Current and future work on forest ecosystem services

Richard Yao
Ecosystem services
Ecosystem Services in New Zealand

• Valuing Nature Conference in Jul 2013
• ES in NZ book - launched by MfE in Feb 2014
  – 539 pages, 36 chapters, >100 NZ scientists
  – Chapter 1.4 – Planted forests
ES provided by NZ planted forests (updated)

Ecosystem Processes
- Supporting:
  - Nutrient cycling
  - Soil formation
  - Primary production

Ecosystem Services
- Provisioning:
  - Wood and fibre
  - Understorey crops
  - Freshwater
  - Biofuel
- Regulating:
  - Carbon sequestration
  - Avoided erosion
  - Air quality
  - Flood mitigation
  - Biodiversity
- Cultural:
  - Recreation
  - Species conservation
  - Rongoa

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

Freedoms of choices and action
Opportunity to be able to achieve what an individual values doing and being

Arrow's colour
Potential for mediation by Socio-economic factors
- Low
- Medium
- High

Arrow's width
Intensity of linkages between ecosystem Services and human well-being
- Weak
- Medium
- Strong

Adapted from Millennium Ecosystem Assessment (2005)
Papers and a report on FES values

**Recreational walking and mountain biking**

**Indigenous forestry report (recreation use values in native and planted forests)**

**Biodiversity enhancement values in planted forests**

**Avoided erosion from afforestation of marginal land**
Recreation value per visit – natural & planted

<table>
<thead>
<tr>
<th>Forest location and type of recreation</th>
<th>Recreational value in 2014$ per visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaimanawa and Kaweka (recreational hunting)</td>
<td>93</td>
</tr>
<tr>
<td>Kaitoke (general recreation)</td>
<td>16</td>
</tr>
<tr>
<td>Coromandel (group visit)</td>
<td>93</td>
</tr>
<tr>
<td>Bottle Lake (general recreation)</td>
<td>47</td>
</tr>
<tr>
<td>Whaka (walking)</td>
<td>38</td>
</tr>
<tr>
<td>Whaka (mountainbiking)</td>
<td>54</td>
</tr>
</tbody>
</table>
Indigenous forestry report

Number of visits per year – natural & planted

- Kaimanawa and Kaweka (recreational hunting): 23,639
- Coromandel (group visit): 20,000
- Bottle Lake (general recreation): 400,000
- Whakarewarewa (walking and MTBing): 304,000
Recreation value per ha per year – **natural & planted**

(Blue bar = value per hectare; dot = forest area)

<table>
<thead>
<tr>
<th>Forest Area in hectares</th>
<th>Recreation value in 2014$ per hectare per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaimanawa and Kaweka</td>
<td>$16</td>
</tr>
<tr>
<td>(recreational hunting)</td>
<td></td>
</tr>
<tr>
<td>Coromandel</td>
<td>$26</td>
</tr>
<tr>
<td>(group visit)</td>
<td></td>
</tr>
<tr>
<td>Bottle Lake</td>
<td>$15,667</td>
</tr>
<tr>
<td>(general recreation)</td>
<td></td>
</tr>
<tr>
<td>Whakarewarewa</td>
<td>$2,468</td>
</tr>
<tr>
<td>(walking and MTBing)</td>
<td></td>
</tr>
</tbody>
</table>

- **Kaimanawa and Kaweka (recreational hunting):**
  - Forest area: 140,000 hectares
  - Recreation value: $16 per hectare per year

- **Coromandel (group visit):**
  - Forest area: 71,900 hectares
  - Recreation value: $26 per hectare per year

- **Bottle Lake (general recreation):**
  - Forest area: 1,200 hectares
  - Recreation value: $15,667 per hectare per year

- **Whakarewarewa (walking and MTBing):**
  - Forest area: 5,667 hectares
  - Recreation value: $2,468 per hectare per year

(Recreation values are in 2014 dollars per hectare per year.)
## Valuing biodiversity enhancement in NZ planted forests (Yao et al. 2014)

<table>
<thead>
<tr>
<th>Threatened Animal/Plant</th>
<th>Current Condition</th>
<th>Option I</th>
<th>Option J</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brown Kiwi</strong>&lt;br&gt;(Frequency of hearing calls in planted forests in North Island)</td>
<td>Kiwi calls heard in 1 out of 200 planted forests</td>
<td>Kiwi calls heard in 1 out of 200 planted forests</td>
<td>Kiwi calls heard in 20 out of 200 planted forests</td>
</tr>
<tr>
<td><strong>Giant Kokopu</strong>&lt;br&gt;(Occurrence in slow moving streams with overhanging native vegetation in planted forests throughout New Zealand)</td>
<td>Kokopu seen in 1 out of 10 suitable streams</td>
<td>Kokopu seen in 3 out of 10 suitable streams</td>
<td>Kokopu seen in 1 out of 10 suitable streams</td>
</tr>
<tr>
<td><strong>Kakabeak</strong>&lt;br&gt;(Occurrence in 20% of the planted forests on the East Coast and Hawke’s Bay)</td>
<td>At least 3 naturally occurring Kakabeak shrubs</td>
<td>At least 20 actively managed Kakabeak shrubs</td>
<td>At least 3 actively managed Kakabeak shrubs</td>
</tr>
<tr>
<td><strong>Auckland Green Gecko</strong>&lt;br&gt;(Gecko sightings in open grounds in planted forests in Northland, Waikato and Bay of Plenty regions)</td>
<td>Gecko sighted in 1 out of 50 walks</td>
<td>Gecko sighted in 3 out of 50 walks</td>
<td>Gecko sighted in 1 out of 50 walks</td>
</tr>
<tr>
<td><strong>NZ Bush Falcon</strong>&lt;br&gt;(Bush falcon sightings while driving through pine forests in Central North Island and Nelson)</td>
<td>Bush falcon sighted in 1 out of 8 drives</td>
<td>Bush falcon sighted in 5 out of 8 drives</td>
<td>Bush falcon sighted in 1 out of 8 drives</td>
</tr>
</tbody>
</table>

Additional amount to be paid yearly in your income tax for five years only

- $0
- $30

I would choose (please tick)
<table>
<thead>
<tr>
<th></th>
<th>Mean WTP</th>
<th>Median WTP</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown Kiwi 1</td>
<td>24.18</td>
<td>18.07</td>
<td>16.78</td>
</tr>
<tr>
<td>Brown Kiwi 2</td>
<td>28.24</td>
<td>21.10</td>
<td>19.59</td>
</tr>
<tr>
<td>Kokopu 1</td>
<td>8.37</td>
<td>6.25</td>
<td>5.81</td>
</tr>
<tr>
<td>Kokopu 2</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Kakabeak 1</td>
<td>8.89</td>
<td>6.64</td>
<td>6.12</td>
</tr>
<tr>
<td>Kakabeak 2</td>
<td>8.37</td>
<td>6.05</td>
<td>8.59</td>
</tr>
<tr>
<td>Green Gecko 1</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Green Gecko 2</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Bush Falcon 1</td>
<td>24.44</td>
<td>18.26</td>
<td>16.96</td>
</tr>
<tr>
<td>Bush Falcon 2</td>
<td>31.68</td>
<td>23.63</td>
<td>23.86</td>
</tr>
<tr>
<td>Indicator for SQ</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

Note: NS means the coefficient is not statistically significant at the five percent level.
Avoided erosion value from afforestation (Barry et al. 2014)

- Forest investment finder (spatial economic model) – estimated the profitability
- New Zealand Empirical Erosion Model (NZEEM) – estimated the reduction in sedimentation of waterways
- Areas in green on the East Coast $\rightarrow$ $1$ loss in $P. \text{radiata}$ planting $=$ at least $3$ in avoided erosion benefit
  - those landowners should be provided with incentives to plant trees on marginal land
# Ecosystem services values from NZ forests

<table>
<thead>
<tr>
<th>Group</th>
<th>Ecosystem service</th>
<th>Forest type</th>
<th>Planted</th>
<th>Natural</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Provisioning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood and fibre</td>
<td></td>
<td></td>
<td>$7.3b</td>
<td>●</td>
</tr>
<tr>
<td>Bioenergy</td>
<td></td>
<td></td>
<td>$1b</td>
<td></td>
</tr>
<tr>
<td>Understorey cropping (e.g. Ginseng)</td>
<td></td>
<td></td>
<td>$4/gram</td>
<td>●</td>
</tr>
<tr>
<td>Freshwater</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td><strong>Regulating</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon sequestration ($4/tonne of CO2)</td>
<td></td>
<td></td>
<td>$100m/yr</td>
<td>●</td>
</tr>
<tr>
<td>Avoided erosion (avoided sedimentation)</td>
<td></td>
<td></td>
<td>$1,250/ha/yr</td>
<td>●</td>
</tr>
<tr>
<td>Flood mitigation (avoided flood damage)</td>
<td></td>
<td></td>
<td>$250/ha/yr</td>
<td>●</td>
</tr>
<tr>
<td>Air quality</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Water quality</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Water quantity</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Habitats</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td><strong>Cultural</strong></td>
<td></td>
<td></td>
<td>$100m/yr</td>
<td>$3m/yr</td>
</tr>
<tr>
<td>Recreation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conservation of endangered species</td>
<td></td>
<td></td>
<td>$28m/yr</td>
<td>●</td>
</tr>
<tr>
<td>Aesthetics</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Cultural heritage</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>
Scion’s economics and land use capability

**Dr Richard Yao (Environmental Economist)**
Economic valuation/assessment of ecosystem services, market values (provisioning), non-market values (regulating, cultural) and spatial economic modelling of ecosystem services

**Dr Juan Monge (Resource Economist)**
Economic land use policy impacts, carbon policy, energy, life cycle assessment, Computable General Equilibrium (CGE) modelling, risk analysis

**Dr Sandra Velarde (Ecological Economist and Forest Engineer)**
Carbon, biodiversity and profitability trade-offs, environmental services compensation and reward mechanisms, land-use change decision making, participatory planning and climate change mitigation

**Duncan Harrison (Spatial Analyst)**
Spatial economic modelling of ecosystem services and land use

**Stefania Pizzirani (Life Cycle Assessment)**
Life cycle assessment and land use within cultural frameworks
Thank you. Any questions?
**TA-8564 REG: Promoting Ecosystem Services and Forest Carbon Financing in Asia and the Pacific-Senior Ecological Economist and Team Leader (44141-012)**

**Date Published:** 26-Apr-2014  
**Deadline of Submitting EOI:** 09-May-2014 11:59 PM Manila local time

### Profile

- **Consultant Type:** Individual
- **Selection Method:** Individual Consultant Selection (ICS)
- **Package Name:** Promoting Ecosystem Services and Forest Carbon Financing in Asia and the Pacific-Senior Ecological Economist and Team Leader
- **Approval Number:** 8564
- **Approval Date:** 06-Dec-2013
- **Estimated Commencement Date:** 03-Mar-2014
- **Estimated Short-listing Date:** 17-Feb-2014

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### Additional Information

- **Possibility of contract extension:** Yes
- **Possibility of consideration for downstream assignment:** Yes
- **Indefinite Delivery Contract (IDC):** Yes
- **Country of assignment:** Philippines; Regional

### Contact Information

- **Project Officer:** Bruce Kevin Dunn
- **Designation:** Senior Environment Specialist
- **Organization:** Asian Development Bank
Request for Proposal (RFP)
FOCUSED ECOSYSTEM SERVICES VALUATION SERVICES

Introduction

The Sonoma County Agricultural Preservation and Open Space District (“District”) is requesting proposals to evaluate the economic value of a variety of natural landscapes and systems within Sonoma County. A county-wide ecosystem services valuation (ESV) report is currently being produced which will provide screening level data and analysis. However, the District desires to develop 10-15 geographically and/or topically focused valuations for use in decision making, outreach and education. These studies may utilize qualitative and quantitative methods and a variety of ecological economic methods. District staff have developed a list of 14 potential studies, and desires consultants to provide a proposed approach, methodology, timeline, and cost estimate for one or more of the studies. Four of these studies are considered “priority” and the District intends to complete these studies immediately. The remaining ten studies will be completed as funding and partners are available, likely over the next 18 months. Consultants may select as many or few of the studies as they are interested in, at one of three levels of detail/types of study as described in this RFP.

With respect to these services, the District desires to enter into an open-scope contract with one or more consultants for an amount not to exceed $150,000 to provide economic consulting services on an ‘as needed’ basis.