

GLOSSARY:

Biome: A community of plants and animals that occupies a distinct region. Terrestrial biomes, typically defined by their climate and dominant vegetation, include grassland, tundra, desert, tropical rainforest, as well as deciduous and coniferous forests.

Greenhouse: A building, room, or area, usually of transparent material, in which the temperature is maintained within a desired range, used for cultivating tender plants or growing plants out of season.

Sluice gates: A water channel controlled at its head by a gate used to control water levels and flow rates in rivers and canals.

Telemetry: The use of radio waves, telephone lines, or other means, to transmit the readings of measuring instruments to a device on which the readings can be indicated or recorded. 2. The measurement of linear distance using a tellurometer.



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Show Me Science Advanced

Electronics - Environmental Applications

K4575DVD

Advanced Teachers Guide

SYNOPSIS:

With the help of electronics, the Eden Project in England has successfully recreated an ecosystem similar to one found in the Caribbean or the Amazon. Scientists and engineers designed a bio-dome to serve as a greenhouse. A series of electronic sensors helps to govern the temperature, humidity and soil composition. Weather stations on the outside detect temperature, solar energy levels, wind speed, and rainfall, which is necessary because it affects the interior of the bio-dome to a degree.

Flooding is a natural disaster that affects people all over the world. Electronic river management systems are being put in place so potential flooding can be identified and possibly controlled. This issue shows how we are utilizing electronics to understand environmental conditions and help to avoid disaster. As more biomes across the planet experience extremes in weather, and as more natural disasters such as hurricanes and tsunamis affect densely populated areas, this technology will increase in importance.

CURRICULUM UNITS:

- Chemistry
- Computer engineering
- Computer science
- Engineering
- Physical science
- Physics

CAREER OPPORTUNITIES:

- Chemist
- Civil engineer
- Computer aided design and drafting (cad)
- Engineer
- Environmental engineer

PROGRAM OVERVIEW:

With advancements in science and engineering, not only can we predict and limit the impact of environmental disasters, but we can imitate nature itself. Scientists created the Eden Project, a hot and humid tropical environment, by building an enormous greenhouse made of a special plastic foil. The material is transparent, allowing for sun to reach the plants.

Recreating this complex tropical environment was achieved with the help of a variety of sensors inside and outside of the greenhouse. Inside sensors check air temperature, humidity and soil temperatures. Outside sensors check temperature, solar energy, wind speed, and rainfall because these factors affect the inside of the greenhouse as well. Humidity sensors are linked to a series of foggers or misting nozzles that turn on and off to maintain a specific humidity index.

To help prevent natural disasters, scientists and engineers have developed systems to monitor potential flood areas. Areas along targeted rivers that have a propensity to flood are equipped with a system that can be broken down into four key elements: Inputs, processing, outputs, and feedback. Inputs are the means by which the system gathers information. 850 outstations along the targeted river are equipped with sensors that record the height of the river and rain gauges to keep track of rising waters. If it rises too fast, there is a warning system to people nearby; otherwise it can usually be controlled by a series of dams or sluice gates. Local weather forecasts are part of the processing. These factors combined create a system that has eliminated dangerous floods by controlling the river at different points through electronics.

ISSUES & CRITICAL THINKING:

1. Discuss with students how technology has helped to prevent damage and loss of life due to natural disasters. Ask them to offer ideas for future technologies regarding floods, hurricanes, tornados, etc.
2. Even though technology solves practical problems and serves human needs, give some examples of how it also creates new problems and needs.
3. Research the history of miniaturization of information processing hardware. Is there a limit to which this miniaturization can occur? If so, what is it?
4. Connect the Eden Project to the Biosphere 2 missions in Arizona in 1991 and 1994. The University of Arizona now owns the Biosphere 2.