

Science & Health

Images From Space Help Map Extreme Poverty

By Steve Baragona

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The fight against poverty is getting help from a new direction: up.

Satellite imagery is helping researchers map areas of extreme poverty. It may help officials identify faster and more accurately when development policies and programs are working, and when they aren't.

Eliminating extreme poverty by 2030 is the first of the 17 [Sustainable Development Goals](#) adopted by the United Nations in 2015.

Experts usually measure poverty by using census data and household surveys. But these tools are expensive, time-consuming and labor-intensive. Countries typically do them only once every several years.

On the other hand, satellites map the entire surface of the globe at high resolution every several days. The imagery is getting better and cheaper as a growing number of public and private satellite networks go into service.

What satellites see

Researchers have used the brightness of lights in nighttime photos to estimate a region's economic activity. Others have applied machine learning to [identify richer and poorer villages](#) from satellite imagery. Another group

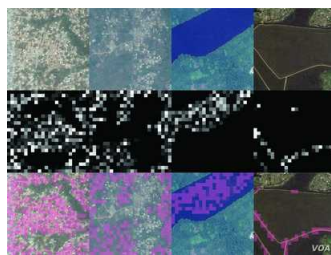
sorted wealthy and impoverished villages and neighborhoods based on building density and vegetation cover.

A new study takes the most detailed look to date. Within a single village, it distinguished the poorest individual households from their wealthier neighbors with 62 percent accuracy.

The study focuses on Sauri, a village in rural Kenya that was part of the Millennium Villages Project, a large-scale poverty alleviation experiment. Detailed information on each household's income and assets was collected in 2005.

In satellite images of the village, researchers measured the size of each dwelling and studied the agricultural land surrounding it.

Not surprisingly, smaller homes generally housed poorer people.



By column, four different convolutional filters (w

By column, four different convolutional filters (which identify, from left to right, features corresponding to urban areas, nonurban areas, water, and roads) in the convolutional neural network model used for extracting features. (Source - Sciencemag.org)

Interestingly, the researchers also found that poorer households tended to have more bare farm fields in September. In this part of Kenya, that usually means farmers are preparing the land for a second crop.

That's a risky undertaking, said University of Edinburgh geographer and study lead author Gary Watmough, because the late-season rains fail up to half the time in this region.

"Generally, [late-season planting] is only done by the poorer households because it's a necessity," he said. "They either don't have enough land or they

need to have that insurance, just in case something else goes wrong."

Satellite imagery also found poorer households' fields were growing crops for shorter periods of time.

"When we looked back into our field data, we could see that often poorer households were actually not planting their crops in their own fields as early as others," Watmough said. "That was because they were contracting themselves out to plant other, wealthier households' crops first."

The money they earned went toward buying seeds. But that meant their own crops had less time to grow.

Exciting and a little scary

The study is a big step forward, demonstrating "the potential for satellite data to distinguish between the wealth of you and your neighbor," said World Bank economist David Newhouse, who was not involved with the research. "Which is scary, a little bit, but also somewhat exciting."

He suggested that privacy concerns would need to be addressed before it could be scaled up.

Also, the markers of poverty found in this area will not be the same everywhere. The approach would need to be tailored to different locations. And the system's accuracy — 62 percent — is not great on its own.

"I think the science is pretty far ahead of the practical feasibility," Newhouse said.

It's probably best not to rely solely on satellite data, experts say. The charity GiveDirectly used satellite images to target donations to people in villages with a high proportion of thatched roofs. These villages were considered worse off than those with more metal roofs.

But people figured it out. Some claimed to live in thatched-roof structures next to their metal-roofed houses in order to qualify for donations.

"This is really a way to use the data, but it's also an example of how people can quickly game it," said remote sensing expert **Damien Jacques**. GiveDirectly has since changed its methods.

There's power, however, in combining satellite data and on-the-ground surveys.

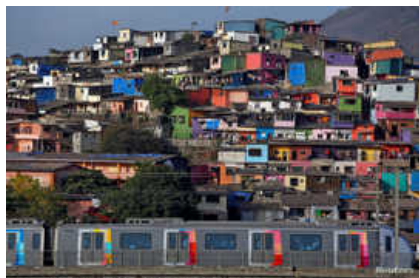
"Using the two types of data, one that is cheap to collect and very frequently available to complement traditional data that are expensive to collect and not frequent, you can get the best of the two," Jacques said.

And remote sensing data on its own can be helpful in places surveyors can't go, such as Yemen or North Korea, or in the wake of disasters.

But it's not clear that changes in poverty are visible from space. That's something Watmough and colleagues will be investigating. They have survey data from Sauri from 2005 and 2008. The next step is to look for differences in the imagery.

"Nobody has ever looked at how poverty has changed over a time period and looked at how a satellite image has changed over that same time period," he said.

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Technological solutions to prevent land corruption require resources, but they do not have to be expensive, land rights experts said Tuesday. Satellite imagery, cloud computing and blockchain are among technologies with the potential to help many of the world's more than 1 billion people estimated to lack secure property rights. But they can be expensive and require experts to be trained. That's where low-tech solutions such...



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