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Valuing Ecosystem Services to Promote Low Emission Development Strategies in the Lower Mekong Region: A Case Study of Khao Yai National Park, Thailand

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Introduction

- The land use and forestry sectors are key contributors of CO₂ emissions in developing Asian nations
- Asian forests are being rapidly converted to other uses, despite the many benefits they provide



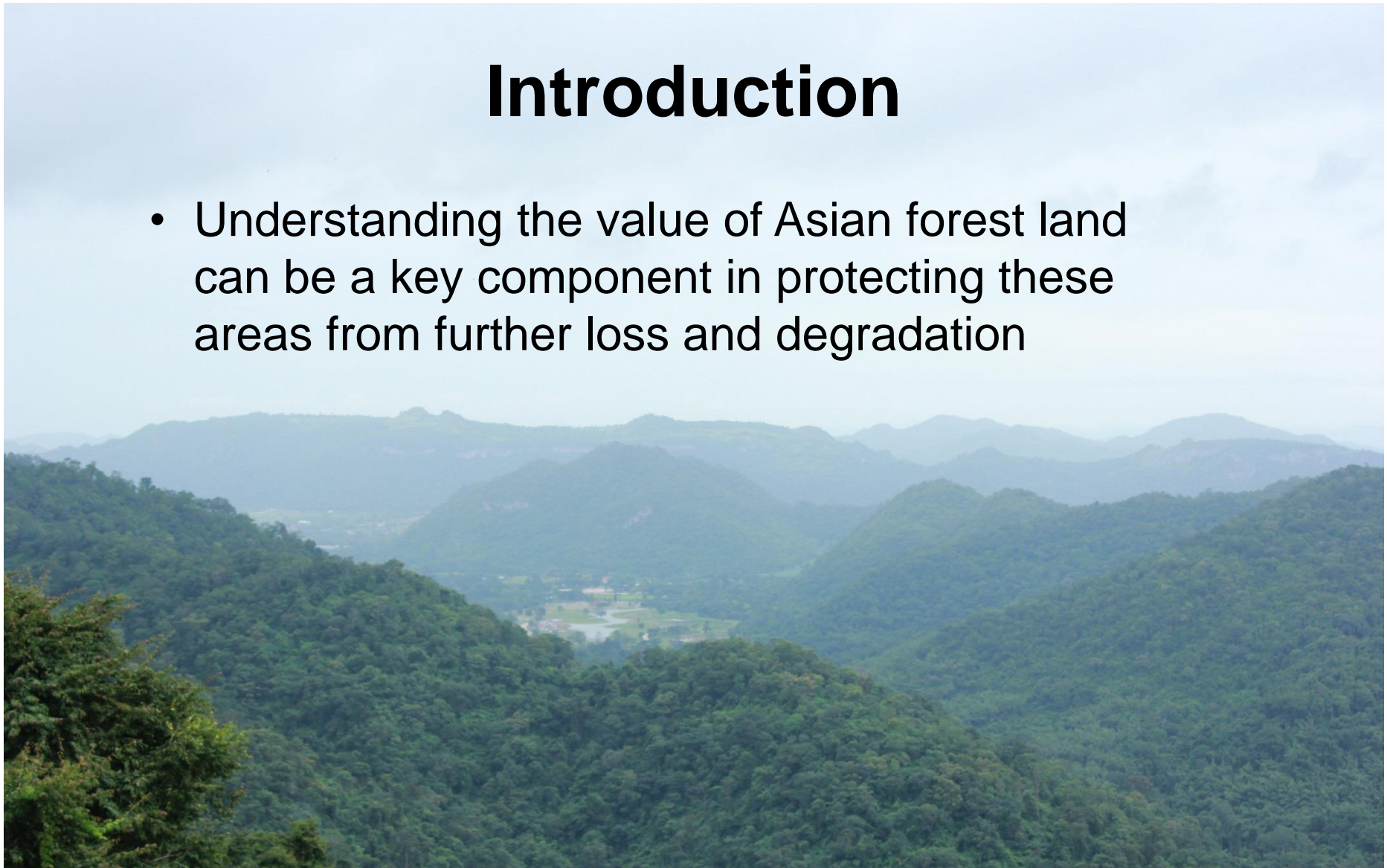


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Introduction

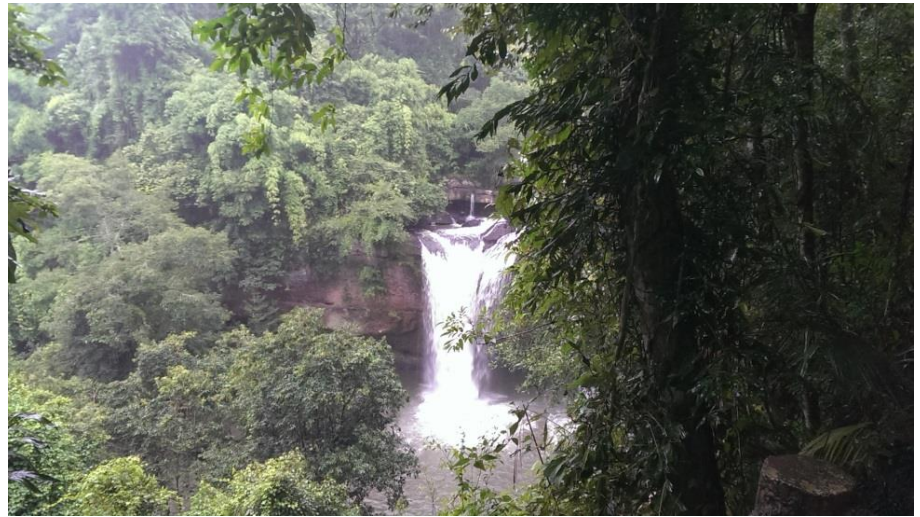
- Understanding the value of Asian forest land can be a key component in protecting these areas from further loss and degradation





Understanding the Value of Forest Lands

- Expressing the value of forests helps to ensure this value is considered in decision making



- Ecosystem valuation can be used to estimate the value of these important aspects



What is Ecosystem Valuation?

- The process of estimating the economic, or monetary, value of ecosystems and the impacts of human activity on ecosystems.





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Objective

Use ecosystem valuation techniques to estimate the value of forest lands in Khao Yai National Park, Thailand

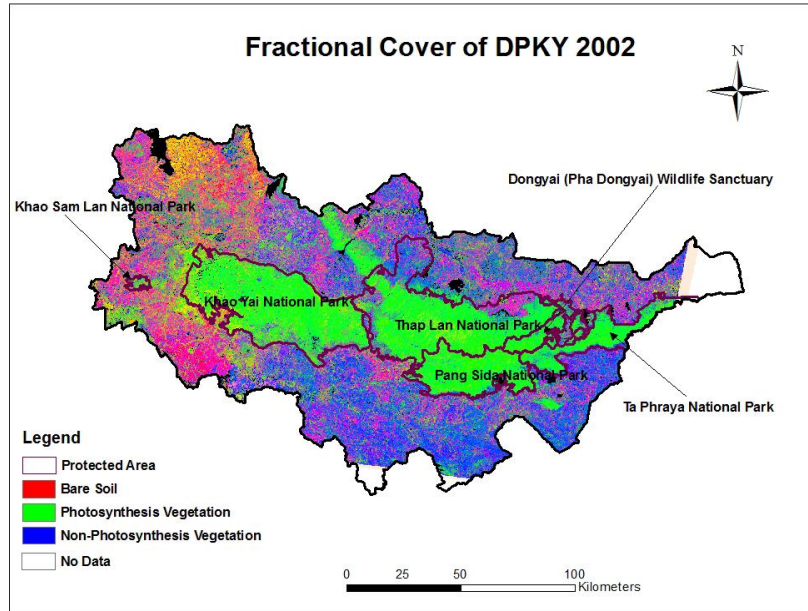
- Thailand's oldest national park
- 216,800 hectares in area, part of the larger Dong-Prayayen Forest Complex
- Area is rich in biological diversity





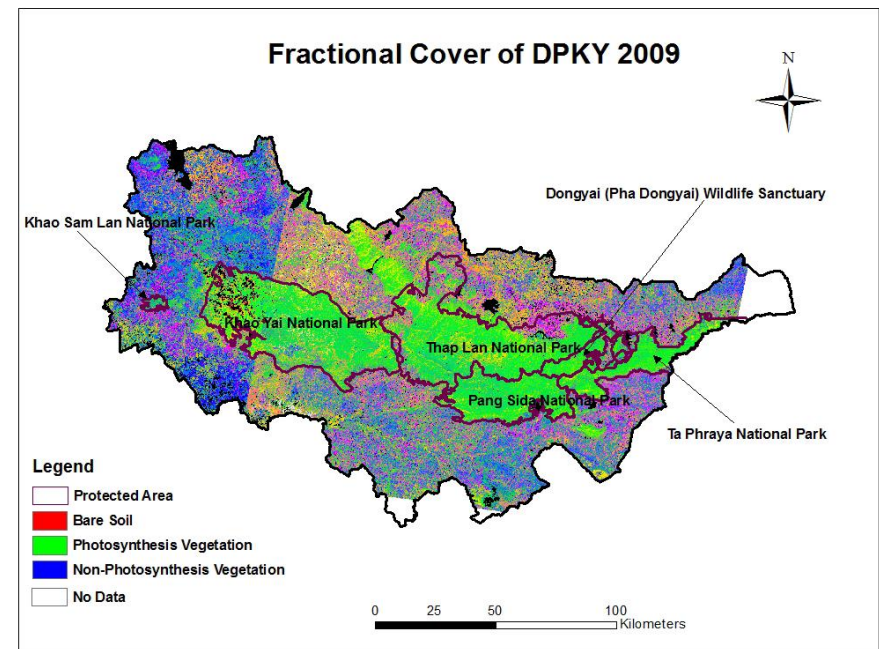
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Deforestation is occurring within the Dong-Prayayen forest complex at a rapid rate

Despite its protected status, deforestation is still occurring within the boundaries of Khao Yai National Park





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An “impact pathways” approach was used to map changes in ecosystem functions to changes in ecosystem services and the resulting effects on values

**Ecosystem
Functions**



**Ecosystem
Services**



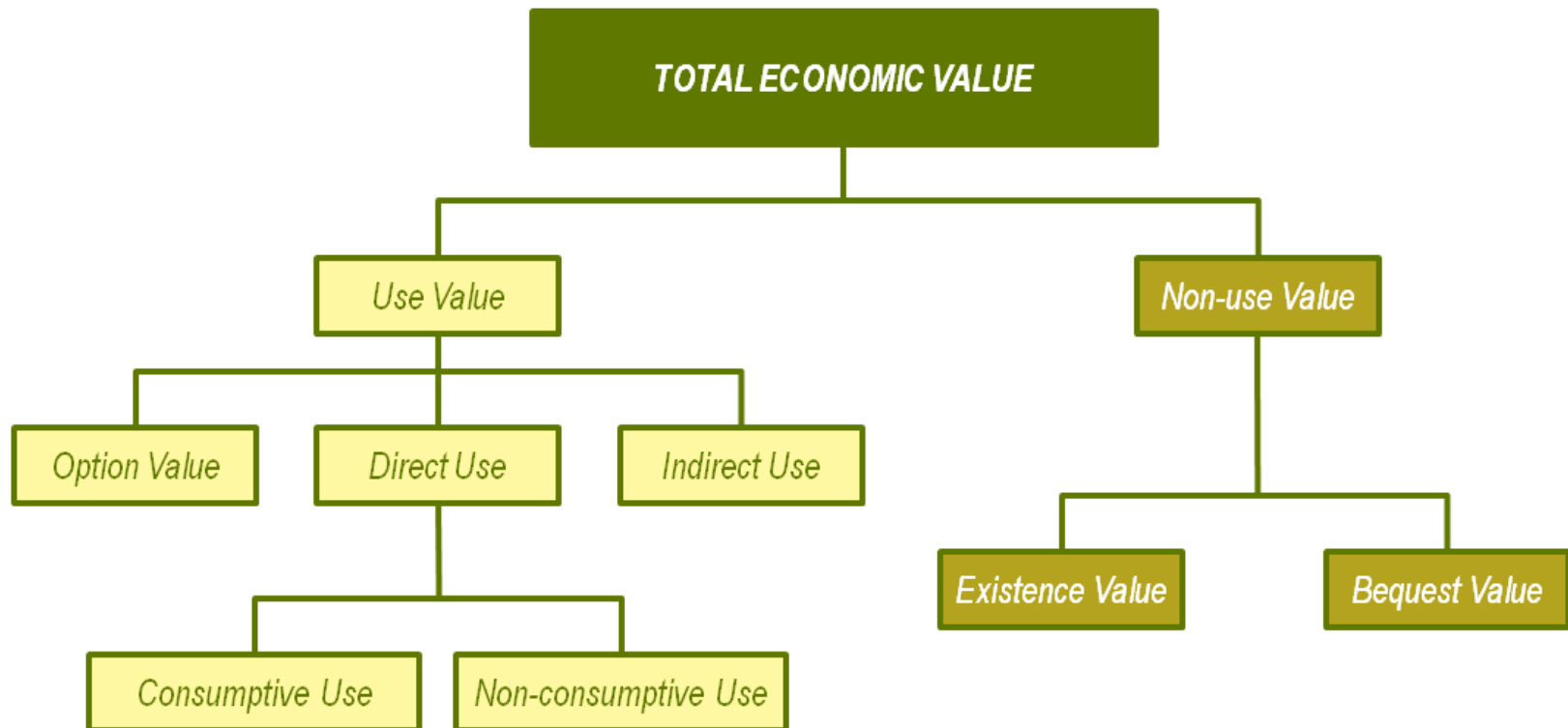
**Ecosystem
Values**



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Types of Values Provided by Ecosystems





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Khao Yai
National Park
example

Benefit
Transfer and
Market-based
methods

Values
estimated for
8 ecosystem
services



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Key Assumptions

Data from World Wildlife Fund's TREEMAPS program was used to model changes in land use over time

30-year period (2013 – 2042) was considered

4% discount rate used to estimate the present value of benefits that accrue in future years

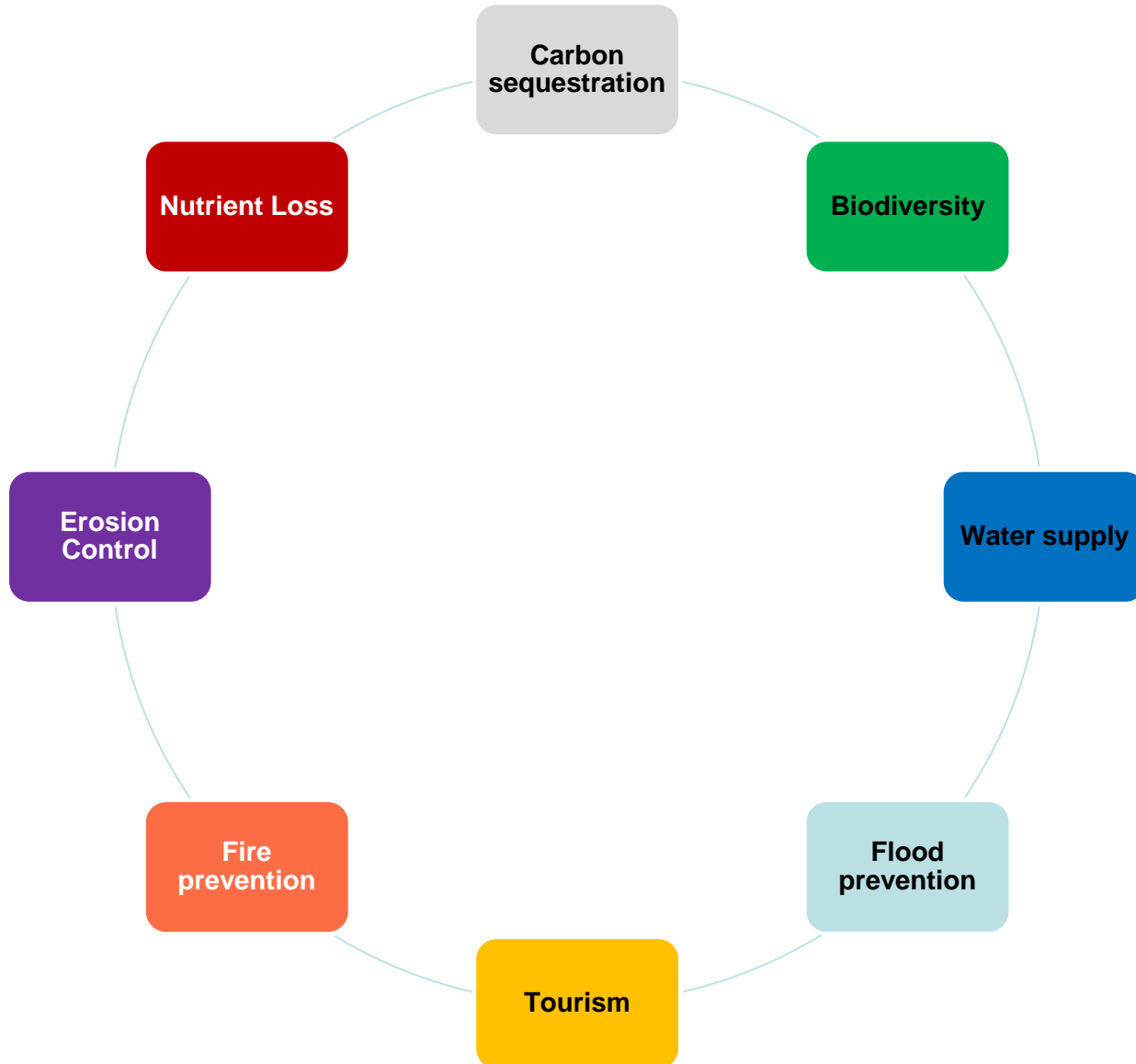
Data used to value some ecosystem services was taken from a Thai government study conducted in Khao Yai

Data used to value some ecosystem services were taken from source studies conducted in other locations



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Carbon Sequestration

Benefit

- Avoided releases of CO₂ for protected forests
- Benefit to society

Method

- Avoided CO₂ quantified based on study in Khao Yai on the tons of carbon emissions avoided per hectare of various forest types
- Avoided CO₂ monetized based on estimates of the Social Cost of Carbon

Results

- Benefits range from \$10.7 million to \$61.2 million over 30 years



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Biodiversity

Benefit

- Protection of genetic and biological diversity
- Benefit to society

Method

- Based on willingness to pay for biodiversity protection
- Benefit transfer (adapted values from Indonesia and Laos studies)

Results

- Benefits range from \$2.8 million to \$55.1 million over 30 years



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Water Supply

Benefit

- Increased water retention, increased water supply, and fewer droughts
- Benefit to local community

Method

- Market-based method (cost to replace water supply services in Khao Yai)
- Benefit transfer (adapted water supply benefits from Indonesia study)

Results

- Benefits range from \$271.1 million to \$956.3 million over 30 years



Benefit

- Results in enjoyment by tourists and income/revenue
- Benefits to tourists, local community, and local and national governments

Method

- Travel cost analysis based on Khai Yai visitors

Results

- Benefits range from \$2.1 billion to \$2.8 billion over 30 years



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Flood Prevention

Benefit

- Flood protection for adjacent communities provided by forested land
- Benefit to local communities

Method

- Benefits estimated based on avoided damages and loss of life from floods or substitute infrastructure
- Adapted values from Indonesia and Laos studies

Results

- Benefits range from \$178.3 million to \$420.3 million over 30 years



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Fire Prevention

Benefits

- Reduction in fire risk to adjacent communities provided by primary forest
- Benefit to local communities

Methods

- Adapted fire prevention benefits from Indonesia study
- Based on avoided damages from fires

Results

- \$80.1 million over 30 years



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Erosion Control

Benefits

- Reduction in erosion resulting in reduced damage to crops
- Benefit to local communities

Methods

- Cost to replace erosion control services in Khao Yai

Results

- \$1.4 billion over 30 years



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Nutrient Loss

Benefits

- Reduction in the loss of nutrients from soil
- Benefit to local communities

Methods

- Cost to replace lost soil nutrients in Khao Yai

Results

- \$191.3 million over 30 years



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Total Ecosystem Service Values for Khao Yai National Park (2013 – 2042)

Ecosystem Service	Total Net Present Value Benefit (2013 USD, 4% Discount Rate)	Percent of Total	Total Net Present Value Benefit (2013 USD, 4% Discount Rate)	Percent of Total
	<i>Low Estimates</i>		<i>High Estimates</i>	
Carbon Sequestration	\$10,675,674	~0%	\$61,241,548	1%
Biodiversity	\$2,823,476	~0%	\$55,145,888	1%
Water Supply	\$271,133,948	6%	\$956,338,784	16%
Tourism	\$2,100,295,817	49%	\$2,782,149,113	47%
Flood Prevention	\$178,327,454	4%	\$420,333,665	7%
Fire Prevention	\$80,140,874	2%	\$80,140,874	1%
Erosion Control	\$1,434,508,175	34%	\$1,434,508,175	24%
Nutrient Loss	\$191,267,757	4%	\$191,267,757	3%
Total	\$4,269,173,175	100%	\$5,981,125,803	100%



Study Limitations

- Benefit transfer results inexact (depends on similarity between case sites)
- Market-price methods can **underestimate** the full value of ecosystem services (no consumer surplus)
- Results provide a measure of benefits but **not opportunity costs** of foregone land uses
- Only **some** of the important ecosystem services in Khao Yai National Park were valued
- Indirect benefits not considered



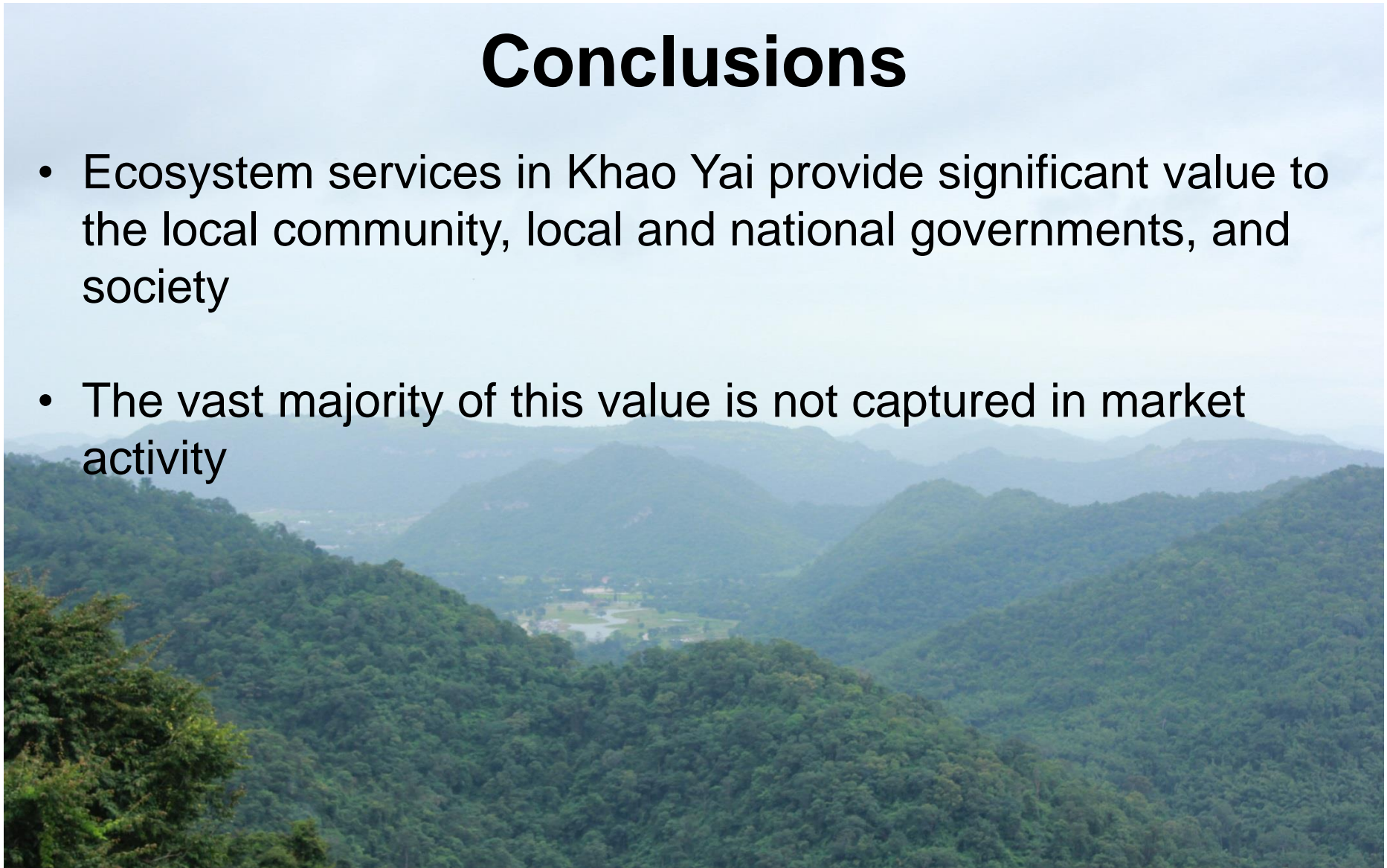


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Conclusions

- Ecosystem services in Khao Yai provide significant value to the local community, local and national governments, and society
- The vast majority of this value is not captured in market activity





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Conclusions

- When ecosystem services are considered, benefits of Khao Yai National Park far outweigh the costs of it, and also outweigh the potential benefits of other land uses

