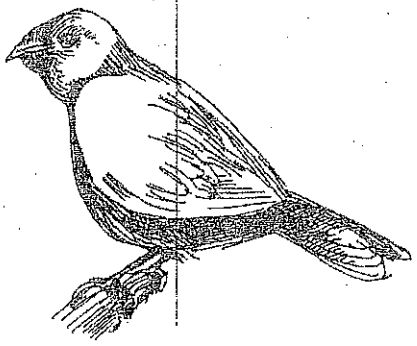
INTRODUCED GOATS VS. GIANT TORTOISES

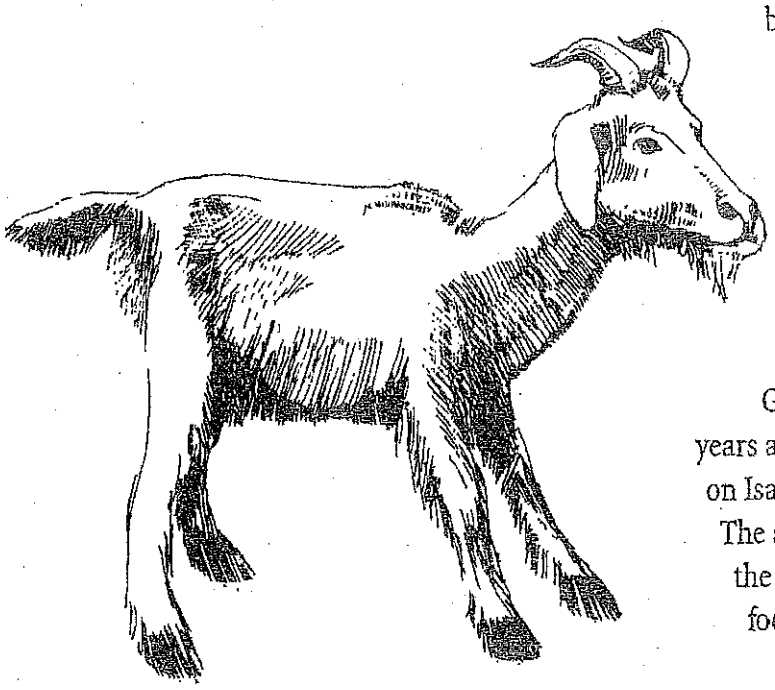
The following is a journal entry from Dr. Betsy Jackson, an ecologist doing research on the habitat of the Galápagos giant tortoise, *Geochelone elephantopus*. Dr. Jackson has recently finished her observations of the tortoises of Española Island and has now set up an observation post on the largest island in the Galápagos Archipelago, Isabela. Dr. Jackson is attempting to document the impact of introduced species such as goats on native populations of giant tortoises.



Isabela Island, August 3, 1999

I have finally finished my first round of research in the Galápagos Islands, spending two weeks on Española Island in the southern portion of the Galápagos. I really love Española because of the great variety of animals I was able to observe there. The antics of the sea lions down on the beach and the courting behaviors of the blue-footed and the masked boobies were a delight to watch. Of course, I was really interested in the tortoises, which have been reestablished on the island of Española. While the population numbers are still fairly low, with careful management and protection these wonderful animals should survive.

Now I've begun the next part of my research on Isabela, the biggest island in the Galápagos. The population of tortoises on Isabela is much larger than on Española, but there is a much larger threat to their success—aliens!! These aliens have horns on their head, cloven feet, and eat just about anything. They're not from outer space, though; these aliens are goats. Goats are considered alien to the Galápagos Islands because they were brought to the islands by humans, not nature.



Goats were brought to the islands nearly 200 years ago, and a recent population estimate of goats on Isabela indicates approximately 100,000 animals. The sheer number of goats is the main problem for the tortoises because they compete for the same food. Not only do goats eat plants, they eat all of

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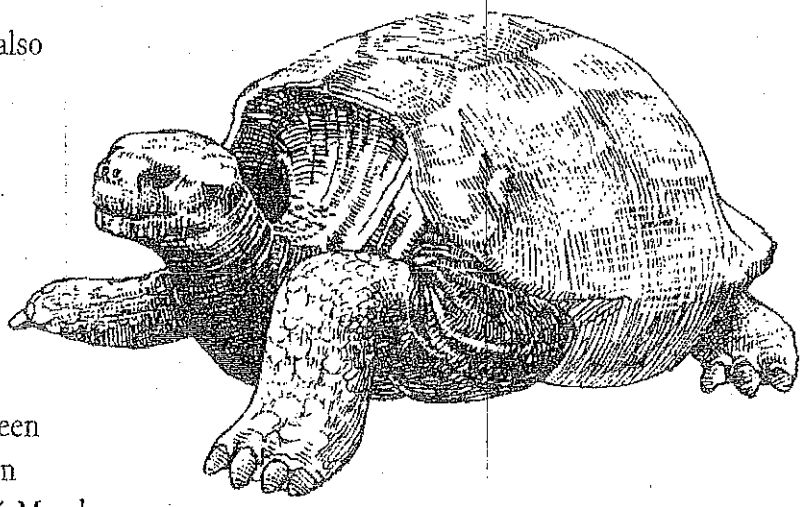
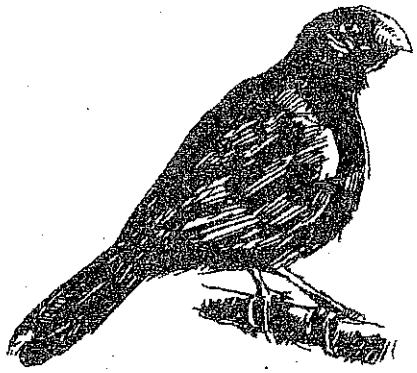
the plants that the tortoises eat. And goats are very good eaters—they eat the native grasses and other vegetation down to the roots—so there is less food for the tortoises, and the plants can hardly recover from the goat grazing activity. Besides being major competitors of the tortoise, these alien goats also affect other animals on Isabela. One of the worst problems is the destruction of ground finch nests. As I walk around the island, I notice areas that show many trampled bird nests, although I never actually saw any goats stepping on them.



The campaign to rid other islands of these competitors to the native tortoise has been pretty successful in the past—goats have been eliminated from Española, Plaza Sur, Santa Fé, Marchena, and Rabida Islands. But Isabela is different. Because it is almost 20 times the size of all these other islands combined, the efforts by the scientists from the Darwin Research Station to eliminate the goats has had little effect on the goat population there.

I have been watching the feeding grounds of the Isabela tortoises for a few days now, and the competition for food does seem to be a problem. Goats eat plants as soon as they start to grow, and the goats are able to migrate from one area to another area on the island fairly easily. Because the tortoises cannot move as quickly or easily over different types of ground, they are not able to move to areas where there may be more food. The recent El Niño of 1997–98 will give some relief because the extra rain will cause the plants to grow more quickly, but I think this is only temporary relief. By the next dry spell, the problem of goat competition will quickly worsen.



I love to watch the tortoises move and graze. There are certainly more of them on Isabela than on Española, but the increased competition for food will be a very big problem unless something is done about the goats.

Greeting the Galapagos Goats

Name:_____

Part 1: Activating Prior Knowledge

In the space below, bullet 5 or more facts that you have learned about non-native (invasive) species over the past couple of days.

Part 2: The Galapagos Goats & Tortoises:

Read the journal entry from Dr. Betsy Jackson. Answer the questions below.

1. What kind of consumers are the tortoises? Explain.

2. What kind of consumers are goats? Explain.

3. What problem does this cause to both species?

4. Who is to blame for this problem? Why? ~~Describe the connection to the species of the week we have been studying.~~

5. How did the introduction of the goat affect the tortoise? Explain thoroughly.

6. How else could the goats affect the island ecosystem? What other organisms/species are involved? Describe the problem the goats are causing for the finches.

7. Describe any long-term effect for the Island of Isabela. Why is Isabela in greater danger than the other islands in the Galapagos?

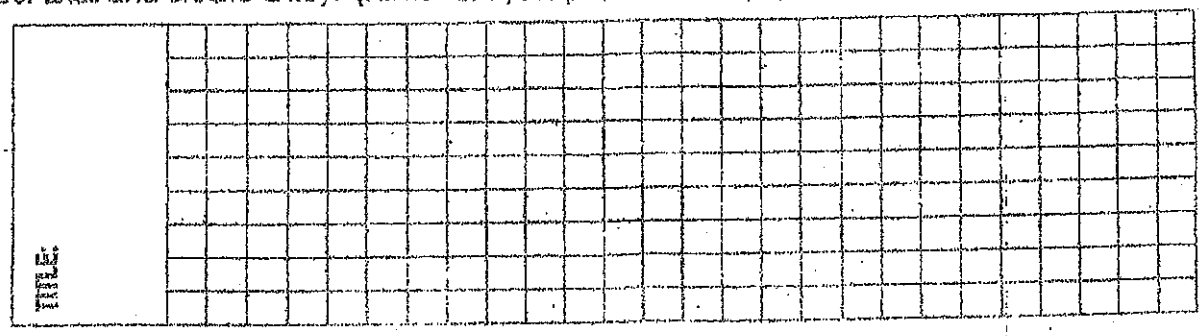
Non-Native Invasion: Goats vs Finches

Initial Analysis:
Describe the appearance of the island:

Data Collection:

	COLOR	# Tree/bush nests	# Ground Nests	# of Finches	# of Goats
In the beginning					1
End of Round 1					
2					
3					
4					

Graph: Create a double line graph of the finch and goat population over time. Be sure to label your axes and create a key! (HINT: Turn your paper sideways!) ☺



Reflection:
1. What was the impact of having the goat population double each round? **Describe** what this modeled!

2. Why was the goat told to close his/her eyes? **Explain** the significance of them not being able to see?

3. Were any birds destroyed directly? **Why or why not?** Were any of the tree nests truly destroyed? **Why or why not?**

4. How did the goats affect the finches **indirectly?**

5. How did the goats directly affect the appearance of the island? (HINT: refer to your initial description of the island!)

Non-Native Invasion: Goats vs Finches
Directions

Background Information:
Galapagos goats were introduced to the island of Isabella by humans. As the goats roam the island in search of food, they cause many problems. For starters, they are able to out-compete the tortoises for food. This has been causing a decline in the tortoise numbers on the islands. The finch population is currently being affected. The grazing goats trample the finch nests that are located on the ground. This, in turn, causes the finch species to lose their shelter. During all of this, the goats are meeting their own needs and their population is growing exponentially.

Codes:

 = trees and bushes with nests – can hold 2 finches each

 = ground finch nests – can hold 1 finch each

The Starting Data:
1. Obtain an island map from your teacher.
2. Record the number of ground and tree/bush finch nests found on the island onto your data table (in the beginning).
3. Using the codes above, determine the finch carrying capacity of the island based ONLY on the limiting factor of **shelter**.
4. Record this number of finches onto your data table (in the beginning).

Goat Time!
Round 1:

1. Assign one group member the role of the goat. Have this student choose a color (pencil, crayon, or marker) to use for round 1.
2. The goat must CLOSE HIS/HER EYES and makes one path through the island by drawing a line.
3. Open your eyes. All group members observe how many nests were "trampled" along the path.
4. Record your data for the end of round 1 on your data table. (HINTS: 1. use the code above to determine the # of finches; 2. the goat has met its needs and doubled in #!)

Rounds 2 – 4:

- Repeat the same process as above **with a different color each round.** Remember: the number of goats you END with in a round is the number you must BEGIN with in the next round! You may need to include more group members as the goat population increases (at some point, you may need to use both hands or make a path twice!)
  - Goats close eyes
  - Goats make a path through the island
  - All group members analyze nests that have been trampled
  - All group members calculate the number of finches that survive by finding shelter
  - All group members record data
- Be sure to record your data at the end of each round
- Create the graph and answer the conclusion questions!