

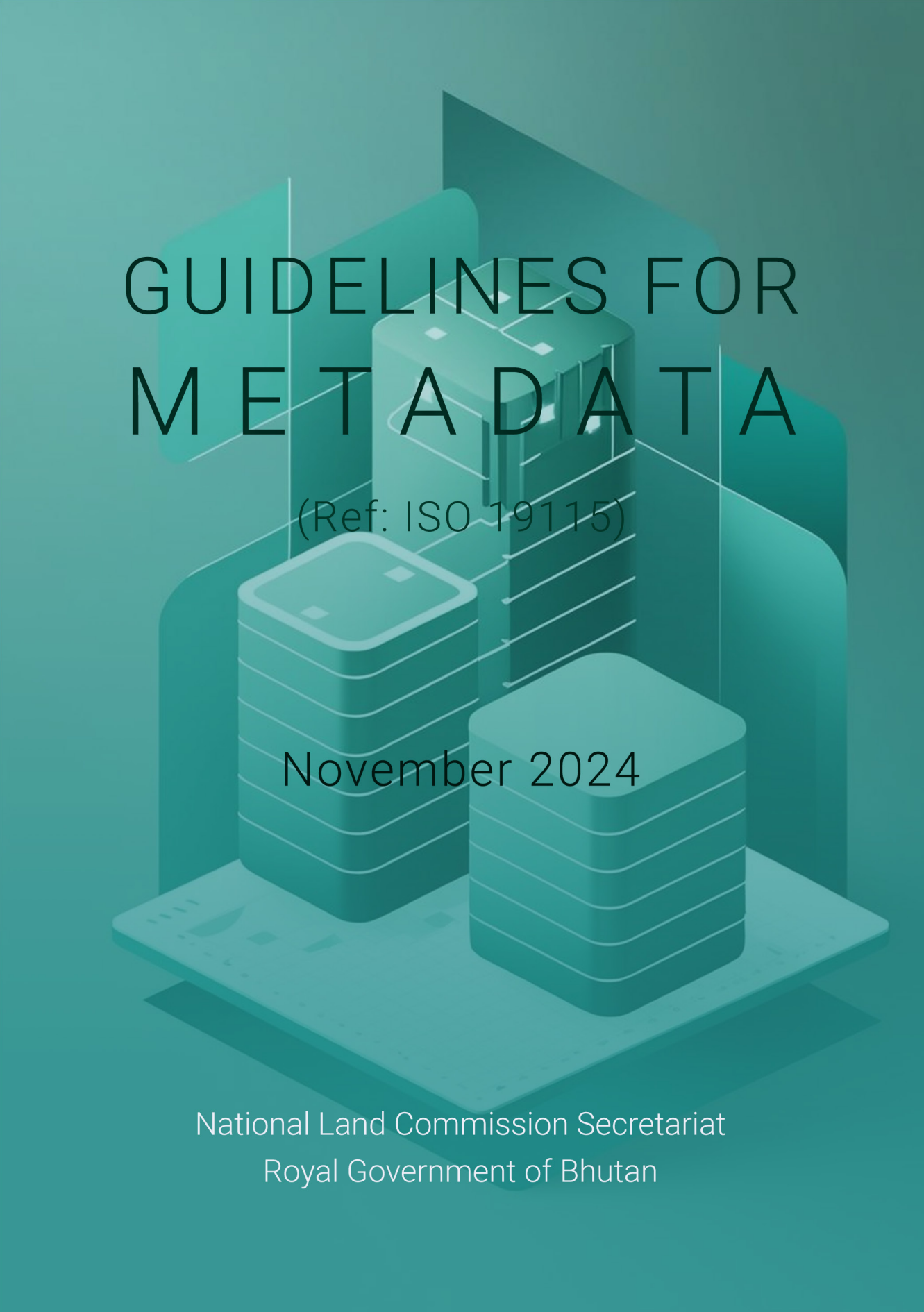
Guidelines

for Bhutan Standard of Metadata

2024

Department of Survey and Mapping
National Land Commission Secretariat
Royal Government of Bhutan



The background is a solid teal color. Overlaid on this are several abstract, three-dimensional geometric shapes in various shades of teal. These shapes resemble server racks or data storage units, with some having horizontal lines indicating multiple layers or drives. The shapes are arranged in a way that creates a sense of depth and perspective, with some appearing to be in the foreground and others receding into the background. The overall aesthetic is modern and technological.

GUIDELINES FOR METADATA

(Ref: ISO 19115)

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National Land Commission Secretariat
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Introduction

The development of geographic metadata standards began with the evolution of Geographic Information System (GIS) and digital mapping technologies. Initially, metadata were compiled as reports for managing dataset production and inventory. Gradually, with the advancement of geospatial technologies, Geographic Information (GI) metadata has become an underpinning resource for data discovery and accessibility.

Metadata is a set of information that captures and describes the basic characteristics of a dataset or an information resource. It describes who, what, when, where, why and how of the associated data, enabling users to find the information and assist its optimal utilization. Metadata plays an important role in data management, facilitating data sharing, interoperability, consistency and a collaboration among the geospatial data creators and users. It improves search and discovery of the dataset, facilitates the organisation of the data content, enables us to understand data lineage, helps in data longevity and importantly ensures the data integrity and compliance of the metadata standards.

Metadata must be reviewed periodically to ensure that it remains up to date and aligned with Bhutan Standards (BTS) for metadata. The revision of the guideline shall be carried out by the Centre of Geo-Information (CGI), NLCS in collaboration with CGI member agencies. This guideline clearly defines the metadata standards and formats for creating consistent and comprehensive metadata ensuring both geographic producers and users to understand and capture the information adhering to the Bhutan Standards (BTS) for metadata.



Objective

The main objective of this guideline is to provide a clear understanding and reference for creation of the metadata so that it ensures consistent adoption of the metadata standards. It shall be applicable to all the geospatial data creators and

producers within Bhutan for metadata creation and management.

The guideline aims to achieve the following objectives;

- To adopt standardized formats and structures for describing various types of geographic information to ensure uniformity in metadata representation.
- To enable seamless integration of metadata across various applications.
- To enhance data searchability, discovery and access.
- To enable users to analyse and assess the suitability of the datasets.

Conformance

This guideline is in line with BTS for geographic information. It is designed to ensure BTS for metadata is consistent, comprehensive, and adheres to the ISO 19115 metadata standard. The definitions for the elements were rephrased for more clarity and easy reference.

General Rules for Metadata Creation

Obligation/Condition

Based on the ISO 19115 metadata standards, each metadata element has the property of the obligation/condition which describes whether a metadata item shall always be documented or sometimes be documented.

The BTS for metadata defines the following three values:

- **Mandatory (M):** The metadata elements that must be included in every metadata record to comply with the ISO 19115 standard. Failure to include mandatory elements will result in rejection in the metadata publication.
- **Conditional (C):** The elements that depend on specific conditions or situations for adoption under which at least one metadata is mandatory.
- **Optional (O):** The optional elements are not mandatory to include in the metadata record but they can be included based on the specific needs and requirements of the data creator or users. Optional elements can have mandatory contents and those contents become mandatory if the optional elements are used.

Element Domain

In adherence to the ISO 19115 metadata standard, each metadata element is defined by its allowable values, known as its domain. These values shall either adhere to a specific range, such as positive or negative integers, or they shall be derived from a set of code values established within a predefined code list as specified in the ISO standard for metadata. For certain metadata elements like ‘abstract,’ ‘purpose,’ etc., the acceptable values shall be in free text format. However, this free text should align with the definitions provided for each respective element. Defining these domains is vital for the creation of metadata and helps in ensuring the quality of metadata.

Metadata Template

Metadata template provides a schema and establishes a common set of metadata terminology, definitions, and extension procedures in line with BTS for geographic information. It provides information about the identification, the extent, the quality, the spatial and temporal schema, spatial reference, and distribution of digital geographic data. Table 1 shows the metadata template for creation of the metadata. The detailed elements and lists with its definition and domain can be referred to annexure I and II respectively.

Table 1: Metadata Template Showing The General Elements

Category	Class	Elements	Sub elements	Obligation/ Condition	Domain
Overview	Item Description	Title		M	free text
		Abstract		M	free text
		Purpose		O	free text
		Use limitation		O	free text
	Topic and Key Word	Topic Category		M	list
	Citation	Title		M	free text
		Date	Created	M	date
			Published	M	date
			Revised	O	date
	Metadata	Details			
		File identifier		O	
		Date Stamp		M	date
		Language		M	list

	Contact	Contacts	Name	M	free text
			Organisation	M	free text
			Position	M	free text
			Role	M	list
		Contact Information	Email	O	free text
			Phone	O	free text
	Maintenance	Update Frequency		M	list
		Next Update		O	date
Resource (Geographic Datasets)	Details	Status		M	list
		Language		M	list
		Character Set		O	list
		Spatial Representation Type	vector/raster	O	list
		Scale Resolution		O	free text
		Distance Resolution		O	free text
	Extents	Extent	Bounding box	M	free text
	Points of Contact	Contacts	Name who provide the data information	M	free text
			Organization	M	free text
			Position	M	free text
			Role	M	list
		Contact Information	Email	O	free text
			Phone	O	free text
	Maintenance	Update Frequency		M	list
		Next Update		O	date
	Constraints	General Constraints	Use Limitation	O	Open/Common/Restricted
	Spatial Reference	Reference Systems	Code eps526	O	free text (Ex. code- EPSG 5266)
	Spatial Data Representation	Vector Representation	Geometric Object	O	code

Content	Image Description	Attribute Description this is for raster	M	free text
		Content Type	M	list
		Imaging Condition	O	list
		Cloud Cover Percentage	O	free text
Lineage	Data Source	Source Description	M	free text
	Process Step	Process Description	M	free text
Distribution	Distribution Format	Format Name	M	free text
		Format Version	M	free text
		autocad and all		
	New Distribution Transfer options	Units of distribution	O	free text
		Transfer size	O	free text

Metadata Creation Process

Metadata can be created using any proprietary or open-source GIS software, as long as it adheres to the ISO 19115 metadata standard. However, it is recommended to create a metadata in ArcGIS software since it has an inbuilt metadata style selection based on the ISO standards implementation specification.

Metadata creators may adopt the following generic process for creation of metadata.

- Select the dataset for creation of the metadata
- Select “ISO 19139 Implementation Specification” as metadata styles (ISO 19139 is the XML implementation of ISO 19115 for machine readability as most of the GIS softwares support this encoding)
- Create metadata records

- Capture all mandatory metadata elements specified in this guideline
- Adhere to the specific domain rule (free text/code list table)
- Review and validate metadata in conformance to this guideline
- Save the metadata
- Use XML format for sharing the metadata



Metadata Validation

Metadata validation is an important process to ensure the complete capture of the mandatory elements and formats described in the guideline. Validation of metadata shall be carried out through the system as well as manual inspection. The system identifies the errors, missing elements, or inconsistencies in the metadata. Manual validation should be carried out to review the metadata records in detail and ensure that all required elements are captured accurately. Moreover, it is necessary to carry out the consistency check to match the required information and align with the content of the dataset.

Metadata validation shall be done by both the creator and the publisher. However, it should be also validated by the system administrator if the metadata is to be published in a system. The following checks need to be considered for metadata validation:

- **BTS Standard Check:** Compliance with this guideline.
- **Completeness Check:** Verify the completeness of all mandatory metadata elements.
- **Content Quality Check:** Assess the quality and coherence of the metadata content, ensuring it aligns with this guideline.



Metadata Sharing and Distribution

To make geospatial information more accessible and discoverable to a wider audience, the sharing and distribution of standardized metadata files is critical. Therefore, every geospatial dataset should encompass the metadata information in conformance with this guideline. Additionally, explicit sharing of metadata can also be done through xml format separately.



Maintenance of Metadata

Metadata maintenance is not only a good practice but also a requirement for the metadata standard. Updating metadata ensures accurate, consistent, and reliable data that can be used to track history, quality, and lineage. It also helps to avoid duplication, errors, and confusion when sharing or publishing data.

Metadata shall be:

- Updated when the particular geospatial dataset is modified.
- Updated by the agency that produced the geospatial data.
- Maintained up-to-date, complete, and consistent over time.
- Reviewed and validated after Updation.



Acronyms

- **BTS:** Bhutan Standards
- **XML:** Extensible Markup Language
- **CGI:** Centre for Geo-Information
- **ISO:** International Standard Organization
- **GIS:** Geographic Information system
- **GI:** Geographic Information
- **NLCS:** National Land Commission Secretariat

Annexure I: Definition of Metadata Elements

SI No	Elements	Definition
1	Title	Name of the dataset
2	Abstract	Clear and concise summary about the dataset's content, and significance.
3	Purpose	The intended purpose of the geographic dataset
4	Use limitation	Restrictions or constraints placed on the utilisation of a particular dataset or geographic information.
5	Topic Category	A high-level classification scheme to assist in the grouping and topic-based search of available spatial data resources.
6	Date	Date when the dataset was created, published, and revised.
7	File identifier	Unique identifier for the metadata
8	Date Stamp	The date of creation of metadata
9	Language	Language used in the metadata or dataset
10	Contacts	Organisation or individual responsible for the metadata /data
11	Contact Information	The contact details of the parties responsible for creating, maintaining, and providing access to the metadata/dataset.
12	Update Frequency	Frequency of metadata and data update
13	Next Update	Date for the next update of metadata and data
14	Status	Progress status of the dataset

SI No	Elements	Definition
15	Character Set	Name of the character set used in metadata/-dataset for representing characters in a computer system (e.g., utf-8)
16	Spatial Representation Type	Geometry used to represent spatial feature in the dataset
17	Scale Resolution	The scale at which the spatial data is represented in the map. Scale resolution is the denominator value (e.g., scale 1/50,000, resolution is 50,000)
18	Distance Resolution	Detail or precision with which distances can be represented and measured in a geospatial dataset.
19	Extent	Geographic extent of the dataset using the minimum and maximum latitude and longitude coordinates
20	General Constraints	It refers to the access restrictions and usage limitations associated with the dataset.
21	Reference Systems	The coordinate reference system used in the dataset.
22	Vector Representation	Information on whether the geographic feature is a point, line, or polygon feature.
23	Image Description	Description of the image information
24	Data Source	Information about the source data used in creating the data
25	Process Step	General description of how the data was created
26	Distribution Format	Data format such as shp/kml/dwg/CSV/etc.
27	Distribution Transfer options	Size of the dataset

Annexure II: Code List

Table 1: Topic Category

ISO Topic Category & Code	Definition	Examples
farming	Rearing of animals or cultivation of plants	Agriculture, irrigation, aquaculture, plantations, herding, pests and diseases affecting crops and livestock
biota	Flora or fauna in natural environment	wildlife, vegetation, biological sciences, ecology, wilderness, sea life, wetlands, habitat, biological resources
boundaries	Legal land descriptions	political and administrative boundaries, governmental units, marine boundaries, voting districts, school districts, international boundaries
climatology Meteorology Atmosphere	Processes and phenomena of the atmosphere	cloud cover, weather, climate, atmospheric conditions, climate change, precipitation
economy	Economic activities, conditions, and employment	Production, labour, revenue, business, commerce, industry, tourism and eco-tourism, forestry, fisheries, commercial or subsistence hunting, exploration and exploitation of resources such as minerals, oil and gas

elevation	Height above sea level	altitude, bathymetry, digital elevation models, slope, derived products, DEMs, TINs
environment	Environmental resources, protection and conservation	environmental pollution, waste storage and treatment, environmental impact assessment, monitoring environmental risk, nature reserves, landscape, water quality, air quality, environmental modelling
geoscientificInformation	Information pertaining to earth sciences,	geophysical features and processes, geology, minerals, sciences dealing with the composition, structure and origin of the earth's rocks, risks of earthquakes, volcanic activity, landslides, gravity information, soils, permafrost, hydrogeology, groundwater, erosion
health	Health, health services, human ecology, and safety	disease and illness, factors affecting health, hygiene, substance abuse, mental and physical health, health services, health care providers, public health
imageryBaseMapsEarthCover	Base maps	land/earth cover, topographic maps, imagery, unclassified images, annotations, digital ortho imagery
intelligenceMilitary	Military bases structures, activities	barracks, training grounds, military transportation, information collection

inlandWaters	Inland water features, drainage systems and characteristics	rivers and glaciers, salt lakes, water utilisation plans, dams, currents, floods and flood hazards, water quality, hydrographic charts, watersheds, wetlands, hydrography
location	Positional information and services	addresses, geodetic networks, geodetic control points, postal zones and services, place names, geographic names
oceans	Features and characteristics of salt water bodies (excluding inland waters)	for example, tides, tidal waves, coastal information, reefs, maritime, outer continental shelf submerged lands, shoreline
planningCadastre	Information used for appropriate actions for future use of the land	land use maps, zoning maps, cadastral surveys, land ownership, parcels, easements, tax maps, federal land ownership status, public land conveyance records
society	Characteristics of society and culture	settlements, housing, anthropology, archaeology, education, traditional beliefs, manners and customs, demographic data, tourism, recreational areas and activities, parks, recreational trails, historical sites, cultural resources, social impact assessments, crime and justice, law enforcement, census information, immigration, ethnicity

structure	Man-made construction	buildings, museums, churches, factories, housing, monuments, shops, towers, building footprints, architectural and structural plans
transportation	Means and aids for conveying persons or goods	roads, airports/airstrips, shipping routes, tunnels nautical charts, vehicle or vessel location, aeronautical charts, railways
utilitiesCommunication	Energy, water and waste systems and communications infrastructure and services	hydroelectricity, geothermal, solar and nuclear sources of energy, water purification and distribution, sewage collection and disposal, electricity and gas distribution, data communication, telecommunication, radio, communication networks
extraTerrestrial	Region more than 100 km above the surface of the Earth	
disaster	information related to disasters	Site of the disaster, evacuation zone, disaster-prevention facility, disaster relief activities.

Table 2: Role Codelist

Name (code)	Definition
CI_RoleCode	function performed by the responsible party
Resource Provider	party that supplies the resource
custodian	party that accepts accountability and responsibility for the resource and ensures appropriate care and maintenance of the resource
owner	party that owns the resource
user	party who uses the resource
distributor	party who distributes the resource
originator	party who created the resource
pointOfContact	party who can be contacted for acquiring knowledge about or acquisition of the resource
principalInvestigator	key party responsible for gathering information and conducting research
processor	party who has processed the data in a manner such that the resource has been modified
publisher	party who published the resource
author	party who authored the resource

Table 3: Update Frequency Codelist

Name (code)	Definition
MD_Maintenance-FrequencyCode	frequency with which modifications and deletions are made to the data after it is first produced
continual	resource is repeatedly and frequently updated

daily	resource is updated each day
weekly	resource is updated on a weekly basis
fortnightly	resource is updated every two weeks
monthly	resource is updated each month
quarterly	resource is updated every three months
biannually	resource is updated twice each year
annually	resource is updated every year
asNeeded	resource is updated as deemed necessary
irregular	resource is updated in intervals that are uneven in duration
notPlanned	there are no plans to update the data
unknown	frequency of maintenance for the data is not known

Table 4: Use Limitation Codelist

Name (code)	Definition
Data access	
open	open data shall be openly and freely accessible
restricted	restricted data shall be used only by the authorized government agencies

Table 5: Progress Codelist

Name (code)	Definition
MD_ProgressCode	function performed by the responsible party
completed	has been completed
historicalArchive	stored in an offline storage facility
obsolete	no longer relevant
onGoing	continually being updated
planned	fixed date has been established upon or by which the resource will be created or updated
required	needs to be generated or updated
underDevelopment	currently in the process of being created

Table 6: Spatial Representation Type Codelist

Name (code)	Definition
MD_SpatialRepresentationTypeCode	method used to represent geographic information in the resource
vector	vector data are used to represent geographic data
grid	grid data are used to represent geographic data
textTable	textual or tabular data are used to represent geographic data
tin	triangulated irregular network
stereoModel	three-dimensional view formed by the intersecting homologous rays of an overlapping pair of images
video	scene from a video recording

Table 7: Geometric Object Type Codelist

Name (code)	Definition
MD_GeometricObjectTypeCode	name of point or vector objects used to locate zero-, one-, two-, or three-dimensional spatial locations in the dataset
complex	set of geometric primitives such that their boundaries can be represented as a union of other primitives
composite	connected set of curves, solids or surfaces
curve	bounded, 1-dimensional geometric primitive, representing the continuous image of a line
point	zero-dimensional geometric primitive, representing a position but not having an extent
solid	bounded, connected 3-dimensional geometric primitive, representing the continuous image of a region of space
surface	bounded, connected 2-dimensional geometric primitive, representing the continuous image of a region of a plane

Table 8: Coverage Content Type Codelist

Name (code)	Definition
MD_ConvergenceContentTypeCode	specific type of information represented in the cell
image	meaningful numerical representation of a physical parameter that is not the actual value of the physical parameter
thematicClassification	code value with no quantitative meaning, used to represent a physical quantity
physicalMeasurment	value in physical units of the quantity being measured

Table 9: Imaging Condition Code Codelist

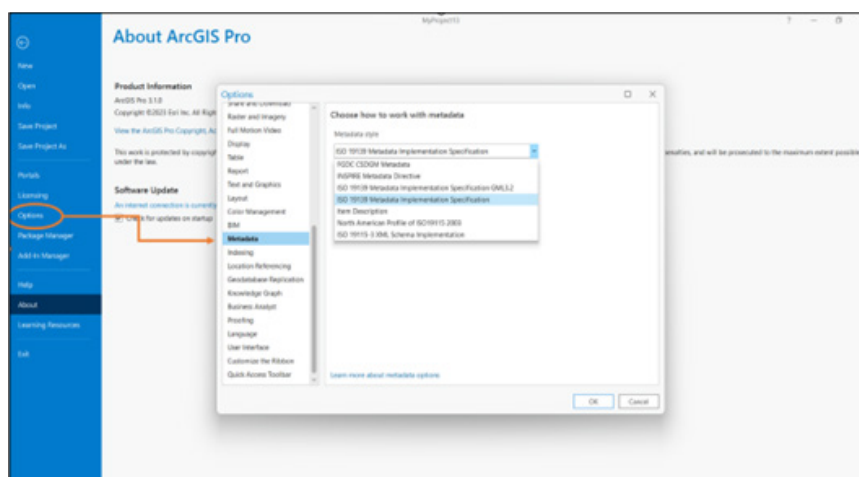
Name (code)	Definition
MD_ImagingConditionCode	code which indicates conditions which may affect the image
blurredImage	portion of the image is blurred
cloud	portion of the image is partially obscured by cloud cover
degradingObliquity	acute angle between the plane of the ecliptic (the plane of the Earth's orbit) and the plane of the celestial equator
fog	portion of the image is partially obscured by fog
heavySmokeOrDust	portion of the image is partially obscured by heavy smoke or dust
night	image was taken at night
rain	image was taken during rainfall
semiDarkness	image was taken during semi-dark conditions – twilight conditions
shadow	portion of the image is obscured by shadow
snow	portion of the image is obscured by snow
terrainMasking	the absence of collection data of a given point or area caused by the relative location of topographic features which obstruct the collection path between the collector(s) and the subject(s) of interest

Annexure III: SOP for Metadata Creation

1. Select Metadata Styles

A metadata style provides access to a set of metadata elements, and a stylesheet for displaying their content.

- Go to: Project (Tab) >> Options >> Metadata
- Select: *ISO 19139 Implementation Specification* from metadata style list

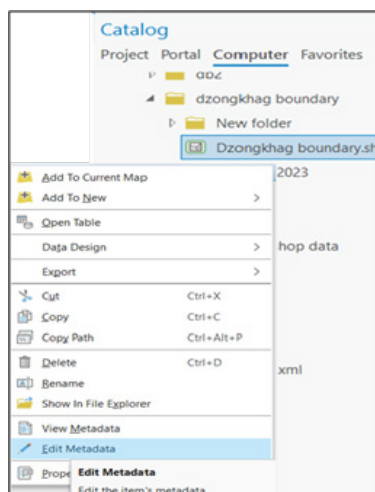


2. Create Metadata

- View tab>> Catalog Pane>> Folder (Navigate to the data)
- Right click >> Edit Metadata

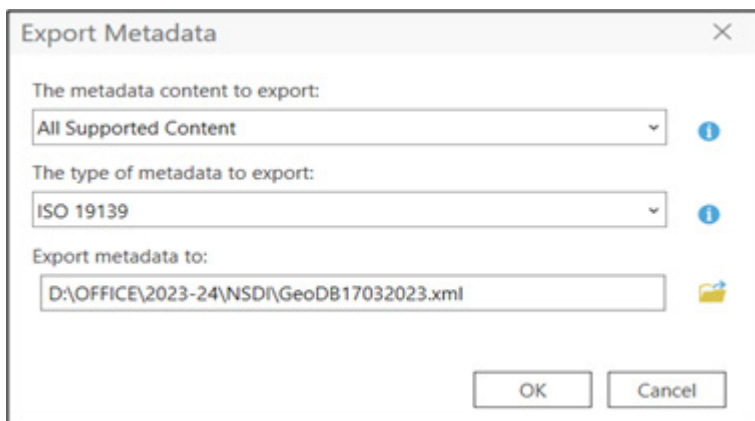
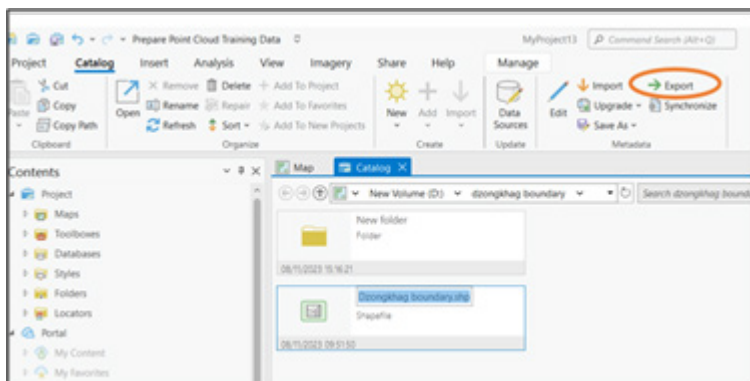
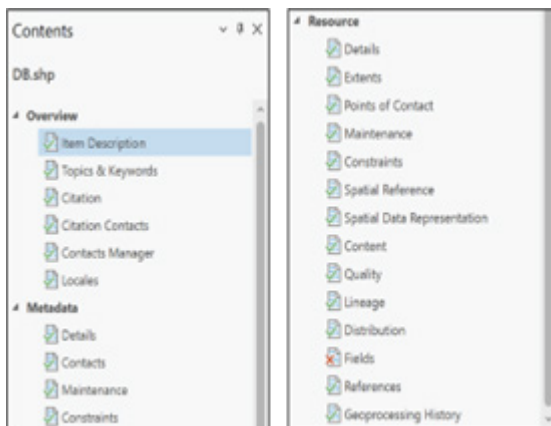
3. Fill Up The Metadata Elements

- Add info in metadata elements based on the contents



4. Export The Metadata

- Close the metadata window and navigate to the catalog pane.
- Right click >> View metadata
- Export metadata



Note: While exporting the metadata in the metadata content to export tab, select all supported content and select ISO 19139 option in the type of metadata to export.

Annexure IV: Metadata Example

Dzongkhag Boundary

ISO-19139 Metadata

Metadata Information:

Metadata language:

Metadata character set: utf8

Last update: 2023-11-08

Maintenance:

Update frequency: asNeeded

Metadata contact publisher:

Individual's name: Pema Wangda

Organization's name: NLCS

Contact's position: GISO

Scope of the data described by the metadata: dataset

Scope name: dataset

Name of the metadata standard used: ISO 19139 Geographic Information – Metadata Implementation Specification

Version of the metadata standard: 2007

Metadata identifier: CD38C09E-9876-4B30-860B-E7FC54246D56

Resource Identification Information:

Citation:

Title: Dzongkhag Boundary

Reference date - creation: 2023-11-07

Party responsible for the resource - publisher:

Individual's name: Pema Wangda

Organization's name: NLCS

Contact's position: GISO

Contact information:**Phone:****Voice:** 16931259**Address:****e-mail address:** pwangda2014@gmail.com**Themes or categories of the resource:** boundaries**Abstract:**

The dataset shows the clear boundary delineation of 20 Dzongkhags with names of each Dzongkhag. It has the attribute information showing the total geographical area against each Dzongkhag. The boundary has been mapped from the 1:50000 scale topographic map.

Dataset language: eng**Dataset character set:** utf8**Maintenance:****Update frequency:** asNeeded**Resource constraints:****Constraints:****Limitations of use:** Open**Spatial representation type:** vector**Spatial resolution:****Dataset's scale:****Scale denominator:** 50000**Extent:****Geographic extent:****Bounding rectangle:****West longitude:** 27**East longitude:** 29**North latitude:** 89**South latitude:** 87**Point of contact - originator:****Individual's name:** Prakash Rai

Organization's name: NLCS

Contact's position: SE

Contact information:

Phone:

Voice: 16931259

Address:

e-mail address: pwangda2014@nlcs.gov.bt

Reference System Information:

Reference system identifier:

Value: EPSG 5266

Data Quality Information:

Scope of quality information:

Level of the data: series

Lineage:

Process step:

Description: This data has been created from a small-scale map of 50000 scale topographic maps. However, minor changes and corrections have been carried out in the later phases by the NLCS upon the request from the local government due to some boundary discrepancies between the two Dzongkhags.

Source data:

Level of the source data: Generated from 50000 scale topographic base map

Distribution Information:

Format:

Format name: Shape file

Format version: Not application

Transfer options:

Transfer size: 10

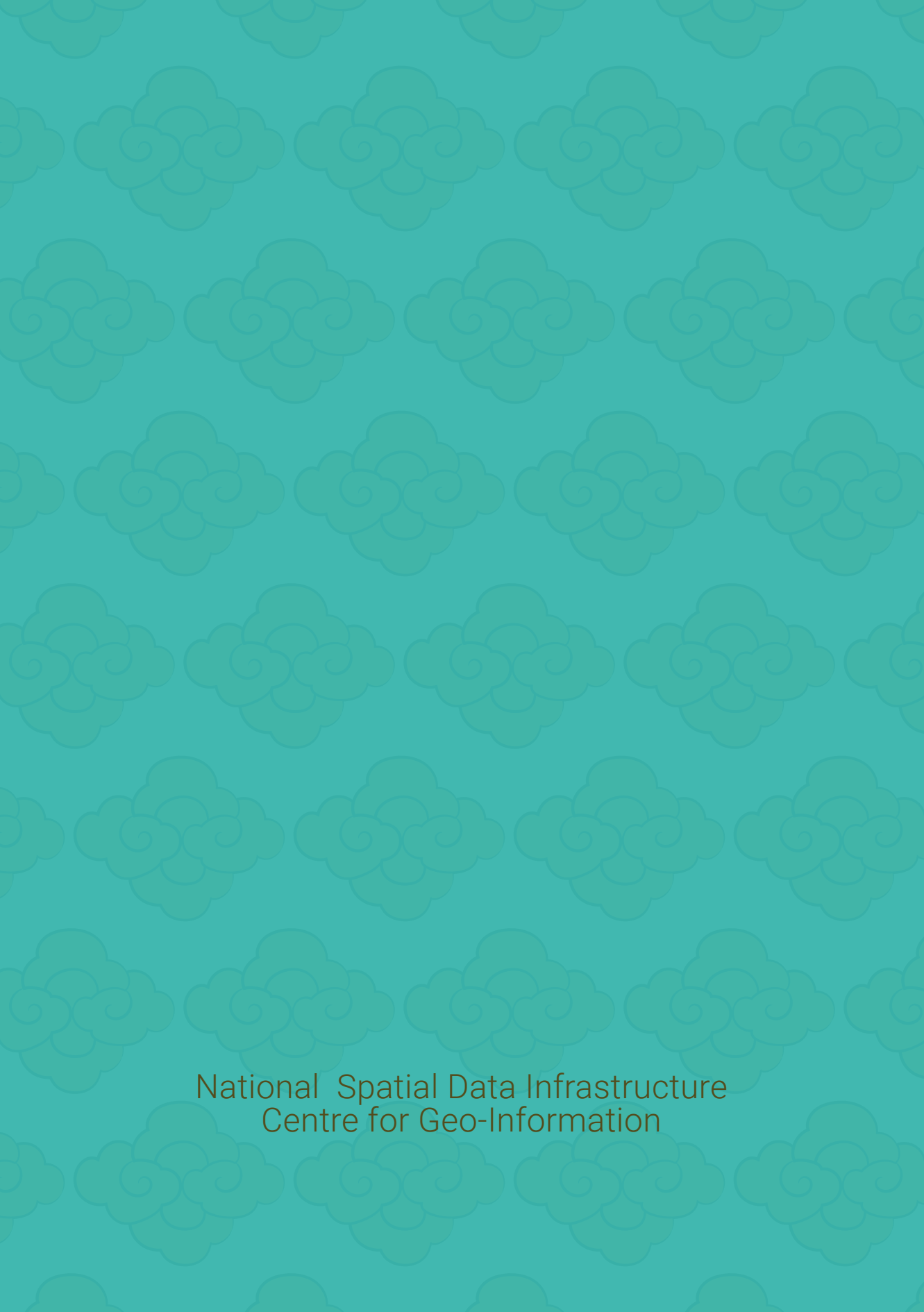
Units of distribution (e.g., tiles): mb

Note: The above metadata was created using ArcGIS Pro software.



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