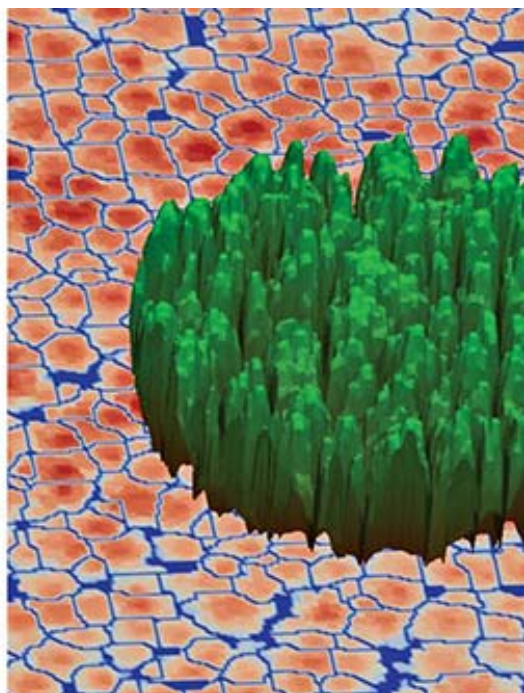# Validation and enhancement of the spatial economic model for planted forests
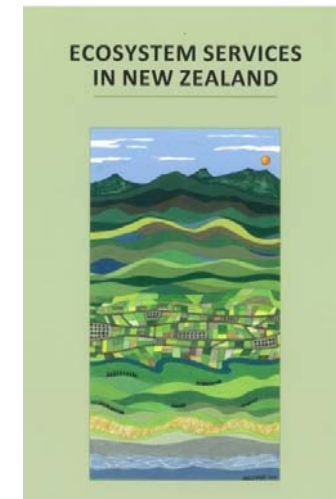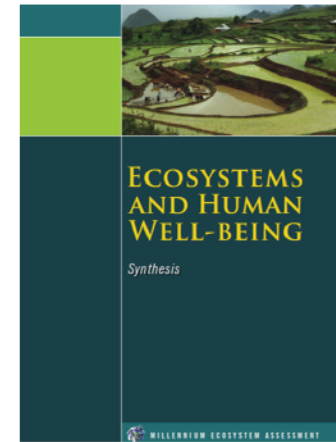
Richard Yao and Duncan Harrison

Outline

- Introduction
- Model validation ($)
- Gathering ecosystem services info and need
- Next steps
- Outcomes

Ecosystem services (ES) approach

- Considers the full range of benefits to humans from ecosystems

- Integrates various disciplines to encourage conversations about ecological, social and economic dimensions of complex issues

- Provides the true value of an ecosystem

- Increases visibility of ecosystem services in decision making

Ecosystem services provided by planted forests

Ecosystem Services

Supporting
• Nutrient cycling
• Soil formation
• Primary production

Provisioning
• Wood and fibre
• Understorey crops
• Freshwater
• Biofuel

Regulating
• Carbon sequestration
• Avoided erosion
• Flood mitigation
• Water purification

Cultural
• Recreation
• Species conservation
• Educational
• Spiritual

Attributes

Security
• Personal safety
• Secure resource access
• Security from disasters
• Employment

Basic material for the good life
• Adequate livelihoods
• Timber
• Shelter

Health
• Strength
• Feeling well
• Access to clean air and water

Social relations
• Social cohesion
• Mutual respect
• Ability to help others

Freedom of choice and action
Opportunity to be able to achieve what an individual values doing and being

Adapted from MEA (2005) and Yao et al. (2013)

Yao, R.T., Barry, L.E., Wakelin, S.J., Harrison, D.R., Magnard, L.A., Payn, T.W., 2013. Planted forests. In Dymond, J.R. ed. Ecosystem Services in New Zealand. Manaaki Whenua Press, Lincoln, New Zealand. Pp. 62-78.

The spatial economic model (FIF+)

- A spatial economic model for New Zealand forestry
  - NZ government agencies (policy)
  - Helps identify land where new forests would be economically viable/unviable (NPV)

- Quantifies environmental benefits
 - C-sequestration, avoided sedimentation, flood mitigation

Barry LE, Yao RT, Harrison DR, Paragahawewa UH, Pannell DJ 2014 Enhancing ecosystem services through afforestation: How policy can help. Land Use Policy 39: 135-145.

Research motivations

- FIF+ economic component **not yet validated**

  → Test the validity of economic estimates by applying it on existing forests (case studies)

- There are several ES. FIF+ can accommodate additional ES spatial value layers

  → Identify ecosystem services that can be added into the model

Validation methodology ($)

- Collect spatial and economic data from case study forests
- Test the reliability of estimates
  - FIF+ estimates vs. actual data
- Face-to-face interview with forest managers regarding the:
  - data provided
  - model design and estimates
  - comments on the model

300 Index, Site Index, Temperature

Slope, Soil, Land Cover, Other Impedances
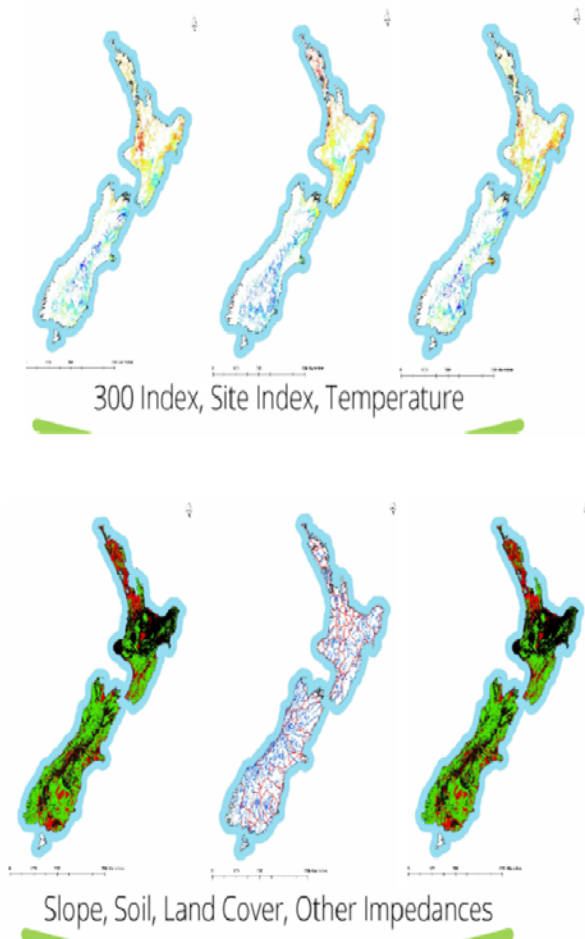
Development methodology (ES)

- Web browsing re ES in the case study forest
- 2nd phase of the face-to-face interview
  - Brief overview of ES
  - Questions on the main ES provided by the case study forests
- Additional information collected via telephone and/or email

Summary of case studies

Case Study Area	Combined Forest Size (ha)	Location	Steps			% Difference (FIF+ vs. Actual)	
			Data Collection	Test	Interview	Costs	Revenue
C1	10K-20K	NI	✓	✓	-	-	-
C2	10K-20K	SI	✓	✓	✓	6	-7
C3	10K-20K	NI	✓	✓	-	-	-
C4	30K-40K	NI	✓	✓	-	-	-
C5	30K-40K	NI	✓	✓	✓	1	1
C6	30K-40K	NI	✓	✓	-	-	-
C7	30K-40K	SI	✓	✓	-	-	-

Validation findings

- Forest managers interviewed satisfied with FIF+
  - Revenue estimates similar to actual
  - Most costs are similar
- Model appropriate for regional and national analysis
- Variation across regions
  - more branchy trees in SI
  - ↑ hindrance factor due to weeds in some NI regions
  - Resource consent for harvesting required in some regions
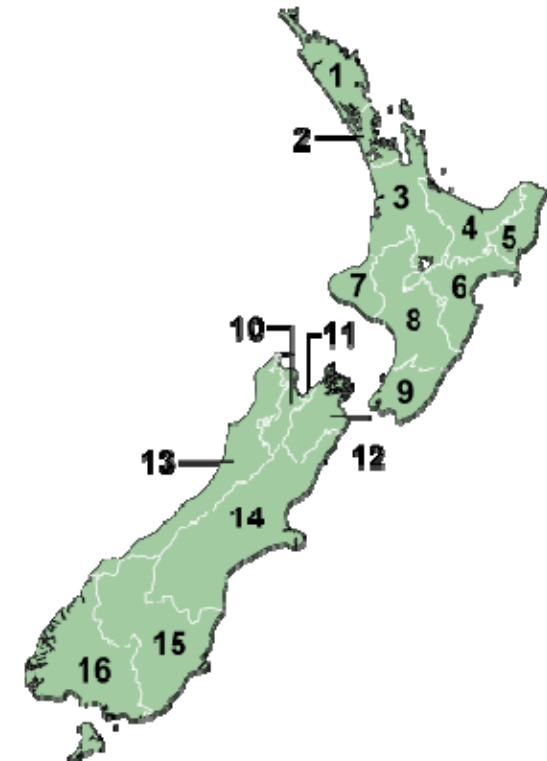
ES identified in case study forests

- Provisioning
  - Logs, drinking water, native tree timber, firewood, game meat
  - Tree fern for fences, biofuel for cogen of heat and power
- Regulating
  - Carbon sequestration, flood mitigation, avoided sedimentation, avoided N
- Biodiversity conservation
  - Habitats for brown kiwi, fern bird, kereru, blue duck, native fish, kakabeak
  - Participation in biodiversity conservation planning
- Recreation
  - Mountain biking, walking, motor biking, hunting, fishing
- Cultural heritage
  - Native reserves, wetlands

Next steps

Case Study Area	Combined Forest Size	Regime	Location	Steps			% Difference (FIF vs. Actual)	
				Data Collection	Test	Interview	Costs	Revenue
C1	10K-20K	Structural	NI	✓	✓	-	-	-
C2	10K-20K	Pruned	SI	✓	✓	✓	6	-7
C3	10K-20K	Structural	NI	✓	✓	-	-	-
C4	30K-40K	Structural	NI	✓	✓	-	-	-
C5	30K-40K	Structural	NI	✓	✓	✓	1	1
C6	30K-40K	Structural	NI	✓	✓	-	-	-

- Complete the economic validation
- Model development/ enhancement
  - Recreation
    - MTB clubs
  - Biodiversity
    - Species conservation
  - Water quality (e.g. avoided nutrients)
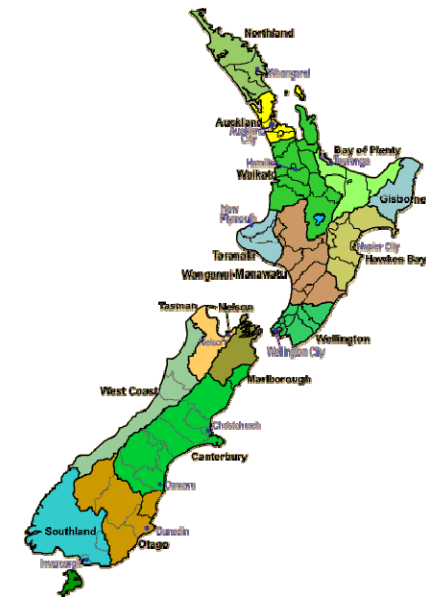   - Nutrient trading ($400 per kg of N)
    - Nutrient models

Outcomes

- The ability to make forest investment decisions that incorporate the full value of key ecosystem services (e.g. forest products, recreation, biodiversity)

- Better understanding of the full value of planted forests at local and national levels and ability to communicate those values.
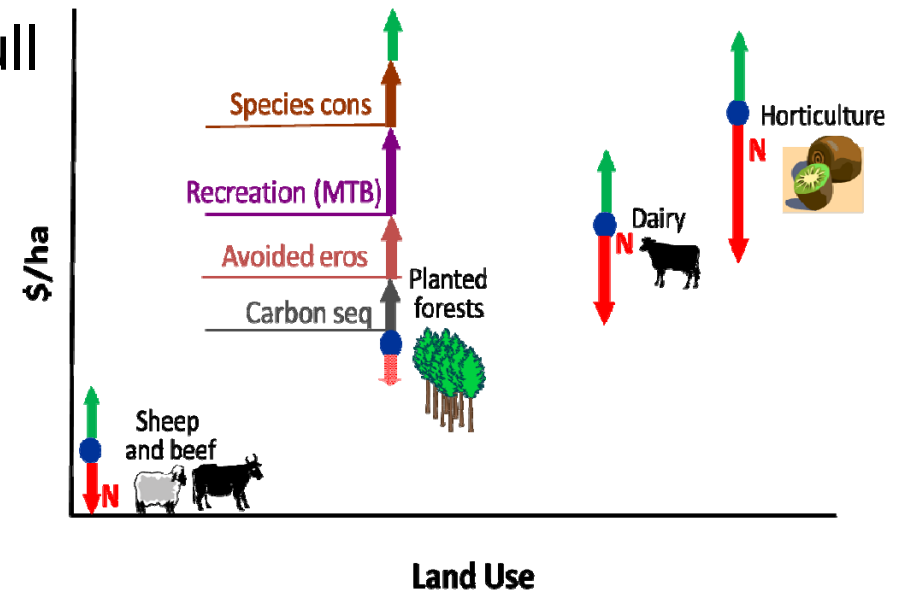
http://research.nzfoa.org.nz/
www.scionresearch/gcff

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24 Mar 2015