

Dr. Diana Liverman

Nobel Conference 55

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So what a wonderful event at this pivotal moment in our response to climate change. And thank you very much for the invitation, though I sort of wish I wasn't following Richard Alley. He's a hard act to follow, the sort of Energizer bunny bouncing around up here with great enthusiasm for his science. And what will distinguish my talk is Richard talks to rocks and ice and actually, my introducer, I believe, talks to bison. Well, I talk to people. And I'm going to talk mostly from a social science perspective about responding to climate change.

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And what I want to talk about is how we can respond to climate change in the context of other global imperatives. Specifically the goals of eradicating poverty and hunger to reduce the suffering of millions of people around the world, as well as people who are in trouble in our own neighborhoods.

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So former U.N. Secretary General, Ban-ki Moon, sort of captures the question that I'm asking us. And he made this challenge at the Paris Climate Conference in 2015. He asked, 'Can we be the first generation to put an end to poverty and are we the last generation that can put an end to climate change.' What that means for me is to ask how can we connect the global goals for sustainable development for all with international efforts to limit warming to one or one point five or two degrees Celsius. How can we ensure better lives in our own communities and other localities while reducing emissions and adapting to warmer climates? How can we connect international efforts with what we're doing locally?

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What are the general development goals that we have for countries and people and communities around the world? Well, even though we're very preoccupied with climate change last week and in this conference, for many people and many countries, the priority is to reduce poverty, whether for humanitarian reasons or in

fact to increase the number of economic consumers, or to reduce social unrest, poverty eradication is an absolute priority.

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There are other goals, often linked to giving assistance to other countries for development, and those include improving access to food, drinking water, giving people sanitation, giving people education, and giving people healthcare. And over the last decade or 20, 30 years, as environmental problems have become more and more evident, the idea of sustainable development came to encompass development that also protects ecosystems that provide important ecosystem services and provide habitat for other species.

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So someone at lunchtime said to me, 'Am I going to go away from this conference feeling very depressed?' And I promised her some optimism. And so I want to tell you about some really great things that have happened over the last 20 to 25 years.

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Twenty years ago, with almost half the world living in extreme poverty, that's under \$1.25 a day, and hundreds of millions without access to clean water, sanitation, education, or healthcare, the United Nations adopted the Millennium Development Goals, or the MDGs for short. There were eight goals and they sought to improve lives in the developing world between 1990 and 2015.

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They had ambitious goals, halving poverty and hunger, reducing child and maternal mortality, increasing access to safe drinking water and to sanitation, increasing education and gender equality and eliminating developing country debt. And many people are not aware of the amazing success in achieving the Millennium Development Goals. And I'm just showing you some of the results here. And I will admit, I'm showing you the most positive ones and then we'll come back to that.

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So the percent of people living in extreme poverty was more than halved over that period. It dropped from 1.9 billion people living in poverty to 836 million, that's

from 47 percent to 14 percent by 2015. Hunger also declined, with undernourishment dropping from 23 percent in 1990 to less than 13 percent in 2015. Another thing that many people care about is the drop in child mortality. It was cut in half from 100 children per 1,000 born dying to 47, saving 6 million children's lives. 2.6 billion people gained access to improved drinking water and 2.1 billion to sanitation. In 1990, a quarter of the developing world lacked access to safe drinking water. In 2015, that had dropped to 9 percent.

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While some goals were not met, almost all indicators that were used to track the MDGs moved in a positive direction. In addition to success on the MDGs, there was another success that's important to the future in terms of climate change and environmental impact. Fertility rates, which are the number of children that each woman has in her reproductive lifetime, have dropped precipitously. There's been a big decline shown on the graph here, but if you go back a little further, you can see even greater declines.

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In 1960 on average in the world, women had four children. Now they're only have two point five and in many, many countries, including in the developing world, that is starting to fall below two. This decline, which is mostly a result of improvements in the status of women, education, employment, reproductive rights. This decline in fertility is slowing population growth and the associated environmental impacts. And if we maintain women's rights and choices, population growth is going to level off soon after 2050 and will play a much less of a role in concern about the environmental future.

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So we've had some incredible successes in development in the last 25 years or so, although there are still millions living in misery, which we must not forget. But at least one goal under the MDGs, one target to the environmental sustainability target, when in completely the wrong direction. And I wonder if you can guess which one it is?

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It's carbon dioxide emissions. Carbon dioxide emissions increased by 60 percent over that 25-year period whilst all of the other MDGs were moving towards a more sustainable role. Now I'm sure you're already starting to think or you know about why you would find that increase in emissions. And it has a lot to do with the number of people who came out of poverty. So some of the growth in the emissions is associated with continued population growth, even though it was starting to slow. A lot of that growth in emissions is that we didn't act. That's one of the things we should feel terrible about because we've known for 40 years that we needed to act.

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But it's also a result of the success in reducing poverty and hunger. Because as incomes increase, people tend to consume more fossil fuels as they get connected to the electric grid. They purchase a vehicle. And in many places, rising incomes are associated with eating more meat and dairy. And this is very evident in China, which actually plays a major role in all of this success that I'm talking about, where income went up 10 times between 1990 and 2010 and greenhouse gas submissions per person tripled to 6 tons per person over the same period.

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In 2015, the United Nations established a new set of goals, the Sustainable Development Goals. And they set out to further decrease and eradicate poverty and hunger, increase even further access to clean water, and in fact in this case, they were absolutes, the SDGs say let's eradicate poverty, not just halve it. They sought to increase access to clean water and energy, education, and health whilst also reducing inequalities, and fostering sustainable cities and consumption. And the SDGs also explicitly set out to protect the climate and ecosystems on land and under water.

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These are incredibly ambitious goals and they are to be met, for the most part, by 2030. And unlike the MDGs that focused on the developing world, the SDGs apply everywhere on Earth. They're for everyone everywhere, not just the developing world. And I think in all of our communities, even though we may not have people living in this sort of extreme poverty and starvation, you can look at the SDGs and

think of them as targets for any community anywhere in our country in terms of sustainable development.

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Many countries, and I've talked to some people particularly in the Caribbean, whether a small country with less government capacity, they are completely overwhelmed by the challenges of meeting these multiple goals whilst also addressing the risks of climate change. And that's one reason why at the Paris Climate Negotiations, the U.N. called on the scientific community to prepare a report. The main focus was on whether one point five degrees would be less dangerous than two degrees of warming. And whether in fact we could get to one point five, whether it was possible to limit warming to one point five. But another goal was that this was the first time the IPCC report that was requested, the one on one point five, was the first IPCC since they'd established the sustainable development goals.

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So we were asked in the one point five report not just to look at how to reduce climate risks, but how to do it in the context of sustainable development and efforts to eradicate poverty. I was an author for Chapter 5, it was a small report with just five chapters. And it was our chapter which tried to focus on the links between climate change, climate action, and sustainable development. And we spent 18 months, it was a fast-track report, and that's fast for IPCC, we spent 18 months assessing the scientific literature on the connections between climate and sustainable development.

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We looked at multiple interactions between climate and development. First of all, we looked at the literature on how climate change is threatening and undermining development's successes, such as those successes with the MDGs or the projects of big international development agencies as well as local communities.

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We also looked at how development progress may be contributing to increased emissions, whether eliminating poverty is sort of guaranteed to increase emissions.

But we also looked at how development progress might increase vulnerability by putting people in a situation where they're going to be more affected by extreme events such as hurricanes. And then finally we looked at what was the much smaller literature, and this would be a call for research because we really, really needed more research to look at it. But what we looked at was how the responses to climate change, how reducing emissions or putting in adaptation projects, how they had synergies and trade-offs with sustainable development. Because we wanted to help countries and communities figure out how to get a triple win. Where you could do stuff that both helped you meet the SDGs and helped you reduce emissions and help you with climate adaptation, if possible, especially when you had limited resources.

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So we were looking for what could we learn about low-emission pathways out of poverty? Can we get people out of poverty without increasing greenhouse gas emissions? Can we have a food system that reduces emissions, adapts to warming, and improves livelihoods? Would, for example, a response to climate change that involves biofuels. We talked about that in the first discussion, threatened food security, or ecosystems.

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But before we talk about what we found in Chapter 5, I'm briefly going to summarize the messages of the one point five report, although they were very well-summarized by Greta Thunberg at the U.N. yesterday. So it's hard to summarize 400 pages but here we go.

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The first message was climate changes here, climates already warmed 1 degree from pre-industrial, and if you only look at the Paris commitments, we're heading for temperatures above three point five. And we also talked about, we all focused on the one point five warming, that's global. One point five global warming is actually much more warming near the Poles or over land and at night. So, for example, in the Southwest U.S., we've already had one point five C of warming.

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Secondly, we concluded that every bit of warming matters. Negative impacts increase significantly if you have a two-degree warmer world compared to one point five. And the example that most people have talked about, that we've discussed, is that at one and a half degrees C, um, or at two degrees C, tropical corals disappear. If we can limit warming to one point five, we will, some of them will survive. So this big difference is in ecosystem system impacts at one point five and two, and I think you can probably see that in the historical record that Richard was looking at. If you go from one point five to two, you'll double the number of people exposed to water and to heat stress. And also poverty increases much more at two than at one point five.

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The message that's had the greatest impact from our report, and I'll be happy to discuss that in the panel, was the one where we said we have to act soon. We have to act yesterday. And we have to make very deep cuts in emissions. The thing that people heard was that limiting warming to one and a half degrees C requires a 50 percent cut in emissions by 2030. And net zero by 2050. Just as an aside, I've had a lot of people, including the media, ask me whether the 2030 date is the apocalypse. And I said, no, that is not what we said. In fact, 2030 was sort of an arbitrary point that we picked. Our most important message was that we need to be net zero by 2050, that we need to have emissions taken out of the atmosphere at the same rate we're putting them in. And that will require very, very steep cuts. Not the elimination of fossil fuels, but very, very steep cuts. The 2030 date was picked actually because of the SDGs, because they're supposed to be met by 2030 and it was also just a convenient year to sort of provide a shorter-term target on the way to 2050. So the world will not end in 2030. And these differences between one point five and two, they're serious but they're not apocalyptic.

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And then the final point we made is that development would be undermined, even at one point five, but more seriously at two. In fact, it's already being undermined at one degree of warming. But we did conclude, and this is where I will try to be optimistic again, that triple wins are possible. It is possible to cut emissions, adapt to warming, and achieve the SDGs, but we'll have to try really, really hard.

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So let's have a look at these four conclusions in more detail. And this, I'm just going to talk a bit about what we found in Chapter 5 about links between climate and sustainable development. So the first question we asked is, how is climate change undermining sustainable development? And I've just listed four examples of many here. We already know that climate change and climate extremes are undermining food production and they're creating food insecurity in different parts of the world. And because we live in a globalized food system, where price signals sort of zoom around the world, except to the most remote subsistence communities, a drought or a hurricane in one place can affect food prices and food security for people all around the world. We get these wave effects if you have a big drop in agriculture production in one region. And that means that this goal of eliminating hunger under the SDGs is seriously threatened by climate change.

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Increasing disaster risks, although there's some debate about the role of global warming in hurricanes, I think people think that the intensity is increasing if not the frequency. But we also have prolonged and severe droughts in many parts of the world. And those disaster risks can really create terrible economic problems. So if we take the case of Mozambique, I mean, we've had several hurricanes since then, but Hurricane Idai, Mozambique was one of the countries that have made tremendous progress on development in improving on the Millennium Development Goals. And it's back where it started following one major hurricane, which devastated agriculture, cities, and infrastructure. And the background to this slide is what's happened in part of the Bahamas just in the last month. And, again, the political leaders have talked about how this has undermined much of their efforts in Development. Climate changes, increasing health risks. That makes it harder to meet the health development goals. One of the MDGs was reduce the incidence of malaria and we know with climate change, we're getting changes in the distribution of mosquitoes that may lead to increases in malaria.

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And then finally in terms of the SDGs, the goals of protecting ecosystems, there are so many examples of how climate change is already affecting ecosystems, loss of bird populations for example, the loss of the corals, and that, of course, makes it much more difficult to achieve the ecosystem SDGs.

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Just last week in terms of food security in the SDGs, we had a workshop on what's happening in Central America and there it is a complex argument, but there has been prolonged drought in the dry corridor. The length of the midsummer drought is increasing and in much of Central America or Mexico, it's not just food security being undermined, it's livelihoods. And it is playing a role in people's decisions to migrate.

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So let's flip it. I just talked about how climate change is undermining development. Well, how might development make climate change worse? Well, I've already referred several times to the idea that reducing poverty can mean higher emissions. Rising incomes are associated in almost all cases with greater consumption of energy. And if the only cheap energy or available energy is fossil fuels, that will result in increases in emissions. Rising incomes are also associated with increased demand for water. And in some cases, the photo is of Shanghai, where much of the development, as China's incomes rise, has been right in the coastal zone. Which means that more and more people are going to be exposed to severe storms. So you can also see ways in which development, increased wealth, increased choice about where you live, can increase vulnerability. And China is an amazing case of rising incomes, bringing people out of poverty, and when people and some of our politicians say, well, the U.S. shouldn't do anything because, you know, China's not doing anything, they forget the incredible victory or success that China has had in bringing millions of its people out of poverty and feeding them much better. And they still have only one-third of the emissions per capita of the U.S.

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In the IPCC report, we looked at a range of strategies for limiting warming to one point five by reducing emissions and for adapting to warming already underway. And these are some of the options that we evaluated in the one point five report. And we looked at their technical feasibility, their economic feasibility, their physical feasibility, were they going to work? But we also looked at what they meant for the development issues, for sustainable development. So for each of these, we said, OK, if we use strategy X for reducing greenhouse gas emissions, how might that either have a synergy or a trade-off with sustainable development? We looked at

efforts to take greenhouse gases out of the atmosphere either through land use changes or through emerging technologies. We looked at geoengineering which David Keith will talk about. And we looked at all these adaptation projects. Most people assume that adaptation's good for and synergistic with sustainable development. But we wanted to make sure that was true. And just to give you a few examples of what we concluded, this is actually from my home state of Arizona. So limiting warming to one point five means steep declines in the use of coal. And, in fact, policies already in place, for example, in California, are moving the western U.S. away from coal as a fuel source.

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But the Navajo Nation in Northern Arizona is a place heavily dependent on coal. They have coal mines that are important to the economy and to jobs. And they have the Navajo Generating Station and the Four Corners Generating Station. They're two of the biggest point sources for carbon dioxide in the whole U.S., particularly in the west. And the decision now that's recently been made to close down the Navajo Generating Station probably at the end of the year could have quite devastating impacts for some workers and for the tribal income, the overall tribal income on the Navajo Nation. Coalmining and coal-fired electricity are important sources of high-paid jobs and income for the tribes.

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And what is sad here is that there are very few plans for a just transition or a Green New Deal or sustainable economic opportunities. One option for reducing emissions in the Southwest, one of the options that people have talked about is, well, maybe the Navajo Nation could become a leader in solar energy. And of course one of the main alternatives to coal running our economy in the American Southwest is solar energy. But solar energy isn't always consistent with sustainable development for the poor.

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Solar energy is not always accessible for poorer communities. In my town of Tucson, when I talk to some of the neighborhoods, people get really mad when you tell them, you should have solar energy on your roof. They tell us, the upfront costs are too high. It's still \$20,000 to get enough kilowatts up on your roof to run your

air conditioning in the summer. Most people can't afford those upfront costs. And then some will say, oh, well, you could get a loan. Well, many poor communities don't earn, don't qualify for loans. They don't have a credit rating that allows them to get the loan. And then the most insulting thing is when some better off person says, oh, but the tax breaks are so good for solar energy. [laughter] Well, if you're not earning enough to pay taxes, you don't benefit from that. And to cap it all, Alec [sounds like] and some of the think tanks are now trying to undermine solar by charging you a lot to connect to the grid. So it's making solar very, very hard. So the challenges of a just transition to a low-carbon world that's equitable and is sustainable are vast both within and beyond the American Southwest.

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Second example I want to talk about is biofuels. Well, many of us, actually probably all of the speakers here, feel pretty guilty about flying. And one of my, you know, selfish dreams is of a low-carbon fuel for air transport. So one of the options and it's very important in the one point five report, the only way that, the only scenarios that keep warming under one point five are ones that rely extensively on biofuels, especially to create an alternative to oil, a liquid fuel. Biofuels are often, I mean, the most sustainable are made from waste products. But a lot of them are made from growing plants, sugar cane, corn, and others.

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The IPCC report estimated that depending on how soon we act, from chance to limiting warming to one point five, we'd have to put large areas of land into biofuels. That could take land out of food security, so it could undermine our goals of eliminating hunger. And/or it will take land out of wildland protection and natural ecosystems, which will undermine the SDGs for protecting land, life on land and in water.

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The other problem is, of course if you put a lot of area into biofuels, that's going to increase food prices with this ripple effect for poor people who already spent a lot of their income on food. So there's another example of a trade-off between climate action and sustainable development.

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The third example that's quite controversial in terms of sustainable development, and I did a lot of research on this when I was at Oxford, is the question of carbon offsetting. So I think most of you will know how carbon offset works. If you're going to take a flight, you can pay an extra tax, if you like, and that will usually go through a company that then buys credits from carbon-reduction projects in another part of the world. So this diagram isn't very good because it doesn't mention individuals, but basically a company or a government or an individual who's feeling bad about flying, they want to reduce their emissions. And what happens is that either they directly, a middle person will invest in an emission project, reduction project in a developing country. It might be a small-scale hydro project. It might be a renewables project. It might be a tree planting project. Or it might actually be some big project to switch from a coal-fired power station to an alternative energy source.

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And that project then, you calculate, estimate the emission reductions that that project achieves, and then you get a certificate that says, OK, you have offset your emissions. And I think when I fly to London, I do offset, even though there are a lot of problems of it. When I fly back and forth across the Atlantic, it's usually 20 or 30 dollars to offset that flight. But the work we did, where we went into communities in Latin America, where there were carbon offset projects showed that they weren't always beneficial for sustainable development. We went into communities where communities were basically people, local people weren't benefiting at all. And offset projects, especially the official clean development mechanism, says that they shouldn't be approved unless there are sustainable benefits to the local community.

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We found places where there was fraud going on. We found places where trees were being planted and then weren't being managed very well. But we also found places where offsets were working very well. So in a study we did in Central America, we found that in general the most beneficial offset projects for the local communities were ones that focused on wind and solar energy. And we even found that those had triple wins, the thing that I'm always looking for. Some of those projects, where there was, for example, solar panels in a community, women were

then able to start having little restaurants or keeping food fresher and it was contributing to their health and the health of the community. And we also found that when a hurricane came, they took the solar panels down and then they would be able to get up and running much faster than the communities that were connected to the grid that took weeks to reconnect. So carbon offsets, they may not reduce additional emissions. I don't really have time to go into detail on that. And they may not affect sustainable development but they might under the right conditions.

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Then talking a little bit about, so I was talking about the trade-offs. And working on those trade-offs for the IPCC, it did make me a little bit depressed. It seemed impossible to eradicate poverty and reduce climate risks at the same time. However, things felt a lot better when we looked at synergies. We found a large literature on synergies, the win-wins, how to increase the efficiency of energy use or replacing fossil fuels, those have significant benefits for public health. So whether it more efficient wood stoves that help reduce the burden on women who are breathing in heavily-contaminated air, if it's using renewables to reduce that pollution more broadly, there are really strong sustainable development benefits between energy efficiency, renewables, and the health goals. And of course there are also benefits in the move towards more plant-based diets because of they tend to be healthier. And so there again, there's a synergy between a response to climate change where people eat less meat and a sustainable development goal that says we want people to have better health.

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So there's a number of other synergies that I've listed here where poverty alleviation and improved health, those can reduce vulnerability to natural disasters. Sustainable food systems are often more resilient in the face of climate change. And if you have a sustainable development goal of protecting ecosystems, that can actually help you adapt to climate change. And I think the example here is of planting mangroves. So protecting, planting mangroves, which is done as a climate strategy to reduce the impact of storms on coastal areas, and to reduce the impacts of sea-level rise. Planting mangroves has been shown in many cases to also provide jobs. That's one of the SDGs and protect species and ecosystems.

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So my friend, Ashwin Kretchrie [sounds like] has started an NGO in India which is planting mangroves to protect the coast, but it's also protecting the habitat of an endangered species, the fishing cat, in a win-win situation.

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We did identify a few adaptation options that can work against the SDGs. Mostly climate adaptation is very good. It helps eliminate poverty. It helps with hunger. It can help protect ecosystems, but not always. Adaptation projects can overlook women. All the money for the project is given to the men. People don't think about women's lives. They can increase gender inequality. Hard infrastructure adaptation such as this sea wall in Indonesia can redistribute risk to others and may only work for a short period of time.

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And we also noticed that there's a big trade-off in that the international funds for adaptation are very limited and sometimes compete with mitigation and other development efforts.

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Wrapping up, I know this is a complicated diagram, but it's a simple idea. The one point five report ended with proposals for what are called climate-resilient development pathways. These are pathways that could achieve the sustainable development goals whilst also lowering greenhouse gas emissions, reducing warming, and promoting climate adaptation. There are some elements of this in the Green New Deal. These sorts of pathways are being explored at the U.N. this week. And in the next IPCC report. I'm the review editor for the chapter that will look at this and I'm really looking forward to more research that will show us how to do this.

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The pathways should maximize the synergies, minimize the trade-offs and seek equity and well-being for all. And I thought I would give you just one example from what I think of as a climate-resilient development project to a triple win or quadruple win project in my own backyard in Tucson. My department is involved

with some of the poorest schools in Tucson, mostly disadvantaged children. And my colleague, Greg Barron-Gafford, has come up with the idea of agrivoltaics. And this is a photo from Manzo Elementary School which is predominantly Latinex and Native American students, most of them on food stamps. And the Manzo ecology project is helping us do research that I think can sort of change the world. It's a mitigation, adaptation and education triple win.

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So here's what's going on. Solar panels, which you can see above the kids here, they're reducing emissions and reducing costs for the school district. They are also catching the rain running off the panels for rainwater harvesting. But the really amazing thing is that the team has found out that if you plant agriculture crops under solar panels in the Southwest where there's a lot of sun, you get much higher yields because we have very, very hot sun during the summer. So the photovoltaics shade the plants. They reduce evaporation. They save water and they increase the yields of healthy foods that the kids then eat for lunch. The other really amazing thing is that in my part of the country, it actually gets too hot for solar panels to work efficiently if they're just out there on their own. The evaporation from the crops cools the solar panels and increase their efficiency so it produces more electricity and if you put these out in the field, or if you think of the kids working out here in their school garden, this is a school garden, they reduce heat stress for workers if you're working under the shaded panels. And then they have this amazing educational value because these kids are now seeing themselves as scientists and contributing to reducing the risks of climate change while also doing things that are good for their health and their community. So for me this is an example of the sort of win-win that I think we should be looking for.

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I'm going to end with a slide that a lot of people use in their talks. But it's absolutely what I'm talking about, what if it's a big hoax? Well, we know it's not a hoax right now. So we're going to create a better world for nothing? We're actually going to create a better world for something. Thank you very much.