Idaho Technology Authority (ITA)

ENTERPRISE STANDARDS – S4000 – INFORMATION AND DATA

Category: **S4240 – Idaho Land Cover Dataset Standard**

CONTENTS:

I. DEFINITIONS

See ITA Guideline G105 (ITA Glossary of Terms) for definitions.

II. RATIONALE

A statewide Land Cover Framework is a critical source of information for resource land management, community and economic development needs, infrastructure maintenance, research and analysis, homeland security, business location intelligence, public safety, and more. Many private sector and public sector entities have business needs for Land Cover Framework data.

III. APPROVED STANDARD(S)

See Attachment.

IV. APPROVED PRODUCT(S)

GIS software used in Idaho is capable of generating the specified file format.

V. JUSTIFICATION

Experience in other states and countries have amply demonstrated that accessible statewide land cover information is important to realizing substantial improvements in land management, economic development, public safety, government efficiency, and citizen empowerment. The return on investment is substantial, cumulative and perpetual.

VI. TECHNICAL AND IMPLEMENTATION CONSIDERATIONS

This standard requires the development of no new datasets but rather the critical evaluation of current and future land cover datasets in relation to the criteria described in this standard. Few jurisdictions will have difficulty implementing the standard if they have GIS capability.

VII. EMERGING TRENDS AND ARCHITECTURAL DIRECTIONS

The statewide dataset will be primarily available through Web map and image services.

VIII. PROCEDURE REFERENCE

The format, content and development of this standard adhere to Policy P5030 for Framework Standards.

IX. REVIEW CYCLE

Review will occur at least annually.

X. CONTACT INFORMATION

For more information, contact the ITA Staff at (208) 605-4064.

REVISION HISTORY

05/16/2019 – Updated Section III. Definitions.

07/01/13 – Changed "ITRMC" to "ITA".

Effective date is August 25, 2011.

STATE OF IDAHO

Idaho Land Cover Dataset Standard
Part of the Land Use Land Cover Theme

Version 1.0
Effective August 25, 2011

Developed by the Land Use/Land Cover Technical Working Group (TWG)

Table of Contents

1.0 Introduction

Following the strategic plan for The Idaho Map (TIM), the Idaho Land use/Land cover technical working group (LULC TWG) was formed to establish the needs and requirements for a land cover framework dataset, review existing land cover datasets for possible adoption, and develop a land cover standard for the framework dataset. The LULC TWG focuses on land use, land cover, and land tenure datasets to support TIM.

This document, the Idaho Land Cover Data Standard, describes the first component of a strategy to develop a statewide Land Cover Framework dataset, to assist with environmental and natural resource agency policy, management, and analysis.

1.1 Mission and Goals of Standard

The Idaho Land Cover Dataset Standard will provide a consistent and maintainable structure for land cover data producers and users, which will help to ensure the compatibility of datasets within and between other framework datasets. Specifically, this dataset standard will assist agencies responsible for the creation, maintenance, and distribution of land cover layers by reducing the costs of data sharing, data development, and data maintenance. It will also help to ensure that land cover attribution is as current as possible.

The goal of the Land Cover Dataset Standard for Idaho is to ensure that land cover data applications are able to acquire data from disparate sources, use and display the results in an appropriate manner, and rely on local data-maintenance resources to assure that the most current dataset is available for all applications. This standard does not identify or endorse a single land cover layer, but rather specifies the minimum technical and operational requirements for a land cover dataset to be recommended as a TIM compliant dataset.

1.2 Relationship to Existing Standards

The Federal Geographic Data Committee (FGDC) has prepared a draft document entitled, *The Earth Cover Classification Standard* and subsequently, the *National Vegetation Classification Standard (version 2.0)*, which served as the basis for the Idaho standard. In addition, all geospatial datasets developed under the Idaho Land Cover Dataset Standard must adhere to the Idaho Geospatial Metadata Standard.[1]

1.3 Description of Standard

The Idaho Land Cover Data Standard describes the essential elements and data structure necessary to adequately describe, produce, and use land cover data in Idaho. The primary purpose of this document is to establish the core set of geospatial information for use as a source for land cover change evaluations and economic assets derived from the natural resources of Idaho. Unlike other states, Idaho has chosen to separate the concepts and standards for land cover from those associated with land use and land tenure. Therefore, the categories of land cover defined by land use will be minimized in this standard. For the purposes of this standard, the following definitions are used:

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[1] http://ita.idaho.gov/psg/s4220.pdf

- Land cover is the physical material on the surface of the earth. Examples include grass, asphalt, trees, bare ground, and water. There are two primary methods for capturing information on land cover: field survey and analysis of remotely sensed imagery.

- Land use is the physical utilization of land by people and is constrained by land tenure. At any one point, there may be multiple land uses, which are regulated by local, state and federal land use law. Land uses are difficult to discern by examining only land cover. For example, trees land cover might indicate a land use type of plantation or a land use type of conservation, etc.

- Land tenure is a legal term defined as land owned by an individual or corporation, who is said to "hold" the land. Land tenure refers to how a society mediates or regulates land use. A land tenure dataset may identify the owner, manager, and the applied management regime. Land under private ownership may be identified simply as "private."

1.4 Applicability and Intended Use of the Standard

This standard is applicable to the geospatial feature set(s) that represent land cover.
The intended use of this standard is: 1) enabling locally produced and maintained datasets to more easily be assembled into a statewide dataset, 2) guiding the accurate documentation of land cover datasets produced for Idaho, 3) providing guidance for the local GIS community to co-register, validate, and improve data models, and 4) facilitating the discussion of additional dependent and interdependent geospatial data.

1.5 Standard Development Procedures

The LULC TWG comprised of representatives from federal, state, regional, and local government agencies and universities developed this standard. The first draft, based upon the Oregon Land Cover standard version 1, was distributed for initial review in February, 2011. Subsequently, the standard was revised and submitted for peer review by stakeholders and the GIS community beginning June 1, 2011 with the comment period closing on July 18, 2011. Presentation and approval for endorsement by Idaho Geospatial Council followed. The resulting standard is described below.

1.6 Maintenance of the Standard

The Idaho Land Cover Dataset Standard will be revised as needed. Revisions can be initiated by members of the LULC TWG or through comments from the GIS community. It is anticipated that as land cover data are collected at improved spatial accuracies, as geospatial applications mature, and as technology for capturing higher spatiotemporal data improves, the standard will need to be updated. The update process could refine the range of attributes considered minimal or the quality of attributes as described in the existing standard.

2.0 Body of the Standard

2.1 Scope and Content of the Standard

While many of the standards developed are primarily for data exchange, this standard is focused equally on data development and data exchange. This is because land cover can change dramatically and quickly (e.g., wildfires) and the technological means whereby land cover is captured also tends to change with the development of new satellite and computer technologies. In addition, few statewide land cover datasets have been developed which can support local decision making. Therefore, this standard is focused first on data development and secondly on data exchange. The objective of the Idaho Land Cover Dataset Standard is to recommend a publicly available, authoritative, statewide land cover raster dataset at 30-meter per pixel (mpp) spatial resolution, with future datasets available with improved spatial resolution (e.g. 10-mpp). This dataset will be made publicly available through the Idaho spatial data clearinghouse (i.e., InsideIdaho).

The means whereby a candidate land cover dataset is recommended as an authoritative, statewide, framework dataset for The Idaho Map is through review by the LULC TWG. The LULC TWG shall evaluate each candidate land cover dataset for compliance with the minimum requirements set forth in this standard (cf. section 2.5). A recommendation for acceptance may then be made by the chair of the LULC TWG to the Idaho Geospatial Council for approval.

The content of this standard is focused on essential data requirements and the accompanying geospatial metadata elements for the Land Cover Framework dataset.

2.2 Need for the Standard

Many state, federal, and local agencies depend on land cover data when conducting environmental analyses, determining the effectiveness of planning activities, and to understand how the landscape is changing. Currently, the lack of a standard prevents integration of locally collected data with regional and national datasets. The exchange of this valuable information will be greatly simplified through the adoption of a minimal data specification and content standard.

2.3 Participation in Standards Development

In 1976, Anderson et al. developed a broad scale land use/land cover standard classification, which has been and continues to be widely used in spite of the rapid expansion of higher resolution data available today. More recently, the Federal Geographic Data Committee completed the National Vegetation Classification Standard (version 2) which effectively supersedes earlier efforts to describe how vegetation resources should be documented to produce uniform statistics for the nation. As with all Idaho Framework standards, public review of and comment on the Idaho Land Cover Data Standard is encouraged.

2.4 Integration with Other Standards

The Idaho Land Cover Dataset Standard follows the same format as other Idaho Framework standards. The specifics of the standard are intimately related to land use which is described in parts of the Idaho Parcels Data Exchange standard (https://gis.idaho.gov/wp-content/uploads/2020/09/Parcels-Std_ver1-1_Nov26_2012.pdf)

2.5 Technical and Operational Context

2.5.1 Data Environment
The data environment for the land cover dataset is a raster file structure, stored in GeoTIFF format (or other non-proprietary raster format capable of storing multi-band data with 16-bit or great pixel depth) with 30-mpp or better spatial resolution, projected into the Idaho state standard geographic reference system (e.g., IDTM NAD83). The preferred raster file format is GeoTIFF as all known raster processing software used in Idaho is capable of reading and writing the GeoTIFF format.

2.5.2 Reference Systems
Three coordinate reference systems are commonly used within Idaho: the Idaho State Plane Coordinate system (divided into State Plane East, West, and Central), Universal Transverse Mercator (divided into UTM Zone 11 and UTM Zone 12), and Idaho Transverse Mercator. For more details see http://ita.idaho.gov/psg/s4210.pdf. Idaho Transverse Mercator (NAD1983) is the required reference system for the Land Cover Framework dataset and has been recognized as the standard reference system in Idaho. The reference system and datum will be clearly documented in the metadata accompanying the dataset along with a fully defined projection file.

2.5.3 Integration of Themes
The primary Framework elements supported by the Land Cover Data Standard are land cover and vegetation.

2.5.4 Encoding
Encoding translates user formats into standard formats. These are not an issue for Land Cover Framework dataset.

2.5.5 Resolution
For the purposes of the Land Cover Framework, this standard recommends a spatial resolution no coarser than 30-mpp with a vision that future datasets will be available having improved spatial resolution (e.g., 10-mpp). A multi-resolution dataset may be used if that dataset satisfies all other aspects described within the technical and operational contexts of this standard.

Related to spatial resolution is minimum mapping unit (MMU). An MMU is "the smallest size areal entity to be mapped as a discrete entity" (Lillesland and Kiefer 1994 as cited in Knight and Lunetta, 2003). A MMU is often applied to raster datasets to address random pixel clutter and salt-and-pepper noise, especially with finer spatial resolution datasets. Adopting a standard MMU has the potential to simplify integration of local and regional maps. The recommended MMU for statewide land cover mapping is 2 ha (approximately 20 adjacent pixels at 30-mpp).

Another consideration related to resolution pertains specifically to the resolution of the land cover data itself. In other words, the granularity of land cover classification. The Idaho Land Cover Dataset standard stipulates a minimum granularity of land cover classification that is compliant and compatible with the current National Vegetation Classification Standard level 1- formation class (e.g.,. NVCS version 2.0 [FGDC 2008]).

2.5.6 Accuracy

It is essential that all aspects of the data be completely documented. Spatial products which conform to the National Standard for Spatial Data Accuracy should be used for source material in digital data capture if available and appropriate.

The Idaho Land Cover Dataset Standard recommends a consistent (95% CI) horizontal positional accuracy not to exceed 0.50 of the raster layer's spatial resolution (e.g., +/- 15m based on 30-mpp spatial resolution) (Weber 2006; Weber et al., 2008). In addition, minimum overall land cover classification accuracy should exceed 75% overall accuracy. Classification accuracy should be established by ground validation of at least 440 randomly located independent sample points (i.e., 10 points per county) used to generate a standard error matrix.

2.5.7 Edge Matching

This standard is intended to support a seamless dataset across Idaho. Similar datasets from adjacent states and adjacent mapping areas using the same reference system should merge without gaps. This can be facilitated by extending the mapped area up to a recommended 10 km beyond the Idaho state boundary. The LULC TWG shall recommend a decision on any classification or mapping issues within the overlapping area.

2.5.8 Feature Identifier

Feature identifiers are not relevant for raster datasets.

2.5.9 Attributes

Attributes are any of the additional information that is collected and shared in relation to the land cover classification, applied to each raster cell. See Section 3 for the specification of minimal and optional characteristics for land cover.

2.5.11 Records Management

The Land Cover Framework dataset will consist of a limited number of distinct editions. Earlier versions of the Idaho Land Cover Framework dataset may be tracked through the data portal at Inside Idaho (http://cloud.insideidaho.org/index.html) where archived datasets will remain available.

2.5.12 Metadata

Geospatial metadata will follow the ISO 19115-2 standard and comply to the Idaho enterprise standard for geospatial metadata (http://itrmc.idaho.gov/psg/s4220.pdf) . Metadata detailing the characteristics and quality of land cover data must accompany the data. These metadata must provide sufficient information to allow the user to determine whether the dataset is appropriate for their intended purpose, as well as inform the user how to access the data.

3.0 Data Characteristics

The data characteristics specified below are subject to revision.

3.1 Minimum Graphic Data Elements

None specified at this time.

3.2 Minimum Attribute or Non-graphic Data Elements

None specified at this time.

3.3 Optional Graphic, Attribute or Non-graphic Data Elements

None specified at this time.

3.4 Raster Object Information

These are the types and numbers of raster spatial objects in the dataset.
Type: compound
Short Name: rastinfo

3.4.1 Raster Object Type

Raster spatial objects used to locate zero-, two-, or three-dimensional locations in the dataset.
Type: text
Domain: The domain is from "Spatial Data Concepts," chapter 2 of part 1 in Department of Commerce, 1992, Spatial Data Transfer Standard (SDTS) (Federal Information Processing Standard 173): Washington, Department of Commerce, National Institute of Standards and Technology): "Pixel" "Grid Cell"
Short Name: rasttype

3.4.2 Row Count

The maximum number of raster objects along the ordinate (y) axis. For use with rectangular raster objects.
Type: Integer
Domain: Row Count > 0
Short Name: rowcount

3.4.3 Column Count

The maximum number of raster objects along the abscissa (x) axis. For use with rectangular raster objects.
Type: Integer
Domain: Column Count > 0
Short Name: colcount

3.4.4 Vertical Count

The maximum number of raster objects along the vertical (z) axis. For use with rectangular volumetric raster objects (voxels).
Type: Integer
Domain: Depth Count > 0
Short Name: vrtcount

Definition of Terms

Cover: the area of ground covered by the vertical projection of the aerial parts of plants of one or more species.

Existing Vegetation: vegetation found at a given location at the time of observation.

Land cover: is the physical material on the surface of the earth. Examples include grass, asphalt, trees, bare ground, water, etc. There are two primary methods for capturing information on land cover: field survey and analysis of remotely sensed imagery.

Land use: is the physical utilization of land by people and is constrained by land tenure. At any one point, there may be multiple land uses, which are regulated by local, state and federal land use law. Land uses are difficult to discern by examining only land cover. For example, trees land cover might indicate a land use type of plantation or a land use type of conservation, etc.

Land tenure: is a legal term defined as land owned by an individual or corporation, who is said to "hold" the land. Land tenure refers to how a society mediates or regulates land use. A land tenure dataset may identify the owner, manager, and the applied management regime. Land under private ownership may be identified simply as "private."

Plant Community: a group of plant species living together and linked together by their effects on one another and their responses to the environment they share. Typically the plant species that co-occur in a plant community show a definite association or affinity with each other.

Urban & other Developed Lands Class: see definitions for Urban/ Industrial / Extraction Areas and Transportation & Energy Linear Features formations.

Urban Area: non-linear built up areas covered by impervious structures adjacent to or connected by streets.   This cover is related to human population centers.

Urban / Industrial / Extraction Areas Formation: includes areas where non-linear artificial constructions cover the surface and which have an impervious (e.g., concrete) surface.   See additional individual category definitions.   This category also includes small vegetated areas within the footprint of these urban / industrial areas.

Vegetated: areas having equal to or greater than 1% or more of the land or water surface with live vegetation cover at the peak of the growing season.

Vegetation Cover: vegetation that covers or is visible at or above the land or water surface.   It is a sub-category of Earth cover. It is the percentage of the ground covered by a vertical projection of the outermost perimeter of the natural spread of the foliage of plants.

References

Anderson, J. R., E. E. Hardy, J. T. Roach, and R. E. Witmer. 1976. A Land Use and Land Cover Classification System for Use with Remote Sensor Data. USGS Professional Paper 964, Reston, Virginia. http://www-nmd.usgs.gov/pub/ti/LULC/lulcpp964

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