**Come Rain or Shine, Podcast Episode 3**

**Precision Ranching Technologies  
Interview with Tony Waterhouse**

**Emily Elias:** Welcome to Come Rain or Shine a podcast of the USDA Southwest Climate Hub

**Sarah LeRoy:** And the Department of Interior, Southwest Climate Adaptation Science Center, or Southwest CASC. I'm Sarah LeRoy, Science Communications Coordinator for the Southwest CASC.

**Emily Elias:** And I'm Emile Elias, director of the USDA Southwest Climate Hub. Here we highlight stories to share the most recent advances and climate science, weather and climate adaptation and innovative practices to support resilient landscapes and communities.

**Sarah LeRoy:** We believe that sharing some of the most forward thinking and creative climate science and adaptation will strengthen our collective ability to respond to even the most challenging impacts of climate change, in one of the hottest and driest regions of the world.

**Emily Elias:** This week Dr. Sheri Spiegel is serving as a guest-host for Come Rain or Shine. Sheri is one of the principle investigators of the Sustainable Southwest Beef project, and will be leading the conversation.

**Sheri Spiegel:** Hi, I'm Sheri Spiegel. Today we're here with Tony Waterhouse all the way from Scotland. Tony is a professor emeritus at Scotland's Rural College and a livestock scientist with over 35 years experience in the study of livestock systems and animal welfare in the United Kingdom. Currently, his research is focusing on opportunities in wearable technology and precision livestock farming with direct recent experience in next generation animal telemetry using the internet of things communication, with technologies capable of providing animal monitoring and animal management, importantly, in real time. Tony is a key collaborator with us on the Sustainable Southwest Beef Coordinated Agricultural Project, and we're lucky to have him on board. Tony was just here giving a live webinar on precision technologies being developed for livestock operations, and we're going to play a few highlights from that now before we jump into the actual interview.

**Tony Waterhouse:** It's great to be here. I’ve added the extra word on the title to add management to sort of, think a bit more about it being just about science in the past but more about what real people will do in the real world and how we move from this period of stuff coming down the road as things you could do to things that people will do. Uh, in terms of technology. So it’s literally a question of, is this the, uh, hold on, I was at the Society of Range Management conference in Denver last week and I asked those top two questions about some of the kit we’ve been doing, so thinking a bit about that, but now I want a bit more, you know, where's this all going to? Where will it end? Where will it start? In terms of real people doing this, this sort of stuff on the ground. I come from a very different country with a very different sort of environment. But the thing to this day, in terms of our extensive systems, in terms of poor quality grazing, a different sort of harsh weather, I’ll mention a bit about that, few old fences and all that sort of stuff, infrequent inspection of animals, typically quite high losses, abnormal for ruminants - cows, higher losses than would be acceptable in the intensive systems and certainly otherwise. Um, so we work in an environment where there’s an issue about the sheep have a lower value than the cattle you know, and how do you trade them off? I think now I’ve learned we've all got labor issues. Even it's just how do people use their own time. And pertinent into this whole issue of precision stuff is communication routes of getting data from the ground to the, to the smartphone, are quite challenging. And it’s probably one of the areas that's gonna make the biggest difference to how we can make it make things work. And yeah a little bit of an afterthought but we tend to think about the animals and the kit and all this, but in actual fact the whole of this, these sort of extensive systems aren’t about that, they’re mainly about the people involved. It's the people who make the difference on the ground, and don't forget that, when we get all worried about technology.

So a little bit about my history, and a bit about this sort of group of people we work with. Is kind of often thought that extensive farmers around the world are slow to change and don't like technology. This just shows [referring to a slide] encompasses some of my, my working history on the left, when I first came to the research station where I am, one of the first things I was involved in was bringing in ultrasonic pregnancy counting of lambs. So counting the number of lambs inside ewes in utero, we wrote one of the first papers on that back in 1986 and actually looked at those false alarm issues, which I’ll [inaudible] later. The point was that over 50% of the farmers in the UK picked up that technology incredibly quickly, because it worked. It did that. It worked and it paid, 50% tried it, another percent tried it and they said “nah, nah, we don't need to know whether we’ve got triplets versus twins they’re the same thing”, but those that liked twins versus singles liked it. So it’s a bit of technology that’s now so old that we think has been around forever, but we had to bring it in. So we were the ones that were the first people that brought that in, and surely it had issues.

For a look at the story of precision stuff, then, a lot of it in cattle is being driven from the intensive systems, [inaudible] some of it but the dairy end of it here, is something again, you can see on the left here we’ve got milking machines, automatic milkers, whatever. On this bottom left you can see a tag there, a WAN tag there, that's called Smart Bull, it’s made in Switzerland, it’s on quite a lot of farms. How many farms, you ask somebody, four hundred is the number I got back as a guess from somebody. And what that does is gives you a map of where the cows are in the shed so you can find them. You’ve got hundreds of cows and you get an alert saying cow 474 is not feeling too good. How do you find her? You need a map. This things will produce maps of a [inaudible] nature as well, in terms of individual, you know, things about health, and things about milk, whatever. And all that sort of stuff. So that's driving that, that’s one of the sensors we've been using, both inside the sheds, but also in our extensive systems. In terms of this, and that’s a motion sensor bit of kit. So some of this is coming down the road from this end, in that we can now do estrus detection, estrus detection by accelerometer, by neck band. I think it’s now the accepted best method. Humans basically are not schooled for this, so now students coming through college are being told: this is the way to go - let’s nowat do it observation-wise, but you know. And the question how much do we move that into extensive pastures.

And feeding through some of the technology in my, our own research groups, looking at neck sensors, ankle sensors, “roomy-watchy” type things, looking at tags in terms of identification, here’s something again looking at heart rate in calves. Ah, and camera-based stuff, thermal imaging, outdoor wear, next to either a walkway, truck with a solar panel there so we can actually monitor animals out in pasture, same kit inside. And there’s some of our work down at the bottom right [referring to slide]. Where, you know I’m talking about beef, we quite like sheep to do this sort of work. Because basically sheep, you can work with sheep, you can discuss things with sheep, cows just break things, don’t they?

So I’m going to talk a bit now about this connecting technologies. And just some sort of illustrative stuff some of which I talked about last week in Denver. Just take you through the data and see where we’re at. So, this is some of the data we’ve been working with, just some of it, there’s quite a lot more, but sort of moving towards from the top, which is about communication, to the bottom, which is the sort of “let’s put it all together in a pack.” So we’ll see more of that.

So, just for a break in my thought, can I ask yourselves, for those that are listening, we’ve got about 20 people in the room. So of the 20 people in the room can I ask those who are willing to volunteer, who's wearing a Fitbit type motion sensor, anybody? Got one. Who's wearing a… two. Who’s wearing a watch? Who’s not wearing a watch? How do you tell the time? Smartphone. Who’s wearing a GPS tracker? Who’s carrying a GPS tracker? Who’s carrying a motion sensor? Some of you know the answer to all these things aren’t ye, you can tell officially, wherever it is, big brother knows exactly where we are all the time. Knows what we’re doing and not what we’re doing, so inside here [smartphone] we’ve got all that kit, that’s helping along with this whole thing, in terms of, all got motion sensors, all got GPS in it, whether you turn it on or off, all got proximity sensors in them as well. Well, they haven't yet got is virtual fencing, but it’s next. And also geo-fencing is part of the language that the general population are doing in terms of thinking about getting alerts when their children or their gran moves outside an allocated area, by using this equipment. So, it’s just something we need to, well it’s coming, it’s just how do we get it into really rural environments where we’re at? So. The question is, is this interesting? The work that you’ve been doing for years, it’s really interesting, it’s fascinating. Is it useful? Well, yes it is useful, but how much does it influence what ranches really do on a day to day basis? Truthfully, it’s the background stuff. And we’re moving where this technology starts to be the thing that starts to be the thing that drives their lives, in the same way as that mobile phone you're carrying around is probably now the thing that synchronizes your lives, will it be the same way when we start bringing that to farmers?

[ding]

**Sheri Spiegel:** Here we are now with Tony to expand a little bit more on his precision ranching technology. So you were just telling me a minute ago why farmers and ranchers in Scotland might be interested in something like GPS trackers or virtual fencing for their livestock.

**Tony Waterhouse:** Well, I mean yeah it’s typical - so it's part of the tradition, and custom of practice that we would, that farmers with cattle out there, in fields or in on the hill would see them every day. We’ve an expectation. But that's made easier by the fact that they tend to graze in in fairly large mobs, so they won't split up and spread out. Now sheep. Hill sheep will spread out all over the place. So the only way you can get them together is to put a dog around them and then they start to pull together and move them. Whereas the cattle, by and large tend to stay out there, in, so if you put out out 30, 40, 50, there’ll be one single lot. You know, maybe the size of your football pitches, basically spreading out. So when you, when you go out to see them, you can see them in one go, but they literally could move a mile two miles in the, in the course of a day, without any trouble. So from one section round to another section around the back of a wood or down a gully, and therefore people spend hours looking for the cows so they could find the cows and that's all they're doing, they’re saying if you could have some way of conveniently making sure that I don't waste my time looking for my cows to check them. Something as simple as that, they go, that would save me, you know, an hour a day. You know?

**Sheri Spiegel:** That's the feedback you get from your farmers, that it saves time?

**Tony Waterhouse:** Yeah, absolutely, that simple little thing. And the other thing is once they can see that sort of thing happening and they can go and do something about it, if they, if they're going in the wrong direction.

**Sheri Spiegel:** Yeah. I'm curious, what are the, in your experience, do you know what they do instead with that time? Is it time with family, or is this maybe too much of a blanket… yeah.

**Tony Waterhouse:** No, I mean, I think our guys, when we look and we've done some work on what people do, they're just [inaudible], and that's part of the problem with farming.

**Sheri Spiegel:** They work more? Or they come up with…

**Tony Waterhouse:** They just work as long as they can. Okay. And then some days they work harder. You know, there's just literally, so they, they don't have a lot of time, you know, to, they could usefully use it els… You know, they don't. They just work, they just do something else. I mean, quite a lot of them are working off site. I mean, it's amazing how many farming families depend on income off site. But, and it's also surprising that historically things that people used to do - go to the market every week, they don't do that anymore. They don't have time for that. So then the market, the weekly market is no longer a place that people get together to meet. So even if they’re putting cattle in, they’ll put them, the lorry’ll come and they’ll just send them off and they'll go, and they will stay at home and carry on fencing or whatever else, because they're now single, single person farms in many situations.

**Sheri Spiegel:** Okay

**Tony Waterhouse:** So it's kind of a lonely existence and all that sort of stuff. So I think the opportunity that they would have to make better use the time is maybe to do more work or, yeah, frankly, yeah, there could be, they could be working smarter, is the obvious thing, whatever that means. But, yeah.

**Sheri Spiegel:** Yeah, I guess we could all use a little bit of that, but so, so you're saying there, there was a culture of getting together to like a cattle auction or a sheep, sheep…

**Tony Waterhouse:** Yeah, the big annual ones are still an occasion for that, without a doubt.

**Sheri Spiegel:** But it was weekly before.

**Tony Waterhouse:** Well before there used to be more of these weekly sales, but now it's back to maybe once or twice a year. So yeah. So people go buy it, go. I mean, the community, we work with they’ve got both Hill sheep and Hill cattle, whether it’d be going to ram sales, whether it’d be buying maybe a few rams and maybe going to the stall cattle sales, and some of the old ewe sales and they'd see quite a lot of people then. But again, everybody says there’s not as many as they used to be, it's become less of a social event.

**Sheri Spiegel:** yeah, yeah.

**Tony Waterhouse:** than it used to be. So we can maybe chat now about new kit, if they join a club together to go to new kit, we've got a project with farmers in the North, certainly. The fact that we can have a, it's around getting some of these new kit out, and getting some of it onto demonstration. They sort of value of the opportunity to go and do something which you think is going to work, as a sort of little club about, let's go and do this together. You know? I think that's actually partially, you know, it’s partly social.

**Sheri Spiegel:** Certainly. So to develop some of the new technologies.

**Tony Waterhouse:** Yeah, and get it into practice. I mean, yeah, somebody got to build, I mean, you need two lots of people to make this stuff work. Somebody's got to build it. Somebody's got to buy it and use it. You have to get

**Sheri Spiegel:** Yeah, somebody’s got to test it.

**Tony Waterhouse:** Yeah. Well, yeah, and sometimes that testing is the real, well, the people who make it sometimes test it. The people who buy it sometimes test it. And then you've got the likes of us who are intermediaries who are the people who again, have influence that are testing it and become a source of independent verifiers of this, or say, why don't you try doing that with it? You know? So, sort of extension service are also part of that process, but unless there’s somebody at the end of the pipeline wants to buy it, it's going nowhere is it?

**Sheri Spiegel:** Right. So have you, given the lack of fencing and kind of the close neighborly kind of situation going on, have, are there, would you say that there's cooperative landscape management kind of approaches, like where neighbors get together and decide, you know, some management approaches that you might need multiple producers doing together, multiple land managers doing together?

**Tony Waterhouse:** Well, not, there's a bit of that, but it's a challenge actually. Seriously. I mean, given the fact that a lot of our landholdings are catchments or half catchment so that there are enough bits of their own, there are some niche conservation scheme, which are government sponsored, the sort of European union subject based conservation scheme where they're looking for catchments of, of groupings of farmers to get together to do the same thing. Our wildland is, grazed by livestock, but we've got red deer as the other major population on it. And the red deer is actually, it's not, it’s a wild animal, but it's controlled by

**Sheri Spiegel:** hunting

**Tony Waterhouse:** and managed. And the, and there are too many of them and all that sort of stuff. So it's, so there’s quite a lot of things, so Scotland's covered in deer management groups, which are groupings of farmers together with little niche conservation agencies who set limits and rules on controlling them. And actually insist, contractually effectively, with the different members, the annual cull to keep deer numbers under control, because if you don’t, we’ve no natural predators anymore of the red deer. So, so we, they need, they need shooting by somebody. So yeah, they’ll either be shot for, for money by people come, nice Americans, nice people from Switzerland

**Sheri Spiegel:** Nice Americans, yeah.

**Tony Waterhouse:** Or, or the people that live on land, shoot them to control them and then sell the, sell the meat off for, for venison. But if you don't shoot them then obviously the numbers become a problem. So they get control on this ca… on the beyond farm scale, but relatively little, little things, mainly it's within farm.

**Sheri Spiegel:** Yeah. So when you say catchment, what do you mean?

**Tony Waterhouse:** Sorry, it’s where all the water goes down to one stream.

**Sheri Spiegel:** Okay. That's what I thought you meant. Okay, a watershed is what we would call it.

**Tony Waterhouse:** Yeah, a lot of our farms, the ridge is a good boundary. Yeah. So yeah, typically it's not uncommon where you can do it, where you know somebody's got that side or maybe two or three people share that watershed, and the ridge is the boundary before you go. And what you want to do is you stop going over the top because you've got, you've got further to get them back.

**Sheri Spiegel:** Yeah. I would think that maybe some of the people in this catchment in one catchment might be talking to the people in the next catchment about just saying, okay, if mine, if my cattle or sheep come up and over, like

**Tony Waterhouse:** Well they do definitely talk about that. They collectively would gather, with sheep, which they disperse much more evenly, and unless something stops them, they’ll just keep going. They just follow their teeth anywhere there’s anything that grows. And they will actually, they will, they will merge at the boundaries. And so it's typical for people to organize their sheep gathers, big events, um, in some sort of organized manner.

**Sheri Spiegel:** at the same time.

**Tony Waterhouse:** either at the same time or as “I'll go today and you go tomorrow,” if I go today, I'll bring that lot in, I'll bring some of my stragglers in, and then I'll go back out and I'll clear the rest of the hill. So that way between the two of, you've cleared all the sheep off rather than you do it in some other way, ‘cuz that, logic would be if you've got two groups, two flocks of sheep meeting along the ridge, you put the dog along the top of the ridge and the sheep’ll go home. It doesn’t work like that. They all mix up. So you end up bringing in maybe 500 ewes and 600 lambs, but maybe you have 20-30 of your neighbor's sheep.

**Sheri Spiegel:** Okay

That's when it's a good day. Disaster is when you get heap more of your sheep in and half your sheep are that direction. So collective management of borders. So we, yeah, so that's actually quite… and you've got to get on with your neighbor, and then somebody has to truck them around, or hunt them back up.

**Sheri Spiegel:** right, yeah.

**Tony Waterhouse:** Cattle by comparison are easy. By and large, they don't, we don't want them to stray. And therefore people are much more. Yeah. And therefore get quite keen on the fact, can we use tools that would stop them straying, cause we don't want them ending up going over to our neighbors. Because you can't just truck them back in the same sort of way.

**Sheri Spiegel:** No.

So why do you think the cattle in your country stay together more versus here? Do you think it's like genetic, do they…

**Tony Waterhouse:** I think it's selection, that we've selected, we've not selected for the ones that dispersed the other way. And we also, that's the way we “teach” them, inverted commas. Yeah, I think they just get used from there…

**Sheri Spiegel:** Did you say inverted commas?

**Tony Waterhouse:** What, what’d I say?

**Sheri Spiegel:** Was it inverted commas?

**Tony Waterhouse:** That means that's sort of quote, yeah. Sorry, I was, I was… this being in a studio, it makes you feel like a, like you’re from somewhere else.

**Sheri Spiegel:** I know. I am to being very othering with your language on this podcast… [laughter]

**Sheri Spiegel:** Yeah. Sorry, listeners. Um, okay. So, okay, so back to the typical kit. So would you say water sensors are typical, that people checking their waterers…?

**Tony Waterhouse:** That would be really good. That would be something you could buy tomorrow, if you can get the communication system working.

**Sheri Spiegel:** Yes

**Tony Waterhouse:** There’s a few “if”s now, you see that's the problem. You know, when and if that starts to happen. And that's the sort of thing which I think would be perfect for people to have a bit of kit that says the water levels are fine, or the water level’s dropping, or the, wherever you've got - the pump’s broken or whatever it is that works the system. Cause some will be pump-driven, some will be gravit, some’ll be rain-filled, whatever. You know, the ball-cock’s basically not working, whatever system you've got, something that tells you it's okay or it's not okay, would be valued. ‘Cause I'm pretty sure a lot of your ranchers will spend time worrying about water or spending time just going to check the thing’s working.

**Sheri Spiegel:** Yeah. I mean, we ran some calculations for the Jornada Experimental Range in Southern New Mexico, and we found that there could be quite a bit of mileage saved. So time driving and gas used for driving, which translates into both money and time.

**Tony Waterhouse:** Yeah. Well that’s the obvious sort of thing, which that sort of sensor looks like. It’s a, if you can get the sensor costing less than the cost of you checking, you’re in a plus.

**Sheri Spiegel:** Yeah. Okay. So that's so, so that would be a top. So it's, where is she - where's my cow?

**Tony Waterhouse:** Where's my cow.

**Sheri Spiegel:** Where’s my cow? The water sensors. And then, um, how about rainfall detection in, I guess for you guys, that's not so… [laughter]

**Tony Waterhouse:** Yeah all we do is open the window. I mean again the classic with weather forecasting, with weather forecasting people have, a lot of time… Now weather forecasters are brilliant at the moment compared to where they used to be.

**Sheri Spiegel:** Sure.

**Tony Waterhouse:** They can look, they can look at radar and all that stuff. So that's great. But, but basically you still want to look out the window and see whether you can get out, or whether you need to get up that morning to go out and gather, is one of the interesting issues. So that’s, that’s, so literally that. But no, I think again, it's, yeah - what would you use it for? I mean, I think, you know, putting asset trackers on the trucks and bikes on, and on sheep dogs, and on shepherds, you know, staff. Just knowing where people are from a safety point of view would be helpful. Man. The number of times I've heard them say, you know, they both set off together, and then “where the [silenced] has he gone?”

You know, they've literally gone down the, you know, two or three miles around the corner, can't hear them. You thinking, where are they? They're having trouble. Where's he, you know, cause you're, you're working together as a team to bring, to bring sheep in, but not, yeah, cows.

**Sheri Spiegel:** Ok. So for us, having remote awareness of weather in far off pastures is quite helpful, because it's super patchy and it's, and it can be raining and pasture 19 and not in pasture 20.

**Tony Waterhouse:** Well, soil moisture, soil moisture sensors, which you pick those up really cheap and easy. Battery-based ones, you stick them in the pasture. They would tell you, they would give you soil moisture. Presumably what will happen is they'll be dry, then they'll get very wet, and then slowly but surely they will go down. Something you need to look at. The sort of thing that’s being used by arable farmers elsewhere. But might be quite handy to know, to spread around, I mean, again, that's a sort of thing which would be part of the internet of things if I could do with them.

**Sheri Spiegel:** Yeah, I guess that gets to the point a little bit even more directly, having a soil moisture probe.

**Tony Waterhouse:** Yeah, yeah.

**Sheri Spiegel:** Um, yes. So. So, um, do you have any advice that you would give to our rancher listeners out here about testing precision technologies? Or maybe, yeah, people who are thinking about adopting them and maybe are on the fence. Any kind of advice you might want to give?

**Tony Waterhouse:** Aye, well, it’s kind of challenging at the moment. I'm currently working with farmers in Scotland about the idea of helping them get some new kit on. That's really in that moment of not yet there. I mean you can't go down to your local farm supply store and buy this stuff.

**Sheri Spiegel:** Do you see that happening?

**Tony Waterhouse:** I think it will do. I mean maybe done over the internet clearly. I think where we're moving with direct sales it’s gonna go on. I mean, again, we talk about the, the virtual fence stuff, well we've actually got global companies who are definitely developing this stuff. They will, they are going to go mainstream with this, in one form or fashion, wherever their relative markets are. And they’re gonna be either be, going with existing supply chains, going directly over the internet in direct sales, but they're going to sell. They want to sell this stuff direct to the sort of people, um, you know, both mainstream ranches and the sort of, you know, the, the lifestyle people maybe, you know, part time farmers might be really interested in this stuff, ‘cause they can then go away to their job, but know at home, everything's fine. That's the sort of issue in our country where I think, again, it's a sort of classic situation that they can check what's going on just as easily from their office desk 25 miles down the road or on a beach in Honolulu if they get, if they ever,

**Sheri Spiegel:** I like this vignette, the beach in Honolulu.

**Tony Waterhouse:** I’ve never, I’ve never been to Honolulu, it sounds cool. But anyway, but literally, wherever that is, they can literally keep an eye on some things that they can do, that before the only way to do it was to get in a truck and drive out there and do it. And I think if you could do that, then that would be interesting. So where would you buy it from? It’s that sort of mode. Most of the startup companies in the sort of technology common is, that's the sort of model, that’s disruptive technology. We're talking about whether we need to break away from the existing local supply store. Some may go down that route and maybe use them as their, their local salespeople. I don't know. I don't know. You may appreciate, I mean, one of the virtual fence companies that's coming in is, is a company that's just being taken over by Gallaghers - the main electric fence suppliers in the U.S., is that right?

**Sheri Spiegel:** Mmhhm. Yeah that’s word on the street.

**Tony Waterhouse:** They’re based in New Zealand, but they're big over here in terms of sales and that. My understanding is they've seen the future and the future isn't all wire. So that's where they're thinking about going into that, into some of those areas. How, how, they've probably got an existing supply route, with their existing people, and they’ll go that direction when they go that direction.

**Sheri Spiegel:** So I've heard some people say that the virtual fence wouldn't be, like, the perimeter fence, it'd be more internal. Is there any reason it wouldn't eventually become the perimeter?

**Tony Waterhouse:** I think, everybody, there are four global companies are doing this. I mean, an American, Dean Anderson, was one of the first people to think of these ideas, okay, uh, 20, 30 years ago.

**Sheri Spiegel:** Jornada scientist.

**Tony Waterhouse:** Was he they? Was he? I didn’t know. I know it was obviously the Southern States of the US. He came across to Scotland and he talked to us and we started our ideas that we'd been playing around with some of these elements, with some companies and some start-ups for a while, but also struggling to get funding to do anything clever. And the industry’s been sort of working, I mean, waiting, for the people make better batteries and better communication routes and all the things you need to make to turn it from a cow that's covered in electronics to something that's basically got a nice neat and tidy collar on. And that's where they moving to now. So, you know, there are four companies, there’s Vence based out of California with New Zealand people, uh, Gallagher's who are based out of Australia and New Zealand, but look like they could potentially end up coming over here as a market cause they've already strongly into things. Um, another company based on focusing on dairy in New Zealand called Halter, a lovely website.

**Sheri Spiegel:** Yeah, I've seen their graphics

**Tony Waterhouse:** And Nofence in Norway. And we're working with them because they're targeting a European market. So they, they will probably all have their things, but they're all probably gonna veer between either direct sales to farmers or through some existing, some existing route. I think there's no doubt in my mind that they're going to try quite hard to sell quite a lot of kit to farmers

**Sheri Spiegel:** And yeah, and maybe eventually go for the perimeter fence.

**Tony Waterhouse:** Sorry, so the fence is - I didn't say that. So all these four appreciate that, they're trying not to say that if you, (sorry), this fence is not a hundred percent fence. It's a good control. It's, it's an internal division. It's something you could use, but you still probably want your external fence. That one along the roadside, they would, they would use wire-wire, and they can use it as some sort of internal divisions or some internal control that previously you might have. I mean, again, we mentioned earlier in some conversations, Allan Savory and the idea of high stocking rapid moves. You need mountains of wire to do that system, but if you adopt that approach with a virtual system, you've got a large perimeter fence, and you just move the animals paddock by virtual paddock.

**Sheri Spiegel:** virtual paddock, yeah

**Tony Waterhouse:** And you can do it automatically. You don't need to go out and do it. You get the virtual fence to do it for you.

**Sheri Spiegel:** I wonder how, yeah… people who do that high intensity, high frequency grazing, I wonder how they're, what they reckon on the virtual fencing.

**Tony Waterhouse:** Well, some people who do it purely from, they think it’s an efficient way to manage grassland. Dairy farmers who strip-graze, that’s what that is. Okay. Some of the people in that area think this sort of approach is great. Because they don't need to move these. They can…

**Sheri Spiegel:** I would imagine it takes a lot of time, and fence.

**Tony Waterhouse:** I mean, people again are using mechanized, they can use an essence mechanized systems to roll the, to roll the fence out. Well just do away with it completely and have a slightly leaky, more sort of fuzzy boundary rather than a hard wire. But in the sort of uplands and areas where, again, where I am, people think, people know that rotation, well-run, rotational grazing -not necessarily the full, Allan Savory high density stuff- is more efficient than set stocking. But the cost of fencing and the cost of putting water pipes in and water tanks in, is a lot. So the logic is, if you can just say, let's do away with that, but we'll have you still need the water. You can still virtually fence your water in and out without having multiple water troughs. You can still just keep those cattle moving on the fresh pasture and resting pasture behind them. And resting’s probably more important than the grazing. Just keep the stock off so that the stuff can recover and get you get a nice, quick re-growth. On the Hill you want to do some sometimes the same thing. Same thing. You know, we quite happily see some of our better pasture used, but then move them onto somewhere else. And you could do that, which with wire is just, you just go, “no we can't”, it's just, it's just not cost effective. And suddenly it becomes possible, and whether it's cost effective, then becomes the interesting question.

**Sheri Spiegel:** Right.

**Tony Waterhouse:** But then the answer is, you know, but you can also automate it. And that's a particular part of the system. They foresee the movements being semi-automated.

**Sheri Spiegel:** Linked to maybe greenness of forage or…

**Tony Waterhouse:** Well no, the point is no, instead of you going out pushing the cattle on, you just open up the fence and push them on with the virtual fence.

**Sheri Spiegel:** No, I thought you meant automated, like set the schedule based on some kind of environmental cues or something.

**Tony Waterhouse:** Well, you could do, eah, Yeah I think that's maybe over…you know, yeah.

**Sheri Spiegel:** [laughter] that might be a step to far?

**Tony Waterhouse:** Whatever decision rulethe people in charge want to adopt, the potential is to get that virtual herding happening whereby instead of you doing, I mean, in Australia it's classic, you know, people use helicopters to bring their cattle. I mean, I wouldn’t be surprised if people in the States do it as well, but certainly it's probably quite a major exercise. And instead of doing that, just, just to set it - two days from now, I want all the cattle from that far paddock into this holding pen, without any people involved. And without any particular stress. Okay, so all done awfully easy-ozie and gentle, without that. And then I’m going well who couldn’t see that was maybe quite an interesting approach. And let us see it happening - prove it works - and then…

**Sheri Spiegel:** So the one piece that that comes to mind with that little, with that kind of scene there is like so, so if no people are involved and the fence is, is the fence line that's being set by a satellite is moving them in. You can do like gradually. Then what if there is one? What if there is some livestock that are in distress or something's going on? Then you would rely on the *other* sensors to identify? Cause when you have people out there, I mean they're, you know…

**Tony Waterhouse:** Oh yeah, I’m born & brought up with moving cattle around, you’ve got to put yourself in the right place, otherwise, they just beat you. I mean they’re all GPS located, they’re all on there. One of the clever things, and why these things, why are these systems are taking so long to come out – you know, I was told by the people who were going to develop it first that it would be next year. Well next year was 2016 it still isn't here because I think the software, it just needed a bit more time to get right, and part of that software is to go re-la… I use the term, it's not something they use, but lasso. It's a terrible use of a Western terminology, but it is. Where the animal either breaks through cause it's been spooked by something, uh, with a dog or just by anything, you let the animal go. That's a standard thing of these systems, with the accelerometer on the motion sensor they can, they will tell the cow, tell the fence to let this cow go through. It wouldn't get shocked. And similarly if it chooses not to go through when the fence has moved behind it. So again, just to make sure everybody's aware. What there is, is a buffer zone that's got a warning signal that gets stronger in one form or fashion as you get nearer the real fence. So the animals respond to the warning sound or even the warning vibration in the collar, so that they can keep being edged along by being, “Oh…” The barrier comes to the back of them and they can, “Oh, that's it, I better move on.” They just quietly move away. If they choose to stay behind and get the electric pulse, which is a lot less than a traditional electric fence, then, most times when they’re trained, they carry on going in the right direction ‘cause they’re being pushed in a directional sense, but if they choose to turn and go the opposite direction, the fence, lets them go.

**Sheri Spiegel:** Because there's the ideas that the theory is, there's a reason for that.

**Tony Waterhouse:** There’s a reason for that. And you don't want to penalize the animal for doing that. And then what you've got, you've got 50 cattle down the road who follow the rules and one or two that spooked. The one or two actually do want to go rejoin that friends. So again, all you do is, for them too, you move the virtual fence behind them and push them in again, and you make sure the virtual fence that's between them isn't there. So it's a one way non-return fence. So again. They can walk back through it. I remember from my dairy farming days, the worst thing when the cows got over the electric fence in the system was getting the two cows over.

**Sheri Spiegel:** ‘Cause they remember the shock.

**Tony Waterhouse:** Yeah. So the easiest way sometimes was to let the whole fence down and let the whole lot through, and then push them all back and put the fence back up. Because the cows, they would be fearful of the, of the, of the, of the fence. But if you've removed it, it's not there. So it will just, they'll just easy-ozie to walk back through. And there's no penalty for them whatsoever for that. So the next time they'll do it prah. So that's what people have been doing in [inaudible]. I mean, again, this is not imaginary. So that's part of what's been happening. The companies have actually been testing this on commercial farms. So ag research, which in New Zealand, the main, the government’s main applied research, agricultural research, had 80 collars on cattle now. And this’ll be the third grazing season, on a beef breeding system, beef breeder farm, putting out in use. Not rangeland, but the sort of classic better pasture system, but with some rough grazing in it. So they’ve been seeing whether or not they can keep them out of it or keep them in it, when it suits them.

**Sheri Spiegel:** Hm, I'll have to look into that.

**Tony Waterhouse:** And shown, and being comfortable it works. It works. I mean, again, just again, that gets over one of the things I'm sure people would ask, so you've got collar on a cow, but in a cow-calf operation, what happens to the calf? Do you put one on the calf? Well they’ve proved, and shown, that you don’t. The calf can leak away, backwards and forwards and the cow is quite confident with that. So it's just sort of, we would use the term “leader-follow” system, when you actually allow them through a creep system and the calf can leak through, but comes back to mum and the cow doesn’t try and get it back. And that way you don't have, you don't need to double up on the kit. And that's a really nice. There's no welfare or any sort of issues ‘cause the calf has not been prevented from going backwards and forwards. So that's the sort of thing I think, I think they're trying quite hard to have a system, and develop, all four companies I'm sure are trying to do it, where it's perceived as a positive welfare story, rather than any sort of elements and negativity about it, but doing it quite cleverly and thoughtfully, and getting some testing and practice.

**Sheri Spiegel:** And that's certainly a great example of how sort of brick and mortar scientific observation or just observation over the years and understanding of animal behavior can feed into some of these technological advances.

**Tony Waterhouse:** Absolutely. I mean, there’s been quite a lot of stuff doing elsewhere. A lot of stuff in Australia. Looking again at how the animals and whether the animals are stressed by this approach. Yeah. So looking at some sort of, again, physiological things to check that, the idea that potentially, you know, you can imagine, you know, in the olden days when you saw an electric fence, if you touched it, you knew you got a really hard shock. That's not nice, but on the other hand maybe it's worse to be sitting somewhere in your work and every so often somebody gives you an electric shock for random, that might actually be quite

**Sheri Spiegel:** worse

**Tony Waterhouse:** Yeah. The random, you know, you may get shocked any, any moment of the day, you're waiting for it. Whereas if you know you touch that wire, you'll get a shock, you say “fool am I”.

**Sheri Spiegel:** Right.

**Tony Waterhouse:** So they’ve looked at cows and seen whether there's a difference between those animals in the electric virtually fenced paddock, have got different physiological, you know, stress hormones. Any difference from those that haven't got any access to that. And by and large, it just says, no, it's not stressful. Which is comforting. You don't want to end up putting animals in something that you think is better, but actually they would get stressed out by it.

**Sheri Spiegel:** That's an important, yeah, that, thank you.

**Tony Waterhouse:** Both for the ranchers, for the, for the buyers of the meat, but also for governments to go, this is a good thing to do.

**Sheri Spiegel:** Yes, governments. So, um, could, could you tell us a little bit about your role in the, um, Sustainable Southwest Coordinated Agricultural Project that's being led by New Mexico State University and has many partners, including the Jornada, Texas A & M University, and various ARS units across the U.S. and a few, um, K-12 nonprofits, these, these sorts of things.

**Tony Waterhouse:** Yeah, I know, I know. Well, I mean, obviously we were a little bit earlier in some of this technology, particularly the communication technology, which you're not talking about, but that's the biggest challenge we get, is getting the information from wherever we have on the animal or in the pasture back to the internet. And that's new technology. We've been doing that for three or four years, so we're slightly ahead of the game on that. So we've got, we've made a lot of mistakes already, so we can pass on those mistakes to colleagues over here. We've got a mutual interest in “what's next?” Um, so as in, I mean, just so it’s honest to your, to your listeners, you know, there's a quite a nice grant going over here to you guys in America, but us Brits, we're just coming over for pennies, for freebies, you know? So we're not getting paid, but we're enjoying the potential to come here, collaborate, and then go steal the best ideas and take them home.

**Sheri Spiegel:** Have you gotten any since you've been over here?

**Tony Waterhouse:** Yeah.

**Sheri Spiegel:** Okay.

**Tony Waterhouse:** Not honestly from here in New Mexico, but from Denver I have.

**Sheri Spiegel:** We'll try to step it up a little.

**Tony Waterhouse:** Yeah, but I think the truth is that, in some of these areas, people aren't talking about it. The companies are building these little bits of stuff and they’re you know, keeping it close to their chest. So the people who can talk about it are the likes of us, who can go, Whoa, why haven’t we tried that? And have you done this now? Have you done that? I can say, you know, the internet is full of lots of information. Only half of it's true. But the biggest challenge is working out which bit’s true and which bit isn't true. And you know, finding out from somebody, you trust, what’s going on. So being part of the club is great. Okay. Um,

**Sheri Spiegel:** do you think this podcast is true even though it's on the internet?

**Tony Waterhouse:** But is there any proof it's on the internet? There’s absolutely no truth-there's no proof- of anything. [laughing] I don’t know, I really don’t know.

**Sheri Spiegel:** All right. Well, thank you again for talking to us today. It's been a pleasure having you here in the Southwestern United States, and I hope you come back to visit us. As we wrap up here, I'm just wondering if you have. Any parting thoughts that you would like to add as your sort of Swan Song as you…? Yeah.

**Tony Waterhouse:** Yeah. I mean, the main thing I'm, I'm keen on, I always have been keen at, any of this kit is only as good as the people who use it. So I think I don't see it as a threat to anything. In terms of stockmanship or stockperson-ship or whatever, it's, it's an, it's an adjunct to people who are currently moving on. I think we've got to work out, you know, so I think it will be, uh, uh, for those people who are going to basically be the politicians who have a thought process about whether it's a good or bad thing to do it, then they should be positive about it. I think it's good for stock. It's better than existing wire. I hate wire as a, as a means. I've seen a lot of things that have gone wrong with wire, both barbed wire and ordinary wire, with stock, and all that sort of stuff. Personally I've torn more waterproof trousers and I dare say by having to climb over them. So yeah. So if we can, if we can reduce that amount of that stuff in the countryside, and our areas, that's a good thing. And I think from the stock point of view, it's a good thing. but I think from a people, the people working the land, I think it's, it's, it's a sort of positive that they could use it as a, it's a tool, but it's only as good as the person who uses it. And I think that's where we've got to make sure that we get the, help get the right tool in the hands of the right people, and do a better job of what they can do at the moment, and hopefully help them survive in a pretty tough environment.

**Sheri Spiegel:** Yeah, that's lovely. And I will say also about this Coordinated Agricultural Project. One of the exciting things, one of the most exciting parts of it is that we're working with five ranchers across the West who are going to actually be testing the kit that that we are building in this project. And so it will be, so we get to actually collaborate scientifically with these ranchers and see

**Tony Waterhouse:** We’re aiming to do the same, on a much smaller scale. In essence. And we’re gonna make our guys buy the kit, because we haven’t got enough money in our system to help them with that, but we're going to help them – our hand is going to be a bit of handholding, so that we share expenses around between us all, and go through those phases. So I think that's a sort of parallel with your bigger scale stuff, which is quite, yeah big and what. We can, again, work with sort of experience of our guys to share that and see how it goes, because it will be about how people adapt.

**Sheri Spiegel:** Yes.

**Tony Waterhouse:** To both the farm, but also how they adapt the kit to make it do what they want, you know.

**Sheri Spiegel:** and to improve, hopefully quality of life, maybe some profitability

**Tony Waterhouse:** Yeah. Welfare of animals, all that stuff. All the good stuff. Yeah, pretty much. We might save the planet yet.

**Sheri Spiegel:** All the good stuff. Alright, well it was a pleasure talking to you.

**Tony Waterhouse:** Thank you very much. Great. Cheers. Bye.

**Sheri Spiegel:** Yeah. Cheers.

**Emily Elias:** Thanks for listening to Come Rain or Shine, podcast of the USDA Southwest climate hub **Sarah LeRoy:** and the DOI Southwest Climate Adaptation Science Center. If you liked this podcast, don't forget to subscribe, like, or follow for more great episodes. If you want more information, have any questions for the speakers or would like to offer feedback, please visit climatehubs.usda.gov or swcasc.arizona.edu. **Emily Elias:** Our sincere thanks to USDA Agricultural Research Service, the Sustainable Southwest Beef Project, and the U.S. Geological Survey for supporting this podcast.