

Managed Timber Production Model

Shan Ma



Forest Services



- The services provided by a forest include:
 - Carbon sequestration
 - Water quality regulation
 - Water quantity regulation (flood management)
 - Biodiversity conservation
 - Pollinator habitat
 - Timber
 - Non-timber forest products (NTFPs): bushmeat, medicine, etc.

Why we are interested in timber

- Timber production is important to human well-being and economic growth across the globe.
- The value of timber would help determine the societal cost of alternative development or conservation plans (i.e., economic opportunity costs).



Tier 1 Timber model

- Analyze the amount and volume of legally harvested timber from natural forests and managed plantations based on harvest level and cycle
 - Forest plantation
 - Simple mix of fastest-growing species
 - Rotational cutting and replanting
 - Even distribution of tree ages
 - Primary, natural forests
 - Retaining much of natural structure and function at least at the beginning of a harvest cycle
 - E.g., logging of rainforests in the Amazon

Property right of harvest

**InVEST
model**

Completely Open
to Households

Completely Closed
to Households

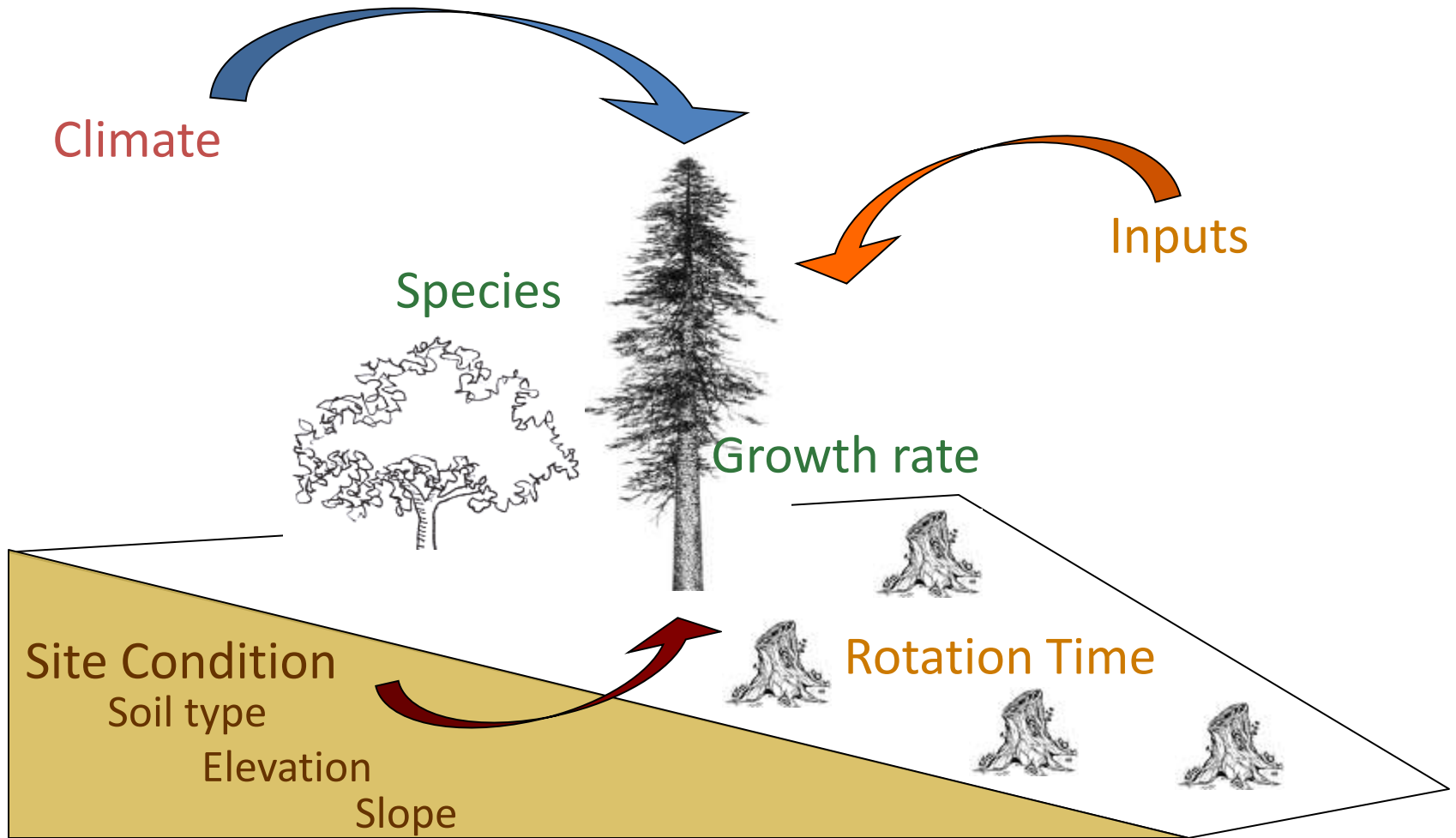


Open access

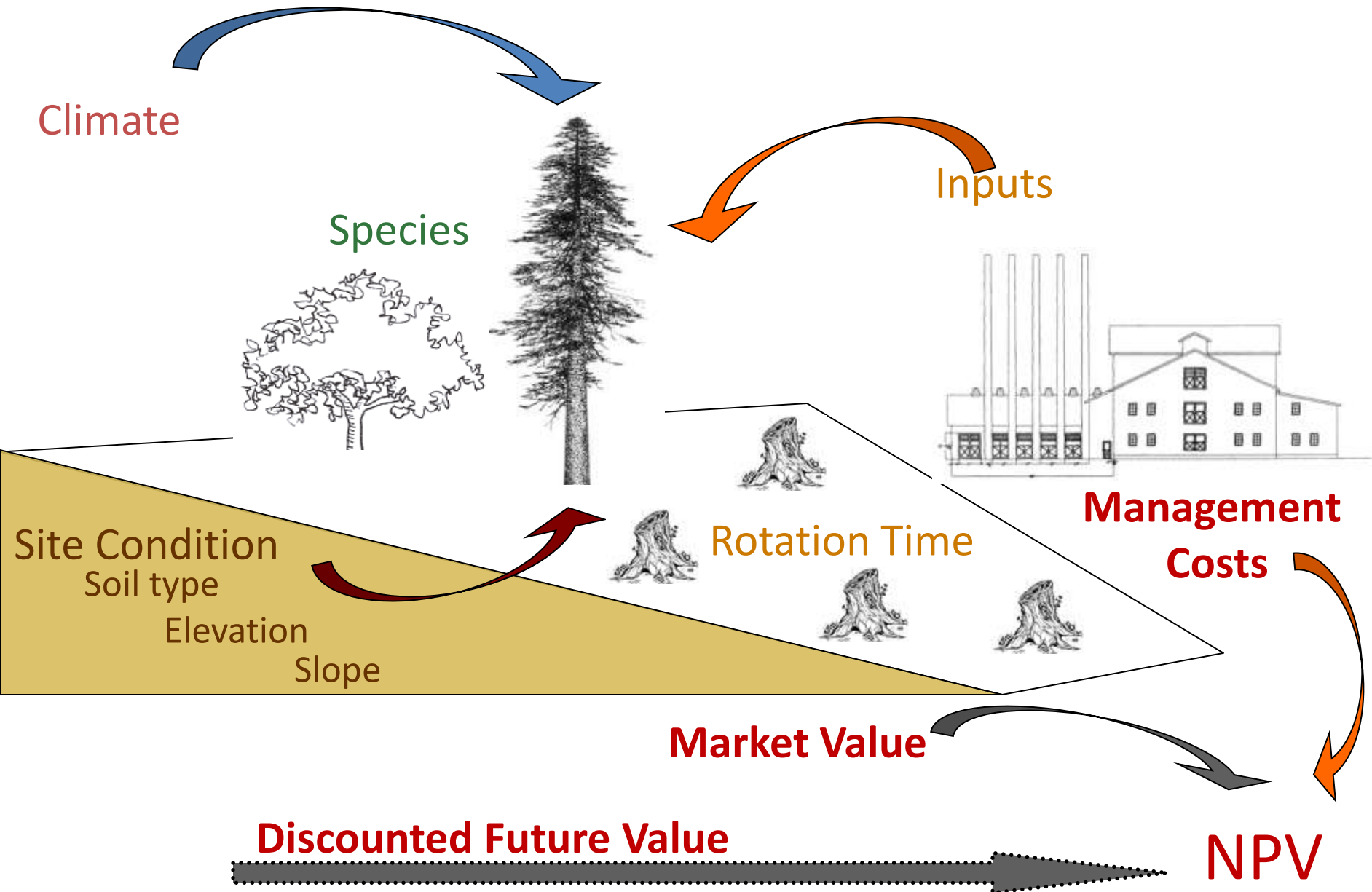
Intermediate access

Exclusive access

Timber yield model



Net present value of timber



InVEST Tier 1 Model

No production function for Tier 1 model

Climate

Species

Inputs

Harvest level

Management Costs

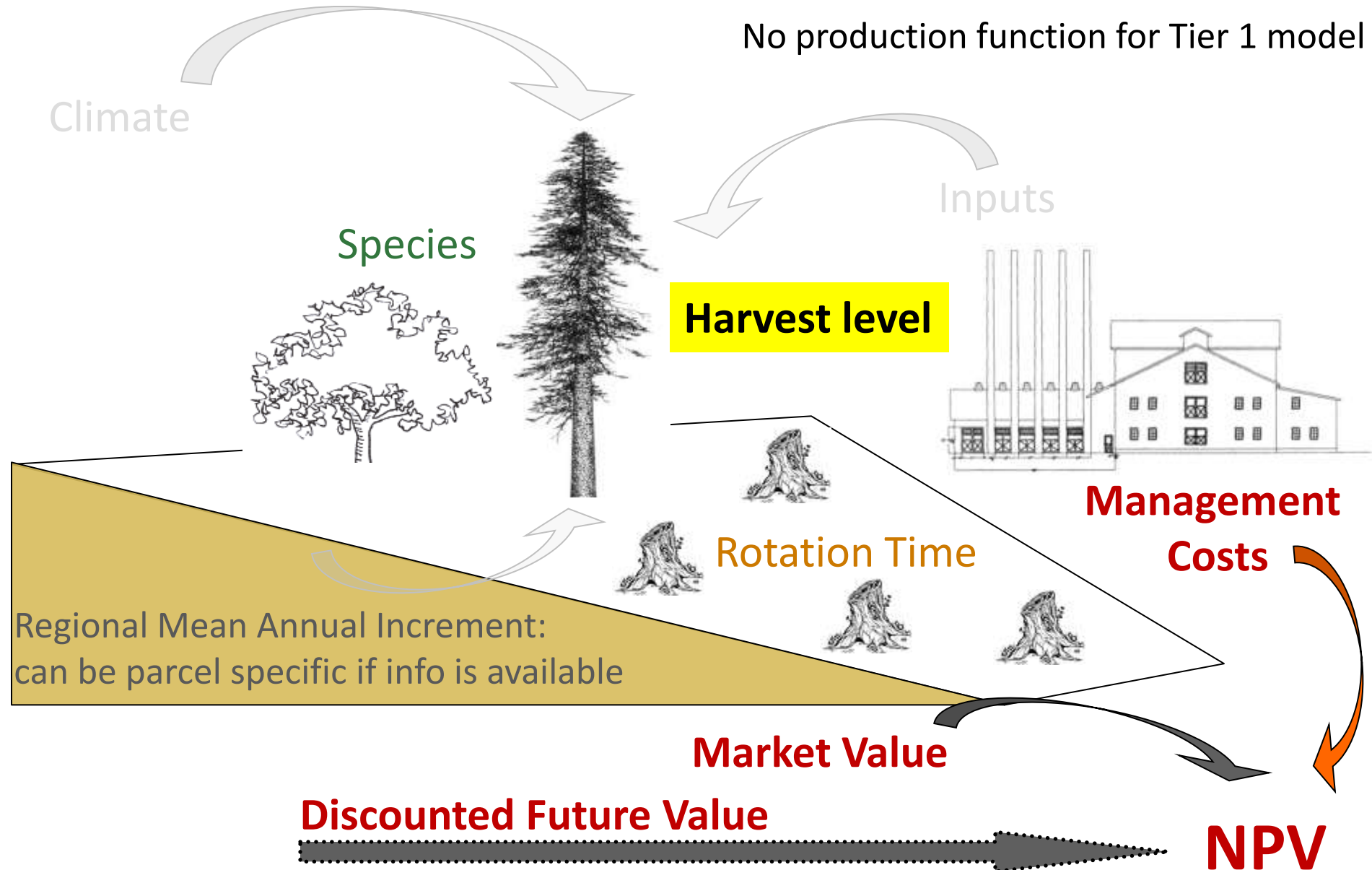
Rotation Time

Market Value

Discounted Future Value

NPV

Regional Mean Annual Increment:
can be parcel specific if info is available

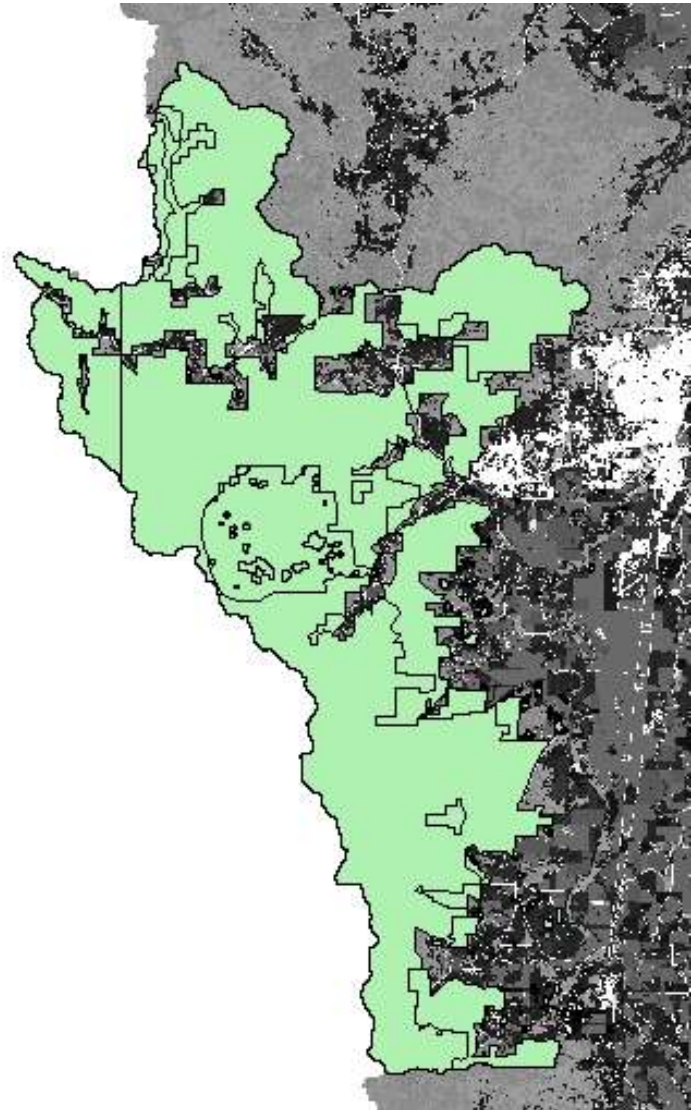


Assumptions

- An entity has a formally recognized right to harvest *roundwood* from a forest
- Forest harvested %, mass of timber harvested, and the frequency of harvest period remain constant
- Harvest-related prices and costs remain constant
- Discount rate remains constant

Data needs (1)

- **Timber management zones (required)**
 - A GIS dataset (vector)
 - Each zone should be given a unique identifier
 - Projected in meters with defined projection
 - Used only for visualization



Data needs (2)

- **Production table (required)**
 - Starting point: year_current or year_future

Parcel_ID	Parcel_area	area%_harvest	Freq_harvest	Harvest_mass	Price	Maint_cost	Harvest_cost	T	Immed_harvest	BCEF
1	1000	2.22	1	80	300	190	50	50	Y	1
2	1000	2.22	1	70	200	260	124	50	Y	1
3	1000	25	20	70	200	310	225	50	N	1
4	500	100	1	95	350	180	45	1	Y	1
5	500	20	2	95	400	190	105	10	Y	1

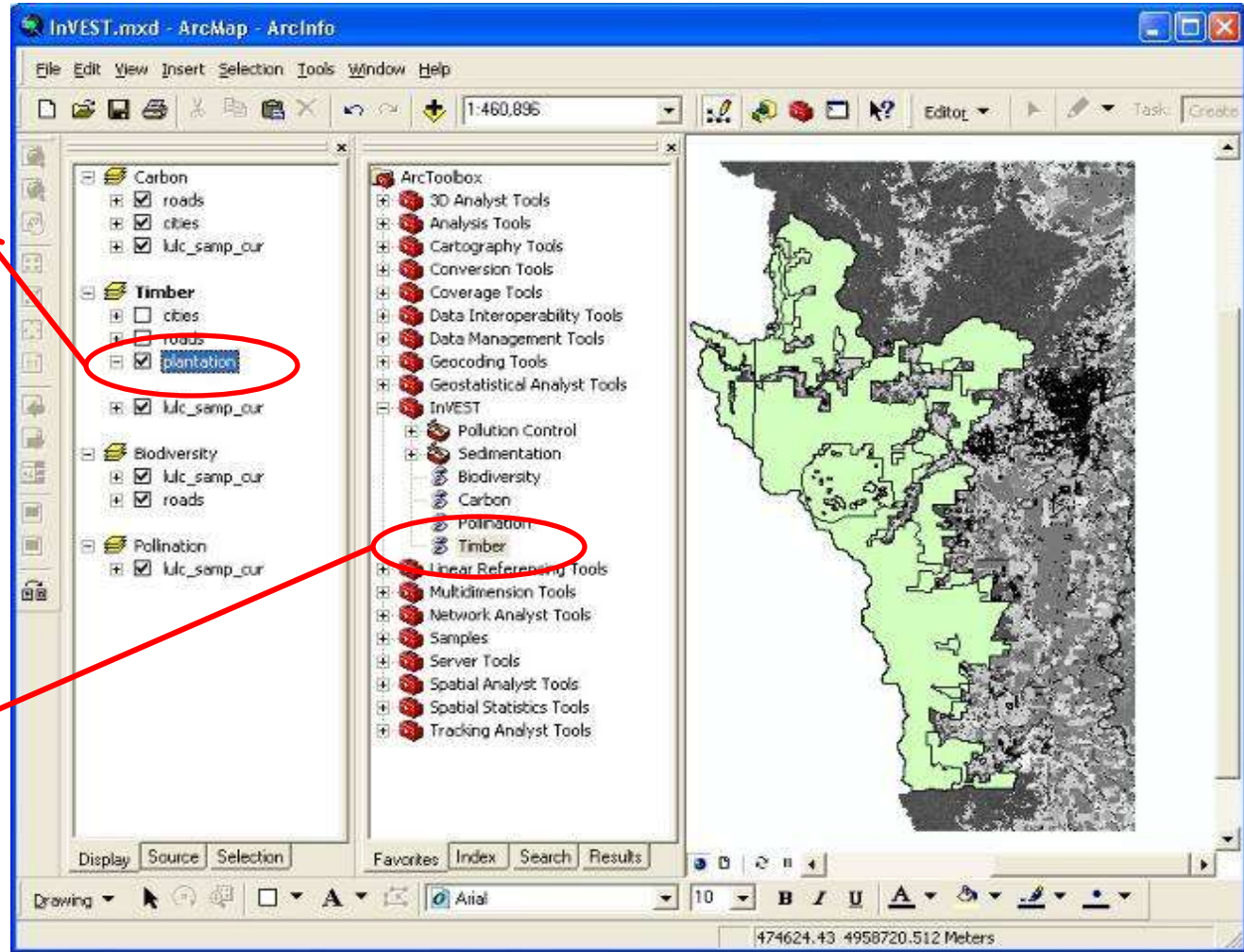
BCEF: Expansion factor that translates the mass of harvested wood into volume. Harvested volume is in m^3 years from year_current or year_future per parcel harvests will be valued 1 if not sure.

Data needs (3)

- **Market Discount Rate (required for valuation)**
 - Reflect society's preference for immediate benefits over future benefits
 - Default value: 7% /year
 - This rate should differ depending on the country and landscape being evaluated

Running the model (1)

Load parcel data:
C:/Invest/timber/input
/plantation



Double click
InVEST
timber tool

Running the model (2)

Shapefile

Production
table

Discount
rate

The screenshot shows the 'Timber' software interface. The main window has a blue title bar and a light beige background. On the left, there are several input fields for parameters. A red box highlights the 'Managed area map', 'Plantation Production Table', and 'Market Discount Rate' fields. Red arrows point from yellow text boxes on the left to these fields. The 'Workspace' field is also visible. On the right, there is a 'Workspace' panel with a description. At the bottom, there are buttons for 'OK', 'Cancel', 'Environments...', '<< Hide Help', and 'Tool Help'.

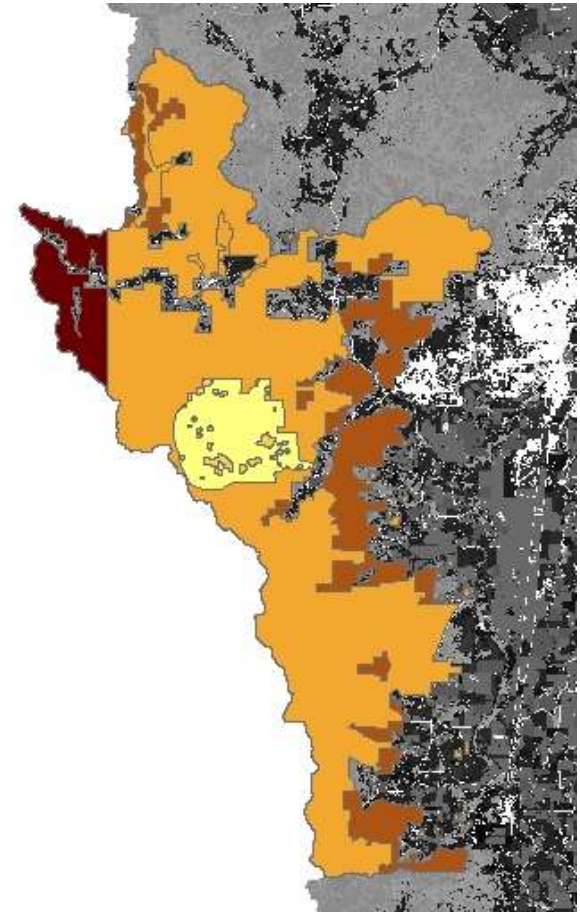
Parameter	Value
Workspace	C:\InVEST\Timber
Managed area map	C:\InVEST\Timber\Input\plantation.shp
Plantation Production Table	C:\InVEST\Timber\Input\plant_table.dbf
Market Discount Rate	7
Results suffix	1

Workspace
Folder that contains all the required data. Results will by default be saved to this location.

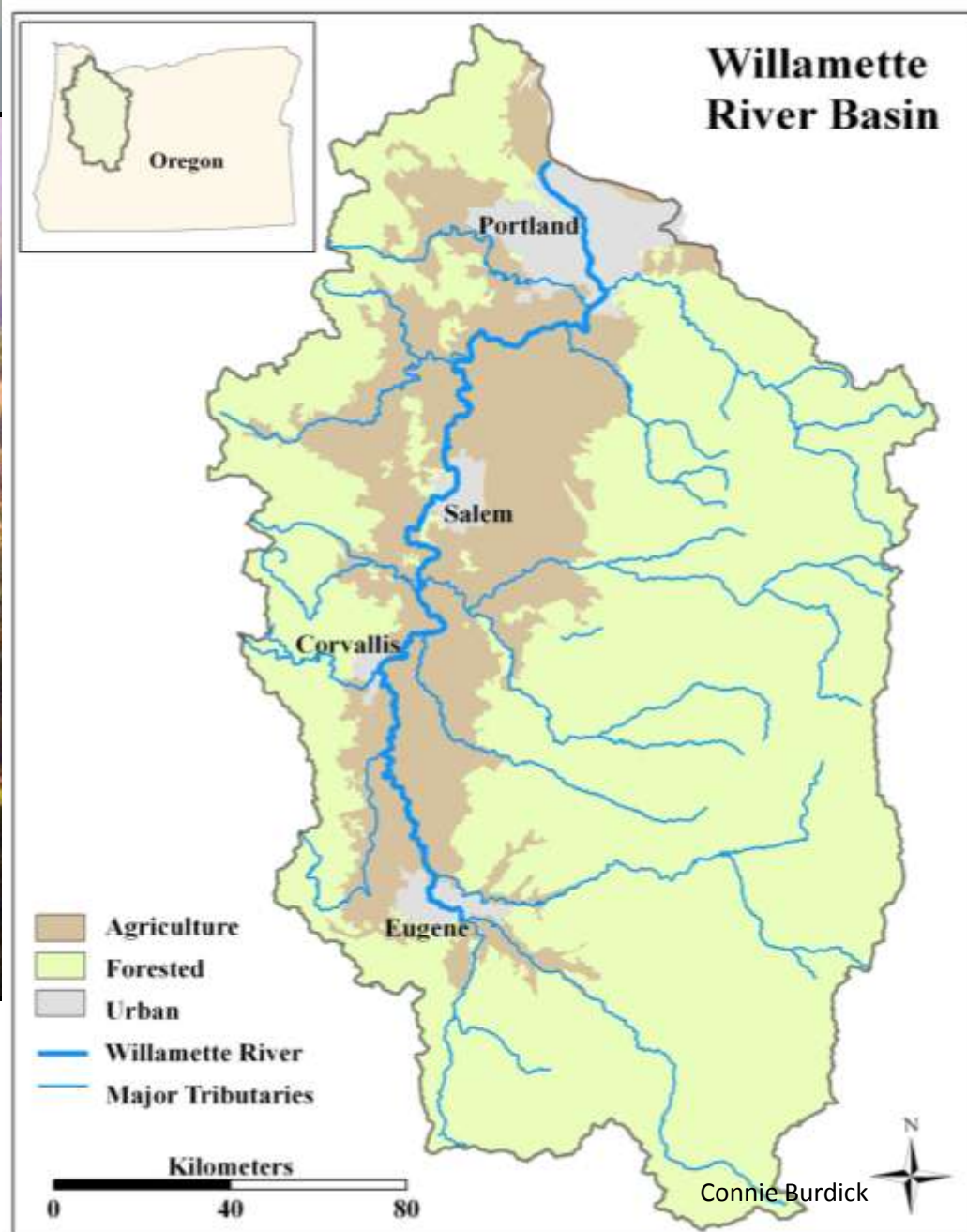
OK Cancel Environments... << Hide Help Tool Help

Model Output

- **Attributes for each timber parcel**
 - **TNPV**: Total net present value of timber production (dollar)
 - **Tbiomass**: Total biomass of harvested wood removed (Mg)
 - **Tvolume**: Total volume of harvested wood removed (m³)



Model application



Willamette River Basin

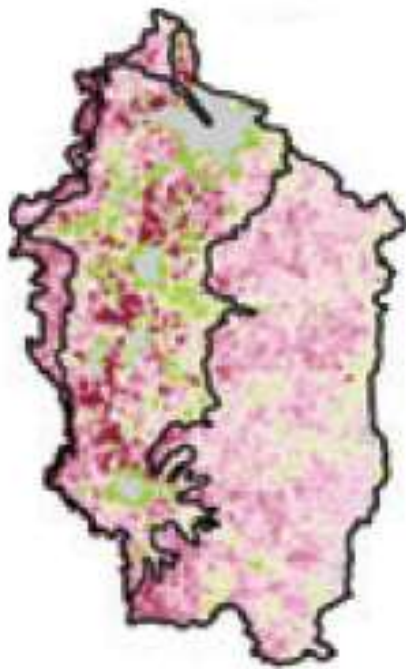
Nelson, et al. Frontiers in Ecology and the Environment 2009; 7(1): 4–11.

Model application

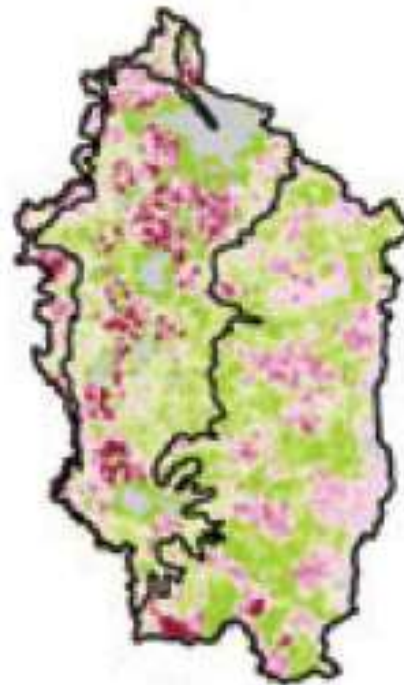
- Willamette River Basin (OR)
 - Loss of 60% old-growth forest due to forest harvest
 - Expected doubling population over the next 50 years
 - **Policy challenge: old-growth forest & wildlife protection vs. local economic development**
 - Stakeholder driven scenarios:
 - Development: allow freer rein to market forces across all components of the landscape
 - Conservation: place greater emphasis on ecosystem protection and restoration

Model application

- **Net present value of commodities (\$/unit area)**
(including **timber**, agricultural crops, and residential housing)



**Conservation
Scenario**



**Development
Scenario**



Model application discussion

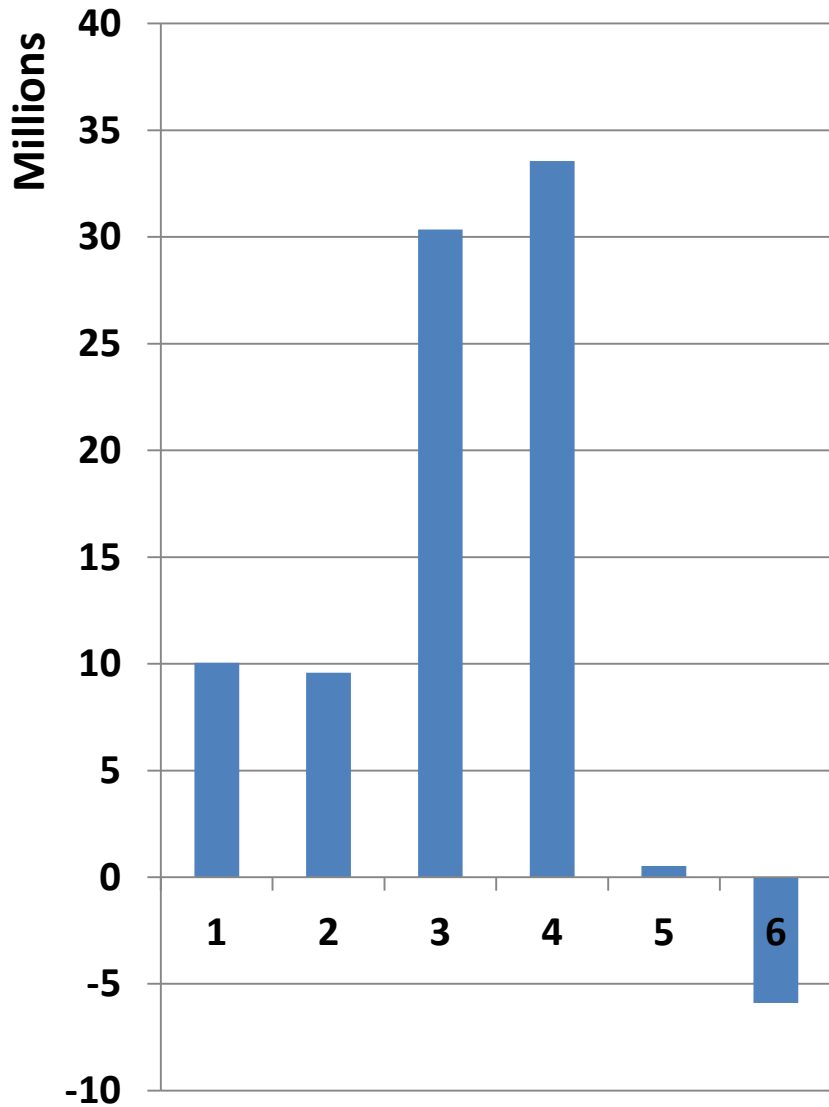
- Where do you plan to apply this model?
- What are the key policy questions?

Hands-on session!

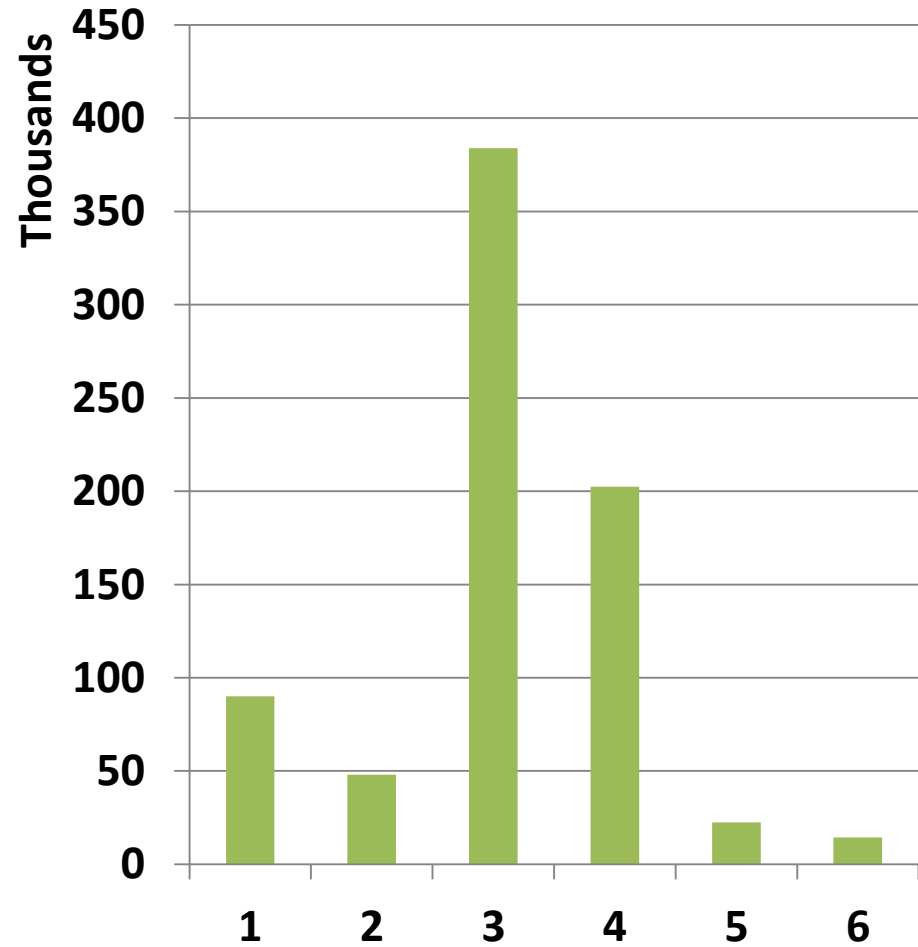


Post-analysis

TNPV

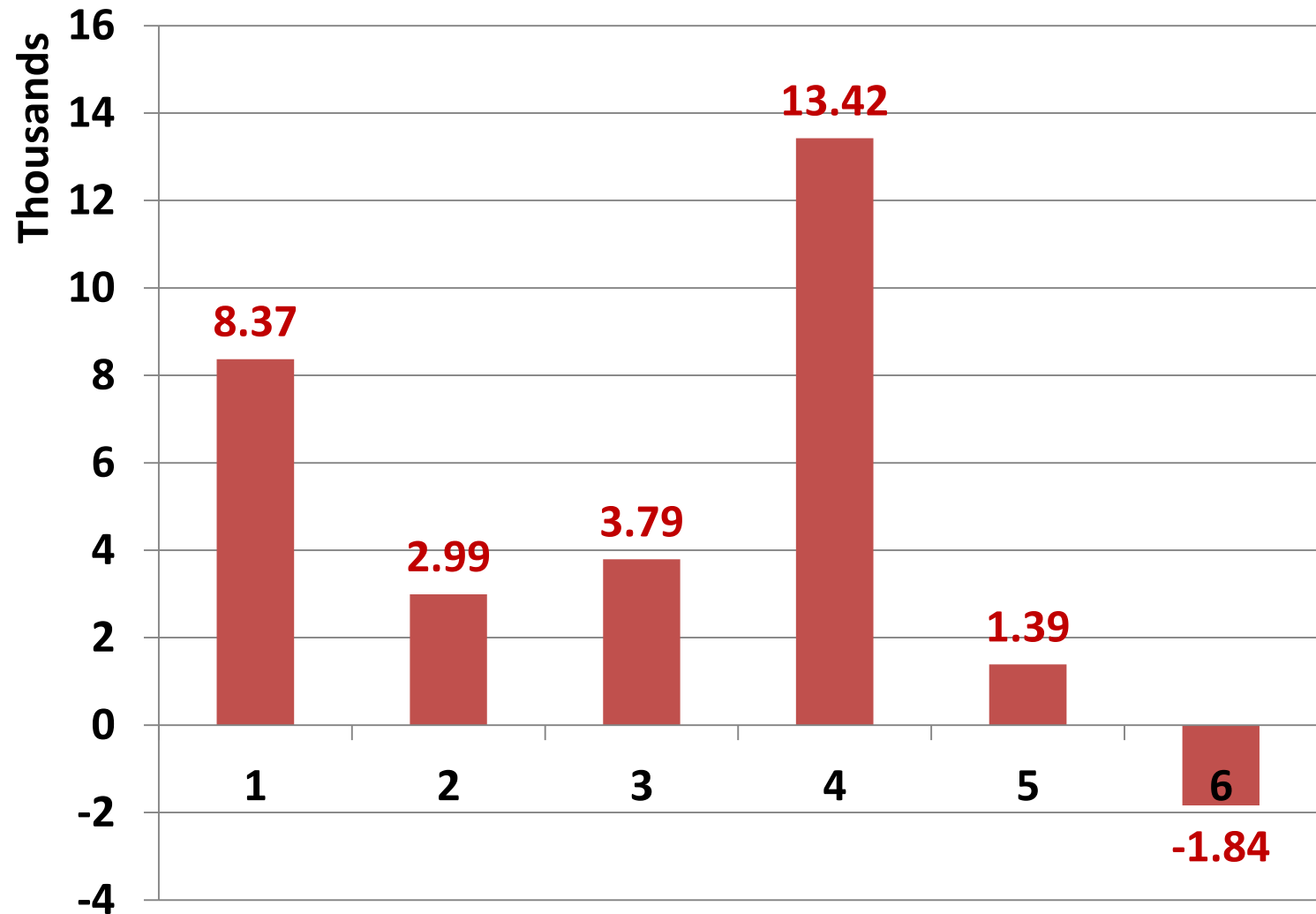


TBiomass



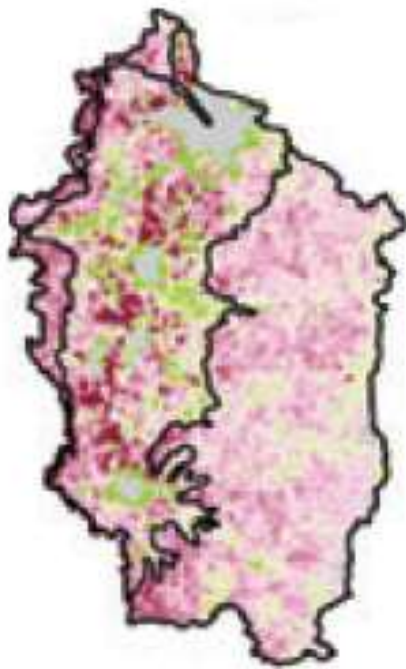
Post-analysis

TNPV/ha

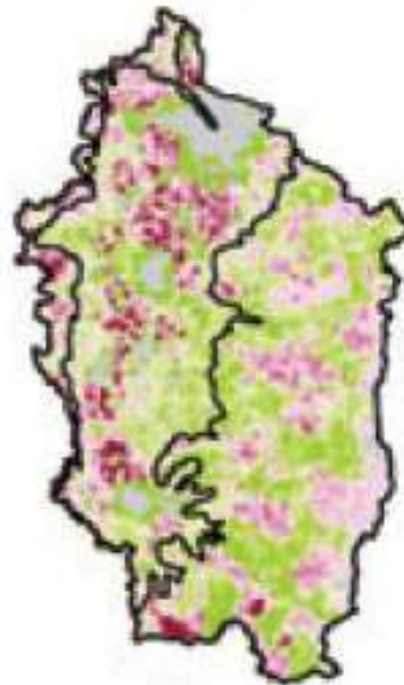


Willamette River Basin Example

- **Net present value of commodities (\$/unit area)**
(including **timber**, agricultural crops, and residential housing)



**Conservation
Scenario**



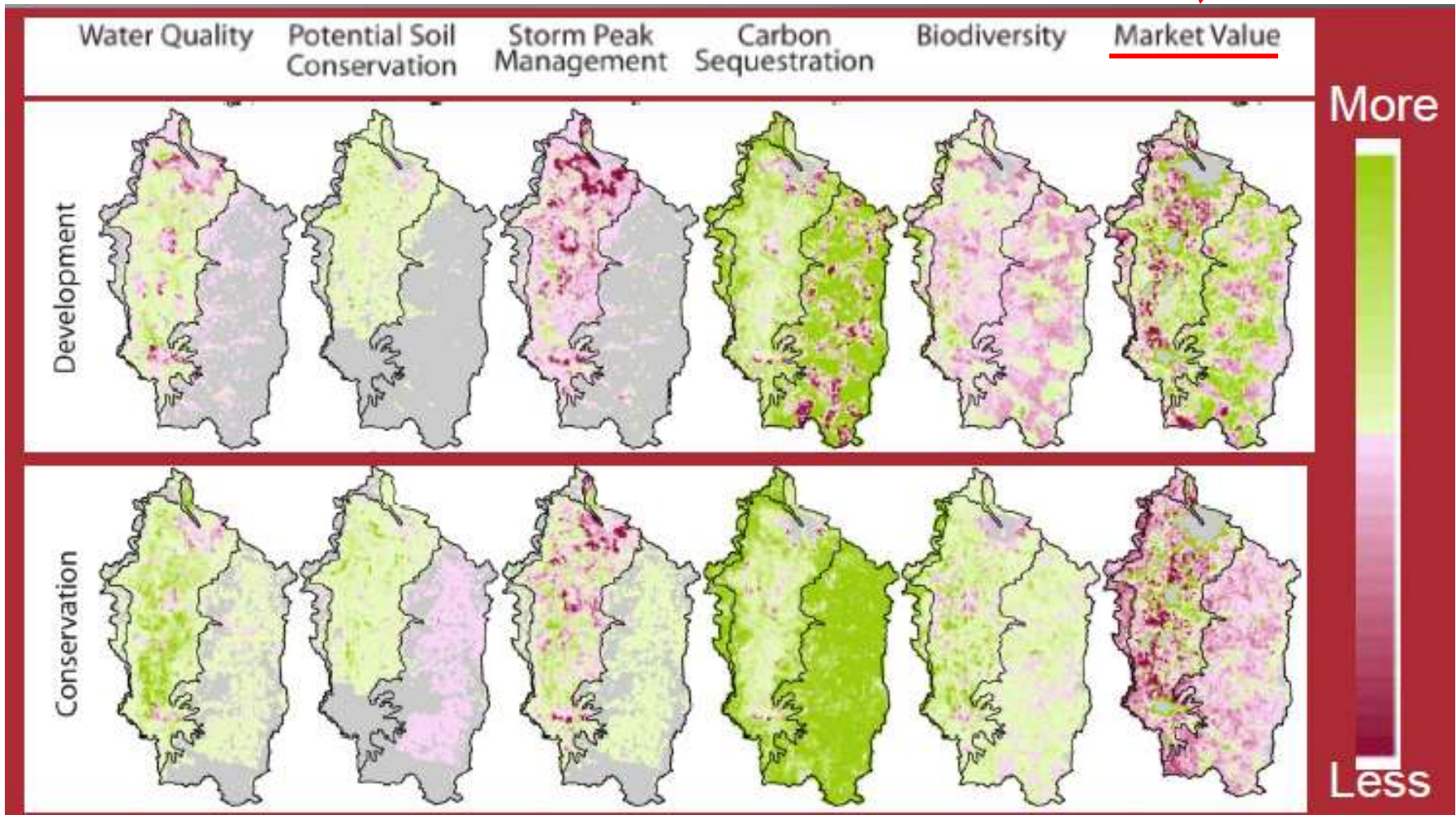
**Development
Scenario**



Synthesis of results (1)

- Willamette Basin case study**

Including Timber



Synthesis of results (2)

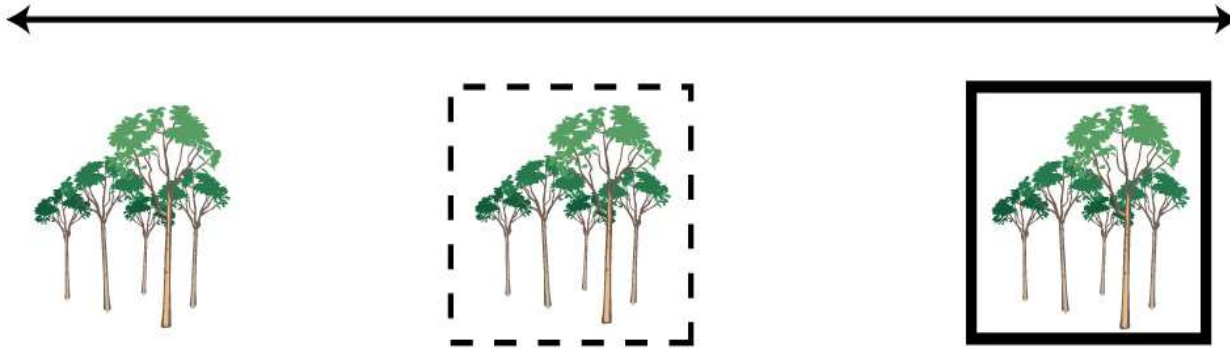
- Trade-off between different services
 - Little tradeoff between biodiversity conservation and other regulating ecosystem services.
 - Obvious trade-off between commodity provision and other types of ES
- Incentive program would alleviate the tradeoff
 - Payments for ecosystem services
 - Conservation easements
 - Government program (e.g., Conservation Reserve Program)

Model Outlook

- Open-access and intermediate timber harvest

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to Households

Completely Closed
to Households



- Tier 2 : dynamic model
 - allowing change of harvest volume and value over time
- Non-timber forest products (separate model under development)
 - Medicinal & Herbal Products
 - Decorative Products
 - Specialty Wood Products
 - Edible Products



Questions and comments



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