



AGRONOMIC RECEPTOR

2022 UPDATE

Agronomic Receptor Evaluation (Eco-Direct Pathway)

Overall Objective:

Applicability of the Ecological Direct Soil Contact pathway as it relates to agronomic receptor species for the White Area of Alberta

Establish path toward a scientifically defensible depth at which the ecological direct soil contact pathway is applicable



Phase 1

Agronomic
Receptor
Evaluation

Phase 2

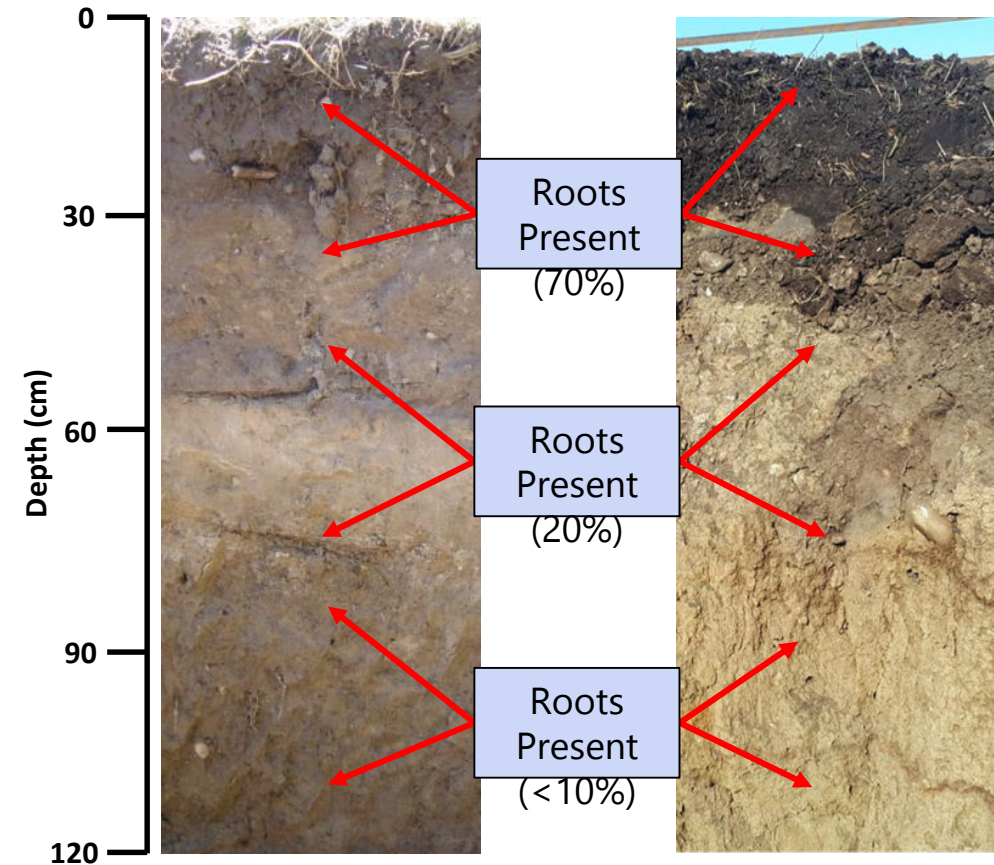
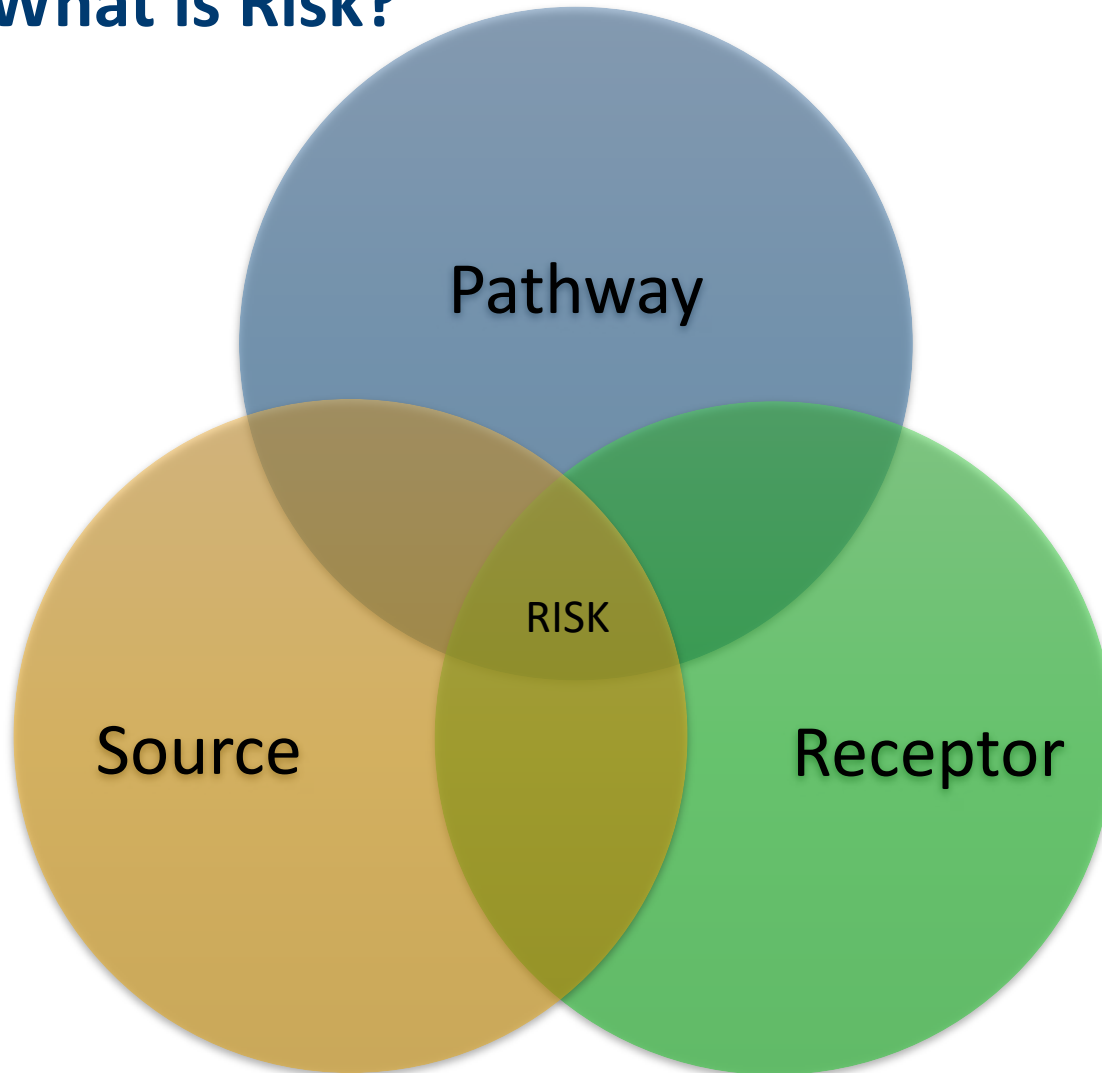
Greenhouse
Study

Phase 3

Field
Validation

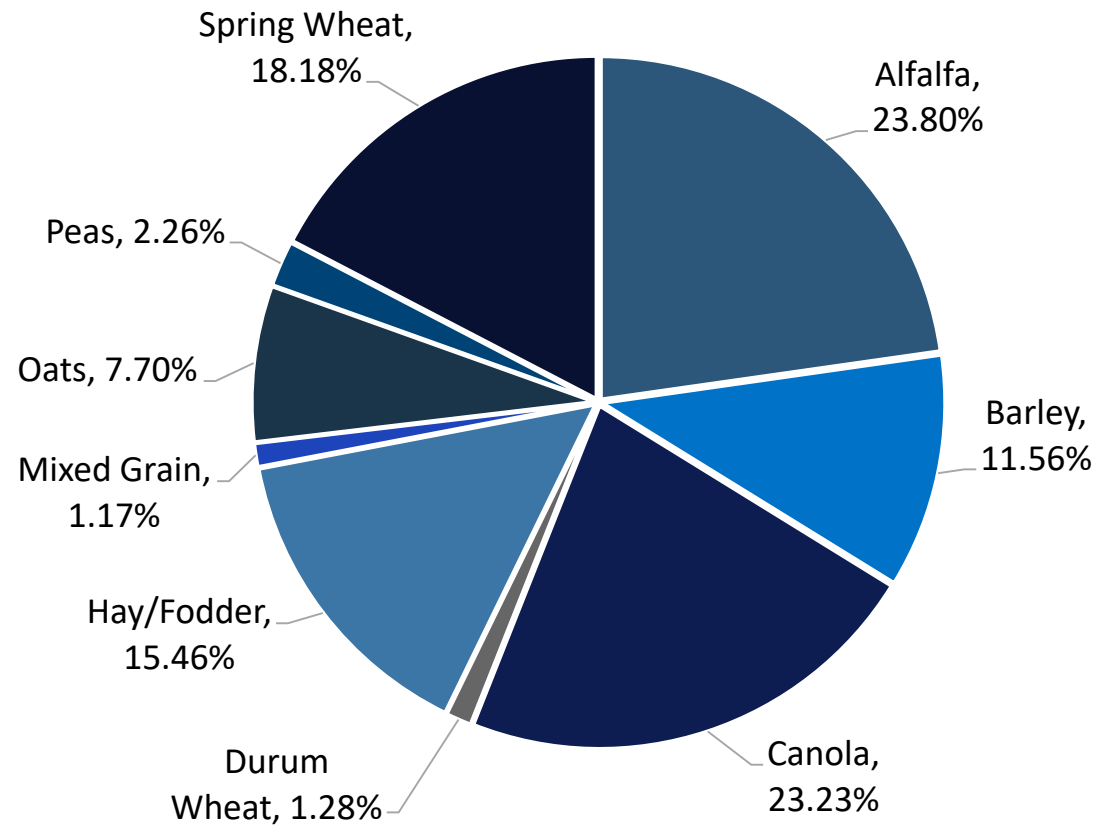
Agronomic Receptor Evaluation (Eco-Direct Pathway)

What is Risk?

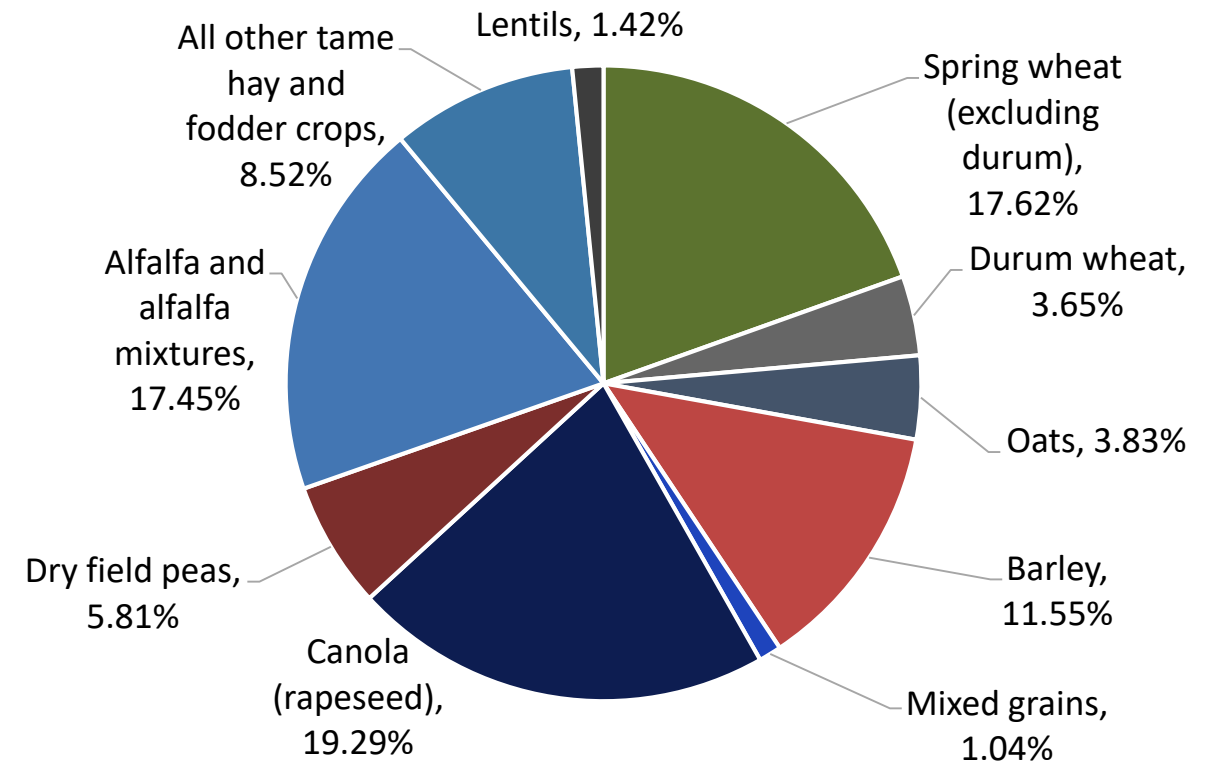


Phase 1: Agronomic Receptor Evaluation

2011 Crop Distribution



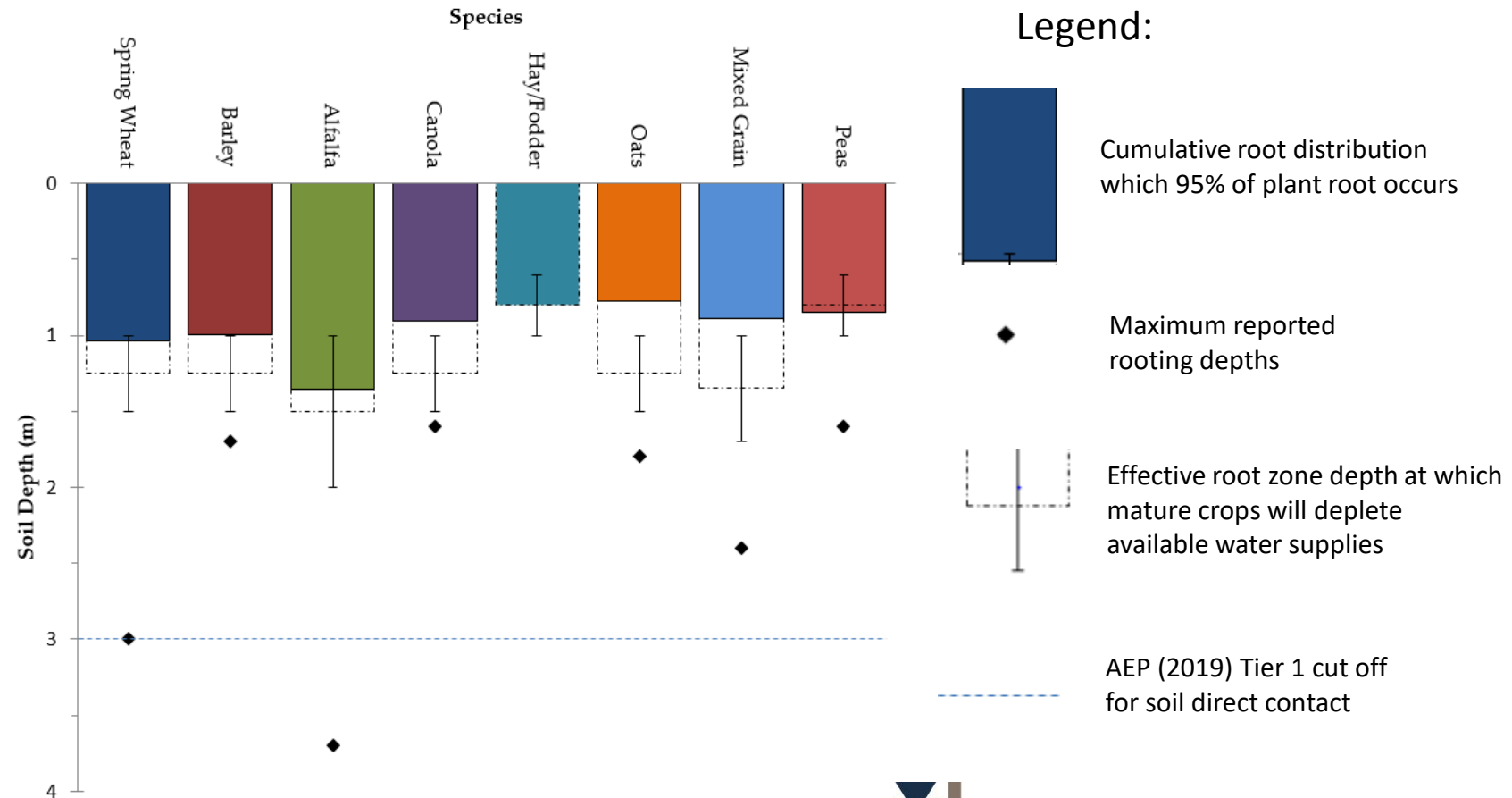
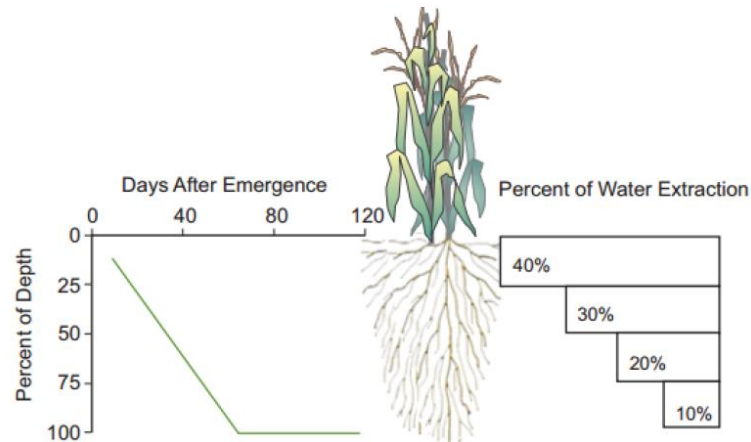
2016 Crop Distribution



Phase 1: Agronomic Receptor Evaluation

Eco-Contact and Effective Rooting Depth

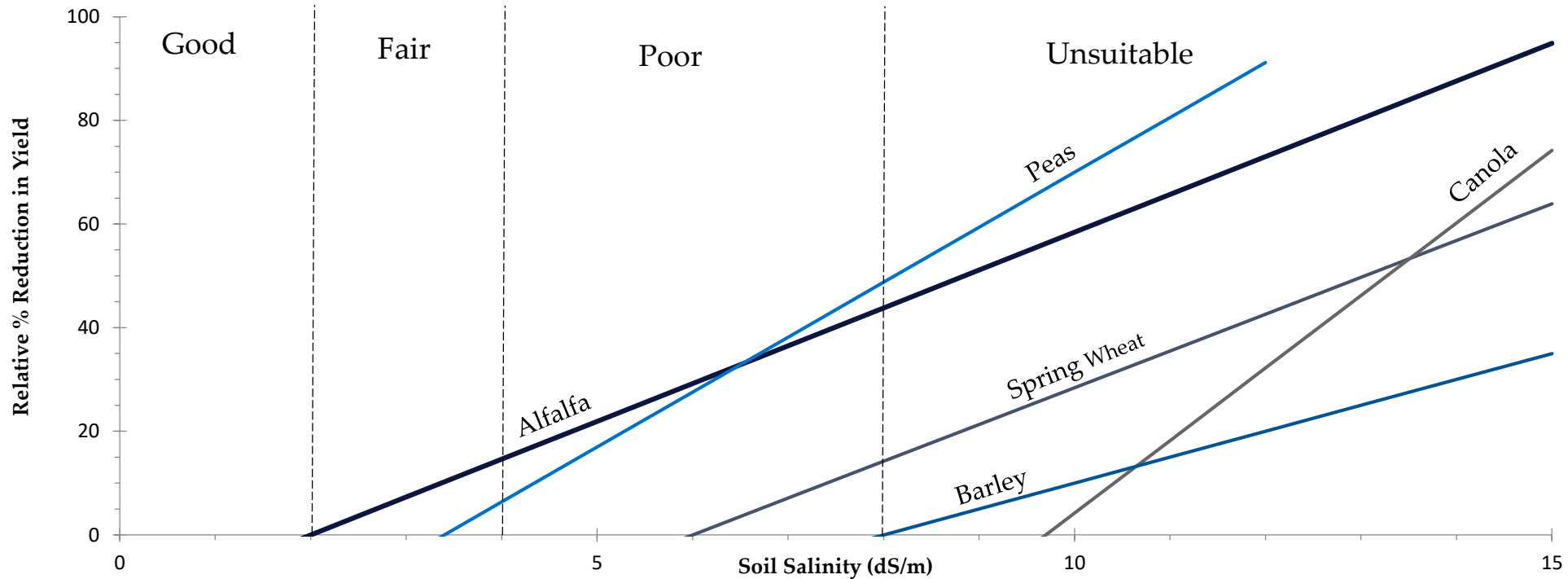
- Effective rooting depth is the zone, or depth, by which most of the plant available water is obtained.



Data adapted from: Jianling *et al.* 2016 and USDA 2016

Phase 1: Agronomic Receptor Evaluation

Eco-Contact and Crop Sensitivity



- Crop sensitivity analysis for a select number of prevalent crop species in Alberta (AENV 2001). The SCARG classification of soil suitability is represented by vertical dashed lines.

Phase 1: Agronomic Receptor Evaluation

Surrogate Species Selection

- Alfalfa chosen as surrogate species in Alberta:



- identified as the deepest rooting species currently, and projected to be (next 10 to 20 years), commercially grown in Alberta



- considered sensitive to salinity



- ubiquitous across all ecoregions



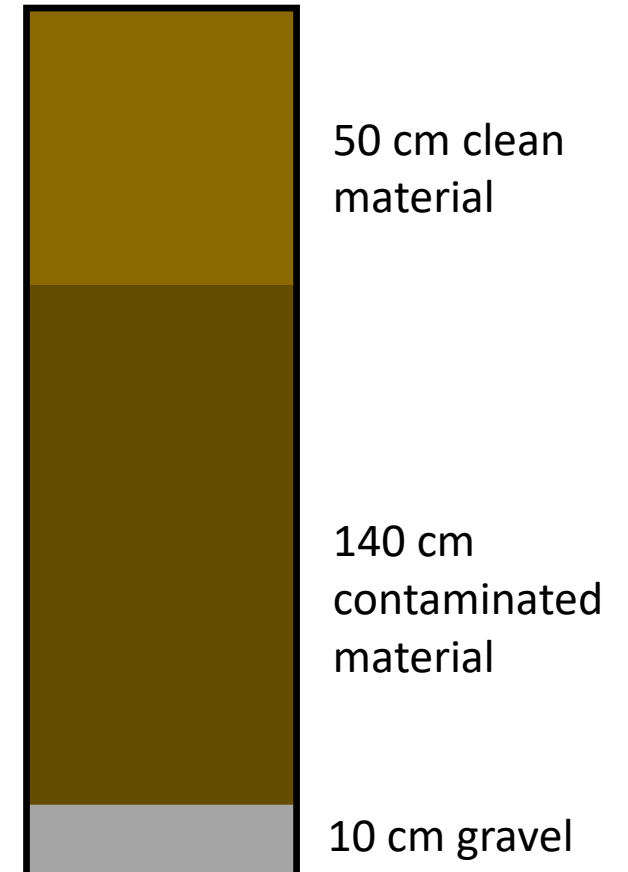
- conservative surrogate



- Objective:** Determine the impact of salinity on above and below ground plant health when found at various depths within the profile

Example: 50 cm bgs treatment

Treatments/Parameters	Number	Description
Surrogate species	1	Alfalfa (<i>Medicago sativa</i>)
Surrogate COPC	1	NaCl (soil spiked to 14.5 dS/m)
Growth Medium/Soil	1	Topsoil (loam)
Depth to salinity (cm)	7	Control (no NaCl added) 50 cm bgs 75 cm bgs 100 cm bgs 125 cm bgs 150 cm bgs 175 cm bgs
Replicates	10	30 cm diameter, by 200 cm tall PVC columns



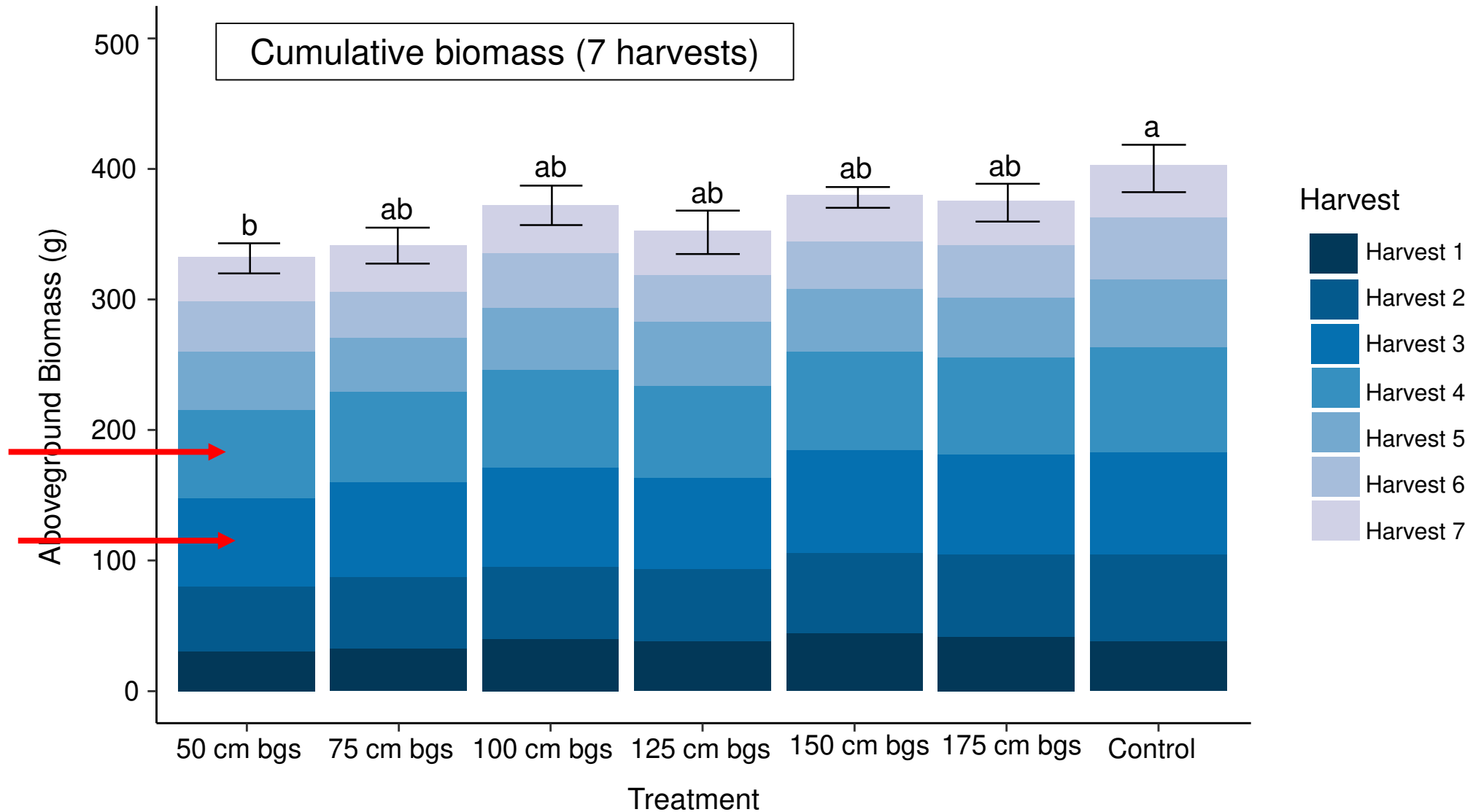
Phase 2: Monitoring

- Measurements:
 - Growth stage
 - Plant height
 - Aboveground biomass (8 harvests)
 - Root biomass, distribution, depth (at takedown)
 - Soil (moisture, salinity)



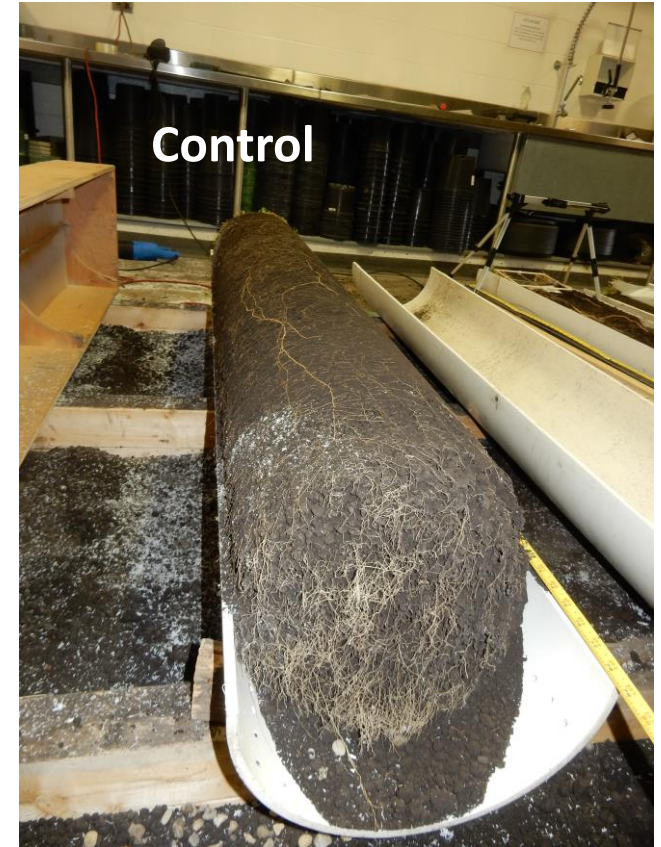
Phase 2: Aboveground biomass

- Differences in salinity treatments varied with time



Phase 2: Belowground growth

- Clear visual impacts of salinity on roots!



Phase 2: Summary

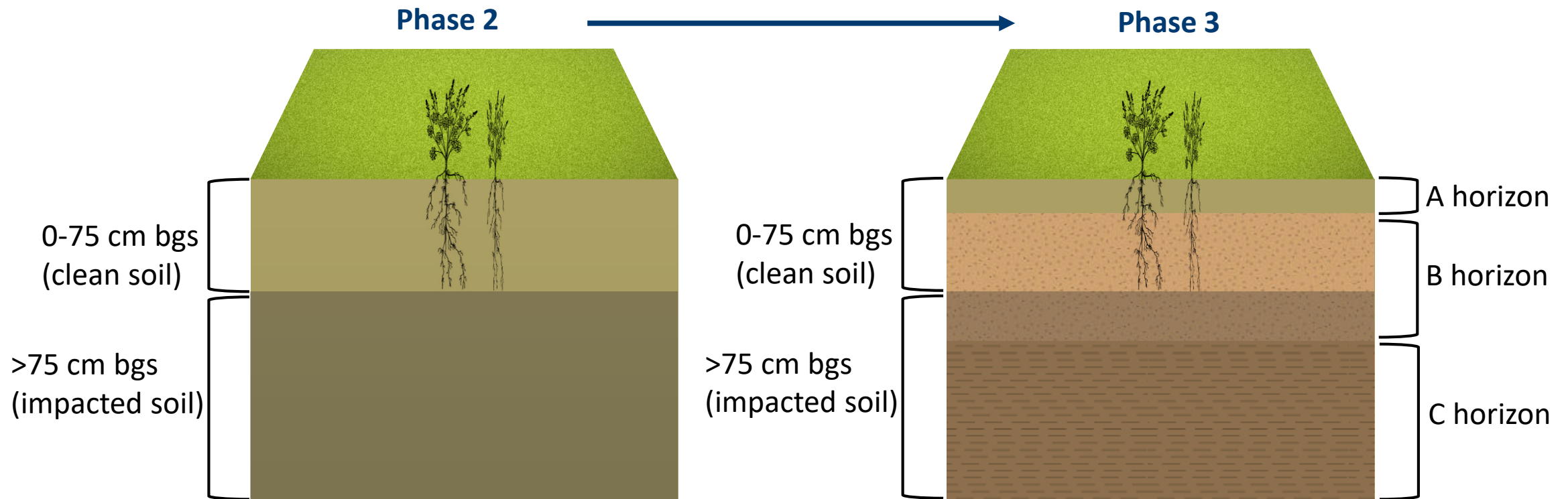
- Effect on aboveground growth not always consistent
- Visual impacts of salinity on roots
- Where root growth restricted, soil organisms likely to be impacted
- Coarse roots impacted with salt contamination present at 150 cm bgs; fine roots may be impacted deeper
 - **Further investigation of root distribution will provide a more complete picture**
- Results anticipated to be of high value to regulators and decision makers regarding soil eco-contact guidelines



Phase 3

Objective

- Validate findings from Phase 2 in a field setting
 - Soil with horizons vs. topsoil used in Phase 2
 - Agricultural species growing in soil with salinity impacts 75 cm bgs or deeper



Phase 3: Field Validation

Site Selection

Treatments/Parameters	Number	Description
Soil Zones	2	Brown Soil Zone Black Soil Zone
Plant Species	1	Alfalfa (<i>Medicago sativa</i>)
Depth to Salinity	1	75-100 cm bgs preferred for the Brown soil zone; down to 150 cm bgs acceptable in the Black soil zone. The depth will be similar for sites within a soil zone, but may differ between zones.
Salinity Concentration*	1	High enough to elicit a negative effect on roots (i.e., >12 dS/m)
Number of Sites (in each soil zone)	3	To allow for scientific rigor and statistical analysis.
Total number of sites = 6		

Phase 3

Monitoring

- Year 1
 - Initial soil characterization
 - Aboveground biomass (if alfalfa already established) or seed alfalfa
- Year 2
 - Aboveground biomass
- Year 3
 - Aboveground biomass
 - Evaluate root depth and distribution
 - Soil salinity
 - Soil invertebrates and microbes (TBD)
- Weather station monitoring in all years



Phase 3

Outcomes (Phase 1-3)

- Provide a robust understanding of the effect of salinity on soil ecological direct contact receptors
- Recommendations for an exclusion depth, with the goal to minimize unnecessary soil excavation and disposal while protecting the environment
 - Cost savings for industry and government
 - Reduce land disturbance through remediation where appropriate



Image: <https://www.picfair.com/pics/05743886-rolled-hay-bails-in-alfalfa-field-with-blue-sky-airdrie-alberta-canada>

You can help! If you have appropriate sites for Phase 3, please reach out to us.