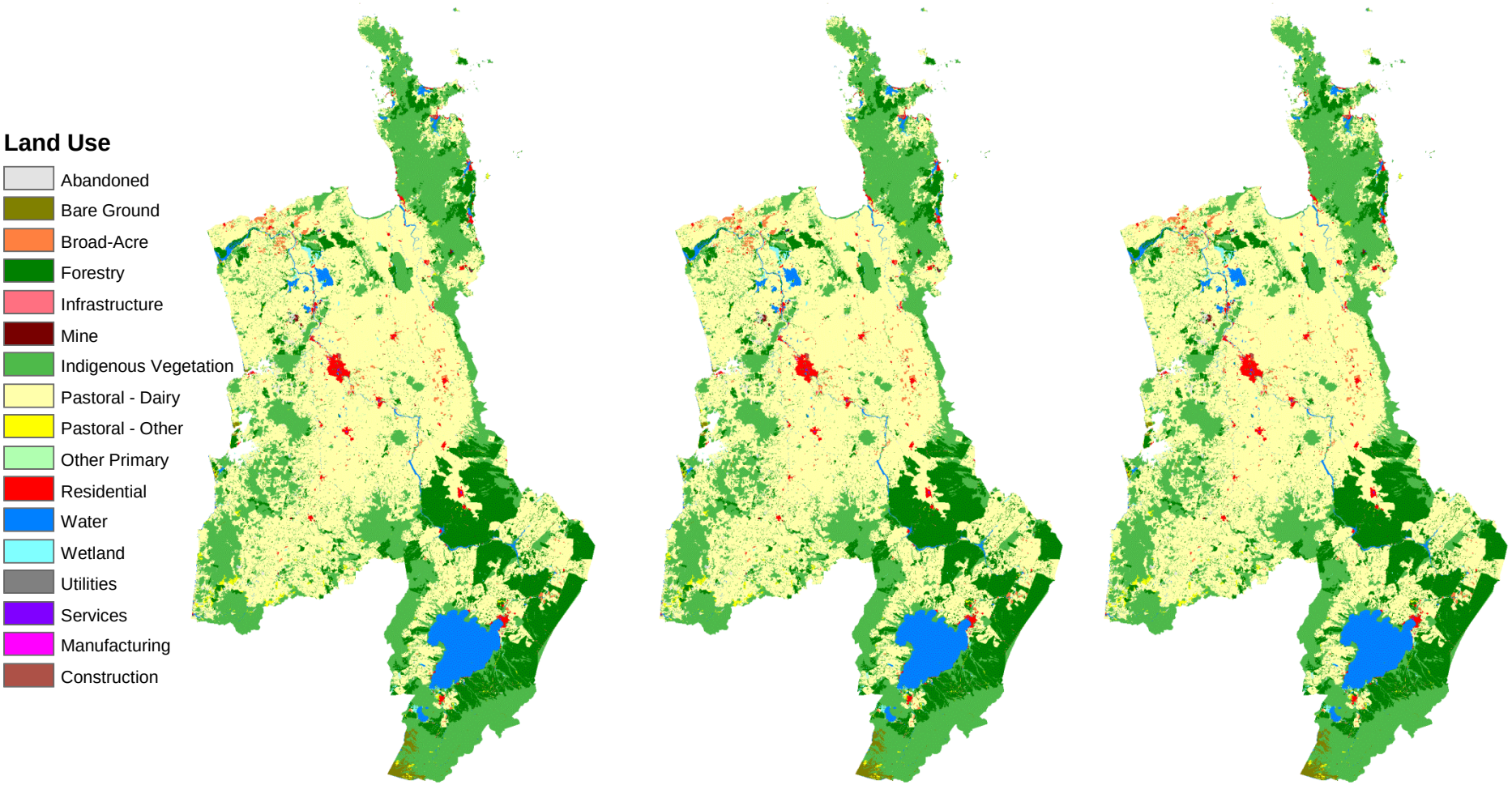
Land for dairying increases ~4% annually

## Diversification

Demand for non-dairy primary production land increases

## Village Life

Residential land increases 7-fold



# Case Study 2 – Future Proof

- **Future Proof** - urban growth study for Hamilton and surrounding districts
- From qualitative to quantitative
- Three "Clues" for quantification (= input for WISE) *(from Future Proof policy documents):*

1. **More compact urban areas**
2. **Productive rural land protected (high quality soils)**
3. **Sensitive natural environments protected**

www.futureproof.org.nz

# From Qualitative to Quantitative

- Input assumptions:
  - Population projections
  - Update infrastructure network

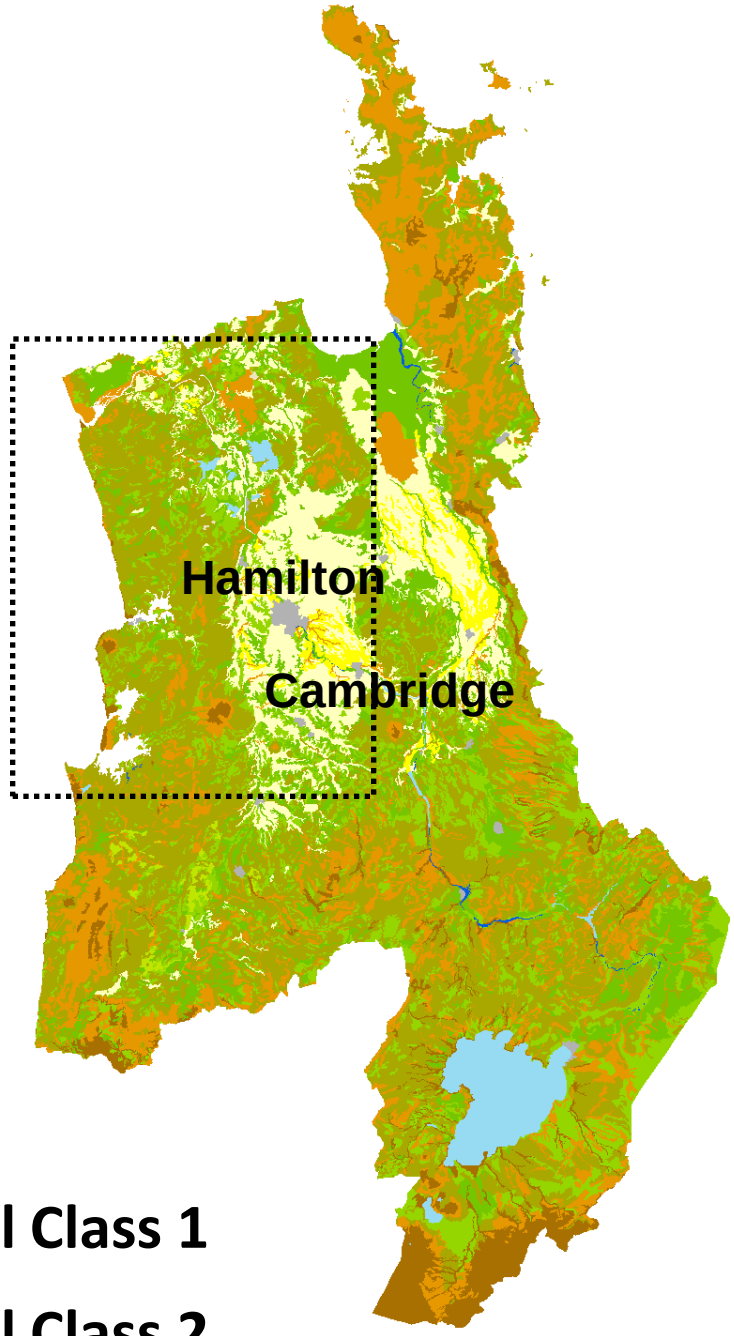
- Run Future Proof scenarios:
  1. Extrapolate current trends (reference scenario)
  2. Compact development and protection of high quality soils

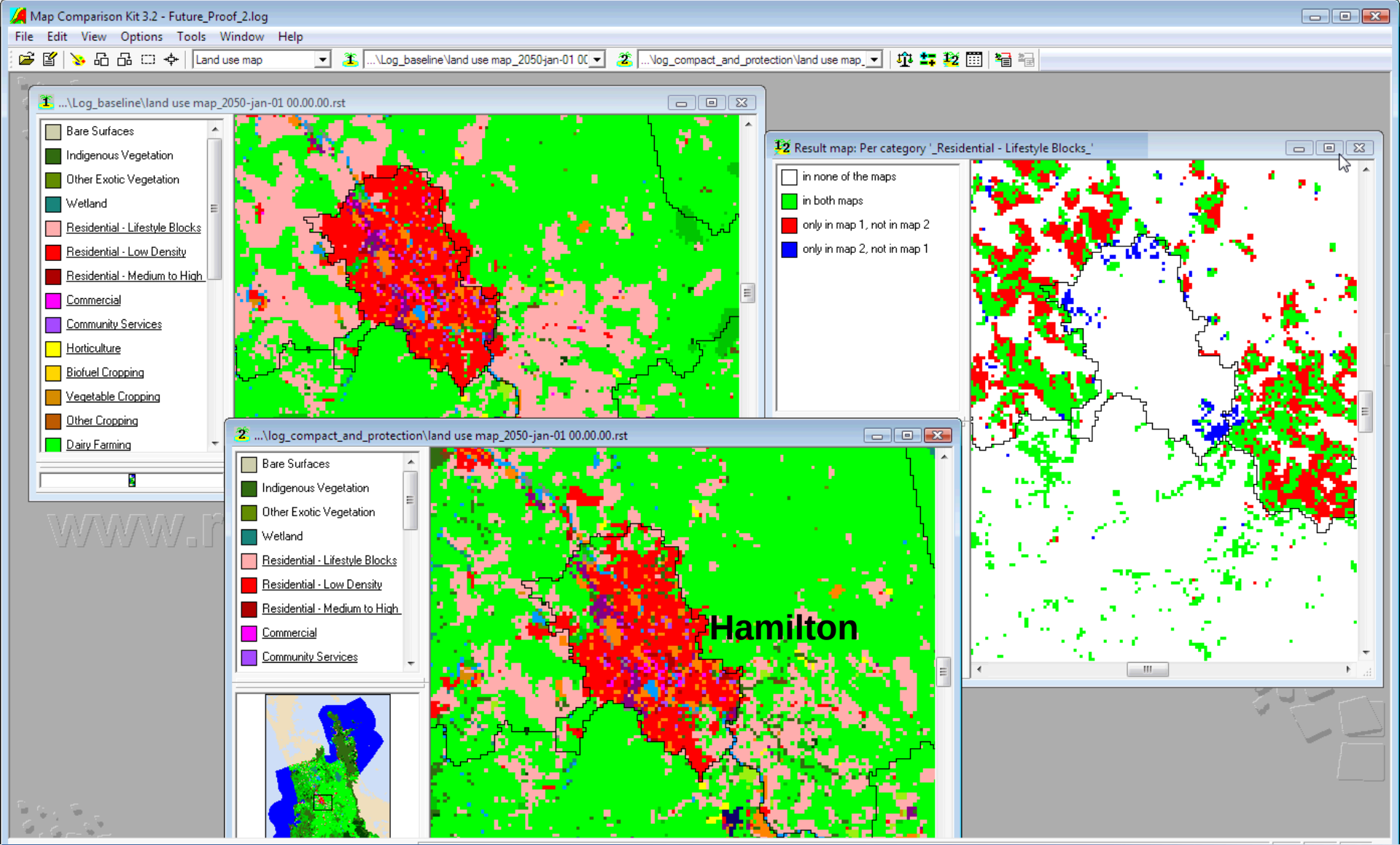
**Scenario: Productive rural areas protected** (high quality soils)

Model input:

No urban development (= 'prohibited' zoning) on Class 1 and 2 soils.
Includes following land use categories:

- **Residential – Lifestyle**
- **Residential – Low Density**
- **Residential – Medium to High Density**
- Commercial
- Community Service
- Manufacturing

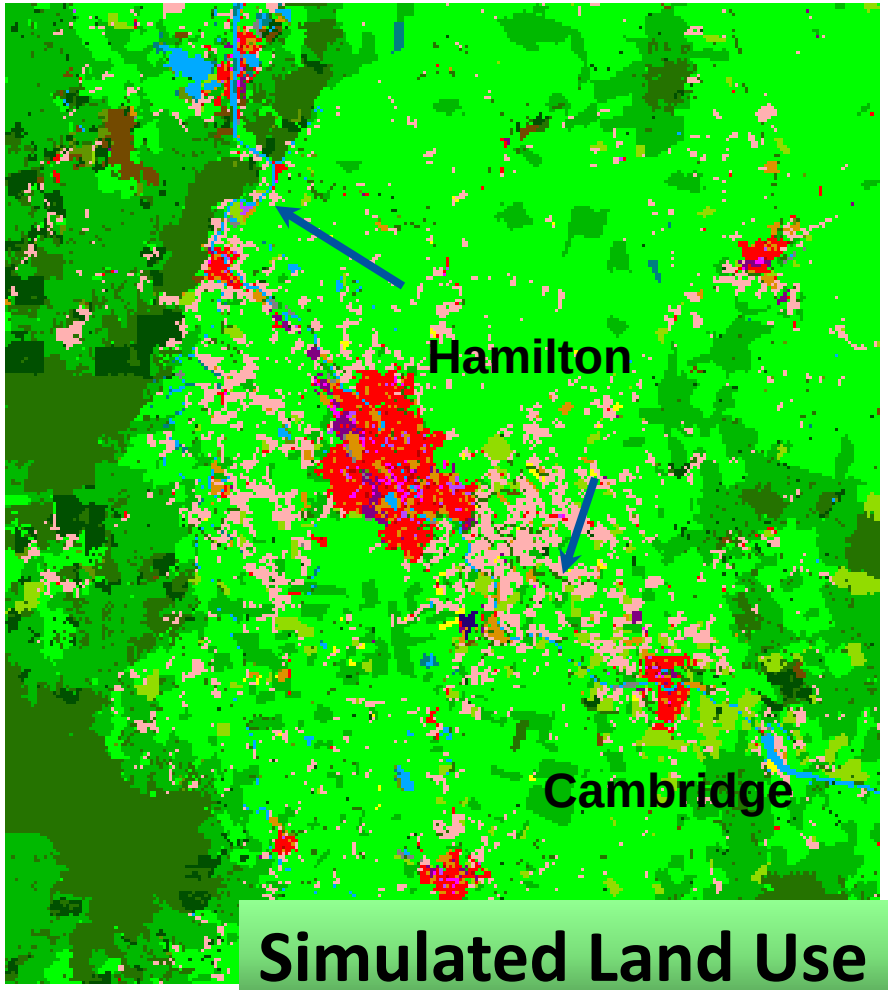




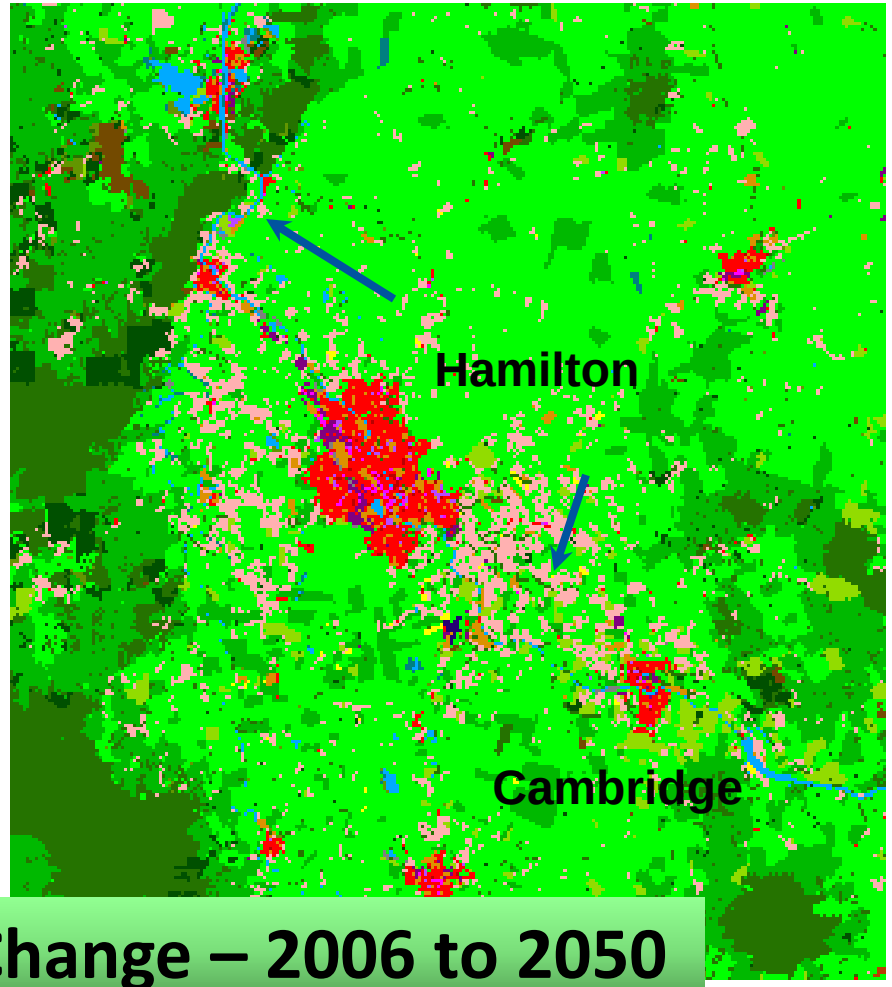

# Creating Futures

# Land Use Change – 2006 to 2050 *(Click to run animation)*

**Current Zoning**



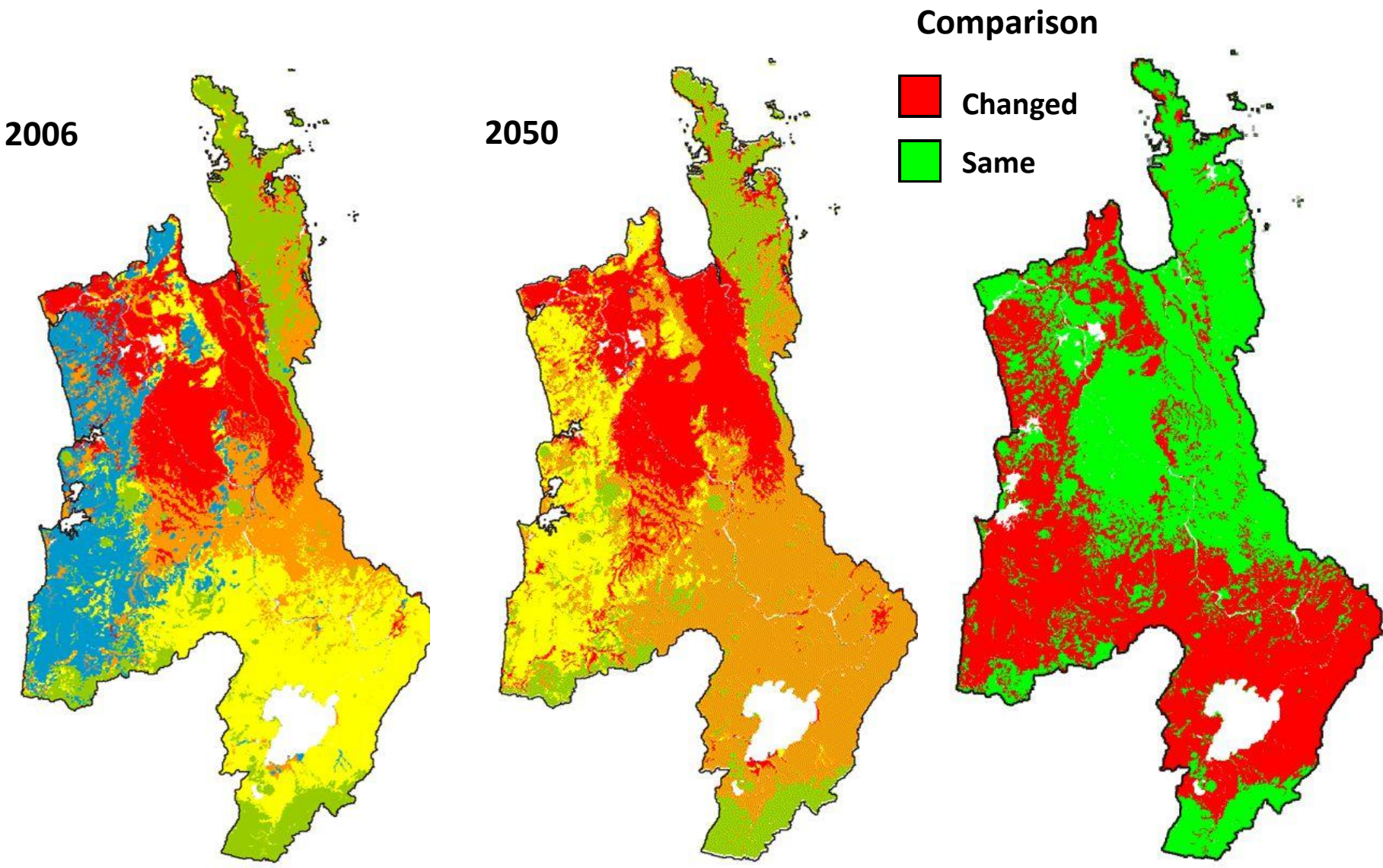

**Protecting High Class Soils**



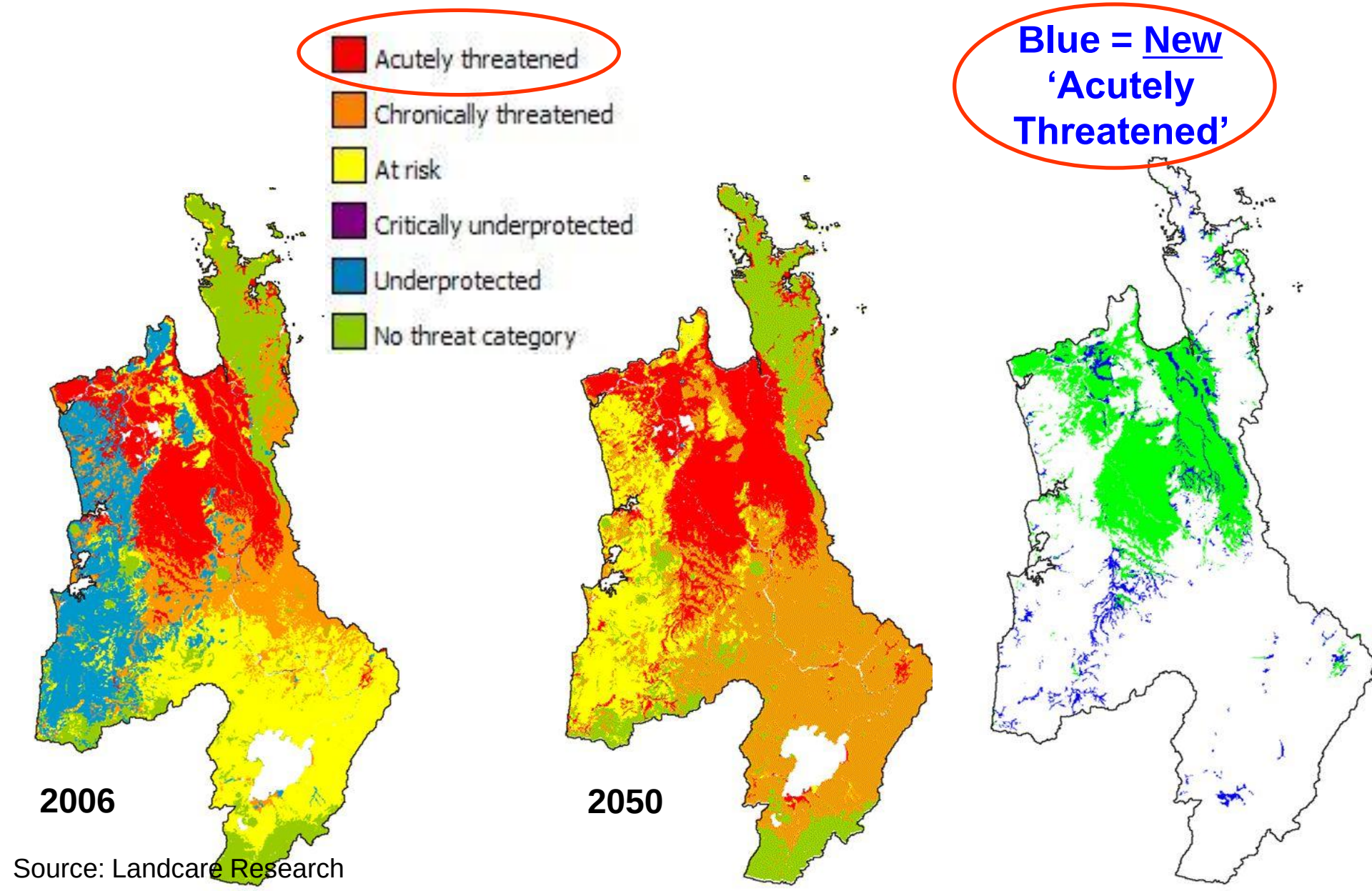

**Simulated Land Use Change – 2006 to 2050**

Model input: Rural and urban land uses are zoned as “prohibited” in areas of Class 1 and 2 soils (high quality) – *refer to right box*

# Case Study 3 - Threatened Environments (Reference Scenario)



# – by Risk Categories




Source: Landcare Research

# Case Study 4 - Regional Carbon Strategy

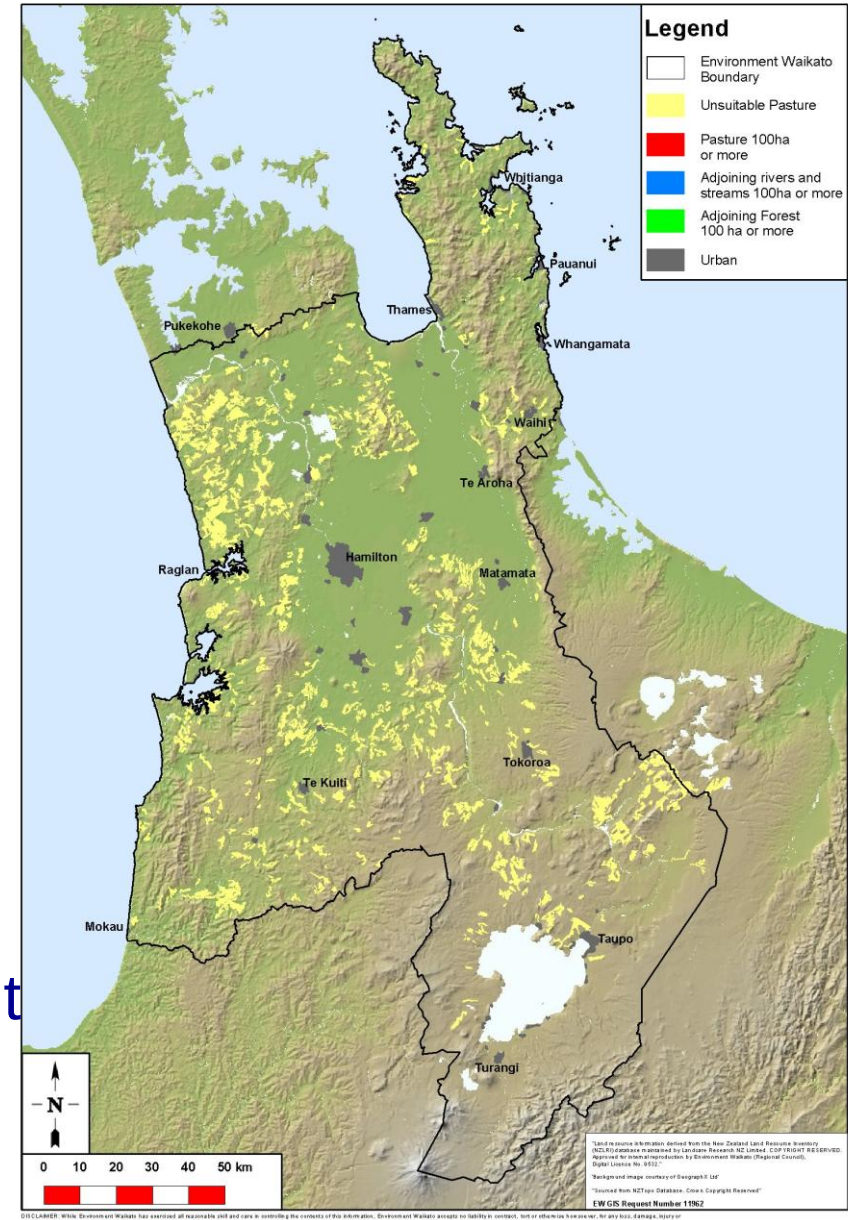
# Steep, Hilly Sheep & Beef

## The Issues

- Declining income
- Soil erosion
- Land management
- Water quality

## The Opportunities

- ✓ Convert steep, erosion prone farming land to forestry
- ✓ [ETS a commercial opportunity]
- ✓ Water quality, land management and biodiversity co-benefits



# Scenarios for policy analysis

**Convert** steep erosion prone farming land to forestry

- About 400,000 ha of suitable land identified

**Two scenarios:**

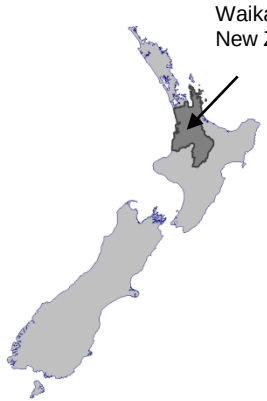
1. Reference scenario ("business as usual")
2. Carbon forestry scenario (convert 80,000ha into new carbon forestry land)

**Analysis includes:**

- Land use, water quality and quantity, biodiversity, value added (GDP), employment

# WISE Model Results

**Forestry Land Use in 2050:**
Comparing reference and carbon forestry scenarios

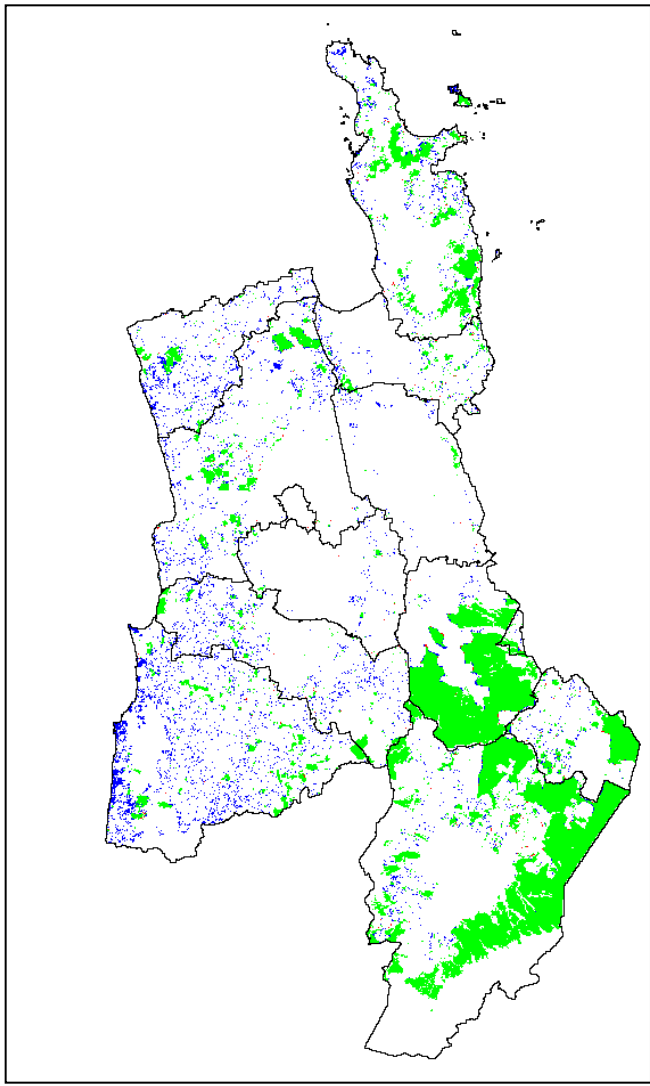



Not forestry in either scenario

Forestry in both scenarios

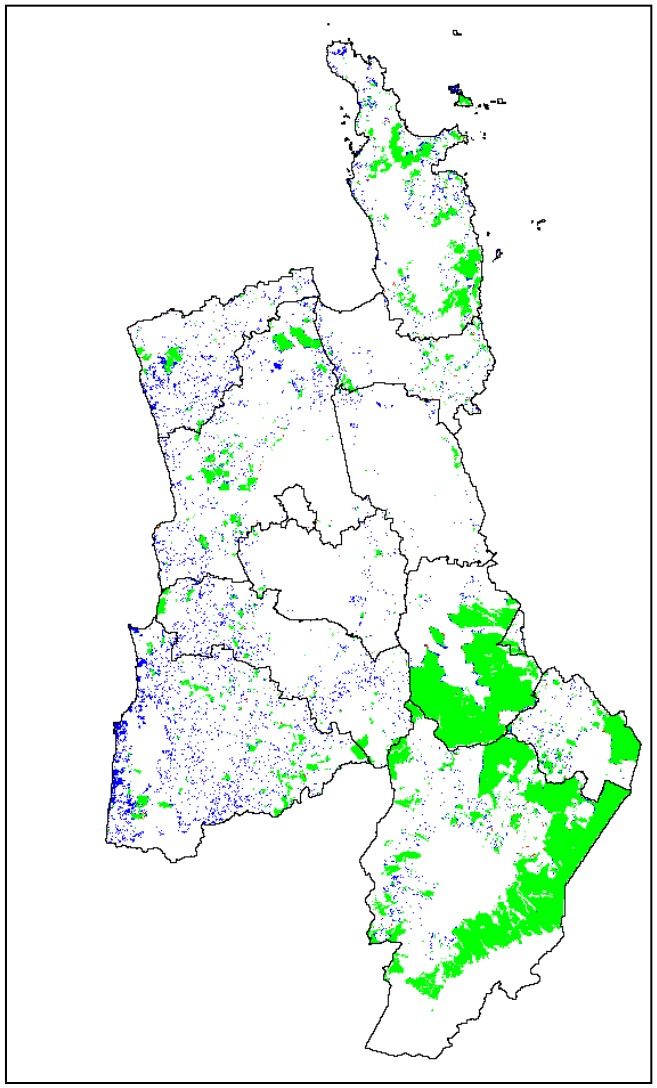
Only forestry in the reference scenario

Only forestry in the carbon forestry scenario



# WISE Model Results (2)

BLUE areas - **Location** of new Carbon Forestry land use



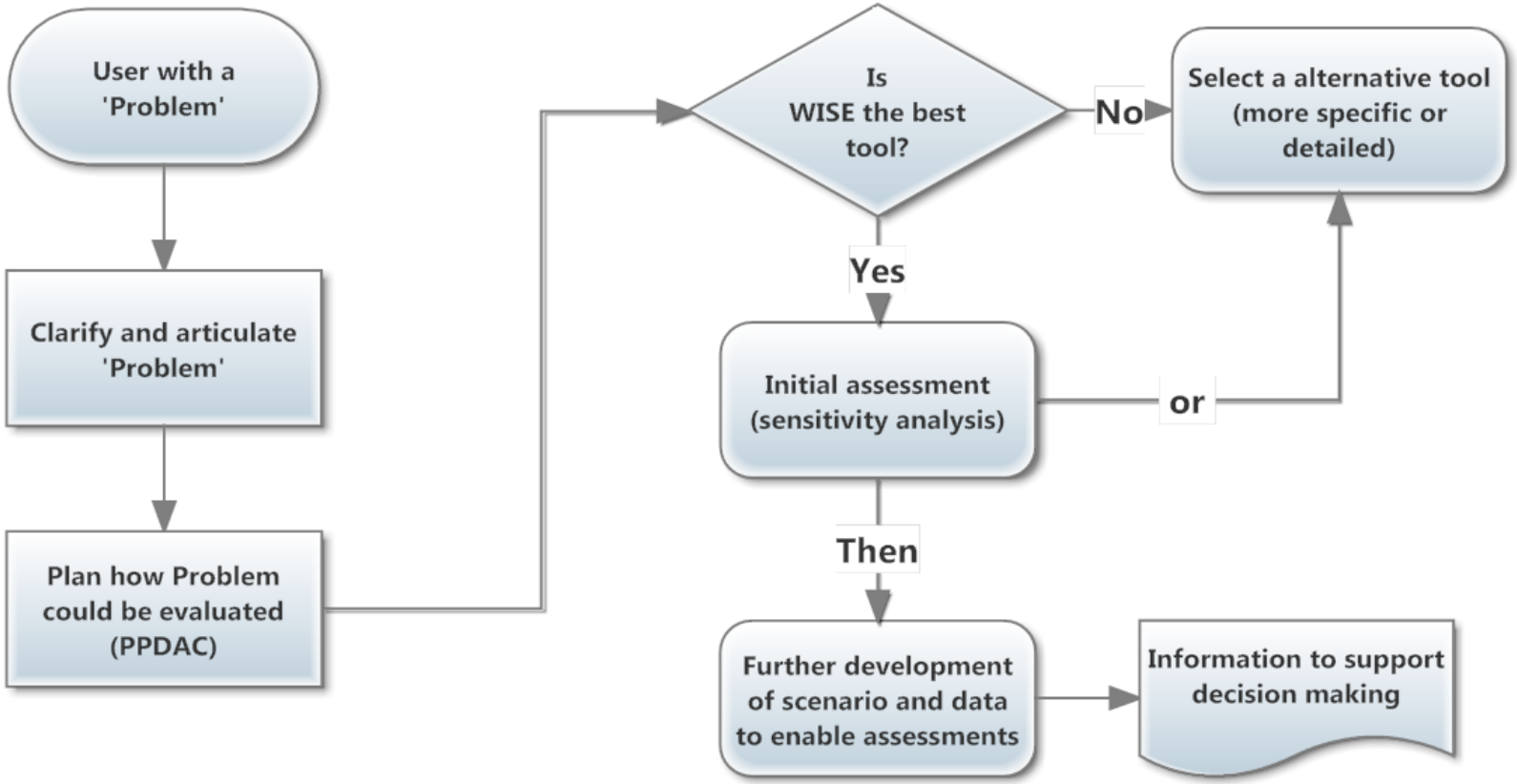
**Impacts on economy:**

- ✓ Land owners profits up
- ✓ Carbon Farming sector: output & jobs up
- ✓ Overall (all sectors): no significant change

**Environmental co-benefits:**

- ✓ Less runoff (flooding)
- ✓ Enhanced biodiversity
- ✓ Reduced erosion (sedimentation)
- ✓ Reduced phosphate and nitrogen loads to waterways

# Using WISE – define your requirements



# How Council uses WISE

- **Linking science to policy** (evidence-based decision-making)
- Explore alternative policy options for regional planning, assess **trade-offs** and prioritise issues - Waikato Spatial Plan
- **Regional** development and **sub-regional** strategies – Economic Development Strategy, Future Proof, RPS/RPs)
- **Cumulative** effects of policy and consents (over space/time)

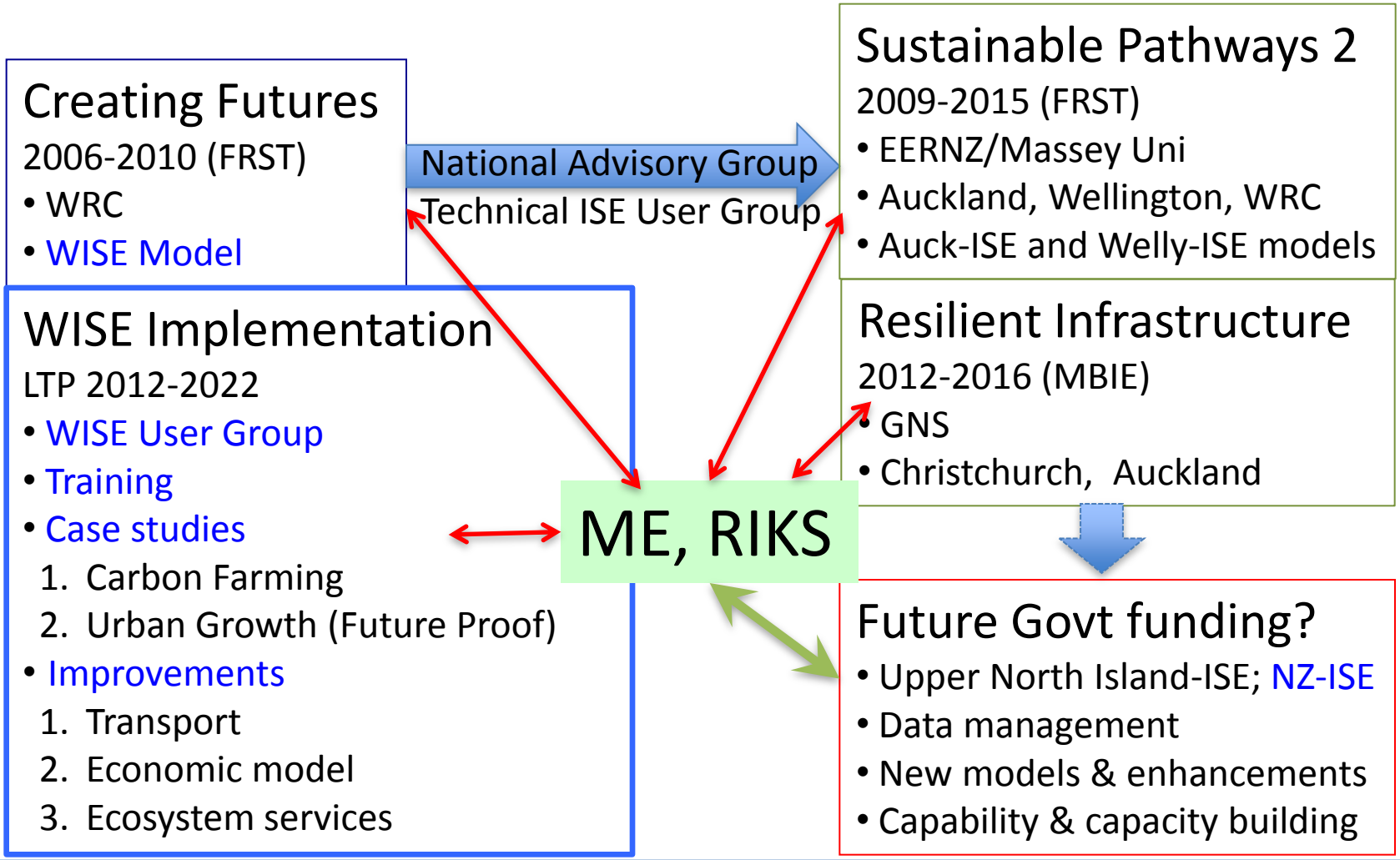
**WISE also provides:**

- Up-to-date data and information
- Access to expert knowledge from all disciplines

# WISE - What's Next?

- Secure long term funding (Council's LTP 2015-2025, $2.5M)
  - **WISE Implementation Plan** ) - ✔
- Establish ***WISE User Group*** (supported by technical experts – modelers, scientists, IT and communication) - ✔
- Build capability and capacity (in-house training) - (✔)
- Test and evaluate WISE using real-life case studies – ***(ongoing)***
- Service agreements with data providers & modelers - (✔)
- Update data and model components - ***(ongoing)***
- Identify and prioritise improvements - ***(ongoing)***
  - improved links between models, e.g. eco-accounts (water, GHG)
  - dynamic land use suitability
  - add other models: ***transport***, ***ecosystem services,*** marine, hazards
  - Combined CA and Agent-based models

# The Bigger Picture




- ✓ Web-based directory of models & DSSs (Envirolink), including case studies http://tools.envirolink.govt.nz/
- ✓ National Advisory Group for Integrated Planning (NAGIP) - http://www.sp2.org.nz/about-the-project/advisory-group/

# User Feedback

| QUESTION | FIRST PROTOTYPE | | SECOND PROTOTYPE | |
|---|---|---|---|---|
| | Agree | Disagree | Agree | Disagree |
| My organisation would benefit from using WISE | 26 | 3 | 21 | 2 |
| WISE enables communication among planners and decision makers | 29 | 0 | 24 | 0 |
| WISE is an easy to use and intuitive tool | 17 | 5 | 19 | 5 |
| I have the impression that in order to use WISE, I need a lot of specific knowledge | 21 | 11 | 17 | 7 |
| I think learning to use WISE is worthwhile, considering the results I can obtain | 27 | 0 | 20 | 1 |
| I would prefer a simpler tool, even if that means less control on the parameters | 6 | 19 | 6 | 15 |
| I would prefer a more complex tool, even if that requires more parameters to deal with | 9 | 13 | 8 | 15 |

# WISE Feedback from Users

- Integrative character of WISE seen as both a benefit (reality) and a challenge (complexity)
- Credibility of results crucial
- **Main expected benefit from users:**
  - Explore ‘what-if’ scenarios in policy development, integrated catchment management and transport network planning
  - Alignment of regional and city/district policies and rules
  - Improves communication
  - Hands-on experience with practical examples
  - Prototyping improves understanding and builds trust

# Some Barriers

- Existing planning practice
- Need for training and capacity building
- Time frames often rushed: political expediency vs. good practice
- Cost/benefit of a different approach uncertain
- Statutory processes and proposed policies often legally appealed – reluctance to use new, untested methods
  - Initial use in non-statutory processes?
- Central government reluctance for integrated strategies

- **Access and capacity of model developers and experts**

# Conclusions

- WISE is a powerful tool to explore complex issues and spatially evaluate alternative policy options and associated trade-offs in an integrated way.
- Capabilities
  - Explore dynamic spatial scenarios using ‘what-if-analysis’
  - Visualise consequences of trends, shocks and policy interventions
- Limitations
  - Overall strategic thinking and evaluation, not detailed planning
  - Limited knowledge on links between models
- Stimulates and facilitates
  - Learning
  - Awareness building
  - Discussion & debate
  - Integration and longer term thinking

Creating Futures

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## Project Overview

The purpose of the recently completed 'Creating Futures' research programme was to develop tools for integrated spatial planning and decision-making. The Government-funded innovative work was led by the Waikato Regional Council in collaboration with an interdisciplinary multi-agency research team. The Waikato Regional Council is now advancing the practical application and further enhancement of these tools. In particular, the regional computer simulation model WISE is evaluated for its use in Council's planning and decision-making processes.

## WISE

The Waikato Integrated Scenario Explorer (WISE) is a dynamic, spatially-explicit computer simulation model that integrates economic, demographic, environmental (climate, hydrology, water quality, biodiversity) and land use (suitability, accessibility, local influence, zoning) information to assess the effects and trade-offs of alternative future development scenarios or the consequences of policy options. The modular platform used to build WISE is transferable to other locations or regions. Similar models are currently developed for Auckland and Wellington (www.sp2.org.nz).

A short video about the spatial planning tool W
Scenario Explorer, has been re

www.creatingfutures.org.nz

## What's New

25 | Release of WISE version 1.2.0