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Woody Biomass Demand & Regional Timber Markets: A Case Study of New England & New York

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OUTLINE

1. Overview

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3. Results

4. Conclusions

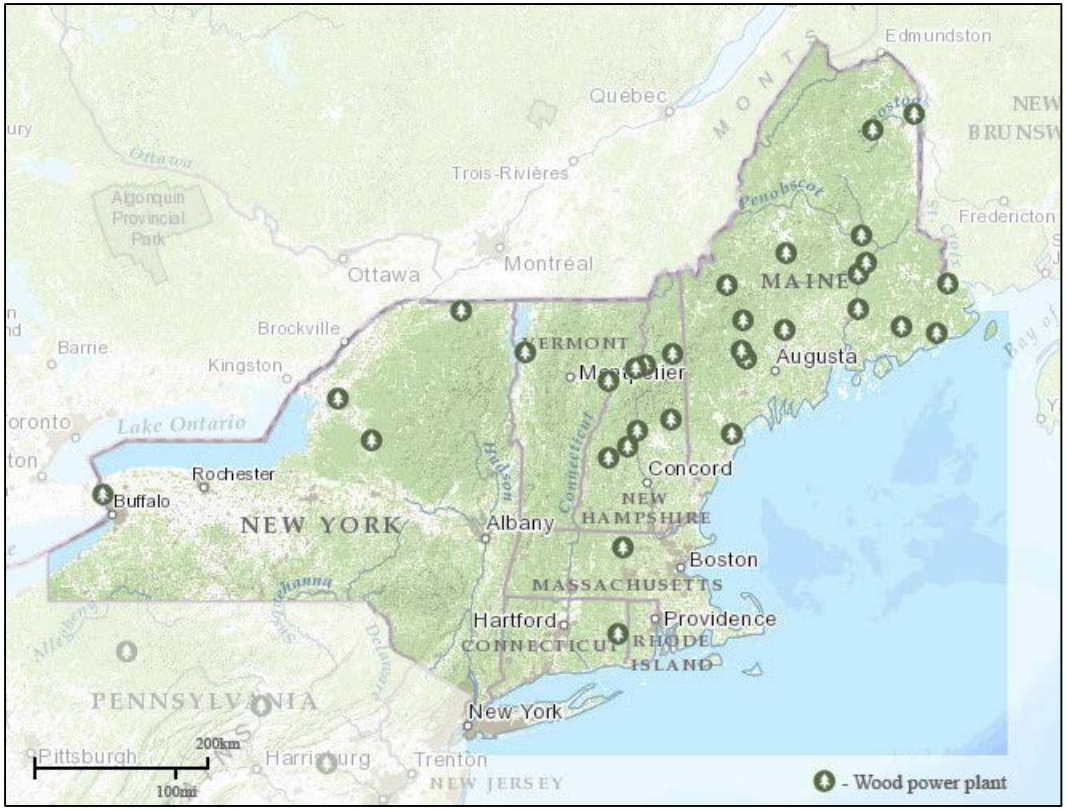
Acknowledgements:

Bob Abt, Jesse Henderson, Ray Sheffield

Overview

New England and New York forested lands have a great potential as a renewable energy feedstock

72% of the land is forest cover and nearly 81% of this forestland privately owned



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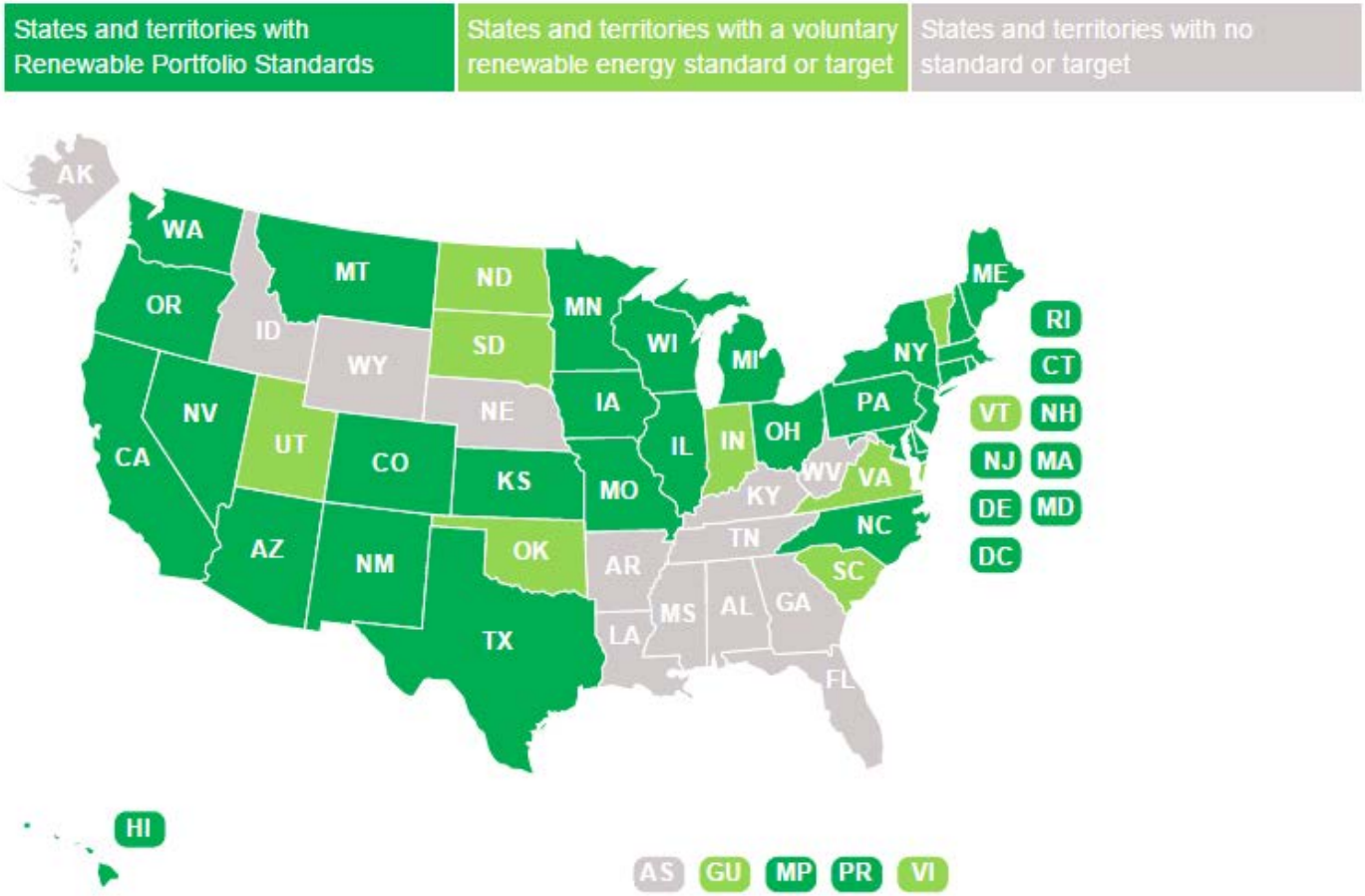
Overview

Policy instruments promoting wood bioenergy use

National level: Energy Policy Act of 2005, Energy Independence and Security Act of 2007
State level: Renewable Portfolio Standards (RPS) and Renewable Energy Certificates (RECs)



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Ecological and Environmental Concerns

Carbon balances
Biodiversity
Nutrient cycling
Long-term productivity

Economic Concerns

Supply and demand for woody biomass
Management opportunity with low grade market
Impacts on traditional wood markets

Objective: How will changing woody biomass consumption affect New England and New York timber markets?

Methods Study Area

Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont

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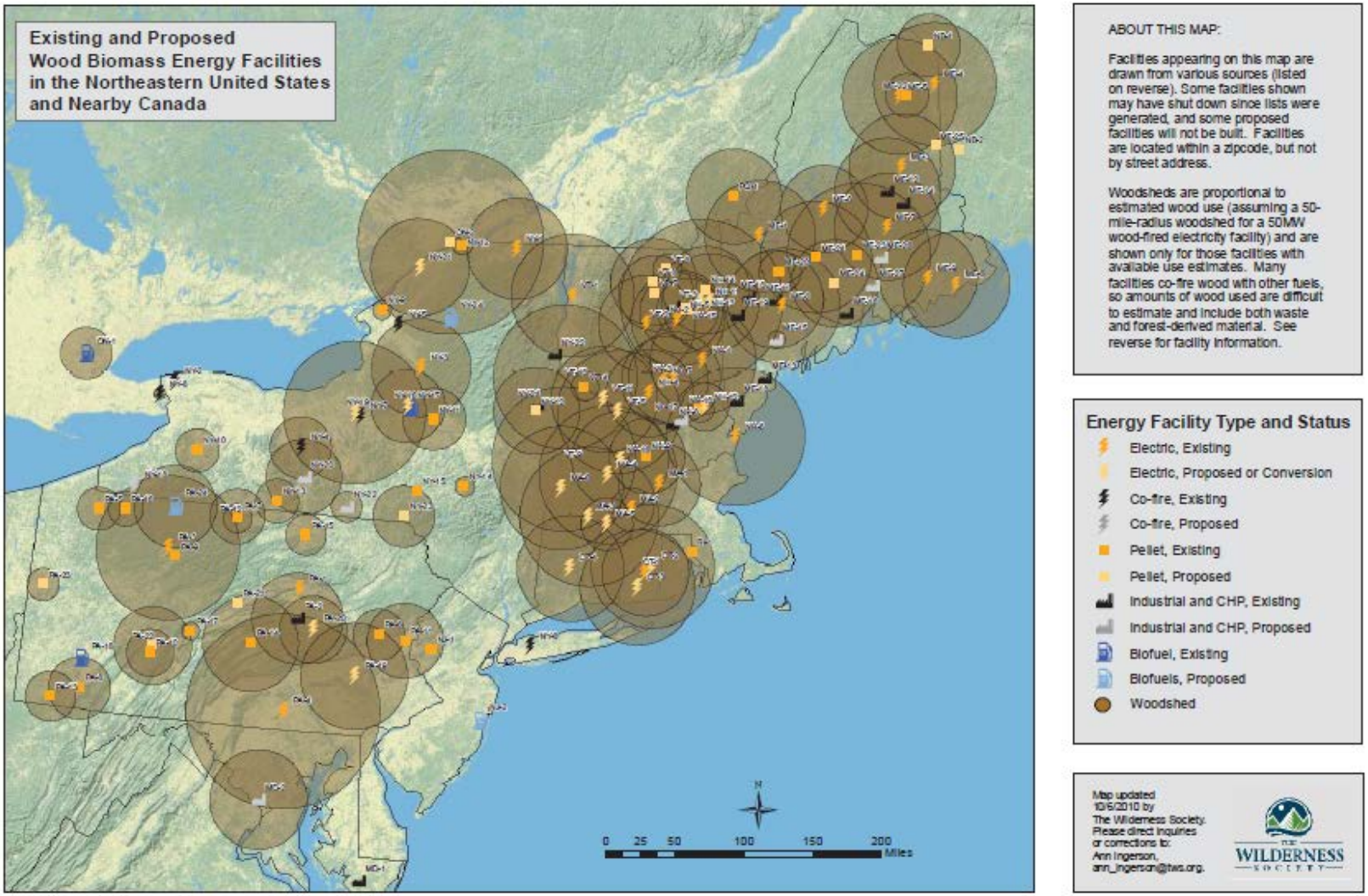
Methods



Existing and proposed wood biomass energy facilities in Northeast

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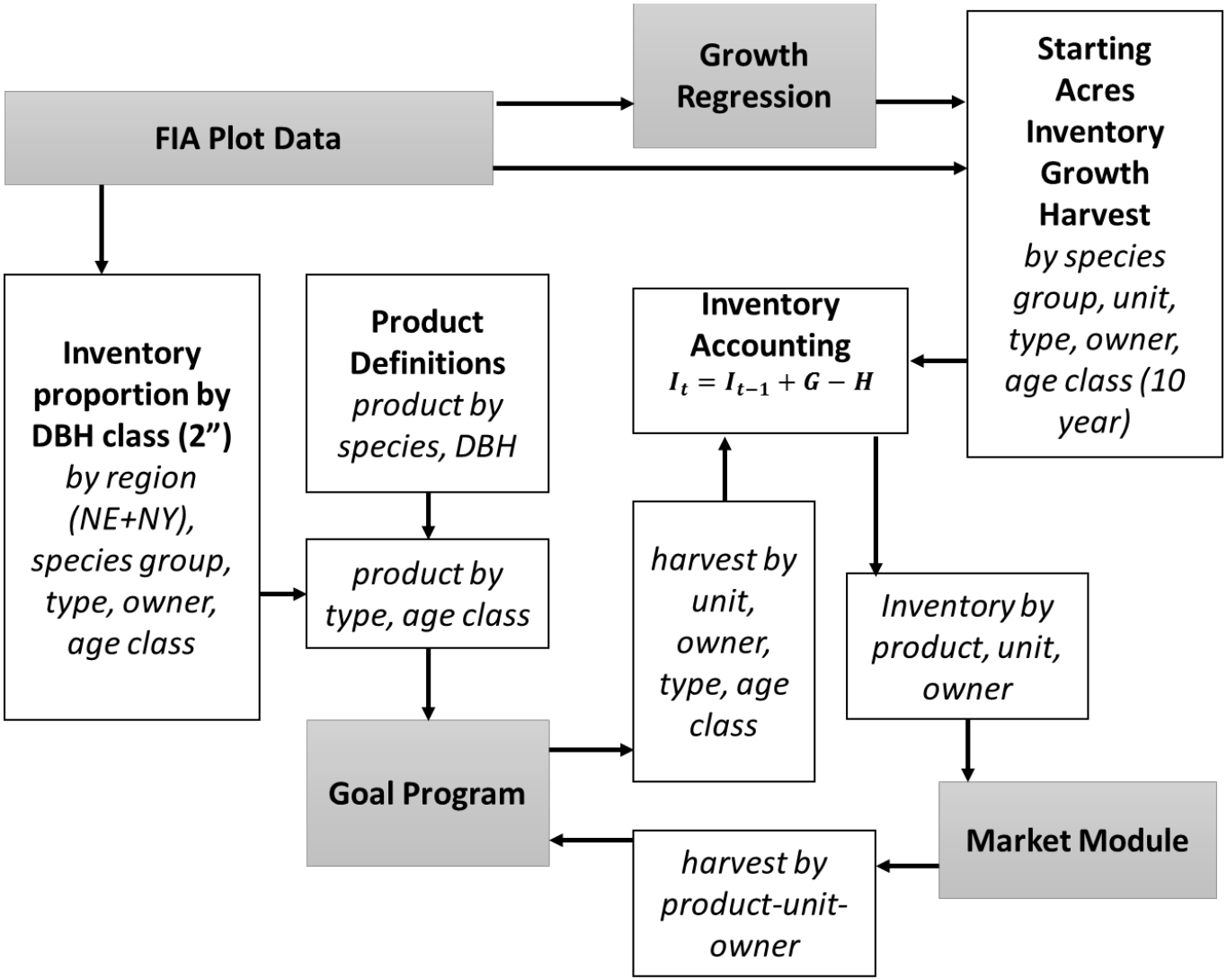
Northeast Sub-Regional Timber Supply Model (NE-SRTS)

Model structure and data flows



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Market Module

Supply:

$$Q_{it}^{S} = V_{it} \cdot P_t^{\beta} \cdot I_{it}^{\gamma} \quad (1)$$

Demand:

$$Q_t^{D} = Z_t \cdot P_t^{\alpha}$$

Equilibrium:

$$Q_t^{D} = \sum_i Q_{it}^{S}$$

Inventory, Growth and Removals are tracked by:

- **Region** – *24 FIA survey units; non-disclosure issues*
- **Ownerships** – *public and corporate and & other private*
- **Product classes** - *softwood pulpwood, softwood sawtimber, hardwood pulpwood and hardwood sawtimber*
- **Management types** – *9 management types (1.4 % dropped)*
- **Age class** - *eleven 10-year age classes (with aggregated upper end to include 100+ year old forests*
- **Partial harvests**

Area of timberland by SRTS management type and ownership class (thousand acres)

Management type	All	Ownership class			
		National Forest	Other public	Private-individual	Corporate
White/Red/Jack pine	3471.67	31.63	456.68	2405.43	577.92
Spruce-fir	6740.64	148.72	403.74	1838.49	4349.68
Other softwoods	464.08	–	131.71	286.14	46.23
Oak-pine	1804.03	5.45	312.83	1269.56	216.19
Oak Hickory	6477.64	26.95	1077.21	4446.66	926.82
Elm/ash/cottonwood	2105.82	1.64	302.64	1535.49	266.05
Maple/beech/birch	21515.23	693.08	1815.58	12004.58	7001.99
Aspen/birch	3039.68	87.89	165.58	1435.12	1351.09
Other hardwoods	1000.63	3.52	153.16	665.37	178.58
All	**46619.42**	**998.9**	**4819.13**	**25886.84**	**14914.56**

Elasticities and sensitivity analysis

Case/ Product	Demand				Supply			
	HW P	HW S	SW P	SW S	HW P	HW S	SW P	SW S
Initial Analysis	0.50	0.50	0.50	0.50	0.70	0.45	0.50	0.50
Case 1	0.45	0.45	0.45	0.45	0.75	0.50	0.55	0.55
Case 2	0.55	0.55	0.55	0.55	0.65	0.4	0.45	0.45

<u>Case 1:</u> *conditions favorable to more wood use* - uniform decrease in demand elasticity values for all products by 0.05 and simultaneous uniform increase of all supply elasticity values by 0.05

<u>Case 2:</u> *less favorable conditions for the wood market* - uniform decrease in supply elasticity values for all products by 0.05 and simultaneous uniform increase of all demand elasticity values by 0.05

Traditional forest products demand

Demand from traditional forest industries (e.g. pulp and paper, lumber and veneer) assumed to slowly grow at the following annual rates:

- **Hardwood Pulpwood**: average rate of 0.47%
- **Softwood Pulpwood**: average rate of 0.25%
- **Hardwood Sawtimber**: average rate of 0.63%
- **Softwood Sawtimber**: average rate of 0.48%

Wood bioenergy demand is constant throughout the projection period at 8.25 million green tons in the Reference Case.

Wood bioenergy consumption scenarios

Case	No supply restriction	Massachusetts-like supply restrictions
Steady growth wood bioenergy consumption	A1	B1
Rapid development wood bioenergy consumption	A2	B2
Wood bioenergy plus Hydropower	A3	B3

Criteria for evaluation

Mean rate of change of **price**:

$$\overline{\%\delta_P} = \frac{1}{50}\left(\frac{P_{t=50} - P_{t=0}}{P_{t=0}}\right) \cdot 100\%$$

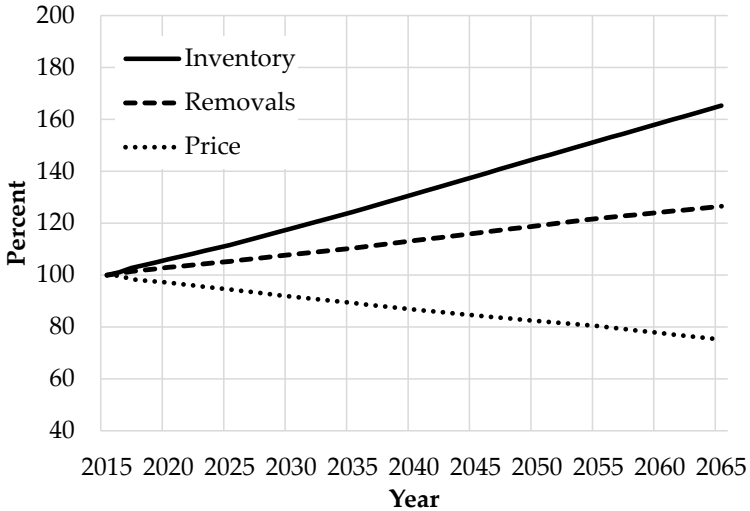
Mean rate of change of **inventory**:

$$\overline{\%\delta_I} = \frac{1}{50}\left(\frac{I_{t=50} - I_{t=0}}{I_{t=0}}\right) \cdot 100\%$$

Mean rate of change of **removals**:

$$\overline{\%\delta_Q} = \frac{1}{50}\left(\frac{Q_{t=50} - Q_{t=0}}{Q_{t=0}}\right) \cdot 100\%$$

Reference Case Scenario



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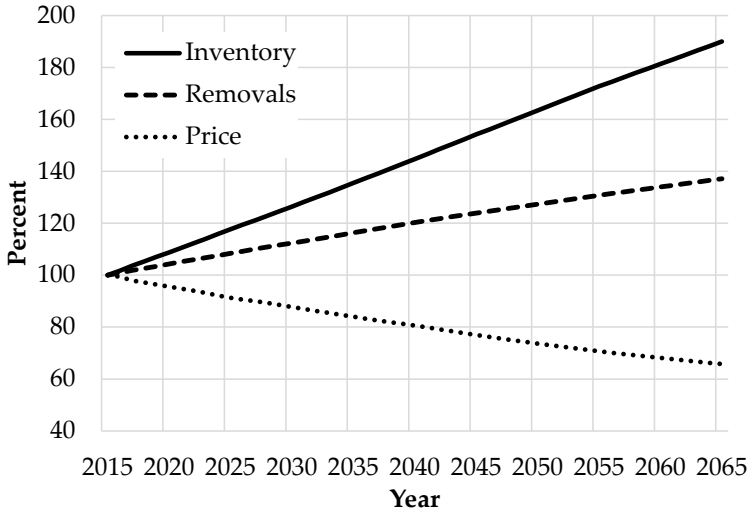

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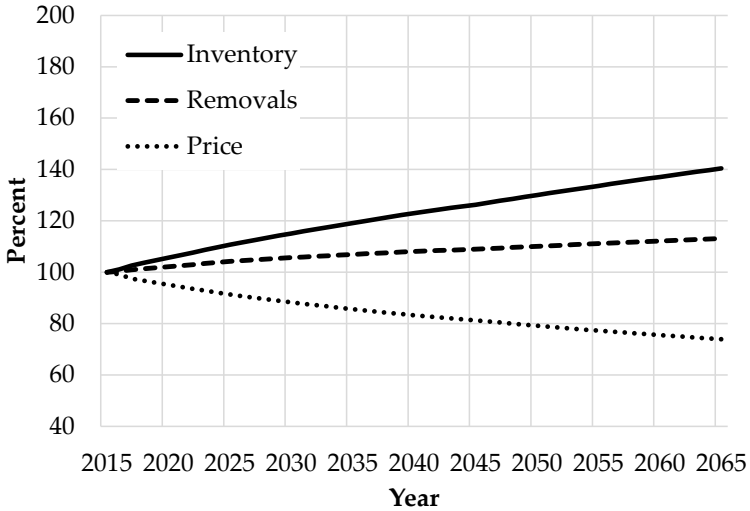

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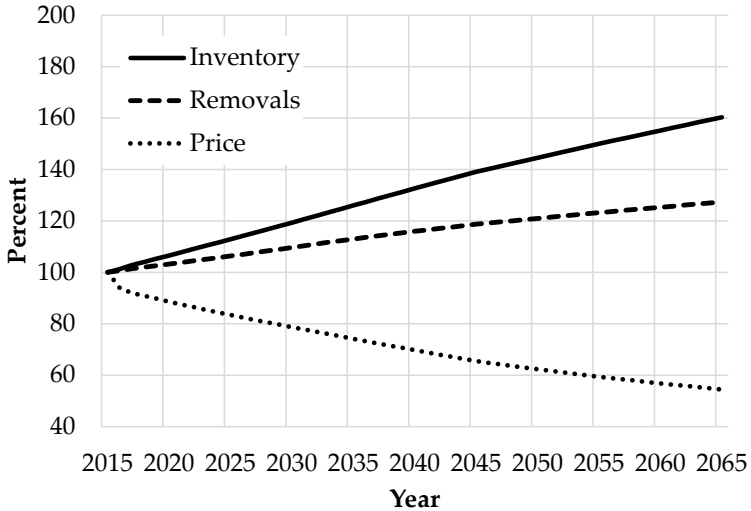
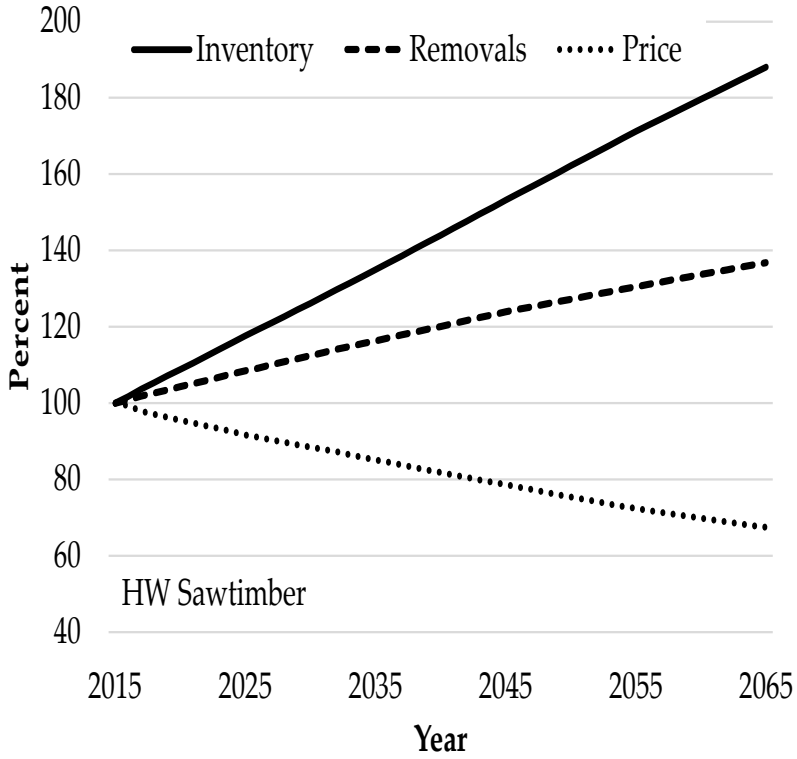
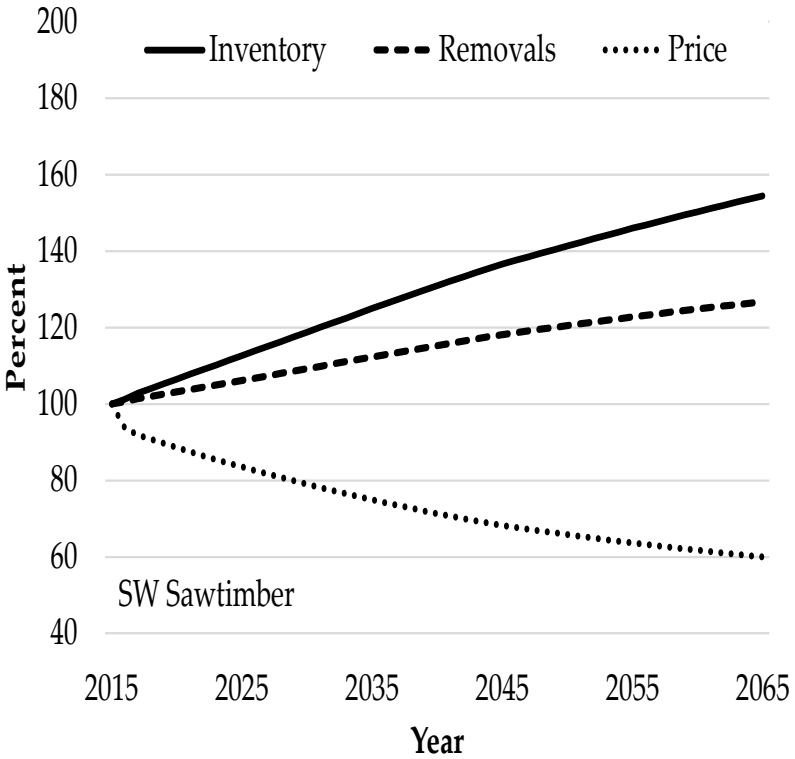


(d)

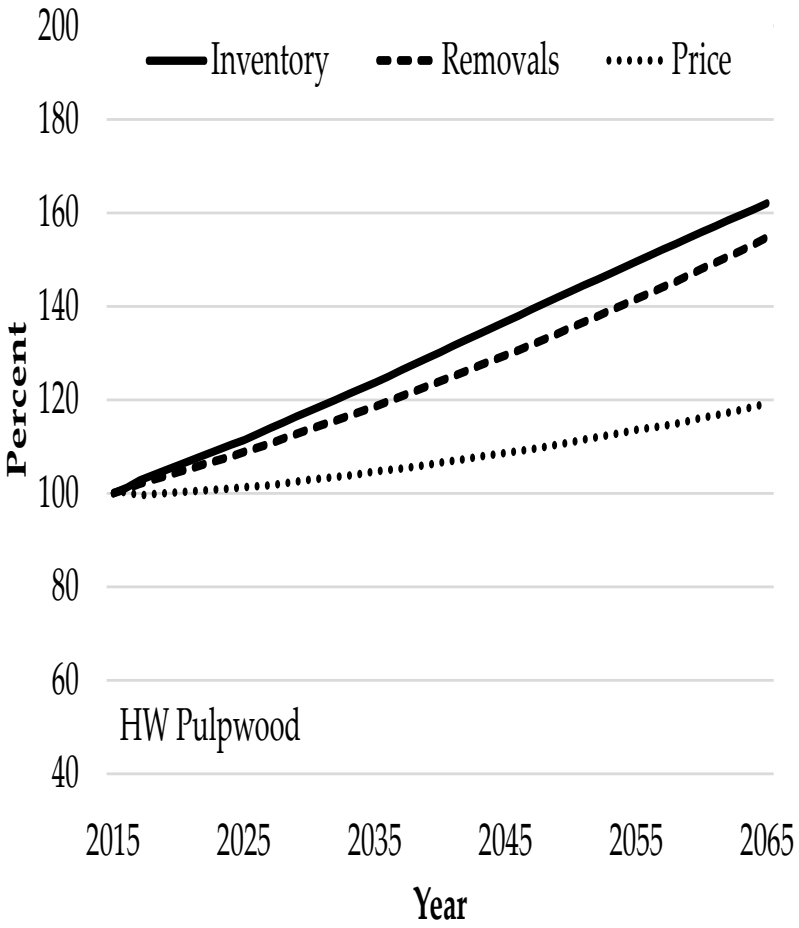
(a) HW pulpwood, **(b)** HW sawtimber, **(c)** SW pulpwood, **(d)** SW sawtimber

Typical Sawtimber Projections (e.g. Scenario A2)





Scenario A1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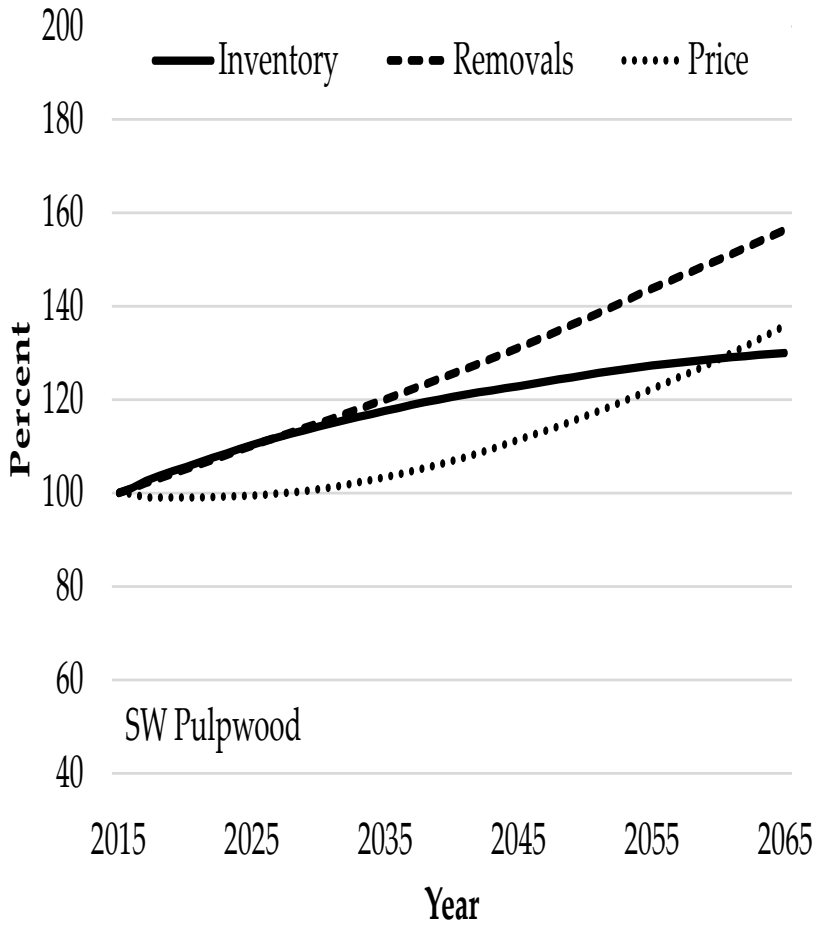
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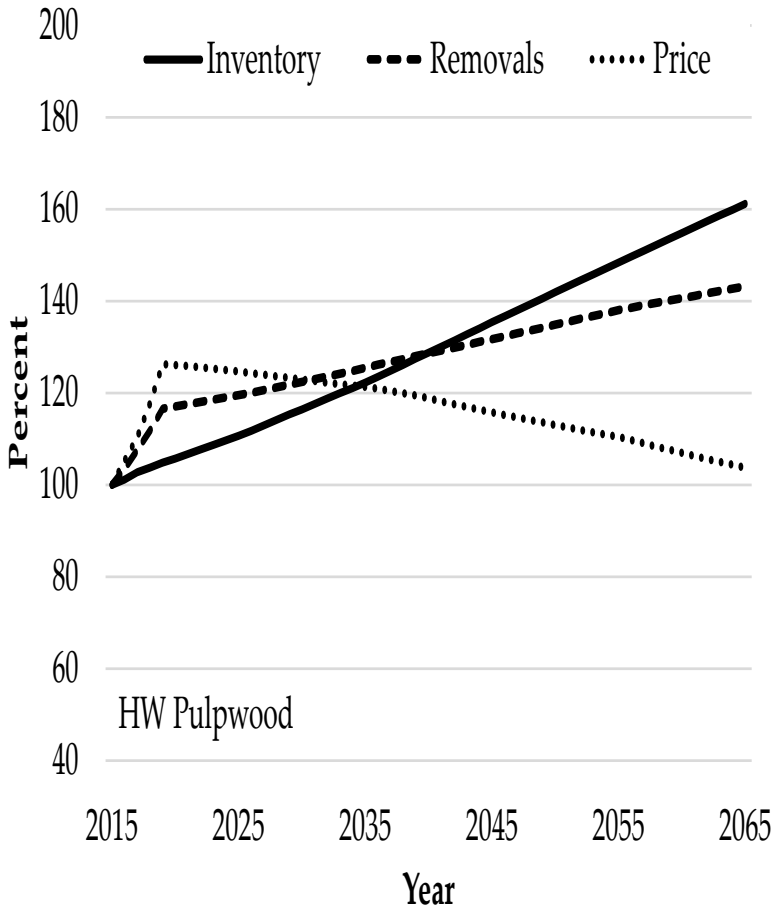
Scenario A2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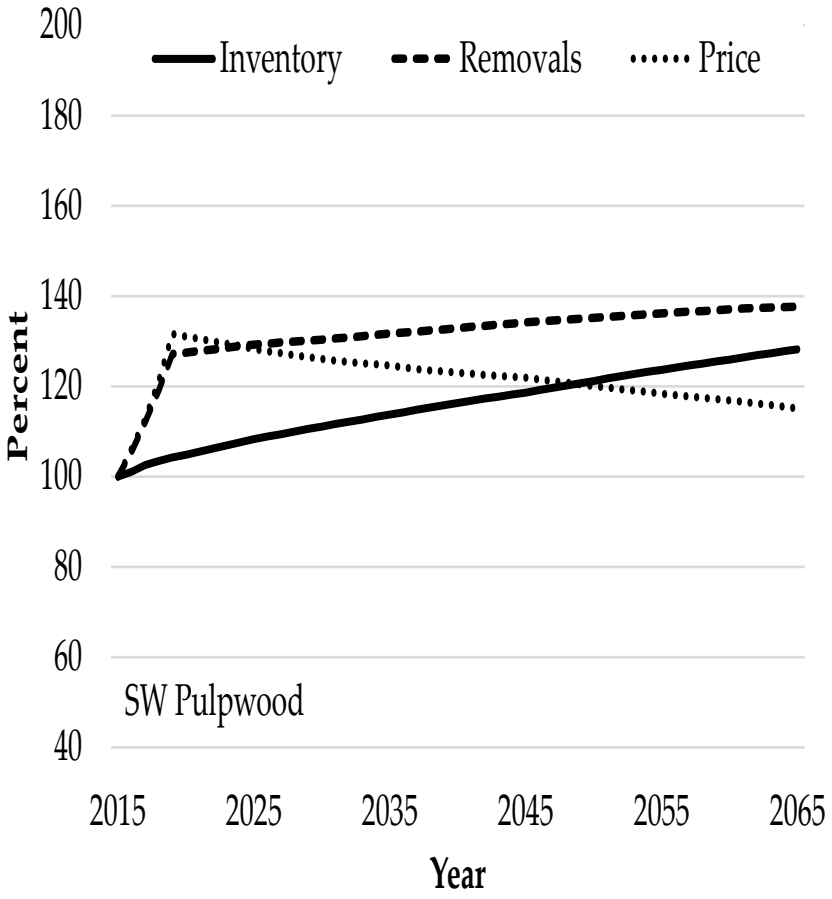
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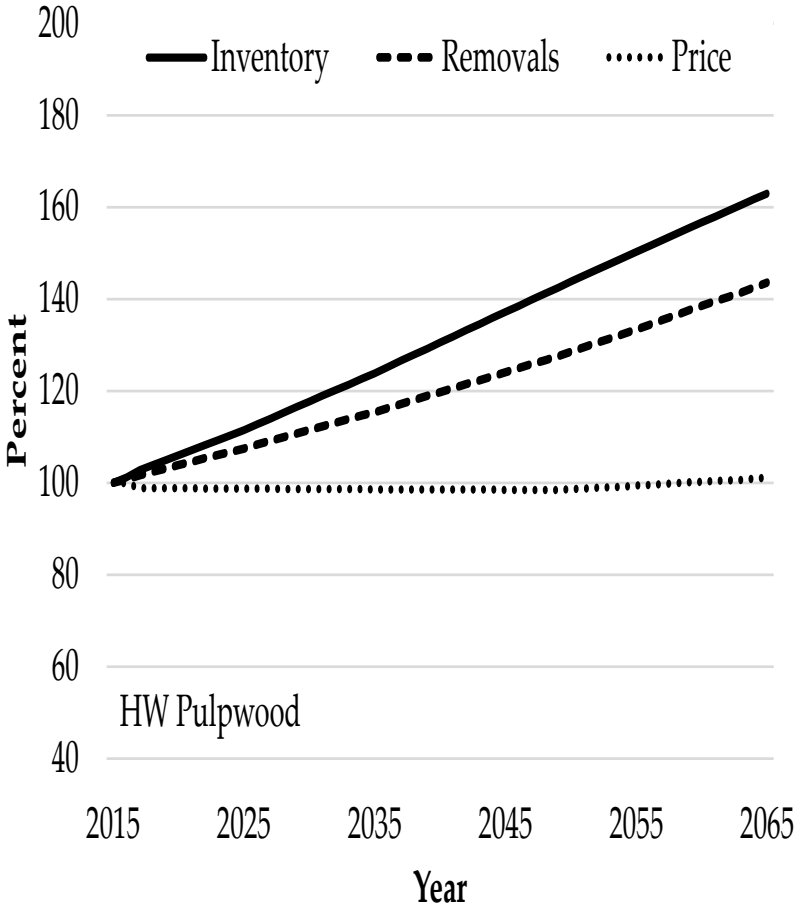
Scenario A3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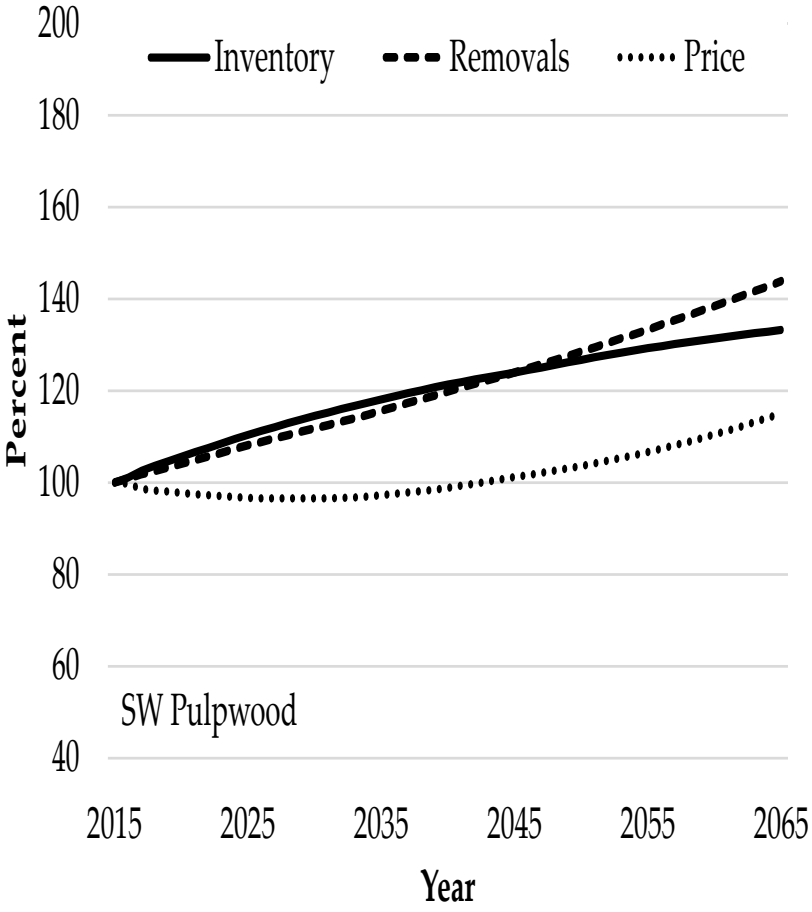
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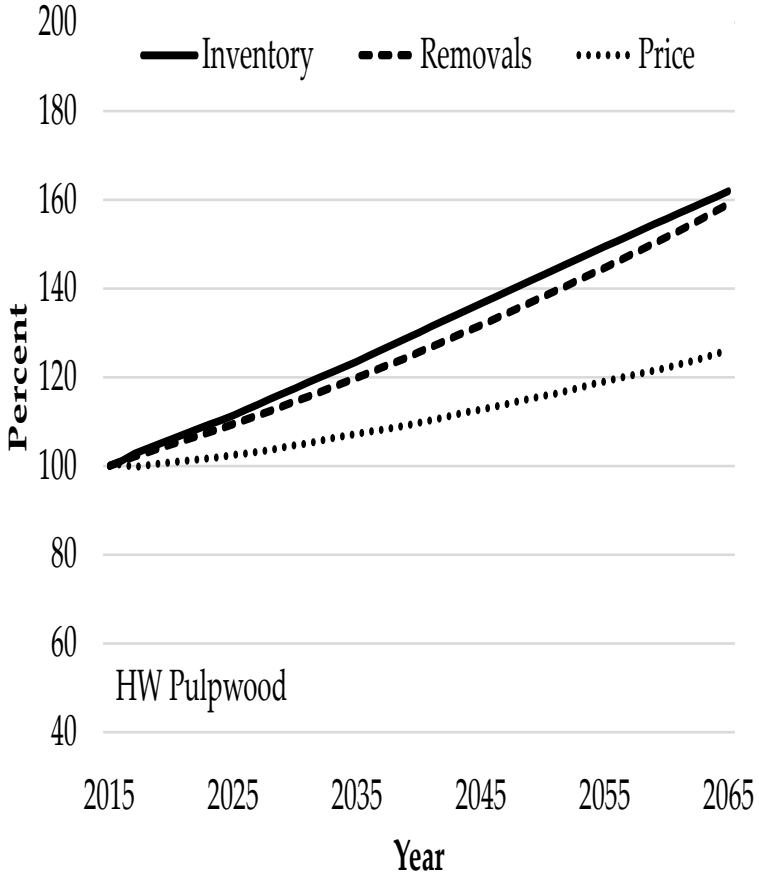
Scenario B1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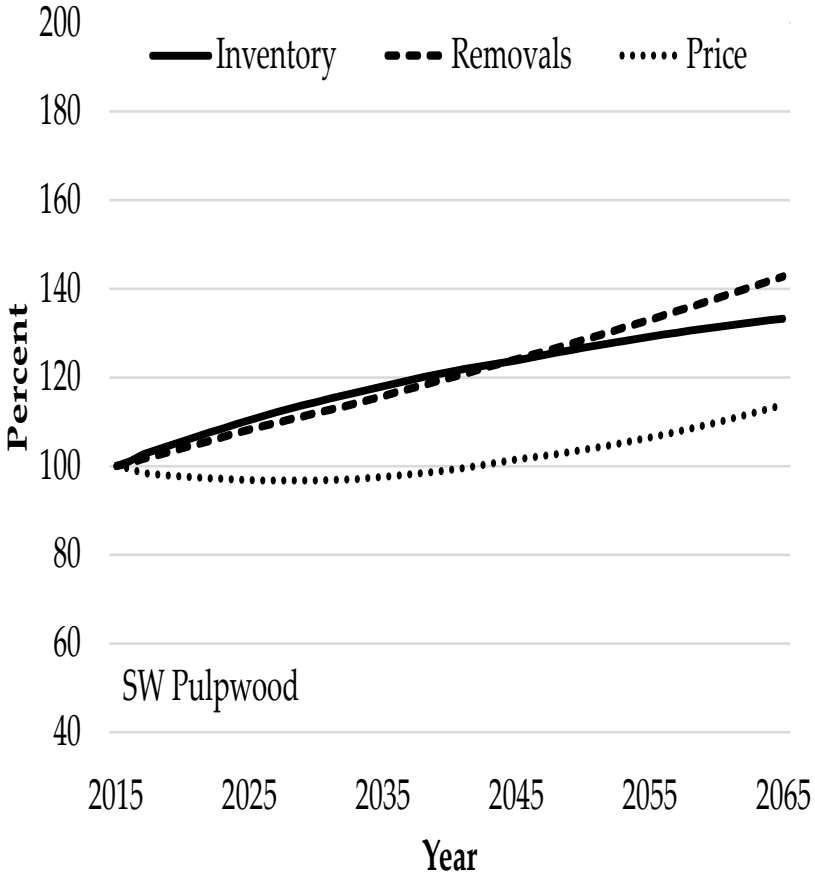
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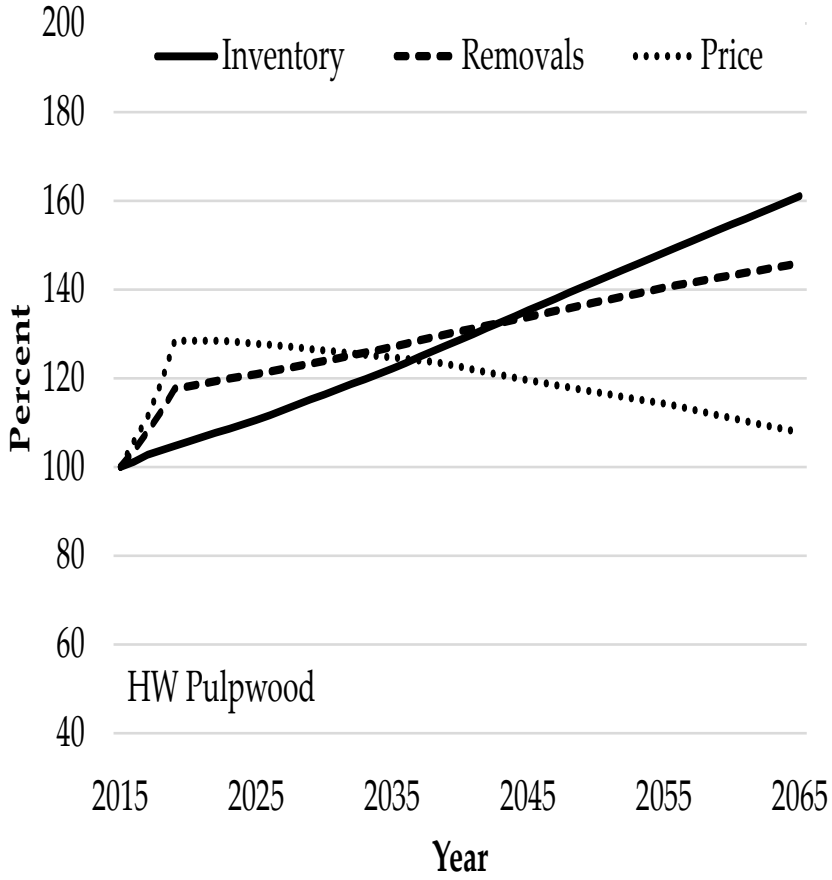
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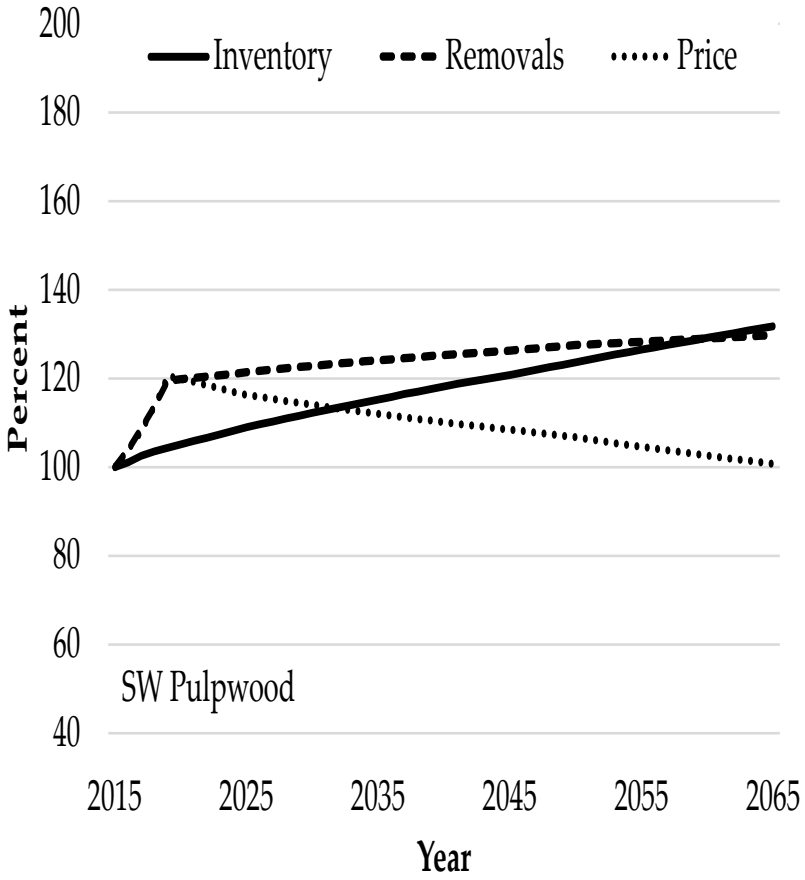
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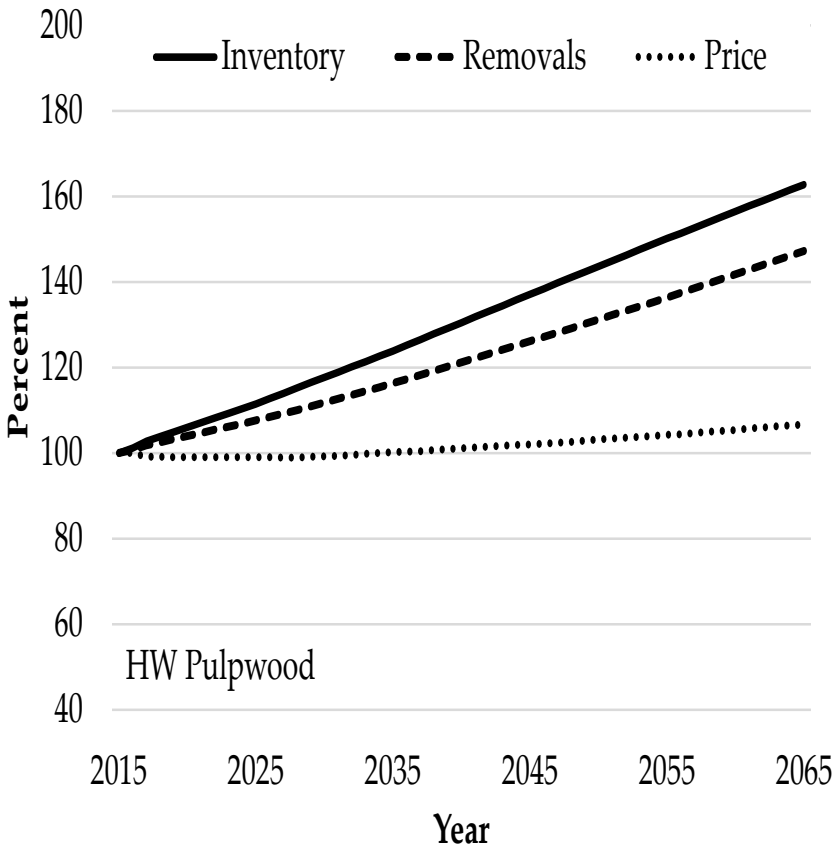
Scenario B3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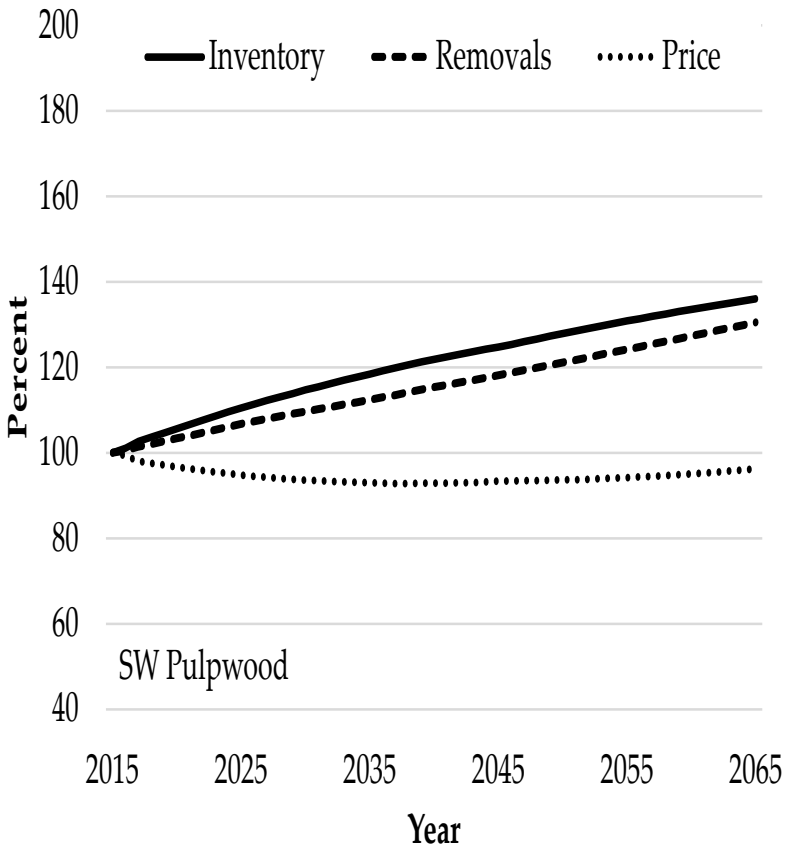
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Conclusions

- in all scenarios involving increased consumption of wood biomass for energy (A1-A3, B1-B3), prices as well as removals increase for SW and HW pulpwood;
- Scenario A1 results in the greatest increase in price and removals of HW pulpwood compared to other scenarios;
- Scenario B1 leads to the greatest increase in price and removals of SW pulpwood;
- Woody biomass consumption for energy had no significant effect on SW and HW sawtimber inventory, removals or prices;
- Case studies of elasticities performed as expected.

Next Steps

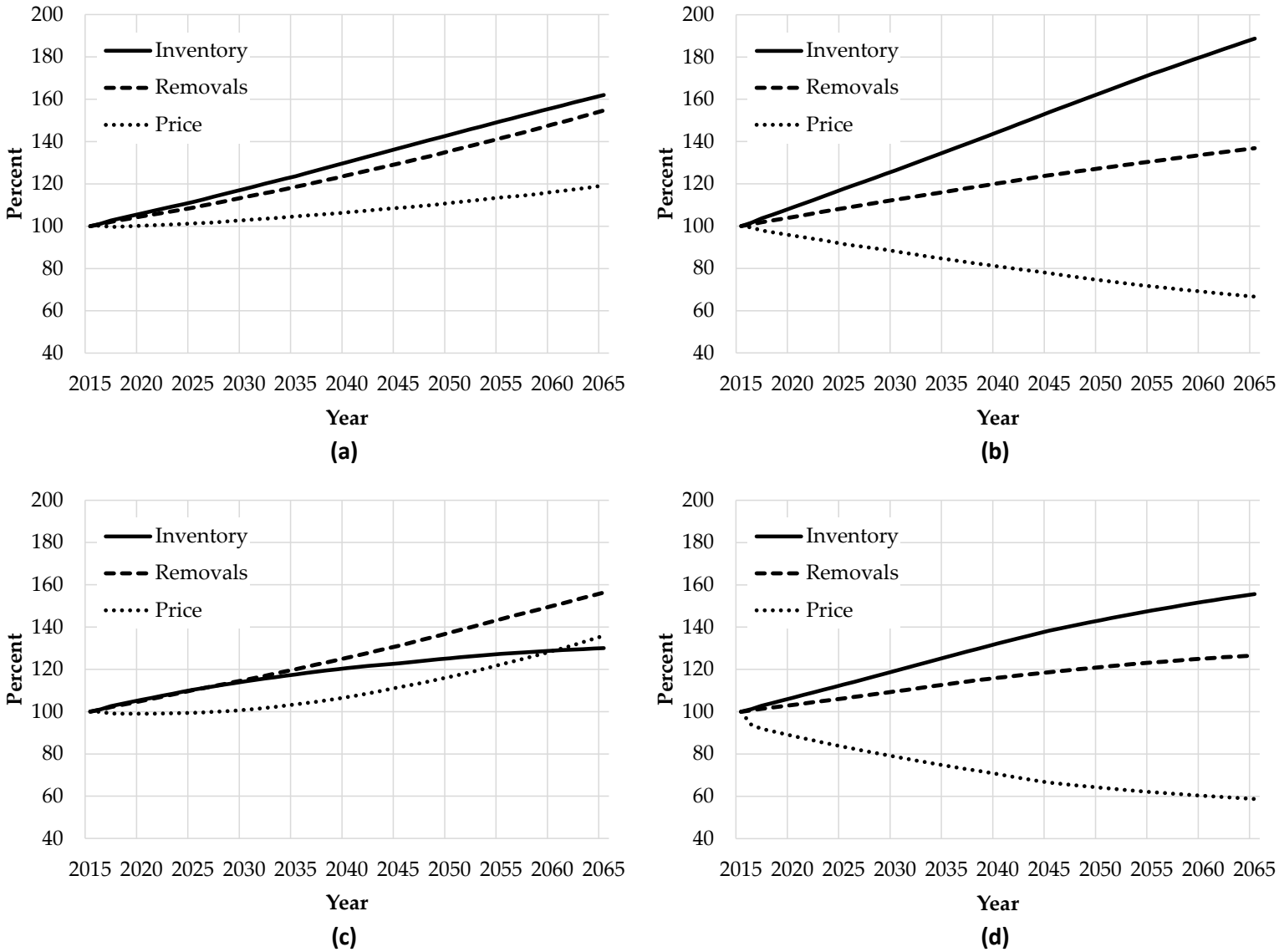
- Policy changes
  - Efficiency requirements (MA)
  - Changes in Renewable Energy Standards (NH, ME)
- Impacts of pulpmill closures
- Carbon balances
- Land use change

Coming Soon: Heat Wave Relief in New Hampshire

Summary of the projection results

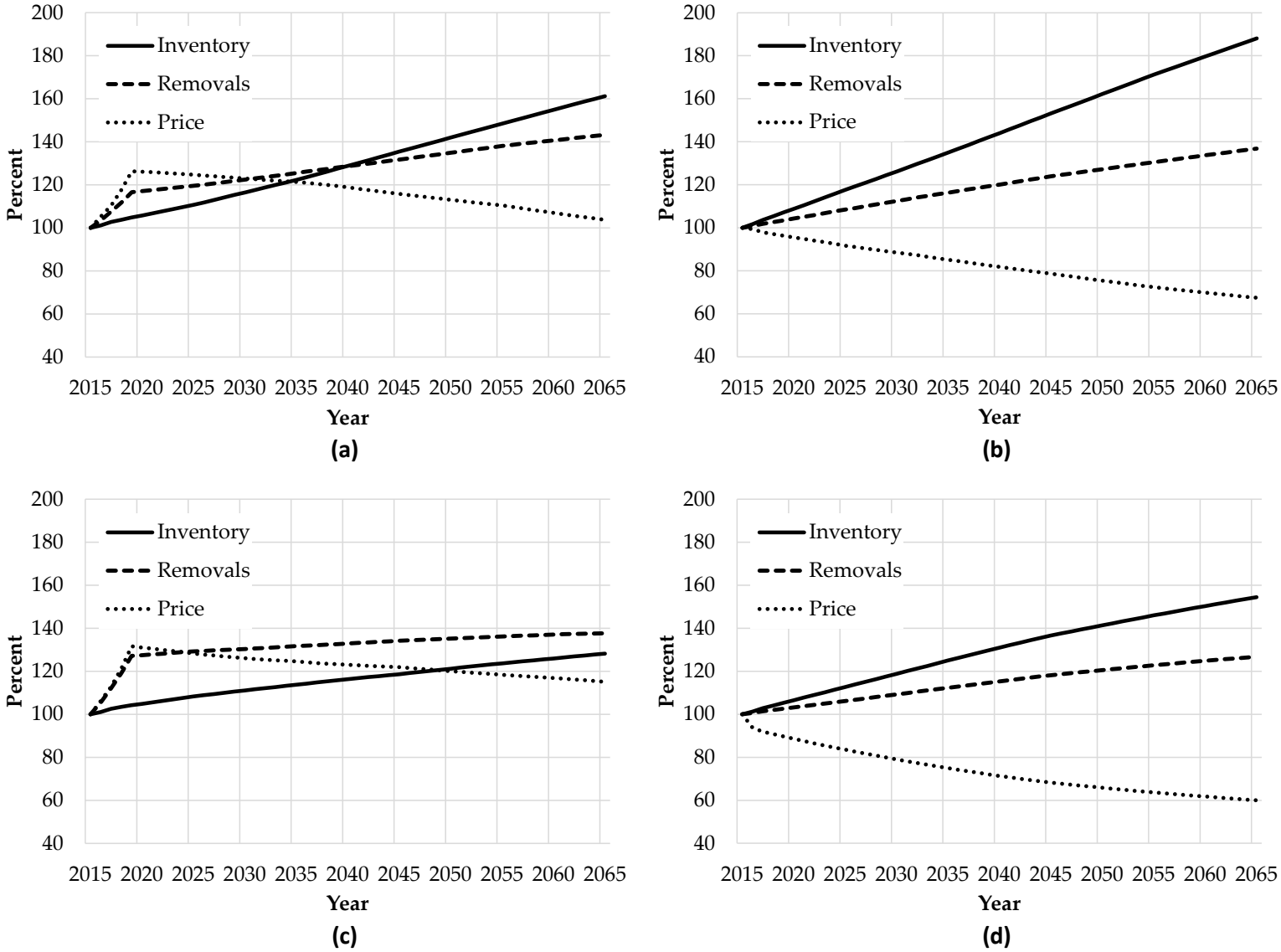
	HW pulpwood			HW sawtimber			SW pulpwood			SW sawtimber		
Scenario/Mean rate of change, %	$\overline{\%\delta_P}$	$\overline{\%\delta_I}$	$\overline{\%\delta_Q}$	$\overline{\%\delta_P}$	$\overline{\%\delta_I}$	$\overline{\%\delta_Q}$	$\overline{\%\delta_P}$	$\overline{\%\delta_I}$	$\overline{\%\delta_Q}$	$\overline{\%\delta_P}$	$\overline{\%\delta_I}$	$\overline{\%\delta_Q}$
Reference	-0.50	1.30	0.53	-0.68	1.80	0.74	-0.52	0.81	0.26	-0.91	1.21	0.55
A1	0.39	1.24	1.10	-0.67	1.78	0.74	0.72	0.60	1.13	-0.83	1.11	0.53
A2	0.07	1.22	0.87	-0.65	1.76	0.74	0.30	0.56	0.75	-0.80	1.09	0.54
A3	0.02	1.26	0.87	-0.67	1.79	0.74	0.30	0.67	0.88	-0.85	1.15	0.55
B1	0.52	1.24	1.18	-0.66	1.77	0.74	0.28	0.67	0.86	-0.86	1.15	0.55
B2	0.16	1.22	0.92	-0.65	1.76	0.73	0.02	0.64	0.60	-0.84	1.14	0.55
B3	0.13	1.26	0.95	-0.67	1.78	0.74	-0.07	0.72	0.61	-0.88	1.18	0.55

Scenario A1



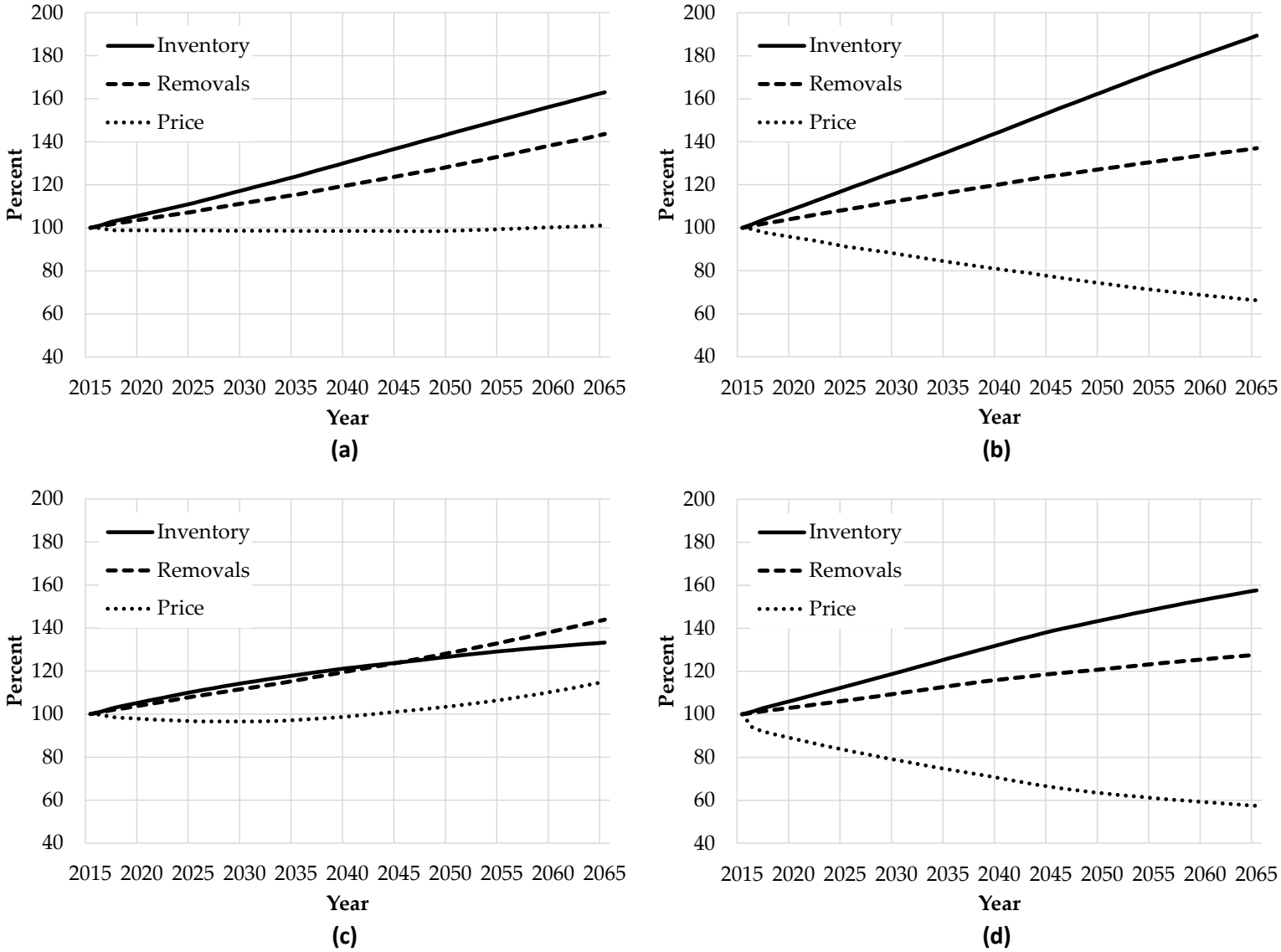
(a) HW pulpwood, **(b)** HW sawtimber, **(c)** SW pulpwood, **(d)** SW sawtimber

Scenario A2



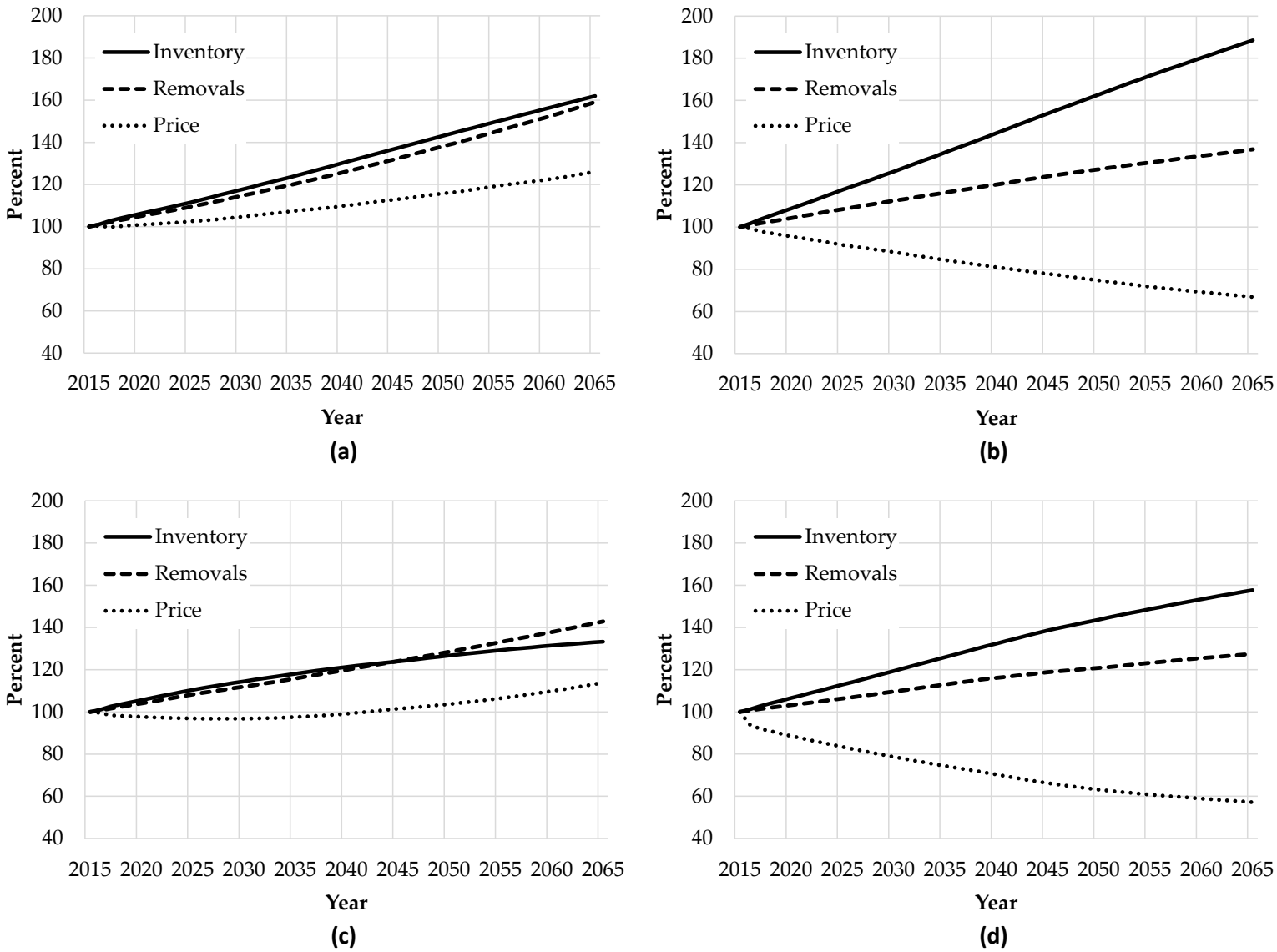
(a) HW pulpwood, **(b)** HW sawtimber, **(c)** SW pulpwood, **(d)** SW sawtimber

Scenario A3



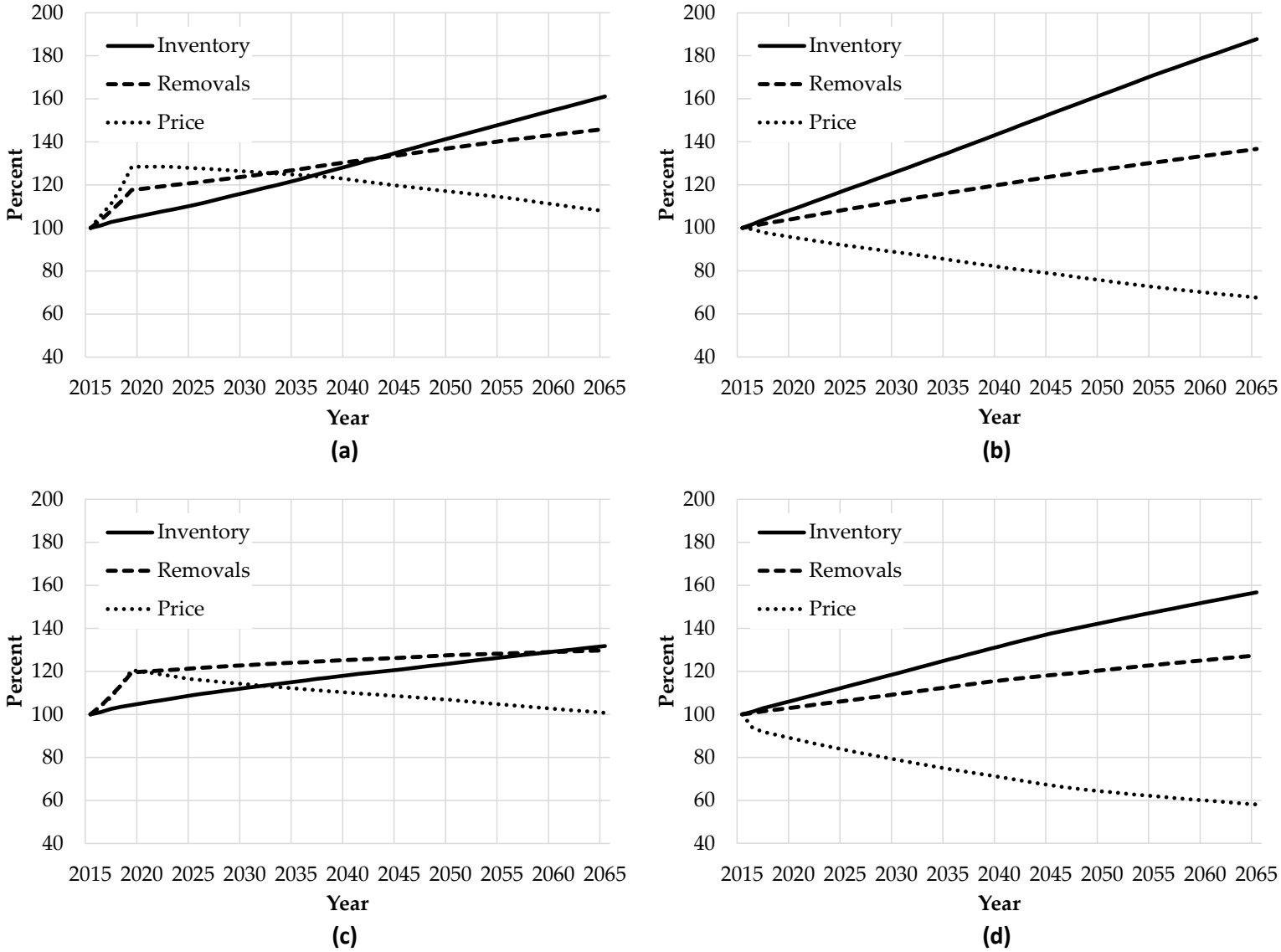
(a) HW pulpwood, **(b)** HW sawtimber, **(c)** SW pulpwood, **(d)** SW sawtimber

Scenario B1



(a) HW pulpwood, **(b)** HW sawtimber, **(c)** SW pulpwood, **(d)** SW sawtimber

Scenario B2



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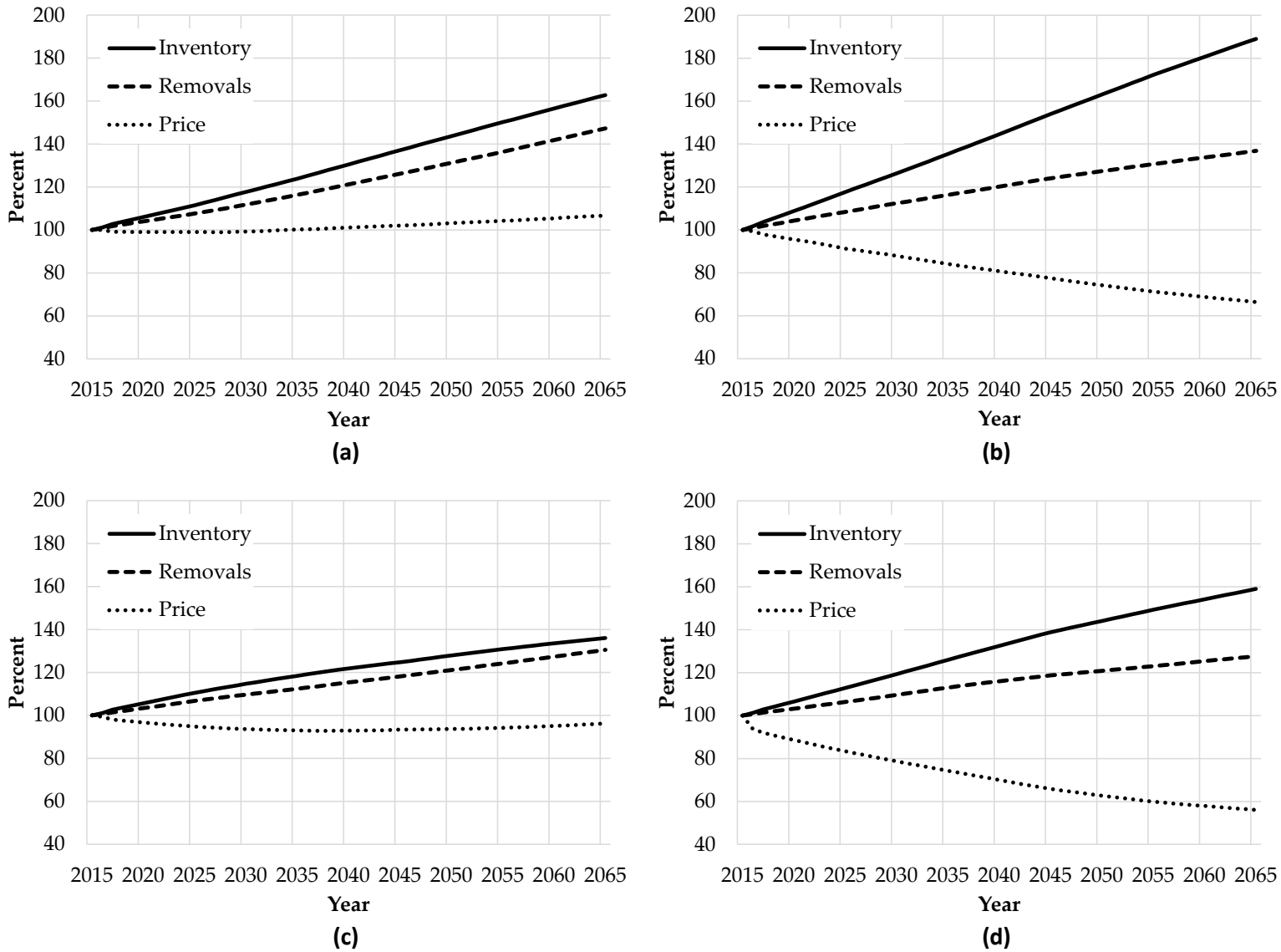
Scenario B3



(a) HW pulpwood, **(b)** HW sawtimber, **(c)** SW pulpwood, **(d)** SW sawtimber