



The Martian Farm: Building Soil from Regolith

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"The Martian Garden: Bridging the Gap from Regolith to Soil" is a comprehensive educational unit that tasks students with transforming sterile Martian regolith into a functional, life-sustaining ecosystem. By assuming the role of "Lead Botanists," students move beyond passive learning to engage in human-machine partnerships, using AI to synthesize complex datasets from rovers. The core challenge involves in situ resource utilization, converting toxic, weathered basalt into fertile soil through a sequence of mechanical, chemical, and biological interventions.

This unit is going is for my 8th grade science class but can easily be expanded or simplified for a higher or lower grade level. Exploring the methodology of using red lava rock to simulate regolith. A primary obstacle is water management; students must engineer solutions for Mars' toxic perchlorate brines using bio-desalination with cyanobacteria and gravity filtration through porous basalt. The biological "living machine" is then establishes a microbial starter kit and pioneer species to fix nitrogen and introduce organic carbon. Arthropods are introduced as "soil architects" to provide aeration and prevent surface capping through physical engineering.

A holistic management framework, guides students in managing the mineral cycle, water cycle, community dynamics, and energy flow. This extraterrestrial simulation serves as a powerful analogy for Earth's soil crisis, drawing parallels between Martian toxicity and terrestrial issues like erosion, salinization, and chemical overuse. Ultimately, the project aligns with Oklahoma Academic Standards, teaching students that sustainability is not merely a mission objective but a fundamental condition for human survival, requiring global cooperation and a deep stewardship of biological communities.

(Developed for Science, grade 8; recommended for Biology, grades 9-10, and Environmental Science and Agricultural Science, grades 10-11)

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