



USGS Landsat Program Update

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U.S. Geological Survey
Department of the Interior
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2018 President's Budget Highlights

2018 LRS budget changes (from 2017 funding levels):

- Landsat 9 Ground System Development (+\$8.3M)
 - Keep pace with NASA for December 2020 launch
- Reduce Satellite Operations (-\$9.0M)
 - Defer non-critical system maintenance, hardware/software refresh
 - Defer distribution of non-Landsat satellite data
- Eliminate National Civil Applications Center (-\$4.8M)
 - Discontinue access to National Technical Means and Commercial Data to support disaster risk reduction, environmental monitoring
- Reduce Science, Research and Investigations (-\$3.3M)
 - End research into ECVs and CDRs; slow development of new products
- Eliminate AmericaView State Grant program (-\$1.2M)
 - Discontinue land imaging support for K-12 and higher STEM education
 - Cease related workforce development and technology transfer

Communication of Landsat Value to DOI Leadership

Visits from LAG membership:

- **Ms. Rebecca Moore**, Director of Engineering, Google Earth Engine & Outreach
- **Dr. Steven Brumby**, Co-Founder and Chief Science Advisor, Descartes Labs
- **Ms. Kass Green**, President, Kass Green & Associates
- **Mr. Tony Willardson**, Executive Director, Western States Water Council
- **Mr. Jed Sundwall**, Global Open Data Lead, Amazon Web Services

Investigations to inform follow-on to L9

The LRS Requirements, Capabilities, and Analysis (RCA) Branch is compiling a post-L9 requirements report by late 2017 with input from:

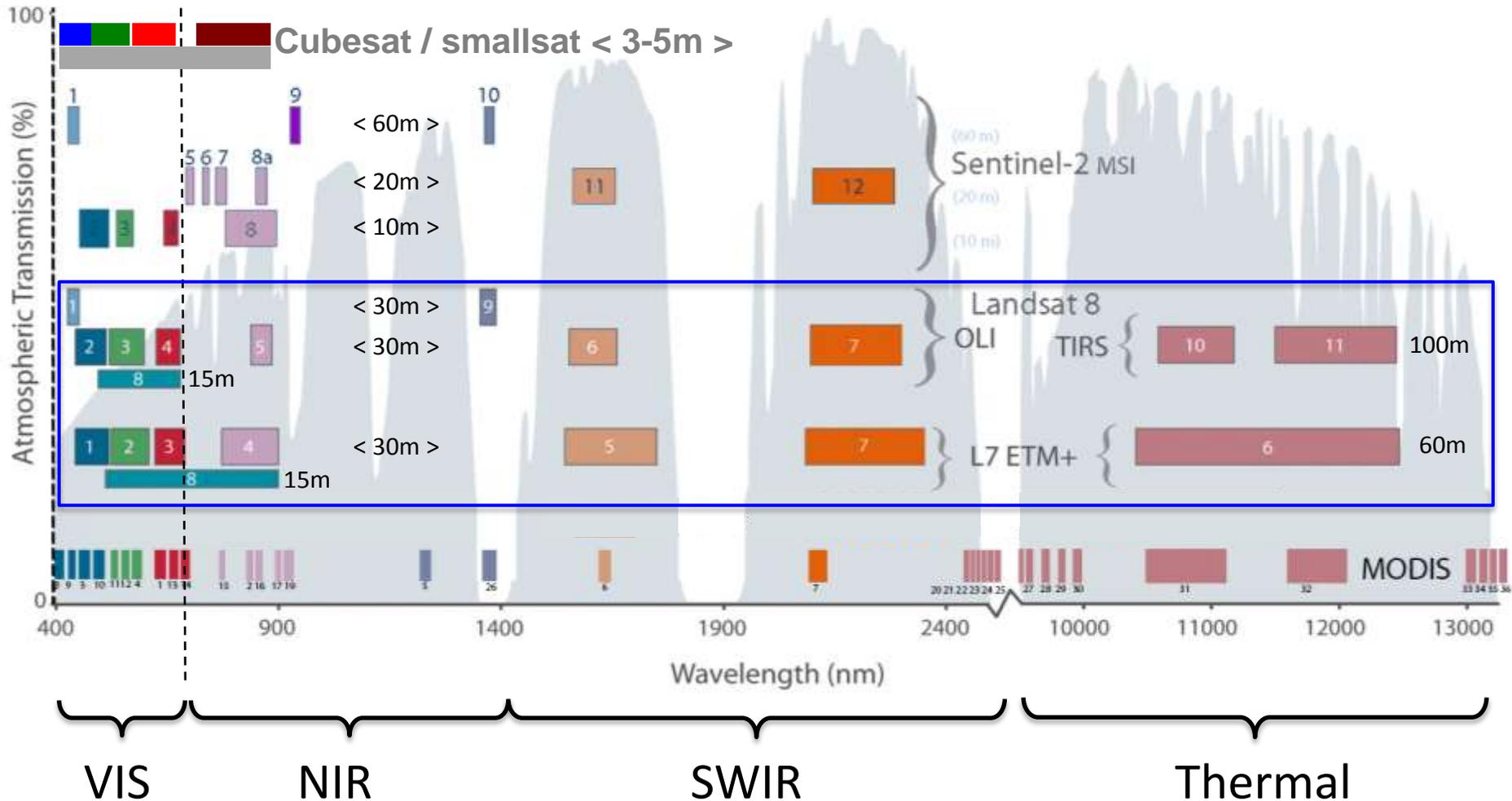
- RCA-EO User Requirements – Broad and detailed assessment of user requirements from interviews across DOI, USDA and other Federal civil agencies.
- Future Landsat requirements RFI – Additional avenue for requirements from non-Federal communities
- National Geospatial Advisory Committee / Landsat Advisory Group
- AmericaView Consortium – Key state and local government requirements
- 2017 Value of Landsat Survey – Desired capabilities and the benefits realized by Landsat usage
- Landsat Science Team Report – Integrated expert views from longstanding leaders in the Landsat science community

This report will inform post-L9 deliberations by NASA & USGS in 2018

Data collection characteristics

	<u>Landsat</u>	<u>Sentinel-2</u>
inclination	98.22 deg	98.56
orb height	705 km	786
period	98.8 min	100.65
swath	185 km	290
revisit	16 day	10

Comparison of Landsat 7 and 8 bands with Sentinel-2



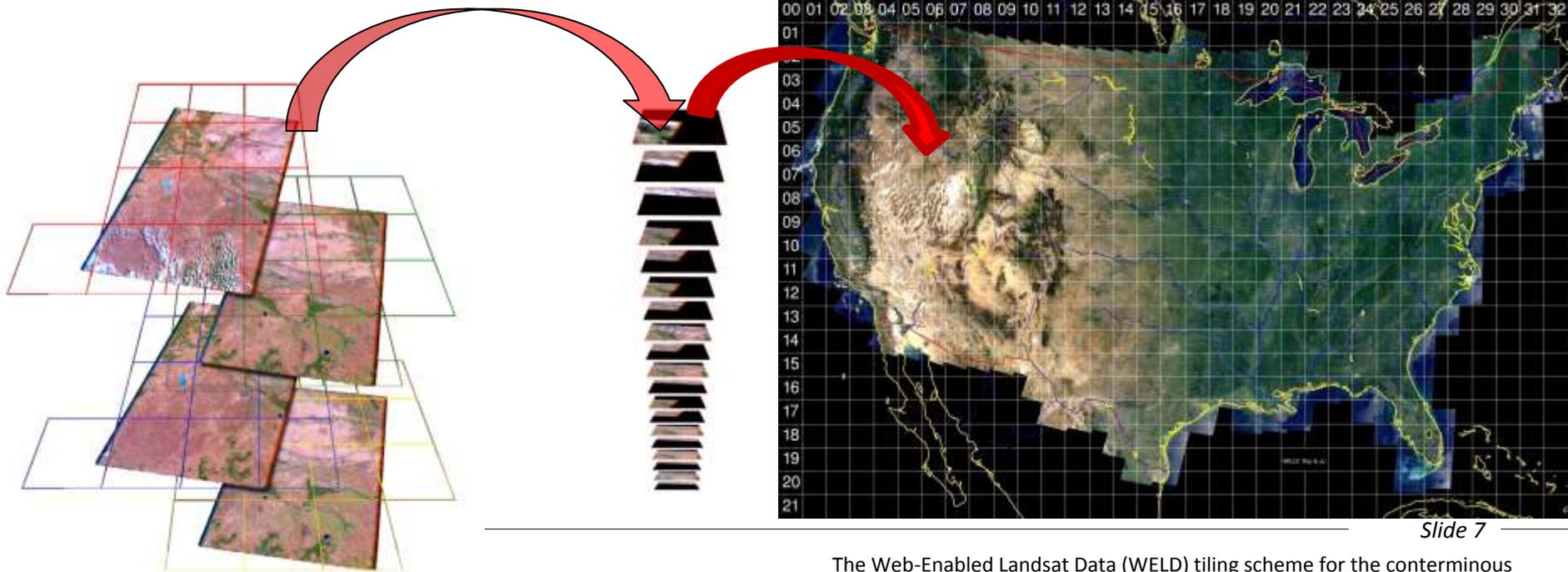
Upcoming Events

- Group on Earth Observations (GEO) Plenary, 23-26 October 2017 in Washington, DC
 - GEO is a partnership of 103 Member governments and the EC and 109 Participating Organizations comprised of international bodies with a mandate in and/or use of Earth Observations
 - <https://www.earthobservations.org/geo14.php>
- Pecora 20 Conference, 14-16 November in Sioux Falls, SD
 - Established by USGS and NASA in the 1970s as a forum to foster the exchange of scientific information & results derived from applications of Earth observing data to a broad range of land-based resources
 - <http://pecora.asprs.org/>

Analysis Ready Data (ARD)

Data processed to a level that enables direct use in applications

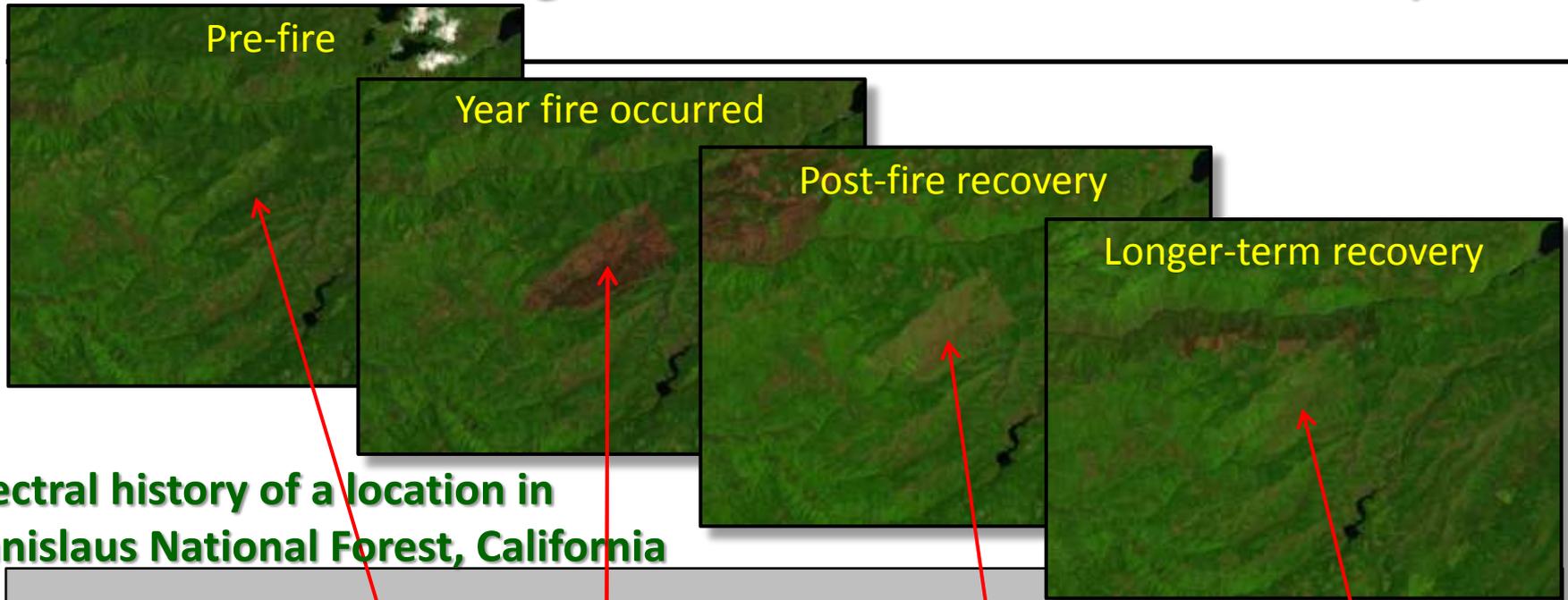
- Allows geospatial, multi-spectral, and multi-temporal manipulations for the purposes of data reduction, analysis, and interpretation
- Consistent radiometric processing scaled to TOA and surface reflectance
- Consistent geometry including spatial coverage and cartographic projection – e.g., pixels align through time
- Metadata of sufficient detail on data provenance, geographic extent, scaling coefficients, and data type



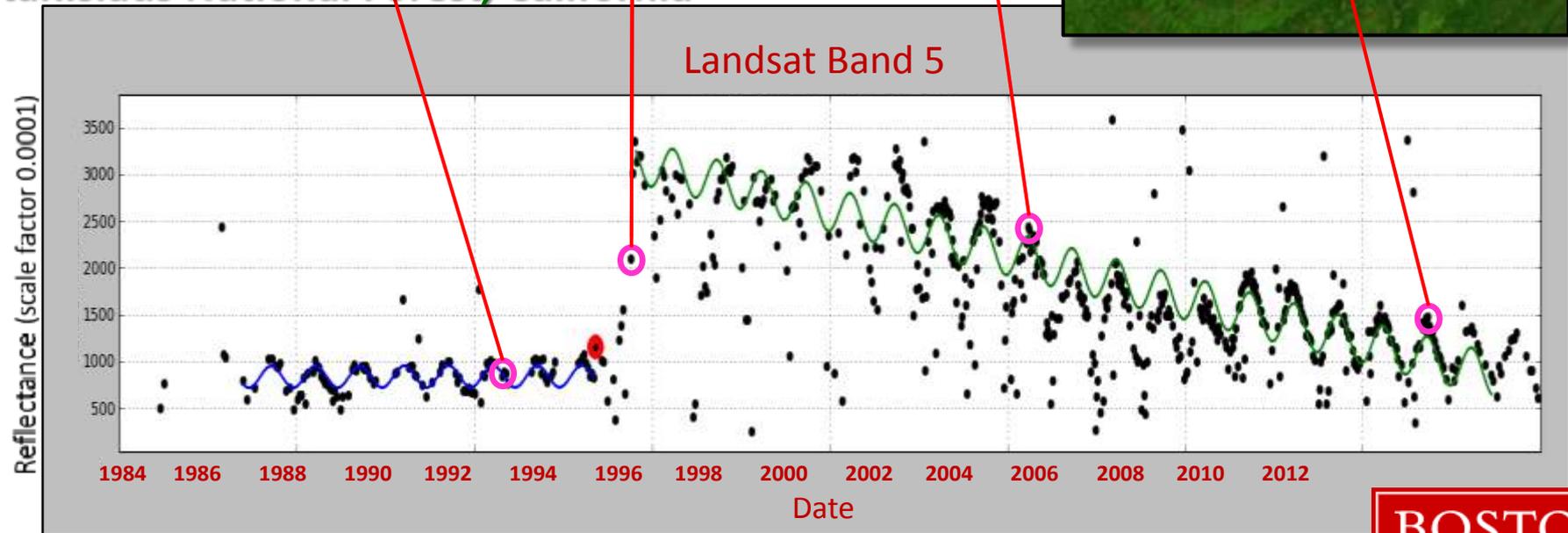
Slide 7

The Web-Enabled Landsat Data (WELD) tiling scheme for the conterminous U.S. being adapted for the LCMAP ARD (graphic courtesy of David Roy, SDSU).

Continuous Change Detection and Classification (CCDC)



Spectral history of a location in Stanislaus National Forest, California



Zhu, Z. and C.E. Woodcock. 2014. Continuous change detection and classification of land cover using all available Landsat data. Remote Sensing of Environment 144:152–171.



LCMAP – Land Change Monitoring, Assessment, and Projection

- Based on Analysis Ready Data construct
- Continuous change detection and classification (CCDC)
- Big data computing infrastructure
- Initial CONUS, AK, HI, 1985-2015 validated capability in late 2017

A few of the related GitHub repositories

- <https://github.com/USGS-EROS> (organization account)
 - [/lcmmap-pyccd](#)
 - python continuous change detection
 - [/lcmmap-pyclass](#)
 - python classification implementation
 - [/espa-surface-reflectance](#)
 - [/ lasrc](#) (Landsat Surface Reflectance Code)
 - Fortran and C versions for Landsat 8
 - [/ ledaps](#) (Landsat Ecosystem Disturbance Adaptive Processing System)
 - Scripts for Landsat 4-7

Conclusion

- Free & open data Landsat data, and LCMAP source code provides a significant community capability land change analysis. (today)
- Free & open Analysis Ready Data (ARD)/LCMAP architecture will revolutionize public access to Landsat time-series analysis. (near-term future)
- Leveraging LCMAP's capability with complementary Earth observation data has tremendous potential for improving our understanding of interconnected Earth processes, and forecasting landscape change. (far-reaching future)