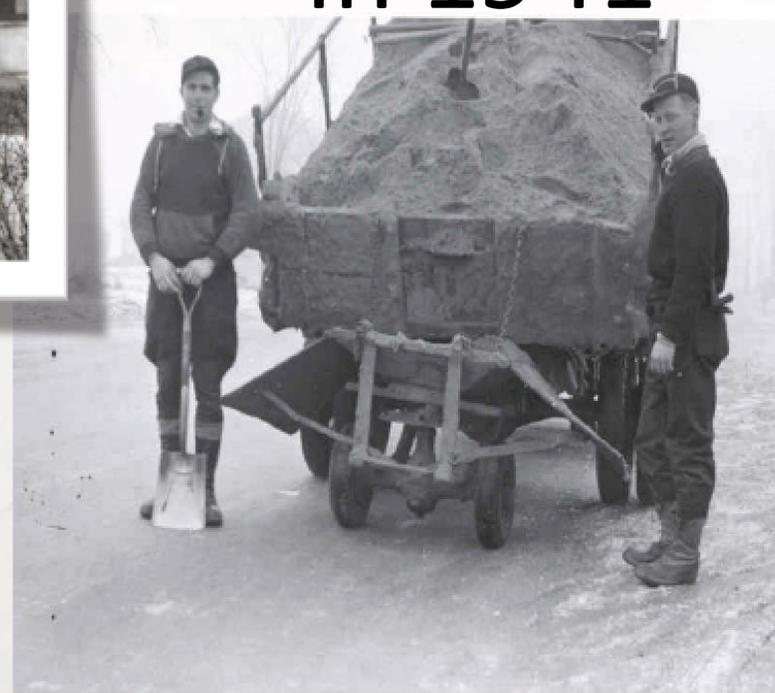




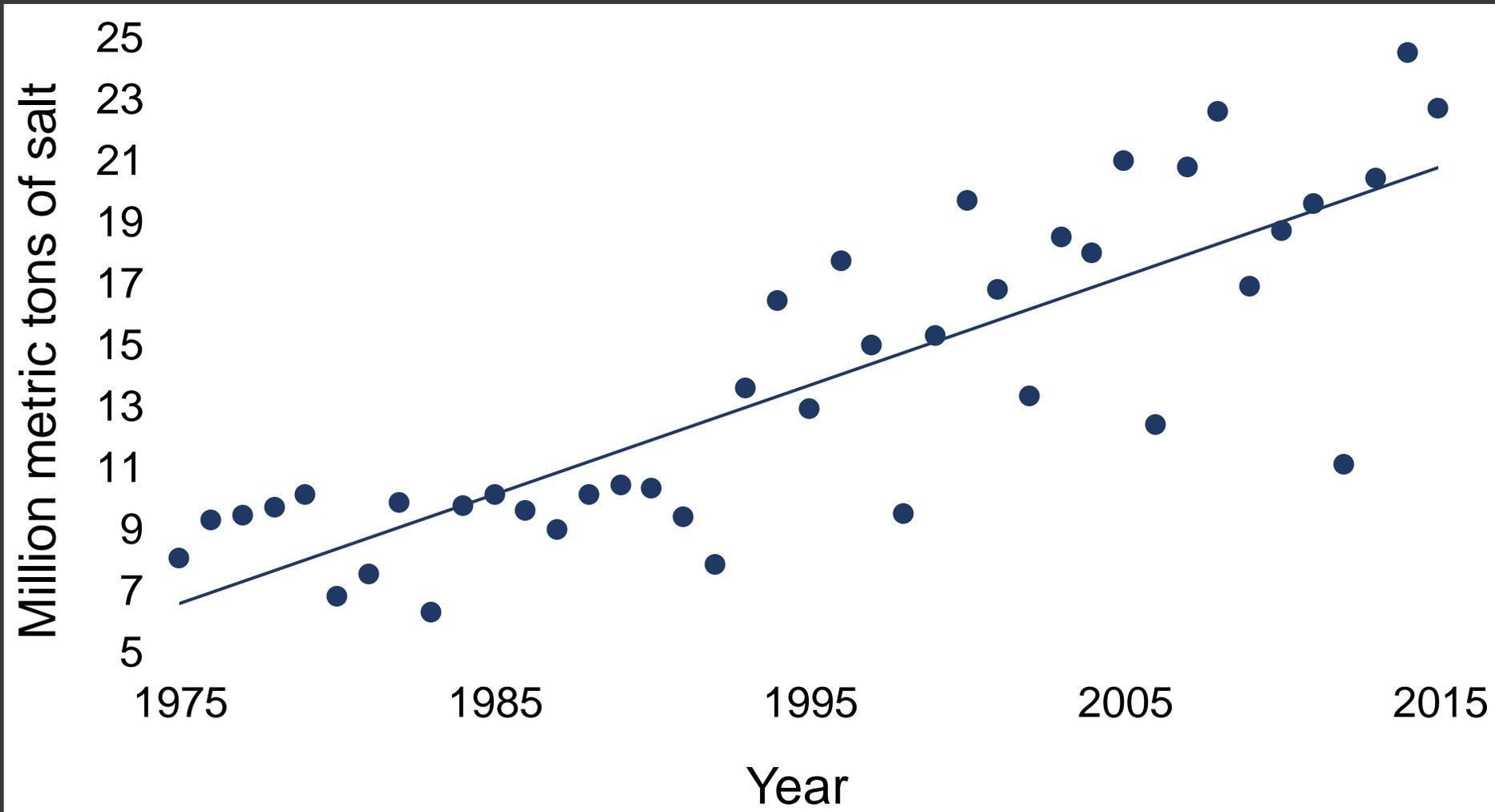
Salt use of professionals in the Lake Champlain basin

Kristine Stepenuck, PhD
Extension Associate Professor
University of Vermont and Lake Champlain Sea Grant
kstepenu@uvm.edu

Salt was first used on roads in 1941



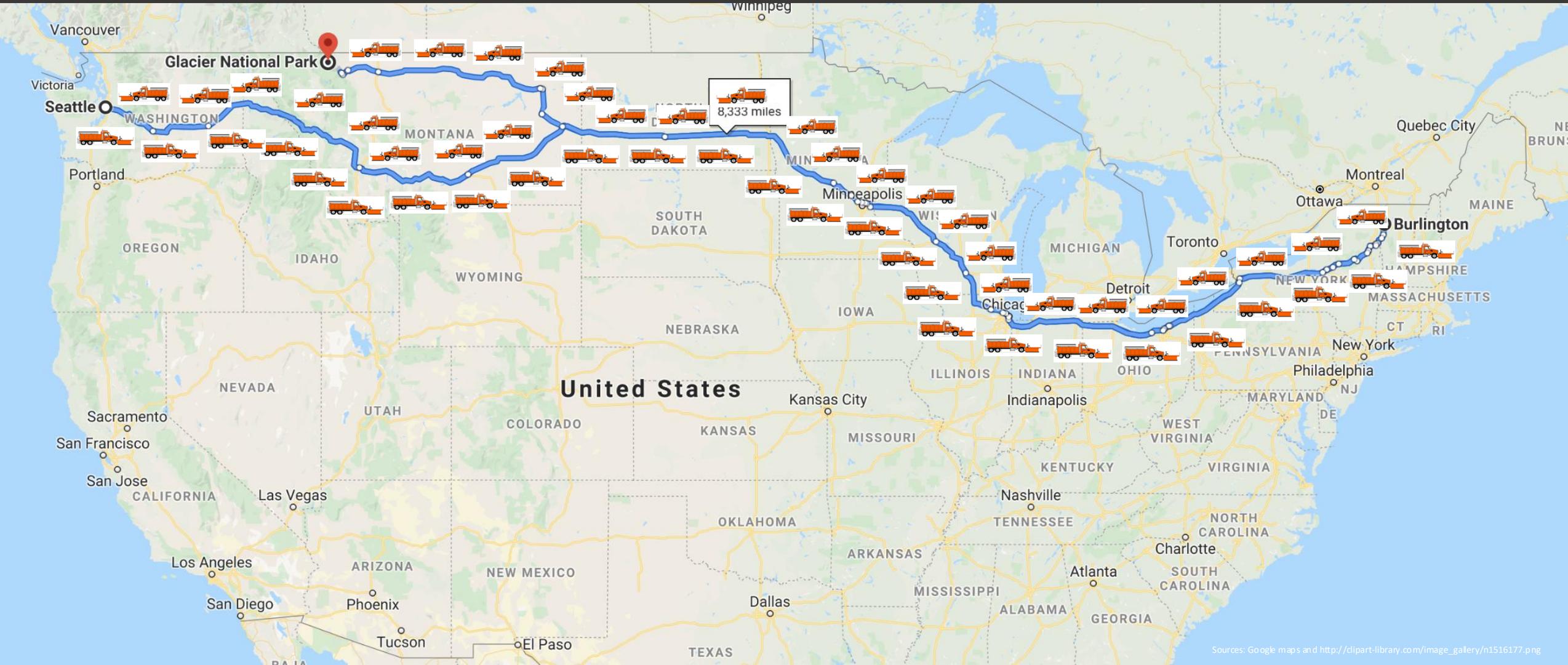
Road salt use in the United States has increased over time



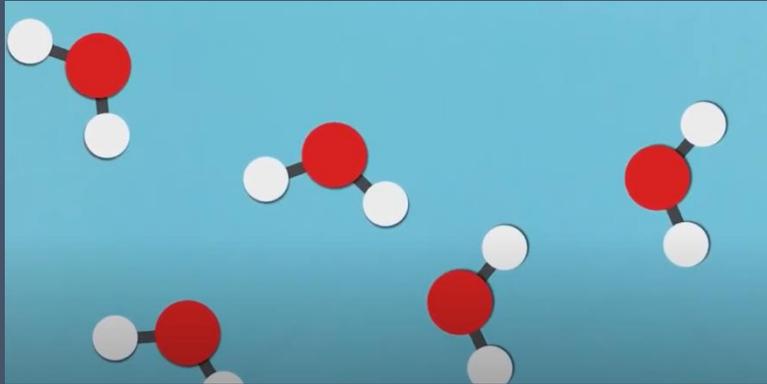
1975-2003

- US road surface increased 6%
- Salt use increased 43%

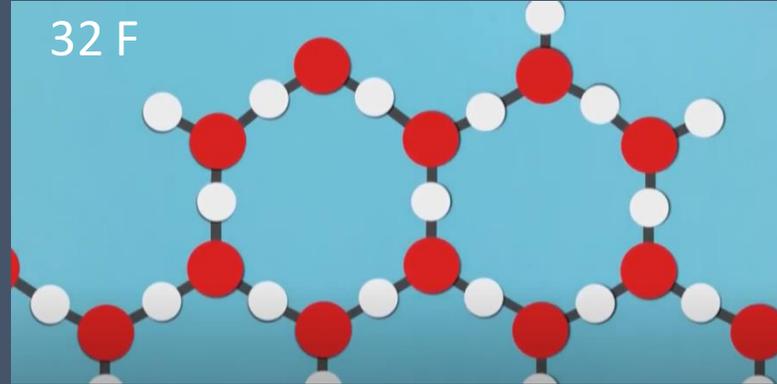
More than 20 million tons of salt are spread each year in the U.S.



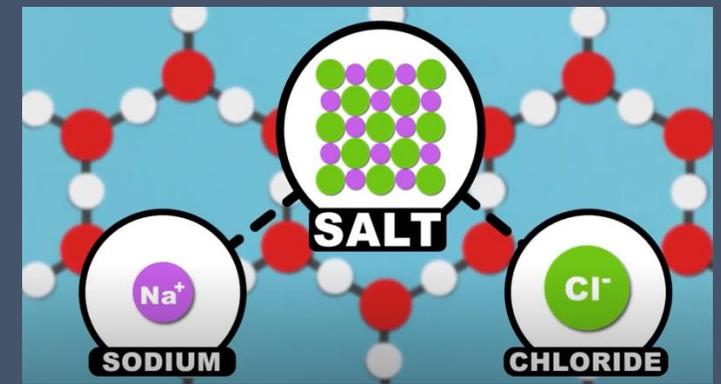
Salt decreases the freezing point of water



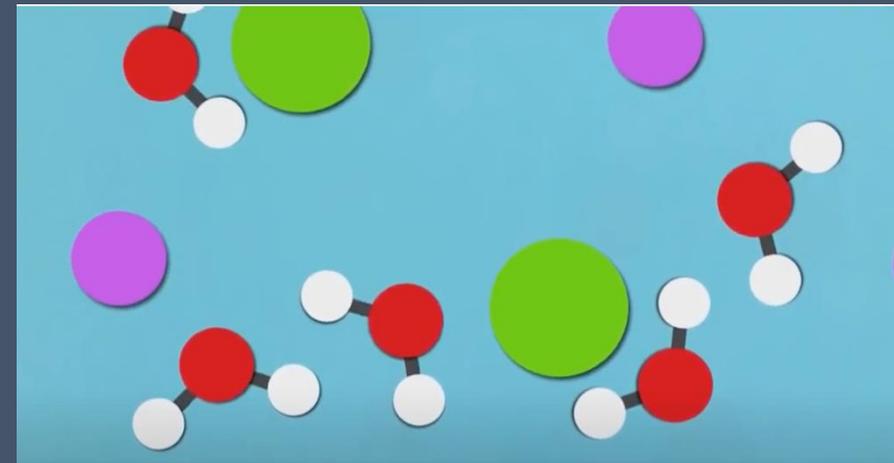
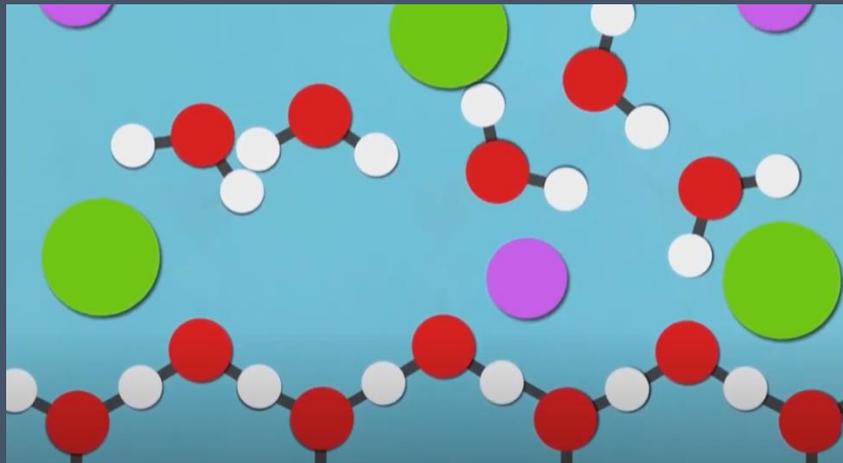
Water



Ice



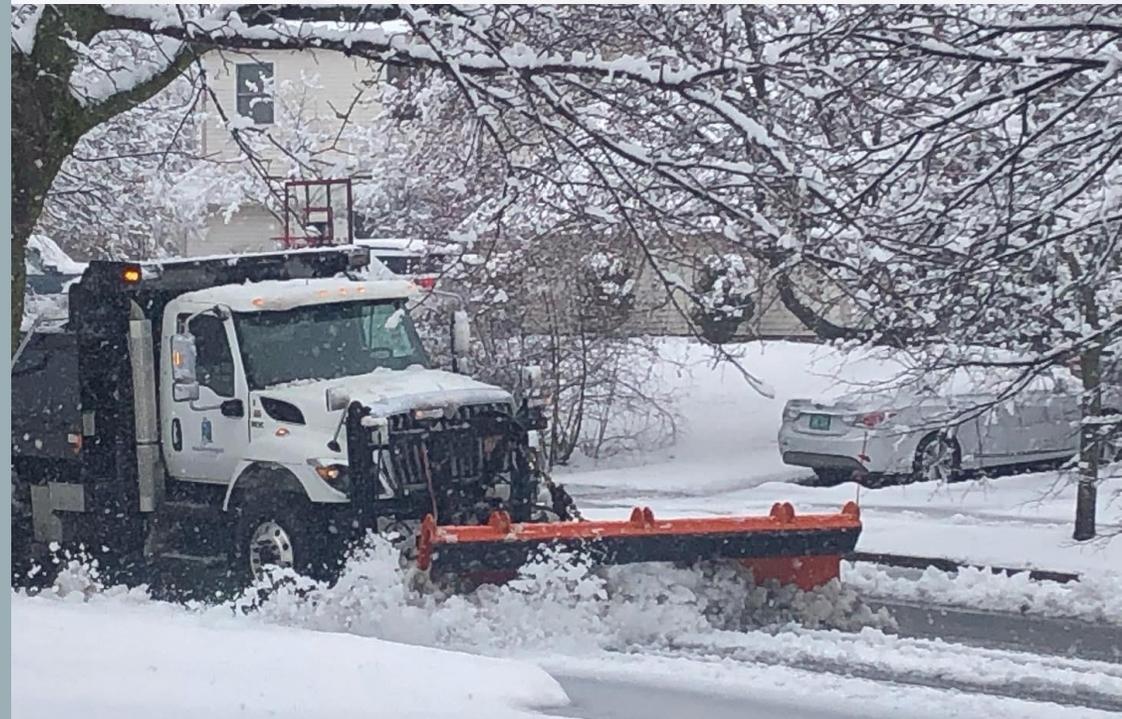
Salt breaks apart into Na and Cl when it mixes with water



Na and Cl move in between water molecules and disrupt them from forming ice

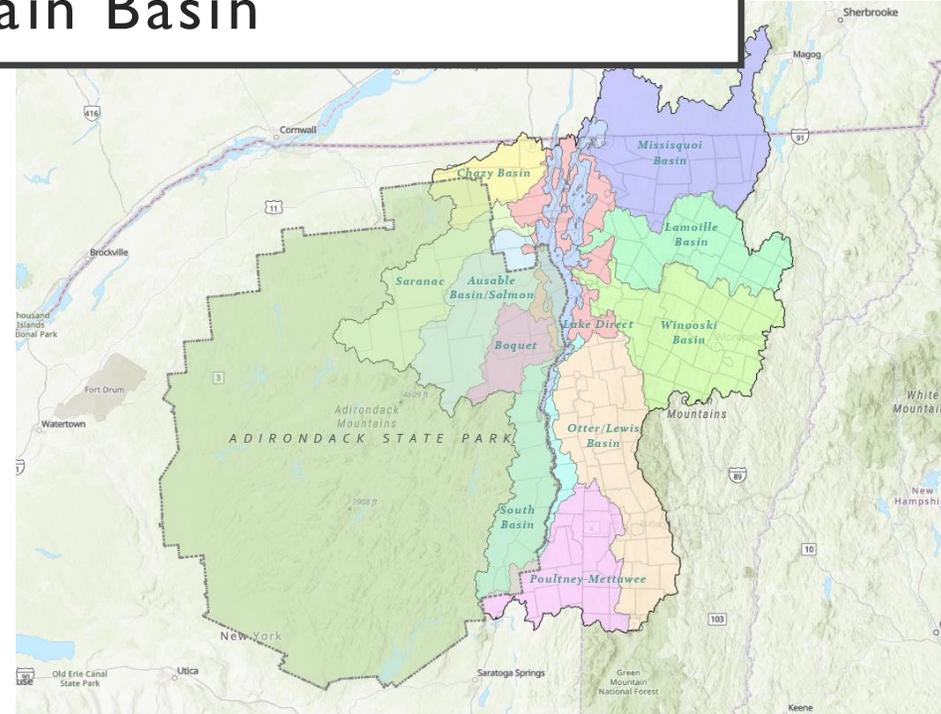
Two surveys conducted

- Municipalities/counties in the Adirondacks and Vermont
- Commercial salt applicators in the Lake Champlain basin

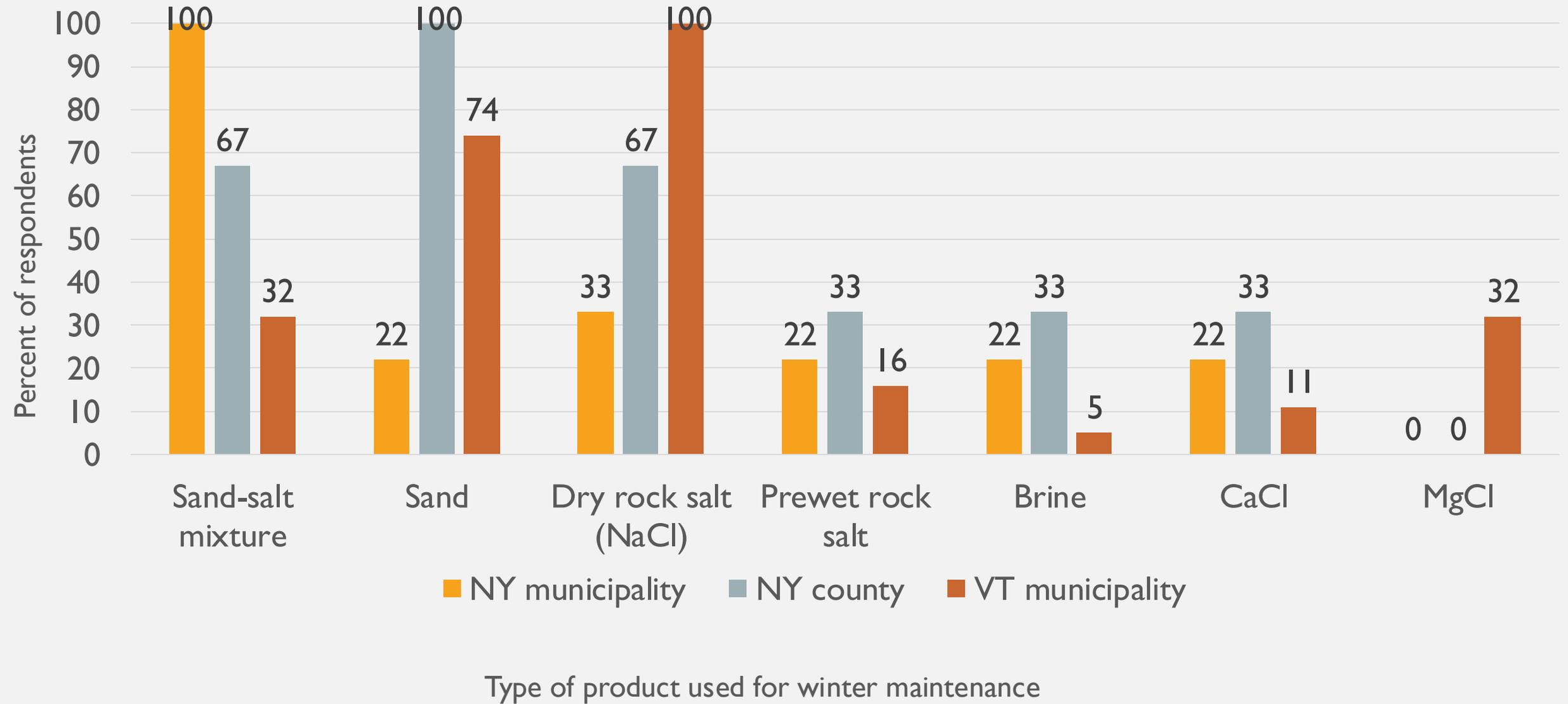


Assessed municipal and county snow and ice management practices in the Adirondacks and Lake Champlain Basin

- 230 people contacted
 - 9 NY counties – 3 responded (33%)
 - 92 NY municipalities – 9 responded (10%)
 - 129 Vermont municipalities* – 19 responded (15%)



Most-used product for snow/ice management varied between states and entity



A photograph of a salt spreader truck on a snowy road. The truck is white with a large hopper and is spreading salt. It has orange lights on top and sides. To the right of the truck is a yellow diamond-shaped sign that says "SPEED HUMP". The road is covered in snow, and there are other vehicles and signs in the background.

ON AVERAGE, MUNICIPALITIES IN THE
ADIRONDACKS AND VERMONT EACH
SPREAD 957 TONS OF SALT PER YEAR

Reduced salt best management practices (BMPs) are an option

- More efficient
- Reduce salt use
- Provide similar level of service
- Do not sacrifice safety

*Environment and Climate Change Canada, 2013;
Nixon & DeVries, 2015;
Transportation Association of Canada, 2013;*

Bryan Davidson CC BY-NC

BMPs and winter maintenance plans are successful

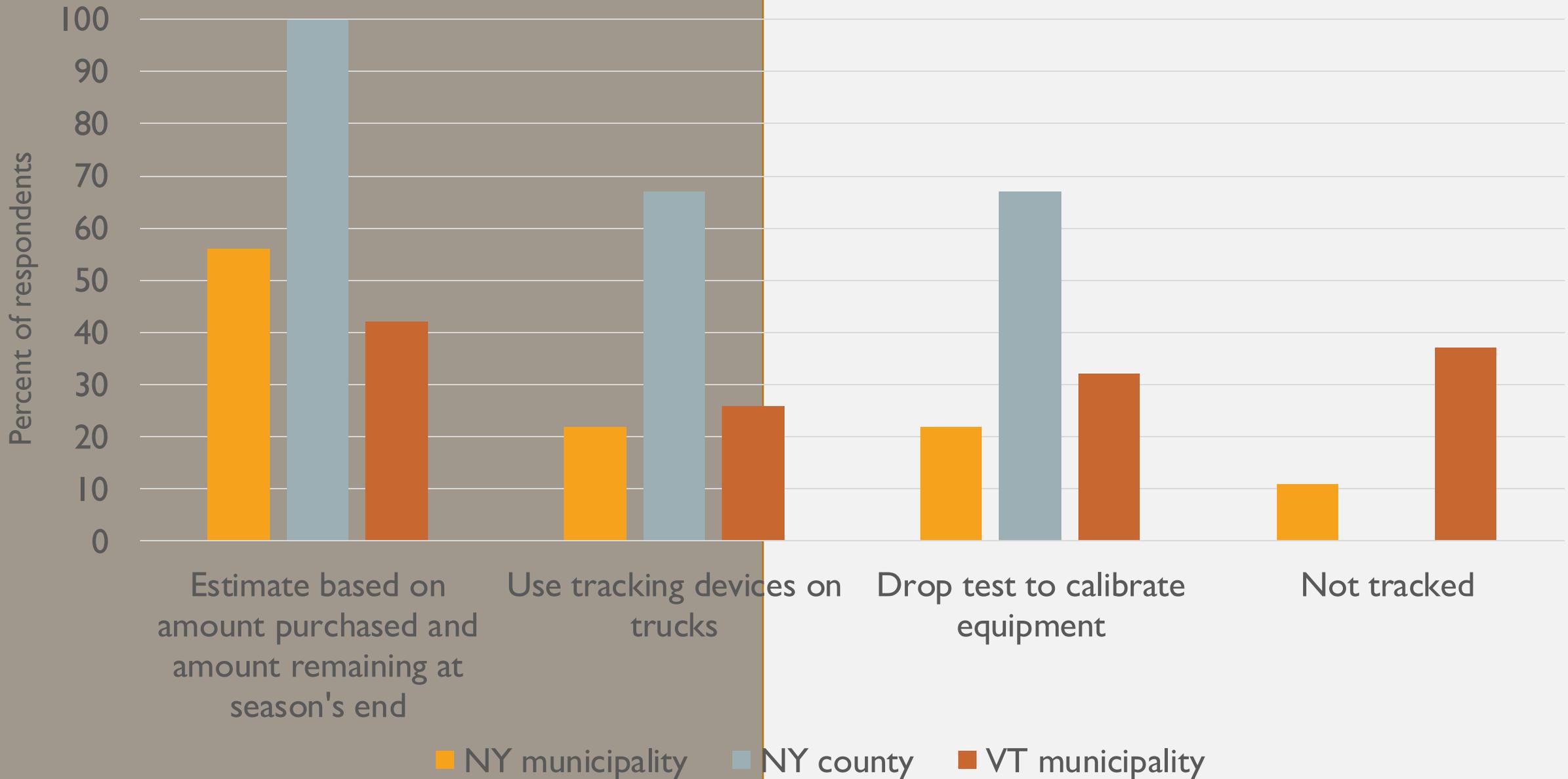
- 13-73% lower sodium chloride usage
- 34% lower winter maintenance costs
- 7% lower rate of snow and ice-related collisions

Adjusting salt application rates and covering stored salt were most often used

	Percent		
	NY M*	NY C	VT
Adjust type or amount of product based on conditions	78	100	90
Cover stored product	88	100	94
Use equipment that allows product application rates to be adjusted	78	67	95
Use detailed weather information	67	67	84
Use equipment that clears snow more effectively	67	33	37
Pre-wet salt at the spinner	11	67	32
Have a winter snow/ice management plan	44	67	42
Measure pavement temperatures	33	33	37
Anti-icing	33	33	42
Pre-treat salt piles	0	0	16

* M = Municipal C = County

The amount of product used was commonly estimated

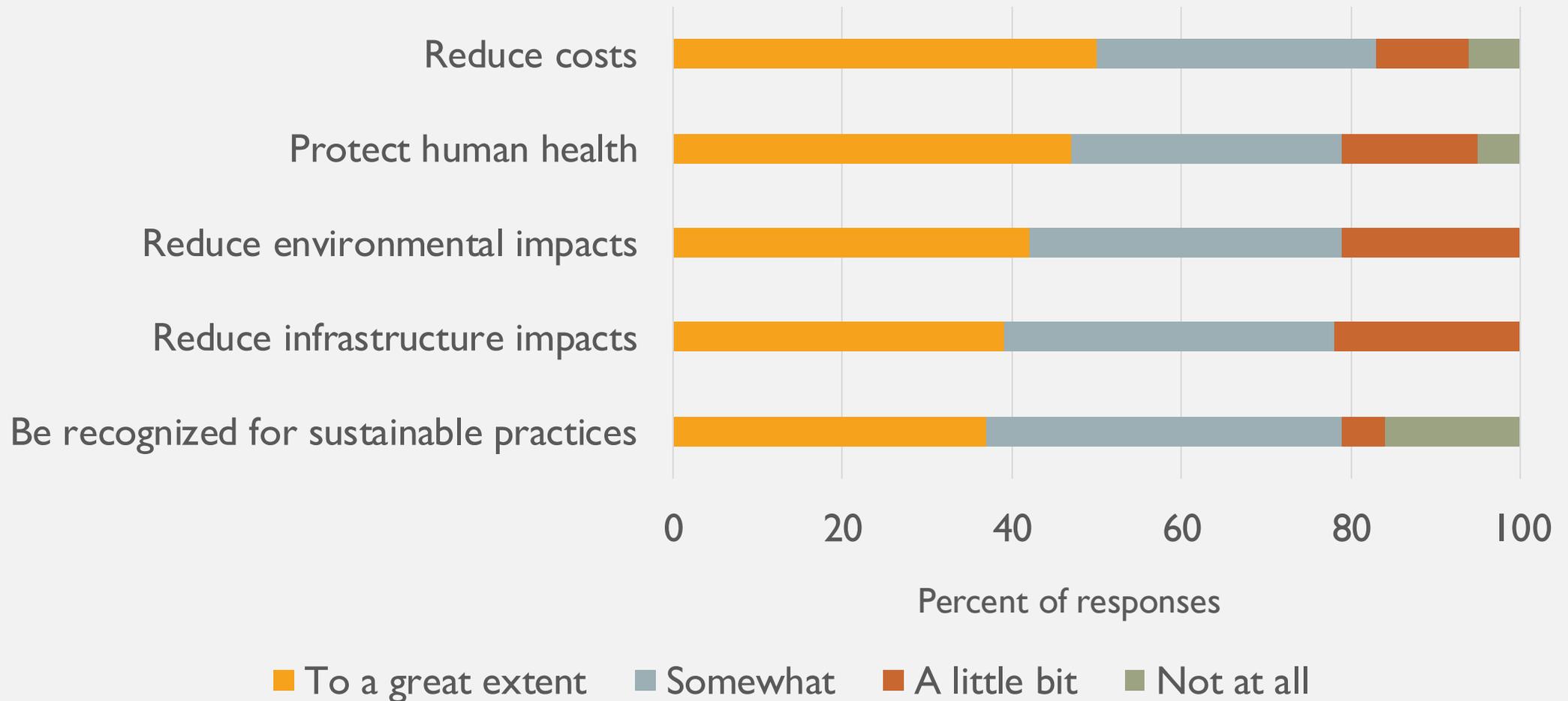


DROP TEST TO
CALIBRATE IS
QUICK AND
SIMPLE

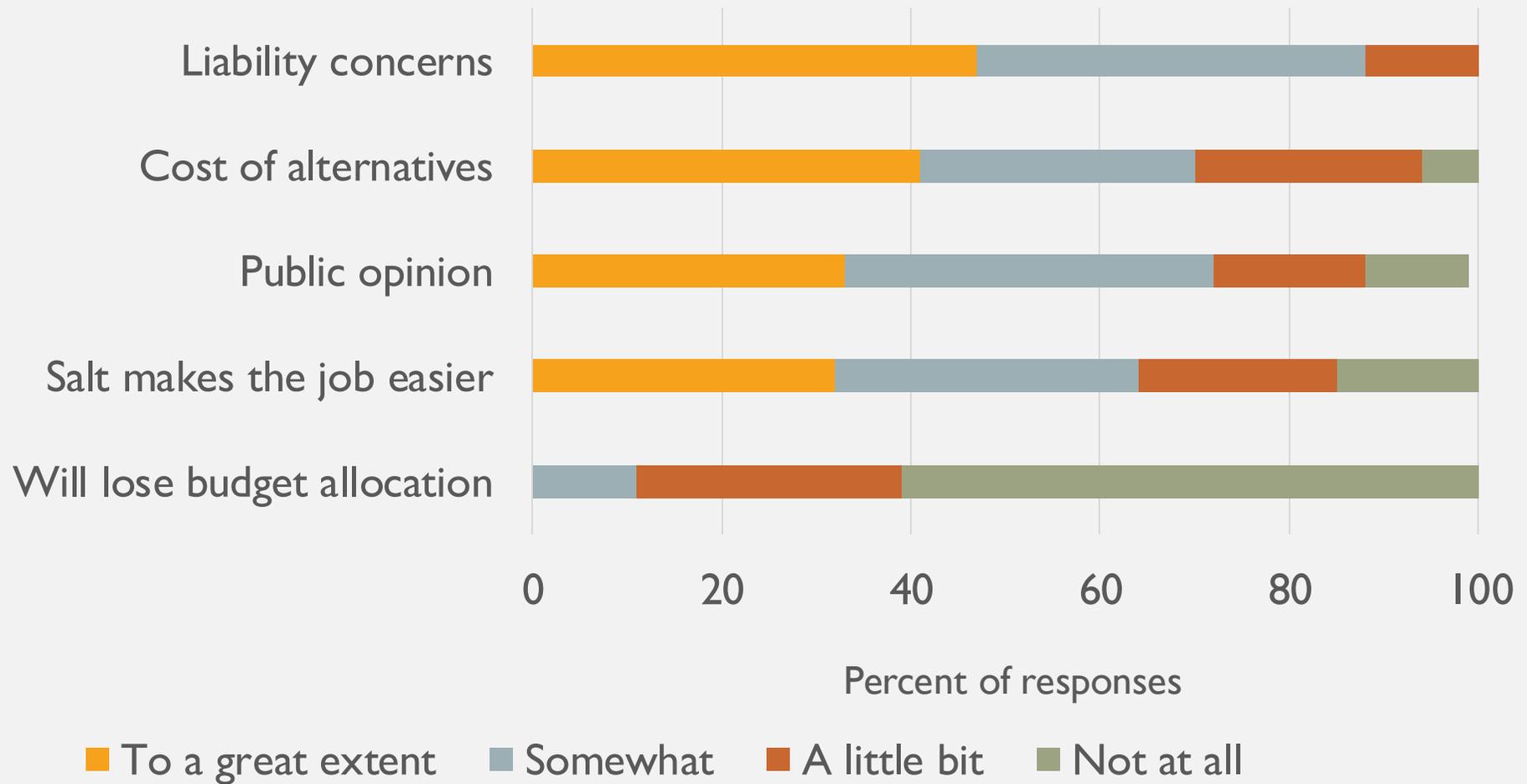
1 Minute

66
lbs

VT MUNICIPALITIES WERE MOST MOTIVATED TO REDUCE SALT TO SAVE MONEY



LIABILITY CONCERNS WERE THE BIGGEST BARRIER FOR VT MUNICIPALITIES TO REDUCE SALT USE





MOST COMMON “VERY USEFUL” RESPONSES TO ENCOURAGE SALT REDUCTION:

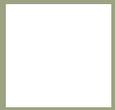
- Funding to purchase updated equipment (70%)
- A public education campaign to change expectations (66%)
- More staff to share the workload (54%)



Limited use of brine or pre-wetted salt



Limited tracking of salt use



Limited measurement of pavement temperatures



Limited use of new technologies to clear snow more effectively



Limited calibration of equipment



Opportunities for shared procurement? Cooperatives?

KEY TAKEAWAYS

Hyde Park's Success Story



Impacts to waterways from commercial applicators may be substantial

- 15% to 40% of salt is applied to parking lots, sidewalks, entryways, and driveways



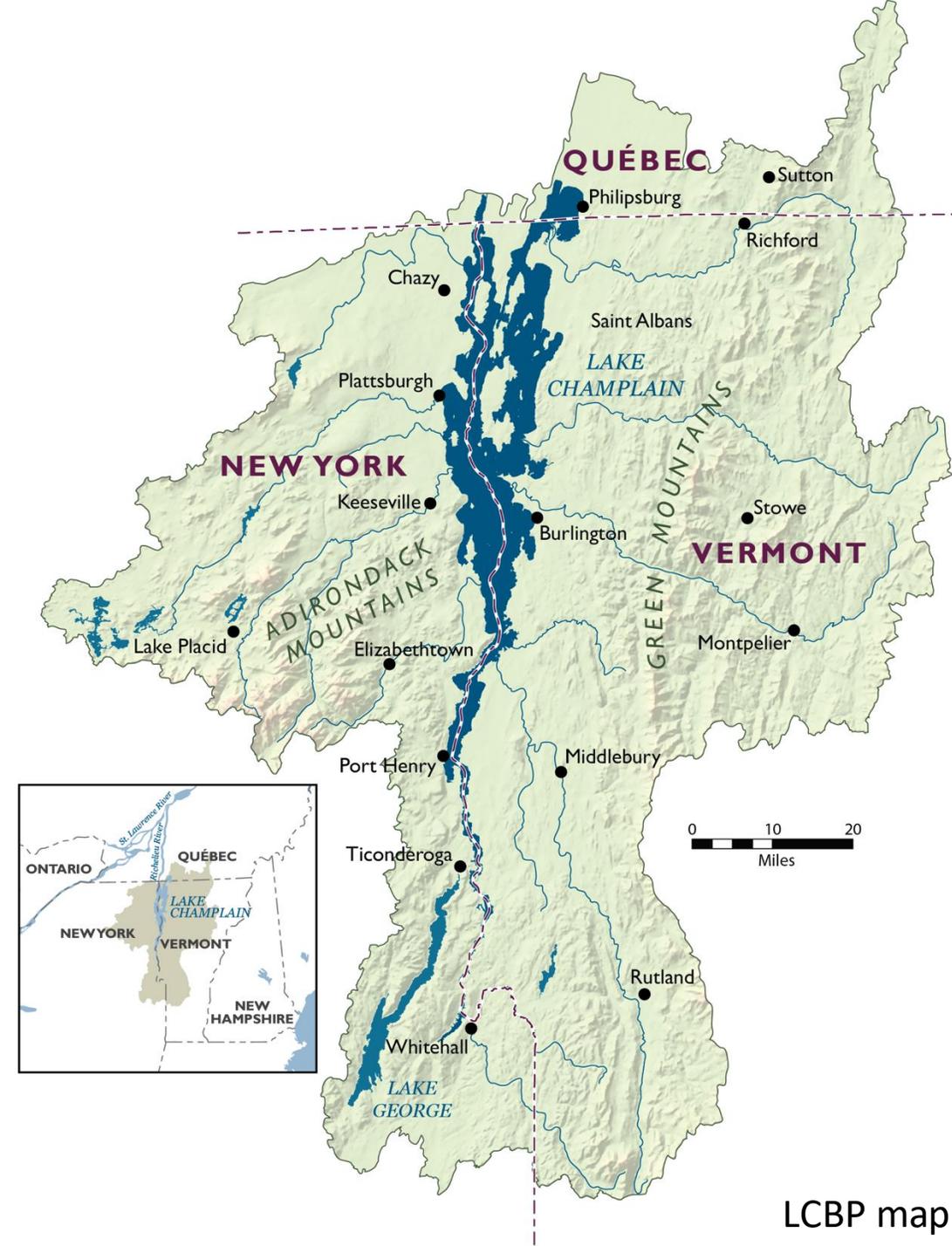
This Photo by Unknown Author is licensed under CC BY-NC-ND



Surveyed commercial salt applicators in the Lake Champlain basin in 2017-8

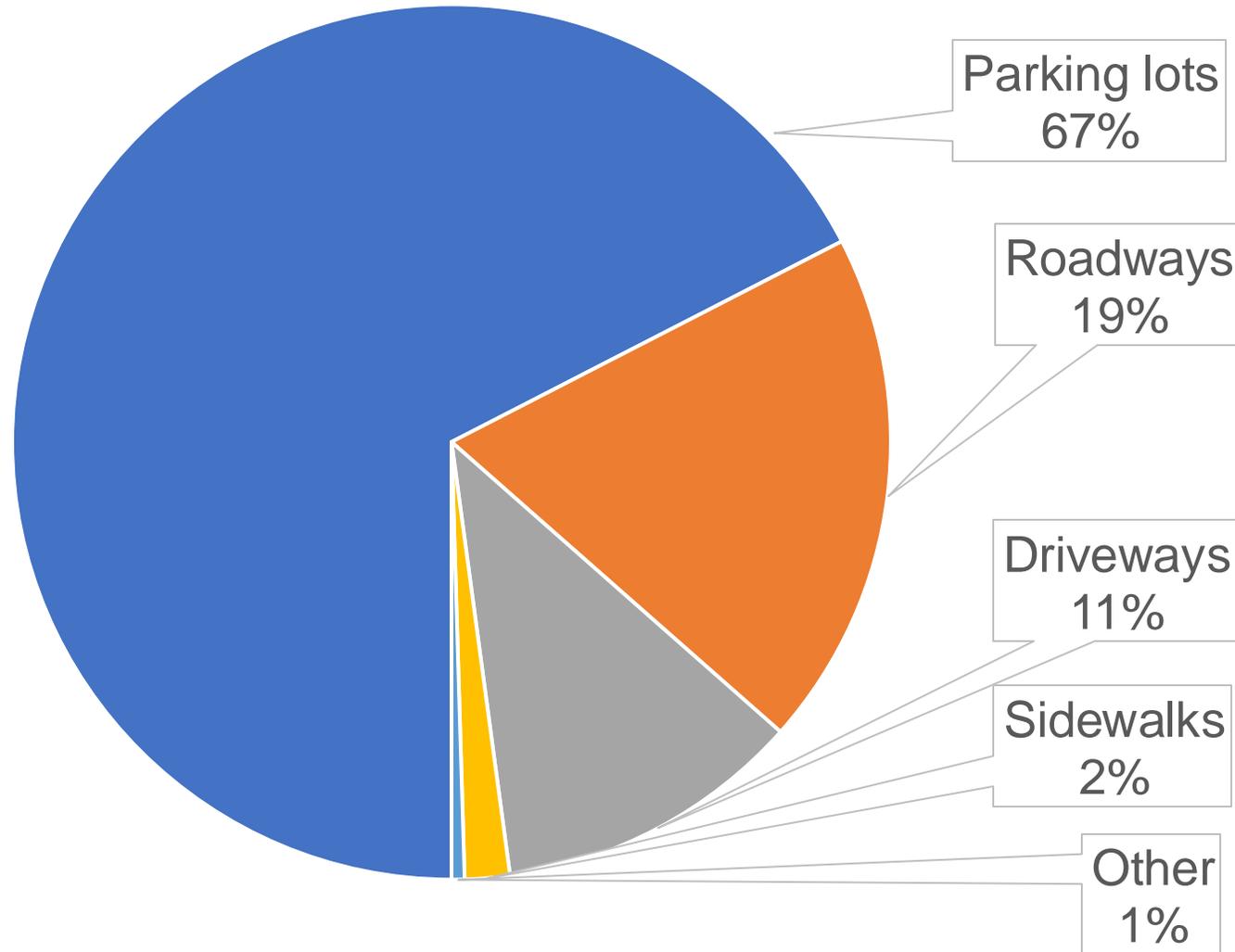
232 companies

70 respondents (30.2%)



Commercial salt applicators serviced parking lots most often

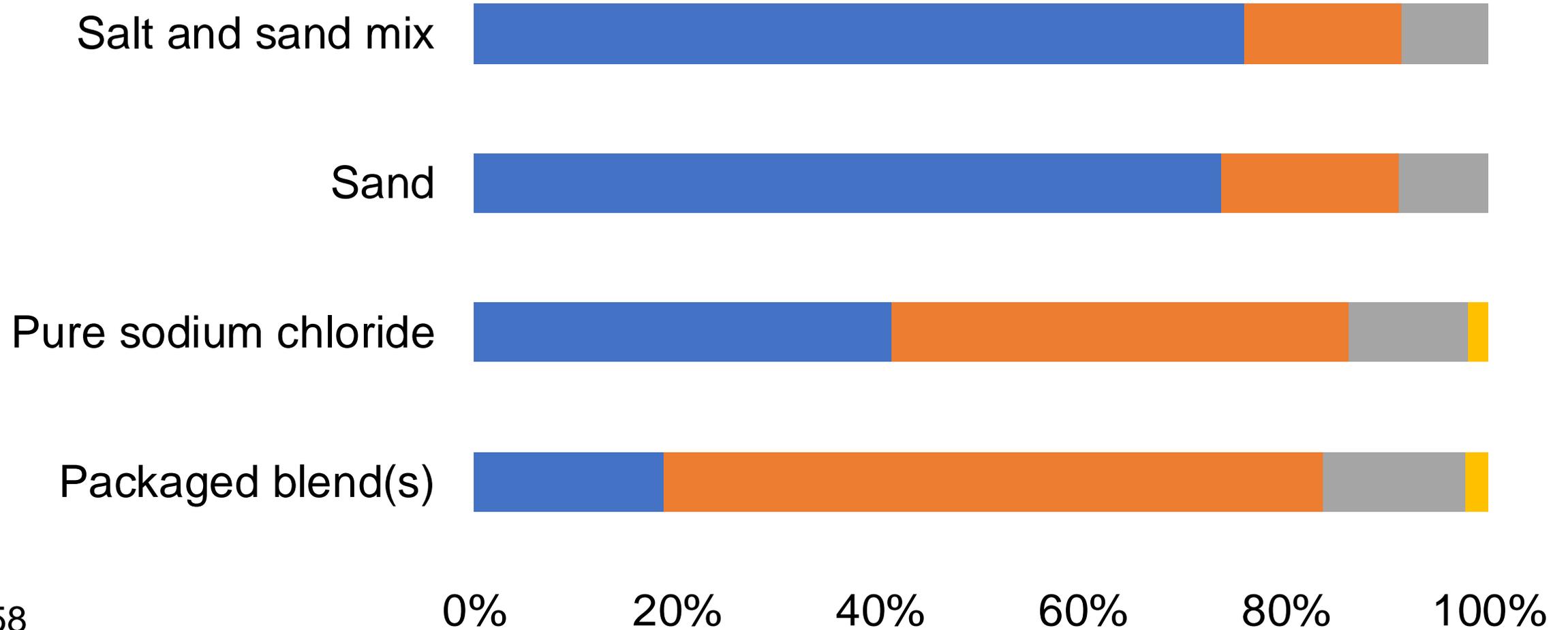
- On average, 24 lane miles serviced per commercial applicator
- 1,042 lane miles reported by 19% of contractors
- → 5,000+ lane miles by commercial salt applicators
- Vermont Agency of Transportation (2016) provided winter maintenance to 6,522 lane miles



n = 43

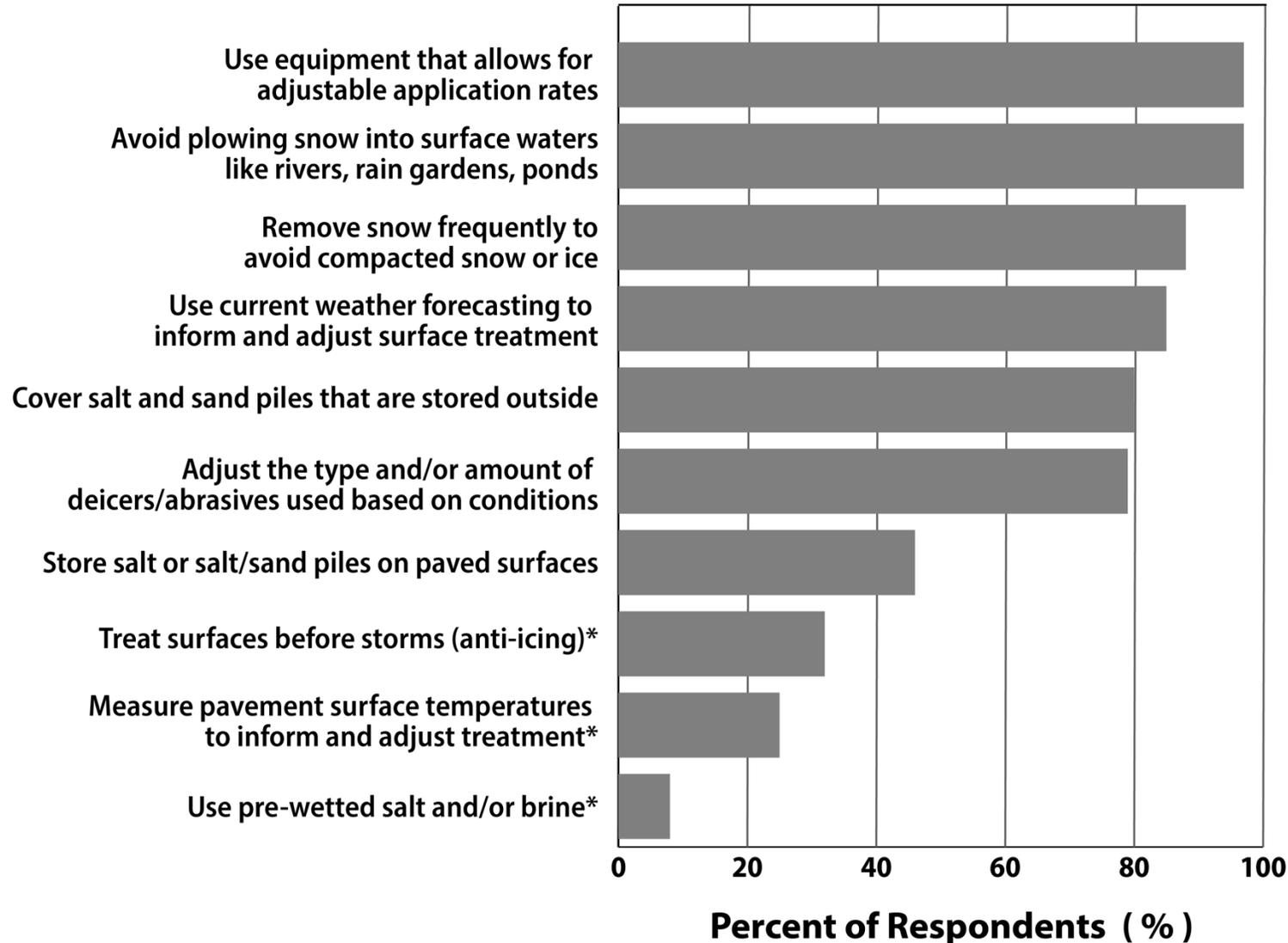
Types of application materials used varied

■ Yes ■ No ■ Not applicable ■ Unsure



$n = 58$

Best Practice



Commercial salt applicators used an average of 6 reduced-salt best practices

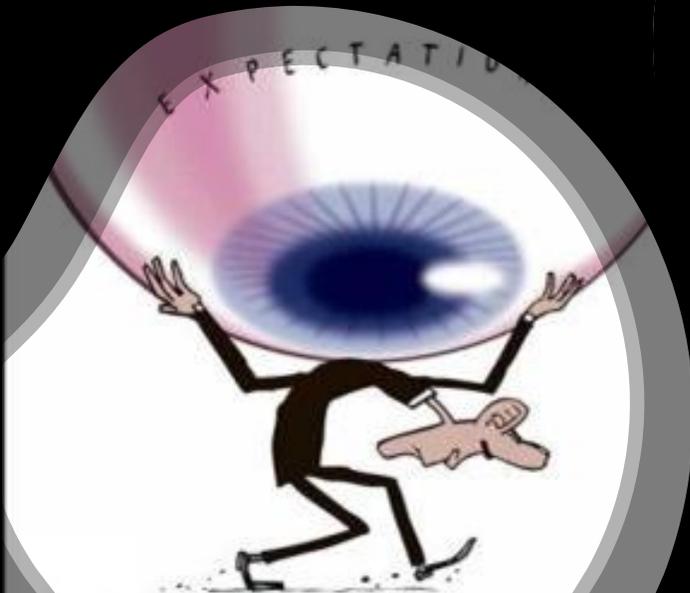
- Survey of 70 commercial snow removal businesses in the Lake Champlain basin



Commercial salt applicators faced several barriers to using reduced-salt best practices



- Costs (60%)
- Time (46%)
- Customer expectations (29%)



n = 70

Sparacino, H., Stepenuck, K. F., & Hurley, S. E. (2024). Understanding reduced salt practices used by commercial snow removal businesses in the Lake Champlain Basin: A mixed methods analysis. *Journal of Environmental Management*, 351, 119957.

Reduced salt best practices are numerous and have varied benefits and challenges



SUSTAINABLE SALT PRACTICES FOR MUNICIPALITIES AND COMMERCIAL SALT APPLICATORS

Sustainable Practice Type	Sustainable Practice Description	Anticipated Benefits and Impacts			
		Environmental	Financial	Liability	Service
Planning	Use precise weather forecasts (7, 10, 11) and road weather information stations (RWIS) to inform salting.	Decreased negative impacts by more effectively using salt, and thereby using less salt.	Increased costs for initial investment (4). Minimal costs to maintain (4). Decreased costs over time by improved knowledge of conditions leading to reduced salt use. Can lead to reduced staff time required (4) and 10-20% decrease in winter management expenses (8).	Decreased liability due to more targeted service for conditions.	Improved service due to more effective and targeted service.
	Reduce amount of rock salt distributed per lane mile (to 50 to 300 lbs/mile) (3,8).	Possibly decreased negative impacts by limiting use of salt.	Decreased costs of materials due to less salt used.	Little or no change.	Little or no change for end users.
	Improve road surfaces, cut back roadside trees and brush to reduce shading (25).	Possible environmental impact due to tree removal.	Sustained costs to keep pavement surface free of potholes and other imperfections and to keep trees pruned.	Decreased liability due to improved visibility and road surface conditions.	Improved service due to improved ability to plow effectively and improved ability



Create a management plan and contract with customers





Cover stored salt



Remove snow before salt application and frequently during storms



Consider site conditions when positioning snow piles

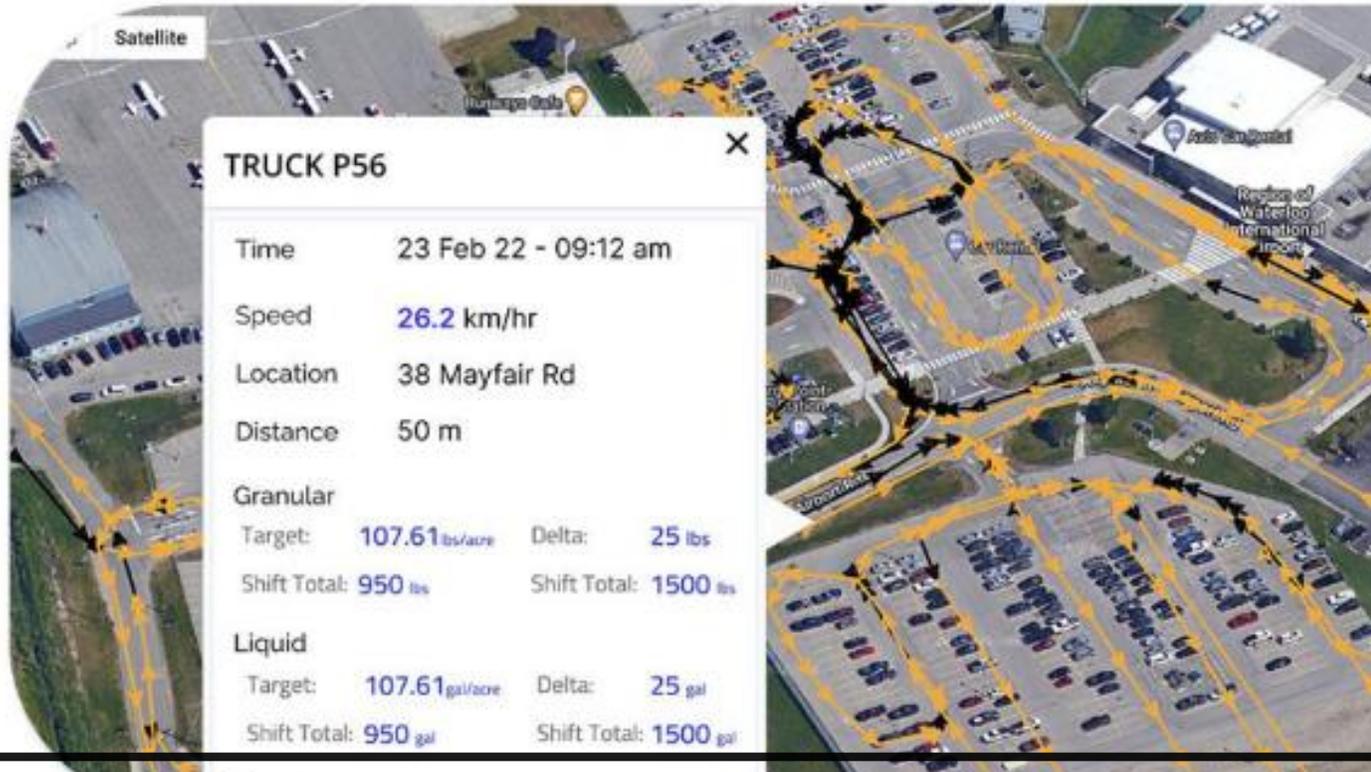


Use segmented and/or secondary plows



Calibrate equipment

go.uvm.edu/salttools



Track salt use by location, vehicle and driver



Use equipment with adjustable application rates (and adjust rates according to conditions)

View

Edit

Use online calculators to inform application

Deicing Product Application Rate Calculator

Surface

Please Select... ▾

Weather

Please select... ▾

Pavement Temperature

Please select... ▾

Temperature Trend

Please select... ▾

Product

Please Select... ▾

MAINTENANCE ACTION

-

APPLICATION RATE

-

go.uvm.edu/salttools

Auger settings Calculator

Number of auger settings

Auger Product amount

Measured width of spread at 10 mph
(ft)

5 to 30

Recommended application rate

(lbs/1000 square feet)

go.uvm.edu/salttools



Treat surfaces before snow and ice accumulation (anti-icing)

Pre-wet salt or
use pre-treated
salt



Image sources: SnowEx (L)
and Innovative Surface
Solutions (R)

Use alternative materials





Measure pavement
temperatures

Provide training, resources and education to staff

