Many scientists conduct scientific investigations in California State Parks . These investigations help solve problems and preserve and protect park resources. Complete the lab sheet so that you can more thoroughly understand the scientific study at which we will be looking.

Scientific Investigation Title

The Research Questions

List some hypotheses that might answer the Research Question.

Predict at least three kinds of data that scientists will need to collect to test the hypothesis.

Identify at least two variables that may affect the yearly data that is collected.

List tools/materials/technology scientists might use to collect their data.

What are some challenges that scientists might have as they try to design an experiment around the hypotheses you listed above.

Use this space to write down your observations during the videoconference.

Observations

After the videoconference you should be able to analyze this scientific investigation and write some conclusions based on the data, shared information and observations you have learned.

Conclusions

Use your projector, overhead or blackboard to show the name of the ***Scientific Investigation Title*** and ***Research Question.***

Have students fill in the answers to the questions prior to the videoconference. The answers below are only a few examples of appropriate responses. Use the Observations and Conclusions Worksheet to capture observations during the videoconference and for formulating conclusions afterwards.

Scientific Investigation Title	***The 2003 Cedar Fire and the regeneration of Cuyamaca Rancho State Park forest***
The Research Questions	***Why do large areas of the forest still have no new tree seedlings?***
	Why is the regrowth dominated by a single shrub species?

Hypotheses that might explain what is happening in the Research Question

Animals are eating all of the new seedlings when they start to grow.
The burned soils can no longer support the growth of trees.
The slopes are too open to wind and weather to allow new trees to grow.
No tree seeds are available for regrowth

Data that scientists will need to collect to better understand the investigation.

Habitats that border the forests and variations in the forests at different elevations.
Plant and animal species that makeup the regrowing areas of forest.
Plant species diversity of the original forest.
History of fire in the area from tree ring data.
Groundcover density, trees of medium and tall size, amount of shade and open areas.
Seedling survival rates by species.
Soil variations in different locations.
Amounts of nutrients in the soil.

Identify variables that may affect the yearly data that is collected

Disease
Temperature history
Rainfall amounts and time of year
Competition from plant species that regrow quickly after fires
Exotic plant invasions
Water retention of soils
Human and animal impact on regrowth

Tools/materials/technology scientists might use to collect their data:

GPS, GIS maps, soil chemistry kits, plant and animal identification guides, tree height and circumference measurements, ropes, flags, survey tape.

Challenges that scientists might have

Large areas to survey in steep mountainous terrain, new seedlings need protection from sun, erosion, disease and predators, identifying the most successful areas to replant and restore.

Create a bar graph that shows the number of three different species of trees planted after the 2003 Cedar Fire. Use a different color for each species, or label your bar with the name of the species.

Use the "years" on the x-axis and the "number of trees" on the y-axis.

Write three statements that explains the data on your graph.

Tree Species	2010	2011	2012
Jeffery Pine	64,275	66,470	61,490
Sugar Pine	2660	6090	7970
Coulter Pine	1875	20,170	10,480
Incense Cedar	6025	0	0
Total Number of Trees Planted			
Total Number of Acres Planted	283	489	454

Calculate the number of trees per acre.

Add the total number of trees planted each year in the table above.

Use the following formula to calculate the number of trees per acre:

Total trees planted/Total number of acres planted = trees/acre

2010

2011

2012

What do you notice about the number of trees planted per acre over the three years of the project?

Write two hypotheses that might explain why there is a change in the number of trees planted over the first three years.

Have students create a bar graph using a different color for each species of tree planted each year for the last three years.

Use "years" on the x-axis and the "number of trees" on the y-axis.

Tree species being planted	2010	2011	2012
Jeffrey Pine	64,275	66,470	61,490
Sugar Pine	2660	6090	7970
Coulter Pine	1875	20,170	10,840
Incense Cedar	6025	0	0
Total number of trees	***74,835***	***92,730***	***80,300***
Total number of acres	283	489	454

Have students figure out how many trees are being planted per acre.

Calculate the number of trees per acre based on the following data:

Total trees planted/Total number of acres planted = trees/acre

2010 - 74,835 /283 = 264.43 (264)

2011 - 92,730/ 489= 189.63 (190)

2012- 80,300/ 177 = 176.87 (177)

What has happened to the # of trees per acres over the first three years of the project?

The number of trees planted per acre has decreased.

Write two hypotheses that would explain the change in the planting procedure.

The habitats where the trees are being planted are different.
The first planting was so successful that they lowered the numbers needed to plant.
The yearly climate differences cause variable success.
There was too much competition in the first year's planting.
They do not have the same amount of money for trees each year.
There are more people weeding and tending the trees so fewer need to be planted.
The erosion decreases over time and planting methods change creating more success.

Cuyamaca Rancho State Park

www.parks.ca.gov/?page_id=667

The California Forest Foundation – This organization's mission is to foster public understanding of forest ecosystems in California and they have many resources for teachers. There are short videos and a variety of lesson plans to introduce students to the basic concepts of forest ecology, fire ecology, mixed conifer forests.

www.calforestfoundation.org

American Forests, the oldest national nonprofit conservation organization in the country, advocates for the protection and expansion of America's forests.

www.americanforests.org/cuyamaca-rancho-state-park-reforestation-project

CUYAMACA RANCHO STATE PARK AND THE 2003 CEDAR FIRE

Cuyamaca Rancho State Park is located 40 miles east of San Diego on Highway 79 in San Diego County, California. The park is situated within the Peninsular Range of mountains with elevations that range between 3,400 feet and 6,500 feet. Vegetation in the park is a mix of grassland, Chaparral, oak woodland, mixed conifer and hardwood forests (Coulter pine, canyon live oak, black oak) and coniferous forests (sugar pine, incense cedar, Jeffrey pine). Coniferous forests dominated the eastern and the northern aspects in the higher elevations prior to the Cedar Fire. The park averaged 440,000 total annual visitors in 2009 and 2010. The developed areas of the park include over 160 campsites, hiking, biking, and equestrian trails, the San Diego Outdoor School Camp, nine permanent and one seasonal residence and one historic house which is not yet open to the public.

In October of 2003, the Cedar Fire burned over 270,686 acres in Southern California including almost the entire Cuyamaca Rancho State Park. This was the largest recorded fire in California as measured by fire perimeter maps which have been used to document the extent of burned areas since the early 1900's. Conifer mortality in the park was extremely high (>95%) due to the fire severity and extremely high temperatures which resulted in very low seed cone survival. Post-fire vegetation is dominated by herbs, shrubs and re-sprouting oak species. Conifer forest is regenerating at only a small fraction of its pre-fire density.

In 2003, the Cedar Fire, California's largest fire in recorded history, destroyed 95% of the conifer forest in the 25,000 acre Cuyamaca Rancho State Park. The Cuyamaca Rancho State Park Reforestation Project is designed to restore the park's diverse native forest. The reforestation work consists of planting approximately 1,000,000 seedlings across 10% of the park lands in strategically located areas. Through maturation and seed dispersal these seedlings will promote the restoration of the conifer forests over time resulting in conditions favorable for critical wildlife habitat for rare and sensitive species, increased recreation values for southern California residents, and improved air quality through carbon sequestration and storage. The Project is currently undergoing third party verification to become the first reforestation project and first project on public lands to become registered at the Climate Action Reserve. Project activities are being conducted by the California Department of Parks and Recreation in partnership with the California Department of Forestry and Fire Protection (CAL FIRE).