

# Neolithic Survivor



**Author:** Ecology Explorers Education team  
**Time:** 3- 50 Minute Class Periods  
**Grade Level:** 6-12

## **Background:**

Sustainability is often defined as meeting the needs of the present without compromising the needs of the future. Archeologists at Arizona State University (ASU) have found that some decisions made by our Neolithic ancestors led to the sustainability or collapse of their villages. One of our basic needs is food, because the energy we use every day needs to be replaced by putting energy back into our bodies. Today, most of us get food from supermarkets, and most students do not understand the basic process of growing food and farming's impact on the local environment. In this lesson we will be asking students to make decisions about producing food based on real scenarios from the Neolithic. Can your students make sustainable decisions?

This lesson is based on a computer simulation model developed by the Medland team. Through this computer model they can predict the short and long term impacts of farming decisions made by households (families of Neolithic farmers) on the local environment. Scientists test what will happen to a village of farmers (population grows, moves, or dies out) under different land use choices (slash and burn, intensive agriculture, with or without animal herding). They are placed on a GIS map of actual watersheds in Jordan and Spain that have been retrodicted to show soil depths, vegetation, and climate for the time period being tested. The model calculates changes to the landscape and to the village under the given scenario. This research is creating an environment that will help us make more informed decisions in the future about how we use our resources and what the long term impacts of those decisions will be for future generations.

## **Who were the Neolithic Farmers?**

They were the earliest people in our history (as far back as 10,000 years ago) to settle down and grow their own food instead of being nomadic hunters-gatherers. The shift to farming caused a cascade of effects on societies and landscapes. This change marked the beginning of cities and modern civilization.

The Neolithic Period occurred at different times, in different areas, depending on when people shifted to agriculture. But it generally occurred around 8,000 B.C.E. and ended around 4,000 B.C.E. when people started using metal. The archeological sites studied in this project range from Neolithic to Bronze Age sites. They grew crops (wheat, barley, lentils, and garbanzo beans) and some had goats, sheep, or pigs. They invented pottery around 6,000 B.C.E., traded for goods, had spiritual symbols/objects, built homes of mud or stone, and developed irrigation towards the end of the Neolithic period. They also cleared forests for farming, practiced prescribed burning to release nutrients back into the soil, rotated crops, and fallowed fields to increase food production from their local environment.

## **Why do we care about the impact of farming thousands of years ago?**

Converting land from a native ecosystem into an agricultural ecosystem has a variety of impacts. Impacts on soil fertility and soil erosion were major challenges faced by the Neolithic Farmers. Farming causes soil erosion and the effects of different land-use practices can still be seen today in the condition of the landscape in the Mediterranean. Overuse of soils can start the process of desertification, which is occurring in Spain, China, Africa and other areas of the world. This reduces global food production as top soils erode 10-40 times faster than they are replaced naturally in different countries. This amounts to over \$37 billion in economic loss yearly in the US alone.

## **How will this simulation work?**

We're going to run a live simulation of the model created by the Medland project in a game called Neolithic Survivor. Students will pretend they are Neolithic farmers and see what happens to their villages based on

the decisions they make about farming the land.

**Objectives:**

- 1- Students will collect human population data for a village with specific energy requirements and demands through a simulation model.
- 2- Students will use information gathered from the Mediterranean Landscape Dynamics Project to make decisions.
- 3- Students will create a graph to display information.
- 4- Students will compare village graphs and evaluate how growth rate and the availability of resources affect the sustainability of each village.
- 5- Students will read an article and make a prediction on the sustainability of our global populations based on the availability and distribution of food currently (only if you choose to do the extension activity).

**Materials:**

- Timer
- Whistle
- Medland background booklet available on website
- Student game sheets, one per group
- Laminated village cards and map of the Mediterranean region
- 5 lbs. pinto beans, separate some into bags containing about ~1000 beans and some bags of 400 beans.  
The number of bags will be dependent on the number of “villages” you will be setting up.
- 1-3 flags per village
- One cup per person
- One tub/bucket
- 30 goat cards, cut out
- Game cards 1 per village, cut out
- Evaluation worksheet, one per student
- Graphing Worksheet, one or two per student depending on number of villages

**Suggested Procedure:**

Several Days before the Lesson:

See the attached descriptions and prepare a map of the area in your schoolyard showing the locations of the different Neolithic villages, and farm fields (beans). Your map could include these features as described (i.e. a map showing elevation for homesteads farming on a slope, location of springs, etc).

Gather all materials. Laminate village cards and cut out goat cards.

Prior to outdoor game:

- 1- Establish where the sidelines will be and where each of the villages will be located. Place a tub/ bucket by the sidelines. This is where groups will dump their beans at the end of each round.
- 2- Place one flag for each village separated from one another in the field. Scatter ~1000 beans evenly around the flag (i.e. don't put them in easy to scoop- up piles but make sure they are easy to find). At the Tell Rakkan village (see Village Cards page) place three separate flags at their site with 1000 beans scattered around each flag.
- 3- On the evaluation worksheet, select the questions appropriate for your grade level. Questions 10 and 11 are more appropriate for high school classes.

## Session One

- Engagement:** Ask students: “Pretend you’re at home and you’re hungry, but there’s nothing to eat. Which would you do: walk to the closest convenient store and get a snack or wait an hour for your parents to get home and make dinner? Take a survey of who would wait and who would go to the store. Ask students to give examples of what they based their decision on. Hopefully your students will give a variety of reasons as to which alternative they would choose. Was energy use part of their explanation (i.e. waiting on the couch for Mom & Dad requires very little energy expenditure vs. walking/driving to a local convenience store)? Explain: many of the decisions made in life are based on energy. This can be quantified by adding the number of calories you take in minus the number of calories you expend. We can create a simple model to base your decision on. If you burn 100 calories an hour waiting for dinner (-100), then it’s worth expending 200 calories walking to and from a nearby store for a 300 calorie snack ( $300-200=+100$ ). If you have to spend 300 calories getting there and back, it’s no longer worth the walk ( $300-300=0$ ). You didn’t gain any extra energy.
- Introduction:** Today we are going to play a game based on a computer simulation model created by archaeologists at Arizona State University. The simulation deals with sustainability.” Write the definition of sustainability on the whiteboard. “Sustainability is meeting the needs of the present without compromising the needs of the future.” Spend a few minutes discussing why sustainability is good. You may wish to share the following information with your students:

The simulation deals with people living thousands of years ago in the Mediterranean . Archeological sites in Jordan (Tell Rakkan) and Spain (Penaguila) show different patterns in how villages impacted the local environment during changing climatic conditions 6,000 years ago. Archeologists wondered how different decisions made by these people led to some villages being sustained, while others disappeared. By working with a variety of scientists, they created a mathematical computer simulation model that could test their ideas about what realistically could have happened to these Neolithic farmers. We’re going to play a game that works a lot like this model does, and test how your decisions could impact your village’s survival and local environment.

- Divide the class into groups of 4 or more people so that there are between 2 and 6 groups. Make the groups as even as possible.
- Pass out one student game sheet per person and one set of laminated village cards per group.
- Using the background information provided by the Medland Booklet, give students information you will find relevant about the Neolithic and the Medland project. Discuss the information as needed. Instruct students to listen with the idea that they will be selecting a village tomorrow.
- Let students read over their choices for a village and discuss in groups which one they would like to pick. Tell them to have several villages selected in case another groups is assigned the village of their choice.
- End the day with students sharing ways that people can foster sustainability.

## Session Two

- Assign each group a village or allow groups to select their village. Use Penaguila and Tell Rakkan for smaller classes and add other villages for larger classes.
  - Direct students to fill out their data sheet with the name of their village, student names, and number of beans per person.
- Read over the rules of the game (below) and head outside to play Neolithic Survivor.

### **Rules**

- Each group represents a village. One person needs to be the recorder and will not collect food. Groups decide who this will be. One person needs to be the runner and will be responsible for bringing beans to the teacher at the end of each round and picking up a game card. This person will also be allowed to collect beans. All others will be food gatherers.

2. There will be 5 - three minute rounds.
3. Rules for a Round:
  - a. Gathering Food: When the round starts each food gatherer leaves the village center and collects **enough beans to feed one person** and brings them back to the recorder. Dump the beans into his/her cup. Return to the field to collect more, each time returning with enough beans to feed one person. They may return to the field and collect more beans as often as time permits
  - b. Data Collection: the recorder places one tally mark on the data sheet every time one of the food gatherers brings back food. These tally marks will show how many people can be fed by the end of the round. This makes bean counting go faster. Students only need to count beans if they are buying goats or farming extra land.
  - c. At the end of three minutes, have the students determine how many people can be supported by the number of beans collected. This should be easy to do based on the tally marks recorded. Add or subtract people from the villages based on what was collected. If your village went from 4 people to 9 in the first round, you will have 4 real players and 5 “ghost players”. Your food gatherers need to collect enough beans to feed all 9 people in the next round or you will lose them. Record the total number of people now in the village on the data sheet at the end of round 1.
  - d. Runner: Bring all beans your village collected to the teacher. Dump these in the tub, collect a game card from the teacher, and return to your village with your cup. If moving farm land (see e below) or buying goats (see f below) carry out these transactions with the teacher before returning to your village.
  - e. Villages with three flags: This group must select one flag to start collecting food. They may move to another flag only after they have collected 60 extra beans. But, they don't actually add extra people. This is the energy needed to “clear” the forest and create the new farm field. They can start using the new field in the next round and cannot use the previous field unless they decide to collect another 60 additional beans and move back there in a future round.
  - f. Some villages may purchase goats (30 beans) from the teacher. Goats can be sold back to the teacher for 60 beans when they need the extra food.
4. You have 3 minutes between rounds to record data, buy or sell goats, and send the runner to the teacher.

#### **Game instructions for teacher:**

1. Blow the whistle to mark the beginning and end of each round. Assist groups at the end of the first round to make sure they are tallying correctly.
2. At the end of each round, collect beans and pass out a game card to each runner. Hand out goat cards to villages trading food for goats.
3. If a village runs out of food, not enough to feed one person (usually around the 3<sup>rd</sup> round): this village dies out and must wait out the game on the sidelines. Add 400 beans to this field, because when fields are left alone (fallowed), soil nutrients are replenished. Another village can choose to move in here before the next round begins, but must pay 60 beans to move because moving requires more energy.
4. At the end of the fifth round, pick up all materials and return to the classroom.

### Session 3

1. Instruct groups to tape their data sheet to the board.
2. Review what happened during the game with these questions:
  - a. Ask students which groups did the best and worst.
  - b. What energy requirements and/or decisions led to this? (Those that had to work harder had to collect more food and this may have slowed down the growth of their village-unless we had a group that overcompensated by working even harder. This is called intensification when you figure out how to get more energy from a given plot of land. We do this through trait selection or genetic engineering, adding fertilizers, using farm equipment, etc...)
  - c. Why did we add beans back into the game? (Soil is a renewable resource. This represents how decomposition of organic matter in soils adds fertility or nutrients back into the soils.)
  - d. What would eventually happen or did happen to the group(s) that grew faster than the harvest could keep up with? Is that homestead sustainable? (If they consume resources faster than they are replaced, they die. That is not sustainable)
  - e. What examples can we think of locally that show systems growing too fast, and were not able to be sustained? (AZ housing prices grew too quickly and crashed. Home loans became very easy to get but many people did not have the money to repay them. This caused too much debt for the banks to carry and put some of them out of business.)
3. Demonstrate how to display the data from one village (one data sheet from board) in a line graph. Instruct each student to create their own graphs for each village. Discuss the differences in the graphs based on students' experiences of how their decisions impacted their population size.
4. Then, have students complete the evaluation worksheet individually.

#### **Evaluation:**

Use the answer key to the student worksheet and point value associated with each answer to come up with a percentage.

#### **Extensions:**

Read the article: "The hungry planet" and complete question 9 from the evaluation handout. The full article can be found at: <http://www.independent.co.uk/environment/the-hungry-planet-414479.html>

## Arizona Standards

### Science

Inquiry Process  
C1-GRHS-PO4  
C3-GR8-PO1  
C3-GRHS-PO1  
C3-GR6-PO2  
C3-GR7-PO2  
C3-GR8-PO2  
C3-GR6-PO3  
C3-GR7-PO3  
C3-GR6-PO4  
C3-GR7-PO5  
C4-GR6-PO1  
C4-GR7-PO1  
C4-GR8-PO1  
C4-GRHS-PO2  
C4-GR6-PO3  
C4-GR7-PO3  
C4-GR8-PO5  
Science in Personal and Social  
Perspective  
C1-GR7-PO1  
C1-GR6-PO2  
C1-GR7-PO2  
C1-GR7-PO3  
Life Sciences  
C3-GR7-PO3  
C3-GR7-PO6

### Math

Data Analysis, Probability and  
Discrete Mathematics  
C1-GR6-PO2  
C1-GR6-PO3  
C1-GR6-PO4  
C1-GR6-PO7  
C1-GR7-PO8  
Number Sense and Operations  
C1-GRHS-PO2

### Social Studies

Geography  
C2-GR6-PO2  
C2-GR7-PO1  
C2-GR7-PO3  
C2-GR7-PO4  
C4-GR8-PO1  
C4-GRHS-PO1  
C4-GR8-PO2  
C4-GR6-PO3  
C4-GR8-PO3  
C4-GR6-PO4  
C4-GR7-PO4  
C4-GR8-PO4  
C4-GR8-PO6  
C4-GR8-PO7  
C4-GR7-PO10  
C5-GR6-PO1  
C5-GR6-PO2  
C5-GR8-PO2  
C5-GR6-PO3  
C5-GR8-PO3  
C5-GR8-PO4  
C5-GRHS-PO4  
C5-GR7-PO5  
C5-GR8-PO5  
C5-GRHS-PO5  
C5-GR7-PO6  
C5-GRHS-PO6  
C5-GR7-PO7

# Neolithic Survivor

## Answer Key



1. Energy required to farm land, soil depth, erosion, goats, how fast or slow students collected beans, 3 points for any of the three answers listed.
2. Check results for answer, 1 point
3. Check results for answer, 1 point
4. Check results for answer, 1 point
5. Any reasonable answer, 1 point
6. Yes/no, 0 points  
Check results for most stable village, 1 point  
The most sustainable village is the one that does not grow rapidly and experiences the fewest deaths overall, 2 points
7. Nonrenewable. Once it is eroded away, that piece of land will not support agriculture within our lifetime, 2 points
8. Negative, 1 point
8. People died or team members lost 1 point
9. 1 or more reasonable answers such as disease, warfare, cultural beliefs, 2 points
10. Any reasonable answer such as urban development, golf courses, drying riparian areas or wetlands for development, invasive species, 2 points
11. Yes or no depending on justification, 2 points ex: phoenix adds new habitat types to the desert with grass lawns, golf courses, tropical habitats and new plants by bringing in non-natives.



Buy for 30 beans  
Sell for 60 beans



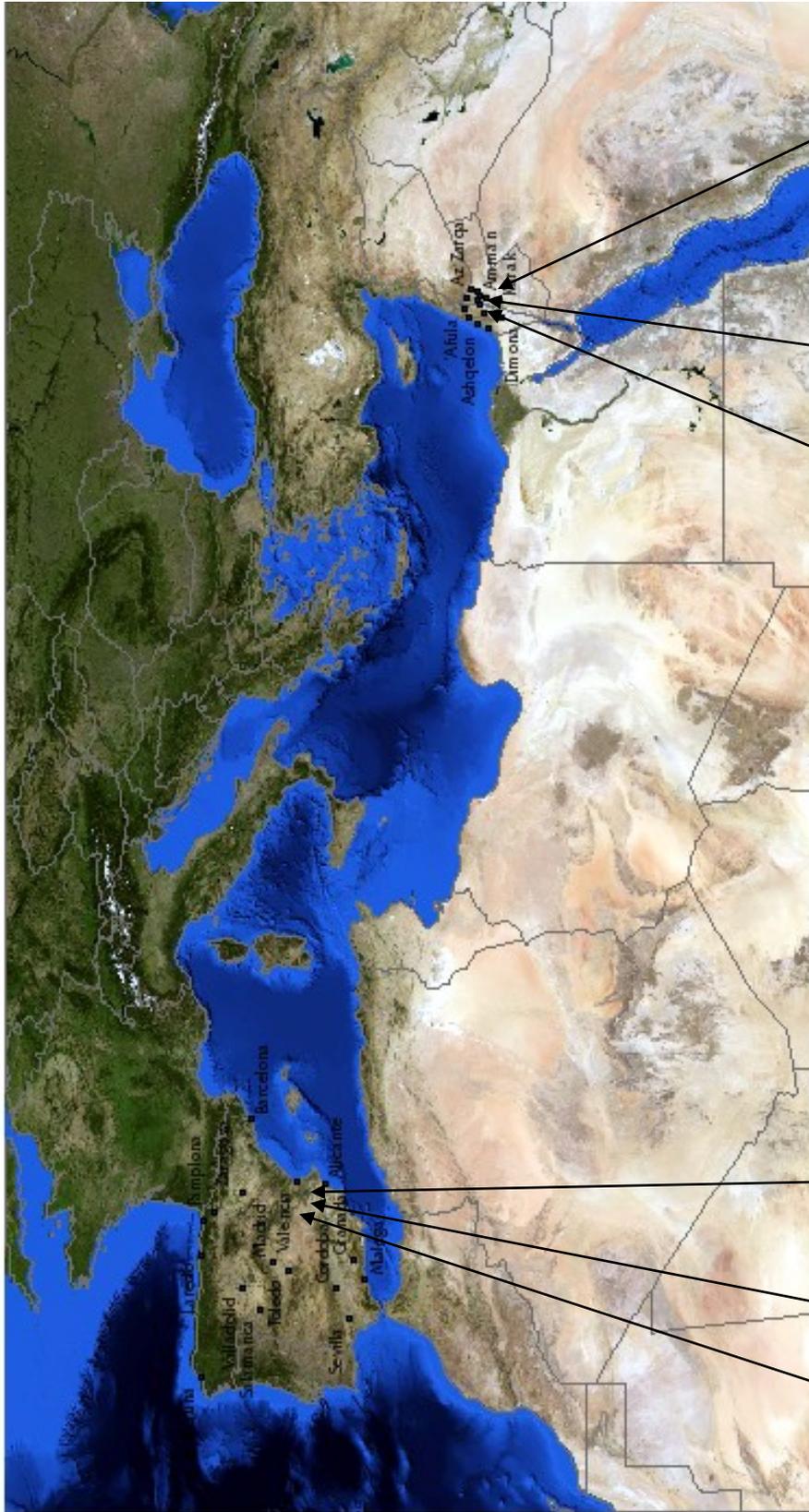
Buy for 30 beans  
Sell for 60 beans



Buy for 30 beans  
Sell for 60 beans



Buy for 30 beans  
Sell for 60 beans



B

D

C

A

E

F

# Mediterranean Neolithic Village Cards

## • Penaguila Valley, Eastern Spain:

You are living on flat, fertile farmland.

Each person in your village needs 2,000 calories a day or 20 beans to survive.

Your land is not large enough to feed goats. They would eat your crops.

**Action Each Round: collect 20 beans per person  
No Goats**

## • Tell Rakkan, Jordan:

You have a big farm covered with large trees that need to be cut down. There are three possible farming locations (marked by a flag). You can only farm one location at a time. To move to another location will require extra energy to clear the fields. You also have room for goats.

Each person in your village needs 3,000 calories a day or 30 beans to survive.

**Action Each Round: Collect 30 beans per person**

**Other Action Options:**

**Move to a new farming location for 60 beans. Move to the new plot in the next round**

• Niuet, Spain:

Your land is flat, but you have a long walk to the natural spring for water. You can have goats.

Each person in your village needs 2,500 calories a day or 25 beans to survive.

**Action Each Round: Collect 25 beans per person**

**Other Action Options:**

**Buy goats for 30 beans**

**Eat/trade goats and get 60 beans**

• Cova de la Sarsa, Spain:

Forest fires are common in summer because of the dry summer season since the climate began to change around 6,000 B.C.E. The fires actually help your farmland by clearing land for you and releasing nutrients back into the soil that help your crops grow. Although the fires also lead to more erosion.

Each person in your village needs 2,000 calories a day or 20 beans to survive.

**Action Each Round: Collect 20 beans per person**

• Jericho, Israel:

Your land is on a hillside making it easier for soil erosion to occur. Therefore, your soils are not as deep and not as fertile.

Each person in your village needs 3,000 calories a day or 30 beans to survive.

**Action Each Round: collect 30 beans per person**

• Jaffa, Israel:

You are living on a rocky, hilly farm. Because of erosion on the hillsides, the soils are not as deep.

Each person in your village needs 2,500 calories a day or 25 beans to survive.

**Action Each Round: collect 25 beans per person**

# Round Cards

<p>Round 1</p> <p>It's 10,000 B.C.E. and farming is just beginning at higher elevations where crops can receive enough rain to grow. Farming created a food surplus which helped increase the human population. <b><u>Add two people to your village.</u></b></p>	<p>Round 2</p> <p>It's 7,000 B.C.E. and farming is beginning to change the natural biodiversity because old forests are cut down and as plants regrow, they are burned back to farm the land again. There are fewer wild plants and animals to eat. <b><u>Lose one person.</u></b></p>	<p>Round 3</p> <p>It's 6,000 B.C.E. The climate is becoming warmer and raining harder. This causes more soil erosion and flooding. <b><u>You lose half of your harvest this round (half your people).</u></b></p>
<p>Round 4</p> <p>Pottery has been invented and begins to spread . You are able to transport more water each trip to the natural spring. This cuts back on the amount of work you have to do. You're able to collect more food. <b><u>Add one person.</u></b></p>	<p>Round 5</p> <p>Irrigation is invented and people are able to move to lower elevations and not rely on natural springs. You can now move to more fertile land. <b><u>Add one person.</u></b></p>	

# Neolithic Survivor

Student Sheet



## **The Background:**

### *Who were the Neolithic Farmers?*

They were the earliest people in our history to settle down and grow their own food instead of moving around to hunt and gather food. They mark the beginning of cities and modern civilization. They lived 10,000 years ago in the Mediterranean region. We're going to pretend we are Neolithic farmers and see what happens to our villages based on the decisions we make.

## **The Scenario:**

Children and teenagers require 2200-2800 calories per day. The exact number of calories your body needs depends on how much energy you burn each day.

For this game, we'll assume each group is burning different amounts of calories depending on how hard it is to farm the land around your village. If the soil is not very good, there are lots of trees that need to be chopped down, or you're farming on hills, you'll need to use more calories or food than a village on flat grass-land that grows many crops. Which do you think burns more calories, walking on a track or up the bleachers at a football stadium? You'll need to collect a certain amount of food depending on which village you choose.

Look at the map and list of villages to choose from. This information comes from actual archaeological sites scientists at ASU are studying. Villages may be assigned by your teacher or chosen by each group.

## **Goal:**

You'll want to try to sustain your village during the game through various challenges that come your way. Which village do you think will be the most sustainable? \_\_\_\_\_

Why? \_\_\_\_\_

## **Rules**

1. Each group represents a village. One person needs to be the **recorder** and will not collect food. Groups decide who this will be. One person needs to be the **runner** and will be responsible for bringing beans to the teacher at the end of each round and picking up a game card. This person will also be allowed to collect beans. All others will be **food gatherers**.
2. There will be 5 - three minute rounds.

### Rules for a Round:

- a. **Gathering food:** When the round starts, each food gatherer leaves the village to collect enough beans from the farm field to feed one person. Bring these beans back to your data recorder and dump them in his/her cup. Return to the field to collect more, each time returning with enough beans to feed one person. You may collect food for the entire round.
- b. **Data Recorder:** put one tally mark on the data sheet every time a food gatherer returns with beans. These marks show how many people can be fed at the end of the round.

# Neolithic Survivor

## Student Sheet



c. At the end of the round, determine how many people can be supported by the number of beans collected. This should be the same as the number of tally marks recorded on the data sheet. Add or subtract people from the villages based on what was collected.

Example: If your village started with 4 people and collected enough food for 9 people, you will have 4 real players and 5 “ghost players”. Your food gatherers need to collect enough beans to feed all 9 people in the next round or you will lose them. Record the total number of people now in the village on the data sheet at the end of round 1.

d. If you can buy or sell goats or move to a new piece of land (see f & g below), count out the extra beans to give to your teacher.

e. Runner: Bring all beans your village collected to the teacher. Dump these in the tub, collect a game card (and/or goat card) from your teacher, and return to your village with your cup.

f. Three flag villages: Your group must select one flag to start collecting food. You may move to another flag only after your group has collected 60 extra beans. This is the energy needed to “clear” the forest and create the new farm field. You can start using the new field in the next round. You cannot use the original field unless you decide to collect another 60 additional beans and move back there in a future round.

g. Some villages may purchase goats (30 beans) from the teacher. Goats can be sold back to the teacher for 60 beans.

4. You have 3 minutes between rounds to record data, buy or sell goats, and send the runner to the teacher.

### Glossary:

Soil fertility- describes how much plant growth the soil can support based on the amount of nutrients, minerals, organic matter, and water it contains.

Erosion- the movement of soil or rock by wind, water, or gravity.

Fallowing- after crops have been harvested, sometimes it is left unseeded the next year so that it can build up more nutrients in the soil through decomposition. This will allow the next harvest to be bigger than if it didn't fallow.

Neolithic- refers to a time period beginning 10,000 years ago when humans began farming. Before this, we relied on hunting and gathering for food. It was followed by the Bronze Age beginning around 3,000 years ago.

# Neolithic Survivor

Student Sheet



Village Name: \_\_\_\_\_ Number of beans/person \_\_\_\_\_

Village Roles:

Recorder: \_\_\_\_\_

Runner: \_\_\_\_\_

Food Gatherers: \_\_\_\_\_

Time 0: Started with 4 players

Round #	Tally marks for number of people you can feed	Total number of people at the end of the round	If allowed, number of goats you have at end of round.	What changes have been made during this round if any? Ex: strategy change, changed fields, lost people due to climate change, etc.
1				
2				
3				
4				
5				

# Neolithic Survivor



Name: \_\_\_\_\_

1. What were three variables that affected population sizes in this game? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

2. Which village had the most people at one given time? \_\_\_\_\_

3. Which village lost the most people after the “climate change?” \_\_\_\_\_

4. Why do you think this village lost the most people?

\_\_\_\_\_

\_\_\_\_\_

5. What was the strategy or decisions that your village made that either helped or hurt your sustainability?

\_\_\_\_\_

\_\_\_\_\_

6. Did you guess the correct village for which would be the most sustainable? \_\_\_\_\_ If not, which one do you think was the most stable? \_\_\_\_\_ Why were they?

\_\_\_\_\_

\_\_\_\_\_

7. Plants (crops) are dependent on fertile soil to grow. Soil is generated naturally on the scale of hundreds of years to thousands of years. Do you think soil is considered a renewable or nonrenewable resource? Why?

\_\_\_\_\_

\_\_\_\_\_

8. Is there a positive or negative relationship between population growth and food availability?

\_\_\_\_\_

9. If a village uses its resources faster than they are replaced, they exceed their carrying capacity. What happened when one of our villages exceeded its carrying capacity?

\_\_\_\_\_

10. Models need to be simple to understand how one variable affects another (land use on population). What other things could affect population size in Neolithic villages that is not included in the model?

\_\_\_\_\_

\_\_\_\_\_

# Neolithic Survivor



11. Farming changes the way the land looks (landscape). Archeologists know that Jordan was covered with forests before farming began. As Neolithic farmers cleared land for crops, they started to change the types of plants in the area. If trees take a long time to grow, and they were always cut down for farmland, then there would only be enough time for smaller plants to grow like shrubs and grasses. Can you think of other ways people change landscapes?

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12. The Medland's scientists realized that farming in the Neolithic actually increased plant diversity in the area. Before farming, Jordan was covered with tall trees. Over time, a lot of these were cut down and replaced by bare land, farmed land, grasses or shrubs. There were more diverse types of habitats. Do you think urbanization in Phoenix has increased or decreased plant diversity and habitat types? \_\_\_\_\_ Why?

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Grade:

## A) Participation points for playing Neolithic Survivor

10 points	7 points	0 points
Stayed on task and assisted team.	Needed 1 or 2 reminders to stay on task and assist team.	Needed to be removed from the game for not participating or 3 or more warnings to stay on task.

## B) Graphing worksheet points

Each label (3 per graph) and each data point (5 per graph) is worth  $\frac{1}{4}$  point.

Each graph has a total of 2 points

We had \_\_\_\_\_ villages/graphs for the class x 2 points each = \_\_\_\_\_ points possible

I earned \_\_\_\_\_ points

## C) Worksheet points

I earned \_\_\_\_\_ points out of a possible 20 points

## D) Total possible points

10 + \_\_\_\_\_ + 20 = \_\_\_\_\_ points  
graphing

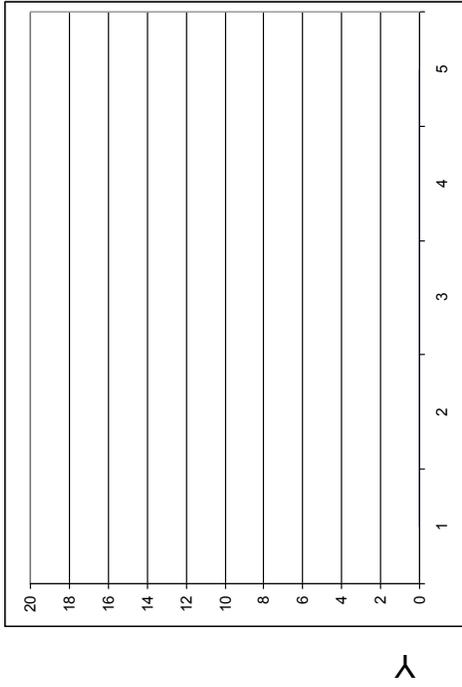
Total:  $\frac{\text{_____}}{\text{(A)}} + \frac{\text{_____}}{\text{(B)}} + \frac{\text{_____}}{\text{(C)}} = \frac{\text{_____}}{\text{(D)}} / \text{_____} = \text{_____} \%$

# Survivor Results Page

Name: \_\_\_\_\_

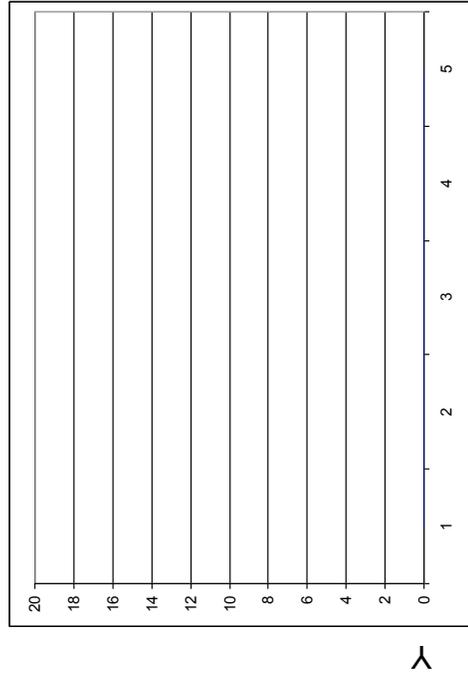
Recorder: list your population size each round on the board. Individually, fill in the graphs to show the population each

Title: \_\_\_\_\_



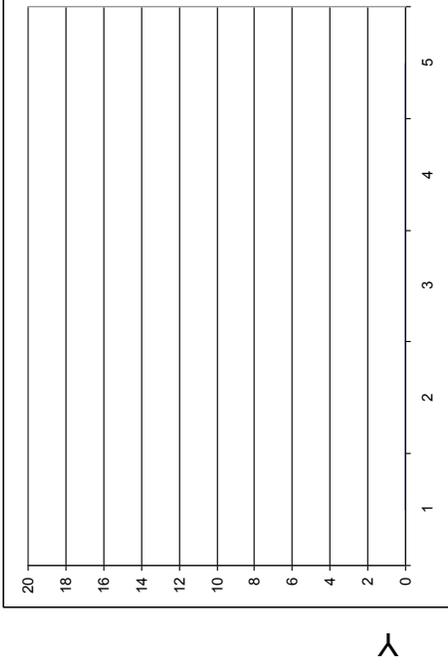
X

Title: \_\_\_\_\_



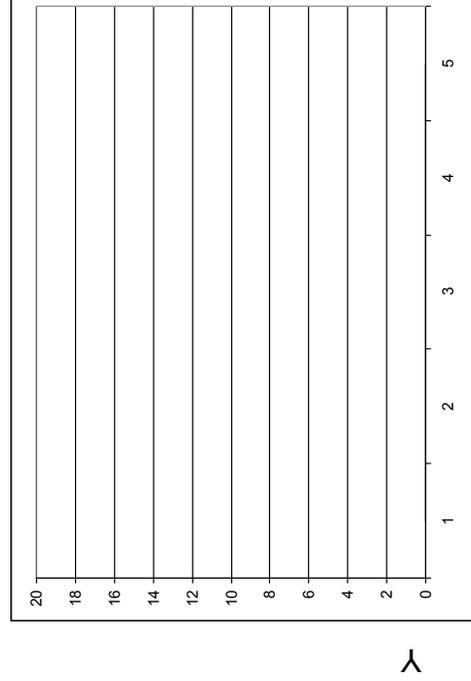
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Title: \_\_\_\_\_



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X

Axis labels:  
Round #  
Population size  
Village name,  
population  
over time



NAME: \_\_\_\_\_

Read the article: "The Hungry Planet". Then, answer the questions on the last page.

## **The Hungry Planet**

**by Geoffrey Lean**

<http://www.independent.co.uk/environment/the-hungry-planet-414479.html> **Sunday, 3 September 2006**

Food supplies are shrinking alarmingly around the globe, plunging the world into its greatest crisis for more than 30 years. New figures show that this year's harvest will fail to produce enough to feed everyone on Earth, for the sixth time in the past seven years. Humanity has so far managed by eating its way through stockpiles built up in better times - but these have now fallen below the danger level.

Food prices have already started to rise as a result, and threaten to soar out of reach of many of the 4.2 billion people who live in the world's most vulnerable countries. And the new "green" drive to get cars to run on biofuels threatens to make food even scarcer and more expensive.

The UN's Food and Agriculture Organization (FAO) and the US Department of Agriculture (USDA), which produce the world's two main forecasts of the global crop production, both estimate that this year's grain harvest will fall for the second successive year.

The gathering crisis has been largely unnoticed because, for once, the harvests have failed in rich countries such as the United States and Australia, which normally export food, rather than in the world's hungriest ones. So it has not immediately resulted in mass starvation in Africa or Asia.

Instead, it will have a delayed effect as poor people become increasingly unable to afford expensive food and find that there is not enough in store to help them when their own crops fail.

The lack of world attention contrasts with the last great food crisis, in the mid-1970s. Then Henry Kissinger - at the height of his powers as Richard Nixon's Secretary of State - called a World Food Conference, in which governments solemnly resolved that never again would they allow humanity to run short of sustenance. The conference, in Rome, resolved to eradicate hunger by the mid-1980s. Kissinger himself pledged that "within a decade, no child should go hungry to bed".

Yet, a generation later, more than 800 million people worldwide are still constantly hungry. And the new food crisis threatens to be even worse than the last one.

It was at the conference that I first met Lester Brown, who has, ever since, been the principal prophet of the coming scarcity, repeatedly warning of the new crisis which is now upon us.

Brown - who now heads the Earth Policy Institute, a respected Washington-based think tank - gleaned his first insights into the world's predicament as a tomato tycoon when he was a teenager. Back in the early 1950s, when he was just 14, he and his brother bought an old tractor for \$200 (£105), rented a couple of fields near their home in southern New Jersey and started growing the vegetables after school.

Soon the brothers were among the top 1 per cent of tomato growers in the United States. They easily qualified for the Ten-Ton Tomato Club - "the Phi Beta Kappa of tomato growers" - which is open to those who harvested that amount per acre.

# Neolithic Survivor

Extension Article



Then Campbell's Soups, trying to lower costs, threw money into research to increase yields. Within a few years, the club had to change its name to the Twenty-Ton Tomato Club. But the pace of improvement could not be sustained. Despite decades of more research growth of yields slowed dramatically; by the mid- 1990s the best growers were getting about 30 tons of tomatoes per acre.

That, says Brown, is what has been happening to the world's harvests as a whole. Between 1950 and 1990 grain yields more than doubled, but they have grown much more slowly since.

"The near-tripling of the harvest by the world's farmers was a remarkable performance," says Brown. "In a single generation they increased grain production by twice as much as had been achieved during the preceding 11,000 years, since agriculture began. But now the world has suffered a dramatic loss of momentum."

Apart from increasing yields, there has always been one other way of boosting production - putting more land under the plough. But this, too, has been running into the buffers. As population grows and farmland is used for building roads and cities - and becomes exhausted by overuse - the amount available for each person on Earth has fallen by more than half.

There are more than five people on Earth today for every two living in the middle of the last century. Yet enough is produced worldwide to feed everyone well, if it is evenly distributed.

It is not just that people in rich countries eat too much, and those in poor ones eat too little. Enormous quantities of the world's increasingly scarce grain now goes to feed cows - and, indirectly, cars. As people become better-off, they eat more meat, the animals that are slaughtered often being fed on grain. More than a third of the world's harvest goes to fatten animals in this way.

Cars are a new concern, the worry arising from the present drive to produce green fuels to fight global warming. A "corn rush" has erupted in the United States, using the crop to produce the biofuel, ethanol - strongly supported by subsidies from the Bush administration to divert criticism of its failure to ratify the Kyoto Protocol.

Just a single fill of ethanol for a four-wheel drive SUV, says Brown, uses enough grain to feed one person for an entire year. This year the amount of US corn going to make the fuel will equal what it sells abroad; traditionally its exports have helped feed 100 - mostly poor - countries. This will not only cut food supplies, but drive up the price of grain, making hungry people compete with the owners of gas-guzzlers.

Brown expects the food crisis to get much worse as more and more land becomes exhausted, soil erodes, water becomes scarcer, and global warming cuts harvests.

Making cars more fuel-efficient, and eating less meat would help but the only long-term solution is to enable poor countries - and especially their poorest people - to grow more food. And the best way to do that, studies show, is to encourage small farmers to grow crops in environmentally friendly ways. But the world needs a new sense of urgency. "We are living very close to the edge," says Brown. "History judges leaders by whether they respond to great issues. For our generation, the issue may well be food security."

# Neolithic Survivor

Extension Article



## Questions:

Cars produce greenhouse gases, which contributes to climate change. Bio-fuels looked like a good way to cut back fossil fuel use. Using the information from the article you read, explain why using bio-fuels may be more complicated than was originally thought.

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Look at the graph below showing human population growth on Earth over time. Does this look like sustainable growth? Explain your answer using the article or what you already know.

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