CATALYST FUND SEEDING

ROYAL SOCIETY TE APĀRANGI

Simulating future Food Value Chain components through the integration of biophysical and techno-economic spatial model

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The New Zealand Institute for Plant and Food Research Limited

Plant & Food Research Rangahau Ahumāra Kai

Manaaki Whenua Landcare Research

SCION FORESTS • PRODUCTS • INNOVATION

NIWA Taihoro Nukurangi

LINCOLN UNIVERSITY TE WHARE WĀNAKA O AORAKI

IIASA International Institute for Applied Systems Analysis

Design the plant-protein supply-chain with lucerne

ATLAS-APSIM

BeWhere-IIASA

Farm

Lucerne shoots
10-22 t DM/ha
(16-21% CP)

Processes:
- *Sowing*
- *Harvesting*
- *Husbandry*
- *… $ + CO_2*

Transport to industry

Transport of raw material

Industry

High-protein ingredients
(>50% CP, with varying proportions of valuable non-protein components)

Protein Extraction

Low-protein, high-fibre coproducts

coproduct (composition)

Main product

Transport to market

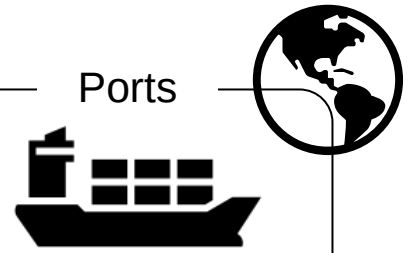
Transport high protein concentrate

Transport coproduct to market

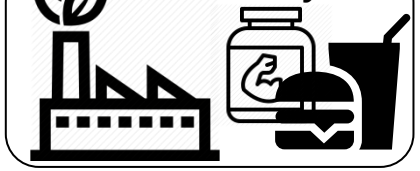
Livestock and aquaculture feed depending on CP

Market

Ports

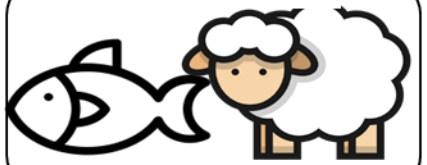


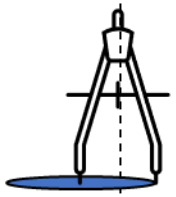
NZ-Industry



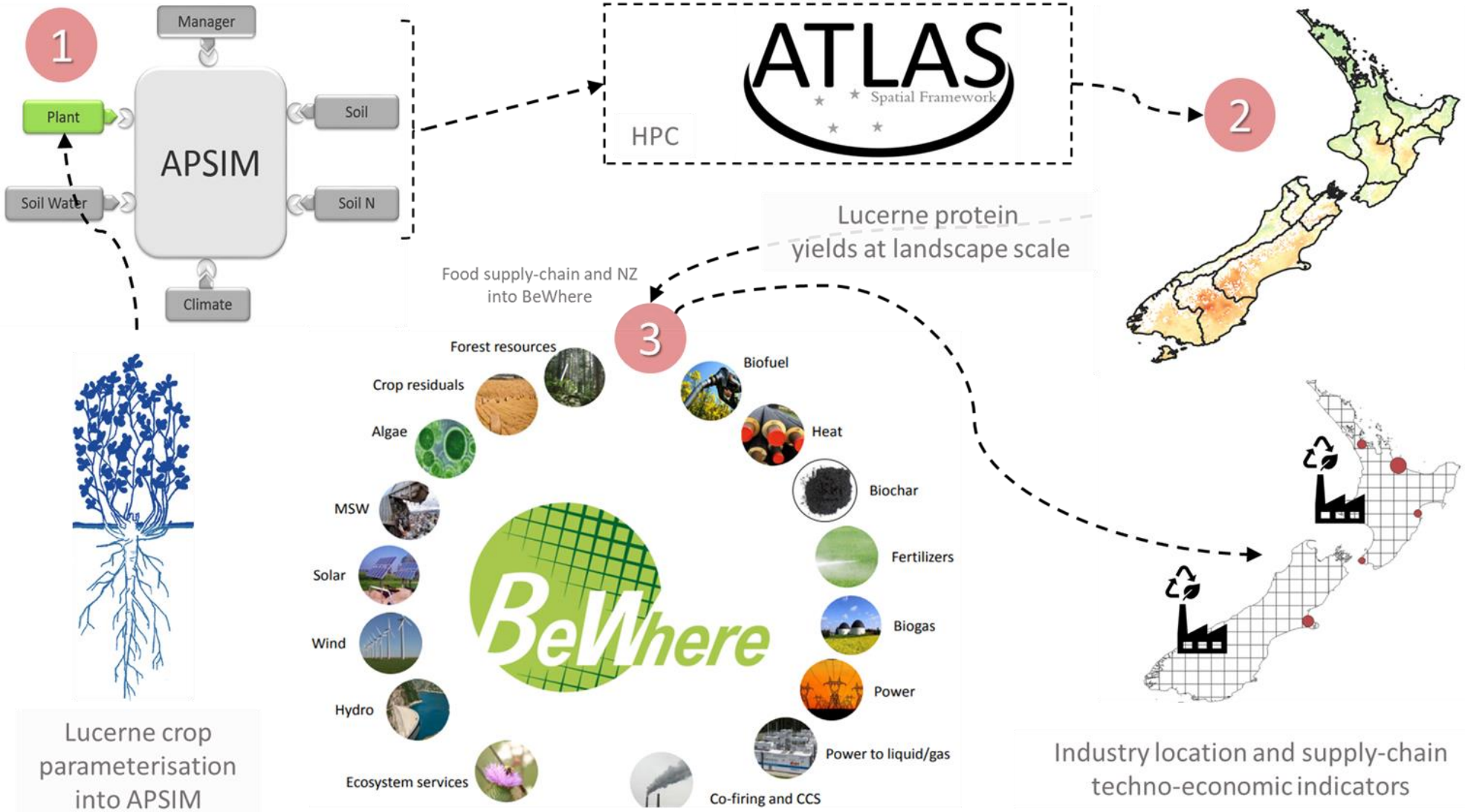
NZ-Retailer

NZ-Farms

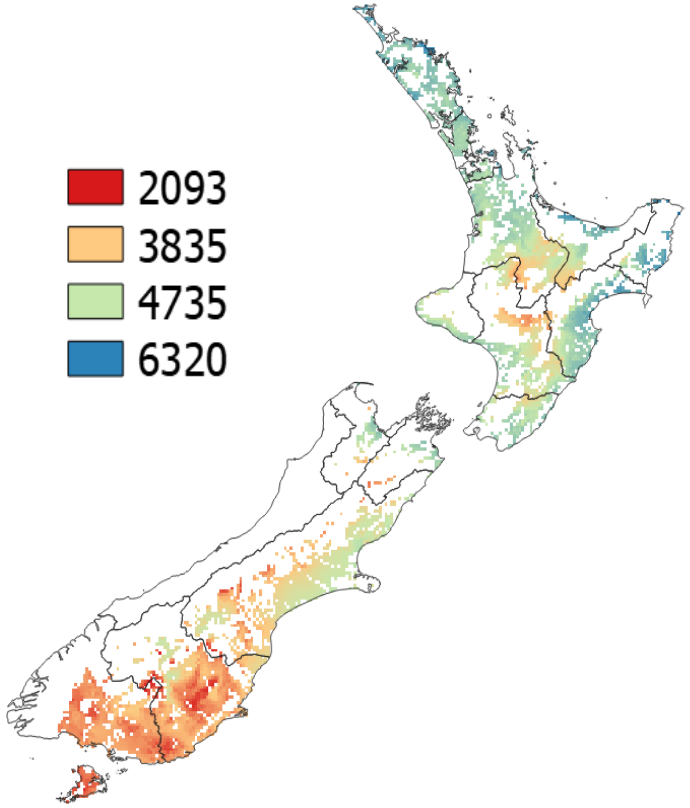




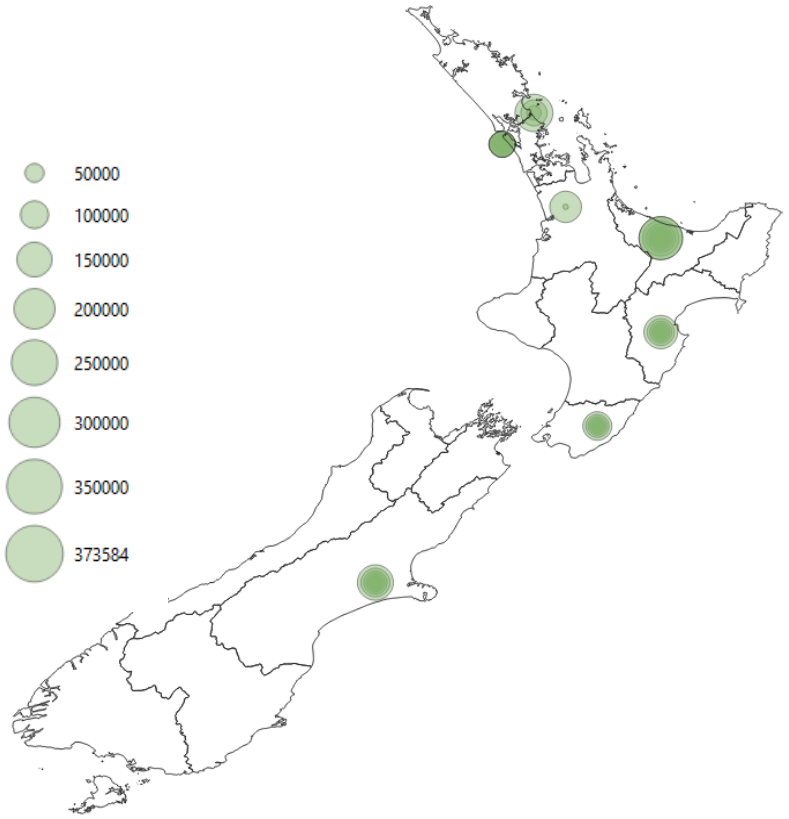
Methods


1
Manager
Plant
APSIM
Soil
Soil Water
Soil N
Climate
HPC
ATLAS
Spatial Framework
2
Lucerne protein
yields at landscape scale
Food supply-chain and NZ
into BeWhere
3
Forest resources
Crop residuals
Algae
MSW
Solar
Wind
Hydro
Ecosystem services
Biofuel
Heat
Biochar
Fertilizers
Biogas
Power
Power to liquid/gas
Co-firing and CCS
BeWhere
Lucerne crop
parameterisation
into APSIM
Industry location and supply-chain
techno-economic indicators

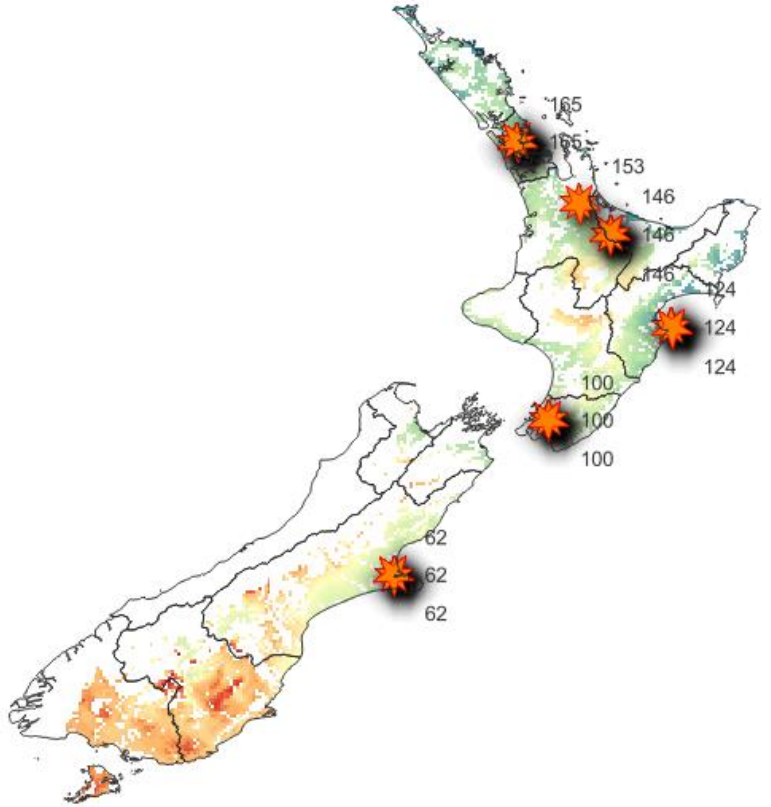
Results



Protein productivity
(kg/ha per year)



Annual supply of lucerne
biomass to processing plants
(kg per year)

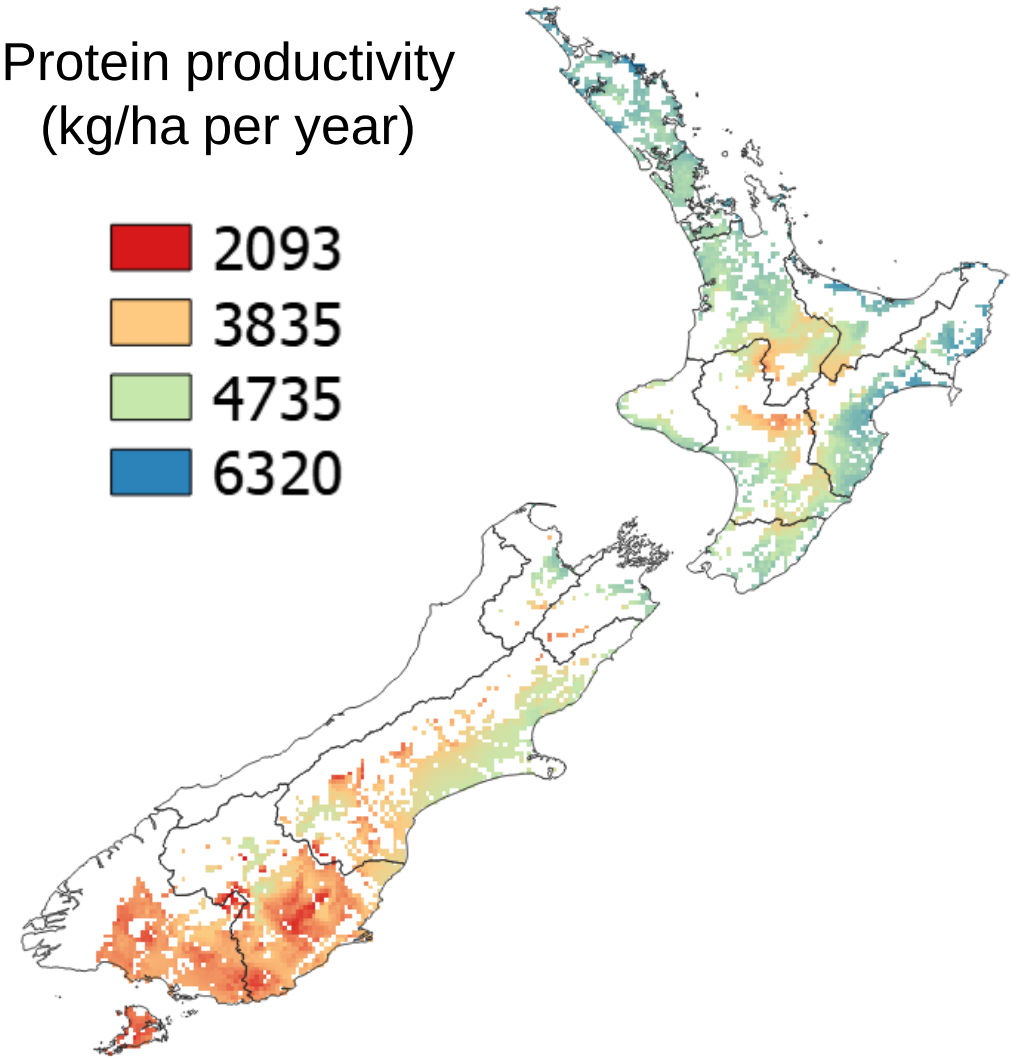


Processing plant locations

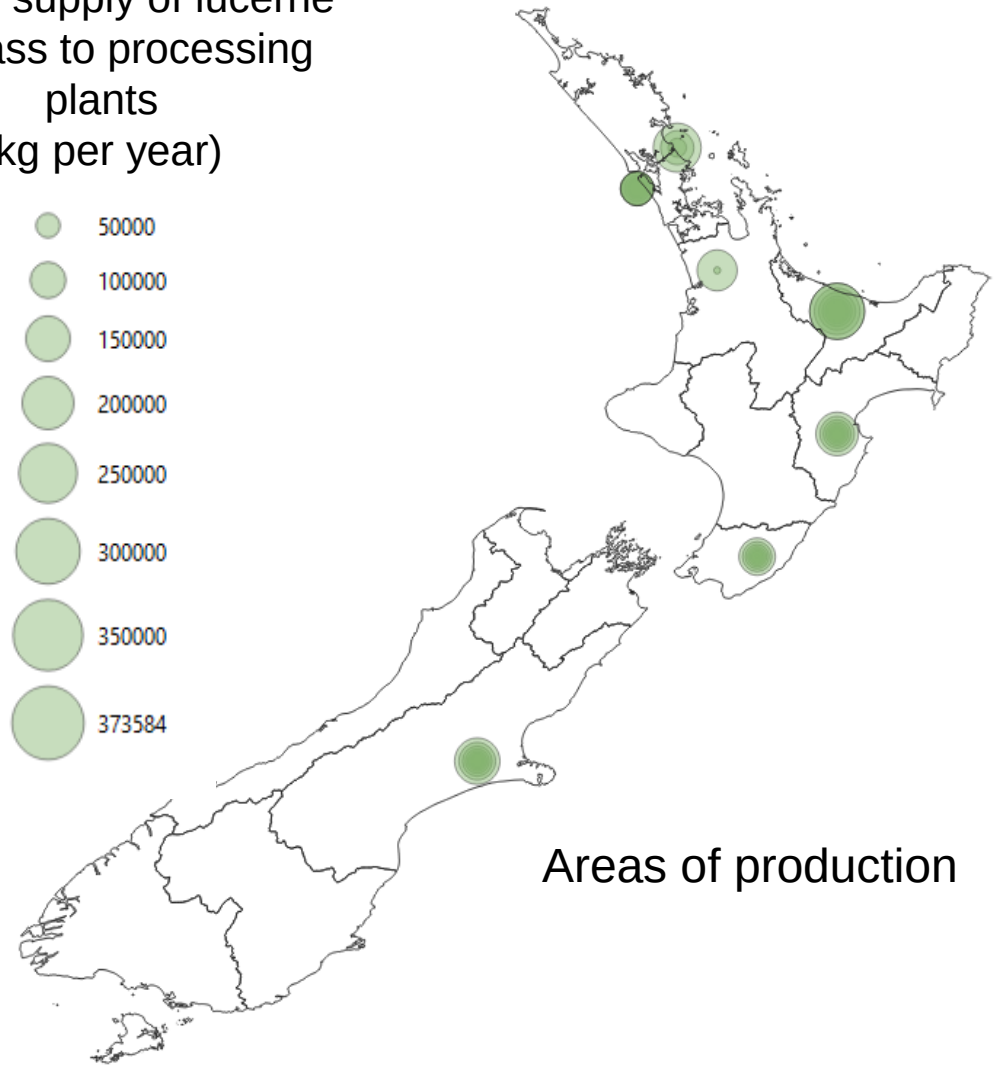
Preliminary results from model sensitivity tests based on hypothetical protein demand

Estimated production areas to supply processing industry

Protein productivity
(kg/ha per year)



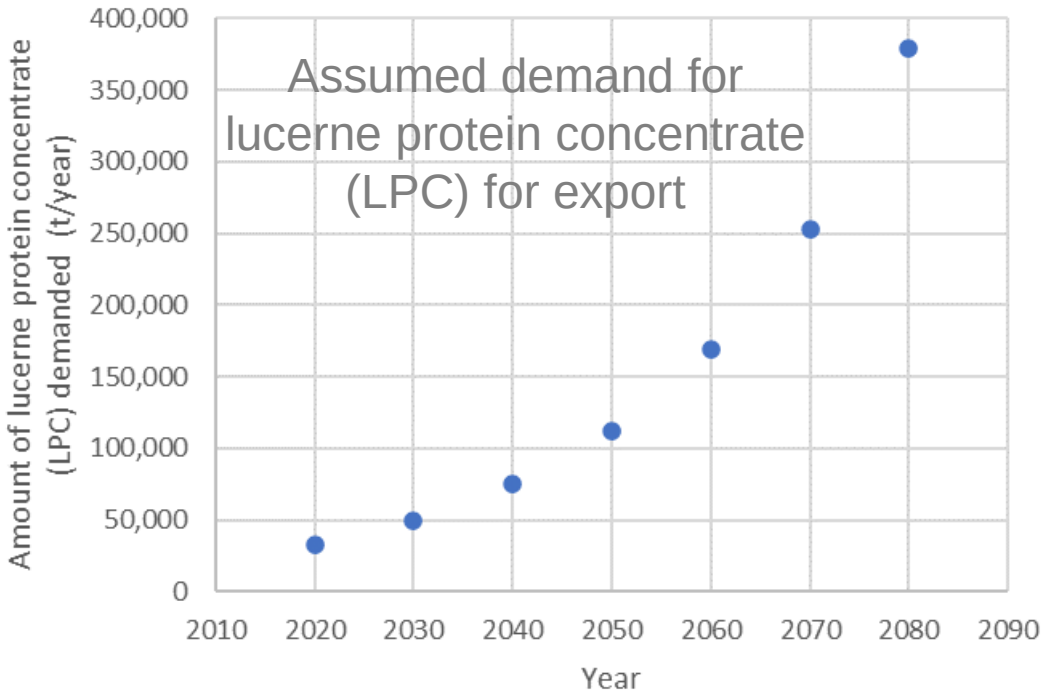
Annual supply of lucerne biomass to processing plants
(kg per year)



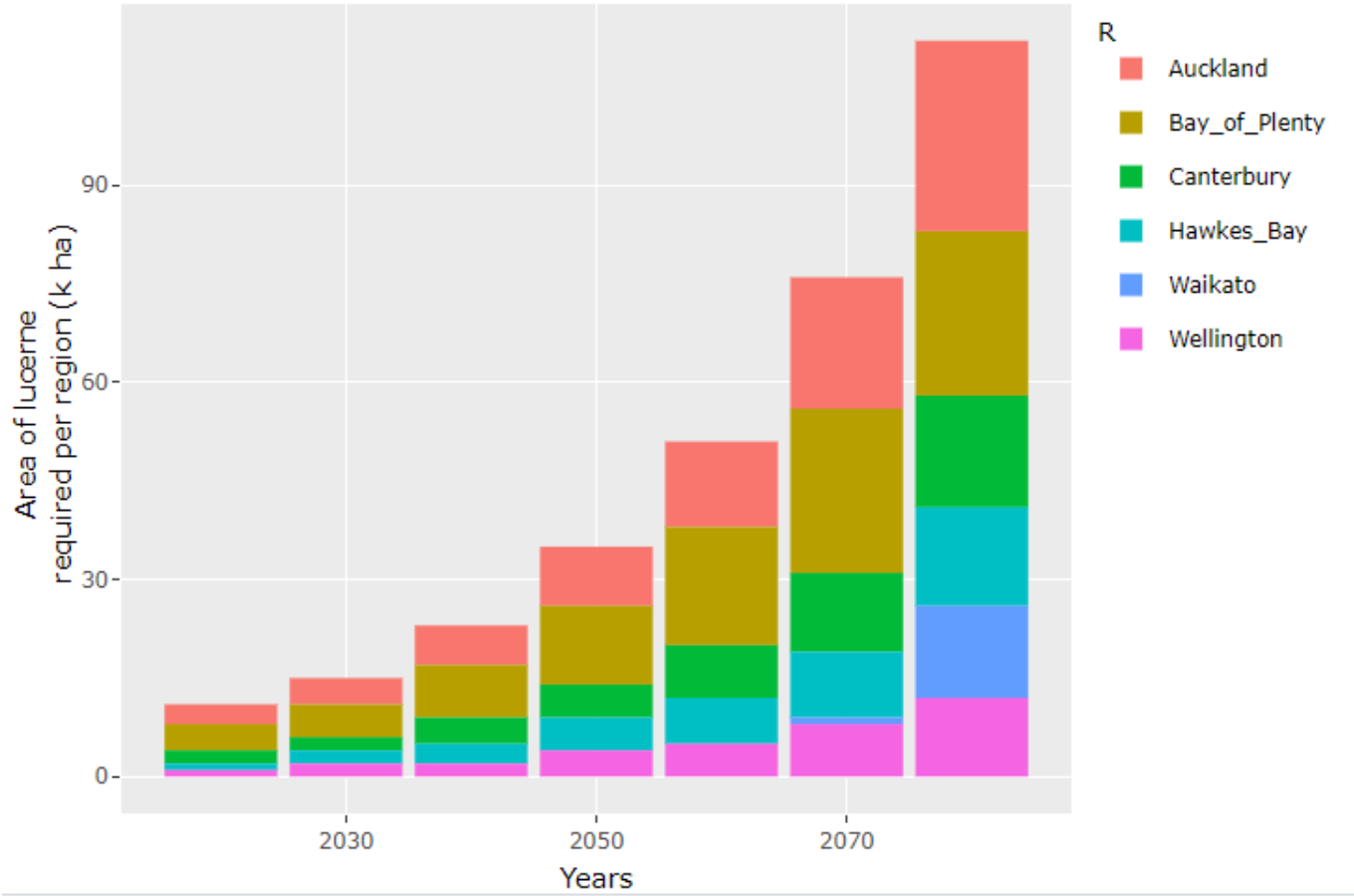
Areas of production

Preliminary results from model sensitivity tests based on hypothetical protein demand

Estimate of lucerne for protein area per region

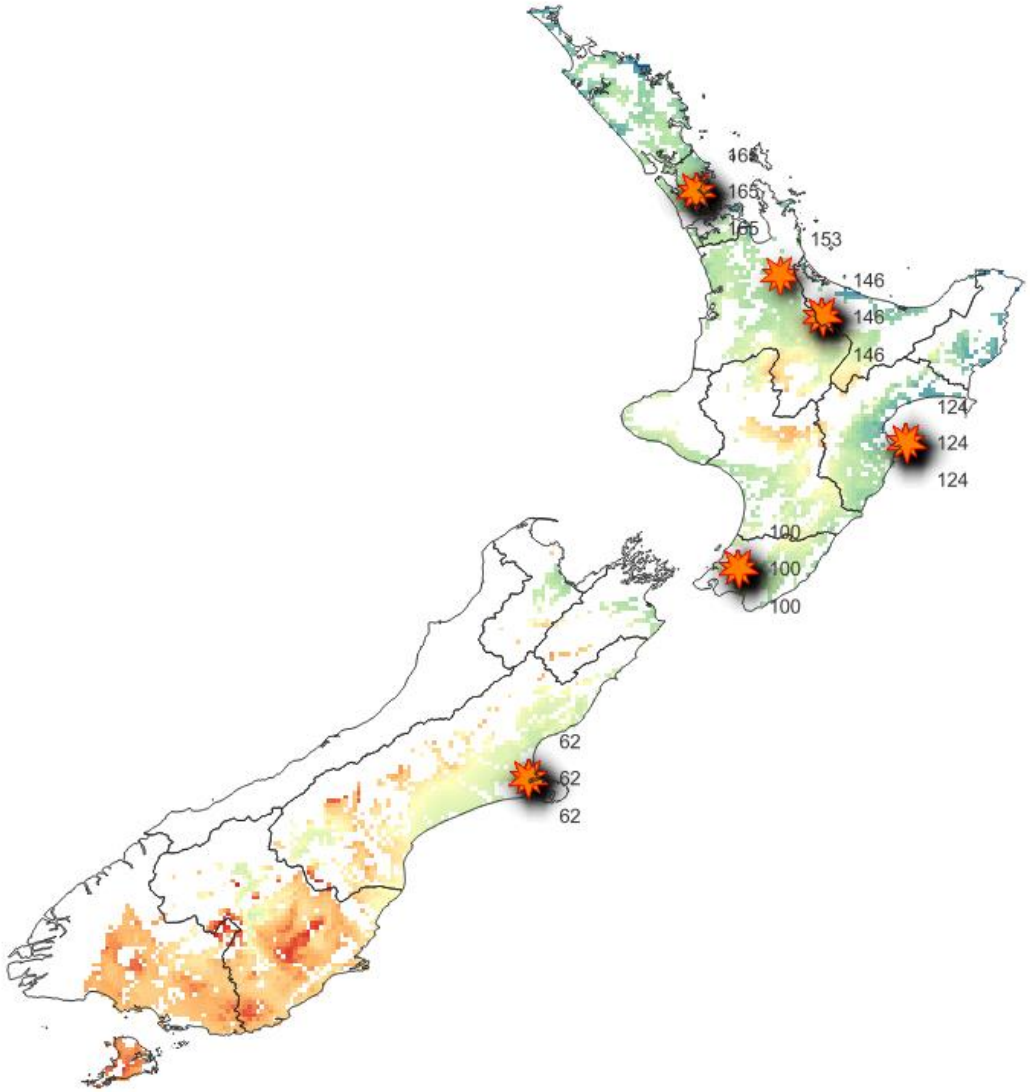


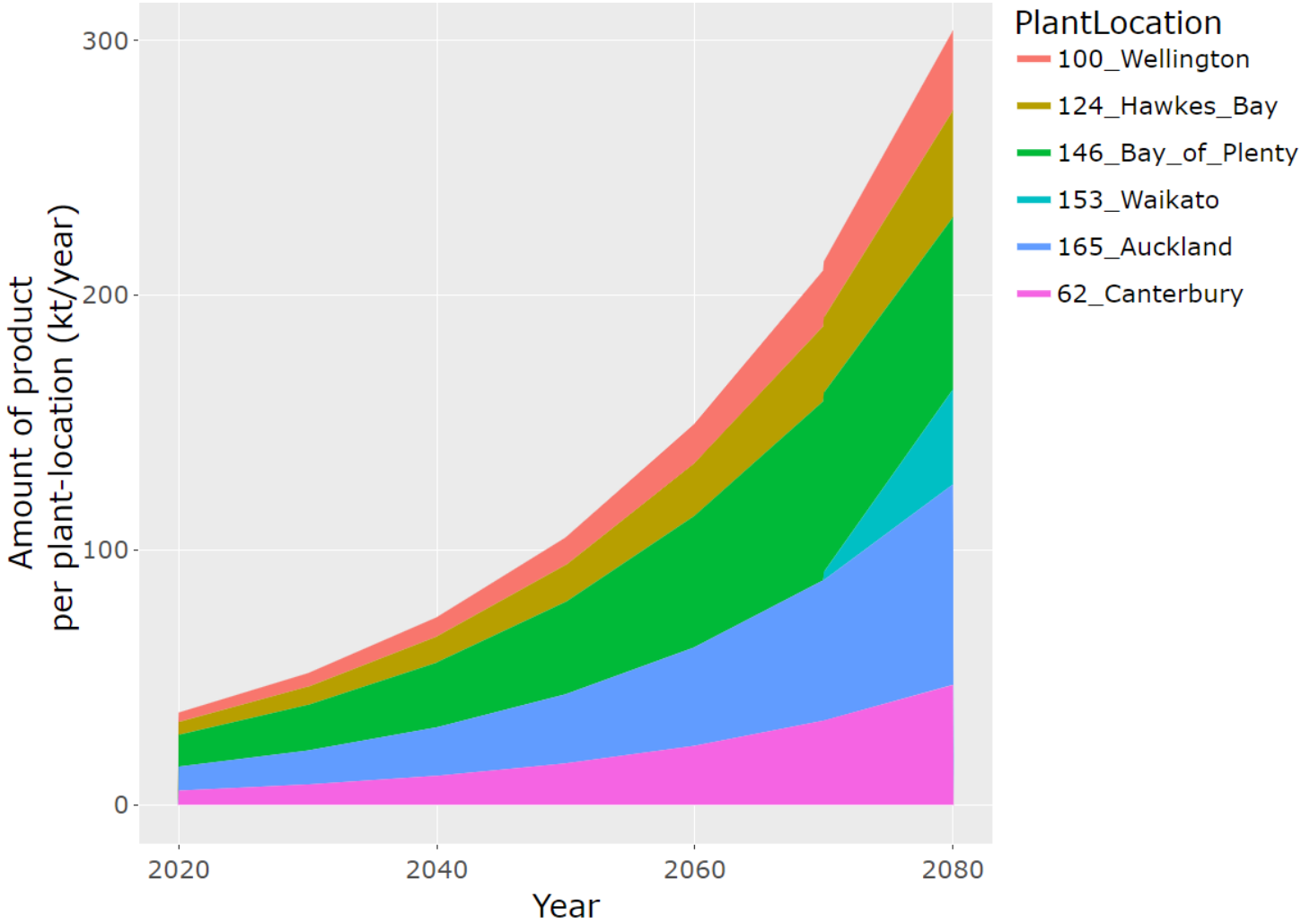
Planted lucerne areas for protein production per region



Preliminary results from model sensitivity tests based on hypothetical protein demand

Estimated location of processing plants





Preliminary results from model sensitivity tests based on hypothetical protein demand

Conclusions

1. It was possible to spatially represent food supply chain components with APSIM/ATLAS/BeWhere
2. Supply and processing plant locations were allocated in high yielding areas close to demand points
3. Demands (amounts and location) were a key driver of spatial model results
4. For next steps after this first sensitivity test run, focus will be on revised parameterisation of costs

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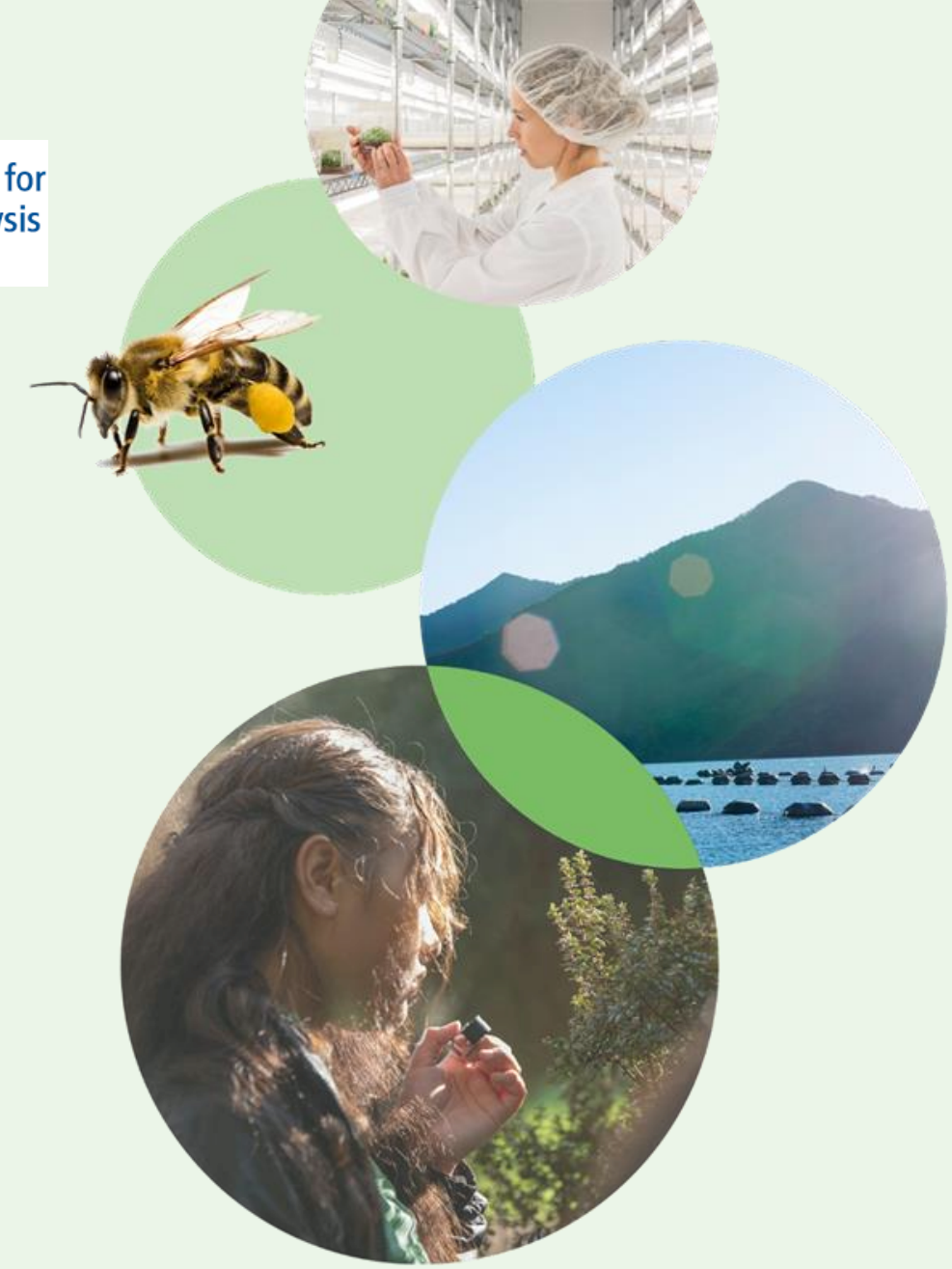

Ngā mihi …Thanks !

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