Remote Sensing meets K-12 earth and environmental education

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Science of *sensing*

Remote Sensing is no longer an experts' science or technology. In the modern social circuitry, most adolescents employ Remote Sensing in their everyday life in some way – from flying an amateur drone through skateboarding with a GoPro to virtually exploring remote landscapes in Google Earth - without realizing the mechanics of the underlying technology. Remote Sensing exhibits immense practical implications in learning situations for the novice.

Despite the promise afforded by satellite imagery, immersive camera technologies, virtual globes, and 3D visualization, the actual implementation of Remote Sensing in K-12 school practice still lags behind other disciplines. This is mainly due to (Ditter et al. 2015):

- thematic complexity of imagery
- lack of educational materials
- technical know-how of the teacher
- image visualization software availability

Looking at the earth from space is an unfamiliar perspective for many adolescents. The nadir perspective, however, makes satellite imagery interesting and motivating to examine, if they are explained carefully, and/or embedded into a framework of additional information from texts, charts, graphics, and maps.

Disciplinary Core Ideas

Content
Life Science
Physical Science
Earth System Science
Engineering

Crosscutting concepts

Big Ideas
Pattern
Cause and effect
Scale, proportion, and quantity
Systems and Systems models
Energy and matter
Structure and function

Science & Engineering Practices

Process
Asking questions/defining problems
Developing and using models
Planning and carrying out investigations
Analysing and interpreting data
Using mathematical and computational thinking
Constructing explanations/Designing solutions
Engaging in argument from evidence
Obtaining, evaluating, and communicating information

Figure 1. Visual Model of Three Dimensions of Science Learning.

Imagery-enabled Learning

A basic competence requested in many national and international standards of education is the ability to extract, interpret, and evaluate geographic information from maps and digital imagery independently.

The Next Generation Science Standards (NGSSs, NRC 2012) for K-12 Science, Technology, Engineering, and Mathematics (STEM) are placing a new focus on active learning just as emerging Remote Sensing technologies are creating ever-greater opportunities for hands on activities.

The NGSSs interlaces K-12 science education around three educational dimensions (Figure 1): 1) the practices through which scientists and engineers do their work (Science and Engineering Practices [SEPs], 'processes'); 2) the key crosscutting concepts that link the science disciplines (Crosscutting Concepts [CCCs], 'big ideas'); and 3) the mainstream ideas of the disciplines of life sciences, physical sciences, earth and space sciences, and engineering and technology (Disciplinary Core Ideas [DCIs], 'content').

Opportunities

Remote Sensing affords creative opportunities to address the requirements of the NGSSs by using key elements from physics and engineering. Satellite image data, information, and immersive visualization environments are critical to modeling earth, environmental, and anthropogenic processes and their complex interactions.

Remote Sensing embraces DCIs concepts of earth and space sciences, life sciences, and engineering, technology, and applications of science such as Earth's systems, Earth and human activities, and Links among engineering, technology, science, and society. Further, Remote Sensing crosswalks the other two dimensions – SEP and CCC – of NGSSs , for example, analyzing and interpreting data, patterns, and structure and function (Witharana and Lynch 2016). Thinking beyond K-12 science curricula , satellite imagery has a marked potential in social studies curricula due to its innate connection to geography. Remote Sensing can be used to develop innovative geography lesson plans (CSDE, 2015).

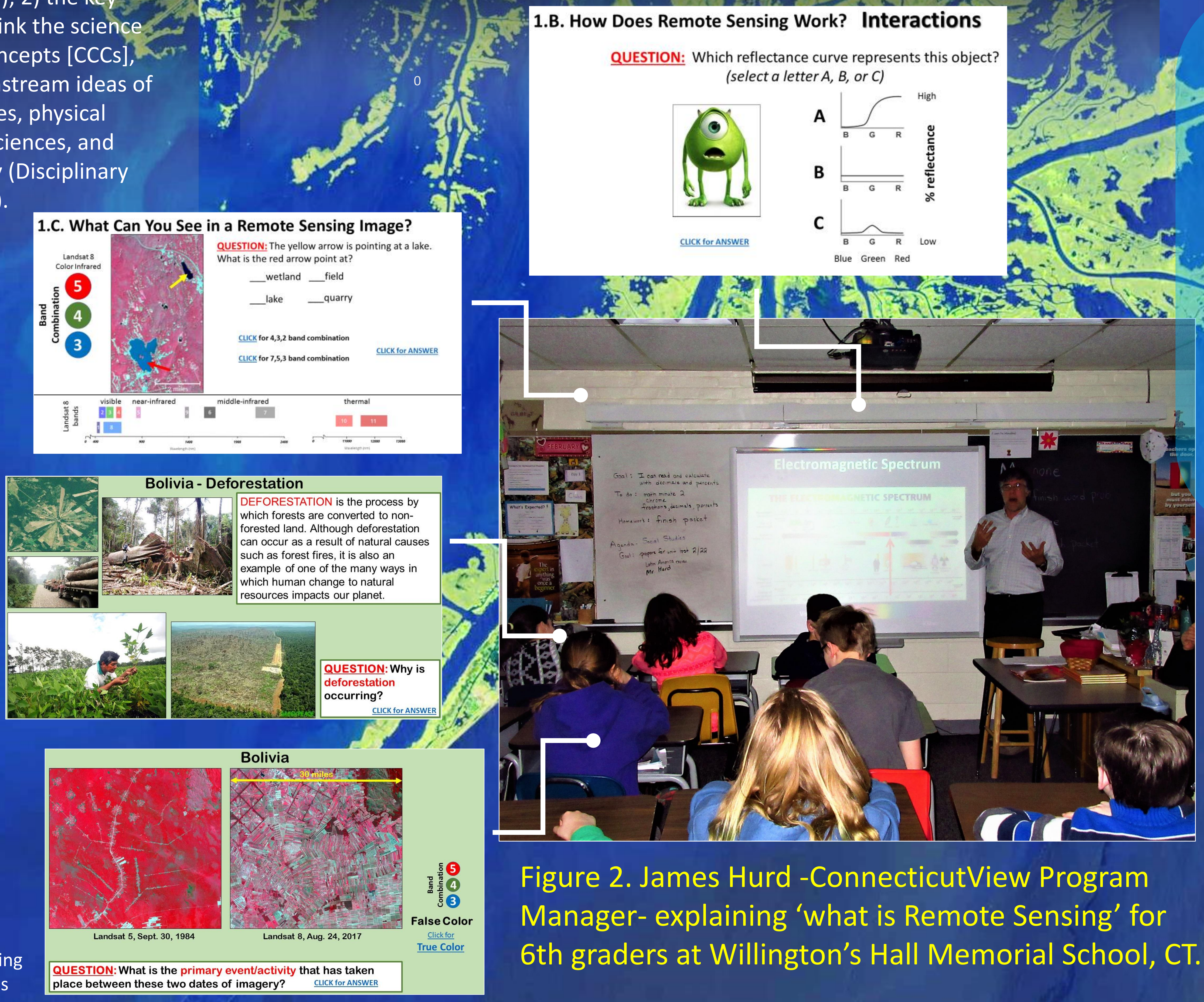

Figure 2. James Hurd -ConnecticutView Program Manager- explaining 'what is Remote Sensing' for 6th graders at Willington's Hall Memorial School, CT.

Focus

The goal of this project is to initiate a suitable landscape, placing ConnecticutView at the epicenter, for developing an interactive web-based learning environment (Figure 3) to harness Remote Sensing in Connecticut's K-12 education, to enhance science as well as social studies curricula. ConnecticutView is continuously working to develop imagery-enabled lesson plans (Figure 2) to promote Remote Sensing as a 'virtual passport' for open-ended exploration of landscapes and the flora and fauna that inhabit them. In doing so, Remote Sensing can facilitate inquiry-based investigations into the interactions among the biosphere, geosphere, hydrosphere, and anthroposphere.

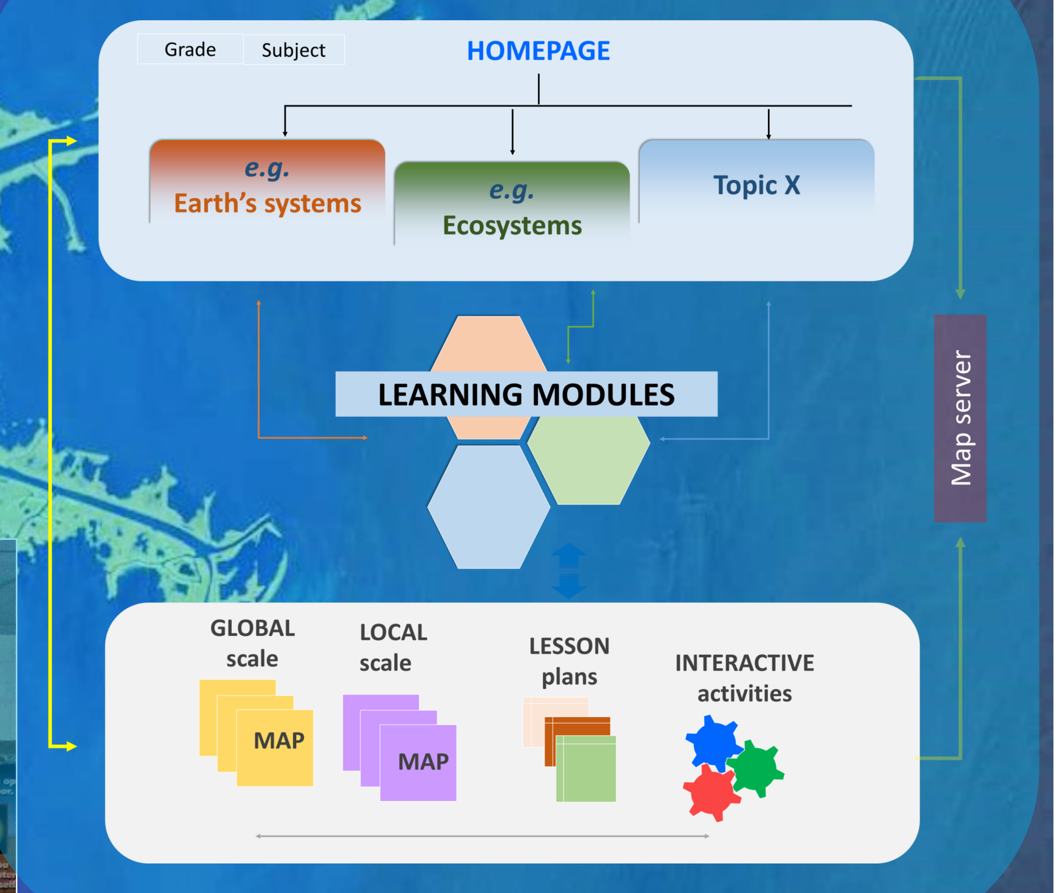

Figure 3. Prototype web-based Remote Sensing environment.

Citations

- CSDE, 2015. Connecticut Elementary and Secondary Social Studies Frameworks, Connecticut State Department of Education,
- Ditter, R., Haspel, M., Jahn, M., Kollar, I., Viehrig, K.; Volz, D. and Siegmund, A. 2015. Geospatial technologies in school-theoretical concept and practical implementation in K-12 schools. International Journal of Data Mining, Modelling and Management, 7(1):3-23.
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Connecticut View

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