Building tools for healthy vineyard soils:

A Salinity Story

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Winery Wastewater Studies Around the World

- **South Africa**
  - Aybar 2007
  - Walsdorff 2004
  - Conradie 2013

- **Spain**
  - Bustamante 2005

- **Greece**
  - Vlyssides 2005

- **Chile**
  - Aybar 2007

- **Australia**
  - Arienzo 2009
  - Laurensen 2011
  - Mosse 2011
What Do We Know About Winery Wastewater?

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

Winter

Summer

A. Kerr et al. 2017, Climatic Change
Crop Sensitivity to Temperature

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

\[ \text{BOD}_5 \]

Biological Oxygen Demand
How Does Winery Wastewater Impact Soils?

Risk of reduction in HC = Little to moderate

Hydraulic conductivity (HC)
Movement of water through soil profile (cm s\(^{-1}\))
HC reduced by clay swelling and dispersion

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


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

Web Interface

Location
Management Activities
Results & Recommendations

In the background

Scenario analysis:
Indices of Salinity and Water Quality & Quantities
Other mitigating factors – plant physiological effects, soil organic matter dynamics

Equation Factors
Climate & Soil
Historic Land Use Information

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Original slide by M. Easter
USDA-ARS / UC Davis research publications that contain this reported work.


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