

- David Glanz: As we speak, 99.2% of New South Wales is in drought with one eighth of the state in intense drought, including greater Sydney and the Blue Mountains. The picture is a little better in Queensland, South Australia and Northern Victoria. So there's never been a better time to talk about water, especially how to save it and how to recycle it.
- David Glanz: Hello, and welcome to this podcast brought to you by the Australian Academy of Technology and Engineering. I'm David Glanz and today I'm talking to Professor Ana Deletic. Ana is a Water Engineer and a researcher, and she's Pro Vice Chancellor for Research at the University of New South Wales. And she's also a fellow of the academy.
- David Glanz: Ana, I know you've done some exciting work on how we can use vertical gardens that can recycle gray water when it's dry and storm water when it's wet. And we'll come back to that. But first, a broader question. Many people are now arguing that climate change is leading to fewer, more extreme rainfall events, and that global warming is contributing to more droughts. So what's your thoughts about that?
- Ana Deletic: Unfortunately, you are right. In many parts of the world we are struggling with water issues due to climate change, but also population growth. Our cities are becoming bigger and bigger, and have to cater for more and more people. Therefore, it's not surprising that we are having issues with urban water supply.
- David Glanz: Well, a few weeks ago, Cape Town in South Africa came very close to actually switching off its water supply and having to go to emergency rationing because of drought. Are we actually seeing that as a possibility for our major cities in Australia?
- Ana Deletic: We were almost there during the Millennium droughts only 10 years ago, we had a crisis in our cities as well. We planned a bit more in advance, so we didn't get there, but it was pretty scary.
- Ana Deletic: So unless we plan for future and plan for these growth of our cities, as well as for unexpected future that climate can bring, we will definitely be in the same problem at some point in time.
- David Glanz: Scary thought. Now, your research is focused on how we can use gray water and rainwater in our cities more effectively. How much urban water are we currently wasting?
- Ana Deletic: Actually, when you do pure water balance for the full biggest cities in Australia, you will see that cities are net producers of water. When you put together all waste water we are generating, and particularly all runoff, which is stone water that the cities are generating as catchments, there is more water coming out of cities than we need for their supply.

- Ana Deletic: Just to give you a number, Melbourne uses around 400 a gigaliter a year and it's roughly the same amount that is discharged from Melbourne as a catchment into Port Phillip Bay. So if we can harvest every single drop that falls on Melbourne, we wouldn't need any extra water.
- Ana Deletic: However, it's not easy and it's not possible, but I'm just giving you an idea about a water budgets.
- David Glanz: Okay. So it's not so much lack of water, but the way we capture it and the way we use it?
- Ana Deletic: Absolutely right.
- David Glanz: Now, you've been working on something called Green-Blue Systems. Can you tell us and the listeners what that means?
- Ana Deletic: Blue stands for water and green stands for nature-based treatment and capturing systems. So as I explained between particularly gray water, which is not that polluted, and stone water, we have lots and lots of resource in our cities.
- Ana Deletic: However, as we discussed, it's very hard to capture or treat these water within a city, which as we know is pretty tight. And there are no areas where you can store these huge water or even put large treatment plants.
- Ana Deletic: However, these nature-based solutions, which use plants and soils engineered systems, they look beautiful, and they can add to amenity of your city. So they are called rain gardens, for example. So they look like any other garden, but whenever it rains, a runoff goes into them, gets treated and can be then reused.
- Ana Deletic: Or even vertical landscapes like green walls, which at the moment I built only because they look good, but they can again become water filters. So plants and soils in both rain gardens, and these green walls can be used to treat these precious stone water and gray water. And in the end then directly reuse for irrigation or toilet flushing.
- David Glanz: Okay. How much re-engineering of our open environment would this take? Because when you talk for instance about gray water, I'm assuming that's quite a big plumbing operation.
- Ana Deletic: It doesn't have to be because we are talking about a light gray water. Which means, imagine even if you live on the third floor or the resident block, and your bathroom is not far from a wall, your outside wall.

Ana Deletic: So all you need to do, get a pipe from your shower and washing basin, because we are not using anything else but very light gray water, can be directed to go along the wall which has got these beautiful hanging gardens or green walls.

Ana Deletic: So whenever you shower that water goes down the wall, outside the wall and gets treated. So it's actually not such a big adjustment and definitely in new blocks this is easily done. And the same is with rain gardens, which again can be used for gray water as well.

Ana Deletic: They are gardens, it's not such a big deal to convert an existing flower bed into a rain garden treatment system. Which can treat both to run off snow water and gray water. So yet it does require a little bit of extra. But if you are using that treated water for irrigation only, then it's actually pretty simple.

David Glanz: Okay, well let's assume I'm brushing my teeth in my apartment on the third floor it. So it's a pretty standard sort of block of units. If there's a vertical garden down one side, how much water can that cleanse and filter and put back into the system?

Ana Deletic: We've done some studies, for example, I'll give you an example for a school. A typically primary school in suburbia everywhere in Australia could generate enough of water to basically have all their needs for the school for non-portable use. It's not for obviously drinking. At the same time provide these beautiful landscape garden.

Ana Deletic: So in a way they can go quite far because particularly shower and wash basin in your bathroom are the most water greedy devices we have in our houses. At the same time, as I said, stone water is pretty abundant.

Ana Deletic: Like in Brisbane, I mentioned Melbourne, but in Brisbane there is staff are more storm water than is needed for portable uses. So city produces 20%, 30% more runoff than it needs. So I'm not worried about the volume that we have. We have lots of resource.

Ana Deletic: I'm more worried about the ways we make this happen, because issues I'm not sure about even economical. They're more social or related.

David Glanz: Correct me if I'm wrong, but I'm assuming that widespread use of vertical gardens would have another spinoff benefit, which would be cooling our cities. Because I think any of us who live in big cities, you're in Sydney, I'm in Melbourne, are aware that cities become heat sinks.

David Glanz: Lots of concrete, lots of tarmac, not enough trees, very, very hot. Sometimes much, much hotter than the surrounding countryside. So is this something that people should be thinking about doing on a heat basis as well as a water basis?

- Ana Deletic: Actually, these systems on multifunctional. The biggest sell for these systems is exactly what you said that they cool out urban environments. What we know, if you have a beautiful green wall it can reuse, it's called human comfort temperature for up to four degrees in its neighborhood.
- Ana Deletic: So if you imagine, for example, a commercial shopping area full of these green structures, the feeling in that area will be like it's four degrees cooler than in nearby same size developments. So they had huge impact on how we feel.
- Ana Deletic: However, even bigger impact they have on property values. What we know, and it was a very interesting hedonic pricing study when they looked in Sydney, how much houses are built nearby rain gardens. Which I mentioned are just beautiful gardens, which treats storm water.
- Ana Deletic: How much they fetched on the market, comparing to houses that don't overlook some of these structures. And they found after looking at 4,005 sold houses, and when they normalize for the size age and all other the features that house got, they found that if your house is 50 meters far from a rain garden, it actually fetches 6% more. Roughly \$55,000 than a house, exactly the same house that is far away from that.
- Ana Deletic: So they found that amenity value of these gardens is very well above anything else that these things do. So value of harvesting water or pollution management is far less than the value that they give to owners of houses that are placed nearby. So it's a very interesting question.
- David Glanz: My last question, this sounds like a win, win, win both on water, on cooling, and even on property prices. Something I hadn't thought about before this conversation. So how close are we to vertical gardens becoming the new norm in our cities? Who's going to be brave enough to start to make them a part of business as usual?
- Ana Deletic: It's not just the vertical gardens. As I said, the rain gardens are far more accepted, and there are lots of them. Only in Yarra, a area of Melbourne, which is pretty central Melbourne, there are 10,000 rain gardens. So they're becoming pretty mainstream.
- Ana Deletic: However, there are so many problems. Some are technical nature, because these are relatively novel systems. I believe that we need to do far more research to make them robust. But also are far more capacity building in the engineering practice so that they can be built up to do good work.
- Ana Deletic: There is still lots of problems with, I'll call it bad implementation. So although designs sometimes are good, how they get executed is a problem, so that's one issue. So there are technical challenges still, but they're nowhere as big as the challenges in governance.

Ana Deletic: The thing is these systems, Blue-Green Systems are multifunctional. So as you are saying, they're win, win, win, but they're win, win, win, between different sectors. So developers or household owners, they win. Usually, urban planners because they beautify area.

Ana Deletic: A microclimate is again something that's councils look after and definitely water. But again, water, you have water supply and water pollution control.

Ana Deletic: However, all these things sit in different structures within our government. If you do optimization on only one of these benefits, these systems don't look that great. If you do optimization of all four benefits, they look amazing.

Ana Deletic: Unfortunately, our governance structure is not well-suited for these multifunctional beneficial technologies, because everyone's optimizing in their own sector. And does not cross subsidize from other sectors. And that's one of the biggest problems, at least Australia has.

Ana Deletic: Unless these different sectors come together, I don't see these systems becoming mainstreamed. Because optimization, as I said, it's always done in only one parameter. But some other countries that are doing different approaches. Trying to be an interesting example.

David Glanz: Well, I hope that there are some people, government and who set the agenda, who listened to this podcast, and take the hint. Because it sounds like a very exciting and beneficial proposition. I'm hoping that a few years from now our cities look quite different and function quite differently from the way they're currently set up. So thank you very much for your time, Ana.

Ana Deletic: Thank you very much for having me.