





The Women of EROS:

Working Intelligently and Compassionately for the Environment, for Humanity

“Earth is very unique in its capacity to sustain life.”
– June Thormodsgard, EROS

By Janet Blank-Libra

The view from June Thormodsgard’s office is phenomenal.

If she looks out her window, her gaze is drawn south and over South Dakota prairie. But her gaze doesn’t stop there; from where she sits she can also see volcanic activity in Hawaii, glaciers advancing in Alaska, and seasons changing in the Outback of Australia. Technology has brought the world to her office.

“The earth is all connected,” says Thormodsgard. As chief scientist at EROS (Earth Resources Observation Systems), a government archive for land data collected by satellite, Thormodsgard is well acquainted with the earth on a global scale. “The environment does not have national or state boundaries,” she says.

Thormodsgard’s intensity invites one to understand her job, to join her in what is, simply put, a visual quest to understand the world we live in, to fathom how it is that she can see a living, breathing planet. And, in fact, she says one can see the earth breathe through the ever-observing “eye” of the satellite. “The radar satellites in space send a signal from the spacecraft to earth; the time it takes to go down, hit the earth and come back is measured,” she says.



So if a volcano has expanded or contracted between two signals, one can see the volcano expand and contract by comparing the pictures.

Thormodsgard’s job, she says, is to keep her eyes and ears open for what is happening across the federal government in the area of earth science, and to help scientists, those working directly for EROS and those working under contract for the U.S. Geological Survey (USGS), plan their research activities and locate funding.

Kristi Kline, 39, is one of those satellite systems scientists. She knows well the satellites that Thormodsgard describes, because she handles all work related to the operation of two Landsat satellites. As Landsat project manager, she heads a \$22 million project—the largest at EROS. Like Thormodsgard, she possesses a world-view of the most literal sort. In the midst of explaining her work, she interrupts herself to ask a question: “Have you done Google Earth?” A person, she says, can go online and, using satellite data, can zoom in on his or her home from space. It’s not an EROS program, but Kline says lots of people are having fun with it. Similarly, a USGS site called Global

Visualization (glovis.usgs.gov) lets visitors view EROS's entire collection online. A person can click on South Dakota, for example, and see the way the satellite views his or her corner of the world by adding, layer by layer, various map characteristics—roads, rivers, railroads, cities.

Later, Jesslyn Brown, an environmental scientist at EROS, mentions Google Earth, too, and immediately turns to her computer to offer a quick lesson. Clearly, she can't get enough of the work she does. If it's about satellites, it's amazing.



And so are these women.

Thormodsgard, Kline, Brown and their associates, Xuexia “Sherry” Chen and Jenn Willems are five of the women of EROS, five of a body of scientists dedicated to understanding and caring for the Earth.

Chen is one of a team of seven working to map the vegetative status of the entire United States, and Willems manages the second-largest budget at EROS—\$10 million—as the manager of the Land Processes Distributed Active Archive Center.

Though the five work in specialized areas, they are part of an interdisciplinary

team of more than 150 scientists with a sweeping vision: maintenance of the earth. For these women and their associates at EROS, anything that relates to satellites, maps, resolution—the earth—is fascinating and of imperative importance.

Those who work at EROS work with data collected by numerous Earth resource satellites. Complicated sensors on the satellites scan the rotating earth and make sense of the earth's landscape through their analyses of light as it is reflected by or absorbed into the earth.

The data is processed into images for visual and computer interpretation. EROS employees manage the archive and study its contents—high resolution multispectral imagery—in an effort to identify global changes that merit investigation: pollution buildup, fire-fuel buildup, soil erosion, excessive deforestation.

What Thormodsgard and her colleagues hold in common, Thormodsgard says, is a fascination with applying satellite technology to their various disciplines.

On a warm, sky-blue day in October, Thormodsgard pulls out a book, *One Planet Many People: Atlas of our Changing Environment*, to help her explain the value of the 30-year archive EROS possesses. In looking at maps of Mesa Verde National Park, Colorado, for which data has been kept since 1973, one can see the progress of natural fire-fuel buildup, and one can see that in the year 2000 fires changed the landscape. A red area, evidence of foliage destroyed in 2000, replaces the purples and pinks. Ultimately, the EROS archive provides scientists a way to detect, measure, and analyze major changes occurring on the surface of the planet. For example, reliable, consistent data supplied by EROS allows the federal government, she says, to make informed decisions about placement of planned fires, which are employed less often than they should be as a way to check unplanned, major fires.

Thormodsgard, who has been with



EROS for more than 25 years, points to a map of the Aral Sea (once the world's fourth largest lake) in Kazakhstan, explaining that the diversion of water from the rivers that flow into the sea for use in irrigation led to the lake's shrinking to half its size between 1973 and 1984. According to the analysis of the data obtained from Landsat images, salt concentrations in the lake increased from 10 to 23 percent, a change that spelled devastation for what was once a vital fishing industry. Perhaps most ominous is the fact that the climate has experienced change—warmer summers and colder, longer winters. Further, the lake-bed, laid bare, has exposed contaminants that have created nutritional and respiratory problems for the population.

“It is one of the worst environmental health areas in the world,” Thormodsgard says.

Thormodsgard, 54, knows that the work she and her colleagues do is critical. “I sincerely worry that mankind has gone too far in altering our environment, that we are creating a nightmare for our children.”

There exists no blueprint for how it is that humankind is to fix what it has damaged. These five women, though, approach their work with a kind of resolution, a

steadfastness that is reassuring to those who do less, in such a deliberate way, to care for the Earth.

Thormodsgard believes they “contribute to the scientific knowledge about how people are linked to their environment.”



“The 30-year archive of satellite data that we have at EROS is a fountain of information on the changes that have taken place in our environment, both natural and manmade,” she says. “The scientific exploration of this archive gives us an opportunity to assess our land management policies. What are we doing right and what are we screwing up?”

Kristi Kline could take a good shot at that question. As Landsat project manager, she works with the companies that use the data—the SAIC (Science Applications International Corporation), Honeywell, and Computer Sciences Corporation (SCS), to name a few. She also works with countries that downlink or collect data from the satellites that were built and launched by NASA in 1972.

Kline points to a map of Alaska, where satellite imagery of a fire helped determine, initially, the size of the fire and then, eventually, where it would be important to plant more trees to avoid problems with erosion. “We’re doing good things to show what the state of the world is,” she says.

“Our work can affect the decisions people make.”

She says satellite data has been used, for example, in court cases in the western United States to document illegal cutting. “The satellite data was critical to the government’s case against whoever was illegally cutting forest lands,” she says. As she talks about the way in which the satellite creates data as it crosses over the earth, she points to a swath of color on a map. “Here is where the forest was cut,” she says. She points to an earlier map that reveals forested land and back to the evidence of illegal cutting.

She goes on. “You can look at various crops around the world and determine the health of the crops—basically how much is going to be produced.”

Hanging on the wall just inside Jesslyn Brown’s office is a sign: “I’m a recycler.” No doubt. Hers is unquestionably a philosophy of stewardship.

An environmental scientist, Brown, 45, studies drought. She investigates the way in which satellite data can enable decision-making and for the past four years has focused, she says, on “how, why and where drought is impacting vegetation growth and vigor.”

“We’ve had multiple years of extreme drought in the West recently. Our goal is to use our satellite data to better monitor and hopefully, ultimately, to predict where and when drought is going to occur.”

In the past year Brown has moved from a technical position to a leadership position at EROS. Like the other women, she hopes her efforts will lead to changes in policy or to the creation of policy that will allow for mindful management of the Earth.

About 12 years ago, a mathematician straight out of college, Jenn Willems joined the staff at EROS. Today, at 34, she is project manager for the LP DAAC—Land Processes Distributed Active Archive Center—one of eight NASA data centers

designed to archive and distribute Earth science data for studying the Earth and its processes.

“Scientists are able to use the data we provide for multiple applications, including those that affect us, such as agricultural applications, natural man-made hazards, environmental changes, etc.,” she says.

“A satellite image is more than a picture. [The satellite] actually senses the earth and gathers data so we can actually tell from a satellite image if something is astroturf or grass. The data is so rich.”

Key to Willems’ success is her ability to work with people. “I work both externally, defining requirements for NASA and the



other DAACs, as well as internally, with the local EROS contractors, to manage the work for the LP DAAC to accomplish,” she says. Though her math skills got her in the door at EROS, her people skills have enabled her to grow in her career.

Ultimately, she says, she wants “to try to ensure that no matter what the need is for data [EROS] can provide it.” The amount of data that she is talking about is five times that managed by the Library of

Congress.

All of the women rely on their favorite visual aid: maps. Chen, 31, who has been with EROS since August 2004, turns often to the maps in her office as she explains her work. A member of the Landfire team, a group that is mapping the vegetation of the entire United States, she says her goal is to identify the vegetative species of an area—trees, shrubs or herbaceous—their respective heights and the percent of coverage each represents.

She points to the 60 zones represented on a map lying on her desk and says she and her team have mapped three zones



this year and will need to complete two more by year's end. She wants her work to enable scientists to better understand the characteristics of the vegetative cover across the United States.

Using Landfire's data, scientists can study, for example, the way in which temperature influences climate change and the degree to which forested areas, compared to other kinds of cover, are able to store CO₂. Such information helps experts battle global warming, Chen says. Humanity, she says, needs to plant more forests.

These women are stewards of the earth, caretakers who seek an understanding of the relationship between humans

and the planet. Each is concerned with answering questions, finding solutions. They work in a high-tech world. When these five women say they hope to make the world a better place to live in, they're not just offering up an idle cliché.

Satellites, says Thormodsgard, allow humanity to look at the Earth as a whole and to develop models that support scientific efforts to sustain the environment. When land-related data is combined with data on the oceans, the atmosphere and weather, gathered by the National Oceanic Atmospheric Administration, scientists are able to get a comprehensive understanding of the planet's environment.

"I feel like what we do in this generation will have incredible impact on the life on our planet, for our children.

"Earth is very unique in its capacity to sustain life. We're not going to be able to take a hike to Mars. We're kind of stuck with the mess we have, and we really have changed the earth in the last 50 years. From space you can see the broad expanse of change created by humankind. I'm not saying we want to go back 50 years, but we certainly want to plan so we're ready for the changes. For example, we might end up with the Arctic melting and creating waterways for transportation. This could create new economic opportunities but it might create real environmental changes elsewhere.

"It's one big huge system," she says.