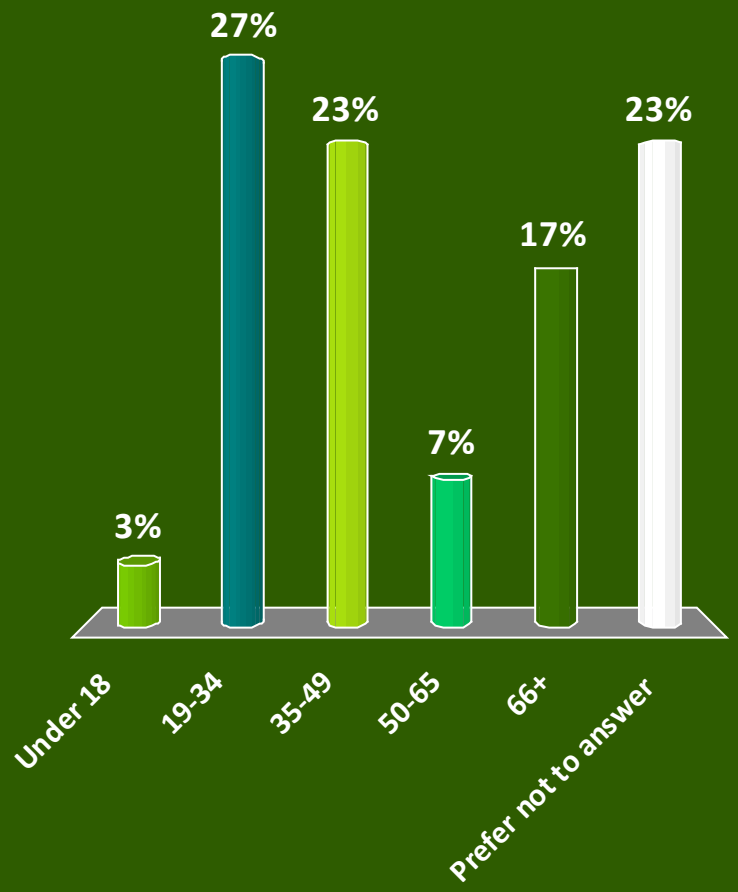
Compost Production and Utilization

Natalie Yoder
M.S. Horticulture and Organic Soil Fertility
Colorado State University
Natalie.Yoder@colostate.edu

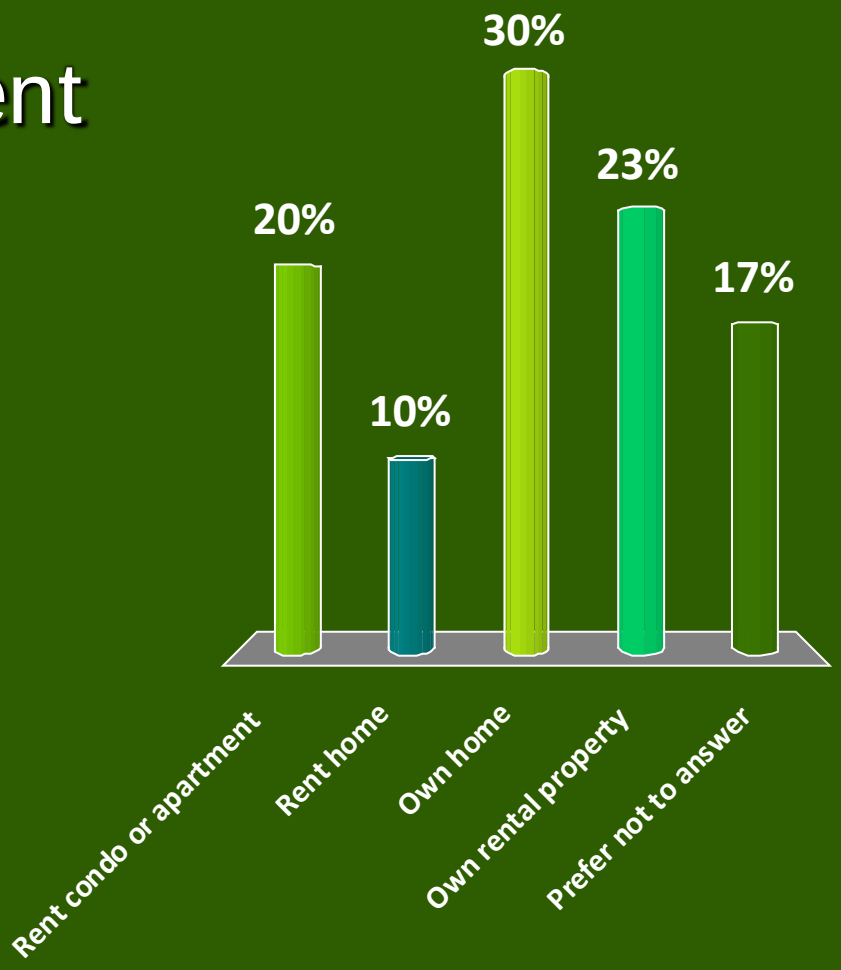
In what age range are you?

A. Under 18
B. 19-34
C. 35-49
D. 50-65
E. 66+
F. Prefer not to answer



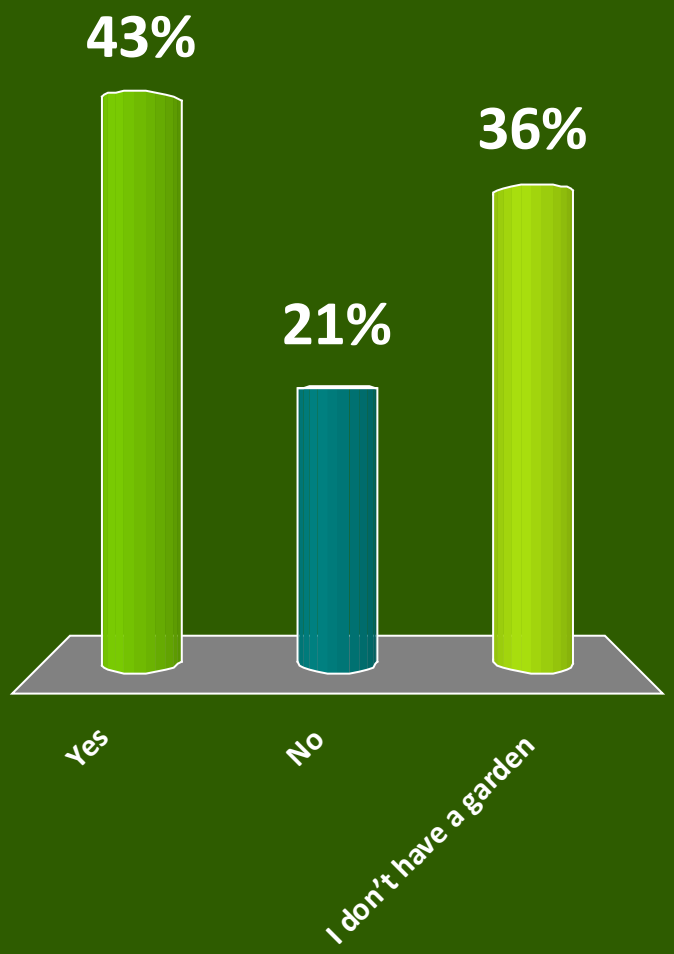
Do you rent or own your home?

A. Rent condo or apartment
B. Rent home
C. Own home
D. Own rental property
E. Prefer not to answer



Do you use compost in your garden at home?

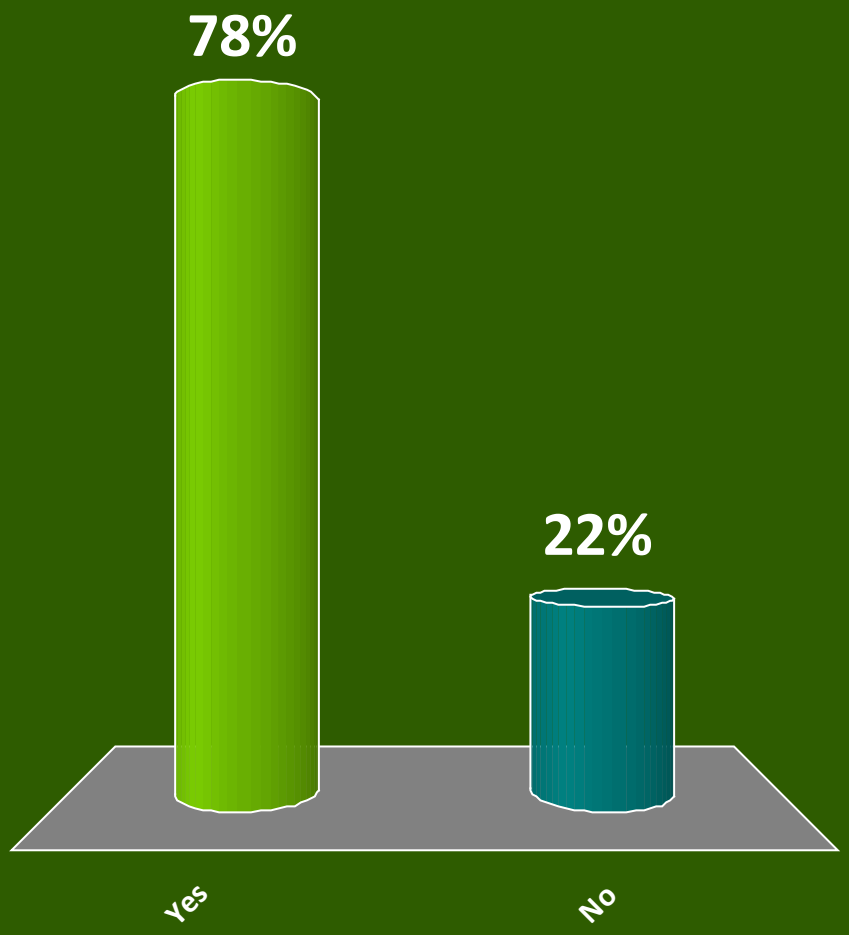
A. Yes
B. No
C. I don't have a garden



Do you currently compost at home?

A. Yes

B. No



How much do you know about compost?

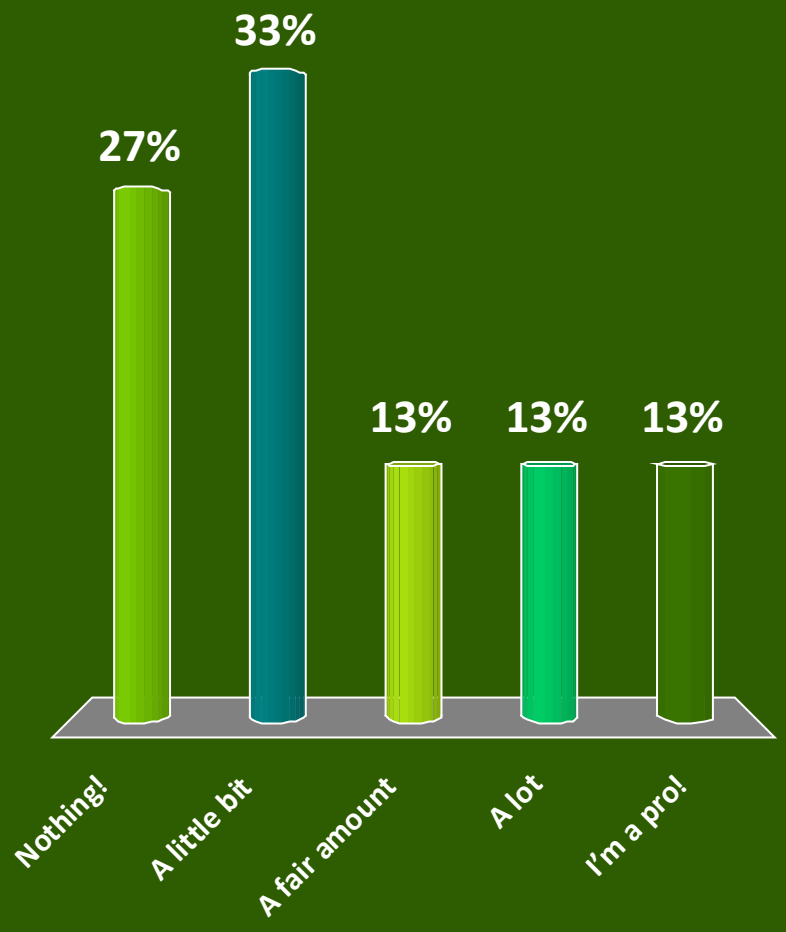
A. Nothing!

B. A little bit

C. A fair amount

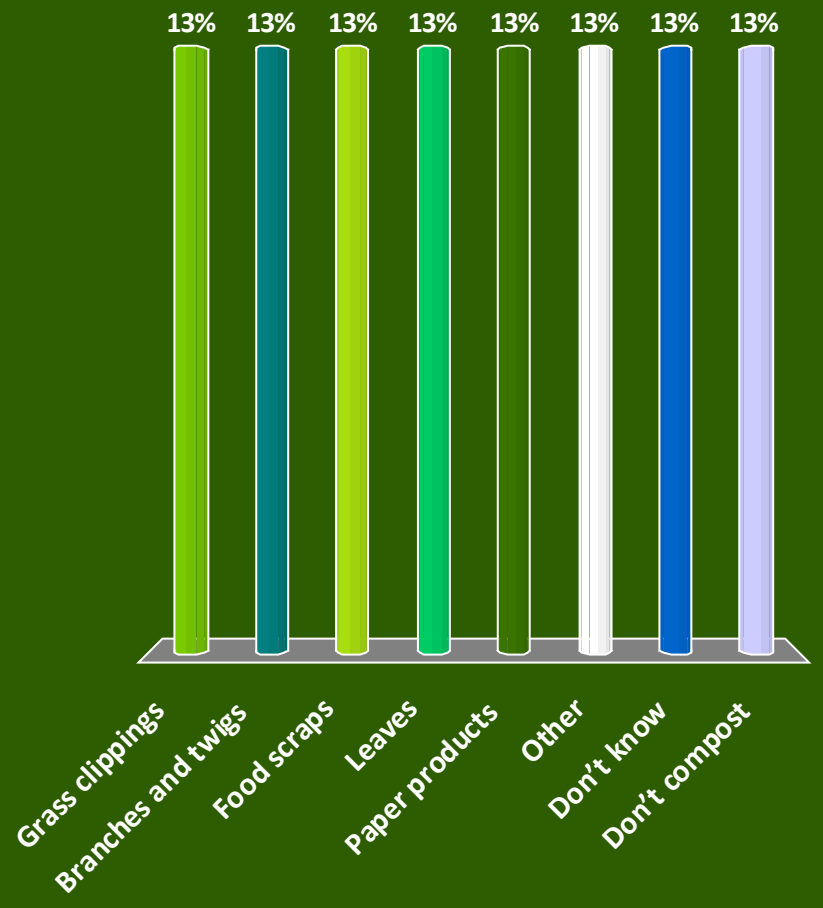
D. A lot

E. I’m a pro!



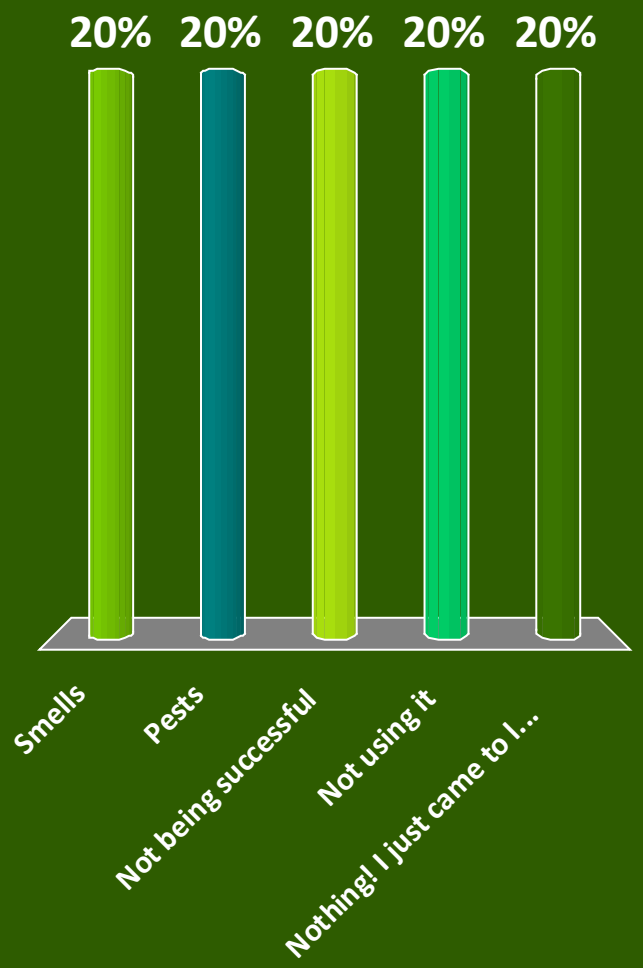
What materials do/will you compost at home?

A. Grass clippings
B. Branches and twigs
C. Food scraps
D. Leaves
E. Paper products
F. Other
G. Don’t know
H. Don’t compost



What worries you about compost?

A. Smells
B. Pests
C. Not being successful
D. Not using it
E. Nothing! I just came to learn more!



Whether you have one horse...

many cows,

a few goats,

or food waste…

Organic matter is a resource!! Don't waste it!

How much of our trash is compostable food waste?

- 2010 Boulder County: 13-15%
- 2010 Larimer County estimate: 13-17.4%
- That's about 20,000 tons/year
  in Fort Collins alone!

Methods of Composting

- Active windrows/bins: **This presentation**
- Passive windrows
  - Requires passive aeration technology
- Worms: Online Fact Sheet (vermicomposting)
  - Building a Worm Bin: http://www.ext.colostate.edu/sam/vermicompost.pdf
  - CSU Extension Compost Site: http://www.ext.colostate.edu/sam/compost.html
  - Worm Digest: http://www.wormdigest.org/

What Are the Benefits of Composting?

- Water conservation!
  - Improves water infiltration and retention
- Feeds soil microbes
- Slow release fertilizer
- Divert waste from the landfill
- Reduces volume of material by approx. 30%

What Are the Benefits of Composting?

- Minimizes pathogen, weed, odor, and insect problems
- Stabilizes nitrogen and phosphorus compounds which minimizes water pollution
- Produces a useful and marketable soil amendment
- Sequesters carbon into a stable form that can be put back into the soil

What is Composting?

- Composting is the
  - managed,
  - biological,
  - oxidation process that converts
  - heterogeneous organic matter into a more
  - homogeneous, fine-particle humus-like material.

from FIELD GUIDE TO ON-FARM COMPOSTING (Rodale Institute)
http://www.css.cornell.edu/compost/OnFarmHandbook/onfarm_TOC.html

MANAGED: what YOU do!

- Provide carbon (C) and nitrogen (N) in **30:1** ratio
- Provide oxygen for oxidation process at 5-50%
- Provide water to keep moisture at 50%

Estimated Carbon-to-Nitrogen Ratios

Browns = High Carbon	C:N	Greens = High Nitrogen	C:N
Ashes, wood	25:1	Alfalfa	12:1
Cardboard, shredded	350:1	Clover	23:1
Corn stalks	75:1	Coffee grounds	20:1
Fruit waste	35:1	Food waste	20:1
Leaves	60:1	Garden waste	30:1
Newspaper, shredded	175:1	Grass clippings	20:1
Peanut shells	35:1	Hay	25:1
Pine needles	80:1	Manures	15:1
Sawdust	325:1	Seaweed	19:1
Straw	75:1	Vegetable scraps	25:1
Wood chips	400:1	Weeds	30:1

BIOLOGICAL:
what microorganisms (MO's) do

- Many species of bacteria and fungi metabolize the C and N to grow and multiply, using oxygen and water in the process

- Composting is farming MO's, which are present in the soil!

OXIDATION

- "In the presence of air"
- Used by MO in respiration
- Oxygen is in pore space in compost windrow
- Use bulking material and turn to maintain pore space for air

A variety of initial materials creates lots of air pockets, or pore space.

Heterogeneous Organic Matter/ Feedstocks

- Kitchen scraps
- Bedding
- Waste hay
- Spoiled feed or grain
- Leaves and grass clippings
- Horse manure

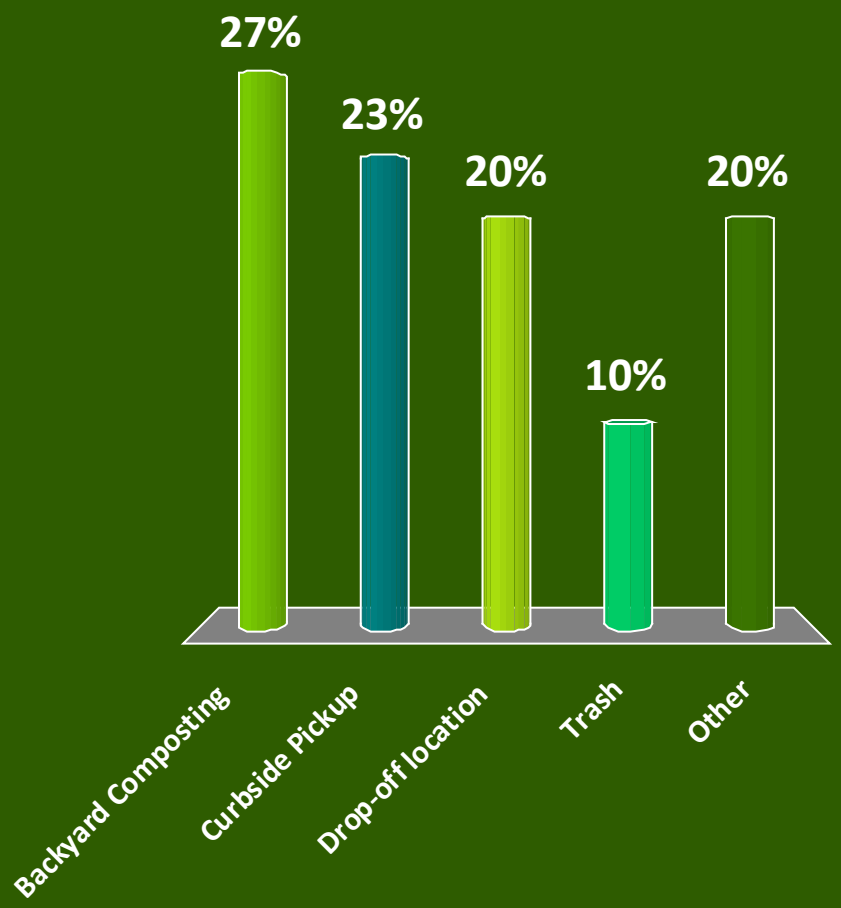
Homogeneous, Fine-particle Humus-like Material

- This is the final product that you are aiming for at the end of a successful composting process.

Let's take a break!

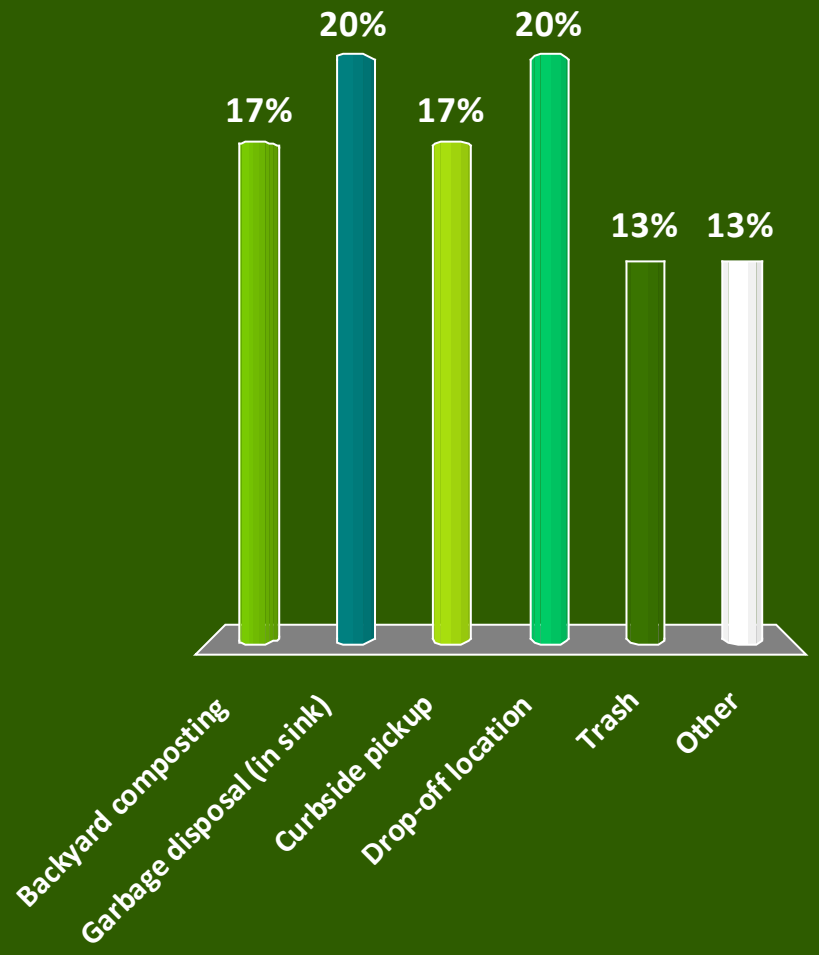
My preferred way to dispose of yard trimmings would be (if available)

A. Backyard Composting
B. Curbside Pickup
C. Drop-off location
D. Trash
E. Other



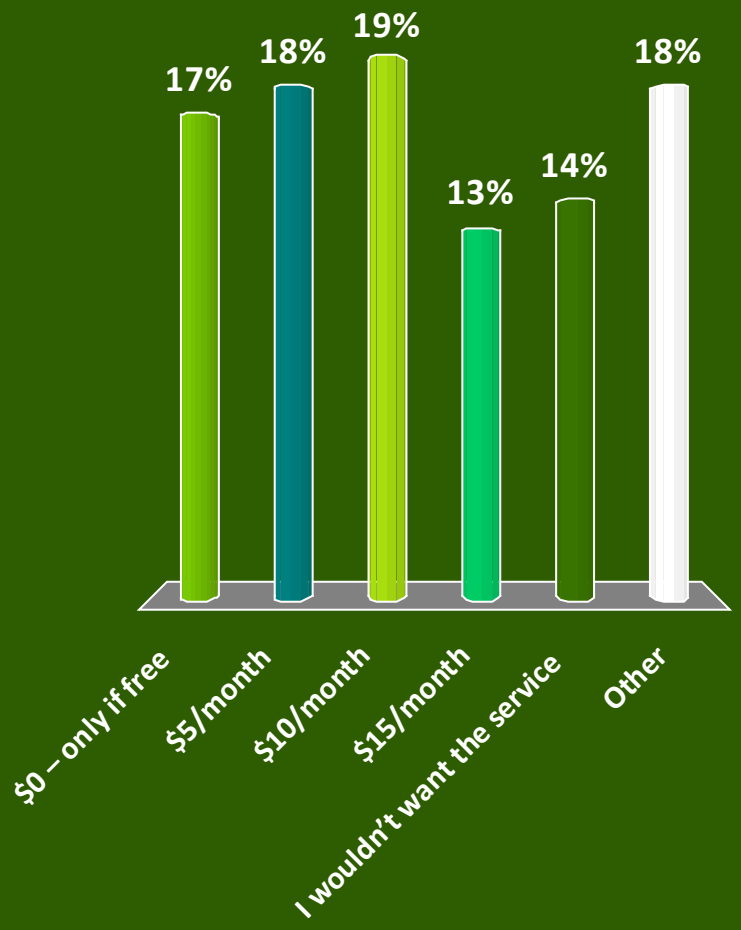
My preferred way to dispose of food scraps would be (if available)

A. Backyard composting
B. Garbage disposal (in sink)
C. Curbside pickup
D. Drop-off location
E. Trash
F. Other



To have my yard trimmings collected curbside, I would pay:

A. $0 – only if free
B. $5/month
C. $10/month
D. $15/month
E. I wouldn't want the service
F. Other



How to Make Compost!

For any scale that you choose

Photo cred: twofoxes.com

Choose a site

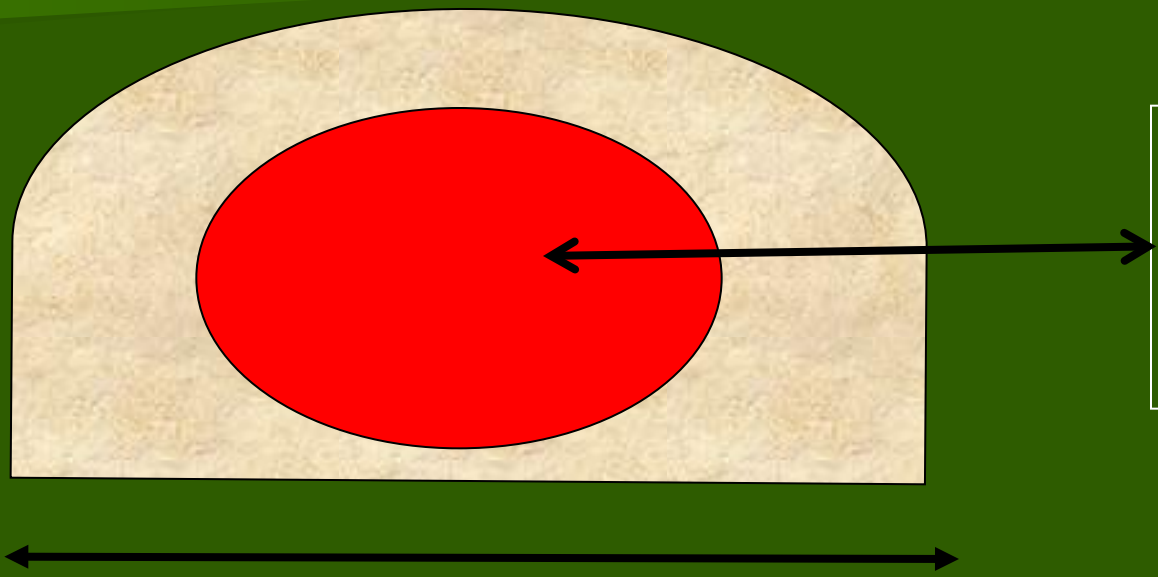
- Mowed area, smooth, slightly sloping
- Near feedstock source
- Near water tap and at least 100 ft. from "waters of the state" or wells
- Control run-on and run-off
- NOT windy!

Building the Pile

- Layer nitrogen-rich feedstock loosely with bulking material, adding water to 50%
- Manage the batch or continuous pile a little differently.

What happens inside the pile?

3-6’ tall



HOT AREA

Height and width depend on your feedstock volumes and equipment

Monitor the Windrow

- Check temperature with compost thermometer (www.reotemp.com)
- Heat is an indicator of biological activity
  - GOAL: 130+°F for at least 15 days where pile was turned at least 3 times during this heat cycle
- Graph or observe heating cycle: increase then decrease (future slide illustrates this)
- After decrease, turn to aerate and add water, use graph to help with timing

Turning Your Compost

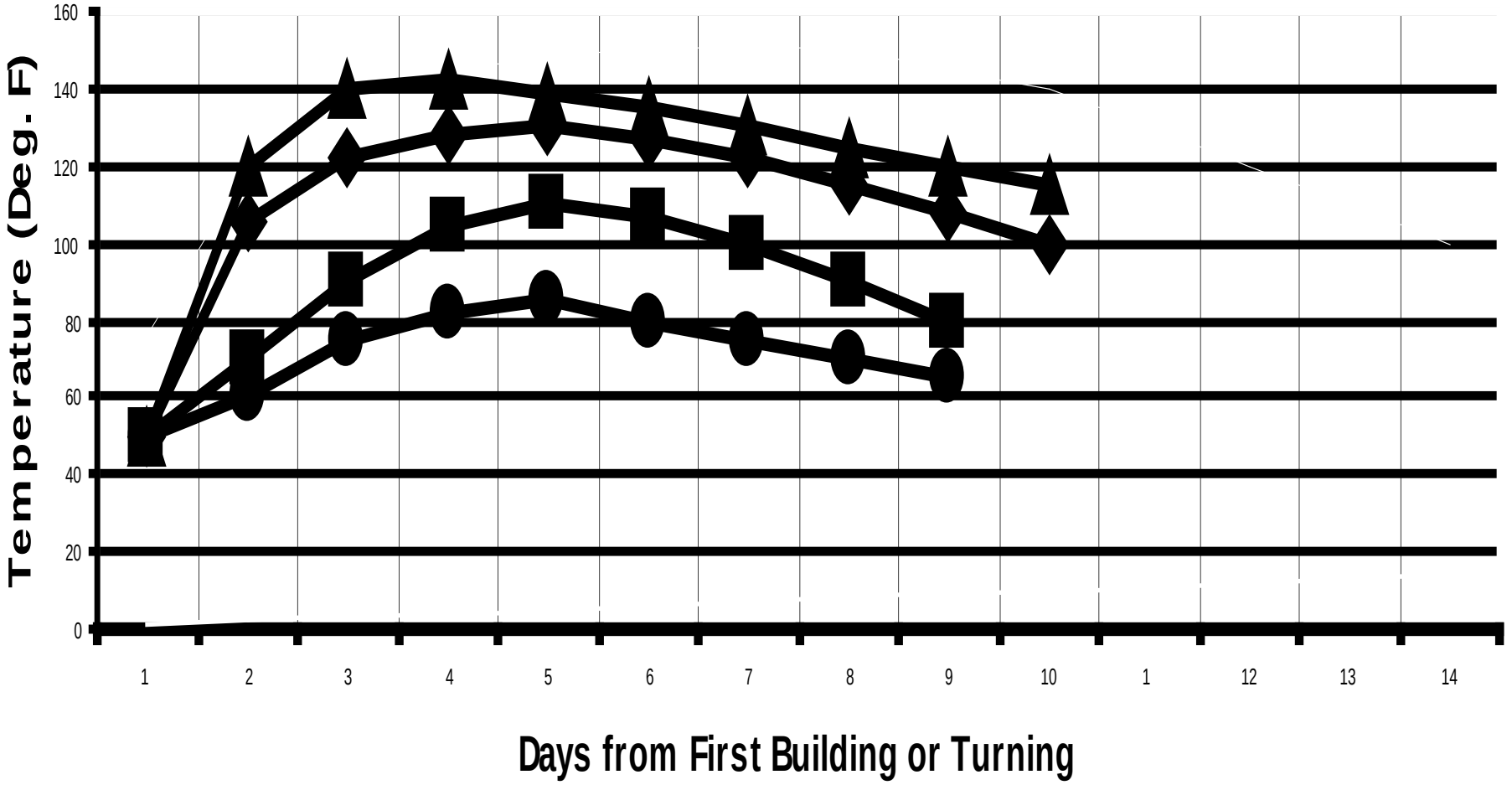
- Easy when you have more than one pile!

- Different Scales
  - Tractor
  - Pitchfork

- Watch your back!

Even in winter composting organisms metabolize enough to produce substantial heat.

Relationship of Time and Temperature to Compost Turning



Continued Monitoring…

- After turning, monitor heat cycle again

- Turn when temperature decreases

- Check moisture and add if necessary
- Repeat turnings until temperature ceases to rise (about 4-5 turning cycles)

Curing Phase

- When temperature curve flattens, mesophyllic (mid-temperature) MO's take over to finish process
- Keep windrow moist, less than 50%
- Cure for 1-2 months

Why cure?

- Assures highest quality product
- pH shifts to neutral
- Soil MO's re-colonize compost, impart disease suppressing qualities to compost
- If too much C left, use of this compost as a soil amendment may cause a temporary N deficiency, just the opposite of what you want!
- Makes compost optimum for plant growth

When is my compost done?

- After heating cycles stop
- After curing
- Check for homogenous, fine-particle humus-like appearance (unfinished material might need to be screened out and reintroduced to another pile)
- Earthy smell (*Actinomyces*)
- Maturity tests: Solvita test (becoming recognized by highway departments), and others, experience!
  - www.woodsend.org

To Assure Quality….

- Keep meat/cheese/bones out of your compost bin
- Know where your feedstocks came from
  - Antibiotics? De-wormer? A mature compost will be antibiotic free
  - Herbicides? Some broadleaf herbicides (chlopyralid) do not break down in the composting process and may deter growth of your broadleaf garden plants
  - Heavy metals? This is typically not an issue in compost unless you are composting biosolids

To Assure Quality…

- Know that your compost is **mature**
  - **Maturity = low microbial activity = fully composted**
  - You will avoid ammonia burn in your plants
  - Nitrogen in your garden soil will not be immobilized by unfinished compost and 'rob' your plants of nutrients
  - Pathogens (E .coli/Salmonella) are destroyed during a well managed composting process
- Test your compost!!! And your soil!!!
  - This will help you determine how much compost your soil needs. More is not always better!

QUIZ!

1. What is the perfect C:N Ratio for your compost pile?
    a. 30:1
2. What is the final stage of composting called?
    a. curing
3. . . .why is it important?
    a. Recolonizes with MO's
    b. pH shifts

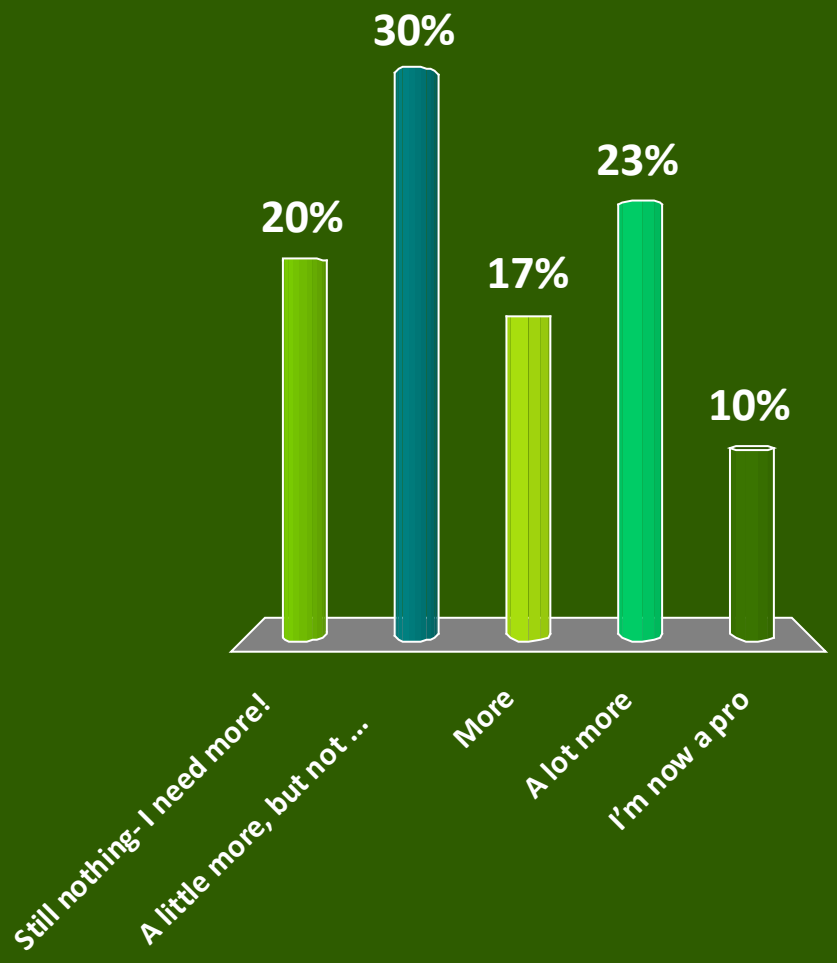
7. What is the most challenging aspect to composting in Colorado?
    a. Moisture!
8. What shouldn't we put in our compost piles?
    a. Meat/dairy/bones
9. ….And why?
    a. Attracts animals and needs a very managed system to compost quickly
10. How do you know when your compost pile has enough water?
    a. Rung out sponge

QUESTIONS?

Happy Composting!

After this presentation, how much do you know about compost?

A. Still nothing- I need more!
B. A little more, but not enough
C. More
D. A lot more
E. I'm now a pro



What is your intention to make changes or share information from the presentation?

A. I do not plan to make any changes
B. I plan to make changes
C. I will not make changes but will share what I learned
D. I plan to make changes and share what I learned