

Diagnosing Salinity Problems

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Causal Factors

Geology: weathering of primary minerals, marine sediments, etc

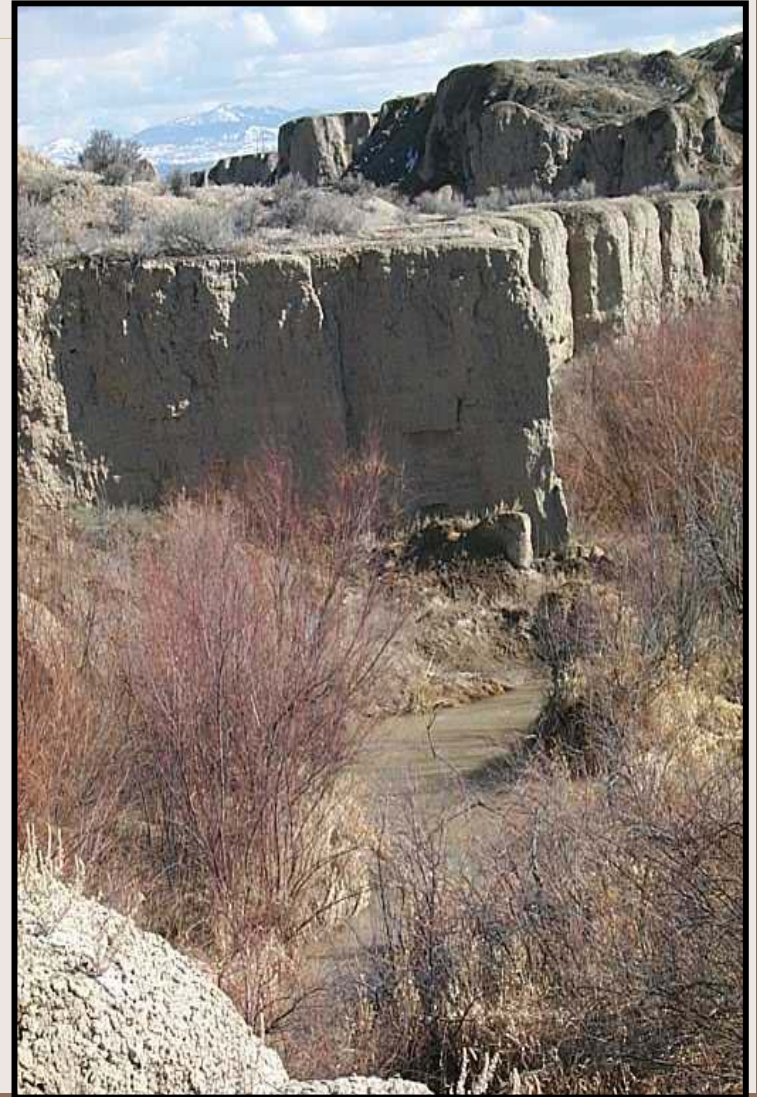
Climate: evaporation exceeds precipitation

Irrigation: water with moderate to high TDS

Water table: near soil surface

Drainage: poor

Other?



Terminology

- **Soluble salts** – major dissolved inorganic solutes
- **Salinity hazard** - total soluble salt content
- **Sodium hazard** - relative proportion of exchangeable sodium (Na^+) to calcium (Ca^{++}) and magnesium (Mg^{++}) ions
- **Alkalinity** - soil pH >7.0 ; “basic” soil, problems usually start at pH >7.8 as nutrient deficiencies
- **Ion specific effects** - effect of chloride (Cl^-), sodium (Na^+), or boron (B) on plants not due to osmotic stress

Generalized Classification of Salt-Affected Soils

Classification	Electrical Conductivity (dS/m)	Sodium Adsorption Ratio (SAR)	Soil pH
Saline	>4.0	<13	<8.5
Sodic	<4.0	≥ 13	>8.5
Saline-Sodic	>4.0	≥ 13	<8.5
High pH	<4.0	<13	>7.8

Lab parameters for diagnosing salinity/sodicity problems

- pH
- Electrical Conductivity (EC)
- Sodium Adsorption Ratio (SAR)
- Exchangeable Sodium Percentage (ESP)
- CEC
- Lime Estimate
- TDS (water only)
- Anions and cations: eg. Ca, Mg, Na, Cl, SO₄, CO₃, HCO₃
- Available gypsum and gypsum requirement
- Soil texture estimate
- Other?



Field Diagnosis

Problem	Potential symptoms
saline soil	<ul style="list-style-type: none">· white crust on soil surface· water stressed plants· leaf tip burn
saline irrigation water	<ul style="list-style-type: none">· leaf burn· poor growth· moisture stress
sodic soil	<ul style="list-style-type: none">· crusting or hardsetting· low infiltration rate; runoff and erosion· dark powdery residue on soil surface· stunted plants with leaf margins burned
saline-sodic soil	<ul style="list-style-type: none">· generally, same symptoms as saline soil
high pH	<p>nutrient deficiencies manifesting as</p> <ul style="list-style-type: none">· stunted yellow plants· dark green to purplish plants

Field Diagnosis – Saline Soils

- Plant may appear water stressed
- Poor germination
- Leaf burn
- White alkali on surface
- Shallow water table











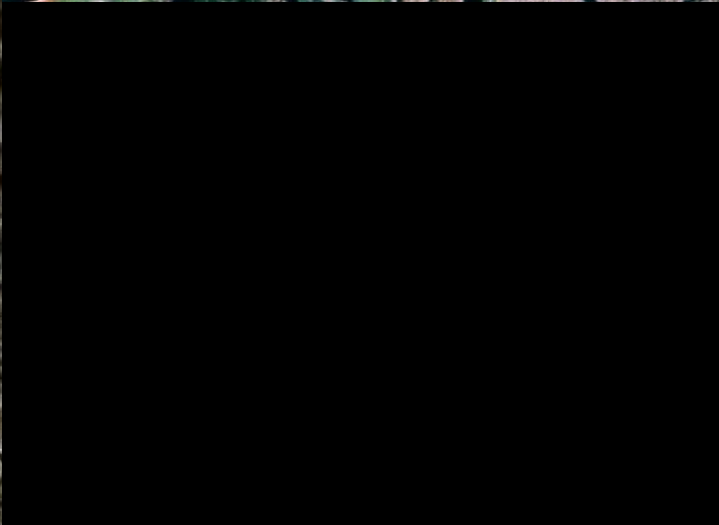
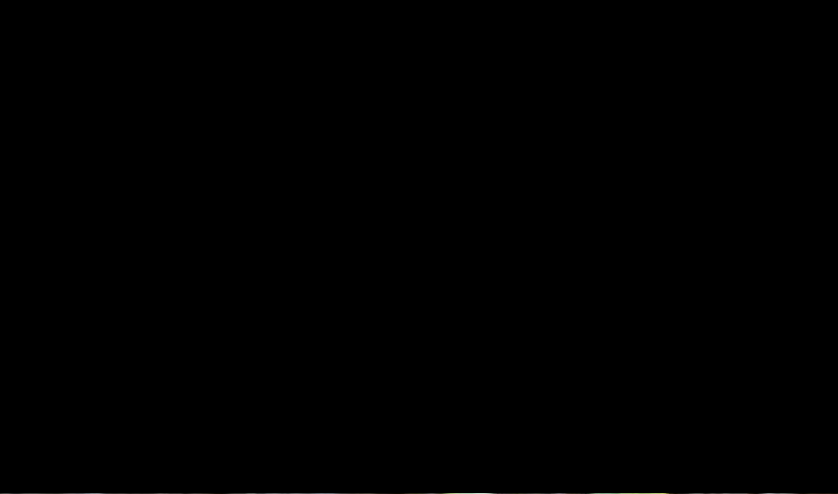




Field Diagnosis – Sodic Soils

- loss of soil structure
- crusting or hardsetting
- low infiltration rate; runoff and erosion
- dark powdery residue on soil surface
- stunted plants
- nutrient deficiencies





Soil Sampling

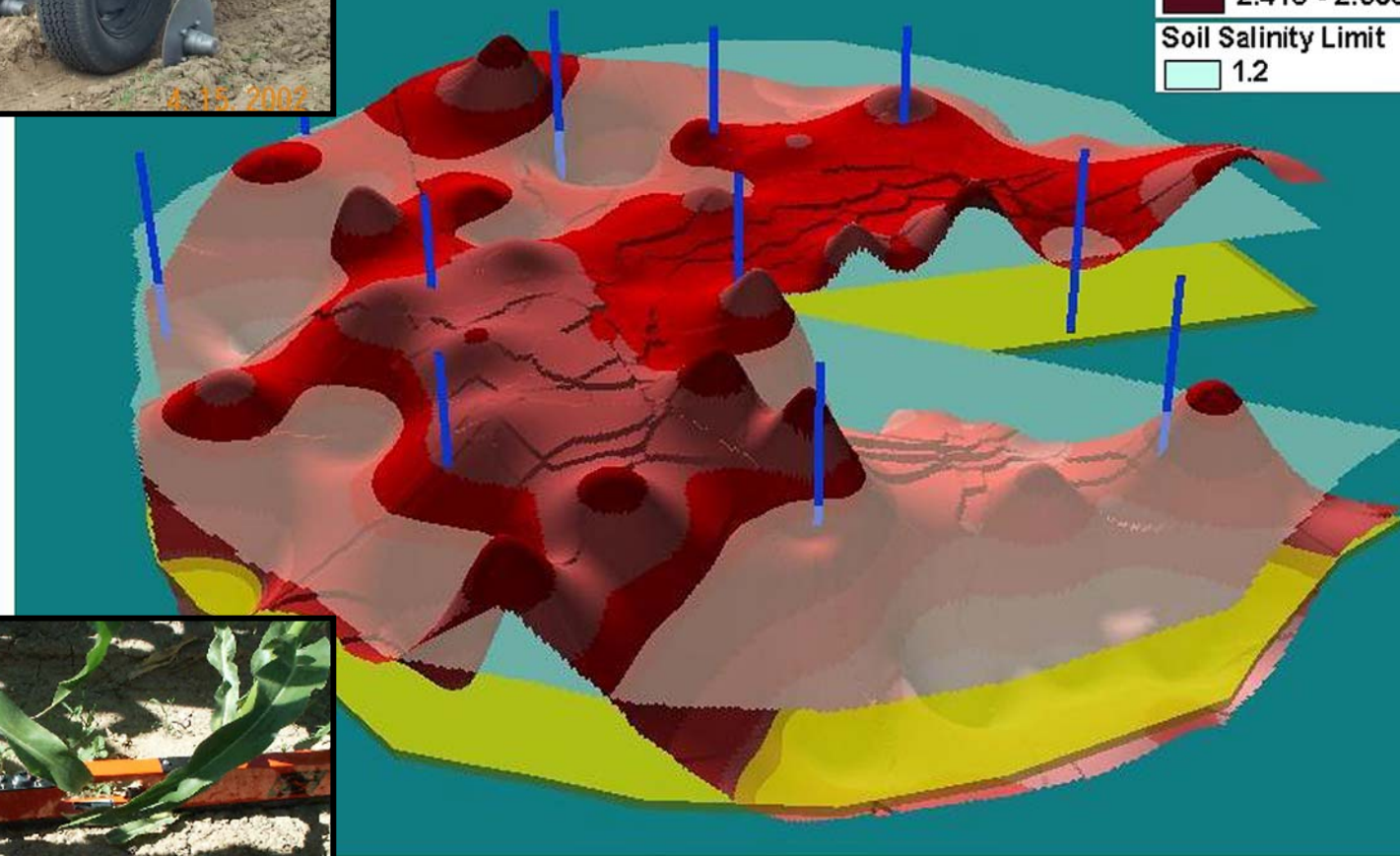




SOIL SALINITY in dS/m

	0.496 - 0.736
	0.736 - 0.976
	0.976 - 1.216
	1.216 - 1.457
	1.457 - 1.697
	1.697 - 1.937
	1.937 - 2.177
	2.177 - 2.418
	2.418 - 2.658

Soil Salinity Limit
 1.2



Irrigation Water Sampling



What lab tests do you need to run ...

- If you are unsure, but suspect a salinity or sodicity problem?
- If you suspect poor quality irrigation water?
- If you know that a salinity problem exists and you want to monitor or calculate leaching requirement?
- If you know that a sodicity problem exists and you want to calculate gypsum requirement?



Evaluate 3 Field Situations

- Given routine soil test analysis and irrigation water analysis ...
 - How would you classify each situation as to salinity hazard?
 - What information did you use to diagnose the situation?
 - What additional field or lab information do you need to plan a management or reclamation strategy?

Summary

- Properly characterize the situation
- Provide grower with good documentation and maps
- Help grower identify and understand problem before it gets out of hand
- Don't make the problem worse - get help