SIGNALFIRE GROUP

Recycling System Analysis for the Vermont Bottle Bill

ANALYSIS OF SYSTEM COSTS AND ENVIRONMENTAL IMPACTS OF THREE SCENARIOS

JANUARY 8, 2025

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Key Findings

- Of the three models studied, Model 3, which includes program management by a producer responsibility organization (PRO) and expansion of the types of beverages included in the bottle bill deposit program, performs most favorably.
  - It is the most cost-efficient on a per container basis
  - It leads to the highest volume of diverted containers
  - It has the greatest reduction in greenhouse gas emissions
  - It has the greatest reduction in litter

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Background & Overview of Three Models

Background

- The ANR of VT DEC commissioned the Signalfire Group to conduct this study to analyze and compare the costs and benefits – financial and environmental – associated with three models for the management of beverage containers via the "bottle bill" deposit return system and the regular Vermont recycling system
- State currently has 54 redemption centers and 69 retail redemption locations (~123 total sites)
- Program places a 5¢ deposit on beer, malt beverages, mineral water, mixed wine drinks, soda water, carbonated soft drinks, and ready-to-drink spirits, and a 15¢ deposit on liquor
- Redemption rate ~72% for containers covered by the Bottle Bill

$$\text{Redemption rate} = \frac{\text{Containers Redeemed (BBS)}}{\text{Covered containers}}$$

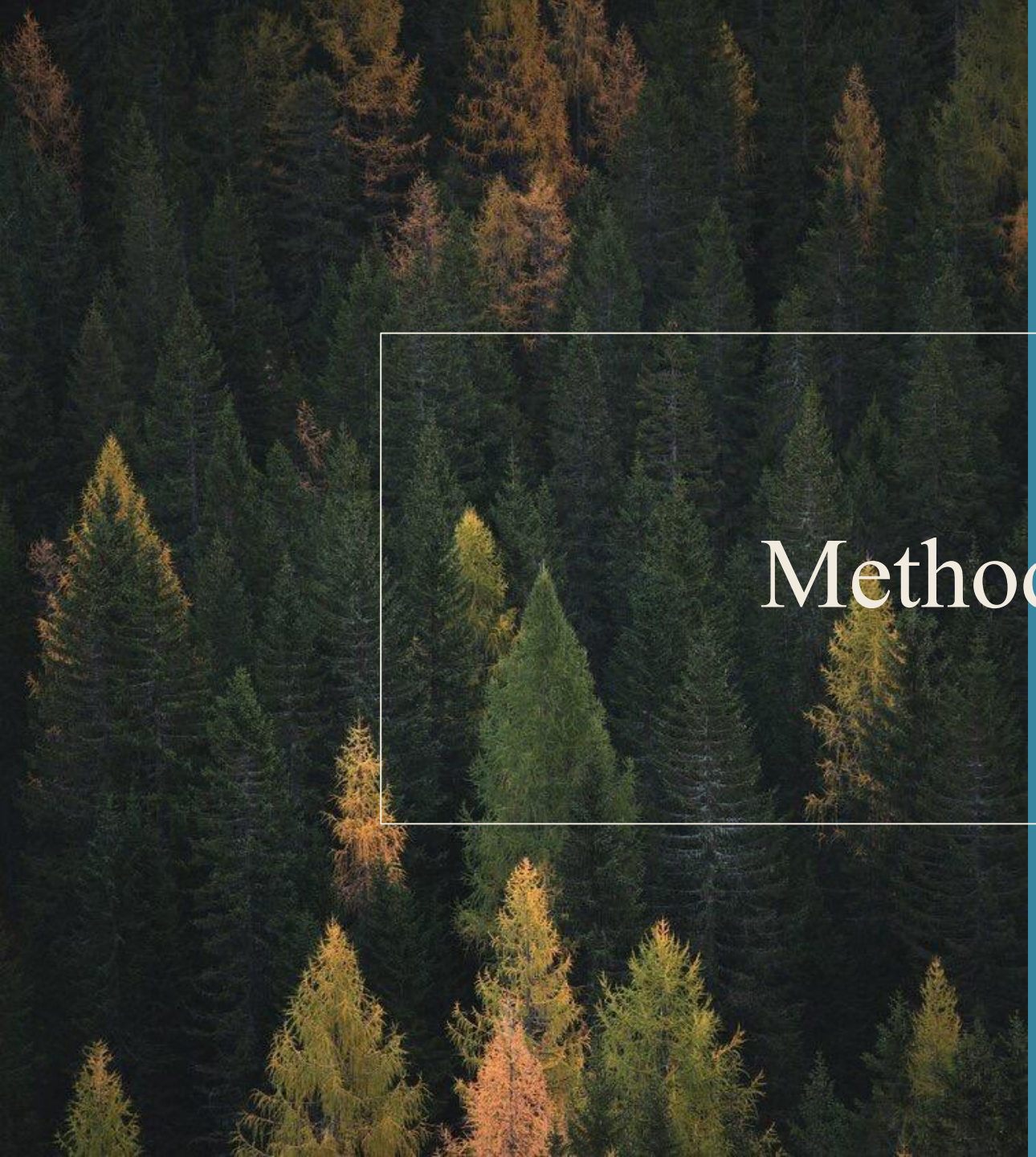
- In 2023, H.158 was introduced (but did not pass) with the aim of expanding the scope of covered beverages. There are still ongoing discussions around potentially reforming VT's Bottle Bill

Three Models

1. **Model 1, Existing Bottle Bill:** The current Vermont bottle bill and recycling systems.
2. **Model 2 (A and B), PRO Bottle Bill:** All currently "covered" bottle bill beverage containers, except liquor, are managed by a beverage manufacturer/distributor producer responsibility organization (PRO); a convenience standard is established to increase redemption sites (similar to H.158), sorting by brand at redemption sites is eliminated, and all redemption sites must accept all redeemable containers, not just what they sell. Model 2A relies primarily on bag drop systems, while Model 2B relies on reverse vending machines (RVM).
3. **Model 3, Expanded Bottle Bill (EBB) with PRO:** Includes all the elements of Model 2 and expands the types of beverages included in the bottle bill deposit program as originally proposed in H.158

Key Differences Between Models

	MODEL 1	MODEL 2	MODEL 3
Beverage Containers Included in Deposit / Redemption System	Beer, wine coolers, other malt beverages, pre-mixed spirits cocktails, carbonated non-alcoholic beverages including sodas, sparkling waters and juices, and carbonated sports and energy drinks (5 cent deposit). Liquor and spirits (15 cent deposit).		All beverages included, except milk, dairy, plant-based beverages, infant formula, meal replacement drinks, and nonalcoholic cider.
Containers Requiring Brand Sorting at Point of Redemption	18% of containers	None, brand sorting at point of redemption is eliminated.	
Containers in Commingling Agreement	82%[1]	100%[2]	
Handling fee	3.5 cents for commingling; 4 cents for others	No set handling fee. PRO negotiates appropriate compensation for the redemption site which would likely be based on a per container fee[3].	
Convenience Requirements	Retailers are required to take back covered containers of the kind, size, and brand they sell, unless they receive an exemption from the Secretary based on alternate redemption sites that can serve the public need.	• Universal redemption • Minimum of 3 redemption sites per county. • Retailers of 5,000 square feet or more must redeem • Municipalities with populations of 7,000+ must have at least one point of redemption.	
Bottle Bill Management	Distributors/manufacturers "Pickup agent" + Dept. of Liquor & Lottery (DLL for liquor	PRO + DLL (for liquor)	
Number of Redemption Sites	123	170	



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Methodology

Approach

- Data collection
- Stakeholder engagement
- Redemption site interviews
- Modeling of:
  - Bottle Bill System (BBS)
  - Recycling System (RS)
  - Separate trips taken by consumers to redeem containers (BBS) or recycle containers via drop-off (RS)
  - Greenhouse gas emissions
  - Bottles from out-of-state redeemed in VT
  - Elimination of brand sorting
  - Choice of technology and its impact on redemption rates and consumer engagement

Stakeholders Consulted During this Study

- Breezeway Consulting LLC, representing the Vermont Commingling Group, LLC
- Casella (MRF operator in Chittenden and Rutland Counties)
- Chittenden Solid Waste District
- Container Recycling Institute (CRI)
- Department of Liquor and Lottery (DLL)
- Green Up Vermont
- TOMRA
- Redemption sites (21 interviews completed across a representative range of locations)
- Vermont Agency of Natural Resources (ANR) Department of Environmental Conservation (DEC)
- Vermont Public Interest Research Group (VPIRG)
- Vermont Retail & Grocers Association

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Comparative Impacts of the Bottle Bill Models

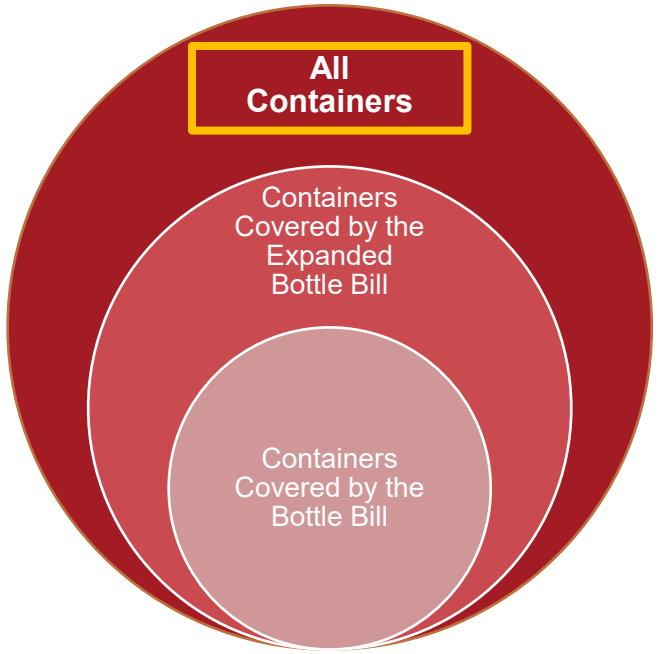
Considerations when Interpreting Results

- **Model 1 costs and convenience:** Current system does not have full compliance. If Model 1 had convenience levels of Model 2 and 3, the total annual cost of Model 1 would increase by ~20%.

- **Model 2 and Model 3 costs and convenience:** Model 2 and 3 quantify costs associated with increased convenience standards. Redemption rates remain the same. Expanded bottle bill systems can increase overall beverage container diversion by capturing more beverage containers from trash/litter in addition to pulling in more containers from the recycling system.

- **Brand sorting is eliminated in Model 2 and Model 3:** There were a wide range of responses regarding potential labor savings from elimination of brand sorting. The analysis reflects the average savings projected.

Material Diversion Rates



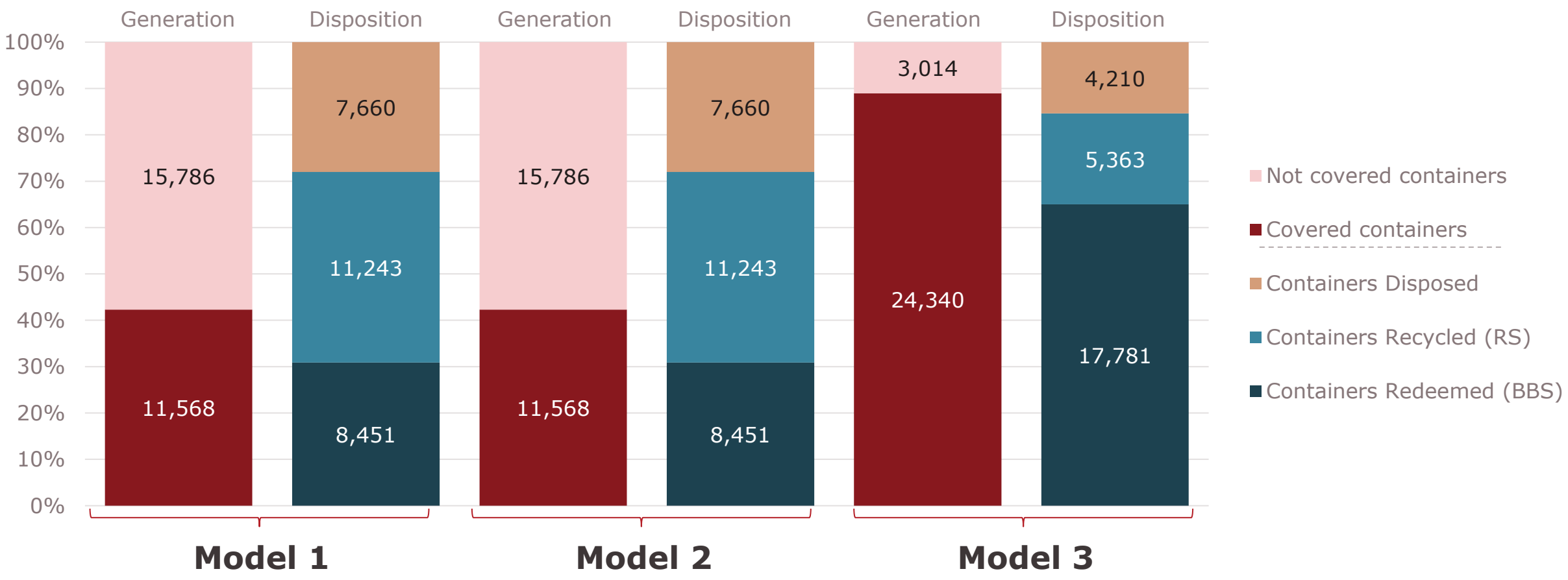
- In Models 1, 2A (Bag Drop), and 2B (RVM), the diversion of beverage containers, through both the RS and BBS, remain at current levels
- Model 3 increases diversion of rate due to expansion of the bottle bill

BEVERAGE CONTAINER DIVERSION RATES	MODEL 1:	MODEL 2:	MODEL 3:
	72%	72%	85%

- Note: Diversion rates for all beverage containers include collection through the RS and BBS. They include all beverage containers sold in VT.

$$\text{Diversion rate} = \frac{\text{Containers Redeemed (BBS)} + \text{Containers Recycled (RS)}}{\text{All Containers}}$$

Comparison of Beverage Container Destinations



In Model 3, more containers are covered by the BB, and more are redeemed. The increase in containers redeemed occurs as containers are pulled from both the recycling and trash streams.

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Costs – Bottle Bill System (BBS)

- **System-Level Costs:** Model 1, 2A and 2B have a similar system-level cost. Model 3 has the highest system-level cost to support the increased container throughput.
- **Per Container Cost:** Model 3 is the most cost-efficient on a per container basis. (Increased throughput and adoption of a strategic mix of technologies - bulk RVMs for high-volume redemption centers and a combination of retail RVMs and bag drop to meet required convenience standards).

Note: If Model 1 met the same convenience standards required in Model 2 and Model 3, the per container cost is estimated to be $0.059.

	MODEL 1:	MODEL 2A, Bag Drop:	MODEL 2B, RVM:	MODEL 3, EBB:
BBS SYSTEM-LEVEL COSTS (excluding latent cost of separate trips taken by consumers to redeem)	**$9.4 million**	**$10.5 million**	**$9.2 million**	**$14.0 million**
BBS COST PER REDEEMED CONTAINER (excluding latent costs of separate trips taken by consumers to redeem)	**$0.050**	**$0.056**	**$0.049**	**$0.040**

Costs – Recycling System (RS)

- **System-Level Costs and Container Costs:** No change in System-Level Costs between Model 1 and 2. 2% increase for Model 3 due to loss of revenue resulting from the Expanded Bottle Bill. Container Costs is reduced for Model 3 as less containers are recycled through the RS (recycled through the BBS instead).
- **Per Container Cost:** Models 1 and 2 per container cost are the most cost efficient across both BBS and RS per container costs, while Model 3 is less cost-efficient in the recycling system on a per container basis, largely due to decreased throughput.

	MODEL 1:	MODEL 2:	MODEL 3:
RS SYSTEM-LEVEL COSTS (all recyclables: paper, cardboard, steel and aluminum cans, glass bottles and jars, plastic bottles and jugs, but excluding latent cost of separate trips taken by consumers to redeem)	$37.95 million	$37.95 million	$38.85 million
RS CONTAINER COSTS (excluding latent cost of separate trips taken by consumers to redeem)	$4.25 million	$4.25 million	$2.2 million
RS COST PER CONTAINER (excluding latent costs of separate trips taken by consumers to redeem)	$0.033	$0.033	$0.045

Overall Financial Cost (BBS + RS)

- **Overall System (i.e., Weighted BBS + RS) per container cost:** Model 3 is the most cost-efficient on a per container basis, given the reduction in costs with the elimination of brand sorting, increased efficiencies through technology adoption and management by the PRO, as well as increased overall volume of containers collected.

OVERALL COST PER CONTAINER (excluding latent costs of separate trips taken by consumers to redeem)	MODEL 1	MODEL 2A, Bag Drop	MODEL 2B, RVM	MODEL 3, EBB
	$0.043	$0.047	$0.043	$0.040

Greenhouse Gas Emissions (GHG)

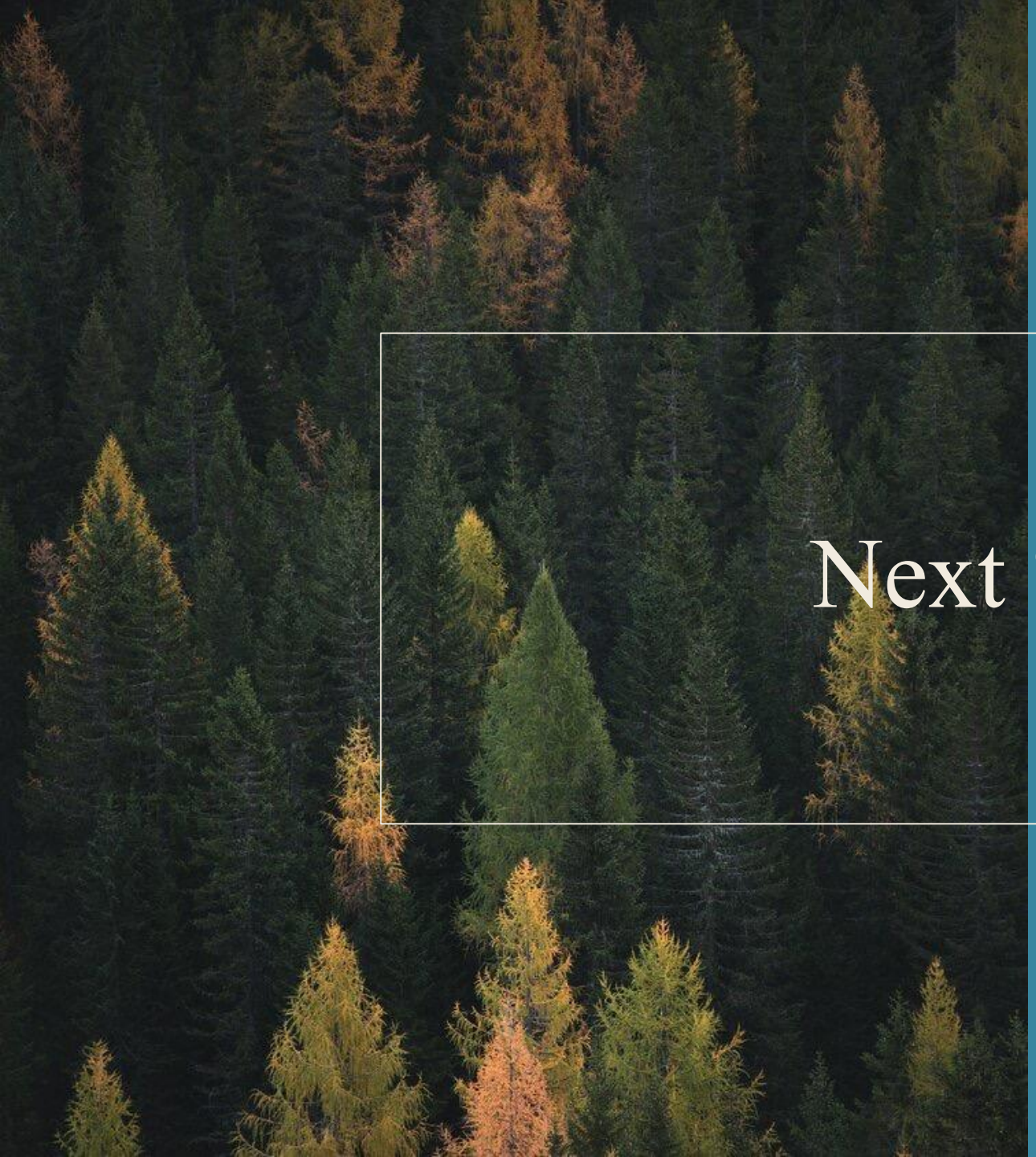
- GHG estimates for beverage containers managed through the BBS and the RS were developed using EPA's Waste Reduction Model (WARM) and supplemented with additional consumer trip information
- Model 2 yields slightly higher environmental benefits than Model 1, primarily due to reduced transportation emissions associated with a higher number of redemption locations. Model 3 provides the most significant environmental benefit (i.e., a greater emission reduction than Models 1 and 2).

		MODEL 1	MODEL 2	MODEL 3
$MTCO_2$-eq Avoided	**BBS**	(21,134)	(21,134)	(31,108)
	RS	(9,244)	(9,244)	(3,158)
$MTCO_2$-eq associated with Separate Consumer Trips	**BBS**	2,344	2,050	2,050
	RS	99	99	47
Net Total $MTCO_2$-eq (exc)		(30,074)	(30,074)	(34,108)
Net Total $MTCO_2$-eq (inc)		**(27,631)**	**(27,924)**	**(32,011)**

Key: (exc) = excluding separate trip cost
(inc) = including separate trip cost

Litter

- Litter tonnage estimates are expected to be the same for Models 1 and 2, with a slight decrease in Model 3 because of expansion in covered beverages.
- **In Model 3, litter decreases by 22% (411 tons in Model 1 to 322 tons in Model 3).**
- **Litter volume** is estimated using 2009 litter studies by Keep America Beautiful and Greenup Vermont.
- **Litter composition** is estimated using data from a 2021 Keep America Beautiful study that suggests a composition of 40% cans, 36% PET, and 24% glass by units. Combined with container per pound conversion factors, this translates to a composition of 6% cans, 7% PET, 1% HDPE, and 86% glass by weight.
- **Reduction resulting from expansion** is estimated to be 40%. This is based o findings from a New York Study (2008-2015).



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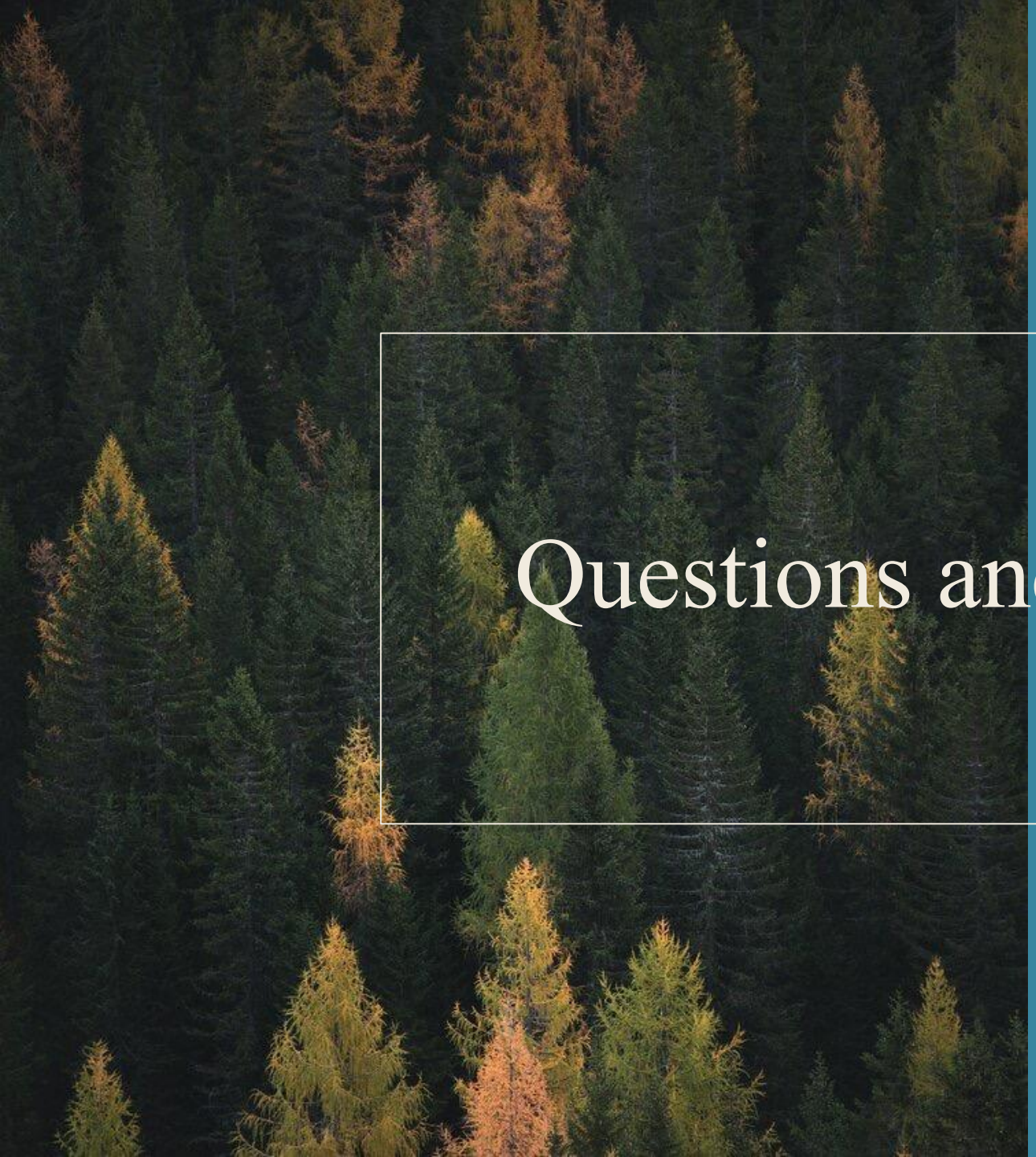
Next Steps

Next Steps

- The reported analyses and metrics on cost, material flows, and environmental impacts are intended to support evidence-based policy decisions.
- This report will continue to be publicly available on the VT DEC website
- DEC and Signalfire Group will be available to answer questions from lawmakers and others



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Questions and Discussion

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