

Ground Beef: Human Impact on Soil Nutrients in Eastern California and Central North Carolina



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I. Motivation

Nitrogen (N), Phosphorus (P), and Potassium (K) are key nutrients for fertile soil. Agriculture is one of the primary sources of N-infused and P-infused emissions in the environment.^{1,2} Animal manure from grazing also contributes to increasing N, P, and K levels in the soil.^{3,4}

Hypothesis: If agriculture and grazing cause higher nutrient content in the soil, then areas with greater human impact should have higher nutrient levels.

II. Background

Eastern California has varied strategies regulating human impact on land (Fig. 1). Samples 1-18 were collected near Bishop, CA.

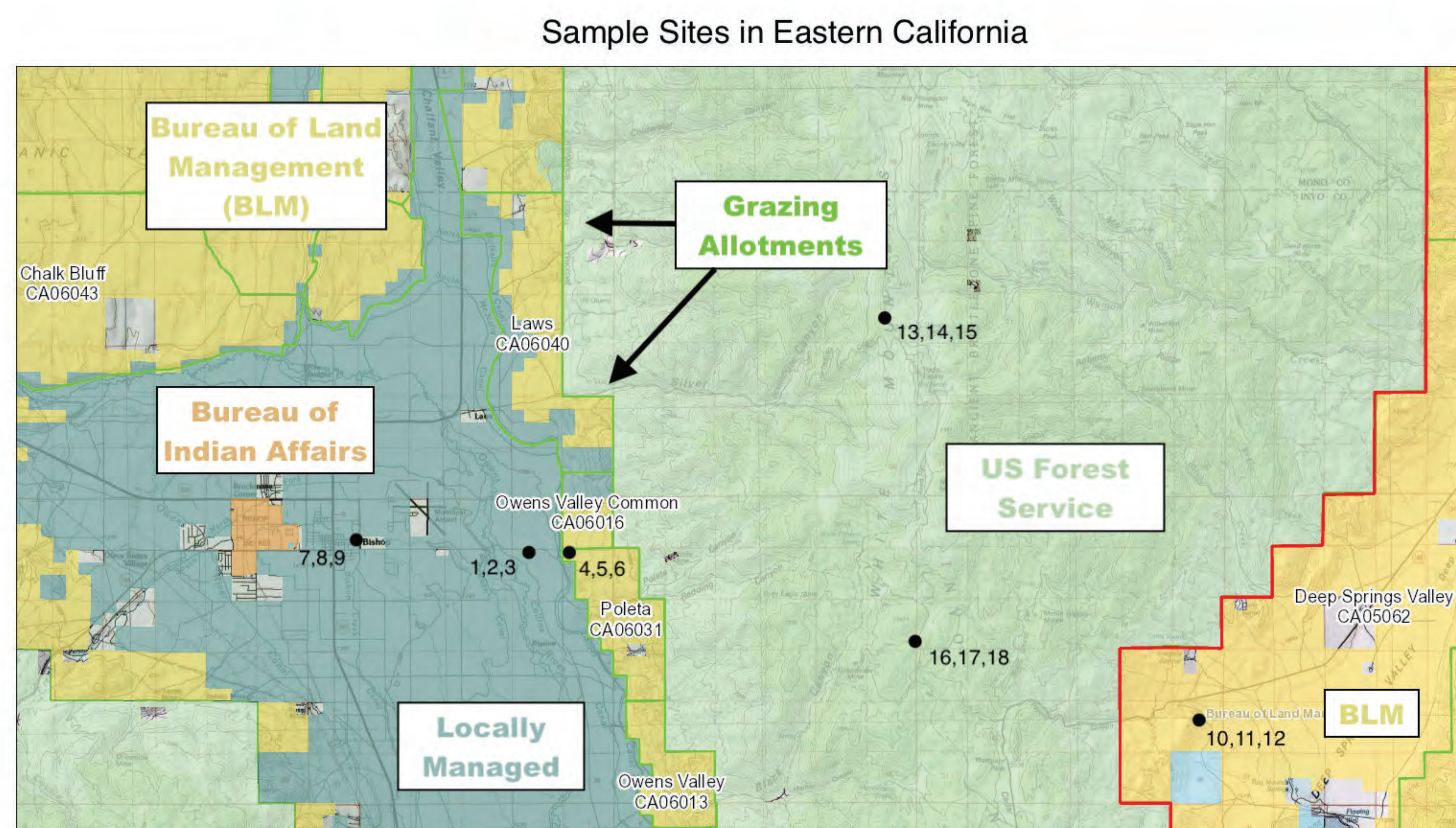


Figure 1: Locations were chosen for their varying levels of human impact. Factors determining impact include varying administrative bodies and cattle grazing allotments.

Historically, Central North Carolina soil was nutrient-dense.⁵ However, sustained agriculture in one area can deplete that soil of its nutrients. Samples were taken in Chapel Hill, NC. Samples (22,23,24) were taken where there was no evidence of agriculture. Samples (19,20,21) were taken from a site where there is evidence of agriculture, including still-visible furrows. Sample sites were separated by a rock wall.

III. Methods

Soil Collection

Soil was collected at a depth of 12-19 cm (Fig. 2). 24 samples were collected at 8 sites (3 samples/site). 6 sites were in CA and 2 were in NC.



Figure 2: Soil collection in California

Soil Separation

Soil was transported in triple-layered plastic bags. The soil was spread out to dry on paper (Fig. 3). Visible organic material and rocks were removed.



Figure 3: Soil samples drying on lab

Centrifuging

For each sample, 8 mL of soil & 40 mL of water were combined in a tube. The mixtures were shaken and then centrifuged for 15 min (Fig. 4). Then, clear water above the sediment was separated out.



Figure 4: Centrifuge in operation

Testing Nutrient Levels

N, P, and K levels were found using nutrient test kits. Nutrient levels were determined based on water color (Fig. 5).



Figure 5: Completed N and P tests

IV. Results: North Carolina

Figure 6: Previously farmed soil was depleted of potassium, while unfarmed land had detectable potassium levels.

Potassium Levels on Natural vs. Farmed Land

Natural Land		Farmed Land	
Sample Number	Potassium Level	Sample Number	Potassium Level
S. 22	1	S. 19	0
S. 23	1	S. 20	0
S. 24	2	S. 21	0

V. Results: California

Nutrient Levels By Human Impact

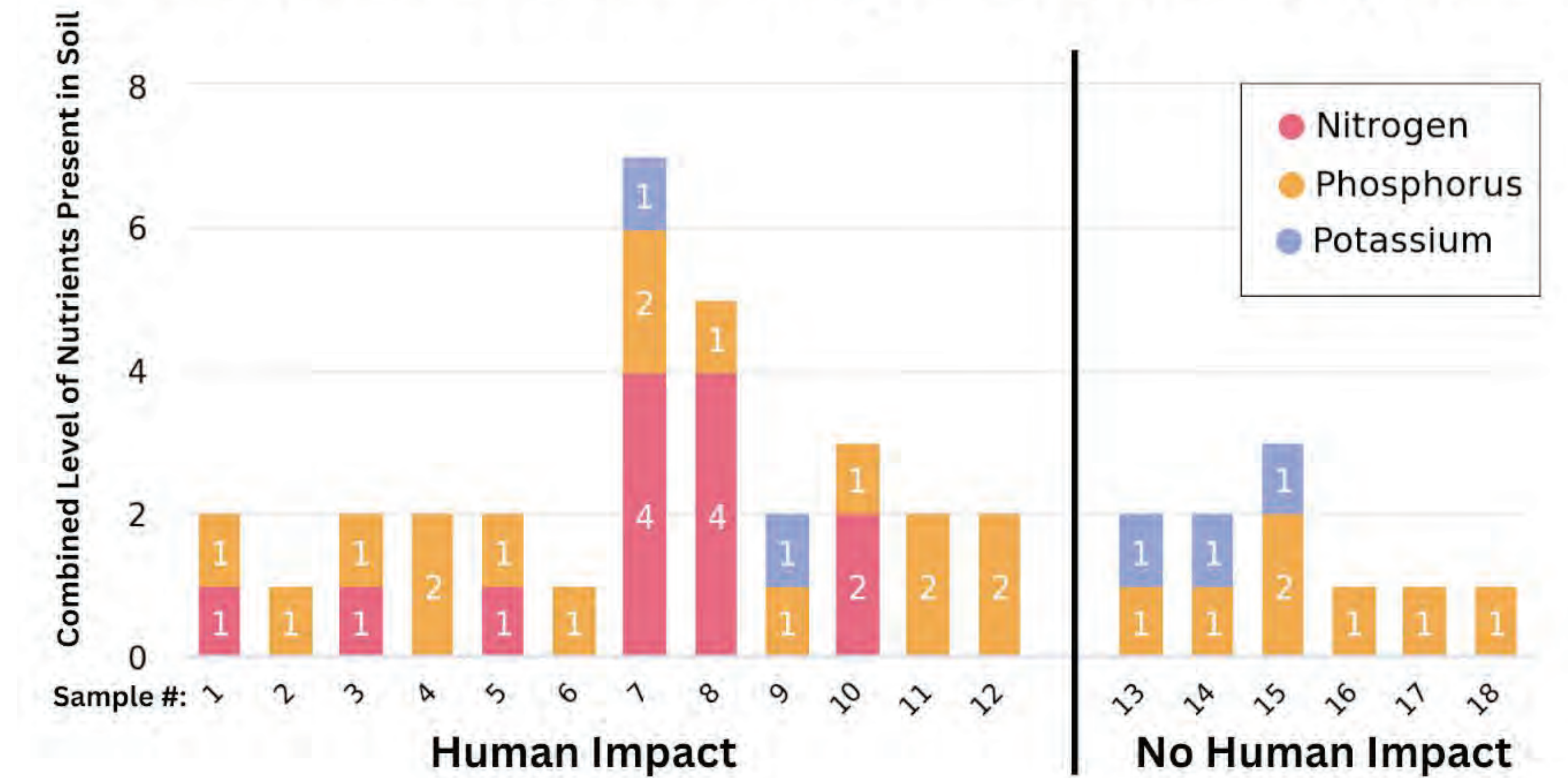


Figure 7: The number and size of each bar shows the level of nutrients found from level 1 (deficient) to level 4 (surplus). Level 0 (depleted) does not appear.

VI. Discussion

- K levels were higher in soil that had not been used historically for agriculture compared to land that had been used. This shows how historical agriculture can negatively impact current soil fertility.
- N levels were significantly higher in the human-developed city park (7,8,9) than in less impacted soils in the city (1,2,3,4,5,6). This shows how recent human development can increase soil fertility.

VII. Future Work

- Complete a quantitative analysis of all soil samples collected, rather than categorization by nutrient density levels, to achieve more precise results that may better illustrate a relationship between elevation and the amount of soil nutrients.
- Further testing of N, P, & K in other areas of Eastern California to compare to the results found in Bishop, CA.
- Expand testing to other nutrients (such as calcium, magnesium, etc.) and acidity of soil in order to determine which plants are best suited to grow in each region.

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