Environmental Research & Education Foundation

Lighting a path to sustainable waste management practices

Results from EREF's AD Survey and Other Projects

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EREF History & Mission

Mission: To advance scientific research and create educational pathways that enable innovation in sustainable waste management practices.

Vision: To light the way towards a more circular economy.

- Founded in 1992 as a 501(c)3 charity
- Non-lobbying organization
- Not a membership organization

Key Programs

- **RESEARCH**
  - Over $16 million in research dollars and 116 projects funded that help shape policy, develop sustainable practices, bring value, and direct the future of solid waste management

- **SCHOLARSHIPS**
  - Educating the next generation of solid waste researchers and technical personnel – 95 scholars since 1998, totaling $2.36 million

- **DATA & POLICY**
  - Conduct state of practice research and trend analyses to benefit to solid waste industry – 18 reports completed since 2014

Data & Policy Program Projects

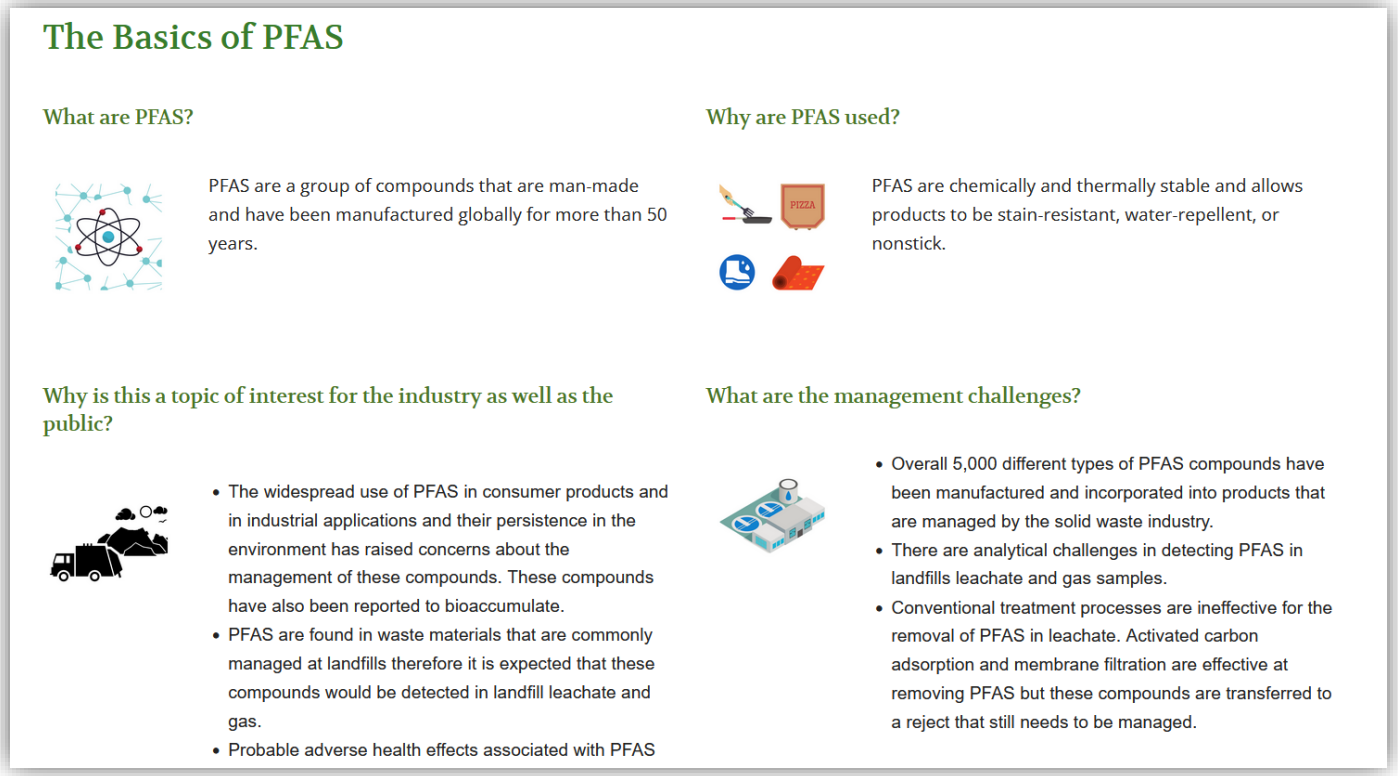
- Update to Municipal Solid Waste Management in the U.S. 2016 and 2019
  - Facility-based estimate of MSW generation, recover and disposal in the U.S.
- Annual Tipping Fee report
  - Annual report on landfill tipping fee trends
- State of Practice of Composting in the U.S.
  - Survey of composting facilities in the U.S. to understand information related to infrastructure and program availability
- Waste Collection Vehicle Fleet Management
  - Compile information on typical practices in waste collection vehicle fleet management

Data & Policy Program Projects

- Two projects that will be discussed in more detail:
  - Anaerobic Digestion of MSW: Report on the State of Practice
  - State of Practice of Organic Waste Management and Collection In Canada

Other EREF Projects

- PFAS Scientific & Technical Studies/Resources
  - Over 600 articles and technical content on PFAS
  - Organized into 10 main categories of content



The Basics of PFAS

What are PFAS?

PFAS are a group of compounds that are man-made and have been manufactured globally for more than 50 years.

Why are PFAS used?

PFAS are chemically and thermally stable and allows products to be stain-resistant, water-repellent, or nonstick.

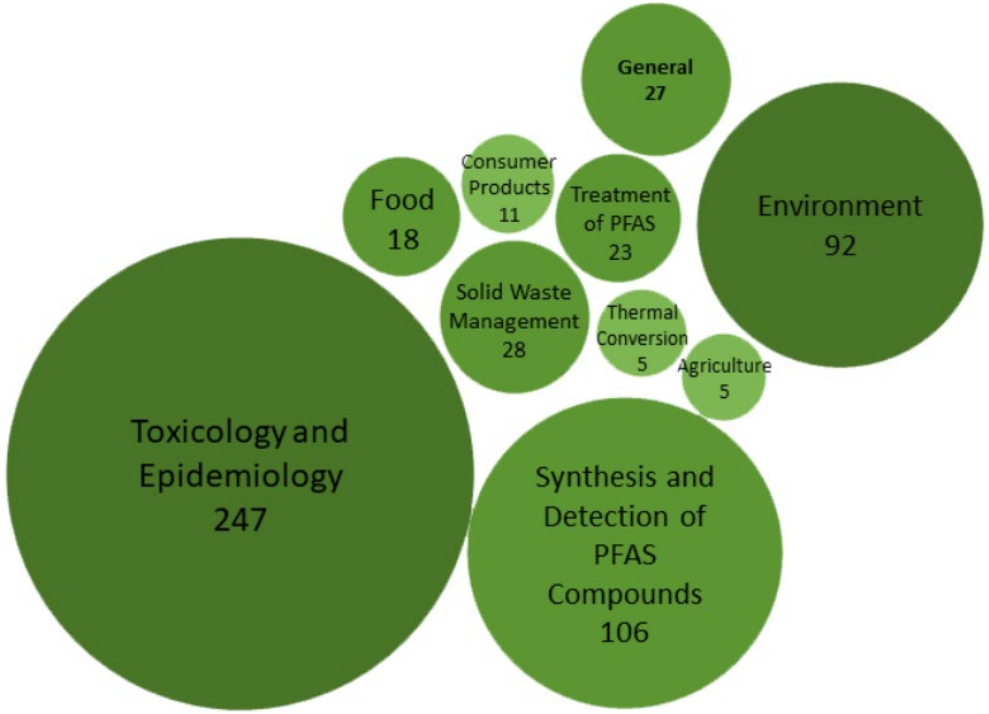
Why is this a topic of interest for the industry as well as the public?

- The widespread use of PFAS in consumer products and in industrial applications and their persistence in the environment has raised concerns about the management of these compounds. These compounds have also been reported to bioaccumulate.
- PFAS are found in waste materials that are commonly managed at landfills therefore it is expected that these compounds would be detected in landfill leachate and gas.
- Probable adverse health effects associated with PFAS

What are the management challenges?

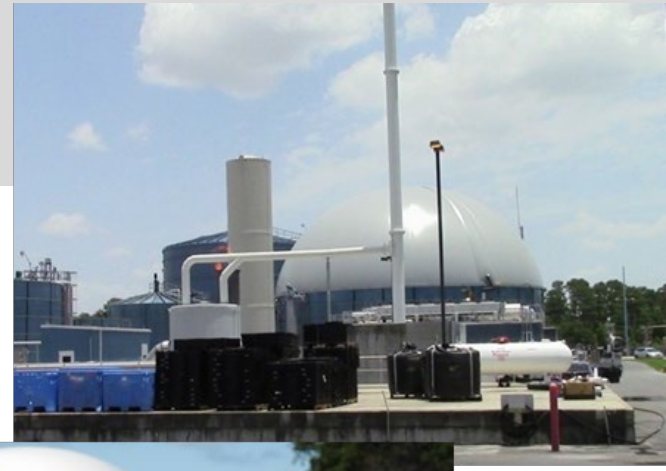
- Overall 5,000 different types of PFAS compounds have been manufactured and incorporated into products that are managed by the solid waste industry.
- There are analytical challenges in detecting PFAS in landfills leachate and gas samples.
- Conventional treatment processes are ineffective for the removal of PFAS in leachate. Activated carbon adsorption and membrane filtration are effective at removing PFAS but these compounds are transferred to a reject that still needs to be managed.

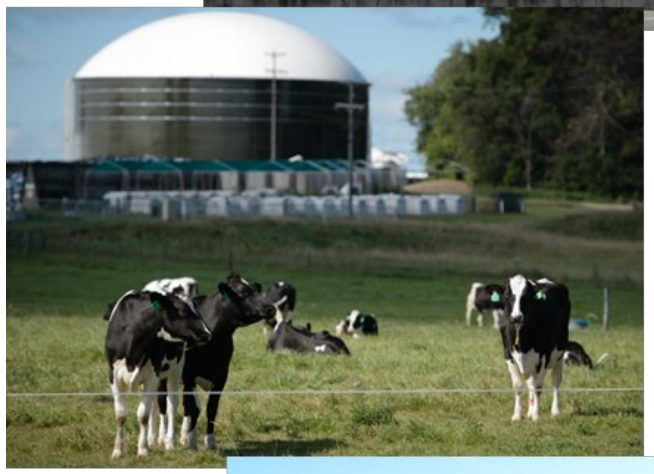
Number of Resources by Category



Anaerobic Digestion of MSW: State of Practice
&
2021 AD Survey Effort

AD of MSW: State of Practice: Objectives





2016 Report Objectives

- Identify and summarize AD technologies used for MSW
- Quantify number and types of AD facilities, amount of MSW processed, and U.S. processing capacity (For 2010 & 2013)
- Summaries current policies related to implementation/use of AD

2019 AD Survey Objectives

- Identification of national WWTP co-digestion facilities
- Quantify changes in number and types of AD facilities, amount of MSW processed

Number of AD facilities in the U.S.

- As of 2019 337 facilities accept MSW organics in the U.S.

	Number of Facilities	
Type	2013	2019
Stand-Alone	25	56
On- Farm	75	108
WWTP[1]	54	173
Total	154	337

[1] 2019 estimate Includes suspected WWTPs based on statistical analysis.

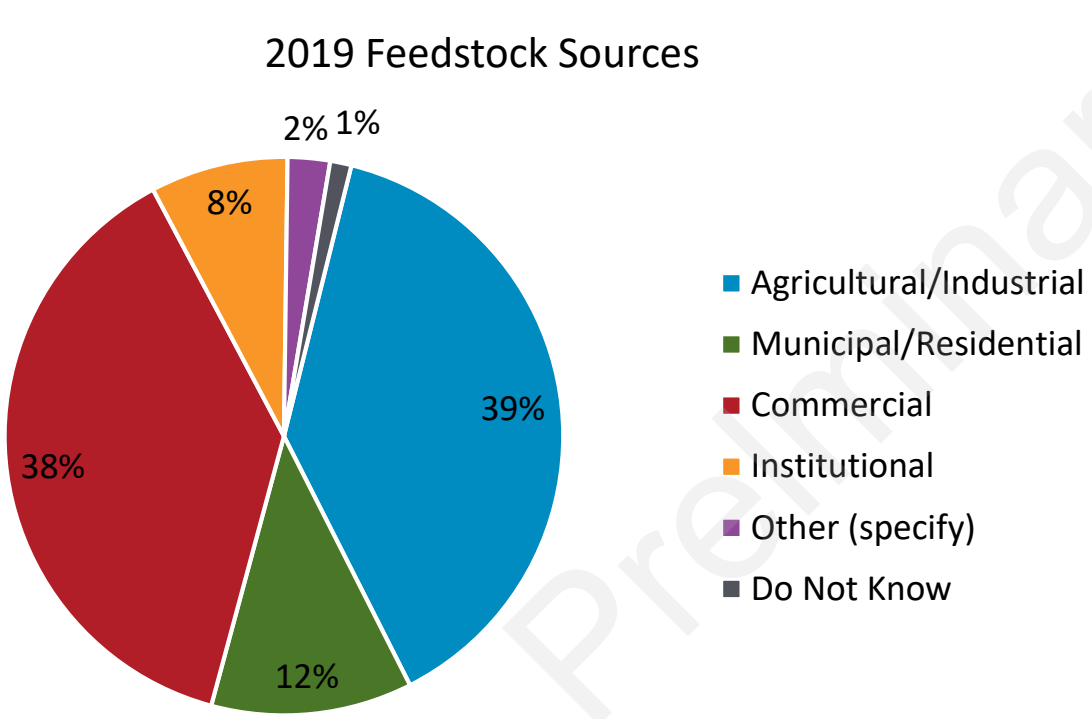
AD Facility Ownership – 2013 Statistics

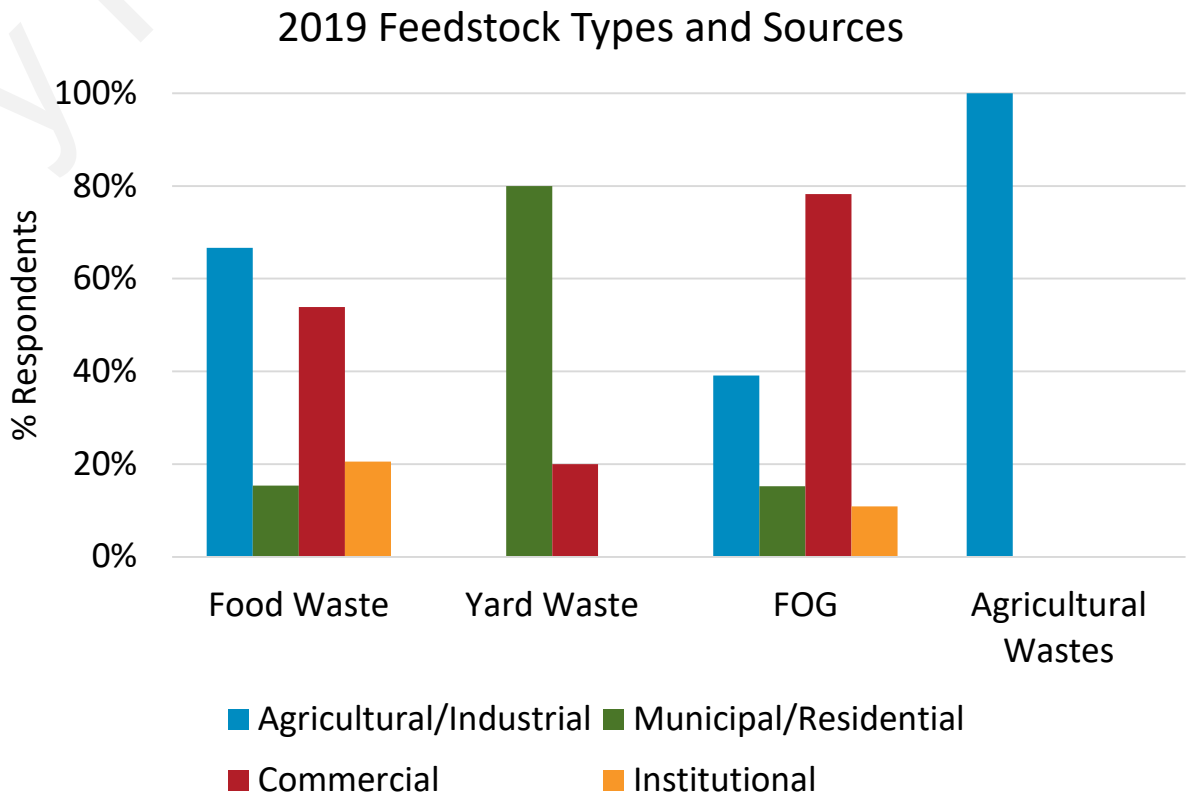
- **Stand Alone**
  - Privately Owned (88%)
    - 52% food/beverage manufacturing
    - 36% private organics management firms
  - Publically owned (12%)
    - 8% university owned
    - 4% local public entities
- **Co-digestion**
  - On-Farm
    - majority privately owned
    - 4 university-owned
  - WWTP
    - typically part of POTW

Facility Type	Portion Privately Owned
Stand-Alone	88%
On-Farm	95%
WWTP	<1%

Types of Feedstock & Sources

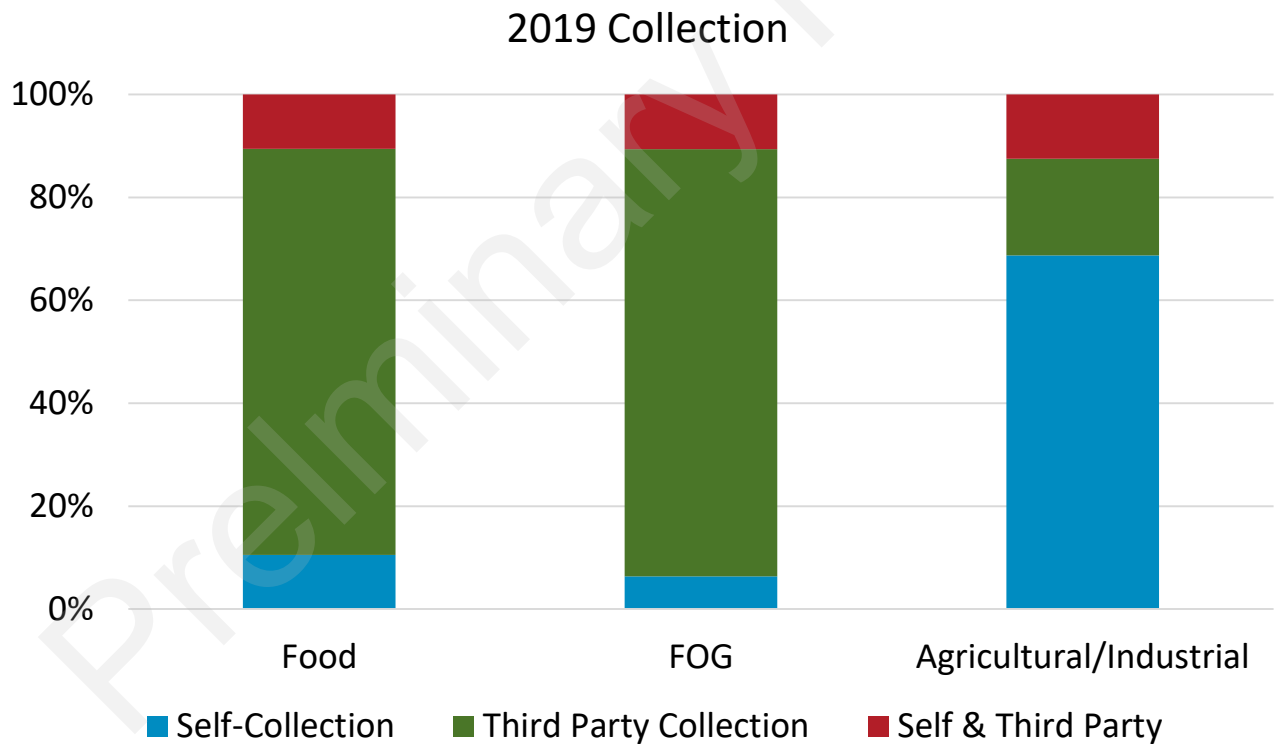
- Food waste and FOG most commonly accepted materials
- Agricultural/Industrial and Commercial sectors most common sources





Feedstock Collection Type

- Most facilities rely on third party collection
  - Except for Agricultural/Industrial wastes which are mostly self-collected



MSW Processing Estimates

- Increase in MSW managed at AD facilities from 2013 to 2019
- Greater uncertainty in 2019 stand-alone facility data due to lower survey response rate

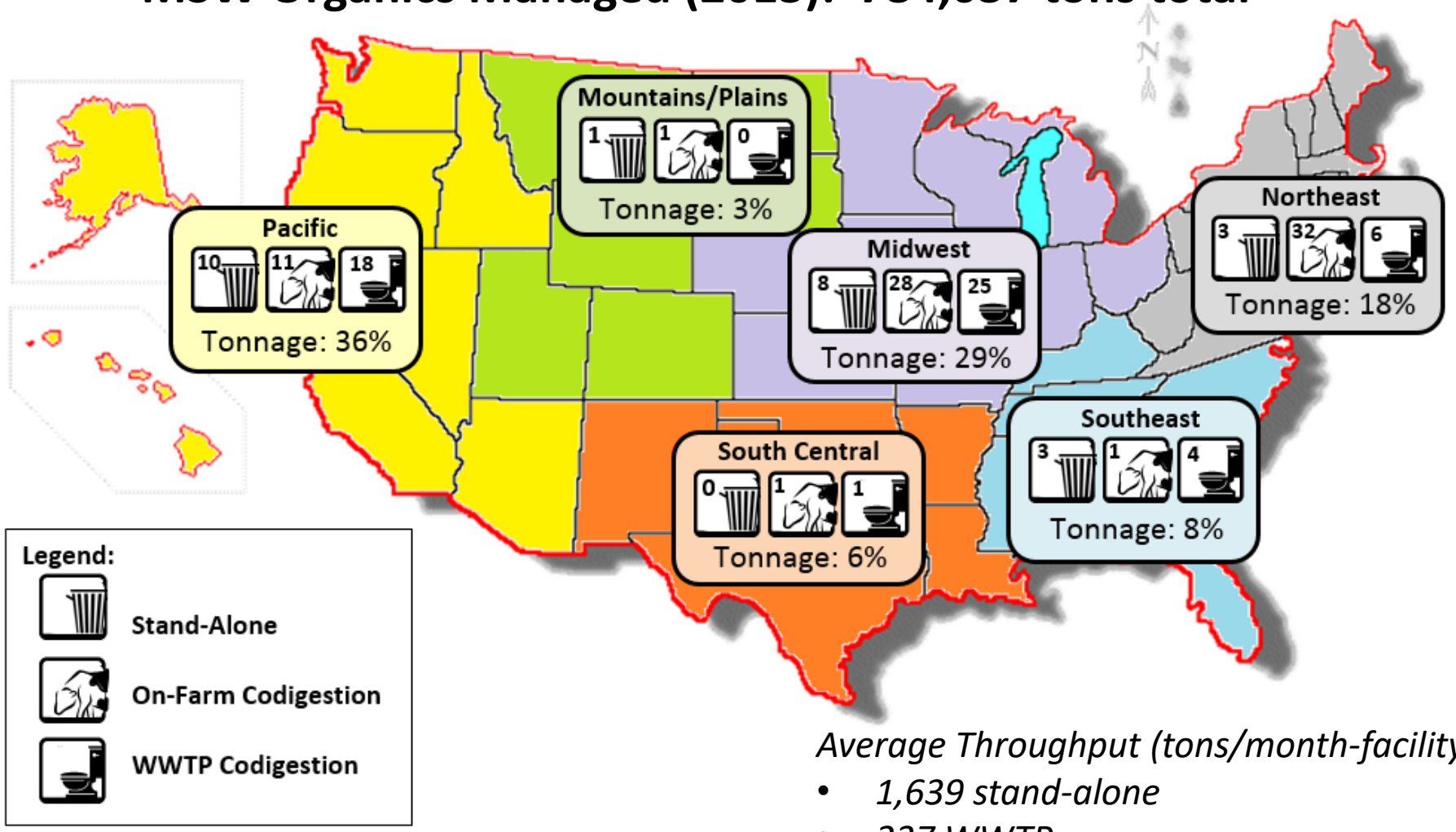
	2013 Estimate	2016 Estimate[1]	2019 Estimate[1]
Stand-Alone Facilities Total Tonnage (30% TS)	411,565	736,415	925,984
On-Farm Facilities Total Tonnage (30% TS)	141,864	160,485	218,898
WWTP Facilities Total Tonnage (30% TS)[2]	230,608	199,596	271,290
Stand-Alone Average Monthly Facility Tonnage	1,639	1,136	1,403
On-Farm Average Monthly Facility Tonnage	158	132	179
WWTP Average Monthly Facility Tonnage	237	121	167

[1] Based purely on survey data and available state data. Values include an adjustment for the percentages of facilities found to process no MSW for each facility type.

[2] 2016 and 2019 estimates Include suspected WWTPs based on statistical analysis.

MSW Organics Managed (2013)

MSW Organics Managed (2013): 784,037 tons total

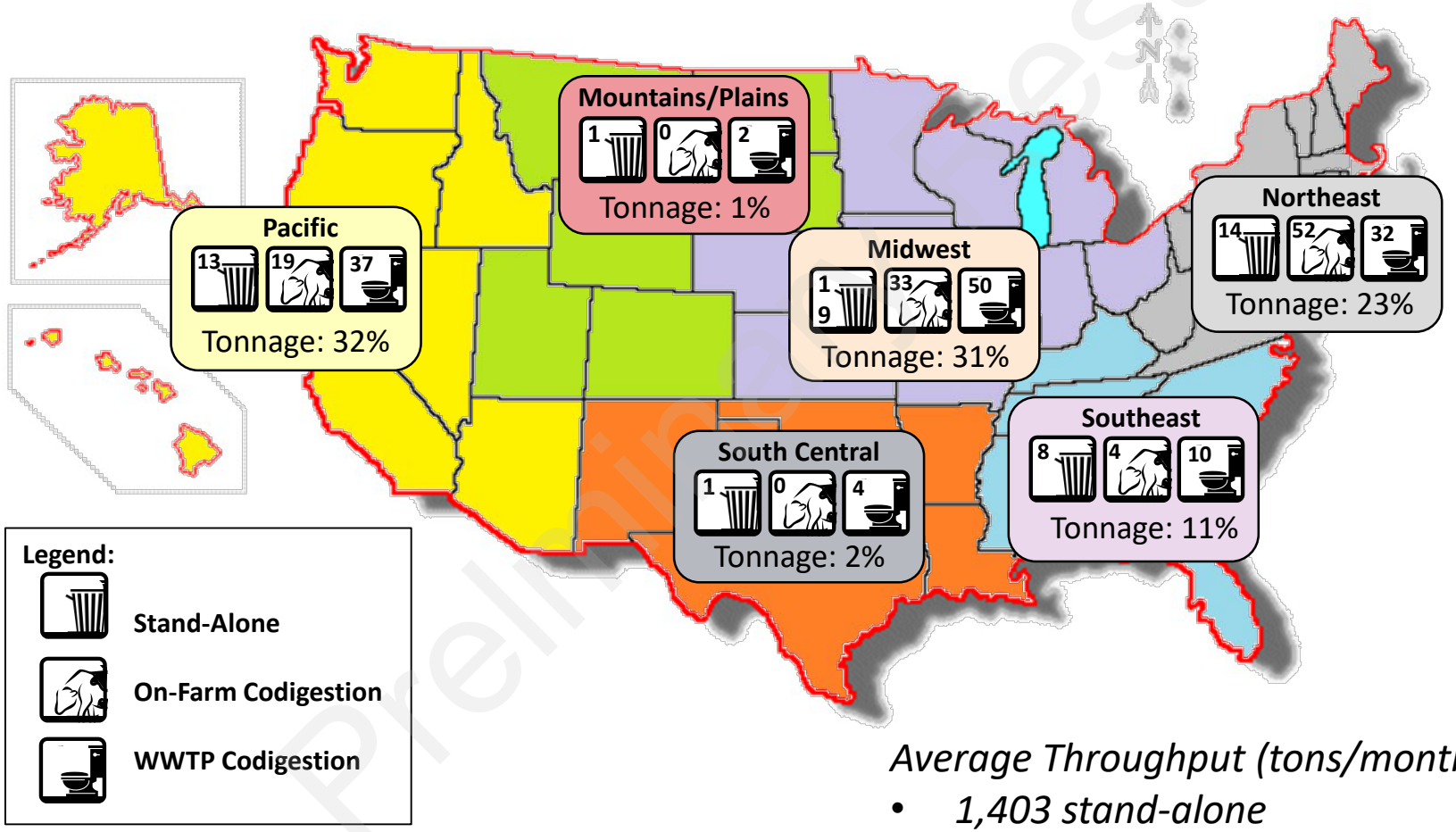


Average Throughput (tons/month-facility):

- *1,639 stand-alone*
- *237 WWTP*
- *160 on-farm*

MSW Organics Managed (2019)

MSW Organics Managed (2019): 1,416,171 tons total



Average Throughput (tons/month-facility):

- *1,403 stand-alone*
- *167 WWTP*
- *179 on-farm*

State of the Practice of Organic Waste Management and Collection in Canada

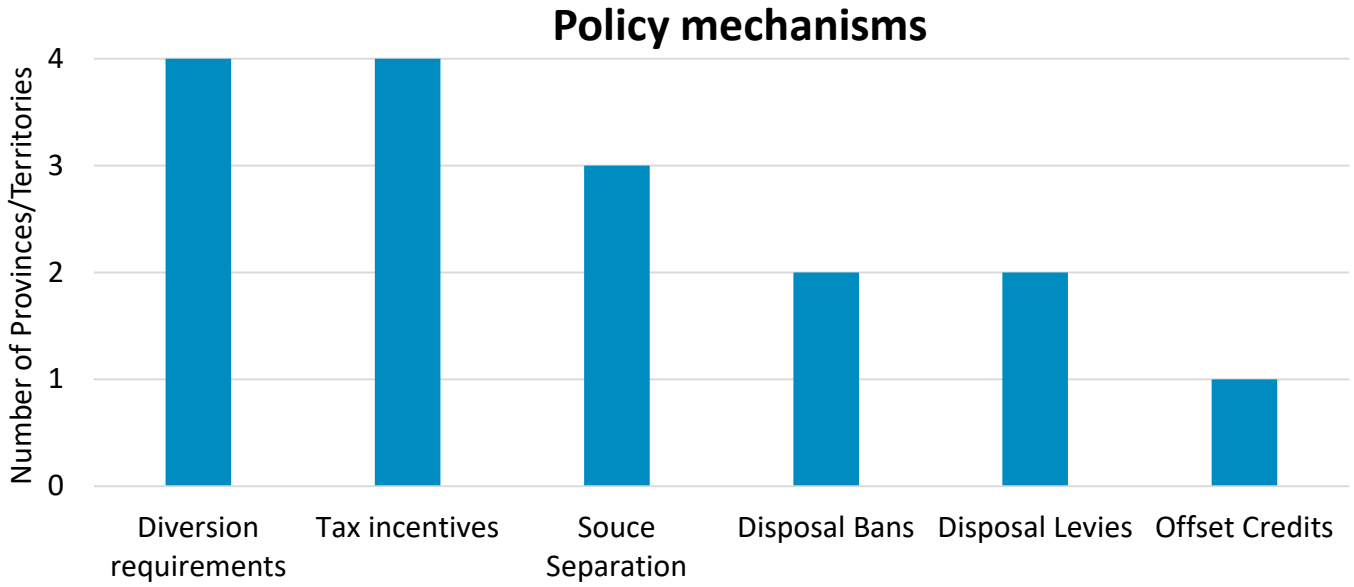
Study Objectives

1. Identify policies, programs, and approval/permitting regimes that are meant to improve organic waste management
2. Evaluate where residential organics diversion programs exist across Canada
3. Identify organics processing infrastructure (e.g., compost and AD) across Canada
4. Calculate generation, diversion, and disposal of organic waste

Policies, Programs, Permitting/Approval Regimes

Policies and Programs Used Across Canada

- 5 major goals for managing organic waste were identified
  - Divert from disposal most commonly cited goal
- 7 types of policies mechanisms were identified
  - Diversion requirements most common policy
  - 2 Provinces have considering extended producer responsibility policies



Accessibility

Accessibility to curbside and drop-off organics programs

- Total number of people living in an area with the specified organics program
- Actual program participation is lower and will depend:
  - Location
  - Program structure
  - Type of residence
  - Participation rate

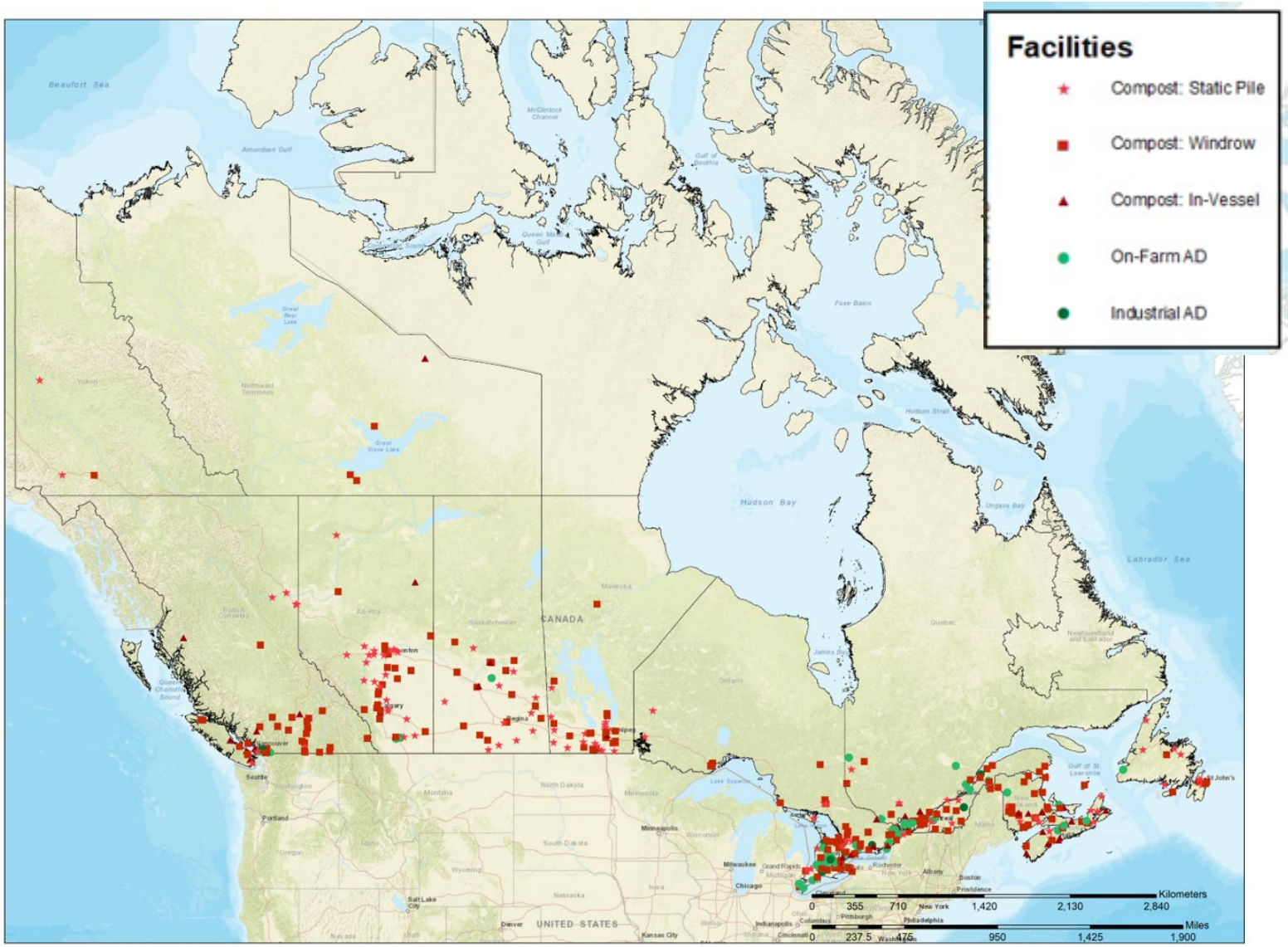
Program Type	Number of People Living in Area with Program	Percent of Total Population
Organics Management Program (Any)	**31,703,912**	**91%**
Curbside (Any)	29,128,173	83%
Leaf and Yard Waste Program	**31,699,256**	**91%**
Drop-off	21,304,947	60%
Curbside	29,003,336	83%
Source Separated Organics Program	**25,877,191**	**74%**
Drop-off	8,599,118	24%
Curbside	24,867,632	71%

Organic Waste Processing Infrastructure

Composting and Anaerobic Digestion Facilities

- Largest concentration of facilities in Ontario and Quebec

Province/Territory	Number of Facilities
Alberta	45
British Columbia	49
Manitoba	24
New Brunswick	36
Newfoundland and Labrador	30
Nova Scotia	24
Ontario	107
Prince Edward Island	3
Quebec	44
Saskatchewan	28
Northwest Territories	4
Nunavut	-
Yukon	3
Total Canada	**387**



Organic Waste Processed

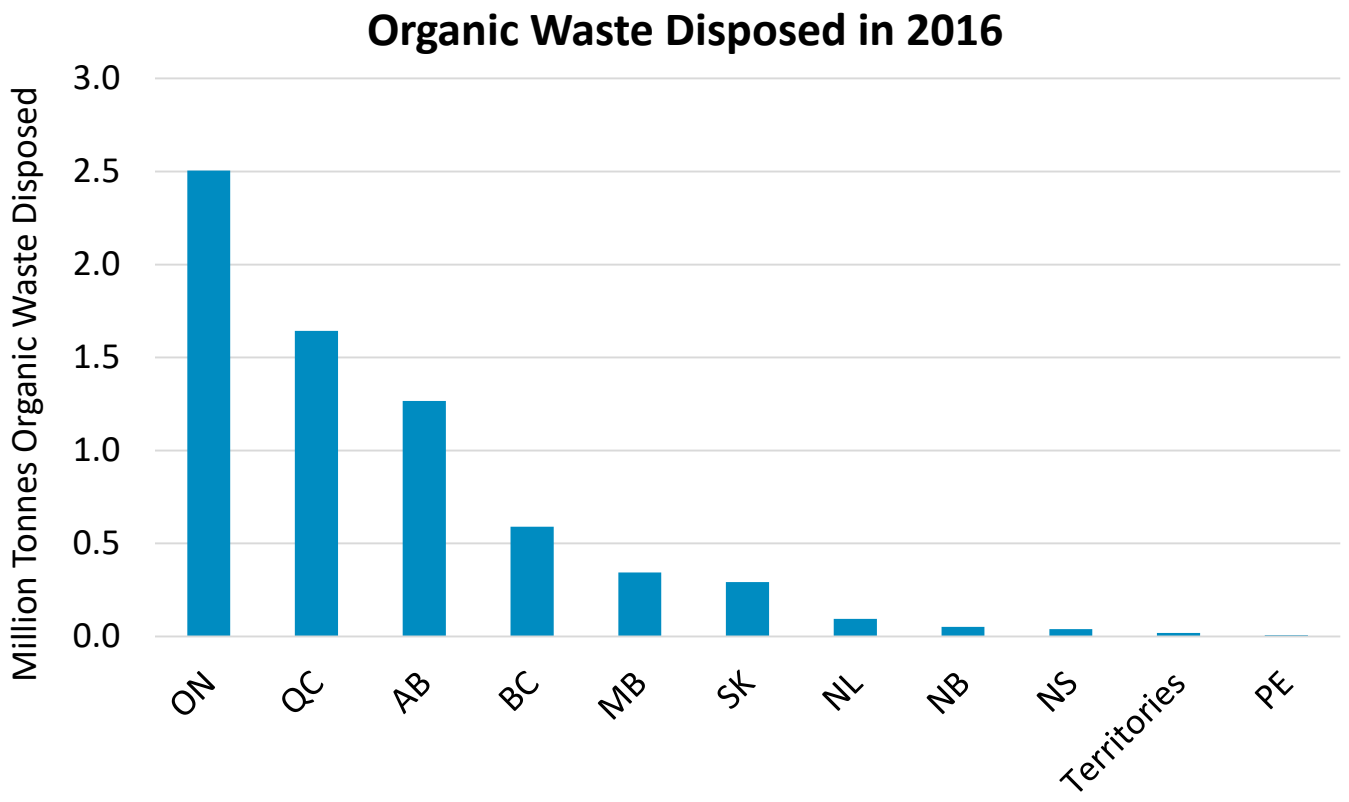
- 4.83 million tonnes of organic waste was processed in 2019
  - 72% was processed by compost facilities

- Large variation in processing capacity due to varied size of facilities
  - Facilities ranged from 50 tonnes to 150,000 tonnes processing capacity

Facility Type	Number	Tonnes per year		Average Tonnes Organic Waste Processed (± standard deviation)	Percent of Total
		Total Organic Waste Processed	Total Compost / Digestate Produced		
Compost	328	3,480,468	1,756,508	10,611 (± 24,282)	72%
Anaerobic Digestion	59	1,350,168	768,718	22,884 (± 30,253)	28%
Total	387	4,830,636	2,525,226	12,482 (± 25,732)	100%

Organic Waste Processed

- In most jurisdictions there is sufficient processing capacity for basic degradable wastes (leaf & yard)
- Insufficient capacity to manage additional source separated organics and food processing waste
- An additional 6.8 million tonnes of food and yard & garden waste were disposed in 2016
  - Comparatively 4.8 million tonnes of organics were processed by available infrastructure



Key Conclusions

- Policies
  - Desire across country for increased diversion of organics
  - Goals, policies, and programs in place reflect desire to increase diversion
- Accessibility
  - Most Canadians have access to at lease residential organics programs for leaf and yard waste
  - Many have access to curbside collection of source separated organics
- Infrastructure
  - Sufficient capacity related to leaf & yard waste
  - Need to build more capacity to increase in SSO diversion – ability to manage more or less status quo
- General conclusions
  - More consistent and transparent data collection needed
  - Better analysis on policy tools and their effectiveness would be beneficial

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Thank You!