

FES in NZ: completed, current and future research

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Overview

- Land use decisions account mainly for market values
 - Dairy > Sheep and Beef > Forestry
- NZ Resource Management Act
 - Section 32 decision making should account for monetary and non-monetary values
- NZ Science Roadmaps Conservation & Environment (total landscape)
- Primary sector (incorporate natural capital and ecosystem services)
- NZ Treasury's Living Standards Framework suggests the need to grow human, social, natural & financial capitals
- A need to have a major leap towards growing NC and increasing ES



Ecosystem Services

The benefits people obtain from ecosystems

From MEA, 2005

PROVISIONING

Water (quantity) Fuelwood Energy and Minerals Food and Medicines Fiber Forage Timber Range Fish and Wildlife

REGULATING

Carbon sequestration Climate regulation Soil stabilization Watershed services (water quality and flood control)

CULTURAL

Aesthetic values Educational values Spiritual values Cultural heritage Recreation

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SUPPORTING

Soil formation Seed dispersal Pollination Nutrient cycling



Forest Investment Framework (FIF)

- A validated spatial economic tool
 - combines data from economic, productivity, geospatial and environmental models
 - forestry (profitability) and ecosystem service components (C-sequestration, avoided erosion, native species habitat)
 - FIF's spatially explicit outputs include maps and tables of the broader values of forests
- Used by scientists, forest companies, iwi & government agencies
- Developing functions nutrient mitigation, water yield, recreation
- More FIF info available at
 https://www.scionresearch.com/science/sustainable-forest-and-land-

management/valuing-the-forest-ecosystem/forest-investment-framework

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FIF's components, inputs, processes and outputs



FIF applications in New Zealand



	ID	Client or Clients	Accessibility	Year	Location	Ecosystems services	Report/Paper title
Afforestation Feasibility	1	Wright Partners Ltd	Publicly accessible	2014	Northland region	Timber, Honey	Te Taitokerau report - Building the business case for economic resilience in Northland
	2	Te Puni Kōkiri	Confidential	2014	Northland, Bay of Plenty, Waikato, Whanganui	Timber, Carbon	Māori land afforestation feasibility study: Phase one
	3	Nga Aho Rangahau o Maniapoto	Confidential	2014	Waitomo, Otoro-hanga, Ruapehu, New Plymouth, Waipa	Timber, Carbon	Nga Aha Rangahau o Maniapoto Forest opportunities
	4	Ngāti Porou, Ministry for Primary Industries, Gisborne Regional Council	Publicly accessible	2014	Gisborne	Carbon sequestration (C)	Climate change and community resilience in the Waipu catchment
omic nt	5	Bay of Plenty (BOP) Regional Council	Confidential	2015	Rotorua Catchment, BOP Region	Timber, C, Sediment	Lake Rotorua Forestry Profit Analysis
	6	Ministry for Primary Industries, Waikato Regional Council	Confidential	2014	Waikato Region	Timber, C, Sediment	Waikato forest investment modelling
cor	7	Waikato Regional Council	Confidential	2014	Waikato Region's marginal land	Timber, Carbon	Waikato farm forest investment modelling
Regional E Develop	8	Environment Southland	Confidential	2015	Southland	Timber, Carbon, Sediment	The Southland Economic Project
	9	Ministry for Primary Industries	Publicly available	2016	New Zealand	Timber and C	Deforestation intensions
	10	Ministry for Primary Industries	Publicly available	2016	New Zealand	Timber and C	Afforestation of NZ's productive areas
	11	Ngāti Porou Forests Ltd.	Confidential	2017	Gisborne	Timber, mānuka oil and honey	Profitability of Pinus radiata and mānuka
ment	12	Bay of Plenty Regional (BOP) Council	Publicly accessible	2014	Ōhiwa Catchment, BOP Region	Timber, C, Avoided erosion, others	Ecosystem services in the Öhiwa catchment
	13	Wenita Forest Products Ltd.	Publicly accessible	2016	Otago	Timber, C, avoided erosion, rec. hunting	Ecosystem Services in the Wenita Forest Products estate
	14	MBIE, Forest Levy and Scion	Publicly accessible	2015	Selected NZ planted forests	Timber, C and sediment	FIF validation and enhancement
sess	15	Whangaparoa 2L Trust, Ministry for Primary Industries	Publicly accessible	2017	Waikura Valley, Gisborne	Timber, C, avoided erosion, habitats	Waikura Valley land restoration project
ce As	16	Horizons Regional Council	Confidential	2017	Manawatu-Whanganui region	Timber, C, avoided erosion	Forest Options in the Manawatū – Whanganui Region
Ecosystem Servi	17	Marlborough District Council, Ministry for Business Innovation and Employment	Publicly accessible	2017	The Marlborough Sounds	Timber, C, avoided erosion	Evaluation of forest management options in The Marlborough Sounds
	18	MBIE and Forest Levy Trust	Publicly accessible	2019	NZ planted forests	Biodiversity enhancement	Economic cost and benefit of biodiversity enhancement in planted forests
	19	Waikato Regional Council	Submitted, under review (publicly acc)	2019	Ohinemuri catchment, Waikato	Avoided erosion, avoided nutrients, water yield	Ohinemuri catchment - freshwater ecosystem services assessment
	20	Hawke's Bay Regional Investment Council	On-going work	2019	Wairoa catchment and other parts of the region	Timber, C, avoided erosion & nutrients, biodiversity	Spatial economic assessment of ecosystem services of potential afforestation areas in HB

18. Economic cost and benefit of biodiversity enhancement in planted forests



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Does the economic benefit of biodiversity enhancement exceed the cost of conservation in planted forests?



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ECOSYSIE SERVICES

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ABSTRACT

This study evaluates a proposed programme that would sustain and enhance the provision of ecosystem services in planted forests. We focused on the evaluation of the benefits and costs of the conservation of the New Zealand brown kiwi, an iconic yet threatened bird species that inhabits planted forests. Yao et al. (2014) found that a sample of 209 New Zealand (NZ) households would, on average, financially support a brown kiwi conservation programme in planted forests. We extend that study using a proof of concept that integrates economic, ecological and spatial approaches. We undertake this in five steps: 1) supplementing a previous discrete choice experiment survey by interviewing more than 900 additional georeferenced households; 2) estimating household-specific means of marginal willingness-to-pay (WTP) values; 3) using econometrics and geospatial approaches to explore WTP determinants; 4) identifying 12 ecologically and economically feasible ecosystem-service sites and calculate the costs of a conservation programme at each site; and 5) aggregating the public benefits of biodiversity at the regional and national levels and calculate the cost-benefit ratio. We found that the value of the proposed biodiversity conservation initiative at the national level can be more than 100 times higher than the overall cost of the programme.

Public Benefit > Cost?

- Evaluated a potential 5-year programme that enhances biodiversity in planted forests.
- Used a framework that integrates ecological, economic and spatial approaches.
- Estimated household-specific means of willingness-to-pay from 1036 NZ respondents.
- Aggregated WTP at the regional and national levels using a spatial approach.
- Results show that aggregated biodiversity benefits can be more than 100 times higher than its cost.
- This framework serves as FIF's biodiversity valuation component.







Benefit/Cost ratio – Aggregated WTP / Programmed Cost

Table 7

Ratio of aggregated WTP value to annualised present value of conservation cost.*

Location	Aggregate WTP value (NZD per year)	Annualised conservation cost (NZD per year)	WTP/Cost ratio
Manawatu-Whanganui	6,255,647	221,252	28.3
Bay of Plenty	7,354,681	216,499	31.1
Northland	4,240,734	181,932	30.6
Waikato	10,797,815	138,371	71.5
New Zealand	111,432,346	747,186	149.1

^{*}Annualised present value of conservation cost (*A*) was calculated using the formula:

 $A = \frac{r * PV}{1 - (1 + r)^{-n}}.$

where *r* is the social discount rate (set at 3%), *PV* is the present value of conservation cost of the five-year programme, and *n* is the number of years (set at 5 years).

- NPV of the 5-year programme = NZD507 million
- Value of the programme in perpetuity = NZD15.2 million per year
- Biodiversity enhancement in planted forests is important to NZ households
- The study provides insights on identifying cost effective and ecologically suitable conservation investments for brown kiwi on private land.

19. Ohinemuri catchment - freshwater ecosystem services assessment



ESA for the Ohinemuri Catchment in Waikato, NZ

(with Brenda Baillie and David Palmer of Scion)

- Ohinemuri catchment = 34,803 hectares
- Applied the Common Classification of ES (CICES) V5.1 to assess freshwater ecosystem services of streams & rivers.
- Used FIF to assess water related ES:
 - avoided erosion, avoided nitrogen, water yield
- Freshwater ecosystem services:
 - Provisioning
 - Eels = ~\$791,500 per year
 - Drinking water = ~\$3,000,000 per year
 - Cultural (recreation)
 - Fishing, walking, cycling, picnicking



Erosion rates (tonnes of sediment per km2 per year)



Annual nitrogen leaching in kg per hectare per year.



Annual water yield volume per ha per year.



Environmental impacts of land uses in Ohinemuri, Waikato



20. Spatial economic assessment of ecosystem services of potential afforestation areas in Hawke's Bay, NZ



Value of afforestation in Hawke's Bay, NZ

with David Palmer, Geospatial Scientist

- Spatial economic assessment of ecosystem services of afforestation areas in the Hawke's Bay region
 - Identified afforestation areas using soil erosion, land use classes and other geospatial data
 - 132,533 ha with high erosion rates (>1,000 tonnes of sediment per square km)
- Used *FIF* to assess
 - Timber (market value)
 - Carbon sequestration, avoided erosion and avoided nitrogen (environmental values)
 - Provision of habitats for brown kiwi (cultural values)
- Provide indicative market and non-market values of afforestation to inform decision making







ES assessment of afforestation areas in Hawke's Bay



Stacking up the timber and non-timber ES



Accounting for multiple values of land uses helps make better policy and investment decisions.



Land Use

<u>Current project under the NZ National Science Challenge - Resilience</u> Economic vulnerability and natural capital (with Juan Monge and Garry MacDonald)





Thank you!



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