The government of Kapikua wants to expand biodiversity conservation efforts on the island. The government has two goals: 1) to protect the overall biodiversity and sustainability of the island ecosystem, and 2) to protect the endemic primates that live in the forests on the island. The endangered primates are unique and very sensitive to habitat changes. This puts them at a higher risk of extinction. The primates have also become a well-known attraction for ecotourists from around the world. The government has enough funds to fully support conservation at only one of four forest areas being considered for conservation. You are a member of the conservation team that will advise on which area should get full conservation support.

In this activity you will learn more about each of the four areas and select one for conservation. You will use additional evidence from an evolutionary tree for the primates to decide which area should be conserved.

**Challenge**

Which of four areas should receive priority for conservation?
Procedure

Part A: Four Possible Conservation Areas

1. With your group, assign to each student one of the four forest areas under consideration for conservation. Work by yourself to read below and on the next pages the summary of your assigned area.

2. In your science notebook, make a chart like the one shown below. Fill in the chart for your assigned forest area.

<table>
<thead>
<tr>
<th>Forest area</th>
<th>Economic outcomes if conserved</th>
<th>Social outcomes if conserved</th>
<th>Environmental outcomes if conserved</th>
<th>Benefits of conserving the area</th>
<th>Trade-offs of conserving the area</th>
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3. Present a summary of your forest area to the members of your group. As your group members present the information about their forest areas, complete the chart.

Area A: Mangrove Forest

UNIQUE CHARACTERISTICS

The mangrove forest on the island is dense with stilt mangrove trees and shrubs that grow in brackish coastal swamps. The roots of the mangrove trees filter the salts out of seawater. They also filter silt and nutrients from river water, allowing clear water to flow to the nearby coral reef. The vegetation serves an important role in the coastal area as a buffer to protect the nearby shoreline villages from hurricanes and other storms. The vegetation also prevents erosion along the riverbanks. Mangroves provide food and shelter to a variety of organisms.

CONSERVATION CONSIDERATIONS

In recent years, partly because of mangrove forest degradation, the inland areas of the island have been damaged by flooding from severe storms that have blown in. Almost all of the buildings and houses in one village were lost to the flooding. The villagers lost their crops and homes, and had to move to other areas.

Mangrove Forest

| Land area to be conserved (%) | 3 |
| Number of endemic species in the area | 14 |
| Number of endemic species threatened | 7 |
If the area is conserved, the island government plans to offer limited permits at a reasonable cost for sustainable ecotourism to the area. For those who live on the island, ecotourism would provide jobs ranging from researchers and tour guides to restaurant waiters, cooks, hotel workers, drivers, and boat crewmen. People who make handicrafts and other goods also would earn money by selling their wares to tourists. Park fees would bring in revenue that would also contribute to the island’s economy.

Currently, island residents have unlimited access to the mangrove forest for fishing and shrimping. Some fishermen have small businesses in which they sell their catch at local markets. Others fish for recreation or to feed their families. If the mangrove is conserved, a strict catch limit will be enforced in order to protect the food sources for a variety of organisms in the ecosystem. The new limits could force the local fishermen to downsize their businesses and reduce their income.

**Area B: Lowland Tropical Rainforest North**

**Unique Characteristics**

The lowland tropical rainforest is the most biodiverse area on the island, although the northern region of the rainforest is less diverse than the southern region. The earliest settlers in the northern area introduced new plants and animals to provide sources of food, medicine, building materials, and decoration. They cleared land to plant agricultural crops, and hunted lizards and birds for additional food. Since the first settlers came to the area, logging, development, and agriculture have destroyed 95% of the northern region’s forest.

**Conservation Considerations**

A small family-run business harvests coffee from the plants they have grown in this forest area. The exported coffee is a desirable commodity for people in other countries, and it is marketed as some of the best quality and most sustainable in the world. It benefits the family and a small number of workers hired to help with the harvest. If the forest is designated for conservation, the family will no longer have access to the forest for their coffee. This would mean lost income, with family members and the small number of people employed by the business losing their jobs. However, the species that live in the remaining 3% of undeveloped area will be protected.
Area C: Lowland Tropical Rainforest South

**UNIQUE CHARACTERISTICS**

The southern region of the lowland tropical rainforest is the most biodiverse on the island. It is larger than the northern region of the rainforest, and because the earliest settlers remained mostly in the northern region of the forest, this area was not as severely deforested as the north. Medical research scientists search for unique species in this area that may provide substances for new medicines. A number of tree-dwelling species depend on the kapok trees as a highway that allows them to move around the forest without having to travel on the ground.

**CONSERVATION CONSIDERATIONS**

If this area were conserved, the vast biodiversity of the area would be protected, including the plant species central to pharmaceutical research and product development. Research scientists would be assigned permits to collect specimens in a sustainable manner from the area. Recently, a team of scientists was sent to the island to research a plant found nowhere else that shows potential as a new malaria treatment. If the treatment is successful, it could save millions of lives. The research institute signed an agreement with the Kapikua government that a percentage of the profit made from products containing substances from Kapikua plants will go back into the island economy.

If this area is conserved, the government plans to build a primate center to research and protect the endemic primates that live in the island forests. This center will also be the focus of a program to educate the public. Permits will be available for ecotourists to visit the center to observe the primates and learn more about them through tours and exhibits. However, the cost of the permits will be much higher for this remote area than the cost to tour the mangrove forest. The primate center and access for ecotourists will require the construction of roads and facilities, which will be done in the most sustainable manner possible. For island residents it will provide such jobs as tour guides, drivers, lab technicians, and instructors.
Area D: Tropical Montane Cloud Forest

**UNIQUE CHARACTERISTICS**

The tropical montane cloud forest ecosystem plays an important role in the water cycle and climate on the island. Experiments have shown that cloud forests prevent the evaporation of precipitation far better than non-cloud forests do. The precipitation in the cloud forest is mostly in the form of fog, which condenses on the trees and drips onto the ground. The water soaks into the soil, where it is stored. Any excess runoff drains into stagnant water pools in the forest. The large water supply in the soil and the pools supports a wide variety of organisms.

**CONSERVATION CONSIDERATIONS**

Such human activities as logging and clearing the land to plant crops have degraded the cloud forest on Kapikua. This is a concern because during the dry season it is important that water from the cloud forest reaches the lower elevations where it is needed for irrigation, power generation, and drinking water. Recently, there have been reports of pollution problems with the water supply in another area of the island. Because of these reports, the government is concerned that in the future there will not be an adequate supply of clean water for the island. If conserved, the cloud forest would supply one source of clean drinking water.

Two decades ago, a corporation bought a portion of the cloud forest to develop a large tea plantation. The tea is highly desirable worldwide because the unique growing conditions give it a flavor that people love. Currently, there is a plan underway to expand the plantation to meet the growing demand for the tea. If the cloud forest is conserved, the tea plantation would not be permitted to expand, the company would not increase its profits, and no additional jobs for islanders would be created.

However, if the area were conserved, the risk of further adverse effects on the water cycle, climate, and organisms that depend on these resources would be reduced. For example, the fastigo whipping frog is a rare species that inhabits only the cloud forest. It lives in bushes close to shallow pools of standing water and breeds in the standing water. If the forest area is not conserved, the frog might be further endangered.
4. In your science notebook, write a brief summary for which forest area you would select for conservation based on the information you have so far. Explain your reasoning.

**Part B: Evolutionary Tree Analysis**

5. In your science notebook, add to the chart you created in Step 2 a column labeled “Phylogenetic diversity of primates.”

6. With your group, compare the evolutionary tree below for each of the four forest areas. The tree shows evolutionary data for primate taxa that are endemic to the island. In the column you created in Step 5, record the number of the node that represents the most recent common ancestor for all of the primates collectively living in each of the four areas.

7. In the column you created in Step 5, describe the phylogenetic diversity of the primate species living in each forest area.

8. Conduct a Walking Debate as a way to share your ideas with the class about which forest area should have conservation priority. Your teacher will explain how to run the debate.
Analysis

1. Which forest did you decide should be conserved? Cite at least three pieces of evidence to explain your reasoning, and state the trade-offs of your decision.

2. Describe three indicators you would recommend using to monitor the success of the conservation over the next 10 years if your recommendation from Question 1 were implemented. These indicators can be any observations that will help determine if the recommendation is successful.

3. What social, economic, and environmental elements of sustainability were involved in your considerations about which area should be conserved?

4. What scientific evidence influenced your considerations about which area to conserve?

**KEY VOCABULARY**

<table>
<thead>
<tr>
<th>biodiversity</th>
<th>lineage</th>
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<tr>
<td>ecosystem services</td>
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<td>taxon</td>
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<td>evolutionary tree</td>
<td>trade-off</td>
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| indicator | }