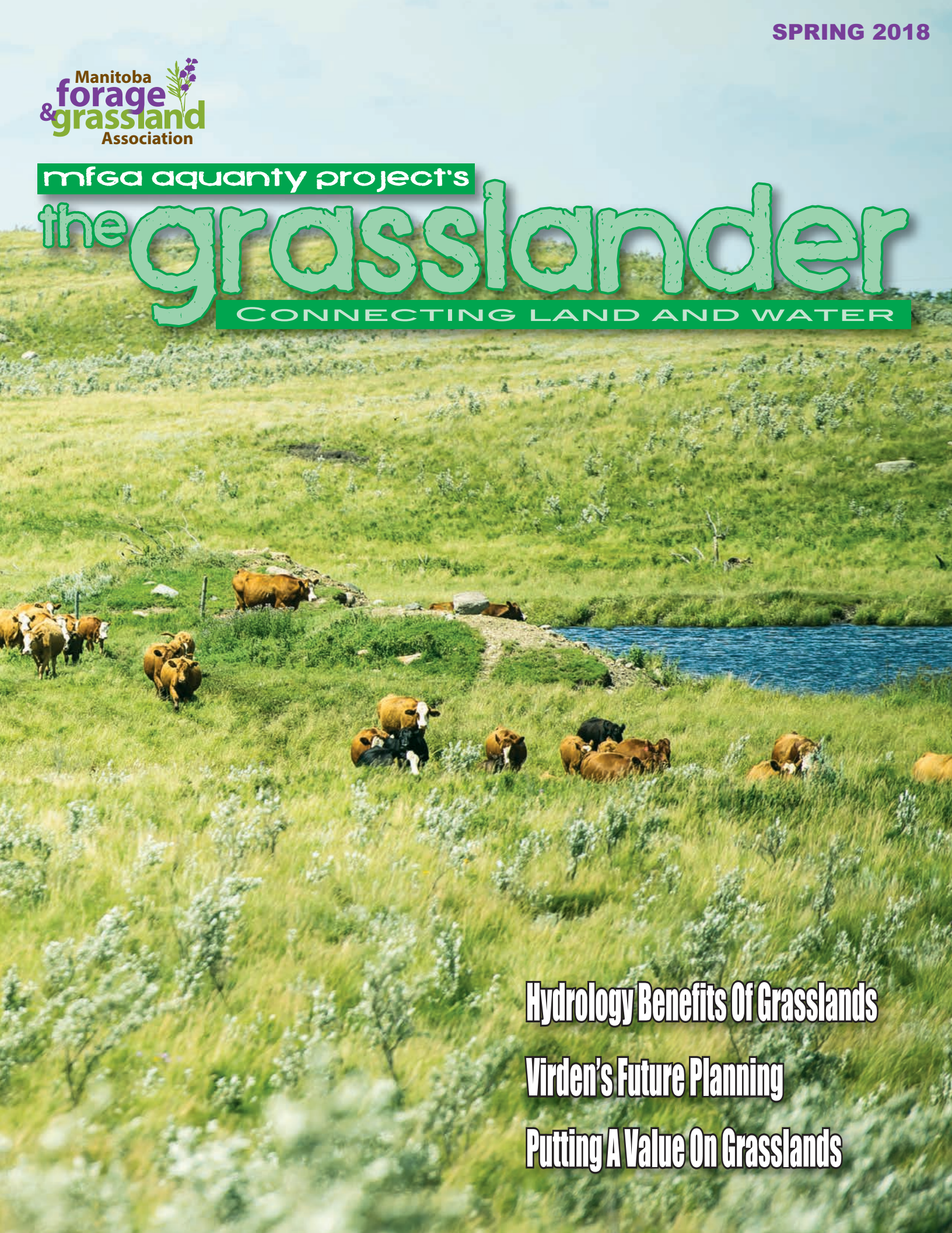
SPRING 2018

Manitoba forage & grassland Association

MFGA AQUANTY PROJECT'S

the grasslander

CONNECTING LAND AND WATER



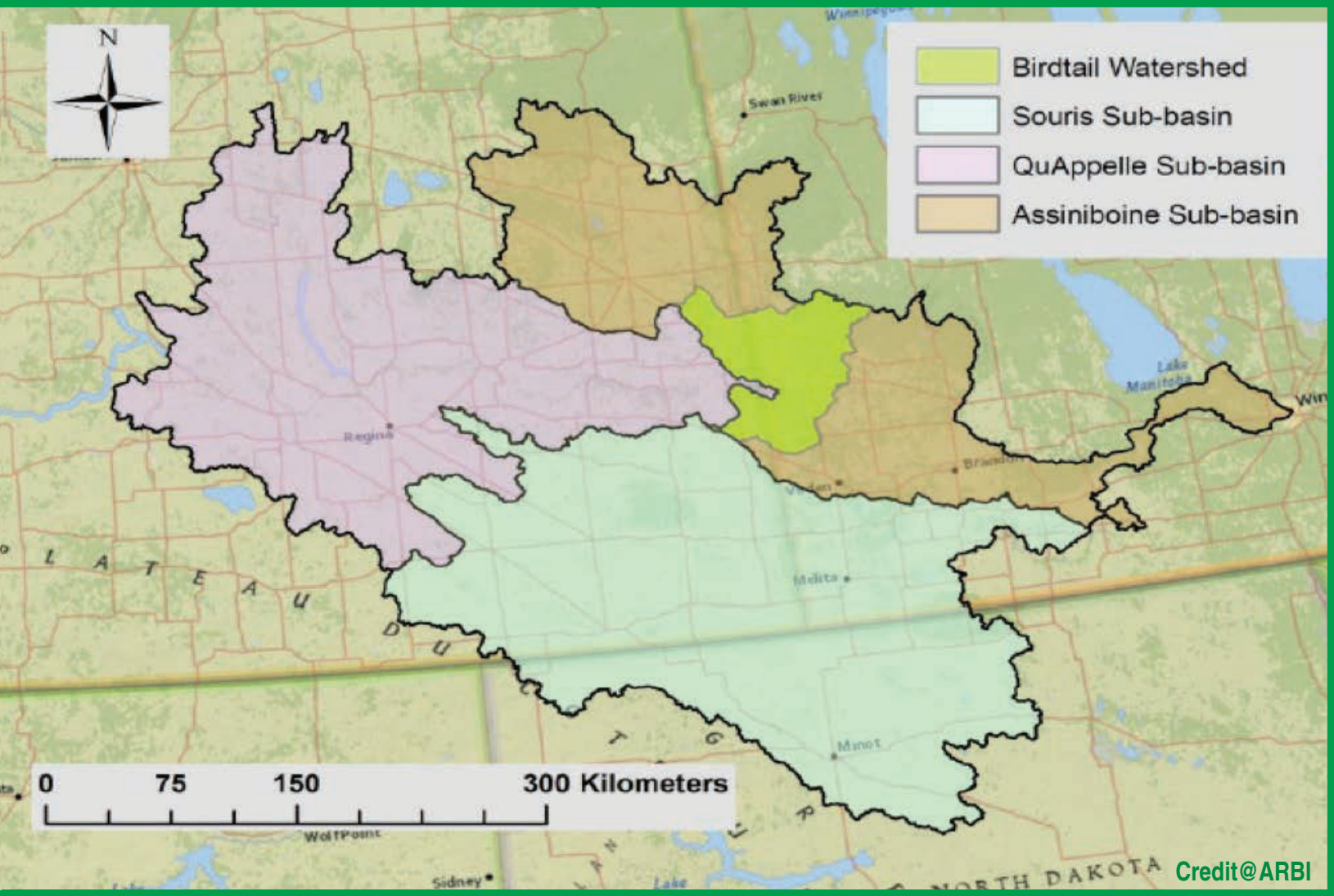
Hydrology Benefits Of Grasslands

Virden's Future Planning

Putting A Value On Grasslands

ASSINIBOINE RIVER BASIN (ARB)

- The ARB covers an area of 162,000 square kilometers. About the size of North Dakota. It is part of the larger Lake Winnipeg Basin.
- Roughly 1.5 million people live and work in the basin.
- The agricultural GDP is estimated to amount to over $10 billion. Natural resources such as oil, gas, potash and coal are also a major part of the basin economy.



Funding for the MFGA Aquanty Project was secured by the Canada and Manitoba governments through *Growing Forward 2*, a federal-provincial-territorial initiative.

Growing Forward 2
A federal-provincial-territorial initiative

Manitoba

Canada

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WINTER 2018

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from the editor

As you will read in these pages, the Manitoba Forage and Grasslands Association (MFGA) Aquanty Project model is a high-resolution HydroGeosphere model developed by the Waterloo, Ontario-based software company Aquanty Inc. to focus on water movement and the role of forages and grasslands in times of flood or drought ahead in the Assiniboine River Basin. Once completed, the model will provide the ability for decision-makers from a wide range of government, agriculture, conservation and community interests to plan for flood and drought resilience in times ahead for the Assiniboine River Basin. This includes information and knowledge critical to future policy and programs around the important role of forages and grasslands in ecological goods and services, landowner incentives, water and grassland management, urban and rural community resilience and green infrastructure.

As the project proponent, MFGA will own the licence for stakeholders to access this exciting, cutting-edge model in the ARB. There will be a series of checks and balances put in place before we launch, such as internal tests, focus groups, different scenarios and stakeholder workshops, to ensure the model is ready to roll with the most momentum after that time. At the end of March 2018, MFGA will have a working HGS model built by Aquanty with the public interface of the model completed by ISM (an IBM company) based in Regina.

The potential of the model as a decision-support planning tool across the entire Assiniboine River Basin is vast and unlimited. We are extremely grateful to many people and groups for this opportunity and their generous support, particularly our Primary Funder/Program: Agriculture and Agri-Food Canada (AAFC), Growing Forward 2, AgriRisk Initiative, our Secondary Funding Partner: Manitoba Agriculture, Growing Forward 2, federal-provincial-territorial initiative, our project's key partners at the Assiniboine River Basin Initiative and our project's core contractors at Aquanty Inc. and ISM/IBM as well as our entire project steering committee (page 19).

Our MFGA promise to all stakeholders from Day One of the project has been to devise a strategy that will allow the most access to the model as we possibly can provide and encourage. We are working on that and will have exciting news on that in the near future. We consider the MFGA Aquanty Project Grasslander magazine as our personal invite and outreach to you to learn more about this exciting model and to motivate your thoughts and actions to incorporate, challenge and embrace this cutting-edge model in creative ways and visionary scenarios that will benefit the entire Assiniboine River Basin.

Muchos Grasses all, looking forward to exciting times ahead,

Duncan Morrison
Editor, MFGA Aquanty Project Grasslander Magazine
Executive Director, Manitoba Forage and Grasslands Association

MFGA: The Grasslanders

By Duncan Morrison

There will certainly be smiles all around as the Manitoba Forage and Grassland Association's (MFGA) Aquanty Project – considered to be among the most exciting land use and water management decision support tools ever developed for the Assiniboine River Basin – sails to completion right on schedule at the end of March 2018. However, for MFGA, the bulk of the heavy lifting with the project is just now beginning, as MFGA will retain the licence rights for user groups to access the cutting-edge model.

"We started out on this project roughly two and half years ago, with a short timeline approval due to the election process blackouts that actually reduced the window of our delivery timeline," says Dave Koslowsky, MFGA chair and a producer from Killarney, Man. "We've been running flat out since. And with the model now into final construction mode, the challenge for us has been continuing to build the drumbeat as the model was being built to get to this point where more than 100 people attended three workshops we held in Winnipeg and Brandon last November and December."

It all came to be after MFGA was approached by Agriculture and Agri-Food Canada's AgriRisk Initiatives to consider being the proponent of an Aquanty HydroGeoSphere model to be developed in the Assiniboine River Basin that would look specifically at the role of forages and grasslands in times of flood or drought. MFGA immediately saw the value of the project for forages and grasslands and accepted the challenge to coordinate and work alongside project experts from Aquanty Inc. and ISM Canada (an IBM company) toward the model's three key objectives: (1) to develop the model, (2) to develop a customized, user-friendly web-based interface to allow stakeholders to access the model and (3) to look at the role of forages and grasslands in time of flood or drought in the Assiniboine River Basin (ARB). The MFGA Aquanty Project focuses on water movement and land use across the ARB's three major sub-basins: the Assiniboine, Qu'Appelle and Souris, as well as a more detailed drill-down on the Birdtail watershed located in the upper reaches of the Assiniboine sub-basin.

"When you understand our people, you can easily understand why MFGA is tremendously thrilled and privileged to have this opportunity with the MFGA Aquanty Project," says Koslowsky. "MFGA is very appreciative of the support of Bruce Stephen of AAFC's AgriRisk Initiatives, and Manitoba Agriculture for their awesome support, as well as our partners on our project management team and steering committee."

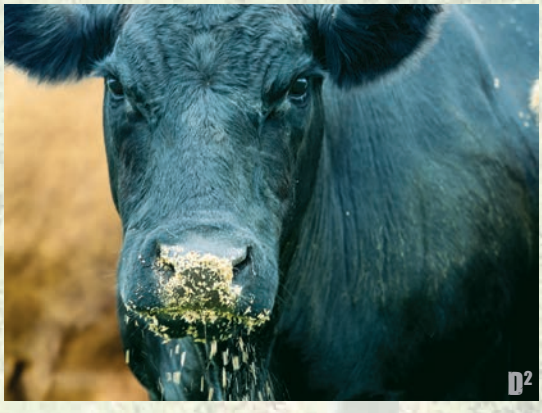
According to Koslowsky, MFGA producers and supporters are the backbone of grass-based farms across the province. And, he says, their kind is found throughout the ARB in Saskatchewan and North Dakota as well. For a model that seeks solutions from grass, having grass champions is a great first step.

"What we have found out is that MFGA is in many ways the face of Manitoba's mixed farmer. Most of us are from western-based Manitoba farms in our organization these days," Koslowsky explains. "We are from family farms that have been in our families for genera-

tions and we have grass front of mind. Most of us run cattle on pasture and rangeland and grow forages for our herds and some of us sell hay too. We water our stock from wetlands on our lands via watering systems, sometimes solar-powered, and as a group we are staunch soil health advocates via grazing practices and cover cropping. Many of us also grow annual crops to supplement our on-farm income."

Many producers face critical decisions on their land about their land and farm operations on a regular basis. Things like herd decisions, crop rotations, buy, sell or lease land discussions, not to mention water management challenges accelerated during times of intense weather by flood or drought. While the benefits of grass come naturally to most grass and beef producers on their own farm decision matrix, the simple fact is growing more grass in better places is not often the first thought for many agricultural producers to stymie flood and drought impacts. Darren Chapman, MFGA's vice chair, considers the MFGA Aquanty Project as a great chance to share with the larger community and land managers alike to help reshuffle the deck when thinking about those areas.

"To MFGA, this model is a decision support tool that examines water movement and the role of forages and grasslands across the ARB in times of flood or drought," says Chapman, who runs a grain, hay and cattle operation with farm partners Parry and Rob Chapman and Jeff Elliott near Virden, Man. "The absolute key for us is that we want as many people as possible to access the model. Especially the user groups and target audiences that can use the model for the most benefit including producer groups, multiple levels of government, research institutes and NGOs." Koslowsky agrees. He says that the first phase of the model will provide a solid understanding of how grasslands and forages can be used to provide large scale benefits under both flood and drought conditions.



"The greatest potential of the model will be when multiple stakeholder groups come together to use the model as a common-interest tool to help plan resiliency into the landscape," says Koslowsky. "When it is utilized by a greater number of interests over larger areas of land, the greatest aggregate good can be accumulated."

However, in some cases, there may be more work and data required. There will be some situations where the model will need to be refreshed with data to provide new scenarios. "Those are more likely to be larger asks across larger land areas and will be tailored accordingly," says Koslowsky. "We will work closely with requesting user groups, Aquanty and ISM to develop those scenarios."

With a community-based focus, Koslowsky is excited for the MFGA times ahead.

"As we head into the next Canadian Agricultural Partnership and with other declared focuses on Green Infrastructure as well as our own province's made-in-Manitoba Climate and Green Plan and the declared want to grow the provinces beef herd, we are entering super exciting times," he says. "There are other phases of the model being proposed and considered as well as tailored scenarios that will drill down even further on the model's planning ability in an area to utilize the model."

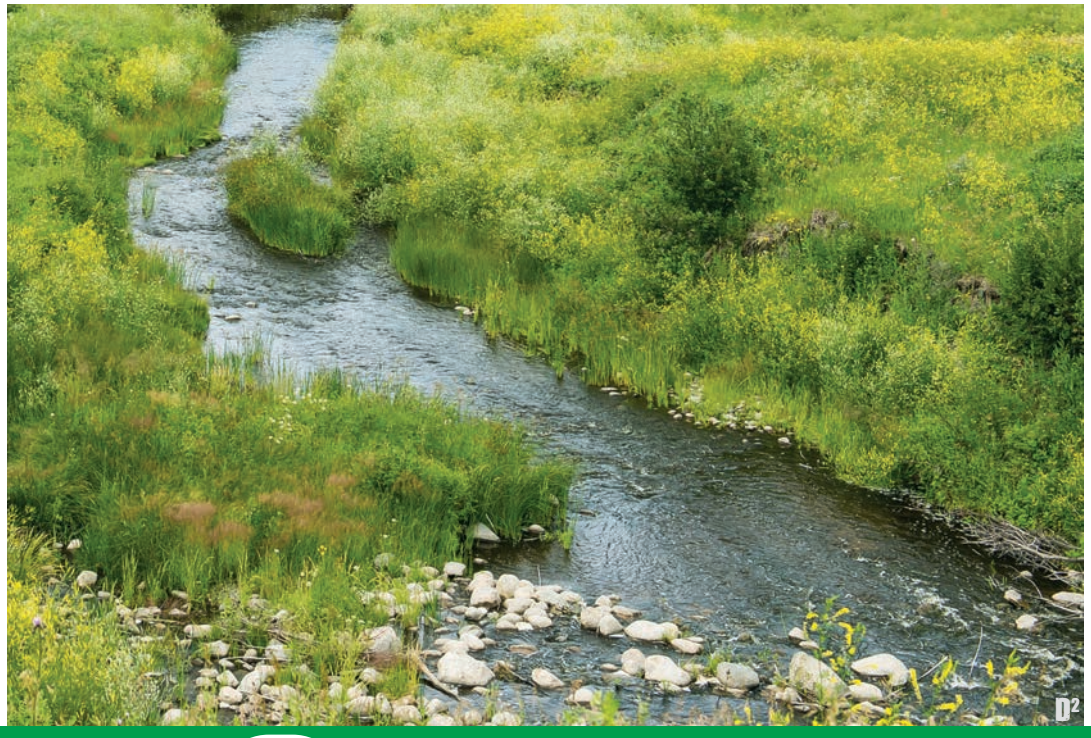
Because the project covers such a vast area and large base of stakeholders, Koslowsky says MFGA will commence an in-house introductory test period before the public launch. He says that all project funders, partners and stakeholders will be kept up to speed as the rollout commences after project completion.

A Few Model

Aquanty's HydroGeoSphere (HGS) models for the Assiniboine River Basin (ARB) are composed of three-dimensional (3D) finite elements, similar in appearance to an assembly of children's interlocking blocks. In total, there are approximately 800,000 of these elements in the full basin model spread evenly over seven layers, which provides spatial resolution that ranges from 150 metres to 4,000 metres, with the higher resolution elements located along the rivers and streams, and in areas with complex topography. Each of the three sub-basin models has about the same number (800,000) of elements, but the elements are spread across a smaller geographic area, so the spatial resolution reaches as high as 50 metres. Within the surface layer of the model over 22,000 kilometres of surface water features are resolved, with flow rates reported at the locations of over 30 existing real-time flow gauging stations.

The subsurface component of the models are divided into specific layers to represent different subsurface materials, with three soil layers (from the surface to one metre in depth) that carry the unique infiltration and water retention characteristics of 522 different soil compositions. Underlying the soil layers are two surficial geology layers (from the base of the soil profile to the bedrock) and one bedrock layer. Groundwater flow within the bedrock layer has been configured so that the effects of a much larger (than the Assiniboine Basin) regional flow system are imparted into the ARB model.

Across the top surface of the model, land use is resolved down to 250 metre resolution, with the major land class groups including deciduous and mixed forests, wetland, cropland, grassland and water surface. Also configured into both the basin and sub-basin scale models are the ARB's most important surface water management features, including the Lake Diefenbaker inflow, the Portage Diversion, and the Shellmouth, Rafferty,



Details

By: Steven Frey

Alameda, Des Lacs, Lake Darling and J. Clark Salyer dams.

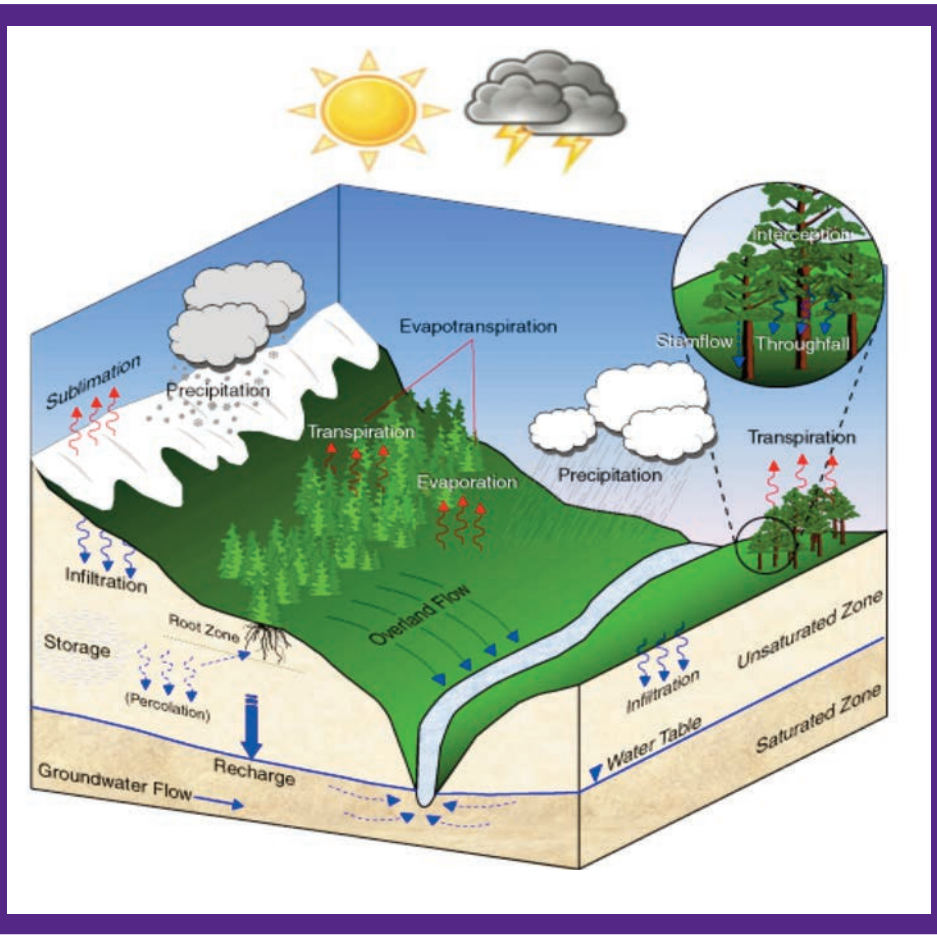
While there is considerable complexity within the model structure, certain components have been designed with adaptability in mind. In particular, the land use configuration and daily climate forcing data can be readily changed using GIS raster data manipulation, while the soil hydraulic properties can be manipulated with a basic text editor.

• Model will provide a better understanding of how land management practices within the ARB can:

• Influence on-land water retention

• Provide planning tool for large scale flood and drought risk mitigation

• Assist in a variety of other applications for various basin stakeholders



COMMUNITY RESILIENCE POTENTIAL IS BIG

By Lorraine Stevenson

For a few tense days in the early summer of 2014 the village of Pierson in southwestern Manitoba was swamped overnight. Unprecedented rain fell over the July long weekend that year, topping off a spring of already twice-normal precipitation as parts of southwestern Manitoba and eastern Saskatchewan were deluged. Over 50 municipalities and other communities in Manitoba would declare local states of emergency that summer. After the initial crisis passed, the cleanup would take months and cost millions.

No one wants to see catastrophic overland flooding like in 2014, 2011 or 2008/09 again. Nor does anyone wish to deal with the flip side of the extreme weather whiplash, the parched lands of drought. Some good news is on the horizon, though, as residents, farmers and land managers throughout the Assiniboine River Basin will soon be able to plan for such weather events through the Manitoba Forage and Grassland Association (MFGA) Aquanty Project's computer model that will look at the role of forages and grasslands in times of flood or drought.

The MFGA Aquanty Project features the Aquanty – a software development firm out of Waterloo, Ont. – HydroGeoSphere (HGS) modelling system which, when completed in spring of 2018, will produce simulations of a range of weather events, including widespread precipitation or heavy snowmelts to predict and measure the groundwater and overland hydrological flows that would result. Proponents say the model has enormous potential as a decision-support tool for designing water management systems and for on-farm planning in the near future. Similar HGS models are already being used worldwide in areas such as Canada's oil sands near the Athabasca River and drought-stricken California. Glenn Young is Keystone Agricultural Producers' representative serving on the MFGA Aquanty Project Steering Committee. Young sees the HGS model as enabling stakeholders and land managers in the Assiniboine River Basin to proactively deal with situations associated with weather extremes, which historically have incurred lost agricultural productivity and huge expenses afterwards.


@UpperAssiniboineConservationDistrictAssoc

For individual farmers who use the model, Young is confident it will prove to be a key planning tool for those "what-works-best-for-my-farm" questions. However, he also says that the greatest good from the model results from the greater aggregate use of the model by groups such as a number of local farms, a watershed authority or provincial departments that oversee greater areas of land.

Five such HGS models are being developed by utilizing existing data for land use planning on the entire Assiniboine River Basin region as well as on a smaller scale individual watershed basis. The key is looking at the role of forages and grasslands in times of flood or drought.

As a farm financial adviser travelling rural Manitoba for over 20 years, with stints working for the Federal Farm Debt Review Board and serving on the Manitoba Farm Mediation Board, Young's seen all kinds of different approaches and farm practices, and how what works in one place often doesn't work somewhere else. He believes that there is always value in learning from what was done the day before and how that worked or didn't work out as planned or expected. Young cites land erosion as one such key area that troubles him and he wonders if the HGS model could help showcase areas where small dams may be placed as an example of proactive land use planning for regions that are often affected.

"The MFGA Aquanty model's ability to future cast volumes of water, how fast they flow and where, will take planning for worst-case scenarios to an entirely new level," says Young. "This is a decision support tool that will give municipalities, conservation districts, water stewardship organizations and land managers a brand-new vantage point from which to manage landscapes to address broad-based regional needs and wants."

Young says the MFGA Aquanty model naturally bridges into other key areas. "The program will provide a lot of information for water quality modelling," he says. "It will add greatly to our province's understanding of the movement of water off fields and into our lakes and waterways. There are many people who live outside the basin who are affected when water ends up going into Lake Manitoba and Lake Winnipeg."

As a predictive model, Young says the model has great potential in the insurance industry with potential as an unprecedented mechanism for determining premium levels to insure against overland flooding.

"The benefit of it is they (insurers) should have a very accurate methodology in calculating what the premium should be," he says. "If you can create an insurance program that brings added value on the hay and forage and livestock end of things and that's cost effective and useful and is going to work when it's needed, then farmers, producers of all types will, I think, take it up."

Young says taxpayers fund the disaster assistance programs through federal and provincial governments that help reduce excessive flooding and the dry, parched lands of drought. Via the findings of the MFGA Aquanty model, Young says the proactive planning initiated could help mitigate risk on future on-farm, provincial and regional lands. "Farmers will benefit but so will others across the province," he says. "The local communities are going to be beneficiaries. Wherever and whenever there is less suffering for people physically and emotionally, and the farmers are buffering these weather events on an economic front, I'm on board with that."

Virden's Future Planning Looks At Water and Grass

By Duncan Morrison

When it comes to water woes around Virden, Man., lifetime area resident Terry Johnson has seen it all. But the former town councillor, farm producer and conservation advocate admits he worries about the town's days ahead the most.

"As a citizen of Virden, I want to start to understand what my risk is," says Johnson. "There are questions that need to be answered on a political, organizational and farm front for higher levels of water management and water quality."

Johnson has had the rare privilege of serving in the public sector for more than three decades, having served as a councillor and reeve in the former Rural Municipality of Archie and as a councillor and deputy mayor of the Town of Virden. Add in many distinguished board terms with numerous organizations, including as a founding member of the Farm Stewardship Association of Manitoba and many other local committees and provincial tribunals, and Johnson has an unrivalled resumé that has put him in contact with many key strategies and action plans over the years. Few, he feels, are more pressing than what Virden is facing today.

"Virden is at the confluence of two major creeks that have seen more drainage projects upstream," says Johnson. "We have watched as more drainage has occurred upstream and the flows have increased at unprecedented levels. The flood of 2014 in Virden took us right to the edge. If Highway 1 gets cut off, we all get cut off."

Submitted Photo

Terry and Joan Johnson

These days, Johnson has lessened his workload on the public service front, though he still sits as a member of the Assiniboine River Basin Initiative and on the Manitoba Forage and Grassland Association (MFGA) Aquanty Project steering committee as the Town of Virden representative to both groups. Johnson is also a commissioner for the Manitoba Clean Environment Commission. Terry and his wife Joan have enjoyed living for over 14 years in Virden and have many friends and acquaintances there. Involvement in the community and region is still very important to the Johnsons, including making sure townspeople understand that the economics of agriculture are driving the bus these days.

"In today's world, the margins of farming are so tight. Inputs are rising, young farmers are forced to max out every acre on longtime fragile lands, including those in the Virden area," he says. "You can't do that out here. Mother Nature always bats last. We are moving into cycles where we need balance on the farm with forages and grasses. It is more critical than ever."

With that as a rallying cry, Johnson knows first-hand that Virden is an economically important regional hub for southwestern Manitoba situated smack dab in the middle of some of the most intensively farmed agricultural landscapes in Canada. He thinks the MFGA's Aquanty Project model's attention to determining the role of forages and grasslands in times of flood or drought is long overdue to achieve tangible societal solutions.

"That's the beauty of the MFGA Aquanty model," he says. "The farm is more than agriculture. It is a way to mitigate risk for the entire community via the forages and grasses. It is something policy-makers will need to be aware of. Looking forward, the Town of Virden is very supportive of this model and others like it that showcases solutions."

Provincial forecasters consistently predict that Virden faces flooding risks, primarily from the Scallion Creek sub-watershed north of town, and from the backwater effects from the Bosshill and Gopher Creeks, which contribute to the total flow in town. Scallion Creek has in the past flooded and flood protection works have included culvert enlargement under Provincial Trunk Highway 1 (the Trans-Canada Highway) just north of town to prevent over-topping and a costly closure of the highway. The new crossing was designed to protect the highway but not municipal infrastructure downstream in Virden. The town now requires additional flood protection options to mitigate future flood risk. Virden is currently updating its flood zone maps within its municipal boundaries as a first step towards implementing municipal flood protection works.

Colin Corneau @ Brandon Sun

"The issues in Virden are pressing and representative of the major climate adaptation issues in hundreds of communities across Manitoba and the Prairies," says Dr. Henry David Venema, planning director, Prairie Climate Centre, International Institute for Sustainable Development. "Climate change is projected to increase the risk of both flood and drought on the Canadian Prairies, and motivates an expanded review of hydrologic risk mitigation options for Virden."

Venema is involved in many plans for water and climate-related issues across the Prairies and beyond. He is leading the design of several important strategic efforts, none perhaps more timely than the Large-Region Climate Adaptation: The Investment Case for Multifunctional Storage in the Assiniboine River Basin, which features Virden's current hydrology, and other major modelling efforts underway.

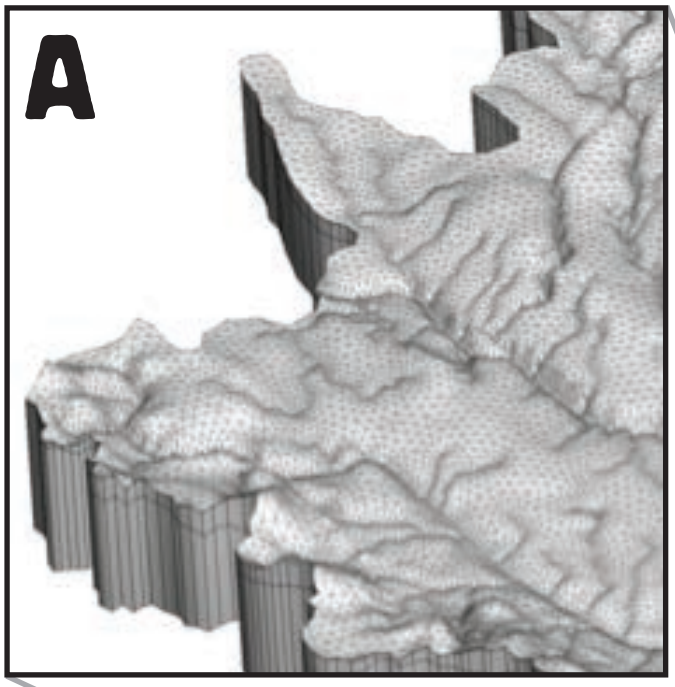
Those include the MFGA Aquanty Project model's hard look at the role of forages and grasslands as flood and drought mitigation tools within the agricultural landscapes of the nearby Birdtail Creek and Scallion Creek. Those tools may help provide solutions for the catastrophic kind of days that Johnson and other Virden and surrounding area leaders fear most.

Fortunately, for the Virden scenario, there are like-minded individuals who share Johnson's and Venema's push for solutions upstream as well with wise land choices. Ryan Canart is the manager of the Upper Assiniboine River Conservation District (UARCD) headquartered in Miniota, Man., north of Virden through the scenic Assiniboine River Valley. This portion of the watershed makes up some of the farthest western reaches of the Assiniboine River Basin within Manitoba.

Canart is no stranger to this landscape. He lives and ranches along the Bosshill Creek and his great-grandfather homesteaded nearby in the headwaters of the Scallion Creek. With his personal connection with most residents of this region and an impressive data set built from the UARCD's 2010 Integrated Watershed Management Plan, Canart and the UARCD were available to help bolster the MFGA's Aquanty Project Model for the Assiniboine River Basin.

Canart says the ability to dig deeper and better understand Virden's hydrology while showing other communities in the Assiniboine River Basin the power and performance of the MFGA Aquanty model is the next phase of the model's evolution.

"We intend to use the model to demonstrate to local stakeholders and policy-makers alike that we can achieve flood risk reductions in Virden and the surrounding farmland," says Canart. "Smart, strategic and effective land use choices based on the model's output can be engaged to not reduce the economic performance of the region. In fact, just the opposite. We will all be better off utilizing the power of this decision support tool."



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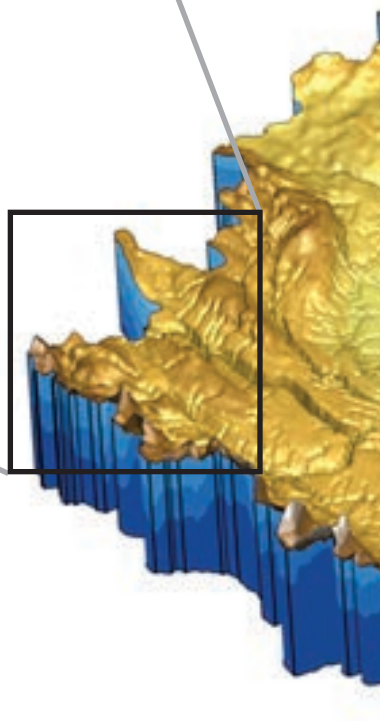

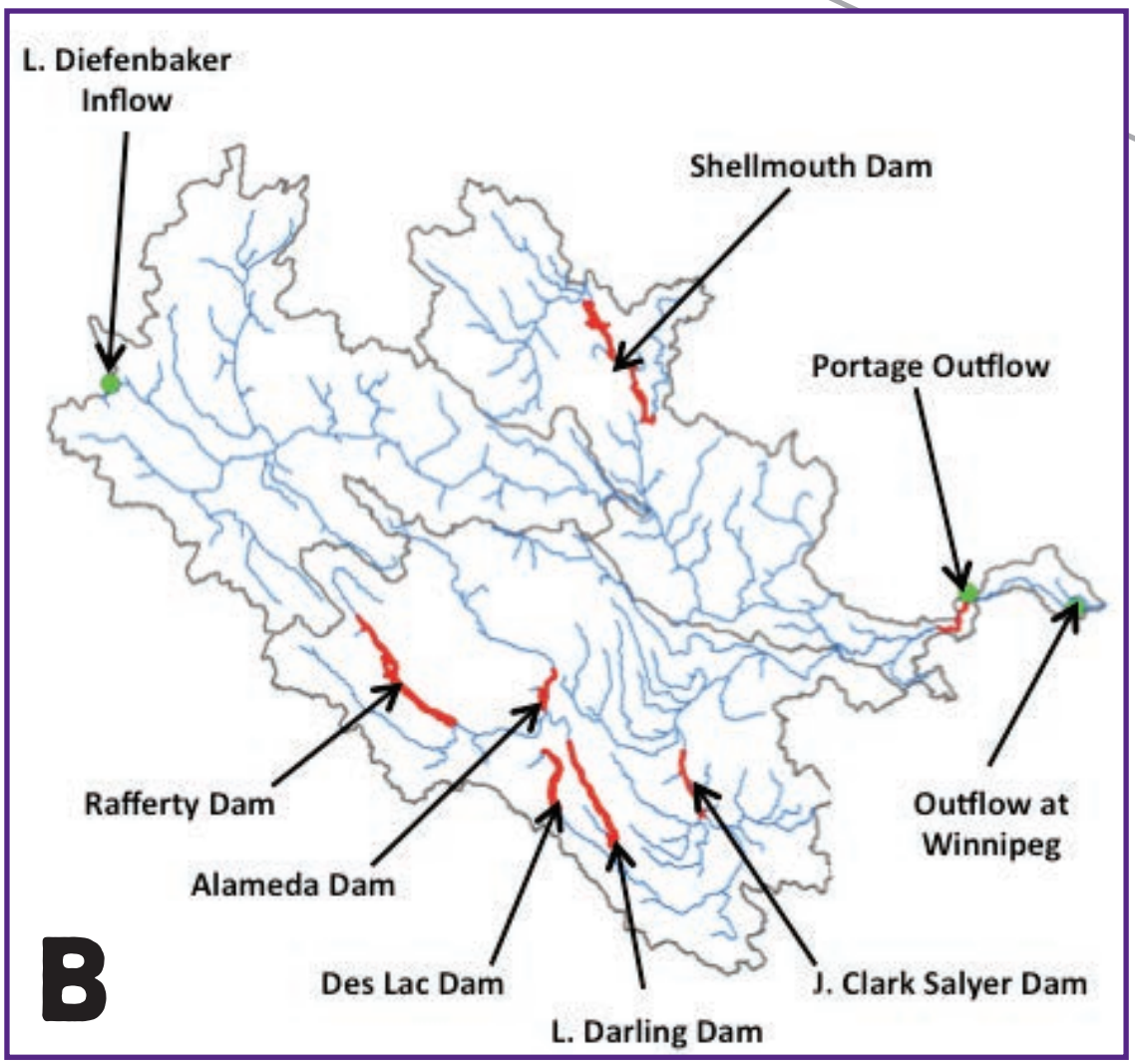

Groundwater Head (m A.S

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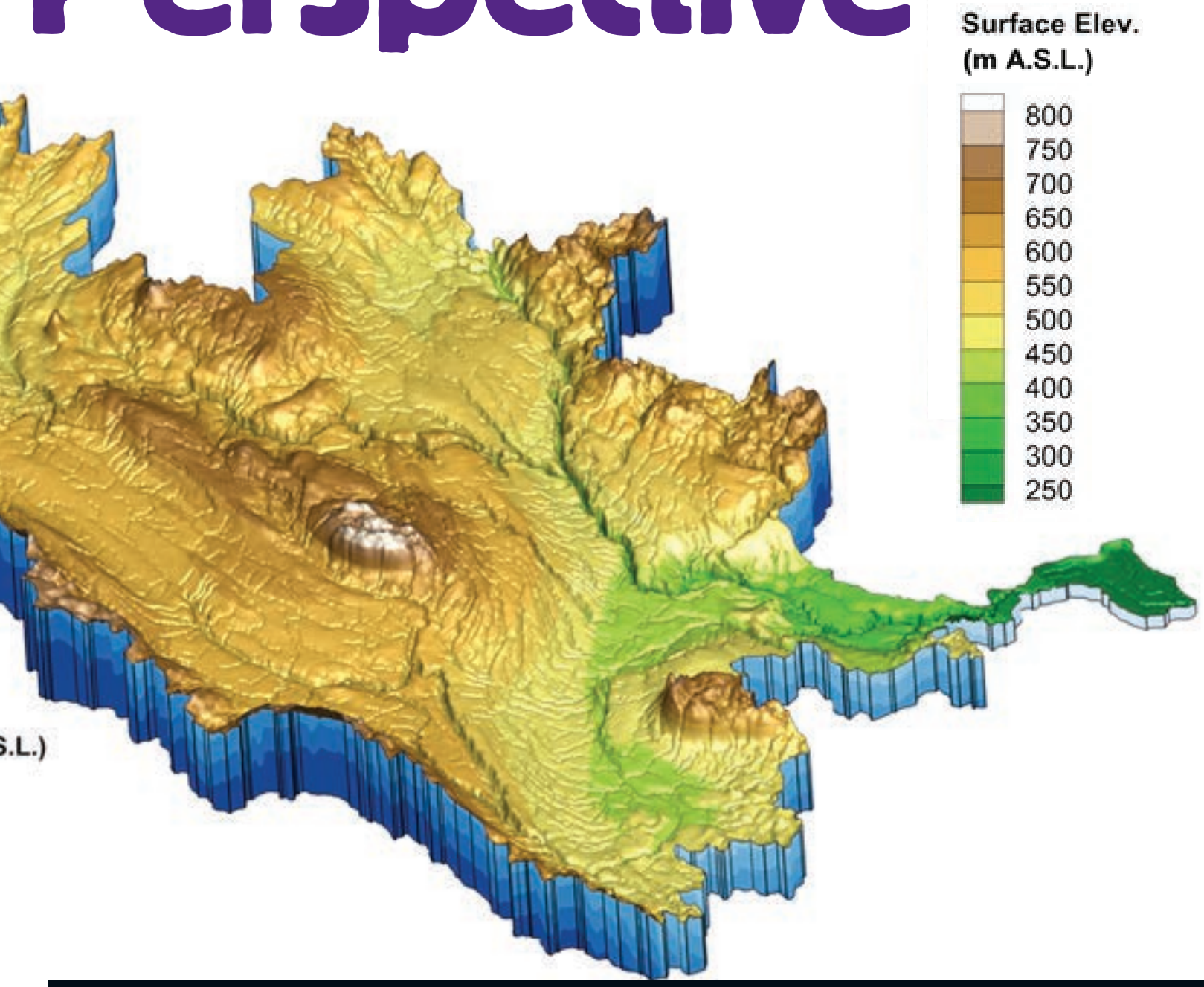
Virtual Perspective



Key physical and hydrologic features of the Assiniboine River Basin are represented digitally in the 3D framework (inset A) of the HydroGeoSphere model, including the major surface water operational structures (inset B), and topography and groundwater (main image)

HYDROLOGY MODEL
FLOOD AND DROUGHT REDUCTION PLANNING
BY: VIRGINIA WILKINSON

It's been an exciting 20 months for ISM Canada as part of the Manitoba Forage and Grassland Association (MFGA) Aquanty Project team developing a unique new hydrology model of the Assiniboine River Basin (ARB). The model is positioned to help to inform land managers, government and stakeholders with leading-edge flood and drought reduction planning, and is on schedule for completion by March 31, 2018.

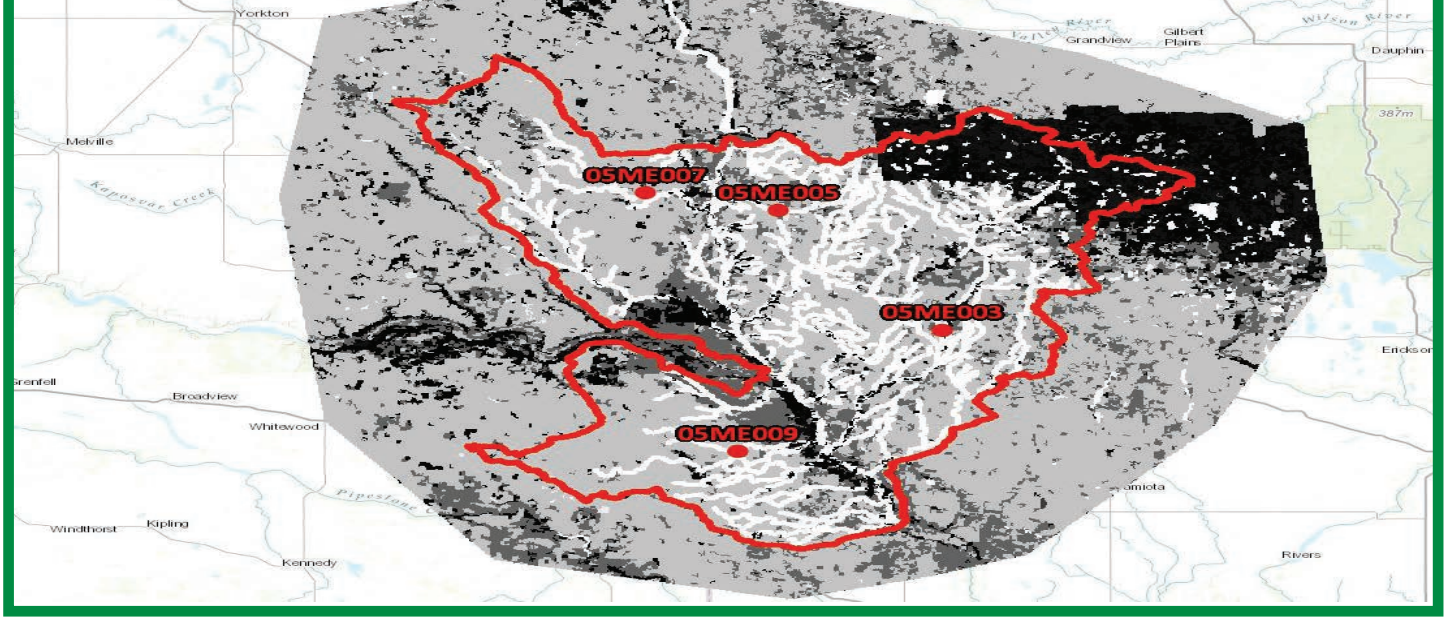
The model pulls together a range of data sets, providing the ability to predict how changes to the land, land use practices and the weather will prevent or reduce floods or droughts in future. The model focuses on water management and uses forages and grasslands for their risk mitigation values and
potential in the ARB.
ISM's role on the project has been to develop the web-based data analytics system which is used to aggregate different data sets, taking the results from Aquanty's model, and producing consumable and actionable outputs for decision makers.

"This project has been very exciting because of its ability to provide such deep insight into how changes to the land use, even minor ones, can impact that land into the future," says Travis Juffinger, predictive analytics specialist, ISM Canada.
The model has been developed so that it can provide a prediction in response to any question relating to the data within it. The model enables a number of different options for examining outcomes of the data analysis. Each of the options includes a comparative analysis function that can integrate a deeper level of analytics into the platform. It enables the comparison of results between different scenarios; for example, the effectiveness of varying widths of riparian vegetation buffers. The Map Viewer is a simple application which enables the viewing of spatial data and can be configured to allow users to "drill down" to focus on specific areas of interest.

The Story Map uses a presentation-style application that can be presented as a story. A story map can detail the path from scenario definition, to the results produced by the model (based on a number of variables related to that problem), through to real-world recommendations based upon the data from the model.

The Time Series application enables the ability to visualize simulated changes over time. It can be constructed for a variety of metrics including soil saturation, soil moisture, etc.

The project team will use the model to examine a broad range of different land use and weather scenarios over the next few months. It is anticipated that in the longer term, the model will be used by land managers, governments and stakeholders as a critical decision support to mitigate the impacts of flood and drought in the ARB into the future.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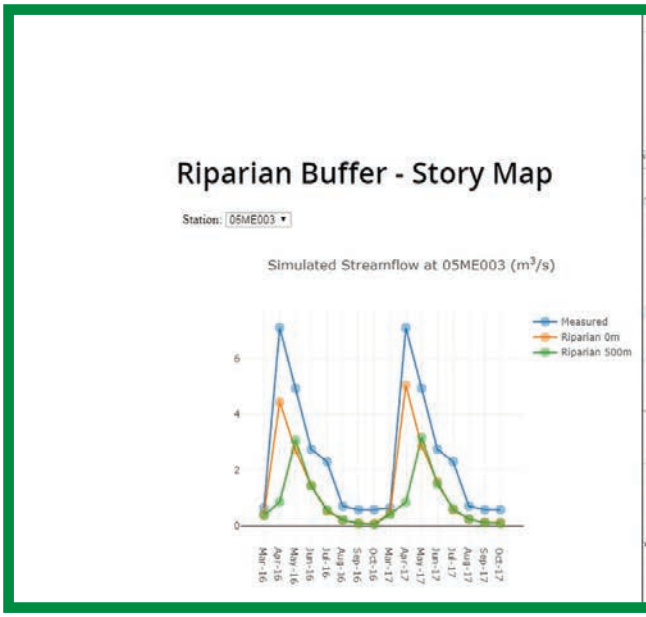
Riparian Buffer - Story Map
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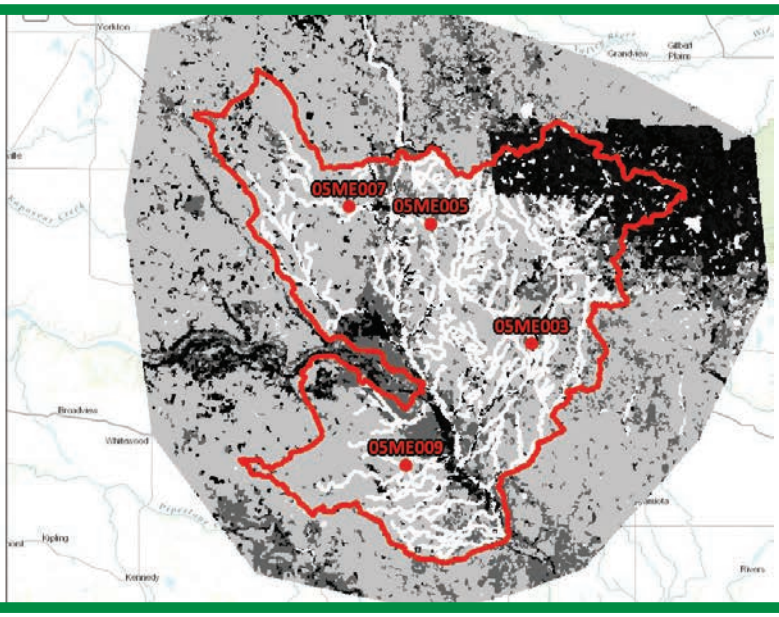
Simulated Streamflow at 05ME003 (m³/s)
Measured
Riparian 0m
Riparian 500m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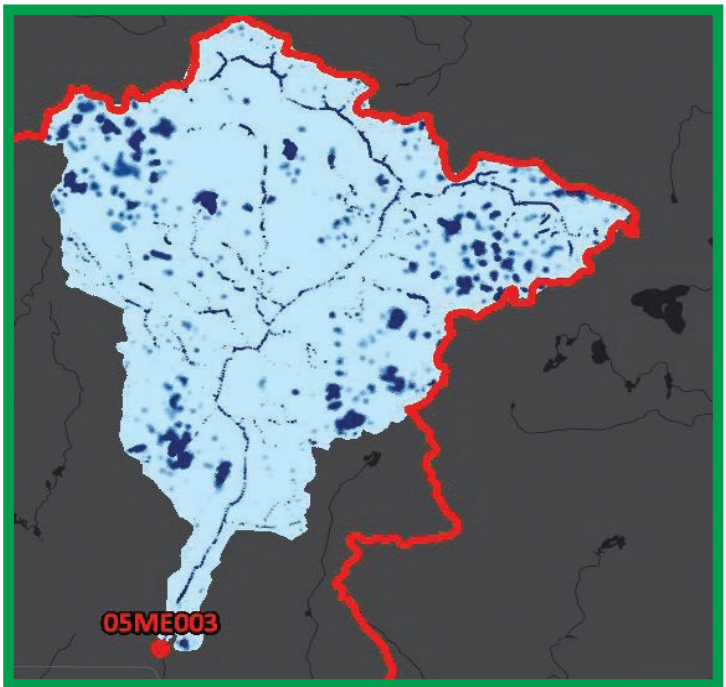
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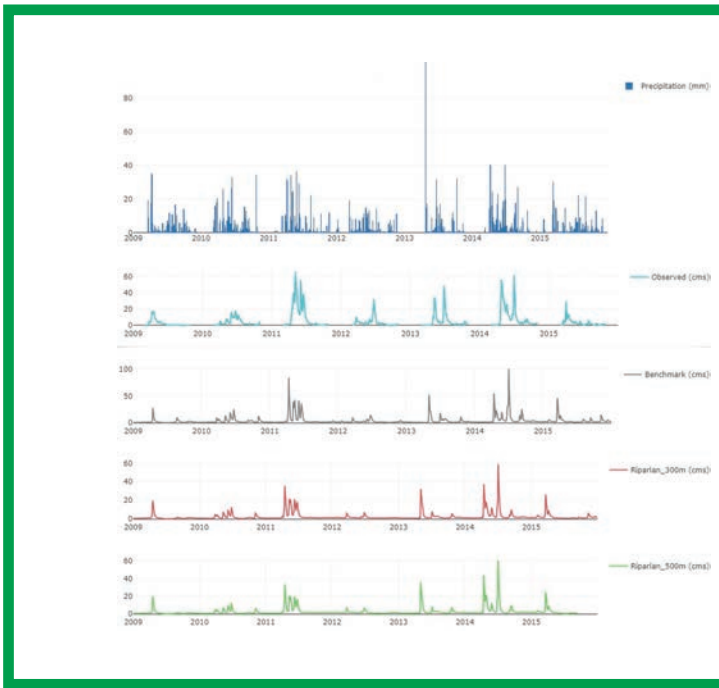
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ARBI: A REALLY BIG IDEA

BY LORRAINE STEVENSON

The acronym ARBI doesn't stand for A Really Big Idea – but it could.

A half decade ago that's what the Assiniboine River Basin Initiative was when those in Manitoba, North Dakota and Saskatchewan began to envision an organization to more cooperatively manage water flowing across their jurisdictions and boundaries.

It became a reality in 2014 after the Assiniboine River Basin Initiative (ARBI) began organizational development and fitting all the pieces together, including the multiple agencies supporting it and the projects and priorities they'd agreed to work on.

This past year ARBI released their Framework Plan to serve as the organization's own guiding document. It's an annual work plan that states ARBI's mission and vision, the key issues it will focus on and expected outcomes for membership, says ARBI chair Dr. Allan Preston.

Key areas in it include drainage-related topics both urban and rural, flooding and drought, water quality both in-stream and downstream, wetlands and riparian zones, soil conservation, and fish and wildlife and outdoor recreation.

"With respect to drainage and wetland protection, we do not yet have the analysis to precisely pinpoint how much landscape water storage is required to stem the impact of spring runoff and flooding," says Preston.

However, ARBI does endorse the principle of "no net loss," which involves setting aside wetlands in proportion to those being drained. It's an approach now detailed in Manitoba Sustainable Development concept documents, although not included in Saskatchewan drainage policy. Preserving "existing wetlands and expanding wetlands or, indeed, expanding forage and grassland acres to act as a sponge to soak up and hold back water, are certainly elements of a program going forward," Preston says.

ARBI is a valuable part of the Manitoba Forage and Grassland Association (MFGA) Aquanty Project that is looking at forages and grasslands in times of flood or drought ahead across the Assiniboine River Basin via the Aquanty HydroGeoSphere model.

Both Preston and ARBI executive director Wanda McFadyen serve on the project's management team and the MFGA Aquanty project's


Dr. Allan Preston

steering committee is co-chaired by Preston.

MFGA is the project proponent and along with Agriculture and Agri-Food Canada's Agri-Risk Initiative will be the licence holders for the risk management tool under development by the Canadian firm Aquanty Inc.

The MFGA Aquanty Project is right on time for completion March 31, 2018, and the project roll-out that will follow soon after is much anticipated, for stakeholder group representatives, who want access to the planning tool to help them predict and monitor how water and land interact in the basin.

Water managers in the Upper Souris Watershed Association in Saskatchewan have used other platforms to model their own sub-basins and gauge flow characteristics under various weather scenarios, says David Pattyson, the association's Estevan-based executive director. Their expectations of the model are that it will provide a glimpse of larger-scale scenarios, he says.

"The Aquanty model will give us opportunity to layer some of this data in a larger geography," he says. "Where we see an advantage to the Aquanty model is that we can take a look at these systems to see how resilient they are to areas of extreme precipitation. Obviously, water quantity for supply is ample in those years. But in years of drier conditions it will be a tool that should give us a little bit of a glimpse into predictability as far as sustainable draws on these water supplies."

"I think it will be a very useful tool in our tool kit as we move forward and grapple with some of the water-related issues here in the basin," he adds.

Pat Fridgen, director of planning with the North Dakota State Water Commission in Bismarck and another ARBI executive committee member, is also keen to see what the MFGA Aquanty Project model can do.

"I've heard a lot about what it should be able to do," he says. His key expectation is that it will be readily accessible to those who need to use it.

"It hopefully will be available out there for water managers to use at a cost that's reasonable," he says. "That's been the whole focus of mine, that it be as available and accessible as possible."

Municipalities' public works or water resource department managers, for example, view it as a helpful planning tool for decision-making on road construction and subdivision location, by using it to predict how major rain events or spring runoff could impact their designs or locations. Likewise, land use managers at conservation districts, water resource boards and water stewardship associations also see it as a planning tool.

Hands-on workshops about the model have been held in Winnipeg and Brandon, with another currently scheduled for Regina early in 2018, says Preston.

ARBI, meanwhile, continues all its other work as a conduit, bringing member agencies together and working on various cross-border issues and concerns.

Saskatchewan landowners' 600 Creek Project to drain over 30,000 acres of land affecting parts of southwestern Manitoba is a prime example of where ARBI has been able to serve in the capacity it was first envisioned.

"On behalf of ARBI, we've travelled extensively around the Assiniboine River Basin this year," says Preston. "Everywhere we go, people are searching for solutions around water and land use. The time for planning our future with the best decision support tools and creating the most effective land-use programs possible is right now."

Potential Model Applications

By Steven Frey

The HydroGeoSphere (HGS) models have been built with the idea that land use change scenarios can be readily incorporated into future simulations in order to test the influence of land cover on the hydrologic behaviour of the Assiniboine River Basin and its three major sub-basins, the Qu'Appelle, Souris and Assiniboine. Additionally, the hydraulic properties of the surficial soils can also be readily changed, providing opportunity to evaluate how agricultural soil health initiatives could provide secondary benefits towards hydrologic end points. From the perspective of rural municipalities and urban areas across the basin, there is opportunity to use the model's ability to zoom in on localized regions for detailed flood risk analysis linked directly to the larger basin behaviour.

It is also important to note that although the models are currently configured to simulate the historic hydrologic behaviour of the basin, the weather scenarios used to drive the simulations can be replaced much like the land cover and soils data. Therefore, any number of potential future climate or extreme weather scenarios can be evaluated for possible influences on the basin's hydrologic behaviour, with the acknowledgement that such analyses carry considerable uncertainty.

Finally, it is also important to recognize the quantitative and physically based nature of the HGS model analysis: detailed insight on hydrologic indices (such as river flow rates) can be gleaned in a measurable manner from the different scenario analyses. This type of functionality makes the HGS models ideal tools for helping to evaluate and quantify the large-scale ecosystem goods and services value associated with land and soil management across the Assiniboine River Basin.

Given that the first phase of the project has extended across only 24 months, not all of the above opportunities have thus far been investigated. However, with the basic models now fully constructed, it can be considered that the "heavy lift" has been made and subsequent applications will be able to leverage this extensive effort.

Aquanty's Steve Frey holds clump of healthy soil during June 2017 tour of Nerbas Farm near Shellmouth, MB.

MFGA AQUANTY
PROJECT BACKGROUNDER

Funding for the MFGA's Aquanty project is chiefly provided by an Agriculture and Agri-Food Canada (AAFC) AgriRisk Initiatives (ARI) Program – Research and Development Stream funding commitment of $1,145,800 and Manitoba Agriculture's commitment of $180,000 to the two-year project. The remainder of the $1,732,300 total
project funding will be provided by partners and supporters via a combination of in-kind and cash contributions.

Term of the Project: March 1, 2016 to March 31, 2018

Applicant/Recipient: Manitoba Forage and Grassland Association (MFGA)

Primary Funder/Program: Agriculture and Agri-Food Canada (AAFC), Growing Forward 2, AgriRisk Initiative

Secondary Funding Partner: Manitoba Agriculture, Growing Forward 2, federal-provincial-territorial initiative

Key Partner: The Assiniboine River Basin Initiative (ARBI)

Core Contractors:

1. Aquanty Inc.: Aquanty Inc.'s core technology is the Hydro-GeoSphere (HGS) hydrologic simulation software. Aquanty Inc. uses a range of high-performance computing resources to run physically complex simulations of water movement through surface water and groundwater flow systems.
2. ISM/IBM: ISM, sub-contracted to Aquanty Inc., will develop a web-based data analytics system (based on the Cognos platform) to interpret the output from the HGS model for the ARB and its major sub-basins, and will provide user-friendly interfaces for multiple stakeholders to interact with the HGS output.

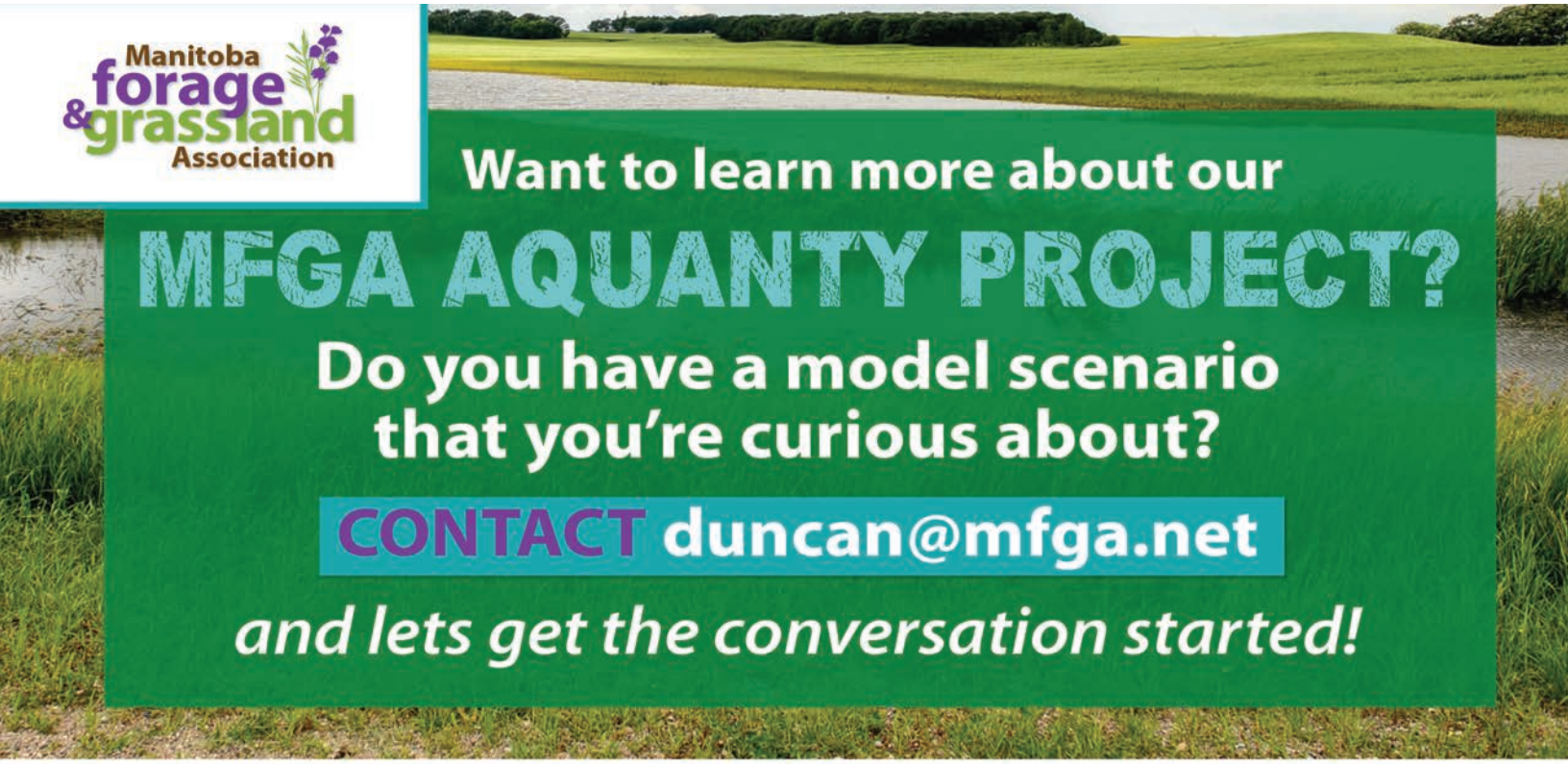
Steering Committee:

- Keystone Agricultural Producers (KAP)
- Agricultural Producers Association of Saskatchewan (APAS)
- Manitoba Beef Producers (MBP)
- Manitoba Conservation Districts Association (MCDA)
- Upper Assiniboine River Conservation District (UARCD)
- Brandon University (BU)
- Assiniboine Community College (ACC)
- Manitoba Sustainable Development
- Manitoba Infrastructure
- Manitoba Agriculture
- City of Minot, North Dakota
- Town of Virden, Manitoba
- Aquanty Inc.
- ISM Canada – An IBM Company
- Assiniboine River Basin Initiative (ARBI)
- Manitoba Forage and Grassland Association (MFGA)

Letters of Support

- International Institute for Sustainable Development (IISD)
- Manitoba Habitat Heritage Corporation (MHHC)
- Manitoba Canola Growers Association (MCGA)
- Manitoba Agricultural Services Corporation (MASC)
- Prairie Improvement Network (PIN)

Governance: Project Management Team comprised of MFGA and ARBI representatives



Putting a Value On Grasslands

By Angela Lovell

Grasslands provide a range of important ecological goods and services (EGS) as well as cultural and recreational benefits to society, but they are currently the most endangered ecosystem in the world.

Grasslands provide habitat for wildlife and increase biodiversity, attracting pollinators and more bird species, but they also sequester carbon, improve soil health, manage water on the landscape, prevent soil erosion and slow the runoff of nutrients into rivers and lakes. Grasslands reduce the negative effects of floods and droughts by holding more water on the land and allowing water to infiltrate deeper into the soil via their deep root systems.

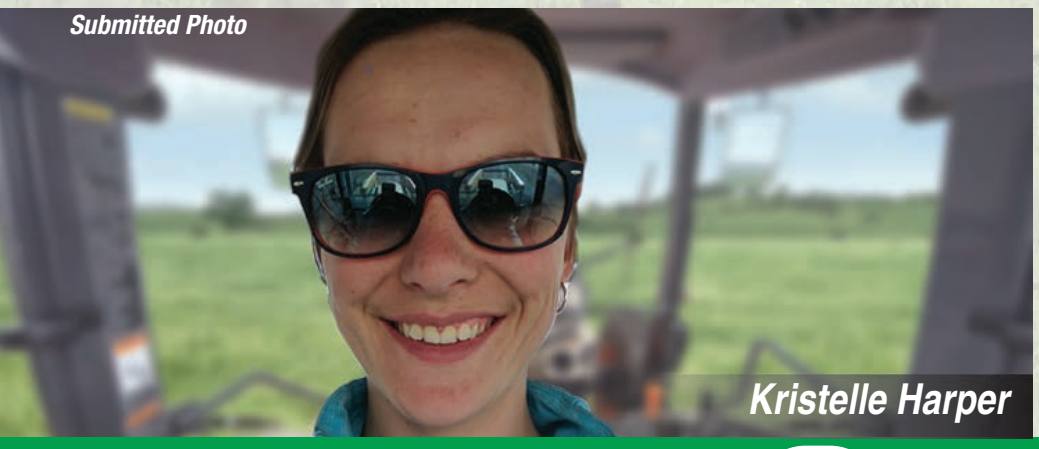
In order to support initiatives aiming to maintain grasslands on the landscape, it is first necessary to better understand the extent of the EGS that they offer, and in particular, their positive impact on hydrology. The Manitoba Forage and Grassland Association (MFGA)'s Aquanty project is currently developing simulation tools to measure and quantify the hydrologic aspects of grassland EGS. This tool-set is designed to provide science-based decision support information for those interested in flood/drought risk mitigation strategies, and how grasslands and the agricultural landscape can play a leading role.

The first phase of the MFGA Aquanty project is looking at the impacts of perennial forages and grasslands on the hydrology of the Assiniboine River Basin in times of flood or drought. From this careful mapping and detailed analysis of the physical properties of the basin, predictive models are being developed that can look at risk scenarios and assess how various land and water management options would impact the basin's hydrologic characteristics.

"In the initial phase of the work, flood and drought risks are front and center," says Henry Nelson, MFGA's Aquanty Project Manager. "But eventually, the intent is to utilize the model to quantify the value of grasslands on the landscape for carbon sequestration, soil health, habitat, biodiversity, and cultural and recreational services."

As of now it is hard to fully understand, but once the influences of grasslands are quantified, it will then be possible to assign an actual dollar value to the EGS that grasslands provide through a cost benefit analysis which will show their real economic value to agriculture and society.

With the flood and drought risk mitigation aspects of the MFGA Aquanty Project soon in hand for decision-makers to consider, the group hopes that the economic values of grasslands and other natural areas to society will soon follow.



Submitted Photo

Kristelle Harper

Kristelle Harper understands the economic impact of converting her

family's cattle operation, Circle H Ranch near Brandon, Man., to a 100 per cent grassland system. Since 2013, she and her dad Brian have produced just under 7,000 pounds more beef off a 130-acre pasture through high stock density grazing, which means having large numbers of animals in a smaller area and moving them multiple times a day. Besides seeing economic benefits, they now recognize the importance of managing the grasslands to maintain productivity in dry years.

Submitted Photo

Dimple Roy

"With the biological life and organic matter increasing in our soil, our water and mineral cycles are improving," says Harper, who also serves as the research coordinator for the Manitoba Beef and Forage Initiative's three demonstration sites in the Brandon area.

Henry Nelson

"There's increased water infiltration due to deep perennial plant roots and soil aggregation that creates channels for water and air to access deeper soil profiles. Even during drought conditions, we can produce more than enough forage to support our operation. Organic matter – which also holds a lot of water – has increased more than one per cent in three years. We harvest more beef, retain more water and sequester more carbon than we ever did before."

Why grasslands are being lost at such a rapid rate is another question that needs an urgent answer. Undoubtedly, economics is a big reason. Rising land prices mean more landowners are looking at developing acres which are more profitable and have better risk protection options.

Given this trend, landowners will need a strong economic argument as rationale to restore or conserve grasslands. While it's clear that the benefits that grasslands' EGS provide are worth real dollars, there is a need for revenue-based incentive programs that recognize and reward their economic value. Currently the Manitoba government is exploring an incentive-based approach to retain grasslands and wetlands as part of their recently-announced Growing Outcomes in Watersheds (GROW) program.

"Incentives need to be targeted and focused on the grasslands that are the most vulnerable and that provide the most benefits and should be designed so that their impact can be measured," says Dimple Roy, director, Water Program at the International Institute for Sustainable Development. "Incentives are good for building momentum on restoring something, creating behaviour change and starting a certain practice that will maintain itself."

Ideally, says Roy, markets will eventually develop to pay for and sustain the EGS grasslands provide. In the longer term these could include markets for things such as plant-based fuels and plastics and fertilizer recovered from plant biomass. Today, markets are already emerging worldwide for carbon, something that grasslands are good at sequestering. For example, the Harpers have increased their soil carbon by 7.5 tons per acre per year since 2013, and if carbon was valued at $20 a ton, that represents a $150 per acre value per year.

As governments develop plans around carbon, the hope is that they will recognize the contributions that grasslands can make to mitigating climate change through sequestering carbon. The MFGA Aquanty Project is a great tool to have in support of land-use decisions for future programs.

"The real benefits to individual farmers are going to come through programs that will make it more profitable to maintain grasslands and forages on the landscape for the good of agriculture, and the public good," says Nelson.

Hydrologic Benefits of Grasslands

By: Steven Frey

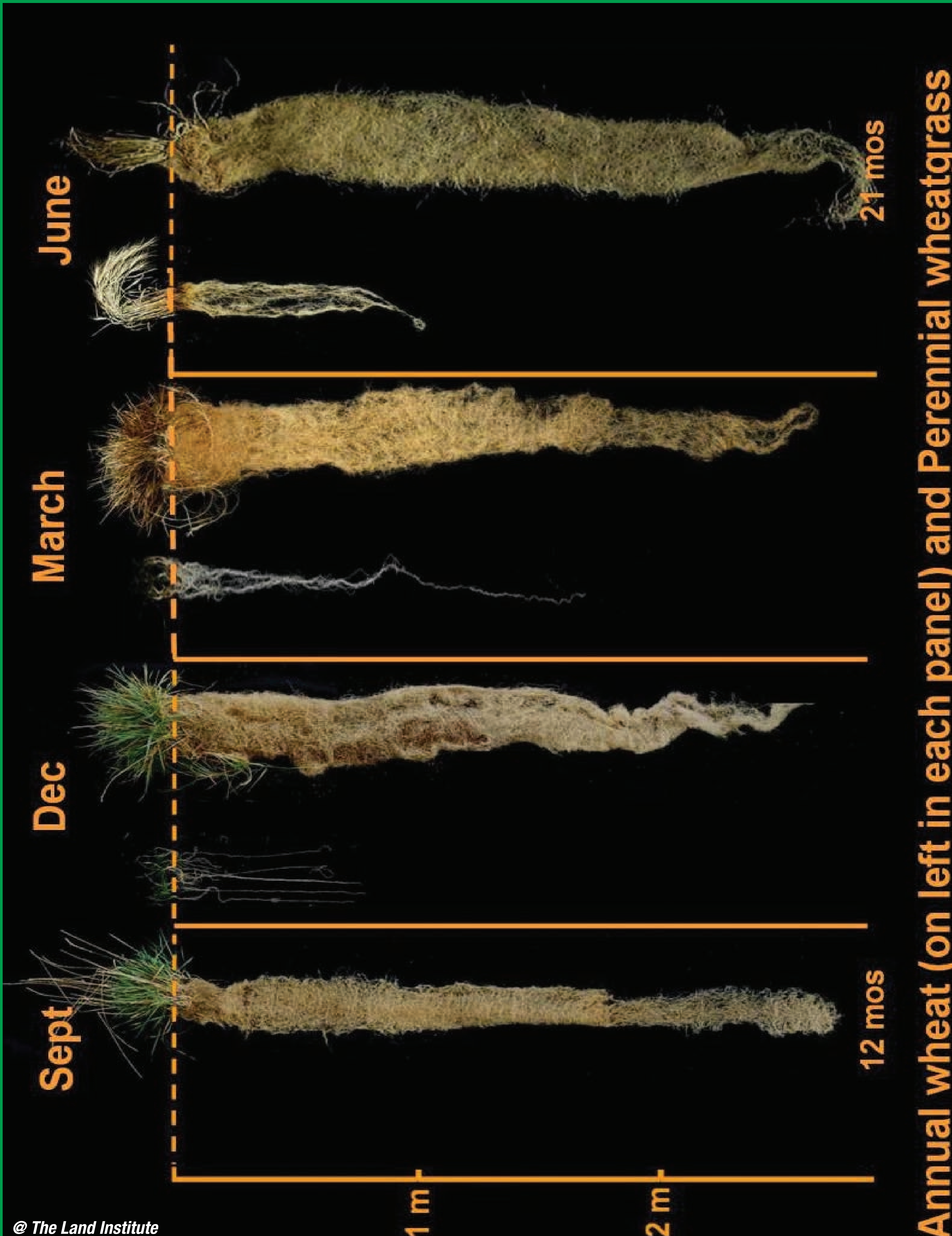
Among the wide spectrum of ecosystem goods and services that grasslands provide are improvements in the hydrologic characteristics of prairie watersheds, which can be termed “hydrologic services.” These hydrologic services include reduction in flood peak flows by slowing runoff to collecting streams and increased retention of water on the landscape, thus improving soil moisture levels during dry periods.

One of the most obvious hydrologic services provided by grasslands is an increase in the frictional resistance to overland flow. For example, it is common in surface water flow modelling to represent ground surface friction with a parameter called the Manning’s coefficient (named for the engineer who derived the relationship), and when modelling flow across grasslands, it can be expected that the Manning’s coefficient can easily be five times higher than that of bare soil. This added friction works to keep water on the land longer during extremely wet conditions (such as spring melts and heavy rains), which in turn acts to reduce peak flow rates in rivers and streams at critical times when flood risks are greatest.

Grasses and their associated dense root network are also well recognized for their ability to increase soil structure and soil organic matter levels, in such a way that the permeability and water holding capacity of the soil is increased. Increased permeability leads to increased infiltration during extremely wet conditions, which acting similarly to the increased friction, reduces peak flow rates in rivers and streams.

Furthermore, the increased water holding capacity of the soil means more water is available to plants, for a longer time, during dry conditions.
Beyond the increase in overland flow resistance, permeability and water holding capacity, grasses provide additional hydrologic benefits during the over-winter and spring melt intervals. Considerable work has shown that grasses act to trap blowing snow, thus keeping snow distribution more even across the land surface, and less concentrated in ditches and other low-lying areas. This in turn reduces the likelihood that snowmelt water quickly finds its way into rivers and streams during the critical spring melt interval, thus decreasing peak flows.

Furthermore, by retaining water (as snow) on the landscape, there is a greater opportunity for infiltration during the spring melt, thus promoting increased soil moisture levels, which can then promote plant growth. In addition, increased snow cover provides increased thermal insulation for the underlying soil profile. In this sense, grasses can reduce the depth of frost penetration, which can then further promote meltwater infiltration during the spring melt. A warmer soil profile also provides a more hospitable over-winter environment for the soil microbiota that act to improve soil health, which then provides further positive feedback to the permeability and water retention properties of the soil.


Sept
Dec
March
June
12 mos
21 mos
1 m
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Annual wheat (on left in each panel) and Perennial wheatgrass
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