
MT2030
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SUN VALLEY 26
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Enhanced Rock Weathering for carbon sequestration

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PLAY. PROTECT. PRESERVE.

What is Enhanced Rock Weathering?

Rock Weathering

- Weathering and demineralization of rock is a natural carbon sequestration process
- Over eons, when water erodes rock, a series of chemical reactions happen between the rock/air/ground materials involved
- Silicate rock naturally sequesters atmospheric carbon as a bicarbonate product in soils



Enhanced Rock Weathering

- So what is *enhanced* weathering?
- Finely crushed rocks + wide areas of land = increased overall surface area of the rock = accelerated rate of carbon drawdown
- Has already been applied in agricultural settings, works like fertilizer



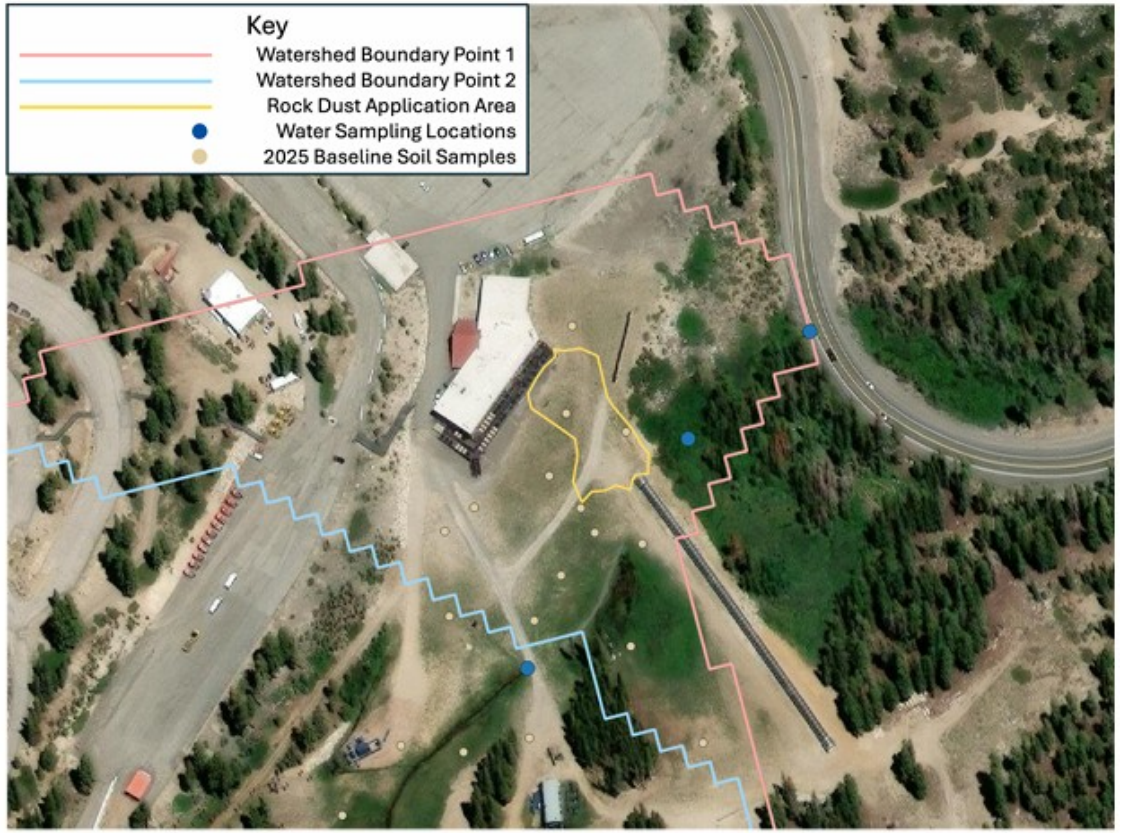
Co-benefits / Why we pursued it

- Soil composition and pH
  - Calcium and magnesium = essential plant nutrients
  - Acidity can affect how plants access nutrients
- Carbon sequestration
- Increased vegetation/erosion control
- Potential for offset fund/buy-in from our partners
- Initial interest in resurfacing an access road



How it worked: Scoping

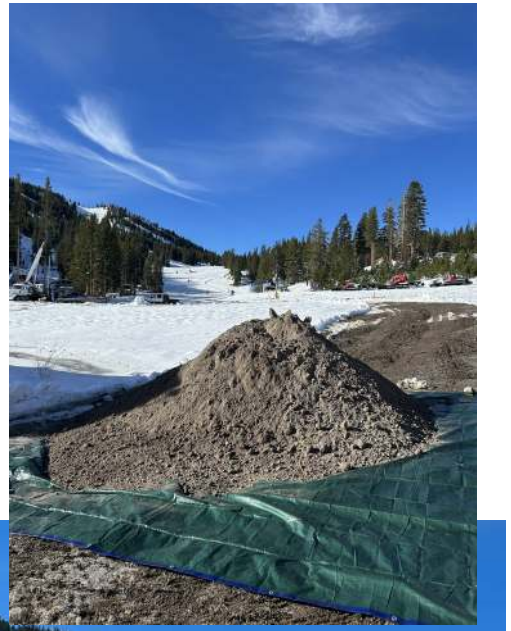
- Comprehensive soil sample
  - 8 locations around the mountain: varying elevations, aspects, and amounts of vegetation
  - Riseline testing determined average pH was around 6 and that a trial project was viable.
- Define trial project area
  - Ease of delivery and spreading logistics
  - 5 acre portion of the main side base area was outlined as a trial area
  - Sampling considerations – this area has a stream running through it, providing a place to collect water samples in addition to soil samples
- Rock amount and type
  - 11 tons
  - Based on Riseline's research, the more finely crushed the rock is, the more carbon it can sequester, so we opted to have this rock delivered in rock dust form
  - Basalt material, sourced as a waste byproduct from a local mining operation



How it worked: Spread

- Pre-spread
  - Collected dozens of composite soil samples in the trial area for a comprehensive baseline of soil conditions.
  - Collected pre-spread water samples from the upstream location of the base area, to have a water baseline.
  - Locations for all these sample sites are mapped out and documented.
- Week of step-by-step…
  - 11 tons of rock dust was deposited in the project area
  - Rock dust arrived from the mine with some water on it, which helped prevent the dust from being dispersed prematurely by the wind
  - We covered it with a tarp (which got blown off), but the water content in the rock dust helped it freeze and stay secured
  - 3 days later, spread the material
  - Spread took 1.5 hours with a small skidsteer
  - Covered 0.5 acres with the rock dust
  - All these details contribut to a full LCA (appendix)







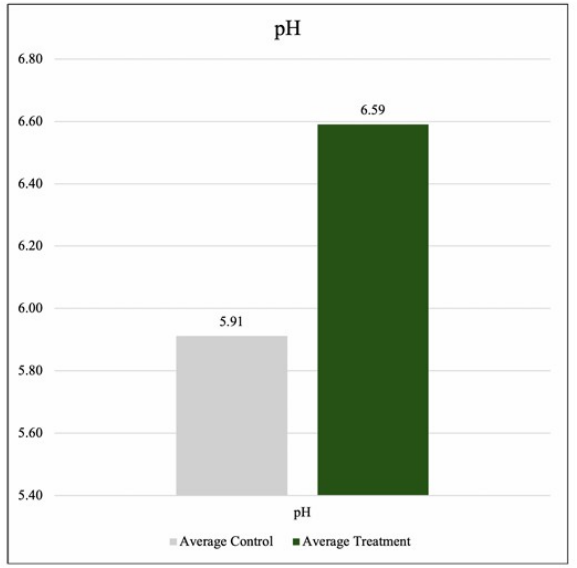
How it worked: Monitoring

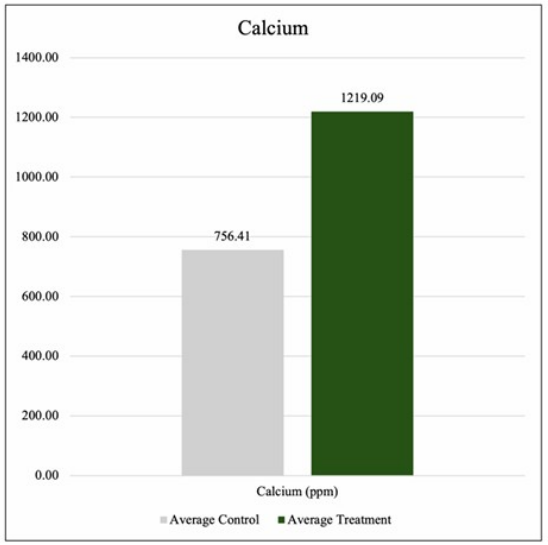
- Immediately after the spread
  - Collected two composite samples (5 separate 10-cm soil cores each) from the spots within this spread area that Riseline had previously sampled
  - Collected water samples from upstream and downstream of the spread area in the weeks following the spread
- After a season of weathering
  - Collected ~20 samples from the spread area and surrounding area that did not have rock spread, to compare impact
  - Collected additional water samples
- Materials send to Riseline Foundation/Yale for testing and modeling of potential impact

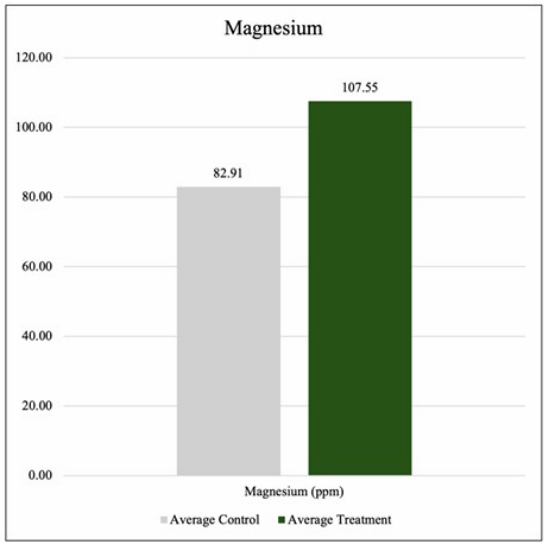


Results: Soil Changes

- Increased pH, Calcium, Magnesium in areas with basalt amendment
- During basalt weathering, the rock can help neutralize soil acidity and release elements such as calcium and magnesium
- Higher calcium levels measured in the treatment soils, and higher pH, show that the basalt is interacting with the surrounding soil
- These changes also have potential benefits for soil conditions and plant growth
    - Soil acidity affects how easily plants can access nutrients through their roots
    - Where acidity can limit growth, a more neutral pH can make some nutrients more accessible
    - Calcium and magnesium are also essential plant nutrients, so their release may provide additional benefits







Results: Stored Carbon

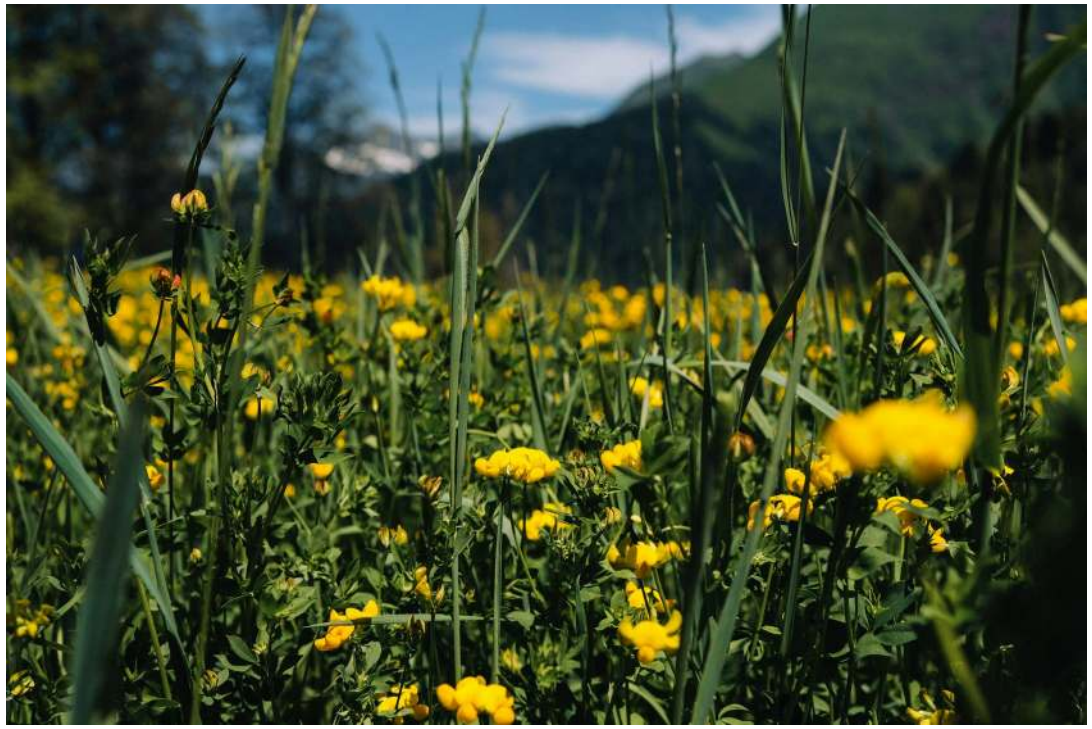
- Samples plugged into a soil geochemical model
- Model determines how much CO2 is needed to drive the observed changes in soil chemistry
- Research partnership: SCEPTER model
  - Soil Cycles of Elements simulator for Predicting TERrestrial regulation of greenhouse gases — SCEPTER
  - Kanzaki et al. [2021]
- On our 0.5-acre spread site, we removed **0.45+/-.1 t CO** in the first year.
  - 770-1,210 lbs



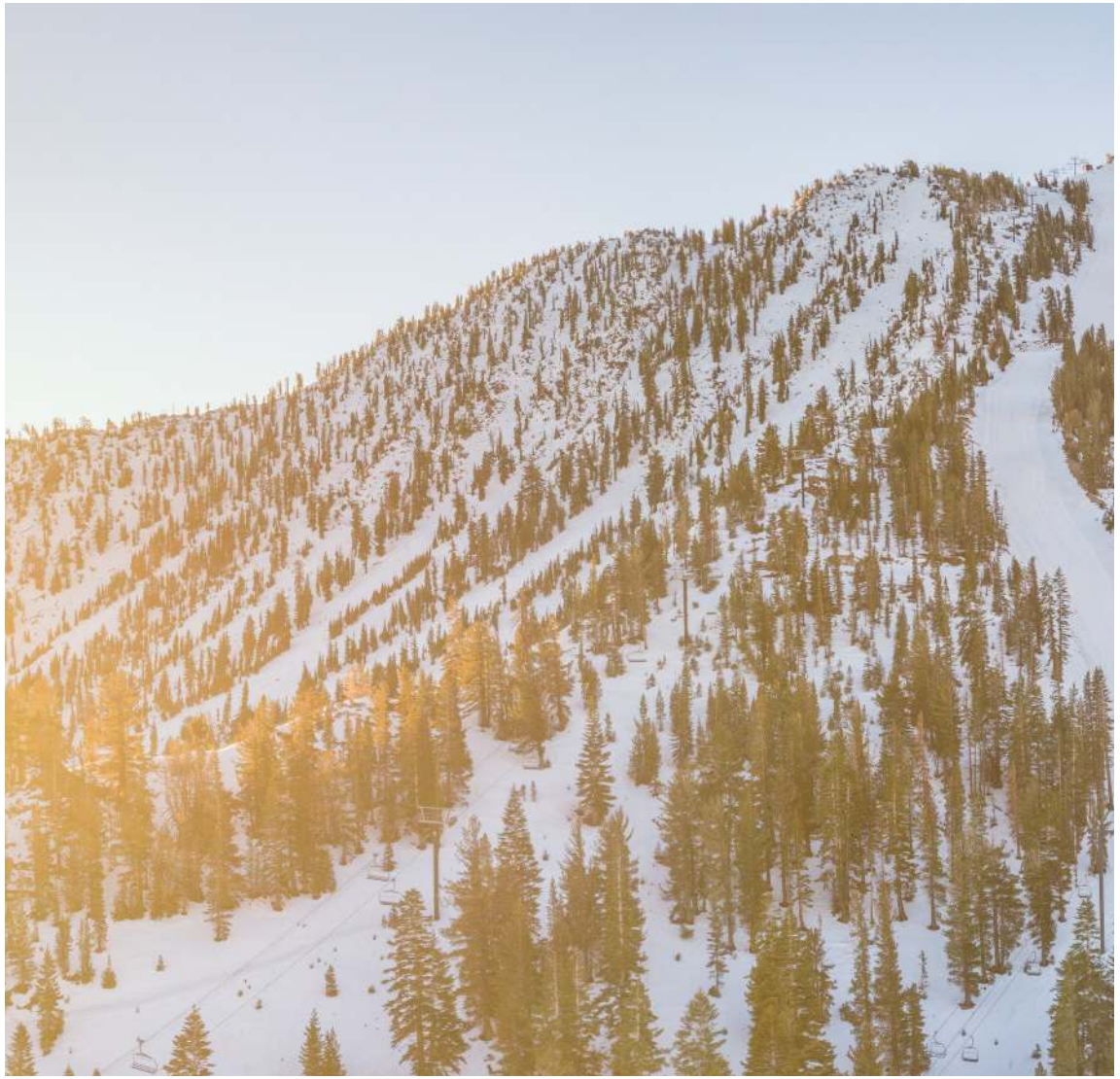


Potential/Next Steps

- Quantify the potential for carbon sequestration on our terrain at scale
- Evaluate whether a large-scale project makes sense as part of Riseline Foundation's network of carbon offset funds
- Share results with our community, for replication of this project and adoption of enhanced weathering at scale
- Potential for regional impact: mine has more 'waste' byproduct rock dust that other landowners in northern NV could deploy
- Potential for industry impact: resorts can try on their terrain depending on access to rock dust/ byproduct



Discussion



Appendix: LCA

- Important for full carbon accounting and viability of formal offset project

Basalt applied	Total LCA emissions
11.02 t	336.13 kg CO_2e

Emissions Profile

Source	kg CO_2e	Share
Rock dust transportation	168.75	50.2%
Rock dust spreading	55.84	16.6%
Staff travel	36.73	10.9%
Sample shipping	29.31	8.7%
Laboratory analysis	24.64	7.3%
Rock dust loading	18.61	5.5%
Sampling consumables	2.26	0.7%

Rock transportation is the dominant modeled source at 50.2% of the project footprint, followed by basalt spreading at 16.6%. The truck-transport calculation is fuel-based and explicitly includes the dedicated 34-mile empty return trip.

Appendix: SCEPTER

- Soil Cycles of Elements simulator for Predicting TERrestrial regulation of greenhouse gases
- Kanzaki et al. [2021]

