Aeolian Additions: The Downwind Effects on Soil and Vegetation in Owens Valley

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Project Objectives

We are well into the first phase of research specified in our proposal, which includes the following objectives: developing a horizon by horizon inventory of silt + clay, $CaCO_3$, electrical conductivity (EC), water extractable salts, sodium adsorption ratio and pH on the same-age, same-mineralogy parent material afforded by post-glacial granitic alluvium. Fieldwork accomplished for the project includes the training of graduate student Dayna Quick in appropriate site selection, soil pit excavation, and site description. We have obtained samples of designated soil horizons from each of the research pits in the field, along with horizon descriptions of depth, boundary, color, rock fragments, and structure. Laboratory work in progress includes analyses of electrical conductivity, water extractable salts, pH and particle size distribution of each soil horizon sample collected.

Approach and Procedures

Fieldwork

To properly identify the potential point-source impact of Owens Lake playa dust on valley soils, our research focus is on comparing soils of relatively the same age and parent material – formed in the end-of-glacial alluvial piedmont on the Sierra Nevada side of the valley. Several fan surfaces in the Owens Valley have been dated, however, the number of sites necessary for our study require us to employ some additional methods. For example, one approach has been site inventorying of boulder count and exposure, extent of vegetation cover, soil surface color, and soil surface gravel content. If in the process of soil excavation we have encountered a strong Bt or argillic horizon, we have assumed it to be a relict soil from earlier glacial times.

Laboratory

For electrical conductivity, we are using a 1:1 soil extract, based on the method provided in Rhoades, 1982. This extract is being refrigerated for use in ionic and elemental analyses of the water-extractable salts using an ICP-AES instrument. pH of the soil is being measured using 1:1 water electrometric method, based on that provided in Hendershot et al. 2008 and Soil Survey Staff, 2004. Particle size distribution is determined using adapted methods of the Pipette method as outlined in Day 1965; Janitzky 1986; Gee and Bauder 1986; Sheldrick 1993, and the Soil Survey Staff 2004. Soil samples are pretreated for removal of soluble salts and carbonates (using NaOAc) and organic matter (H_2O_2). Sand, silt, and clay fractions of each sample are being reserved for possible use in elemental analyses to be conducted at a later date.

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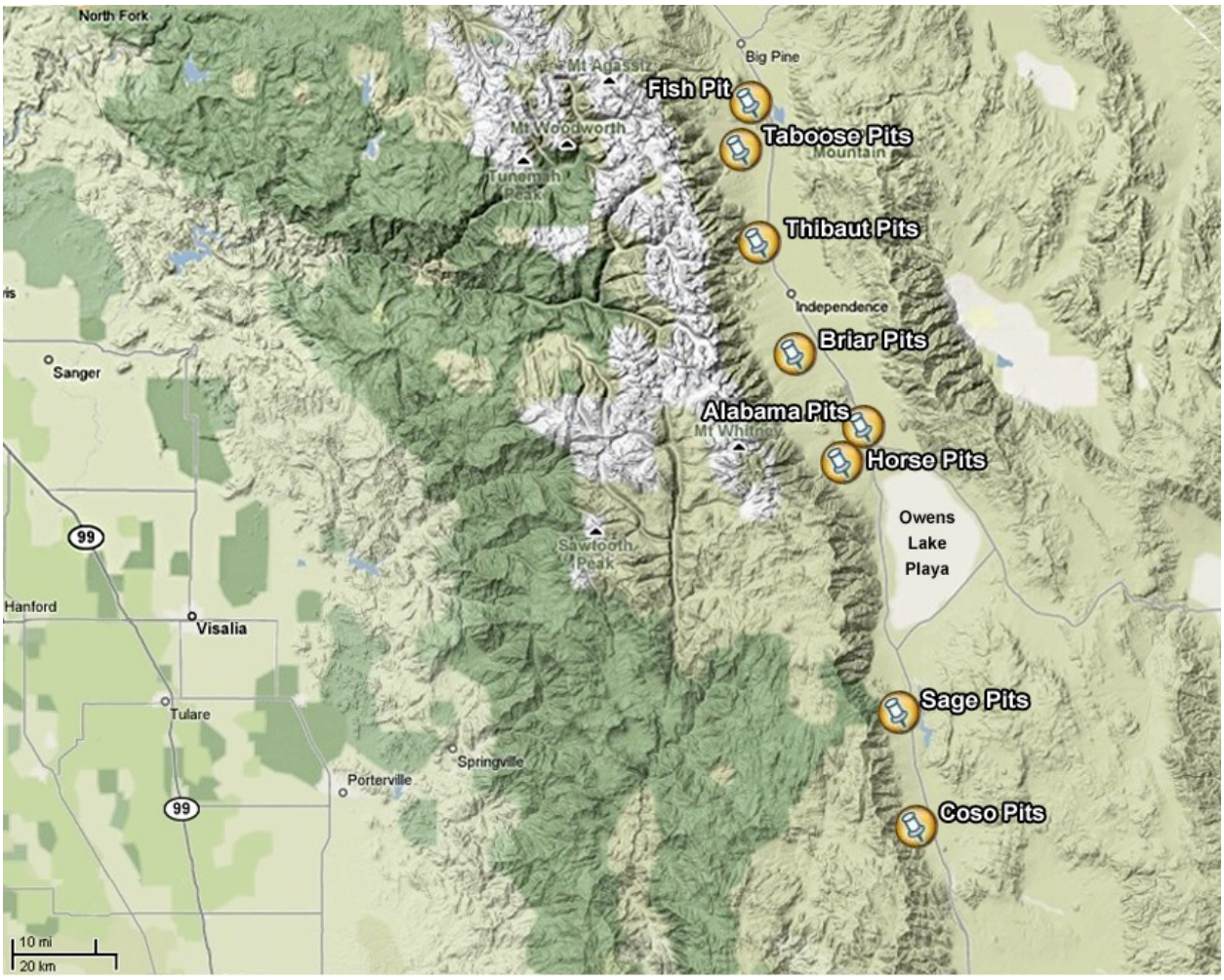

Figure 1: Google Earth image showing the name and location of the eight sampling sites along Owens Valley.

Results

Thus far, we have obtained samples from 15 soil pits from eight locations over a distance of approximately 120 km (*see fig. 1 for locations*). Results are being compiled from the four analyses in progress. Preliminary results show soils to be loamy sand in texture, and in the mildly alkaline range with low electrical conductivity. However, early results (*see table 1*) show the Alabama site soils, situated immediately northwest of Owens Lake Playa (*see fig. 1*), to be significantly higher in electrical conductivity than the Fish and Taboose site soils we have sampled at the farthest distance north in the valley. We would expect the increase in electrical conductivity to be a result of the nearness to the playa and an increased input of salt-rich playa dust.

Remarks

A significant portion of time during this past year has been spent locating appropriate sampling locations in the field, and updating laboratory methods and procedures appropriate for this study. The hydrometer method of particle size analysis already in place in the soils lab here at the University of California, Santa Barbara, was recognized to be insufficiently sensitive in terms of detecting the small differences in silt and clay found in the sandy soils of the valley. Switching to the pipette method of particle size analysis necessitated becoming familiar with the procedures and acquiring the requisite equipment and supplies for them. It is possible that in the future we will have access to a laser diffraction based approach of particle size analysis. We plan to have the first phase of our research completed by March, at which time we will enter the second phase of our research. This is the tracer phase, in which we will use isotopes as tracers to more directly link the Owens Lake playa source to the soil and vegetation properties.

Table 1: *The electrical conductivity of three soil pits at three sampling locations in Owens Valley. These include Alabama 01, located closest to the playa, and Fish 01 and Taboose 01, located furthest from the playa.*

Sample ID	**EC**
Location (horizon depth in cm)	**(US)**
Alabama 01 (0-5)	257
Alabama 01 (1.5-5)	608
Alabama 01 (5-19)	510
Alabama 01 (19-31)	1107
Alabama 01 (31-47)	1069
Alabama 01 (47-65)	1123
Fish 01 (0-4)	237.8
Fish 01 (4-25)	113.0
Fish 01 (25-40)	79.2
Fish 01 (40-52)	108.4
Fish 01 (52-64)	106.1
Taboose 01 (0-0.25)	149.9
Taboose 01 (0.25-4)	69.7
Taboose 01 (4-19)	25.8
Taboose 01 (19-35)	42.5
Taboose 01 (35-59)	21.2
Taboose 01 (59-86)	15.1

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