TRANSCRIPT EPISODE 4

Citizens4Earth

A. UNDERWRITER ANNOUNCE 00:15

Announcer, over music:

"THE CROWD & THE CLOUD" is made possible by NSF, the National Science Foundation, Where Discoveries Begin."

1. TEASE

Waleed VO:

OUR WORLD IS AWASH IN DATA, POWERING THE ECONOMY, AND EMPOWERING INDIVIDUALS.

BUT EVERYWHERE THERE ARE IMPORTANT GAPS

…ABOUT LIVING STANDARDS IN RURAL AFRICA…

OR TEMPERATURES IN TURBULENT NEARSHORE WATERS.

THAT'S WHERE TECHNICAL INNOVATION PLUS CITIZEN SCIENCE CAN PLAY A ROLE.

Waleed at the California Academy of Sciences aquarium, San Francisco:

I'M WALEED ABDALATI. I WORKED FOR NASA FOR MANY YEARS, USING SATELLITES TO STUDY THE EARTH.

BUT IN THIS SERIES I'VE MET SURFERS DEDICATED TO PROTECTING THE ENVIRONMENT…

AND BIRDERS WHO PURSUE THEIR PASSIONS AND AT THE SAME TIME CONTRIBUTE KEY INFORMATION TO A HUGE BIOLOGICAL DATABASE.

IN THIS EPISODE, A YEAR IN THE LIFE OF CITIZEN SCIENCE, CAPTURING SEASONAL CHANGE FROM COAST TO COAST, AND GENERATING DATA THAT INFORMS CONSERVATION POLICIES FOR TREES, BEES, BIRDS AND BUTTERFLIES.

AS WE SAID WHEN WE BEGAN OUR JOURNEY THROUGH "CITIZEN SCIENCE IN THE DIGITAL AGE"…

Waleed to camera at St. Michaels:

For years you've watched science programs on public television. Now you're invited to do science.

SERIES AND EPISODE TITLES:

Synthesized voices say "The Crowd" and "The Cloud" in various languages.

Computer voice:
Citizens4Earth

Christmas for the Birds
Counting not Killing

Heron reflected in water.

Mariel:
Just being outdoors in the habitat itself, even when nothing's around, it's just breathtaking, you know?

ANGEL AND MARIEL ABREU ARE SERIOUS BIRDERS.

I HAD AN OPPORTUNITY TO JOIN THEM IN EVERGLADES NATIONAL PARK FOR THE AUDUBON SOCIETY'S ANNUAL CHRISTMAS BIRD COUNT, "CBC" FOR SHORT.

Waleed:
I feel like I need snowshoes here.

Angel:
The trick is to keep on moving, or to have webbed feet or long toes, like these birds have, you know?

(laughter)

Interview and AMNH stills:

L3
Brian Rapoza
Compiler, Tropical Audubon

Brian:
Christmas Bird Counts actually began 115 years ago.* The tradition started as an alternative to people going out on Christmas and shooting birds. That was actually a Christmas tradition. And people decided, "Let's try something different."

*Brian's interview was recorded in 2015. The Bird Count started in 1900, as the narrator makes clear.

ORNITHOLOGIST FRANK CHAPMAN ORGANIZED THE FIRST CHRISTMAS BIRD COUNT IN 1900.

IN THAT YEAR, VOLUNTEERS COUNTED BIRDS IN JUST A HANDFUL OF PLACES.

Pungo snow geese come in to land. Dissolve to CGI map showing current Bird Count locations:

TODAY, VOLUNTEERS SPOT SPECIES AND NUMBERS EACH WINTER AT THOUSANDS OF LOCATIONS ACROSS NORTH AMERICA.

(Bird sound)

….AND THE CBC HAS GROWN INTO ONE OF THE WORLD'S LARGEST ECOLOGICAL DATA SETS.

Angel:
So there's two species in particular we're looking for now: Nelson's Sparrow and Saltmarsh Sparrow.

And those two species are only really found in this… these types of habitats here.

Here comes a Bald Eagle, sorry to cut you off…

Waleed:
No, it's alright.

Our national bird, yes!

Angel:
So you notice this guy is, uh, its head is not very bold white yet. It's almost an adult bird, I would say probably a four, four and a half year-old bird.

Waleed:
Wow.

SEEING A BALD EAGLE WAS A THRILL FOR A BIRD COUNTING NEWCOMER LIKE ME.

BUT THESE VETERAN BIRDERS WERE MORE INTERESTED IN ONE OF THE UNIQUE *LOCAL* SPECIES.

Angel:
I just saw our first Nelson's Sparrow.

Mariel:
Awesome!

(Music)

Waleed, VO and to camera:
You can see that the people engaged in the Christmas Bird Count are having fun. They love being out in nature and spotting birds.

But the data gathered in one of North America's oldest citizen science projects have become a unique and valuable resource for understanding our changing environment.

(Bird calls)

Brian:
We're helping scientists to understand more about birds.

The scientists can't do it themselves simply because there's not enough scientists.

Birders in both locations and Mariel entering data on her phone:

Why should thousands of scientists be collecting this data when there's thousands of ordinary citizens that can do it just as well?

Pungo scenes:

We do it for free because we love to do it. And why shouldn't scientists take advantage of that?

Jose Barros with binoculars:

AMONG THE MANY RESEARCHERS USING THE BIRD COUNT DATASET ARE THE AUDUBON SOCIETY'S OWN BIOLOGISTS, BASED IN SAN FRANCISCO.

Chad:
The CBC actually has really good coverage in densely populated areas.

In addition, we have circles located in rural areas as well as national parks and national forests.

L3:
Chad Wilsey
National Audubon Society

So, throughout the North American continent there's really pretty good coverage from the CBC counts.

Music and walking in Pungo:

Location/place super:

Pungo Unit
Pocosin Lakes National Wildlife Refuge
North Carolina

L3:
Mike Dunn
Naturalist

Mike:
Who was that?

Downy, yes, downy woodpecker, yeah. See the fork in the tree there?

Walking:

Mike:
Flicker, yeah, there goes a flicker. So we got three woodpeckers right here.

L3:
Candan Soykan
Fmr. National Audubon Society

Candan:
The process for getting Christmas Bird Count data into our system involves many steps.

Woman in Pungo calls to bird:

When people are in the field counting birds, they record their own checklists.

Mike:
Shovelers in flight… this little group here, this is the first time we have ever seen them, here.

What did you get? Phoebe?

Candan, over scenes of compilation event in Pungo:

Those checklists are then passed on to compilers who compile the information and submit a complete checklist for a given year.

Pungo birders:
Horned auk?

Woman raises hand, and someone says, off-camera:

Yes!

Tree swallow?

Common moorhen?

Yes!

American coot.

(With emphasis)

YES!

Hoo!

Candan, over CGI map graphic:

That information is then passed on to a regional editor.

If they see a very unusual species recorded, they might check in with the compiler and say, “Did you all really see that species?”

ONCE THE DATA ARE QUALITY-CHECKED, THEY ARE ADDED TO THE MAIN CBC DATABASE.

Candan:
It’s important for ecologists to think big, because the problems the world is facing are large.

A good data set is going to be collected over a long period of time and be spatially extensive. So, cover a large area.

From that perspective, this Christmas Bird Count is an excellent data set.

Mike Dunn:

It's real interesting data to look at. And people are really starting to crunch the numbers. There's enough data now after 115 years.

Chad:
Frank Chapman in 1900 couldn't have imagined how useful the CBC dataset would be.

Having this long term dataset allows us to identify the relationship between birds and climate and think about how climate change may impact those birds.

The Audubon Birds and Climate Report is a comprehensive report looking across 588 different species and trying to quantify the potential impacts of climate change on the distributions of those species.

And we found that nearly half of those 588 species may need to make dramatic shifts in response to climate change.

ONE OF THOSE "SPECIES AT RISK" IS THE NELSON'S SPARROW.

THAT'S ONE OF THE BIRDS I WAS LUCKY ENOUGH TO SEE DOWN IN THE EVERGLADES.

Chad:
So Nelson's Sparrow is classified as "climate endangered" for the winter months based on models built with CBC data.

CGI based on Audubon maps:

BY LATE THIS CENTURY, NELSON'S SPARROW IS PROJECTED TO LOSE MOST OF ITS WINTER HABITAT AND BE FORCED TO SPEND WINTERS FURTHER NORTH ALONG THE COAST.

Chad:
We know that birds are highly mobile and so we would expect that they are able to shift their distributions in response to a changing climate.

What we don't know is whether they're going to find all the resources that they require to live and survive.

It may be that their specific food resources or nesting resources are not found or won't shift at the same rate that the bird is capable of shifting in.

It's those *ecological mismatches* that are potentially the most threatening component of climate change.

Chad:
Even if you're not a bird lover or an environmentalist, understanding the potential impacts of climate change on birds is important, because birds are a surrogate for ecosystems in general.

And so if birds have the potential to be threatened by climate change, natural ecosystems in general are likely to be at risk due to climate change.

WITH THE LONG-TERM PERSPECTIVE THAT THE CBC PROVIDES, BIOLOGISTS CAN UNDERSTAND HOW BIRD POPULATIONS CHANGE OVER TIME.

Candan:
For me, part of it is just feeling like you are part of something bigger, of knowing that there's thousands of people across the world doing the same thing.

THOUSANDS OF PEOPLE AROUND THE WORLD, *ALL* COUNTING BIRDS. AND THIS YEAR, I WAS ONE OF THEM.

BUT CAN CITIZEN SCIENTISTS CONTRIBUTE DATA THAT CAN BE TRUSTED?

Candan:
One of the concerns with the Christmas Bird Count data is the fact that it's collected by citizen scientists rather than professionals.

But skilled birders are often as good or better at identifying birds as professional scientists. Candan

I WITNESSED THIS FIRSTHAND IN THE EVERGLADES.

ONE OF THE BIRDERS I MET THERE, PAUL BITHORN, KNEW THE BIRDS HE WAS COUNTING LIKE THEY WERE OLD FRIENDS.

(Music and natural sounds)

Waleed:
I feel like my blood pressure's gone down ten points just being here! Just spectacular.

Waleed to Paul:

So how long have you been doing this?

Paul:
Well this particular count, I've been canoeing down this trail for the last 30 years

Waleed:
30 years?

Paul:
I was a plumber for 41 years. I'm now retired.

Waleed:
But you've been birding longer than you've done anything, huh?

Paul:
I have been birding for over 50 years. I started as a Cub Scout. We had to identify 10 species of birds, and I've been birding ever since.

Once you get the bug, you'll have it for life.

Paul, Jose, Angel, Mariel and Waleed toast the end of a successful count:

I've got a tight-knit circle of friends here in Miami that, we all bird together. We're literally family. That's a fact.

Waleed:
So how much longer do you plan on doing it?

Paul:
I'll be doing it as long as I'm alive.

CGI URL:
CrowdAndCloud.org/Birds

Waleed pacing on the beach at Sandy Hook, NJ, and now we see surfers behind him:

But while birding has a long history of contributing to citizen science activities, another outdoor activity is just getting started.

2. SMARTFIN

See "senior" surfers in the ocean:

Once again, it has the capability of filling important gaps in the data but this time, instead of feathers flying high in the skies it's fins slicing through the oceans.

Smartfin
"Stoked" for Science

6AM… A SOMEWHAT CHILLY DECEMBER MORNING ON A BEACH NEAR SAN DIEGO, CALIFORNIA.

BUT FOR THESE MEN AND WOMEN, THE DAY STILL BEGINS WITH THEIR USUAL MORNING RITUAL…

L3
Chad Nelsen
CEO, Surfrider Foundation

Chad:
One of the stereotypes that's really unfortunate about surfers is that they're sorta these lazy, burned out, dropout people from society, and it couldn't really be farther from the truth.

Beach shots, and surfers getting ready shots:

We were down here at sunrise this morning, and the only people stirring on the beach at 5:30, a quarter to six, were a bunch of surfers who got up in the dark to come surf before work.

Every day they wake up, and they read the NOAA offshore buoys that talk about swell direction, period, wave height. They come down to the beach, and they're paying attention to the tide.

To camera and VO shots of Smartfin surfers in the water, and slo-mo shots of other surfers:

L3

Tyler Cyronak
PhD, Scripps Institution of Oceanography

Tyler:
As a surfer, you're actually in the ocean, and you experience what the ocean is doing at that moment very viscerally.

NASA CGI showing the ocean, and a NOAA map of where ARGO buoys can be found.

Waleed:
I USE SATELLITES TO STUDY EARTH…

AND A LOT OF WHAT YOU SEE FROM SPACE, OF COURSE, IS OCEAN.

BUT WE KNOW OUR SEAS ARE CHANGING IN IMPORTANT WAYS.

THEY'RE WARMING …AND SEA LEVEL IS RISING.

AND AS THE OCEAN ABSORBS MORE AND MORE CARBON DIOXIDE IT'S ALSO GETTING MORE *ACIDIC*.

Beautiful reefs and fish, and underwater fisherman:

THAT THREATENS CORAL REEFS AND THE FISHES, *AND* THE FISHERMEN WHO DEPEND ON THEM.

SO WE ALSO NEED MEASUREMENTS OF WHAT'S CALLED "pH" – AN INDICATOR OF WATER'S ACIDITY.

SATELLITES AND SOPHISTICATED SENSORS DO A PRETTY GOOD JOB OF GENERATING DATA ON WHAT'S HAPPENING FAR OUT AT SEA.

Waves from the beach:

BUT CLOSE TO SHORE, IT CAN COST AS MUCH AS *ONE MILLION DOLLARS* TO STUDY A SINGLE BAY!

AND THEN THERE'S THOSE WAVES!

L3
Andy Stern
Founder, Smartfin

Andy Stern:
Then I saw a map of the eastern seaboard of the United States and along the coast, there was fuzziness.

Stills of Stern:

ANDY STERN IS A RETIRED NEUROLOGIST.

HE'S FOUNDER OF AN ENVIRONMENTAL N.G.O. CALLED "THE LOST BIRD PROJECT" WHICH COMMISSIONS LARGE SCULPTURES OF EXTINCT SPECIES.

HE'S ALSO WORKING TO HELP GENERATE DATA TO PREVENT MORE DAMAGE TO THE OCEAN.

ANDY HOPES THERE WILL BE NO NEED FOR A "LOST CORAL PROJECT."

Andy:
There was a lot of good, precise data in the ocean. And I was told that the fuzziness along the coast, what's called the "nearshore", there was really a data gap.

Massive, crashing wave between the talking heads:

Tyler:
To put sensors in something like the surf zone is difficult for a number of reasons, one of which is it's just a very dynamic zone where there's lots of waves breaking, a lot of energy being released.

So to put something out there that will stay there, and not get damaged, is difficult.

Andy:
So, I thought, that's interesting, surfers are at the "nearshore." They're the ones who really know the oceans.

Something like half of mankind worldwide lives on the coasts, and that's where the data isn't secure.

So I said, (claps hands) "We're doing it."

Benjamin Thompson gets ready to surf:

I reached into the surfer community here in San Diego, and found Benjamin Thompson. Then and I said…

Back to Andy:

"Hey, Benjamin, can you make a surfboard fin that measures ocean chemistry?" And he said, "Sure."

Benjamin surfing:

As time went by, I realized that had I asked him to make a surfboard that would take me to the Moon, he would have said, "Sure!

Benjamin and colleagues at work, muffled conversation:

He brought a team of engineers together and three years later, we have Smartfin.

Benjamin Thompson:
This is what the Smartfin looks like on the outside. The only thing you see is an LED and a little hole for water to move through.

CGI details key components:

On the inside it looks like this. Right here there's a battery. This is a circuit board. This is an inductive charger, and here we have our pH sensors.

CONTRAST A SMARTFIN WITH THE SIZE AND COST OF THE INSTRUMENTS WHICH SCRIPPS RESEARCHERS CURRENTLY USE, BOTH TO CAPTURE OCEAN DATA AND TO CHECK THE ACCURACY OF THE SMARTFINS.

Scenes with Tyler Cyronak at Scripps, testing the sensor:

Tyler:
What we're trying to do in this test tank is compare the measurements the Smartfins are making which are temperature, salinity and pH, to measurements made on state-of-the-art scientific equipment that is actually deployed by oceanographers out in the ocean.

THESE KINDS OF SENSORS CAN COST UP TO TWENTY THOUSAND DOLLARS EACH.

Wipe to Smartfins being manufactured:

BY CONTRAST, SMARTFIN'S DEVELOPERS ARE AIMING FOR A COST OF LESS THAN *TWO HUNDRED* DOLLARS PER FIN.

L3
Benjamin Thompson
Lead engineer, Smartfin

Benjamin:
It's pretty rad because it all fits in a fin. At the level of precision and accuracy that we have for both salinity and pH, the current state of the art is like a massive bench top data acquisition system that you have to plug into 120 volts.

ONCE THE SURFERS ARE BACK ON SHORE, THEY DOWNLOAD THE DATA TO THEIR SMARTPHONES.

Benjamin downloading data beside his car:

Benjamin:
The data will move from the fin to your phone and then from the phone to our servers. And then it's processed. And there you have a surfer just hitting a few buttons has done legitimate science.

(Surfing sounds)

Chad:
The act of riding a wave really, sort of, is trying to get as close and tap in to that sort of ocean energy in the ocean as possible, y'know, even trying to get under and inside of it.

And the fin is along for that ride. So I think there's a really interesting compatibility between the fin that's collecting all of this information and the surfer who's, y'know, so in tune, and in touch with the ocean.

L3
Stephanie Mumma
Project Lead, Smartfin

Stephanie:
For me as a scientist… I get to go surfing for science. (Laughs) There's not much better than that.

I love surfing, I love science and putting them together and being able to interact with people and try to bring that same “stoke” to them for science and surfing is really great for me.

A SMALL GROUP OF SURFERS HAVE BEEN COLLABORATING IN A PILOT STUDY WITH SCRIPPS TO SEE HOW DATA GATHERED IN THE LAB COMPARES TO DATA COLLECTED OUT IN THE SURF.

Stephanie:
The beta testing program is twofold. One, is to see how well the fin actually works as far as uploading data, and functionality of the actual fin.

And the second is just to collect more data to actually see how the fin is operating with regard to the sensors.

CLIFF KAPONA, ORIGINALLY FROM HAWAII WHERE SURFING WAS BORN, IS A BETA TESTER FOR SMARTFIN.

HE’S ALSO A PHD STUDENT AT SCRIPPS.

L3:
Cliff Kapano
PhD, Scripps Institution of Oceanography

Cliff:
If we’re able to have source data, right, from the reef, y’know, we understand …collective …huge database of what’s the salinity, what’s the temperature, and what’s the pH, we can profile the chemistry on the reef a lot more effectively.

And you know if we remove ourselves from the places we are trying to protect, I think we’ll always fall short of our goal.

(Music)

Chad:
Surfers travel all over the world. They go to all these places with these sensitive coral reefs in Indonesia, and, y’know, all over the South Pacific.

And so I think surfers provide, really, a sort of a unique opportunity to expand the data collection in a way that research dollars… it would just take so much money to get done.

Round up of surfers around the world:

THE UNITED STATES HAS SOME 3 MILLION SURFERS…

AUSTRALIA, DESPITE ITS SMALLER POPULATION, HAS ALMOST AS MANY.

THERE ARE EVEN HALF A MILLION IN GREAT BRITAIN.

WORLDWIDE, IT’S ESTIMATED THAT SOME 23 MILLION MEN AND WOMEN SURF.

Tyler:

When you look at surf breaks from an aerial point of view, you can start to see how many surfers are actually out in the water, and you can start to realize how much of an impact that has the potential to make.

Scene in parking lot, downloading the data:

BUT FOR SMARTFIN'S CREATORS, THE FIN IS NOT JUST ABOUT COLLECTING HIGH-GRADE SCIENTIFIC DATA.

Andy:
For the citizen, you've contributed to understanding our oceans, and it makes the science more accessible.

You can acquire enormous amounts of data for next to nothing, and often the data cannot be obtained any other way.

I think of Smartfin as a citizen science project which is seeing the ocean not only as a very, very *cool* playground, but also as a fragile and critical part of the Earth's environmental system.

Dolphins race in front of a ship.

URL CGI:
CrowdAndCloud.org/AdventureScience

3. FALL
Waleed: lead to "Year in the Life of CS": pollinator garden, Jamaica Bay Wildlife Refuge, Gateway National Recreation Area.

CU's of birds and butterflies, and flowers. Shots of Waleed looking, and interacting.

So social media and new technologies can make life better for people everywhere.

But can citizen science and apps also protect the species with whom we share the planet?

Researchers talk about "phenology"—studying how plants and animals respond to seasonal changes, and—yes, as we'll see—there's an app for that.

We're going to journey through a year in the life of citizen and travel across the nation, from coast to coast.

Let's start in late summer/early fall, with flowers blooming but with concerns about the number, and health, of pollinators.

FALL
Plants, Pollinators
& Resilience

Kerissa and Kemp walk their trail, pointing out reference trees along the way:

"Yeah, this is witch hazel #1…"

Kerissa VO:
My name is Kerissa Battle. We are right now in place called Bearsville, in the heart of the Catskills.

L3
Kerissa Battle
New York Phenology Project

I grew up in Jamaica, Queens, with no real context for the natural world, really at all.

As a young adult, when I did discover that it existed, I fell in love, pretty… pretty hard and fast, as young adults do.

KERISSA, AND HER HUSBAND, KEMP BATTLE, DOCUMENT SEASONAL CHANGE USING A SMARTPHONE APP.

Kerissa:
The National Phenology Network has created this incredible resource, this observing platform called "Nature's Notebook."

(cross-talk)

We walk the trail frequently, pretty much every day, take my dogs out, and hit the trail, and make my observations on my iPhone.

Kerissa to Kemp:
"Let's start with question 1, do we have breaking leaf buds still?"

Kerissa VO:
And my observations are included in the data set, just like anyone else.

KERISSA WAS SO IMPRESSED WITH "NATURE'S NOTEBOOK" THAT SHE FOUNDED THE *NEW YORK PHENOLOGY PROJECT*, WITH A SPECIAL FOCUS ON PLANTS AND POLLINATORS.

Kerissa behind flowers:
One of the main focus of the New York Phenology Project is plant/pollinator synchronization.

So we're looking at the timing or the mismatch of timing between plants and pollinators that depend on them for nectar, and the plants that depend on the pollinators for effective pollination.

Handling aster:

This is a late season flower… so it's really important in terms of its nectar value for a lot of pollinators.

CU's of the purple flowers and bees at the Refuge garden:

Quite a number of our sites have it on their observation lists. Jamaica Bay Wildlife Refuge, for example, is a site…

Musical bridge:

THIS WILDLIFE REFUGE IS WORKING WITH BOTH ADULT AND TEENAGE CITIZEN SCIENTISTS NOT JUST TO SUPPORT THE HEALTH OF PLANTS AND POLLINATORS, BUT ALSO TO RESPOND TO THE IMPACTS OF "SUPERSTORM SANDY."

L3
Dan Meharg
Education Specialist/Park Ranger
Gateway National Recreation Area

Dan:
We're here in Jamaica Bay. This is part of Gateway National Recreation Area and the specific spot we're at is the Jamaica Bay Wildlife Refuge.

L3
Emily Fano
Senior Manager, Eco-Schools USA
National Wildlife Federation

Emily
We're about 45 minutes from Manhattan in the largest urban national park in New York.

Dan:
During Hurricane Sandy, we had a 14 foot tidal surge.

The seawater came in through the entrance from the Atlantic Ocean into Jamaica Bay.

Emily:
We recruited schools in Brooklyn and Queens that were directly impacted by Superstorm Sandy.

They suffered the effects firsthand of this dangerous storm. And we wanted them to come and see not only what happened in their neighborhoods but also what happened to the local ecology here, in their backyard.

L3:
Justin Herbert
Student, Rockaway Collegiate High School

I lived through Sandy. It was cold and there was no lights, no heat, not really nothing.

L3
Ethan Minney
Student, Rockaway Collegiate High School

If you were outside you could see the water level actually rising to its peak and then it went over the boardwalk. It was just crazy.

(wind)

L3:

Teneisha Blackman
Student, Rockaway Collegiate High School

It was very scary and, like… you… It just happened so quick you didn't know what to do or how to react to what happened in the situation you were in.

THE PARK SERVICE STARTED WORKING WITH THE *NEW YORK PHENOLOGY NETWORK* TO MAKE RECOVERING FROM SANDY ALSO SUPPORT HABITAT RESTORATION.

Dan to the students:

Dan:
So what would we have to do to transform this area that was damaged by Sandy into a place that's going to attract more pollinators? What happens next?

Female teen:
With more seeds there's more birds. With more birds there's more places for the plants to grow.

Dan:
Yes, right. So, you need, like… We're trying to start up that whole engine that has sort of been broken by Sandy.

CU flowers and pollinators:

Emily:
What we're concerned about is the decline of pollinators nationwide and also globally. And we're looking at the decline of their food supplies, the decline of their habitats.

Kerissa:
Jamaica Bay Wildlife Refuge now is starting to do a lot of incredible work with pollinators and native plant restoration.

So if you know, for example, that a particular bumble bee is mismatched with the plants that it visits you can focus conservation effort, building native habitat.

Emily:
Pollinators are essential to our survival. They're responsible for a third of every bite of food we take. And they are as important in urban settings as they are in rural or suburban settings.

Kerissa:
Some of the teachers that I met are at Jamaica Bay Wildlife Refuge to build native bee hotels, so to create habitat you can put in backyards…

Dan to students:

Dan:
We're gonna have to look really closely to see if we see any pollinators right now.

You're just going to count how many pollinators we see in one minute.

So I'm gonna tell you when to start. And somebody's already spotted one.

Dan:
When we report data, the other people in the network get to be part of the data that we're collecting.

See students gathering and sifting seeds:

Kerissa:
Students will be coming out and collecting the seeds, to plant in more patches like this.

So that's one of the conservation efforts around increasing habitat for pollinators where *anyone* can actually make a difference.

Emily:
We're teaching students that even small actions can make a difference for pollinators, even in cities.

Sometimes we hear about studies that are very large in scale, but we don't really know locally what's happening in our own communities and it's the citizen scientists that are gathering that data and helping us understand what's happening on a very *micro* level, and that's almost as important as what's happening on very large scales.

Ethan:
It makes me feel good because it makes me know I'm doing something good for the environment, and it makes me realize, you know, that I'm actually helping. It might be in a small way, but I'm still making a difference.

Dan and student walk through the Refuge:

Dan:
If you were a bumblebee, and you were flying around here and looking at this area right now, what are you thinking about this area?

Why would you not want to be here if you're a bumblebee?

Male teen:
Not many flowers!

Dan:
Yeah, not a lot of flowers.

If we're gonna put plants back here, we need to put plants that are resistant to salt spray and storms like Hurricane Sandy because we're likely to get one again.

So one of the plants I pointed out to you was this one over here….

Kerissa:
Some of the species that we are working with don't have data sets so this is baseline.

This is just getting that first look at what's actually happening phenologically with these species.

Dan:
What I always say to the kids is that the data that we're collecting is really important to members of the Phenology Project, so they can compare their blooming goldenrod with the time our blooming goldenrod is blooming.

Students collecting data:

Emily:
We're moving students from education to action, knowing that they can collect data, and also then restore habitat for pollinators.

Montage of any and all scenes… seniors and students, Maureen at work, kids at Gateway:

Kerissa:
And what is fantastic about the Citizen Science movement is that you have people who can steward these small green spaces, and pay attention to what is actually happening in them.

Are they seeing certain pollinators that they haven't seen before in that particular area? Are they moving from patch to patch?

When you empower people in their own backyards, at their schoolyards, in their city parks, in the places they are already going, it's more likely that you can actually create connectivity across the landscape.

4. WINTER

WINTER
Masses of Monarchs

Coastal CA scenes, birds:

Jessica Griffiths, VO:
We're on the Central Coast of California which is really the heart of where monarch butterflies spend the winter.

L3:
Cheryl Powers
Western Monarch Count volunteer

Cheryl to camera and VO:
The monarchs that are overwintering here has never been here before they never been to this part of California before.

Jessica, VO:
These monarchs have come from all over the Western us so they've come from Arizona, Nevada Utah, Washington State, Oregon State.

L3:
Jessica Griffiths
Wildlife biologist

They have flown hundreds maybe even in a thousand miles to these exact spots.

Cheryl:
There are about 200 locations along the California coastline where the monarch butterflies overwinter and this happens to be one of their favorite places.

The underside of the monarch butterfly is actually very well camouflaged.

L3:
Steven Thrasher
Western Monarch Count volunteer

Steven:
They're not very impressive if you don't know what to look for. But then you look, you see, "Oh that's a couple hundred butterflies all together. Oh that's pretty amazing. (Gestures) Oh, come look! Come look!"

(laughs)

Jessica:
Back in 1997, a group of concerned citizens decided that there needed to be a better, more standardized way of keeping track of monarch butterflies, and they noticed that monarch butterflies tend to peak in population at the overwintering sites around Thanksgiving, Thus was born the Western Monarch Thanksgiving count.

Cheryl:
Volunteers go out and try to find and count the monarch butterflies

Jessica:
Today we are counting monarch butterflies at Pismo Grove.

Jessica, to the volunteers:

This site is the largest overwintering site in California. There's nowhere else that has more monarchs than this, so you guys are getting trained at kind of the mothership, right now.

Citizen science is more than, y'know, people who are excited or participating, or want to make a difference.

There has to be some science behind it, and so in the case of the Western Monarch Thanksgiving Count, all of our volunteers are rigorously trained on the proper counting protocol.

It's easy to lose your place. I will always go, let's say, left to right, bottom to up, a predictable zigzag pattern.

(Music swells as monarch stretches wings)

Volunteer, off camera:
And it's important to do the whole site.

Jessica:

Yes.

Volunteer:
At one time…

Jessica:
Yes, you want to count…

(Cross talk)

Jessica:
Because they move…

Monarchs take off:

Group:
Whoa!!

Beautiful!

Jessica:
Training our citizen scientists is extremely important to the data collection process.

In order to identify trends and to be able to say something about the data, and properly analyze it, then you need to have standardized data collection protocols in place.

Steven:
It's done in the morning because once they get warm enough to fly, it's impossible to count them.

(Laughs)

So you've gotta count them when they're clustering.

Cheryl:
We are recording the location, we're recording the numbers... exactly where the butterflies are in the trees.

What the activity of the butterflies are, whether they're sunning, whether they're by themselves, whether they're in clusters.

Steven:
When you're doing the count, you usually count a small group, a group of ten, and you go…

Counting montage.

1, 2, 3, 4… 5, 6, 7, 8… 9, 10, 11, 12, 13, 14…

Steven:
…65… 75. There's uh... there's 95...about a hundred.

Cheryl:
Counting method is basically like counting jellybeans in a jar.

Jessica:
I mean this does look very daunting, but breaking it up is the key.

And just …making sure you guys are on the same page when you're counting.

Cheryl:
And this information is all compiled by the Xerces Society, and it contributes to our understanding of what's going on with the population of the Western Monarch butterfly.

Jessica
The data that has been collected by hundreds of volunteers has really, actually, highlighted that over the last 20 years, the monarch population has declined in the western United States by about 90%.

These volunteers are the lifeblood of the Count.

It's being turned into management and conservation recommendations that can be implemented on the ground by homeowners, citizens, landowners, land managers, to better preserve monarch butterfly habitat and make a difference.

CGI URL:
CrowdAndCloud.org/Monarchs

Waleed VO:
CHECK OUT THIS LINK TO FIND OUT ABOUT PLANTING MILKWEED, THE MAYORS' MONARCH PLEDGE, AND OTHER STEPS TO HELP PROTECT THIS ICONIC SPECIES.

32:18
5. SPRING

SPRING
Timing Trees

Jennifer Owen-White, VO:
We are in the desert Southwest and wherever there's water that's where people want to be.

People started settling here in the Albuquerque area and they realized that there was an issue when the river flooded.

The people here decided that we needed to control the river and keep it within its banks.

We kept the river from flooding and that flooding was what created this beautiful cottonwood forest.

L3:
Jennifer Owen-White
Manager, Valle de Oro National Wildlife Refuge
US Fish and Wildlife Service

Without that flooding, when these cottonwood drop their seeds, they don't have moist soil to germinate in.

THE VALLE DE ORO REFUGE WAS PREVIOUSLY THE SITE OF A DAIRY FARM.

TO RESTORE IT TO A MORE NATURAL HABITAT, VOLUNTEERS FROM NEARBY PUEBLOS, LOCAL SCHOOLS, AND OTHERS ARE DOCUMENTING WHEN BUDS BURST AND SEEDS FALL.

THOSE DATA WILL HELP PROMOTE THE GROWTH OF NATIVE COTTONWOODS, AND BEAT BACK THE INVASIVE SIBERIAN ELM.

Girls, VO:
Today we are observing Cottonwood and Siberian elm trees on the Refuge to see what the growth of the tree is like, and to enter it in our "Nature's Notebook."

One volunteer to the other:

Girl #1:
Notice like there are little tiny, little buds on the branches.

Girl #2, recording the data:
No open flowers. Pollen release, not yet.

Girl #1:
Mm… mm.

Girl #2:
No fruits.

THE PHENOLOGY APP PLUS CITIZEN SCIENCE ARE DELIVERING HYPER-LOCAL DATA ABOUT SPECIES-SPECIFIC SEASONAL CHANGES THAT WOULD OTHERWISE BE MISSING.

Jennifer:
When we monitor the cottonwoods, we're learning about when they are budding, when they're dropping their seeds, and that's going to help us when we recreate flooding events. We can recreate flooding events at the exact right time so that the cottonwoods drop their seeds and that they germinate.

So we don't need to plant hundreds of cottonwoods, so that they grow on their own.

So that's a big part of what we're doing with "Nature's Notebook."

Volunteer and Jennifer looking at laptop:
"So I guess you can compare them…"

Jennifer:
We also have other projects that we've linked with "Nature's Notebook", like the BEMP program, the Bosque Ecosystem Monitoring Program, where they're studying the water levels in the river and the groundwater and that's going to help us with restoration.

Birder speaks to students:

Alright, let's see what we're seeing…

Jessica, VO:
It's important for us to collect the zero data, the "no" data, when we don't see things. But it's also important for our volunteers to stay engaged and to stay excited about the project if they do get to see wildlife.

Birder, gesturing with a feather:
So, really quickly, what could be some signs that we might observe, even if we don't see the animals that are out here

Male student:
The robin is actually here from January till about September.

Jessica, VO:
So we wanna pick some of those birds like the Canada Geese or the Sandhill cranes that we know people are gonna see, but that will also inform us about how our restoration work is going.

One of the most exciting things is that data that we collect here isn't just used for Valle de Oro. It goes into a national database and scientists and educators all across the country can access this data.

Students enter data:

Jessica, VO:
And I'm so grateful for all of the volunteers who give their time and their energy to collect this data.

It's not easy. It's not quick.

Jennifer:
Another coyote hangin' out in the field over there…

We've been seeing a lot of coyotes lately, especially the past couple of months, in the winter when we've had so many Sandhill cranes and geese on the property. The coyotes have loved it out here.

Jennifer:
I think this is a mutually beneficial relationship where the volunteers are learning more about wildlife and plants in their community, and most importantly they feel like they're giving back to something big and something special.

Hot air balloon flight over the river and bosque:

They're not just out there collecting data, entering it, and then they see nothing of it. They get to come out here and they get to experience how their data is being incorporated into the Refuge design.

(Music)

6. SUMMER

SUMMER
Counting Crabs

Bob Allen, VO:
We're here in southern New Jersey on the Delaware Bay, and tonight we're doing a horseshoe crab census.

Adrianna:
It has not started raining!

Man:
We don't talk about that.

L3:
Adrianna Zito-Livingston
Cape May Preserve Coordinator
Nature Conservancy

Adrianna:
This is our motivation to have a quick and efficient survey tonight.

So show of hands who's done a survey before? OK.

L3
Bob Allen
Assistant State Director
Nature Conservancy NJ

Bob:
Horseshoe crabs are thought to be between 350 to 400 million years old, really without any changes, so they are older than the dinosaurs, these are truly ancient creatures…

Barb:
When I first came here 35 years ago you couldn't walk on this beach in the summer time at this time of year without stepping on horseshoe crabs.

Waleed VO:
SUMMER ALSO BRINGS MIGRATING BIRDS, SUCH AS THE RED KNOTS WHO TOUCH DOWN TO FEAST ON CRAB EGGS.
CGI map:

RED KNOTS ARE LONG DISTANCE TRAVELERS, FLYING 10,000 MILES FROM TIP OF SOUTH AMERICA, ALL THE WAY NORTH TO THE ARCTIC.

L3:
Barbara Holm
Volunteer

Barbara:
They stop here to fatten up on the way, and they fatten up on the horseshoe crab eggs, which at least until global warming started, happened at the time that the Red Knot arrived.

HORSESHOE CRABS COME ASHORE TO SPAWN AT HIGH TIDE, WHEN THE MOON IS NEW OR FULL.

A FEMALE LAYS SOME 90,000 EGGS EACH YEAR, ATTRACTING MULTIPLE MALES, ALL COMPETING TO FERTILIZE THEM.

Adrianna:
Most species that lay a ton of eggs, it's one of those one-in-a-million, 1-in-a-billion chances of surviving, partly because of their own spawning strategy and then partly because of the shore bird buffet that happens.

HUMANS WERE ALSO HARVESTING THE CRABS, USING THEIR BLOOD FOR MEDICAL PURPOSES, AND THEIR BODIES TO CATCH EEL AND CONCH.

Bob:
One of the popular uses of horseshoe crabs is to actually use them as bait. So many of those horseshoe crabs were harvested that populations started to decrease.

In the early 2000's the shore bird populations started to really decline rapidly.

And it was thought that the reduction in horseshoe crabs numbers and the eggs that they produce, was probably the root cause.

But there wasn't a lot of data.

What we'll be doing is walking along the beach and putting out survey equipment. It's just these real simple PVC square that we put down. And we count the horseshoe crabs that are in it.

And by doing that over and over again on a whole bunch of beaches along the Delaware Bay, we can track horseshoe crab populations.

Adrianna to the volunteers:

Adrianna:
We'll need at least one pacer, ideally two per team.

You can either count the number of footfalls it takes you to go 10 meters, or every other step. Whatever is going to be easiest for you to remember.

A lot of things can affect the number of crabs that are spawning, so we record all of those things on our data sheet. Things like wave energy, cloud cover. We get that a bunch of different ways.

A bunch of crabs are starting to come up on the beach and the feeding frenzy of laughing gulls, tells me there's a whole bunch of eggs actually out there in the sand already.

See the number of loose eggs, all with fresh yolk.

The shorebird biologists actually liken it to cheesecake, because it's so high in fat and nutrition.

Adrianna:
The data that that you're getting, the number of males and the number of females…

We will be identifying them both based on position and also size.

Adrianna explains sex differences:

Adrianna:
Males have these boxing glove claws, they have a hook on them, and they use that hook to grasp the female right here.

So again female underneath, and a *whole* bunch of males.

This is a pretty high sex ratio for horseshoe crabs, which is another piece of information that comes out of the spawning survey.

Adrianna:
So, Karen is feeling to see if there's a female and she's gonna try to find another one.

A healthy population in horseshoe crabs should have a fairly high sex ratio.

STARTING IN 2006, THE DECLINE IN CRABS AND SHOREBIRDS LED ENVIRONMENTAL AGENCIES TO IMPLEMENT STRICT LIMITS ON CATCHING HORSESHOE CRABS.

Barbara:
There's been a moratorium. Now this is the 8th year of the moratorium. One of the things we are looking for is, are they starting to come back?

A male horseshoe crab takes 7 years to reach sexual maturity.

Sharon:
So this is the first year since the moratorium was put on, so it will be interesting to see if they see an increase in the number of males.

Eric Merkel:
I've been doing this for two years or so. I love the environment. I like the horseshoe crabs.

I think it's cool that they've pretty much been here forever. A lot longer than humans have been here. Millions of years or so…

And if their numbers start declining now, then I think we can clearly say that people are the ones who are at fault for it.

Shots of Eric tipping the crabs right side up:

And I like to feel that I'm helping. Even a little bit. It still makes me feel a little better inside.

Barb:

17 males and…?

Female voice, off screen:
3 females.

Barb:
3 females, OK.

Bob:
So, right now in New Jersey, there's no harvest of horseshoe crabs allowed.

And in order for that to be changed over time, for harvest restrictions to be lifted, we need to know that the horseshoe crabs have returned to sufficient numbers to support the shorebird numbers.

And so the results of surveys like this citizen science survey actually inform the decision-making on whether the restrictions can be lifted or not.

The only way these kinds of surveys happen up and down the Bay is with the help of volunteers.

There's just no way that it could be covered with professionals. And the volunteers do an *awesome* job doing these kinds of surveys so it's fantastic data.

Herb and Sharon Siefken:
We've been doing this for 5 years.

It's interesting. But we were both teachers, now we are retired and we want just to see what we could do to help out.

Herb on camera:
And it's a very interesting topic and a lot of fun!

URL CGI
CrowdAndCloud.org/CountingCrabs

At SFO downtown Farmer's market.

7. DATA FOR DEVELOPMENT
Waleed to camera:
In the developed world, data are often as plentiful and varied as food at a farmer's market.

In developing nations, however, it's often quite different. The data just aren't there.

But for farmers, knowing *what crops* are selling *where* and for *how much* is essential information.

And for governments, knowing what crops *grow* where is critical for developing food policies for entire nations.

(Music)

43:10

Data for Development

Talip:
Every single data point has a human story.

(Music)

That human story, the story that tells me how agriculture is linked to nutrition outcomes. how people make employment choices, whether they have access to healthcare, what determines that?

Being able to answer these questions are important.

But for me to able to do that, I need to be here, I need to be able to observe it. I need to get to this place.

L3:
Talip Kilic
World Bank

It could be 3 hours away from the asphalt road. It could be 15 minutes away. For us, it doesn't matter. We need to get there, we need to get it done.

Cut to Talip walking through Kampala with James.

IN UGANDA, TALIP IS WORKING WITH LOCAL PARTNERS AT THE BUREAU OF STATISTICS TO FILL A DATA GAP ABOUT LIVING STANDARDS, ALL ACROSS THE NATION.

James:
I've been working with Talip since 2009. It all started with a need to have routine regular and reliable statistics.

L3:
James Mwonge
Head of Surveys
Uganda Bureau of Statistics

If you need to know where you are going and how you are moving there, then you need statistics.

Footage of training session

TALIP, JAMES AND COLLEAGUES HAVE TRAINED HUNDREDS OF UGANDANS TO COLLECT ACCURATE DATA FROM THE HOUSEHOLD SURVEYS.

THAT MIGHT SOUND EASY, BUT IN A BUSTLING BIG CITY LIKE KAMPALA, WITHOUT STREET NAMES AND NUMBERS,

…OR IN THE REMOTE COUNTRYSIDE

…CAPTURING THE DATA THAT CAN SHAPE SUSTAINABLE DEVELOPMENT POLICIES IS NEVER EASY.

(Music)

Talip:
When we think about a typical household survey interview in Kampala, in some sense getting there is a sensory overload.

When you're walking through the streets of Kampala you will find traffic jams.

You will find people on motorcycles, getting off taxis. People from different walks of life, different ethnicities, people that speak different languages.

You might find yourself in a very busy marketplace with all sorts of goods and produce sold around you. People doing all sorts of jobs.

So at the end of the day doing surveys in urban Kampala becomes quite difficult.

Talip:
Here in Uganda, roughly 20 percent of the population is estimated to be living in poverty.

L3
Talip Kilic
Senior Economist, Living Standards Measurement Study
The World Bank

So for us to really end extreme poverty, we need to be able to benchmark it. We need to be able to measure it well, and do that in a sustainable fashion.

James:
Most of the population is largely rural. We have about 20% living in urban areas but 80% live in rural areas.

Talip:
Getting to our intended destinations, is really one of the most challenging parts of our job.

(Music)

The thrill of getting to an enumeration area, one of 80,000 enumeration areas that we could have sampled from, picking that one, and setting that target, and going there is a thrill in and of itself.

And especially if you think about a landscape like this, which is just simply epic, is a romantic idea.

(Music)

Talip:
Looking behind me, it really gives you that sense that agriculture is a key contributor to these people's lives

If you think beyond this community, if you think about Uganda, agriculture is a primary contributor to the gross domestic product.

Talip:
Right now, we just got done measuring her parcel.

So to capture the area of the parcel the enumerator is following the head of the household, walking the perimeter of the parcel so that we can demarcate the parcel boundaries.

And as she's doing that, the enumerator has her GPS unit on, basically recording her track.

GPS SENSORS GET POSITION DATA FROM SATELLITES, BUT JUST AS WITH SURVEYS OF TREES, BIRDS OR BUTTERFLIES, IT TAKES BOOTS ON THE GROUND, FEET IN THE FIELD, TO ADD THAT LOCAL KNOWLEDGE WITHOUT WHICH THE DATA WOULD HAVE NO MEANING.

IT TAKES BOTH HIGH TECH AND HUMANS.

Talip:
From the moment the interviewer asks a question, the response becomes a numerical data point.

When you look at the numbers you can see how that is changing our understanding of Africa, how it's changing the understanding of these economies that did not have these data before.

James:
We have been monitoring poverty since 1992. And in 1992, 56 percent of the population was poor in Uganda.

And that number has reduced to 19.7 percent.

It is statistics that informed poverty eradication action plan. How far have we moved, where are we now.

Even when we are long gone, y'know, whoever comes to take over, will be able still use these methods to monitor change, this is where we moved from, and this is where we are.

And so, to me, collecting information and seeing it being used, that's the satisfaction I get.

URL
CrowdAndCloud.org/DataForDevelopment

8. WRAP

Citizen Science in the Digital Age

Waleed to camera:
My background as a scientist, working for NASA and universities, has shown me the value of the Big Picture perspective we get when we look at Earth from space.

But diving into these projects we've covered in THE CROWD & THE CLOUD, I've learned that the up close and personal perspective, people collaborating and sharing data via the *cloud*, is an excellent way to gather the information we need to help solve the challenges we all face.

Scenes from all programs in the series:

From earthquakes to epidemics, from air quality to Alzheimer's research, from the health of our oceans to the safety of our drinking water, citizen science and crowdsourcing *do* make a difference.

And citizen science *is* science. The better the data, the bigger the impact, for scientists, policy-makers and the public.

CGI
Citizen Science
for Scientists

L3
Chris Wood
eBird developer
Cornell Lab of Ornithology

Chris:
Citizen science is revolutionizing the way that scientists understand the world around them.

Citizen science allows us to bring together people of all cultures, many different languages all around the world, and bring these data together in a way that allows us to understand the world in a way that's never before been possible.

Kerissa:
I think a lot of scientists are starting to recognize that we can't do it alone, and that having eyes on the ground, and boots on the ground, is really the only feasible answer for the type of data that we actually need to collect to answer some of the most pressing questions we have about global change.

CGI
Citizen Science
For Communities

L3:
Deb Thomas
Resident, Clark WY

Deb Thomas:
If everyone would take care of their own backyard, the whole planet would look a lot better.

Wherever you live, you're the one who notices what's happening in your community.

You're the one that sees it first. You notice the changes in your environment.

L3
Denny Larson
Founder, Bucket Brigade

Denny:
And that's really what the Bucket Brigade is, a community participating in research it's conducting on itself. Rather than allowing outsiders to come in and dictate the type of study that's done.

Deb:
So if you can unit the people living on the ground and those people who are trained, it's a really strong union, because you are getting both sides. You are seeing people who recognize what's happening and then you can combine that with people who know how to test that, and actually monitor that, and get results.

L3
Jeff Warren
Research Director/Co-Founder, Public Lab

Jeff:
It's sort of a new way of thinking about science. It's funny to say it, but it's like science serving the people.

L3
Shannon Dosemagen
Co-Founder, Public Lab'

Shannon:
We want it to be a two-way street, not just flowing one way.

It's the act of saying, we also have our own stories, and we also have information that can be contributed.

Jeff:
We're looking at existing instruments and we're saying, "Actually, we could do this a lot cheaper. We could do this a lot better."

We could take 10 times or a hundred times more data, for a fraction of the price. And we're doing it more openly. We're sharing everything open source.

L3
Margaret Gordon
Co-founder, West Oakland Environmental Indicators Project

Margaret Gordon:
And being able to have the tools and resources, and the devices to prove your point.

It's about the actual putting together and advocating for something that is personal or interpersonal, to an individual or a community that's being impacted.

But most citizen science, when you start talking about citizen science, they be talking about birds, and flowers, and trees, but we be talking about *human beings*.

CGI:
Crowdsourcing
for Medical Research

L3
Amy Robinson
Executive Director, EyeWire

Scenes of ALZ families:

Amy:
Alzheimer's is terrible. It's horrendous. It impacts almost everyone you know, not directly in that they have it, but that almost everyone knows someone or will know someone who is negatively impacted by a neurodegenerative disease like Alzheimer's.

Amy on camera:

And to me, if we can further research, and if we can engage the world to make these discoveries, that's something that you can't even quantify the value of.

L3
Pietro Michelucci
Human Computation Institute, EyesOnALZ

Pietro:
Up until recently, we didn't have a way to combine those planetary resources, all "team human", in getting everyone to kind of support this.

We're taking these tasks that the technicians do in the lab, and we're putting it online. And we're gamifying it. So anyone can go on and use this natural perceptual process to attack this problem.

L3
Chris Schaffer
Biomedical engineering, Cornell

Chris Schaffer
The results are stunning. They've definitively shown that the crowd can produce medical diagnostic information with as good of an accuracy, sensitivity, and specificity as a trained pathologist.

Pietro:
And those few minutes multiplied by 10,000, 100,000, a million people, gets the job done very quickly.

CGI:
Crowdsourcing for
Disaster Response

L3
Jenelle Eli
American Red Cross

Jenelle:
When a big disaster like the Nepal earthquake happens, the Red Cross gets inquiries from all over asking what people can do to help.

What's amazing about OpenStreetMap is that people can help right away by making edits to OpenStreetMap. So within 48 hours, 2,000 volunteers made edits to OpenStreetMap to help disaster responders on the ground deliver relief supplies.

L3
Nama Budhathoki
Kathmandu Living Labs, Nepal

Nama:
We live in a connected world. Something good happens somewhere, people can take example. Hey this happened in Nepal. You know, why can't we do that? If Nepal can do that, we can do this. That will inspire…

Andy:
Jacques Cousteau said, "People protect what they love." Surfers love the ocean. And I think that's a lot of the motivation for them stepping up as citizen scientists.

Shannon:
I think that we should always question. I don't ever think that we should be a society or a group of people that just accepts what somebody tells us, that's not how we make progress.

Kerissa:
The field is growing, and it's certainly become a movement, and a movement that's making a difference.

Waleed to camera:
We hope you've enjoyed these stories of people just like you, engaged in gathering and making sense of data about the world around them.

C&C website with project finder:

Waleed VO:
NEXT WE INVITE YOU TO GO ONLINE AND FIND PROJECTS NEAR YOU AND JOIN IN THIS NEW WAY TO DO SCIENCE.

Waleed to camera:
Today's citizen science is serious science. It's personal and powerful. It's a tool that's available to anyone, and its potential is as large as the world around us.

For THE CROWD & THE CLOUD, I'm Waleed Abdalati.

Web announcement, voice and on-screen text:

To learn more about
THE CROWD & THE CLOUD and the stories in this series please visit CrowdAndCloud.org

End credits:

Underwriter announce:

"THE CROWD & THE CLOUD" is made possible by NSF, the National Science Foundation, Where Discoveries Begin."

End