

IGC Oral Presentation Summary: XXV IGC Congress

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This paper will give an overview of the XXV International Grassland Congress thematic, keynote, and plenary sessions. The theme of the XXV IGC Congress meeting was “Grasslands for Soil, Animal, and Human Health.” We had many people attending, presenting, and participating in all these sessions. Within a month after the conclusion of the Congress, the proceeding’s papers presented at the meeting will be available on the IGC app. By the end of 2023 all papers will be available for download through any search engine at internationalgrasslands.org.

The three plenary speakers each focused on one of the main themes of Congress; soil, animal, and human health. The first plenary speaker was Dr. Richard Bardgett on the theme of soil health and he emphasized harvesting biodiversity for soil health. One aspect of his presentation was about sowing mixed plant communities and how more diverse root systems can enhance the resistance of key microbial mediated processes to drought. A main point was that diverse ecosystem and the interactions of various root systems within the micro-community will enhance resistance to drought.

Dr. Jin-Shing He was the first of five keynote speakers. He focused on the sub-theme of grassland ecology with a specific focus on biodiversity and ecosystem functioning. His main emphasis focus was the grasslands of the Tibetan plateau in China and Dr. He gave a number of examples of research from this region. One example was from the 1980’s showing a growth curve with plant production from early, middle, and late season cool season plants. Then Dr. He compared this to plant growth in the 2010’s, when the vegetation grew earlier and faster but the growth period was compressed. His study showed that increasing temperatures occurred in the 2010’s versus in the 1980’s. There may be some advantage for an earlier and compressed growth period if producers are harvesting stored forage, but in a grazing system having vegetation that grows earlier and faster may be a disadvantage. When the growth periods are compressed, the grasslands are losing production for a majority of the season, particularly the middle and end of the season.

There were 19 thematic sessions during this meeting, and I would like to give a few highlights from these sessions. On Monday May 15th, Dr. Pat Kaiser organized a session called “Grassland Ecology, Achieving Resilient Sustainable Grasslands Through Restoration of Ecological Norms.” He discussed how wildlife and soil resources have declined over time. Over a 100-to-150-year period in the eastern USA, there has been a conversion of native warm season grasslands to non-native pasture species. Restoring those areas requires the development of strategies. This session had six speakers, and each talked about strategies that could be used to restore native grassland. They also spoke about promoting native warm season grass establishment, which requires highlighting opportunities for grazing that are profitable for producers. If planting native grasses is not going to be profitable for producers, then a yearly

payment would need to be paid for maintaining this native vegetation. Profitability was one of the main themes and focuses of this session.

The next thematic session was organized by Dr. Jennifer Tucker and colleagues and was titled “Alfalfa in Warm Climate Regions.” Speakers focused on growing alfalfa in the southeastern USA rather than shipping hay from the central and western USA. Much of the market for alfalfa in this region is for dairies and horse owners, but the mindset is that alfalfa cannot be grown in hot humid climates. During this session they discussed how this common misconception is incorrect. Alfalfa can be grown successfully in this region and can be integrated into cropping, livestock, and integrated systems. Producers valued the higher forage quality achievable with alfalfa and its ability to provide an extended grazing season. The speakers were optimistic that alfalfa could fit into these systems and a big emphasis was put on partnerships that can be developed and adapted to this region.

USDA-ARS and University researchers organized a thematic on equine grazing systems, entitled “The Keys to Sustainability and Horse Welfare”. The main emphases were the latest concepts and their practical application in equine systems. In Florida an example was provided of using a species that has rarely been discussed for horse grazing. *Rhizoma peanut* is a perennial peanut that is an excellent legume, very well adapted to the climate of South Georgia, Florida, and other coastal states, and can fit into an equine grazing system. This species does not have to be relegated for cattle production. Dr. Jennifer Weinert-Nelson discussed the grazing horse microbiome and the research that is being conducted to understand the relationship between poor nutrients, hindgut microbiome, and grazing horse metabolism. There were highlights during this session on equine rotational grazing research and outreach initiatives, particularly highlighting what is happening in programs at the University of Florida and at the University of Kentucky.

Another thematic session was conducted on understanding social media and digital resources. The main point was how to translate science so that it is applicable to producers in the field. Integrating social media into research is one way of translating science. Most research professionals that work with producers know that they do not want to read manuscripts. So how can we effectively translate the results? Speakers in this session spoke about increased transparency and interaction with producers through social media posts and using it as a tool, particularly to get early adoption by producers. An example was given of Phil Mosel, an alfalfa producer in Georgia, who has now become an advocate for extension information and regularly posts on social media to influence other producers.

One of the last thematic sessions to take place on Monday was the NIRS consortium thematic session. This session provided basic information on NIRS and how it can be as accurate as wet chemistry for forage analysis. The speakers spoke about how the consistency of sample preparation was essential to optimize the use of NIRS equations. In addition, they talked about the importance of the material being at the same moisture content when it goes into the NIRS machine. In essence, ensuring material is dry before you scan it can make a difference in the quality of analysis. There are also a number of handheld NIRS units that show promise for use in developing countries where labs are not available. There are significant limitations to these units because of the sample preparation, sample presentation, equations for these units, difficult

software interface, and durability. All those considerations need to be taken into consideration before handheld units can be used with confidence.

The final thematic session on Monday afternoon was on plantain, the title of this session was “A Journey from Weed to Delivering Multiple Values in Farm Systems.” Plantain is a broadleaf plant, particularly populous in the eastern United States, and generally considered a weedy species. Forage analysis shows good quality, high protein, good digestibility, but this plant is typically not eaten by livestock. Dr. Bill Rumball, a plant breeder in New Zealand, started breeding plantain for improved growth and palatability. These improved varieties have proven to be invaluable part of New Zealand’s pastures. They are realizing that this former weed reduced nitrogen leaching losses by up to 60% and nitrous oxide emissions by up to 50%. That is something that was not thought of when these varieties were being developed 20-30 years ago. There is also a reduced nitrogen concentration in urine patches when plantain is in the system. They are finding that root exudates from plantain inhibit sheep urine nitrification in soil.

On the morning of Tuesday May 16th, the first plenary speaker was Dr. Sara Place. She spoke about animal health in a sustainable context. Dr. Place highlighted the value of having animals on the landscape in grasslands. One could argue that we do not need livestock on the land because they take up acres that should be used for food production. Dr. Place discussed the fact that there is a lot of land across the world that should not be cropped without severe land degradation. In recent decades a popular argument is that ruminant livestock are not good for the food system because the pounds of feed per pound of product. Dr. Place related that finishing beef for the last few months on grain can require over 12 pounds of feed per pound of meat. A broiler chicken is 1.6 pounds of feed per pound of meat. Using that statistic there is a huge amount of feed to grow a pound of beef, but this does not take into account the majority of the feed for beef cattle is forage based. A better perspective is to consider pounds of human edible feed, particularly corn and soybean fed to beef cattle. Using this parameter USA grain finished beef consumes just 1.6 pounds of human edible feed per pound of gain. Broiler chickens require 1.4 pounds of human edible feed per pound of gain and pork 2.0 pounds. When you look at the net protein contribution from each of those animals, or the meat from those animals, values greater than one mean there is more high-quality protein generated than used. Net protein contribution is 2.66 with grain finished beef, 0.86 with chicken, and 0.71 with the pork. That means that monogastrics, poultry and pigs, are consuming more high-quality protein or human edible protein than they are producing. In essence, society is getting a lot more out of beef animals from a standpoint of human edible protein.

Dr. Johannes Isselstein, spoke on the diverse use of grassland systems in his keynote address on grassland production and utilization. He showed a painting from 200 years ago in Europe that highlighted the importance of grassland ecosystems and cattle being an integral part of that ecosystem. Grasslands and ruminant livestock create a symbiotic relationship in those environments. Dr. Isselstein highlighted his long-term grazing experiment studying the effect of cattle and grazing intensity on grassland ecosystem services. He spoke on different grazing intensities and long-term stocking averages. His main point focused on stocking rates, livestock gain per unit area, forage residual height, and how all these fit into ecosystem services.

Dr. Paulo Carvalho, in his keynote presentation on livestock production systems emphasized reconnecting grazers to grasslands. In one of his first slides he gave an example of how grazing animals can enhance soil health. Like many of the talks, particularly the keynotes, he spoke about the benefits of grazing animals. They are not detrimental to the environment, which is heard a lot in the popular press. Dr. Carvalho overviewed a study from work in Brazil published in *Applied Soil Ecology*, that showed that if only lime was applied to pastureland then soil gram-positive bacteria dropped by 29%, actinomycetes dropped by 21%, and microbial biomass dropped by 27%. There was no grazing, but lime was added to increase pH. When grazing animals were introduced into the system without lime or fertilizer, in this example sheep, there was a 29% increase in saprophytic fungi. When grazing was incorporated with recommended lime and fertilizer there was a 140% increase in the arbuscular mycorrhizal fungi.

The first thematic session on the second day of the congress was entitled “The Role of Legumes in the Anthropocene Era,” otherwise known as the current era. Legume incorporation can increase forage biomass, reduce nitrogen fertilizer, and also reduce nitrogen emissions and mitigate methane emissions. Legume responses to climate change may vary due to interactions between factors and elevated CO₂ and temperature. Legume breeders should consider epigenetic impacts on plant phenotypes and response to environmental changes. Speakers emphasized that forage legumes can be very important in the common era, and there are major detriments to just relying on nitrogen fertilizers for forage production.

Dr. Michael Flythe from the USDA-ARS-FAPRU lab at the University of Kentucky, organized the thematic session, “The Good, the Bad, and the Ugly of Secondary Metabolites.” Secondary metabolites refer to products that are being produced by the plant, or in some cases, by fungi or bacteria associated with the plant that are not necessary for growth. Good examples of these are isoflavones and condensed tannins. These compounds can have significant effects on livestock growth, nitrogen partitioning and methane emissions but this depends on the creativity in presentation and delivery of those compounds to livestock. The compounds also have the potential to create improvements in the nutrient density of animal products. The work being done at the University of Kentucky in red clover shows that some isoflavones cause vasodilation sufficient to negate the vasoconstriction caused by toxic tall fescue. In other plant species, compounds like condensed tannins lead to greater bypass protein and greatly reduced chances of bloat. There are many benefits of secondary metabolites. Ergot alkaloids were given as examples of what Dr. Flythe would call “the bad, and ugly” secondary metabolites. Those compounds have profound negative effects on animal growth and performance. Livestock can also have lifelong alterations resulting from ergot alkaloids during gestation and continued residual effects throughout their life.

Dr. Greg Halich at the University of Kentucky organized a thematic session on extending the grazing season. This session started with a researcher from Canada, Dr. Vern Baron, who spoke about swath grazing. In western Canada, there’s about six months of the year that the ground is covered in snow, or the soil is frozen, so there is no forage growth. Extending the growing season is a difficult practice to implement during these harsh winter months. About 30 years ago, some innovative producers decided to make late season hay cuttings, but rather than

bale they would just let the “hay” stay in the field and graze the swaths over winter. Alternately, they tried planting cereal crops like wheat in the middle of the summer. Then in October when cold weather began the wheat was still green and growing. The wheat was then cut, put in a swath and left in a field to be frozen and grazed by animals overwinter. These practices began known as “swath grazing” and revolutionized cattle production in western Canada. Swath grazing would be more difficult in a state like Kentucky because the swath would be rained on overwinter and would deteriorate and mold. Alternatively, bale grazing provides an option to extend grazing by putting bales in the field in the fall, string electric fence between those bales, and rotating livestock every few days. The animals are provided with sufficient forage, and the soil is getting the benefits of animal manure and urine spread over the entire field. Another presenter in this session spoke about alternative forages, such as brassicas, that provide rapid high-quality biomass and increase production per unit area while extending the grazing season.

Dr. Carol Williams from the University of Wisconsin organized a thematic session titled “Diverse Perennial Circular Systems.” A more simplified version of this title would be diverse perennial forages. If perennial forages exist in a system, then it is a perennial system. They are diverse and they continue to work in recycling the nutrients in pastures. If perennial forages are used in crop rotations, they provide living mulch. The main point of the session was to highlight the importance of forages and particularly perennial forages. The unique title was meant to capture the imagination of attendees.

Another thematic session on Tuesday was on variety testing. With the southeastern United States becoming warmer and wetter, several talks focused on the need to have more testing of forage varieties and reverse the decline in testing in recent years. Researchers were encouraged to look for resilient varieties, and that both yield and persistence should be a requirement of forage variety tests. Variety testing coordinators were challenged to consider accelerated stand loss protocols, like close continuous grazing. Regional collaborations should be pursued with forage variety testing similar to initiatives with grain crops. The limitation is that there are not as many companies in forages, so profits and profit margins are lower than with grain crops.

A memorable thematic session focused on the lifelong contributions of Dr. Norm Taylor at the University of Kentucky entitled “Clovers Around the World.” Dr. Taylor was a clover breeder at the University of Kentucky for close to 60 years. Many of the researchers attending this symposium knew Norm, and how he devoted his life to collecting clover genetic resources from around the world and to clover genetic improvement. One talk focused on these germplasm resources and how they were donated to the USDA germplasm bank, to be maintained for future plant breeders. Talks were also given on the full range of clover genetic resources including red clover, white clover, and annual clovers for forage systems and for cover crops.

Another thematic session focused on soil health and carbon sequestration. Grasslands are a major source of carbon sequestered in the soil. Speakers emphasized that crop production systems around the world for centuries have been making use of the carbon and other nutrients built up through the proper management of grasslands. Many talks were given about carbon credits, and that evaluations need to be made not just on a one- or two-year basis, but a decade-

long basis. To develop a viable carbon market, short- and medium-term pastures should be integrated into cropping systems to maximize carbon sequestration.

Dr. Frédéric Leroy gave the third plenary lecture on grasslands and human health. He entitled his presentation “The Roots of Humanities’ Future.” He emphasized the value of animal source foods and animal source protein. Dr. Leroy contrasted the belief of some that humans do not need animal source protein, but that sufficient protein can be obtained solely from plant-based products. Dr. Leroy made the point that it is very difficult to have a balanced diet just from plant sources. A recent report from the FAO showed that diets with minimal animal source foods led to an increase in calories consumed and a 50% reduction in protein. He spoke about public health priorities. Right now, in the United States, the recommendations are to limit protein consumption, particularly red meat consumption. There may be some benefits to these recommendations, but they have led to an increase in metabolic syndrome, an increase in obesity, high blood pressure, hypertension, and insulin resistance. Dr. Leroy ended with the rhetorical question, “when we speak about healthy eating, are we talking about what’s really best for people or is it just promoting the agenda of a small group?”

Dr. Amy Ganguli provided a keynote presentation entitled “Grasslands at a Crossroads: Contemplating the Status of Grassland Ecosystem Services.” She emphasized that scientists should endeavor to translate research into something that people can grasp. She spoke about grazing and ecosystem service delivery and the global drylands where grazing sustains the livelihood of billions of people. When researchers speak about maintaining grasslands, they should talk about the value of these ecosystems for more than just the livestock that live there. Dr. Ganguli highlighted a study showing there are 327 dryland regions in 25 countries across six continents. The study discussed the effect that grazing pressure and ecosystem services has on these regions.

Dr. Dana Kelly gave the last of the keynotes and she spoke about social challenges in the grasslands. One of the examples she gave was gender, and the need for gender equality worldwide. Half of farmers are women, and although it varies between countries, there is often discrimination. Forty percent of the world’s countries have constraints on women’s rights to own property. Even though women are farming the land and are raising a lot of the livestock, they may not be able to own the property that they are using. Women landholders in Latin American make up less than 25%, and in the Middle East and North Africa make up less than 5%. The size of women’s land holdings in Bangladesh, Ecuador, and Pakistan are typically half the size of men. Dr. Kelly spoke about innovations for small farmers and helping women farmers. She also gave a number of examples of other social challenges in the grasslands. She emphasized that grassland agriculture is not all about production and it is not all about maintaining the ecosystem, but there are a number of social issues that need to be addressed.

Dr. Lynn Sollenberger from the University of Florida led a thematic session about preparing the next generation of grassland scientists. When he spoke about his own experiences, he highlighted the value of mentorship. Mentorship is positively associated with a wide range of productivity measures and career achievement. Dr. Sollenberger discussed how high quality student mentorship leads to continued success of the student even after they leave university. The

other panelists for this session spoke about carefully choosing your mentor since much of the success a student has is based on the style and supportiveness a mentor gives. As a mentor, building a development plan based on the individual will create a healthy environment for them to thrive. The development plans should be based on the student's strengths and weaknesses.

One of the last thematic sessions was on livestock production systems and revisiting the nutrient value of forages to the animal and to the agroecosystem. One example from this thematic was that management approaches can be developed to integrate grasslands into farming systems and provide ecosystem services essential for the sustainability of agriculture.

A thematic session was organized by scientists with Corteva, where they spoke about enhancing grasslands through weed and brush management. Biomass productivity and livestock capacity can be increased through management of problem weeds. Average daily gains can also be increased. If a pasture contains weedy plants, then that is going to be a problem for grazing livestock. When weeds are controlled grassland system resiliency is improved. Presenters emphasized that controlling grassland weeds and brush does not have to happen through herbicides but can happen through management. Integrated strategies should be used, and one speaker gave examples of new precision technology that includes drones and artificial intelligence for spot spraying to improve the efficiency of weed control. In essence, the drone applicator goes over the field and when it sees weeds, or even specific species of weeds, the sprayer activates in that one spot and sprays the weed rather than the whole field.

The final thematic session was "Restoring Ecological Function on Rangelands Degraded by Invasion of Annual Grasses." Speakers overviewed a broad range of native grasslands and their diverse ecosystems, and then they provided a number of examples. One of the main emphases of this thematic was the growing prevalence of weedy or invasive annuals competing with native perennials. One of the worse examples is cheatgrass (*Bromus catharticus* Vahl.) which is crowding out native grasslands in the Western United States. There is potential value in using pre-emergent herbicides to control these annuals and allow the native perennials to have a better chance. Areas where invasive annuals have been successfully controlled saw an increase in wildlife, pollinators, and beneficial plants, and biodiversity in general. Re-establishment of a grassland, particularly managing invasive annuals on a perennial grassland, is exceedingly difficult. Therefore, emphasis should be placed on being proactive, and focusing on the most productive grasslands first, then move into degraded areas. In summary, when a grassland site is slightly overgrazed, then proactive management will ensure that it never becomes fully degraded.

There were over 200 volunteer oral papers at the XXV IGC Congress. There were about 120 thematic presentations, 8 plenary and keynote presentations and almost 200 oral volunteer presentations plus many poster presentations. One example of the many excellent volunteer oral and poster presentations was given by Christian Morano. He explained how his research group had identified grazing personalities associated with individual cattle in the steep rugged rangelands of southern New Zealand. With GPS trackers and genotyping for a grazing gene, researchers were able to categorize animals into short range grazers, medium range grazers, and long-range grazers. They proposed that these categories could be used as a cattle selection tool. If the long-range grazers were selected, then there would be a more efficient use of the pasture. If

the short and medium range grazers were selected, they would remain close to the water system, the long-range grazers resulting in less effective use of the whole system.