

# How climate change is impacting Africa's water availability- Transcript

[00:00:00] **Suzanne Carter:** [00:00:00] Welcome to the African climate breakdown podcast, a show on climate change with a particular focus on Africa. I'm your host, Dr. Suzanne Carter, and I lead the coordination unit of the future climate for Africa research program, or FCFA a program that works to improve the understanding of how Africa's climate is changing, how that affects communities and what can be done to create a climate resilient future.

[00:00:31] Join us as we delve into the innovative research of FCFA and hear underground stories of climate change in Africa. And so the climate conversation continues. In our previous episode, we looked at some of the science behind climate change in Africa. One of the issues which we could already see from that episode was a significant risk that climate change poses to water resources over the continent.

[00:00:54] This time we're going to dive deeper and look at how climate change affects. One of our most [00:01:00] essential resources. Joining me is Kornelia Lipinge, an environmental and water researcher from Namibia. Kornelia. Thank you for co-hosting with me. Can you share a little bit about what you do?

[00:01:13] **Kornelia Lipinge:** [00:01:13] Thank you for having me, Susan, it's great to be here.

[00:01:16] I am currently working as a project coordinator at the Sci-Tech center for noble energy, energy efficiency in 2017 to 2019. I worked with had been committed research on future resilience for African cities and lens project. An embedded researcher is someone who acts as a bridge between policy and research.

[00:01:37] I worked with the university of Namibia and the city of Ventura to understand decision-making in the city around climate risk and sharing the knowledge they can gain through the fracture research for the city during the project, diverse stakeholders, decision makers, and producers of climate information participated in learning labs, which consists of exercise.

[00:01:59] In [00:02:00] games designed to explore relevant issues in co-produce potential solutions. In one of them, we looked at visuals and stories that easily explained the likely changes in climate based on climate models, projected for being too. New water restrictions have been imposed in Cape town. South Africa in India, rising temperatures threatened to make a severe water crisis.

[00:02:24] They're even worse. The greatest global risks of our time, the shortage of water by 2050, the United nations says more than 5 billion people could be facing water shortages across the globe. Kornelia, I'm sure you also have some interesting lived experience when it comes to water availability, living and working in such an arid country, like in the beer.

[00:02:48] I grew up in Namibia, the dress country in the Sub-Saharan Africa. Oh, I mean, I know rainfall is estimated to be 285 millimeters of their total rainfall. 83% [00:03:00] evaporates, 14% is used up by vegetation. 1% recharges grown with it, and only 2% becomes

runoff and maybe harnessed in dense. In our context, the effect that climate change has on what the supply can be devastating.

[00:03:16] I remember growing up in Northern Namibia that there are droughts affecting subsistent, farmers, crops, and livestock. However, at the end of that end, we experienced floods as well. I guess the thing, what there was plenty and did not finish seeing it in the combination from the river, which

[00:03:40] However, this changes. I started working in bento. I've learned how, what is very precious. And we have been experiencing water crisis over the years in the city of Ventura, just the municipality has put up measures to save what.

[00:03:55] **Suzanne Carter:** [00:03:55] It's sobering to think. That's something we take for granted can be in jeopardy. [00:04:00] It reminds me of the drought in Cape town, not so long ago where we were weeks away from the city, turning off all municipal water supply. After three years of below average rainfall, Cape town was facing the possibility of severe water shortages. And in 2018 city announced that they were a few months away from turning off the taps in what was termed days zero. Let's hear more on that. How the city of Cape town responded to this drought from Dr Gina Ziervogel an Associate professor at the Department of Environmental and Geographical Science at the University of Cape Town in South Africa.

[00:04:34] **Dr Gina Ziervogel :** [00:04:34] Many people heard about day zero and we're in the city of Cape town was facing severe drought.

[00:04:41] And the challenge was that it's a city of over 4 million people and the city government, um, the metropolitan government really didn't want to run out of water, not be able to provide essential services. So they set a. Centerbridge at which we're in the dance with [00:05:00] 13.5%, they would say it was stage two of the crisis.

[00:05:04] And at that point, people would no longer get water in their taps and we'd have to queue at, uh, what we call pods points of distribution to get their water. This made a lot of media coverage around the world and the drought was the van hip town, but a lot of responses were put in place that helps to reduce the impact of the drought.

[00:05:23] So there was significant reduction in use of water by residents and businesses. There was water pressure management devices, um, put in place, uh, pressure management zones that produce the pressure water management devices, the cut of water households, using a high amount and a number of technical responses, but there was also a coordination of, uh, government trying to think through what a better response might look like over time, it became clear that sharing data and information with citizens was really important. The water [00:06:00] dashboard got developed that people could see what level the dams were at. Residents and businesses really came to the party and reduced how much water they were using.

[00:06:08] Um, there was eventually rain in the 2018 season that helped to start filling up the dams. So it really was a multi-player response. Partnerships were developed. We saw incredible innovation from people on how to save water, be more efficient businesses, change what they were doing. And the biggest lesson was that water.

[00:06:29] Can't just be seen through an engineering and infrastructure lens. It really has to be seen and understood holistically from an environmental and from a social lens, from an economic lens. And when you take all those things into consideration and integrate those in your approach, you can have a more well-adapted city.

[00:06:48] **Suzanne Carter:** [00:06:48] With many cities across Africa, dealing with water issues. Examples such as Cape town's day zero may be an indication of the types of crisis African cities may face. If they do [00:07:00] not plan for climate change. We've invited a few FCFs researchers to discuss their experiences and insights.

[00:07:07] Joining us is Brenda Mwalukanga one of the embedded researchers from the FRACTAL project who worked with the university of Zambia and the Lusaka city council on issues of informality and water in the city.

[00:07:19] We also have Dr. Dan Lapworth a principal. Hydrogeochemistry at the British Geological Survey who has worked with the HyCRISTAL team studying water resources in the Lake, Victoria Basin. So happy to have you both.

[00:07:32] **Dr. Dan Lapworth:** [00:07:32] Thank you, Suzanne. It's lovely to be here.

[00:07:34] **Brenda Mwalukanga:** [00:07:34] Thank you. So I'm happy to be here.

[00:07:36] **Kornelia Lipinge:** [00:07:36] Brenda could you tell us a bit about some of the water issues which are facing Lusaka and how climate change might impact within the city?

[00:07:45] **Brenda Mwalukanga:** [00:07:45] Uh, thanks Kornelia. Um, Lusaka has quite a number of issues. Um, I think it's important for me to state that, uh, Lusaka is 70% informal settlements. Uh, so even the manifestation of [00:08:00] water risks and issues within the city, uh, has quite a high impact on the population. So we have issues of flooding that come about due to the terrain, the geographical makeup, the high water table.

[00:08:14] We also have issues of, um, Poor quality water and also poor quantity. Not because we have inadequate resources, but because in terms of management and, uh, supply, uh, we have very limited access, uh, by, um, a majority of the population. And then also because of the rapid urbanization and the increase in demand for water from commercial and economic activities. There's unregulated obstruction, which also poses a risk to the quality and the quantity of water that is available within the city of Lusaka.

[00:08:50] **Suzanne Carter:** [00:08:50] Thanks Brenda, building from Kornelia and Gina's experiences, it seems that water supply issues are a big challenge for Southern African cities, but [00:09:00] I would like us to also shift to East Africa.

[00:09:02] Dan, could you share some of your insights into how climate change is likely to impact water resources in the Lake Victoria Basin? And could you tell us more about what this means for cities in this region?

[00:09:13] **Dr. Dan Lapworth:** [00:09:13] Well, first of all, um, it's probably worth mentioning that, um, the Lake Victoria Basin itself is quite a humid region, so quite a wet region, um, and there are a great deal of uncertainty around future climates within that region.

[00:09:27] However, um, current, uh, research. Uh, on, on climate impacts, um, how has sort of highlighted maybe a more, a more humid, uh, context in the future and also possibly a more intense rainfall events, which obviously has impacts potentially on surface waters. Uh, within this basin and, and, um, particularly on flooding and, and the frequency of flooding and the extent of flooding.

[00:09:52] So I think one, one aspect to focus on, particularly for the Lake Victoria Basin, being a slightly wetter basin, uh, will be, um, the [00:10:00] impacts on surface waters, the impacts on flooding, and then the impacts on, um, inundation, uh, for lower lying parts of the basin and some of these. Uh, lower lying parts of the base and I've occupied by cities.

[00:10:12] Um, and two of the cities we've been looking at are, um, Kampala and also, um, Kasuma in Kenya and parts of these cities have particularly low-income, uh, uh, settlements are located within these lower lying regions of the city, um, and are likely to be more impacted even, even though they're currently, uh, it'd be fair to say very impacted by flooding, um, and by, by, uh, by, by rainfall events.

[00:10:41] And we've seen that very, very, uh, I obviously recently in the last few months. Um, but I think this is likely to be a larger issue going forward as there is greater pressure on, on, on settlements and greater pressure on these, these urban areas as they developed. And as the population increases, [00:11:00] um, there's going to be greater pressure on these lower lying areas of land and more informal settlements.

[00:11:05] And, um, Impact on other infrastructure, such as potentially critical transports infrastructure, like roads and bridges and maybe communication networks as well. So I think flooding is probably the one to be, to be focused on in this particular region of Africa.

[00:11:25] **Suzanne Carter:** [00:11:25] Thanks. Dan, it's quite interesting that in one region of Southern Africa, droughts and water scarcity has, seems to be the major issue. And in East Africa got the opposite where floods are probably going to be the thing that is driving most of the water issues. However, there is the commonality of having either too much or too little water and these water supply issues really. Um, it seemed to be something that we need to delve into in terms of how do we manage those better.

[00:11:49] So Kornelia, and then maybe Brenda, if you could pop in after, I wonder if you could share from your experiences, how the cities have learned from each other in how to respond to these kinds of issues.

[00:12:00] [00:12:00] **Kornelia Lipinge:** [00:12:00] So in terms of, um, during the fractal project, we had acidic city to city exchange where Brenda and myself were involved. We traveled to either the cities and we have learned how it's important to have city to city discussions in how, uh, different cities manage, water it's an example of Intuit has been leading. In the water reclamation activities, uh, it is which then Lusaka has learned as another example. Uh, Namibia is very strict in terms of brown water regulations, which also then, you know, soccer, that was a problem.

[00:12:38] But from our exchange, it seemed that Masako had learned and put up the regulations thing.

[00:12:44] **Suzanne Carter:** [00:12:44] Thanks Kornelia. And Brenda, what are your views?

[00:12:46] **Brenda Mwalukanga:** [00:12:46] So Lusaka was able to learn from, um, Vento, which is, um, a city that is faced with water scarcity, uh, in the sense that, um, it's been able to reclaim water, but also to develop alternative sources [00:13:00] that are not only reliant on, um, um, rainwater, uh, Considering its climate conditions.

[00:13:07] And with the learning exchanges that occurred between the city or Windhoek Kefir officials and the city of Lusaka officials, uh, the city of Lusaka has been able to put in place, um, projects that are looking to develop alternative sources of, uh, water, uh, uh, not heavily rely on the Kafier river, which is likely to be impacted by climate change in the future and will result in declining water resources.

[00:13:33] Also, I think Windhoek coming to Lusaka. They were able to see how from a planning and a, an urban slum upgrading strategy, uh, they could, um, incorporate the informal settlements that were, um, developing around their city, uh, how to ensure that they are able to provide water, which is a right, that everybody has despite them being in locations where, um, perhaps, uh, they have [00:14:00] settled informally and illegally and vice versa as well. So for instance, even the metered taps within, um, the city of Windhoek have been replicated in areas that in tender within the city over Lusaka.

[00:14:13] **Suzanne Carter:** [00:14:13] Great. That's, that's a really interesting insight. Um, I'm going to switch to Dan again. Uh, could you maybe share some thoughts, Dan, about how cities should be engaging with these wider water management issues, water resource management issues and plans. Do you think African cities are doing this and should they be doing more to ensure a sustainable water supply?

[00:14:32] **Dr. Dan Lapworth:** [00:14:32] I mean, I'm not going to speak for all African cities. Um, my experience is, is, is only in a few. And I think this, this, this dialogue and this conversation is certainly happening between cities and, and wider stakeholders and other responsible agencies within each country. But I'm sure more could be done.

[00:14:50] Um, I mean, I've got there, there are, uh, some, some examples, like, can, I can point to. That we've done as part of HyCRISTAL, um, colleagues at the university of Leeds have [00:15:00] been working alongside the city councils, both in Kasuma and Kampala to look at this issue and particularly the, the, um, the issue of water supply, but also sanitation and the impacts on sanitation and the impacts that flooding will have on, on the functionality of sanitation systems.

[00:15:18] Um, on the operations of, of sanitation systems and how that may impact on public health, um, and also on water in these settings. So I think, um, that's one, one aspect of particularly a focus on, I think the other one that's been touched on by the other contributors is also this fact that you've got multiple types of, of water resource that people are using within, within the urban, uh, within the urban system. So there's, there's lots of, um, smaller, um, private supplies. These may be boreholes or Wells that people are using as well as the network to pipe water that's being supplied. Um, and in, in the case of Kampala and Kasuma, this, this pipe supplies coming from the Lake itself from [00:16:00] Lake Victoria, treated Lake water.

[00:16:02] Um, so there's a great dependency on that particular surface water resource, but also there is a, there is a kind of a diffuse network of, of groundwater resources that people are also using. Um, In part, because of the accessibility of this piped network scheme, not,

not stretching everywhere and not being everywhere within the urban context, not being affordable to everyone as yet, and also not being available.

[00:16:26] Um, uh, and, uh, and I think, you know, the cities and the agencies, the ministry of water and environment that we're working with in Uganda are certainly doing a good job at looking at, uh, Across the wider area across the, um, the, kind of the national, the national picture. If you'd like looking at looking at how water resource will be available and change under different climates.

[00:16:48] Um, but I think there's a lot more work and it looks a lot more complicated when you start to look at the city level. Uh, there's a lot more stakeholders, a lot more partners that, that needs to be involved within that, within that dialogue. [00:17:00] Um, and I think it's one that needs more work. Um, But, uh, but it, it certainly, uh, certainly there, and it's certainly evidence within the stakeholders minds, you know, this issue of, of, of change at changes in climates and how it may impact on their, on their resources and impact on their livelihoods within those settings.

[00:17:18] **Kornelia Lipinge:** [00:17:18] Brenda Um, how have you engaged with decision makers or on with the climate issues in soccer, during the FRACTAL project, as well as within Lusaka with the security initiative?

[00:17:31] **Brenda Mwalukanga:** [00:17:31] So I'm with the FRACTAL project, we would organize learning labs, um, to bring together, um, city decision makers, researchers, technocrats, um, into the same room to learn about the issues of water, to learn about issues of climate change, uh, would also organize specific trainings and dialogue.

[00:17:53] So for instance, would have, um, uh, governance dialogues that. Specifically deal with [00:18:00] policymakers and only those that are around governance and decision-making would also have specific dialogues that would focus around, um, generating or co-producing climate information. So we'll, uh, broaden and also narrow.

[00:18:15] Focus, uh, in terms of our engagement and also dependent or not the city needs that we identified. So for instance, even our meat department and even the water resource management authority team recognize that they need a specific training around climate modeling. So we would engage them around trainings, around specific dialogue, where we would try to understand what their challenges are and to tailor the type of training and learning that would be, um, that would capacitate them, but also would be beneficial for them. And then, um, in the last two years, we have been engaging them on what is called a as the Lusaka Water Security Initiative.

[00:18:54] Which is a coordination platform, a multi-stakeholder platform that also brings in [00:19:00] civil society and the private sector. And the idea is that we should have different actors that have oversight on the different risks, uh, to water, to energy, and also to climate change within the city of Lusaka. But more importantly, that we take a multi-stakeholder approach in addressing, um, Uh, those issues that we identify within the water sector, uh, bearing in mind that, um, climate is also likely to impact them the water sector.

[00:19:27] So we've, we've tried to use learning approaches, uh, on the fractal project, which has also been replicated into, uh, the Lusaka Water Security Initiative. We've used them

tailor made, um, dialogues for specific audiences. We recognize that our partnership is a broad range from private sector, civil society research as policymakers.

[00:19:49] So sometimes you have to zone in and tailor make that dialogue specific to the interests and to the learning gaps over specific. Um, Target audience. [00:20:00] And other times we brought in inside different actors can recognize the different experiences that, uh, our different actors and partners are experiencing, but more importantly, how we can collate and put together our resources to address these challenges in the water sector.

[00:20:16] **Suzanne Carter:** [00:20:16] It seems that those that are most impacted by water resource issues are those that are living in peri-urban or informal settlements where municipal services are not as developed as other parts of the city. Uh, Brenda, would you like to comment on what cities are doing? What cities like Lusaka are doing to ensure that safe water supply is given to the people in those kinds of areas?

[00:20:39] **Brenda Mwalukanga:** [00:20:39] I think, uh, Lusaka again is 70% informal. So I think from the nineties, we have, uh, recognized that, um, those that come to Lusaka have a right to the city. And so they've been attempts to upgrade some of these, um, uh, slums and also to regularize them. And if, uh, as a city authority, they regularize a particular [00:21:00] area that has been deemed as informal. It means that they are now mandated to provide the requisite services. And so, um, over the years, what has been happening is that, um, they have been developing, uh, what is called a water security action and investment planning process that, uh, also recognizes the need to provide water in these informal settlements and also to provide the other requisite, um, services such as drainage and so on.

[00:21:27] So, um, what, what, um, Lusaka has been doing is that they have been engaging in processes, such as the water security action and investment planning process, the community engagement and empowerment, um, process. Uh, to utilize, um, acts such as Urban and Regional Planning Act, the Decentralization Act or policy that requires that a bottom up approach should be used with, um, the citizen taking control of their development, which also includes water supplies services, and, uh, [00:22:00] water security issues.

[00:22:01] So they've been undertaking a process of developing a local area plans. That, uh, reflect water security with, um, support from the private sector led by the local authority and also, um, uh, the Lusaka Water Supply and Sanitation.

[00:22:18] **Suzanne Carter:** [00:22:18] Thanks so much, Brenda, I'm going to ask Dan if he could answer the same question and whether they are potentially similar issues of informality in Uganda.

[00:22:27] **Dr. Dan Lapworth:** [00:22:27] Yes. I think that, I think it's fair to say there are. Um, and, and also in Kenya and the Kasuma case study, we looked at as well. I think that the, um, it was very similar challenges in terms of the network, uh, of public water supply that's treated and distributed, um, sometimes not being available, but in some areas or not being available all the time in other areas.

[00:22:47] But I think, you know, that the, the councils and the, and the, um, The public bodies responsible for water supply and private bodies. We're responsible for, I have done an

awful lot of work and trying to extend those [00:23:00] networks and make them more available to people, to other people. Um, but I think there's, there is a continued challenge.

[00:23:05] There's still a lot of work to be done. It's not reaching everybody. Um, and also a lot of people are still dependent on alternative sources that are considered certainly, um, unimproved and an, a much higher risk sources. Potentially.

[00:23:18] **Kornelia Lipinge:** [00:23:18] We've heard from the example, uh, the bays, you know, in South Africa, Cape town, uh, that sharing data and information with citizen was an important approach to reducing the, what they use during the drought in 2018. Dan how important do you think assessable water resources data is for ensuring sustainable with the supply for cities?

[00:23:42] **Dr. Dan Lapworth:** [00:23:42] Yes, I think that's an, I think it's an important issue. I think, um, first of all, there, there are two sides of that equation, but both, uh, the, um, understanding of citizens in terms of the particular water stress, um, episode that they were, then for instance, that the Cape town example that you, that you draw on, I think it's important for [00:24:00] citizens to understand how they can reduce demand and potentially reduce use under particularly water stressed, uh, conditions on how to do that effectively. And I think communication around that is, is particularly important.

[00:24:14] But there's also on the flip side, there's also understanding. Uh, the water resource that is available and how vulnerable that is, uh, to changes in climate and maybe episodes of the dryer, um, and how, and how the blend of groundwater and surface water and other, other water sources are, um, Uh, may be impacted by future climates.

[00:24:36] Um, and I think it's partly around understanding the vulnerability of the current infrastructure and network and about future-proofing that and making sure that more climate resilient infrastructure is in place. So that may be. In, in some examples that may be extending, uh, groundwater resource availability within that region, if that's possible, uh, or indeed, uh, extending, uh, surface water [00:25:00] capacity to it, to allow for the fluctuations in the climates in the future.

[00:25:05] **Suzanne Carter:** [00:25:05] Thank you so much, Brenda. And Dan, when looking at these examples, it's clear that water issues are already a major concern across Africa, making it all the more important to plan for climate change. And water supply may become even more erratic. Let's take a look at what the foolish team working in Malawi and Tanzania is doing to improve how water resources are managed in the future.

[00:25:27] Professor Julien Harou is chair of Water engineering at the University of Manchester, and is one of the co-investigators of the UMFULA project. The UMFULA team has been doing research around how governments should consider climate change in the planning of developments within river basins in both Tanzania and Malawi.

[00:25:45] Particularly hard to navigate the impact these developments may have on the water availability for the environment and other vital economic sectors. This research has provided a vital tool for the government to manage offs within the Rufiji river basin [00:26:00] in Tanzania. Yeah. Thank you for joining us, Julien.



[00:26:03] Thanks for having me. It's a pleasure to be here. Thank you. He's heard a little, but about some of the water issues facing African cities, but I'm interested to learn a little bit more about what can be done to plan for the future. Julien. Could you tell us maybe something about what, um, Fuller has been doing around the water energy food nexus?

[00:26:20] **Julien Harou:** [00:26:20] Yes. Thank you. Um, so the UMFULA is looking at different river basins in Malawi and in Tanzania. And the part that I work on specifically with colleagues at London School of Economics and other Universities in the UK and universities in Tanzania. Is the Rufiji River Basin. That's, uh, a beautiful river basin in the Southeast of the country.

[00:26:41] It has most of the hydro-power potential and most of the hydro-power installed capacity currently in Tanzania. And it also has a whole series of national parks and a beautiful areas in a wide range of different, um, sort of geographical environments. Uh, it's a beautiful place. [00:27:00] And. Therefore, this was an interesting study to do there.

[00:27:04] There are some very large infrastructure assets that are being considered by the government and currently a large, a hydropower dam that's planned the Rufiji Basin hydro-power project. And so, you know, the questions that, that this research projects ask are very real. And, uh, there's considerable interest, uh, in the, in the answers to all these questions.

[00:27:27] So it's both a rewarding and interesting place to work, but it's also not a, not an easy one because there's considerable attention placed on, on what we do and what we say. So it's not one of those case studies where the, the work is completely divorced from reality. There is a large hydropower dam planned by the government.

[00:27:49] It will be very expensive. It will require a lot of sacrifices. And so these questions about trade-offs between different benefits and the resilience and the viability of the asset [00:28:00] under climate change are not academic questions. They're very real questions. And this made the project a very especially interesting.

[00:28:09] **Suzanne Carter:** [00:28:09] What was the results of the project? What did you manage to influence within the governments in the Rufiji River Basin?

[00:28:16] **Julien Harou:** [00:28:16] Well, that's always difficult to say how much we were able to influence the way that water infrastructure is decided upon an energy infrastructure is a really complex social political process and also historical. This hydro-power project used to be called the Steelers Gorge dam because it was first a, I wouldn't say planned, but it was first recommended by someone who visited that basin maybe over a hundred years ago. Uh, and so it adopted his name for a long time. Now the name has changed and the planning has changed, but one could consider that the, the consideration of putting in this hydro-power asset, the Rufiji Basin, uh, hydro-power project has been in process for over a hundred years.

[00:28:59] So. [00:29:00] Uh, the, the, the one or two years that we worked on it, of course is almost insignificant in that, in that wider context. But what, you know, what we try to do is that we, you know, the fundamental tool of, I would say modern, uh, river basin planners is a river basin simulation model. And that you can think of that as just like a spreadsheet that counts the water over a time and space, and just looks at how that water generates benefits.

[00:29:25] And that's really fundamental. Part of the approach that we use is that we're just using a computer to count the benefits of water. So where does the water occur in the river basin? And how has that distributed over time and space and the different, uh, the different tributaries of the rivers and where does it create benefits?

[00:29:45] And those benefits are quite varied. Um, of course there's the obvious economic ones, like the hydro-power and there are several dams, uh, already there, but there's also all sorts of complex ecosystem and biological benefits. There's also irrigation [00:30:00] schemes. And then of course, all the, you know, a lot of people live off of food from the river and that the amount of food and fish that's available in the river and at the mouth of the river and the Delta is dependent on the river flow.

[00:30:14] So it's a really complex social, economic, biological, web, and system of resources. And, you know, as scientists and engineers. And sociologists working on this project, you know, we, we have a relatively simple approach where we just use the computer to count the water where it happened, where it occurs, where it manifests and where it generates benefits and that river basin and model then, uh, can be connected to some, uh, exciting new artificial intelligence algorithms.

[00:30:47] Um, that's a big advance in the last 10, 15 years. You have these new artificial intelligence algorithms that allow to search for information and for search for good solutions very quickly. A [00:31:00] bit like when you search on Google for information. Well, what we do is we connect our, our search engine to our river base and model.

[00:31:07] And then we just asked the simple question. Given these 10 benefits, the ones that I listed before, what are combinations of future interventions, development actions in the river basin that could be most beneficial and which would most appropriately trade off the benefits between different social groups, different regional groups, different geographies.

[00:31:28] And different economic and social different sectors as well, different economic sectors, for example, irrigation and hydropower. So we have produced this tool and made it available, uh, and in the recent Dified and NERC and UMFULA extension, we've been able to place the tool online and are now training people in its use.

[00:31:47] So it's an exciting project, how much we've actually been able to influence the, you know, the actual design parameters of the dam, you know, that's almost too early to comment. I think what we're trying [00:32:00] to do is to create almost a institutional cultural shift between the, between a more closed in the hush hush culture of planning for hydro-power where finance ministries, and maybe some of the water and energy infrastructure, you know, are having pretty much closed conversations at a sort of technocratic financial level and trying to open, open that up into a more broad-based.

[00:32:25] A discussion with more civil society and more stakeholder involvement, which says why don't we make big investment decisions in river basins, by looking at a more broad, in a more rich palette of different metrics of performance and different social and environmental and economic benefits. So rather than just saying, okay, here's a river base and how much megawatts can we get out of it?

[00:32:50] Looking for more, you know, trying to paint a more complex picture and to see how can we really, how as humans can we harness that river base and in such a [00:33:00] way that many different, uh, social economic and environmental benefits can be, can be obtained from it.

[00:33:06] **Suzanne Carter:** [00:33:06] Thanks Julian. I wanted, if you could explain a little bit about what the water energy food nexus is and how that interacts with the kind of work that you're doing?

[00:33:15] **Julien Harou:** [00:33:15] Water energy, food nexus. Um, you know, I thought the nexus was sort of an official word that always went with water, energy food. It turns out I've met many, many other colleagues from other fields of research that also claimed the nexus word to be theirs. I think it's also a phrase made by Google. So anyways, the nexus is that is a piece of jargon that is used in many contexts, but in this case it's referring specifically to.

[00:33:42] Water energy food. And actually we, we call it the WEFEE nexus with an E at the end, uh, linking to environment. So water, energy, food environment. What that's referring to is that there are these several systems in the world where those resources are deeply connected and [00:34:00] certainly river basins. This is probably one of the most clear examples. So in a river basin, you have obviously rivers. So the water is of course obvious, but then in many countries in the world, and often in Africa, the level of a national energy production from hydropower is very high. And that's also true in Tanzania. So. The river basin is, is literally generating the power supply for the country.

[00:34:27] So there's a water energy elements. The food comes in in that, you know, agriculture can be done with the natural rainfall, but it can often become more productive if supplemented with irrigation. So that's when a further water is applied, taken from rivers and put on fields. So. There's the food part. And then finally, the environment, the fourth element of the nexus is relates to the fact that the rivers are teeming with life.

[00:34:55] And, you know, they, they support all sorts of fish and, and, uh, plants [00:35:00] and, and biology. And when that river water goes out into the ocean, it sustains in the Delta, all sorts of ocean, biological life. So there's a huge web of life and it's not just. Sort of environment interest. I mean, there's thousands and thousands of people in the Rufiji Basin whose entire livelihood and culture is intimately tied and dependent on that rich biological life in that ecosystem.

[00:35:23] So there's the problem right there. The nexus is that I just told you the four elements and I just told you how essential each one of them is. Um, and that's the problem is that, um, you know, if the four are essential, Oh, whenever you do something like, for example, invest in a new dam, like we are going to now in Tanzania.

[00:35:42] Well, how does the contributions, or how do the benefits assigned to each of those four elements of the nexus? How are they redistributed? By this human intervention. So in summary, the nexus is about connections between four resource systems and that whenever you [00:36:00] intervene to further the benefits of one of the nexus elements, the other three feel the impacts of this, and those can be either benefits or costs.

[00:36:09] **Kornelia Lipinge:** [00:36:09] So Julien, can you tell us how should climate change information be included in the planning of infrastructure for what to resources.

[00:36:17] **Julien Harou:** [00:36:17] Okay, thanks for that question, Kornelia. Well, you just asked the question, which was the, um, well, I think it was, you know, this project was a few million pounds over four years.

[00:36:26] So you asked the 4 million pound question. That's not an easy question to answer, you know, how should climate change information and climate change science intervene and be used in decision-making it's an extremely difficult question. It's one that the whole world is grappling with. From national governments to river basin agencies, to funders of development, projects and infrastructure, for example, like the world bank and other lending institutions and grant giving institutions, you know, and it really, that question is.

[00:36:59] You know, [00:37:00] and, and so just to, to remind you that, you know, so the complexity is not just the water energy food environment nexus, the way that the river basin combines those four elements. But it's also that the future of those four systems is of course, very much uncertain. And it's driven by the conditions, the rainfall, the temperature of the future, which is unknown.

[00:37:23] And not only that, but also. The social and political changes that might, that might follow from future changes in conditions. So climate change adds a real, another difficult dimension to this conundrum of how should we make investments and decisions today for infrastructure and for systems that are in place in the future when we don't know the future.

[00:37:47] Right. So how do you intervene in the supply demand system? You know, an economist or an engineer would ask the question, you know, how should I intervene in this supply demand system? When I don't know future supply and I don't know future demand. So in this [00:38:00] case, supply would be, for example, the rainfall, how much rainfall is there going to be?

[00:38:03] And the demand is where are people going to live? What are they going to? What, what mix of energy, water and food services are they going to require? Are they going to want. You know, how wealthy is Tanzania going to be in 30 years and how, what access to international water, energy and food markets, especially food markets will it have and what will be its access to energy markets.

[00:38:26] So there are many different elements of uncertainty and perhaps one of the most troubling ones is climate change. And so should we, you know, should we even, because climate change is uncertain, should we be considering it today when we make, when evaluating investments for the future? Because if it's uncertain, well, how can we do that?

[00:38:47] **Suzanne Carter:** [00:38:47] Thank you so much, Julien, for sharing the amazing work you're doing and explaining these complex issues for us, we really look forward to seeing how the tools you have designed to have an impact in the future.

[00:38:57] **Julien Harou:** [00:38:57] Thank you very much.

[00:38:58] **Suzanne Carter:** [00:38:58] It's been a rich [00:39:00] episode with so many insights. Kornelia, what were your key take home points?

[00:39:04] **Kornelia Lipinge:** [00:39:04] These are some of the things that stood out for me, firstly, that they said need for more resilient, what the infrastructure, this is one of the ways

to build resilience for climate change risk, and secondly, a blend of different water resources, innovation and robust decision-making would help in managing future climate risk.

[00:39:24] Lastly, inclusion of decision makers and stakeholders is essential to planning for water resource management.

[00:39:32] **Suzanne Carter:** [00:39:32] Absolutely minor that you can still make plans to adapt. Even when there is uncertainty about what the future climate will be. Informal settlements are common in African cities and water supply issues are there for a lot more complex, relying on both formal water sources and unregulated, possibly unsafe sources.

[00:39:51] And lastly, what our supply issues are going to continue to be really important for most African cities. Although some are planning for too little and others for too much. [00:40:00] Cape town's drought and day zero is a particularly good example of the kinds of challenges cities may be facing in the future.

[00:40:08] We've come to the end of this episode. Thank you for tuning in. We would love to hear from our listeners. If you have any burning questions or comments, please email [info@futureclimateafrica.org](mailto:info@futureclimateafrica.org). If you'd like to learn more about the work mentioned on this podcast, please visit [future climate africa.org](http://futureclimateafrica.org).

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