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**Rwanda: Addressing agricultural education, especially via emerging digital resources, may prove paramount to enhancing this country's future – and protecting it's natural resources**

*“Challenges of Rwandan goat farmers change perspective for South Dakota veterinarian”* – that headline in a South Dakota newspaper (Hunsucker-Brown, 2019) recently caught my eye, since I also raise goats. The article highlighted a young South Dakota veterinarian's trip to the African country where she had the opportunity to teach her goat care expertise to subsistence farmers, most of them women and children. Dr. Katie Hunsucker-Brown observed that access to veterinary help is minimal in the rural Rwandan countryside and the women and children had minimal knowledge about deworming goats to prevent coccidia, or how to detect and treat the illness among their goats, but they were grateful to be taught the information. Her travel was through the Christian Veterinary Mission program (Hunsucker-Brown, 2019).

After reading the article, I wanted to do more research about this small country that I was only vaguely familiar with. Located just south of the equator and landlocked within central Africa, Rwanda has a population of just over 12 million people and a total land mass of 24,668 sq km (CIA, 2018). For comparison, the small country is about the size of the state of Maryland, with as many people as the city of Los Angeles. With its small land size and large population, Rwanda is one of the world's most densely populated countries.

Most people have probably heard of Rwanda in the news because of the civil unrest that has existed there and the horrific killing (genocide) of as many one million citizens in 1994. The country's struggles can be traced back to 1959, when the Rwandan ethnic group the Hutus overthrew the Tutsi king. In the years that followed an estimated 150,000 Tutsis were driven into exile in bordering countries and thousands of Tutsis were killed. In 1990, the children of these exiles began a civil war as a rebel group named the Rwandan Patriotic Front (RPF). The war went on for four years creating extensive economic, political and ethnic tension and ultimately resulted in the April 1994 Hutu-led genocide directed at the Tutsi population. In late 1994, the Tutsi RPF were able to defeat the national army and Hutu militia and established a new national government. By 1999 – only twenty years ago – Rwanda held its first local elections. Paul Kagame became Rwanda's president in 2000, and in 2009, Rwanda joined the Commonwealth of the East Africa Community to become better integrated with its neighboring countries (CIA 2018). Most recently, Rwanda was in the news when Kagame won the election in August 2017 to serve his third term as president (after changing the constitution in 2016 to allow him to serve a third term.) Kagame is very popular and won with 99% of the vote (Platas, 2017).

Some people may also know Rwanda because it is home to the last mountain gorillas on earth, of which there are fewer than 1,000 remaining. Thus, the scenic country with the mountainous Volcanoes National Park along its western border is a popular tourist destination for “gorilla trekking” (Sack, 2015). The website AboutRwanda.com (n.d.) describes the country as “The Land of a Thousand Hills” because of its rolling landscape. As a result many areas of the country are terraced to raise agricultural crops. In the west, Volcano Karisimbi is the highest peak at nearly 15,000 feet in elevation. Overall, the high elevation areas of the country keep Rwanda's climate sunny and a comfortable 60 to 70 degrees, even though the country is near the equator. Lower elevation areas do experience hotter temperatures. Rwanda is often green thanks to its two rainy seasons including February through April and November to January. June through August is considered the dry season (CIA, 2018).

Aside from those distinctions, Rwanda is primarily an agriculturally focused country. Only about 17% of the Rwandan people live in urban areas, which are primarily located in the center of the country near the capital city of Kigali or on the western portion of the country near Lake Kivu. The remaining 83% of Rwandans live in rural areas, with more than 70% primarily involved in farming to raise food to feed their families (CIA, 2018). The majority of Rwandans live on less than \$1.50/day (Hunsucker-Brown, 2019).

About three-fourths of the land in Rwanda is agricultural land with 47% classified as arable land, 10% in permanent crops, and 17% in permanent pasture. Forest also covers 18% of the Rwandan landscape. (CIA, 2018). The primary crops grown include coffee, tea, bananas, beans, maize and potatoes, as well as livestock. Many Rwandan farmers also raise livestock, particularly goats, chickens and cattle, and opportunities to expand on fattening cattle for meat production have been explored (D'Andre et al. 2017). Coffee and tea are the major exports along with maize, rice, potatoes and some livestock to other Eastern Africa countries. Agriculture accounts for 33% of Rwanda's GDP (FAO, n.d.).

Farms are small in Rwanda, with most plots on average only 0.6 hectares (Conway, 2016), which is equal to about 1.5 acres or about two football fields. Most farm work is done by women and children; many are widows and orphans after the 1994 genocide. A farming challenge is that often land is steeply sloped and not all in one location. Therefore it is common for some farmers to use flat land for growing crops that they can sell, and steeper sloped areas to grow crops to feed their families (Conway, 2016). With livestock, the separation between farm or grassland fields from where the farmer lives can create a challenge because, as was pointed out from the South Dakota veterinarian's visit (Hunsucker-Brown, 2019), livestock are often stolen if they are not constantly being watched.

The moderate Rwandan climate does allow farmers two growing seasons running from February to June and again September through January. This allows for growing some surplus crops to market and year-round grazing. Extra revenue made can allow for renting more land or for sending children to school (Conway, 2016).

Rwandan families are often large, however, with increased education about contraception that is declining. The average number of births per woman decreased from a 5.6 in 2005 to 4.5 in 2016 (CIA, 2018). Rwanda families live in a home together, but there may be several nearby buildings for elderly parents and extended family. Most families raise their own food to eat, and the family diet is quite simple: beans, potatoes/sweet potatoes and bananas and other fruit. If the family can afford it, they will eat meat, but malnutrition is significant (Hunsucker-Brown, 2019).

Regarding infrastructure among the rural population, 72% has access to safe drinking water, and 63% has access to sanitation facilities. Most Rwandan children attend school and seventy percent of the total population over the age of 15 is literate (can read and write). However, electricity access is a challenge, it is estimated less than 20% of those in rural areas have access (CIA, 2018), but the government is working to improve that greatly (Sievert, 2018). However, per her personal visit South Dakota veterinarian Katie Hunsucker-Brown reports many villages do not have water or electricity.

In addition to poverty and lack of electricity, other challenges facing Rwanda's agricultural sector as identified by "FAO in Rwanda" (n.d.) include

- high rates of soil erosion and land degradation on the steep sloped countryside,
- low levels of productivity in both crop and livestock production primarily due to inefficient practices and low adoption of advanced technology such as fertilizer and improved genetics.
- limited access to value-added and processing opportunities for ag products.

That said, the government of Rwanda has strived to be progressive and appears to recognize that investing in agriculture is key to bringing the country out of poverty. According to "FAO in Rwanda" the PSTA4

strategic plan which outlines future agricultural priorities in the country include: a focus on better land management, a shift toward marketing to enhance farm profitability, and investment in research and skills development (FAO, n.d.)

The current FAO report goes on to state, *“The overarching goal of PSTA4 will be the transformation of Rwandan agriculture from a sector characterised by low productivity to a sector using knowledge to increase productivity and investing in value addition and commercialization. This shift is needed to ensure that a reduced agricultural workforce will be able to meet the demand of an increasingly urban population within the context of a resilient and sustainable food system ensuring food and nutrition security for the Rwandan population....It will be modeled on needs-based solutions for various groups of farmers and will ensure that marginal-subsistence farmers are supported with social protection programmes and other measures in terms of skills development to ensure they graduate out of subsistence farming and into jobs along the agricultural value chains and beyond (on-farm and off-farm job creation).This transformation will be inclusive with empowering measures to ensure women and youth will not be left out...”*(FAO, n.d.)

Based on these statements, I believe Rwanda is ready to invest in agriculture education, and is committed to ensuring that women and children are involved in this process. Given that many Rwandan women and children already do much of the daily farm work and are among the poorest individuals in the country, I believe it is important to focus on bringing ag educational opportunities to them. And, based on Dr. Hunsucker-Brown’s personal experiences with Rwandan women and children in goat production, she expressed that they were “grateful to learn” (Hunsucker-Brown, 2019.)

To date, Rwanda has had several success stories in bringing groups of women together to learn about and improve their agricultural efforts. Hunsucker-Brown (2019) reported that the women she worked with were a group of 50 widows from four villages who had been selected to receive a young female goat to start their herd four years ago. The widows have since grown their herds and worked in a learning community within each village meeting regularly to learn about goat production and solve other conflicts that arise. Similarly, a “sisterhood of women farmers” has been established among Rwandans by New York-based nonprofit Humanity Unified International (Russo, 2016). The women work together on projects at a 25 hectare farm and tend to their own individually assigned plots as well to learn methods to increase their farming skills and yield production during the year-long program.

While these in-person programs are working successfully and should be continued, I suggest that these organizations should also integrate emerging digital resources, namely short YouTube-like videos relating agricultural information, into courses when teaching Rwandan women about agriculture. Doing so, may then allow Rwandan farmers to feel more comfortable with information and communication technology (ICTs) especially as it becomes more available as a personal education tool for the future. Eventually, these women may also be able to review the information on a mobile phone at their leisure to become more proficient with the ag information. Moreover, these farmers who have the opportunity to be involved in training courses with digital resources might also share the videos with other farmers within their village, thus expanding ICT literacy and reaching a larger audience of Rwandan farmers to accelerate the rate of adoption of new ag technology and conservation methods, and ultimately benefitting their farm profitability while also protecting natural resources for the future. Additionally, as Rwandan farmers become comfortable with online technology they will be better equipped to use other digital technology apps and tools that are continuing to be developed for marketing, record-keeping, digitally accessed insurance programs and more (Ekekwe, 2017).

Similarly, if short videos, especially ones with brief agricultural management content, were integrated into rural Rwandan schools, the next generation of Rwandans would begin to gain ICT skills, learn about agriculture, and take that information home to share with their families – again potentially expanding and

accelerating the adoption rate of improved agricultural production and conservation methods. To make ag education a reality, a format similar to America's ag education and FFA courses could be modeled. However, I would focus on implementing this program at the middle school ages (6<sup>th</sup>-9<sup>th</sup> grades), to ensure youth are exposed to agriculture at an age where it can instill a strong foundation for influencing their future. To stretch financial resources, I believe 5 to 6 farmer educators could be procured and then create video segments that then could be shared within classrooms throughout the country. Through live video conferencing, students could then engage with the educators to ask specific questions as needed.

While this recommendation may initially seem far-fetched for a developing country that struggles with poverty and electricity, consider the fact that access to information and communication technologies (ICTs) in Rwanda has improved greatly in the last several years, largely due to efforts by the Rwandan government. A 2017 Rwanda Utilities Regulatory Agency report indicated Internet penetration in the country was at 33%, and a 2016 International Telecommunication Union (ITU) report indicated mobile telephone penetration was 70%. Surprisingly, the Rwandan government also reports that rural communities have a high rate of mobile phone usage, made possible by a well-developed mobile network covering almost 100% of the country (Rwanda Freedom on the Net, 2017). Add to this the fact that the Rwandan government is investing in large scale efforts to bring electrification to the entire country (Sievert, 2018), and the country is also seeing investments in solar energy which is creating new opportunities for lights, mobile phone chargers, and even television for rural Rwandans (Nuwer, 2017).

Potential online resources that may prove useful to expand ag knowledge and education in Rwanda include AccessAgriculture and Agtube. Currently, AccessAgriculture (2019) offers a broad video library of ag-related content that may be useful for Rwanda ag teaching programs directed at adults and children. The videos are available in seventy-five different languages. Similarly, on Agtube (2019) anyone can upload their own informational videos as long as they relate to agriculture in developing countries. While these two websites offer extensive resources, recognizing that 70% of the Rwandan population speaks only Kinyarwanda (Rwanda Freedom on the Net, 2017), and given that the Rwandan people are very supportive of the country's president, the Rwandan government and the minister of agriculture might consider developing their own series of ag-related videos in the native language as they explore efforts to bring more agricultural knowledge and skills to their citizens. Doing so would allow them to address ag topics specific to the country of Rwanda – such as conservation practices to protect soil health on the steep hillsides, crop selection and management practices to improve yields on Rwandan specific crops, and animal health practices important for Rwandan livestock production. Marketing and value-added agriculture topics could also be addressed.

The Internet is truly changing the world – with many opportunities still to come as developing countries gain greater access to electricity, mobile phones and Internet capabilities. To help advance agricultural production in Rwanda for the future, I believe it is important to start preparing the farmers there to utilize emerging digital resources to increase their ag knowledge and skills. Women and children are often willing and eager to learn, and investing in their ag education is sure to bring a brighter future to Rwanda.

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