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So thank you so much for coming out to the first session of the day, after our plenary, but the first technical session. Today, we're going to be having a discussion, and we'll have some interaction about scenarios, disaster scenarios, imagining how natural hazard events and other types of events can affect the communities where we live and where we work, and what we can do to help increase resilience and to build,

just help communities be able to face shocks in a better way. So I'm Janice Rogers from Geohazards International, and I have with me a wonderful panel that you'll get to meet in a few minutes. So today, we're going to be talking about concealing the future in the form of scenarios, help us to mitigate risk.

So we have an interactive component. We're going to be doing a Mentimeter poll if you all want to go ahead and scan the QR code and get ready for that. We'll do that in a couple of minutes. There's also, the code is here as well, and on the board in the back.

So first of all, we'll just introduce our panel. I'll say a few things, and then we'll hear from our panelists, and then we'll have a discussion. And so, we hope to hear from you. So before we start, I want to talk about what I mean by scenario.

This is something that is, this term is used very differently by a lot of different types of professionals working in different ways, but how I'm going to be using this term today is a scenario is work that examines and depicts the impacts that a plausible but hypothetical hazard event would, or a sequence or another occurrence, maybe a pandemic, perhaps a climate impact, would inflict on people the built in natural environments and society.

So today, we're going to be talking about scenarios that not only describe that event, but also what happens. What happens to buildings, what happens to infrastructure, what happens to the land itself, and then the consequences for people and for society.

A very simple example, this is a hospital, the Himalayas in Bhutan, what might happen if they have a particular earthquake. We looked at several earthquakes, but what might happen to the facility, and then what the impacts are in their ability to deliver medical care and serve the community.

So this is a very simple example, but you can use scenarios in a lot of ways to help describe risk, describe consequences, and more importantly, what can we do to reduce those. So today, I have a wonderful panel.

We have Professor Nori Omaki from Kyoto University, Dr. Helen Crowley from the Global Earthquake Model Foundation, Dr. Ramesh Gargane from INSET, the National Society for Earthquake Technology in Nepal, Dr.

Laurie Johnson of Laurie Johnson Consulting, Dr. Anne Wine from the US Geological Survey, and I'm Janice Rogers again. So these professionals have all used scenarios in different ways to help reduce risk and to build resilience.

And now we are going to go to our poll, so we'd like to hear from you. So if we could switch over to the Mentimeter now. Okay, did everyone get the chance to get the QR code? No, okay, maybe we can switch back, sorry.

We'll leave this up a second. Okay, did everyone have the QR code now? Almost, okay, I hope it's working, okay. Okay, so can you please raise your hand if you have ever developed a disaster scenario?

Okay, several people, oh, lots of people, wonderful, wonderful. Okay, now, for which country did you prepare your scenario? Those of you who've developed a scenario before. Okay, let's see, oh, we have the US, we have Canada.

India, Nepal, New Zealand, oh, okay. Like South Africa. So we have quite a lot of geographic diversity, people who have been preparing scenarios all over the world, Africa, Asia, Pacific, South America, North America.

Wonderful. Thank you. Let's see if we have any more.

Okay.

Well, let's go to the next question. So raise your hand if you've ever used a disaster scenario. Lots of you, okay, thank you. Thank you. And then for what main purpose, if you've used a scenario before, for what purpose did you use it?

I think you might have to pick one if you pick the main purpose. I know many times we use scenarios for multiple things. We might use them for preparedness drills or exercises. We might use them for planning.

We might use them to speak to the public. The example I gave from Bhutan, we used them to talk to doctors because they're used to the medical field and not thinking about earthquake damage in their buildings.

All right. Lots of disaster risk reduction planners. Emergency response planners. Thank you. I'm curious to see you separate.

I'm curious for the two of you.

We have some recovery planters here, so yeah. The question is, who's used scenarios for recovery? Well, public awareness, there we go.

Okay, I think.

Has everyone had a chance to complete the poll if you would like to? Okay. All right, so we have a lot of planning, we have a lot of risk communication with partners, some recovery planning, a little bit of primarily public awareness.

Okay, well thank you all. If we could go back to the slides now. Okay. Okay. Let's see. Okay, so thank you. Now we're going to hear from our panelists. So if we could call Professor Noriyomaki.

Thank you.

You can take this mic, I think. We'll use this one.

Okay. Good morning. This is Norio Maki. I'm from Japan. So maybe I should start my presentation and I would like to share with you about the Japanese experience of scenario -based risk planning. And let's start from the 1990, before 1995.

Today, our next year would be the 30th anniversary of Kobe earthquake. And before Kobe earthquake that we didn't have the, uh, what we did is that we just put that some big shaking place at the abas- just under the knees of the cities.

And we just did the scenario for the interpret one. But as you know that the active fault line caused the huge devastating damage to the cities. Our government decided to check the active fault. And after that we did that risk assessment based on the found active scenario within in Japan.

We have, do you know when I started? In Japan we have almost hundreds. Okay. One minute. And also one minute. Okay. And also our central government developed such a nice mapping system. We can check that the possibility of each, uh, fault line based scenario.

And also we compile all those active faults and the interpret scenario. And then now we, uh, here, now the place we are here is the high risk of the Oba, uh, anyway, strong shaking. And this is the, what we did after Kobe earthquake.

And then now we starting to do the new things for recovery planning. That is why I, uh, and what do we, how we did those scenario is that the mainly for public awareness. And also we use that for the, uh, response planning, but that the, the use is very limited.

And now we are working for the recovery plan, pretty does the recovery planning and the to make a recovery planning. We need another scenario. And, uh, I don't, I I'm afraid that I will not have enough time to do explain that.

But that the, for example, from a community which have a high risk of the tsunami, uh, this is a map or not. This is the map for evacuation and it's a worst case scenario. But now we develop the, another tsunami simulation and, uh, this is more a high possibilities and all the civil working so that now we do have another scenario so that we should know that the based on the, we should decide that the,

which scenario we use based on how we review those scenarios, those a simulation. Uh, this is the end of my place. Thank you very much.

Thank you very much, Professor Maki. We're going to have an opportunity to ask questions, but at the end, so thank you. Next, if we could have Helen Crowley, Global Earthquake Model Foundation.

Thank you. Get my slide. So I have three minutes as well to talk about Jim's experience with earthquake scenarios. So we use OpenQuake Engine, which is our open source software for running earthquake scenarios.

So this is for ground shaking and ground failure and calculating the impacts of earthquakes. And we really accelerated our experience with scenarios and running scenarios for different users through a project called TREC, so Training and Communication for Earthquake Risk Assessment.

And so this project, we were working in particular in cities in Ecuador, Dominican Republic, and Colombia. And we were working not just with researchers in academia and universities, but also with the municipalities from those three cities.

And the first thing that we really did was to have workshops with the end users and stakeholders of those scenarios and to discuss with them what were the scenarios that were going to be considered. Were we going to repeat a past historical event?

Were we going to consider a fault that's close to the city? And to really design with them, co -develop those scenarios with them. Also, what were the needs in terms of the outputs? Often, there were requests for things like numbers of trucks, numbers of tents, food, and water.

But we realized quite quickly that our models, which are really based on the buildings and the people in the buildings, and those metrics on the collapsed buildings and the displaced people was really what we needed to start with.

And then from there, those other metrics could then be calculated by the different users. So here's an example for one of the scenario profiles that we produced. This is just for one of the cities in Cali in Colombia.

So apologies, it's in Spanish. Spanish will be able to read it. But what we're seeing, so it's changing here from different scenarios that were considered. We're seeing different columns there showing the different areas of the city and ranking them in order of the values from the scenario.

So we have a number of collapsed buildings, a number of fatalities, injured people, displaced people, and so on. And so then that's a ranking. And at the bottom there, we're also showing the global results for the whole city, and also an indication of uncertainties.

So here, we're showing also the uncertainties in those metrics. We've continued to work now in another project, FORCE. Both of these projects have been funded by USAID. In the FORCE project, we're also working in Bhutan, in Nepal, and in El Salvador.

This is just an example of some work we're doing in the project to also look at forecasting exposure, forecasting the built environment in the future. How many people, how many buildings, what will the vulnerability of those buildings be in the future so we can also run future scenarios, like what if in 30 years an event would happen.

Also in Bangladesh, we have a project here funded by UNDRR, working with Ministry of Disaster Management and Relief, and a number of other universities and academic institutions. And here, the needs really came for us to go beyond groundshaking and to consider secondary hazards.

So here, we're considering liquefaction in particular, and also bringing in not just buildings, but road networks, and transportation networks, and the impact of liquefaction on those networks. Just a final comment on some of the challenges.

So we're presenting often to audience that are not technical, and so we have realized through this work that we need to also train through producing a number of training materials on what are earthquakes, what are the impacts of earthquakes, what do those scenario profiles mean before we even look at the results of the scenarios.

So that's really one of the challenges. And I have some thoughts about the future, but I think we'll save those probably for the discussion. Thank you.

Thank you, Helen. Next, we're going to hear from Nepal, Dr. Ramesh.

Thank you very much. Good morning, everyone. I'm Ramesh Gurgaon from Nepal, and we have experience of developing scenarios in several cities in Nepal, Pakistan, Bangladesh, and several countries. And I'm sharing three of our lessons.

We have several, but three minutes, three lessons. The number one lesson for us through different projects and programs that we have learned is it's very important to change the scientific loss estimation results to the people to understand.

So this is an example that we had calculated the potential damage to the water supply pipelines from earthquake. It came off like the 1 ,200 breaks to the pipeline with more than four -inch diameter.

When we share that information, even for the planners and decision -makers, it's difficult to understand. But when we translated that to the potential functionality and the impact that we are not getting water for the six months to this area, and then after one week scenario, even after a week, you see this is Kathmandu Valley, and all this, the central part is the mostly organized area.

And we don't get water there. It's very simple and easy to understand by people, even the decision -makers and the planners. So this conversion of the scientific information to the language that people understand is very important.

This is for the planning purpose. So the demystification of the science and technology is, I think, very important. That's number one lesson while we develop the scenario. Similar lessons is for people, even it's related to more for the public awareness, that further translation of those, even, informations to a comic book for students.

We have a typical character, Kathmandu character, the typical person and family. We have the Bhaija, the typical character, the clerk, the head of his. What happens to his family just after the earthquake, one week after the earthquake?

And then one month after the earthquake, six months, even a year. So we have a whole book of histories based on those scientific calculations. And then when people read it, then they can link to their own families and their friends and others, and then how the support came.

And we had this scenario together with the Geohedra International, Janice's office, and then with USAID support quite long back. And we revised that after 2015 earthquake because the context changed, the potential, the support made change, and then the risk also changed.

So we have this. So this story from the scenario is very important also for the wider communications and to understand by people. So that's the second lesson that we have. The third one is more recent.

We are a part of tomorrow's cities, the project that we have been implementing in several cities and countries. It was the rigorous five years research, and now we are in the process of implementation.

We have a whole session tomorrow, whole day, so please come to the small hall there. But one of the aspects that I would like to bring here is the future exposures, that Helen talked a little bit with the examples.

But in our case, the city level, it's more of the quite detailed future exposure. The particular location, type of the buildings, their individuals, their education, economic, cultural, several aspects, so that the mayors of the city can decide properly now, not only based on whatever we have, but also whatever we may have in a particular area.

So the right side is a coconut in one of the area in Kathmandu. And we have such a detailed future exposures planning. And there can be several possibilities. That's just one example. And then they can check which one to choose.

So this is another third lesson for us. Thank you so much.

Thank you very much and we'll now hear from Dr. Anne Wine at the U .S. Geological Survey.

The United States Geological Survey has co -produced for 17 years multi -hazard scenarios and these are the shakeout scenario which became an international shakeout drill. Maybe it's in your country.

A series of atmospheric river storms in the winter based on a past historical event but more likely to happen in the future. A long -distance tsunami with rupture characteristics like the Tohoku Oki earthquake and finally an earthquake sequence and that is learning about the aftershock sequence that happened in Canterbury New Zealand.

So most recently this haywire scenario was published in three volumes of earthquake hazards and engineering implications and societal consequences. So the scenario earthquake sequence I think it's one of the first scenarios to have really evaluate through a whole sequence over a few years.

Our objectives were to communicate about earthquake hazards and inform about risk reduction and support response and recovery planning. Hundreds of researchers and practitioners built the building here of the scenario and each story is the earthquake hazards and the engineering impacts and the societal consequences.

On the third floor the community at risk you can see that box there and our next speaker Lori is going to elaborate on the deeper analysis that occurred there. So this scenario was wired as in that's why haywired to test our strength and our connectedness.

The technical and peer -reviewed reports in the three volumes were distilled into story maps, fact sheets, a movie and an exercise toolkit. The movie is widely watched and used in community meetings.

The toolkit breaks down the scenario into discussion based exercises immediately so people can immediately start exercising and thinking about their organization with references back to the scenario that does not require reading thousands of pages.

And another successful product was up in the top right there, liquefaction and sea level rise and this came out of questions our engagement partners were asking. What about

the interaction between sea level rise, raising the ground water, increasing the probability of liquefaction and that got like 400 ,000 hits in its first year.

Throughout we've held a lot of workshops with lifeline operators and fire chiefs, telecommunications industry, economic and regional economists and businesses but we had two major events. There was outsmart disaster that rolled out all the hazards and the engineering aspects and then we had the haywired connection which is really focused on all our societal analyses and collaborations and these two events relied on consortia who helped us run the meetings,

facilitate them and bring them to the people and that was peer there in the joint venture Silicon Valley. So just in closing, there's a few things that I've learned about co - producing scenarios. One is having that geographic GIS hub for all the data so you can integrate across the hazards, across all the engineering results and with all the societal data.

I really think it's important to value and respect our partners for whatever they may bring to the table. Our lifeline analysis was very varied in contribution from the lifeline operators but you can still bring it all together and to be very flexible in your process because it's a lot of connections of one thing leading into another and invariably there are delays and so having sort of back out ways of doing things and readjusting is important and also involving trusted messages so the regional economists are already got their networks of people that trust them with the message so having them helping us with the analysis and creating what the messages were I think is very effective.

Thank you.

Thank you, Anne. Now we'll hear from Dr. Laurie Johnson.

Thanks, Janice, and good morning. So I'm just going to continue on with the work that I did in the haywired scenario. And just as a little background, I worked on all of the scenarios that Ann mentioned.

My work had largely been policy related, looking at the implications of these scenarios from a number of perspectives for the response planning, recovery planning, and resilience planning, and preparedness.

What I was really interested in doing with haywired, and Ann and the team at USGS accepted it, was that I really felt we wanted to push the envelope a little bit and look at long -term recovery and what the implications of complex scenario like this was for recovery planning and policy in the San Francisco Bay Area, an area I live in, I know well, and I know the planning community really well.

So one of the first challenges is that typically when we build these scenarios, the tools that we use have limitations. And so one big limitation we had was that Hazus is the main, the loss estimation tool that FEMA developed, is the main tool that we use for the calculations of damage.

But we did a number of other damage calculations outside of Hazus, so we needed a way to integrate those together so that we had a real picture of building damage and displacement and damage levels. So that really was the underpinning of me deciding to, and working with Ann, to come up with a definition of communities at risk.

And what we meant, that there are places where community functions will be severely impaired or cease to exist for months, even years. For me, this was like my work in New Orleans after Hurricane Katrina or even the blighted neighborhoods in Northridge that we began to call ghost towns after the 1994 earthquake in Los Angeles.

Where residents may be forcibly displaced because of direct damage to their homes and neighborhoods or voluntarily relocate because there are waves of displacement after large and densely damaging events like this because they cannot contain services or otherwise recover.

So it was a three -part methodology that we developed. The first is where are those communities at risk once we integrate all that damage data together? Who lives in those communities at risk so that we could really understand the displacement risk?

And what are the long -term recovery implications? So just quickly to talk about this, once we integrated in all the different types of damage, we looked at areas where there was concentrated building damage.

I interviewed a panel of experts who work on housing and population displacement after disasters. There is no defined level at which an area becomes at risk of additional voluntary displacement because of the direct damages.

But we decided very conservatively, everyone thinks the number is even higher than this, but we said any place with a US census tract where 20% or more of the building damage was in a complete or severe damage state, extensive damage state, meaning in our terms in the United States, the building was yellow or red -tagged.

So that would lead to additional seepages and waves of displacement from people around that as well. So that actually brought the numbers up for Haywiret a lot, damage to nearly a million residential buildings, which is 1 .4 million housing units or a third of our regional housing stock.

And nearly 50% of all those uninhabitable or completely destroyed housing was in these areas of concentrated damage. So the damage was concentrated in the concentrated damage areas. And then we looked at who lived in those areas.

And what we found was that actually in the multifamily, where we had the areas of concentrated multifamily damage, we actually had a huge portion of the Bay Area's population. So our most vulnerable multifamily housing also had the highest numbers of people were in those areas.

So as many as 1 .4 million people live in those areas where 20% or more of the multifamily building damage was extensive or complete. And we also looked at their vulnerability indicators and found that there were 340 ,000 people in these areas of concentrated damage that had five or more of the 10 community vulnerability indicators.

So really underscoring that displacement risk was very high in these areas because of the vulnerability also associated with the people living in these areas. We also developed indicator sets for young and mobile populations, assuming that if children don't have schools, ties to the community, that they're gonna wanna move as well.

And then lastly, what we did was actually put together a typology. And this for me was really to begin to help planners understand where areas of concentrated damage are and are likely to be the communities at risk.

So these are areas with substantial land damage building or infrastructure damage caused by liquefaction or landslides, areas with surface fault rupture, including after slip, areas with the concentrated building damage from ground shaking and fire, and areas with substantial infrastructure and transportation damage.

And then out of that was actually a set of policy recommendations that we've continued to advocate for in the Bay Area. Thank you. Sorry, I ran over.

And now I'll just, I want to share a very brief overview of some research that we have been doing to take all of the lessons from many of the scenarios that you just heard about and many others around the world.

And then now we're going to start talking about the future. How do we take scenarios into the future? So at GeoHazards International, after doing a number of scenarios, including the one that Ramesh mentioned, we started thinking about, well, how can we make these better?

How can we make them more effective? How can we use them to mitigate risk? Not necessarily preparedness exercises or recovery planning, but we're interested in pre -disaster mitigation at GeoHazards International.

So we looked at what's been done, and then we developed some practice advances on how can we make scenarios more effective, again, focused on mitigation. And now we're about to be applying those in a follow -on project, and this is supported by the U .S.

Agency for International Development, and also some of the formative research was supported by the U .S. Geological Survey. So what did we do? We interviewed people in four locations, California, Nepal, Ecuador, New Zealand.

We are looking, by the way, at geologic hazards. You hear a lot about earthquakes today. That's because earthquakes are rare in any one place, and it's hard for people in the community if they haven't experienced it to imagine what might happen.

So we use it really as a risk communication tool. So we looked at a lot of scenarios worldwide. These are what was available in the various places where we were doing interviews, lots of a large body of knowledge in various places.

What did we learn? First of all, very important, the development process in creating a scenario. People getting together, having conversations, that co -production element with stakeholders was especially essential.

The scenario itself had to be scientifically and technically credible, of course, and realistic and plausible. The outputs had to be practical, communicated clearly, and have some specific recommendations so that people knew how to take things forward.

And that's really where the work starts, is taking it forward after you have your results. So we wrote some guidance, and you all might have received a card when you came in. This has got the same QR code, and to get our guidance on how we make scenarios more effective for mitigation.

This is for people who both develop and use scenarios who might participate in the process. It was generated for geologic hazards, but it's broadly applicable, the principles are, to both hydromet disasters and climate hazards.

And there are different parts that you might only need to look at a couple of these chapters. It's meant to be a very flexible tool if you are working on scenarios or you

would like to. So with that, I think we can take, thank you all very much for listening to our introduction.

I would like to take a couple of questions from the audience on the presentations, and then we'll have our panel, if our panel could go ahead and come up. Yes, in the back. Okay. Yeah, John.

Can I ask a question of the panel? of course.

Yes, on any, you may ask a question on any of the presentations.

Okay, so I really appreciated the presentations. I'm really demonstrating how important the scenarios can be. My question is around how important you would see uncertainty in, I saw, you know, you see a lot of the, in a sense, to present the scenarios to the public, you need to make it simple, you need to make it, or to whatever audience, you need to make it clear.

And that's part of the objective is to take the complexity out of the analysis and make it simplified so that people can actually visualize it. But at the same time, the uncertainty in those numbers is extremely important in how one would ultimately use it.

So, and I was thinking, Laurie, in your presentation about presenting numbers of homeless, numbers of damaged buildings, these, we know as scientists and engineers that these are hugely uncertain estimates.

So maybe you could comment on that. So, and.

In the analysis, we actually show the many different means that we came up with. So there were ranges, but there were means for all of these different things. So we looked at different concentrations of damage by occupancy type, and then we actually – and then all of the occupancy types combined, all of those had ranges.

We are communicating the means, but the full table of ranges are in there for anybody who wants to dig deeper. But I agree with you, John. I think one of the big challenges is really not – I guess I would say from the beginning, all of the USGS projects assumed a plausible, realistic, but not extreme scenario.

So we tried to mitigate just kind of overall the uncertainty with these scenarios by not picking an extreme scenario. The further you go on the curve, the higher the uncertainty gets. And I think that's how we always approached all of the analytics, at least in the community at risk, was where we felt uncomfortable, we backed off, we communicated means.

The number USGS put out for the – in the engineering implications of haywire was 152 ,000 displaced households. And I really know in my heart of hearts that number is going to be much greater. And that's really what I set out to do, was to show that the vulnerability and the likely voluntary displacement that's going to go on is going to be much greater.

And I wanted emergency managers to be preparing for that, because our emergency plans are preparing for about 100 ,000 households in the Bay Area being displaced. And I know it's going to be higher. So that's just my gut, my experience in this field, looking at recovery after disasters.

Okay, briefly, I have two comments. Yes, we simplify, but we also intensify, and we go much deeper than you could if you were doing a probabilistic analysis and running thousands of scenarios. The other thing is that we gave background, so we showed all the faults in the Bay Area, the probabilities of those faults rupturing, zoomed in on haywide, we showed different ways that fault could rupture,

and then the message was, for this scenario, this is all relevant to any outcomes of anything that happens in the Bay Area. Seems to go over okay.

OK, we have time for one quick question here in the front.

Hello, thank you for your presentations. I'm really interested in how your scenarios are being applied or used, you know, taken up by practitioners, by emergency managers or whoever across the board.

to be Ramesh if you can.

Yeah, so, you know, for many purposes, that's why the communications, you know, they can come in. So, you know, mostly, earlier, we used more even for the public awareness that this is the level of the consequences, and that comes there, you know, on certain days also, it's matter of communication again.

There are two parameters. One is making, you know, the small, medium, and large so that you have all the range. But at the same time, among the, you know, the scientific communities, it's more of the consensus if there is uncertainty.

So if there is no consensus among the professionals, then there is a question. But if we have wider discussions in the process, that we can minimize. But for the youths, you know, we are using for three main purpose, the, you know, the awareness so that, you know, people are aware so that, you know, the demand for the risk reduction and planning and others.

The second is the, you know, the preparedness planning and recovery planning for the existing risk. And then the third one is for the, you know, risk reduction so that, you know, the planning aspects are considered, risk reduction policies, for example, building code implementations and others are considered.

So this is how we are using it.

Thank you. All right. Thank you. I'm going to pose a question to the panel. But it's also a question for the audience, and so be thinking about your response. I'll give a chance for

people to also answer this question in a minute, but we'd like a panelist to take maybe one minute since we don't have a lot of time.

And the question is, what do you see as the future directions with scenarios and why? Maybe we could start with that.

Okay, so I didn't show in my slide, but I'm very much interested about how we can show the possibility, uncertainty of the scenario. So I'm developing the scheme to evaluate the originating the scenario that the government shows.

And that is another thing. And also we would like to make several scenario corresponding to the purpose, how we use those simulation, like awareness raising or emergency responsibility recovery to be different.

Yeah, for us, the future of scenarios, there are a couple of points. Number one, in the process, participatory, the multi -hazards, future -oriented, inclusive. I think these are the very important points now.

Earlier, we developed the landslide scenario, earthquake scenario, trying to combine now. Earlier, we developed and we communicated now, co -productions and working together with the communities and the cities.

And then, not only for the existing, but the future exposures and also, the future heads are considering the climate change. So these are, I think, the directions. Thank you.

Thank you so I think I mentioned this yesterday as well looking at different possible futures so in addition to future exposure but how might the vulnerability of buildings look if we look at different types of retrofitting different implementations of building codes different vulnerabilities and showing what might the future be depending on what we what we do and also looking at the costs of those and sort of cost benefit but that would that would be my suggestion is to to really use these scenarios to say what the future might look like depending what we do today

My hopes are that we'll be pushing the envelope on the scenario development technology to make sure that we do integrate all the potential areas of damage and loss together more. So we need to work on our tools.

And the second area that I'm excited about, because some gym researchers and others have picked up the interest, which is really about doing displacement modeling. We just didn't have good, you know, everything that we did was a very GIS intensive, thanks to the masterful GIS, geographic analyst at USGS.

You know, we did a very data intensive analysis, but Nicole Paul and others at Stanford as well are really moving the modeling forward in this area. So I'm excited about that because I think that's really an essential next piece of scenario development is to understand who gets impacted and how many people really are impacted.

I really want to endorse what Ramesh said, your three points. And I've been interested in diversifying the engagement of our scenario. So there are hundreds and hundreds of people, researchers and practitioners involved in our effort.

But we miss a lot of populations. And I experimented with a few collaborations with some diverse students with diverse backgrounds. And what I learned was one is targeting the population, for example, minority small businesses or mutual aid operations.

Another approach they took was taking a topic. So, you know, we have communities at risk. We have economic analysis. But the topic she took was food security. And just by gathering around that topic, then you bring in a really purposeful, all kinds of people can participate.

And it was a very nice example, also with an anthropologist at a university who used a process where listening to the community first before even bringing haywire into their attention. And a LPGQT plus center ended up not ever mentioning earthquakes at the beginning, but they ended up wanting to clarify disasters and prepare their center for earthquakes because they had better understood what their vulnerabilities were.

Right. We've heard a lot of fantastic ideas for the futures of scenarios. One of the benefits of going last is everyone said pretty much everything I was going to say. I love that people are thinking about inclusion, thinking about multi hazard approaches, thinking about taking things into the future.

I think that's a real advance that we can make is the end scenarios have done some of this, but really bringing in some of the techniques for business strategy planning and helping expand people's perspectives and just look help with mitigation decision making across hazards.

I think that's an exciting possibility for the future. And now we'd like to hear from you. Maybe we can have three or four people. What do you think those of you that use scenarios or work with them or would like to what do you think the future directions might be or perhaps also what are the needs that you see?

Anyone would like to go?

Yes.

So, we're from the Australian Institute for Disaster Resilience and we have a couple of different approaches to scenarios that we're sort of developing and thinking about. One in particular is called a transformative scenario approach and it starts from the socio - economic kind of future possibilities and it maps out four different futures into the world.

So, rather than kind of diving straight into the kind of technical scientific element of scenarios that we've kind of seen here, we get people to really imagine what these worlds look and feel like and sound like because we know that the future isn't going to look and feel like what the world is that we live in today is and then we overlay that kind of future kind of climate change projection into that world.

And the purpose of this scenario in our field is, in the first instance particularly for emergency agencies, to really stress test whether their plans and their strategies and that kind of resourcing and operational requirements will hold up in those future worlds with those natural hazards with the climate change overlay.

So, that's one approach that we're trialling at the moment and we're getting a lot of really good traction with that.

Other thoughts?

I'm Olivia from the National University of Singapore. I was really excited about what Helen said about looking at trying to model the impact of interventions. Because what we find when we look at the individual level is that people's actions are driven more by their perceptions of the protective action than they are by their perceptions of the risk.

So in many cases, the conversation, the most constructive conversation we can have is about retrofitting or raising building standards or applying building standards more consistently. And so if much of what you do is about communicating the risk, but being able to link that to communications about the intervention I think would be sort of enormously promising and help to trigger some of that action that we all want to see.

Does anyone else have something they'd like to share?

Thanks. Mark Penning from UCL and the Tomorrow Cities Project. We also have an approach a little bit like yours, where we start with normative visioning and then layer future hazards on that to understand what future risk might look like.

But one of the challenges, I think, that we've surfaced in the work is both the advantage of GIS as a platform for holding data, which was mentioned, but also the limitations of that. Of course, there are many things that people would desire in the future that can't easily be represented in a GIS format.

So we work quite hard to iterate between community actors and the GIS colleagues to find out what those residuals might be and how to bring them back in. So I wondered if there are reflections about the challenges of a GIS way of imagining futures in this way.

Does anyone want to take that question?

Yeah, this reminds me about working with the anthropologist. So he came to USGS to give a talk and he basically was saying, you know, the way you do your GIS analysis of populations is just not really explaining why people are there in the first place and, you know, exactly how an anthropologist thinks.

But what happened, so he took your approach of going, working with the community, and then we bought Laurie's analysis back in. And in the end, the two worked together. So a lot of the GIS analysis confirmed what people were saying, but they also elaborated because there's no transgender data in GIS, for example, which is most important to that community.

Yeah, I would just add that I think when it comes to things like vulnerability indicators, that's where you're really on shaky ground. You know, I think we feel pretty comfortable to some extent with mapping physical things, but once we get into the social things and we're using GIS to map social things, just like working with LGBTQ community, that is not one of our 10 community vulnerability indicators in the Bay Area.

We have age, we have, you know, household income, you know, a number of other things, single households, but we don't actually have, you know, people with, you know, like sexual preferences or something like that, that actually is, you know, a discriminatory vulnerability indicator.

Things like that aren't in our indicator set. So I think we're really missing, you know, a huge amount of stuff and that's where you get on shaky ground.

Okay, we...

Yes.

Just a quick example of application of scenarios. In adaptation planning, we have used scenario planning for climate risk modeling and adaptation plan for island nations, where we had a full phase of doing technical work, developing the climate models and how it's going to affect people, infrastructure.

And then we took it to the next phase where we were looking at sector -specific adaptation plans, and that's where I think picking scenarios from event sets of hurricane wind or sea level rise and explaining to the community how these could be really utilized for future planning policy, I think that was a good application we thought for using scenarios.

And that kind of honed in on some of the questions that were very important for the stakeholders to kind of decide and act on the future.

All right, well, thank you, everyone. I would like to now open it up for any further comments or questions to the panel on any of the presentations, on sharing your experiences, any of that. So please.

So I heard a lot of, quite a mixed group of ideas here this morning. There was some scenarios, there was loss estimates, there was risk assessments, and so on. Whatever we want to call these things. And we know there's a lot of different ways, a lot of different ways of envisioning possible futures as consequences of different actions that we take today.

So you're saying, what would be useful advances? And I think, certainly, better technology, better techniques would be useful advances. But I think it'd be really helpful to have some way of articulating the intentionality of this stuff.

And it depends on the purpose and the audience. How does someone in this room, someone not in this room, know which approach and which way of doing that approach is going to be the best thing that's going to be best designed for their purpose?

And we've had a lot of experience over the years doing this in a lot of different places, in a lot of different ways. And it seems like that would be a useful contribution at this point.

Thank you. If I could just respond to that really quickly. The new guidance document that we developed has a chapter on setting objectives as working with your communities to figure out exactly those questions because the scenarios are so flexible to figure out what you want to do and why and how you might go about it.

So there's some material in there that might be helpful in thinking those things through. So hopefully that'll be a resource for people. Are there other questions on anything for our panelists? We've got about three minutes left before the next session.

starts. Janice, I wanted to offer something. Absolutely. Because back in the, after the Northridge and Loma Prieta earthquakes in California, the company I work for, we also did research and we wrote a National Science Foundation grant.

We wanted to develop an exercise for local government officials to do, bring the public works director, the planning director, the economic person, the city official, you know, manager and elected officials together, all these different disciplines and have them focus on rebuild, preparing to rebuild after a major earthquake.

We were concerned about more earthquakes happening. And our premise was we didn't have the tools at that point in time to actually do a whole bunch of different scenarios for all these different cities.

So we looked at the literature as urban planners. We do scenarios all the time to sit down and do a land use plan for a city. I mean, doing the normative approach first is what urban planning does. And so we developed this exercise where we said, you know, you tell us you must pick an area that has heavy building damage.

You must pick one of those must be a residential area. One must be a commercial area. You must pick an area that has geologic hazard damage. You must pick an area with infrastructure damage. And then we took them through the tasks of doing damage assessment, developing policies for temporary uses, and then looking at areas that might not be might need change as part of rebuilding.

And we, you know, it was really it was a National Science Foundation research study. Was that a plausible way to do a scenario and do an exercise to get the outcome we wanted, which was to help city officials begin to think about rebuilding after a disaster?

And it was wildly successful. FEMA picked it up. They had training on this for years where they would send a whole city, you know, top staff to a FEMA Institute to get this training. And it has there is no GIS.

There is no loss estimation to software involved. And people can do this. People know their communities and they can tell you where the vulnerable buildings are. They know where the infrastructure is already leaky.

So it is not something that we have to have all of this sophistication in order to actually use the concept of scenarios. But I agree with Rob's point. It's knowing what your intended outcome is first.

And then you can design, you know, a scenario event, exercise or game to achieve the outcome.

We have, I think we might have time for one question.

Thank you very much. I'm Sarah from United Cities and Local Government Barcelona. And I have a question on the loss estimation. Because when we look at triggering it down into communities, the poor families, which Laurie referred to when you have to leave, they usually don't have never a bill on what they have lost.

And they will spend 10 years to build their house again. And it's very similar to evictions that if you don't calculate the cost of their working hours to build up their livelihoods and also the economic system, you don't have an argument to really calculate the cost.

So if you now look into disaster, for example, I'm a German citizen and there is exact numbers for every single piece you have lost in a disaster. So the disaster seems very, very expensive via Encarpmento, the same disaster or a much bigger disaster had occurred.

And of course, cost estimation is not there. So how can you, with your loss estimation, contribute that the non -insured livelihoods are also estimated in cost? Because I think we need these figures and numbers.

And as more regions in the world will contribute, as more evidence we might have.

Yeah, just to bring the, you know, we have the economic loss also calculated, and then of course, you know, the more risk -reduced scenario, larger infrastructures, more economic loss than the, you know, the social or the casualty and others.

And then, you know, if it's more vulnerable buildings and infrastructures, it's more of the casualty, generally in the poor comes less economic loss. So there is a, you know, again, it's plus and minus.

If we see only from the economic perspective, it's a very low risk in that sense, but actually in terms of the potential casualty, there might be quite a larger.

I think that's an important point. It's that the amount might not be high, but it's very, very important for those, for the people who are affected. It's, it can be personally devastating. So, I think this is a place where our tools maybe do need to improve in the future.