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#392: Feeding the 9 billion: Inconvenient truths about global food security

VOICEOVER

This is Up Close, the research talk show from the University of Melbourne Australia. ANDI HORVATH I'm Dr Andi Horvath. Thanks for joining us. Today we bring you up close to one of the most important grand challenges of our time, the global management of future food and nutritional security. We exist in a world where 30 percent of people are starving while the planet's human population continues to surge. Our natural resources like water and arable land are shrinking and pollution and dramatic changes in climate are increasing, all alongside whilst there are concerns about energy use and our food choices. The need for global sustainable and profitable agricultural practices are a recognised imperative. Food security, by definition, exists when all people at all times have physical, social and economic access to sufficient, safe and nutritious food. Although we have a long way to go before a full blown food security crisis, the consequences of not acting together or acting now are dire. It will lead to global unrest and comprises the wellbeing of humanity. Together globally we have to do more with less in more difficult circumstances and act now. But how? Professor Tim Reeves has explored that very question in concrete terms. How can the world feed more than nine billion people in 2050 in a manner that advances development of nations and reduces the pressure on the environment? In this episode Tim explores the complexities and priorities for action. Tim Reeves is an honorary professorial fellow at the University of Melbourne and is based at the Faculty of Veterinary and Agricultural Sciences. Tim is also the recipient of the Centenary of Agriculture Medal and in 2003 he received the Centenary of Federation Medal. Professor Reeves is the Chair of the Agricultural Forum of the Australian Academy of Technology and Engineering. Welcome to Up Close, Tim.

TIM REEVES

Thanks very much Andi.

ANDI HORVATH

Let's start with our target. How much food do we need by 2050?

TIM REEVES

The Food and Agricultural Organisation of the United Nations, FAO, estimates that we need to increase food production by about 70 percent. However, if we look at the total calories that have got to be produced by 2050 it's roughly a doubling from now. The reason is, we've got more people, 150 people per minute being added to the population of the world, but also their dietary preferences are changing towards more meat, hence this higher target.

ANDI HORVATH

Now, we're expecting about 10 billion people in about 2050 is that right?

TIM REEVES

Yes, somewhere between nine and 10 billion people. Tremendous challenge to feed.

ANDI HORVATH

Currently we're at 7.5 billion people. What is the current status of our food security on our planet in terms of malnutrition to obesity and the so called triple burden which I've heard you refer to?

TIM REEVES

Yes, that's it. I mean we're already grappling with this triple burden around food and nutritional security. We've got nearly a billion people on planet earth that go to bed hungry every night because they have insufficient calories and protein. We've got an additional two billion people who are malnourished because they don't get access to vitamins and vital trace elements in their staple diets. Now we have over a billion people who are in fact over nourished and over consumption of energy rich foods, resulting in a whole range of metabolic diseases.

ANDI HORVATH

Tim, have we ever really had real food security?

TIM REEVES

No, it's always a struggle. Now, what has happened is that through technology and the ingenuity of farmers, we've managed to keep up global supplies of food, but when one takes access into account, no, I mean we've made little dent on that billion people who are totally undernourished.

ANDI HORVATH

So what has been the consequences of large scale agricultural practices on the environment, because this is part of the picture for food security?

TIM REEVES

Absolutely. As I said before, these practices have helped us to increase productivity and food supply, but they've come with consequences for the environment. Tremendous impacts for example on our lands and soils. We've lost a lot of agricultural land to urbanisation and to dams, but also we've lost the value of a lot of agricultural land through degradation, incorrect farming practices, over cultivation.

Water, perhaps the biggest challenge of all, we're seeing in many parts of the world withdrawal of water resources that are clearly unsustainable. Of course, as you've got more people with a finite or dwindling supply of water, then you're going to have less water per person.

Agriculture already uses 70 percent of total fresh water withdrawals and that's an extremely huge challenge for us as we go to produce more food. Lastly, is air - we're talking about greenhouse gas emissions and reducing them. Globally agriculture accounts for about 30 percent of global greenhouse gas emissions and if we're going to double food production by 2050 with business as usual, it would mean the doubling of those greenhouse gas emissions. It would be totally unsustainable.

ANDI HORVATH

Okay. So we have a problem with the gas, the air, the soils, the water, it's not looking good. Also with the triple burden, some people starving and others obese, there are other parameters that influence food security and they're obviously political, economic and social. So tell us more about those. For instance, food distribution comes to mind.

TIM REEVES

I guess the biggest issue that we look at right across the world relates to food loss and food waste and we've got quite different pictures across the world. In developing countries some of those food losses and waste are at the farm level, but when we get to the western world most of those losses and waste are at the consumption level. This comes about through a whole range of issues, a great fussiness of us in the western world around freshness at the supermarket and also over consumption, too large portions. If we could do something about that it would make a huge difference.

ANDI HORVATH

Tim, tell me more about food losses at the consumption end, how big is it?

TIM REEVES

It's very big. In the USA and in Oceania - which Australia is a part - we're not only the biggest wasters and losers of food in the world, but around 60 percent of it is at the consumption end. When one drills down into what that 60 percent comprises we find a number of things, one is that a lot of food is wasted in supermarkets. We have an obsession with use-by dates. Now, you look at a product and it says use-by and once it hits that use-by date off the shelf it has to come. You could have bought the same product the day before and it's in your fridge a week or two later and it's still perfectly fine. Our obsession with use-by dates is a contributing factor. The second one comes around what we purchase and how we use it. There seems to be an attitude that food is a commodity. That we've lost our respect for it. Oh well, I'll buy that much, oh, I'll buy a bit more. Not a good idea.

ANDI HORVATH

We need to respect the food?

TIM REEVES

We need to respect food much more greatly as it still is in developing countries. Buy too much, waste it at home throwing it out, too large a portions are served - some of which may be eaten - all of which may be eaten with consequences for health - again, that goes out and ends up in land waste. So this is an area that is the absolute leaver if someone hears a program like this or reads something and says, well what can I do? Well everyone can start at home by reducing food loss and food wastage by building their respect for food again and by selecting the sort of things that they want to eat, buying the right amounts and not wasting it - using it effectively.

ANDI HORVATH

Tell me about the rural and urban populations. Has that shift affected food production?

TIM REEVES

It's an enormous challenge because we're looking by about 2050 that about 70 percent of the world's population will be urbanised - it's somewhere about 50/50 at the moment. Even in developing countries at the moment it's close to 50 percent, which means that you're going to have more people in the city waiting for that food to arrive for them to eat and less people out there in the country producing that food. That's an absolutely important factor.

ANDI HORVATH

Tim, what's the role of urban and peri-urban contributions to future food security?

TIM REEVES

I think it's got an increasingly important part to play. We said before that by 2050, 70 percent of the world's population is going to be urbanised. There's a great potential for them to be even further separated from agriculture now at the moment and have absolutely no idea of where their food comes from. So I see urban agriculture, firstly, being important in terms of - it's a contribution that it can produce fresh food right where the consumers are etcetera, but it's not so much the production in terms of food security, it's that urban agriculture helps to connect urban people back to where their food comes from and that's a real value that I see from urban agriculture. It would be great if you walked into a supermarket and there was a sign up that said, fresh food, thank a farmer. Farmers? Food? Ah, there's a connection. Urban farming helps to bring that.

Now peri-urban farming has a really important role to play and this is where we need to think very much about city planning. A lot of prime agricultural land is being lost to urbanisation. As we see these cities expanding, those houses, apartments, highways, they're being built on land - land that previously produced food. I think we've really got to think carefully about our peri-urban planning and that sometimes you'll hear cities talk about, well in our planning we're going to have a greenbelt. I think we need to look at, should we be having an agricultural food producing belt there, because that reduces the costs in terms of energy and a whole range of things, of getting fresh food to markets, also, for those that are commuting, it lets them see food production again and increases those connections. There's some really exciting things happening and I heard a very good example of it happening in

Milan in Italy. They had the food expo there last year and as a result of that, city of Milan is relooking at its planning to incorporate urban and peri-urban agriculture much more closely into its planning processes. I think a lot of cities around the world could and should be doing that.

ANDI HORVATH

Tim, we have to ask, what is the worst case scenarios for humanity of unchecked consumption and non-cooperating markets and nations?

TIM REEVES

Well the World Economic Forum which met at Davos in January 2017, looked at this and it looked at four trajectories. Basically those that will look after ourselves or those that are based on just really intensive consumption have tremendous potential impacts, not just on food security, but on global and regional security. It's already been shown that food and water security, have been factors in some of the conflicts around the world that are being dealt with at the moment.

ANDI HORVATH

Okay, so it's not looking good. It's looking like unrest and conflict. Is it also going to impact on where people are going to be moving around on the planet?

TIM REEVES

Oh absolutely. I mean if people are living in regions where there is insufficient food and insufficient water, they're not going to stay there. They're going to move. Initially they're going to move to cities and this is contributed to some of the conflicts that we're seeing at the moment across the world and then they're going to leave the country. So this attitude that, oh we'll just look after ourselves because we've got plenty etcetera, that isn't going to work because if you've got plenty and other people have got none, they're going to want to come to where you are.

ANDI HORVATH

Tim, what are the best case scenarios, the ones we're aiming for for future food security?

TIM REEVES

What we're really looking for is what is called open source sustainability. That is where the countries of the world trade both food and they trade the knowledge about how to produce your own food more sustainably and with greater nutrition in those foods. There are various elements of that, but they clearly are the sort of approaches that we want to see, that we have an open market system around trading food, we have an open marking system about helping nations wherever they are, produce their own food as much as they can. It has to be remembered that nearly 70 percent of global food production comes from the small holder farms in developing countries and that only between 10 and 15 percent of food is actually globally traded.

ANDI HORVATH

Are we seeing some of those best case scenarios emerge? I'm thinking of the ugly

food movement and also local farmers' markets.

TIM REEVES

We're seeing some pricing things happening. Yes, in our own society we're looking at some really good things - the second harvest type things, the farmers' markets as you say. These are really good. We need to be doing much better in some of the developing countries of helping them lift both productivity and profitability, but do it in ways that minimise environmental impacts and hopefully actually improves the ecosystems in which they operate.

ANDI HORVATH

I'm Andi Horvath and you're listening to Up Close. In this episode we're talking about taking action for future food security with Tim Reeves. Tim, let's talk about an action plan - a to-do list of priority areas if we're going to feed the people, feed the people of the future and do it sustainably. Now you've talked about five grand challenges you want to act on. The first of the five is loss and degradation of natural resources. Tell us about that. How do we halt that and how do we do it on a global co-operative scale?

TIM REEVES

It's absolutely essential that we do. We're going to have more people requiring more food, but we're losing land - prime agricultural land - at something at least five million hectares a year. When we look at the condition of some of the land that remains that's not urbanised, again, it's been calculated that around 30 percent of that has been degraded in the last 40 years. So we've got an enormous challenge. We just can't have business as usual. In relation to soil degradation we really need to be pushing conservation agriculture. This is a much better way of producing food that has zero tillage, retains the mulch on the soil surface, diverse farming systems with both livestock and crops and trees and pulses and cereals etcetera, has really good water management and integrated pest management.

ANDI HORVATH

Remind me what zero tillage is.

TIM REEVES

Zero tillage means not cultivating the soil - slotting the seed of the next crop into uncultivated soil. Over cultivation of our soils is the largest contributor to the degradation of our soils that I've talked about. We just can't have soils being smashed by cultivators and bared because that makes them prone to erosion from the wind and from rain.

ANDI HORVATH

Economically, could investment into these types of strategies help drive this?

TIM REEVES

Absolutely. The Food and Agriculture Organisation of the United Nations has Save and Grow as one of its major thrusts which is this sustainable intensification of

agriculture including conservation agriculture. Really what that's about is producing more with less. How can we increase the productivity and at the same time profitability, but do it with much more judicious use of inputs - much greater input use efficiency and much greater care for our natural resources of soil and water and air.

ANDI HORVATH

Tell me about the notion of nexus. Is this how we get everyone to cooperate? When you talk about nexus, what are you referring to?

TIM REEVES

Well I believe that one of our failings to date in terms of dealing with these issues, is that we tend to look at one issue at a time. So there's something wrong with water, we'll come up with a decision about water. Oh there's something about energy, we'll come up with a solution about energy. But all of these things are connected in a nexus. One looks at the nexus between agriculture, food, water, energy, climate change and population and we really need to start looking at these things in those nexus type approaches, not as individual problems where you come up with a solution for energy - oh yeah, hydro power would be really good in terms of renewable energy but it has dramatic effects on irrigation and food production and on the environment. That's a sort of an example of what I'm talking about.

ANDI HORVATH

Keeping this notion of nexus in mind your second grade challenge is adaption to climate change. Now changing weather patterns and weather extremes, increased CO2 are already underway. How does this affect crop yields?

TIM REEVES

Climate change is already affecting food production around the world right now, including here in Australia. We're seeing the impacts of greater variability in our climate, greater extremes and they can be at both ends, that can heat and drought at one end and floods and frosts at the other end. These are already dramatically impacting us. One of those that's affecting a lot of developing countries already is sea level rise, because a lot of their low land rice paddocks are being inundated by salt water either underneath or literally flooding over the top. Here in Australia, a study just being completed by CSIRO scientists, led by Zvi Hochman, and what that showed is that since 1990 wheat yield potential in Australia has gone down by 26 percent as a result of climate change. Now that is a clarion call and every government agency in Australia and every industry body in Australia should sit up and take notice and say, hey, it can't be business as usual.

ANDI HORVATH

Does it actually then translate to the quality of our food? Does it change our bread?

TIM REEVES

Absolutely, because one of the things that we're finding in relation to climate change - I mean obviously as it gets hotter and drier it's going to affect the choice of crops and livestock that we use, but what we're finding is that one of the aspects of

climate change which is rising atmospheric carbon dioxide, which is now about 406 parts per million, has gone up dramatically even in the last 20 years, that this can have real effects on the nitrogen protein nutrition of both crops and livestock. In some really good studies being done under the AGFACE facility which is a world class facility based at Horsham in country Victoria here in Australia, that has shown that a variety of wheat grown identically except growing one plot under today's carbon dioxide, we're growing another plot under elevated carbon dioxide - when you look at the loafs of bread made from those exactly same variety of wheat, the loaf of bread that has been produced from the wheat under the elevated carbon dioxide is half the size of the loaf from the other. There are other impacts from elevated carbon dioxide on the protein nutrition of livestock, which is equally concerning. Again, we have to adapt to elevated carbon dioxide to maximise any advantages and minimise the disadvantages.

ANDI HORVATH

Surely the way forward then are technological fixes. Let's get our engineers onto the case.

TIM REEVES

Certainly we need to be looking at how we can deal with all of these factors and my belief is that - and this applies to all nations and it certainly applies here in Australia - is that all the innovation that we're producing that can impact in and around food and agricultural production, we need to look at it through the lens of climate change and we say, well here's the new technology, what will it do in terms of helping us to adapt to climate change? In some cases one could look at two technologies, they're both very good when you look at them in isolation, but only one of them will really have the impacts of adaptation to climate change that we need. One of the things that we have to remember when we're looking at these long term issues is that short term fixes do not work. Two to three year projects receiving \$100,000 have very little part to play in solving these long term sustainability issues. These issues require long term, patient, targeted, co-investment and that's the only way we're going to be able to adapt to the challenges of climate change and other issues.

ANDI HORVATH

Tim, your third grand challenge is a category all on its own - it's nitrogen use and current efficiency or inefficiency, as you like to say. Our nitrogen footprint appears to be just as critical as our carbon one. Tell us about the nitrogen fertilizer problem. I never realised it was so huge.

TIM REEVES

Nitrogen fertilizer is absolutely critical to our food security. It's been calculated that nitrogen fertilizer accounts for more than 50 percent of the protein in human diets, that's how important it is. The use of nitrogen fertilizer has absolutely skyrocketed across the world. But the elephant in the room in relation to the nitrogen fertilizer is that the efficiency of that use is only 50 percent. So here we've got a very costly input that depends on its production - it takes about four barrels of oil equivalent to produce one tonne of Urea, the most commonly used nitrogen fertilizer - and we're

looking at it being wasted. Now this has economic costs of course, but it has tremendous environmental costs because that excess nitrogen is being lost into the atmosphere as greenhouse gases, it's being lost in the waterways as pollution, here in Australia that includes pollution of the Great Barrier Reef, and it's also soaking in the groundwater and causing contamination of our groundwater.

ANDI HORVATH

Tell us about the solutions to the nitrogen fertilizer problem.

TIM REEVES

Apart from increasing the efficiency of our nitrogen usage which we need to do and I think the breakthroughs we need there are more energy efficient nitrogen fertilizer to have slower release and that are much more matched to what the plant needs. But the other thing is we've got another choice and that choice is biologically fixed nitrogen from legumes. While nitrogen fertilizer use has skyrocketed, actually our investment in biologically fixed nitrogen from legumes has gone down both globally and nationally here in Australia. Globally the Consultative Group on International Agricultural Research, which is an extremely important organisation, does not have a dry land cropping program at the moment involving legumes through biologically fixed nitrogen. Here in Australia our emphasis on both grain legumes in cropping systems and on pasture legumes, grazed by livestock, has gone down dramatically. When I started my work 50 years ago we produced much more of our nitrogen in our farming systems from legumes compared to from nitrogen fertilizer. The ratio was something about 20:1. Today that ratio is about 3 or 4:1 because we're using much more nitrogen fertilizer and much less biologically fixed nitrogen. We need to change that. It makes economic sense and it makes environmental sense and also can help us reduce our nitrogen footprint.

ANDI HORVATH

I'm Andi Horvath and our guest today is sustainable agriculture expert Professor Tim Reeves. We're talking about priority action for future food security here on Up Close. Tim, the fourth of the five grand challenges are food loss and waste. These are kind of social and cultural challenges. This issue of overnutrition and undernutrition is really a political and economic one. It's often referred to as the food gap, as I've heard you call it. Can we redistribute the food now?

TIM REEVES

Firstly, it's not just about redistribution. The World Resources Institute has said, look, even if we could distribute the food we've got in the world now, there would still be a substantial food gap there - a calorie gap. When we look at this whole issue of food loss and waste, it's counter-intuitive because I've talked about the struggles of producing more food and here we are right now over 30 percent of what we currently produce is wasted or lost and when one looks at the sources of that loss and waste it varies according to the countries that you're in. In developing countries much of that loss and waste is around the farm - it's from pests and diseases, it's from storage that are affected by vermin, rats etcetera, etcetera. On the other hand in the USA and Oceania - includes Australia - we are not only the biggest wasters and losers of

food in the world, but around 60 percent of our loss and waste comes at the consumption end. That's something that we can do something about and that we must do something about. One of the things that it needs to be realised that if the world can dramatically reduce this rate of food loss that we currently have, it actually would affect food nutritional security right across the planet, because it would reduce our 2050 target, it would reduce that food gap and it would also have really beneficial impacts on environment.

ANDI HORVATH

Now Tim do we need to rethink our diets as well? Maybe lean towards a more vegetarian diet? In our Up Close interview with Professor Mark Sutton in episode 386, he talks about having far less meat in our diet; he calls it demitarian.

TIM REEVES

Absolutely. Obviously these are sensitive issues and it comes down to personal choice. But education is a clear part of this and there have been some really good studies that have done - they've shown that, yes, at the moment - let's look at it the other way round, that as we're going from people wanting to consume grain directly to more meat you're talking about huge extra use of water. You're talking about something like 10 to 15 times more water to produce a kilogram of beef for example compared to a kilogram of grain and so therefore obviously if people were eating less meat that would really help with water. But it also can help us in a range of other ways as I said before, if we could reduce that rate of food waste by 50 percent by 2050 it would reduce the world food gap at that time by 25 percent. If all consumers were vegetarian and ate to nutritional guidelines this would reduce global nitrogen usage by 50 percent. The average daily water consumption of a meat eating person is twice that of a vegetarian.

ANDI HORVATH

Your fifth and final grand challenge is perhaps the most vital driver in allowing for future food security and that's restoring the neglected and eroded rural communities. Now the draw card to the city away from farming is a global issue as you've outlined. Tell us about the extent of the problem and possible solutions.

TIM REEVES

This is extremely important. I called it the neglect and erosion of rural communities and it's a global issue. By 2050 around 70 percent of the world's population will be urbanised. That means there's going to be more people in the city waiting for their food, less people out there producing it. Even today there's roughly 50 percent of urbanisation in developing countries. The key policy dilemma that leaders around the world grapple with but rarely get right is this, you'll often hear global leaders saying, we're going to keep food prices down. People in the cities, there's going to be affordable food, etcetera, etcetera. Good, if you look at it in isolation. But if you drive or hold prices down so low that farmers who produce the food cannot make a profit, you're going to have no farmers left in those rural areas to produce the food. So food security is going to be totally lost. It's going to be a disaster. So we really have to look at what it is that needs to be done to keep efficient farmers out there at the front

line of food security producing that food. There are a number of things - there's the pricing issue that I've just talked about which is fundamental. But then, when you look at most rural communities around the world, that includes here in Australia, you find that the infrastructure, the services, education, access to health, a whole range of issues, are much poorer in rural areas than they are in the city. I have a very good friend who runs a very, very good and efficient farm no more than 250 kilometres from Melbourne and yet he cannot get mobile phone reception at his house. How can you run a multimillion dollar business like that? We wouldn't tolerate it in the city. So rural people in all parts of the world are looking at now two even greater uncertainties about their livelihoods and their future. One is that digital divide that I've just talked about - access to ICT information technologies which they need for their businesses which is not coming along fast enough in many rural areas and the other uncertainty is being caused by climate change because what we have to understand is that our rural communities and our farmers, they are at the front line of climate change. So every time we read about heat, drought, frosts, floods - today here in March 2017 an impending tropical cyclone off the coast of Queensland - these impact farmers and food producers in dramatic ways. So it's a greater uncertainty and that's why greater attention has to be given to these rural communities.

ANDI HORVATH

Tim, I have to ask, a lot of rural representation in the area of politics tends to be more conservative when it comes to climate change and the environment. They have a more cautious approach. Is that countering the efforts for viewing development through a climate change lens?

TIM REEVES Certainly it can. I mean the interesting thing is that I work around the world and there is hardly a country in the world - in the developing world - where we have this debate about climate change. It seems to be something that we feature here in Australia and perhaps in other countries of the world like the USA, but in reality every other country accepts that it's happening and wants to do something about it, now. I mean that brings me back to listening to what the electorate is saying and what are their concerns and what we're seeing now is that clearly they're very concerned about climate change, the National Farmers' Federation here in Australia believes climate change is extremely important and we need measures for adaptation and also for mitigation. So getting that community participation is critical. I spoke to some friends who live in rural areas here in Australia and their number one concern was the distance they are away from government. They said, government's really got little idea of what the real issues are. Well you won't understand that unless you listen to them. There's been a very good local example here in Victoria called Voices for Indi in an electorate which really has allowed people to have a huge input and say in what they think is important rather than what someone sitting elsewhere thinks is important.

ANDI HORVATH

Tim, there are common themes in your solutions to future food security - the reduction of loss and waste, the need for greater efficiencies, simultaneous requirements for enhancing productivity, profitability, sustainability and also clear

vision and strategy for these priority themes. You also talk about the need for longer term patient investment for sustainability issues. So what's next? What's happening out there now and next year?

TIM REEVES

What we need to do more effectively at the start is to concentrate our attentions on the nexus issues that I've talked about - agriculture, food, energy, water, people, human health. We're not good at doing these things because we've got health organisations that do this and we've got agricultural organisations that do that and we've got water organisations that do that and we've got power organisations that do that. How can we effectively get really well run nexus approaches to these issues? We need clear targeted policies around these areas and then it'd be cohesive. Then we need to invest in research development, education, infrastructure. We need to look extremely carefully at these and then we need long term patient, co-investment, governments, private sector all having inputs into these sort of programs. At the moment we look at the world - and it's same here in Australia - that is dominated by short term thinking - quick fixes. Well the issues we're talking about about global food security, global nutritional security, adaptation to climate change, nutrition and human health, reducing food losses and waste are not quick fix issues. Long term, patient, targeted, co-investment.

ANDI HORVATH

The management of food security is critical for food security now and in the future. Tim, thanks for being our guest on Up Close.

TIM REEVES

Thank you very much indeed.

ANDI HORVATH

We've been speaking about the critical management of livestock and crops to ensure food supplies for the future with Tim Reeves, Honorary Professor at the University of Melbourne's Faculty of Veterinary and Agricultural Sciences. You'll find a full transcript and more info on this and all our episodes on the Up Close website. Up Close is a production of the University of Melbourne Australia. This episode was recorded on 27 March 2017. Producer was Kelvin Param, audio engineering by Gavin Nebauer. I'm Dr Andi Horvath. Cheers.

VOICEOVER

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