

<b>Want to know...?</b>	<b>Sections in FGDC metadata</b>
Map scale or resolution	Data Quality - Lineage
How current?	Identification – Time Period
Which area is covered?	Identification – Spatial Domain
How is data processed?	Data Quality – Lineage
How accurate?	Data Quality - Accuracy
Datum, map projection	Spatial Reference
Data structure {vector, raster}	Spatial Data Organization
Attributes	Entity and Attribute

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GEOG 482 / 582 : GIS Data Management

# Lesson 8: Spatial Data Standards, Metadata, and User Training

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# Overview

Learning Objective Questions:

## **Data Standards**

1. What is a spatial data standard and why are spatial data standards important?
2. How do we characterize types of standards?
3. What spatial data standards does OGC provide?

## **Spatial Metadata Standards**

4. Why are metadata important?
5. What are three spatial metadata standards, who created them, and how are they used?
6. What are some software tools for working with spatial metadata?

## **User Training**

7. Why is user training important?
8. What are four levels of user training?
9. What is training needs assessment and who uses it?
10. What are three phases in training needs analysis?

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## **Lesson Preview**

Learning objective questions act as the lesson outline.

Questions beg answers.

# Spatial Data Standards

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## 1. What is a spatial data standard and why are spatial data standards important?

### Spatial data standards

a document or collection of documents that establishes a common language, terminology, accepted practices and levels of performance, as well as technical requirements and specifications, that are used consistently for the development and use of products, services and systems in the context of spatial data.

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### Key terms

Data standard

### Why important?

Standards commonly provide a shared understanding for processes, products, and/or services

In essence, a commonly shared language developed by a 'community of practice', e.g. for use in GIS data management work.

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## 2. How do we characterize types of standards?

### **Categories (kinds) of standards as a 3D matrix**

(Y&H Figure 5.1 p. 130)

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Three primary categories (types or classes), each with subcategories (sub-types or sub-classes):

- 1) Forms of standard – technical specifications (restrictive), conventions, guidelines (permissive)
- 2) Implementation – voluntary (used by popular), mandatory (legally enforced)
- 3) Level of granularity – information system (general), data structures, data contents, data values (detailed)

Let's look at each of these three categories with sub-categories in more detail on following slides...

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# Forms of standards

## Forms of standards...

*Technical specifications* – most rigid and exactly of all standards, will yield consistent and identical results

*Conventions* – also called rules and protocols, are more flexible and more accommodating of variations in implementation, and therefore will yield similar but not necessarily identical results

*Guidelines* – most flexible type of standard and they provide a broad set of criteria against which the quality and performance of products, services, or systems can be assessed

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### Key terms

Specifications  
conventions  
guidelines

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# Implementation

**Generally, two implementation approaches to standards**

*Mandatory* – standards implemented through government legislation and regulations

*Voluntary* – standards implemented through consensus and popular acceptance by user community

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# Level of granularity

## **Four levels of detail – main focus on data interoperability**

*Information system standards* – apply generally and broadly to depict the overall architecture of the system

*Data structure standards* – organize the way in which data are logically and physically represented

*Data content standards* - provide rules for representing each element defined in the data structure covering, e.g., formats for dates, times, quantities and addresses

*Data value standards* – object or feature catalogs, providing lists or tables of terms, names, classification codes and other types of permissible values that are allowed for a particular element defined in a data content standard

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# Classification of Standards

Open standards – all standards that were developed using some or all of the principles of open standards. Stakeholders participate voluntarily in standards development, the use of consensus in the review and standards review process, e.g., W3C community

Public domain standards – maintained by an organization for the general good, e.g. ISO 19115 content metadata and OGC standards

Proprietary standards – developed by organizations for internal use in the manufacturing of products or delivery of services, e.g. Esri shapefile or Autodesk DXF has become a public domain standard

Mandatory standard

De jure standards – by law or policy and strictly enforced

De facto standards – by popular acceptance

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## Key terms

Open standards

Public domain



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### 3. What spatial data standards does OGC provide?

Open Geospatial Consortium (OGC) specifications address many geospatial issues, 65 at last count on 10/16/2019.

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OGC standards are at varying stages of development, some completed and others recently started. See next slide for geospatial data focused standards.

Technical working committees form around a topic.

500+ organizational members, thus many representatives involved

You too might want to help out some day.

A reference model helps organize thoughts.

<https://www.opengeospatial.org/standards/orm>

See OGC web site for latest about OGC standards and latest list....

<http://www.opengeospatial.org/standards>

and approved schemas: <http://schemas.opengis.net/>

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# OGC Implementation Specifications

## Spatial data services and application

Catalog interface, coordinate transformation, filter encoding

## Spatial data encoding

Geography markup language (GML), a geospatial XML

## Application programmer interfaces

Simple feature/CORBA

Simple feature/ SQL

Simple feature/OLE/COM

## Internet Mapping

Stylized layer description

Web feature service

Web map context

Web coverage service

Web map service

## 4. Why are (geo)spatial metadata important?

Metadata – information that describes data to clarify content, for example...

- source of the data including who and where it was produced
  - when the data were produced
  - why the data were produced
  - how data can be obtained
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Why important...

Uniformity of data collection – comprehensive and structured list of definitions

Data management – provide overview insights about the value of data assets

Data use – how are data fit for what use (fitness for use)

Data understanding – provide various insights about the data as data volume grows

Data sharing – easy way to transmit meaning from one unit/organization to another

Data archiving and Warehousing – provide insights about how data can be combined

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# Availability of metadata

Is metadata always available?

- No

What if metadata are not available?

- Look for data dictionary at least; or
- Contact persons in charge

Since it is of considerable value to interpret the character of data,  
look for it.

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## 5. What are three spatial metadata standards, who created them, and how are they used?

### 1. Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM)

- FGDC composed of US Federal agencies that make considerable use of geographic data
- Focus on direction of National Spatial Data Infrastructure, including metadata and data quality standards

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#### Key terms

ANSI  
ISO  
FGDC

### 2. American National Standards Institute (ANSI) Z39.50 GeoProfile

- ANSI is an industry oriented professional body, Libraries
- Data not included in the FGDC standards

### 3. International Standards Organization (ISO)

ISO 19115 for Metadata and ISO 19157:2013[2014] for Data quality

Latest on metadata content and quality for FGDC and ISO - see

<https://www.fgdc.gov/standards/news/fgdc-iso-metadata-standards>

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# FGDC Content Standard for Digital Geospatial Metadata (CSDGM)

FGDC now recommends use of ISO 19115 as better

- Availability of spatial data
- Documents fitness for use
- Means of accessing spatial data
- Transfer of spatial data from producer to user
- Establishes names of metadata elements and composition of elements
- Adopted by many countries around world, including ISO Technical Committee who created ISO 19115

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**Key terms**

# Reading FGDC content metadata

<b>Want to know...?</b>	<b>Section in FGDC metadata</b>
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WA State subset of FGDC CSGDM info at <https://ocio.wa.gov/policies/16000-spatial-data-management-policy-standards/16102-spatial-metadata-standard>

# Spatial metadata - data quality interpretation

	<b>Space</b>	<b>Time</b>	<b>Attribute</b>
<b>Accuracy</b>	Positional accuracy		Attribute accuracy
<b>Consistency</b>	Logical consistency		
<b>Completeness</b>	Completeness		Completeness

where

- Column: components of geographic information
- Row: components of data quality

**Accuracy:** lack of discrepancy between measurement and values considered true (e.g. is this location near true value?)

**Consistency:** whether given components conform to logical rules (e.g. any digitizing error?)

**Completeness:** whether what's required is encoded in data (i.e. anything missing)



# Fitness for use as a data quality perspective

## Sample questions about fitness for use (1):

Does map scale or **resolution** of the data provide the level of details required by the application?

- Using low-resolution satellite image for street-level survey is not acceptable
- Any generalization algorithms used?

Is data **current** enough to support needs identified earlier on?

- Using outdated data for replacing an old map is not acceptable

Are specific **characteristics** of data useful for the application?

- Topology for routing operation
- Multispectral image for land use detection
- Non-planar representation for 3D visualization

Are data processing steps, called **lineage or provenance** (library term), linked to usefulness of data for specific applications?

- Some processing steps brought about irreversible effects on data (e.g. unknown algorithm parameters)

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### Key terms

Fitness for use

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## Sample of questions about fitness for use (2):

- Is the stated level of **accuracy** sufficient given error tolerance?
  - Requirements for accuracy vary highly by the applications
  - Required types of accuracy vary by information needs (e.g., measuring parcel size requires relative accuracy while surveying requires absolute accuracy)
- Is the stated level of **completeness** of features or attribute adequate to needs?
  - Some entities and attributes are required rather than optional
- **Logical consistency** of data?
  - Does data lack conformance to logical rules? (e.g., is identifier generated properly? Doesn't data has too many sliver?)
  - Does metadata indicate that the agency put any effort into quality control? (e.g. lack of information in data quality section)

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# ANSI Z39.50 GeoProfile

- Metadata Standards for FGDC CSDGM lie outside the scope of Z39.50
  - Supports search and retrieval of metadata and data sets
  - Not much going on in this realm for several years
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# ISO 19115 Metadata and ISO 19157 Data Quality

- International Standards Organization WorkGroup 3 Technical Committee (ISO TC211)
- Incorporates FGDC CSDGM as a profile  
Incorporates many other elements
- Worldwide metadata standard  
Conformance Level 1 metadata – core 50 elements for discovery  
Conformance Level 2 metadata – complete inventory of metadata

International Committee for Information Technology Standards

- INCITS/ISO 19115-1:2014 – Metadata Content
- INCITS/ISO 19157:2013[2014] – Data Quality

Descriptions available here...

<https://www.fgdc.gov/standards/news/fgdc-iso-metadata-standards>

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## 6. What are some software tools for working with spatial metadata?

- Metadata Capture and Documentation Tools
- Intelligent metadata extractors – scan a spatial data and extract metadata elements
- Form-based metadata entry wizards – GUI helps users extract metadata elements
- Hybrids – ESRI’s ArcCatalog, For ArcGIS approach see...

[http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#  
//003t0000002w000000](http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//003t0000002w000000)

- Check out the FGDC web page about identifying a suitable metadata tool and for list of tools available

<https://www.fgdc.gov/metadata/geospatial-metadata-tools>

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# Example tools for metadata creation

How do I create/update metadata?

- Use metadata creation/editing tool
  - ArcCatalog from ESRI
  - *tkme* from

<http://geology.usgs.gov/tools/metadata/tools/doc/tkme.html>

How do I check if this metadata conforms to FGDC Content Standard?

- Use metadata validation tool
  - Install program *mp* from

<http://geology.usgs.gov/tools/metadata/tools/doc/mp.html>

Now 'legacy tools' (somewhat out of date but still interesting) since they focus on FGDC CSDGM

# User Training

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## 7. Why is user training important?

**Users** are those who find value in ‘working’ with data as well as those you support operation and use of data

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User education and training differ.

- Education is more long-lasting, focusing on concepts and technology mix.
- Training focuses more on technology use.

User training is part of spatial database systems implementation; bring people on board for technology use

User training is important from a project management perspective

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# Four categories of users

- Project sponsors. Who are ultimately responsible for the decisions that get made with the information created from the database?
- Systems Staff. Database administrators, systems analysts, and application programmers
- Production and/or professional staff. Frequent access to the database, e.g., for transactions processing it might be business analysts, planners, resource managers
- Occasional users. Those who less frequently use the database, e.g. to inform and enlighten themselves



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## 8. What are four levels of user training?

- Organizational – briefing and presentations to senior management
- Occupational – raise general skill level of all who use the system
- Individual – raise skill level of specific person
- Popular – directed at the public or less frequent user; product specific training

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## 9. What is training needs assessment and who uses it?

Systematic set of procedures undertaken for the purpose of setting priorities and making decisions about program or organizational improvement and allocation of resources.

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Need – gap between what a user needs to know and what the user knows

Metadata training is important to GIS databases because...

- Sharing of data for collaborative work is ‘big’
- Understanding the content is central to understanding use potential
- System standards broadly and metadata standards more specifically foster ‘easier’ sharing and understanding

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## People who need training are part of the assessment...

- new people are hired by organization
- existing members of staff are given new job assignment
- new working methods, including new technologies
- new application are implemented
- major upgrade of a software version
- increase in productivity is desired
- higher standards in job performance

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## 10. What are three phases in training needs analysis?

### 1) Pre-assessment (scoping and planning for what to do...)

- Identify major areas of need
- Identify data sources to be used
- Proposed level of competency

### 2) Assessment (data collection about what has been done...)

- Collection of data
- Perform preliminary data analysis (exam
- Competency model

### 3) Post assessment (data analysis and communication)

- Refine expected level of competency
- Prioritized training needs
- Develop action plan
- Communicate results to sponsors
- Implement the action plan

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# Implementing User Training Strategy

Consider the following:

- Prioritize User Training Needs – among different user types
- Establish timeframe of training programs – rights skills at right time
- Location – go to the users
- Method of Delivery – make it engaging for the users
- Train-the-Trainer – spread the training load by involving others
- Evaluation and improvement – assess how training was or was not effective for each of the user types and each of the levels of training

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# Summary

In this lesson, you learned about...

1. Spatial data standards and why they are important
2. Types of standards
3. Spatial data standards from OGC
4. Importance of metadata
5. Three spatial metadata standards
6. Spatial metadata tools
7. Importance of user training
8. Four levels of user training
9. Training needs assessment and who needs it
10. Three phases in training needs analysis

Contact me at  
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have questions or  
comments about this  
lesson.

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**END Lesson 8: Spatial Data Standards,  
Metadata, and User Training**