Rangitaiki Landscape Scenarios Participatory Process

Testing an ecosystem service based approach to inform decisions

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LINK Seminar

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THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

UC UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Landcare Research
Manaaki Whenua

agresearch

SCION
forests · products · innovation

Ecosystem services classification

LANDCARE RESEARCH
MANAAKI WHENUA

PROVISIONING

Products obtained from ecosystems

- Food & fibre
- Freshwater
- Biomass fuel
- Wildfoods
- Ornamental resources
- Biochemical, natural medicines & pharmaceuticals
- Genetic resources

REGULATING

Benefits from regulation of ecosystem processes

- Air quality regulation
- Climate regulation
- Water regulation
- Erosion control
- Water purification & waste treatment
- Biological control
- Disease regulation
- Pollination
- Natural hazard regulation

CULTURAL

Non-material benefits obtained from ecosystems

- Recreation & ecotourism
- Ethical & spiritual
  - Aesthetic values
  - Spiritual & religious values
  - Cultural heritage values
  - Social relations
  - Sense of place
  - Cultural diversity
- Inspirational & education
  - Inspiration
  - Educational values
  - Knowledge systems

SUPPORTING

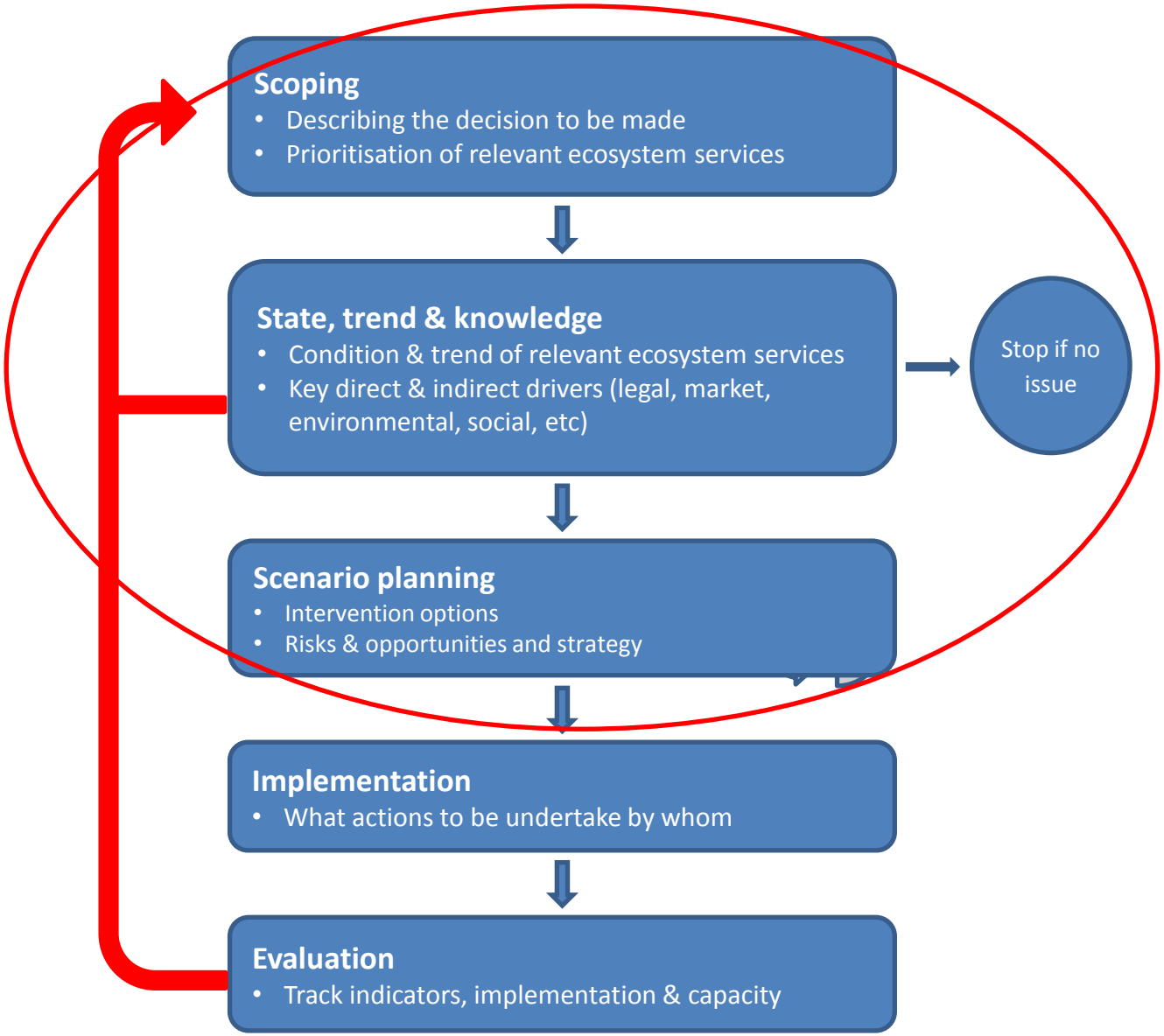
Services necessary for the production of all other ecosystem services

- Nutrient & water cycling
- Primary production (e.g. photosynthesis)
- Production of atmospheric oxygen
- Provisioning of habitat
- Soil formation & retention

Source: Millennium Ecosystem Assessment 2005, modified by Landcare Research


Māori Aspirations
Tangible and Intangible Benefits
Provisioning
Regulating
Cultural
Supporting
Ecosystem Services
Cultural Values
Mātauranga Māori

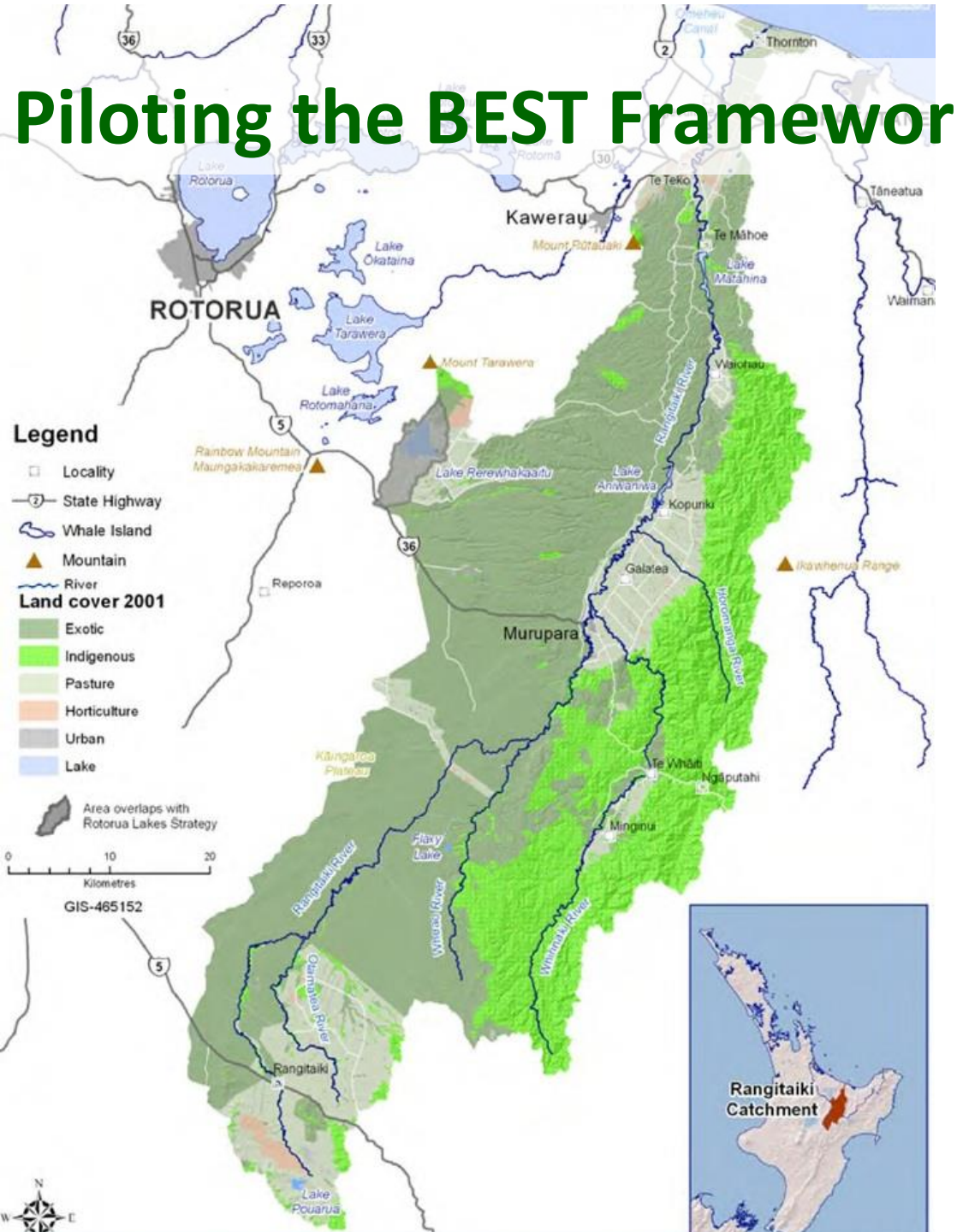
BEST Decision-making Framework



Purpose of the process

- Explore future options for the Rangitaiki landscapes with community members
- Identify development opportunities
  - in a way that resonated with the needs & aspiration of the community
  - that considered the range of ecosystem services
- Test how ecosystem service concepts can support natural resource decisions

Piloting the BEST Framework in the Rangitāiki



Why this catchment?

- Co-governance Forum --The Rangitāiki River Forum -- have clear vision for the catchment
- Diversity of landscapes, land uses & stakeholders
- Multiple potential future options
- Variety of implementation pathways

The Group

Involved 12 people representing:

- Conservation & NGO
  - DOC
  - Environmental NGO (Fish & Game)
- Māori – 2 iwi groups, Māori dairy farmer
- Farming
  - Sheep & beef, dairy & dairy cooperative
- Local government
  - Regional councillor, district councillor
  - Regional Council staff member
- Tourism
- Missing: forestry & electricity generators

Seven workshops

1. Introduction

- ***Building a common platform***
- *Share knowledge and build a common understanding in the group around the Rangitāiki catchment and the ecosystem services approach*

2. Field trip

- ***Exploring the catchment***
- *Further extend collective knowledge and understanding of the catchment and the ecosystem services it provides*

3. Prioritise

- ***Recognising ecosystem services***
- *Identify the local natural resources, current uses and associated services critical for delivery of the groups objectives*

4. Future scenarios

- ***Scoping future landscape scenarios***
- *Identify future drivers, translate these drivers into possible alternative future land use and management scenarios for the catchment*

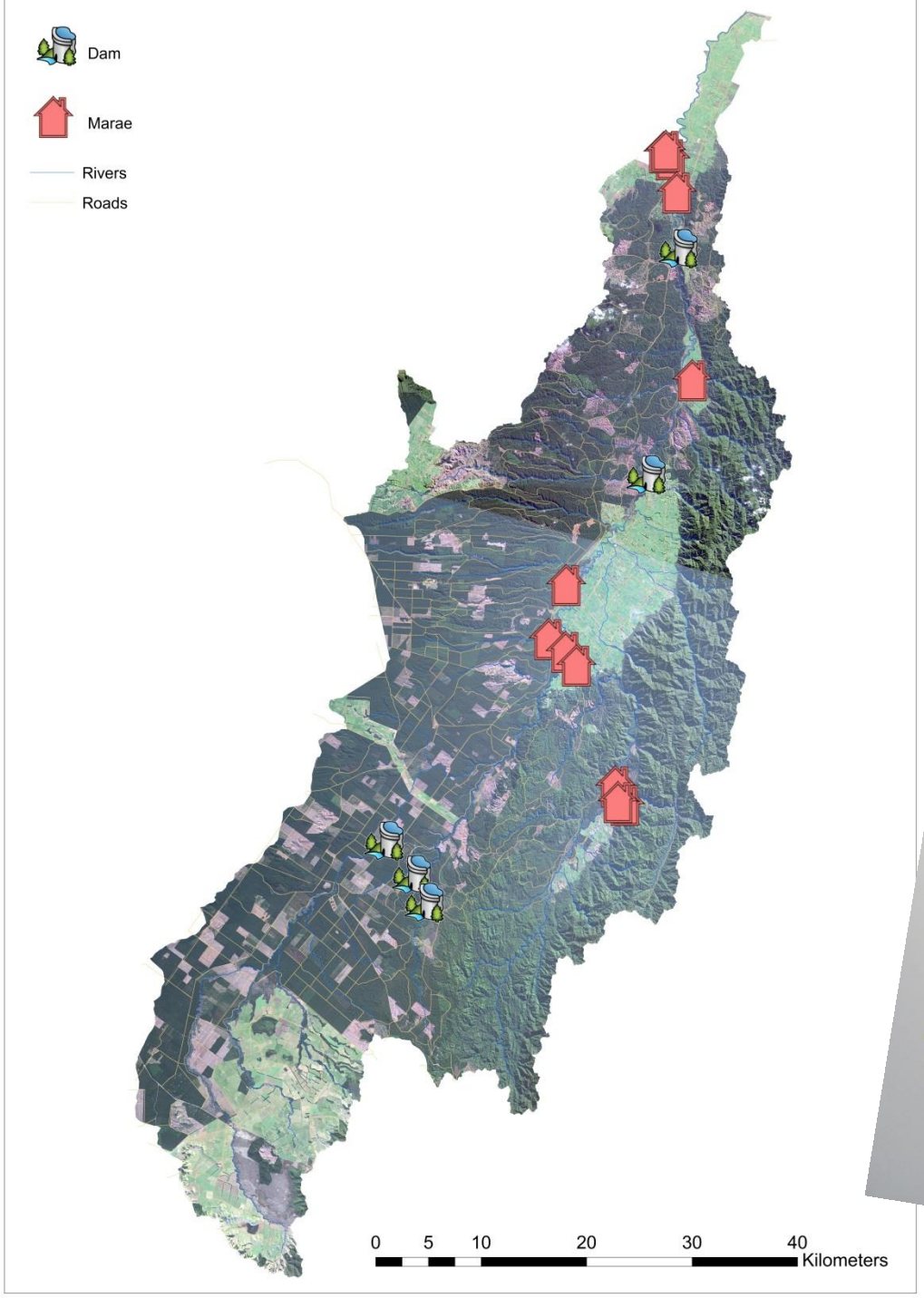
5 & 6. Future forecast

- ***Exploring the scenarios***
- *Discuss scenario findings based on modelling*

7. Strategise

- ***Strategising***
- *Identify decisions/options for future actions*

Rangitāiki Catchment



Ecosystem Services: Prioritisation Questions

Dependency:

1. Does current land use management in the catchment depend on this ecosystem service?
2. Does this ecosystem service have cost-effective substitutes/alternatives?

Impacts:

1. Is the quality or quantity of this ecosystem service changing?
2. Is the change positive or negative?
3. Is the change impacting on the ability of others to use/benefit from this ecosystem service?

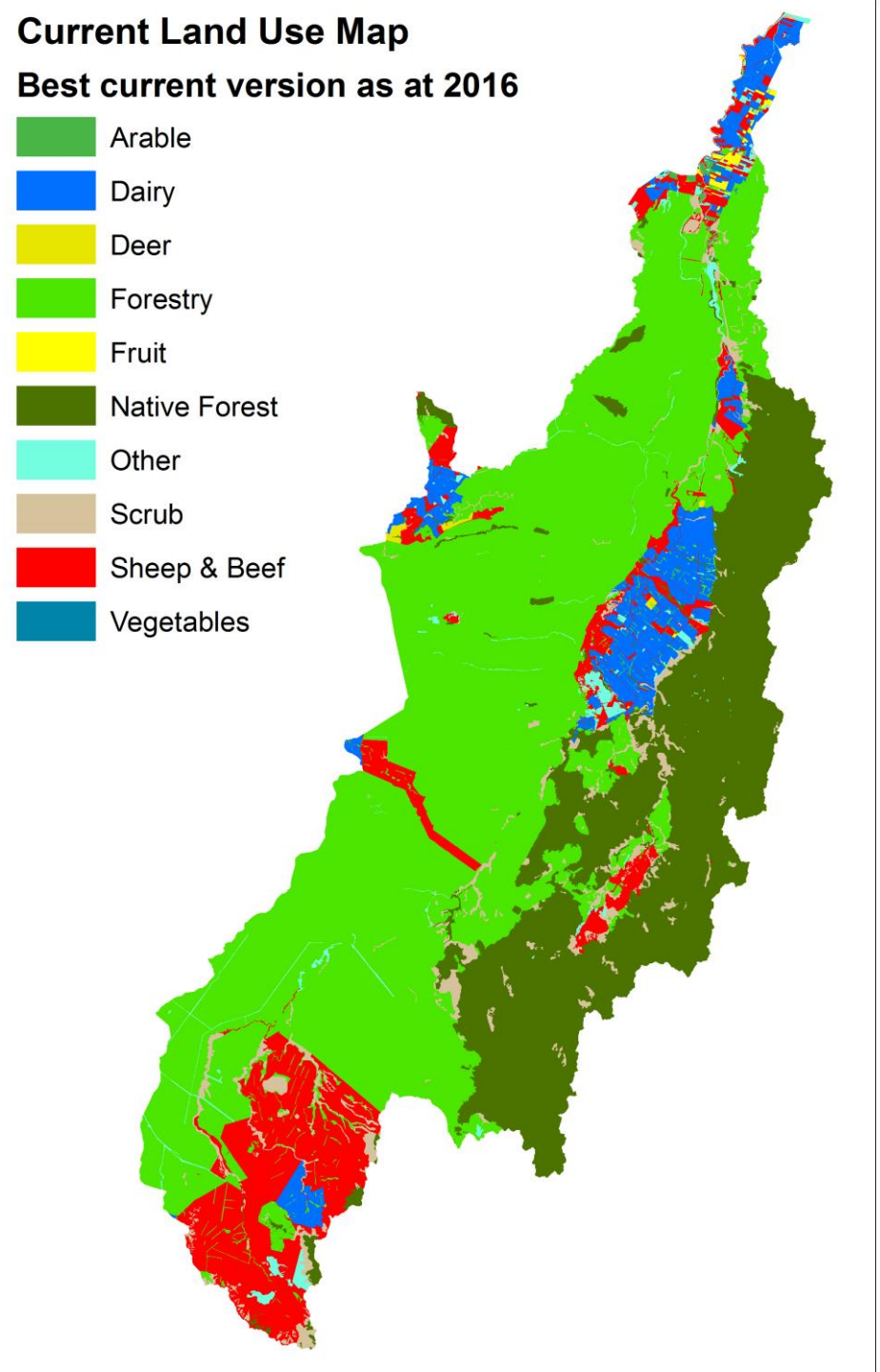
	Low Landscape Diversification	High Landscape Diversification
Community thinking about longer term goals	***Scenario A***	***Scenario B***
Community thinking about shorter term goals	***Scenario C***	***Scenario D***

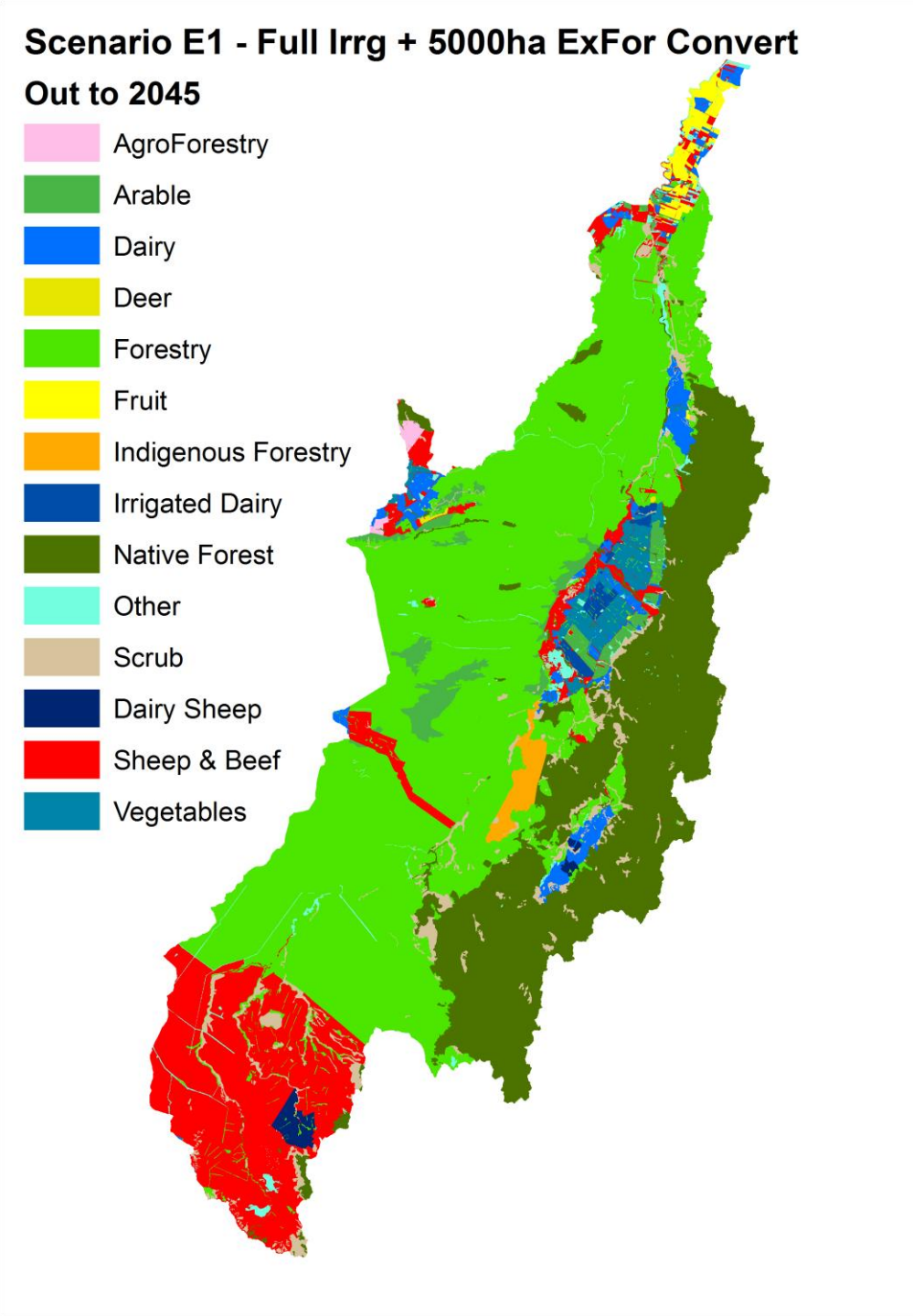
	Low Landscape Diversification	High Landscape Diversification
Community thinking about longer term goals	***Scenario A*** 	***Scenario B*** ↑ indigenous forest logging ↑ agroforestry ↑ irrigation dairy → high value crops ↑ kiwifruit Tourism: mix of options available Social/cultural: ↑ jobs, cohesion, cultural use, biodiversity
Community thinking about shorter term goals	***Scenario C*** 	***Scenario D*** ↑ dairy ↑ kiwifruit some Forestry → Sheep and Beef Tourism/social/cultural: little change

TODAY

	High Landscape Diversification
Community thinking about longer term goals	***Scenario B*** ↑ indigenous forest logging ↑ agroforestry ↑ irrigation dairy → high value crops ↑ kiwifruit

Scenario D	Scenario E1	Scenario E2
As in Scenario B Southern part: ↑ sheep and beef ↑ dairy sheep Central Plains: Fully irrigated ↓ dairy ↑ high value crops	***As in Scenario D*** 5,000 ha of LUC 3 Forestry → vegetables	***As in Scenario D*** 50,000 ha of LUC 4 Forestry → Sheep and Beed


Current Land Use Map
Best current version as at 2016
Arable
Dairy
Deer
Forestry
Fruit
Native Forest
Other
Scrub
Sheep & Beef
Vegetables


Scenario E1 - Full Irrg + 5000ha ExFor Convert
Out to 2045
AgroForestry
Arable
Dairy
Deer
Forestry
Fruit
Indigenous Forestry
Irrigated Dairy
Native Forest
Other
Scrub
Dairy Sheep
Sheep & Beef
Vegetables

Summary - % Change vs Current

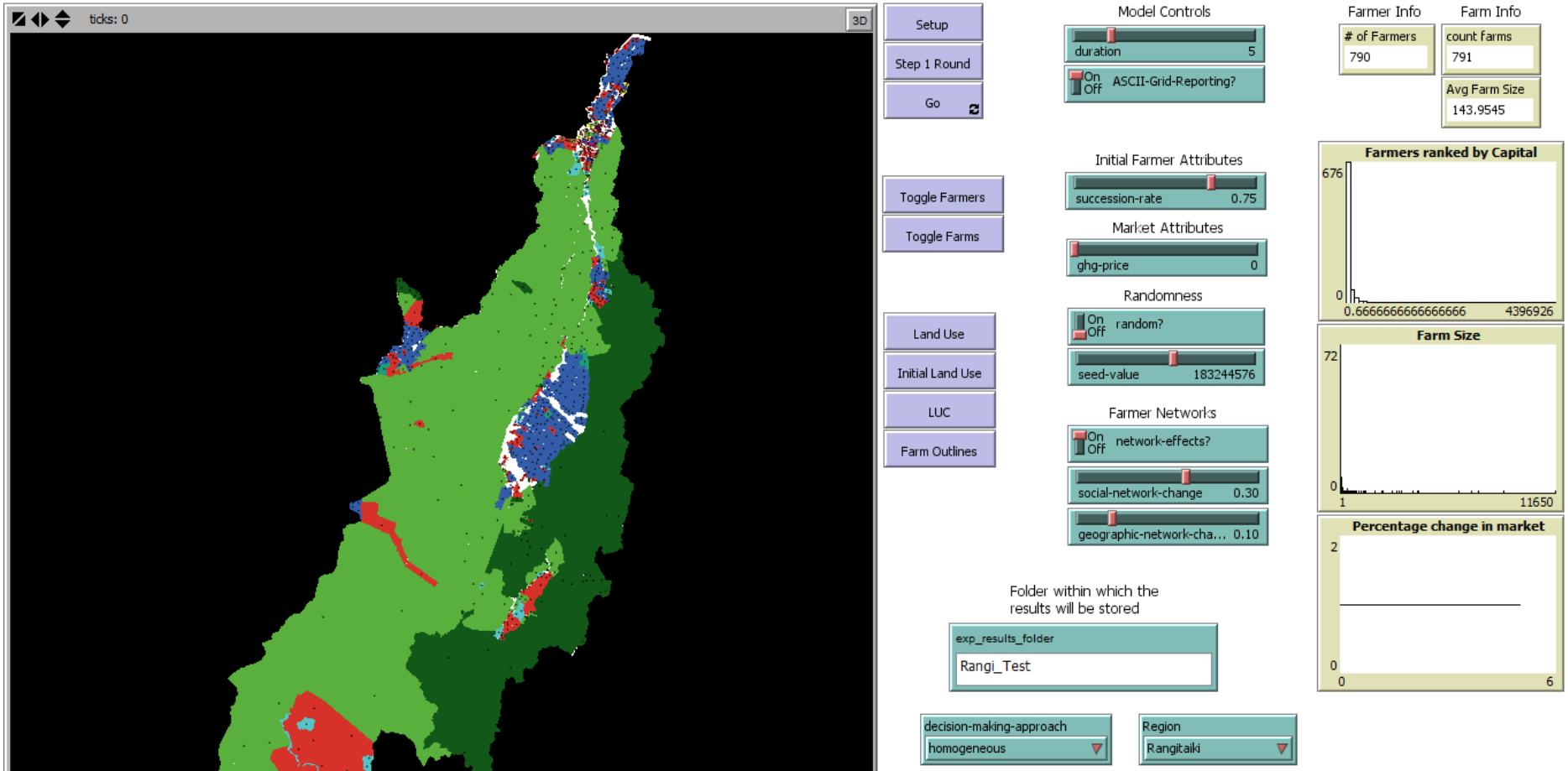
	Scenario B - Long Term	Scenario C - Short Term	Scenario D	Scenario E1	Scenario E2
Profit	23.5%	5.5%	28%	30.5%	19.5%
Net GHG Emissions	1.7%	-2.4%	-5.8%	-10.4%	-55.2%
N Leaching	4.5%	6.2%	2.7%	7.4%	24.4%
P Loss	-2.0%	0.8%	1.0%	0.9%	25.3%
Sediment	-2.9%	0.1%	0.7%	1.2%	19.8%
E.coli	-7.2%	7.4%	-13.7%	-13.4%	45.9%
Labour*	~101%	~9%	~182%	~186%	~192%

* Related to primary production activities only

Scenario Modelling

- Guide – Scenario E1
- SRDM
- Economic (Current Prices)
  - Prices
  - Production
- Social
  - Change in succession
  - Effects of
    - Strong vs. Weak networks

ARLUNZ



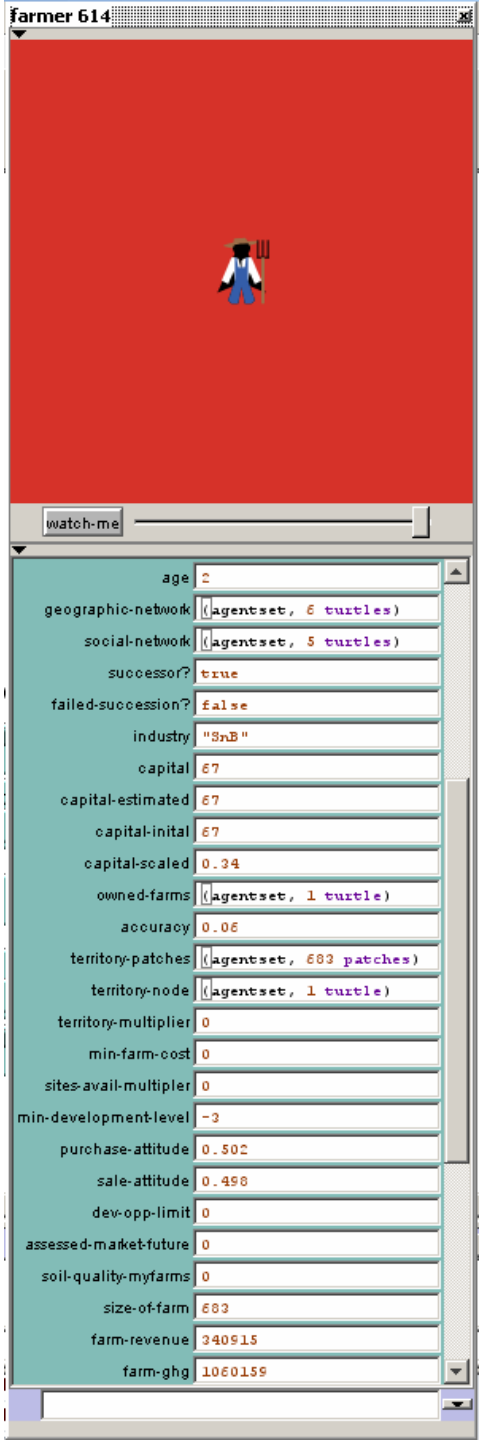
NetLogo GAMS python

Morgan FJ, Brown P, Daigneault, A. 2015. Simulation vs. Definition: Differing Approaches to Setting Probabilities for Agent Behaviour. Land. 4(4):914-937. http://dx.doi.org/10.3390/land4040914

Morgan FJ, Daigneault A. 2015. Estimating Impacts of Climate Change Policy on Land Use: An Agent-Based Modelling Approach. PLoS ONE 10(5). http://dx.doi.org/10.1371/journal.pone.0127317

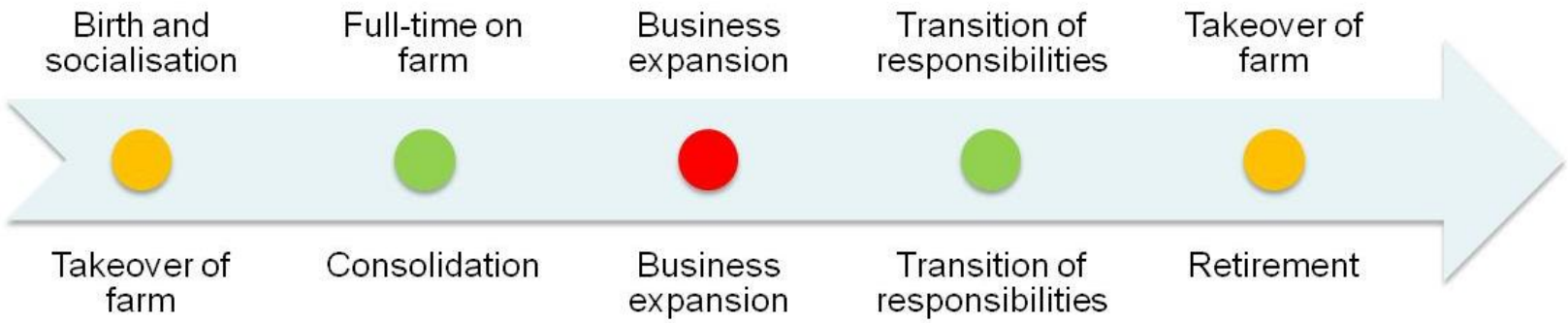
ARLUNZ Farmer agents

- Satisficing approach
- Primarily profit/production driven
- Land use change is tempered by:
  - Land use
  - Farm stage
  - Social and geographic networks
- Behaviour parameterised using specified probabilities



ARLUNZ - Time and Networks

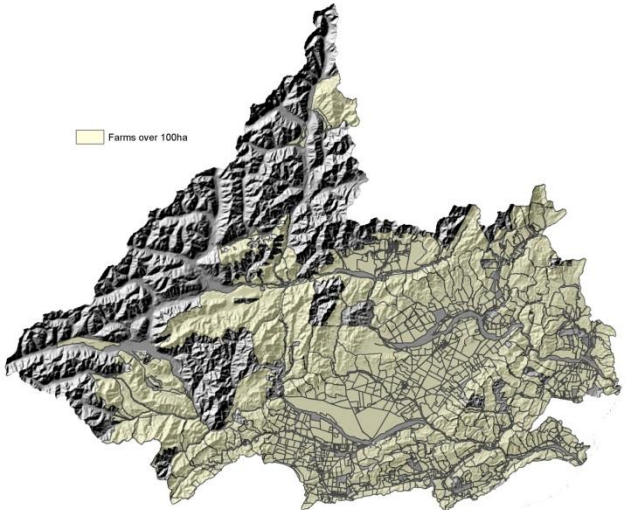
Successor



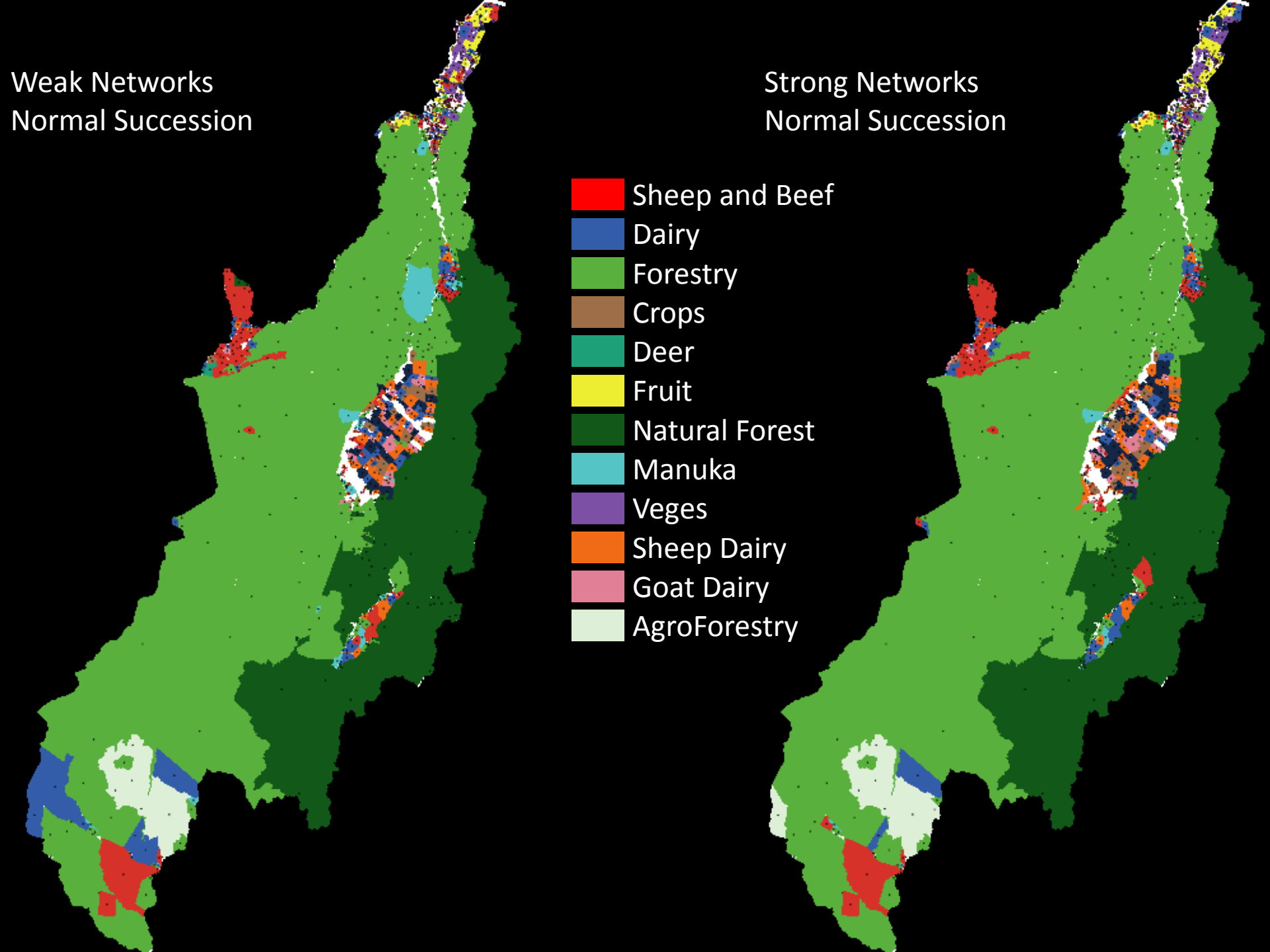
Incumbent

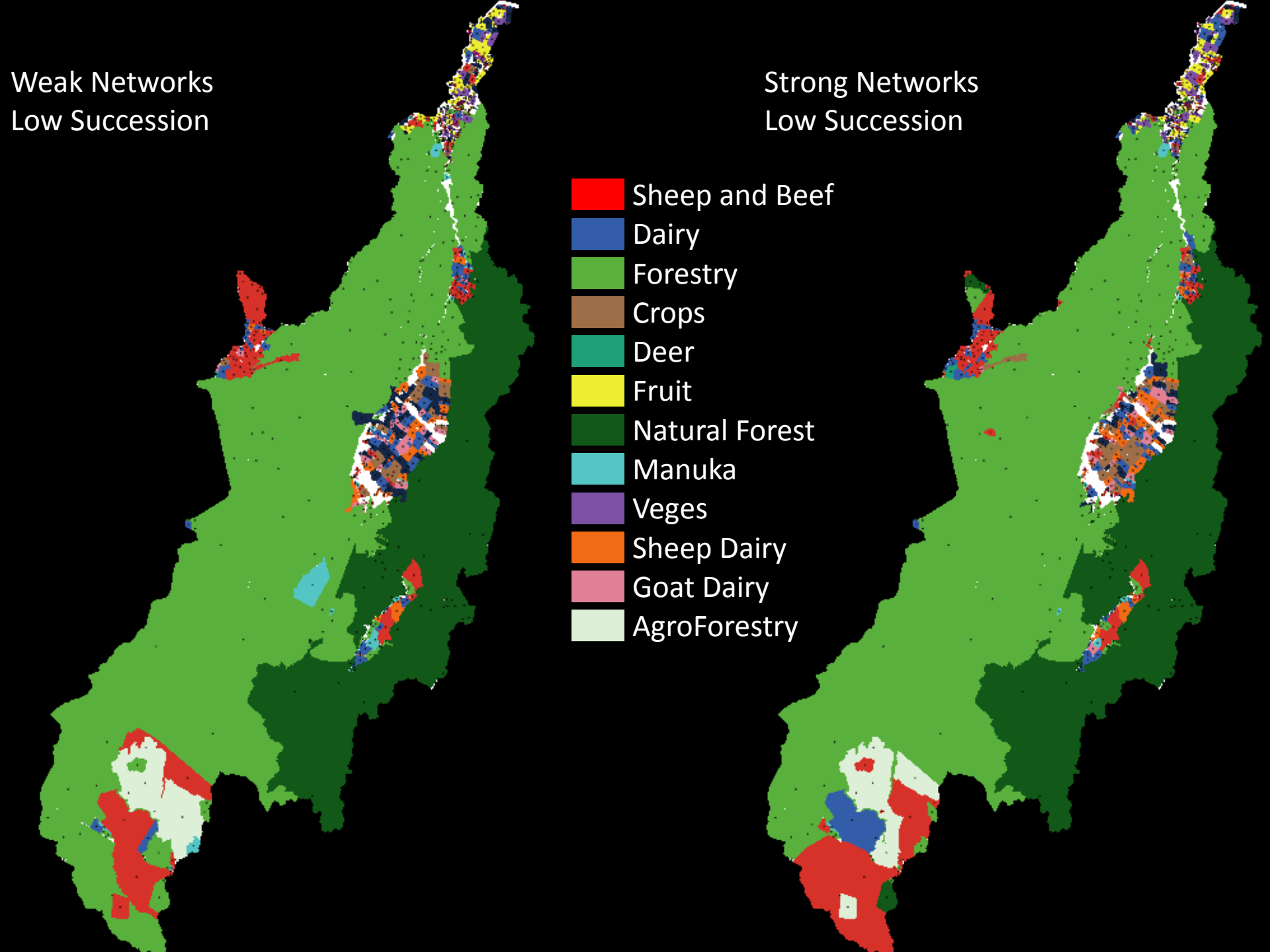
Burton, Forthcoming

Social Network



Geographical Network


Weak Networks
Normal Succession
Strong Networks
Normal Succession
Sheep and Beef
Dairy
Forestry
Crops
Deer
Fruit
Natural Forest
Manuka
Veges
Sheep Dairy
Goat Dairy
AgroForestry


Weak Networks
Low Succession
Strong Networks
Low Succession
Sheep and Beef
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Crops
Deer
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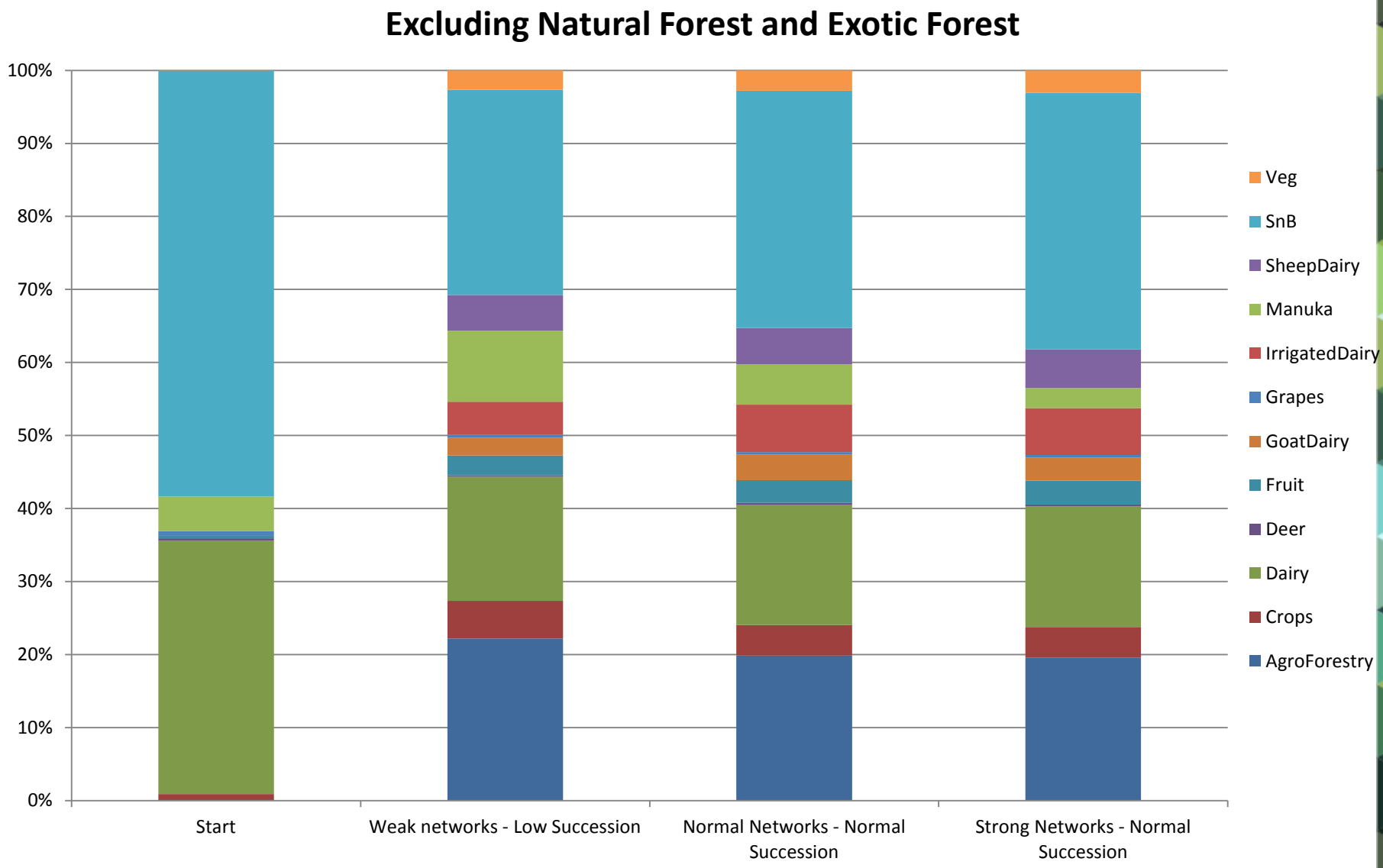
Natural Forest
Manuka
Veges
Sheep Dairy
Goat Dairy
AgroForestry

Summary - % Change vs Current

	Scenario D	Scenario E1	Weak network Low succession	Normal network Normal succession	Strong network Normal succession
Profit	28%	30.5%	14.7%	18.4%	20.9%
Net GHG Emissions	-5.8%	-10.4%	8.5%	8.9%	8.8%
N Leaching	2.7%	7.4%	-0.9%	7.6%	9.8%
P Loss	1.0%	0.9%	-24.7%	-13.3%	-10.1%
Sediment	0.7%	1.2%	-6.1%	-5.9%	-6.1%
E.coli	-13.7%	-13.4%	-29%	-30%	-27%
Labour*	~182%	~186%	~49%	~46%	~51%

* Related to primary production activities only

Change in land use



Regulating Services

Scenarios		D	E1	WN, LS	NN,NS	SN, NS
Air quality reg: pollen		↑↑↑	↑↑↑↑	↓	↓	↓
Climate reg		↓↓	↓↓	↑	↑	↑
Water reg: flow		↑↑↑	↑↑↑	↓	↓	↓
Erosion control		–	↓	↑	↑	↑
Water purification & waste treatment	N	↓	↓↓	–	↓	↓
	P	–	–	↑↑	↑	↑
Biological control						
Disease regulation		↑↑	↑↑	↑↑↑	↑↑↑	↑↑↑
Pollination						
Natural hazard reg						

Cultural Services

Scenarios	D	E1	WN LS	NN NS	SN NS
Recreation & eco-tourism					
Ethical & spiritual values					
Educational & inspirational values					

Increase	↑
Decrease	↓
Little/no change	–
No data (estimate)	↑ – ↓

Supporting Services

Scenarios	D	E1	WN,LS	NN,NS	SN,NS
Habitat provision: all forest	↓↓	↓↓↓	↑	–	↓

Provisioning Services

Scenarios	D	E1	WN,LS	NN,NS	SN,NS
Crops	↑↑↑↑	↑↑↑↑↑	↑↑↑↑	↑↑↑↑	↑↑↑↑
Livestock: Milk	↓↓↓	↓↓↓	↓	↓	↓
Livestock: Meat	↑↑↑	↑↑↑	↓↓	↓↓	↓↓
Capture Fisheries					
Wildfoods: honey	↓	↓	↑↑	↑	↓
Timber & wood	↓↓↓	↓↓↓↓	↑↑	↑↑	↑↑
Fibres & resins	↑↑↑	↑↑↑	↓↓	↓↓	↓↓
Ornamental resources					
Biomass Fuel	↓↓↓	↓↓↓↓	↑↑	↑↑	↑↑
Freshwater					
Genetic resources					
Biochemicals, natural medicines & pharmaceutals: Rongoa & ginseng	↑ ↑	↑ ↑	↑ ↑↑↑	– ↑↑	↓ ↑↑

Opportunities Identified

- Re-configure catchment conversations
- Utilise the enormous forest areas differently
- Grow tourism
- Raise the profile of the catchment
- Develop rongoā products
- Undertake spatial planning for the catchment
- Attract big business and industry to the catchment
- Make this catchment a place to study

What were the hard bits?

- Availability of knowledge/data/info
- Choice of indicators
- How to include indigenous cultural values
- Language & communication
- Use in decision-making

Land Cover		Ecosystem service													
		Global Climate	Regional and Local Climate	Water Timing and Flows	Erosion Control	Water Purification	Waste Treatment	Disease Mitigation	Pollination	Habitat Provision	Nutrient Cycling	Soil Formation	Primary Production	Water Cycling
Forest	Indigenous Forest	6	16	30	12	30	0	3	0	18	32	1	15	5
	Deciduous Hardwoods	0	0	1	1	0	0	0	0	0	2	0	0	0
	Exotic Forest	12	12	36	18	28	0	2	0	12	49	8	14	10
Scrub and/or Shrubland	Manuka/ Kanuka	2	1	3	3	1	1	0	0	3	8	0	1	1
	Fernland	0	0	0	0	0	0	0	0	0	1	0	0	0
	Matagouri	1	0	1	1	0	0	0	0	0	3	0	0	0
	Sub-alpine Shrubland	0	1	1	0	1	0	0	0	0	2	0	0	0
	Mixed Exotic Shrubland	0	1	0	0	1	0	0	1	1	0	0	1	0
	Gorse and/or Broom	1	0	0	0	0	0	1	0	0	1	0	0	1
Grassland, sedgeland & saltmarsh	Flaxland	0	0	0	0	0	0	0	0	1	0	0	0	0
	Tall Tussock Grassland	1	7	17	1	15	0	0	0	7	16	1	6	0
	Low Prod. Grassland	2	1	4	1	3	0	0	0	4	9	1	4	1
	High Prod. Exotic Grassland	17	17	41	22	35	1	5	1	21	51	8	13	10
Cropland	Short-rotation Crops	4	1	7	4	3	0	0	0	0	12	2	3	2
	Perennial Crops	0	1	1	0	1	1	2	0	0	0	0	0	0
Artificial surfaces	Urban Parkland	0	0	0	1	0	0	0	1	0	1	0	0	0
	Built-Up Area (Settlement)	0	3	3	1	3	0	3	0	3	1	0	0	0
	Surface Mine & Dump	0	0	0	0	0	0	0	0	0	0	0	0	0

Landscape decisions

Key messages

- Clear messaging throughout the process
- How indigenous peoples value are recognised
- Usefulness of building up the modelling to tell the story with the group
- A good lunch goes a long way!

Many Thanks

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Scrub and/or Shrubland	Manuka/ Kanuka	2	1	3	3	1	1	0	0	3	8	0	1	1
	Fernland	0	0	0	0	0	0	0	0	0	1	0	0	0
	Matagouri	1	0	1	1	0	0	0	0	0	3	0	0	0
	Sub-alpine Shrubland	0	1	1	0	1	0	0	0	0	2	0	0	0
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	Surface Mine & Dump	0	0	0	0	0	0	0	0	0	0	0	0	0

No. of Studies

0
1 - 5
6 - 10
11 - 20
21 - 30
> 31

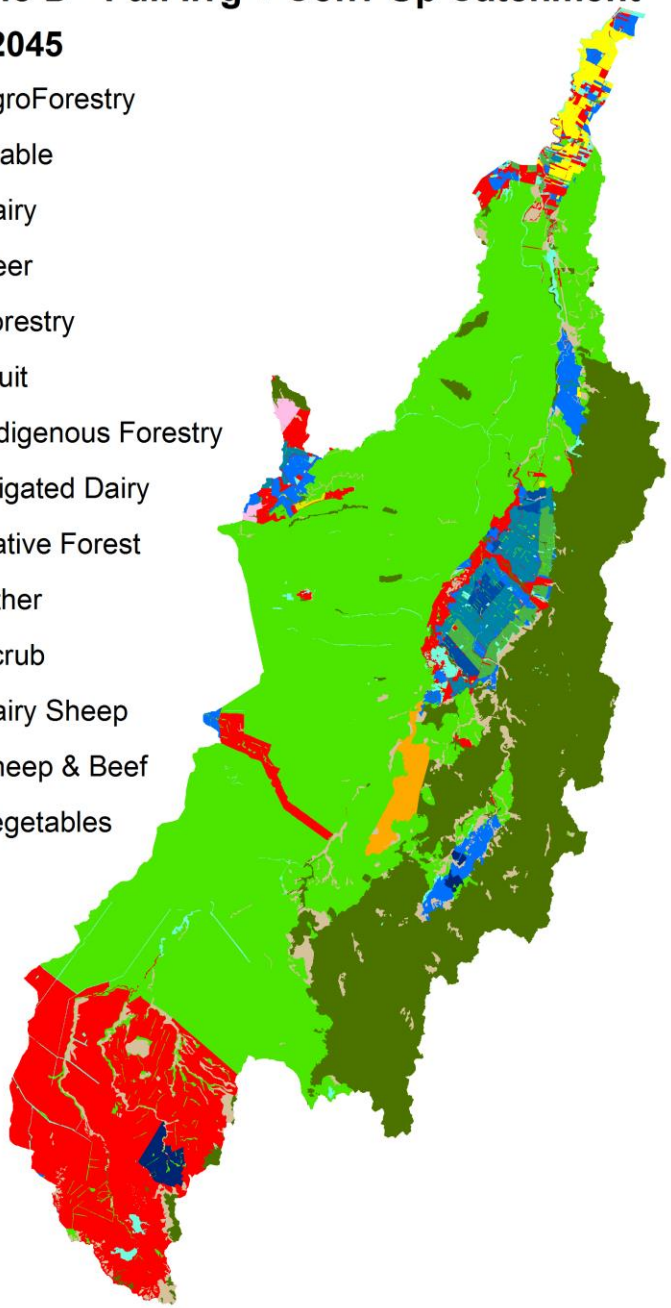
Pathways for the Rangitāiki

objectives	Potential Ecosystem services Indicators
Tuna are protected	Water quality, N, P and sediments - Little impact
Habitats that support indigenous biodiversity are created protected & enhanced	Area of native vegetation - Depends (only small though)
Water quality restored	Water quality: N, P and sediments - P improves - N likely increases
Prosperity is enabled within limits	Number of jobs & catchment profit - Improves
Relationship between communities is encouraged	Strengthened networks between land owners show a range of benefits which we modelled
Practice of kaitiakitanga is recognised & provided for	Cant be modelled, but can be practiced
Naturalness is respected	Area of native forest vegetation unchanged, but slight increase in native scrub (Manuka)
Access to river is maintained and enhanced	Cant be modelled, but can be practiced

Scenario D - Full Irrg + Conv Up Catchment

Out to 2045

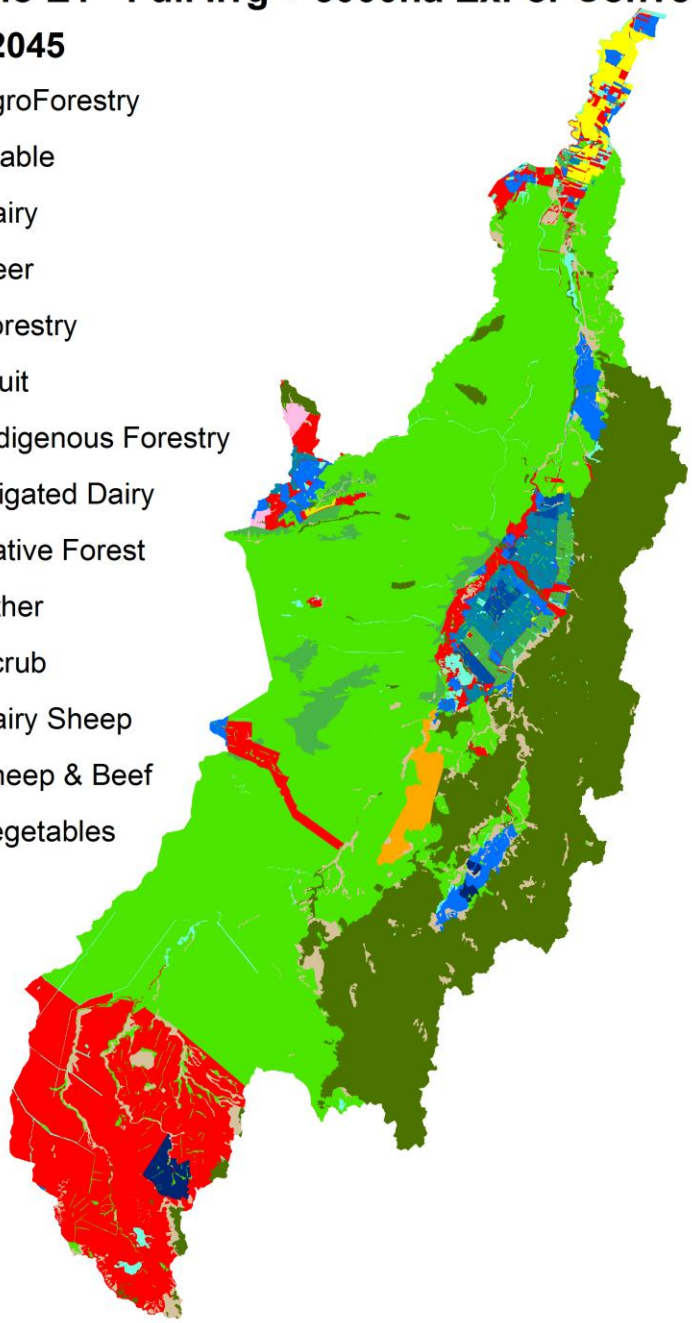
- AgroForestry
- Arable
- Dairy
- Deer
- Forestry
- Fruit
- Indigenous Forestry
- Irrigated Dairy
- Native Forest
- Other
- Scrub
- Dairy Sheep
- Sheep & Beef
- Vegetables



Scenario E1 - Full Irrg + 5000ha ExFor Convert

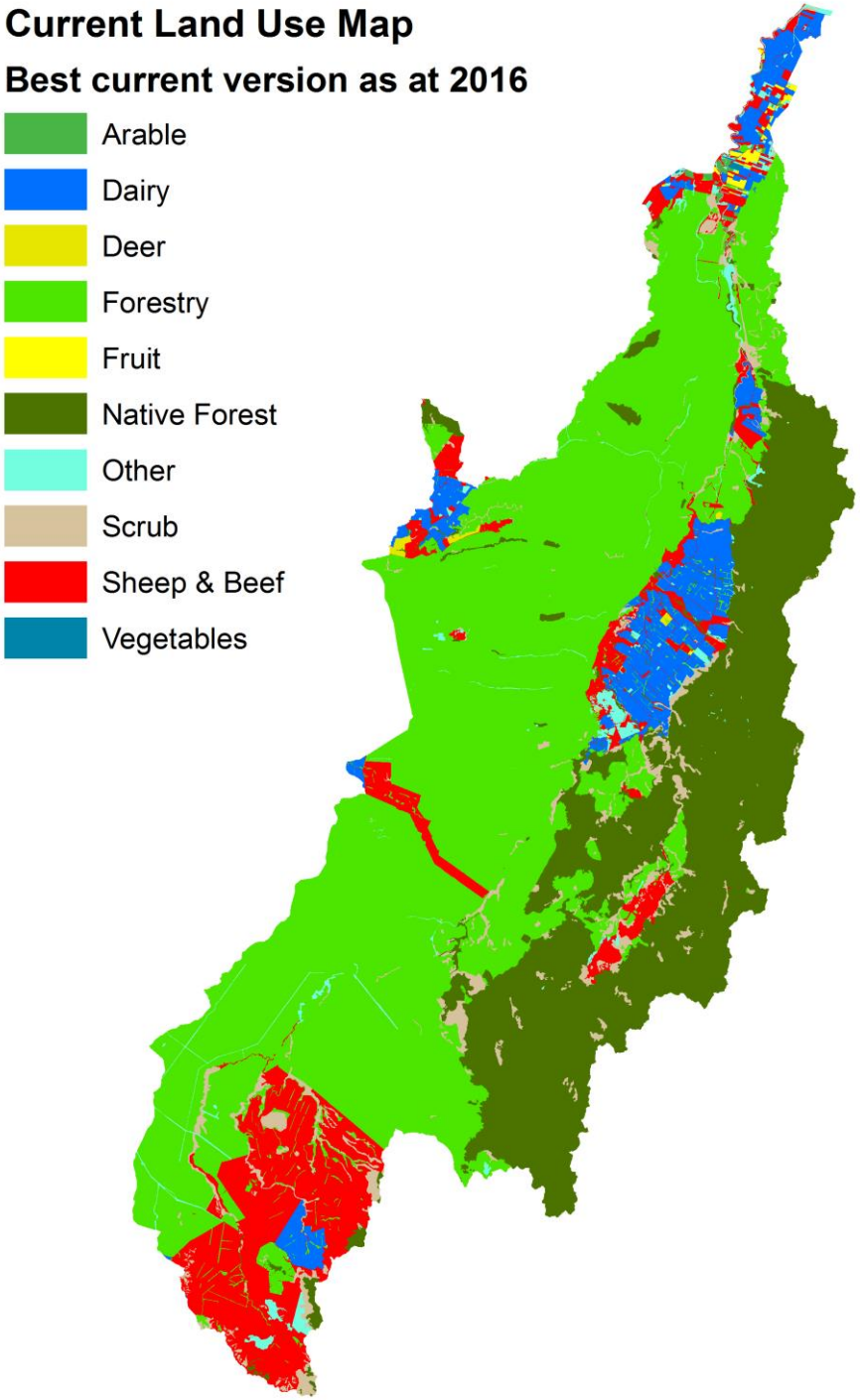
Out to 2045

- AgroForestry
- Arable
- Dairy
- Deer
- Forestry
- Fruit
- Indigenous Forestry
- Irrigated Dairy
- Native Forest
- Other
- Scrub
- Dairy Sheep
- Sheep & Beef
- Vegetables



Current Land Use Map

Best current version as at 2016



Preferred Scenarios

→Somewhere between D and E1

- **Scenario D:**
  - Galatea is irrigated – mostly fruit/veg & some dairy
  - Top of catchment is SNB
- **Scenario E1**
  - Galatea is irrigated – mostly fruit/veg & some dairy
  - Top of catchment is SNB
  - ~5,000 ha of LUC3 land in Kaiangaroa Forest moves into veg (depending on LUC suitability)