Building tools for healthy vineyard soils:

A Salinity Story

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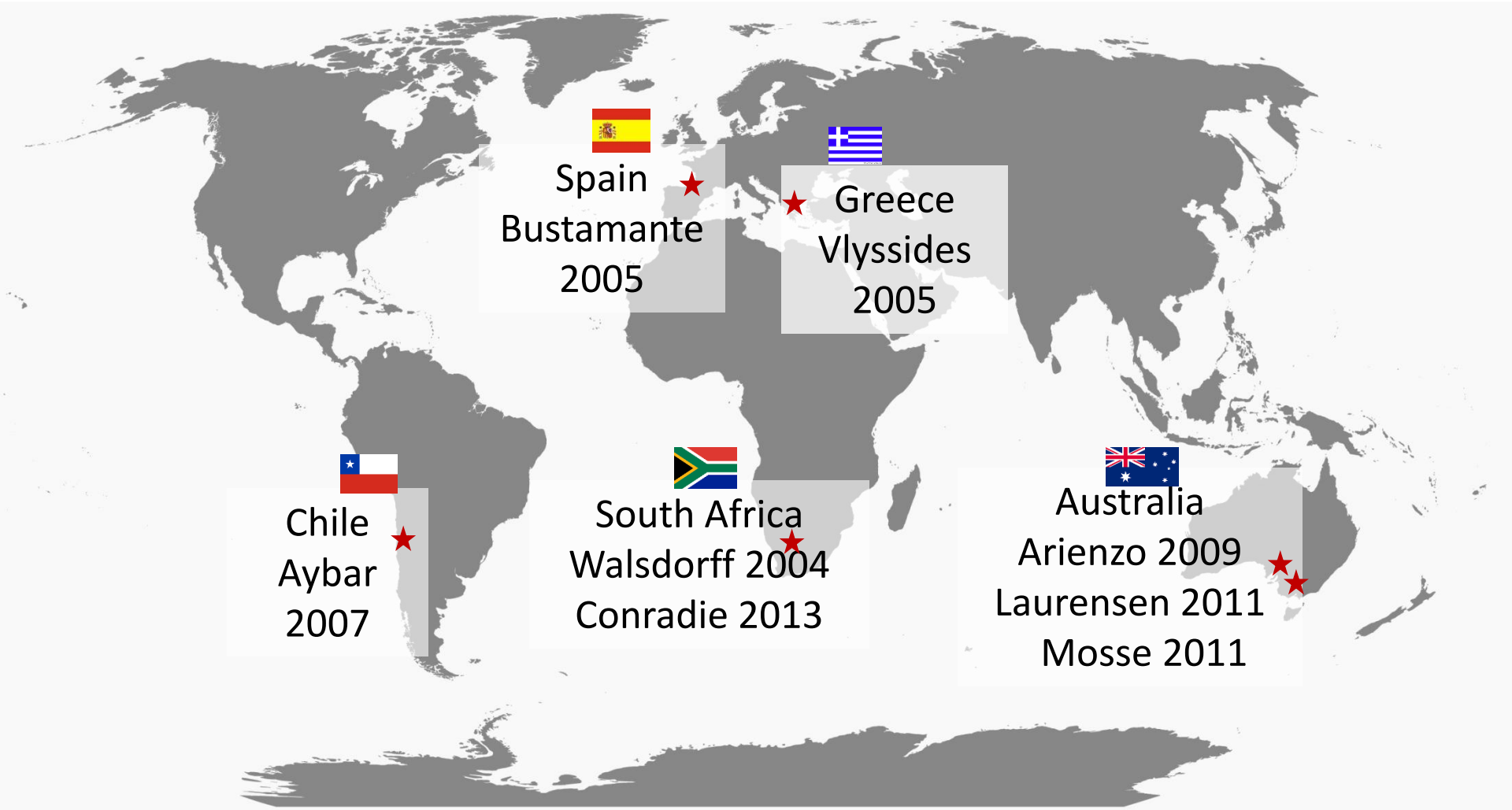
Winery Wastewater Studies Around the World



What Do We Know About Winery Wastewater?

- Grape pulp, skins, & seeds, lees, tartar, & fining agents
- Cleaning compounds → Often Na^+ and K^+ based
- Organic acids, alcohols, esters, & polyphenols
- Widely fluctuating acidity, organic loads, & flow volume
- Treatment approaches vary

Constructed wetland

Objectives

Baseline of winery wastewater for Northern & Central California

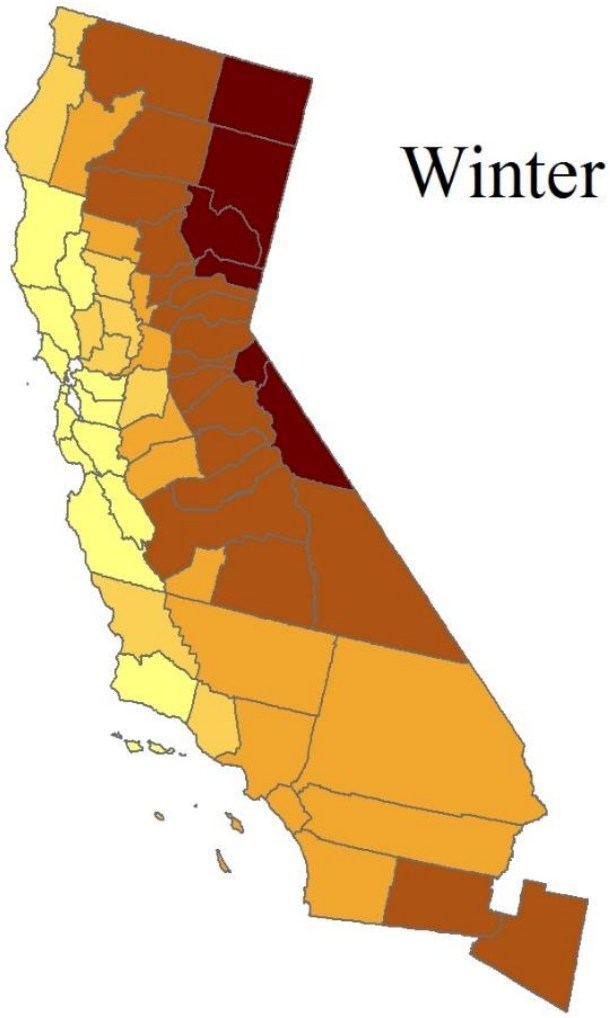
How do Na^+ and K^+ affect hydraulic conductivity (HC) of soils of diverse dominant mineralogy?

Pictures eliminated

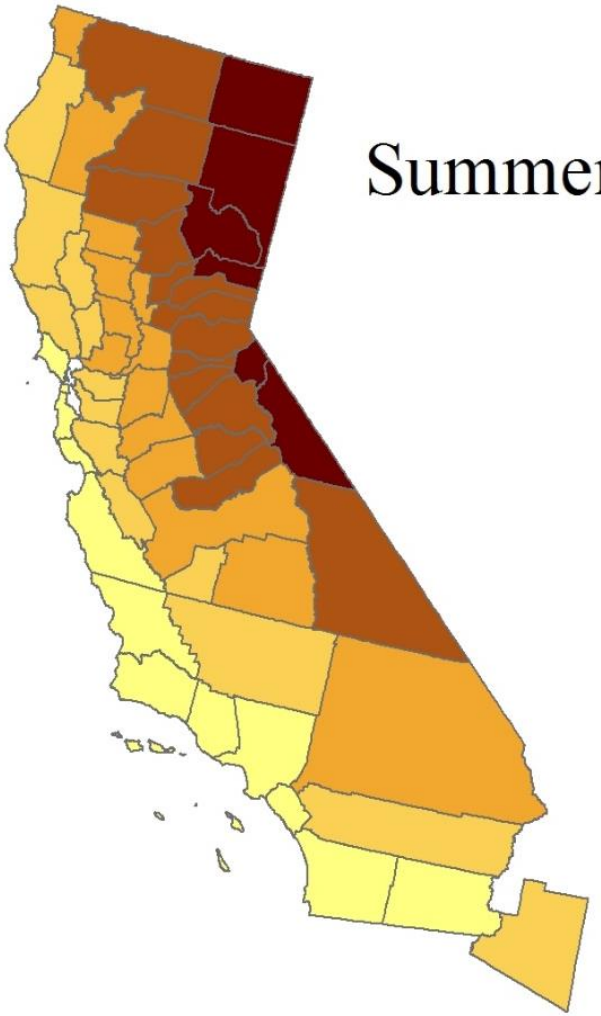
Long-term View: mitigating temperatures in 2040-2069

Increases in temperature, °C

2.4 — 3.9



Winter



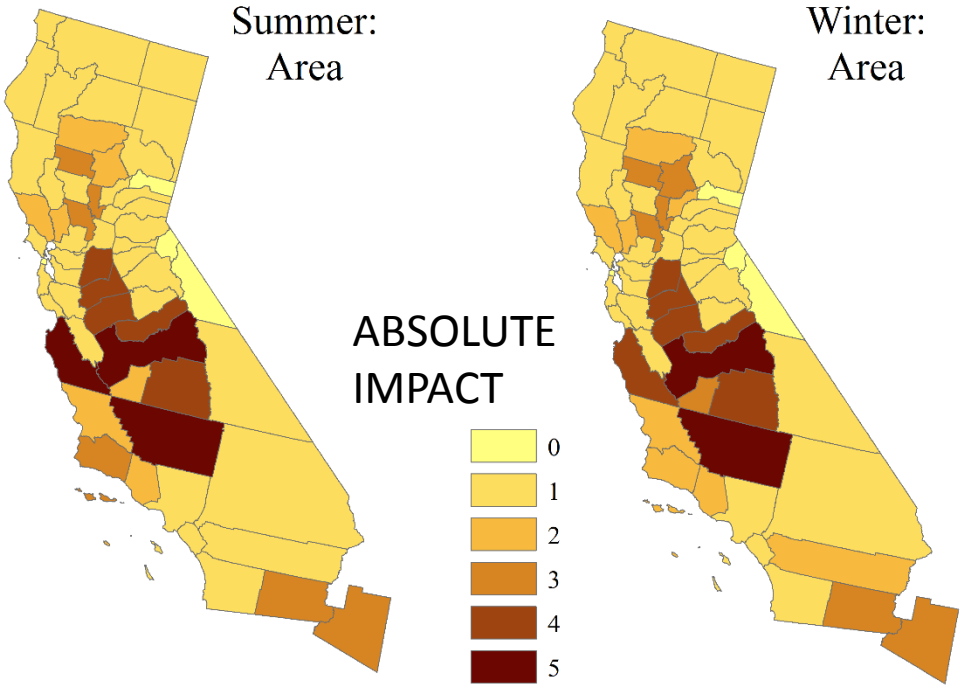
Summer

A. Kerr et al. 2017, Climatic Change

Crop Sensitivity to Temperature

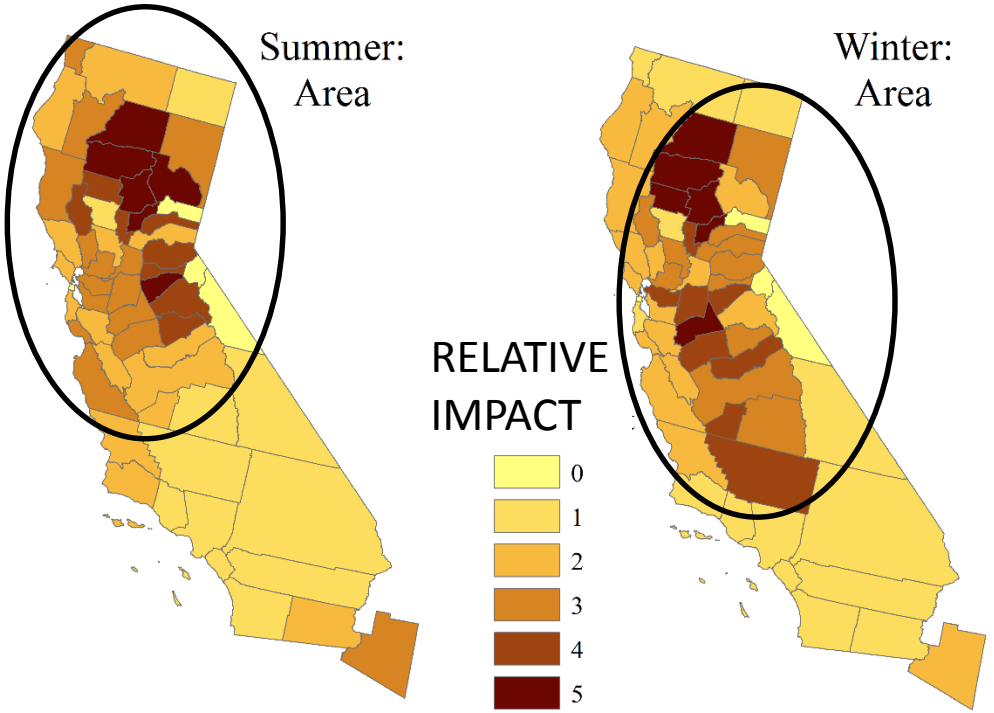
0 5

Effects of total specialty crop acreage by county



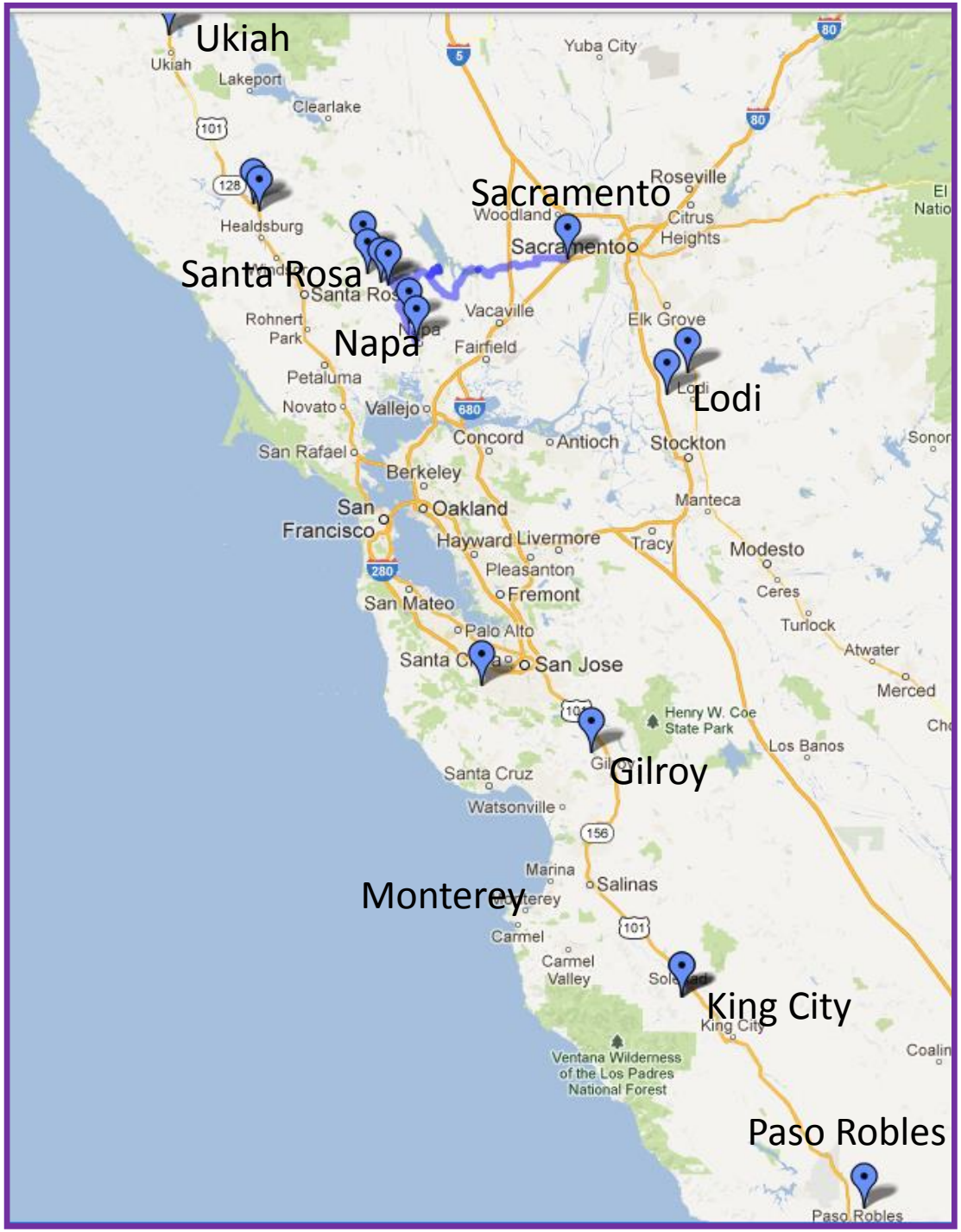
Scaled by acreage→

Reflects counties with low acreage but sensitive crops

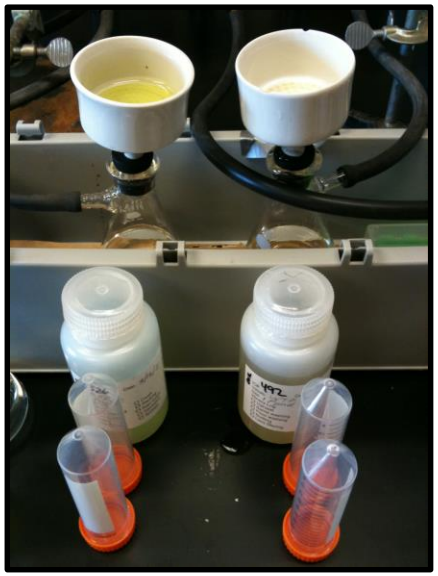


Winery Wastewater Survey

- Winery background surveys conducted
- 18 Wineries **pre-treatment** and **post-treatment** WW samples monthly for 2 years
- Winery activities logged



Winery Wastewater Analysis Methods



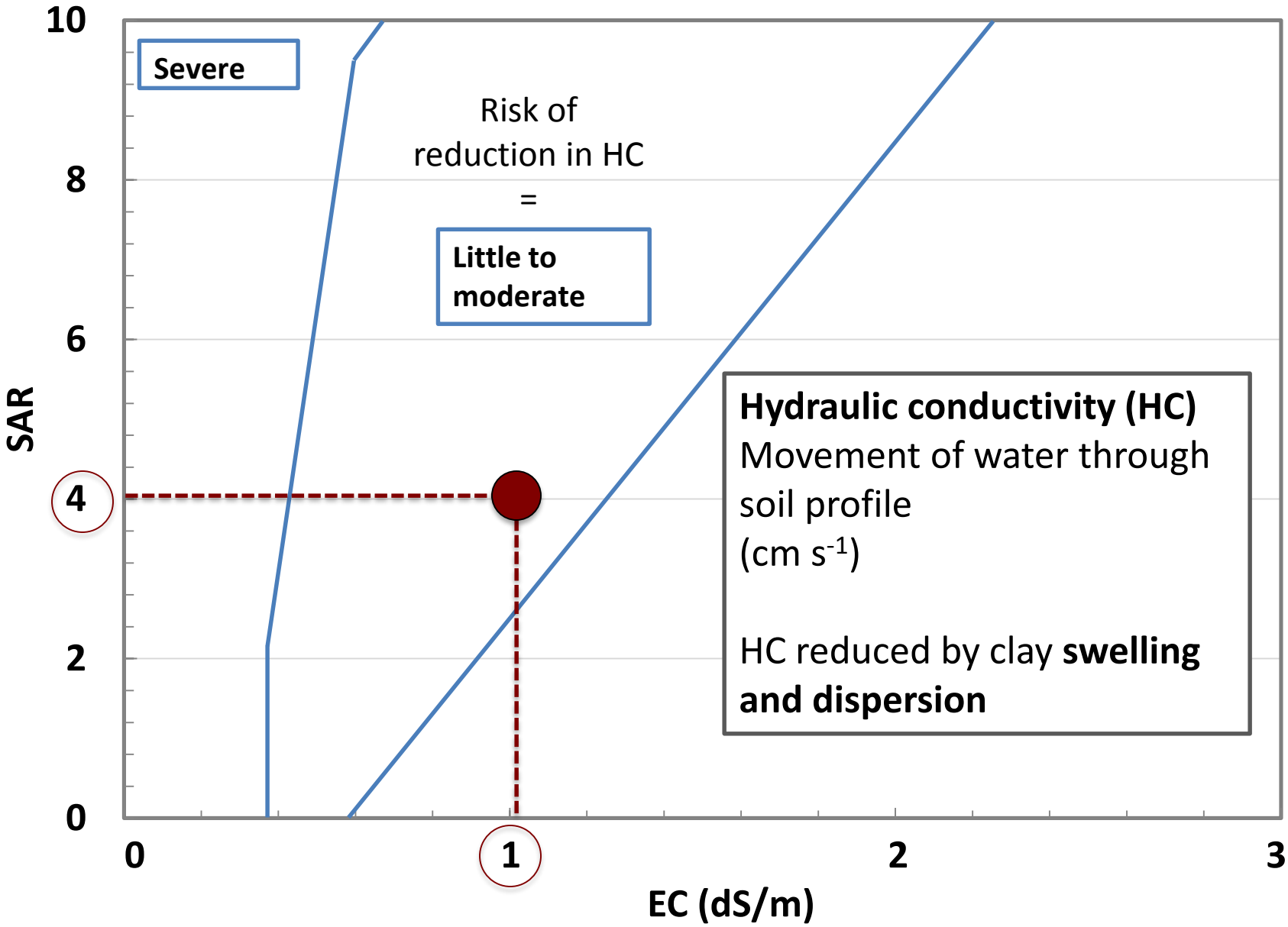
Dissolved organic carbon (DOC)

pH & EC

Ion composition

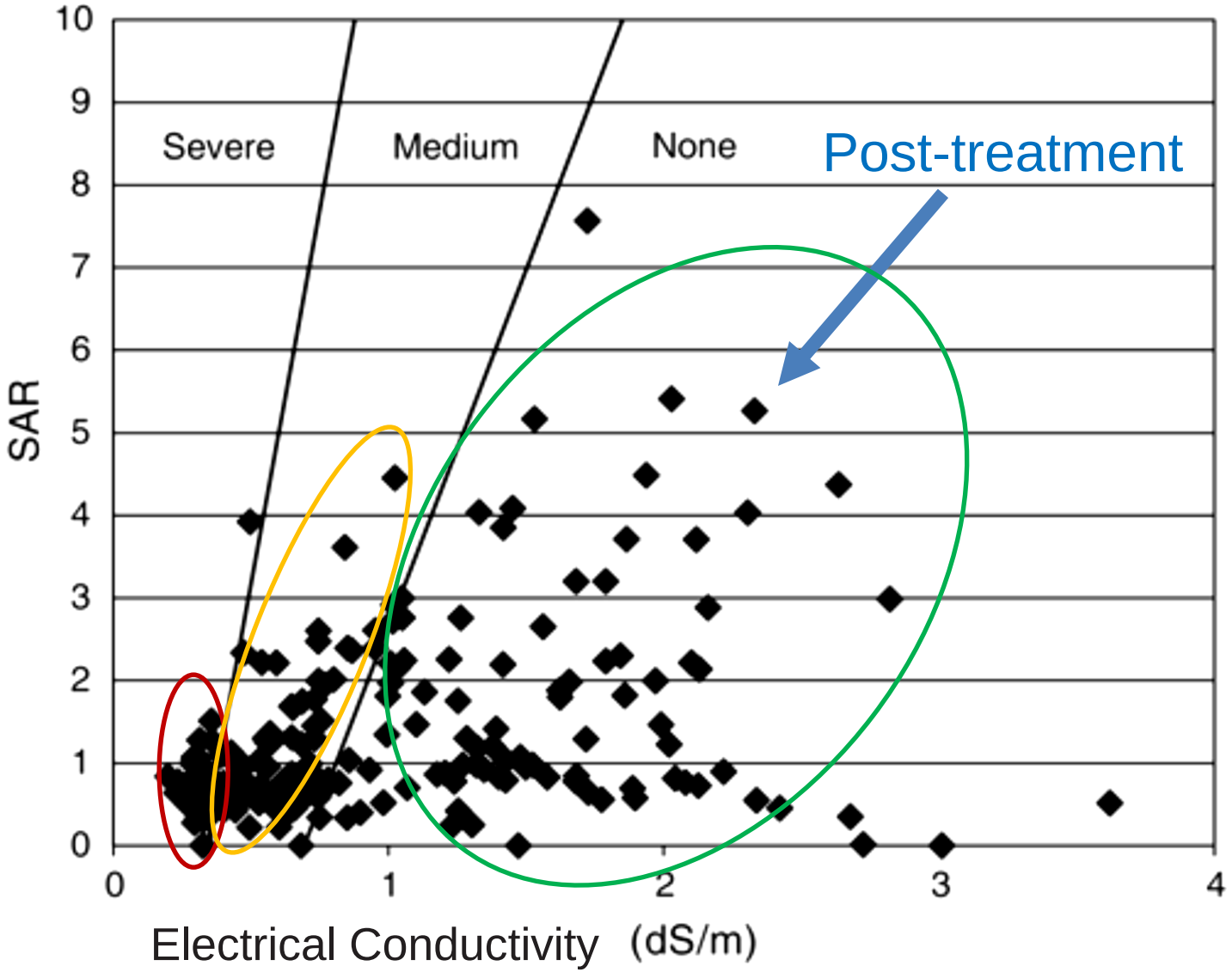
BOD_5
Biological Oxygen Demand

How Does Winery Wastewater Impact Soils?



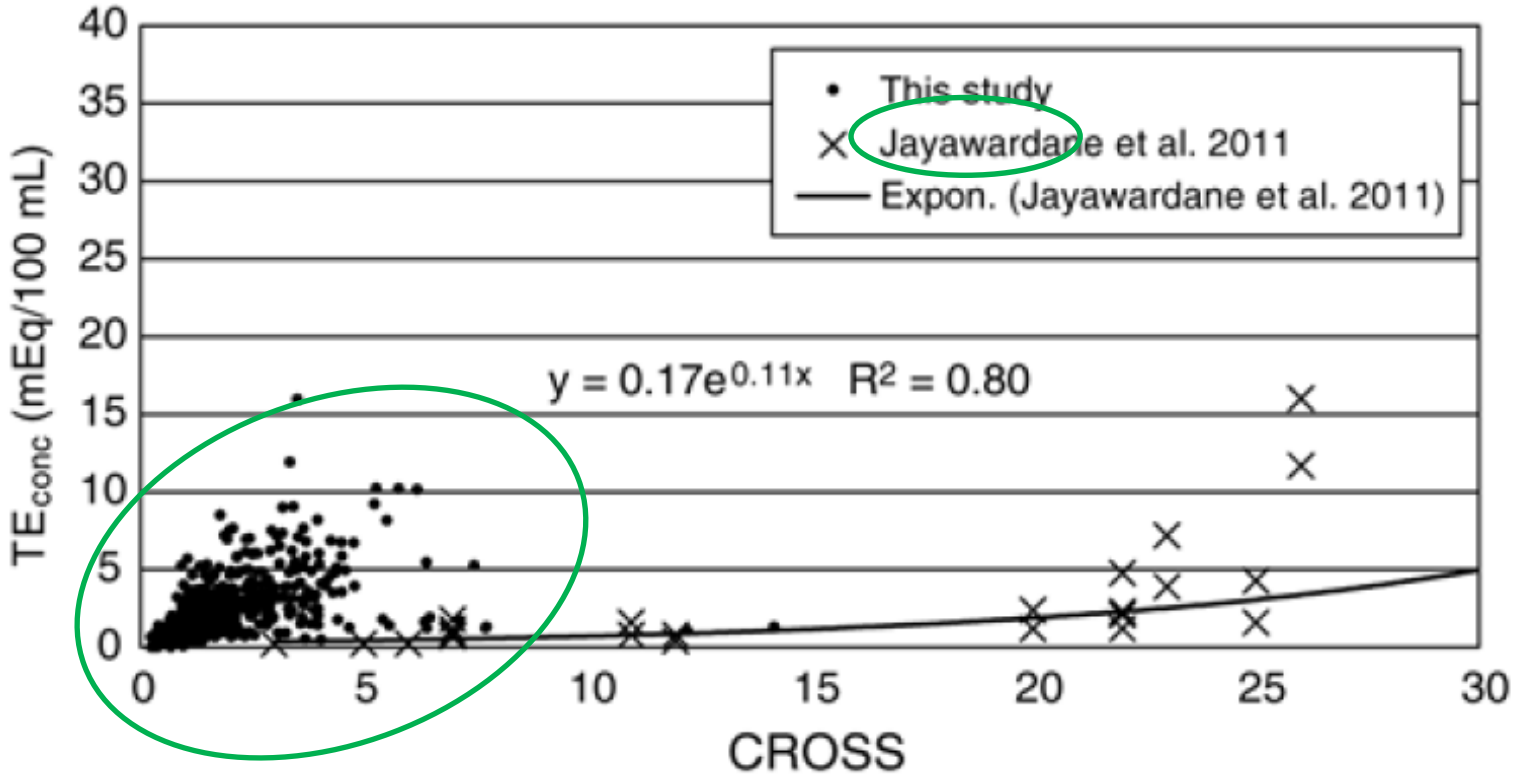
Adapted from Rhoades, 1977; and Oster and Schroer, 1979; Taken from Ayers and Westcot 1985. Water Quality for Agriculture. FAO Irrigation and Drainage Paper 29 rev. 1 FAO Rome.

Predictions for reductions in soil hydraulic conductivity, HC



Risk zones adapted from Ayers and Westcot (1985).

Points above the line =
no anticipated impact on soil hydraulic conductivity

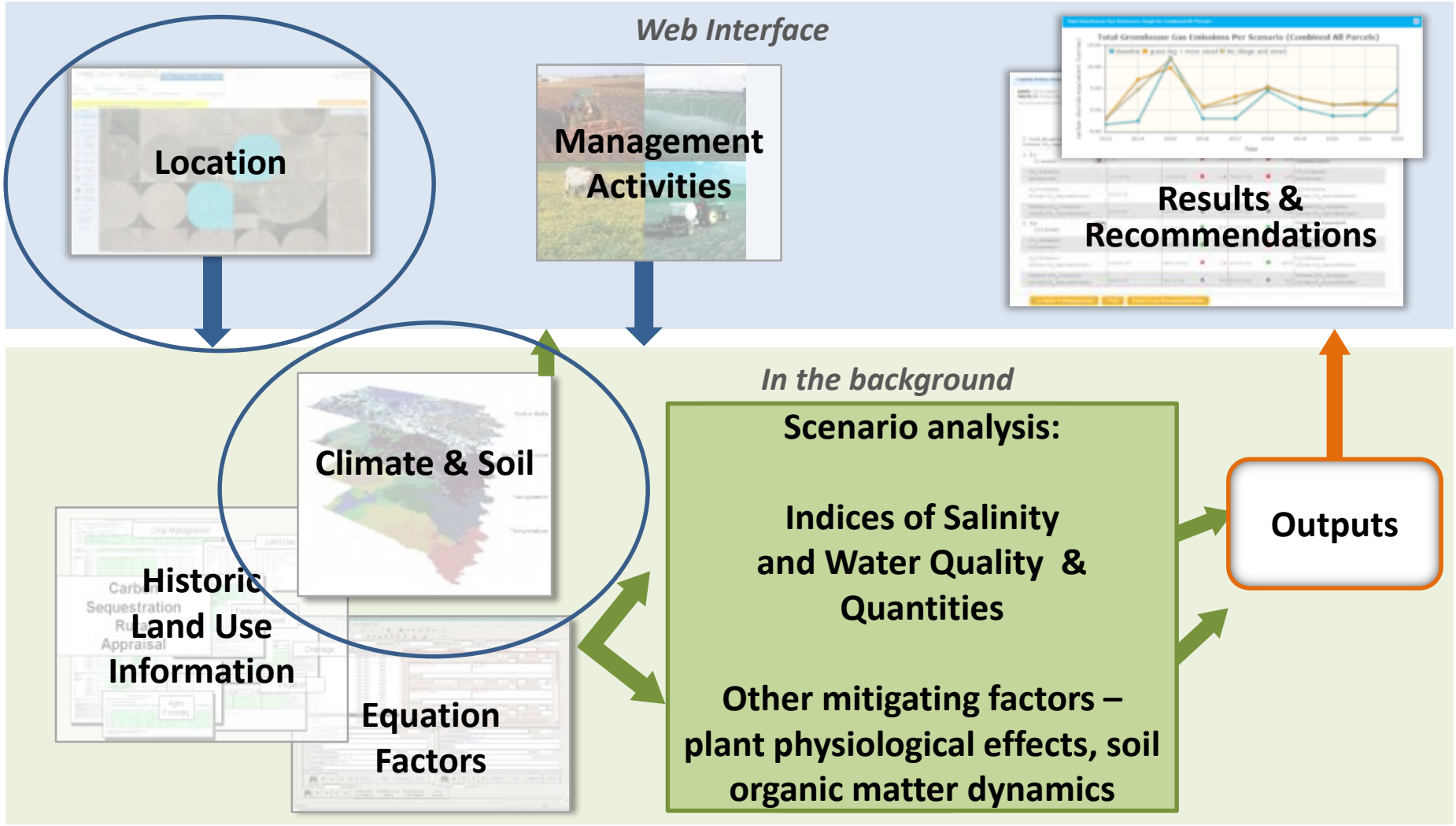


$$\text{CROSS} = (\text{Na} + a\,\text{K})/[(\text{Ca} + b\,\text{Mg})/2]^{0.5}$$
$$= \text{SAR}^* + a\,\text{PAR}^*$$

Rengasamy and Marchuk, 2011. Soil Research. 49:280-5

Oster, J.D., Sposito, S., Smith, C.J. 2016. California Agriculture, volume 70, no. 2, pp. 71-76

Conceptual Vision of Tool to Manage Salinity and Wastewater



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Original slide by M. Easter

USDA-ARS / UC Davis research publications that contain this reported work.

Buelow, M.C., K. Steenwerth, S.J. Parikh. 2015. The effect of mineral-ion interactions on soil hydraulic conductivity. Agricultural Water Management.152:277-285.

Buelow, M.C., K. Steenwerth, L.C.R. Silva, S.J. Parikh. 2015. Characterization of winery wastewater reuse in California. American Journal of Enology and Viticulture. 66:3, 302-310.

Kerr, A., J. Dialesandro, K. Steenwerth, N. Lopez-Brody, E. Elias. 2017. Vulnerability of California specialty crops to projected mid-century temperature changes. Climatic Change. Published online 7 September 2017. DOI 10.1007/s10594-017-2011-3

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