Dual discounting in Renewable Resource Planning under Risk

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INTRODUCTION

Public planning of renewable natural resources, explicitly or implicitly, fits within the intergenerational context, and thus begs the question of how the future flow of goods, services, and costs should be evaluated against the present.

The scarcity of ecosystem services relative to that of manufactured goods and services is increasing over time, demanding that an ecological discount rate should be smaller than an economic discount rate.

Besides its multi-objective nature, public planning of renewable resources also entails high dimensional stochasticity as future is largely unknown. Therefore, not only the expected future value of ecosystem services matters, their variability does too.

CASE STUDY

Mixed Douglas-fir and western hemlock forests in the US Pacific Northwest. Home to high-quality timber and a number of endangered or threatened species, including the northern spotted owl.

Public land management in the region has been a subject of immense controversy and conflict. Between 1998 and 2008, over 20% of all litigation cases against land management decisions by US Forest Service was filed in Oregon and Washington. A significant portion of these cases challenged Forest Service's decision on harvesting trees, demanding less volume of timber removed from national forests in the region. The Northwest Forest Plan, a series of federal policies involving multiple federal agencies managing the public forests within the norther spotted owl habitat range, aims at meeting two needs: habitat for the species and demand for forest products.

Human capital cannot completely substitute natural capital.

The growth rate of ecosystem services is significantly lower than that of manufactured goods and services.

How to balance economic development AND ecological integrity in public resource planning?

Unintended consequences?

RESULTS

1. Economic objective only

NPV* of timber harvests would be $27,529 per hectare. However, less than one percent of the forest would be suitable for the NSO to inhabit.

2. Ecological objective only

Over 61% (SD: 17%) of the study region would qualify as suitable NSO habitats and the resulting NPV was $8,652 per hectare.

3. Both objectives but different discounting schemes

	Max NSO habitat (1%) s.t. NPV≥0.5NPV* (5%)	Max NSO habitat (5%) s.t. NPV≥0.5NPV* (5%)
E(NSO) (%)	58.89	56.45
E(NPV) ($/ha)	13,765	13,765
SD(NSO) (%)	20.73	23.51

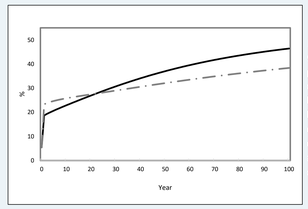

Figure 1. The expected percentage of forests suitable for NSO in the first century of planning, in dual-criteria scenarios. The objective was to maximize the total discounted habitat while keeping the NPV of timber harvests greater than or equal to half of its maximum achievable value. The solid line represents an ecological discount rate of 1%, and the dashed line 5%. The economic discount rate was 5% in both cases.

CONCLUSION

For the case study, the gain in adopting the dual-discounting scheme was moderate. A 1% ecological discount rate would lead to a higher portion of the forestlands suitable for the NSO to dwell. Its standard deviation and relative variance in the steady date were also lower than those with a 5%-rate, suggesting a more stable natural habitat for this threatened species. Perhaps the most gain lied in a faster conversion to the optimal forest condition for habitat conservation.

Dual-criteria management, although much superior than single-objective management in terms of balancing contradictory goals, may bring unintended consequences. By introducing market volatility to natural-resource decision making, the temporal variability of ecosystem increases because management decisions adapt to changes in the economic system. Thus, resource managers are urged to consider the variance of the criteria under consideration, in addition to their expected values.

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