



TAKE CARE OF TEXAS: EDUCATOR MATERIALS

# LESSON PLAN

## Introduction to Landfills

### Objectives

To understand the importance of landfills and demonstrate how reducing waste, recycling, and composting can extend the lifetime of landfills

### Prerequisites

A general understanding of landfills and their purpose, and the ability to perform basic multiplication and division.

### Duration

45 minutes

### Materials

“Introduction to Landfills” Worksheet

### Introduction

Whenever we have an item that we cannot reuse, donate, compost, or recycle, we throw it into the garbage. However, when you throw something into your trash can, it does not just disappear. It is picked up by a garbage truck and taken to a landfill—an area where trash is buried in a unit designed for that trash. It is important that waste ends up in a facility designed to receive it. Waste that is not properly disposed of can damage soil and groundwater.



In Texas we use several different types of landfills, depending on types of waste. **Type I landfills** are standard landfills for municipal solid waste, which comes from places like your house or your favorite restaurant. **Type IV landfills** only take in brush and yard waste, while also accepting waste from construction or demolition activities. Type IV landfills do not take in **putrescible waste**, which is waste that decomposes quickly, causing odors and attracting pests.



M-75e-1 (10/20)

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Much of the material we send to landfills can be recycled or composted. In a study by the Texas Commission on Environmental Quality (TCEQ), it was discovered that 49% of waste sent to Texas landfills could have been recycled and another 20% could have been composted. That means that 69% of the waste that ended up in landfills could have been diverted. Recycling and composting can greatly extend the lifetime of a landfill. Landfills are expensive to authorize, construct, and operate.

Also, expanding existing landfills or finding appropriate locations for new landfills is a challenge for communities.



It is unlikely that every Texan will start recycling and composting overnight, but we can each take individual steps to reduce our waste and dispose of it properly. To learn more, visit the Take Care of Texas website to discover easy ways to reduce your waste.

## Procedure

In this activity, you will (1) estimate how many years of landfill space we have left in Texas and (2) estimate how much waste, on average, each of us generates.

While it is likely that the Texas population will continue to grow and individual waste generation rates may change, we will assume in this exercise that the annual waste generation rate for 2019 will not change. We'll also ignore possible new landfills that would add waste space until they are authorized.

## Determine Years Left in Texas Landfills

1. In 2019, Texans sent 36.80 million tons of waste to landfills. In 2019, there was 1,930 million tons of space left. Space is usually measured as volume, but we're using tons because we have assumed a density for the waste. Plug the data into the following formula to estimate the number of years before we run out of landfill space in Texas. How many years are left?

$$\text{years left (years)} = \frac{\text{space left (millions of tons)}}{\text{rate of disposal } \left( \frac{\text{millions of tons}}{\text{years}} \right)}$$

2. Use this number to calculate what year we can expect to run out of landfill space.

## Determine Your Personal Impact

3. If there were **29 million Texans** in 2019, how many tons of waste did each Texan produce on average?
4. If **1 ton = 2000 lbs**, how many pounds of trash did the average Texan produce?

# How Recycling and Composting Could Save Landfill Space

5. A TCEQ study found that about 49% of waste sent to Texas landfills could have been recycled. If Texans recycled everything they could, what would be the annual rate of disposal?
6. Using the annual rate of disposal from the previous question, how many years would we have left in Texas landfill space? What year would that take us to?
7. The same TCEQ study also found that 20% of waste sent to Texas landfills was compostable. If, in addition to the recycling, Texans composted everything they could, either through home compost bins or municipal curbside pick-up, what would be our annual rate of disposal?
8. Using the annual rate of disposal from the previous question, how many years would we have left in Texas landfill space? What year would that take us to?

## Answer Key

1. 
$$\frac{1930 \text{ million tons}}{3680 \frac{\text{millions of tons}}{\text{year}}} = 52.4 \text{ years}$$

2.  $2020 + 52.4 = 2072$

3. 
$$\frac{36.80 \text{ million tons}}{29 \text{ million Texans}} = 1.3 \text{ tons per Texan}$$

4. 
$$1.3 \text{ tons} \times \frac{2000 \text{ lbs}}{1 \text{ ton}} = 2,600 \text{ lbs per Texan}$$

5.  $36.80 \text{ million tons} \times 0.51 = 18.8 \text{ million tons}$

6. a. 
$$\frac{1930 \text{ million tons}}{18.8 \left( \frac{\text{millions tons}}{\text{year}} \right)} = 103 \text{ years}$$

b.  $2020 + 169 = 2189$

7.  $36.80 \text{ million tons} \times 0.31 = 11.4 \text{ million tons}$

8. a. 
$$\frac{1930 \text{ million tons}}{11.4 \left( \frac{\text{millions tons}}{\text{year}} \right)} = 169 \text{ years}$$

b.  $2020 + 169 = 2189$

## Glossary

- **Putrescible Waste:** waste that decomposes and might cause odors and attract pests.
- **Type I Landfills:** the standard type of landfill used in Texas. These landfills receive putrescible and other waste from homes and businesses.
- **Type IV Landfills:** landfills that only accept brush, construction or demolition waste, and similar, non-putrescible waste.

## Texas Essential Knowledge & Skills (TEKS)

### Science TEKS

- **6<sup>th</sup> Grade:** §112.18.b. 2A-E; 3A-D; 7A.
- **7<sup>th</sup> Grade:** §112.19.b. 2A-E; 3A-D.
- **8<sup>th</sup> Grade:** §112.20.b. 2A-E; 3A-D.

### Mathematics TEKS

- **6<sup>th</sup> Grade:** §111.26.b. 1A-G; 3A-E; 9A,C; 10A,B.
- **7<sup>th</sup> Grade:** §111.27.b. 1A-G; 2; 3A-B; 10A,C; 11A-C.
- **8<sup>th</sup> Grade:** §111.28.b. 1A-G; 2A,D.

## References

- Texas Commission on Environmental Quality. **Study on the Economic Impacts of Recycling.** [www.tceq.texas.gov/p2/recycle/study-on-the-economic-impacts-of-recycling](http://www.tceq.texas.gov/p2/recycle/study-on-the-economic-impacts-of-recycling)
- Texas Commission on Environmental Quality. **Municipal Solid Waste in Texas: A Year in Review; 2019 Data Summary and Analysis.** [www.tceq.texas.gov/assets/public/comm\\_exec/pubs/as/187-20.pdf](http://www.tceq.texas.gov/assets/public/comm_exec/pubs/as/187-20.pdf)