**The Teal Spruce Sampling Game: Student Instructions**

You are scientists trying to figure out how the Teal Spruce tree arrived at the distribution we see today (marked in green on the map). Glaciers during the last Ice Age covered most of where Teal Spruce is now distributed (everything above the dotted blue line on the map). We know that Teal Spruce trees managed to survive at the far south end of their range, near what is now the town of Huville. However, scientists noticed something odd about the distribution of Teal Spruce: it is split into two populations, a “west population” and an “east population”, separated by a mountain range. Scientists can’t decide where the East Population came from. Some think that the Heath Mountains are too big of a barrier for Teal Spruce to have crossed, and that they must have managed to survive the Ice Age in the small, glacier-free portion of the eastern range. Others, however, point out that Teal Spruce does not do well in a cold climate. They say the East Population had to have been wiped out by the last Ice Age, and that a migration from the West Population is the only possible explanation.

Where did the East Population come from? Did it move in from the west, or did it spring up from ice-age survivors in the east? Big events, like ice ages, have a big impact on the distribution of a species that tend to leave telltale signs in their DNA. By comparing the DNA of samples taken across a species distribution, scientists can piece together clues about the species history and determine how those populations came to be where they are. Your group will go out into the field and collect DNA from the Teal Spruce trees to look for clues that could explain how their unusual distribution came about.

**Playing the Game**

*Part 1: Decide on a sampling strategy*

Talk with your group and answer the following:

1. What is the question you are trying to answer?
2. What do you think are some possible answers to that question?
3. For each of those answers, what DNA patterns would you expect to see?
4. What sites do you need to sample to be able to answer your question?
5. How many samples can you afford to collect from those sites?

*Part 2: Collect your samples*

After deciding on a sampling strategy, your group will need to collect samples. You can collect up to 6 samples for each site, provided you have the necessary budget. When you reach a site, draw the number of samples you decided upon (1-6). As you draw a sample, fill in its color at the appropriate site on your map. Black out any samples on your map that you did not collect, so that only your data remains visible. Continue until you have collected all your samples. (***Example****: You collect 5 samples from site “H” and find 3 blue and 2 red, so you would fill in 3 blue spaces, 2 red spaces, and 1 black space for site “H”*).

*Part 3: Interpret your data*

1. Look at the DNA evidence you found during your field collections. How do they compare to what you expected in Part 1, questions 2 and 3? Can you see a pattern? Which answer do you think they match?
2. What do you think happened to Teal Spruce during the last Ice Age, and what happened to it afterwards?

Wait for the other groups to reach this point. Each group will make a short presentation to the other groups with what they found. Pay close attention to other group’s results and see how they compare to your own conclusions.

1. Did the other groups reach the same conclusions? If not, did they use a different sampling strategy?

Now that everyone has presented their results, the teacher will show you what having perfect data would have looked like (all six samples from all ten sites)

1. Have the overall conclusions changed? Did having all the data make a difference?
2. What is the optimum sampling strategy if funding is limited?