

# Project brings a Mars farm plot to Wisconsin

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Valles Marineris, Mars. Credit: NASA

Two University of Wisconsin-Stout professors are taking their students to Mars.

The geologist and ecologist re-created the dusty surface of Mars in a dirt lab and a greenhouse on the campus 25 miles west of Eau Claire, in Menomonie. Their mission: to explore the plot of "The Martian," Hollywood's blockbuster space movie that gets at what is essential to supporting life and growing food.

The professors gathered about 400 pounds of glacial subsoil from Chippewa County and cooked it at 1,000 degrees for about two hours to zap all life-sustaining organic materials.

Then they challenged their students in a junior-level [soil science](#) and conservation class for environmental science majors, and a plants and people general education course for Honors College students, to figure out what to add so potatoes could grow in the reddish-orange soil devoid of the good stuff that soil on Earth naturally contains, stuff that the soil on Mars does not.

Students didn't learn by memorizing facts and definitions of soil science. They tackled a complex problem that required them to apply critical thinking to foundation knowledge to find solutions. Then they played the what-if game as they began to understand how all the pieces fit together.

"It's like taking a fun toy apart to see how it works, and then putting it back together," said Matt Kuchta, a UW-Stout associate professor of biology and geologist who teaches the soil science and conservation class.

"The Martian," starring Matt Damon as an astronaut stranded on Mars, has topped box office sales for four of the past five weekends. It's based on a 2011 science fiction novel by Andy Weir with elaborate technical details that are accurate, except for the stuff about the wind on Mars. That's pure fiction.

While Mars is famous for not having anything growing there, the astronaut in the movie is a resourceful botanist who figures out how to grow food in a covered habitat with every bit of bio-matter he can find - from food scraps to his own waste, combined with a little bit of water. His goal is to survive until he can be rescued.

Kuchta started reading the book the movie is based on last January, and quickly realized the plot was almost entirely based on soil science.

"One of the goals for the human race is to explore and view other worlds," Kuchta said. "It struck me as a perfect theme to help students understand concepts of soil science, and not just rural agriculture. It's important if we want high yields of corn or soybeans, but understanding the soil system also is important to manage a forest or conserve a prairie habitat."

It was actually Kuchta's father, a high school biology and chemistry teacher with an environmental science background, who suggested Kuchta simulate soil on Mars by sterilizing glacial subsoil from Chippewa County. The subsoil consists of sand, gravel, silt and clay dropped by melting glaciers tens of thousands of years ago.

The other professor involved in the Mars soil expedition is Mandy Little, an associate professor of biology who is married to Kuchta.

One of her goals was to teach non-science majors what goes into designing an experiment.

Her students added composted garden soil to the Martian soil to grow potatoes. Many of the potatoes rotted because there were diseases in the composted soil. They also had the challenge of using cooked soil that didn't hold water without adding organic material to it.

The class started with a clean slate - soil that contains no organic material - and watched how plants extract water from the soil; how microorganisms interact with organic and mineral components of soil; and what kinds of minerals are present and provide important nutrients for plant life.

Students in Little's class used Miracle-Gro and packing peanuts as [organic material](#) to give the Martian soil the capacity to hold nutrients and water. They planted potatoes, beans, rye and parsley. The rye is doing the best, and the potatoes that were started with cut-up potato pieces also are doing well because they started with food storage, Little said.

"It's all about understanding how the system works and being able to make predictions based on how the soil system will respond to various changes," Kuchta said.

Earth's soil system is interconnected with the biosphere in which living organisms are found. Gases are exchanged between the soil and the atmosphere, and hydrology comes into play through rainfall. Breaking down fragments of rocks and minerals in the soil system connects to geology.

Some students suggested adding hair to the soil because it would be accessible to someone isolated on another planet. They also thought about food scraps and bits of clothing.

They didn't use human waste to fertilize the soil, like in the movie. They used worm droppings called casings.

The first class assignment was to read the first chapter of the book online. The professors also showed their classes the trailer for "The Martian" movie.

"I want them to be interested in science and have it be accessible," Little said of the students in her class whose only real-world experience with [soil](#) science someday may be growing vegetables and composting.

Seeing firsthand the hedging that scientists must do because they don't

start out with all the answers helps students understand the role science plays in society, she said.

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