Economic-Ecological Evaluation of Temporary Biodiversity Offsets in Alberta's Boreal Forest

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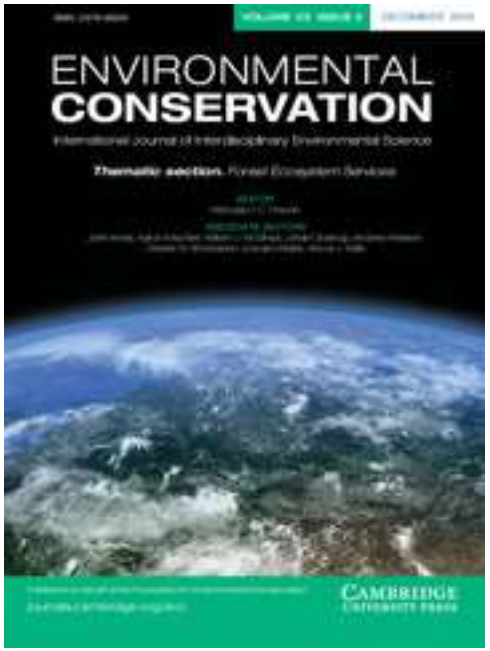
References



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Economic-ecological evaluation of temporary biodiversity offsets in Alberta's boreal forest

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Experimental Economic Evaluation of Offset Design – Reports for Alberta Land Use Secretariat (2011)
https://www.landuse.alberta.ca/LandUse%20Documents/Experimental%20Evaluation%20of%20Offset%20Design%20Options%20Research%20-%202011-11.pdf

https://www.landuse.alberta.ca/LandUse%20Documents/Experimental%20Evaluation%20of%20Offset%20Design%20Options%20Summary%20-%202011-11.pdf

Principles of Offsetting

- No-Net-Loss (net positive impact)
  - Offsets must be “additional”
    - Biodiversity benefits must be greater than baseline (what would be achieved without offsets)
  - Reliance on habitat restoration to avoid “paper parks”
  - Devalues existing habitat relative to restored habitat
  - Relies on the mitigation hierarchy for avoidance

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Principles of Offsetting

- Permanence
  - Offsets on public lands and inability to secure ‘permanence’
  - Some evidence that permanence is not always desirable
    - Habitat suitability changes with dynamics of land use
  - What are the dynamics of biodiversity loss, restoration, and development under an offset program
    - Offset market – autonomous decisions

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Modeling Conservation Offset Policies

- Experimental Economic Analysis of Offset Options for Alberta
  - AITF, UofA, Melbourne University, EarthEcon, ABMI
  - Undertaken for AB Land Use Secretariat
  - Objective
    - Understand the effects of alternative offset policies on ecological and economic outcomes
    - Identify key cost drivers
    - Identify unanticipated consequences

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Study Parameters

- Geographic Scope:
  - The boreal forest region of Alberta (434,000 km2)
- Sectors Analyzed: forestry and energy sector
- Offset Requirements: all impacts must be offset for each period
- Eligible Activities for Offset Credits
  - Reclamation and restoration activities
  - Delaying or cancelling projects
- Offset Duration:
  - Temporary – for one period

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Measuring Equivalence

Ecological Condition based on Biodiversity Intactness

→ based on deviation of expected abundance of species from reference conditions

→ determined for each species and then averaged across species

M**easure from 0 (totally altered landscape) to 100 (pristine landscape)**

Offset Eligibility Rules

- **"Avoided Loss"** – contributes to biodiversity from setting aside land in its current condition
- **"Restoration"** – restores land to suitable habitat for biodiversity
- **Time lags**
  - Difference between management action and when offset benefits are recognized
  - 5 year time lag
    - Benefits "immediate"
  - 20 year time lag

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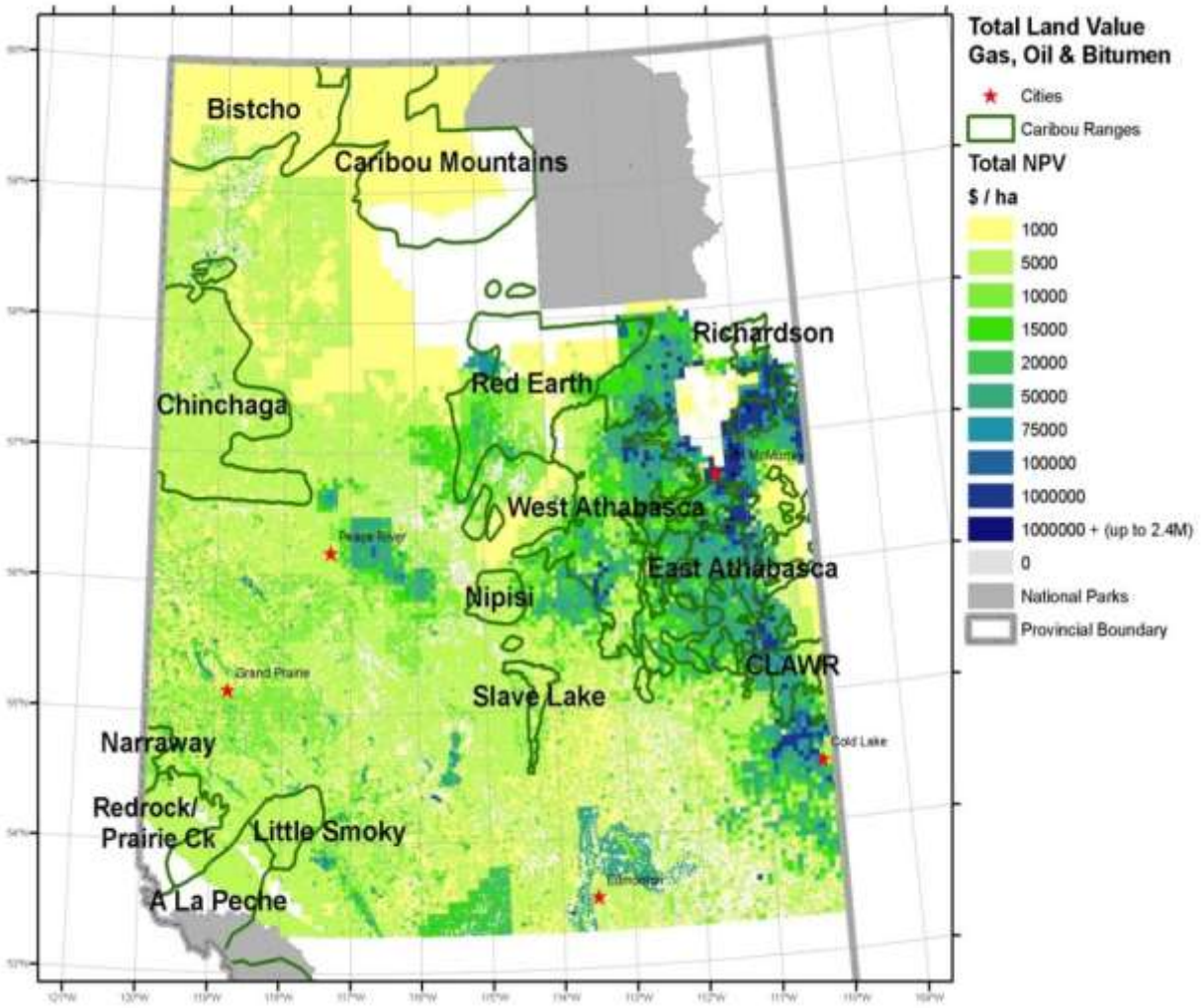
Cost of Offsets



- Net Present Value of Oil and Gas Development + Restoration Costs
- Restoration Costs = $25,000 per ha

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Scenarios Modeled

	Offset Rules			
Eligibility Rules	No net loss of ecological Condition (Intactness)	No net loss Intactness within LUF Regions	No net loss intactness within Natural Subregions	No net loss of intactness within Natural Subregions + Grizzly Habitat
Avoided Loss Only	X			
Restoration Only (5 year lag)	X			
Avoided Loss and Restoration (5 year lag)	X	X	X	X
Avoided Loss and Restoration (20 year lag)	X			

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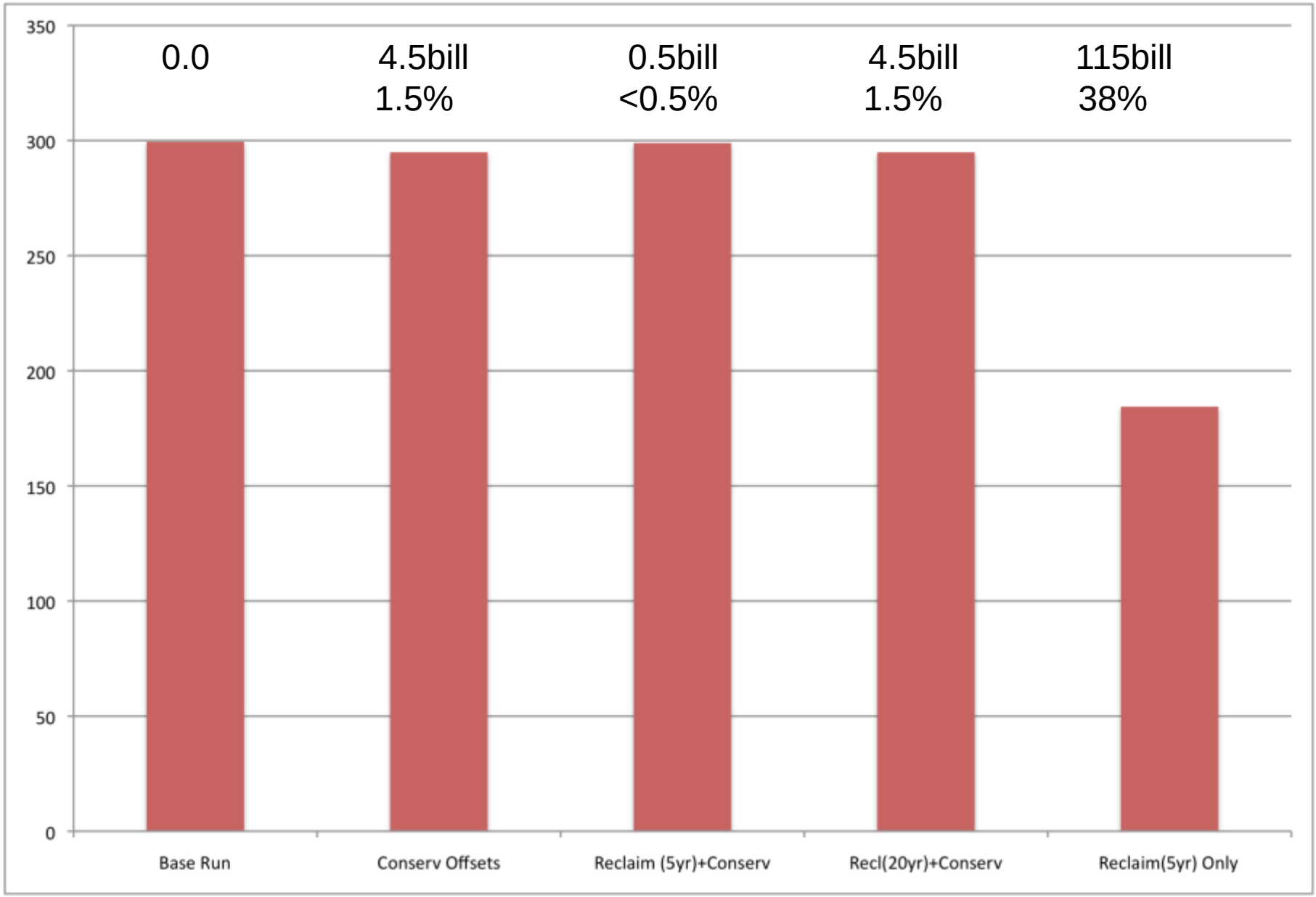
Offset Costs by Scenario



Offset Costs by Scenario

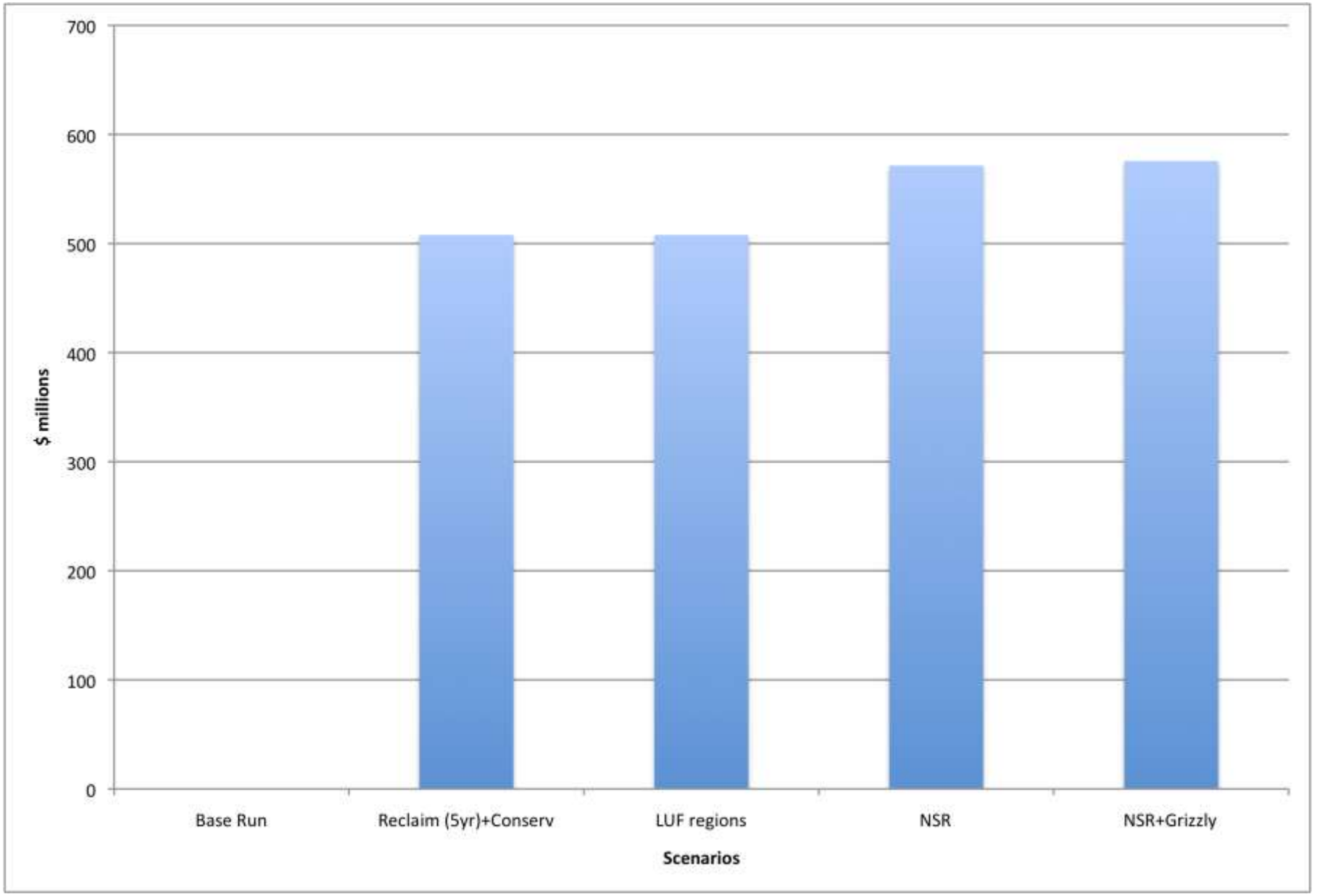
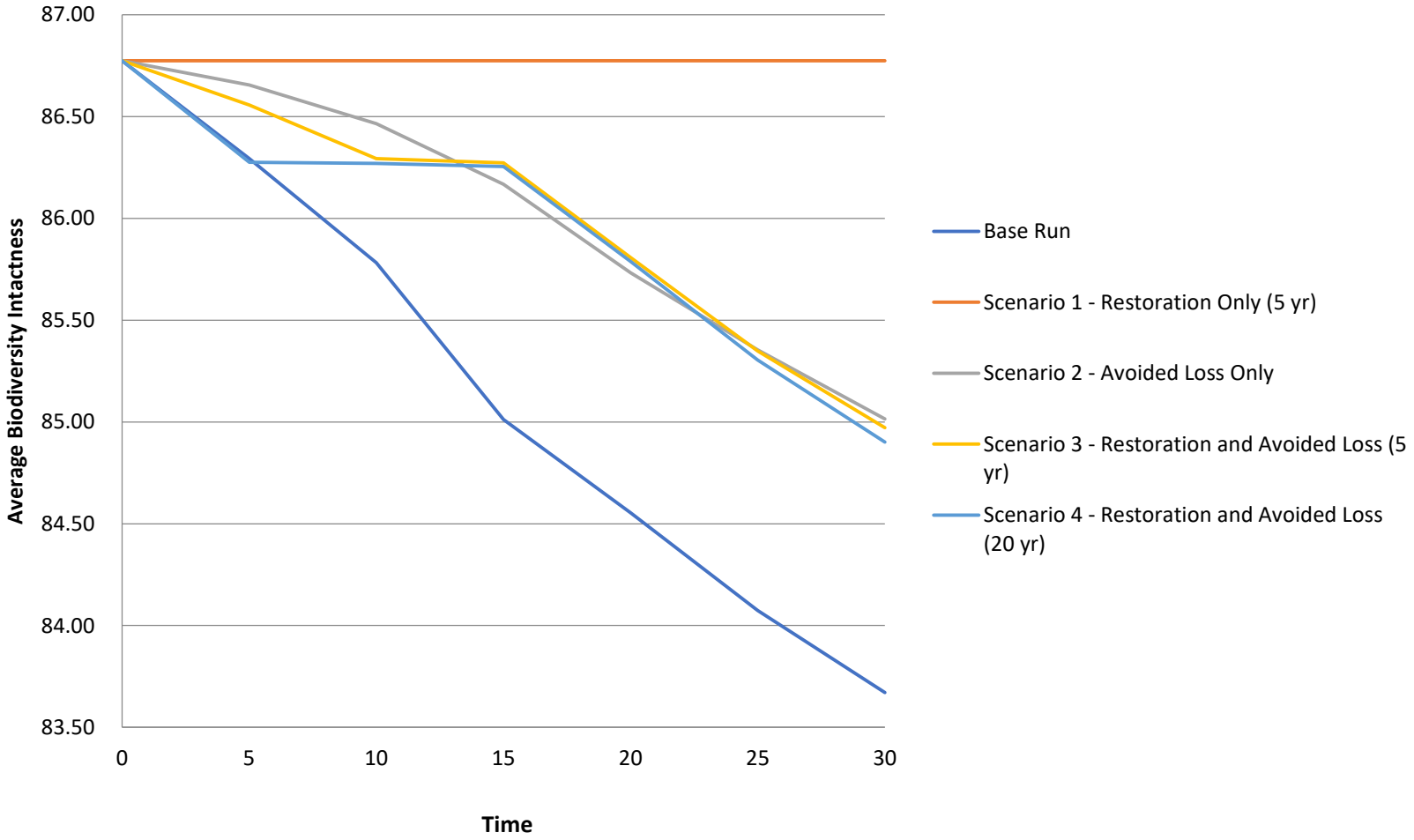


Table 2 Comparison of net present values and offset policy costs under base case and alternative offset policy scenarios.

Offset Scenario	Net Present Value (millions)	Policy Cost (Difference from Base) Base	% Difference from Base
Base Case No Offset Requirement	$299,438	NA	NA
Scenario 1 – Restoration only	$184,409	$115,029	-38.4%
Scenario 2 – Avoided loss only	$294,913	$4,524	-1.5%
Scenario 3 – Restoration and avoided loss (5 yr. lag)	$298,930	$508	-0.2%
Scenario 4 – Restoration and avoided loss (20 yr. lag)	$294,908	$4,530	-1.5%
Scenario 5 – Scenario 3 with offsets with regional trade restrictions	$298,930	$508	-0.2%
Scenario 6 – Scenario 3 with natural subregion trade restrictions	$298,866	$572	-0.2%
Scenario 7 – Scenario 3 + natural subregion and grizzly habitat trade restrictions	$298,862	$576	-0.2%

Change in Biodiversity Intactness



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Regional Variations

Table 4 Regional distribution of offset policy outcomes including the initial and final Net Present Values (NPVs) of development (C$ millions), the total number of Alberta Township System sections of land in which development was delayed (avoided loss), and total area restored (ha) for four sub-watersheds over 30 years.

Region		Lower Athabasca	Upper Athabasca	Lower Peace	Upper Peace
Initial area (sections)		35,054	31,290	73,251	28,071
Baseline NPV $C millions		183,321	33,924	41,796	40,378
Δ NPV C$ millions	Scenario 1	-65,682	-11,038	-26,307	-11,707
	Scenario 2	-1,492	-260	-2,566	-211
	Scenario 3	-27	-62	-75	-32
	Scenario 5	-35	-74	-56	-40
	Scenario 6	-24	-63	-91	-40
	Scenario 7	-24	-64	-90	-40
Area avoided loss (sections)	Scenario 1	0	0	0	0
	Scenario 2	28,365	8,455	48,979	4,802
	Scenario 3	20,859	7,255	36,393	3,771
	Scenario 5	20,981	7,296	36,197	3,975
	Scenario 6	12,474	7,504	34,694	3,892
	Scenario 7	12,474	5,432	34,685	2,760
Area restored (ha)	Scenario 1	26,130	8,655	128,808	14,974
	Scenario 2	0	0	0	0
	Scenario 3	10,913	5,654	122,288	12,538
	Scenario 5	22,543	29,870	71,632	35,774
	Scenario 6	23,232	21,648	96,349	29,395
	Scenario 7	23,189	22,535	96,273	30,506

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Discussion

- Time between restoration and creation of offset (i.e. delivery of the product) is crucial
  - Restoration by itself is expensive
- Accounting for No-Net-Loss
  - Biodiversity benefits of restoration largely not empirically validated
    - Time lags, site failure, irreplaceability
- Including avoided loss buys time both ecologically and economically while benefits of restoration sites are 'proven'
  - From a dynamic risk perspective we need policies that provide incentives for a combination of habitat protection and habitat restoration

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Conclusions

- Previous Models
  - Consider offsets in the context of optimal reserve design/systematic conservation
  - Permanence
  - Assumes “planning” and decentralized outcomes the same

- This Model
  - Temporary Offsetting
  - Dynamic LUC/forest dynamics
  - Solves the market problem – completely private decision making and no targeting

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Conclusions

- Offset principles embed a social choice between cost and biodiversity
- Temporary Offsets may be desirable or necessary in some situations
- “paper parks” versus additional “on paper”
  - Unavoidable information asymmetry
- Accounting rules based on assumptions
  - Need a better understanding of the dynamics of landuse change and restoration
  - Need better understanding of the dynamics of restored and protected sites in terms of contribution to biodiversity

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