

# WYOMINGVIEW APPLIED REMOTE SENSING RESEARCH ACTIVITIES IN THE ERA OF NO-COST LANDSAT DATA

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## ABSTRACT

One of the goals of WyomingView is to identify opportunities for applied research projects that incorporate remotely sensed data. Other goals include outreach, data archive, and educational activities. WyomingView is part of the AmericaView ([www.americaview.org](http://www.americaview.org)) program funded by the USGS. These applied research projects were often initiated based on queries from federal and state government agencies that were tasked with managing Wyoming's vast natural resources. Undergraduate and graduate students from University of Wyoming were also involved in these projects and have gained valuable experience in working with remotely sensed data for generating land cover/use information. Availability of free Landsat data to users through the USGS data archive has tremendously increased both the number and scope of these applied research projects. Students can now obtain images that are suitable for their research objectives rather than modifying their objectives to match the limited number of no-cost Landsat images from other archives maintained by WyomingView or similar programs. This presentation will describe the WyomingView applied research program and how it has benefited from the no-cost Landsat data. Experiences gained by students who worked on these 'real-world' projects will be highlighted as well.

**KEYWORDS:** AmericaView, WyomingView, USGS, Education, Natural Resources

## INTRODUCTION

WyomingView's goal is to promote remote sensing applications through consortium development, data distribution, education and applied research activities (Sivanpillai and Driese, 2007). Working with the consortium members in federal and state government agencies we identified opportunities for applying moderate resolution Landsat data for monitoring and mapping Wyoming's vast natural resources. Through surveys we identified that difficulties in accessing and pre-processing imagery data and familiarity with data processing skills prevented the widespread use of imagery data in these agencies. In certain instances agency personnel required evidence that Landsat data would provide necessary information to address their management needs. For example, the personnel in the Bureau of Land Management (BLM) regional office wanted to ensure that Landsat data would provide necessary information for monitoring vegetation re-growth following prescribed fires. Similarly the Wyoming Game & Fish Department personnel wanted to assess the utility of Landsat data for mapping conifers that were encroaching within aspen stands. Answers for these and other questions were not readily available in the literature, hence formed the basis of the WyomingView's applied remote sensing research program.

## WYOMINGVIEW APPLIED RESEARCH PROGRAM

The primary focus of WyomingView's applied research program (ARP) is to address questions pertaining to the suitability of Landsat and other remotely sensed data for natural resource management in Wyoming. Participating agencies and consortium members did not provide any financial resources, instead they provided field data and technical support in the form of answering questions that might arise during image processing. During the first few years (2003-05), WyomingView coordinator conducted most of these applied research activities and collaborators included an USDA Agricultural Research Service (ARS) scientist and a UW faculty. These applied research activities resulted in peer-reviewed publications (Sivanpillai and Booth, 2008; Sivanpillai and Miller, 2008).

**ASPRS 2011 Annual Conference  
Milwaukee, Wisconsin ♦ May 1-5, 2011**

Since 2006, we included UW students in WyomingView ARP. Students enrolled in various remote sensing courses were required to complete a class-project as part of their course requirements, and many of them expressed interest in working on “real-world problems” rather than working on projects that were based on sample imagery provided by USGS and NASA for various parts of the world. For example one can obtain images for Brazilian Amazon to assess deforestation, or Lake Chad or Phoenix Metropolitan Area for highlighting land cover changes. While these images highlighted global issues, more and more students were interested in working with management issues in their state or region. Working on local and regional issues also enhanced their learning process (Sivanpillai and Driese, 2008).

Later this program expanded to included research activities that are of interest to our consortium members. For example, several students had worked with USDA Forest Service or BLM in the field to fight wildfires. These students were interested in applying remotely sensed data for mapping the impact of wildfires i.e., burn severity. Currently not all projects are initiated by our consortium members (Table 1) but are relevant to their management activities. Further description of these projects along with student testimonials can be found at [www.uwyo.edu/wyview](http://www.uwyo.edu/wyview). Several undergraduate students have presented their research findings in Wyoming Undergraduate Research Day Conferences.

**Table 1. List of WyomingView student interns and their research topics involving remotely sensed data**

<b>WyomingView Interns</b>	<b>Research Topic</b>
Ms. Tanna George, Biology	Conifer encroachment in meadows
Mr. Vincent Salerno	Mapping crop growth in small farms
Mr. Adam Stephens	Wildfire
Mr. Brice Stanton	Wildfire
Mr. Garrett Klein	Mapping crop growth
Mr. Laramie Wiginton	Mapping crop growth
Mr. Brett Fahrer	Conifer encroachment in meadows
Mr. Travis Yeik	Mapping crop growth
Mr. Paul Arendt	Beetle infestation in Medicine Bow NF
Ms. Karley Shepperson	Cheatgrass monitoring in rangelands
Ms. Alyson Courtemanch	Snow mapping
Mr. William Lamar Gray	Surface area changes in Ocean Lake, WY

One of the reasons for our success is due to the availability of no-cost Landsat data through USGS. During the first few years of our program, student access was limited to freely available data sources such as the WyomingView data archive, Global Land Cover Facility (University of Maryland, USA), and USGS legacy collections such as NALC triplicates, or Global Land Survey 2000 and 2005 datasets ([glovis.usgs.gov](http://glovis.usgs.gov)). WyomingView had approximately 300 Landsat images in its archive. Students have to find images that are available in one of these archives in order to address their research needs since purchasing these images were outside the reach of most students and their instructors. When scenes of their interest were not available in these databases, students modified their research questions in order to match the available images.

When USGS made its entire Landsat collection available for no-cost in December 2008, most of these restrictions went away. Students can download and work with any Landsat scene for their research as long as it is cloud free. Students did not have to modify their research questions in order to match the images that are freely available through certain sources.

With the availability of free Landsat images, the scope of most projects has vastly expanded. For example one WyomingView intern, Mr. William Gray, looked at the changes in Ocean Lake’s surface area for 27 years. He obtained 2 images per year (or 54 Landsat images total) and digitally classified them to map the surface area of Ocean Lake, and analyzed the inter- and intra-annual changes. Ocean Lake is an important ecologic and economic resource located in North-Central Wyoming. Further he presented his research findings in a regional conference (Gray and Sivanpillai 2010). Without free Landsat images it would not have been possible for this student to obtain 54 images (at specific times during the course of 27 years) and conduct this analysis.

Similarly another WyomingView intern, Mr. Paul Arendt, obtained Landsat images since 2000 that were acquired at a specific time of the year (early-to-mid fall) to map the spread of bark beetle infestation in Medicine Bow National

Forest. Bark beetles are attacking hundreds of hectares of conifer stands along the Inter Mountain West of the US, and will result in major land cover changes for years to come. Mr. Arendt was able to download appropriate images that would distinguish the conifers from other vegetation found in this forest. He also presented in research findings in a regional conference (Arendt and Sivanpillai, 2010).

The number of students enrolling in UW remote sensing courses continues to increase. They also realize the value of no-cost Landsat data for their research projects in comparison to their predecessors who had to pay between \$600 and \$800 for each Landsat scene.

## CONCLUSIONS

Availability of no-cost Landsat data has opened vast opportunities for WyomingView interns and consortium members in terms of conducting applied research projects. Students and consortium members can download Landsat images for their specific needs as long as they are cloud-free. The quantity and quality of research conducted by our student interns are testimonies that highlight the value of no-cost Landsat data.

## REFERENCES

- Arendt, PA, Sivanpillai R, 2010. Changes in spectral reflectance characteristics of lodgepole pine following bark beetle outbreak. *Proceedings from the GIS in the Rockies 2010 Conference*, Sept 14-16, 2010. Loveland, CO.
- Gray WA, Sivanpillai R, 2010. Construct a Large-Scale Time Series Study for Water Resources Management Using Free Archive of Landsat Satellite Images. *Proceedings from the GIS in the Rockies 2010 Conference*, Sept 14-16, 2010. Loveland, CO.
- Sivanpillai, R, Booth, T.D, 2008. Characterizing rangeland vegetation using Landsat and 1-mm VLSA data in central Wyoming (USA). *Agroforestry Systems*, 73(1):55-64.
- Sivanpillai, R., Driese, K.L., 2008. WyomingView: No-cost remotely sensed data for geographic education. *Journal of Geography*, 107(4-5):154-160.
- Sivanpillai, R., and K.L. Driese, 2007c. Remote sensing educational opportunities available through WyomingView, *Proceedings from the ASPRS 2007 Annual Conference*, Tampa, FL. May 2007.
- Sivanpillai R, Miller SN, 2008. Benefits of pan-sharpened Landsat imagery for mapping small water bodies in the Powder River Basin, Wyoming, USA. *Lakes & Reservoirs: Research and Management*, 13(1):69-76.