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Soil conductivity study and implications for fish and farming compatibility in the Swinomish agricultural area

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Soil conductivity and implications for fish and farming compatibility in the Swinomish agricultural area

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Introduction

- The Swinomish agricultural area is in the Skagit River Delta, a major agrarian region in Puget Sound
- Formerly a network of tidal channels serving as salmon habitat, the tidelands have since been diked and drained
- In 2005, the Swinomish Indian Tribal Community (SITC) began restoration to demonstrate compatibility of fish habitat and agriculture
- Muted tidal regulators (MTRs), operated to optimize tidal inundation and fish passage, replaced traditional tidegates, prompting a 2015 study to evaluate soil conductivity impacts on agriculture

Objectives

- To characterize soil conductivity of Swinomish agricultural area and Restoration area by comparing 3 methods:
  1. Electromagnetic (EM) surveys
  2. In-situ measurements
  3. Lab sample analysis
- To assess land suitability for crops based on soil conductivity

Methods

EM Surveys (March 4-24, 2015)
- EM38-MK2 conductivity meter with Allegro CX handheld data logger &Hemisphere R130 DGPS receiver (Fig. 1)
- Surveyed two soil depths (0.75m and 1.5m)

In –situ Measurements & Laboratory analysis (May 5-7, 2015)
- Field Scout Direct Soil EC Meter (Fig. 2)
- Measured two soil depths (6in &12in), lab analysis (12in only)

Figure 1. EMK38-MK2 conductivity meter in PVC sled.

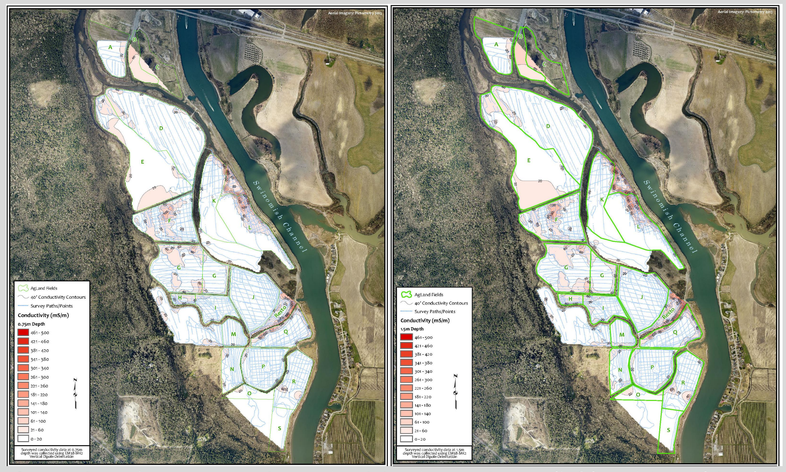
Figure 2. Field Scout Direct Soil EC Meter

Table 1. Soil salinity class, conductivity values and effects on crops as adapted from Abrol et al. (1988) and conversions from Rhoades et al. (1999) and USDA-NRCS (2014).

Soil Salinity Class	EM Conductivity (mS/m)	In-situ Conductivity (mS/m)	Lab sample Conductivity (mS/m)	Effect on Crop Plants
Non saline	0 – 23.6	0 – 200	0 – 135	Salinity effects negligible
Slightly saline	23.6 – 47	201 – 400	136 – 255	Yields of sensitive crops may be restricted
Moderately saline	47 – 93.8	401 – 800	256 – 505	Yields of many crops are restricted
Strongly saline	93.8 – 187.5	801 – 1600	506 – 1005	Only tolerant crops yield satisfactorily
Very strongly saline	>187.5	>1600	>1005	Only a few very tolerant crops yield satisfactorily

Results

EM Surveys (Figs. 3-4)
- Conductivity levels were low in most fields
- Higher conductivity at greater depth (1.5m vs 0.75m) and in Restoration area



Figures 3-4. Electromagnetic conductivity data at 0.75m (left) and 1.5m (right) depths in Swinomish agricultural area.

In –situ Measurements & Laboratory analysis (Fig. 5)
- Conductivity levels were low in most fields
- Higher conductivity at greater depth (12in vs 6in) and in Restoration area

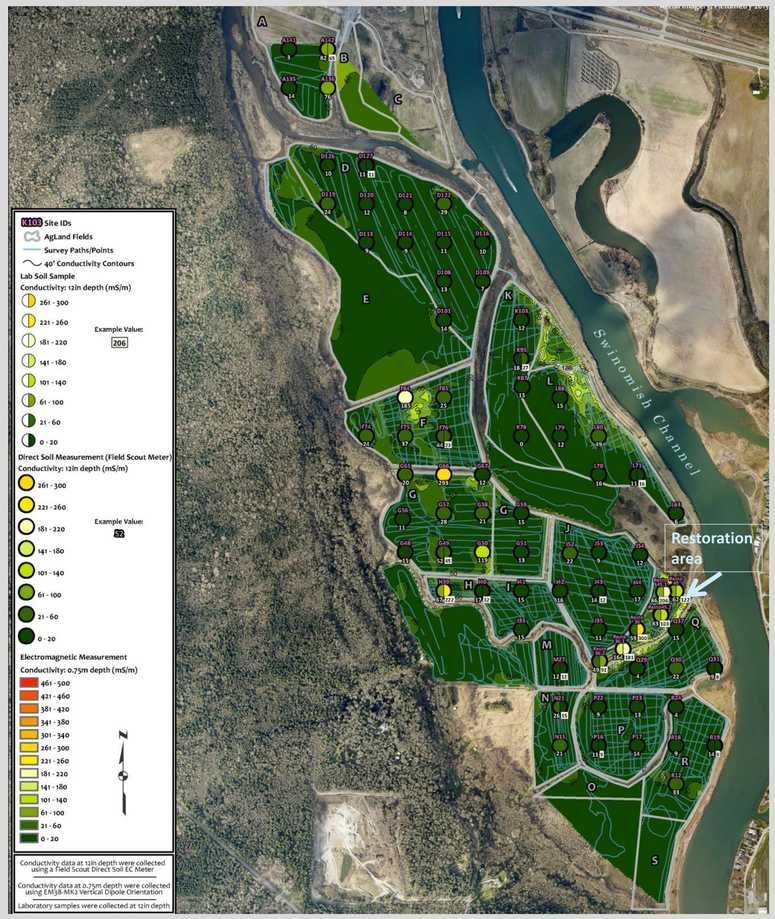


Figure 5. EM survey data, in-situ measurement data, and lab conductivity data in Swinomish agricultural area.

Discussion

Methods Assessment
- Electromagnetic conductivity data trends were largely mirrored by the in-situ data and laboratory data
- Restoration area had the most variable conductivity and most variation between methods
- Both electromagnetic and in-situ data indicated slightly greater conductivity levels at greater depth within each method

Salinity Characterization and crop effects (Table 1)
- Vast majority of agricultural land 'non-saline' with negligible crop effects (Fig. 6)
- Isolated 'slightly saline' to 'very strongly saline' areas: adjacent to drainage ditches and main Channel dike, low-lying wetlands and Restoration area

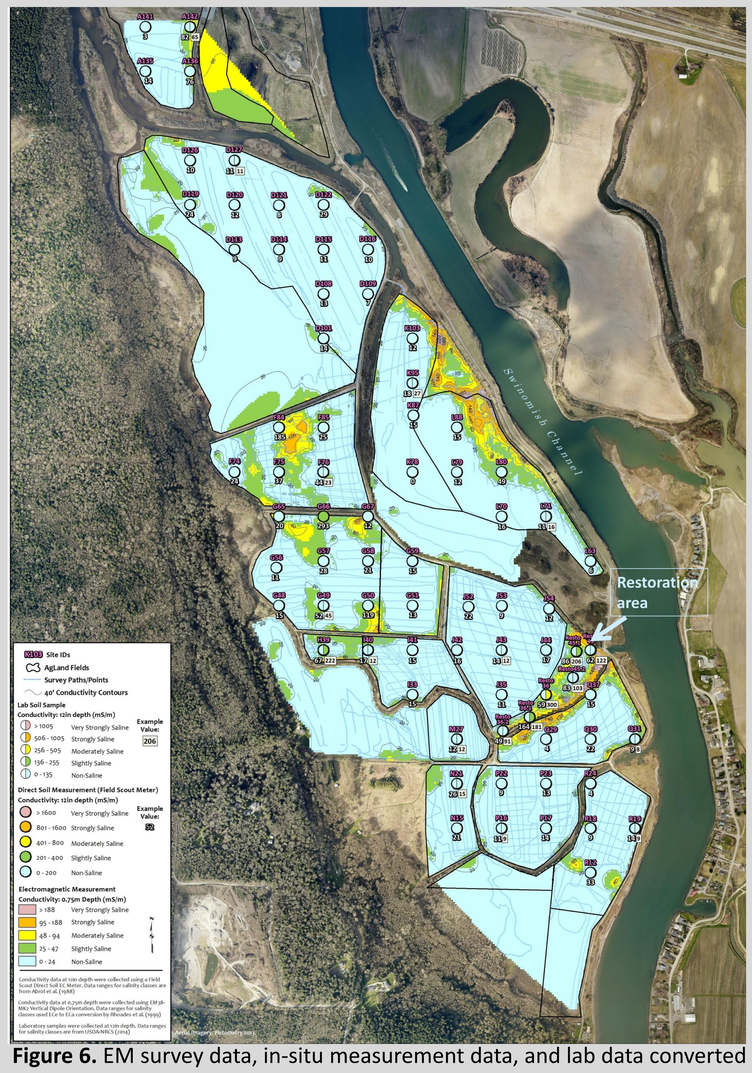


Figure 6. EM survey data, in-situ measurement data, and lab data converted to salinity classes (Abrol et al. 1988, Rhoades et al. 1999,USDA-NRCS 2014).

Conclusions

- The restoration and tidegate replacements, which allow for increased tidal inundation designed to enhance fish habitat, resulted in limited salinity intrusion to adjacent cropland
- This study demonstrates the compatibility of fish habitat restoration and adjacent farming practices

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