Mapping the Grassroots

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Last May, with the Deepwater Horizon oil-spill disaster barely two weeks old, Jeff Warren stood in the park outside the New Orleans Museum of Art, conducting a tutorial in kite-flying. "The rule of thumb is, less than 10 miles an hour is good balloon weather," he cheerfully told his audience. "More than 10 miles an hour is good kite weather."

Warren, a recent graduate of the MIT Media Lab, is the founder and driving force behind Grassroots Mapping, a technological movement premised on a simple yet radical idea: for less than $100 you can generate your own high-resolution satellite imagery. That includes the cost of a cheap digital camera and the kite or helium-filled weather balloon required to send it aloft -- although a $2 Mylar emergency sleeping bag, or even a trashcan liner, will work fine too.

It would hardly seem necessary these days. We are awash in remote imagery: scores of satellites orbit Earth, gathering more data about the planet's workings than the planet's scientists can process. Thanks to the likes of Google Maps, mapping has become household entertainment; as I write this, I can call up a satellite image and just make out the lawn furniture in my backyard.

Yet as the proponents of Grassroots Mapping note, there are limits to what satellites can reveal, particularly when it comes to monitoring environmental change. The best remote imagery is either top-secret or commercially owned, and thus impossible or prohibitively expensive to access. What's freely available is often too low in resolution to be genuinely useful; Google Maps imagery can't make out objects smaller than a foot (and often no better than 10 feet) across. Worse, the view is stale: the average satellite image on Google may be anywhere from six months to three years old or more.

So if, like most every citizen along the Gulf Coast last spring, you were anxious to see exactly where and when oil from the spill would start fouling the Gulf Coast shore -- and track the impacts afterward -- you were out of luck. Eager to help, Warren contacted the Louisiana Bucket Brigade, a community nonprofit group that provides information on the various oil-related health and environmental issues that plague the region. He told them about Grassroots Mapping and flew down from Boston to teach the group how to generate an overhead view for themselves.

In just 20 minutes on the art-museum lawn, Warren gave a lesson in how to build and loft a "community satellite," as he calls it. First, set your camera to "continuous mode," so it shoots every second or so; attach the camera to your balloon or kite like so (a free

instruction kit can be downloaded from the Grassroots Mapping Web site); tie on a length of kite string or fishing line, and away you go. Fly for as long as you like, several times a day even. Afterward, with photo-editing software, the resulting images are stitched into maps covering an area of several square miles, at a resolution 10 to a 100 times sharper than what Google imagery can offer. A balloon floating at 200 feet, for instance, can make out approaching bands of oil, tarballs on the beach, and pelican colonies on the Chandeleur Islands, part of Louisiana's Breton National Wildlife Refuge.

Since May, Brigade volunteers have made scores of mapping expeditions in the Gulf, often from the back of a motorboat. They have amassed -- and placed online, in the public domain -- an impressive array of imagery of the spill and its effects. "It's a really valuable source of information," says Shannon Dosemagen, the Bridage's oil-spill response coordinator. "It shows the effects on animals and how the coastline is potentially changing."

The Grassroots Mapping concept occurred to Warren a little over a year ago, after watching some friends tie a camera to a balloon for fun "That's the moment where the possibilities of this work occurred to me." He tried it out first in Lima, Peru (where he'd lived for a while), helping land-rights activists chart the rapid growth of squatters' camps on the city's outskirts. Soon he'd teamed up with Stewart Long, who runs Gonzo Earth, a commercial-mapping service in the Bay Area, and has donated his image-processing skills to the Grassroots Mapping effort. (While the balloons themselves are cheap and easy to fly, piecing together the images and georeferencing them -- many point-and-shoot cameras carry GPS units that geotag photos -- can be a laborious process.) For Long, more accustomed to working with finicky radio-controlled airplanes, the notion of balloon-mapping was a revelation. "I created a photostream from my grandma's house in suburbia in like 15 minutes," he says. "I had about 4,000 photos, covering about 4 square miles of contiguous area, a square mile of it in high resolution."

The environmental applications were readily apparent. In Appalachia, Warren and Long taught the balloon-mapping technique to activists anxious to monitor local mountain-top mining operations, which often occur well off the beaten path, and make the environmental impacts visible to the local public. They met with Adam Griffith, an environmental scientist at Western Carolina University who has worked closely with the group Coastal Care, which monitors issues such as beach erosion, sand mining, and the effects of oil spills. Griffith's own research involves propagating and cultivating native bamboo; in balloon-mapping he instantly saw a simple way to track the growth of his transplant sites. "It's a really inventive way to look at short-term change across a host of fields -- ecology, biology, mapping the impacts of natural disasters," he says.

Grassroots Mapping has even reached New York. (See "Photo Gallery: Mapping the Gowanus Canal.") Liz Barry, an architect and urban designer, is helping community organizers create a detailed map of the Gowanus Canal, a notoriously polluted waterway in Brooklyn, with a balloon-mounted camera. The Gowanus was recently named a Superfund site and is now the focus of a revitalization project. But before the area can be developed into a park, greenway, or some other public resource, designers need an

intimate and comprehensive rendering of its offerings -- natural swales, sewage overflow outlets, or relics of its Revolutionary Era past. The detail they're acquiring by balloon can't be attained by satellite, Barry says. "Which manholes are where; the gas lines, the sewers, electrical. It's extremely hard to collect this sort of information from all the different agencies, and some isn't even available."

In one sense, Grassroots Mapping is akin to what's being called community or participatory mapping, a sort of "open cartography" movement whereby data is crowd-sourced and quickly plotted. After the Haiti earthquake, the online community Crisis Mappers Net provided a website where anyone who'd spotted a downed bridge, a collapsed building, or a person in need could email (or text, or Twitter, or call in) an alert and see it flagged on a map; the resource proved an enormous boon to aid workers. The Louisiana Bucket Brigade provides something similar, so residents can readily report and track health issues or oil-related damage in their communities. "We see it as another form of environmental monitoring," says Dosemagen.

For the moment, Grassroots Mapping is less about that sort of data overlay and more about the underlying fundament -- the map itself, and the empowerment that derives from seeing it. "The best thing is to be able to distribute this imagery back to community members," Dosemagen says. "It's a powerful way to give people a different perspective on what's right in front of them." The next step for the images, she notes, "is making sure that researchers know about them"

But the Grassroots Mapping effort is fast evolving. With several collaborators, including Barry, Dosemagen, Griffith, and Long, Warren has created the Public Laboratory for Open Technology and Science, a sort of umbrella organization working to broaden the kind of data that do-it-yourself mapping can provide. For instance, they're developing a DIY spectrometer that, attached to a balloon, could be used to track the spectra from pollutants and chemical spills. With a homemade camera, one could map, say, the heat loss from buildings over a wide area. Or you could begin monitoring the growth of specific plants (which reflect visible and infrared light in differing ratios), to track revegetation efforts or even chart the spread of invasive species.

Above all, Grassroots Mapping is low-tech proof that we can all be high-tech researchers; sometimes the most groundbreaking tool isn't the flashiest or priciest, but the one that almost anyone can use at almost no cost. "Folks don't generally think of cartography as something they can do," Griffith says. "We're in position of power when we're making maps." Grassroots Mapping, he adds, "has put that power in the hands of the masses."