



**Grade Level:** Middle School

**Subject Correlation:** Social Studies, Math

**Objective:** To reveal the sources of pollution/waste, develop an understanding of how the waste we produce adds up, and to encourage students to reduce their waste production and increase the amount the recycle.

**Students will be able to:**

1. Distinguish between recyclable and disposable wastes.
2. Give concrete examples demonstrating the value of recycling by calculating the amount of disposable waste produced by the U.S. and the entire world with and without recycling.

**Length:** 35 – 40 minutes (up to two classes with extension activity, which students can also do for homework)

**Teacher Preparation:** The teacher should collect one day's worth of trash produced by the class by saving the contents of the garbage. Try to make sure the garbage contains various types of both recyclable and non-recyclable materials. Teacher will also need to bring in a scale.

**Outline (with times)**

5 minutes

*Introduction*

- Ask the students if they think they pollute/waste a lot. Why/why not? Write the answers on the board. Then, shock them with the following information:

- "Did you know that only 2 man-made structures on Earth are large enough to be seen from space? Can anyone guess what they are? The answers are the Great Wall of China, and the Fresh Kills Landfill!" (Teacher may need to explain what these are. See [Picture File](#).)

- Surprise students by dramatically holding up a bag of garbage and announcing that it is the contents of one day's worth of garbage. (The teacher may want to have an arranged bag of "garbage" on hand with appropriate amounts of recyclable and non-recyclable contents.)

20 minutes

- Have a student come to the front of the class and weigh the bag of garbage. As a class figure out how much garbage the school, city, state, and country produces by multiplying the weight of the garbage by the number of

students in the school and people in the city, state, and the United States (290 million). Stress that these amounts are only for one day's worth of garbage. You may want to figure for one year by multiplying by 365.

- Ask students where their garbage goes and what happens to it.

Information on landfills:

[Landfills, www.lalc.k12.ca.us/uclasp/ISSUES/landfills/landfills.html](http://www.lalc.k12.ca.us/uclasp/ISSUES/landfills/landfills.html) or

[Zero Waste America, www.zerowasteamerica.org/BasicsOfLandfills.htm](http://www.zerowasteamerica.org/BasicsOfLandfills.htm)

- Talk with your class about what materials can be recycled – plastic, metal, glass, paper... Give examples of each.

- Go through the items and divide them into recyclable and non-recyclable items. The teacher may need to describe the difference using some examples. Place the recyclable garbage in a different bag for recycling.

- Weigh the bag of garbage without recyclable contents. How much less does this bag of garbage weigh? Figure out the difference for the class, city, state, country and the world. Again, you may want to multiply this figure by 365 to figure out how the difference over a year. (If the weight difference is insignificant, emphasize the size difference.)

#### 10 minutes

- Challenge the students to produce less waste – have the students brainstorm what they can do to help. (*Make sure they know that many forms of waste are harmful to the environment...ask them why.*) Come up with a class incentive to produce less waste such as a longer lunch break or a special story/movie.

- Consult the local government to learn what can be recycled in their neighborhoods and how to do it – collection times, special instructions, etc.

**Class Homework Assignment:** Research recycling and composting efforts in your school and in your community. Discuss what you find. Is it satisfactory? What more can be done? Consider writing a letter to the editor of the school or local newspaper, community leaders, elected official. Your class may also want to discuss the school's recycling program with the student council, parent-teacher association, and/or the school administration. Describe why you and your class are satisfied/dissatisfied with the recycling and composting efforts in your school or community.

**Extension Activity:** Use the following Web sites to help your students learn how to start a compost pile at your school or home (or see EDN's [Classroom Composting](#) lesson in the science section of the curriculum):

[Guide to Composting, http://www.gardenguides.com/TipsandTechniques/compost.htm](http://www.gardenguides.com/TipsandTechniques/compost.htm)

[Build a Backyard Compost Pile, http://www.mastercomposter.com/pile/bldapile.html](http://www.mastercomposter.com/pile/bldapile.html)

- Visit [Earth Day Network's Web site](#) to find an environmental group in your community. Invite somebody to come in and talk to your class about sustainable living, consumption habits and garbage generation!

- Visit a recycling facility in your community. They usually provide educational tours to school groups.

**Additional Worksheets for Homework or Classroom Exercises:** Be sure to discuss the following graphics with your students before allowing them to answer the questions as a class, in small groups, individually, or for homework. Talk about each category in the table and the pie chart. If you want students to practice graphing, this would be a good activity.



# Waste Production and Recycling Efforts in the United States

The following chart shows that although Americans are recycling more, we are also producing more waste. As the American population goes up, so does the amount of waste we produce. However, as the percent of waste recycled goes up, tons disposed per person goes down.

Survey of Previous Year	U.S. Population	(mostly) Municipal Waste Generated (tons)	Increase	Percentage Recycled	Tons Disposed	Tons Disposed Per Person
1990	246,819,230	269,000,000	-----	8%	247,480,000	1.002
1991	249,439,545	293,613,000	+24,613,000	11.5%	259,847,000	1.041
1992	252,124,362	280,675,000	-12,938,000	14%	241,380,000	0.957
1993	255,001,827	291,742,000	+11,067,000	17%	242,146,000	0.949
1994	257,752,702	306,866,000	+15,124,000	19%	248,561,000	0.964
1995	260,292,437	322,879,000	+16,013,000	23%	248,617,000	0.955
1996	262,760,639	326,709,000	+3,830,000	27%	238,498,000	0.907
1997	265,179,411	327,460,000	+1,751,000	28%	235,771,000	0.890
1998	267,636,061	340,466,000	+13,006,000	30%	238,326,000	0.890
1999	272,690,813	374,631,000	+34,165,000	31.5%	267,108,215	0.979
2000	281,421,906	382,594,000	+7,963,000	33%	256,338,000	0.911
2001	286,345,000	409,029,000	+26,435,000	32%	278,139,720	0.979

Data source for above table and below pie chart: **BIOCYCLE**

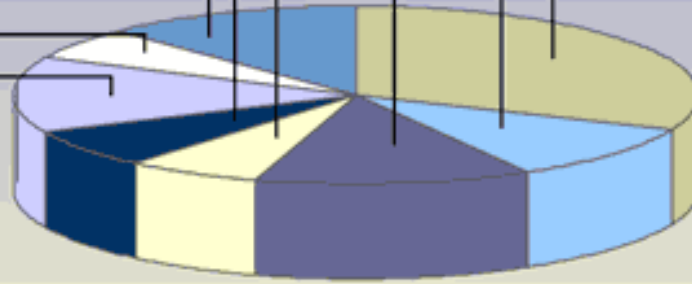
### Questions for discussion based on the above table

1. a. How much larger was the US population in 2001 than in 1990?  
 b. How many more tons of waste were generated in 2001 than in 1990?  
 c. How many more tons of waste were disposed (actually went to a landfill) in 2001 than in 1990?  
 d. Why do you think the increase in the amount of trash generated is so much larger than the increase in the amount of trash that actually went to landfills?
  
2. Contrast how much people recycled in 1990 with how much they recycled in 2001. Describe how this affected the amount of trash disposed of per person between 1990 and 2001.
  
3. How has recycling affected the trash we pass?



## Net Waste Disposal, 1997 (after recycling)

Paper	31.3%	48.9 mil tons
Yard Waste	10.4%	16.2 mil tons
Plastics	13.0%	20.4 mil tons
Metals	6.4%	10.1 mil tons
Wood	7.0%	11.0 mil tons
Food Waste	13.6%	21.3 mil tons
Glass	5.8%	9.1 mil tons
Other	12.3%	19.3 mil tons



Total Waste Disposal: 156.3 million tons

Source: Characterization of MSW in the U.S.:  
1998 Update, U.S. EPA, Washington, DC

Questions for the pie chart: (to be answered as a class, in small groups, or individually)

1. Which of the above categories are commonly recycled? Which can be recycled in your neighborhood?
2. The sum of these commonly recyclable categories adds up to how many millions of tons? How much waste would be recycled using the standards in your neighborhood?
3. What percent of the total waste can be commonly recycled? What percentage of waste can be recycled using your neighborhood's standards? Is this close to the same percentage of recyclable garbage that you found in your class during the earlier exercise?
4. Which of the above categories can be composted?
5. The sum of all the compostable categories adds up to how many millions of tons?
6. What percent of total waste can be composted?
7. How much of the Net Waste total can be eliminated by recycling and composting?
8. How does recycling and composting effect the trash we pass?



## Answers to table and pie chart questions

### Table Questions

- The US population increased by 39,525,770 people.
  - The US population generated 140,029,000 more tons of waste.
  - The US population disposed of 30,659,720 more tons of waste.
  - RECYCLING – Although the population generated much more waste per person in 2001 than in 1990, the amount of waste per person that was actually disposed of in landfills actually fell due to the US population's recycling efforts.
- The percent of waste recycled increased dramatically, and therefore the amount of waste disposed per person decreased (even though the total amount of waste generated increased).
- Between 1990 and 2001, the amount of waste disposed of increased at a smaller rate (12%) than the increase in US population (16%) and at a much smaller rate than the amount of waste generated (52%).

### Pie Chart Questions

- Which of the above categories are commonly recycled? Which can be recycled in your neighborhood? *All categories mentioned (except for "other") are recyclable. However, paper, plastics, metal, and glass are commonly recyclable. Answers will vary for what can be recycled in your neighborhood.*
- The sum of these commonly recyclable categories adds up to how many millions of tons? How much waste would be recycled using the standards in your neighborhood? *88.5 million tons of commonly recyclable waste. Answers will vary using neighborhood standards.*
- What percent of total waste can be commonly recycled? What percentage of waste can be recycled using your neighborhood standards? Is this the same percentage of recyclable garbage as you found in your class during the earlier exercise? *Again, all categories can be recycled, but using the answers for question 1, 56.5% of the total waste can be commonly recycled. Answers to the other questions will vary.*
- Which of the above categories can be composted? *Yard waste, food waste, and some woods. (Use the following Web sites to explain what a compost pile is, Guide to Composting, <http://www.gardenguides.com/TipsandTechniques/compost.htm> and Build a Backyard Compost Pile, <http://www.mastercomposter.com/pile/bldapile.html>).*
- The sum of all the compostable categories adds up to how many millions of tons? *(About 37.5 million tons/48.5 with wood).*
- What percent of total waste can be composted? *(24% or 31% with wood).*
- How much of the Net Waste total can be eliminated by recycling and composting? *It is possible to eliminate all the above waste, except possibly for "other." However, 137 million tons, or 87.7%, can be eliminated through typical recycling and composting methods.*

How does recycling and composting effect the trash we pass? *The more trash we pass towards biodegradable compost piles, the less trash finds its way to landfills.*

