Valuation uncertainty in an ecosystem service tradeoff assessment.

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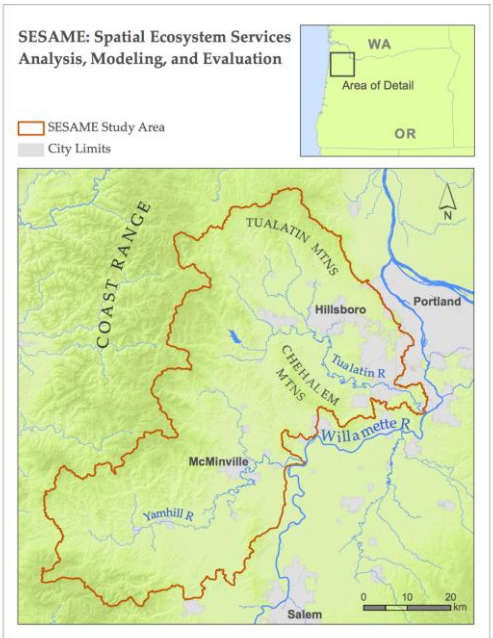
Project: Spatial Ecosystem Services Analysis, Modeling and Evaluation (SESAME)

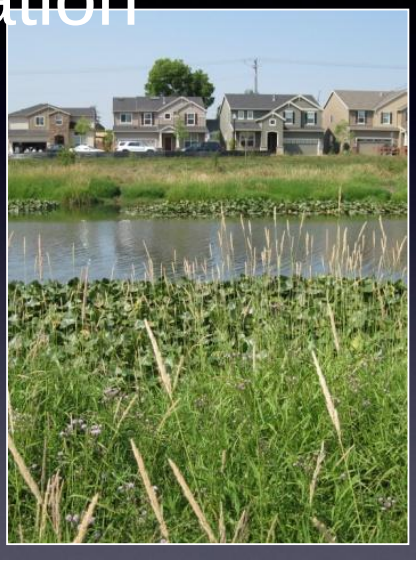
SESAME

- Multi year project assessing ES on multiple scales (landscape & field)
- Provision changes under LULC change & climate scenarios
- Full suite of Ecosystem Services
- Multiple Models
  - InVEST; SWAT; COTE
- Study time frame 2010-50



Impetus and motivation

- Land use modifications affect ecosystem services and biodiversity (Nelson et al. 2009, Hansen et al. 2005).
- Few studies have looked at the combined effects of land development and climate change on ecosystem service provision.



Economic Component

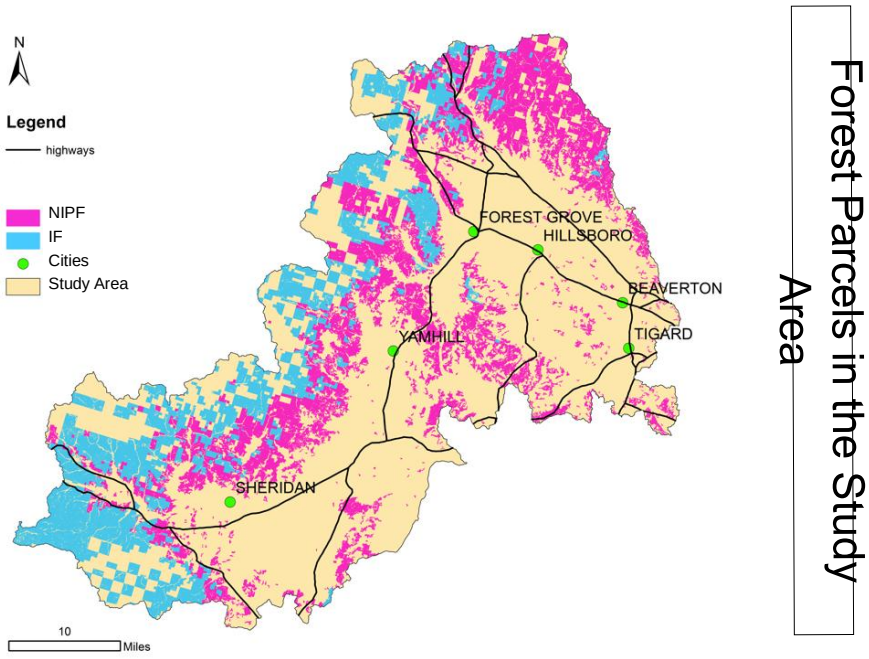
End Service	MEA Classification	Type of value	Valuation method
Agriculture	Provisioning	Direct: *consumptive*	Market: *net returns*
Row Crops			
Grass Seed			
Pasture			
Orchard/Vineyard			
Forestry/HWP	Provisioning	Direct: *consumptive*	Market: *net returns*
Rural Residential Land	Provisioning	Direct: *consumptive*	Market: *hedonic market value*
Carbon pools/ sequestration	Regulating	Indirect	Avoided cost *(meta estimate)*
Water provision	Provisioning	Direct: *consumption*	Avoided cost: *alternative sources*
Water Quality: nutrients (N,P) & sediment retention	Regulating	Indirect/Direct	Avoided Cost: *meta analysis*

Research Question

- How does uncertainty in valuation of ES affect tradeoff assessments?
- Scenario: private forest conversion to rural residential land use.
- Ho: Non-market services will have ↑ uncertainty (possibly affecting switching points).

Methods & Assumptions

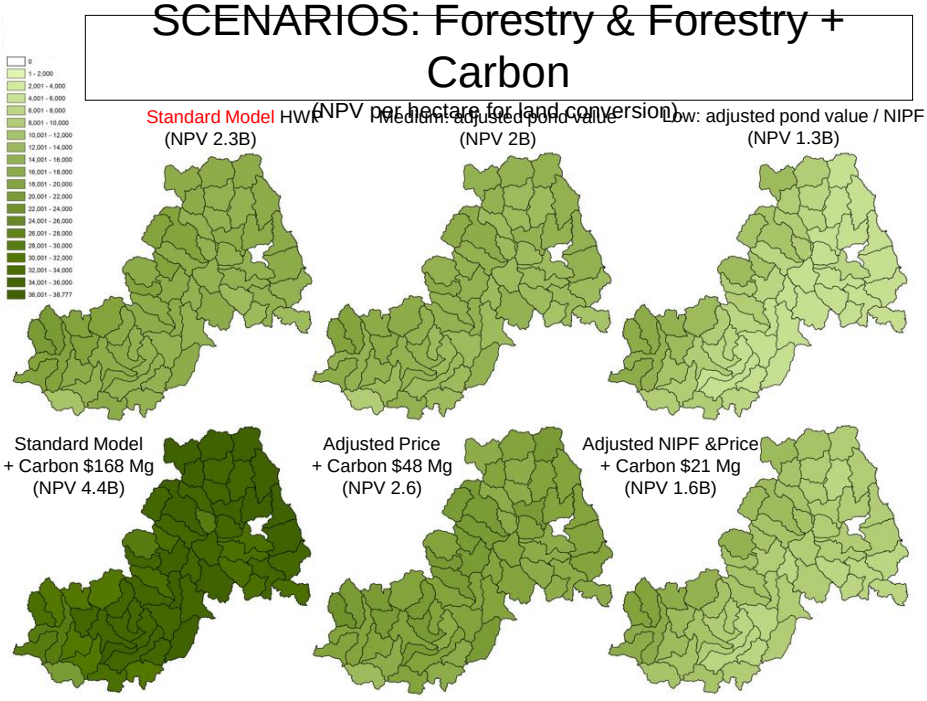
- Value the flow of ecosystem services
  - HWP: even flow/maximum sustainable yield ***Douglas Fir***
    - Even distribution of age classes (45 year IF/90 year NIPF)
    - DFSIM/King Site Index: intensive management regime
    - Harvest Cost Flight et al. 1998
- Social Cost of Carbon (US EPA; Tol 2009 median & mean)
  - Carbon: sequestration & flux from clear cut
- Social Discount Rate 3%
- Rural Residential Land: bare land sales outside UGB
- Replicating & Improving work by Polasky et al. 2008 and Nelson et al 2009.



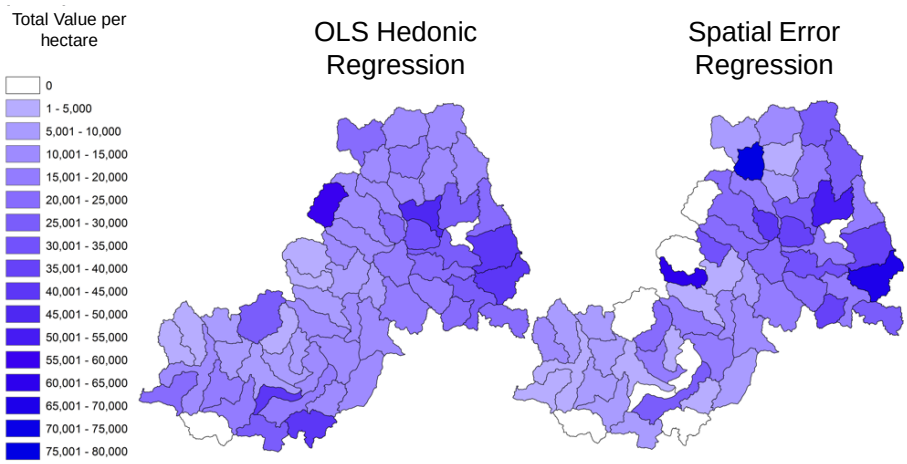
Forest Parcels in the Study Area

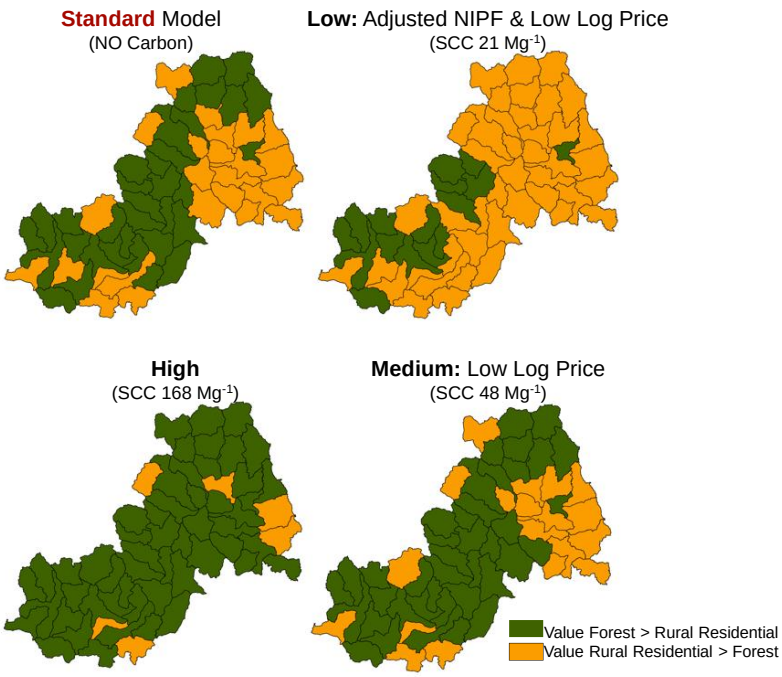
SCENARIOS: Forestry & Forestry + Carbon

(NPV per hectare for land conversion)



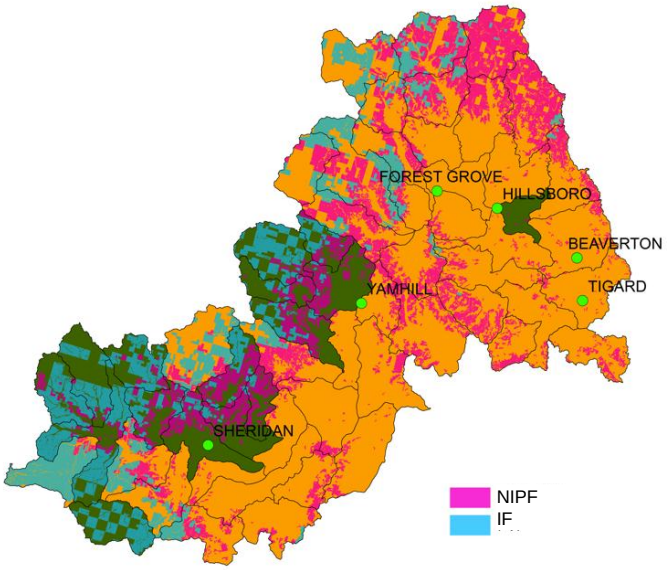
Rural Residential Land Values
(per hectare).



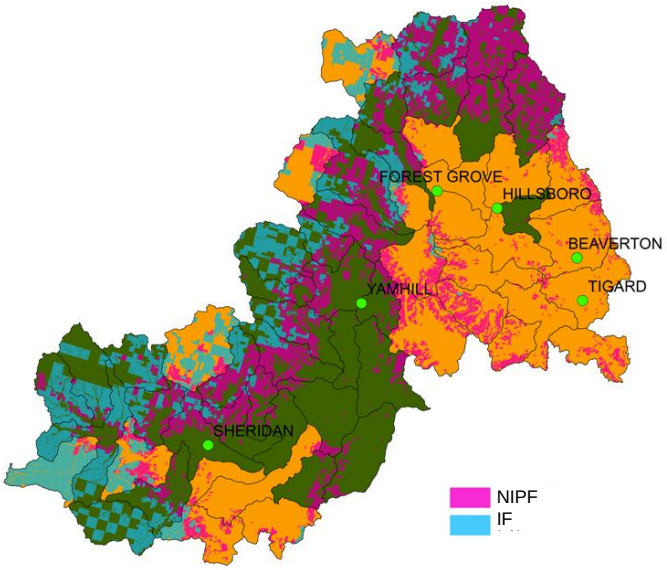


Spatial Patterns of Forestry & Rural Residential Land Value

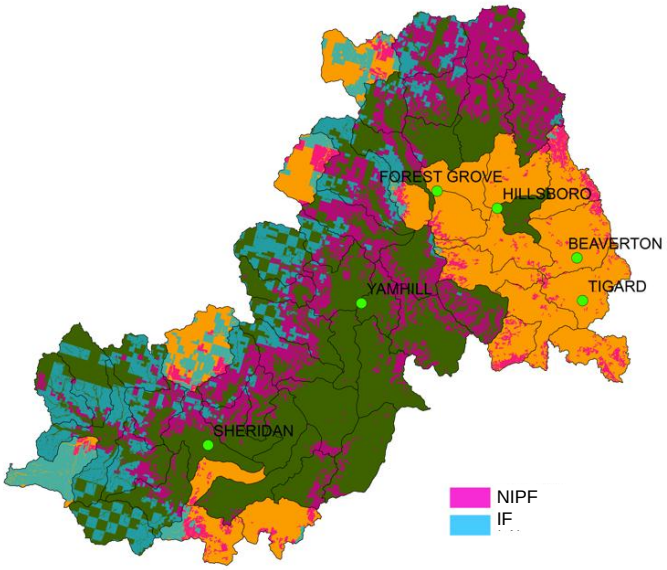
LOW: Adj NIPF, Low log price, Low Carbon



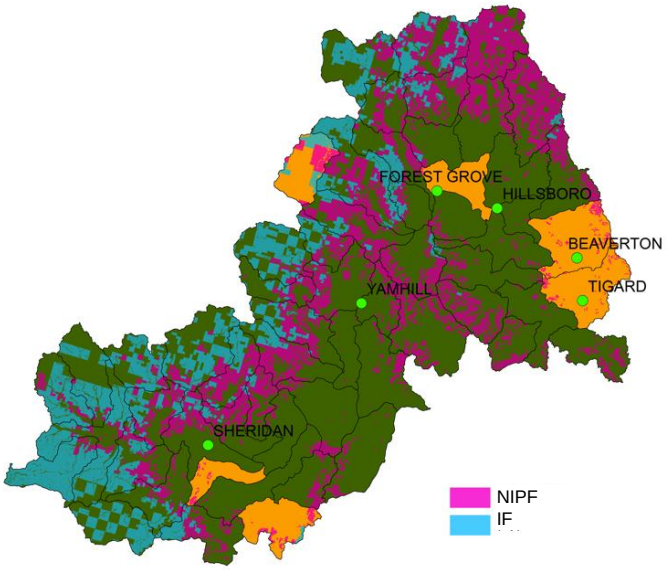
STANDARD: no carbon



Medium: low log price, medium carbon



HIGH: High Carbon



Discussion

- The spatial configuration of resources matters.
  - Spatial relationship affect the quality of the analysis (spatially correlated errors).
  - Finer scales reveals heterogeneity across the landscape
- Uncertainty in non-market valuations can overshadow biophysical parameters.

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Spatial Errors Regression

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Acknowledgments

SESAME TEAM
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Spatial Results Residential Land

Variable	Estimated Coefficient	OLS Estimated Coefficient
ln(Acres)	-0.6622809***	-0.6774321***
ln(Gravity Index)	0.4910658***	0.5317133***
Elevation	0.0017474**	0.00108
Slope	-0.0004825	0.0062837
Metro	0.3046864**	0.212844
Polk	-0.6412984*	-0.6336863*
Time Trend	0.0446447***	0.0427759***
Lambda	0.4160108***	
Constant	8.054644***	8.002513***
Akaike Info Criterion	1743.08	1789.56
Schwarz Criterion	1776.92	1823.4
Log Likelihood Value	-863.5399	-886.778

* Indicates significance at a 0.10 level,
**- significance at a 0.05 level,
***- significance at a 0.01 level

OLS Results

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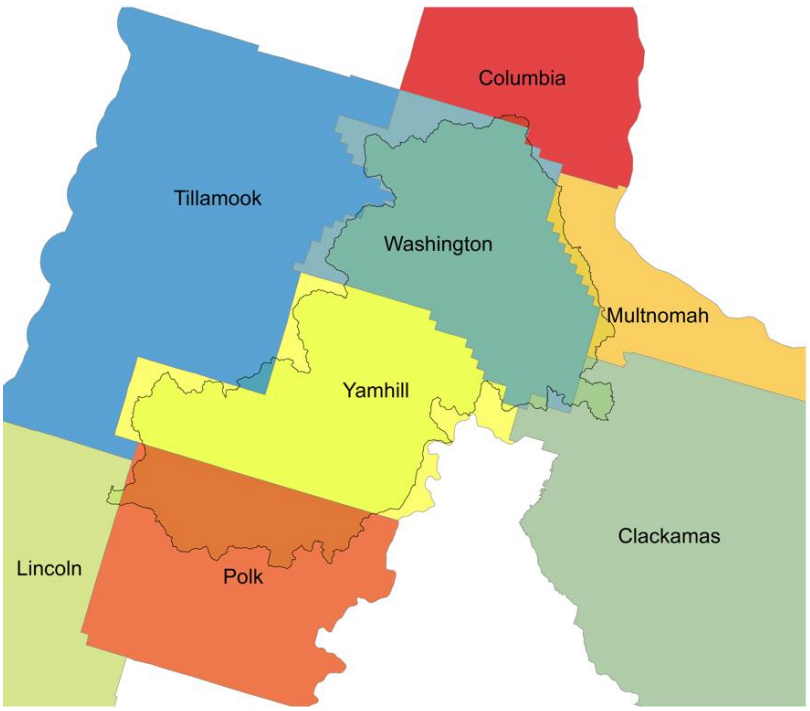

Counties within Study Area

6th Field Watersheds/HUC12s
within Study Area