00:04

I was in a village in Samoa, in the South Pacific, and I don't remember when the rain started, just that it didn't stop. For more than a month, 24 hours a day, it just kept coming. The rivers rose, and soon no one or nothing could come in or out. We were just there, in the flood.

00:27

Have you or a loved one ever been affected by flooding? Think about it. Chances are, based on statistics, you or someone you know has been impacted by flooding. There's a powerless feeling in a flood. You can't stop the rivers from rising. But for the first time, we are in a place where we can shift the power paradigm of flooding.

00:56

According to the World Water Resource Institute, flooding is the most globally impactful of all natural disasters, taking between 4,000 to 5,000 lives every year. In the United States, 14.7 million properties, homes, businesses are at substantial risk of flooding, costing billions in economic losses every year. In fact, in 2010, we spent 176 billion dollars on global flood recovery, which is equivalent to roughly 20 percent of the grocery bill for every family in the US for one year. And by 2080, we're projected to spend over four trillion dollars on global flood recovery. Wow, that's a lot of money.

01:49

Now I'm talking in terms of groceries because that's something I can wrap my head around. I know how much I spend on food. But that money could go to anything: to the national debt, health care, education, back to the citizens. You can do a lot with four trillion dollars.

02:05

Now we're pretty good in knowing just how bad a flood will be, and we're pretty good at knowing when they're going to happen. We've been looking to solve flooding since our earliest civilizations, Since Noah, we've been looking for a flood workaround. So why is this still such a huge problem? Because we love water, we need it, we always have to have it. We build our cities next to oceans and rivers because being next to this critical resource makes our lives easier. In fact, today most of the world lives in coastal areas, and more and more of the world lives in urban zones. Students and entrepreneurs seeking bright futures are drawn to exciting opportunities in cities. In 2008, for the first time, half the world's population was urban. By the time my little girls are my age, more than 70 percent of the world's population will be urban. That's a rapid growth.

03:11

And as cities rapidly grow, they alter their landscape, resulting in more stormwater runoff, a decrease in water quality and ultimately greater impacts due to floods. We seek to allay this through stormwater and floodplain management, but in our dynamic and constantly evolving urban environments, the numbers suggest our traditional approaches just aren't enough. Unfortunately, those hurt the worst are the most vulnerable. Low-income unsanctioned housing is often located in areas of an elevated flood risk. Families and communities without the ability to prevent and combat the economic upheaval associated with flooding are those hurt the worst, and are hurt repetitively.

04:01

This is a global challenge. And I saw this, stranded in the village of Samoa, where those same floodwaters destroyed crops, flooded markets and shut down businesses. I took this picture in Vanuatu, where this recently washed out bridge had previously connected communities to their farms and schools. Living in Thailand and working in Vietnam and Cambodia, seasonal urban flooding made daily activities like commuting not only a challenge, but risky. Floodwater is not clean. This was reinforced this summer when 63 million people in Southeast Asia were affected by floods. I saw this working in Afghanistan, where the dry climate is perfect for flash floods. Lack of resilience, rapid urban growth and flood frequency have unfortunately made Afghanistan one of the world's leaders in deaths per capita due to flooding, on top of dealing with decades of war. This was reinforced in the spring and summer of 2020, when thousands lost their homes and hundreds lost their lives in flooding in Afghanistan. And I saw this working in projects in Kenya, Sierra Leone, Paraguay, Haiti. But we see this in our own hometowns. We see this in Philadelphia when we drive around after a storm or when we cross Lancaster Avenue near Villanova. We've seen this when the Mississippi River floods. We've seen this in hurricanes like Harvey, Katrina and Sandy. We saw this this summer in Isaias, and we will see this again. This is a challenge that unites us. And these are challenging times, but they're interesting times.

05:53

Sir Isaac Newton said, "If I've seen further, it's because I've stood on the shoulder of giants." And from the shoulders of giants, we can see the world like we've never seen it before. This is an image taken by the astronauts of Apollo 17. They were some of the first to see our whole Earth. Our beautiful lonely planet had just been revealed. By 2029, 57,000 satellites will orbit our planet, generating hundreds of terabytes of Earth data every single day. We are alive in the data revolution. Data is being generated constantly, not only through satellites, but gauges and sensors, through our own actions, just using our cell phones. Scientists and engineers are learning how to harness this information to gain novel insights into how floods work and illuminate new solutions. Sitting here at Villanova, we can predict ideal locations for infrastructure in Haiti and Kenya and apply artificial intelligence to know where a river will

cross its banks in Utah -- from our desk. This is being coupled with advancements in infrastructure. In recent decades, engineers have realized new ways to harness stormwater. Green stormwater infrastructure, like the one shown here, mitigates the flood pulse while cleaning stormwater, using tools from the soil and plants. Infiltration, evaporation and transpiration -- this has been shown to be effective and efficient in meeting federal water regulations, and is surprisingly cost-effective, too.

07:35

Although this is a fairly new type of infrastructure, it's revolutionizing the urban landscape. In Philadelphia in just 10 years, thousands of green storm water systems have been implemented, taking the city from being one of the worst offenders of water quality to a global leader. And they're not alone. Similar programs exist in New York City, Portland, Detroit and many, many others. And the success of these programs has fueled global popularity. But the benefits aren't just limited to stormwater but extend to community health and well-being, environmental restoration and floodplain management.

08:17

So these are exciting times. These are times of hope, times that we have the potential to stand up to the challenge of flooding. And here's the great part: we can all be part of meeting that challenge. This is an issue of civil infrastructure, and civil infrastructure is meant to serve civil societies, which includes all of us. It includes everyone.

08:44

So how does one get involved? Number one, use your voice. We need to be investing in solutions. The World Resources Institute showed that for every 1 dollar spent on flood protection infrastructure in India, it resulted in 248 dollars of avoided damages. Similar results were shown in other countries. If we can invest in mitigation, we can assuage the cost of flood recovery, ultimately reducing the cost of losses due to flooding. In the United States, where much of our infrastructure is aging, it needs to be replaced or updated. But civil infrastructure is not one-size-fits-all. It has to meet the needs of the community that it serves. So what are the needs of your community? How has flooding impacted you? Speak up, let your representatives know, take part in public hearings and be part of finding the solution for your community.

09:47

Number two, use your actions. Imagine a raindrop falls on your roof. As it rolls over your sidewalk or your yard, what does it take with it? The stormwater coming from your home or your business or your community impacts the rivers and the streams that it drains into. So make your

property or your community part of the solution. Volunteer to help maintain green stormwater infrastructure or create and invest in green stormwater infrastructure at your home or your business. This is an example from Villanova. I've circled it in red because it's not that obvious. This isn't a big, obtrusive piece of infrastructure. This is an obtainable, feasible solution.

10:36

And number three, innovate. Stage is set. Developments and data, computational power, water resource management have opened the door for advancements. But this isn't just an issue for engineering; this includes all of us. Arts, education, biology, chemistry, urban planning, public health, governance, business, all of us. So what's your solution? What's your innovation? What are the next steps?

11:12

Flooding has been an issue that we've faced since our earliest societies. But for the first time, we have the potential for which we can find solutions. The damages, the cost, the lives lost. We can change that. In our yards and our communities and our cities, with our voices and our actions and our innovations, we can find solutions and we can shift the power paradigm of flooding.

11:42

Thank you.