

National Geospatial Advisory Committee – Landsat Advisory Group

PRODUCT IMPROVEMENT: Advise USGS on potential means of modifying the current products to make them more useful to commercial information providers and value-added analystsⁱ

Landsat imagery provides the United States and the world with continuous, consistent monitoring of critically important global resources. Supplying an unprecedented record of global land cover status and change for the last 40 years, Landsat imagery is an essential “national asset” which has made and continues to make critical “contributions to U.S economic, environmental, and national security interests.”ⁱⁱ Additionally, Landsat imagery is the ‘Gold Standard’ in remote sensing data, providing the standard against which other satellites and imagery are measured and calibrated.

To date the products from the USGS are used mostly by government agencies as well as the science community. The science community are more adapt at working with the often complex imagery and formulas to derive their models, vs. the users in many government and commercial organizations where the expertise is more in integrating the measurements with other data sources.

Accordingly the Federal Geographic Data Committee requested that the Landsat Advisory Group of the National Geospatial Advisory Group review ‘current and future Landsat data and information product characteristics, including potential means of modifying the current products to make them more useful to commercial value-added information providers’ⁱⁱⁱ. The aim of this document is to provide USGS with recommendations on how the products from the USGS can be improved so as to further increase the utilization and value of Landsat imagery for science, government and commercial organizations.

It is recommended that USGS further improve Landsat products to both enhance the scientific value of the imagery, but also to provide additional value to the commercial and government organizations wishing to extract the maximum value from the imagery. Such organizations need guidance on how best to use Landsat data and the ability to reference standardized products from which their business processes are derived. The LAG recommends that the USGS:

- Must strike a balance between the products created by the USGS and those created by commercial organizations. The USGS should clearly define the level of products it will produce and avoid competition with commercial organizations.
- Refine Landsat geometric accuracy to enable better change detection and refinement of the radiometric measurements so that they can be better associated with known quantities. Improved accuracy is a primary interest of science, commercial and government organizations.
- Continue to improve the existing L1G product by refining both the geometric and radiometric accuracy through the use of additional control and terrain models used to geometrically correct the imagery as well as through continual calibration of the instruments against ground truth. In addition to geometric accuracy, USGS should seek to improve the co-registration of L1T products. Co-registration is key to reducing artifacts in change analysis. While the current process is very good, it can be improved. USGS should consider additional computational techniques and source data such as a better DEM to improve the co-registration.
- Define a standard surface reflectance product by documenting and publishing a standardized method for the creation of Surface Reflectance products from Landsat and collecting and distributing the parameters (such as elevation, weather, temperature & humidity) required to compute these from the L1T.

- Help consolidate scientific research and publish best practices on how to create a range of products including different indices of vegetation and soil types and Climate Variables. USGS should clearly define these products along with the associated validation criteria for such products, so that multiple commercial and government organizations can create and distribute the products backed by well-defined standards. Where such products are dependent on other sources (such as elevation, or other variables) then these source products should also be made accessible. Such standardization of the product will help establish the more wide spread use of the products.

Provide documented samples of the derived products against which organizations can test their product processing. There is little need for USGS to actually create and distribute such products as they can typically be quickly computed from the provided L1T, so long as the algorithms and parameters for their computation are published. Multiple organizations would create the products and be able to reference the USGS defined standards or refine them to create higher level products that are still based on these documented standards. There is an analogy with the production of different fuels and gasoline. These are all created from crude oil. Standards exist for different grades of gasoline and fuels, although they are created by many companies. For some users of high performance cars or planes the specific octane rating is important. For the majority of users, the ability to obtain fuel of a specified grade from multiple sources has led to massive use and been an enabler for some of the world's largest industries.

- Provide the facilities to certify or validate derived products generated by other organizations. This can be achieved in a similar manner that standards organizations check for compliance.
- Make the L1T product simpler to access. The existing products from USGS are currently accessible only via FTP type services that require the complete scene to be downloaded. It is suggested that new APIs (Application Programming Interface) are investigated that enable the subsets of imagery to be downloaded to multiple cloud processing environments which are likely to be used in the near future for the creation and distribution of multiple products created from Landsat imagery. A similar recommendation is provided in the Cloud recommendations (separate LAG document).

The recommendations provided will enable the Science community to continue to refine and develop high grade products, but also enables the commercial organizations to use a well-defined standard that will enable clearer comparison of products and increase their use.

ⁱ This paper was approved by the NGAC Landsat Advisory Group on December 3, 2013 and adopted by the NGAC as a whole on December 11, 2013. The members of the Landsat Advisory Group are: Kass Green, Kass Green & Associates (Co-Chair); Roger Mitchell, MDA Information Systems, Inc. (Co-Chair); Peter Becker (ESRI); John Copple, Sanborn Map Co.; David Cowen, Univ. of South Carolina; Joanne Irene Gabrynowicz, Univ. of Mississippi; Rebecca Moore, Google, Inc.; Tony Spicci, State of Missouri; Cory Springer, Ball Aerospace & Technologies Corp.; Darrel Williams, Global Science & Technology, Inc.; Tony Willardson, Western States Water Council.

ⁱⁱ Marburger, J. 2005. Landsat Data Continuity Strategy Adjustment. Executive Office of the President. Office of Science and Technology Policy. December 23, 2005.

ⁱⁱⁱ Federal Geographic Data Committee, Initial 2013 Guidance to the National Geospatial Advisory Committee, March 2013 (<http://www.fgdc.gov/ngac/meetings/april-2013/2013-fgdc-guidance-to-ngac.pdf>)