Human, Animal, and Ecosystem Health

Wednesday, May 21, 2008
Woodrow Wilson International Center for Scholars

Edited Transcript – Deana Clifford

Well, thank you so much. I have the honor of closing the talks this afternoon, and Gladys and Steve have amazing programs, and every time I see Gladys talk I'm just inspired, so it's really exciting to hear about what conservation for public health is doing.

What I'm going to do now is shift you a little bit south and a little bit east into the country of Tanzania, to a drier landscape known as the Ruaha Ecosystem. And this is a unique project. It's a partnership between academic institutions and non-governmental organizations, and it's called the Health for Animals and Livelihood Improvement Project, and we work in the Ruaha Ecosystem of Tanzania and our main goal is to these linkages, again; to assess these health and economic impacts of zoonotic diseases and water scarcity on human, animal, and wildlife populations in the Ruaha Ecosystem in Tanzania. We are supported by the Global Livestock Collaborative Research Support Program, which receives their support from USAID, and we're a big collaborative project with the lead institution being UC, Davis. We work very closely with our partner on the ground, Wildlife Conservation Society, Ruaha Program, and with the veterinary school in Tanzania, Soguena [spelled phonetically] University, and also the University of Vermont.

I'm going to give you a little bit of background about why we're working in this region. As Steve was pointing out these approaches of how to work in conservation, we had started as a landscape approach because we have a landscaping crisis and I'll talk to you about that, talk to you about what we're trying to do about the linkages between animal and human health and conservation, and a little bit about our successes to date. We're a young project, just -- oh, we're just approaching three years old, not quite there yet. So, I'll tell you what we've done so far and where I hope that we'll be going in the next year.

The Ruaha landscape is one of Tanzania's largest protected areas. Ruaha National Park forms the core of this protected area, with four game reserves and a new community-based wildlife management area at the southern border of the park. And as Steve has mentioned earlier, similar to other countries, Tanzania has started a community-based wildlife

ONE WOODROW WILSON PLAZA, 1300 PENNSYLVANIA AVENUE, NW, WASHINGTON DC 20004-3027 T 202.691.4000 F 202.691.4001
E-MAIL: ECSP@WILSONCENTER.ORG WEB: WWW.WILSONCENTER.ORG/ECSP

management initiative where this area bordering the park has the 21 villages that comprise this area, which have donated pieces of their land to be specifically wildlife habitat, and together the villages have formed an association that manages this land -- and just about six months ago they were formally approved to manage this conservation area.

Ruaha is a large area. This is larger than the country of Denmark, so we're talking a significant ecosystem in Tanzania and the great -- [break in audio] -- which flows from Usangu Game Reserve, which is actually now part of Ruaha National Park. It starts in the reserve, flows through the southern portion of Ruaha National Park, where heavy density wildlife areas, through some of the villages and into Mtera Reservoir. And this river is the lifeblood of this ecosystem.

Why is Ruaha important? Why are we working there? Ruaha has high conservation significance. It sits at the border of the East and southern Africa phytogeographic zone, so we have both flora and fauna representative of both areas of the country. We have one of Tanzania's largest elephant populations, and also it's one of the last strongholds for the African wild dog. But, with even this high biodiversity, Ruaha's also extremely important for rural livelihoods. Ruaha has, basically, a larger proportion than average of what we call traditional livestock keepers, who you'll hear me refer to as pastoralists. We have a large number of pastoralists in Ruaha who are completely dependent on the natural resource base in this area. These pastoralists have less access to healthcare, they live further away from the village centers, and politically, they're pretty marginalized in Tanzania. They don't have a voice in the local and village governments.

And it's big enough that Ruaha is significant for national development. Currently, tourism comprises 17 percent of Tanzania's gross domestic product, but Tanzania really wants to develop what they call the Southern Circuit. For those of you who have been on the Northern Circuit, which is the Serengeti, Ngorongoro, the Southern Circuit is destined to become Ruaha, Selous and Mkumi [spelled phonetically]. And there are big plans for development because this part of the economy is growing very quickly in Tanzania. The other reason Ruaha is significant on a national level is the river, the Great Ruaha, generates 70 percent of Tanzania's electricity. That river flows into the two hydroelectric dams, and that's a lot of power coming from this one ecosystem.

So, why are we working here? It's boiling down to water. It's a problem of water. Prior to 1993, the Great Ruaha River flowed year round. The wetlands that feed the river acted like a

ONE WOODROW WILSON PLAZA, 1300 PENNSYLVANIA AVENUE, NW, WASHINGTON DC 20004-3027 T 202.691.4000 F 202.691.4001
E-MAIL: ECSP@WILSONCENTER.ORG WEB: WWW.WILSONCENTER.ORG/ECSP

sponge during the dry season, keeping that river flowing. But since 1993, the Great Ruaha River has been drying up for longer and longer periods each year. In 2005, for example, we had 119 days where no water flowed in this river, and this is the same spot on the river taken after the river starts to flow in December and during the entire period from September through about mid-December. This is what the river looked like, and this is not a good situation for people, livestock, or wildlife.

What are the consequences? Why is this happening? There are intensive water diversions for agriculture at the headwaters of the Great Ruaha River. This water is being diverted out and it's not coming back in. And the water diversions are also occurring during the dry season, when the water is needed the most. The wetlands have been damaged by intensive agricultural grazing, so cattle have now been removed from the wetlands areas, but the effects of years and years and years of intensive cattle grazing of these areas the wetlands have not repaired themselves yet.

So we have agricultural water diversions, after effects from environmental damage from livestock, and we have ended up with a big problem in this ecosystem. We've seen intense conflicts now between agriculturalists and livestock keepers fighting for what land is left and what water is left in the system. There's more grazing pressure as the cattle are going into smaller and smaller areas where dry season water is available. We've seen more wildlife conflicts. This is an example of something that started a few years ago. At remaining water holes, we've had poisoning incidents where organochlorines, organophosphates are dumped into the water; animals are killed and then sold as bush meat. So, this has a significant concern for human health as well as animal health.

Tourism revenues: how much money is a park going to make when there's no water and the wildlife go away? Ruaha National Park is very underutilized, and the areas where the water is drying are the prime areas where the tourists go, so this is a problem. And the wildlife management area has just started. The purpose of this area is to bring tourism revenue. The wildlife are supposed to generate income for the communities, but where there's no water, there's no wildlife. So currently the wildlife management area is making two dollars per square kilometer right now while the park is making 300. So we have a lot of potential here, but the wildlife management area won't hold together unless we have some ecosystem restoration in the area.

We're also seeing less wildlife. Very simply, buffalo are declining in Ruaha. We don't

ONE WOODROW WILSON PLAZA, 1300 PENNSYLVANIA AVENUE, NW, WASHINGTON DC 20004-3027 T 202.691.4000 F 202.691.4001
E-MAIL: ECSP@WILSONCENTER.ORG WEB: WWW.WILSONCENTER.ORG/ECSP

know why; they're just not there. Now tourism operators are reporting that they just can't find buffalo. We've seen smaller herds and the spatial distribution of these animals is changing. Maybe they've left, maybe there's a disease problem. We don't know. There's a big lack of information here.

Along with less water, we assume that there will be a decline in water quality. Also, the national economy, for those of you who may have been in Tanzania in 2006, Tanzania had a power crisis. For four months out of 2006 we had a drought. Those reservoirs dried up and Tanzania had no power for about four months, only in the evenings for a very limited period of time and that brought this ecosystem to the stage and to the policymakers once the power went out is Dar es Salaam and all the other big cities in Tanzania. So this became a forefront, and that was one of the impetus for actually removing the cattle from the game reserve and changing the grazing policy in that area. But the water diversions continue and this system hasn't repaired itself yet.

Question mark disease. Do we know? We have a great conservation partner on the ground called Wildlife Conservation Ruaha Landscape Program and they started hearing reports of animals dying, both wildlife and also livestock, and that's what prompted us to start thinking about this issue. Does water limitation create more disease? We've seen it before: you have increased numbers of livestock bordering protected areas; you have humans, livestock and wildlife coming together at diminishing water sources that are of poorer quality; you may increase the risk of disease transmission between all these populations.

So, where do we even start? That was a big question we had, and so we took an approach that is pretty common, and a lot of you have taken it; we started saying "I can't answer the whole problem, that person can't answer, we don't have the expertise," so we formed interdisciplinary, multidisciplinary partnerships. So on our project we have conservation ecologists, landscape ecologists, epidemiologists, human health professionals, an ecological economist, every sort of facet we could possibly think of, microbiologist, a water pathogen expert, trying to come together with different perspectives to talk about these issues that affect so many different disciplines. We started by involving stakeholders right from the beginning, and our job, what we do at the Wildlife Health Center is to use the stakeholder involvement and then to conduct applied science. So, HALI is a research project but also a capacity building project, but we do have a strong research agenda. And then we use that through the research to provide education in capacity building.

ONE WOODROW WILSON PLAZA, 1300 PENNSYLVANIA AVENUE, NW, WASHINGTON DC 20004-3027 T 202.691.4000 F 202.691.4001
E-MAIL: ECSP@WILSONCENTER.ORG WEB: WWW.WILSONCENTER.ORG/ECSP

So these were the results in 2005. We had stakeholder meetings with officials from the park, local government, academia in Tanzania and both internationally and non-governmental organizations. And all did agree that even though we had very little preliminary data, disease was affecting this ecosystem, and that the highest priority diseases to look at were impacted by these water scarcity issues and affected human health, in especially immunocompromised people, and that would adversely affect livestock productivity but also had the potential to affect wildlife. And so for our project, for HALI, we have focused on tuberculosis, which Steve had outlined earlier, specifically the bovine form of TB because it can affect wildlife, livestock, and people, and also brucellosis, another bacteria with a very similar transmission pathway. Again, people get it through ingestion of raw milk, of fresh milk products, undercooked meat products. And tuberculosis, we're also working with a population that has very close contact with their cattle. Some of the pastoralists will sleep in the same corral with their cattle. They are constantly surrounded by their cattle. That is their life; that is their culture. And also water borne bacteria and parasites. So, we wanted to look at who was putting what in the water, and where were the pathogens coming from.

So, briefly, this is just sort of for reference. It's on the Web cast as well. What our main goals were is to say, "What is out here and who is spreading it to who, and what is the impact of water scarcity? Is that making the disease situation worse in this area?" So, we decided our goals are to determine -- just look at the prevalence in transmission ecology of TB and Brucella and water borne pathogens among wildlife and livestock and the pastoral communities, and look at the effects of water management on this issue. Also, we wanted to go past just health and look at economic livelihoods. How do pastoralists with sick cattle have to change their livelihood strategies? What do they have to do? Or is it an issue? Or are they far away from a water source? And how does that impact the mom and the family and the children that have to go get that water when their regular water sources dry out? We wanted to look at all these issues to eventually sort of be able to identify and mitigate these risks whenever possible, and also to really assess what the local capacity is for disease diagnosis and strengthen and enhance that capacity.

So this is sort of an integrated approach. What we've been doing for the past year and a half is getting data, getting information, getting out into the community, testing animals. We work with hunters, because we do have hunting in the region that we're in, to get samples from wildlife that are hunted in the wildlife management area sandwiched between the villages and the park. We work with pastoralist households and we test their livestock, both

their sheep and their goats and their cattle. We test them for TB, Brucella, and also for fecal pathogens. We're sampling water sources, water sources that are used just for wildlife, water sources that are heavily impacted by villages and livestock, to look at the different disease loads over time as the river is drying to possibly identify high risk periods when the water quality at certain places gets really, really poor.

We're coupling disease data with survey data. We have a survey that has been administered to 160 households looking at health, both human and livestock; economics, what do people sell cattle for, why do they sell cattle, which sometimes it turns out they like to sell the sick cattle, right? Because the sick cow isn't going to be an asset in your herd, so you sell it. So, why are they selling cattle? What are their perspectives on disease? Why do they think they have disease in their livestock at all? And how much knowledge do they have about the transmission of certain diseases? So together we're trying to use this data to make solid recommendations for water management and for disease prevention, and to look at both the health and economics of disease in this ecosystem that is affected by water.

This is just a brief map showing you where we've been, which is all over. The wildlife management area run by the community is this yellow strip. The park is here and we are active in the 21 villages that comprise this area. So we're interviewing households. The same households that we interview and get the economic data and the health data, we're also testing their livestock. So, we have both disease data and socioeconomic data in those households. We've been testing wildlife as well and water sources in wildlife only areas and in livestock and people mixing areas. And this is one of the early products, like I said, coming into our second year, that has come out.

This is a map showing where the cows are. Step number one, where are the cattle and are they a risk to the wildlife? What we've found out is if you go from green to yellow to red, red is the highest density areas of cattle, while green being the lower density, and these red areas have a cattle density of up to 68 cattle per kilometer, so they're very dense. And as you can see, there are some very cattle-dense areas in very close proximity to the wildlife management area and we've actually hired teenagers, secondary school leavers, to accompany the pastoralists' herds on walks when they go to graze and track where these cattle go. So, some of these strange lines in here are what we call herd follows. They spend the day with the livestock just taking a GPS location every time the herd stops. And what we've seen in quite a few herds is that they go in and out of the conservation areas, so they're not there all the time but they do go there and they go stop at watering points inside and they

ONE WOODROW WILSON PLAZA, 1300 PENNSYLVANIA AVENUE, NW, WASHINGTON DC 20004-3027 T 202.691.4000 F 202.691.4001
E-MAIL: ECSP@WILSONCENTER.ORG WEB: WWW.WILSONCENTER.ORG/ECSP

come back out. So, we have some mixing of these populations, which is not surprising because the forage is much better inside the conservation area than it is in the area where all the cattle are.

So, what have we found out to date? We've had two years of testing for bovine tuberculosis and we have discovered that it is present in the wildlife in the Ruaha ecosystem and this changing some of our concepts about how managers might want to manage that protected area. But it's in buffalo, which are the major reservoir species for TB in that ecosystem and we have identified it in an impala, so we know -- we don't know for sure, but there's likely been contact. We're working on trying to figure out if the strains that buffalo and impala have are the same types of tuberculosis that the livestock have in the area, and that's the connection. It's sort of who is giving it to who. But what it tells us is if we're going to practice disease control in the villages and say we're going to get rid of TB in the villages, we now likely have a wildlife reservoir so we have to be careful about how we manage disease prevention programs.

Our household surveys are yielding really interesting information. We're just starting to analyze them. We just finished them and we surveyed 160 households. And this is Mariam Nguvava [spelled phonetically] and she's our socioeconomic researcher, and she has trekked by foot, by bike, by car if she's lucky, to all of these households and sat with these people and really spent time getting to know the pastoralists, getting to know what their perceptions are. We've also talked to village leaders. It's interesting to compare what village leaders think are the problems and what pastoralists think are the problems.

And all this work is ongoing as part of Michele Mazazera's [spelled phonetically] Ph.D. He's currently at the University of Vermont. So, we're working on this. We've introduced new diagnostic techniques to [unintelligible] University, who is vastly becoming a center of excellence for both tuberculosis research and microbiology in the region, so we're excited about that. And we have a really high level of community involvement. Somebody's actually coming, talking. We're providing feedback. We talk to the pastoralists. We work with them, interpret the test results with the livestock owners present so they understand the disease and they understand how to prevent it. We're now working on follow-up with these households, trying to figure out if they're following some of the advice we're giving, if they're not and if they're electing not to then why. What are the decisions that are making them say no, I know that cow has TB but I'm not going to sell it, you know, I'm not going to

ONE WOODROW WILSON PLAZA, 1300 PENNSYLVANIA AVENUE, NW, WASHINGTON DC 20004-3027 T 202.691.4000 F 202.691.4001
E-MAIL: ECSP@WILSONCENTER.ORG WEB: WWW.WILSONCENTER.ORG/ECSP

cull it, I'm -- you know, I'm keeping in the herd. Then why? Why are they taking that risk? So, those are some of the questions we're interested in.

We're very active in training in capacity building, being part of the university program. We have two masters' students, both Tanzanian getting their education in Tanzania, one Ph.D. student who is Rwandan, getting his education in the U.S. and we've had three externs, all three of them African nationals. So we are really committed to this work. And this is one of our master's students, Annette Kitambe [spelled phonetically], and she's working on water quality issues, so she's working with a local government technician and they're reading a water quality test.

So any time we can we're trying to pull in interested people. We've trained community game scouts how to reduce their own risk of disease contamination, because they go into the field with the hunters, they often butcher the carcasses, the conditions are not sanitary, and they're being put at a risk, so we teach them. They know how to recognize the diseases. They already know. That knowledge is there, so we just are trying to show them simple measures to reduce their own personal risk. And we also hire community came scouts as field assistants.

In the lab we're doing the same thing, more training in capacity building. This is Dr. Vontrina Miller [spelled phonetically] from the University of California, Davis. Her expertise is in water microbiology and protozoal pathogen work. She just finished a visit to Tanzania training the [unintelligible] University laboratory staff, so now they are doing more advanced biochemical tests looking for pathogens, like salmonella and Shigella and Vibrio, in the water sources, and then we're going to actually source them out and see if we have the bad bacteria with some pathogenic factors or not so bad there. And again, this is Jonah [Unintelligible]. He's working on TB culture.

And so, where are we going from here? We're a two-year project. We're just starting to get results. If I come back in a year or two, I will have some really great information for you, I know I will. But right now what we want to do is we're gathering this information and we're starting to look ahead and say, okay, where in the landscape is the TB? Are houses that are close to wildlife more affected? Are they not more affected? Are houses that are more water limited more affected? What are the relationships?

ONE WOODROW WILSON PLAZA, 1300 PENNSYLVANIA AVENUE, NW, WASHINGTON DC 20004-3027 T 202.691.4000 F 202.691.4001
E-MAIL: ECSP@WILSONCENTER.ORG WEB: WWW.WILSONCENTER.ORG/ECSP

And the next question that we're staring to get to is the human factor. As Gladys has aptly pointed out, they've started a community TB treatment program as part of Conservation Through Public Health. It's something we really want to do, and we've been talking with the National Institute for Medical Research, which works with the National Tuberculosis and Leprosy Foundation in Tanzania, and they're very interested, especially in the pastoralist communities, because very little has been done to look at the effectiveness of community DOTS, the daily observed treatment programs, in nomadic communities. Would that sort of a system work? What are going to be the things we need to change to make it work? And along with that, we can get data looking at how much TB is in the pastoralist households. We know what's in their cattle. We know what's in the wildlife. We still yet don't know what's in the people, so that's one of our next steps.

We're also looking into sustainable biosand filtration technology at households, so actually making sand filters to filter bacteria and protozoa out of the water. They're pretty reasonably priced and it could be set up as a microenterprise, so that's one of the things we're looking at as well. We're partnering with another G. L. Crisp project to investigate whether or not we could start that initiative in our region. And providing feedback in August, we're going to start community workshops starting to present some of the data and get some extra opinions from people about what they think as well as filling in holes in our data. So we'll do both smaller groups, women's groups, and larger village workshops starting to get that outreach component going. We're starting radio shows. We had a radio show on water quality, and we're hopefully gearing up for World Rabies Day in September to maybe do a show also about rabies. But again, starting to get into the community network and starting to formalize how we're going to move our research into education and intervention efforts.

And eventually, we'll move it into policy, so that is one of our goals. It's one of our bigger goals, is how does this all relate? Is there an amount of water in the Great Ruaha that if you kept that river flowing would reduce the disease burden in the river? We don't know, but maybe that's a point we can get to with our data and that's what we're trying to get to, another argument to make interventions to keep the water flowing in this system. And that's pretty critical.

So again, this is value of one health. I think through all of these presentations it's probably become clear but these problems are complicated. We need multidisciplinary teams. We need long-term funding because these issues don't tease out in one or two years. We need sustainable funding and efforts to make these issues work. And Ruaha is at a crux. It can be

ONE WOODROW WILSON PLAZA, 1300 PENNSYLVANIA AVENUE, NW, WASHINGTON DC 20004-3027 T 202.691.4000 F 202.691.4001
E-MAIL: ECSP@WILSONCENTER.ORG WEB: WWW.WILSONCENTER.ORG/ECSP

a model for how one health works and how these complex problems can be solved, or it can be a casualty. And we're right at that point where we don't know what's going to happen with this ecosystem. So, we're going to push forward and keep trying to find solutions and hope that we're going to be a model.

And there is a Web site reference and also a handout outside with a more in-depth article about the HALI project. Again, we're from the Wildlife Health Center and UC, Davis, and also G. L. Crisp, our primary sponsor, is based out of UC, Davis as well and just a brief thanks to have me here.