Getting down to earth …from space

Dr. Benoit Rivard
UVic - Hyperspectral Remote Sensing
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For over 50 years, scientists and engineers have employed novel materials, systems and technologies in spaceflight and exploration. Many of these have then been spun-off or adapted for applications here on Earth. Hyperspectral remote sensing is one such example. It became prominent when robotic rovers and planetary orbiters began exploring and mapping the Martian surface. In fact, some of the most compelling evidence of water on Mars in the past came via this technology. Hyperspectral remote sensing is now also being used for terrestrial applications. A leader in this initiative is Dr. Benoit Rivard.

Dr. Rivard is the newly-appointed BC Leadership Chair in Hyperspectral Remote Sensing at the University of Victoria. The provincially-funded BC Leading Edge Endowment Fund provided $2.25 million to support the Chair. And this was matched by the University and the University of Victoria Foundation.

After getting an MSc in geology at McGill University (Montreal), he studied imaging technologies at the Earth and Planetary Remote Sensing Laboratory at Washington University (St. Louis). There, he earned his PhD under Dr. Raymond Arvidson, a principal scientist on the Mars Rover and Orbiter program. Dr. Rivard could have continued in planetary studies, but his first love was Earth Geology. So, he returned to Canada in 1990 and took an appointment at York University developing research projects in thermal imaging. He then moved on to the Canada Centre for Remote Sensing, creating applications for images obtained by the Canadian *Radarsat* satellite. He began his academic career at the University of Alberta, where he spent 12 years and served as Director of its Centre for Earth Observations Science. He came to BC in 2008.

Hyperspectral remote sensing enables scientists to obtain simultaneous images in many narrow, contiguous spectral bands. Each image pixel provides information about a target's chemical composition, brightness and absorption characteristics. As a result, hyperspectral data offers a more detailed examination of a scene than does data collected from broad, widely separated spectral bands. Dr. Rivard and his group will be developing improved algorithms and image processing techniques.

"It's comparable to spectroscopy in chemistry," he explains. "It allows you to fingerprint targets and infer their chemical and physical properties, either from close measurements in the field, or from aircraft and satellites above the earth's surface." The University of Victoria owns an airborne hyperspectral remote sensing system, operated in tandem with a LIDAR (LIght Detection And Ranging) system -- the only such platform currently being used in Canada. It operates it in partnership with Terra Remote Sensing Ltd. of Sidney, BC, a surveying company. "This was a key factor in persuading me to come to BC," he says. "Another factor is that the strength of image processing in Canada has definitely shifted westward in recent years."

There are geological, geographical, biochemical and environmental applications for this novel remote sensing technology. UVic scientists and their students are using it to look for early indications of mountain pine beetle infestations in forests,

for instance. As well, hyperspectral remote sensing can reveal much about the state of the forest canopy and the stresses it's experiencing due to environmental change and degradation. The main thrust of Dr. Rivard's research, however, will be in the geological area, identifying rocks and minerals in support of mapping and mineral exploration.

He especially enjoys speaking to school children about his work. "When I'm in the classroom I ask them why we need to identify rocks. Then I explain how we do it.

Traditionally we would go out in the field, pick-up rocks, break them apart and examine them with a hand lens. Remote sensing is like that lens, only it's located farther away. We can use it to tell geologists where they should be looking for mineral ores in a large land area."

For more information, visit http://geog.uvic.ca/rivardlab .

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