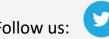


Welcome to *The Current*, the North Central Region Water Network's Speed Networking Webinar Series

# Nutrient Reduction Best Management Practices in Cold Climates: 2PM CT

- 1. Submit your questions for presenters via the Q&A panel. There will be a dedicated Q & A session following the last presentation. The Q&A panel can be found via the Q&A icon at the bottom of the webinar screen.
- 2. If you are experiencing technical issues or have questions about the North Central Region Water Network or *The Current* Webinar Series please use the chat feature. The chat feature is accessible via chat icon at the bottom of the webinar screen.
- 3. A phone-in option can be accessed by clicking the up arrow on the mute icon and clicking 'Switch to Phone Audio'.

This session will be recorded and available at northcentralwater.org and learn.extension.org.



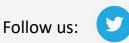




#### Today's Presenters:

- **Mike Ell**, former Environmental Sciences Administrator, North Dakota Department of Environmental Quality
- Jason Vanrobaeys, Lead for Agroecosystem Resilience, Agriculture and Agri-Food Canada
- **Mitchell D. Timmerman**, Agri-Ecosystems Specialist, Manitoba Agriculture and Resource Development

Follow @northcentralh2o and #TheCurrent on Twitter for live tweets!







#### Mike Ell



Mike Ell graduated from North Dakota State University in 1982 with a BS degree in Zoology and in 1985 he received his MS degree in Zoology. Following graduation Mike began his career with the North Dakota Department of Health working in the Atmospheric Deposition Program. Beginning in 1992 until his retirement in May 2019, Mike Ell served as the Environmental Sciences Administrator in the North Dakota Department of Health's Watershed Management Program, now the North Dakota Department of Environmental Quality. Mike is married to his wife of 39 years, Lana, has two children Katie and Jacob and two beautiful granddaughter, Aubree (14) and Amiya (10). During retirement Mike enjoys fishing, hunting, golfing, and taking care of the "girls." He is currently in the process of building a new lake cabin in Minnesota where he plans on spending a lot more in time in retirement.





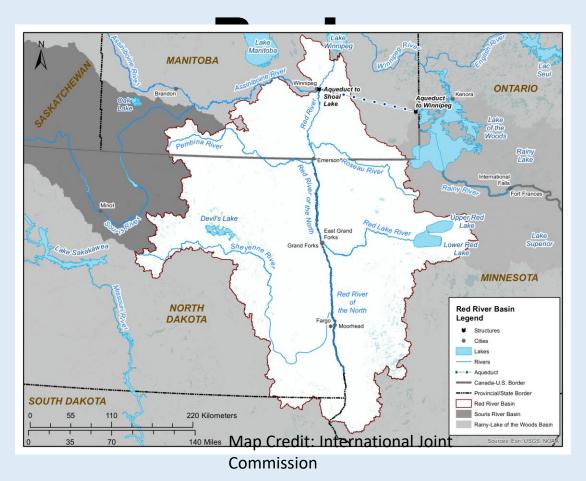
## RED RIVER BASIN / COLD CLIMATE AG NUTRIENTS BMP WORKSHOP

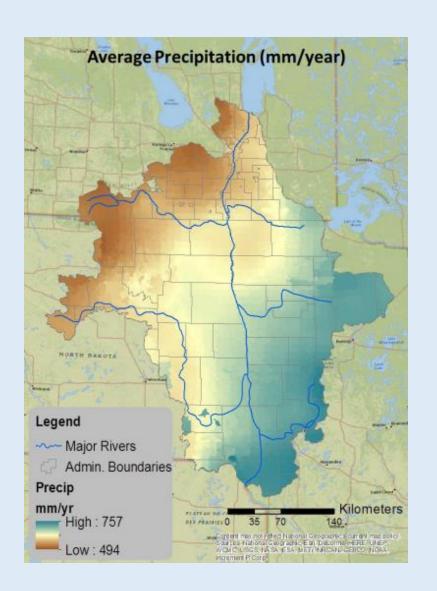
**Introduction, Purpose and Process** 

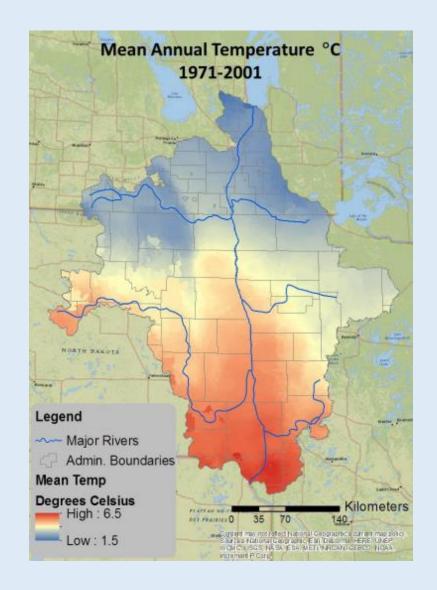


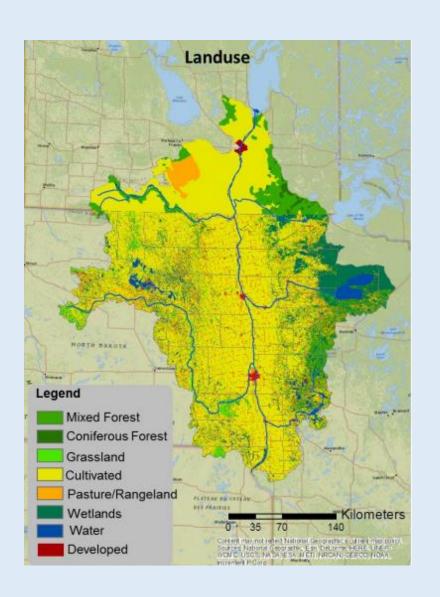


# Introduction to the Red River of the North

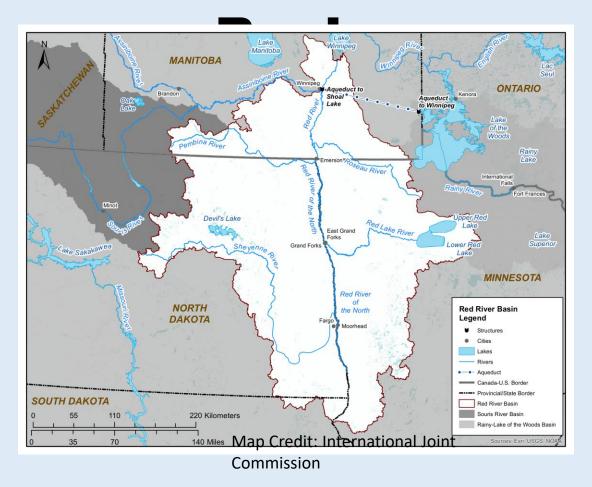








# International Red River of the North



# Relevant Components of the IRRB Nutrient Management Strategy

- Develop a shared understanding of jurisdictions nutrient regulatory frameworks.
- Recommend and implement Nutrient Load Allocation and/or Water Quality Targets for Nutrients.
  - Identify high priority areas for implementing nutrient reduction measures.
  - Identify nutrient reduction actions and activities for the Red River basin that could assist in achieving nutrient load allocations and/or water quality targets for nutrients.
  - Develop a common set of indicators for measuring progress.

#### Unique Characteristics of a Cold Climate

- A short growing season reduces agronomic options and time available for BMP implementation.
- Precipitation falls as both rain and snow, which affects where and when water accumulates and moves.
- Snowmelt is a mechanism for runoff, which influences runoff timing and the forms of nutrients contained in runoff.
- Freeze-thaw events, both their frequency and duration, affect water and nutrient dynamics.

# Additional BMP Implementation Considerations in the Red River Basin

- Multiple political jurisdictions
- Soil Texture predominantly fine to very fine-textured
- Topography predominantly nearly level

Surface and Subsurface Drainage

- · First **Organization** meeting June 29, 2017
  - 7 participants
- Planning committee expanded to 40 members
  - State, provincial and federal agency staff
  - University extension staff and researchers
  - Soil and water conservation/management districts
  - Commodity groups
  - RRBC and NCRWN support



# Workshop Objectives

Describe the current factors and mechanisms affecting nutrient fate and transport on agricultural lands and their delivery to surface waters;

•Discuss pertinent research regarding BMPs designed to reduce nutrient loss from agricultural lands;

·Identify gaps in our understanding of BMPs designed to reduce nutrient loss and to determine the potential for collaborative research efforts to address those gaps;

Develop a report documenting the discussion and potential areas of consensus regarding BMP recommendations to farmers.



- · Setting **Outline** with basin characteristics.
  - Geology, soils and soil nutrients\*.
  - Hydrology, runoff characteristics and water quality trends\*.
  - Cropping and livestock management systems in the basin.
  - Other natural resources concerns in the basin.

    \* Presented in a pre-workshop

webinar.

- · Nutrien Outlige ent BMPs
  - Cropping Systems
  - Integrated Livestock Systems
- Nutrient Transport Reduction BMPs
  - Field Erosion Pathways
  - Field Runoff Pathways
- Vegetative BMPs
  - Nitrogen
  - · Phosphorus

<sup>\*</sup> Presented in a pre-workshop webinar.

- · Structur Qualitye
  - Surface Drainage
  - Subsurface Drainage (i.e., tile drainage)
  - Subsurface Drainage Treatment
- Integrating BMPs and Addressing Multiple Resource Concerns
  - Stacking BMPs to Maximize Nutrient Reduction
  - Addressing Multiple Benefits

<sup>\*</sup> Presented in a pre-workshop webinar.

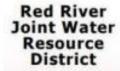
## **Break-out**

- · Followed Sters stroms resentations.
- Tasked with:
  - Gathering additional information on the BMPs discussed.
  - Reach consensus on BMPs that work.
  - Identify BMPs which should be a priority for implementation.
  - Identify additional research needs for BMPs applied in cold-climates.
- Break-out reports to the group.
- Presentations and reporting summarized by technical writers.
  - Nitrogen
    - Dr. David Mullu, PhD., University of Minnesota
  - Phosphorus
    - David Whetter, AgriEarth Consulting, Ltd.

# Thank you

- · Workshop<sup>t</sup> planning committee
- Workshop participants
- Red River Basin Commission
- North Central Region Water Network
- University of Minnesota Crookston











Northwest Regional Sustainable Development Partnership

UNIVERSITY OF MINNESOTA EXTENSION





**Division of Water Quality** 

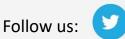




#### Jason Vanrobaeys



Jason grew up near Elie, Manitoba. His education includes a Bachelor of Science in Environmental Science, a Master of Science in Environment and Geography, and an Advanced Diploma in Geographic Information Systems. He has worked for Agriculture and Agri-Food Canada since 2000 and has been at the Morden Research and Development Centre in Manitoba since 2006. His experience includes over 20 years of soil and water conservation projects with a specialization in hydrology, water quality, and watershed management technology. Jason is currently the Lead for Agroecosystem Resilience in the Living Laboratories Division of the Science and Technology Branch.





## Cold Climate BMP Performance for Nutrient Reduction in the Red River Basin

2019 International Workshop and Report Summary





## **Workshop Summary Report**

#### Co-authors:

- David Whetter, M.Sc., P.Ag., AgriEarth Consulting Ltd.
- Dr. David Mulla, Department of Soil, Water, and Climate, University of Minnesota



Photo credit: Red River Basin Commission



Report Sub-Committe	ee
Member	Agency / Institution
Mike Ell	North Dakota Department of Environmental Quality (retired)
Greg Sandness	North Dakota Department of Environmental Quality
Scott Korom	North Dakota Soybean Council
Jeppe Kjaersgaard	Minnesota Department of Agriculture
Rita Sveen	United States Department of Agriculture
Jason Vanrobaeys	Agriculture and Agri-Food Canada
Arthur Friesen	Environment and Climate Change Canada
Sharon Reedyk	Environment and Climate Change Canada
Mitch Timmerman	Manitoba Agriculture and Resource Development
Brian Wiebe	Manitoba Agriculture and Resource Development
David Lobb	University of Manitoba
Lindsay Pease	University of Minnesota
Tom Sherer	North Dakota State Universiy
Rebecca Power	University of Wisconsin
Anne Nardi	University of Wisconsin
Ted Preister	Red River Basin Commission

**Workshop Summary Report** 

#### **Contents:**

- Basin characteristics
- Summaries of presentations and breakout sessions
  - for N by BMP category
  - · for P by BMP category
- · BMP stacking
- Research gaps
- Summary
- References
- Appendices



https://www.redriverbasincommission.org/rrbc-projects

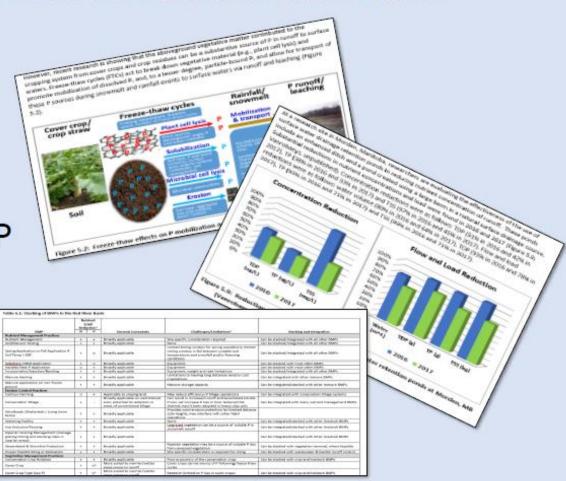
#### Presentations and Breakout Sessions

#### Section 4, 5 and 6 - Summaries for:

Nitrogen by BMP category

Phosphorus by BMP category

BMP "stacking"



#### **Section 8**

- Table 8.1
   Nitrogen
   (2 pages)
- Table 8.2
   Phosphorus
   (2 Pages)

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#### **BMP Summary** Table -**Structure**

- BMP Category / Type
- **Consensus Level** 
  - Strong
  - Weak
- **Effectiveness** 
  - High
  - Low
  - Uncertain
- Limitations / Research Gaps

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Ninste care of the reduced below agronantic crap requirements without reducing crop yield. Science-based firesholds for residual soil Nahould be established

Addressing limitations in some cropping systems and in some areas or years with a small spring

Artistic Closed regulations may be required to change practically US; may require costly storage

Utcertain May be effective it particulate NHs+ is the configurations. More suited to steeper landscapes

Need respect to show it reduces edge-of-field loose. Lack of research linking to edge-of-field losses of N

Limited applicability in re-till systems

mprage

National Section Control of the Earth Control of th

#### **BMP Summary** Table -**Structure**

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  - Weak
- **Effectiveness** 
  - High
  - Low
  - Uncertain
- Limitations / **Research Gaps**

Table	R.1 Summ	ary Tab	ie for BMPs for Nitrogen Load Reduction								
Catagory	Practice	CRP#	Servificial Management Practice (SMP)	Com	kritop serous velof encet/		ediversor for induction	Linksfore and Research	Sage		
	596		Nutrient Hanagement	2	guer	Г	High.	Nicote cannot be reduced below agronantic crop requirements follows based thresholds for residual soil Nichould be estab	its without reducing oro fished	pyield.	
P act			Soli Manure Testing to Determine Application Bales	38	rong		на				
8			Spring Natifiert Application (Instruct of full)	3	provid	П	High	Addressing limitations in some cropping systems and in some operation window	e areas or years with as	multipring	
1 2			Variable Rate Application	w	Profe.	U	itoxtain	Need respect to draw it reduces edge-of-field loose.			
1			inhibitors/Slow Release Fortilizers/Split Application	Wesk			mjn	Lack of research linking to edge-of-field losses of N			
2			Incorporation Injection Banding	2	nong.		High	United applicability in ro-till system			
			Manura Application on Non-traces Ground	2	rang	Т	High.	Artisticioningulation nay be required to charge gradio regarder	e in US; may require con	fly storage	
	338		Contour Farming	2	rang.	U	itoetaln	Hay be effective if particulate NH+ is the dominant form. N	tore suited to steeper is	пфиции.	
18	329		Conservation Tillage			_					
and Practi	380	CPSA. CP188 CP178							Workshop Conserves	ITHOUS NEWS	
å	473/362		Riperion-Grazing Messagement (manage grazing timing and stocking rates in riperion eross)	å	Practice	CRP		Beneficial Management Practice (BMP)	[freeled agreement]*	N Reduction <sup>2</sup>	Unitefices and Research Gags
1.0	560		Streambank and Shareline Protestion		635		Predict	/Wastewater Hilter Majo	Weak	Uncertain	
"			Feedlot Sting Relacation				Veseto	tion Removal disaffer areas, ditches, cover crock	Week	Oreertain	
-	328		Comerciation Crop Ratelion				Strateg	fc:Tillage/CropiResi@Incorporation (chop, spread, harrow, ad till)	Week	Uncertain	Relative impacts of nandom raughness vs. residue cover en ersolon

Drainage Water Management (controlled the image)

9217454

393

412

Cover Crip

Filter Strip (grand)

à.			# i			Indicate endicated energy						
No. andre		115	Twe-Stear Ditch	Week.	Unerstain	Effectiveness at removing Numertain						
N P	657	CP27 CP28	Wetland Restoration (departm/ponded)	Mong	ніда	hiting took and cost-benefit needs more investigation in PRE						
î		CP25	Wetland Restoration (riperian Ylsodpilain)	Strong	High	Siting tools and cost-benefit needs more inventigation is RRS						
ä	638		Water and Sediment Control Basin	Strong	High	Lock of permanent storage may limit efficacy						
			tradi Dano/Yendo/teoreoire	Mong	High	Sting tools and cost tenefit needs more investigation in FRE, sedimentation cardinals offsetiveness and litegers.						
	784		Worstewater and Preedict Burnoff Control	Mong	High	May be limited to applicability in Red River valley thate plaint where cattle feed at and courself operations are not common.						
			Nutrient-Rich Sediment Removel Iweter retention areas)	Weak	Uncertain	Scientific basis is sound cost-benefit studies required requires vegetation re-establishment.						
wdu	Wishbor consensus. Investor any amount sublewed by workshop participants on the effectiveness of EMPS to conduct on limit N leading to the Ead Divertice. If practice is already implemented in participant or all of EMPS it may not lead to further duction but it is important to so level is defined as another but conditions to be practical to maintain the reductions adopted more reductly increase reduction.											

Strong

Strong

Not effective Needs to be combined with edge-of-field treatment to reduce the volume of randfilling, water retention ponds.

Effective excitor outsired retention doublibe compared in upring v. some patential to capture and retain snowmelt water?

Research is needed to develop bloceactors that can simultaneously re-during paring when temperatures are cold and retention time is small

tibe limitations (towards) salf-landscape conditions) other water quality concerns (e.g., salts), requires means of irrigation or sub-irrigation

reports on taking landout of production; citing is critical. Yook to identity optimalisacations

Categories include training-broad agreement accounterful deprending and in the resoccious accounterful accounter section in the participant, training-broad agreement accounterful production and an invasion accounter full production and an invasion and an invasion and the production and an invasion and

Table 8.1 Summary Table for BMPs for Nitrogen Load Reduction

#### **BMP Summary** Table -**Structure**

- BMP Category / Type
- **Consensus Level** 
  - Strong
  - Weak
- **Effectiveness** 
  - High
  - Low
  - Uncertain
- Limitations / **Research Gaps**

Practice CSP # Servefold Management Practice (SHP)				Cor	orkeles represent level of restrict	•		erecon x Claud Linkbellens and Rosearch	Gage		
	596		Nutrient Management	9	burg		н	Notate cannot be reduced below agronanic crop requirement Science-based thresholds for residual cell N should be estable	its without reducing a fished	ropyleld.	
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1			Spring Natifiert Application (Instead of full)	3	krad		н	Addressing limitations in some cropping systems and in some operation window.	e areas or years with a		
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1	Inhibitors/Slow Release Fortilizers/Split Application		West			-	gh Lack of research linking to edge-of-field looses of N				
g l			Incorporation Injection Banding	Strang			-	gh Umlad applicability in ro-till systems			
			Manure Application on Nan-Income Ground	9	Brang		- 14	<ul> <li>Aufsächlosolingsächlung nay be required to charge practic usgrades</li> </ul>	e in US; may require o	offly storage	
7	330		Contour Farming	9	brang		Uhp	rtain   Hay be effective if particulate NHs+ is the dominant form. N	fore suited to steeper	landscapes.	
8	229		Conservation Tillage	_				1			
and Practs	380	CPSA CP188 CP17a	Windowsk/Melterleb/Uning Snow Pence	Ι,	è				Workshop		
ð.	473/562		Riperion Grazing Management (manage gracing finding and stocking rates in riperion order)	3	Pro	etice i	CRP#	Sereficial Management Practice (SMP)	(level of agreement)*	Effectiveness for N Reduction <sup>2</sup>	Unitation and Research Gaps
3	160		Streambank and Shoreline Protestion		435 Per			Freedoc/Wastewater Filter Strip	Weak	Unsertain	
			Feedot Sting Relocation					Vegetation Removal Bruffer areas, ditalies, cover crapt	Week	Oreertain	
E S	328		Conservation Crop Ratelion					Strategic Tillage/Crop-Residencorporation (chop, spread, harrow, ratational till)	<u>,ēi</u>	Uncertain	Relative impacts of random raughness vs. residue cover on erasion carérol should be studied
and Pract	340		Cover Crisp	L				Extended/Winter Grading	-	Not effective	Practice will have succeived a soming. More be comparable to an unitreated confined operation. Needs to be examined with edge of field treatment to neduce the volume of randfile guyester retention possible.
ě.			Filter Strip Grand	•	50	84		Drainage: Water Management: (controlled the image)	100	Uncertain	Effection receives and rest retention doubt be compared in spring or commer months (i.e., limit patential to capture and retain provincell water)
1	393	CP21		ı				Drainage Water sycling	-	High	sibe limitations (towards) wall-tandscape randitions); ather water quality concerns (e.g., salts); requires means of irrigation or sub-irrigation.
8	412		Cress Waterway	١.				Blowactor E G	· 😇	Uncertain	Research is needed to develop bioreactors that can simultaneously remove N and P, expecially during spring when temperatures are cold and retention time is small.
5	512		Parture Hayland Planting (convention to personal cover)	1		6	90	Culvert Resizing 5.0	- A	High	respects on taking landout of production; ulting is critical took to identity optimalisations should be evoluated in RRS
Pag	e			) marian			115	Per Stear Ditch	ű	Uncertain	Effectiveness at removing Numertain
				d b			OP27 OP28	stretised Bestoration (dep	Q	High	tribling took and cost-benefit needs more investigation in MRB

Sting took and cost herefit need

operations are not common

Shrong

Manage

and transferoic/teoroics

638

duction but it's important to note it is effective and should continue to be practiced to maintain the reduction or adopted more widely to increuse reduction

removement of the protection to be the contract of contract to the processor operation to the reduction of activity to the contract to the con

#### BMP Summary Table -<u>Structure</u>

- BMP Category / Type
- Consensus Level
  - Strong
  - Weak
- Effectiveness
  - High
  - Low
  - Uncertain
- Limitations / Research Gaps

	Practica	/20+	Strefeld Management Practice (SMP)	0	torkels process (avail o	no af	1	forences for Limitedians and Research	Case					
Η		CHE						Note the state of the state of the law second in the state of the stat		Miskogor				
П	596		Nutr Sort Management	1	Strang	E	Ι,	Science-based firesholds for residual soil N should be estab	fished	- sp-jenu-				
			soli Manure Testing to Determine Application Bates	1	Strong	E		sp.						
l			Spring Nutrient Application (instead of full)		Strang	•		Addressing limitations in some cropping systems and in som operation window	Addressing limitations in some cropping systems and in some areas or years with a small spring operation window.					
ı			Variable liste Application		Oral	k.	Line	within Need respective show it reduces edge-of-field looses						
			Inhibitors/Slow Release Fortilizers/Split Application		West	t.	١.	ligh Lack of research linking to edge-of-field losses of N	Lack of research linking to edge-of-field losses of N					
ı			Incorporation/Injection/Banding		Strang	ŧ		igh Umbedupplicability inno-till system						
-			Manure Application on Non-frazee Ground		Strang	E		Artisticuling latiers noy be required to charge practice approfes	ain US; may require o	odly storage				
7	330		Contour Farming		Strang	•	Uho	ertain Hay be effective if particulate NHs+ is the doni runt form. N	fore suited to steeper	landscapes.				
ıl	329		Conservation Tillage	٠.			_	1						
	380	CPSA CP168 CP178		Γ					Workshop					
ı	473/062		Riperion Grazing Management (manage grazing fiming and stocking rates		1.				Consensas (Invelor	Effectivenes. for				
H	100	a martin artist Care					CSP4	Beneficial Management Practice (BMP) Feedint/Wastervater Filter Strice	agroement/*	N Reduction Uncertain	Litel tefons and Research Gags			
H														
4			Fredict Sting Relacation		$\perp$			Vegetation Removal druffer area, ditches, cover crapt	Wesk	Unerstain				
ı	328		Conservation Crop Ratetion					Strategic Tillage/CropiResi hcorporation (chop.spread, harrow, relational HII)	ığı	Ungetein	Relative impacts of nandom resigness vs. residue cover on erasion carérol should			
	340		Cover Crisp	П				Extended/Winter Grazing	- S-	<del></del>	Practice will increase N looses in spring. Mos be comparable to an universed confin Needs to be combined with edge-of-field treatment its neduce the volume of name neteration possible.			
u					Т	554		Drainage Water Management (controlled dna inage)	778	Underside	Effective excitor outsired retention doublible compared in spring or commer man patential to capture and retain seconds water?			
	393	CP21	Filter Strip (grand	н				Drainage Water Sycling	- 5	8	site limitations (towards) said-landcape randitions; other water quality concerns requires mean of irrigation or sald-irrigation			
	412		Greso Waterway					Birractor 📻 ै	:07	Updatin	Research is received to develop bioreactors that can simultaneously remove N and during porting when temperatures are cold and returning to time it small.			
	512		Parture Hayland Planting (convention to perential cover)		1800		90	Calvert Resizing 500	.āj	ec	reports on taking landout of production; citing is critical tools to lifestify optimal should be evaluated in 885			
	ď				n washes		115	Two Stage Ditch	ğ	备	Effectiveness of removing Numbertain			
					100	657	CP27 CP28	Mediand Bestoration (departm) ponded)	Q	High	siting took and cost-benefit needs none investigation is 1998			
					1		CP25	We fixed Bestoref lov (riperian Ylaodpilain)	Strong	High	Sting took and cost-benefit needs more investigation in RRS			
				1	Ä	638		Water and Sediment Control Basin	Strong	High	Lack of permanent storage may limit efficacy			
								trial constraint trovers	1810ng	High	Siting tools and cost tenefit reeds more investigation in RRB, redimentation can't effect (except and librory).			
						79.6		Wastewater and Feedlist EuroPT Control	18 ong	High	May be limited to applicability in Red River valley flake glaid where cattle Resiliate operations are not common.			

90173

#### **BMP Summary** Table -Structure

- BMP Category / Type
- **Consensus Level** 
  - Strong
  - Weak
- **Effectiveness** 
  - High
  - Low
  - Uncertain
- Limitations / **Research Gaps**

Table	R.1 Summ	ary Tab	le for BMPs for Nitrogen Load Reduction								
Catagory	Practice	CRP#	Geneticial Management Practice (SMP)	Con	Makep senses unled second/	1	fweren tur luction <sup>2</sup>	Limitations and Rossansh	Sage		
	596		Nutrient Hanagement	2	grang	-	ign.	Ninste cannot be reduced below agronantic crop requirement Science-hased thresholds for residual soil Nichould be estab	its without reducing of fished	ropyleld.	
Practi			Soli Manure Testing to Determine Application Bates	3	rong		igh.				
8			Spring Nutrient Application (Instruct of fulf)	2	rang		Syn:	Addressing limitations in some cropping systems and in some operation window	e areas or years with a	griqulum	
di ii			Variable lists Application	v	lvak	Line	wtain	Need recounts to choos it reduces edge-of-field boost.			
I			Inhibitors/Slow Release Fortilizers/Split Application	v	lesk.		tigh:	Lack of research linking to edge-of-field losses of N			
8			Incorporation Injection Banding	2	rang.		ligh:	United applicability in ro-till system			
			Manure Application on Non-trasse Ground	2	rang	-	igh.	Artification ingulations may be required to charge graction	ais US; may require o	ortly storage	
	338		Contour Farming	2	rang.	Uto	etán	May be effective if particulate NHs+ is the classificant form. N	fore suited to steeper	landscapes.	
8	329		Conservation Tillage								
and Practs	380	CPSA CP168 CP178	Windbreak/ShelterSels/Living Snow Pence	Ę					Workshop	Declivos	
90	473/362		Riperion-Grazing Management (manage grazing firning and stocking rates in species arous)	ð	Practice	CRP4		Seneficial Management Practice (SMP)	Conservati (Invelor agreement)*	tur N Reduction	Gertefonse
1.5	160		Streambank and Storeline Protection		635		reeduc	Wateuser New York	Weak	Uncertain	
-			Feedlot Sting Relacation				Vesetot	in Reworldoffer area, ditches, over creat	Work	Uncertain	
dess	328		Comerciation Crop Ratiotion	1			Strategic	c Tillage/CropiResi@Acorporation (chop, spread, harrow, w/till)	é	Unquigh	lelative impacts of random resighness vs. nesk
Ě							Extende	d/Winter Grazing (Cold free discrease assessment)	:54		tractice will increase N looses in spring. Mostle Reach to be combined with edge-of-field treat

Culvert Resizing

Marrong

554

657

Filter Strip (grass)

Cristo Waterway

412

512

categories include: triang - broad agreement across workdrap porticipants; steak or agreement across workshop participants (none discussion and/or research may be required

### **BMP Summary Table Phosphorus**

#### **Nutrient Management**

Category	Practice	CRP#	Beneficial Management Practice (BMP)	Workshop consensus (level of agreement) <sup>1</sup>	Effectiveness For P Reduction <sup>2</sup>
ses	590		Nutrient Management	Strong	High
Nutrient Management Practices			Soil/Manure Testing to Determine Application Rates	Strong	High
ment			Spring Nutrient Application (instead of fall)	Strong	High
age			Variable Rate Application	Weak	Uncertain
Man			Inhibitors/Slow Release Fertilizers/Split Application	Not discussed	Uncertain
trient			Incorporation/Injection/Banding	Strong	High
N			Manure Application on Non-frozen Ground	Strong	High

## **BMP Summary Table Phosphorus**

#### **Erosion Control**

Category	Practice	CRP#	Beneficial Management Practice (BMP)	Workshop consensus (level of agreement) <sup>1</sup>	Effectiveness For P Reduction <sup>2</sup>
Erosion Control Practices	330		Contour Farming	Strong	Uncertain
	329		Conservation Tillage	Weak	Uncertain
	380	CP5A CP16B CP17A	Windbreak/Shelterbelt/Living Snow Fence	Weak	Uncertain
	472/382		Riparian Grazing Management (manage grazing timing and stocking rates in riparian areas)	Strong	High
	580		Streambank and Shoreline Protection	Strong	High

#### **BMP Summary Table Phosphorus**

#### **Vegetation Management**

Category	Practice	CRP#	Beneficial Management Practice (BMP)	Workshop consensus (level of agreement) <sup>1</sup>	Effectiveness For P Reduction <sup>2</sup>
	328		Conservation Crop Rotation	Weak	Uncertain
Vegetative Management Practices	340		Cover Crop	Weak	Uncertain
	393	CP21	Filter Strip (grass)	Weak	Uncertain
	412		Grass Waterway	Weak	Uncertain
	512		Pasture/Hayland Planting (conversion to perennial cover)	Weak	Uncertain
>	635		Feedlot/Wastewater Filter Strip	Weak	Uncertain
			Vegetation removal (buffer areas, ditches, cover crop)	Strong	High
			Strategic Tillage/Crop Residue Incorporation (chop, spread, harrow, rotational till)	Weak	Uncertain
			Extended/Winter Grazing (in-field feeding management)	Strong	Not effective

# **BMP Summary Table Phosphorus**

### **Structural Practices**

Category	Practice	CRP#	Beneficial Management Practice (BMP)	Workshop consensus (level of agreement) <sup>1</sup>	Effectiveness For P Reduction <sup>2</sup>
Structural Management Practices	554		Drainage Water Management (controlled drainage)	Strong	Low
			Drainage Water Recycling	Strong	High
			Bioreactor	Weak	Uncertain
		80	Culvert Resizing	Strong	High
		115	Two-Stage Ditch	Weak	Uncertain
	657	CP27 CP28	Wetland Restoration (depression/ponded)	Strong	High
	657	CP23	Wetland Restoration (riparian/floodplain)	Strong	High
	638		Water and Sediment Control Basin	Strong	High
			Small Dams/Ponds/Reservoirs	Strong	High
	784		Wastewater and Feedlot Runoff Control	Strong	High
			Nutrient-Rich Sediment Removal (water retention areas)	Weak	Uncertain

# **BMP Summary Tables**

**General Overview** 

Geographic Applicability

Site Specific

Broad

Strong Science and High Effectiveness

 Most erosion control practices

- Most nutrient management practices
- Structural practices that capture or minimize runoff

Weak Science
or Uncertain
Effectiveness

- Most vegetative management practices
  - Windbreaks/shelterbelts
    - Tile drainage BMPs

# Research Gaps

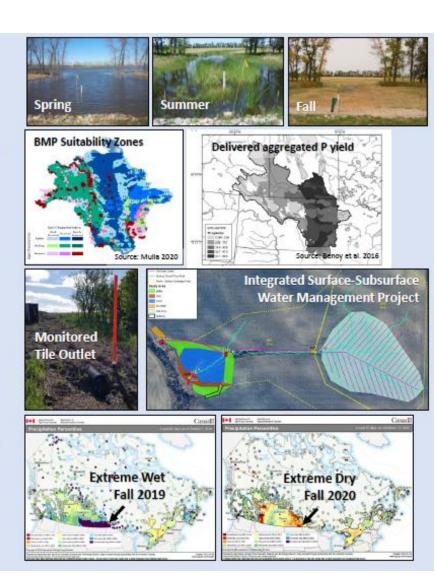
- Section 7
- Categorized by
  - Nutrient (N, P, or both) and
  - BMP category
    - Nutrient management
    - Erosion control
    - Vegetation management
    - Structural practices



## Research Gaps - Summary

Improved understanding of hydrology and nutrient transport in cold climates and how that impacts BMP performance:

- · Seasonality snowmelt, non-growing season events
- Nutrient dynamics sources, form, pathways
- Types of practices
  - in-field, edge-of-field, subsurface (tile) drainage
- "Stacked" or cumulative, integrated practices
  - Synergistic BMPs that protect soil, reduce erosion and minimize nutrient export
- Trade-offs
  - Soil health, habitat, flood mitigation, flood and drought resilience, carbon footprint, greenhouse gas emissions, etc.
- Effects of climate change
- Research <u>AND</u> demonstration sites in representative landscapes



# Research "Next Steps"

### Potential for a "Cold Climate BMP Research Network"

- International collaboration on targeted BMP research to address gaps
  - Toward coordinated experiments, compatible data, representative sites, shared results and extension

#### Capitalize on existing initiatives

- Discovery farms
- 4R Nutrient Management Project: Keep Fertilizer on the Farm
- · Agroecosystem Living Laboratories
- Long Term Agroecosystem Research
- Other research and demonstration sites (e.g. RRBC Cass County Project)



Keep Fertilizer on the Farm: Using the 4R Framework to Support Sustainable Nutrient Management in the Northern Great Plains

Lead Researcher:

Dr. Lindway Person

Assultant Professor and Extension Specialist in Natrians and Water
Management:
University of Minnesota

Collaborating account ists and universities

Dr. Amitura Chatterioe, North Dakots State University

- Dr. Amitara Chamerjee, North Dakota State University
- Dr. Jeppe Kjærregsard, Minnesota Department of Agriculture
- Dr. David Lotth, University of Manitoba
- Dr. Stephen Crittenden, Agriculture and Agri-Food Canada
- + Left Fixen. The Nature Conservancy
- Warren Ferme, Minnesota Agricultural Water Resource Center
- · Dr. Merrin Macrae, University of Waterloo
- · Dr. Heidl Peterson, Sand County Foundation
- . Dr. Mitchell Timmerman, Manitoba Agriculture
- · Dr. Henry Wilson, Agriculture and Agri-Food Carada





# Thank You!

Workshop material: <u>z.umn.edu/bmpworkshop</u>

Report: https://www.redriverbasincommission.org/rrbc-projects

#### For more information contact:

Jason Vanrobaeys

Lead, Agroecosystem Resilience
Living Laboratories Division
Science and Technology Branch
Agriculture and Agri-Food Canada
jason.vanrobaeys@canada.ca

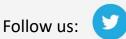


## Mitchell D. Timmerman, M.Sc.

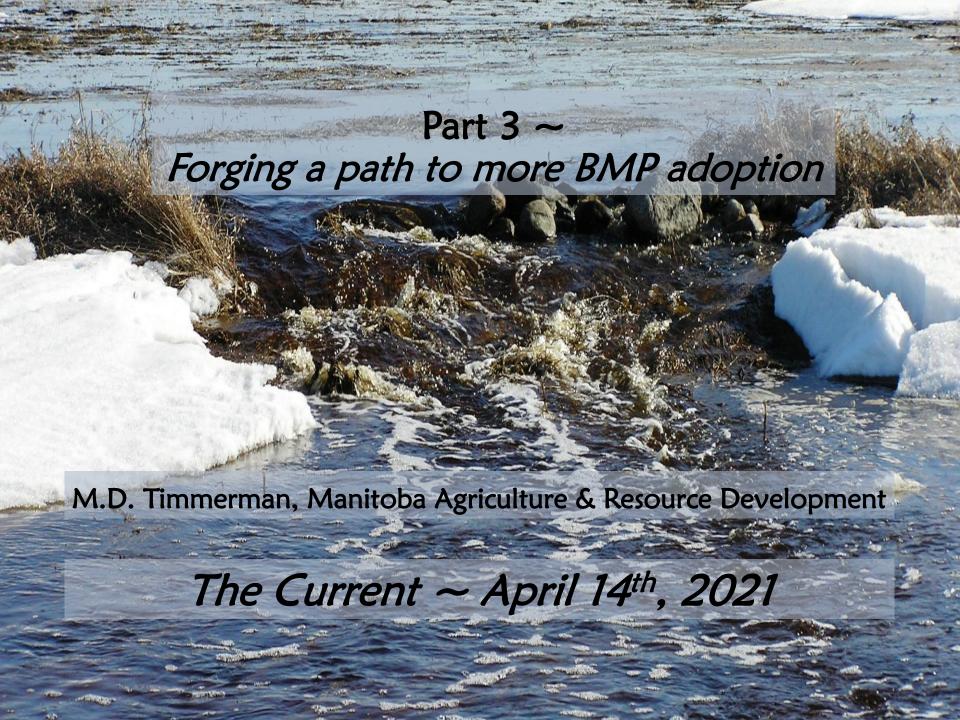


As an Agri-Ecosystems Specialist for Manitoba Agriculture and Resource Development, Mitchell strives to cover all of the bases: soil, water and nutrient management in a production and profitability context.

His work spans extension, BMP incentive programming and regulatory support. He was raised by a proud family of crop and livestock farmers on the majestic hummocky landscape of the Pembina Hills.



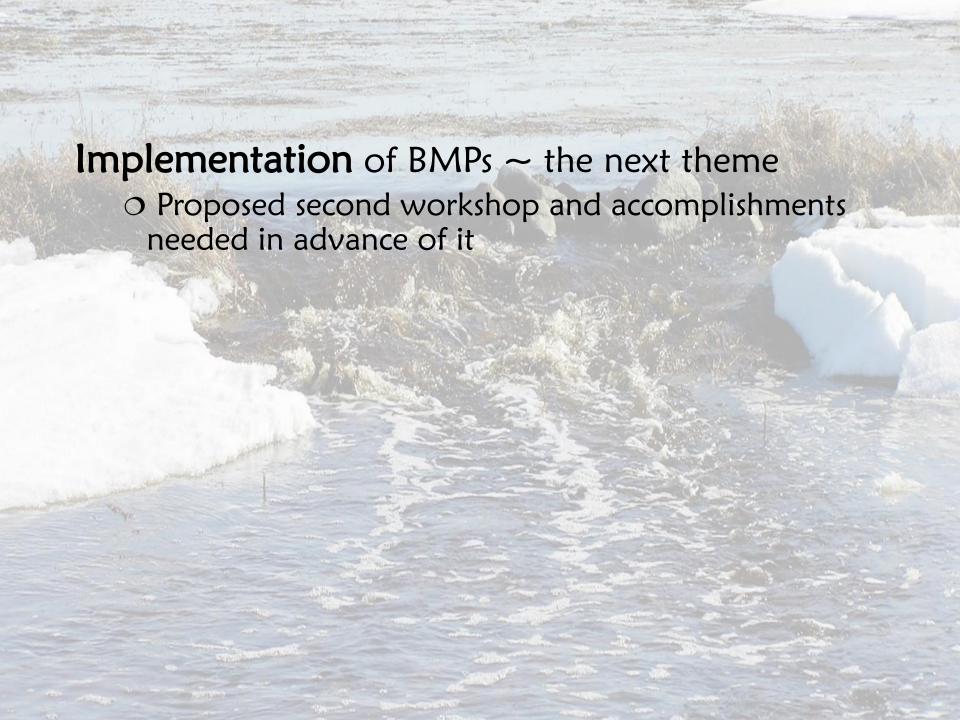






# Extension of the Workshop's deliberations and outcomes

- O Final report ~ posted to the Web
- Fact sheets ~ two plus one
  - overview
  - research gaps
  - uniqueness of the Basin ~ context for water quality BMPs addressing agricultural nutrients



# Implementation of BMPs ~ the next theme

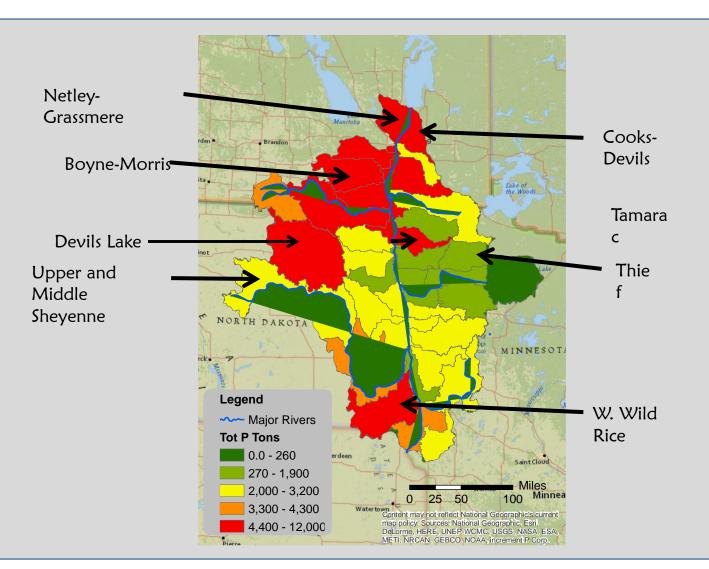
- Proposed second workshop and accomplishments needed in advance of it
- Implementation of a different, though related, sort ~
   all of the various players in this drama, their roles
  - Government
  - Industry
  - Farmers
  - Researchers
  - Environmental NGOs ... and all of the rest

# Implementation of BMPs ~ the next theme

- Proposed second workshop and accomplishments needed in advance of it
- Implementation of a different, though related, sort ~
   all of the various players in this drama, their roles
  - Government
  - Industry
  - Farmers
  - Researchers
  - Environmental NGOs ... and all of the rest
- Feasibility criteria for implementation at scales of watershed, farm and field

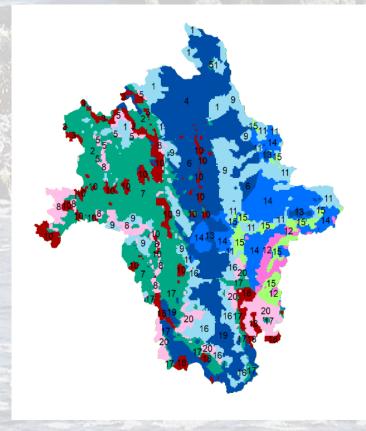


Total P Load (U.S. tons) for Major Watersheds

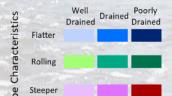


# Where will the BMPs work?

BMP suitability zones across the Basin delineated based on climate, soil and landscape factors.



Location ID	BMP Suitability Zone					
1	Colder Dryer Flatter Well Drained					
2	Colder Dryer Rolling					
3	Colder Dryer Steeper Poorly Drained					
4	Colder Dryer Flatter Poorly Drained					
5	Colder Dryer Steeper Well Drained					
6	Cooler Dry Flatter Poorly Drained					
7	Cooler Dry Rolling					
8	Cooler Dry Steeper Well Drained					
9	Cooler Dry Flatter Well Drained					
10	Cooler Dry Steeper Poorly Drained					
11	Warm Wetter Flatter Well Drained					
12	Warm Wetter Steeper					
13	Warm Wetter Flatter Poorly Drained					
14	Warm Wetter Flatter Drained					
15	Warm Wetter Rolling Well Drained					
16	Warmer Wetter Flatter Well Drained					
17	Warmer Wetter Rolling					
18	Warmer Wetter Steeper Poorly Drained					
19	Warmer Wetter Flatter Poorly Drained					
20	Warmer Wetter Steeper Well Drained					



Soil Characteristics



- O Workshop participants agreed that the scientific community must strive to get its story straight prior to seeking further practice change in the agriculture industry.
- The gathering at Crookston served as a first step towards achieving consensus on the science and a common message to producers regarding agricultural solutions to water quality problems in the region.

### Exhibit A – Scented fertilizer



# Spring manure application?

#### By Allan Dawson

CO-OPERATOR STAFF

In some ways spring is the best time to apply manure, but in other ways it's not.

Crops get the best use of nutrients when applied in the spring. but with seeding being a priority there's often not a lot of time. says Petra Loro, Manitoba Agriculture and Resource Development's livestock environment specialist.

But if farmers are running low on manure storage space it's an

In some ways spring is the best time to apply manure, but in other

Manure can also be applied to forage and some crops during the growing season with the right equipment, she said.

"People can go in after first cut," Loro said. "With com it's an equipment issue. You can drive on it before a certain stage and it will bounce back. I imagine industry will seek all of those opportunities to do in season as well as pre-seeding."

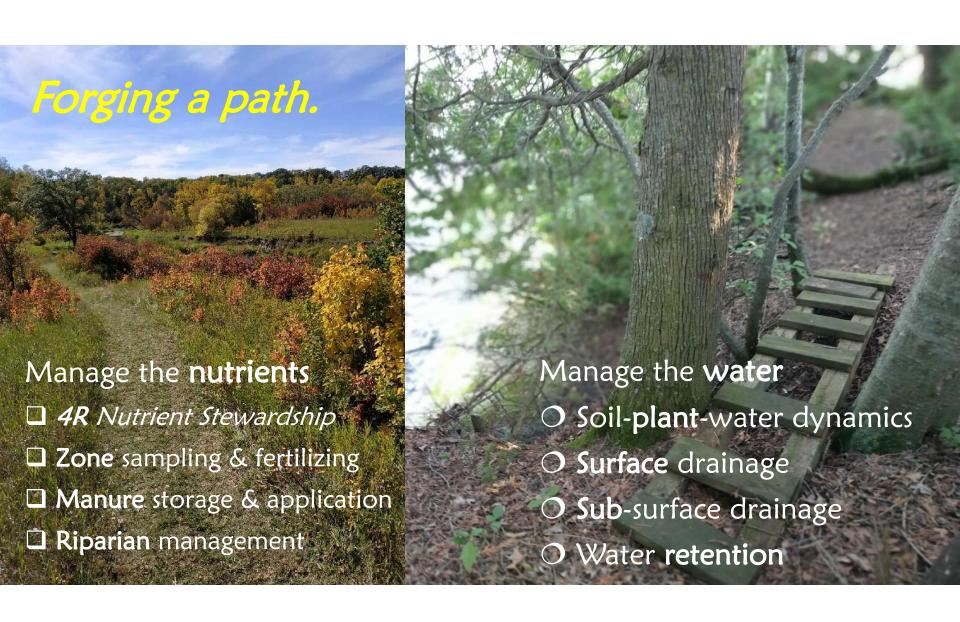
allan@lbcpublishing.com @allanreporter

# Further Basin-wide collaboration in research and more

- 4Rs+drainage research project co-ordinated by the U of Minnesota – Crookston
- O Global Water Futures, the UofS-based Institute for Global Water Security ~ Keeping P on the Land workshop in March 2021

# Further Basin-wide **collaboration** in research and more

- 4Rs+drainage research project co-ordinated by the U of Minnesota – Crookston
- O Global Water Futures, the UofS-based Institute for Global Water Security ~ Keeping P on the Land workshop in March 2021
- o proposed federal water agency in Canada
- Manitoba's provincial water strategy



# Is now a good time?

## Canadian equipment sales drop as net farm income plunges

**FARM INCOME TAKES A NOSEDIVE** 

Realized net farm income crashed in 2018 after

stretch of above average levels. The loss of key

capping farm receipts while expenses continue realized net farm income below what it was a di

Realized Canadian net farm income, 2018

(\$billions, in constant 2012 dollars):

High prices, weak loonie, record production and low inte farming boom for a decade, but the good times appear to

Statistique



average area (in acres)

900

#### BY SEAN PRATT SASKATOON NEWSROOM

Canadian farmers are feeling the financial pinch of lost markets and rising expenses after a prolonged period of prosperity, according to recently published statistics.

Net farm income plummeted 46 percent (in constant 2012 dollars) in 2018 after seven years of aboveaverage incomes. The outlook for 2019 is equally grim.

Farmers are reeling from the loss of key markets like China and India for canola, pulse crops, and until recently, meat products.

"The impacts of events such as these and others will be reflected in farm cash receipt and net farm income figures for 2019," said Statistics Canada.

Canadian farmers benefitted from high crop and livestock prices, a low Canadian dollar, record



Canada

#### Fewer farms, but they are larger

Total number of agricultural operations and average area (in acres) per operation, 1871 to 2016 census years, Canada

number of farms (thousands)

900 800 700

600



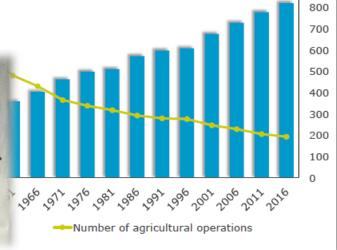
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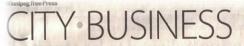
B5 WEDNESDAY FEBRUARY 5, 2020

BUSINESS ECHOR: SHAM MINIS 201-697-7292 © CITEDESCOPREPRESSURAÇA © MUNISPEGREEPRESS, CAM

Manitoba producers faced droughts, feed shortages, floods, early snow and a costly carbon tax

'An incredibly trying year for farmers'







City receives reports of flooding,

# Downpour

Hasell said th

drought to an end, but meteorologists at

the time described it as more like a mist

than a rainfall. Another 1-2 mm fell last

"Thankfully, it was not sewer back-

was also extrem

September 27, 2019

#### **Drought Causes State of Emergency for Majority of Manitoba Cattle Producers**



EVIN ROLLASON

HAT a difference a day can make to turn a desert into a lake.

After getting well-below-normal preipitation for most of May, parts of Winfipeg were deluged with so much rain n a few short hours Wednesday that hose areas are now at, or above, the verage — 56.7 millimetres — normally ecorded for the entire month.

The deluge is responsible for closing ne doors at Wolseley's Tall Grass Prai-

Environment Canada warning prearedness meteorologist Natalie Hasell aid the city typically receives an averge of 56.7 mm of precipitation in May, nd Wednesday's rain nearly matched

hat in one fell swoop in certain areas. The Weatherlogics meteorological rm reported 74.2 mm in North River

"It all depends where in the city you first and second floors. ere," Hasell said.

It went all the way down to almost are essential to ensuring the health of livestock ground water sources

Funding is provided through the Managing Live

# 2019 – a year of contrasts



the wake of the storm, the city received reports of one basement flooding. plugged catch basins on 20 back lanes and 38 streets, 21 incidents of sewer backup with clean water and 13 incidents of sewer backup with raw sewage.

Tabitha Langel, one of the four owners of Tall Grass Prairie Bread Company Many motorists' drive home from on Westminster Avenue, said when the work were stymied at the Jubilee Street rain began pouring outside Wednesday underpass on Pembina Highway, which it wasn't long before it began pouring was impassable for a time. Driedger inside their business said that can happen during periods of heavy rainfall when the underpass "My husband and I first knew about drainage systems are overwhelmed.

it when an employee phoned and said, 'Please come," Langel said. "We walk The city's combined sewer system in and it was like a movie. It was like became overwhelmed and raw sewage had to be discharged into the river instead of being directed through a treat Langel said there was water ment plant.





Thanks
for your
attentio
n,
fellow
lake
lovers.





### **Question and Answer Session**

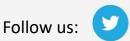
We will draw initial questions and comments from those submitted via the chat box during the presentations.

#### **Today's Speakers**

Mike Ell – mell@bis.midco.net

Jason Vanrobaeys — <u>jason.vanrobaeys@canada.ca</u>

Mitchell Timmerman – <u>Mitchell.Timmerman@gov.mb.ca</u>







### Thank you for participating in today's *The Current*!

Visit our website, northcentralwater.org, to access the recording and our webinar archive!

Upcoming webinar from our soil health team, The Soil Health Nexus:

Ag Policy and How it Impacts Soil Health Practice Adoption

Next Wednesday, April 21 at 2pm CT

https://soilhealthnexus.org/

