

Lab scientists are helping to solve world's environmental problems

Although scientists are not fortunetellers and may not be able to predict the future, with modern technology and knowledge, they are able to answer many questions about what could happen and how the outcome of certain events could be made less severe or avoided.

Human activities, especially the burning of fossil fuels — like coal and oil — cause increased levels of carbon dioxide (CO₂) and other so-called “greenhouse gases” into the atmosphere.

The latest global climate research shows that the amount of CO₂ in the atmosphere has increased by 30 percent, and the heat-trapping greenhouse gases most likely have contributed to increased global temperatures. The quality of life for future generations, not to mention life itself, could be drastically changed. Will these serious outcomes really happen? Maybe not. Scientists at the Lawrence Livermore National Laboratory are already working on ways to avoid them. Here are some problems that Lab scientists are working on today.

Forecasting large climate changes

- Scientists use special computers and programs to improve monitoring. With these very advanced computers, they can devise simulations or models that can be used to tell what the climate is like around the world. They can observe the warming of the Earth over the past century and how it has resulted from fossil fuels that were used for energy. These models can forecast large climate changes over the next 100 years.

Studying earthquakes

- Lab scientists study how the ground shakes during earthquakes. They monitor activity from the Bay Area, California and Nevada to Eurasia and the Middle East. They work with scientists around the globe to record seismic

activity. Additional efforts include modeling the 1906 San Francisco earthquake and simulations of future earthquakes on Bay Area faults.

Analyzing energy use

- The Livermore Lab analyzes the nation's energy production. Lab researchers track energy trends, demands and uses, looking for opportunities to improve our nation's energy mix.

In addition, they hope to find new alternative energy sources that can increase efficiency and reduce waste. They hope to develop plans to help our nation eliminate increased carbon emissions by the year 2050.

Developing new techniques

- Scientists are developing carbon-free energy sources and techniques to capture and store carbon dioxide. This will help reduce the use of fossil fuels and energy sources that add so much carbon dioxide to the atmosphere.

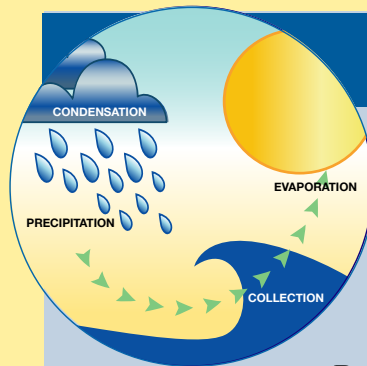
Investigating alternative energy forms

- The Laboratory also is investigating alternative forms of energy that do not generate greenhouse gases. Future energy demand can be met only through a mixed use of all available energy sources that are environment-friendly, like solar, wind and water. Solar and fusion are energy sources that will take on more

importance, but today they are limited because of their high cost and their small contribution to the energy demand.

Solving water supply problems

- Lab scientists are developing water treatment and monitoring technologies to solve water monitoring, treatment and management problems. They are creating models that accurately forecast climate change impacts on the regional water supply like the amount of snow pack and rainwater needed to grow crops, fish, recreational and other needs. *



Understanding the Earth's cycles

In order to understand climate change, we need to know about cycles. A cycle is a group of events that is repeated again and again, and relate to one another. When we figure out how the cycles work, we'll be able to understand what needs to be done to protect the Earth. The Earth has a limited amount of water. That water keeps going around and around in what we call the “water cycle.”

This cycle is made up of several main parts:

A. Evaporation occurs when the sun heats up water in rivers or lakes or the ocean and turns it into vapor or steam. The water vapor or steam leaves the river, lake or ocean and goes into the air.

B. Condensation happens when water vapor in the air gets cold and changes back into liquid, forming clouds.

C. Precipitation occurs when so much water has condensed that the air cannot hold it anymore. The clouds get heavy and water falls back to the Earth in the form of rain, hail, sleet or snow.

D. Collection occurs when water falls back to Earth as precipitation. It may fall into the oceans, lakes or rivers or end up on land. When it ends up on land, it will either soak into the earth and become part of the groundwater that plants and animals use to drink or it may run over the soil and collect in the oceans, lakes or rivers where the cycle starts. *

Get a job that's down to Earth

When you are ready to choose a career, you may be interested in one of the following exciting and important jobs.

You could be an environmental scientist

If you become an environmental scientist, you will work to solve some of the most serious problems facing the world today. Environmental scientists help protect our natural resources, like land and water. They examine how certain chemicals affect plants, animals and people, and they conduct research on rainfall, temperature and pollutants that affect an area.

A scuba diver takes coral samples to measure the amount of manmade carbon dioxide the reefs have absorbed.

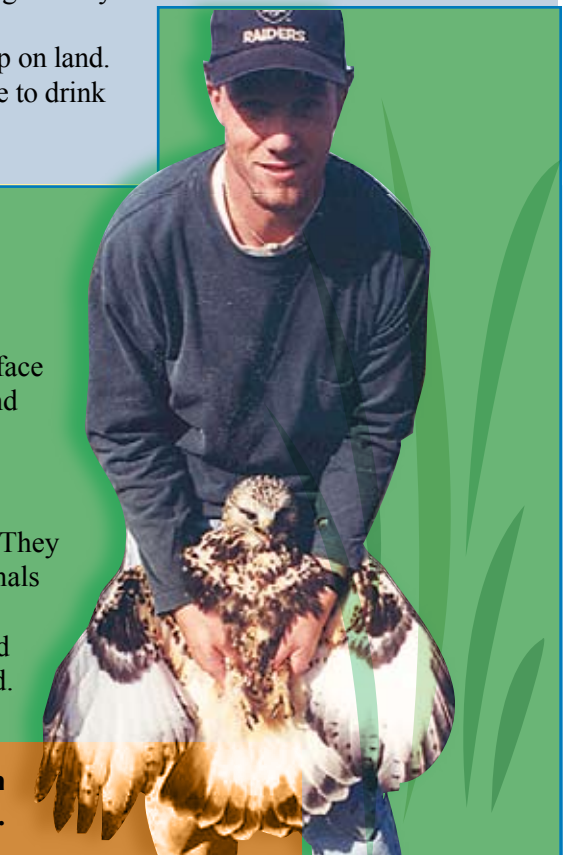
You could be a hydrologist

The work hydrologists do is important in flood control and environmental preservation. Hydrologists study the amount and flow of underground and surface water. They look at rain fall and how it affects the soil. They use computers and other instruments. They monitor the change in water cycles.

You could be a wildlife biologist

Wildlife biologists love the outdoors, wild animals and working with people. They understand how animals interact with their environment and know where animals live, what they eat and how they move from one place to another. They keep records and charts, and use computers to track their results. They are interested in keeping animals safe and know which animals are endangered or threatened.

A wildlife biologist works with a rough-legged hawk.



At the Discovery Center

Experience a bit of San Francisco's Exploratorium

The Laboratory's Discovery Center has five exciting exhibits on loan from the Exploratorium now through August. You will learn more about the Earth's natural phenomena.

Rift Zone uses air bubbling up through fine sand to create a small-scale landscape. With the turn of a knob you are in control. Change the pressure of the air and create different shapes and patterns that explain various kinds of rift zones and volcanoes.

Also at the Discovery Center: See a new display about the work Livermore Lab scientists are doing to protect the Earth and environment.

The Discovery Center is located off Greenville Road on East Gate Drive and is open to the public Tuesday through Friday from 1-4 p.m. and Saturdays, 10 a.m.-2 p.m. Call (925) 423-3272 for more information or visit http://www.llnl.gov/pao/com/discovery_center.html

Avalanche lets you play with cascading black sand. Rotate the orb filled with sand to create mountainous shapes that result in avalanches, deep ravines or mountains.

Cloud Rings force fog through a round hole giving rise to a whirling puff of smoky vapor high in the air.

Coupled Resonant Pendula shows how the movement of two pendulums is interrelated. Every time the first pendulum swings, it pulls on the lower connecting shaft and gives the second pendulum a small tug.

Drawing Table calls on you to be artistic. By swinging a table that has a pen attached, you'll make beautiful complex patterns. *



Exhibits at the Discovery Center include, from top, Drawing Table, Cloud Rings and Coupled Resonant Pendula.



Going organic at Camp Arroyo

Camp Arroyo, a 138-acre park located in South Livermore, has a unique environmental education center that was built using sustainable green building practices such as recycled glass countertops, recycled yogurt container toilets and shower stalls, newspaper insulation, rice-bale construction,

and sustainably harvested wood doors. Fourth, fifth and sixth grade students can attend Camp Arroyo to learn about sustainable lifestyles with four healthy lifestyle themes: Organic Gardening, Eco-Building, Preserving Nature, and the Ohlone Indians. For more information about Camp Arroyo, visit http://www.ebparks.org/camp_arroyo/arroyo_main.htm *

How you can help the Earth keep its

Here are some ways you can help the Earth. (Check the box if you are already doing the activity.)

Walk, ride your bike or take a bus instead of going by car.

Don't waste electricity. Remember — when not in use, turn off the juice (electricity). Turn off lights when you leave a room, or shut off the TV, radio or your computer when you're not using them.

Remember the three R's: Reduce — Reuse — Recycle. Don't buy a lot, and you won't throw as much away. Instead of tossing an item in the trash, think of how you might use it again. Recycle soda cans, paper, clothes, furniture; anything that you would send to the trash, try to reuse it.



Can you think of some other ways to help the Earth?

Lawrence Livermore National Laboratory

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SUPER SCIENCE NEWS

This Super Science Newsletter looks at the Earth and the environment, the work done at Lawrence Livermore National Laboratory to help solve some of the problems facing the Earth, and what you can do to help.

The good Earth — up close and personal

Some of the biggest challenges facing our world today involve the health of our planet.

Each one of us plays a role in preserving the Earth. If we want future generations to enjoy our planet's beauty and all that it has to offer, we need to do much better about keeping it in good health.

The world we live in today is quite different from that of 200 years ago, when there were few modern inventions and little industry. Today, in the United States, almost every family owns one automobile or more. We travel long distances in cars,

trains and planes. We need fuel to power transportation. We also use an enormous amount of electricity to run our homes and factories and operate computers, appliances and machines.

We use a lot of energy to keep our community, our state and our country running smoothly, so we can live more comfortably and accomplish all the work there is to be done.

But there is a downside to our enormous energy use. By using too much fuel, we are changing the mixture of gases in the atmosphere and potentially are changing the temperature and climate. *



What is the greenhouse effect?

Do you know what a greenhouse is? It is a glass or plastic building where plants are grown. These buildings are very warm because the walls allow the sun's rays in, but keep the heat from getting out.

Think of the Earth as being inside a huge greenhouse. There are certain gases that act much like the walls of the greenhouse. Water vapor, carbon dioxide, methane and nitrous oxide keep heat from escaping into space.

Activities like burning gasoline to drive cars and trucks; burning oil, coal or wood to produce electricity; and cooling and heating buildings are just a few actions that release greenhouse gases into the atmosphere. With more and more of these gases in the air, more and more heat is trapped. What happens? The Earth remains warm and will continue to get warmer. *

Climate change is a hot topic

For the past 10,000 years, the Earth has experienced mostly stable temperatures. But, for the past 100 years, scientists have noticed the Earth seems to be warming.

While some scientists believe that climate changes are natural, others think changes are occurring faster because of our actions. Some say that we can slow it down if we choose.

Increasing temperatures can cause major changes in the climate around the world.

Consider these possible effects.

✓ New coastlines would form. Because water expands as it is heated, and oceans absorb more heat than land does, sea levels around the globe would rise. Glaciers worldwide would begin to melt, also causing a rise in sea level.

✓ Cities on coasts would flood. Warm places that now receive frequent rain and snow might become hotter and drier.

✓ Plants and animals unable to take the heat would become extinct.

✓ Hurricanes, tornadoes and other storms caused by changes in heat and water evaporation could occur more frequently and become stronger. *