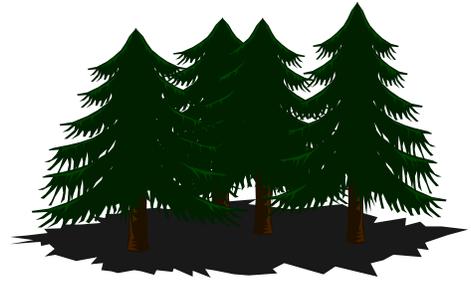

Forever Trees



A Sustained Yield Activity

Objective

One of the most important principles guiding the management of our national forests is “sustained yield.” Sustained yield simply states that no more timber is harvested than can re-grow. It is usually assumed that this applies to each year of harvest (more or less) rather than some long-term average. If managed by the principle of sustained yield, our forests should continue to produce a constant amount of timber without diminishing.

This activity introduces the concept of sustained yield by way of a game. The consequences of harvesting trees (or any resource) at a rate exceeding sustained yield, as well as the results of practicing sustainable methods, are demonstrated. Additional information is provided for further exploration of this topic through groups discussion and individual projects.

Appropriate Grade Level: 7th-12th

Time Required: 1 Hour

NGSS Standards: MS-ESS3-4,
HS-ESS3-2

Materials

Game boards (5)

Rule sheets (5)

5 bags of 70 wood disks and 4 pennies

Game data sheet master copy

Graph/Question sheet master copy

Background Information

The practice of sustained yield sounds simple: cut no more than grows each year. However, there are many hidden challenges, and it is easy to misjudge the allowable cut.

Sometimes there must be temporary exceptions. If fire, drought, or some other disaster results in an unexpected number of dead or dying trees, they are typically harvested before they lose their value. This harvest may exceed what is sustainable over the long term. It is assumed that the over-cut in one year will be compensated for by lower cuts in future years until the balance is restored.

In other cases, the estimated allowable cut may fail to account for years of drought, or loss of soil fertility, or even the loss of soil with each harvest. This may lead to over-cutting, and it may take many years before the mistake is recognized and corrected. This can lead to many years with minimal harvest until the balance is once again reached.

Also, if some land is taken out of timber production, say, to make a park, this



affects the allowable cut. If preceding years figured this land into the timber base, harvest would have exceeded the allowable cut based on the new, reduced timber base. The cut will have to be reduced by more than just the land taken out of production until a new balance is reached.

Because we are only on our first or second harvest on most federal lands, we don't fully understand the implications of timber harvest in this region. In particular, we are just beginning to understand the impacts of timber harvest on soil fertility. As one forester explained our current knowledge of forestry "It's as if the first farmers said 'we know all there is about farming' after the very first or second harvest of wheat in Mesopotamia thousands of years ago." We have a lot to learn and it is prudent to proceed conservatively.

Foresters learned the hard way in Germany where they have been harvesting timber for much longer than here in the western United States. Much of their forested areas now produce timber at a much lower rate than they did originally. Something in the soil has changed, but what is uncertain.

The concept of sustained yield is (hopefully) applied to the management of all renewable resources. These include bag limits for hunting (deer, ducks, etc.), quotas for fishing both recreational and commercial, shellfish harvest, and grazing.

Activity

This activity introduces the concept of sustained yield by way of a game. Both the consequences of practicing sustained yield and harvesting trees (or any resource) at a rate exceeding sustained yield are demonstrated. Students may be surprised by the limited amount of timber that must be harvested in order to produce a 'sustainable' forest.

1. Break the students into up to five groups and give each group a game board, rules sheet, and bag of 70 wood disks and pennies. Make copies of the game Datasheet and the Graphing/Questions worksheet for each student.
2. Read the instructions with students carefully before they begin. Although the game may seem complicated at first, once they take a few turns it will become clearer. Students will record their data on the data sheet, then complete the graphs and answer the questions.
3. This game requires a good bit of math, but is meant to demonstrate the difference between harvesting methods and can lead to further discussion about sustainability.
4. You should allow a full hour to play. If you are shorter on time, the class can be split up so that some groups play round one (harvesting 12 disks each turn) and some groups play round two (harvest 8 disks per turn), then share their results with the class.



Forever Trees: Will your forest be sustainable?

Rules of the Game



Materials:

- 1 Game board (16 squares, 12 of which can be occupied by forest)
- 70 wooden disks
- 4 pennies
- 1 datasheet

Set-up:

Stack 5 of the wooden disks onto each of the 12 stump squares. Each stack of disks represents an entire tree.

Rules:

- ✓ There will be two rounds. In round one, you must harvest at least 12 of the wooden disks per turn. In round two, you will harvest at least 8 disks per turn.
- ✓ You must take an entire tree (stack of disks) when you harvest.
- ✓ You may not harvest any tree that is one or two disks tall, as they are too young to produce lumber.
- ✓ Trees cannot grow more than 8 disks tall because they are older trees that do not grow as fast as younger trees.

Play:

Round One: *Each turn you will **Select, Grow, Remove, Record.***

1. **Select** the trees you want to harvest by putting a penny on top of each of the chosen trees. (Remember: You may have to harvest over the minimum number of disks. For example, in the first turn you must take three trees of 5 disks each, so there will be 15 disks removed)
2. **Grow** all of the remaining trees by adding a disk to the top of the stacks without pennies, including any open 'stump' squares.
3. **Remove** the selected trees from the game board. This is your harvest.
4. **Record** the timber harvested (number of disks removed) and the timber remaining (number of disks left on the board).
5. **Repeat** for twelve turns.

Round Two: *Repeat the steps above, harvesting 8 disks per turn!*

Analyze:

Graph the results on the worksheet and answer the questions. Compare the methods of harvesting. Which one was sustainable?

