

Activity: Nutrient Cycling

Topics

1. Decomposition
2. Decomposer Organisms

Teacher's Guide

Activity Overview:

Students will participate in a game to model how carbon and nitrogen are (re)cycled in healthy ecosystems. Each student will take on a unique role to see how these elements move through our plants and decomposers.

Game Objective:

The goal is to keep the ecosystem functioning for as many rounds as possible by managing the supply of elements (**carbon, nitrogen, oxygen**). **PLANTS** build structures from **ELEMENTS**, while **DECOMPOSERS** break down those structures to recycle elements into the ecosystem.

Game Instructions:

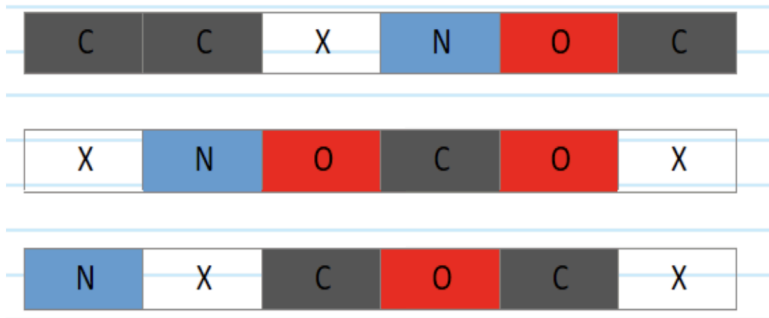
The game takes place over several rounds. Each student is either a **PLANT** or a **DECOMPOSER**. The game lasts until a group's ecosystem runs out of elements.

1. Split the class into groups of FOUR.
 - a. 3 students will be assigned the role of **PLANTS**
 - b. 1 student will be assigned the **DECOMPOSER**

Instruct PLANTS to number themselves off to determine the order in which they will build their structures.

2. Provide each group with a deck of playing cards.
 - a. Each deck should contain **24** cards
 - i. 12 **LANDFILL** cards
 - ii. 8 **LEAVE AS IS** cards
 - iii. 4 **COMPOST** cards

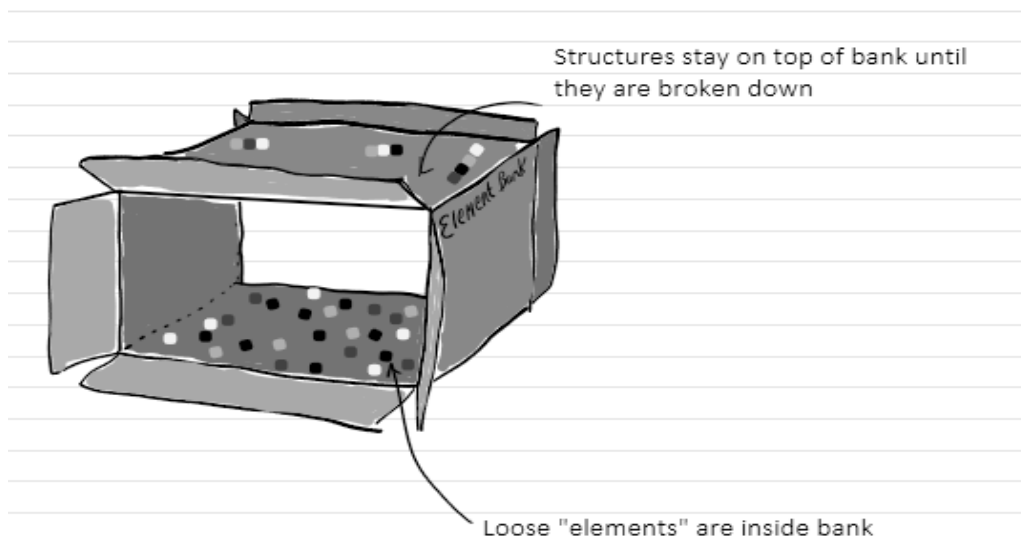
3. Each **PLANT** should select one of these three **FORMULAS**.



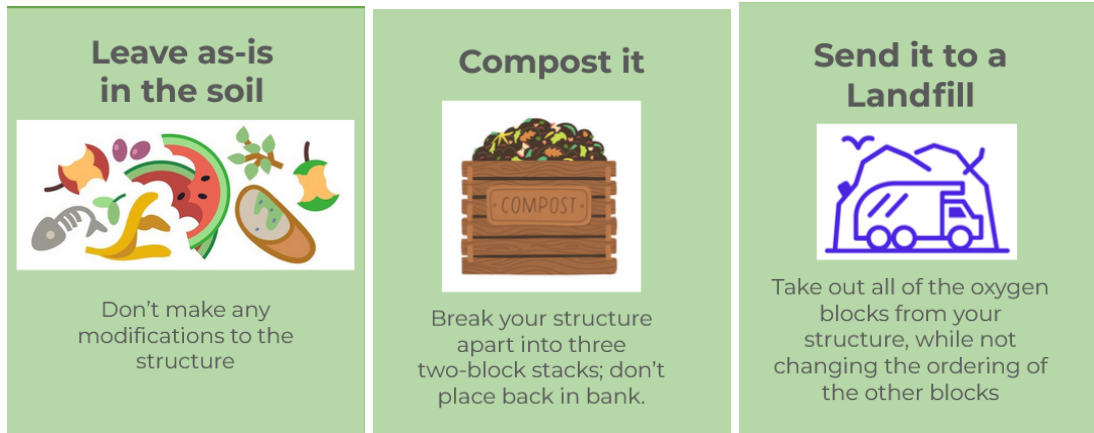
- **C** - Carbon
- **N** - Nitrogen
- **O** - Oxygen
- **X** - Filler

Suggestion: Project this image to the class and have the **PLANTS** choose a formula for themselves. There should be **FOUR** unique colors.

During each round, PLANTS will draw colored blocks from a box labeled **ELEMENT BANK** to try to build the structure with their chosen **FORMULA**.



The single blocks inside of the box represent "**ELEMENTS**". **PLANTS** need these single blocks to build their structures. They can only assemble their structure **one block at a time** and **can only be assembled in a single round**. A **PLANT** will assemble their structure based on the number they assigned themselves at the start of the game. (**EXAMPLE:** **PLANT** #1 will select the **ELEMENTS** needed to build their structures from the box. Once they have built their structures, the second **PLANT** can start building their structure.)



4. If a **PLANT** can make their structure in a single round, they must also pull a “**FATE**” card from a deck. This will determine where their structure will end up at the end of the round. **There are three possible fates:**

- a. **LEAVE AS IS:** Structures will be placed on top of the box intact
- b. **COMPOST IT:** Structures will be broken apart into three, two-block pieces to be composted
- c. **LANDFILL:** Structures can end up in a landfill (resulting in the removal of their oxygen blocks from the game),

“**FATES**” happen *instantly*. After plants build their structure, they follow the instructions on the card they draw.

Note: Regardless of which “**FATE**” card is drawn, all structures are kept on top of the **ELEMENT BANK** to signify they are still in the game (**EXCEPTION:** If the **LANDFILL** fate card is drawn, the oxygen blocks have to be removed from the game.)

5. As the **PLANTS** draw out single building blocks, the carbon and nitrogen supply is depleted. **DECOMPOSERS** will break apart the structures into single pieces to be put back into the **ELEMENT BANK**.

DECOMPOSERS get to work instantly. After a **PLANT** creates its structure, assigns it a **FATE**, and places it on top of the **ELEMENT BANK**, the **DECOMPOSER** will consider the following criteria to see if it can return blocks to the bank.

DECOMPOSERS can completely disassemble a structure and return each piece to the bank only if:

- The structure contains an **OXYGEN** block
- The structure contains a **CARBON** or **NITROGEN** block at one of its ends

Example:

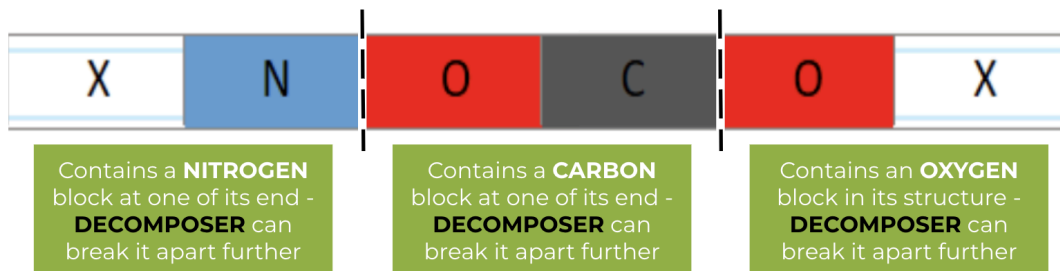
Scenario: A PLANT selects FORMULA #2 and assembles its structure.

Possible Fate: **COMPOST IT**

Complete Structure:



Structure AFTER “Compost It” fate card:



Possible Fate: **LANDFILL**

Complete Structure:



Structure AFTER “LANDFILL” fate card:



OXYGEN blocks are removed and remaining blocks are reassembled **IN ORDER**

Structure does not contain a **CARBON** or **NITROGEN** block on either end. **DECOMPOSER** can not break it down further.

Note: In this scenario, if a “**LEAVE AS IS**” card is drawn, **DECOMPOSERS** cannot break the structure down because it does not contain a NITROGEN or CARBON block on either end.

6. Last Rule of the Game: At the start of the FOURTH round, any **OXYGEN** blocks removed from the game can be added back into the **BANK**.

7. The game ends for a group when, in a single round, there are not enough elements in the bank for any **PLANT** to make their structure.

Student groups should keep track of how many rounds they play and the number of landfill cards they pull. After the game concludes for all groups, instructors can host a group discussion for students to share how many rounds they were able to play and how many landfill cards were pulled.

Materials List

- A large cardboard box (1 per group)
- A deck of 24 “fate cards” (1 per group)
- Linking cubes - 4 unique colors (1 per group) - Refer to the table below
- Blank paper

CARBON: COLOR 1 (45 blocks each)

NITROGEN: COLOR 2 (30 blocks each)

OXYGEN: COLOR 3 (45 blocks each)

OTHER: COLOR 4 (30 blocks each)

Supplemental Materials

- [Activity Slides](#) (includes game cards)