

Cold Prairie Challenge

A wide-angle photograph of a vast field of mature wheat. The wheat stalks are heavily laden with a layer of snow, creating a textured, white and tan landscape. The field extends to the horizon, where a line of trees is visible against a grey, overcast sky. The overall scene conveys a sense of a cold, winter day in a prairie region.

April 13, 2020
PLNT 670-001
GEFSES-CREATE

Alynne Ribano, Annis Fatmawati, Kristy Myles,
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Cold Prairie Challenge

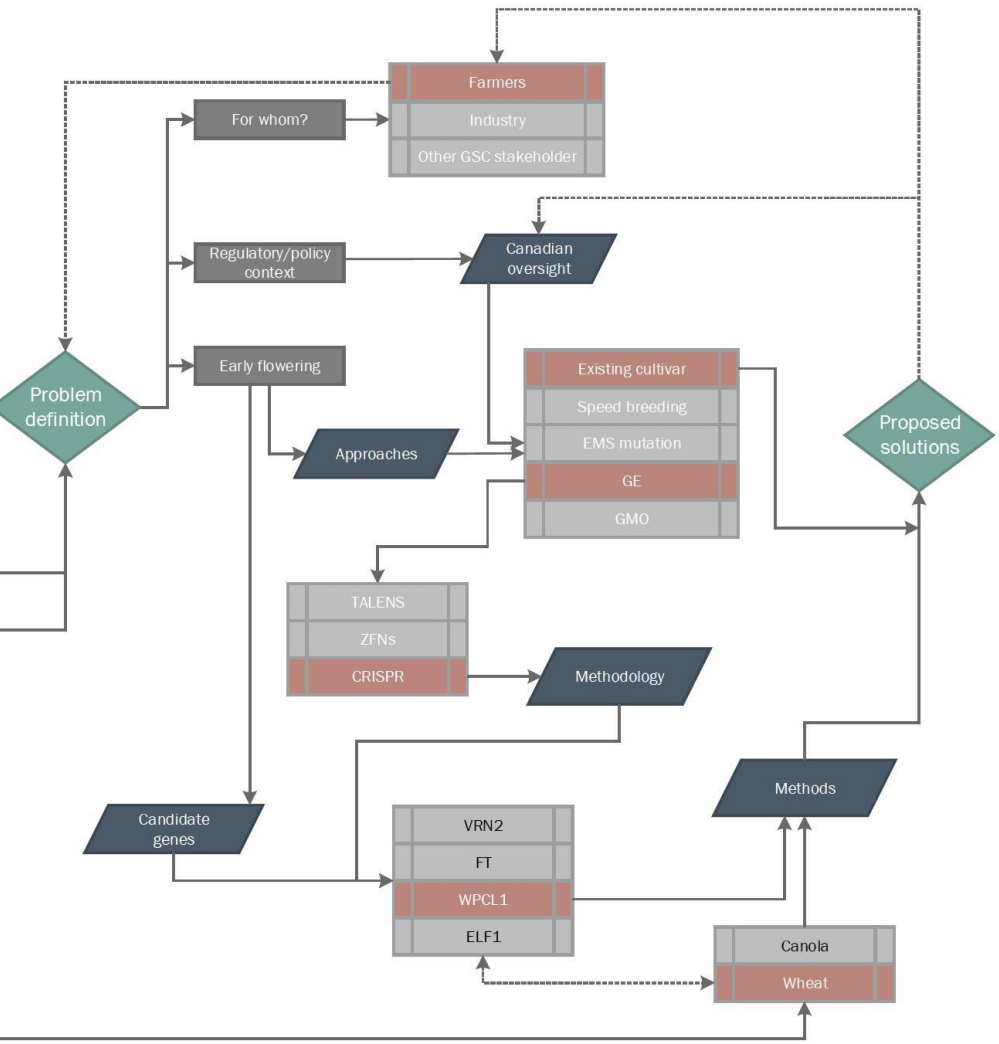
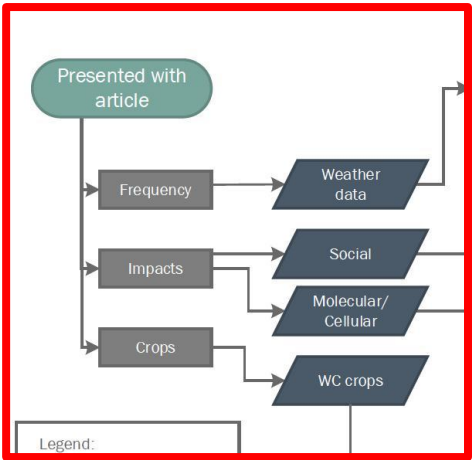


**The Sprout: Snowmageddon
leaves \$3 billion of Alberta Crop in
Fields**

October 12, 2018

By Kelsey Johnson and Charlie Pinkerton

Cold Prairie Challenge: Decision Making Process



What was missing?

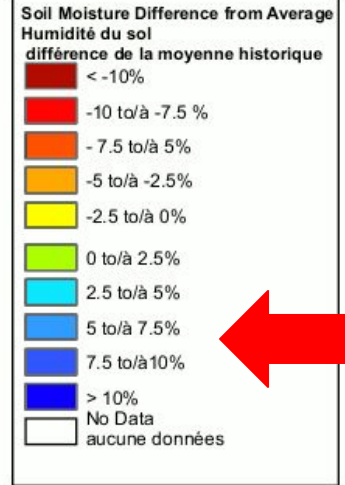
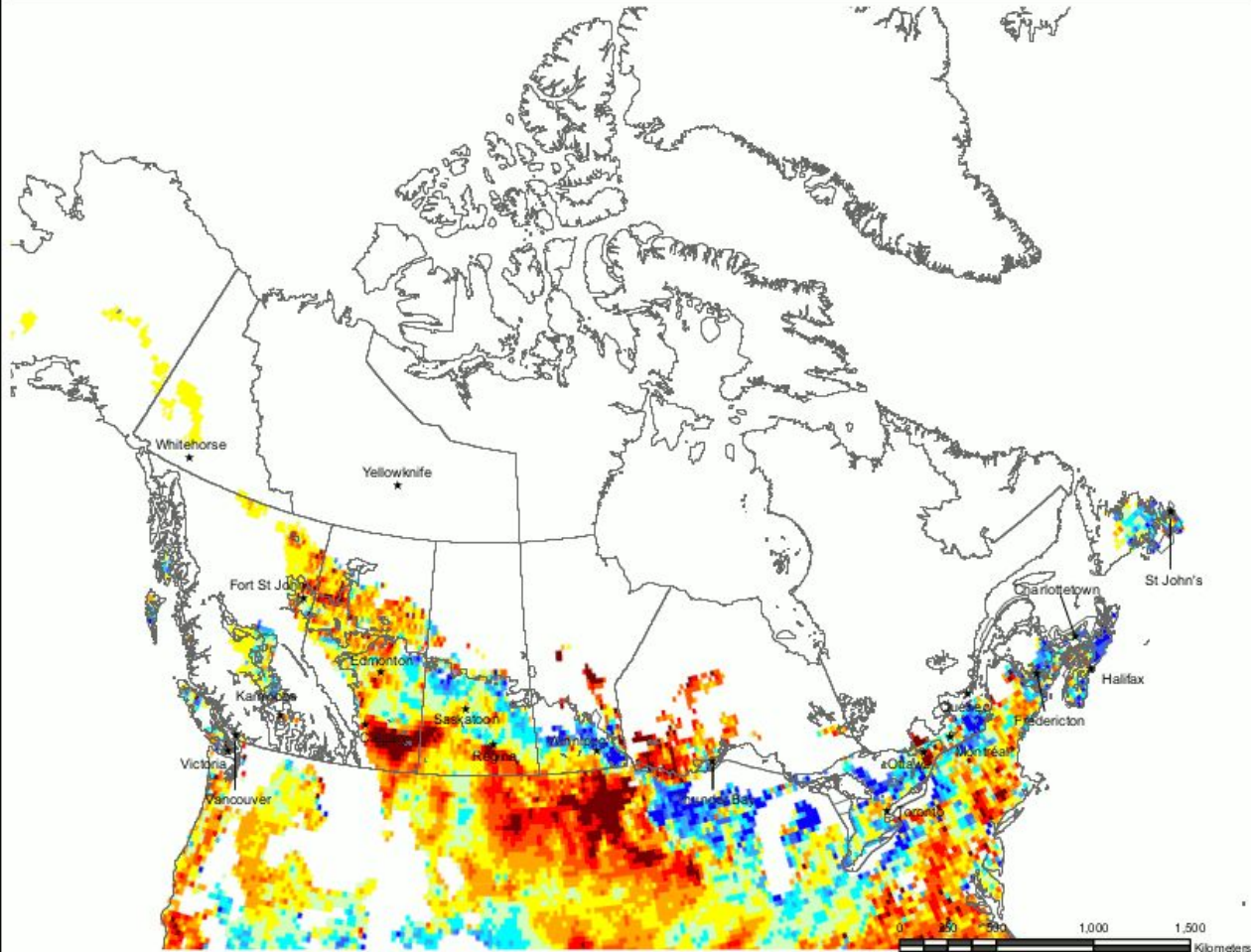
- Which crops?
- One-off event?
- How big are the impacts?

What was missing?

- Which crops?
- One-off event?
- How big are the impacts?



Week 14 and 15 (April 4 - April 17), 2016 / Semaine 14 et 15 (4 avril au 17 avril), 2016



Impacts on seed quality

- Canadian Grain Commission
- Official Grain Grading Guide (45 factors)
 - Sprouted
 - Frost Stress
 - Immature



Social and Economic Impacts

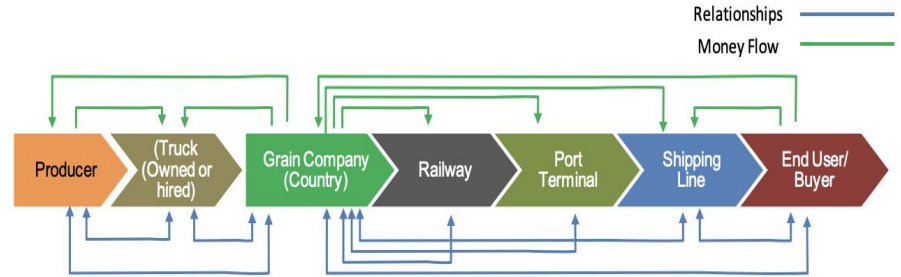
“Agriculture is both extremely important to the Canadian economy and inherently sensitive to climate”- Lemmen and Warren, 2004

FARMERS



- Affecting Livelihood
- Surging Debt
- Suicide as an Occupational Hazard

GRAIN SUPPLY CHAIN



...Continued

EXPORTS

- Have lagged due to poor grain quality
- Plummeted by 53 per cent for FY 2018-19

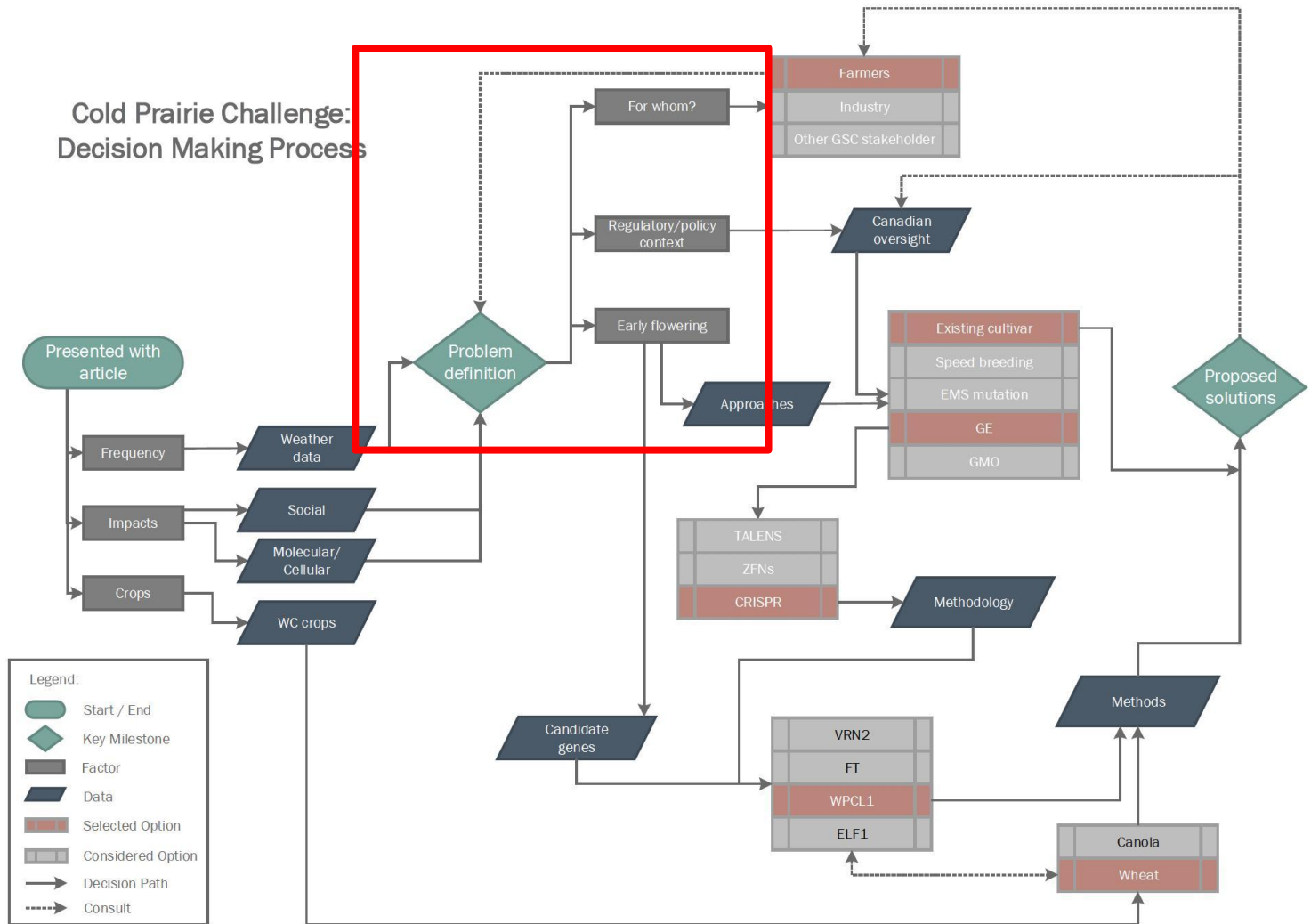


FOOD SUPPLY

- Imbalance between food supply and demand
- Food Insecurity



Cold Prairie Challenge: Decision Making Process



- Legend:
- Start / End
 - ◆ Key Milestone
 - Factor
 - Data
 - Selected Option
 - Considered Option
 - Decision Path
 - - - Consult

Regulatory context in Canada

- Product-triggered regulation
 - Plants with novel traits (PNT)
- Complex
- environmental / health safety focus
- **Permissive toward GE**

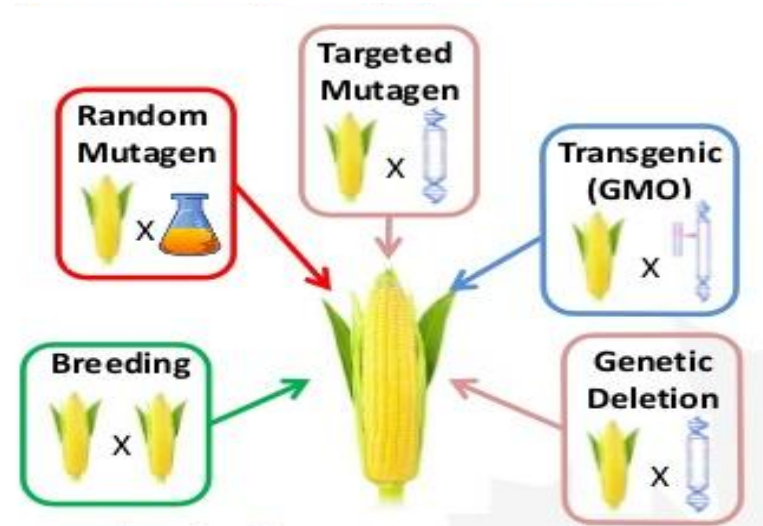
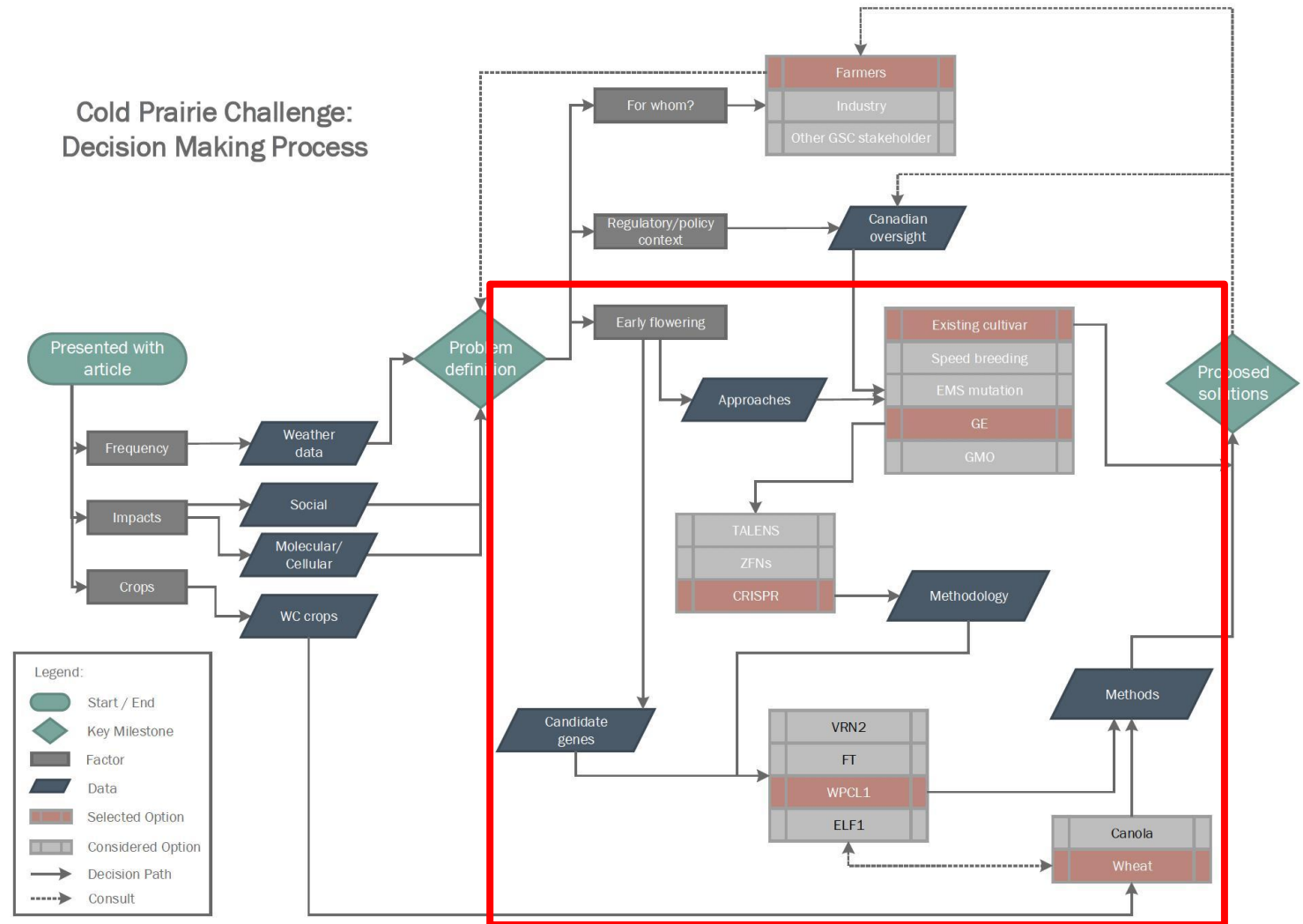


Image source: Tibelius 2018

Cold Prairie Challenge: Decision Making Process



List of early flowering cultivar

Varieties of Spring Wheat

Variety	Maturity Rating	Protein (%)	Test Weight (lb/bu)	Thousand Kernel Weight (g)	Resistance to sprouting	Category
Carberry - check	L	14.00	63	39	F	Canada Western Red Spring Wheat
AC Splendor	VE	0.9	61	61	F	
Go Early	VE	0.3	61	40	P	
Parata	E	0.7	64	39	G	
CDC Titanium VB	E	0.5	65	41	P	
5604HR CL	E	-0.7	63	33	G	
AAC Connery	E	0	62	40	VG	
AAC Redwater	E	0	64	35	G	
AC Intrepid	E	0	62	39	G	
Thorsby	E	-0.5	64	38	G	
Whitehawk	E	-0.9	63	33	G	Canada Western Hard White Spring Wheat
CDC Desire	E	0	62	44	G	Canada Western Amber Durum Wheat

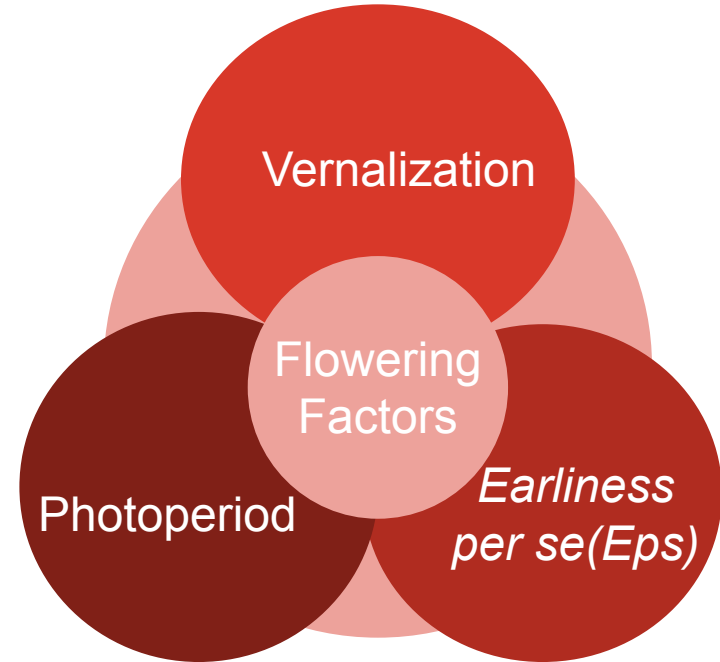
NOTE: Early flowering varieties has not been reported yet for this category, Canada prairie Spring Red Wheat Canada Western Special Purpose Wheat Canada Western Soft White Spring Wheat

Abbreviations and rating scales

- Maturity: VE = Very Early, E = Early, M = Medium = Late, VL = Very Late
- Resistance Ratings: VP = Very Poor, P = Poor, F = Fair, G = Good, VG = Very Good, EX = Excellent

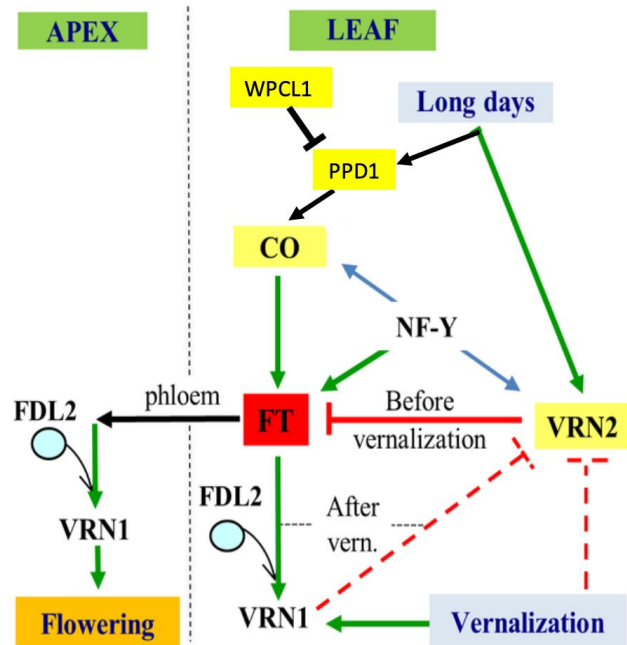
Candidate Gene Selection

Wheat Flowering



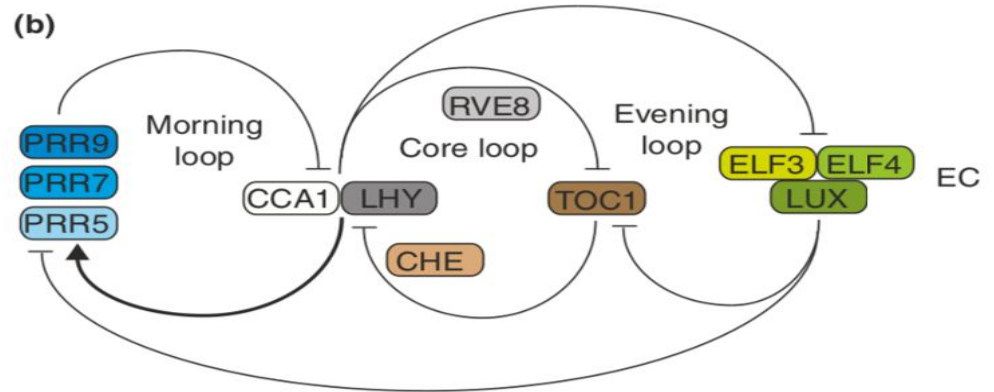
Complex Interplay of Genes & Environment During Flowering

Wheat Flowering Pathway



Source: Modified from chen et al 2012

Circadian Clock In Arabidopsis

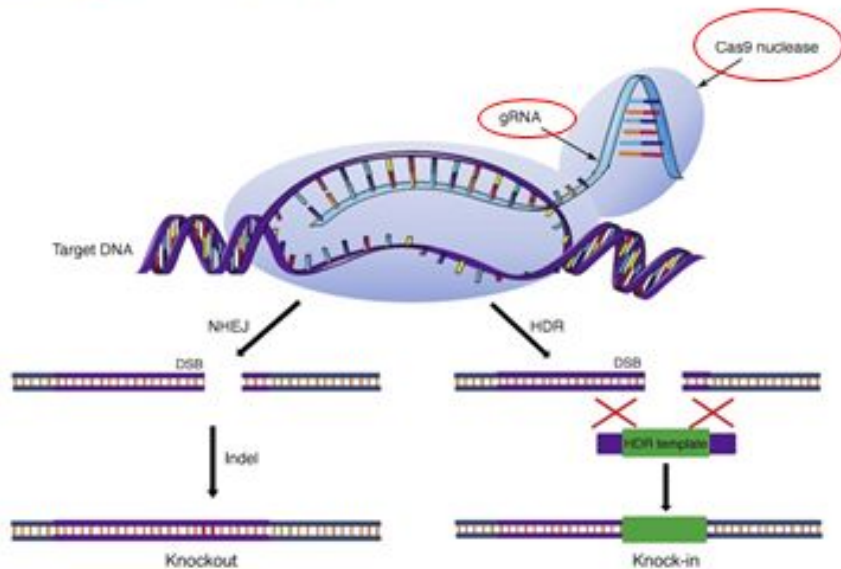


Source: Staiger et al 2012



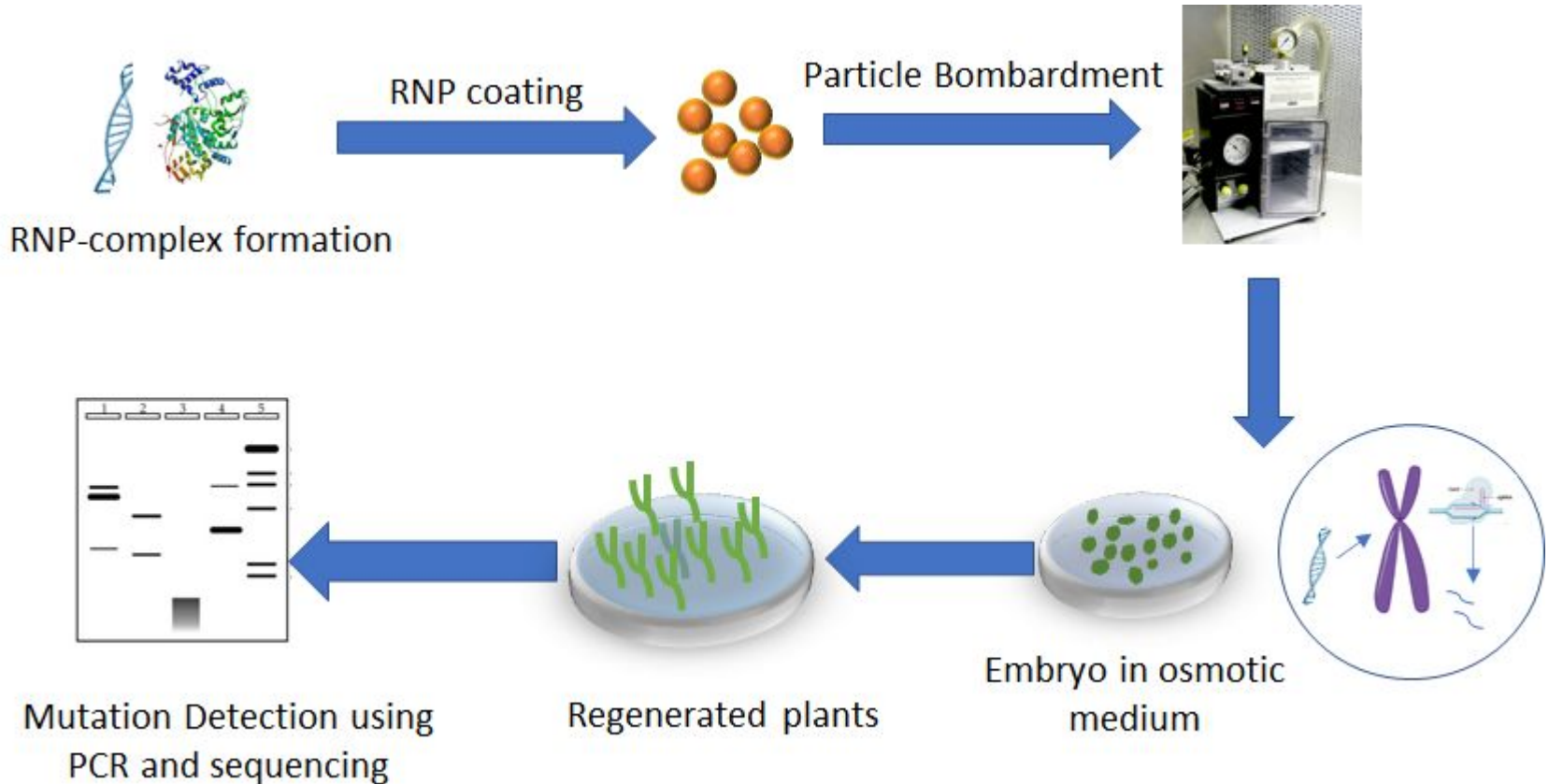
CRISPR-Clustered Regularly Interspaced Short Palindromic Repeat

IDEAL TOOL

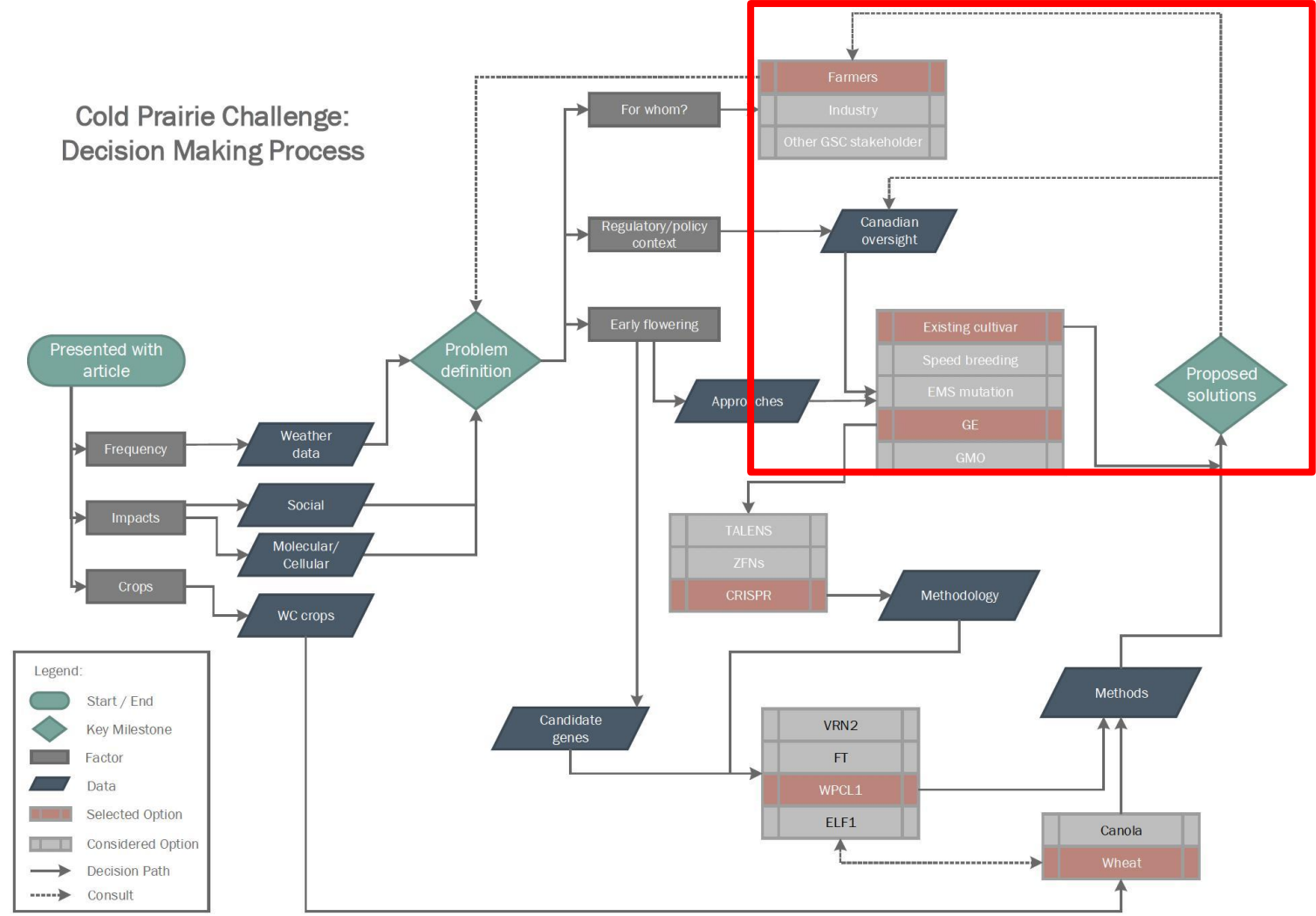


**CRISPR-Cas9
Ribonucleoprotein
Complexes**

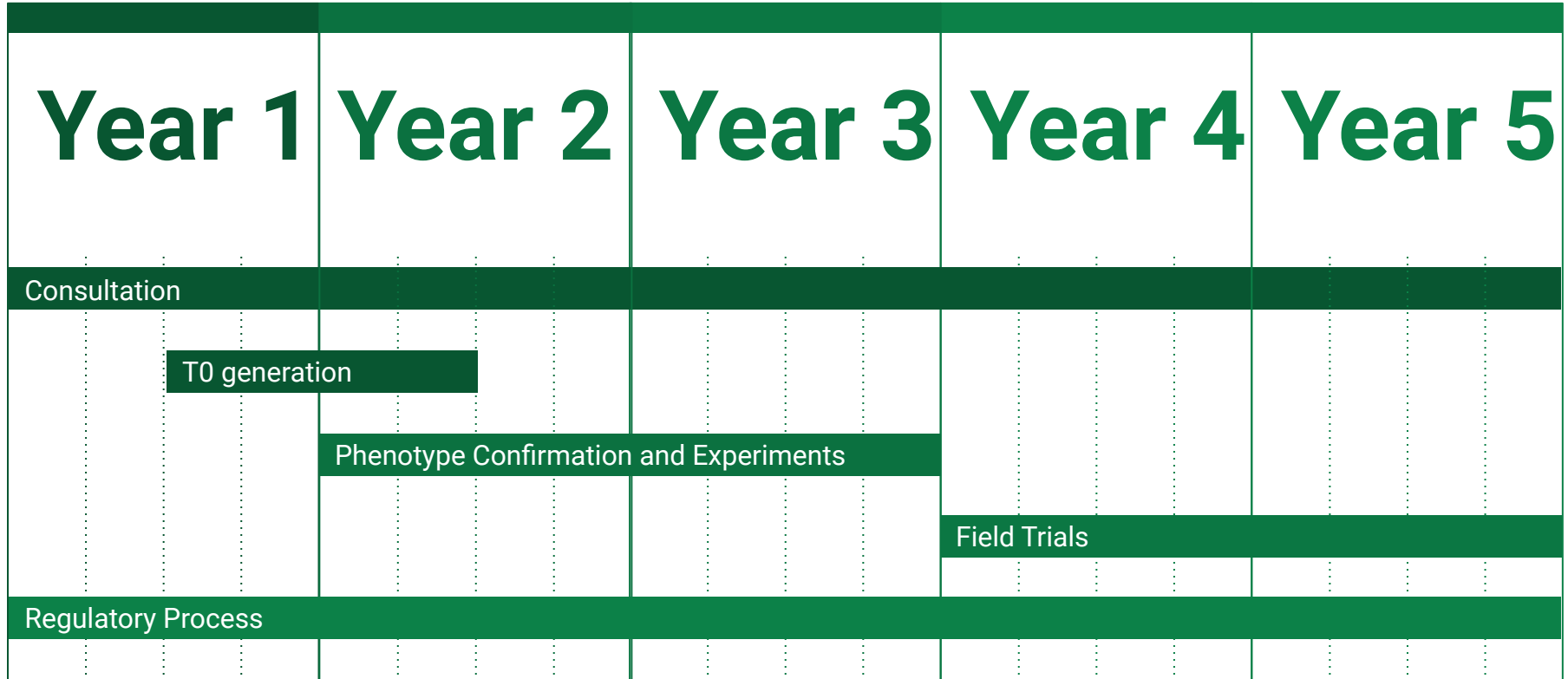
Knockout-based CRISPR/Cas9



Cold Prairie Challenge: Decision Making Process



Projected Timeframe



Conclusion

- “Snowmageddon” is a complex issue
- Tremendous potential for CRISPR/Cas9 to address issue

Thank You

