Welcome to the WASTE track!

While you're waiting…

Please imagine a RESILIENT waste management system here in Maine

What THREE WORDS (or short phrases) would you use to describe that RESILIENT system for dealing with waste?

Tell us what you think:

- Via website at: PollEv.com/cynthiaisenh541
- Via text: text cynthiaisenh541 to 37607, then text your three words

THE UNIVERSITY OF MAINE

Maine Sustainability and Water Conference

Full Day Waste Track

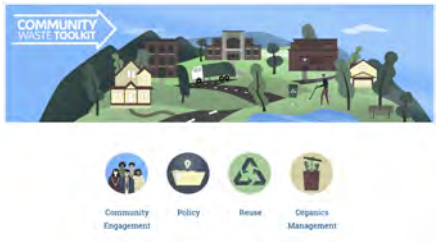
March 31, 2022

THE UNIVERSITY OF MAINE

Welcome!

Senator George J. Mitchell Center for Sustainability Solutions

Materials Management Research Group




ISHOULDBEMOPPINGTHEFLOOR

The waste problem…

Economic:

- Valuable resources buried or burned, economic strain on municipalities

Environmental:

- Ocean plastics, resource use and depletion, water and land use, biodiversity loss, leachate, water pollution, methane emissions…

Social:

- Waste often "exported" from wealthier communities and into most vulnerable. Value of discards increasingly captured.

Political:

- State and federal waste hierarchies, missed recovery and reduction goals

Session I: Resilient Materials Management

- **Debbie Saber:** the problem and disruption
- **Travis Blackmer & Michael Haedicke:** what do waste professionals think is resilient
- **Dominique DiSpirito:** resilience is planned
- **Jean MacRae:** resilience requires systems thinking
- **Susanne Lee:** resilience requires flexibility and adaptation

Additional sessions on reusable service ware, reuse and EPR!

Financial and Environmental Cost of Personal Protective Equipment (PPE) Waste in Healthcare Organizations

Debbie Saber, PhD, RN, CCRN-K; Anne Norris, PhD, RN, FAAN; Jeff Reinking, PhD; Greg Trompeter, PhD; Deb Sanford, MBA, MSN, RN

US healthcare organizations generate up to 25 pounds of solid waste per patient/day, which contributes to the industries' 7,000 tons of waste produced daily[1]

- Driven -- in part -- by increasing disposables to reduce spread of multidrug resistant organisms (MDROs) and life threatening viruses[2]

1. American Hospital Association (AHA). Sustainability Roadmap for Hospitals. Updated 2015. Available at: http://www.sustainabilityroadmap.org/topics/waste.shtml Accessed: November 1, 2021
2. Haque MS, Sharif S, Masnoon A, Rashid E. SARS-CoV-2 pandemic-induced PPE and single-use plastic waste generation scenario. *Waste Manag Res.* 2021;1:3-17. doi: 10.1177/0734242X20980828

Current Hospital Healthcare Waste Disposal Process

Regulated

Regulated

Unregulated

Waste from Contact Precautions (CP; gowns/gloves) for MRSA Infection[3]

168 hour data collection period (stable medical patient)

- 10.5 lbs waste/patient/day
  - 92.5% Unregulated
  - 5% Regulated - red bag
  - 2.5% Sharpes

- 43% of the waste generated was from PPE
- Per patient/week
  - 234 gowns
  - 514 nitrile gloves

Other items included
Medication Package
Plastic syringe
Paper products (e.g., cups)
Gauze bandages
Patient care pads
IV bags

3. Saber DA, Howlett B, Waterman T, de Tantillo L. Solid waste and disposal processes for isolated patients with infectious disease. Online J Issues Nurs. 2018;23(2). http://doi: 10.3912/OJIN.Vol23No02PPT3

What are the Financial & Environmental Costs of PPE Waste?

- Aim I: Determine the direct labor, direct materials, and indirect weekly per patient room costs of contact precautions for medically stable patients infected with MRSA
  - PPE purchases
  - PPE storage
  - Labor costs from waste disposal and observation to don/doff

- Aim II: Estimate the annual financial and environmental costs associated with contact precautions in medically stable patients

Aim I

Table 1. Direct Material Costs

Materials	Quantity Utilized	Cost Per Unit ($)	Total Cost
PPE			
Gloves	514	0.11	56.80
Gowns	234	0.91	212.41
Waste Disposal			**$ 269.21**
PPE Waste in lbs	30.77	0.39	12.06
			$ 12.06
		Total Direct Materials Costs for One (1) CP Room for a Week	**$ 281.27**

Saber DA, Norris AE, Reinking J, Trompeter G, Sanford D. Analyzing the cost of hospital contact isolation practices: Implications for nursing administrator practice, research, and policy [in press]. *J Nurs Admin.*

Aim I

Table 2. Time/Motion Study Results, Labor Rates, and Cost Values Used to Calculate Direct Labor Costs

Activity by Employee Classifications with Activity Subtotals	Room Entry/ Disposal Frequency per CP Room per Week[a]	Percent Total Employees (%)	Average Time to Complete Activity (s)	Hourly Rate Based on Labor Classification[b] ($)	Labor Burden @ 28%[c] ($)	Total Labor Rates per Hour, Including burden ($)	Cost per One Unit of Activity ($)	Total Weekly Cost ($)
Donning PPE								
Ancillary Staff	56	24	63.4	16.15	4.52	20.67	.36	20.38
Staff RN	128	55	70.2	36.94	10.34	47.28	.92	118.02
Certified Nursing Assistants	49	21	71.2	22.95	6.43	29.38	.58	28.48
Subtotal	233	100	---	---	---	---	---	**$166.88**
Doffing PPE								
Ancillary Staff	56	24	25.2	16.15	4.52	20.67	.14	8.11
Staff RN	128	55	17.9	36.94	10.34	47.28	.23	30.03
Certified Nursing Assistants	49	21	31.8	44.55	12.47	57.02	.50	24.64
Subtotal	233	100	---	---	---	---	---	**$ 62.78**
PPE Waste Disposal								
Janitorial - Empty Refuse	19	100	79.5	15.30	4.28	19.58	.43	8.33
Subtotal	19	100	---	---	---	---	---	**$ 8.33**
							Total Direct Labor Costs for One (1) CP Room for a Week	**$237.99**

Saber DA, Norris AE, Reinking J, Trompeter G, Sanford D. Analyzing the cost of hospital contact isolation practices: Implications for nursing administrator practice, research, and policy [in press]. *J Nurs Admin.*

Aim I

Table 3. Indirect Costs for PPE Activity
A. PPE Labor

Overhead Costs PPE Labor Activity[a]	Number of Employees	Percentage of Time per Week (%)	Rate per Hour ($)	Labor Cost Burden @ 28%[b] ($)	Total Hourly Rate ($)	Total Labor Cost per Week ($)	Total labor Cost for Activity per Week ($)	1 Room out of 411 Total Rooms (%)	Total PPE Overhead Cost per Week ($)
Purchasing									
Source and purchase	1	1.0	17.01	4.76	21.77	870.91	8.71	0.24	0.02
Pay related invoices	1	1.0	17.01	4.76	21.77	870.91	8.71	0.24	0.02
Receiving									
Receive and stock (warehouse)	1	1.0	17.34	4.86	22.20	887.81	8.88	0.24	0.02
Stocking									
Receive and stock (warehouse to hospital)	1	3.1	17.34	4.86	22.20	887.81	27.52	0.24	0.07
								Total Indirect Labor Costs for 1 CP Room for 1 Week	**$ 0.13**

Table 3. Indirect Costs for PPE Activity
B. Storage

Storage Location	Square Footage	Annual Square Footage Rental Costs ($)	Total Weekly Cost ($)	1 Room out of 411 Total Rooms (%)	Total PPE Storage Costs per Week ($)
Warehouse storage for PPE	22,000	9.50	4,019	0.24	2.26
Supply closet storage in hospital	1,630	35.00	1,097	0.24	0.02
				Total Indirect Storage Costs for 1 CP Room for 1 Week	**$ 2.28**

Saber DA, Norris AE, Reinking J, Trompeter G, Sanford D. Analyzing the cost of hospital contact isolation practices: Implications for nursing administrator practice, research, and policy [in press]. *J Nurs Admin.*

Aim I

Total Cost:

Table 4. Total cost for CP per room per week, annualized per room cost, and annualized per hospital cost

Cost category	Value
PPE Donning and Doffing Direct Labor	$ 237.99
PPE Materials & Disposal	281.27
Overhead Indirect Labor and Storage costs	2.41
Total costs	
Weekly for one (1) CP room	$ 521.67
Annualized Cost for one (1) CP Room	$ 27,127
Annualized cost for Healthcare organization (MDRO rate at 5% of capacity)	$ 557,463

Saber DA, Norris AE, Reinking J, Trompeter G, Sanford D. Analyzing the cost of hospital contact isolation practices: Implications for nursing administrator practice, research, and policy [in press]. *J Nurs Admin.*

Aims I & II

Annually:

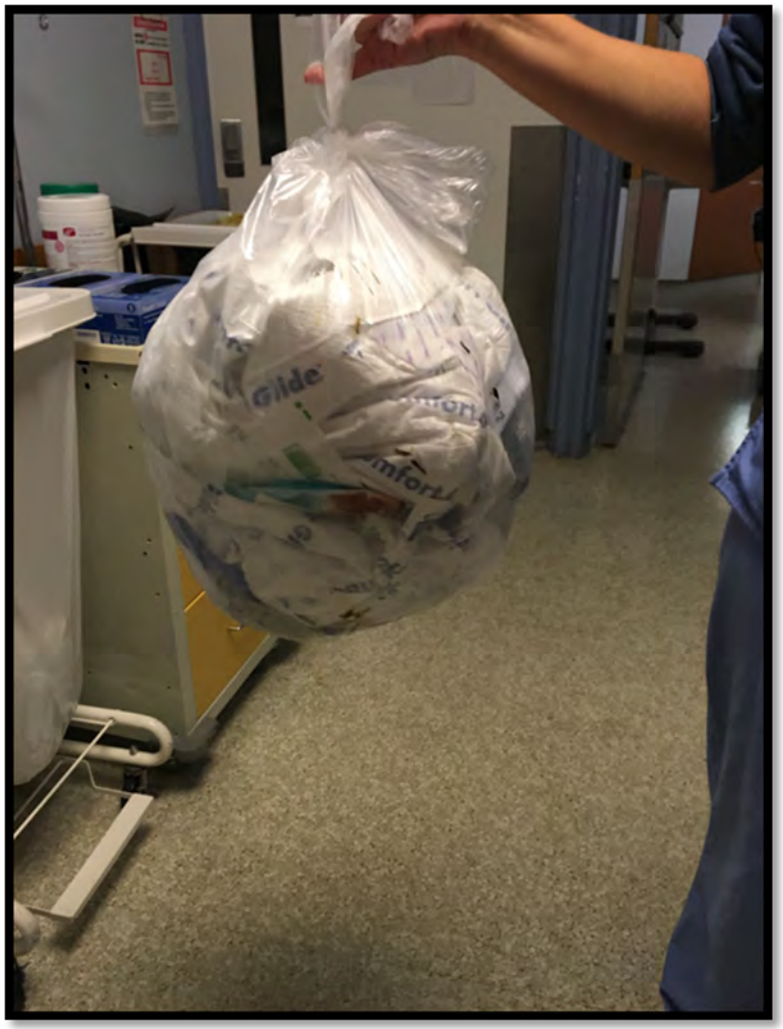
PPE waste for **1 patient** could:

- Contribute over 1,600 lbs of MSW

PPE waste for **100 patients** could:

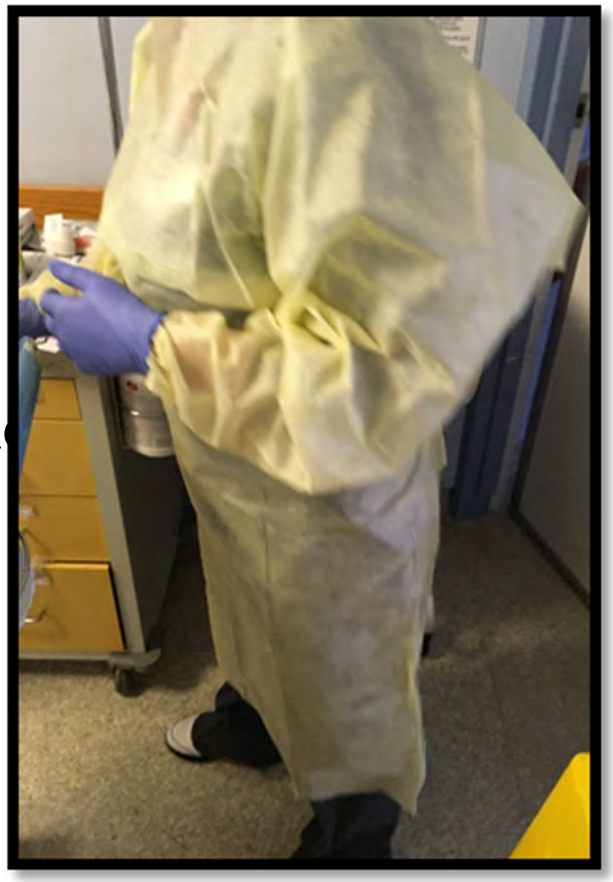
- Contribute over 160,000 lbs (80 tons) of MSW
- Cost $2,712,700

MSW is directed to incineration/landfill or directly to landfill



Solutions That Contribute to Materials Management Resilience

1. Reusable gowns
   - Laundry
   - UV lights
2. Policy changes
   - Gowns that can be used for multipl patient care room visits
   - Update isolation policies
3. Biodegradable gowns/compostable gowns



DISRUPTION!: Risk and Resilience in Maine's Materials Management System

Materials Management Research Group: Brieanne Berry, Travis Blackmer, Jared Entwistle, Michael Haedicke, Cindy Isenhour, Susanne Lee, Jean MacRae, Deborah Saber, Linda Silka, Erin Victor

- Green Sword (2017)
- Fiberight (April 2018)
- Covid-19 (March 2020)

How do stakeholders envision **resilience** in Maine's materials management system? What are the challenges and what are the opportunities?

WHAT DID YOU THINK?

What is resilience?

Definitions vary by field:

- adapt
- cope
- withstand
- avoid
- mitigate

Related to waste…???

[??? *ability to continue to dispose of items at a predetermined, acceptable cost ???]*

No clearly accepted definition of **RESILIENCE** in Waste Field

What stakeholders expect the system is able to do

- Is my _____ going to get picked up?
- How much does it cost?
- That cost ^^^ can't change
- Is what we are doing "good" for _____ [the earth, community, future, etc.]

Research methods

Open-ended stakeholder interviews (N=14)

- Municipal representatives (6)
- State regulators (3)
- Waste processors (5)

*4 research participants connected to MRC/Fiberight

Sample questions

- What would a resilient materials management system look like?
- What are some opportunities you see to build a resilient system in Maine?
- What risks do you see on the horizon?
- How could we mitigate these risks?

Thematic coding of interviews

Two rounds of coding organized information in the interviews into key themes:

- How do stakeholders evaluate Maine's materials management system?
- How do stakeholders envision increased resilience in the future?

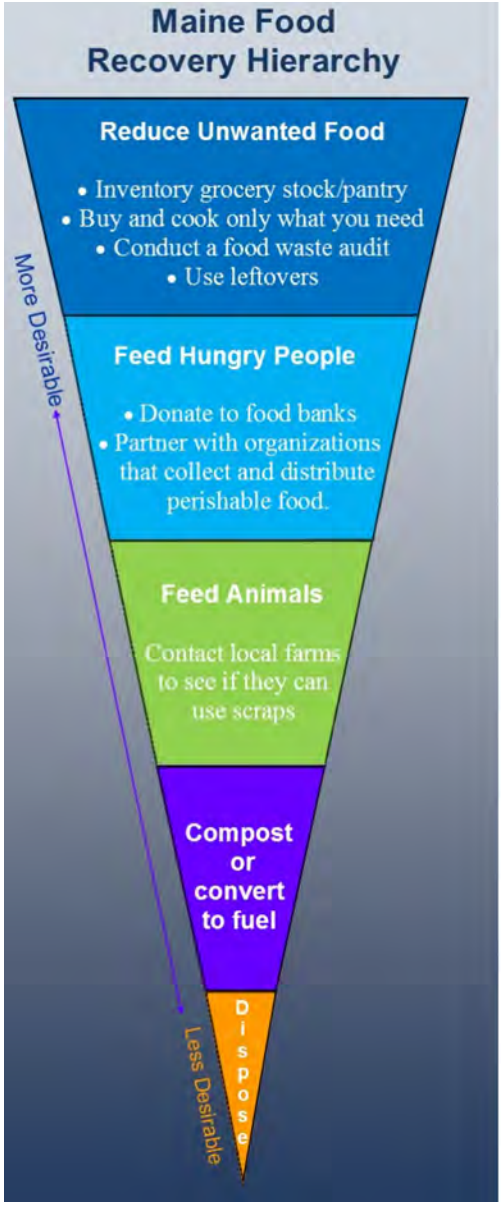
Emerging Codes:

- **Adaptive/Flexible (AF)**
- Cooperation Among Processors (CP)
- Data and Knowledge (DK)
- Disruptions (DS)
- **Local/Regional Solutions (LR)**
- **Public Policy and Regulation (PR)**
- Systems Thinking (ST)
- Waste Generator Participation (WG)

Code I: Policy and Planning

Code captures statements related to stakeholder perceptions of policy conditions, problems, and needs.

- Incentives
- Criticism of Voluntary Policies
- Scale Questions
- Flexible & Localized



Code 2: Local and regional solutions

Code captures obstacles and opportunities related to creating local and regional materials management solutions.

- Investing in local/regional waste management solutions
- Global market provides the cheapest solutions, but it also increases the risk of disruption
- Need to balance integration into global markets with local self-reliance.
- "It's nice to have those collaborative partnerships that help us connect with people all over the world. But in times of crisis, it's nice to have our own, too."

Code 3: Adaptive and flexible systems

Code captures stakeholder ideas for creating systems that are adaptive and flexible in the face of risk.

- "That's what we need to do. Think outside the box. Innovation and creativity. That's it. And that's how - that's the only way Maine's resiliency is going to happen."

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Reliable, Accessible, Sustainable:
Why Food Waste Diversion Must Be Part of Resilient Materials Management System for Maine

Dominique DiSpirito

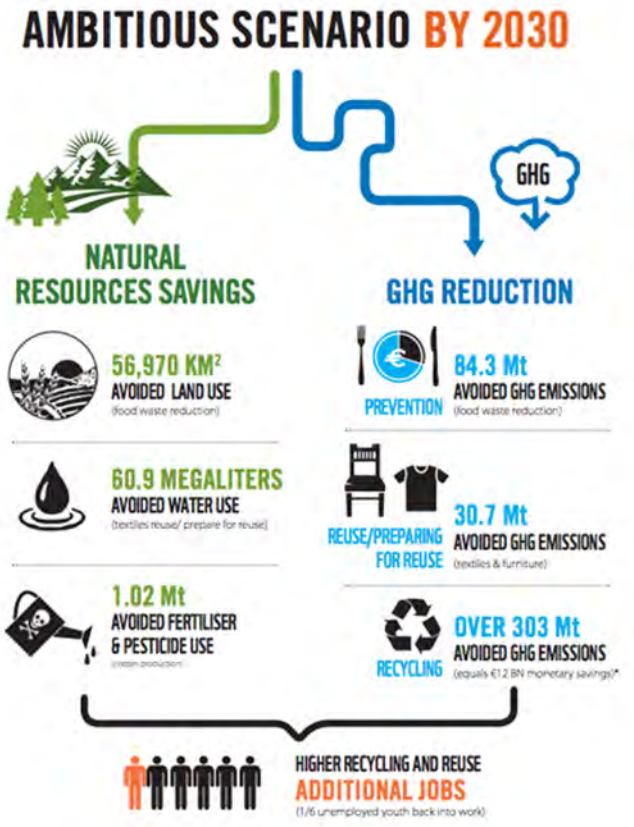
Methodology

Interviews

- 10 professionals involved in materials management
  - State agencies, haulers, advocacy non-profits, state legislature
- 2 professionals from Vermont Department of Environmental Conservation
- Anonymous Survey
  - Sent out to municipalities across the state
  - Asked about Pay-As-You-Throw and organics recycling programs
- Organizational Reports and Policies!

Food Waste Diversion Policy & Resilience

- Key to fostering equity & consistency among municipalities
- Creates collaborative partnerships across sectors
- Reaches higher diversion rates
- Establishes strong support networks for troubleshooting



Vermont's Universal Recycling Policy

- Started phasing in at 2014, last phase in 2020
- Emphasized creating parallel services to trash
- Established strong support networks for diversion activities
- 3x increase in food donations, 53,000 tons diverted

Barriers to Food Waste Policy in Maine

- Logistical Challenges
  - Concentration of Processing & Digesting infrastructure
  - Regional Characteristics
  - Resource inequities across municipalities- financial and personnel restraints
- Maine Climate Plan does not include food waste diversion
- MRC/Fiberight Contracts
- Low costs to produce and dispose of waste

"Reducing waste is a major issue, but it is difficult to implement at the municipal level when we are limited in time, staffing levels, and the host of local priorities."

"You know, it's just that communities, groups of volunteers do have limited time. They have limited yeah, they have limited limited funds, and it doesn't feel like that's enough to move the needle."

Stepping Stones: Food Waste Policy in Maine

- Donor Tax Credit for Food Donations
- Compost Management Plan
- Solid Waste Diversion Grant Program
- One Climate Future Plan- Portland and South Portland
- Unit-based pricing for waste disposal (PAYT)
- Composting programs (Mitchell Center Pilots & More)

Envisioning a Path Forward

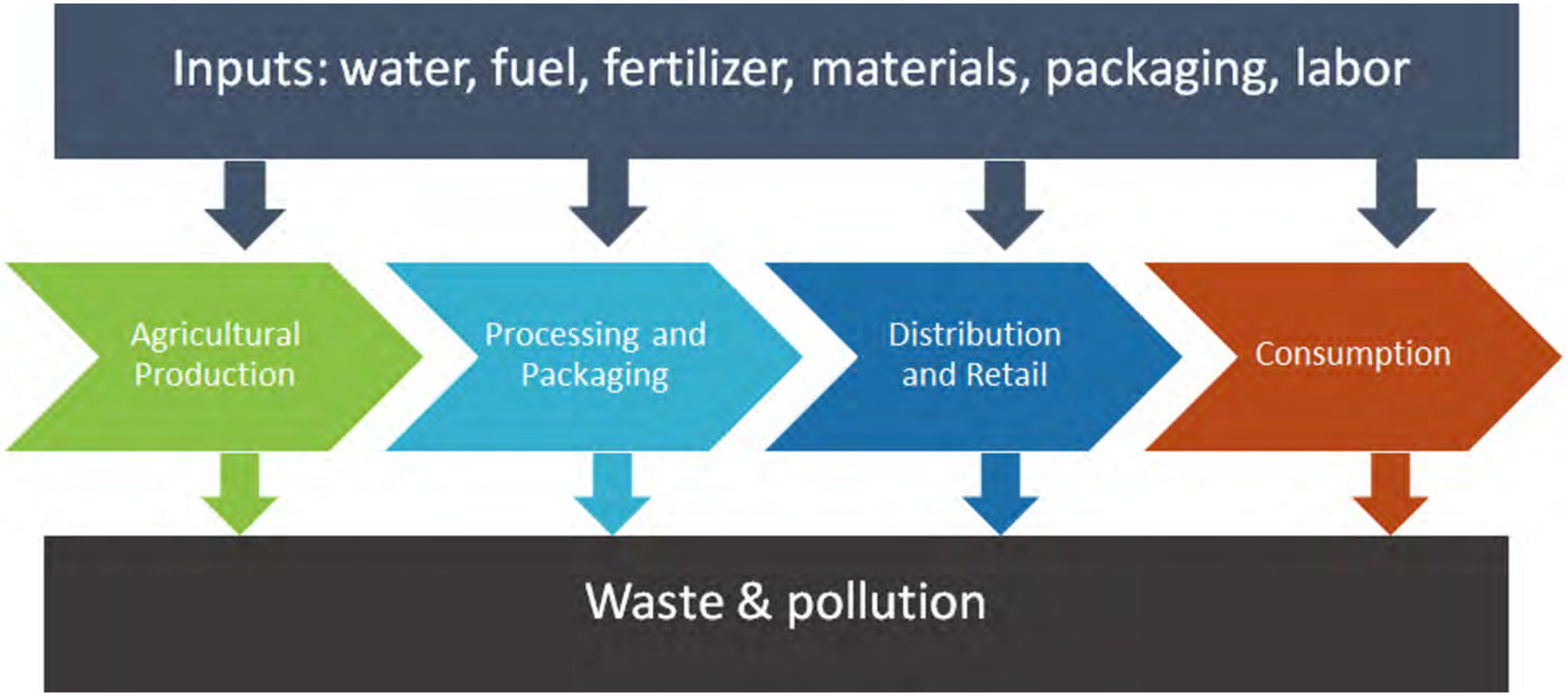
- Increase in franchise fees for waste disposal
- UBP/PAYT research & grant development
- MRC/Fiberight research & reconciliation
- Incorporate Food Waste Diversion into Maine Climate Action Plan

"I do believe firmly that legislation, smart policy, scientifically driven, non arbitrary limit setting policy, can drive the development of market and industry."

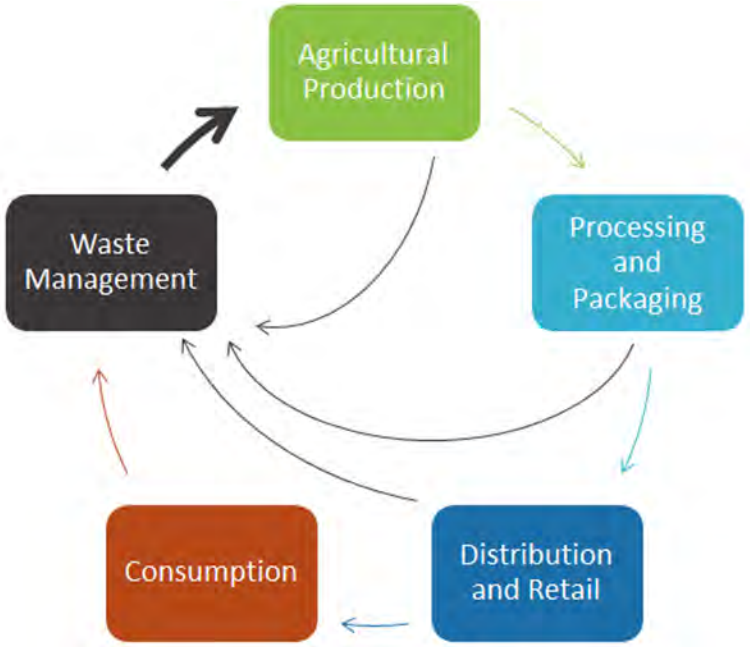
Contamination of Food Waste

Dr. Jean MacRae

Linear food systems are wasteful

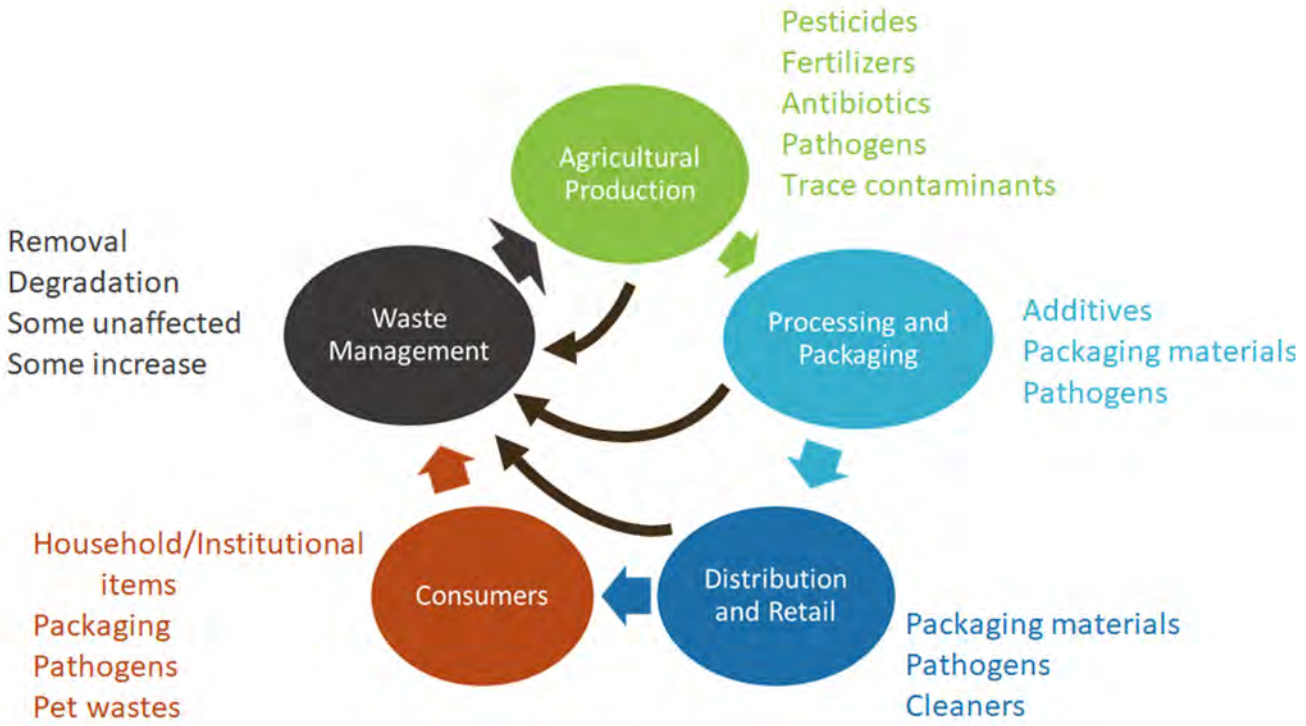


Circularized systems reduce waste, energy use & pollution



What could go wrong?

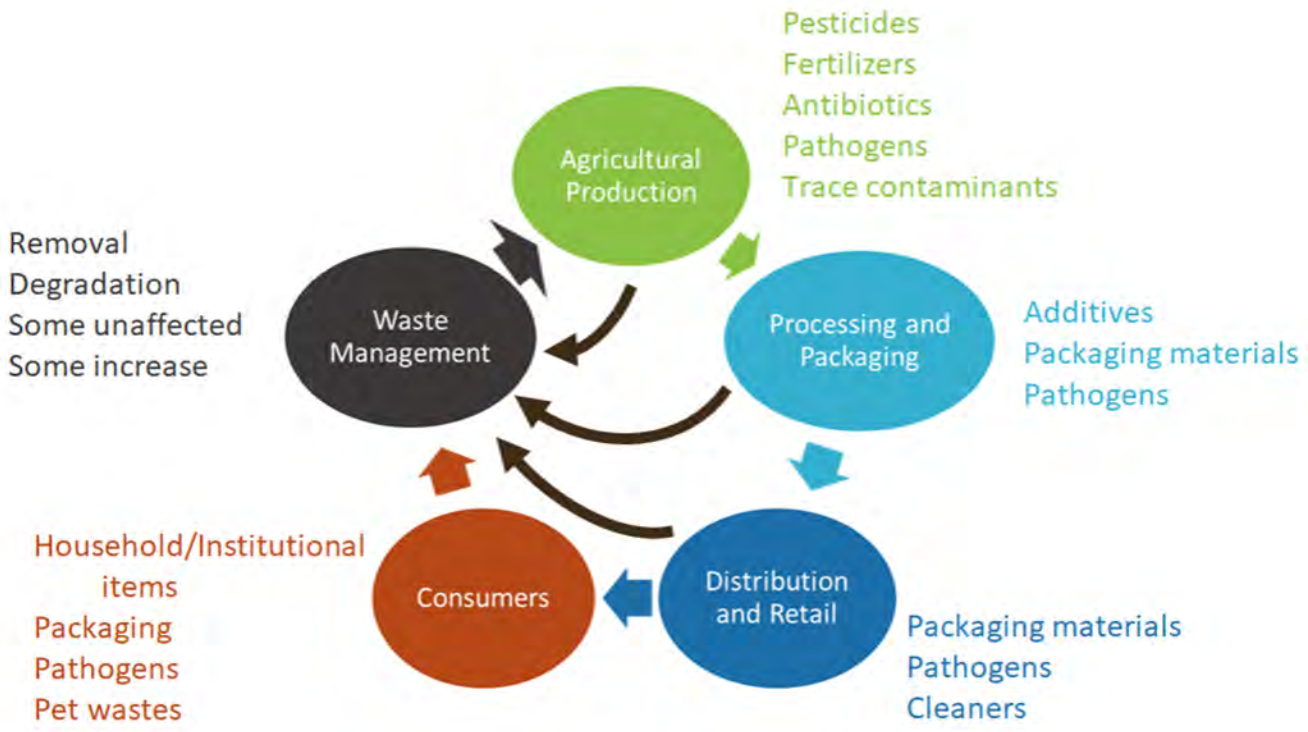
- Physical
- Chemical
- Biological
- Economic
- Social



Is a circular system safe?

What are waste processors concerned about?

What contaminants are in the waste?

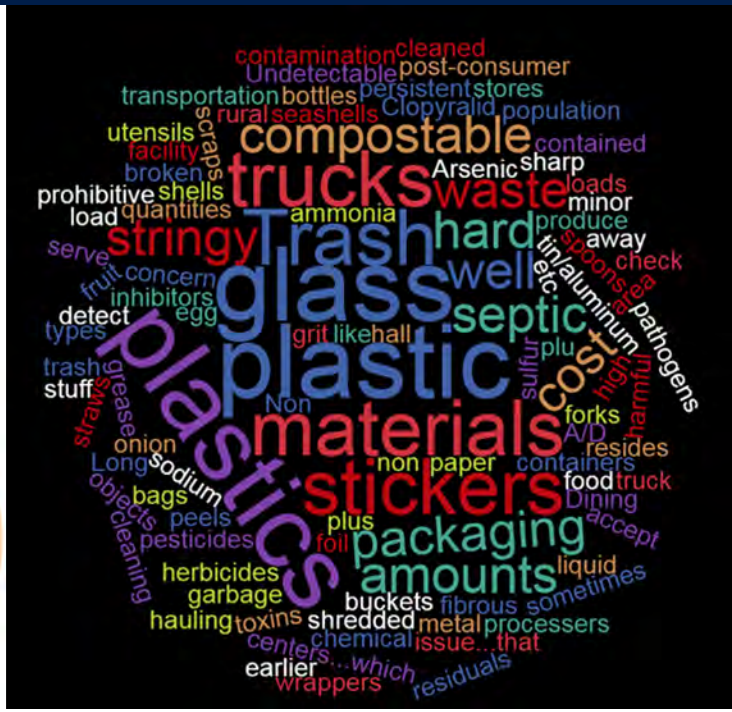


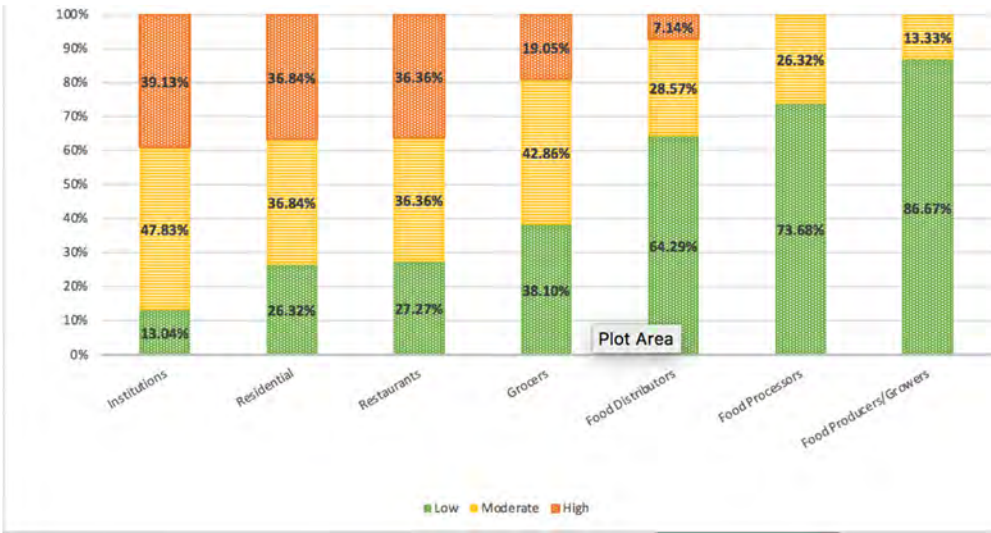
What processors think

Trash
Sharps
Trace toxins
- Pesticides
- Herbicides
- Arsenic
- Cleaning chemicals

Process inhibitors

Greater **risk** the farther from producer





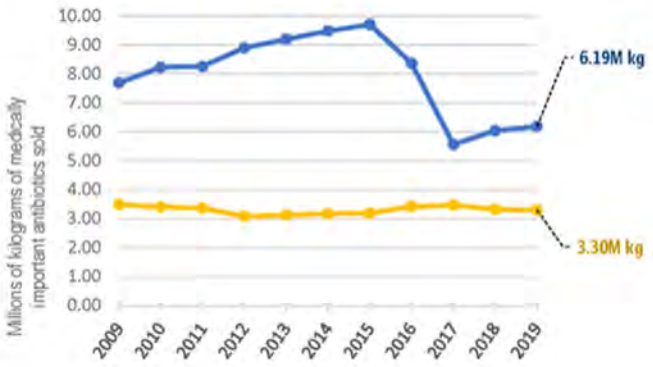
What we found in the waste

- Quite a bit of non-food waste
  - 82% of samples had some non-food waste
  - ~ half samples had some non-compostable material
  - Regulatory requirement didn't matter
- Heavy metals not a problem
  - Well below regulatory limits, if detected
- Very few pathogens detected
  - *Salmonella* in 3% of samples at very low level (< LOQ)
  - *Listeria* 11% of samples , 5⁄8 < LOQ, rel abundance 10^{-7}

What we found in the waste

Antibiotic resistance genes are a concern because

- They can jump to pathogens
- They make treatment of infections more difficult

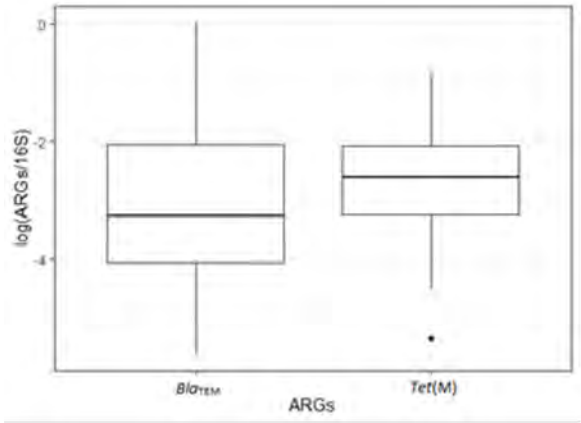


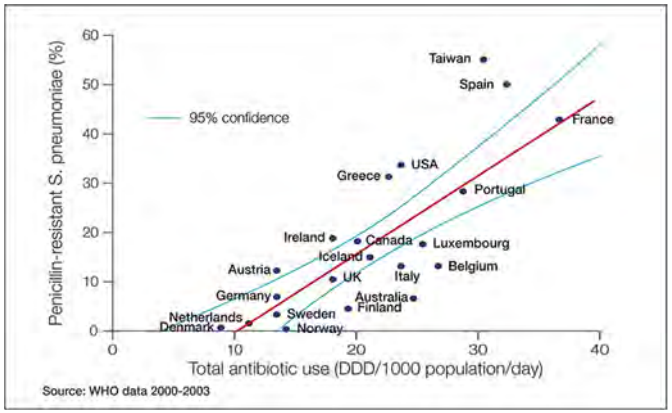
Agricultural Use

Human Medical Use

Antibiotic resistance genes were common and abundant

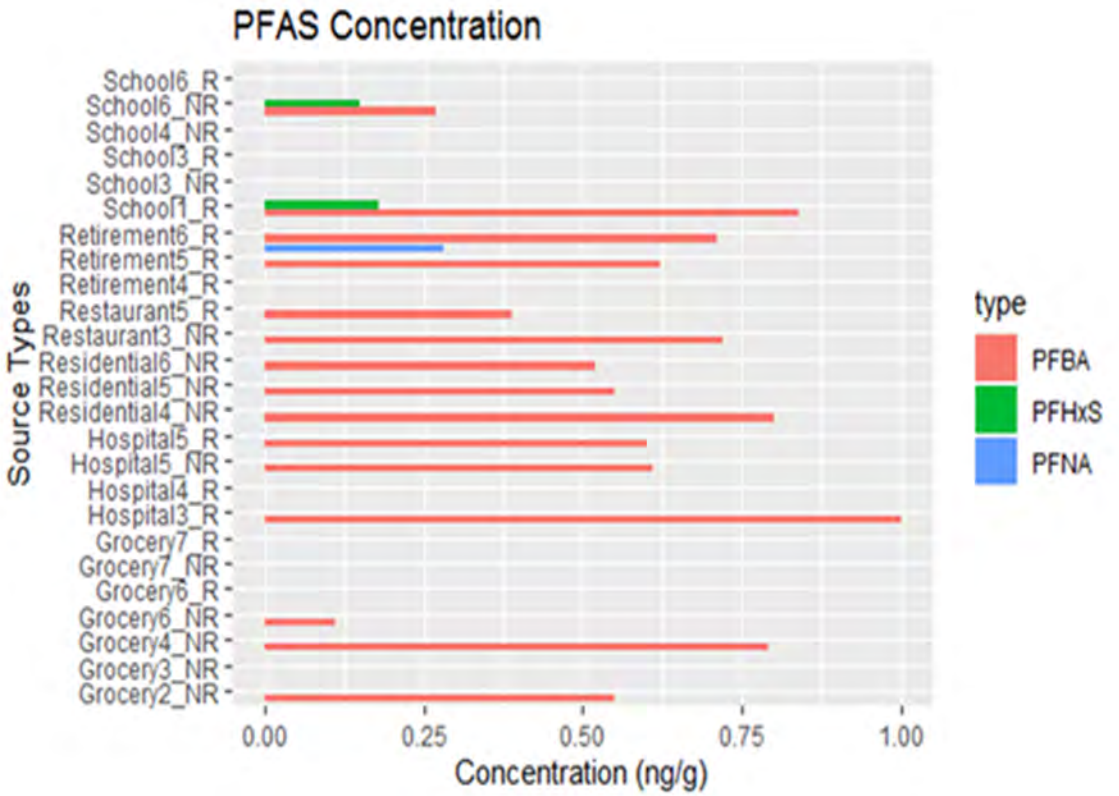
- 97% had penicillin resistance genes
- 96% had tetracycline resistance
- No *mcr-1*





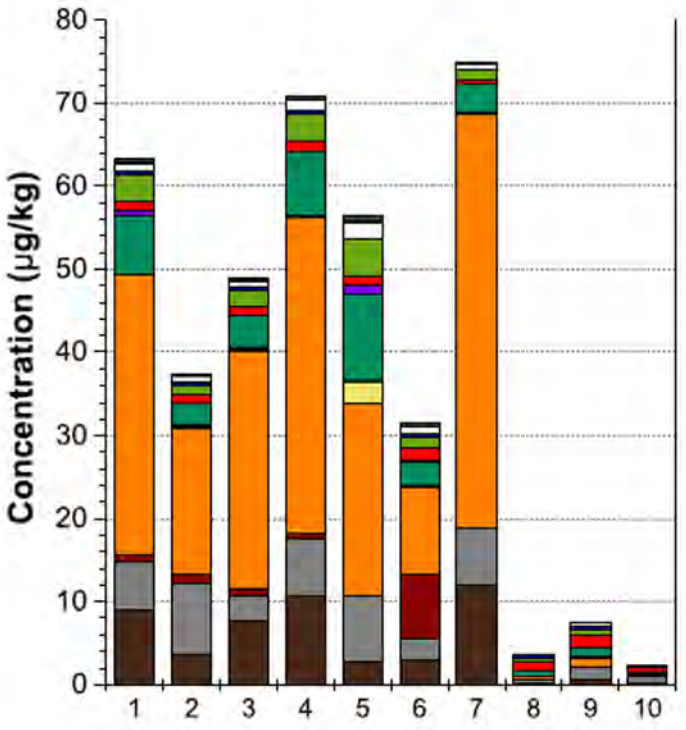
What we found in the waste

- PFAS of concern because they don't go away & toxic at very low levels
  - Toxic at very low levels (cancer, immunity, cholesterol, low birth weight…)
- PFAS contamination in 60% of samples
  - PFBA up to 1 ng/g
  - PFHxS (0.15, 0.18 ng/g)
  - PFNA (0.3 ng/g)
- Could be in food or from packaging



The take-aways

- Processors don't control what comes to them
  - Work with sources to reduce contamination
- PFAS need to be kept out of the system
  - Don't compost packaging!
  - Agitate to get PFAS out of food contact materials
- Antibiotic resistance
  - Likely reduced by composting, but AD ?
  - Less of a problem if not used in animal rearing
- Circular food system can be safe
  - Researchers need to get relevant information to processors
  - We all need to work on keeping the system safe



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Food Waste in Maine

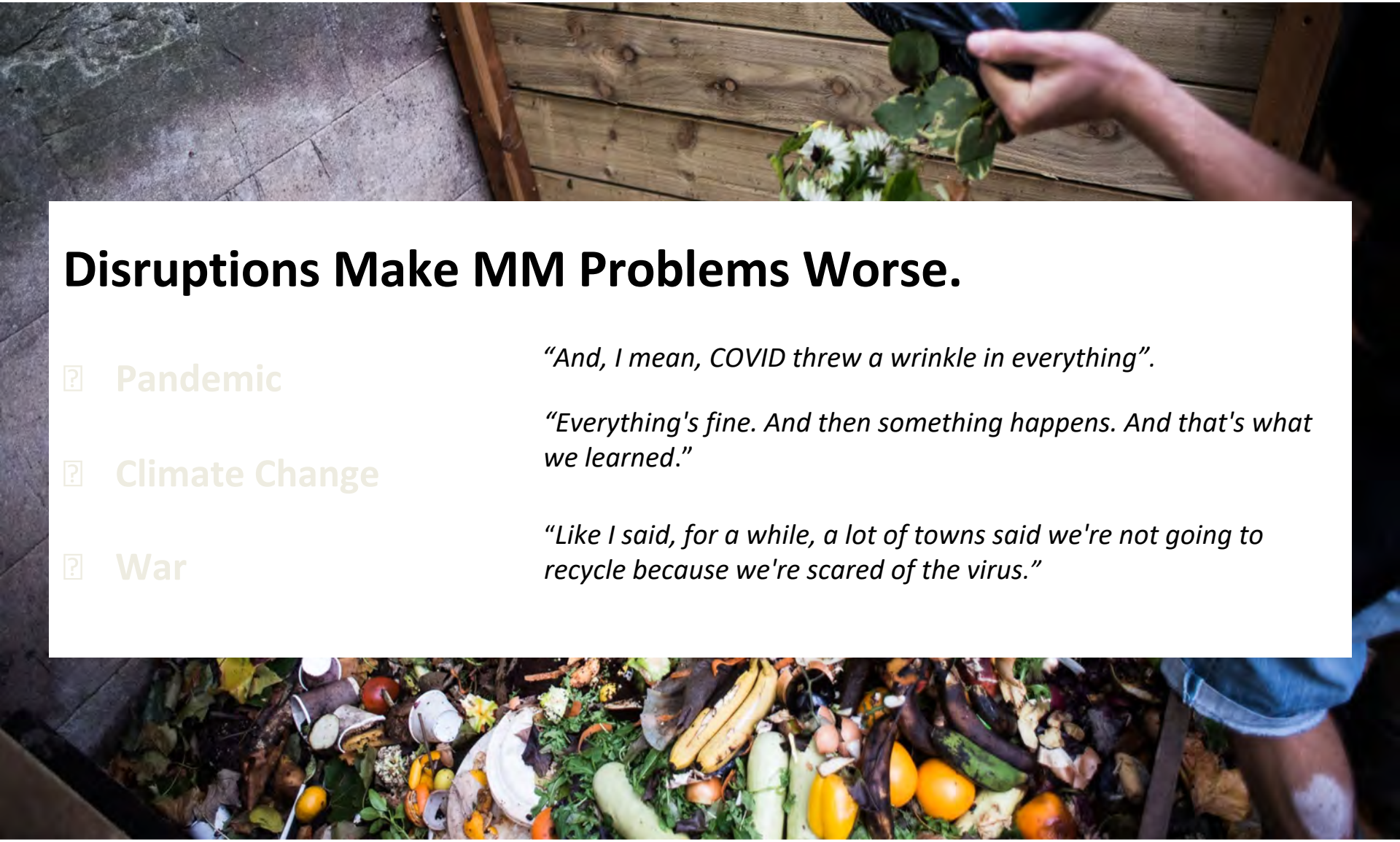
A Sustainable & Resilient Materials Management Opportunity

Food Rescue MAINE

Maine Food – Too Good to Waste

Food Waste is a Materials Management problem.

- 40% of food produced is never eaten
- Wastes resources producing wasted food: water, energy, soil and labor
- Largest single component (30%) of waste stream
- 68% of wasted food analyzed is still good and edible
- Contributes to growing hunger and food scarcity
- Harms our living environment: climate, water, and air



Disruptions Make MM Problems Worse.

- Pandemic
- Climate Change
- War

“And, I mean, COVID threw a wrinkle in everything”.

“Everything's fine. And then something happens. And that's what we learned.”

“Like I said, for a while, a lot of towns said we're not going to recycle because we're scared of the virus.”

Materials Management Opportunity

Sustainable & Resilient Solutions

adjective: **sustainable**
1. delivers triple bottom line benefits for long-term

adjective: **resilient**
1. able to withstand or recover quickly from difficult conditions
2. adaptable and flexible

Maine Food Waste Solutions Are <u>Sustainable.</u>

"Triple Bottom Line" Benefits

PROFIT

PLANET

PEOPLE

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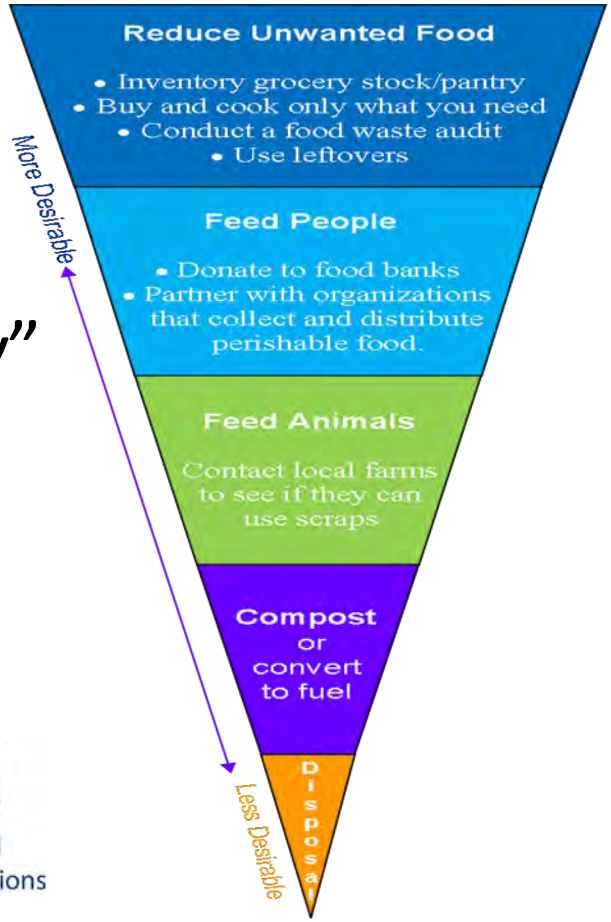
Maine Food Waste Solutions Are <u>Resilient.</u>

"*Maine Food Recovery Hierarchy*"



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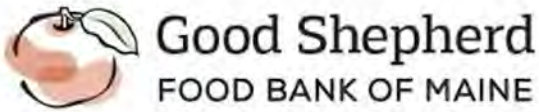
Maine Food Waste Solutions Are <u>Resilient.</u>



“Big Six” Maine Food Waste Solutions

SOLUTION 1: ENABLE TRACKING & MEASURING OF FOOD USAGE

SOLUTION 2: CREATE MAINE STATEWIDE “FOOD RESCUE” SYSTEM

SOLUTION 3: EDUCATE MAINE CONSUMERS OF ALL AGES ABOUT FOOD WASTE

SOLUTION 4: BUILD MAINE'S FOOD PROCESSING INFRASTRUCTURE

SOLUTION 5: PROMOTE INCREASED FOOD DONATION

SOLUTION 6: FOOD RECYCLING

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Solution Pilots

Solution #1: ***Food "Tracking & Measuring"***

Northern Light Maine Coast Hospital

HM HOSPITALITY MAINE

DEPARTMENT OF CORRECTIONS

Solution #2: ***Food Rescue***

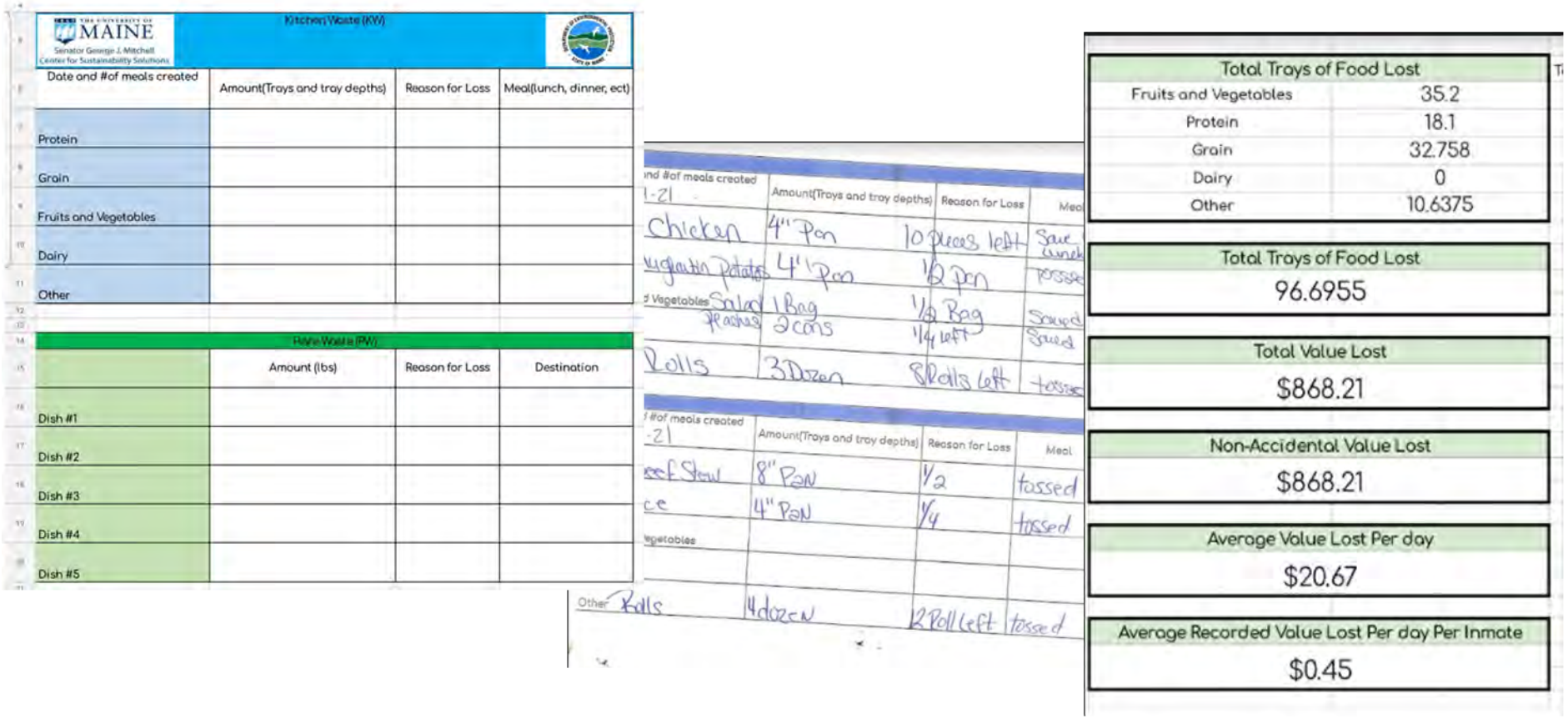
FOOD RESCUE US

UNE

Good Shepherd FOOD BANK OF MAINE

Solution 1 – Pilot Sample

Mitchell Center Food Service Food Waste Tracking and Analytics Tool



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Kitchen Waste (KW)

Date and #of meals created	Amount(Trays and tray depths)	Reason for Loss	Meal(lunch, dinner, ect)
Protein			
Grain			
Fruits and Vegetables			
Dairy			
Other			

Plate Waste (PW)

	Amount (lbs)	Reason for Loss	Destination
Dish #1			
Dish #2			
Dish #3			
Dish #4			
Dish #5			

ind #of meals created	Amount(Trays and tray depths)	Reason for Loss	Meal
1-21			
Chicken	4" Pan	10 pieces left	Save
ugeatin Potatoes	4" Pan	1/2 Pan	Tosse
Vegetables Salad	1 Bag	1/2 Bag	Saved
Peaches	2 cans	1/4 left	Saved
Rolls	3 Dozen	8 Rolls left	tossed

#of meals created	Amount(Trays and tray depths)	Reason for Loss	Meal
-21			
eef Stew	8" Pan	1/2	tossed
ce	4" Pan	1/4	tossed
egetables			
Other Rolls	1 dozen	2 Roll Left	tossed

Total Trays of Food Lost	
Fruits and Vegetables	35.2
Protein	18.1
Grain	32.758
Dairy	0
Other	10.6375

Total Trays of Food Lost
96.6955

Total Value Lost
$868.21

Non-Accidental Value Lost
$868.21

Average Value Lost Per day
$20.67

Average Recorded Value Lost Per day Per Inmate
$0.45

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Solution Pilots

Solution #3: ***Education and Action***

Maine Municipal Association

PORTLAND PUBLIC SCHOOLS

PORTLAND PUBLIC LIBRARY

Solution #4: *Farm Food Infrastructure*

Jordan's Farm
Cape Elizabeth, Maine

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Cooperative Extension

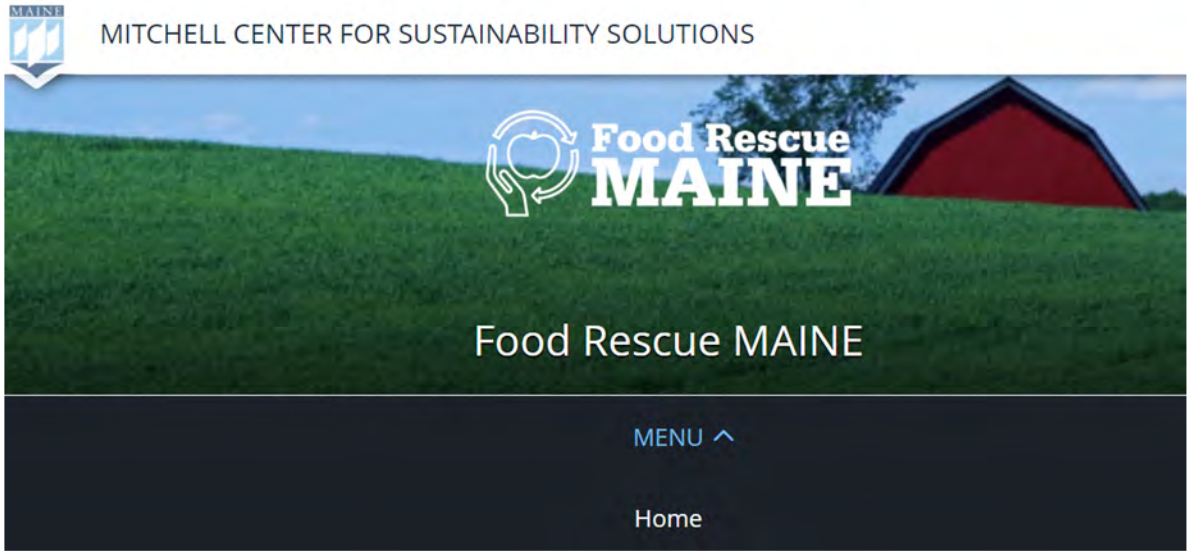
MAINERS FEEDING MAINERS

DEPARTMENT OF CORRECTIONS

Solution 3 – Pilot Sample

Maine School Curriculum

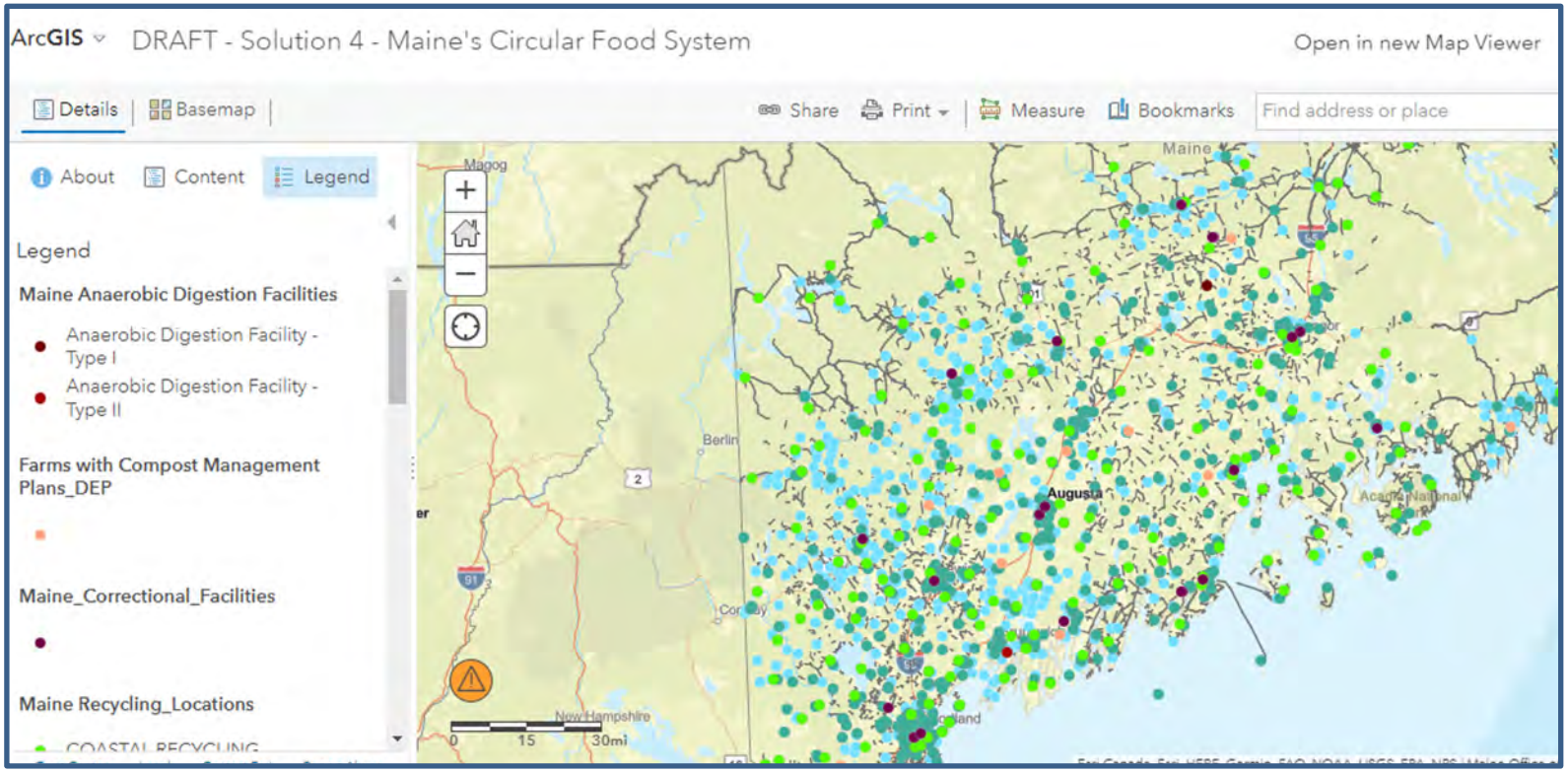
Website



Social Media

Solution 4 – Pilot Sample

Maine Circular Food System Solutions GIS Map



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Solution Pilots

Solution #5: *Food* ***Donation Toolkit***

MAINE GROCERS AND FOOD PRODUCERS ASSOCIATION

Good Shepherd FOOD BANK OF MAINE

HM HOSPITALITY MAINE

Solution #6: ***Divert Food Waste from Maine Landfills***

DEPARTMENT OF ENVIRONMENTAL PROTECTION · STATE OF MAINE ·

Kennebec Valley Council of Governments
Regional service, local results

AGRI-CYCLE

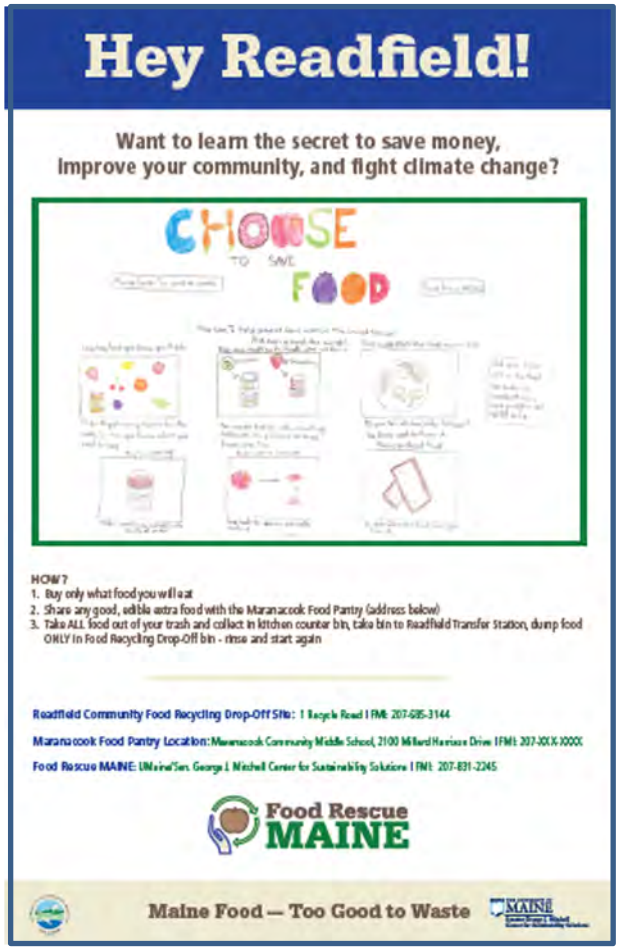
Solution 6 – Pilot Sample

City of Portland Food Recycling Data Tracking: 5 – 9/21

Community Food Recycling Portland

	Residential Food Waste					
Month	Number of Totes	Weight of Totes (LBS) *	Weight of Totes (Tons) *	Cumulative Costs ($)	Cost of Landfill Disposal of Diverted Waste ($)*	Savings ($)
May	84	10920	5.46	516	409.5	-106.5
June	74	9620	4.81	456	360.75	-95.25
July	86	11180	5.59	524	419.25	-104.75
August	87	11310	5.655	528	424.125	-103.875
September	88	11440	5.72	472	429	-43

* The weights recorded in this table are estimates provided by We Compost It. Additionally, calculations based off of weights (cost of landfill disposal and savings) may vary in reality from what is reported above given that we are using estimated weights.



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Maine Food Waste Solutions

1) Expand Education for Students & Community
2) Grow University + Stakeholder Collaborations
3) Build Resilient Maine "Circular Food System"

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Student Internships

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Maine Food Waste Solutions Summit
April 15, 2022

Food Rescue MAINE
Maine Food – Too Good to Waste