Modelling the land-use response to climate change: LURNZ simulations for RCP 8.5

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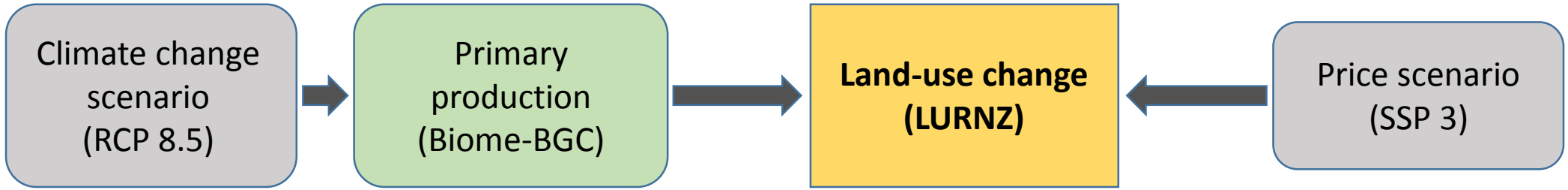
Main Points

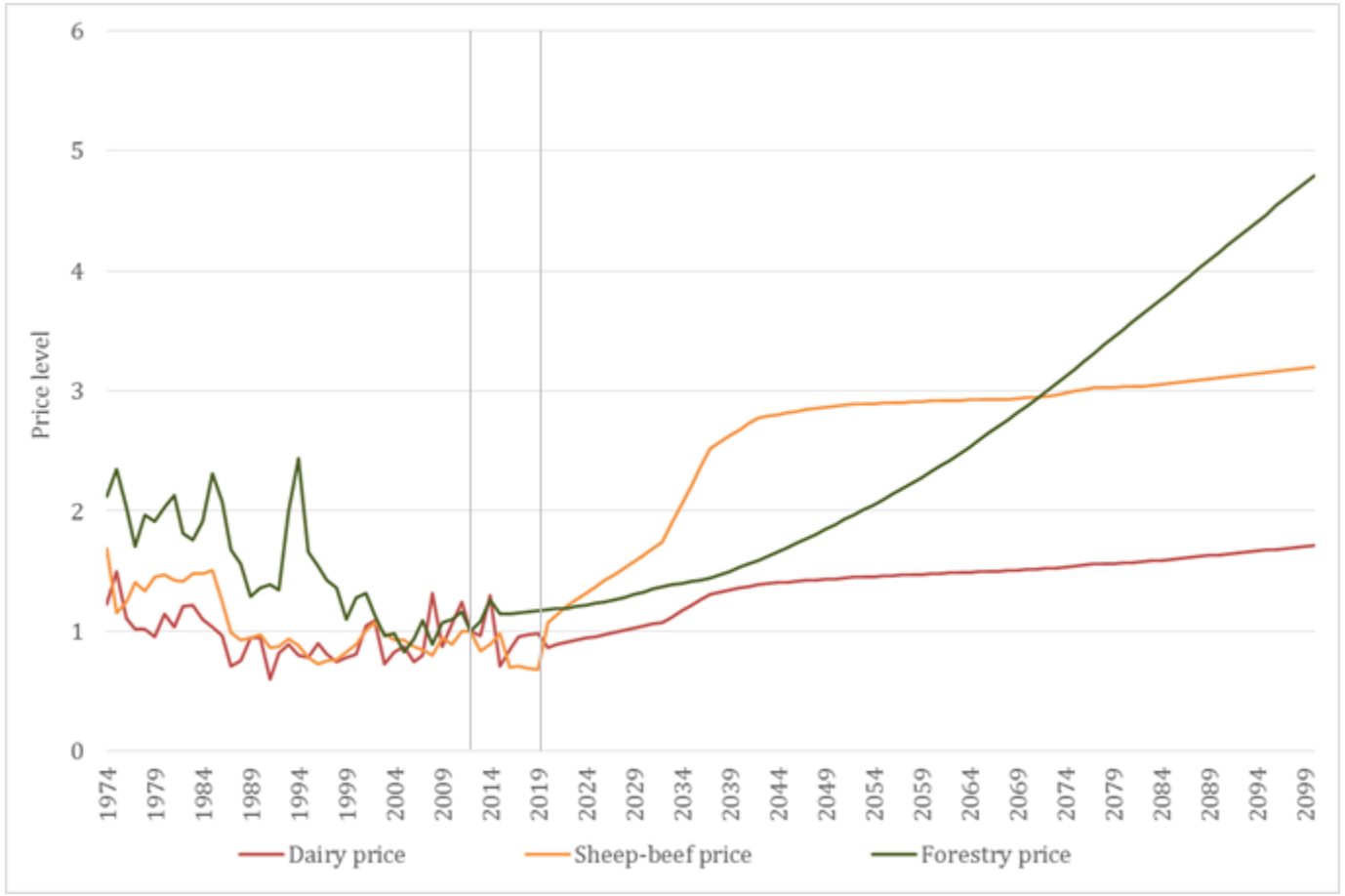
- Caveats…
- SSP 3 – price effect volatile
- RCP 8.5 – climate effect
  - NZ: increase in dairy and forestry
  - NZ: decrease in sheep-beef and scrub
  - Upper Waitaki: little change
- Land-use impact consistent across climate models
- Rate of land-use change not high in historical context

Land Use in Rural New Zealand (LURNZ)

- Econometric model of national land use
- Drivers of land-use change in LURNZ
  - Commodity prices
  - Pasture yields (spatial)
- Simulations require assumptions about future prices and yields (out to 2100)



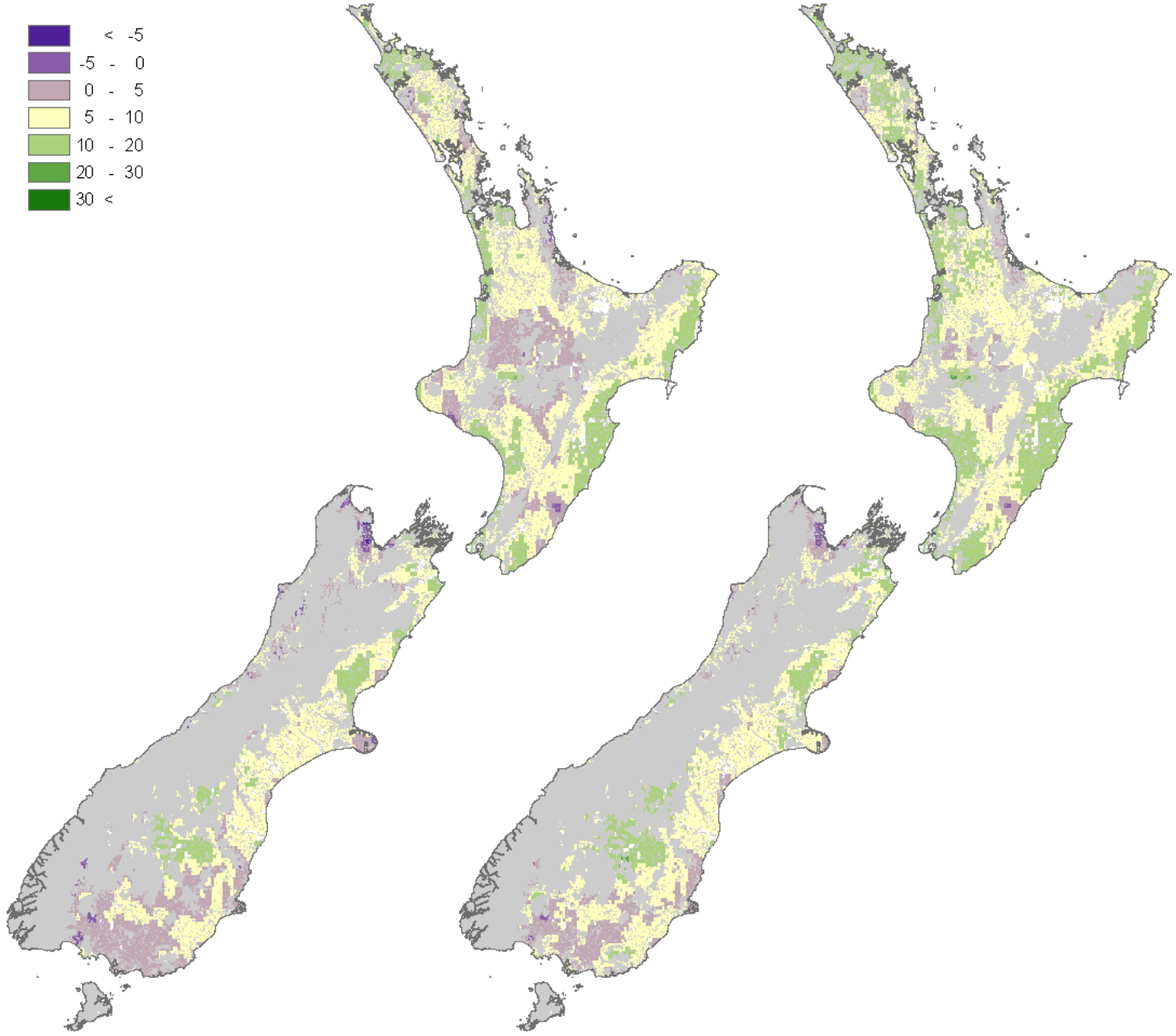
SSP 3 commodity prices



- "Fragmented world"
  - Barriers to trade
  - High inequality
  - High population
- Projections:
  - MPI
  - CLiMAT-DGE
- Pastoral vs forestry price paths

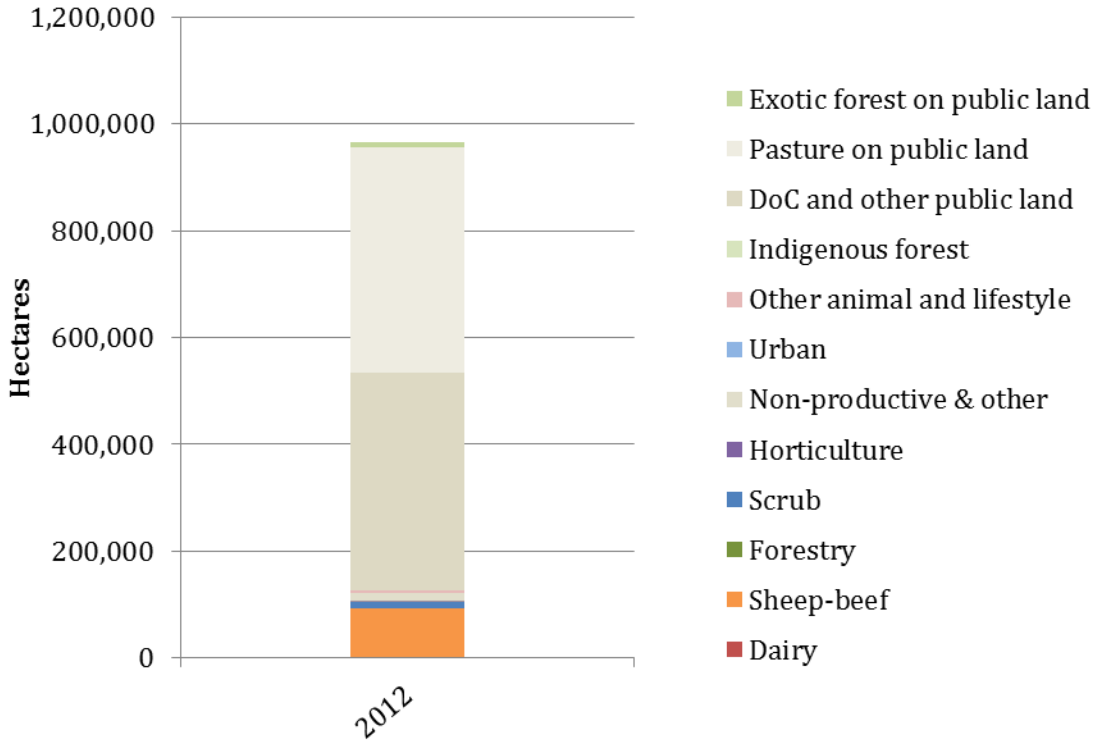
RCP 8.5 yield changes

- End of century
- Model ensemble
- Sheep-beef / dairy



Caveats

- General
  - SSP 3 prices far beyond historical range – speculative
  - Modelling changes in mean climate only
  - No adaptation other than land-use change
  - Irrigation potential is not modelled
- Upper Waitaki
  - Only small fraction of catchment is modelled



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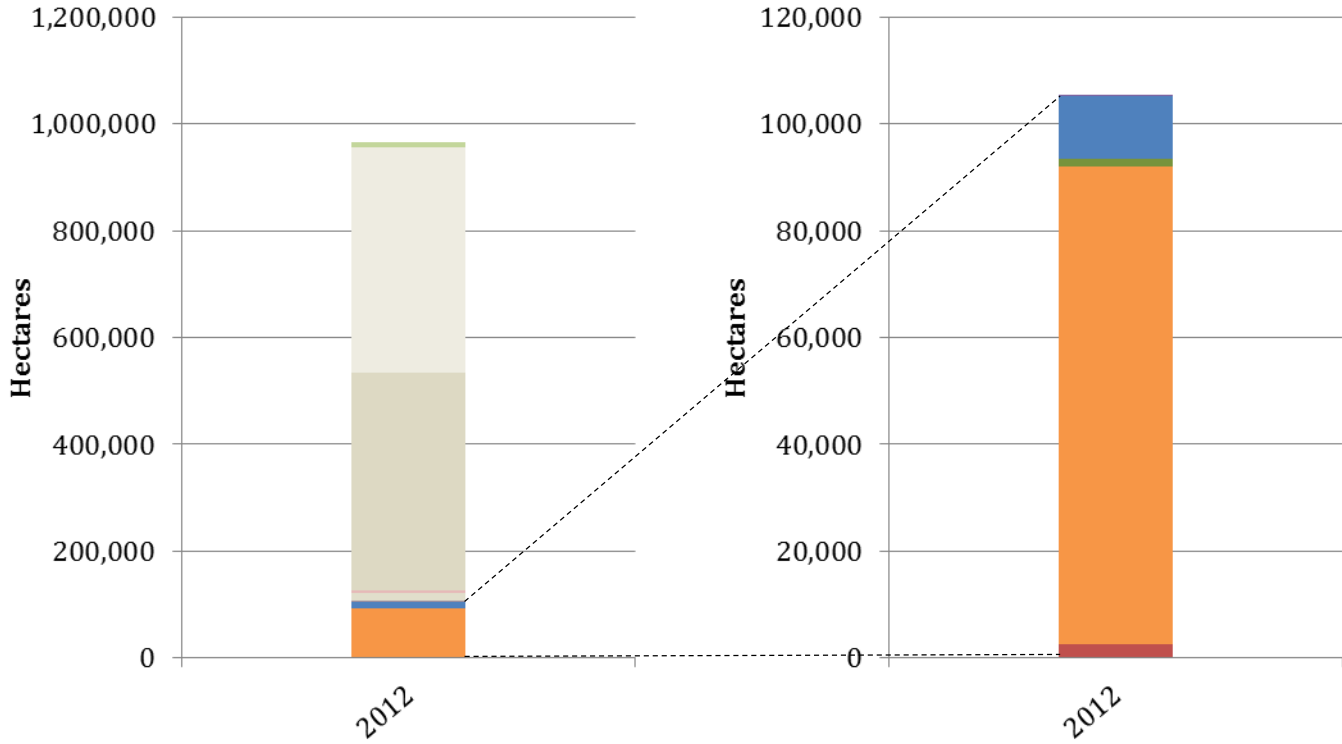
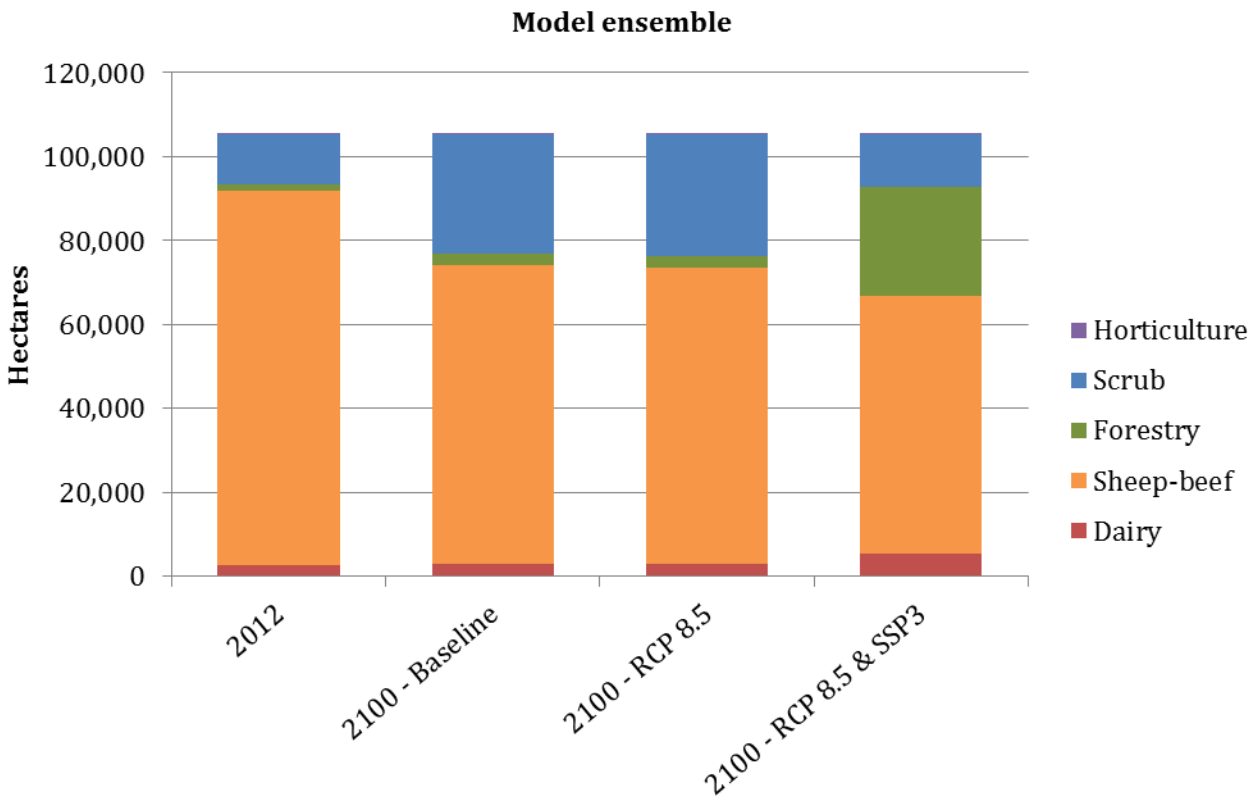


Land use – Upper Waitaki

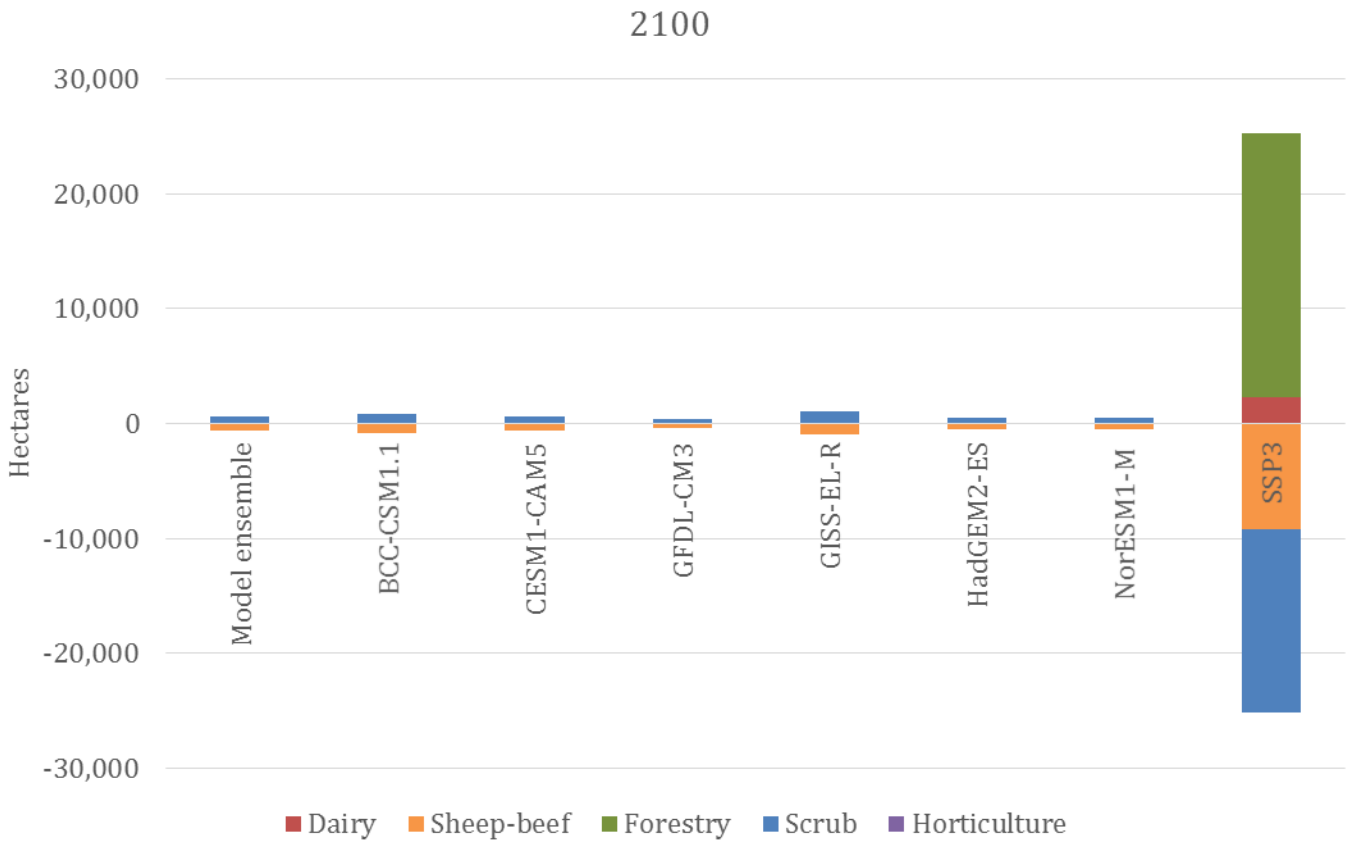


- Baseline: some abandonment of sheep-beef (-20%)
- Climate effect: almost none
  - Similar for rest of catchment?
- Price effect:
  - Large increase in forestry
  - Some increase in dairy
  - Fall in sheep-beef and scrub
- At SSP3 prices: plausible but…

Land-use change – Upper Waitaki

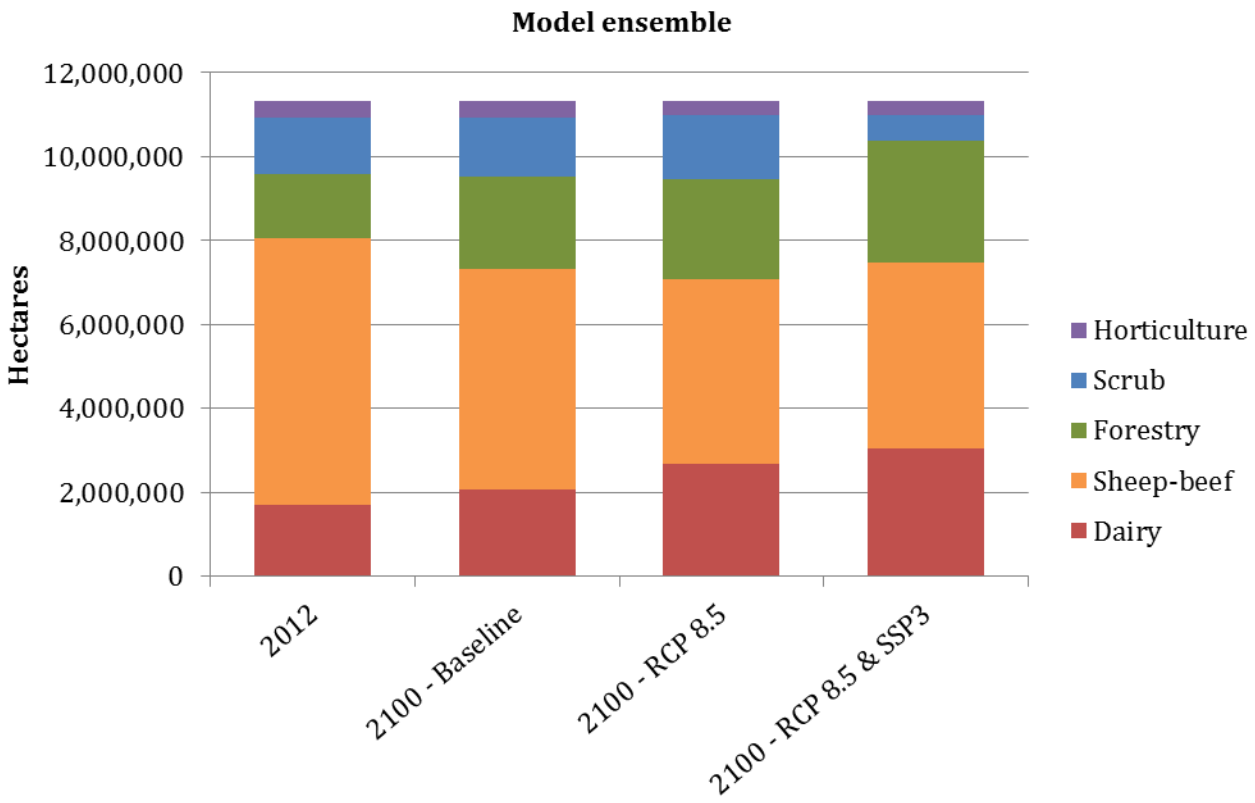
- Shows changes only
- Very little effect from climate change

Land-use change – Upper Waitaki



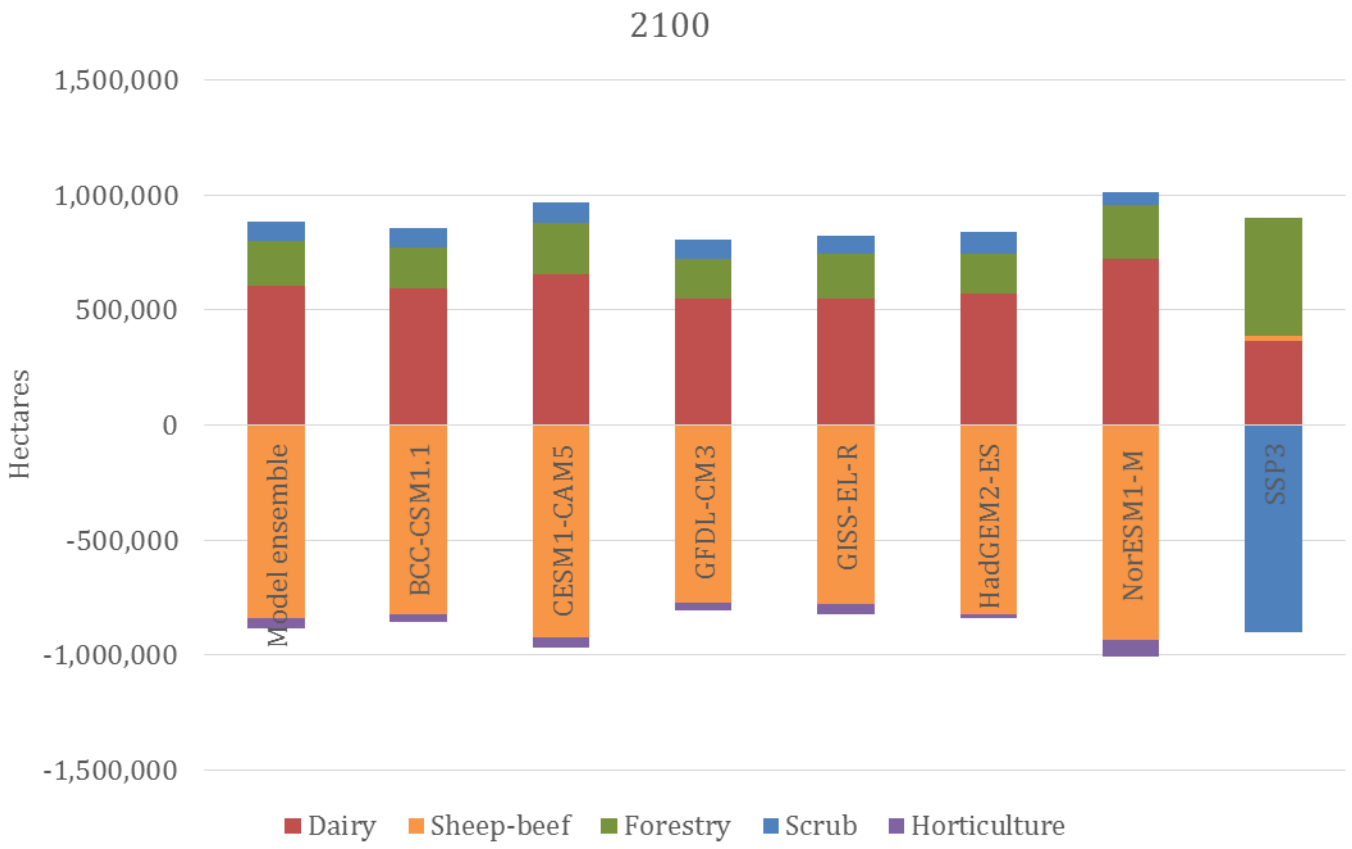
- Shows changes only
- Very little effect from climate change
- Consistency across climate models (6+1)

Land use – New Zealand



- Baseline: sheep-beef to dairy & forestry
- Climate effect:
  - dairy +18%
  - sheep-beef -11%
  - others small +
- Price effect:
  - large increase in forestry
  - also increase in dairy
  - little effect on sheep-beef
- At SSP3 prices: plausible but…

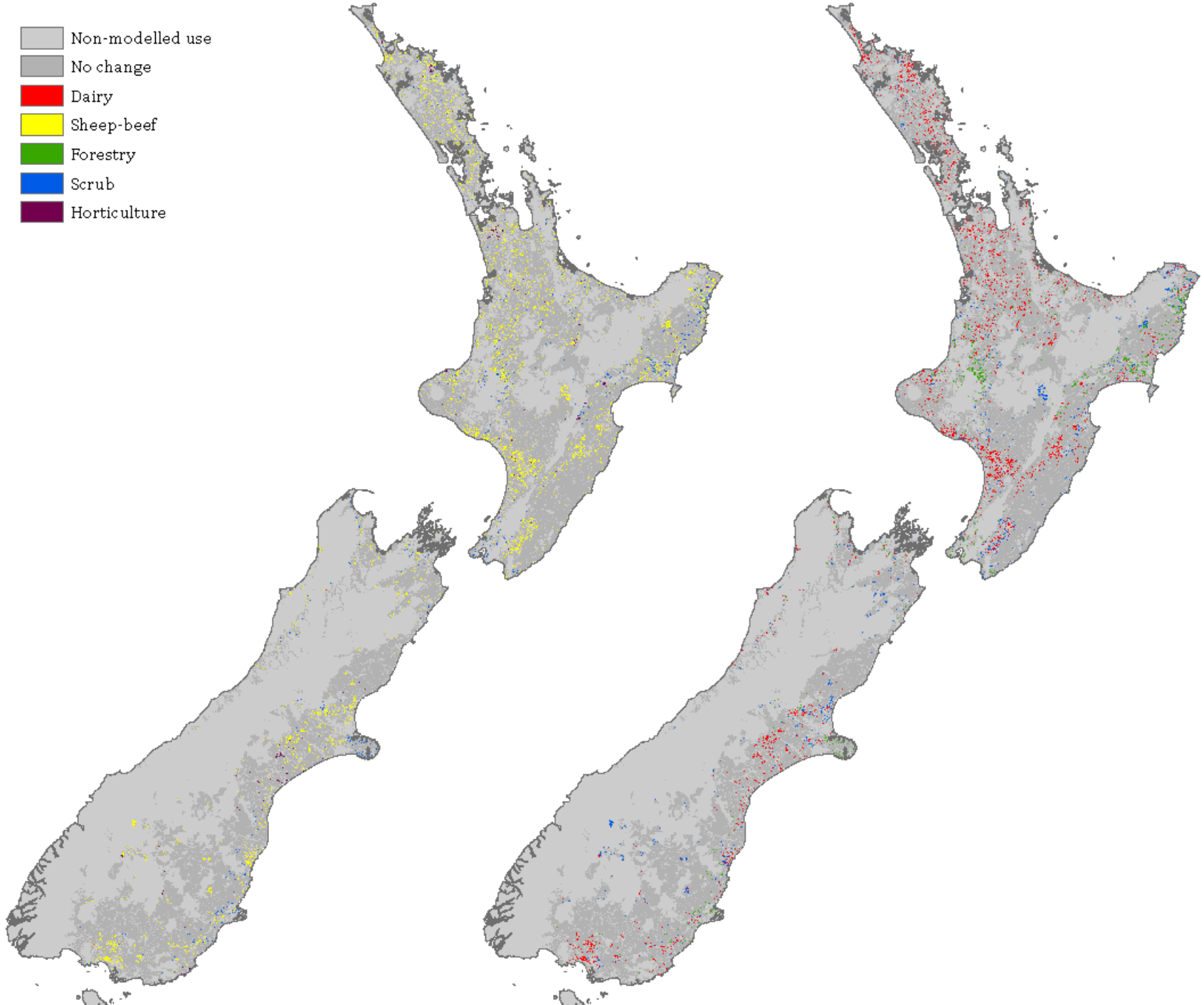
Land-use change – New Zealand



- Results largely consistent across climate models

Land-use impact

- End of century
- Yield effect only
- Converting from / converting to



Conclusion

- Rate of land-use change not high in historical context
- Climate effect (RCP 8.5)
  - Potentially further pressure on New Zealand's water resources
  - Forestry may offset some of the increase in GHG emissions
  - Consistent across climate models
  - Changes in mean climate only, no adaptation
- Price effect (SSP 3): plausible but highly volatile given extreme prices
- Upper Waitaki
  - Modelling small fraction of catchment area (but…)
  - Very little effect from climate change
  - Potentially much larger effect from price changes (forestry from scrub and sheep-beef)